ENGINE SECTION

FOREWORD

This portion of the service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of both the fully qualified and the less-experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

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1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into six volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- ENGINE SECTION
- TRANSMISSION AND DIFFERENTIAL SECTION
- MECHANICAL COMPONENTS SECTION
- BODY AND ELECTRICAL SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following six types of areas.

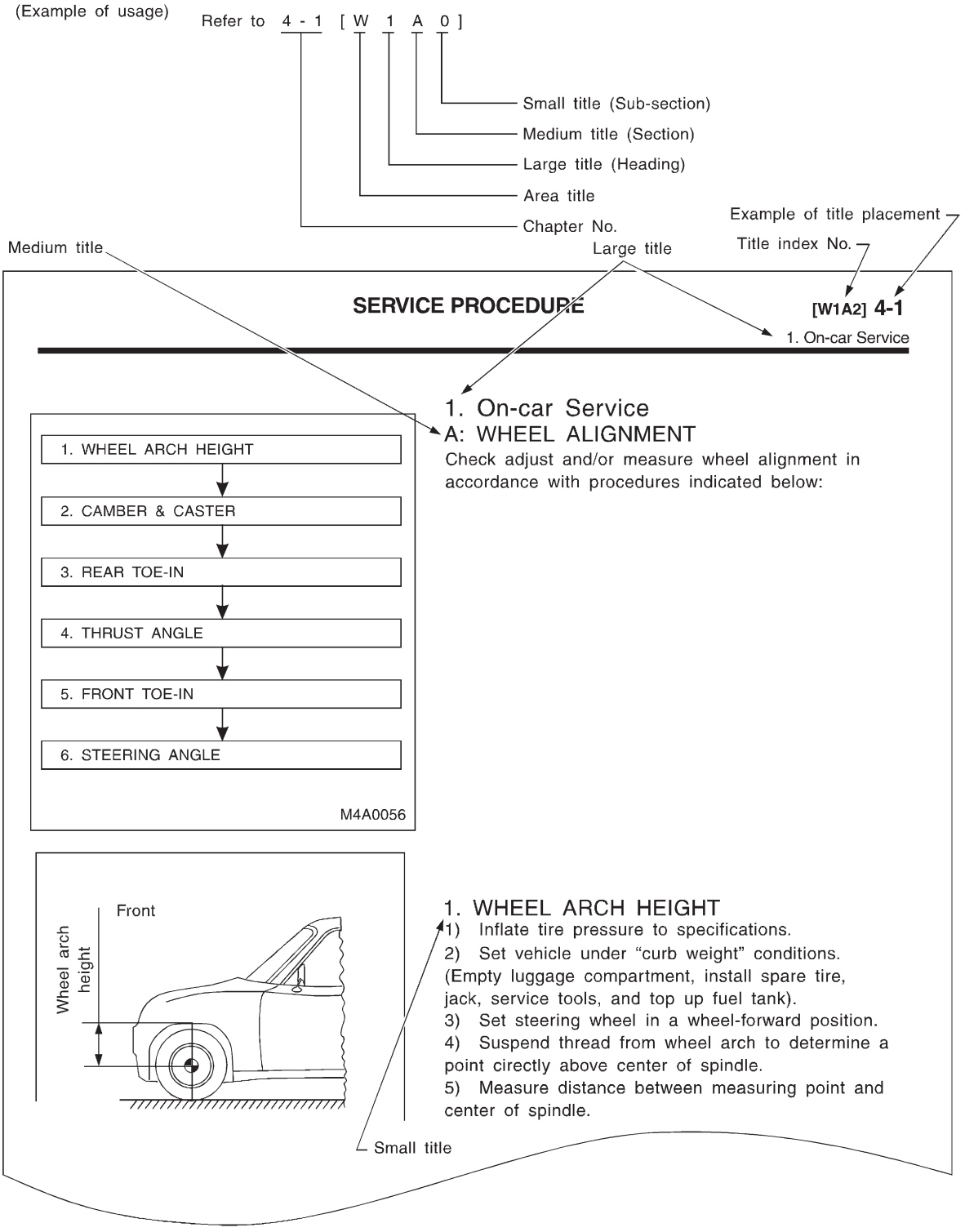
S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS (MECHANICAL)
T	DIAGNOSTICS (ELECTRICAL)
D	WIRING DIAGRAM

● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the six types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

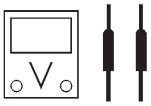
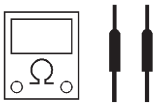
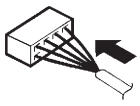
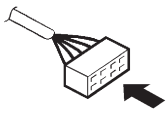
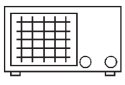
● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.



H0M0010

- In this manual, the following symbols are used.

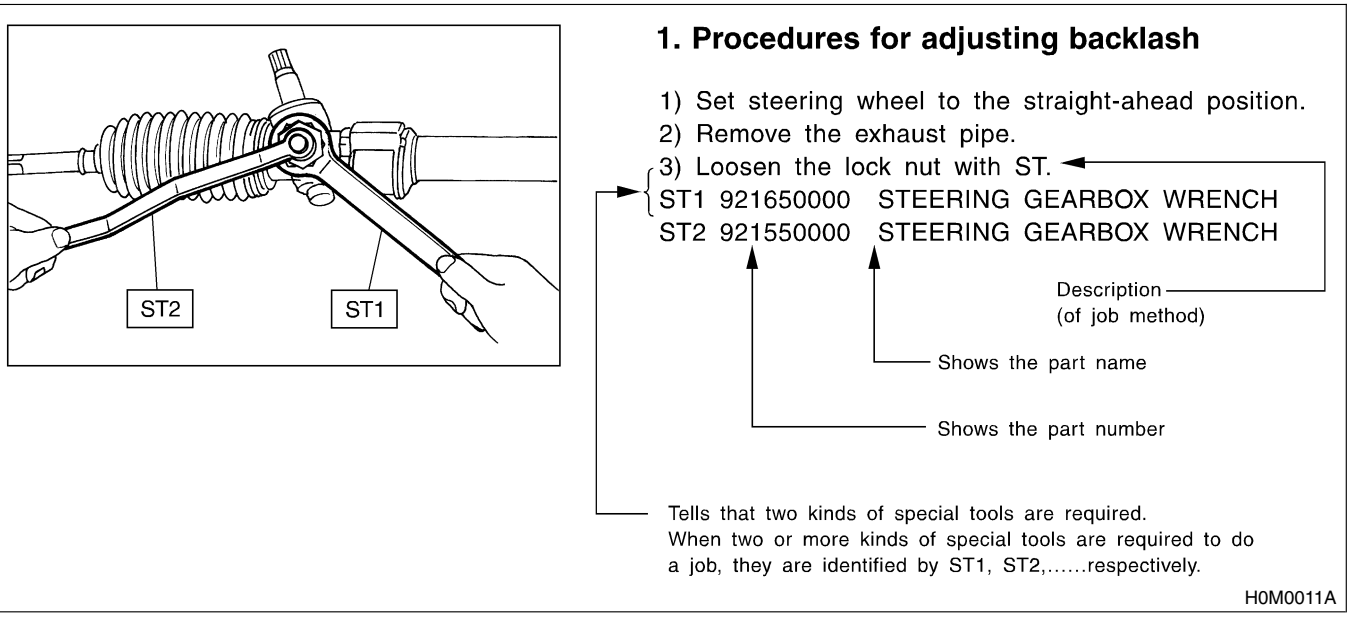
Symbol	Description
*	Selective part
★	Replacement part
 S0M0001	Should be lubricated with oil.
 S0M0002	Should be lubricated with grease.
 S0M0003	Sealing point
T S0M0004	Tightening torque

Character	Description
 B0M0002	Circuit tester ● Voltage measurement
 B0M0003	Circuit tester ● Resistance measurement
 B0M0004	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0005	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0006	Oscilloscope
B0M0007	Oscilloscope positive probe
B0M0008	Oscilloscope earth head

● **WARNING, CAUTION,** NOTE

WARNING:	Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
CAUTION:	Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
NOTE:	Indicates the hints, knacks, etc. which make the maintenance job easier.

● SPECIAL TOOLS
When any special tool is required to perform the job, it is identified by “ST” in the applicable illustration and its part number is shown in the manual.

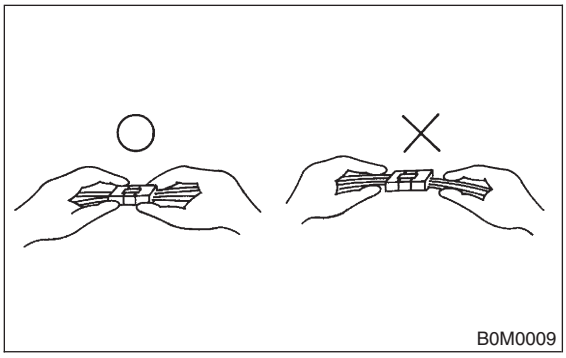


3. Basic Checks for Diagnostics

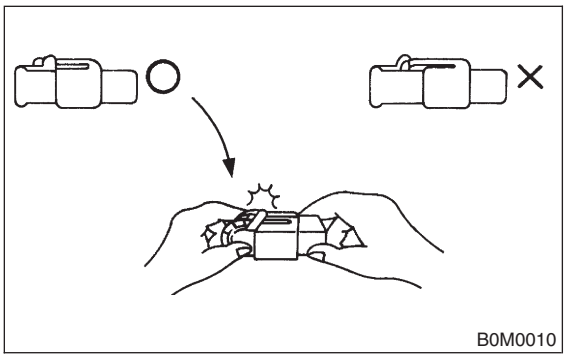
A: DISCONNECTING CONNECTORS

- Always hold the connector itself.

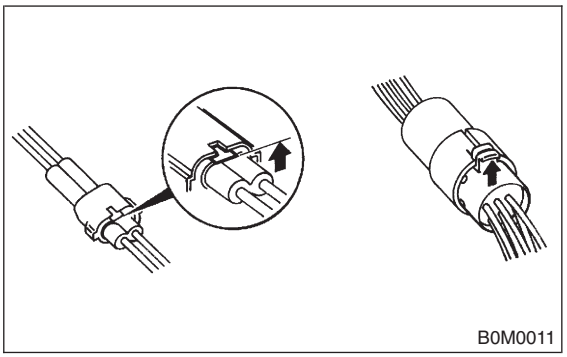
CAUTION:
Don't pull the harness.



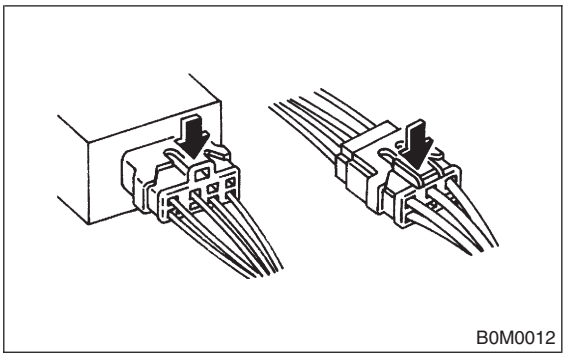
- Inspect a connector by pushing it all the way in. If the connector is equipped with a locking device, push it in until a clicking sound is heard.



- To disconnect a locking connector, first release the lock, then pull the connector off.
<Unlock by pulling the locking tab.>



<Unlock by pushing the locking tab.>

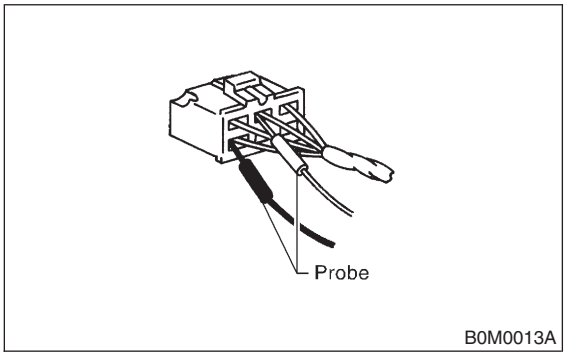


NOTE:
- After disconnecting connectors, visually check for contamination, distortion, or damage of connectors before reconnecting them. Also, check for loose or missing terminals.
- If there are any contamination, or water droplets on the contact points of the terminals, wipe them off using an air gun or a waste cloth. Never polish the contact points using sandpaper. If polished with sandpaper, the surface plating may peel off.
- Avoid excessive impact and twisting force to connectors when connecting. Otherwise, connector housings or terminals may be damaged.
- When disconnecting waterproof connectors, be sure to prevent the inner waterproof seal from collapsing.

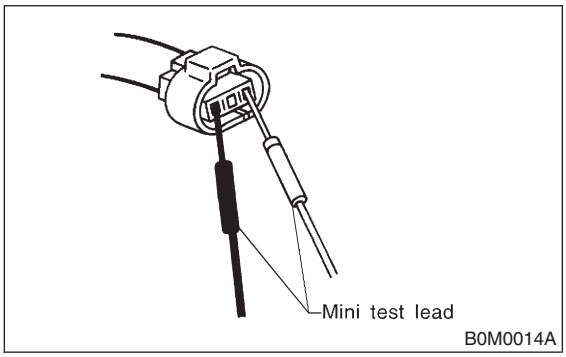
B: INSERTING A PROBE

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

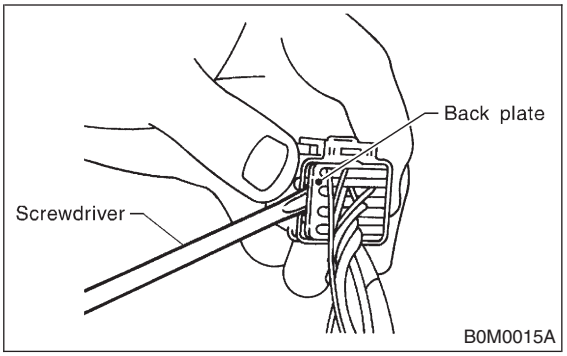
- Generally, probes are inserted into connectors from the rear side (wire side).
- When removing the shock protector take care not to deform it; this also applies to waterproof connectors, which cannot be tested from the wire side.



- Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.



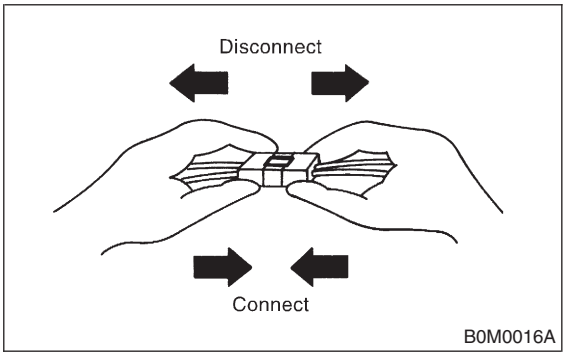
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, since the terminals might brake off.)



C: CHECKING FOR POOR CONTACT ON PLUG-IN CONNECTORS

1. POOR CONTACT

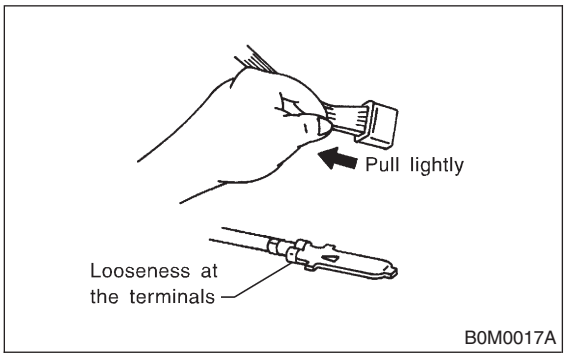
Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. Quite often a plug with poor contact will work perfectly again after it has been pulled off and reconnected. If harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of trouble.



2. VISUAL INSPECTION

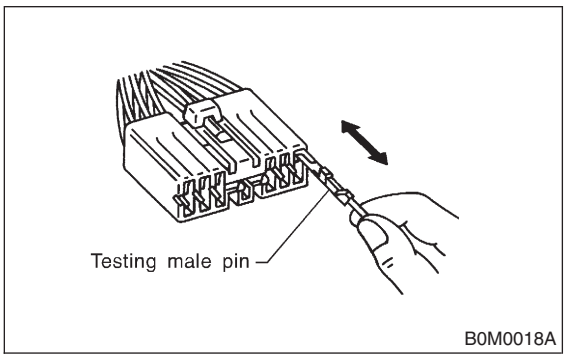
1) Disconnect the two connector halves.
2) Check the connector pins for signs of corrosion or foreign material.
3) Check the connector for loose and damaged terminals, and make sure they are set correctly in the connector.

NOTE:
When the harness is pulled lightly, the terminals should not come out.

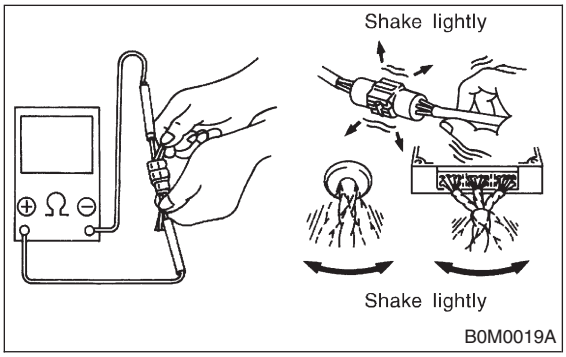


4) Insert the male pin of the connector into the female pin, then pull it out.

NOTE:
If one of the pins allows to pull out easily, it is a likely source of a malfunction.



5) Shake lightly the connector and the harness, and check for sudden changes in voltage or resistance.



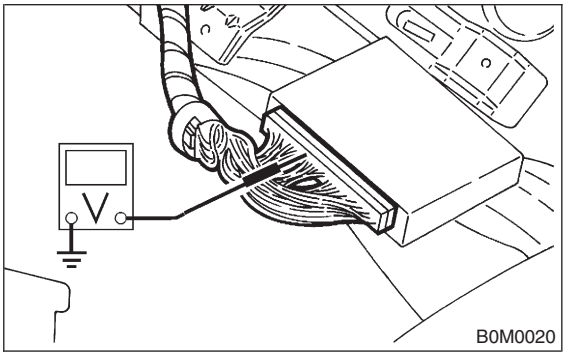
4. Diagnosis and Checking Procedure Using Instruments

A: USING A CIRCUIT TESTER

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

1. VOLTAGE CHECK (range set to DC V)

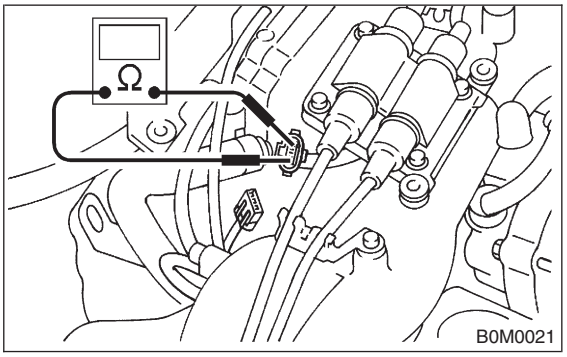
Connect the positive probe to the terminal to be tested, and the negative probe to body ground. (or the ground terminal of the ECM)



2. CHECKING THE CONNECTION (range set to Ω)

Measure the resistance and check for open or shorted wire in the harness or the connector.

NOTE:
This check must be carried out with both connectors disconnected.
(This avoids by-passing the connection through other circuits.)



1) Check for open circuit. (range: Ω × 1K)
Measure the resistance between the respective pins in both connectors.

Specified resistance:
More than 1 MΩ (No continuity) Open circuit
Less than 10 Ω (Continuity) O.K.

2) Check for correct insulation value. (range: Ω × 1K)
Measure the resistance between the pins in both connectors, as well as between the suspected pin and the body. (body short)

Specified resistance:
More than 1 MΩ (No continuity) O.K.
Less than 10 Ω (Continuity) Short circuit

3) Resistance measurement (range set to Ω)
Measuring the internal resistance of sensors, solenoid valves etc. to check the operating condition of components.

NOTE:
● Select the appropriate range for measuring the internal resistance, or the measurement will result in an incorrect reading.
● Before changing the measurement range the gauge must be reset to zero.

B: USING A SUBARU SELECT MONITOR

With this testing procedure the defective component can be determined by directly monitoring input/output signals of the ECM or the trouble codes.

1. FEATURES

● A variety of data can be checked without movements from the drivers seat, passenger's seat or from outside the vehicle.
● This unit allows the identification of the type of malfunction, for example whether the cause is an open or shorted wire in the input/output signal line, or whether the breakdown of a component is caused by a lack of maintenance.

2. DIAGNOSIS

● Refer to the reference values for input/output and control data to determine whether the malfunction is caused by a worn out component, an open wire, a short etc.
● Perform the diagnostics procedure as described in chapter "Check based on trouble codes" by monitoring the trouble codes.

NOTE:
It will be easier to determine a malfunction if the vehicle data for normal conditions are available for comparison.

C: USING AN OSCILLOSCOPE

A malfunction can be determined by displaying the waveforms of input/output signals on the oscilloscope.

1. DIAGNOSIS

A simple comparison of the waveforms may lead to an incorrect diagnosis. To exactly determine the sources of the malfunction it will be necessary to determine them under consideration about information other than waveforms.

2. APPLYING INPUT/OUTPUT SIGNALS

Connect the probe directly with the terminal of the signal.

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WIRING DIAGRAM SECTION	6-3 Wiring Diagram

EMISSION CONTROL SYSTEM AND VACUUM FITTING 2-1

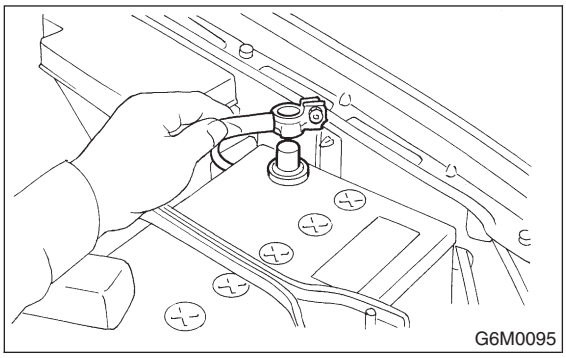
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3. Canister 5
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5. Fuel Temperature Sensor 6
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7. Pressure Control Solenoid Valve 9
8. Main Fuel Level Sensor 11
9. Drain Filter 13
10. Fuel Sub Level Sensor 14
11. Vent Valve 15
12. Shut Valve 16
13. Drain Valve 17

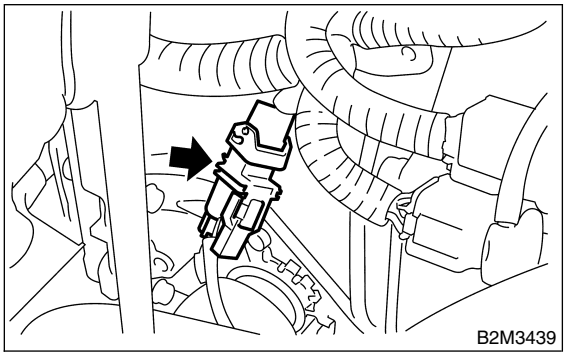
1. Front Catalytic Converter

A: REMOVAL

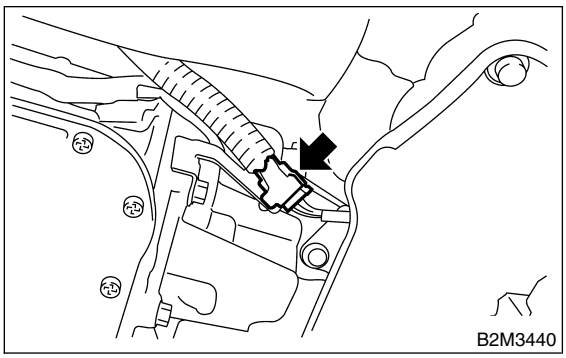
1) Disconnect battery ground cable.



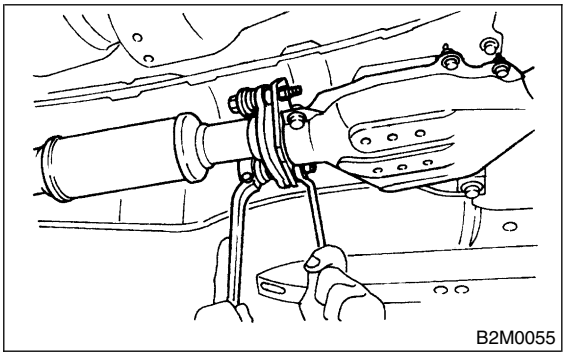
2) Disconnect front oxygen (A/F) sensor connector.



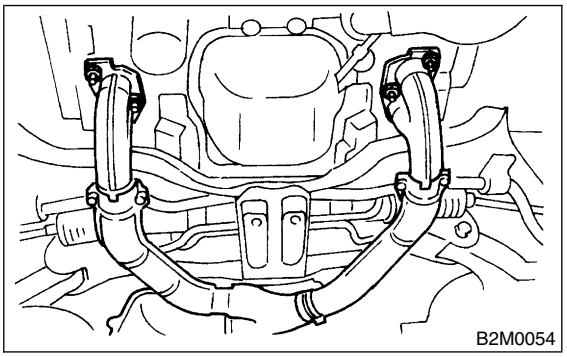
3) Lift-up the vehicle.
4) Remove under cover.
5) Disconnect rear oxygen sensor connector.



6) Separate front and rear catalytic converter assembly from rear exhaust pipe.

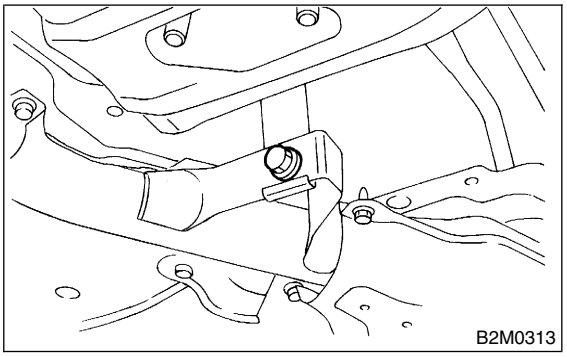


7) Remove front exhaust pipe from cylinder heads.



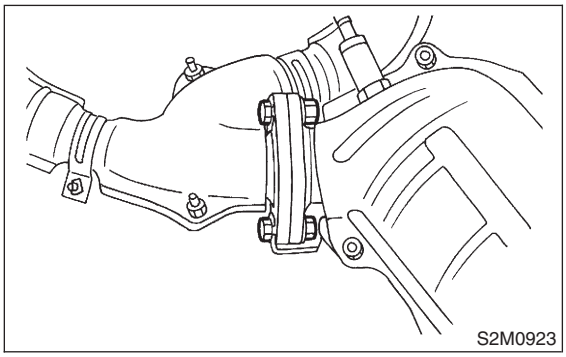
8) Remove front and rear catalytic converter assembly from hanger bracket.

CAUTION:
• Be careful not to pull down center exhaust pipe.
• After removing center exhaust pipe, do not apply excessive pulling force on rear exhaust pipe.



9) Separate front and rear catalytic converter assembly from front exhaust pipe.

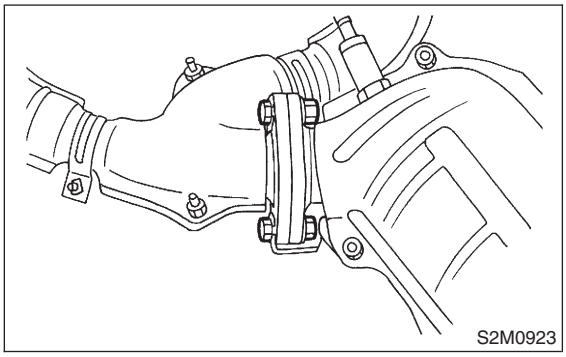
NOTE:
The rear catalytic converter is integrated with front catalytic converter. Therefore, the procedure for removing rear catalytic converter is the same as the description above.


S2M0923

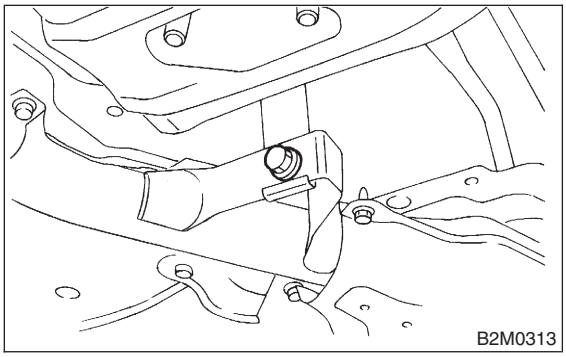
B: INSTALLATION

CAUTION:
Replace gaskets with new ones.

1) Install front and rear catalytic converter assembly to front exhaust pipe.

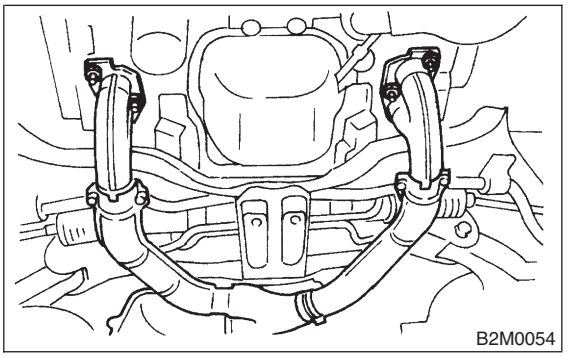

S2M0923

2) Install front and rear catalytic converter assembly.
Temporarily tighten bolt which installs center exhaust pipe to hanger bracket.


B2M0313

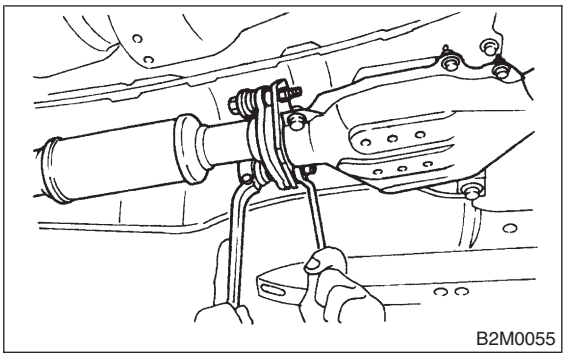
3) Install front exhaust pipe to cylinder heads.

Tightening torque:
30±5 N·m (3.1±0.5 kg-m, 22.4±3.6 ft-lb)


B2M0054

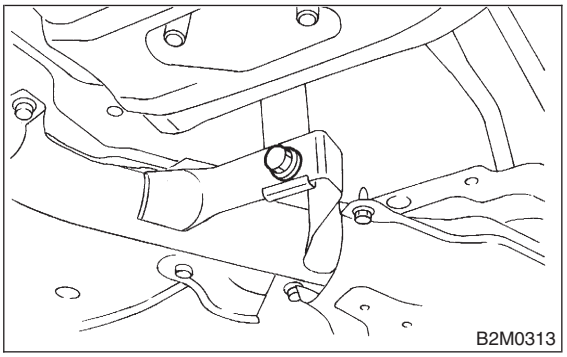
4) Install front and rear catalytic converter assembly to rear exhaust pipe.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

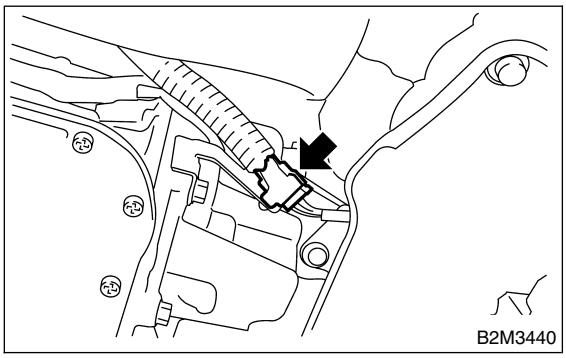

B2M0055

5) Tighten bolt which holds front and rear catalytic converter assembly to hanger bracket.

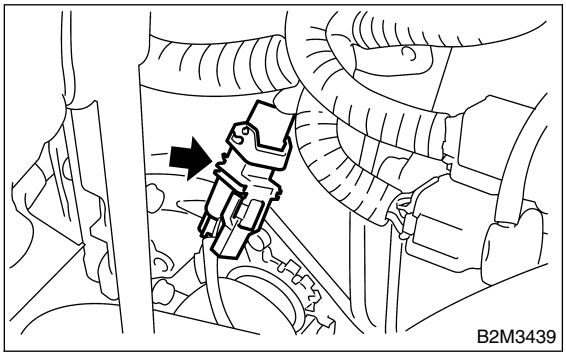
Tightening torque:
35±5 N·m (3.6±0.5 kg-m, 26.0±3.6 ft-lb)


B2M0313

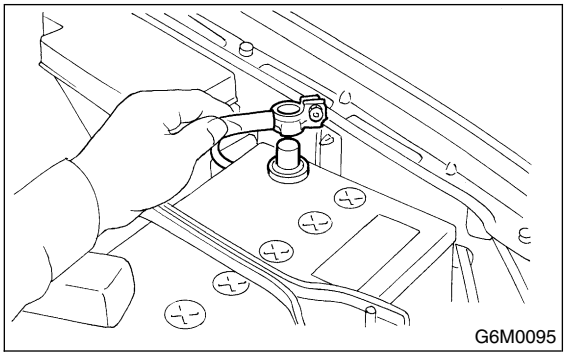
6) Connect rear oxygen sensor connector.



7) Install under cover.
8) Lower the vehicle.
9) Connect connector to front oxygen (A/F) sensor.



10) Connect battery ground cable.



2. Rear Catalytic Converter

A: REMOVAL

The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the those for the front catalytic converter. <Ref. to 2-1 [W1A0].>

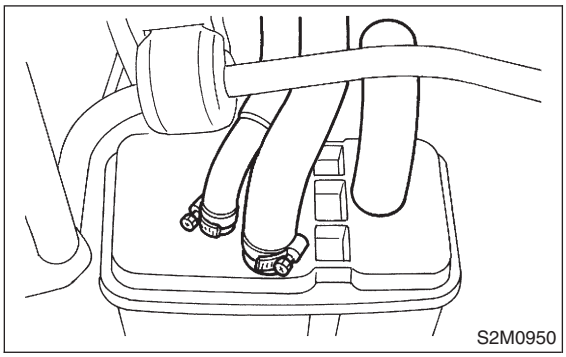
B: INSTALLATION

The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the ones described under front catalytic converter. <Ref. to 2-1 [W1B0].>

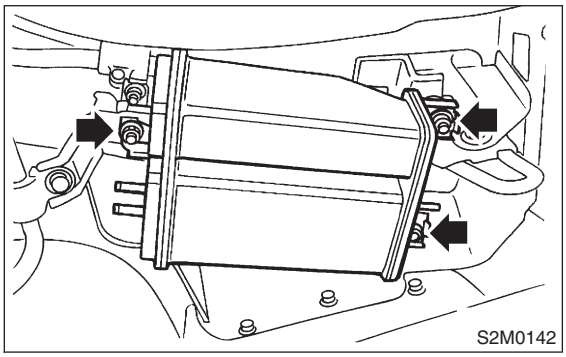
3. Canister

A: REMOVAL AND INSTALLATION

1) Lift-up the vehicle.
2) Disconnect evaporation hoses from canister.

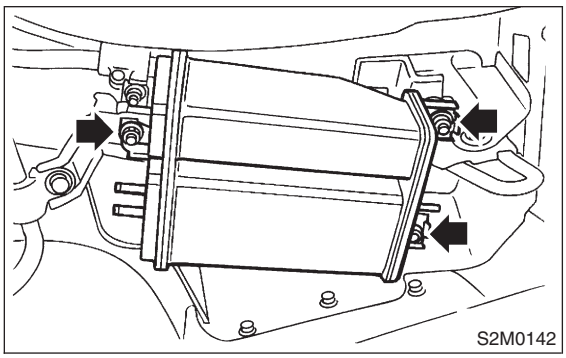


3) Remove canister from body.



4) Installation is in the reverse order of removal.

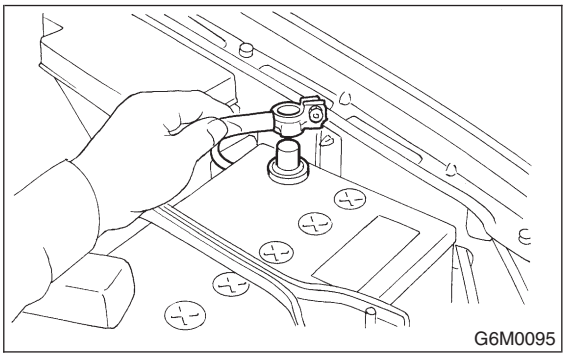
Tightening torque:
22.5±7 N·m (2.3±0.7 kg-m, 16.6±5.1 ft-lb)



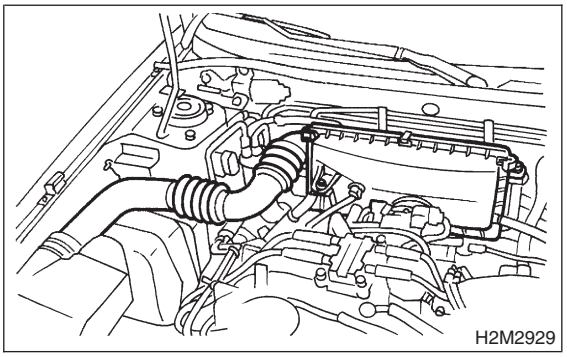
4. Purge Control Solenoid Valve

A: REMOVAL AND INSTALLATION

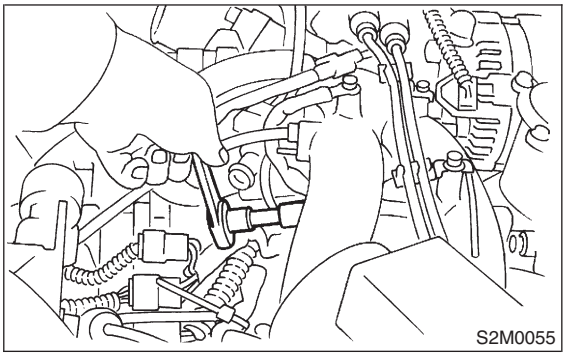
1) Disconnect battery ground cable.



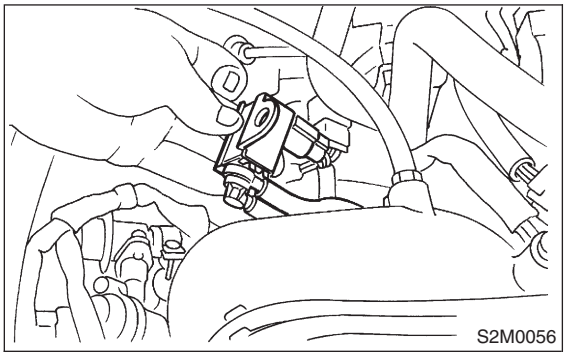
2) Remove air cleaner case and air intake duct. <Ref. to 2-7 [W1A0].>



3) Remove bolt which installs purge control solenoid valve to intake manifold.

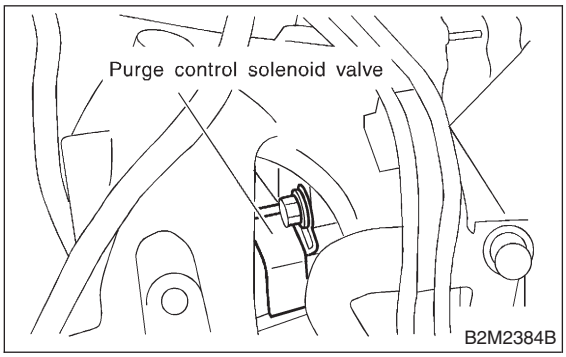


4) Take out purge control solenoid valve.
5) Disconnect connector from purge control solenoid valve.
6) Disconnect vacuum hoses from purge control solenoid valve.

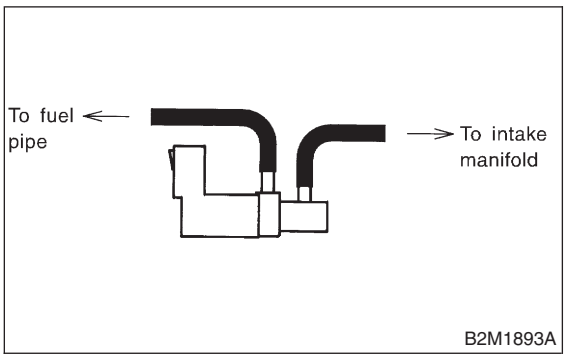


7) Installation is in the reverse order of removal.

Tightening torque:
15.7±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)



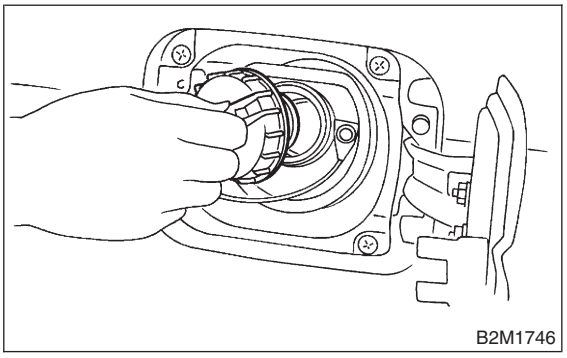
CAUTION:
Carefully connect the evaporation hoses.



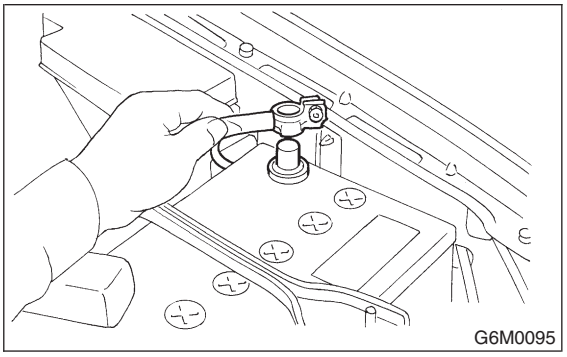
5. Fuel Temperature Sensor

A: REMOVAL

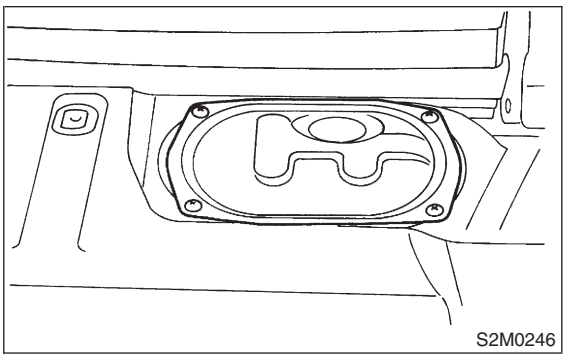
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel filler lid, and remove fuel filler cap.



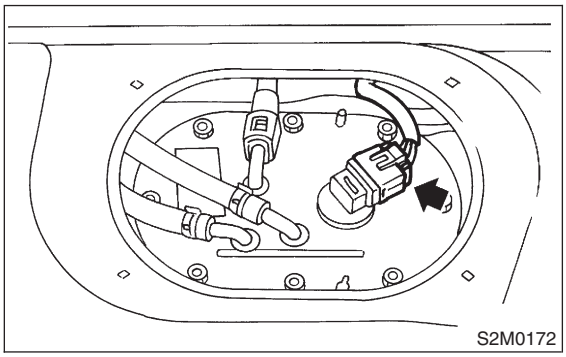
3) Disconnect battery ground cable.



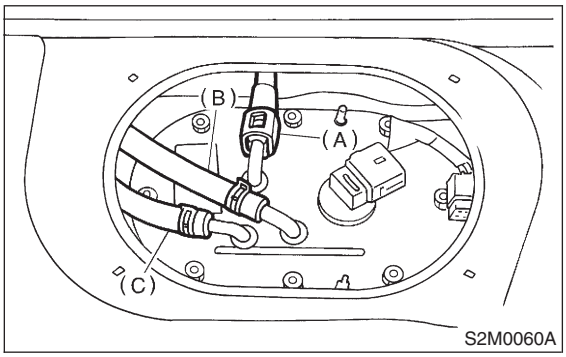
4) Remove the floor box located just behind the rear seat.
5) Remove service hole cover.



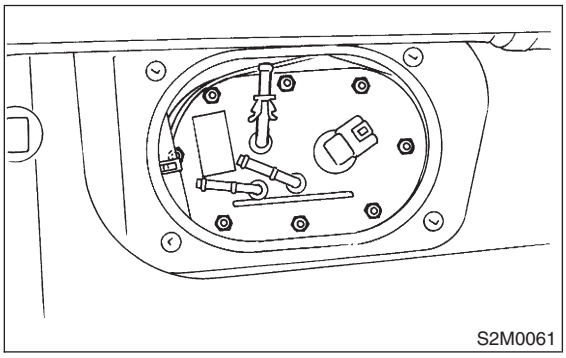
6) Disconnect connector from fuel pump.



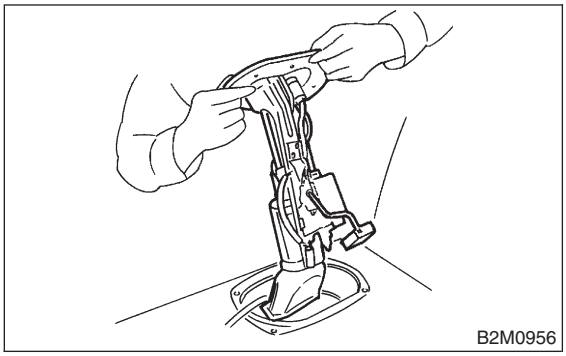
7) Move clips, and then disconnect fuel delivery hose (A), return hose (B) and jet pump hose (C).
8) Disconnect quick connector, and then disconnect fuel delivery hose (A). <Ref. to 2-8 [W7A0].>



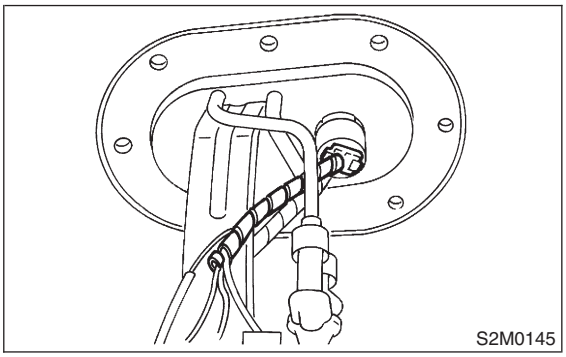
9) Remove nuts which install fuel pump assembly onto fuel tank.



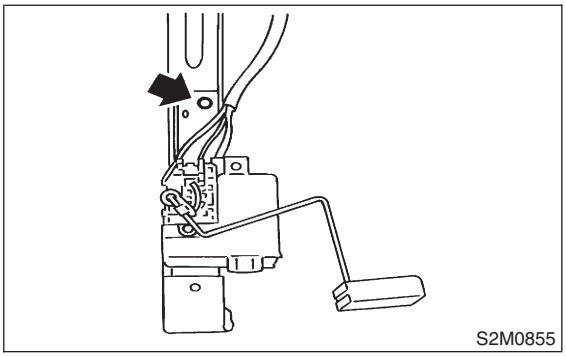
10) Take off fuel pump assembly from fuel tank.



11) Disconnect connector from fuel pump bracket.



12) Remove main fuel level sensor from fuel pump assembly. <Ref. to 2-1 [W8A0].>



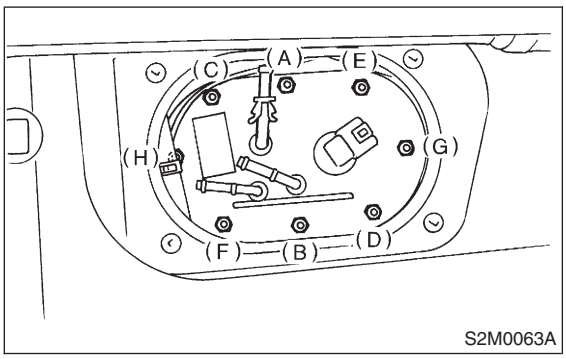
NOTE:
Fuel temperature sensor is a unit with fuel pump. If replacing it, replace as a fuel pump.

B: INSTALLATION

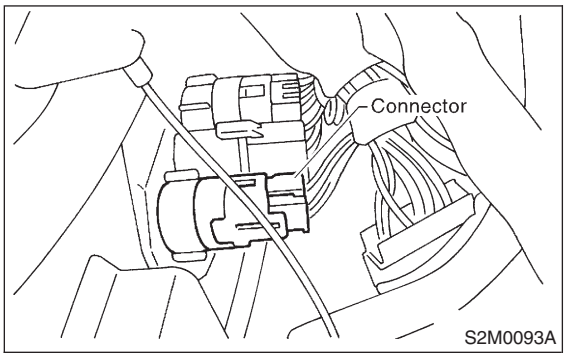
CAUTION:
Leave fuel filler cap open when tightening nuts, to prevent fuel from flowing out through fuel delivery and return pipes. Close fuel filler cap after tightening nuts.

Installation is in the reverse order of removal. Do the following:
(1) Always use new gaskets.
(2) Ensure sealing portion is free from fuel or foreign particles before installation.
(3) Tighten nuts in alphabetical sequence shown in figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



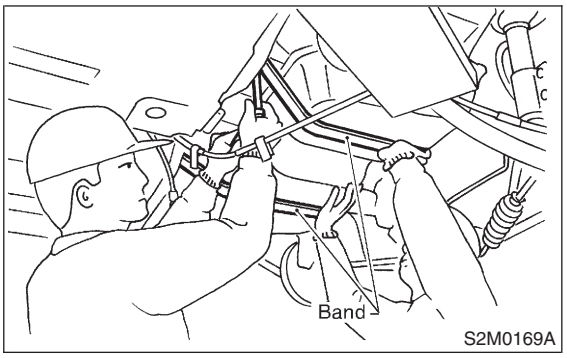
(4) Connect connector to fuel pump relay.



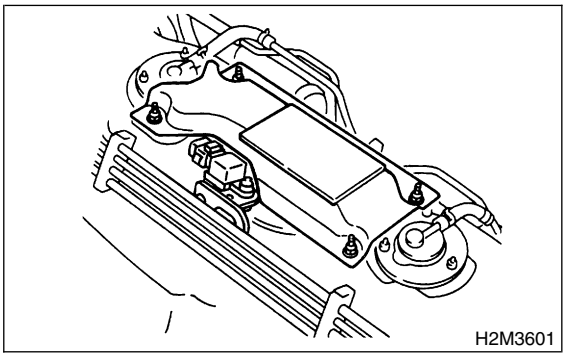
6. Fuel Tank Pressure Sensor

A: REMOVAL AND INSTALLATION

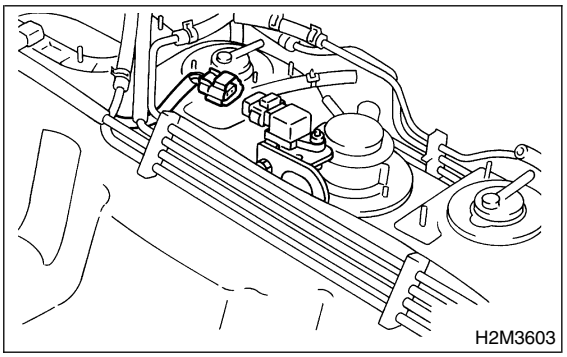
1) Remove fuel tank. <Ref. to 2-8 [W2A0].>



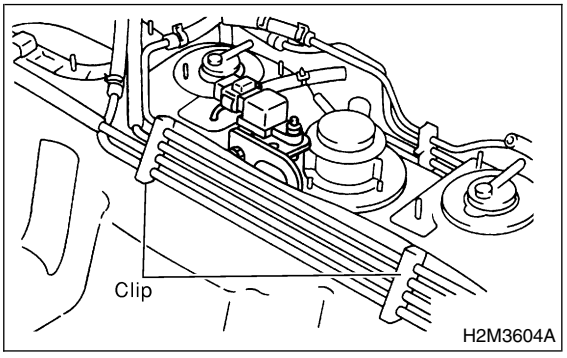
2) Remove protector cover.



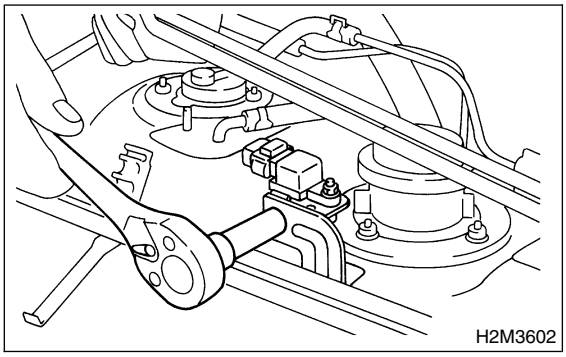
3) Disconnect connector from fuel tank pressure sensor.



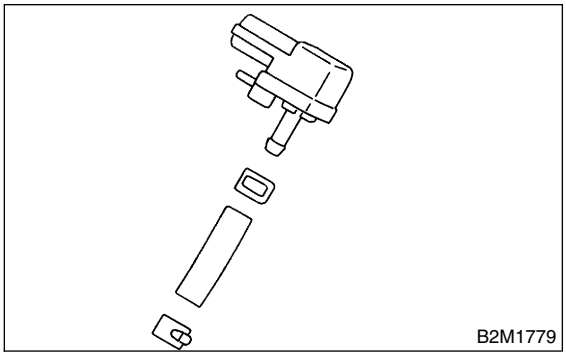
4) Release clips which hold fuel pipes onto fuel tank.



5) Move two fuel pipes to upper side, and remove bolt which install fuel tank pressure sensor to bracket.

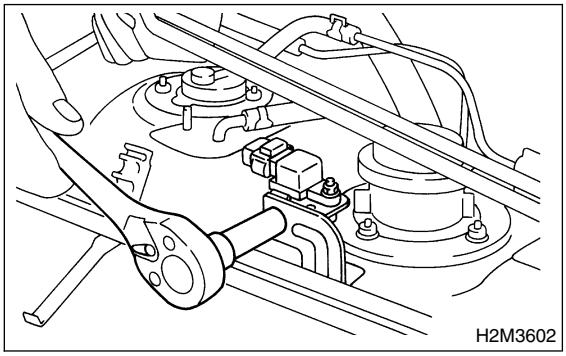

H2M3602

6) Move clip, and disconnect pressure hose from fuel tank.
7) Disconnect pressure hose from fuel tank pressure sensor.


B2M1779

8) Installation is in the reverse order of removal.

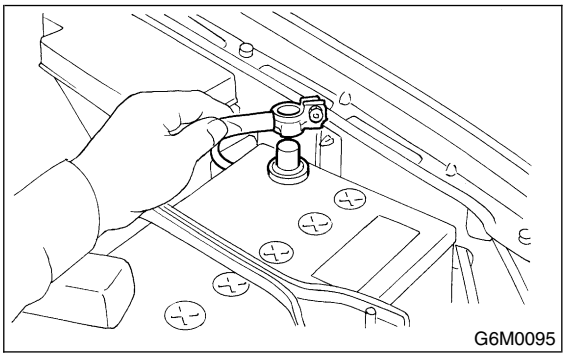
Tightening torque:
7.35±1.96 N·m (0.75±0.20 kg-m, 5.4±1.4 ft-lb)


H2M3602

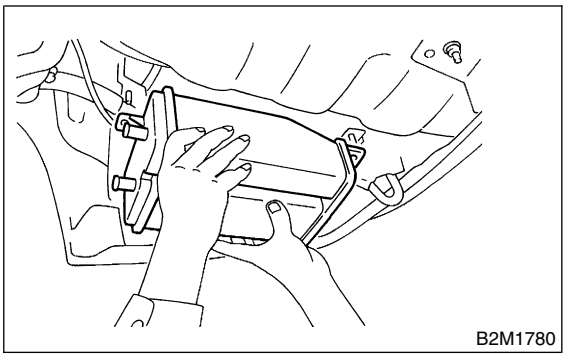
7. Pressure Control Solenoid Valve

A: REMOVAL AND INSTALLATION

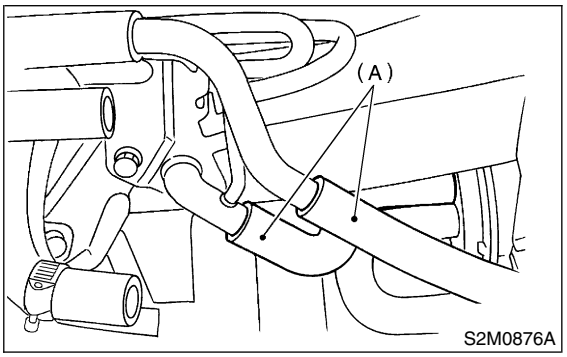
1) Disconnect battery ground cable.


G6M0095

2) Remove canister. <Ref. to 2-1 [W3A0].>

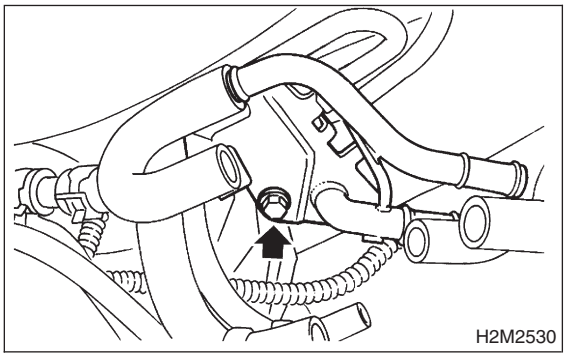

B2M1780

3) Disconnect evaporation hoses (A) from joint pipes.

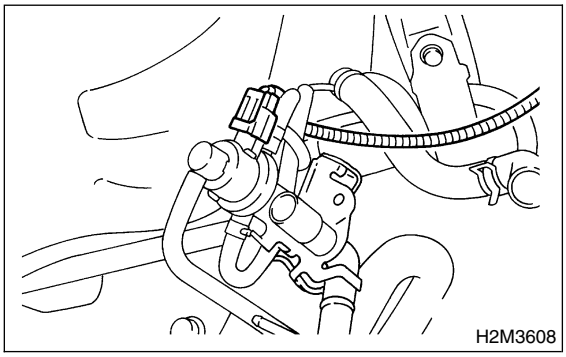


S2M0876A

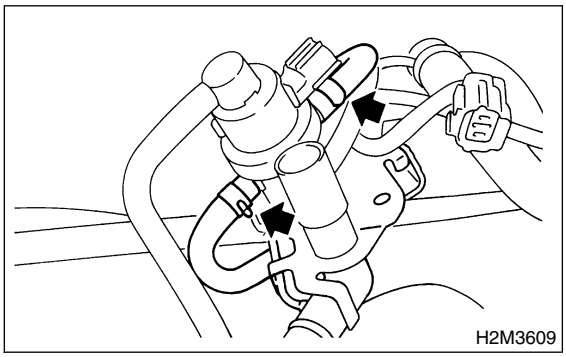
4) Remove bolt which installs pressure control solenoid valve holding bracket on body.



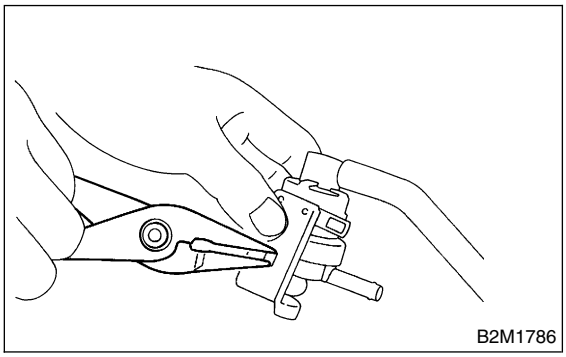
5) Disconnect connector from pressure control solenoid valve.



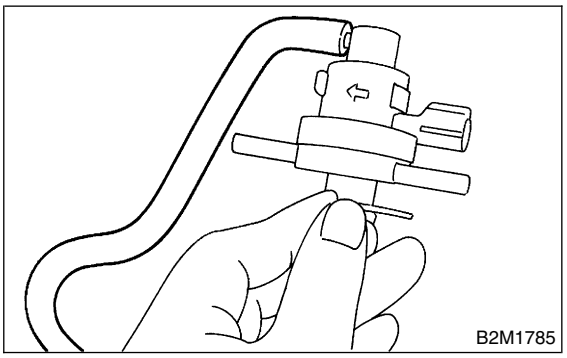
6) Disconnect two evaporation hoses from pressure control solenoid valve.
7) Remove pressure control solenoid valve with bracket.



8) Remove pressure control solenoid valve from bracket.

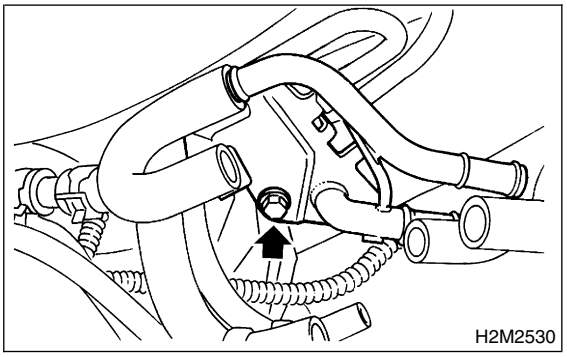


9) Disconnect vacuum hose from pressure control solenoid valve.



10) Installation is in the reverse order of removal.

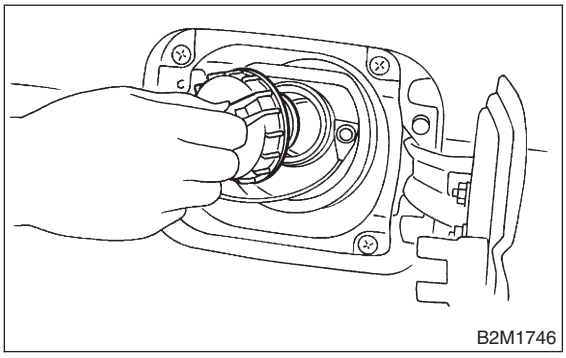
Tightening torque:
17.6±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)



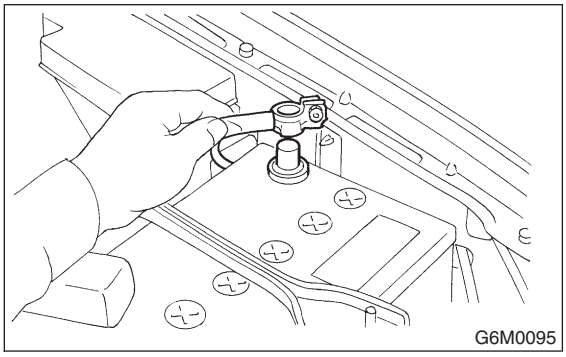
8. Main Fuel Level Sensor

A: REMOVAL

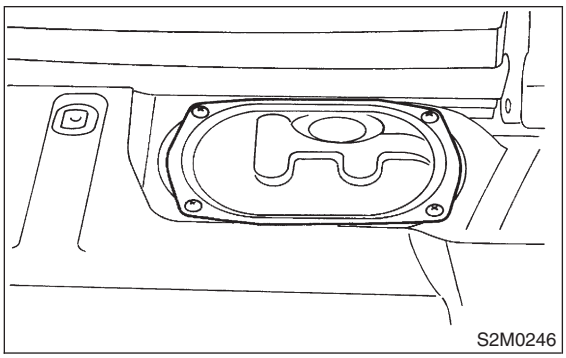
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.



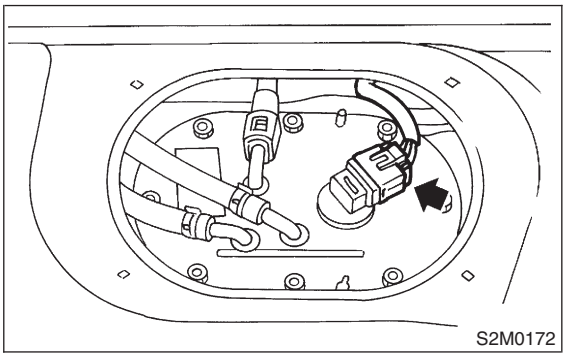
3) Disconnect battery ground cable.



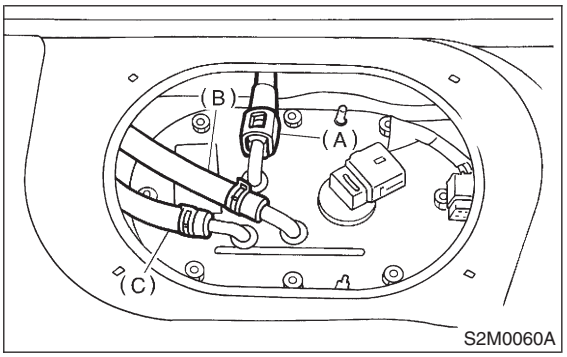
4) Remove the floor box located just behind the rear seat.
5) Remove service hole cover.



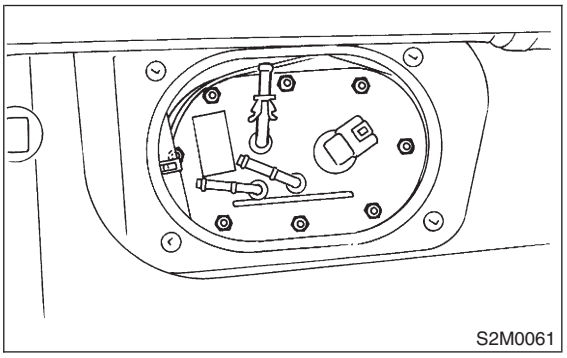
6) Disconnect connector from fuel pump.



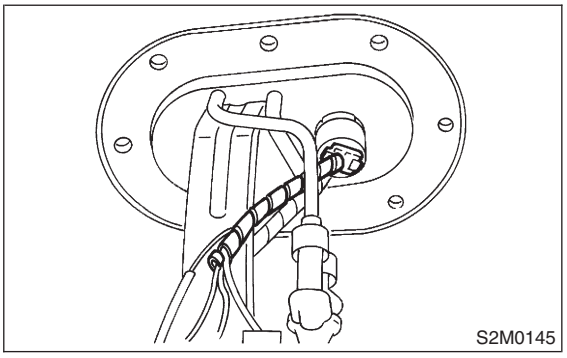
7) Move clips, and then disconnect fuel delivery hose (A), return hose (B) and jet pump hose (C).
8) Disconnect quick connector, and then disconnect fuel delivery hose (A). <Ref. to 2-8 [W7A0].>



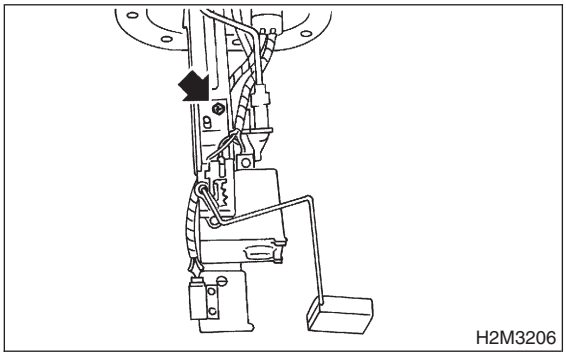
9) Remove nuts which install fuel pump assembly onto fuel tank.



10) Take off fuel pump assembly from fuel tank.
11) Disconnect connector from fuel pump bracket.



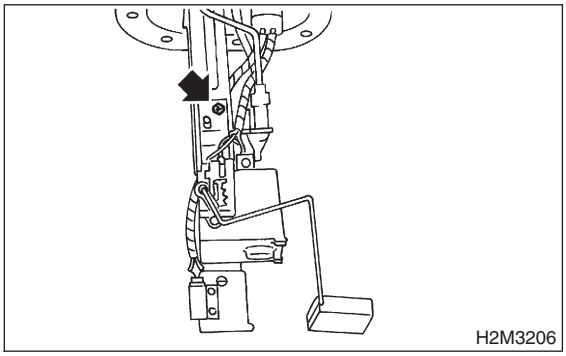
12) Remove bolt which installs fuel level sensor on mounting bracket.



B: INSTALLATION

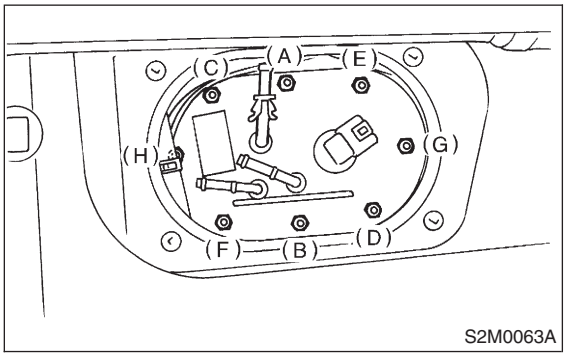
CAUTION:
Leave fuel filler cap open when tightening nuts, to prevent fuel from flowing out through fuel delivery and return pipes. Close fuel filler cap after tightening nuts.

Installation is in the reverse order of removal. Do the following:
1) Install the fuel level sensor onto the mounting bracket.

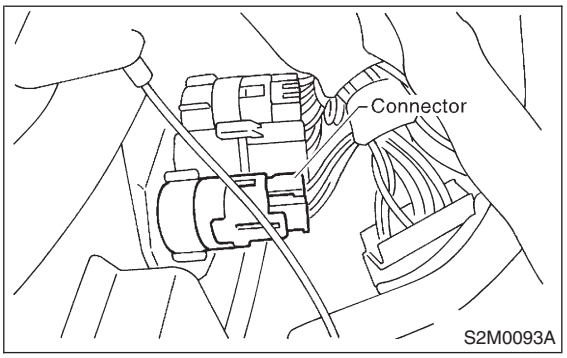


2) Always use new gaskets.
3) Ensure sealing portion is free from fuel or foreign particles before installation.
4) Tighten nuts in alphabetical sequence shown in figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



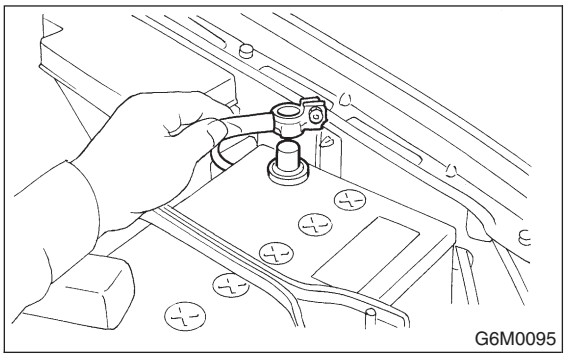
5) Connect connector to fuel pump relay.



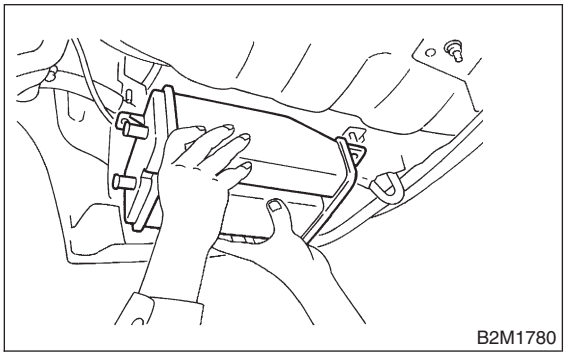
9. Drain Filter

A: REMOVAL AND INSTALLATION

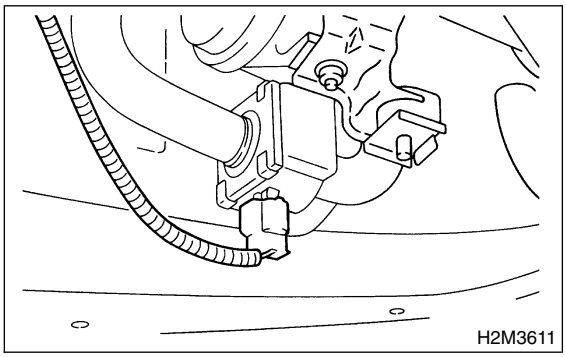
1) Disconnect battery ground cable.



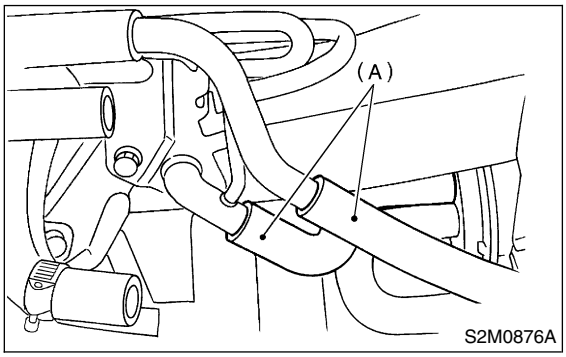
2) Lift-up the vehicle.
3) Remove canister. <Ref. to 2-1 [W3A0].>



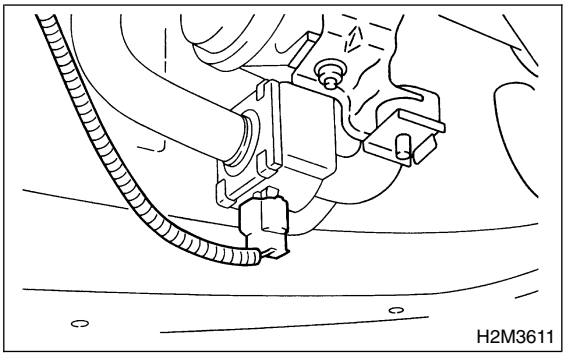
4) Disconnect connector from drain valve.



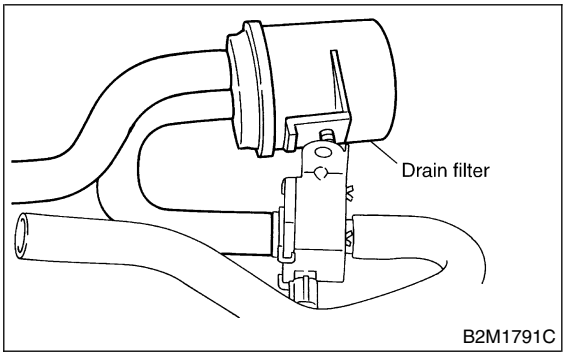
5) Disconnect evaporation hoses (A) from joint pipes.



6) Remove nut which installs drain filter and drain valve brackets on body, and remove them as a unit.

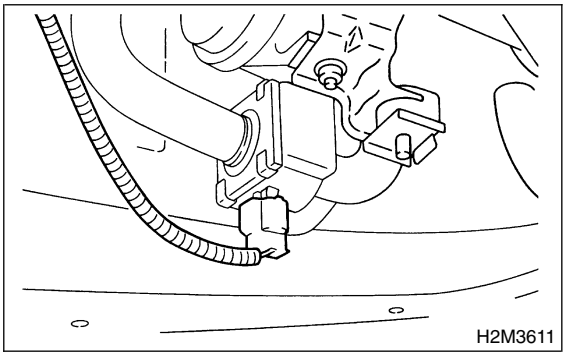


7) Disconnect evaporation hoses, and remove drain filter.



8) Installation is in the reverse order of removal.

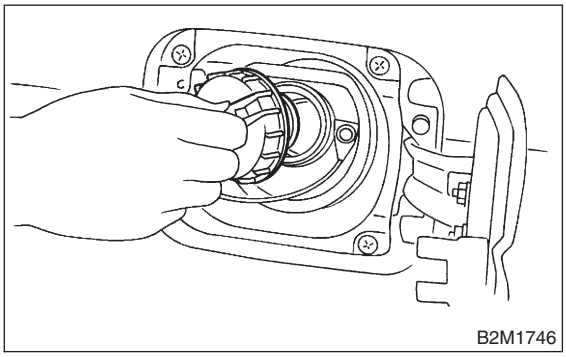
Tightening torque:
22.5±7 N·m (2.3±0.7 kg-m, 16.6±5.1 ft-lb)



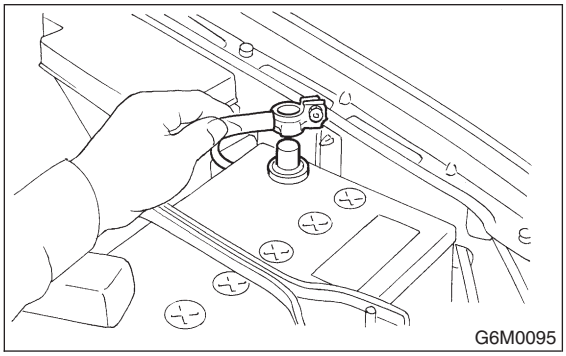
10. Fuel Sub Level Sensor

A: REMOVAL AND INSTALLATION

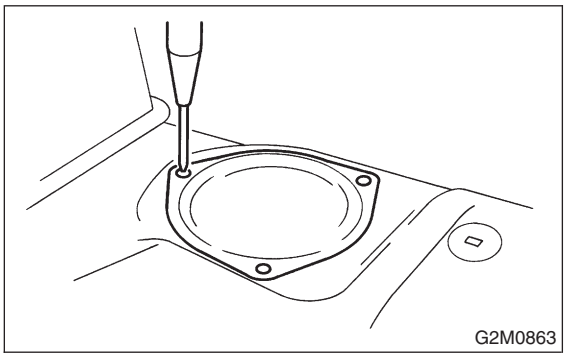
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Open fuel flap lid, and remove fuel filler cap.


B2M1746

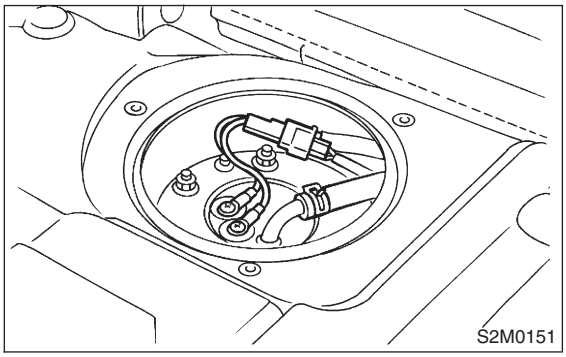
3) Disconnect battery ground cable.


G6M0095

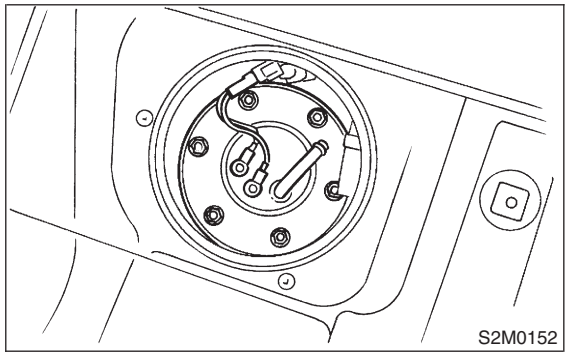
4) Remove service hole cover.


G2M0863

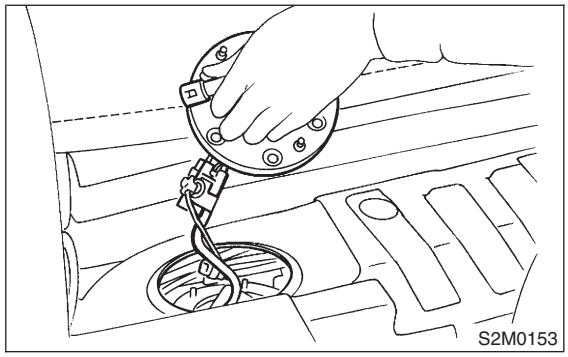
5) Disconnect connector from fuel sub level sensor, and disconnect jet pump hose.


S2M0151

6) Remove bolts which install fuel sub level sensor on fuel tank.

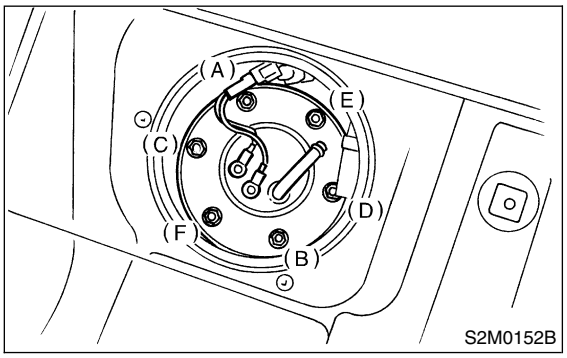

S2M0152

7) Remove fuel sub level sensor.

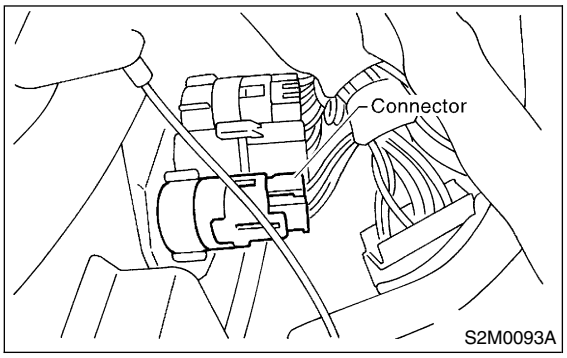

S2M0153

8) Installation is in the reverse order of removal. Do the following:
(1) Install fuel sub level sensor.

Tightening torque:
T: 4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



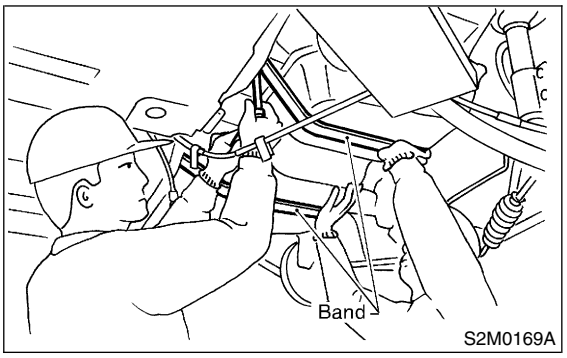
(2) Connect connector to fuel pump relay.



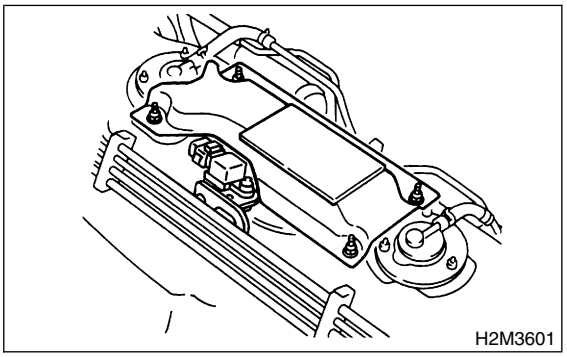
11. Vent Valve

A: REMOVAL AND INSTALLATION

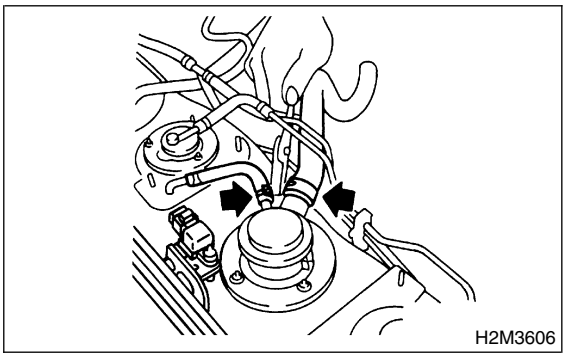
1) Remove fuel tank. <Ref. to 2-8 [W2A0].>



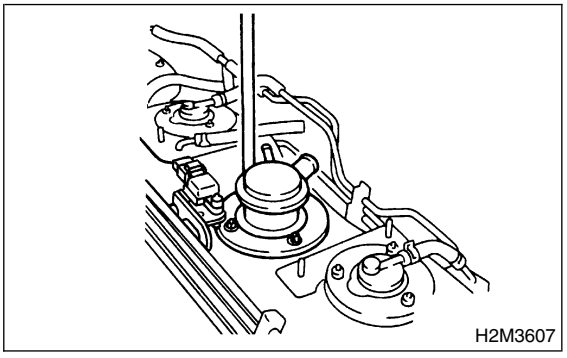
2) Remove protector cover.



3) Move clips, and disconnect hoses from vent valve.



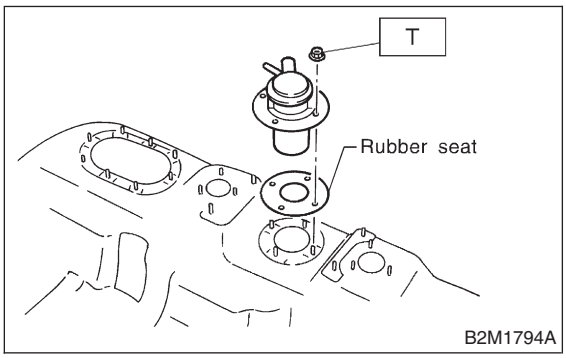
4) Remove nuts which install vent valve on fuel tank.



5) Installation is in the reverse order of removal.

CAUTION:
Replace rubber seat with a new one.

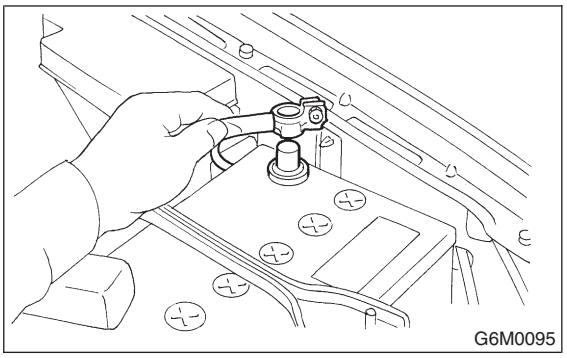
Tightening torque:
T: 4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



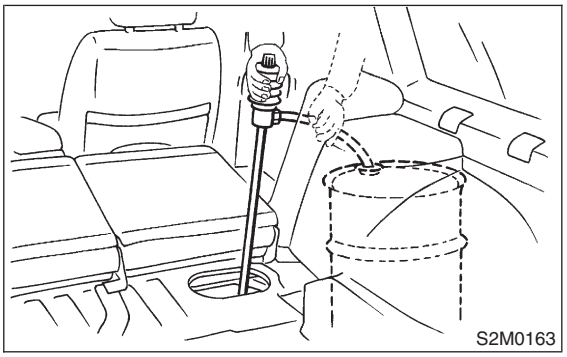
12. Shut Valve

A: REMOVAL AND INSTALLATION

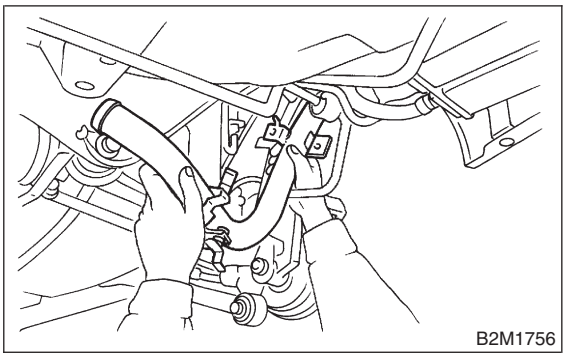
1) Disconnect battery ground cable.



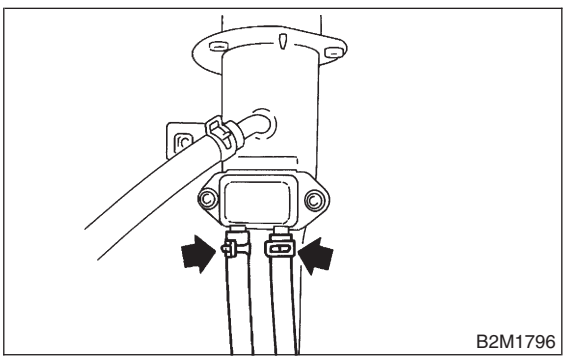
2) Drain fuel from fuel tank. <Ref. to 2-8 [W1C0].>



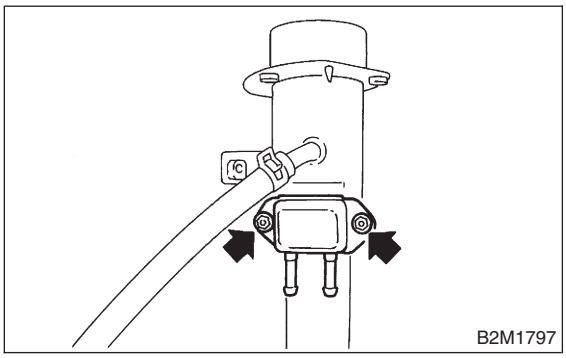
3) Remove fuel filler pipe. <Ref. to 2-8 [W3A1].>



4) Disconnect evaporation hoses from shut valve.

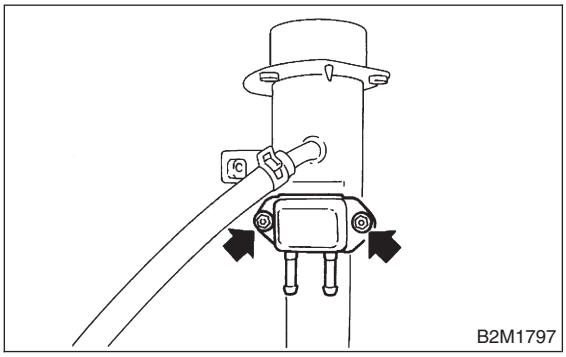


5) Remove shut valve from fuel filler pipe.



6) Installation is in the reverse order of removal.

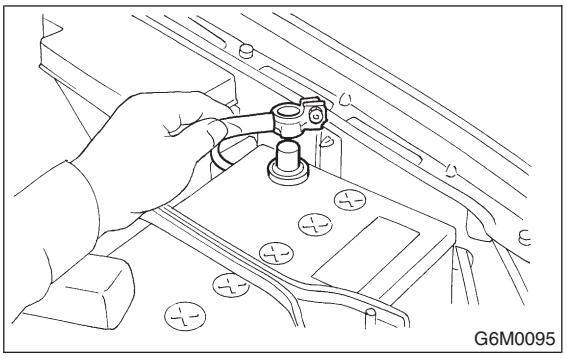
Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



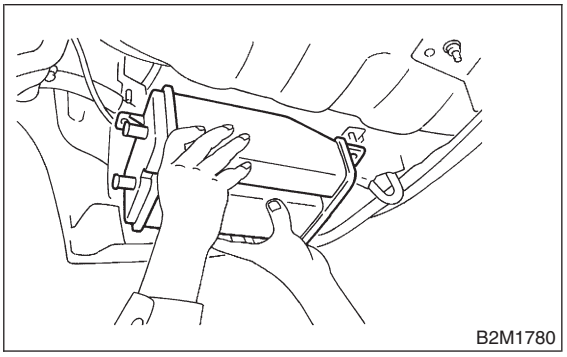
13. Drain Valve

A: REMOVAL AND INSTALLATION

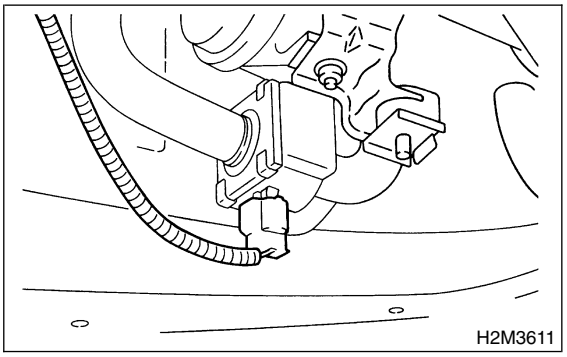
1) Disconnect battery ground cable.



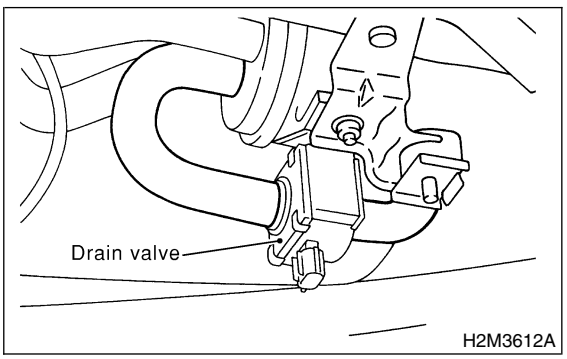
2) Lift-up the vehicle.
3) Remove canister. <Ref. to 2-1 [W3A0].>



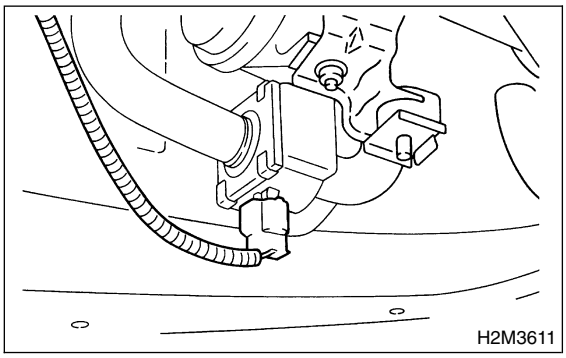
4) Disconnect connector from drain valve.



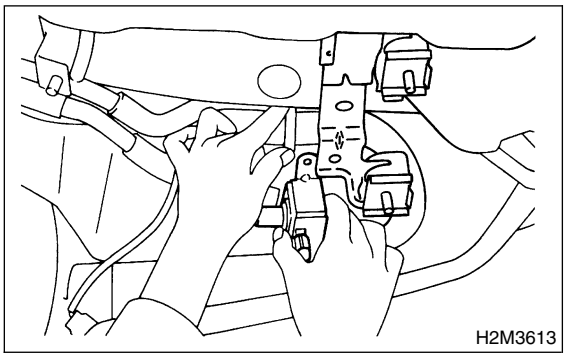
5) Disconnect evaporation hoses from drain valve.



6) Remove bolt which installs drain filter and drain valve brackets on body.

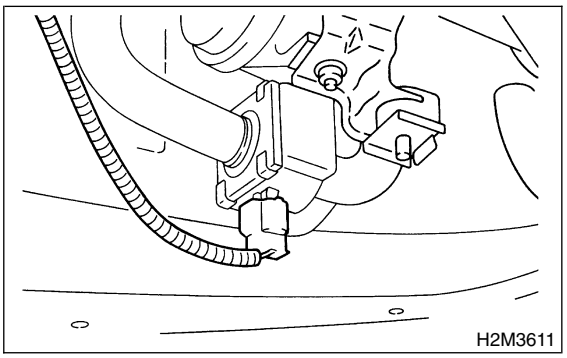


7) Move drain filter to upper side, and remove drain valve with bracket.



8) Installation is in the reverse order of removal.

Tightening torque:
22.5±7 N·m (2.3±0.7 kg-m, 16.6±5.1 ft-lb)



ON-CAR SERVICES 2-2

Page

W SERVICE PROCEDURE 2

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2. Ignition Timing 2
3. Engine Idle Speed 3
4. Engine Compression 4
5. Intake Manifold Vacuum 5
6. Engine Oil Pressure 5
7. Fuel Pressure 7
8. Valve Clearance 8

1. Foreword

This chapter describes major inspection and service procedures for the engine mounted on the body. For procedures not found in this chapter, refer to the service procedure section in the applicable chapter.

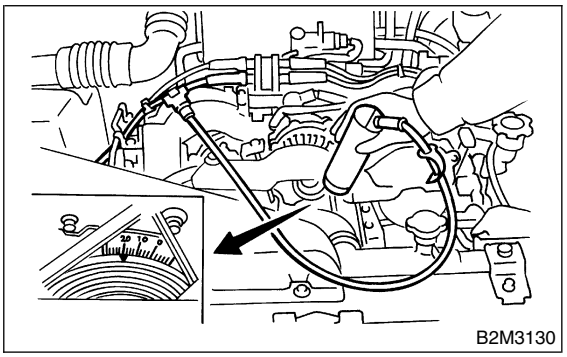
2. Ignition Timing

A: MEASUREMENT

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) Warm-up the engine.
2) To check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with the timing light.
3) Start the engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:
10°±8°/650 (MT model)
15°±8°/700 (AT model)



If the timing is not correct, check the ignition control system.
Refer to 2-7 On-Board Diagnostics II System. <Ref. to 2-7 [T100].>

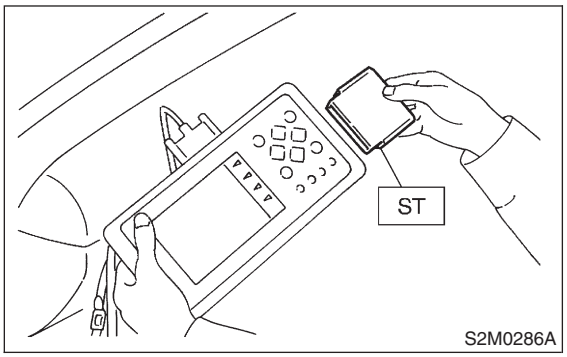
3. Engine Idle Speed

A: MEASUREMENT

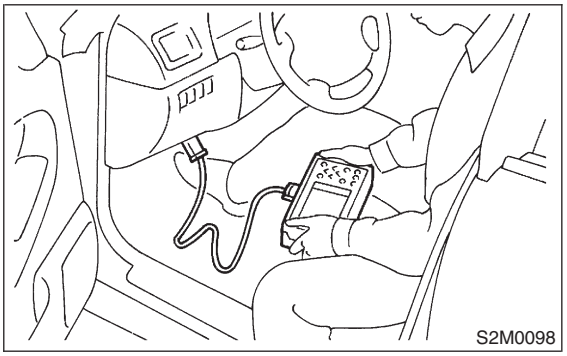
1) Before checking idle speed, check the following:
(1) Ensure that air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and that hoses are connected properly.
(2) Ensure that malfunction indicator light (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.
3) Stop the engine, and turn ignition switch to OFF.
4) When using SUBARU SELECT MONITOR;

NOTE:
For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

(1) Insert the cartridge to SUBARU SELECT MONITOR. <Ref. to 1-6 [G1100].>

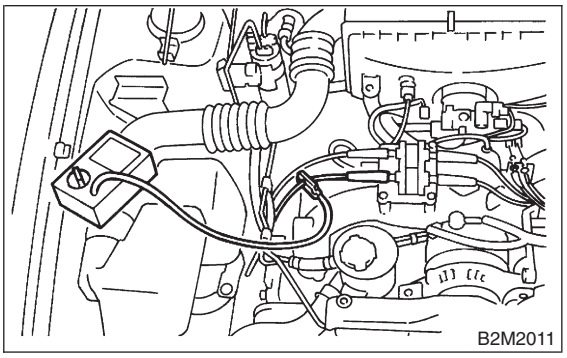


(2) Connect SUBARU SELECT MONITOR to the data link connector.
(3) Turn ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
(4) Select {2. Each System Check} in Main Menu.
(5) Select {Engine Control System} in Selection Menu.
(6) Select {1. Current Data Display & Save} in EGI/EMPI Diagnosis.
(7) Select {1.12 Data Display} in Data Display Menu.
(8) Start the engine, and read engine idle speed.



5) When using tachometer (Secondary pick-up type).
(1) Attach the pick-up clip to No. 1 cylinder spark plug cord.
(2) Start the engine, and read engine idle speed.

NOTE:
● When using the OBD-II general scan tool, carefully read its operation manual.
● This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.



6) Check idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed (No load and gears in neutral (MT), or N or P (AT) position):
650±100 rpm (MT model)
700±100 rpm (AT model)

7) Check idle speed when loaded. (Turn air conditioning switch to “ON” and operate compressor for at least one minute before measurement.)

Idle speed [A/C “ON”, no load and gears in neutral (MT) or N or P (AT) position]:
850±50 rpm

CAUTION:
Never rotate idle adjusting screw. If idle speed is out of specifications, refer to General On-board Diagnosis Table under "2-7 On-Board Diagnostics II System". <Ref. to 2-7 [T100].>

4. Engine Compression

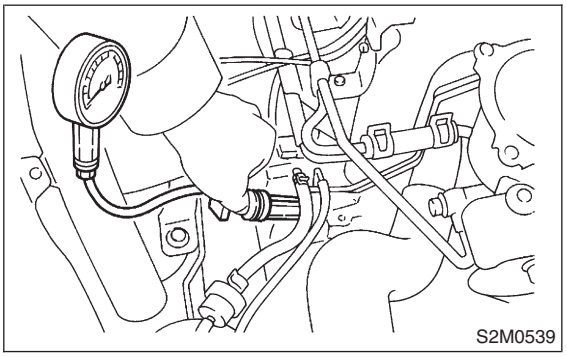
A: MEASUREMENT

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) After warming-up the engine, turn ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Disconnect battery ground cable.
4) Remove all the spark plugs. <Ref. to 6-1 [W3A0].>
5) Disconnect connectors from fuel injectors.
6) Connect battery ground cable.
7) Fully open throttle valve.
8) Check the starter motor for satisfactory performance and operation.
9) Hold the compression gauge tight against the spark plug hole.

CAUTION:
When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

10) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.



11) Perform at least two measurements per cylinder, and make sure that the values are correct.

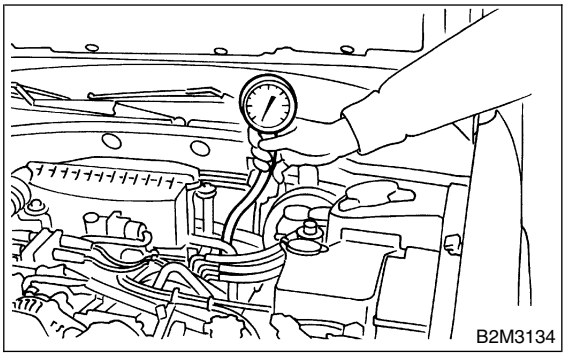
Compression (350 rpm and fully open throttle):
Standard;
1,079 — 1,275 kPa (11.0 — 13.0 kg/cm^2, 156 — 185 psi)
Limit;
1,020 kPa (10.4 kg/cm^2, 148 psi)
Difference between cylinders;
49 kPa (0.5 kg/cm^2, 7 psi), or less

5. Intake Manifold Vacuum

A: MEASUREMENT

1) Warm-up the engine.
2) Disconnect the brake vacuum hose and install the vacuum gauge to the hose fitting on the manifold.
3) Keep the engine at the idle speed and read the vacuum gauge indication.
By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.

Vacuum pressure (at idling, A/C "OFF"): Less than –60.0 kPa (–450 mmHg, –17.72 inHg)

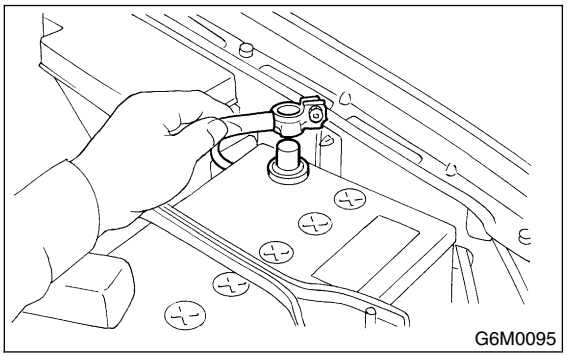

B2M3134

Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket or disconnection or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

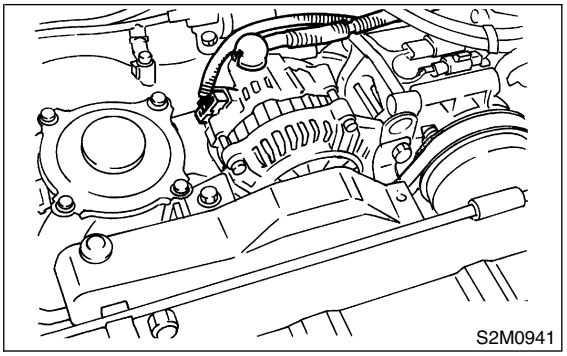
6. Engine Oil Pressure

A: MEASUREMENT

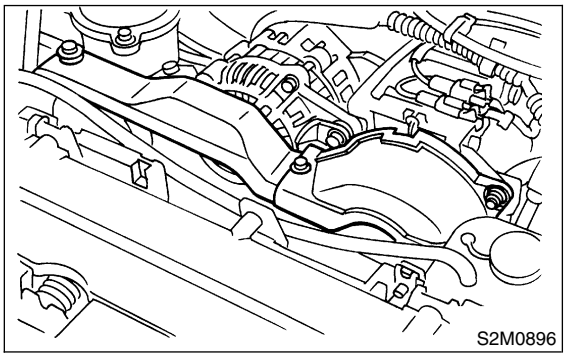
1) Disconnect battery ground cable.


G6M0095

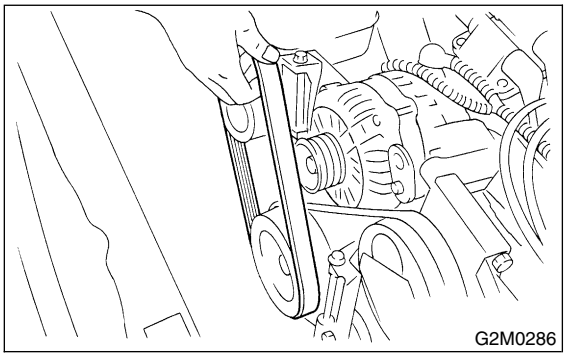
2) Remove generator from bracket.
(1) Disconnect connector and terminal from generator.


S2M0941

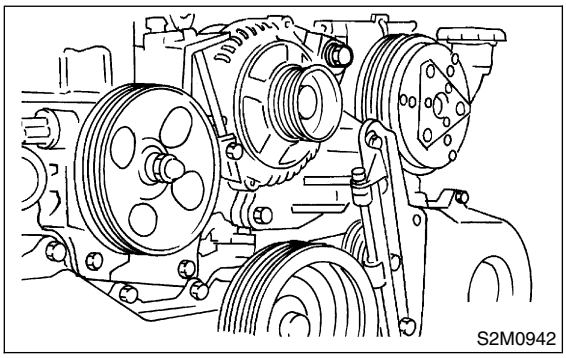
(2) Remove V-belt cover.


S2M0896

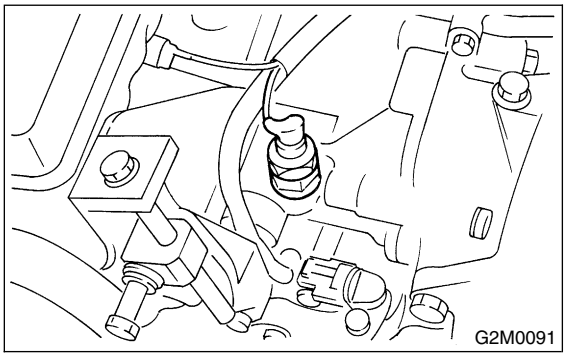
(3) Loosen lock bolt and slider bolt, and remove front side V-belt.


G2M0286

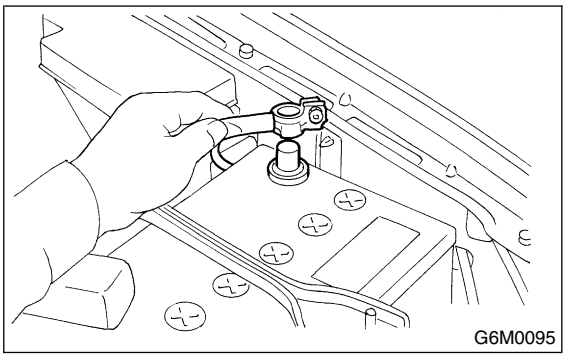
(4) Remove generator lock bolt.
(5) Remove bolt which install generator on bracket.


S2M0942

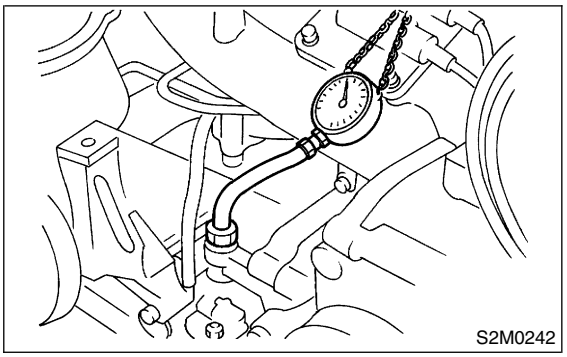
3) Disconnect connector from oil pressure switch.
4) Remove oil pressure switch from engine cylinder block. <Ref. to 2-4 [W3A0].>


G2M0091

5) Connect oil pressure gauge hose to cylinder block.
6) Connect battery ground cable.


G6M0095

7) Start the engine, and measure oil pressure.


S2M0242

Oil pressure:
98 kPa (1.0 kg/cm^2,14 psi) or more at 800 rpm
294 kPa (3.0 kg/cm^2, 43 psi) or more at 5,000 rpm

CAUTION:
● If oil pressure is out of specification, check oil pump, oil filter and lubrication line. Refer to 2-4 ENGINE LUBRICATION SYSTEM. <Ref. to 2-4 [W100].>
● If oil pressure warning light is turned ON and oil pressure is in specification, replace oil pressure switch. Ref. to 2-4 ENGINE LUBRICATION SYSTEM. <Ref. to 2-4 [W300].>

NOTE:
The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring oil pressure, install oil pressure switch. <Ref. to 2-4 [W3B0].>

Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)

9) Install generator and V-belt in the reverse order of removal, and adjust the V-belt deflection. <Ref. to 1-5 [G2A0].>

7. Fuel Pressure

A: PRECAUTIONS

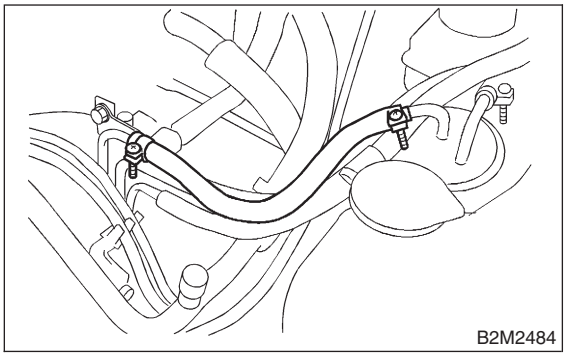
WARNING:
- **Place "No fire" signs near the working area.**
- **Disconnect ground terminal from battery.**
- **Be careful not to spill fuel on the floor.**

B: MEASUREMENT OF FUEL PRESSURE

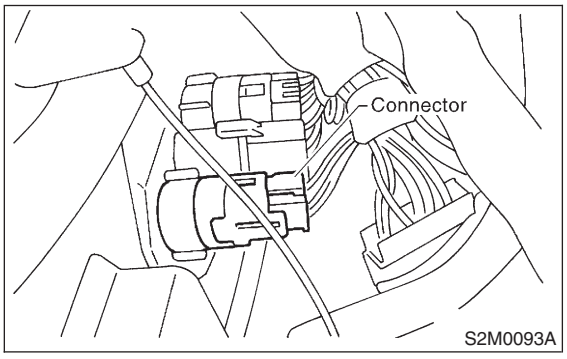
WARNING:
Before removing fuel pressure gauge, release fuel pressure.

NOTE:
If out of specification, check or replace pressure regulator and pressure regulator vacuum hose.

1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Remove fuel filler cap.
3) Disconnect fuel delivery hoses from fuel filter, and connect fuel pressure gauge.


B2M2484

4) Connect connector to fuel pump relay.

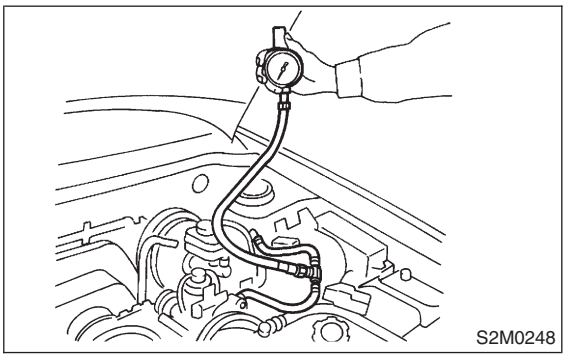


S2M0093A

5) Start the engine.

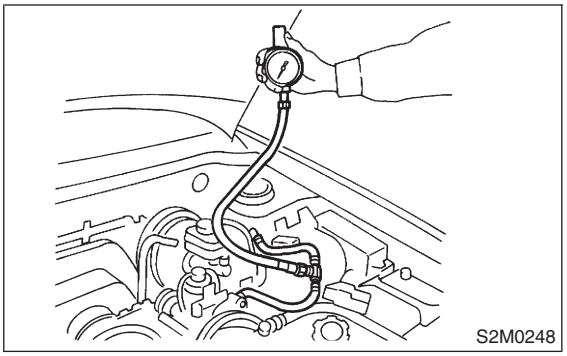
6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from collector chamber.

Fuel pressure:
Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)


S2M0248

7) After connecting pressure regulator vacuum hose, measure fuel pressure.

Fuel pressure:
Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm^2, 30 — 34 psi)


S2M0248

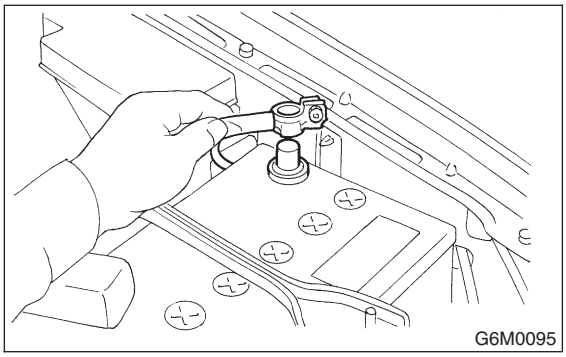
NOTE:
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1.4 to 2.8 psi) higher than standard values during high-altitude operations.

8. Valve Clearance

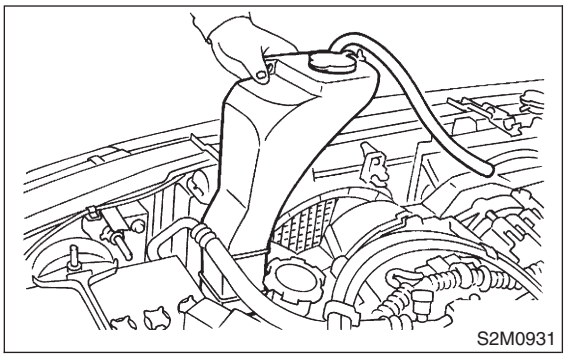
A: INSPECTION

CAUTION:
Inspection and adjustment of valve clearance should be performed while engine is cold.

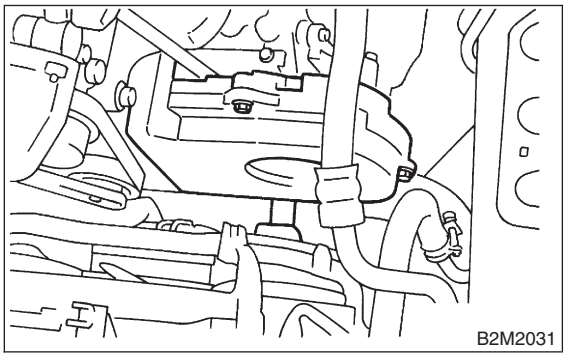
1) Set the vehicle onto the lift.
2) Disconnect battery ground cable.


G6M0095

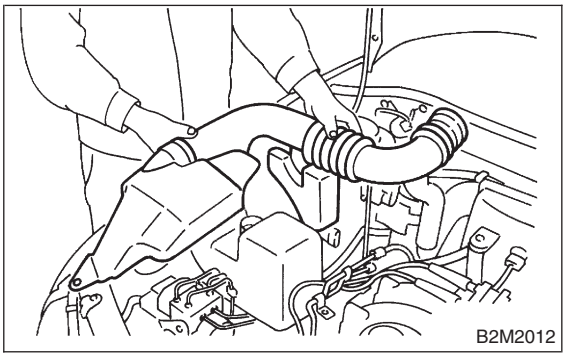
3) Remove engine coolant reservoir tank.
<Ref. to 2-5 [W8A0].>


S2M0931

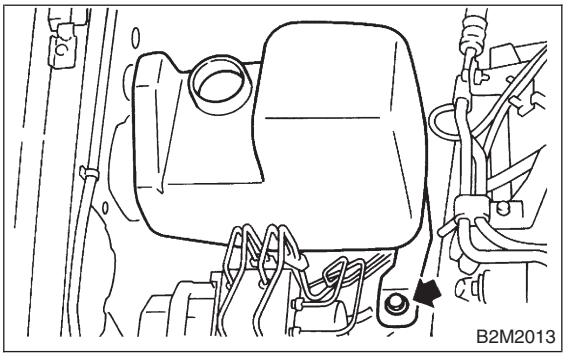
4) Remove timing belt cover (LH).


B2M2031

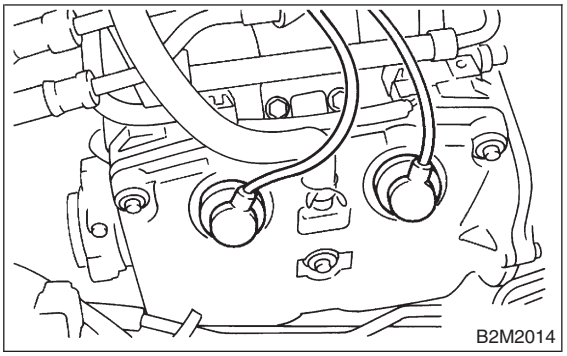
5) Remove rocker cover.
6) When inspecting #1 and #3 cylinders:
(1) Remove air intake duct as a unit.


B2M2012

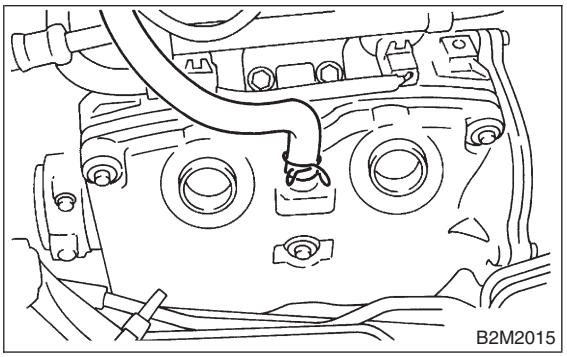
(2) Remove resonator chamber.


B2M2013

(3) Disconnect spark plug cords from spark plugs (#1 and #3 cylinders).

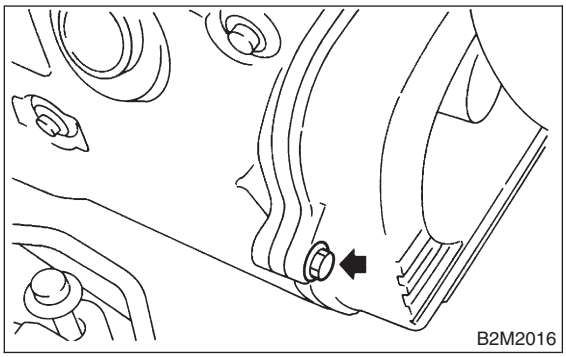

B2M2014

(4) Disconnect blow-by hose from rocker cover (RH).

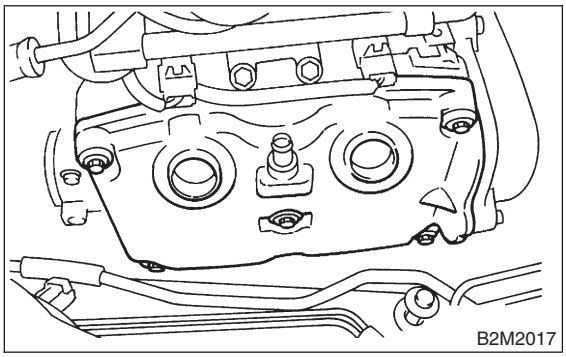

B2M2015

(5) Lift-up the vehicle.
(6) Remove under cover.

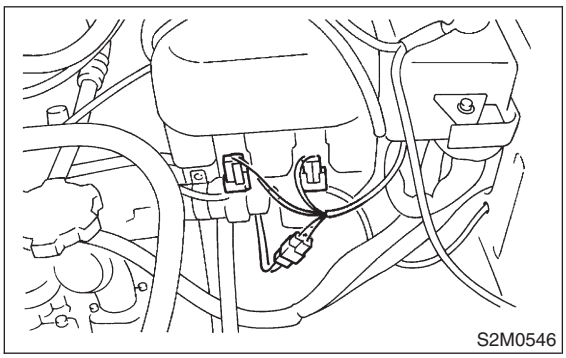
(7) Place suitable container under the vehicle.
(8) Lower the vehicle.
(9) Remove the timing belt cover (RH) bolt.


B2M2016

(10) Remove rocker cover bolts, then remove rocker cover (RH).

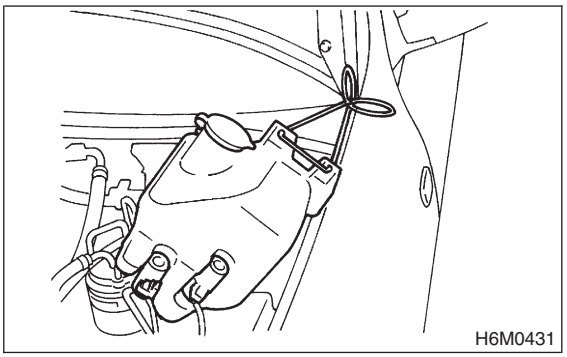

B2M2017

7) When inspecting #2 and #4 cylinders:
(1) Disconnect battery cables, and then remove battery and battery carrier.
(2) Disconnect front window washer motor connector.
(3) Disconnect rear gate glass washer motor connector.

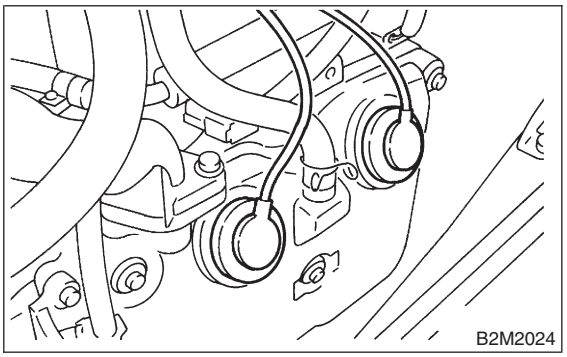

S2M0546

(4) Disconnect rear gate glass washer hose from washer motor, then plug connection with a suitable cap.

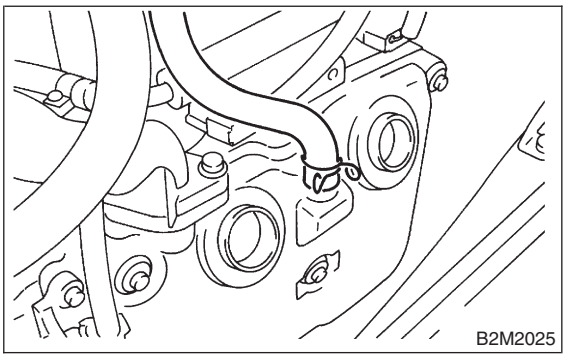
(5) Remove the two bolts which hold washer tank, then secure the tank away from working area.


H6M0431

(6) Disconnect spark plug cords from spark plugs (#2 and #4 cylinders).

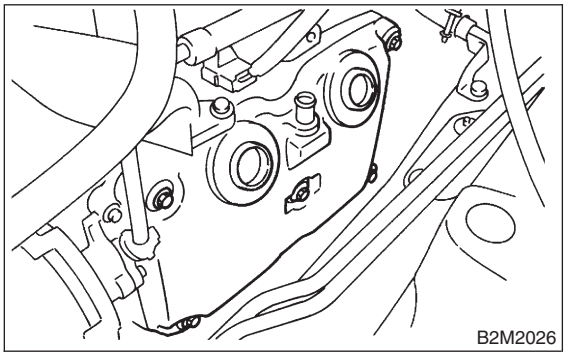

B2M2024

(7) Disconnect blow-by hose form rocker cover.


B2M2025

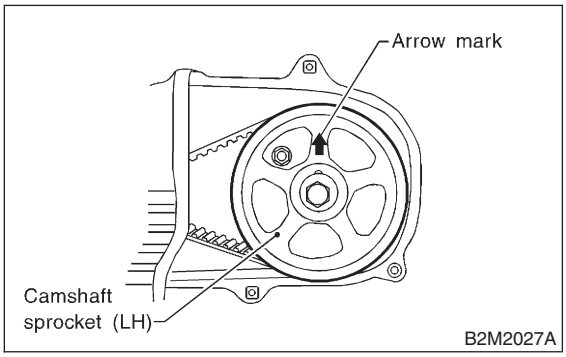
(8) Lift-up the vehicle.
(9) Remove under cover.
(10) Place suitable container under the vehicle.

(11) Remove rocker cover bolts, then remove rocker cover (LH).



8) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

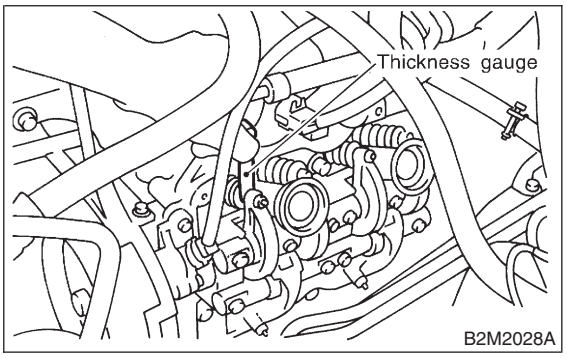
NOTE:
When arrow mark on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of the compression stroke.



9) Measure #1 cylinder valve clearance by using thickness gauge.

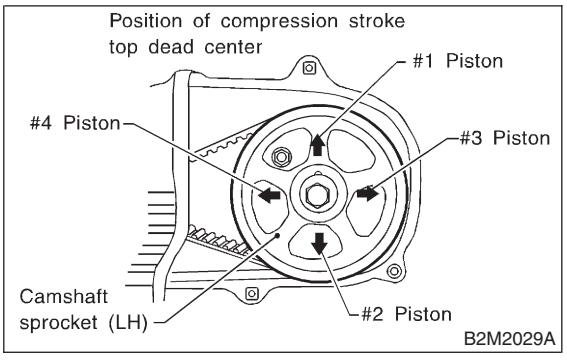
CAUTION:
● Insert the thickness gauge in at as horizontal a direction as a possible with respect to the valve stem end face.
● Measure exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake: 0.20±0.02 mm (0.0079±0.0008 in)
Exhaust: 0.25±0.02 mm (0.0098±0.0008 in)



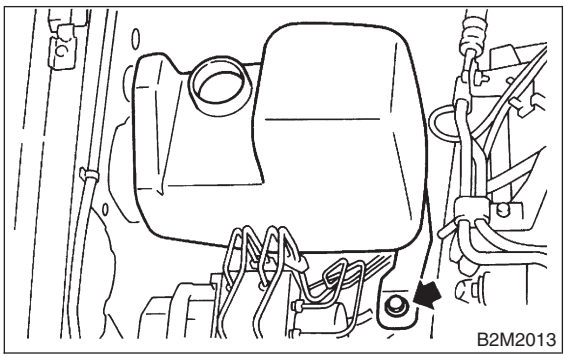
10) If necessary, adjust the valve clearance. <Ref. to 2-2 [W7B0].>
11) Similar to measurement procedures used for #1 cylinder, measure #2, #3 and #4 cylinder valve clearances.

NOTE:
● Be sure to set cylinder pistons to their respective top dead centers on the compression stroke before measuring valve clearances.
● To set #3, #2 and #4 cylinder pistons to their top dead centers on the compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



12) After inspection, install the related parts in the reverse order of removal.

Tightening torque:
33±10 N·m (3.4±1.0 kg-m, 25±7 ft-lb)

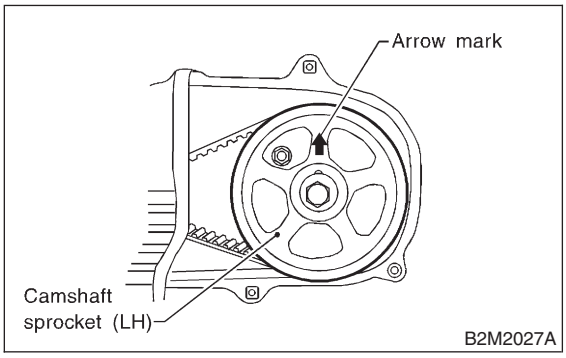

B2M2013

B: ADJUSTMENT

CAUTION:
Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:
When arrow mark on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of the compression stroke.



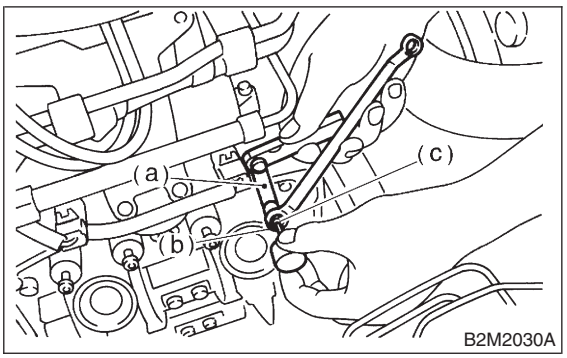
B2M2027A

2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Place suitable thickness gauge.
(3) While noting valve clearance, tighten valve rocker adjust screw.
(4) When specified valve clearance is obtained, tighten valve rocker nut.

Tightening torque:
10±1 N·m (1.0±0.1 kg-m, 7.2±0.7 ft-lb)

CAUTION:
• Insert the thickness gauge in at as horizontal a direction as possible with respect to the valve stem end face.
• Adjust exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake: 0.20±0.02 mm (0.0079±0.0008 in)
Exhaust: 0.25±0.02 mm (0.0098±0.0008 in)



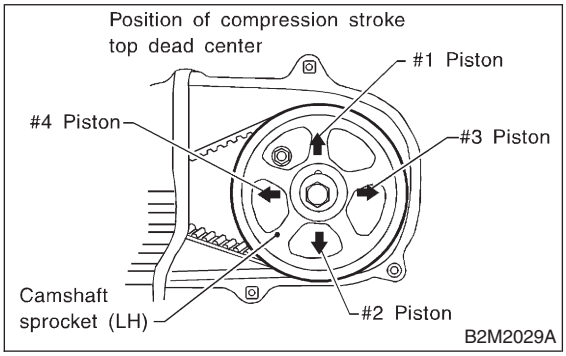
B2M2030A

(a) Thickness gauge
(b) Valve rocker nut
(c) Valve rocker screw

3) Ensure that valve clearances are within specifications.
4) Turn crankshaft two complete rotations until #1 cylinder piston is again set to top dead center on compression stroke.
5) Ensure that valve clearances are within specifications. If necessary, re-adjust valve clearances.

6) Similar to adjustment procedures used for #1 cylinder, adjust #2, #3 and #4 cylinder valve clearances.

NOTE:
- Be sure to set cylinder pistons to their respective top dead centers on the compression stroke before adjusting valve clearances.
- To set #3, #2 and #4 cylinder pistons to their top dead centers on the compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



ENGINE 2-3

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1. Engine

A: SPECIFICATIONS

Engine	Type			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve arrangement			Belt driven, single over-head camshaft, 4-valve/cylinder
	Bore x Stroke		mm (in)	99.5 x 79.0 (3.917 x 3.110)
	Displacement		cm^3 (cu in)	2,457 (150)
	Compression ratio			10.0
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm^2, psi)	1,079 — 1,275 (11.0 — 13.0, 156 — 185)
	Number of piston rings			Pressure ring: 2, Oil ring: 1
	Intake valve timing	Opening		1° BTDC
		Closing		51° ABDC
	Exhaust valve timing	Opening		50° BBDC
		Closing		6° ATDC
	Valve clearance	Intake	mm (in)	0.20±0.02 (0.0079±0.0008)
		Exhaust	mm (in)	0.25±0.02 (0.0098±0.0008)
	Idling speed [At neutral position on MT, or “P” or “N” position on AT]		rpm	700±100 (No load) 850±100 (A/C switch ON)
	Firing order			1 → 3 → 2 → 4
	Ignition timing		BTDC/rpm	10°±10°/700

B: SERVICE DATA

NOTE:
STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter US: Undersize OS: Oversize

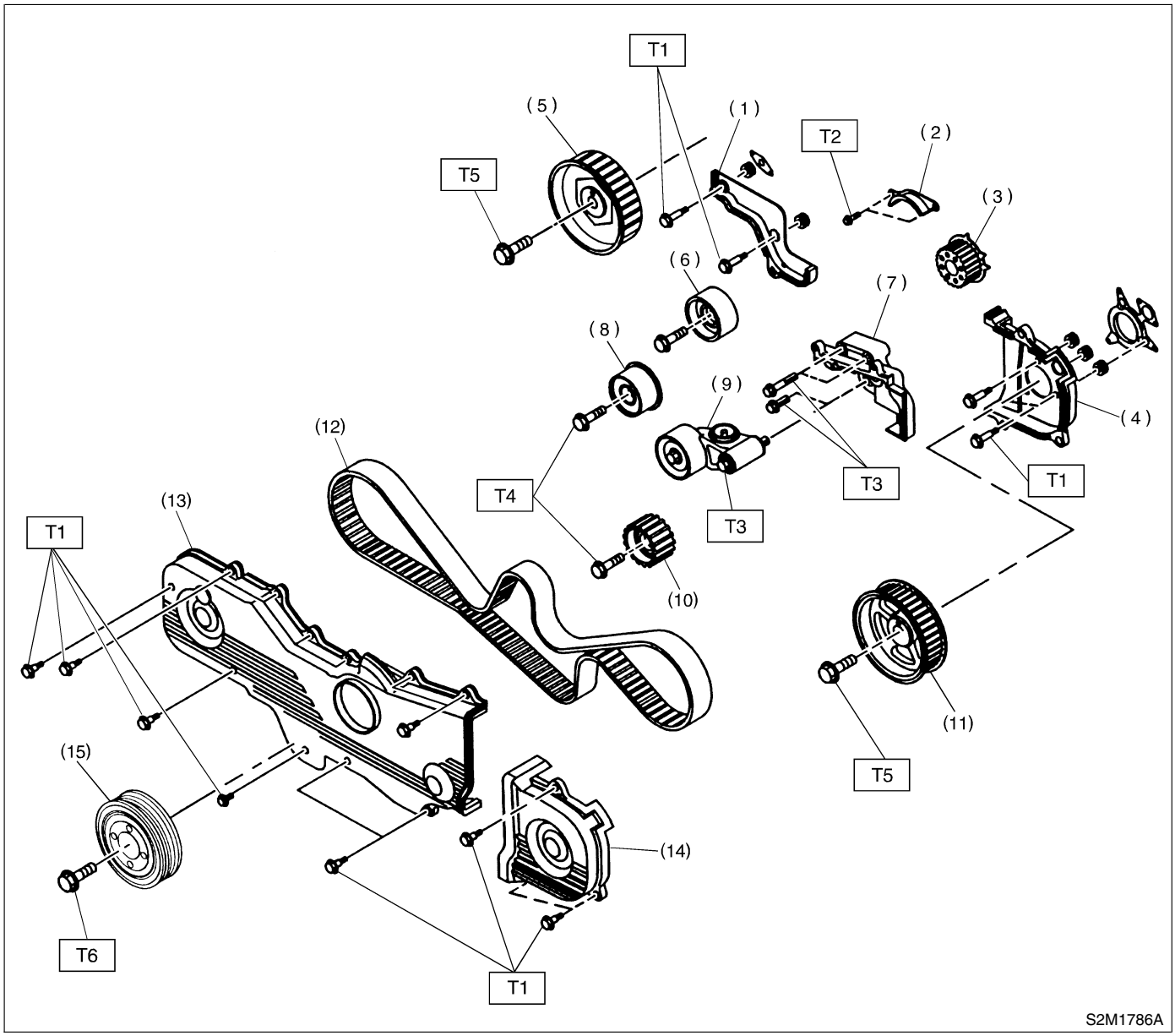
Belt tensioner adjuster	Protrusion of adjuster rod			5.2 — 6.2 mm (0.205 — 0.244 in)
Belt tensioner	Spacer O.D.			17.955 — 17.975 mm (0.7069 — 0.7077 in)
	Tensioner bush I.D.			18.00 — 18.08 mm (0.7087 — 0.7118 in)
	Clearance between spacer and bush		STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)
			Limit	0.175 mm (0.0069 in)
	Side clearance of spacer		STD	0.20 — 0.55 mm (0.0079 — 0.0217 in)
			Limit	0.81 mm (0.0319 in)
Valve rocker arm	Clearance between shaft and arm		STD	0.020 — 0.054 mm (0.0008 — 0.0021 in)
			Limit	0.10 mm (0.0039 in)
Camshaft	Bend limit			0.020 mm (0.0008 in)
	Thrust clearance		STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)
			Limit	0.11 mm (0.0043 in)
	Cam lobe height	Intake	STD	39.485 — 39.585 mm (1.5545 — 1.5585 in)
			Limit	39.385 mm (1.5506 in)
		Exhaust	STD	39.257 — 39.357 mm (1.5455 — 1.5495 in)
			Limit	39.157 mm (1.5416 in)
	Camshaft journal O.D.			31.928 — 31.945 mm (1.2570 — 1.2577 in)
	Camshaft journal hole I.D.			32.000 — 32.018 mm (1.2598 — 1.2605 in)
	Oil clearance		STD	0.055 — 0.090 mm (0.0022 — 0.0035 in)
			Limit	0.10 mm (0.0039 in)
Cylinder head	Surface warpage limit			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Standard height			98.3 mm (3.870 in)

Valve set	Refacing angle			90°
	Contacting width	Intake	STD	1.0 mm (0.039 in)
			Limit	1.7 mm (0.067 in)
		Exhaust	STD	1.4 mm (0.055 in)
			Limit	2.1 mm (0.083 in)
Valve guide	Inner diameter			6.000 — 6.012 mm (0.2362 — 0.2367 in)
	Protrusion above head		Intake	20.0 — 20.5 mm (0.787 — 0.807 in)
			Exhaust	16.5 — 17.0 mm (0.650 — 0.669 in)
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)
			Limit	0.6 mm (0.024 in)
		Exhaust	STD	1.2 mm (0.047 in)
			Limit	0.6 mm (0.024 in)
	Stem diameter		Intake	5.950 — 5.965 mm (0.2343 — 0.2348 in)
			Exhaust	5.945 — 5.960 mm (0.2341 — 0.2346 in)
	Stem oil clearance	STD	Intake	0.035 — 0.062 mm (0.0014 — 0.0024 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	120.6 mm (4.75 in)
			Exhaust	121.7 mm (4.79 in)
Valve spring	Free length			54.30 mm (2.1378 in)
	Squareness			2.5°, 2.4 mm (0.094 in)
	Tension/spring height			214.8 — 246.2 N (21.9 — 25.1 kg, 48.3 — 55.3 lb)/45.0 mm (1.772 in) 526.6 — 581.6 N (53.7 — 59.3 kg, 118.4 — 130.8 lb)/34.7 mm (1.366 in)
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Cylinder bore	STD	A	99.505 — 99.515 mm (3.9175 — 3.9179 in)
			B	99.495 — 99.505 mm (3.9171 — 3.9175 in)
	Taper		STD	0.015 mm (0.0006 in)
			Limit	0.050 mm (0.0020 in)
	Out-of-roundness		STD	0.010 mm (0.0004 in)
			Limit	0.050 mm (0.0020 in)
	Piston clearance		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.050 mm (0.0020 in)
	Enlarging (boring) limit			0.5 mm (0.020 in)
Piston	Outer diameter	STD	A	99.485 — 99.495 mm (3.9167 — 3.9171 in)
			B	99.475 — 99.485 mm (3.9163 — 3.9167 in)
		0.25 mm (0.0098 in) OS		99.725 — 99.735 mm (3.9262 — 3.9266 in)
		0.50 mm (0.0197 in) OS		99.975 — 99.985 mm (3.9360 — 3.9364 in)
	Standard inner diameter of piston pin hole			23.000 — 23.006 mm (0.9055 — 0.9057 in)
Piston pin	Outer diameter			22.994 — 23.000 mm (0.9053 — 0.9055 in)
	Standard clearance between piston pin and hole in piston			0.004 — 0.008 mm (0.0002 — 0.0003 in)
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).

Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.35 — 0.50 mm (0.0138 — 0.0197 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.70 mm (0.0079 — 0.0276 in)
			Limit	1.5 mm (0.059 in)
	Clearance between piston ring and piston ring groove	Top ring	STD	0.040 — 0.080 mm (0.0016 — 0.0031 in)
			Limit	0.15 mm (0.0059 in)
		Second ring	STD	0.030 — 0.070 mm (0.0012 — 0.0028 in)
			Limit	0.15 mm (0.0059 in)
Connecting rod	Bend twist per 100 mm (3.94 in) in length		Limit	0.10 mm (0.0039 in)
	Side clearance		STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)
			Limit	0.4 mm (0.016 in)
Connecting rod bearing	Oil clearance		STD	0.020 — 0.046 mm (0.0008 — 0.0018 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.486 — 1.498 mm (0.0585 — 0.0590 in)
			0.03 mm (0.0012 in) US	1.504 — 1.512 mm (0.0592 — 0.0595 in)
			0.05 mm (0.0020 in) US	1.514 — 1.522 mm (0.0596 — 0.0599 in)
			0.25 mm (0.0098 in) US	1.614 — 1.622 mm (0.0635 — 0.0639 in)
Connecting rod bushing	Clearance between piston pin and bushing		STD	0 — 0.022 mm (0 — 0.0009 in)
			Limit	0.030 mm (0.0012 in)
Crankshaft	Bend limit			0.035 mm (0.0014 in)
	Crank pin and crank journal	Out-of-roundness		0.020 mm (0.0008 in) or less
		Grinding limit		0.250 mm (0.0098 in)
	Crank pin outer diameter		STD	51.984 — 52.000 mm (2.0466 — 2.0472 in)
			0.03 mm (0.0012 in) US	51.954 — 51.970 mm (2.0454 — 2.0461 in)
			0.05 mm (0.0020 in) US	51.934 — 51.950 mm (2.0446 — 2.0453 in)
			0.25 mm (0.0098 in) US	51.734 — 51.750 mm (2.0368 — 2.0374 in)
	Crank journal outer diameter	#1, #5, #3	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)
		#2, #4	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)
	Thrust clearance		STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)
			Limit	0.25 mm (0.0098 in)
	Oil clearance		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.040 mm (0.0016 in)

Crankshaft bearing	Crankshaft bearing thickness	#1, #5	STD	1.998 — 2.011 mm (0.0787 — 0.0792 in)
			0.03 mm (0.0012 in) US	2.017 — 2.020 mm (0.0794 — 0.0795 in)
			0.05 mm (0.0020 in) US	2.027 — 2.030 mm (0.0798 — 0.0799 in)
			0.25 mm (0.0098 in) US	2.127 — 2.130 mm (0.0837 — 0.0839 in)
		#2, #3, #4	STD	2.000 — 2.013 mm (0.0787 — 0.0793 in)
			0.03 mm (0.0012 in) US	2.019 — 2.022 mm (0.0795 — 0.0796 in)
			0.05 mm (0.0020 in) US	2.029 — 2.032 mm (0.0799 — 0.0800 in)
			0.25 mm (0.0098 in) US	2.129 — 2.132 mm (0.0838 — 0.0839 in)

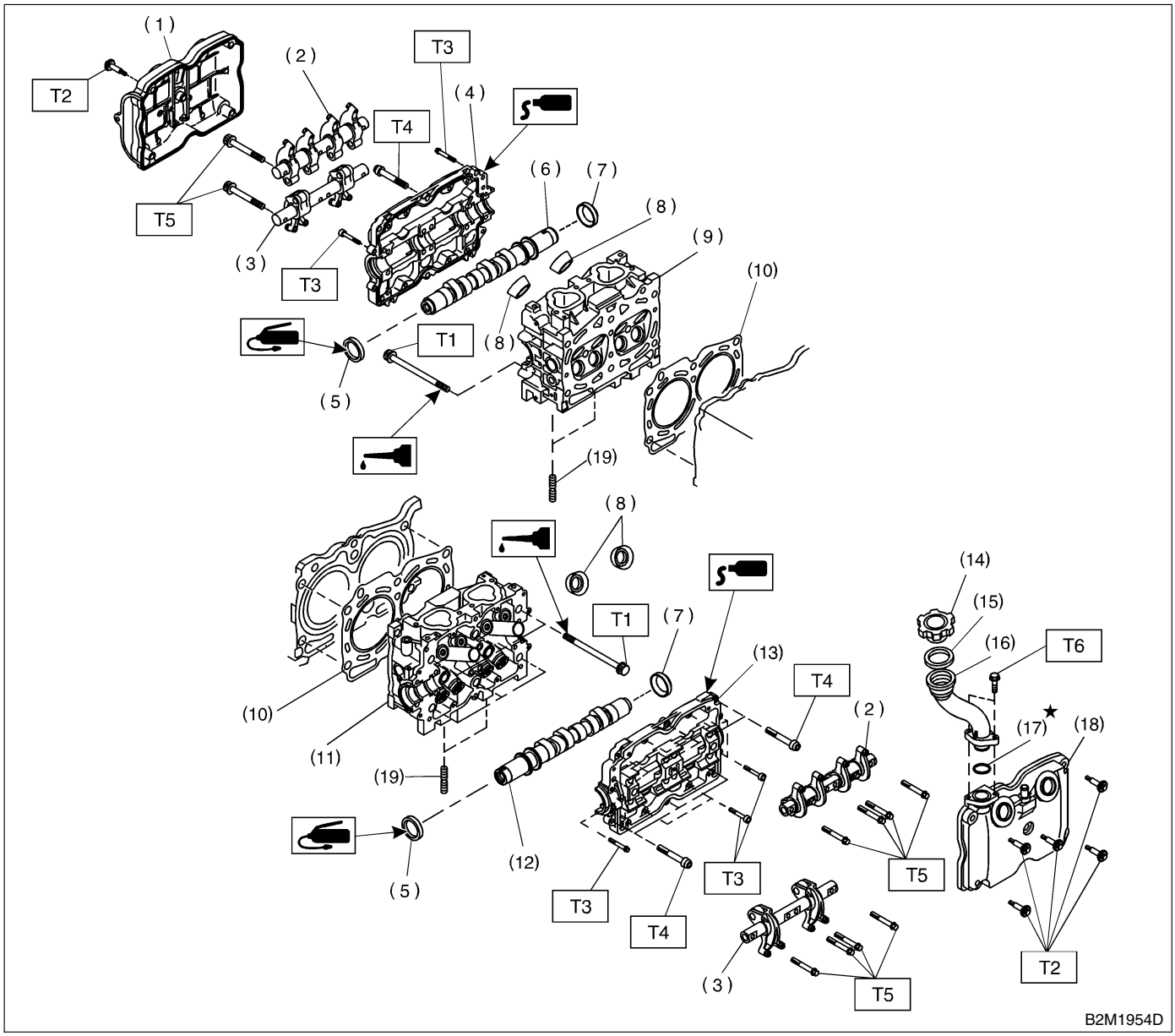
1. Timing Belt



(1) Belt cover No. 2 (RH)
(2) Timing belt guide (MT vehicles only)
(3) Crankshaft sprocket
(4) Belt cover No. 2 (LH)
(5) Camshaft sprocket No. 1
(6) Belt idler (No. 1)
(7) Tensioner bracket
(8) Belt idler (No. 2)
(9) Automatic belt tension adjuster ASSY
(10) Belt idler No. 2
(11) Camshaft sprocket No. 2
(12) Timing belt
(13) Front belt cover
(14) Belt cover (LH)
(15) Crankshaft pulley

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 9.8±1.0 (1.0±0.1, 7.2±0.7)
T3: 25±3 (2.5±0.3, 18.1±2.2)
T4: 39±4 (4.0±0.4, 28.9±2.9)
T5: 78±5 (8.0±0.5, 57.9±3.6)
T6: 177±5 (18.0±0.5, 130.2±3.6)

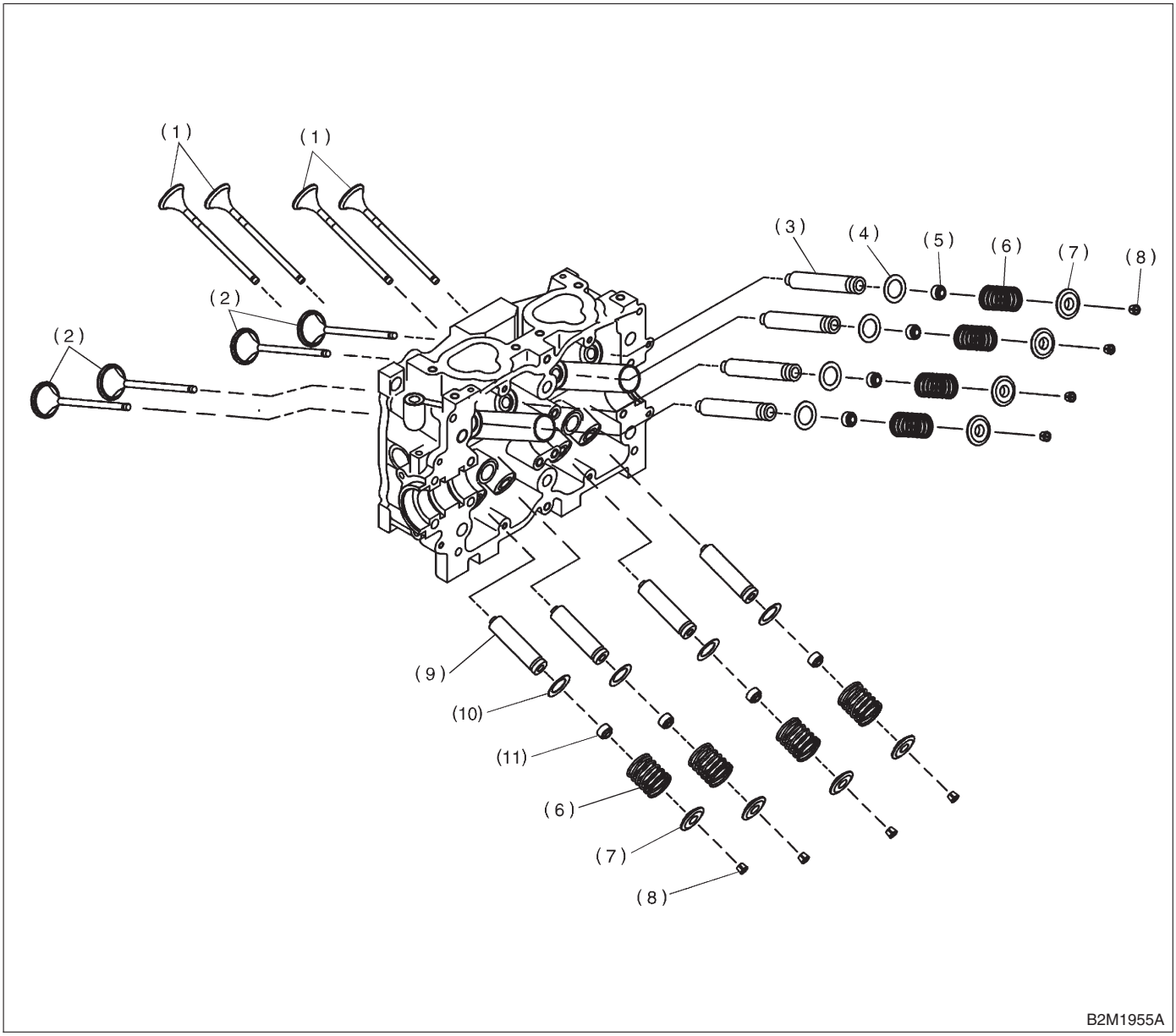
2. Cylinder Head and Camshaft



(1) Rocker cover (RH)
(2) Intake valve rocker ASSY
(3) Exhaust valve rocker ASSY
(4) Camshaft cap (RH)
(5) Oil seal
(6) Camshaft (RH)
(7) Plug
(8) Spark plug pipe gasket
(9) Cylinder head (RH)
(10) Cylinder head gasket
(11) Cylinder head (LH)
(12) Camshaft (LH)
(13) Camshaft cap (LH)
(14) Oil filler cap
(15) Gasket
(16) Oil filler pipe
(17) O-ring
(18) Rocker cover (LH)
(19) Stud bolt

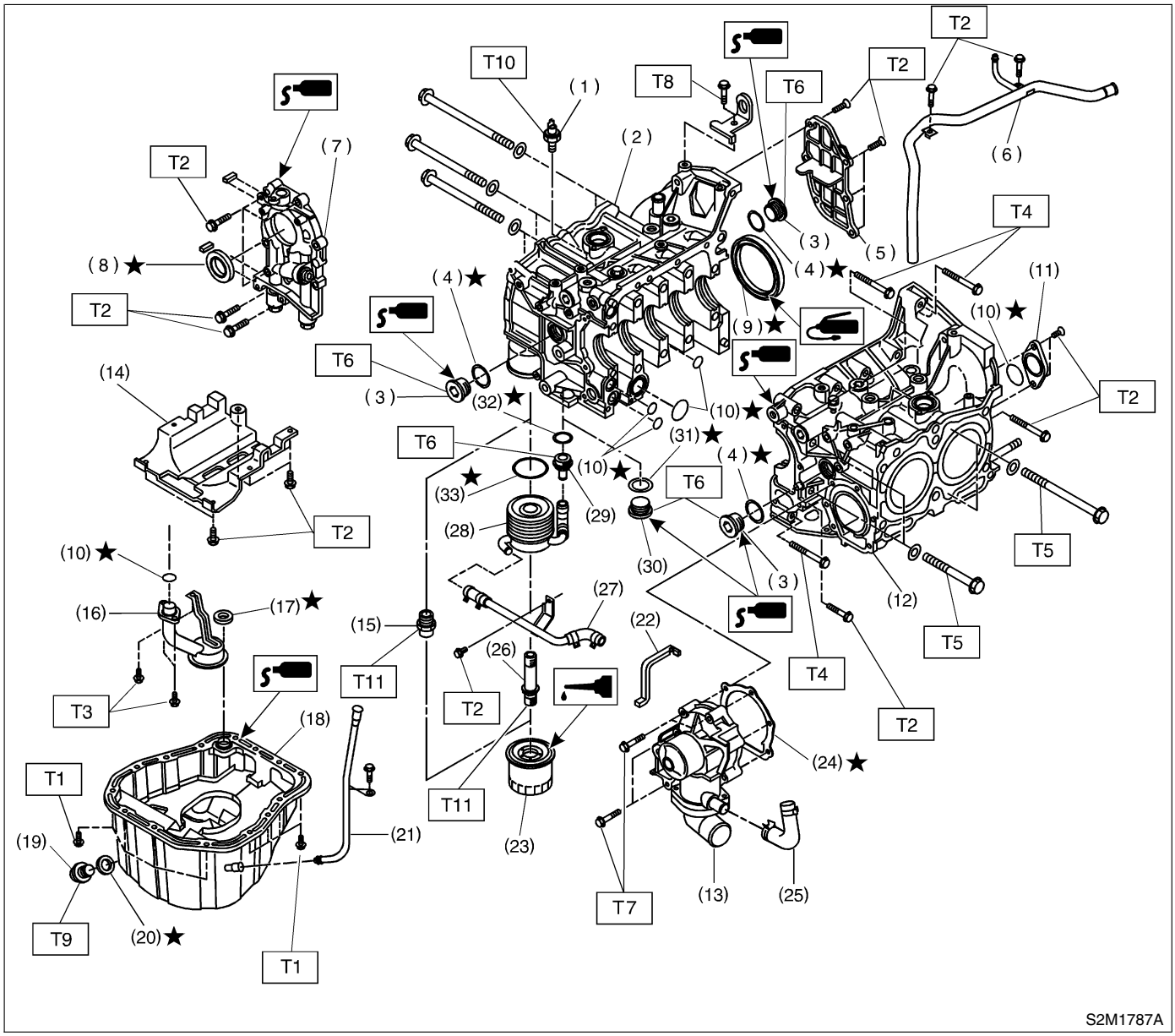
Tightening torque: N·m (kg-m, ft-lb)
T1: Refer to [W6E1].
T2: 5±1 (0.5±0.1, 3.6±0.7)
T3: 10±2 (1.0±0.2, 7.2±1.4)
T4: 18±2 (1.8±0.2, 13.0±1.4)
T5: 25±2 (2.5±0.2, 18.1±1.4)
T6: 6.4±0.5 (0.65±0.05, 4.7±0.4)

3. Cylinder Head and Valve Assembly



(1) Exhaust valve
(2) Intake valve
(3) Intake valve guide
(4) Intake valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Retainer key
(9) Exhaust valve guide
(10) Exhaust valve spring seat
(11) Exhaust valve oil seal

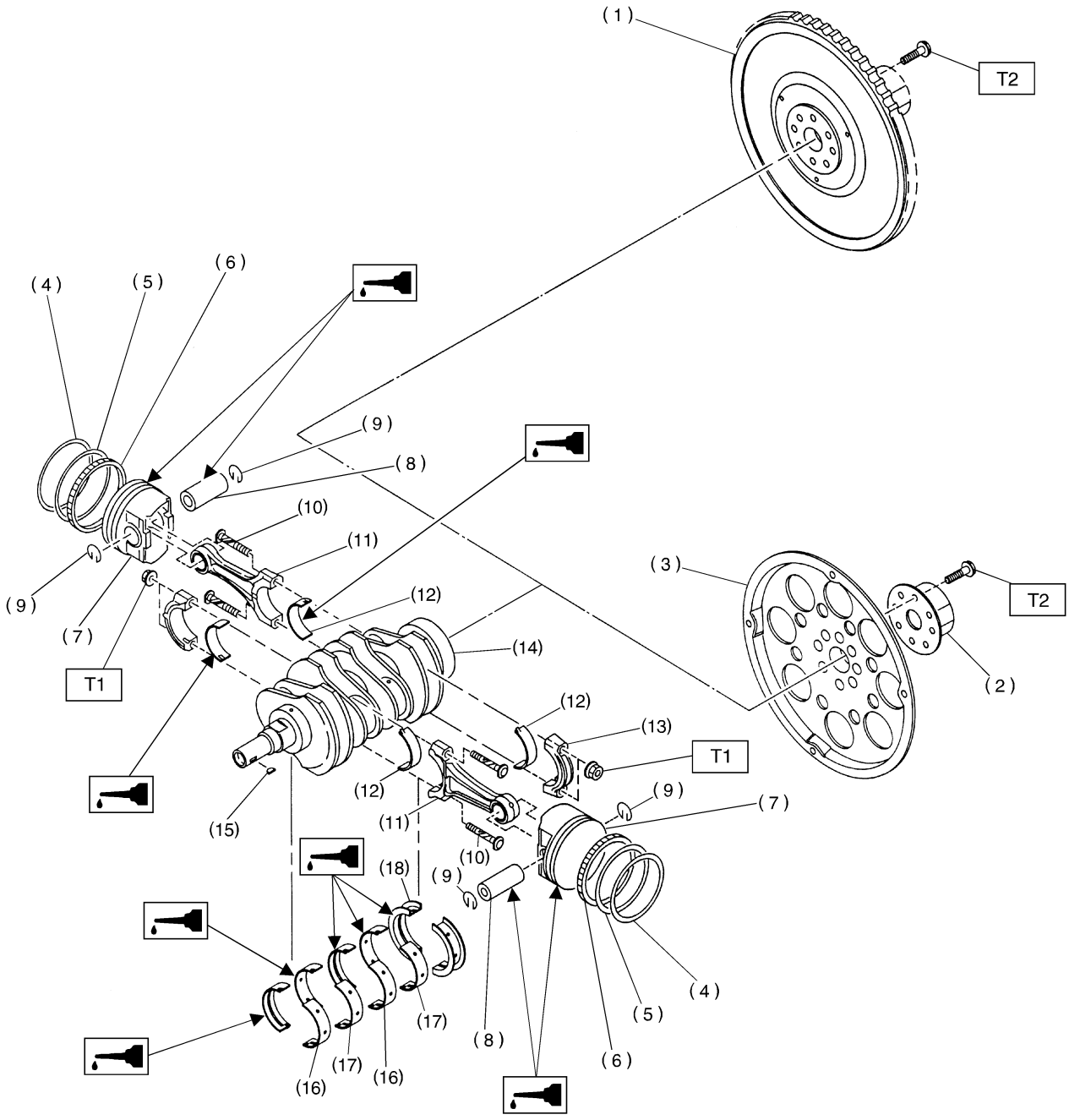
4. Cylinder Block



(1) Oil pressure switch
(2) Cylinder block (RH)
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block (LH)
(13) Water pump
(14) Baffle plate
(15) Oil filter connector
(16) Oil strainer
(17) Gasket
(18) Oil pan
(19) Drain plug
(20) Metal gasket
(21) Oil level gauge guide
(22) Water pump sealing
(23) Oil filter
(24) Gasket
(25) Water pump hose
(26) Connector (AT vehicles)
(27) Water by-pass pipe (AT vehicles)
(28) Oil cooler (AT vehicles)
(29) Nipple (AT vehicles)
(30) Oil cooler connector (MT vehicles)
(31) Gasket (MT vehicles)
(32) Gasket (AT vehicles)
(33) O-ring

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7)
T4: 25±2 (2.5±0.2, 18.1±1.4)
T5: 47±3 (4.8±0.3, 34.7±2.2)
T6: 69±7 (7.0±0.7, 50.6±5.1)
T7: First 12±2 (1.2±0.2, 8.7±1.4)
Second 12±2 (1.2±0.2, 8.7±1.4)
T8: 16±1.5 (1.6±0.15, 11.6±1.1)
T9: 44 (4.5, 33)
T10: 25±3 (2.5±0.3, 18.1±2.2)
T11: 54±5 (5.5±0.5, 39.8±3.6)

5. Crankshaft and Piston

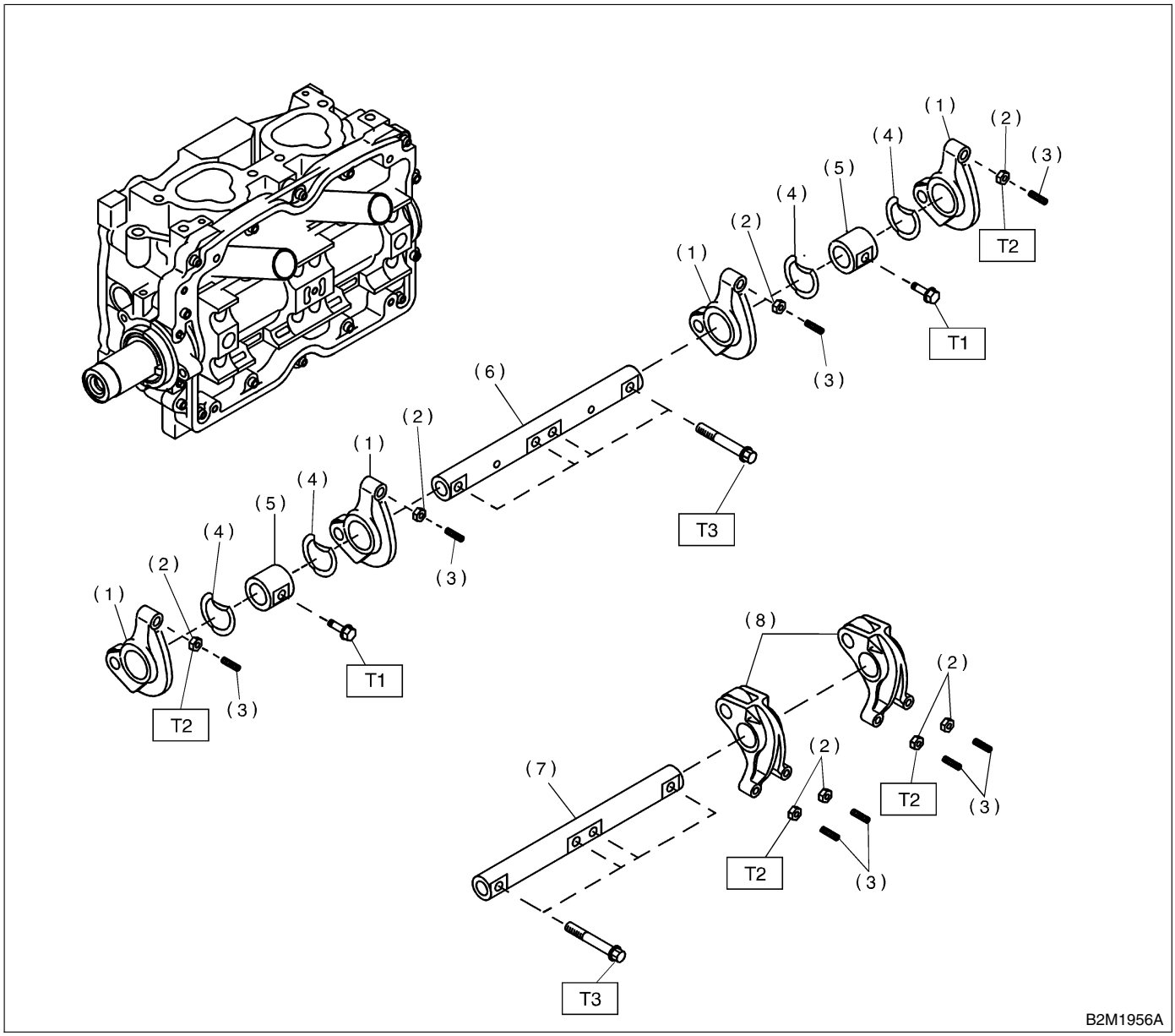


B2M3429A

(1) Flywheel (MT)
(2) Reinforcement (AT)
(3) Drive plate (AT)
(4) Top ring
(5) Second ring
(6) Oil ring
(7) Piston
(8) Piston pin
(9) Circlip
(10) Connecting rod bolt
(11) Connecting rod
(12) Connecting rod bearing
(13) Connecting rod cap
(14) Crankshaft
(15) Woodruff key
(16) Crankshaft bearing #1, #3
(17) Crankshaft bearing #2, #4
(18) Crankshaft bearing #5

Tightening torque: N·m (kg-m, ft-lb)
T1: 44.6±1.5 (4.55±0.15, 32.9±1.1)
T2: 72±3 (7.3±0.3, 52.8±2.2)

6. Valve Rocker Assembly



(1) Intake valve rocker arm
(2) Valve rocker nut
(3) Valve rocker adjust screw
(4) Spring
(5) Rocker shaft support
(6) Intake rocker shaft
(7) Exhaust rocker shaft
(8) Exhaust valve rocker arm

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 10±1 (1.0±0.1, 7.2±0.7)
T3: 25±2 (2.5±0.2, 18.1±1.4)

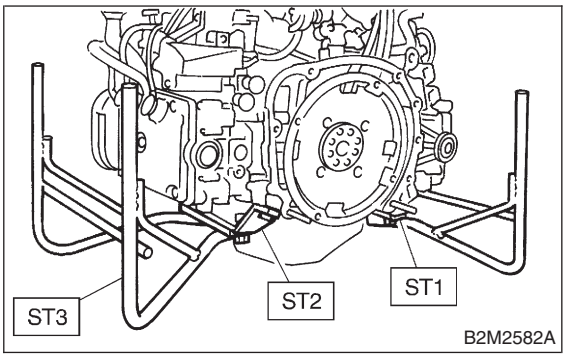
1. General Precautions

1) All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.
2) Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
3) Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
4) All removed parts, if to be reused, should be reinstalled in the original positions and directions.
5) Bolts, nuts and washers should be replaced with new ones as required.
6) Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.

2. General Procedure

1) For the procedure of removing the engine from the vehicle, refer to 2-11 ENGINE AND TRANSMISSION MOUNTING SYSTEM. <Ref. to 2-11 [W2A0].> However, before going into the procedure, it is necessary to do the following.
- Before disassembling engine, place it on ST3.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817000	ENGINE STAND



2) It is possible to conduct the following service procedures with engine on the vehicle, however, the procedures described in this section are based on the condition that the engine is removed from the vehicle.
- Timing Belt
- Valve Rocker Assembly
- Camshaft
- Cylinder Head

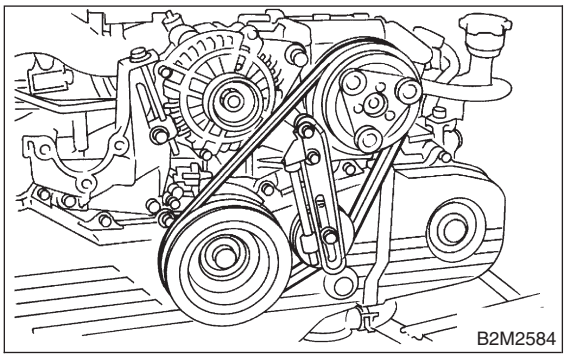
3) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for over hauling of the engine it-self when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

3. Timing Belt

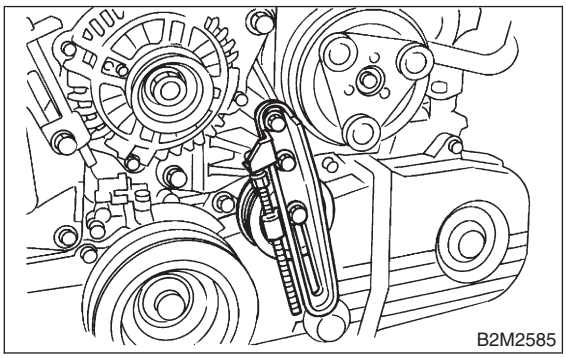
A: REMOVAL

1. CRANKSHAFT PULLEY AND BELT COVER

1) Remove A/C belt. (With A/C model)

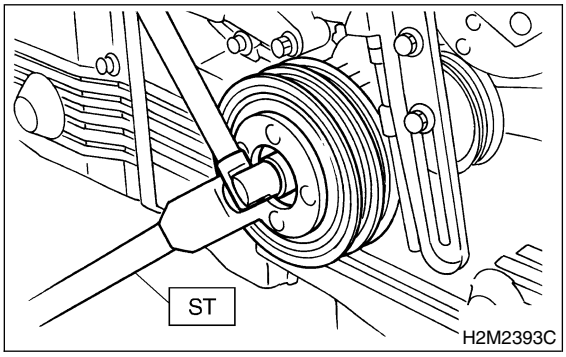


2) Remove A/C belt tensioner. (With A/C model)

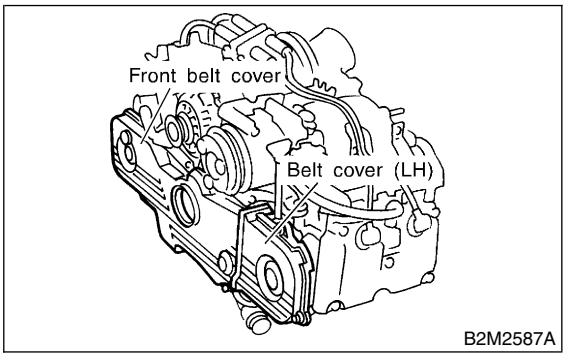


3) Remove crankshaft pulley bolt. To lock crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

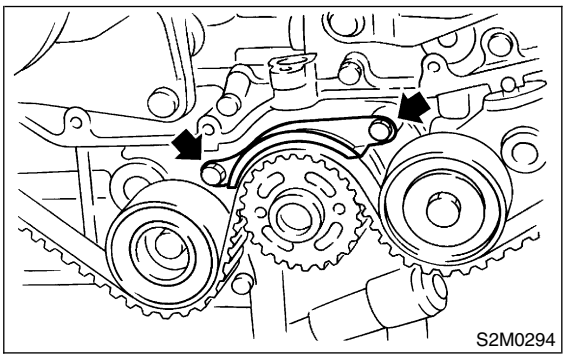


4) Remove crankshaft pulley.
5) Remove belt cover (LH).
6) Remove front belt cover.



2. TIMING BELT

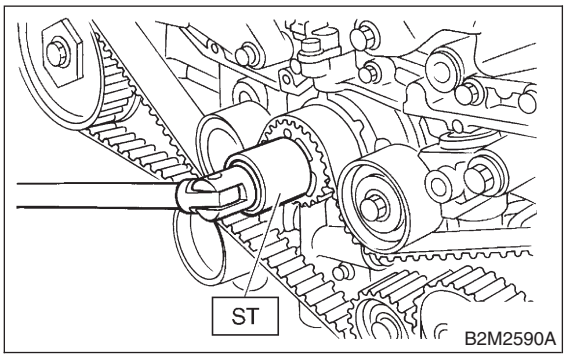
1) Remove timing belt guide. (MT vehicles only)

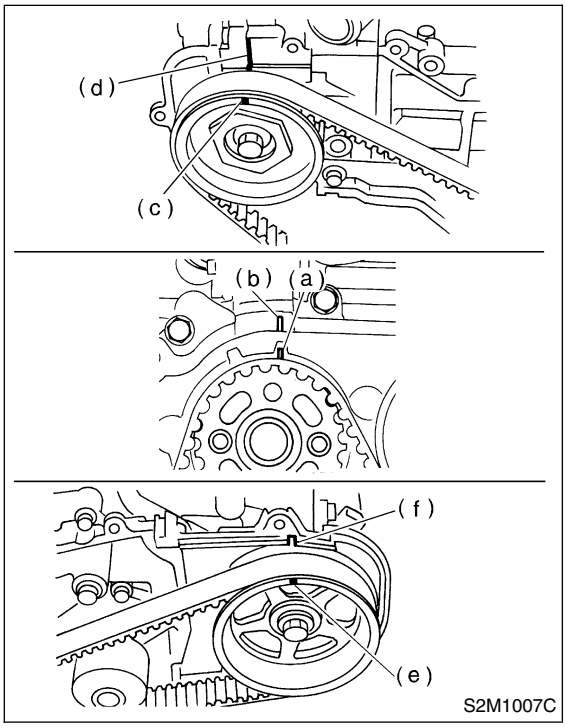


2) If alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as shown in procedures below.

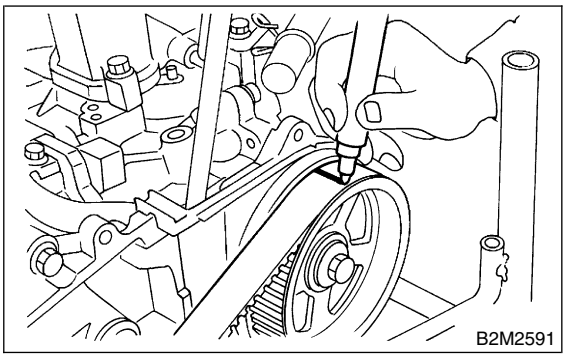
(1) Turn crankshaft using ST. Align mark (a) of sprocket to cylinder block notch (b) and ensure that right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) and/or left side cam sprocket mark (e) and belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET





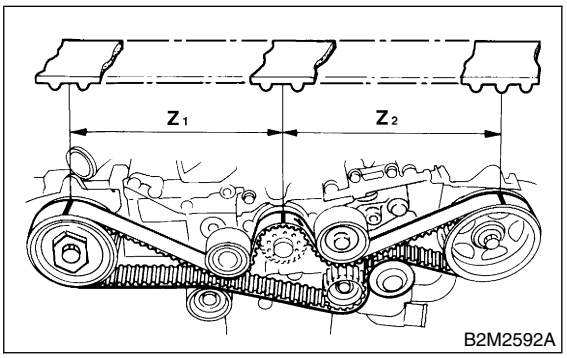
(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the crank sprocket and cam sprockets.



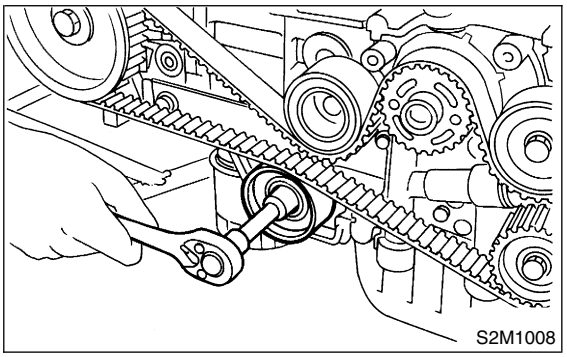
Specified data:

Z_1: 44 tooth length

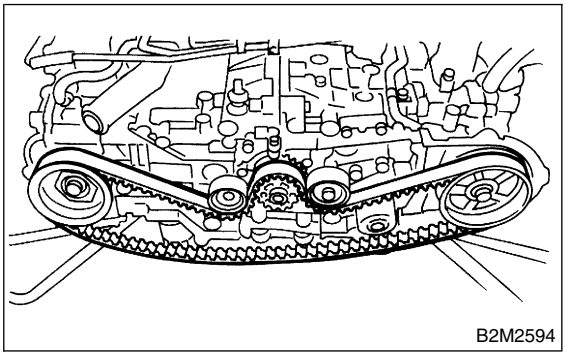
Z_2: 40.5 tooth



3) Remove belt idler (No. 2).
4) Remove belt idler No. 2.

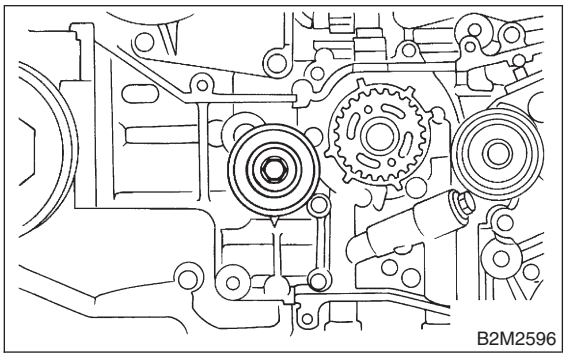


5) Remove timing belt.

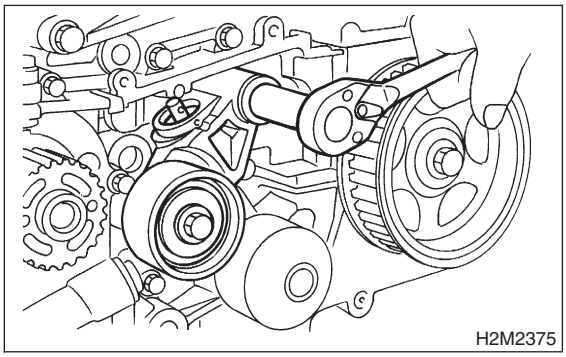


3. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove belt idler (No. 1).

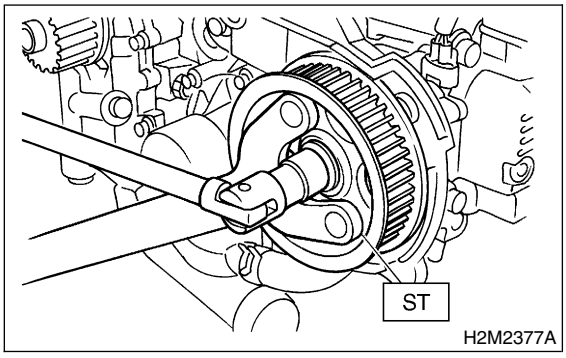

B2M2596

2) Remove automatic belt tension adjuster assembly.


H2M2375

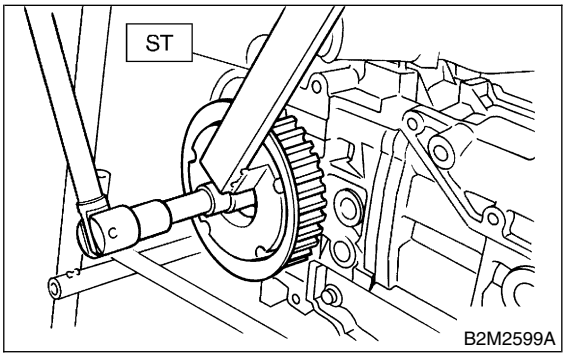
4. CAMSHAFT AND CRANKSHAFT SPROCKET

1) Remove camshaft sprocket No. 2. To lock camshaft, use ST.
ST 499207100 CAMSHAFT SPROCKET WRENCH



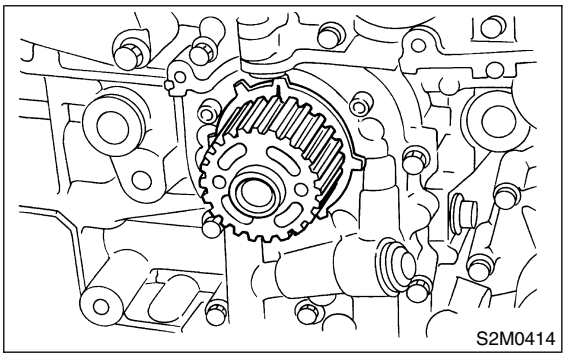
H2M2377A

2) Remove camshaft sprocket No. 1. To lock camshaft, using ST.
ST 499207400 CAMSHAFT SPROCKET WRENCH



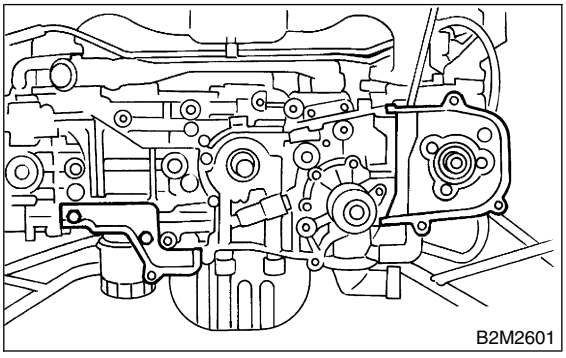
B2M2599A

3) Remove crankshaft sprocket.

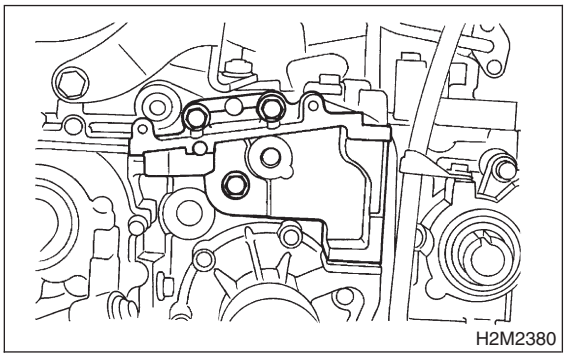

S2M0414

4) Remove belt cover No. 2 (LH).
5) Remove belt cover No. 2 (RH).

CAUTION:
Do not damage or lose the seal rubber when removing belt covers.


B2M2601

6) Remove tensioner bracket.


H2M2380

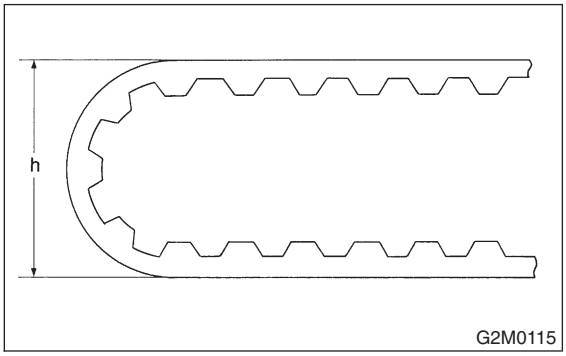
B: INSPECTION

1. TIMING BELT

1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.
2) Check the condition of back side of belt; if any crack is found, replace belt.

CAUTION:
• Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
• Do not bend the belt sharply.

Bending radius h:
60 mm (2.36 in) or more



G2M0115

2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.

CAUTION:
Slight traces of oil at rod's oil seal does not indicate a problem.

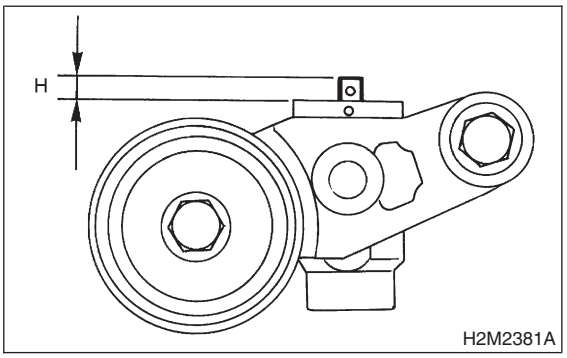
2) Check that the adjuster rod does not move when a pressure of 294 N (30 kg, 66 lb) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kg, 66 lb), check it using the following procedures:

(1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this motion 2 or 3 times.
(2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kg, 66 lb) to it. Check adjuster rod stiffness.
(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push adjuster rod vertically.
• Press-in the push adjuster rod gradually taking more than three minutes.
• Do not allow press pressure to exceed 9,807 N (1,000 kg, 2,205 lb).
• Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.

4) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension H:
5.7±0.5 mm (0.224±0.020 in)



H2M2381A

3. BELT TENSION PULLEY

1) Check mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace automatic belt tension adjuster assembly if faulty.
2) Check tension pulley for smooth rotation. Replace if noise or excessive play is noted.
3) Check tension pulley for grease leakage.

4. BELT IDLER

1) Check belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check belt idler for grease leakage.

5. CAMSHAFT AND CRANKSHAFT SPROCKET

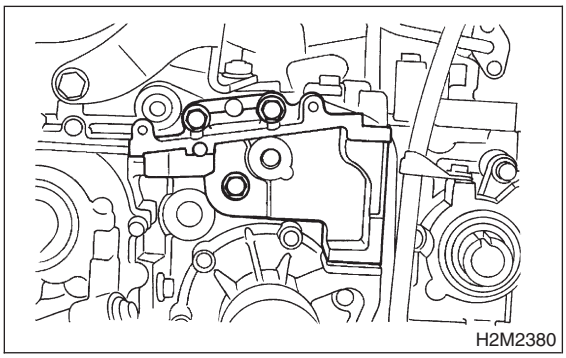
1) Check sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

C: INSTALLATION

1. CAMSHAFT AND CRANKSHAFT SPROCKET

1) Install tensioner bracket.

Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)

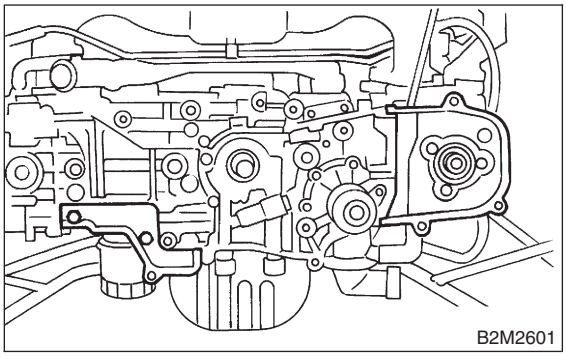

H2M2380

2) Install belt cover No. 2 (RH).

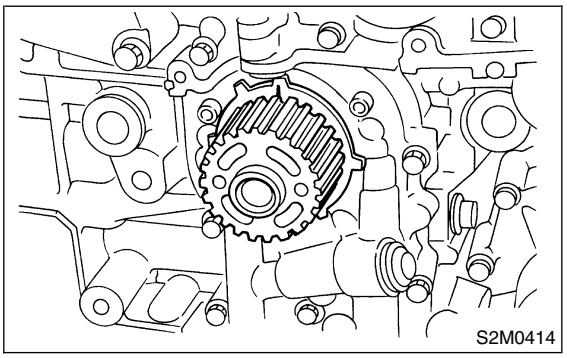
Tightening torque:
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)

3) Install belt cover No. 2 (LH).

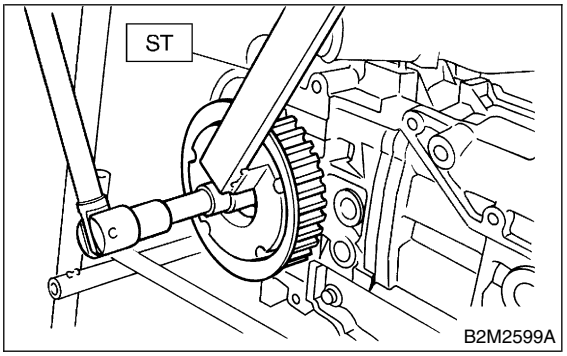
Tightening torque:
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)


B2M2601

4) Install crankshaft sprocket.


S2M0414

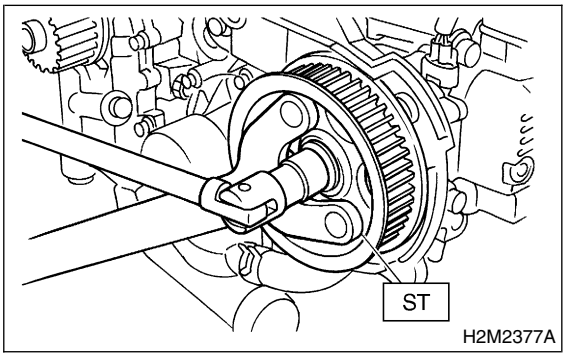
5) Install camshaft sprocket No. 1. To lock camshaft, use ST.
ST 499207400 CAMSHAFT SPROCKET WRENCH



B2M2599A

6) Install camshaft sprocket No. 2. To lock camshaft, use ST.
ST 499207100 CAMSHAFT SPROCKET WRENCH

CAUTION:
Do not confuse left and right side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.



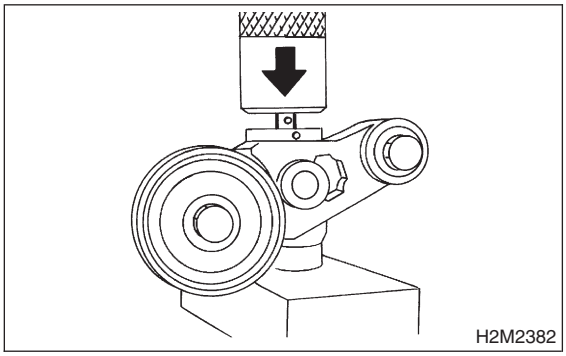
H2M2377A

2. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

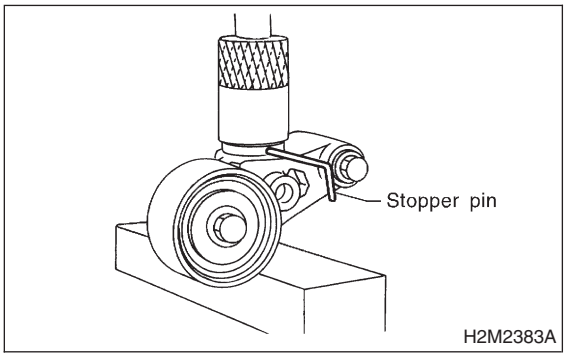
1) Preparation for installation of automatic belt tension adjuster assembly;

CAUTION:
● Always use a vertical type pressing tool to move the adjuster rod down.
● Do not use a lateral type vise.
● Push adjuster rod vertically.
● Be sure to slowly move the adjuster rod down applying a pressure of 294 N (30 kg, 66 lb).
● Press-in the push adjuster rod gradually taking more than three minutes.
● Do not allow press pressure to exceed 9,807 N (1,000 kg, 2,205 lb).
● Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.
● Do not release press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.
(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kg, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.


H2M2382

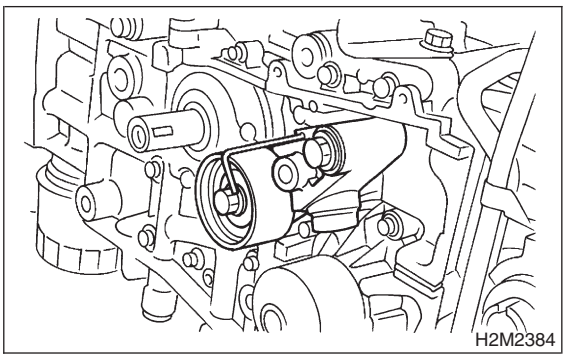
(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



H2M2383A

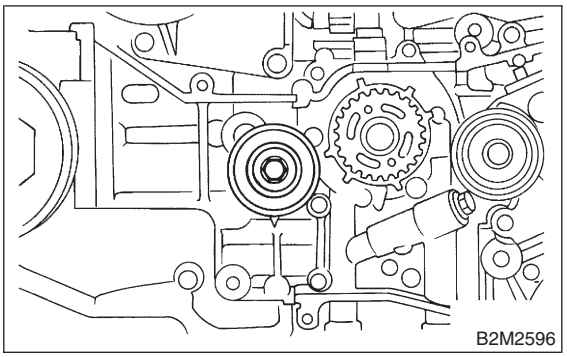
2) Install automatic belt tension adjuster assembly.

Tightening torque:
39±4 N·m (4.0±0.4 kg-m, 28.9±2.9 ft-lb)


H2M2384

3) Install belt idler (No. 1).

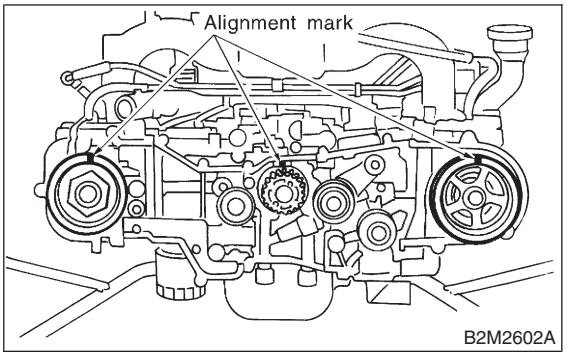
Tightening torque:
39±4 N·m (4.0±0.4 kg-m, 28.9±2.9 ft-lb)


B2M2596

3. TIMING BELT

1) Installation of timing belt
(1) Turn camshaft sprocket No. 2 using ST1, and turn camshaft sprocket No. 1 using ST2 so that their alignment marks come to top positions.

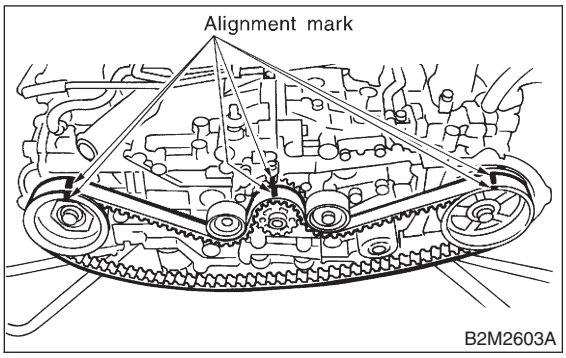
ST1	499207100	CAMSHAFT SPROCKET WRENCH
ST2	499207400	CAMSHAFT SPROCKET WRENCH



B2M2602A

(2) While aligning alignment mark on timing belt with marks on sprockets, position timing belt properly.

CAUTION:
Ensure belt's rotating direction is correct.

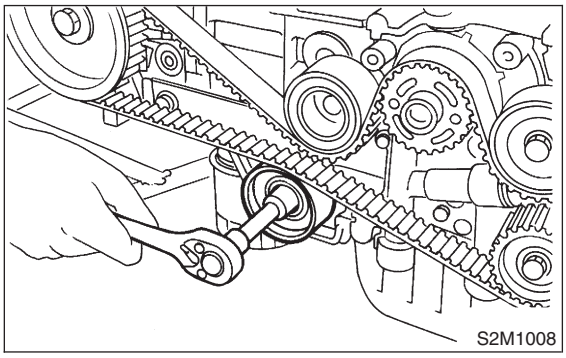


2) Install belt idler No. 2.

Tightening torque:
39±4 N·m (4.0±0.4 kg-m, 28.9±2.9 ft-lb)

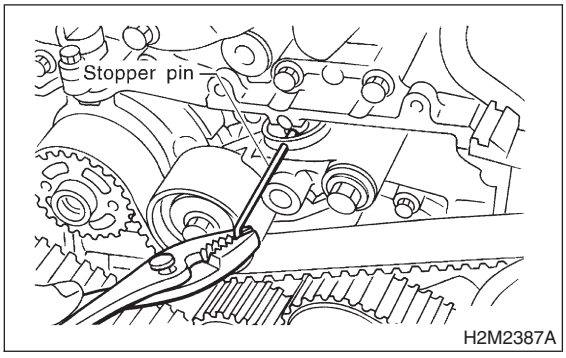
3) Install belt idler (No. 2).

Tightening torque:
39±4 N·m (4.0±0.4 kg-m, 28.9±2.9 ft-lb)

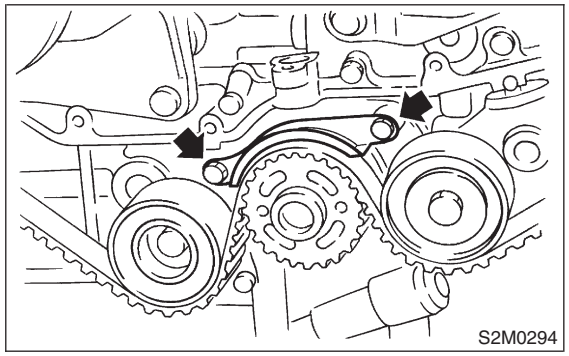


4) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove stopper pin from belt tensioner adjuster.

CAUTION:
After properly installing timing belt, remove rocker cover and ensure that the valve lash adjuster contains no air.

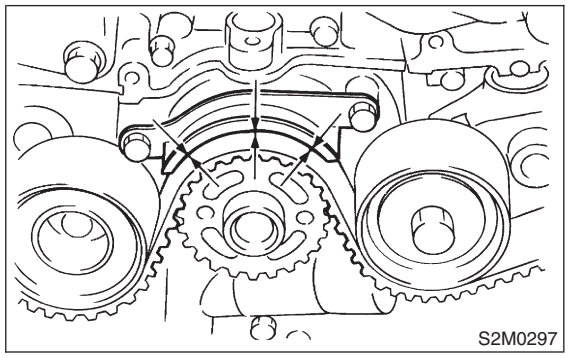


5) Install timing belt guide. (MT vehicles only)
(1) Temporarily tighten remaining bolts.



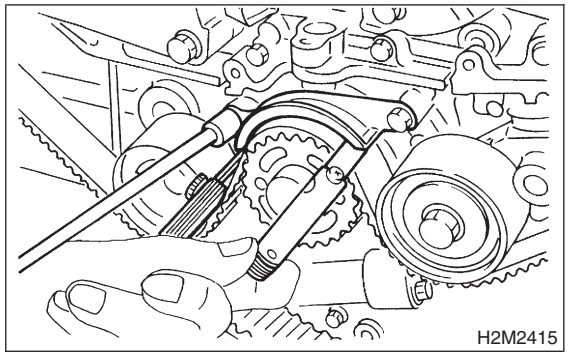
(2) Check and adjust clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten remaining bolts.

Tightening torque:
9.8±1.0 N·m (1.0±0.1 kg-m, 7.2±0.7 ft-lb)



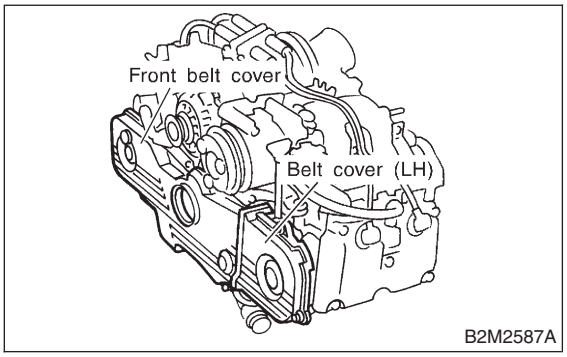
4. CRANKSHAFT PULLEY AND BELT COVER

1) Install front belt cover.

Tightening torque:
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)

2) Install belt cover (LH).

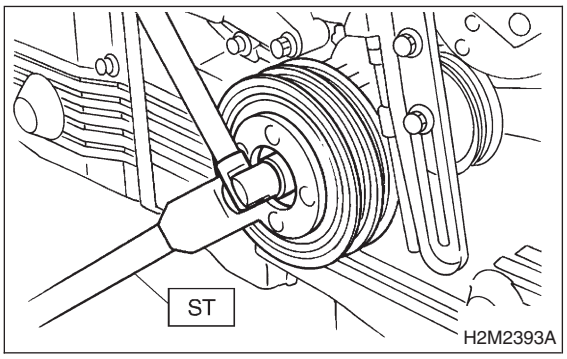
Tightening torque:
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)



3) Install crankshaft pulley.
4) Install pulley bolt.
To lock crankshaft, use ST.
ST 499977100 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley thread using an air gun.
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kg-m, 33 ft-lb).
(4) Tighten the crankshaft pulley bolts.

Tightening torque:
177±5 N·m (18.0±0.5 kg-m, 130.2±3.6 ft-lb)



5) Confirm that the tightening angle of the crankshaft pulley bolt is 65 degrees or more. If not, conduct the following procedures (1) through (4).

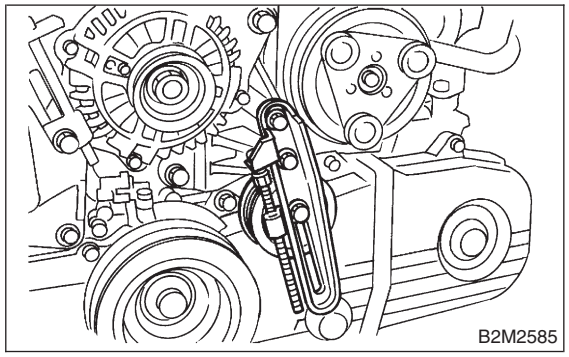
(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:
12369AA011

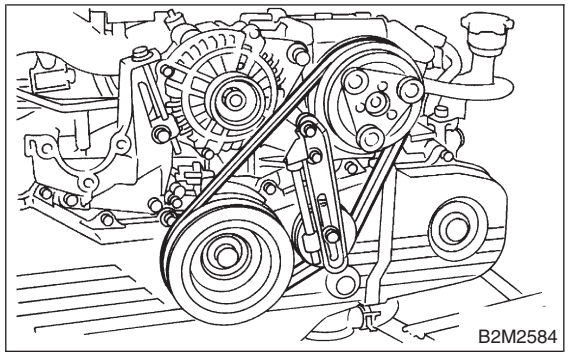
(2) Clean the crankshaft thread using an air gun.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kg-m, 33 ft-lb).
(4) Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

CAUTION:
Conduct the tightening procedures by confirming the turning angle of the crankshaft pulley bolt referring to the gauge indicated on the belt cover.

6) Install A/C belt tensioner. (With A/C model)



7) Install A/C belt. (With A/C model)

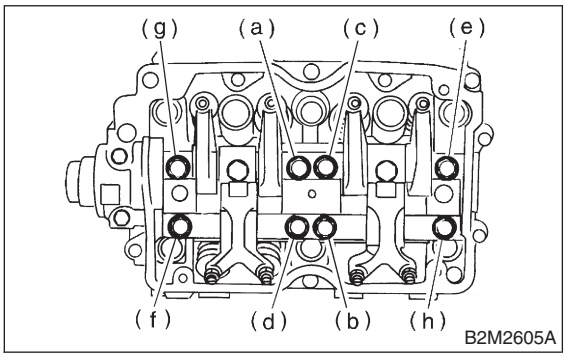


4. Valve Rocker Assembly

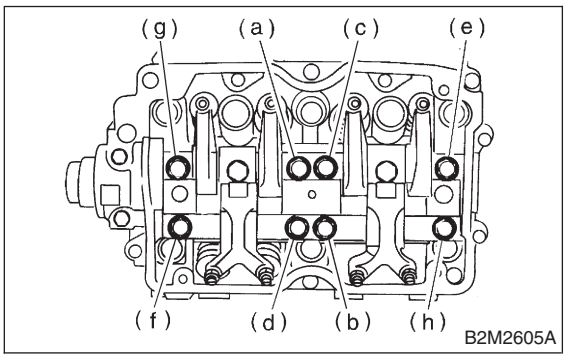
A: REMOVAL

1) Disconnect PCV hose and remove rocker cover.
2) Removal of valve rocker assembly
   (1) Remove bolts (a) through (b) in alphabetical sequence.

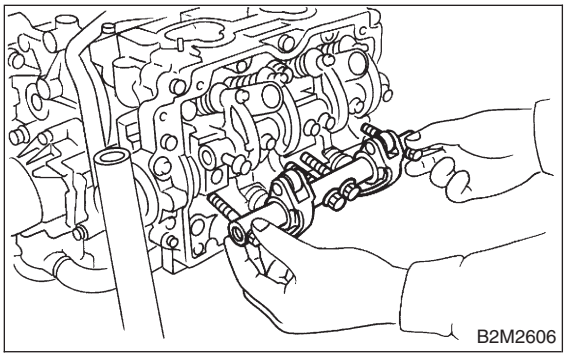
CAUTION:
Leave two or three threads of bolt (a) engaged to retain valve rocker assembly.



(2) Equally loosen bolts (e) through (h) all the way, being careful that knock pin is not gouged.



(3) Remove valve rocker assembly.



B: DISASSEMBLY

1) Remove bolts which secure rocker shaft.
2) Extract rocker shaft. Remove valve rocker arms, springs, plates and shaft supports from rocker shaft.

CAUTION:
Arrange all removed parts in order so that they can be installed in their original positions.

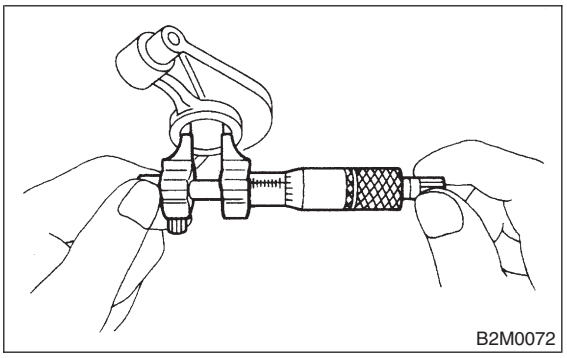
3) Remove nut and adjuster screw from valve rocker.

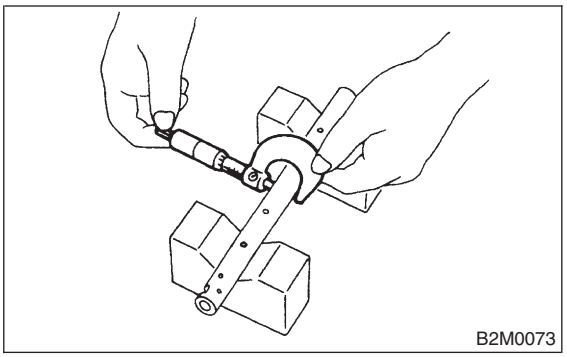
C: INSPECTION

1. VALVE ROCKER ARM

1) Measure inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between arm and shaft:
Standard
0.020 — 0.054 mm (0.0008 — 0.0021 in)
Limit
0.10 mm (0.0039 in)





2) If oil clearance exceeds the limit, replace valve rocker arm or shaft, whichever shows greater amount of wear.

Rocker arm inside diameter:
22.020 — 22.041 mm (0.8669 — 0.8678 in)

Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

3) Measure inside diameter of rocker shaft support and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between support and shaft:
Standard
0.005 — 0.039 mm (0.0002 — 0.0015 in)
Limit
0.05 mm (0.0020 in)

4) If oil clearance exceeds the limit, replace rocker shaft support or shaft, whichever shows greater amount of wear.

Rocker shaft support inside diameter:
22.005 — 22.026 mm (0.8663 — 0.8672 in)

Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

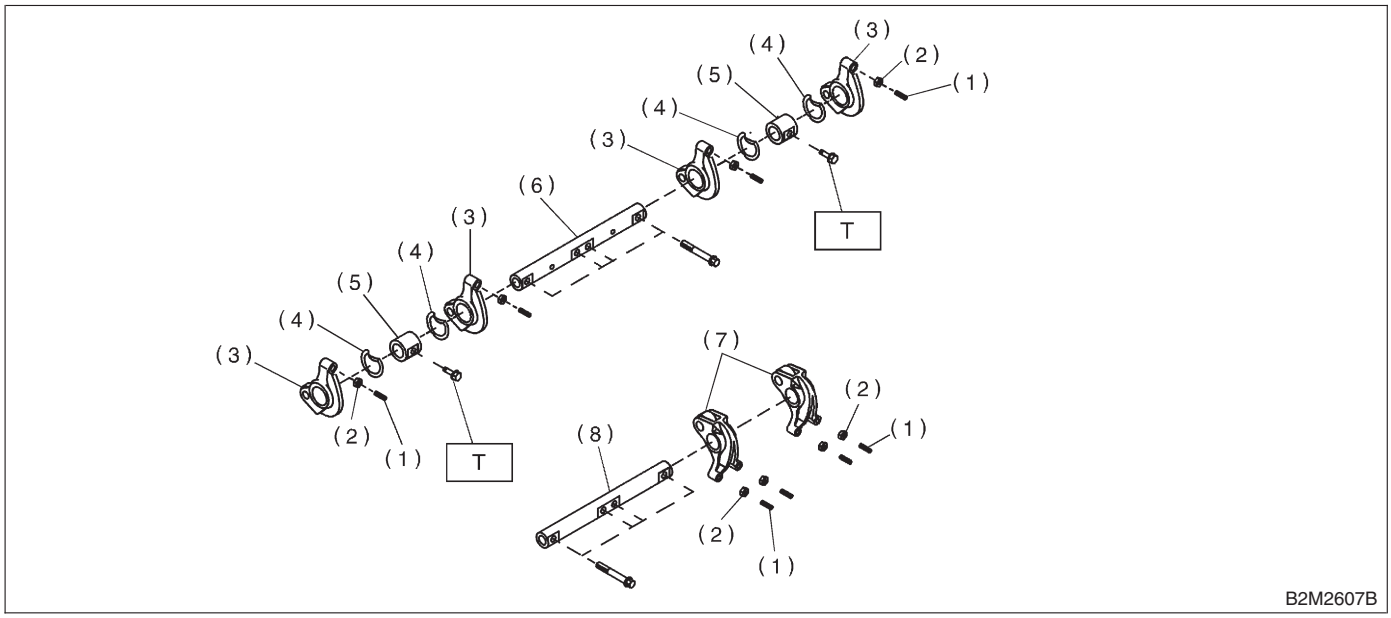
5) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace valve rocker arm.
6) Check that valve rocker arm roller rotates smoothly. If not, replace valve rocker arm.

2. INTAKE AND EXHAUST VALVE ROCKER SHAFT

Visually check oil relief valve of shaft end for any of the following abnormalities.
- Breaks in check ball body
- Foreign particles caught in valve spring
- Oil leakage at check ball

CAUTION:
Repair or replace valve rocker shaft as necessary.

D: ASSEMBLY



(1) Valve rocker adjust screw
(2) Valve rocker nut
(3) Intake valve rocker arm
(4) Spring
(5) Rocker shaft support
(6) Intake valve rocker shaft
(7) Exhaust valve rocker arm
(8) Exhaust valve rocker shaft

Tightening torque: N·m (kg-m, ft-lb)
T: 5±1 (0.5±0.1, 3.6±0.7)

1) Install adjuster screw and nut to valve rocker.
2) Arrange valve rocker arms, springs and shaft supports in assembly order and insert valve rocker shaft.

Tightening torque (Shaft supports installing bolts):
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)

CAUTION:
Valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure parts with same markings are properly assembled.

3) Install valve rocker shaft securing bolts.

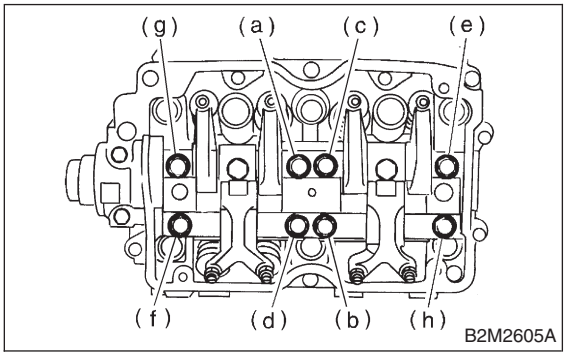
E: INSTALLATION

1) Installation of valve rocker assembly
(1) Temporarily tighten bolts (a) through (d) equally as shown in figure.

CAUTION:
Do not allow valve rocker assembly to gouge knock pins.

(2) Tighten bolts (e) through (h) to specified torque.
(3) Tighten bolts (a) through (d) to specified torque.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



2) Adjust the valve clearances. <Ref. to 2-2 [W8B1].>
3) Install rocker cover and connect PCV hose.

5. Camshaft

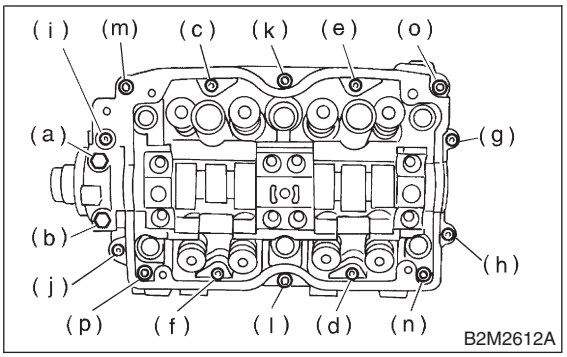
A: REMOVAL

1. RELATED PARTS

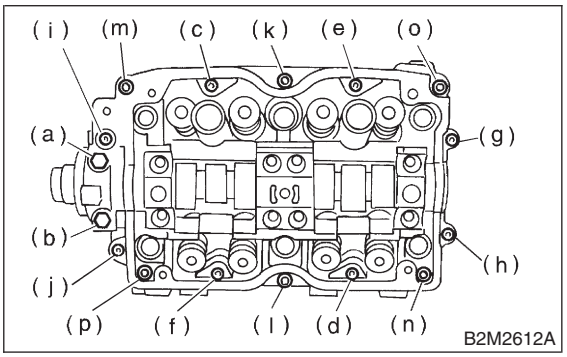
Remove timing belt, camshaft sprockets <Ref. to 2-3 [W3A0].> and valve rocker assembly. <Ref. to 2-3 [W4A0].>

2. CAMSHAFT (LH)

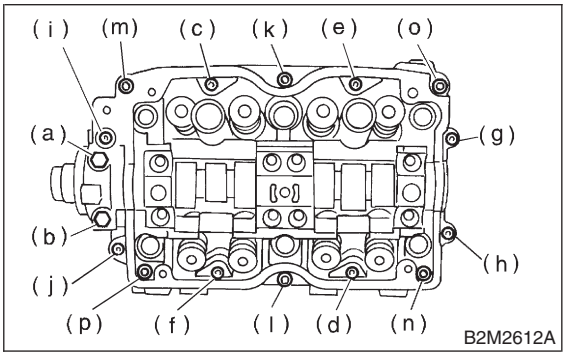
1) Remove camshaft cap.
(1) Remove bolts (a) through (b) in alphabetical sequence.



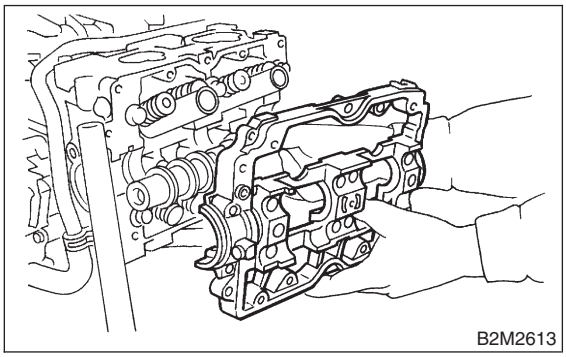
(2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.



(3) Remove bolts (k) through (p) in alphabetical sequence using ST.
ST 499497000 TORX PLUS



(4) Remove camshaft cap.

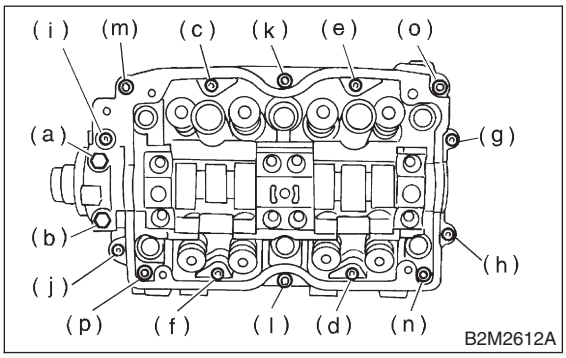


2) Remove camshaft (LH).
3) Remove oil seal.
4) Remove plug from rear side of camshaft (LH).

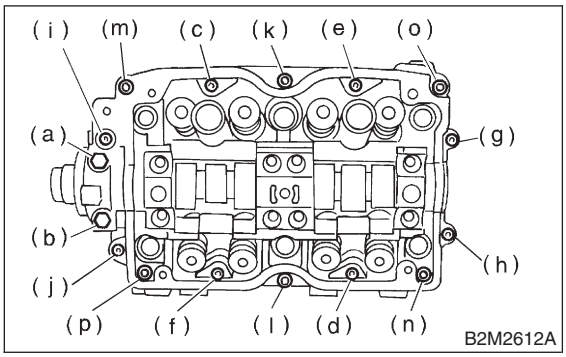
CAUTION:
• Do not remove oil seal unless necessary.
• Do not scratch journal surface when removing oil seal.

3. CAMSHAFT (RH)

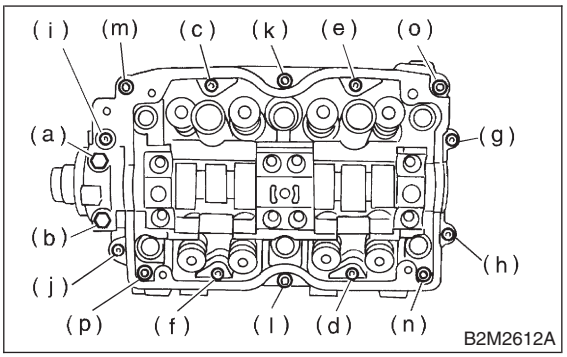
1) Remove camshaft cap.
(1) Remove bolts (a) through (b) in alphabetical sequence.



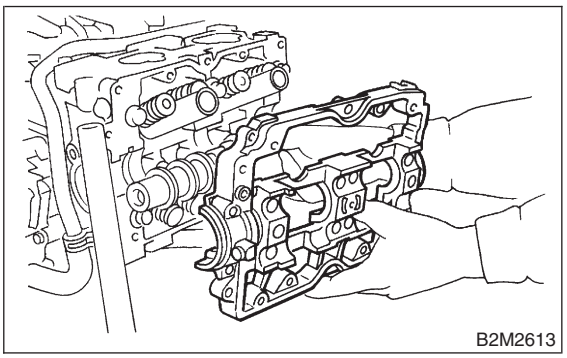
(2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.



(3) Remove bolts (k) through (p) in alphabetical sequence using ST.
ST 499497000 TORX PLUS



(4) Remove camshaft cap.



2) Remove camshaft (RH).
3) Remove oil seal.
4) Remove plug from rear side of camshaft (RH).

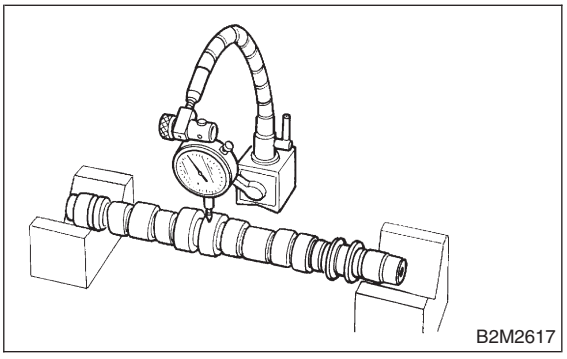
CAUTION:
• Do not remove oil seal unless necessary.
• Do not scratch journal surface when removing oil seal.

B: INSPECTION

1. CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:
0.025 mm (0.0010 in)



2) Check journal for damage and wear. Replace if faulty.

3) Measure outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between the two (= oil clearance). If oil clearance exceeds specifications, replace camshaft or cylinder head as necessary.

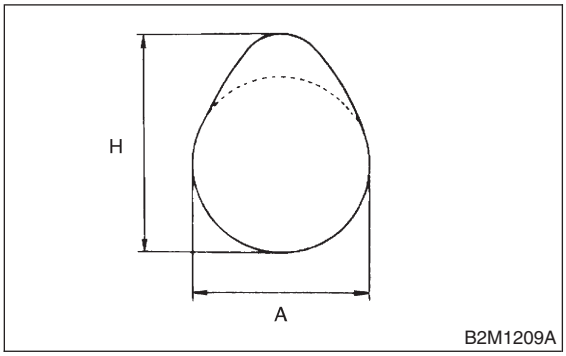
		Unit: mm (in)
Clearance at journal	Standard	0.055 — 0.090 (0.0022 — 0.0035)
	Limit	0.10 (0.0039)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

4) Check cam face condition; remove minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Cam height H:

Item		Unit: mm (in)
Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
	Limit	39.385 (1.5506)
Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
	Limit	39.157 (1.5416)

Cam base circle diameter A:
IN: 34.00 mm (1.3386 in)
EX: 34.00 mm (1.3386 in)

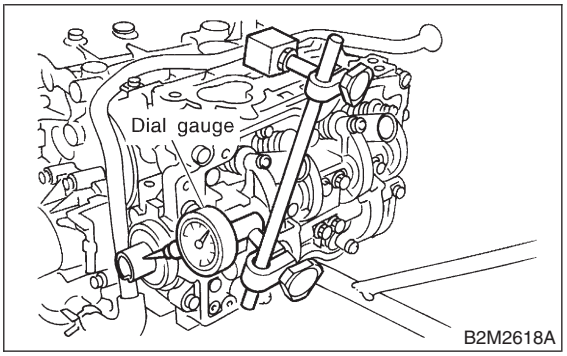


2. CAMSHAFT SUPPORT

Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace camshaft support.

Standard:
0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:
0.10 mm (0.0039 in)

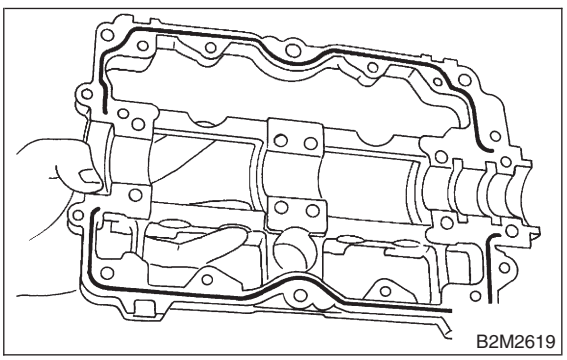


C: INSTALLATION

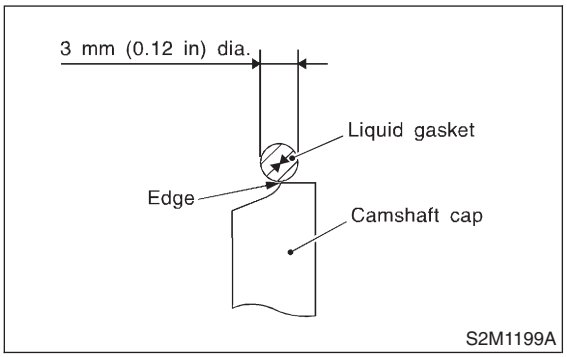
1. CAMSHAFT (LH)

1) Apply a coat of engine oil to camshaft journals and install camshaft (LH).
2) Install camshaft cap.
   (1) Apply liquid gasket on the around of camshaft cap.

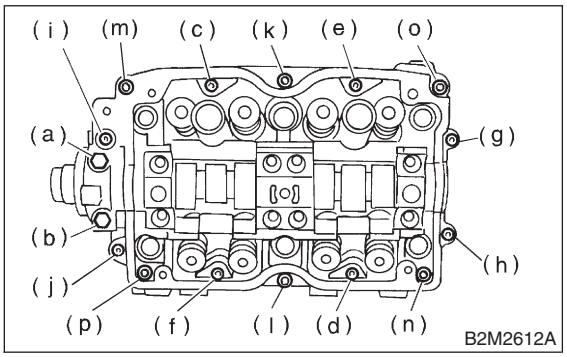
Liquid gasket:
THREE BOND 1280B



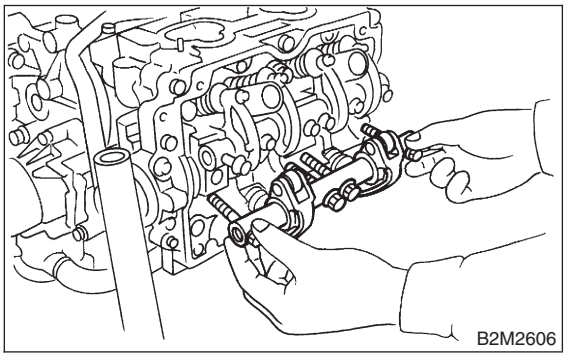
NOTE:
Apply a coat of 3 mm (0.12 in) dia. liquid gasket along edge of cam cap mating surface.



(2) Temporarily tighten bolts (g) through (j) in alphabetical sequence.

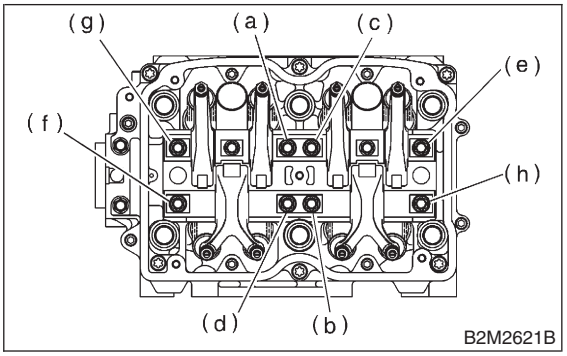


(3) Install valve rocker assembly.
<Ref. to 2-3 [W4E0].>



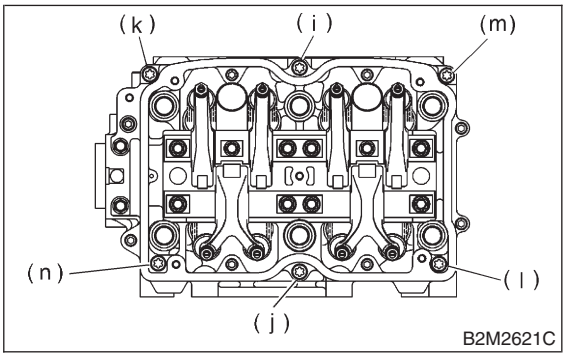
(4) Tighten bolts (a) through (h) in alphabetical sequence.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



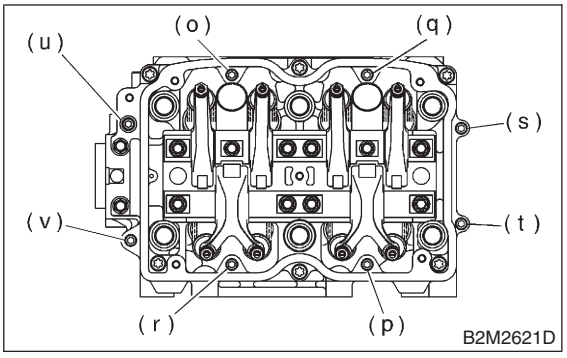
(5) Tighten TORX bolts (i) through (n) in alphabetical sequence using ST.
ST 499497000 TORX PLUS

Tightening torque:
18±2 N·m (1.8±0.2 kg-m, 13.0±1.4 ft-lb)



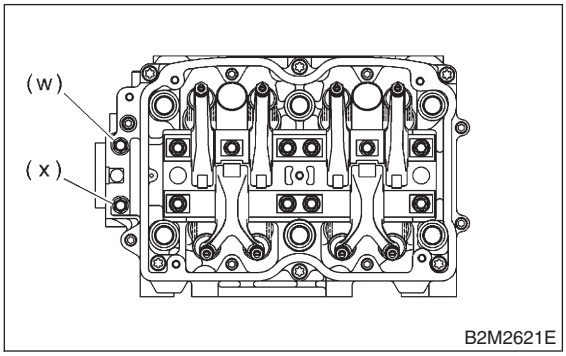
(6) Tighten bolts (o) through (v) in alphabetical sequence.

Tightening torque:
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)



(7) Tighten bolts (w) through (x) in alphabetical sequence.

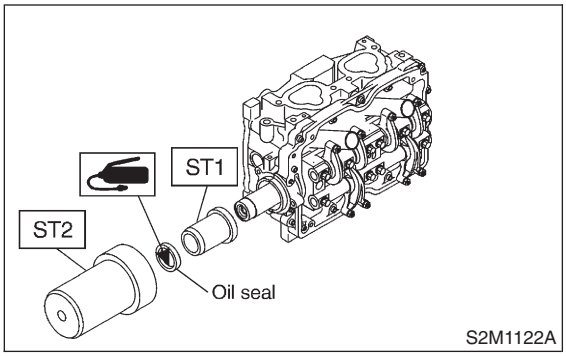
Tightening torque:
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)



3) Apply a coat of grease to oil seal lips and install oil seal (A) on camshaft using ST1 and ST2.

CAUTION:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587500 OIL SEAL INSTALLER



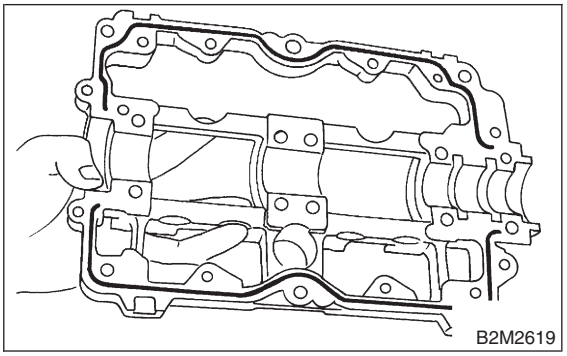
4) Install plug using ST.
ST 499587700 OIL SEAL INSTALLER
5) Install oil level gauge guide.
6) Install camshaft position sensor support.

2. CAMSHAFT (RH)

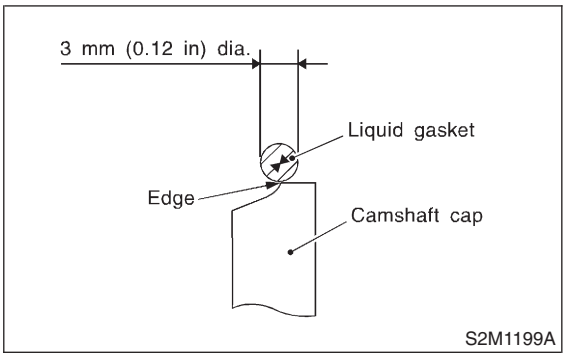
1) Apply a coat of engine oil to camshaft journals and install camshaft (RH).
2) Install camshaft cap.

(1) Apply liquid gasket on the around of camshaft cap.

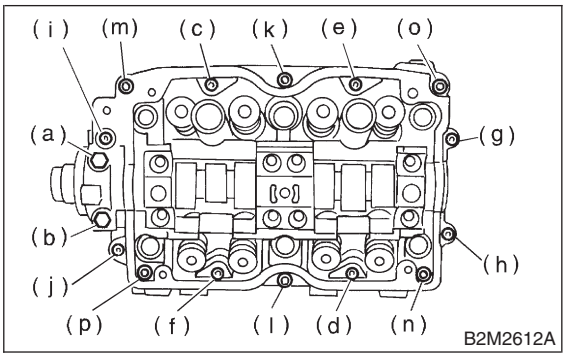
Liquid gasket:
THREE BOND 1280B



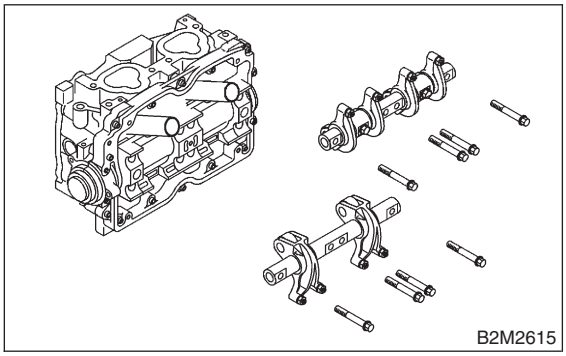
NOTE:
Apply a coat of 3 mm (0.12 in) dia. liquid gasket along edge of cam cap mating surface.



(2) Temporarily tighten bolts (g) through (j) in alphabetical sequence.

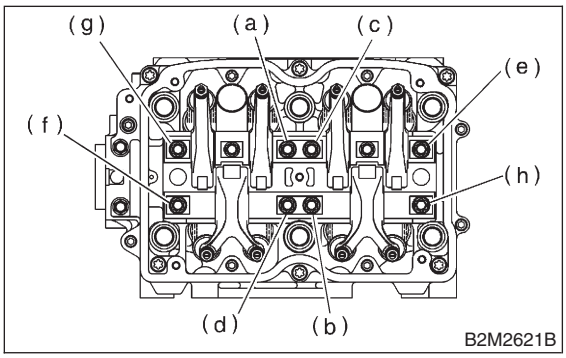


(3) Install valve rocker assembly.
<Ref. to 2-3 [W4E0].>


B2M2615

(4) Tighten bolts (a) through (h) in alphabetical sequence.

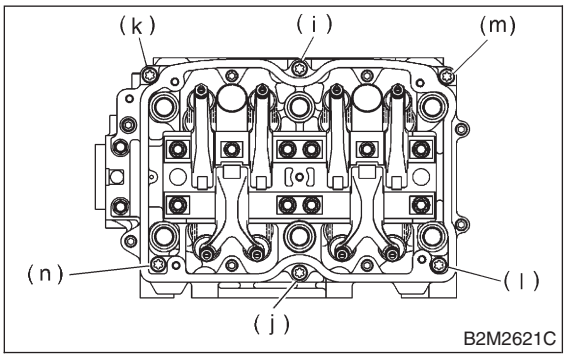
Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



B2M2621B

(5) Tighten TORX bolts (i) through (n) in alphabetical sequence using ST.
ST 499427000 TORX PLUS

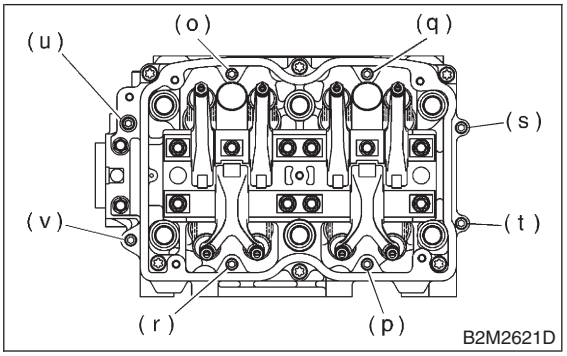
Tightening torque:
18±2 N·m (1.8±0.2 kg-m, 13.0±1.4 ft-lb)



B2M2621C

(6) Tighten bolts (o) through (v) in alphabetical sequence.

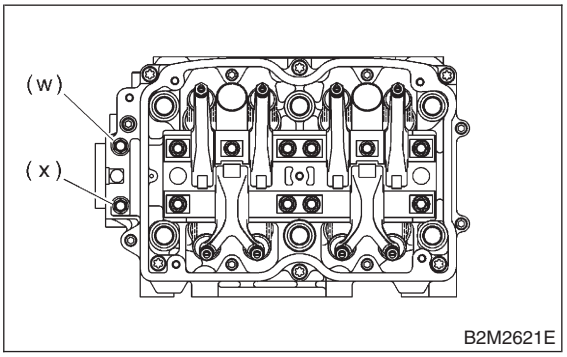
Tightening torque:
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)



B2M2621D

(7) Tighten bolts (o) through (p) in alphabetical sequence.

Tightening torque:
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)

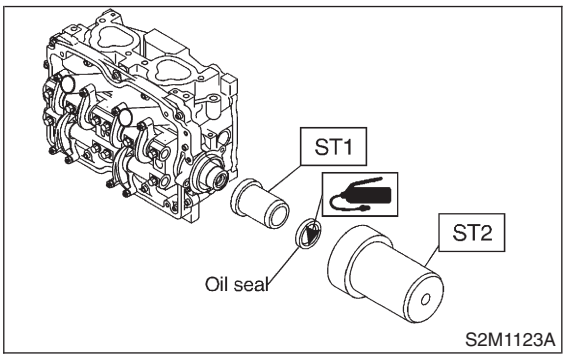


B2M2621E

3) Apply a coat of grease to oil seal lips and install oil seal (A) on camshaft using ST1 and ST2.

CAUTION:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587500 OIL SEAL INSTALLER



S2M1123A

4) Install plug using ST.
ST 499587700 OIL SEAL INSTALLER

3. RELATED PARTS

1) Adjust the valve clearance. <Ref. to 2-2 [W8B1].>
2) Install rocker cover and connect PCV hose.
3) Install timing belt. <Ref. to 2-3 [W3C0].>

6. Cylinder Head

A: REMOVAL

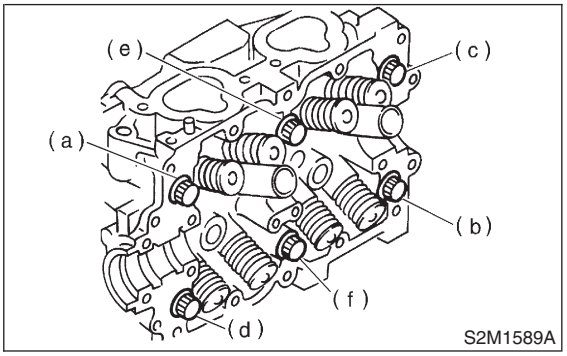
1. RELATED PARTS

1) Remove intake manifold. <Ref. to 2-7 [W3A0].>
2) Remove bolt which installs A/C compressor bracket on cylinder head. (With A/C model)
3) Remove camshafts. <Ref. to 2-3 [W5A2].>

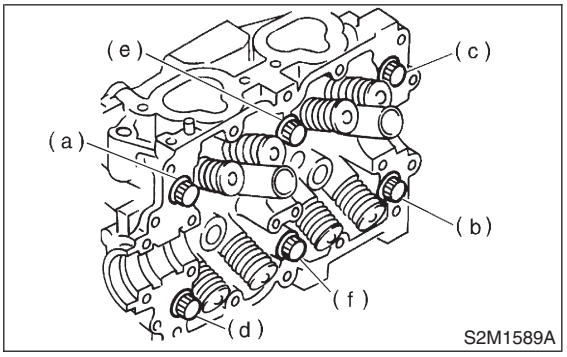
2. CYLINDER HEAD

1) Remove oil level gauge guide attaching bolt (left hand only) and oil level gauge guide.
2) Remove cylinder head bolts in alphabetical sequence shown in figure.

CAUTION:
Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



3) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
4) Remove bolts (a) and (b) to remove cylinder head.



5) Remove cylinder head gasket.

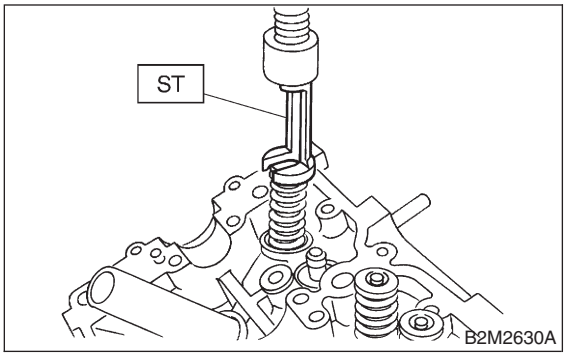
CAUTION:
Do not scratch the mating surface of cylinder head and cylinder block.

6) Similarly, remove right side cylinder head.

B: DISASSEMBLY

1) Place cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE
2) Set ST on valve spring. Compress valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST 499718000 VALVE SPRING REMOVER

CAUTION:
- **Mark each valve to prevent confusion.**
- **Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.**



C: INSPECTION AND REPLACEMENT

1. CYLINDER HEAD

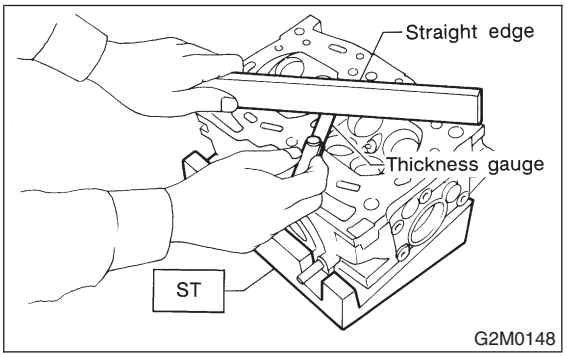
1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.
Also make sure that gasket installing surface shows no trace of gas and water leaks.
2) Place cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE
3) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge and thickness gauge.
If the warping exceeds 0.05 mm (0.0020 in), regrind the surface with a surface grinder.

Warping limit:
0.05 mm (0.0020 in)

Grinding limit:
0.3 mm (0.012 in)

Standard height of cylinder head:
97.5 mm (3.839 in)

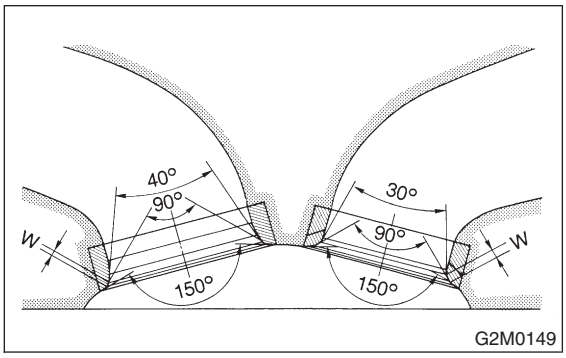
CAUTION:
Uneven torque for the cylinder head bolts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.

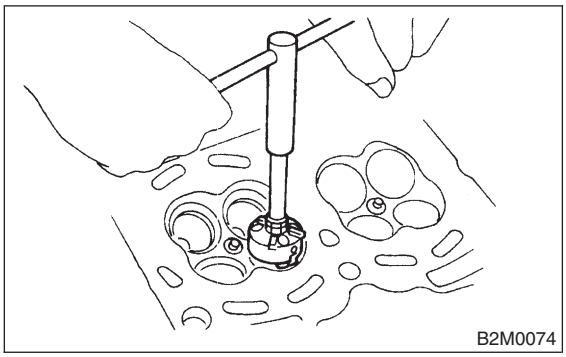


2. VALVE SEAT

Inspect intake and exhaust valve seats, and correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width: W
Intake
Standard 1.0 mm (0.039 in)
Limit 1.7 mm (0.067 in)
Exhaust
Standard 1.4 mm (0.055 in)
Limit 2.1 mm (0.083 in)

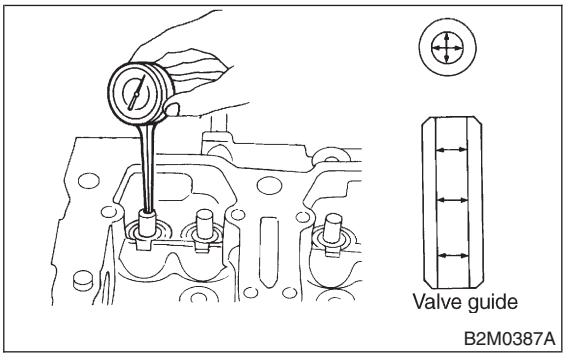


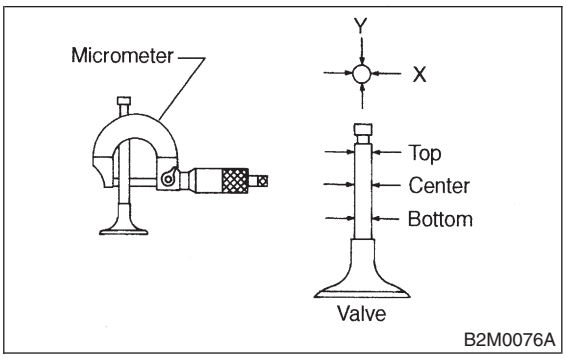


3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Clearance between the valve guide and valve stem:
Standard
Intake 0.035 — 0.062 mm (0.0014 — 0.0024 in)
Exhaust 0.040 — 0.067 mm (0.0016 — 0.0026 in)
Limit
0.15 mm (0.0059 in)





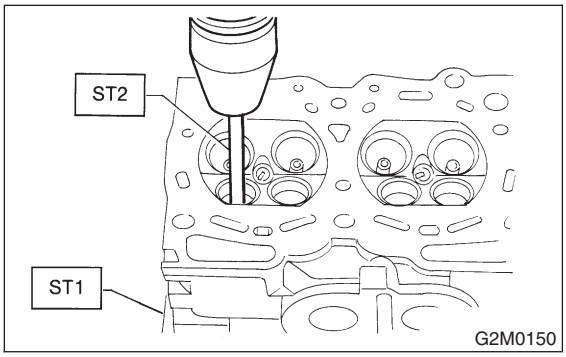
2) If the clearance between valve guide and stem exceeds the limit, replace valve guide or valve itself whichever shows greater amount of wear. See following procedure for valve guide replacement.

Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

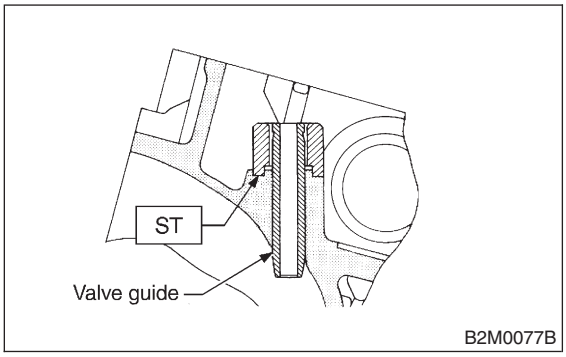
Valve stem outer diameters:
Intake
5.950 — 5.965 mm (0.2343 — 0.2348 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

(1) Place cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.

(2) Insert ST2 into valve guide and press it down to remove valve guide.
ST1 498267800 CYLINDER HEAD TABLE
ST2 499767400 VALVE GUIDE REMOVER

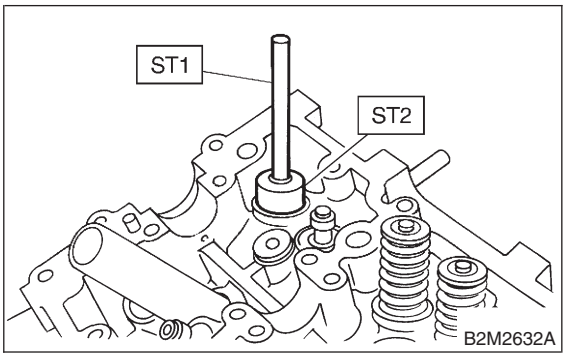


(3) Turn cylinder head upside down and place ST as shown in the figure.
Intake side:
ST 499767700 VALVE GUIDE ADJUSTER
Exhaust side:
ST 499767800 VALVE GUIDE ADJUSTER



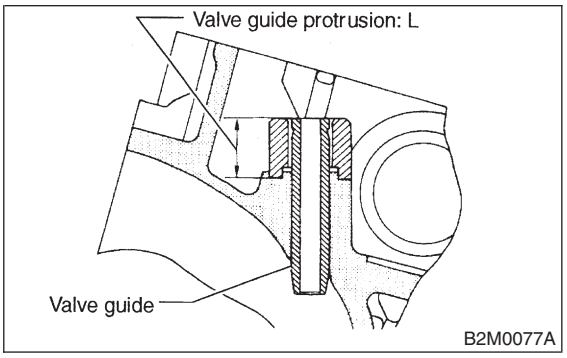
(4) Before installing new oversize valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.

(5) Put new valve guide, coated with sufficient oil, in cylinder, and insert ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.
ST1 499767400 VALVE GUIDE REMOVER
Intake side:
ST2 499767700 VALVE GUIDE ADJUSTER
Exhaust side:
ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

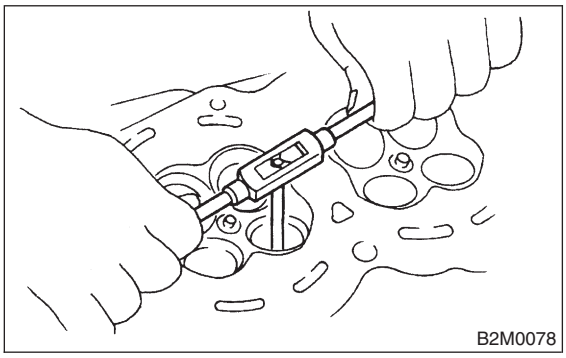
Valve guide protrusion: L
Intake
20.0 — 20.5 mm (0.787 — 0.807 in)
Exhaust
16.5 — 17.0 mm (0.650 — 0.669 in)



(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean valve guide to remove chips.

CAUTION:
• Apply engine oil to the reamer when reaming.
• If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
• If the inner surface of the valve guide becomes lustrous and the reamer does not chips, use a new reamer or remedy the reamer.

ST 499767400 VALVE GUIDE REAMER



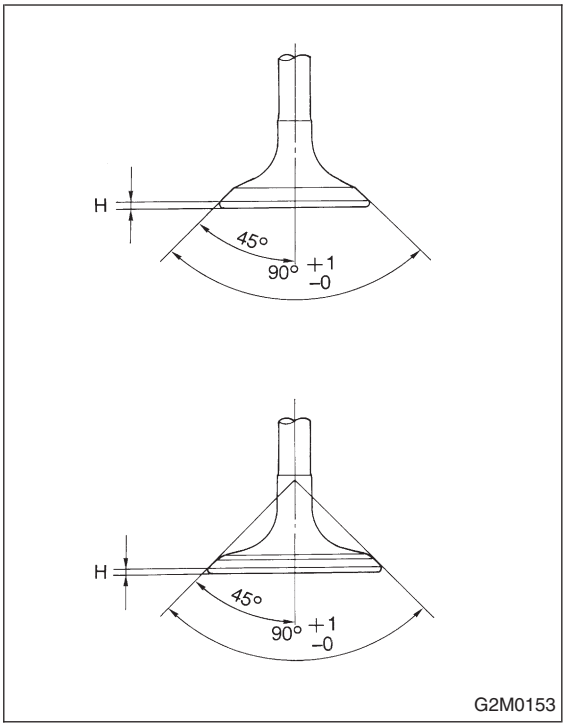
(8) Recheck the contact condition between valve and valve seat after replacing valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if “H” is less than the specified limit.

H:
Intake
Standard 1.0 mm (0.039 in)
Limit 0.6 mm (0.024 in)
Exhaust
Standard 1.2 mm (0.047 in)
Limit 0.6 mm (0.024 in)

Valve overall length:
Intake
120.6 mm (4.75 in)
Exhaust
121.7 mm (4.79 in)

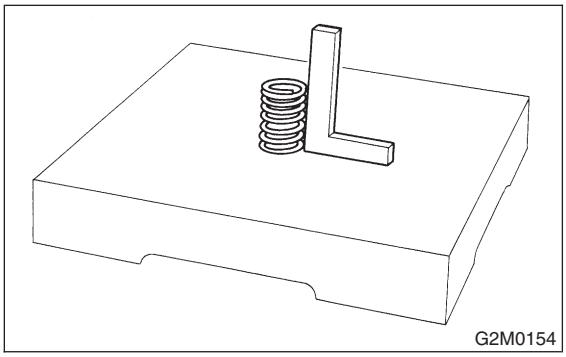


2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. <Ref. to 2-3 [W6C2].> Install a new intake valve oil seal after lapping.

5. VALVE SPRING

1) Check valve springs for damage, free length, and tension. Replace valve spring if it is not to the specifications presented below.
2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

Free length	54.30 mm (2.1378 in)
Squareness	2.5°, 2.4 mm (0.094 in)
Tension/spring height	214.8 — 246.2 N (21.9 — 25.1 kg, 48.3 — 55.3 lb)/ 45.0 mm (1.772 in)
	526.6 — 581.6 N (53.7 — 59.3 kg, 118.4 — 130.8 lb)/34.7 mm (1.366 in)



6. INTAKE AND EXHAUST VALVE OIL SEAL

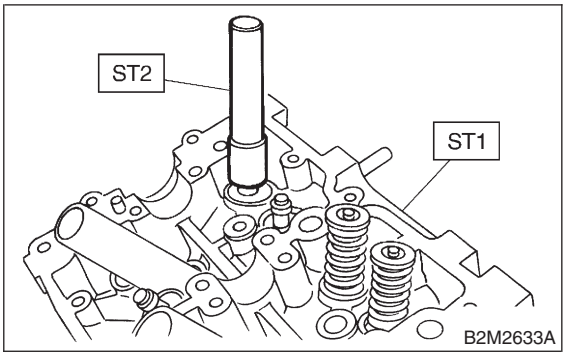
Replace oil seal with new one, if lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced. Use pliers to pinch and remove oil seal from valve.
1) Place cylinder head on ST1.
2) Press-fit oil seal to the specified dimension indicated in the figure using ST2.

CAUTION:
• Apply engine oil to oil seal before press-fitting.
• When press-fitting oil seal, do not use hammer or strike in.
• Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.

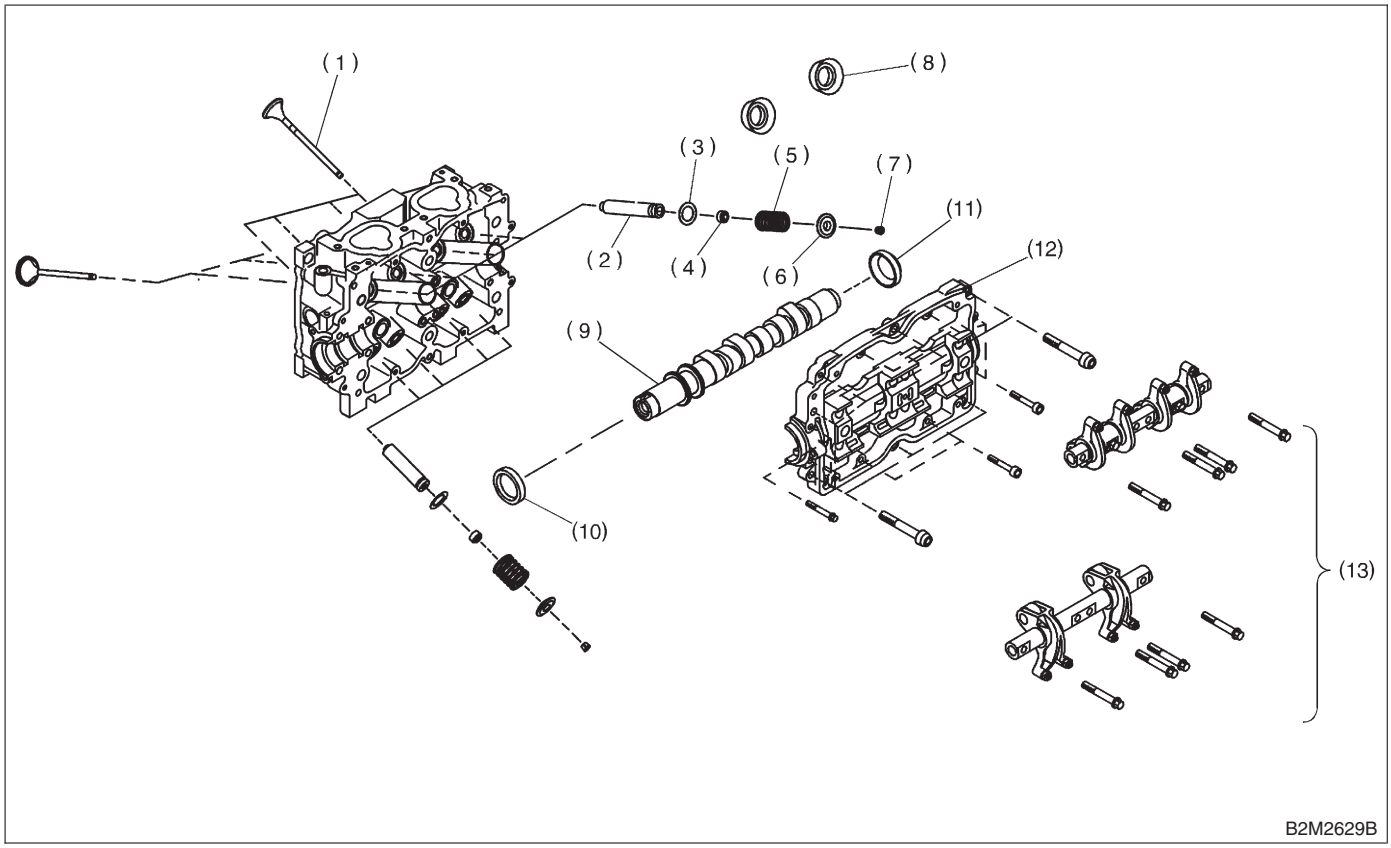
ST1 498267800 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

Color of rubber part:
Intake [Black]
Exhaust [Brown]

Color of spring part:
Intake [Silver]
Exhaust [Silver]



D: ASSEMBLY



(1) Valve
(2) Valve guide
(3) Valve spring seat
(4) Oil seal
(5) Valve spring
(6) Retainer
(7) Retainer key
(8) Spark plug gasket
(9) Camshaft
(10) Oil seal
(11) Plug
(12) Camshaft cap
(13) Valve rocker ASSY

1) Installation of valve spring and valve
(1) Place cylinder head on ST.

ST 498267400 CYLINDER HEAD TABLE

(2) Coat stem of each valve with engine oil and insert valve into valve guide.

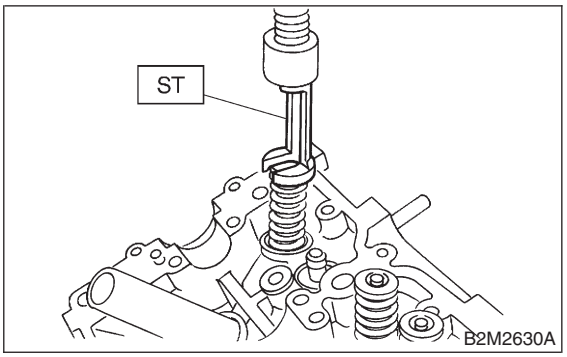
CAUTION:
When inserting valve into valve guide, use special care not to damage the oil seal lip.

(3) Install valve spring and retainer.

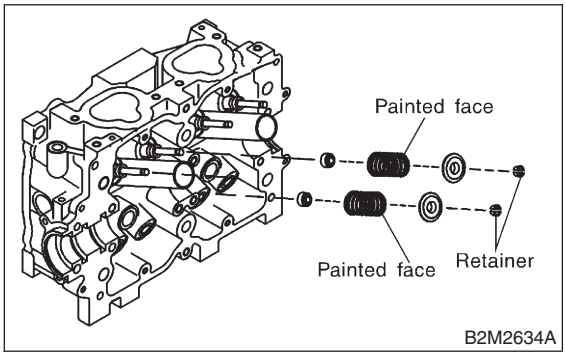
CAUTION:
Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

(4) Set ST on valve spring.

ST 499718000 VALVE SPRING REMOVER



(5) Compress valve spring and fit valve spring retainer key.



(6) After installing, tap valve spring retainers lightly with wooden hammer for better seating.

E: INSTALLATION

1. CYLINDER HEAD

1) Install cylinder head and gaskets on cylinder block.

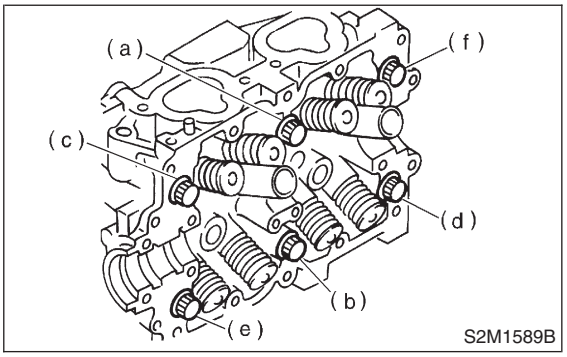
CAUTION:
Use new cylinder head gaskets.

2) Tighten cylinder head bolts.
(1) Apply a coat of engine oil to washers and bolt threads.
(2) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb) in alphabetical sequence.
Then tighten all bolts to 69 N·m (7.0 kg-m, 51 ft-lb) in alphabetical sequence.
(3) Back off all bolts by 180° first; back them off by 180° again.
(4) Tighten bolts (a) and (b) to 34 N·m (3.5 kg-m, 25 ft-lb).
(5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kg-m, 11 ft-lb).
(6) Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:
Do not tighten bolts more than 90°.

(7) Further tighten all bolts by 80 to 90° in alphabetical sequence shown in figure below.

CAUTION:
Ensure that the total "re-tightening angle" [in the former two steps], do not exceed 180°.



3) Install oil level gauge guide and tighten attaching bolt (left side only).

2. RELATED PARTS

CAUTION:
Be careful not to scratch the mating surface of cylinder block and oil pump.

1) Install camshafts. <Ref. to 2-3 [W5C0].>
2) Install intake manifold. <Ref. to 2-7 [W3D0].>
3) Tighten bolt which installs A/C compressor bracket on cylinder head. (With A/C model)

7. Cylinder Block

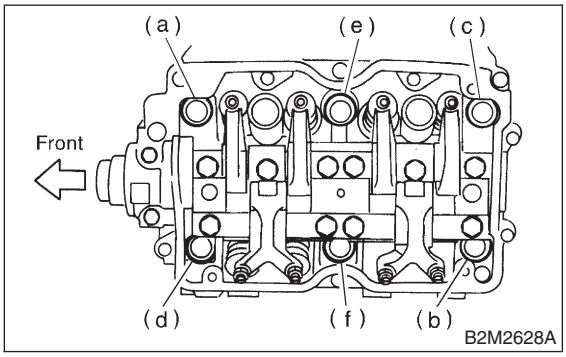
A: REMOVAL

1. RELATED PARTS

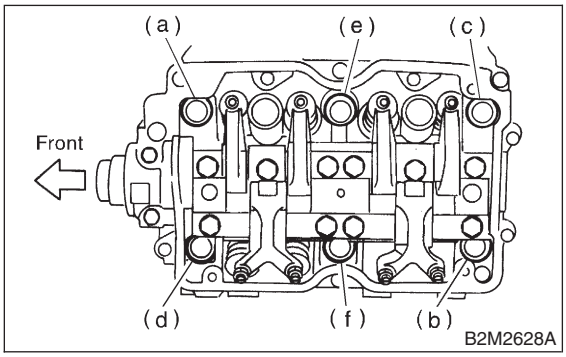
NOTE:
Before conducting this procedure drain engine oil completely if applicable.

1) Remove intake manifold. <Ref. to 2-7 [W3A0].>
2) Remove timing belt. <Ref. to 2-3 [W3A0].>
3) Remove A/C compressor bracket. (With A/C model)
4) Remove generator and A/C compressor with their brackets.
5) Remove cylinder head bolts in alphabetical sequence shown in figure.

CAUTION:
Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



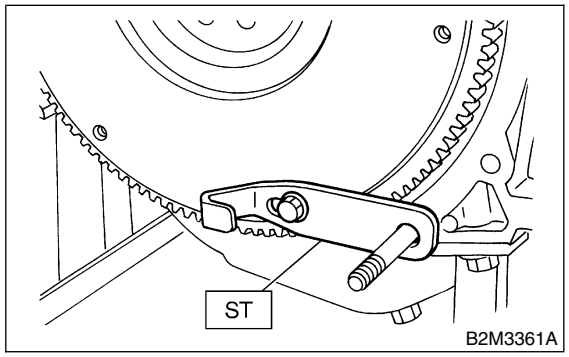
6) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
7) Remove bolts (a) and (b) to remove cylinder head.

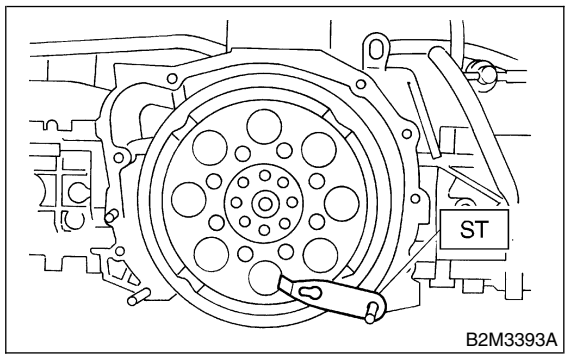


8) Remove cylinder head gasket.

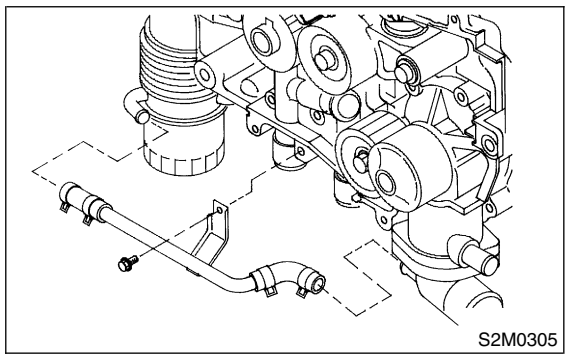
CAUTION:
Do not scratch the mating surface of cylinder head and cylinder block.

9) Similarly, remove right side cylinder head.
10) Remove clutch housing cover (MT vehicles only).
11) Remove flywheel (MT vehicles only) or drive plate (AT vehicles only).
Using ST, lock crankshaft.
ST 498497100 CRANKSHAFT STOPPER





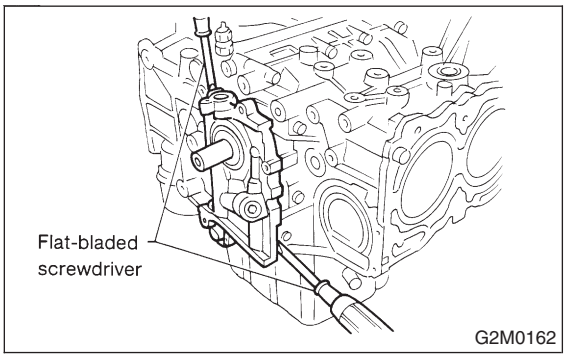
12) Remove oil separator cover.
13) Remove water by-pass pipe for heater.
14) Remove water by-pass pipe between oil cooler and water pump (AT vehicles only).



15) Remove water pump.

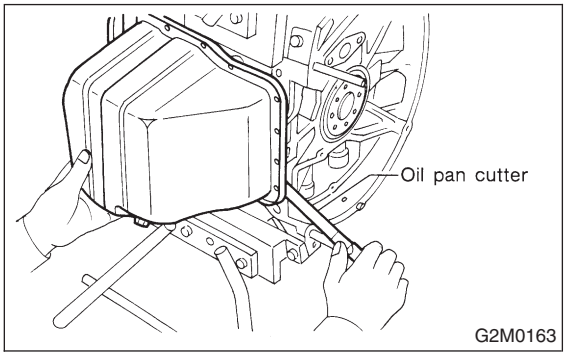
16) Remove oil pump from cylinder block.
Use a flat-bladed screwdriver as shown in figure when removing oil pump.

CAUTION:
Be careful not to scratch the mating surface of cylinder block and oil pump.

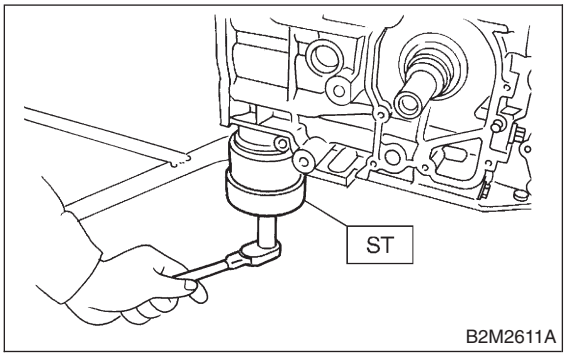


17) Removal of oil pan
(1) Turn cylinder block with #2 and #4 piston sides facing upward.
(2) Remove bolts which secure oil pan to cylinder block.
(3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance and remove oil pan.

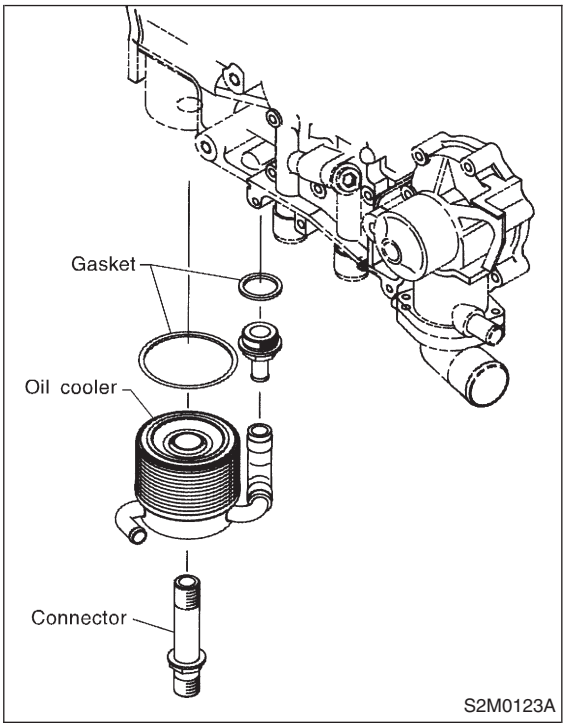
CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.



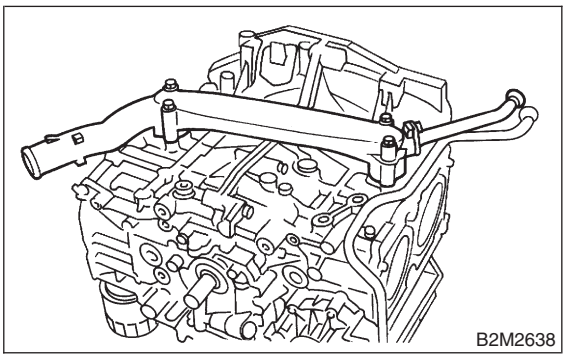
18) Remove oil strainer stay.
19) Remove oil strainer.
20) Remove baffle plate.
21) Remove oil filter using ST.
ST 498187300 OIL FILTER WRENCH



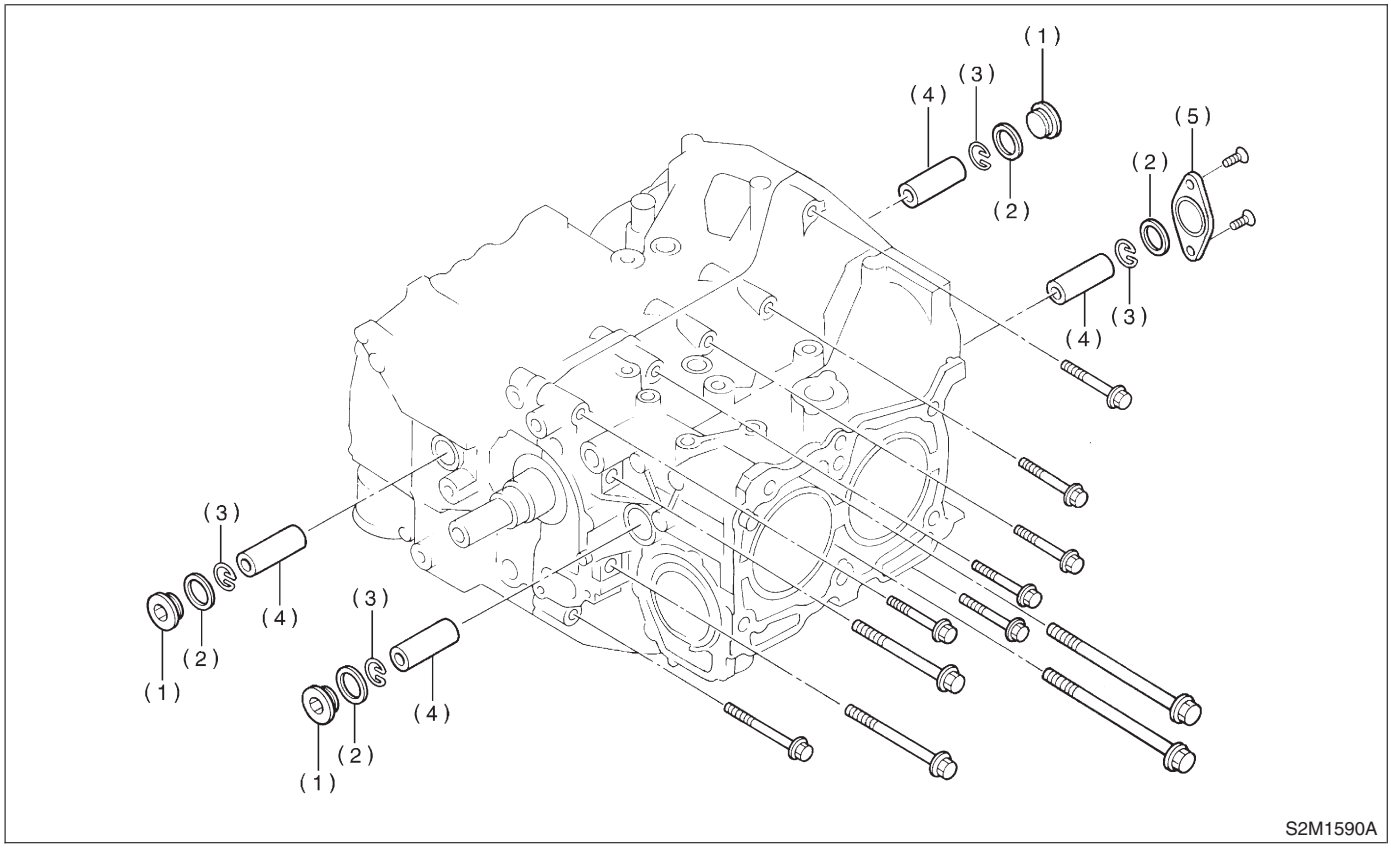
22) Remove oil cooler (AT vehicles only).



23) Remove water pipe. <Ref. to 2-5 [W7A0].>

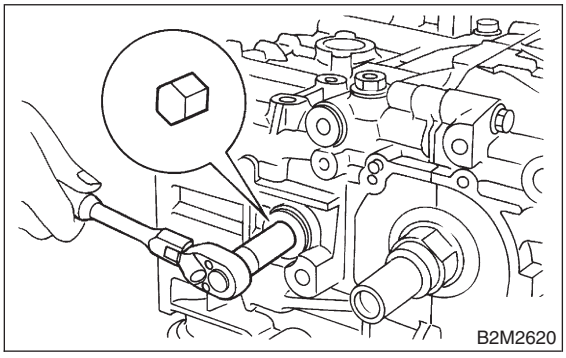


2. CYLINDER BLOCK

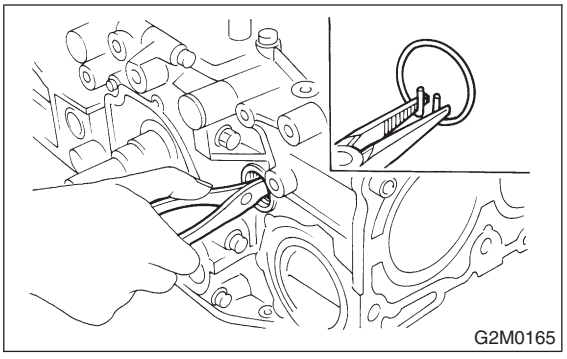


(1) Service hole plug
(2) Gasket
(3) Circlip
(4) Piston pin
(5) Service hole cover

1) Remove service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].

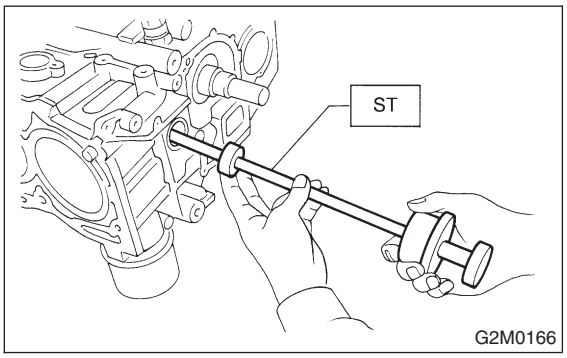


2) Rotate crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove piston circlip through service hole of #1 and #2 cylinders.



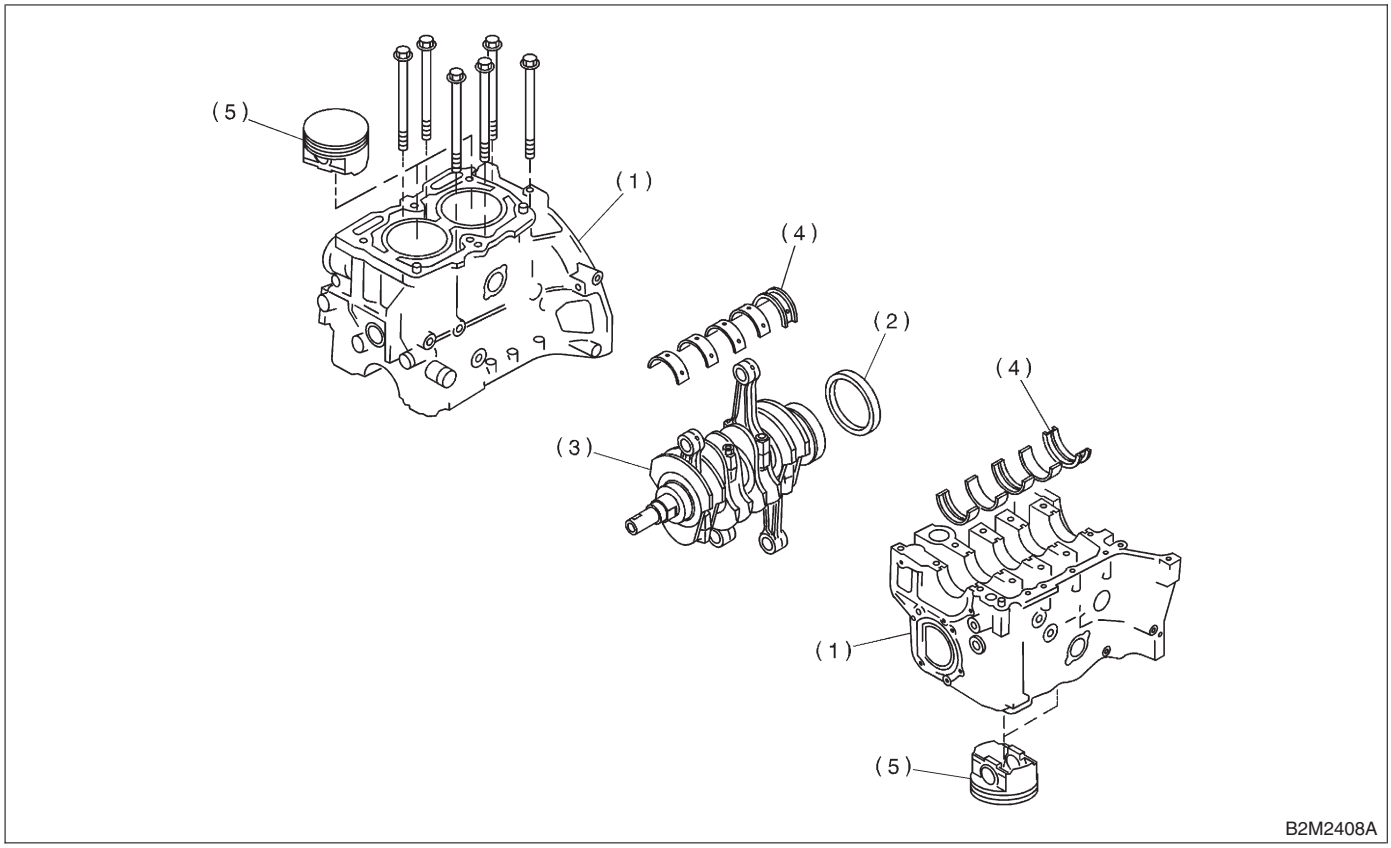
3) Draw out piston pin from #1 and #2 pistons using ST.
ST 499097700 PISTON PIN REMOVER

CAUTION:
Be careful not to confuse original combination of piston, piston pin and cylinder.



4) Similarly remove piston pins from #3 and #4 pistons.
5) Remove bolts which connect cylinder block on the side of #2 and #4 cylinders.
6) Back off bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.
7) Set up cylinder block so that #1 and #3 cylinders are on the upper side, then remove cylinder block connecting bolts.
8) Separate left-hand and right-hand cylinder blocks.

CAUTION:
When separating cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



(1) Cylinder block
(2) Rear oil seal
(3) Crankshaft
(4) Crankshaft bearing
(5) Piston

9) Remove rear oil seal.
10) Remove crankshaft together with connecting rod.
11) Remove crankshaft bearings from cylinder block using hammer handle.

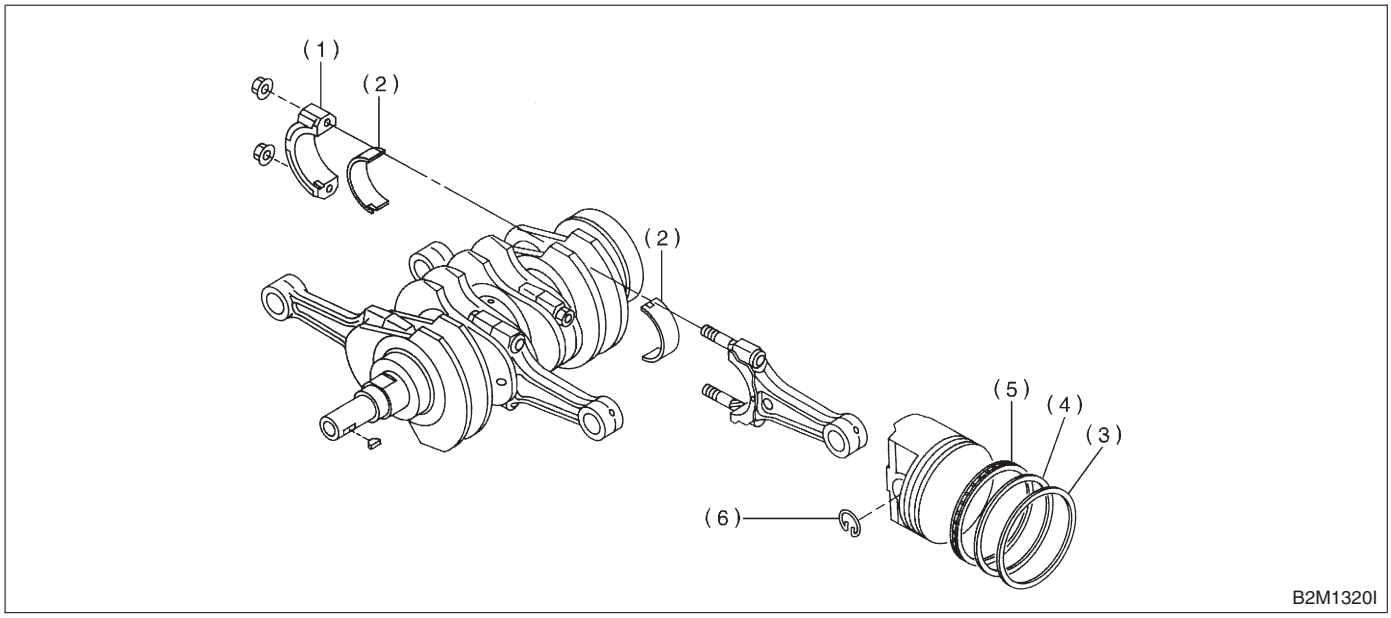
CAUTION:
Do not confuse combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

12) Draw out each piston from cylinder block using wooden bar or hammer handle.

CAUTION:
Do not confuse combination of piston and cylinder.

B: DISASSEMBLY

1. CRANKSHAFT AND PISTON



(1) Connecting rod cap
(2) Connecting rod bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Circlip

1) Remove connecting rod cap.
2) Remove connecting rod bearing.

CAUTION:
Arrange removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

3) Remove piston rings using the piston ring expander.
4) Remove the oil ring by hand.

CAUTION:
Arrange the removed piston rings in good order to prevent confusion.

5) Remove circlip.

C: INSPECTION

1. CYLINDER BLOCK

1) Visually check for cracks and damage. Especially, inspect important parts by means of red lead check.
2) Check the oil passages for clogging.
3) Inspect crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.05 mm (0.0020 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder block:
201.0 mm (7.91 in)

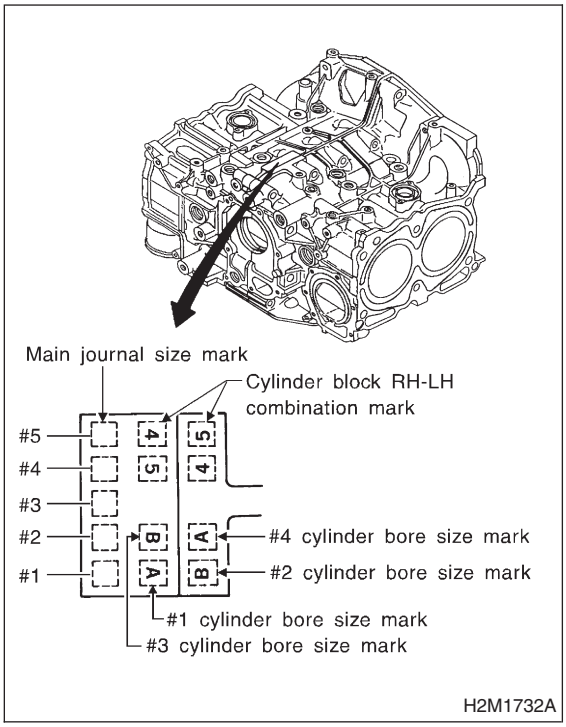
2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the cylinder block's front upper surface.

CAUTION:
Measurement should be performed at a temperature 20°C (68°F).

NOTE:
Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as a guide line in selecting a standard piston.

Standard diameter:
A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)

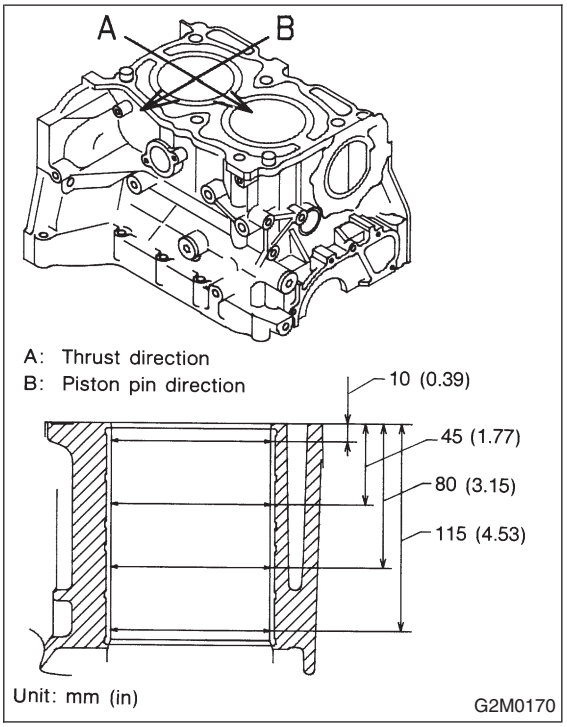


2) How to measure the inner diameter of each cylinder
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the figure, using a cylinder bore gauge.

CAUTION:
Measurement should be performed at a temperature 20°C (68°F).

Taper:
Standard
0.015 mm (0.0006 in)
Limit
0.050 mm (0.0020 in)

Out-of-roundness:
Standard
0.010 mm (0.0004 in)
Limit
0.050 mm (0.0020 in)



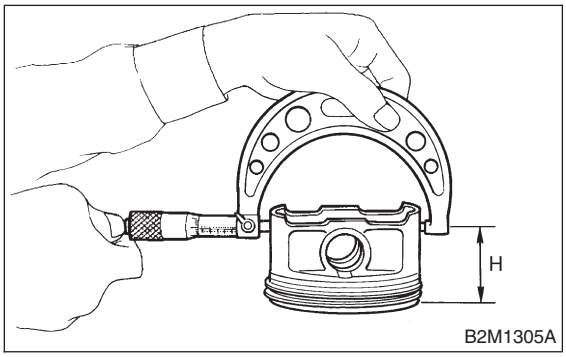
3) When piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

4) How to measure the outer diameter of each piston
Measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:
37.0 mm (1.457 in)

Piston outer diameter:
Standard
A: 99.485 — 99.495 mm
(3.9167 — 3.9171 in)
B: 99.475 — 99.485 mm
(3.9163 — 3.9167 in)
0.25 mm (0.0098 in) oversize
99.725 — 99.735 mm
(3.9262 — 3.9266 in)
0.50 mm (0.0197 in) oversize
99.975 — 99.985 mm
(3.9360 — 3.9364 in)



5) Calculate the clearance between cylinder and piston.

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):
Standard
0.010 — 0.030 mm (0.0004 — 0.0012 in)
Limit
0.050 mm (0.0020 in)

6) Boring and honing
(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebore it to use an oversize piston.

CAUTION:
When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the crankcase.

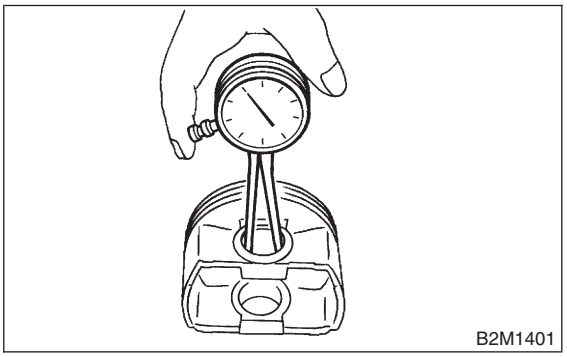
CAUTION:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

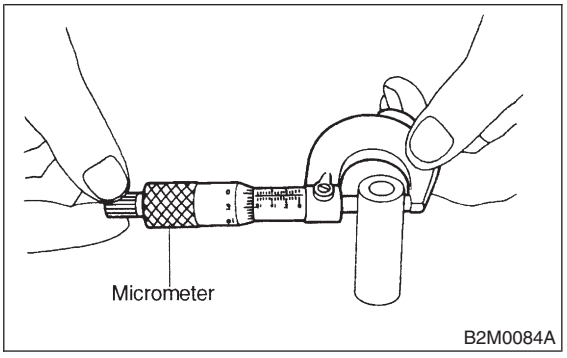
Limit of cylinder enlarging (boring):
0.5 mm (0.020 in)

3. PISTON AND PISTON PIN

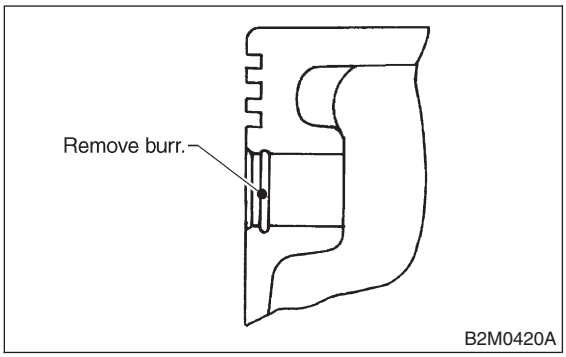
1) Check pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.
2) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to 2-3 [W7C2].> If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.
3) Make sure that piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

Standard clearance between piston pin and hole in piston:
Standard
0.004 — 0.008 mm (0.0002 — 0.0003 in)
Limit
0.020 mm (0.0008 in)





4) Check circlip installation groove on the piston for burr. If necessary, remove burr from the groove so that piston pin can lightly move.

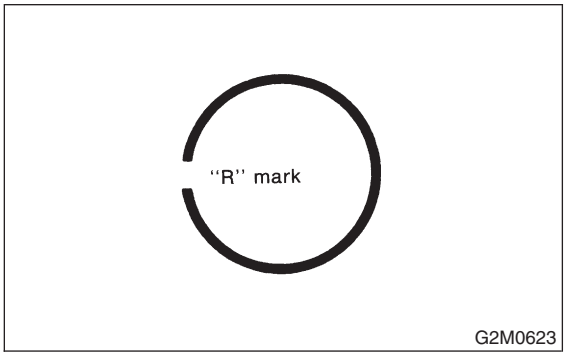


5) Check piston pin circlip for distortion, cracks and wear.

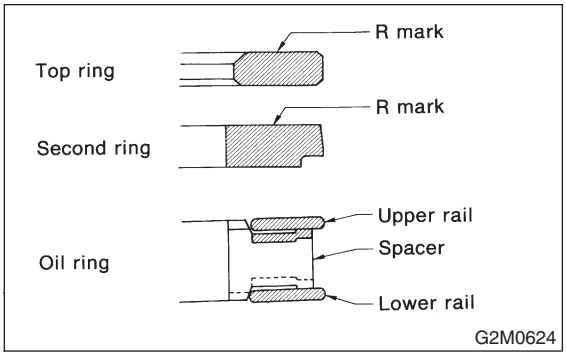
4. PISTON RING

1) If piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace piston ring with a new one of the same size as the piston.

CAUTION:
• "R" is marked on the end of the top and second rings. When installing the rings to the piston, face this mark upward.



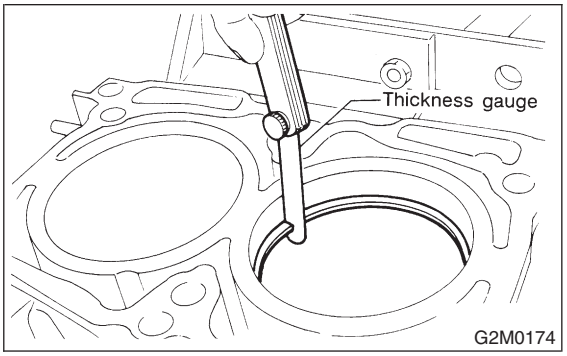
• The oil ring is a combined ring consisting of two rails and a spacer in between. When installing, be careful to assemble correctly.



2) Squarely place piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

Unit: mm (in)

		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.35 — 0.50 (0.0138 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.70 (0.0079 — 0.0276)	1.5 (0.059)

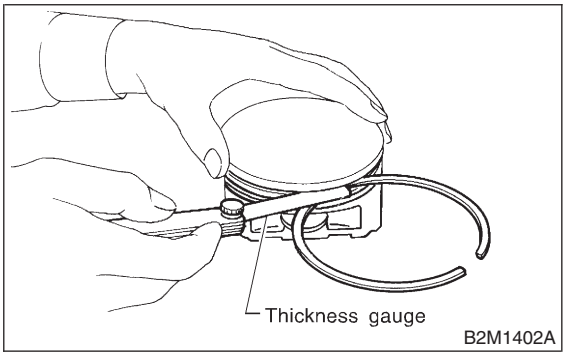


3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

CAUTION:
Before measuring the clearance, clean the piston ring groove and piston ring.

Unit: mm (in)

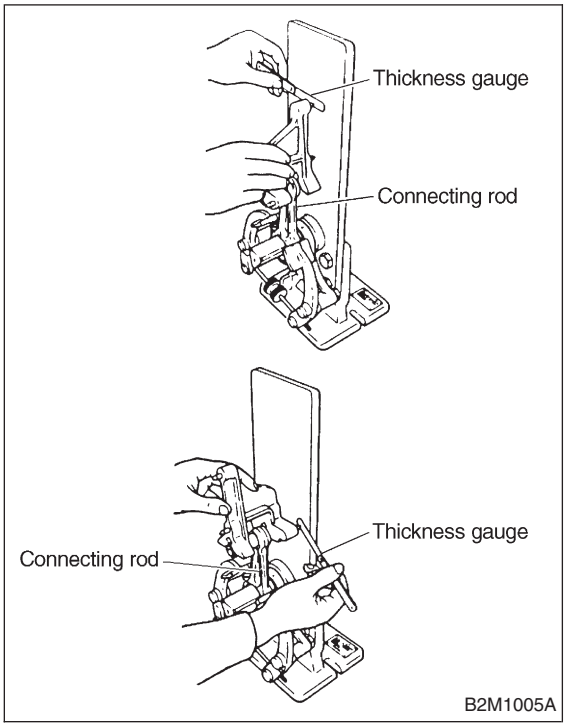
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)



5. CONNECTING ROD

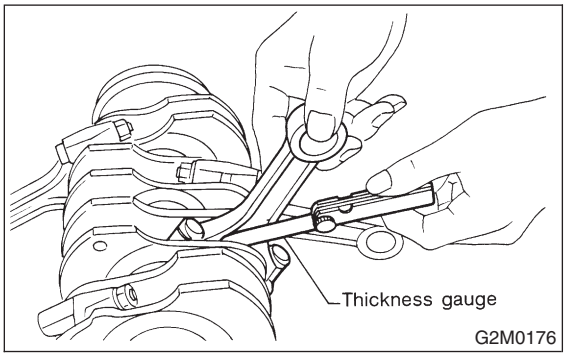
1) Replace connecting rod, if the large or small end thrust surface is damaged.
2) Check for bend or twist using a connecting rod aligner. Replace connecting rod if the bend or twist exceeds the limit.

Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



3) Install connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace connecting rod if the side clearance exceeds the specified limit.

Connecting rod side clearance:
Standard
0.070 — 0.330 mm (0.0028 — 0.0130 in)
Limit
0.4 mm (0.016 in)



4) Inspect connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

5) Measure the oil clearance on individual connecting rod bearings by means of plastigauge. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

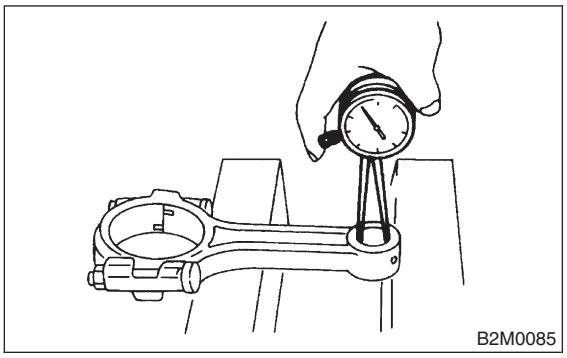
Connecting rod oil clearance:
Standard
0.020 — 0.046 mm (0.0008 — 0.0018 in)
Limit
0.050 mm (0.0020 in)

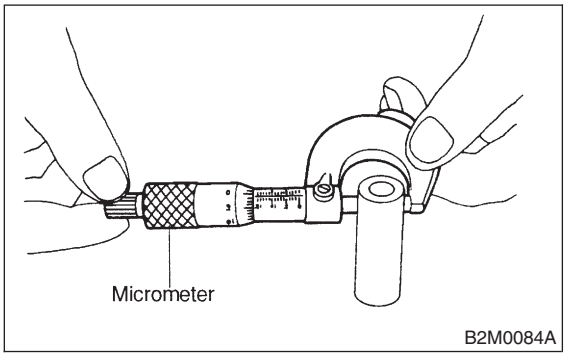
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.486 — 1.498 (0.0585 — 0.0590)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)
Limit
0.030 mm (0.0012 in)

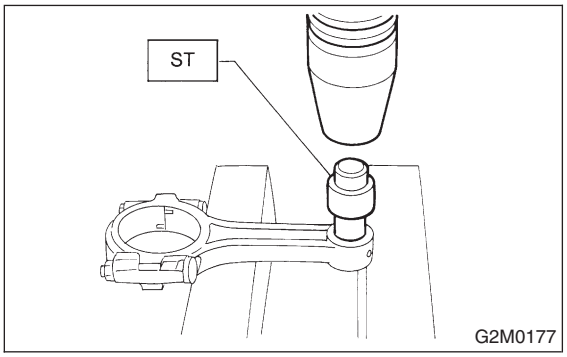

B2M0085



B2M0084A

7) Replacement procedure is as follows.
(1) Remove bushing from connecting rod with ST and press.
(2) Press bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



G2M0177

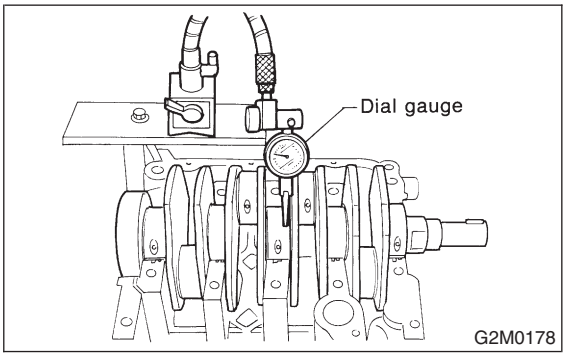
(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
(4) After completion of reaming, clean bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

CAUTION:
If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position crankshaft on these bearings and measure crankshaft bend using a dial gauge.

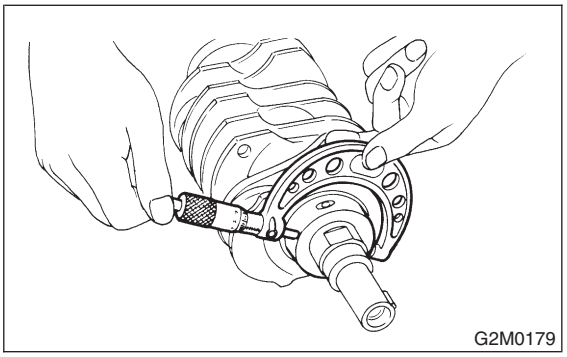
Crankshaft bend limit:
0.035 mm (0.0014 in)



G2M0178

3) Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace bearing with a suitable (undersize) one, and replace or recondition crankshaft as necessary. When grinding crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:
Out-of-roundness
0.020 mm (0.0008 in) or less
Taper limit
0.07 mm (0.0028 in)
Grinding limit
0.250 mm (0.0098 in)


G2M0179

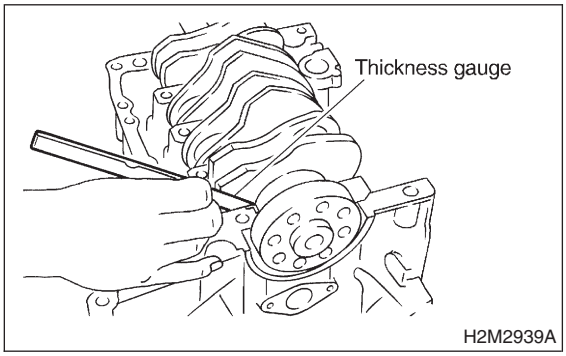
Unit: mm (in)

		Crank journal diameter		Crank pin diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.492 — 1.501 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.620 — 1.623 (0.0638 — 0.0639)

O.D. ... Outer Diameter

4) Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace bearing.

Crankshaft thrust clearance:
Standard
0.030 — 0.115 mm (0.0012 — 0.0045 in)
Limit
0.25 mm (0.0098 in)



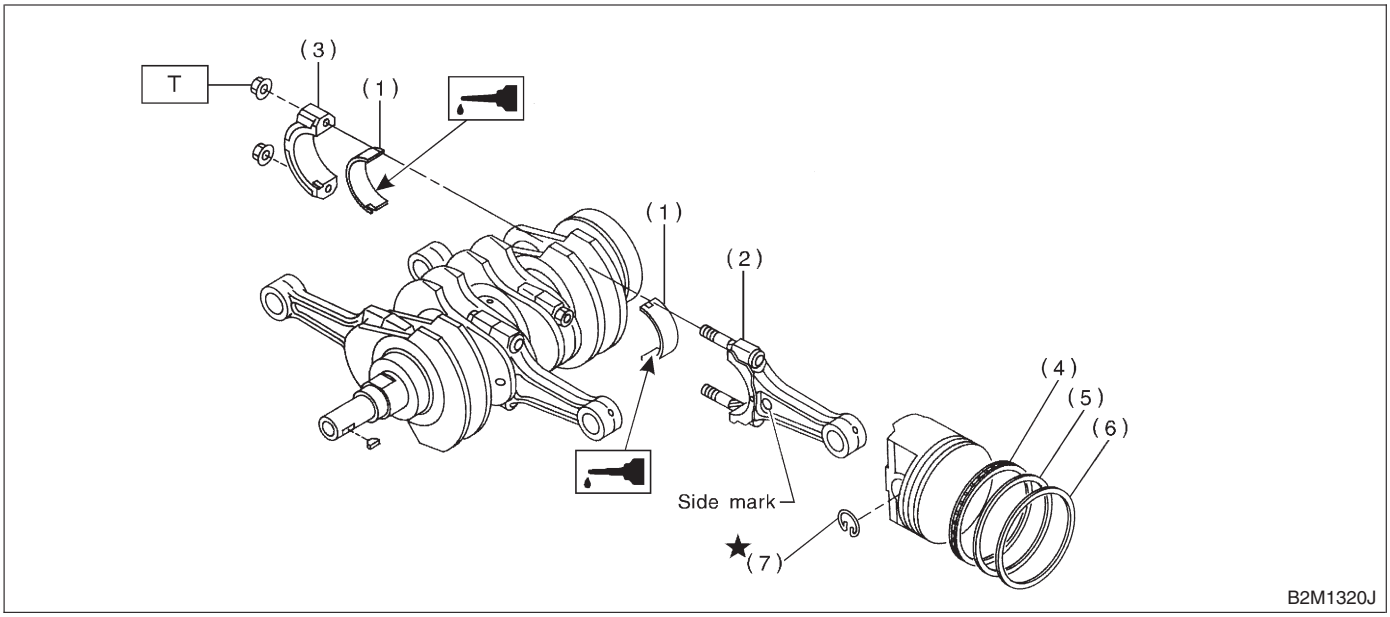
5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting, and wear.
6) Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specification, replace defective bearing with an undersize one, and replace or recondition crankshaft as necessary.

Unit: mm (in)

Crankshaft oil clearance	
Standard	0.010 — 0.030 (0.0004 — 0.0012)
Limit	0.040 (0.0016)

D: ASSEMBLY

1. CRANKSHAFT AND PISTON



(1) Connecting rod bearing
(2) Connecting rod
(3) Connecting rod cap
(4) Oil ring
(5) Second ring
(6) Top ring
(7) Circlip

Tightening torque: N·m (kg-m, ft-lb)
T: 44.6±1.5 (4.55±0.15, 32.9±1.1)

1) Install connecting rod bearings on connecting rods and connecting rod caps.

CAUTION:
Apply oil to the surfaces of the connecting rod bearings.

2) Install connecting rod on crankshaft.

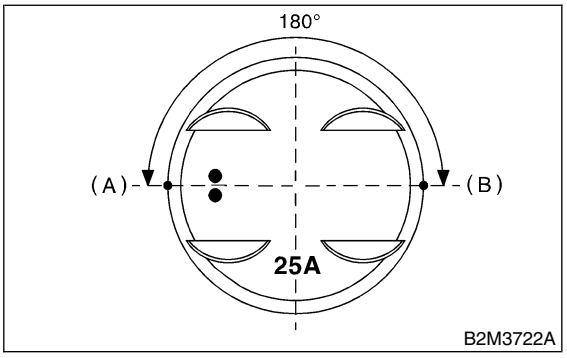
CAUTION:
Position each connecting rod with the side marked facing forward.

3) Install connecting rod cap with connecting rod nut.
Ensure the arrow on connecting rod cap faces the front during installation.

CAUTION:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
• When tightening the connecting rod nuts, apply oil on the threads.

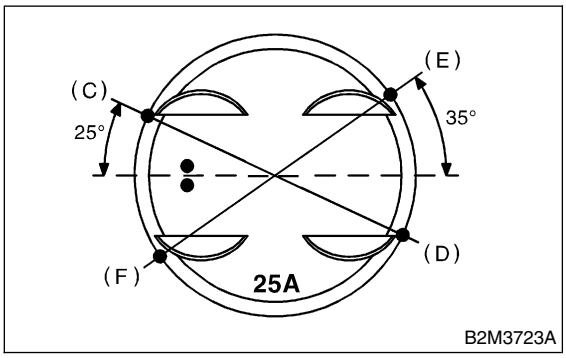
4) Installation of piston rings and oil ring
(1) Install oil ring spacer, upper rail and lower rail in this order by hand. Then install second ring and top ring with a piston ring expander.

(2) Position the top ring gap at (A) or (B) in the figure.



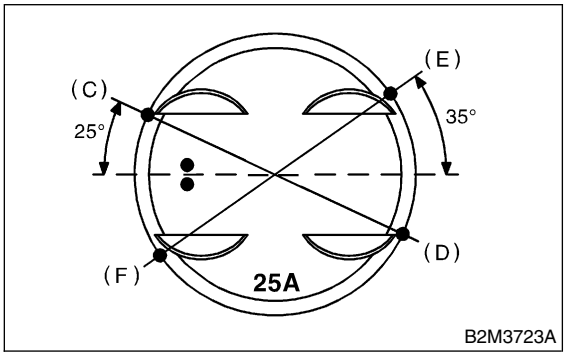
(3) Position the second ring gap at 180° on the reverse side for the top ring gap.

(4) Position the upper rail gap at (C) or (D) in the figure.



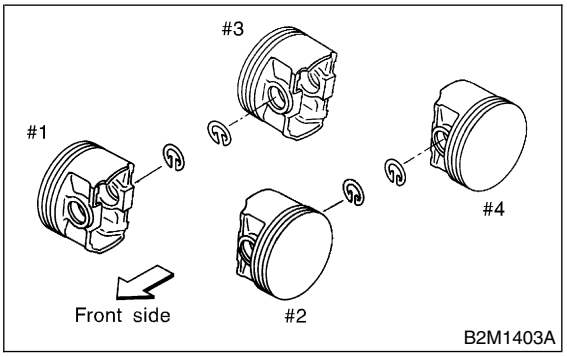
(5) Position the expander gap at 180° of the reverse side for the upper rail gap.
(6) Position the lower rail gap at (E) or (F) in the figure.

CAUTION:
● Ensure ring gaps do not face the same direction.
● Ensure ring gaps are not within the piston skirt area.

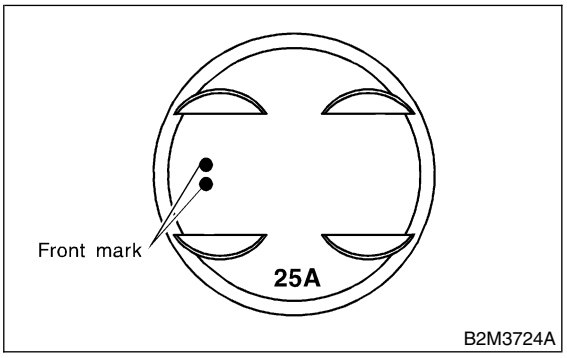


5) Install circlip.
Install circlips in piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

CAUTION:
Use new circlips.

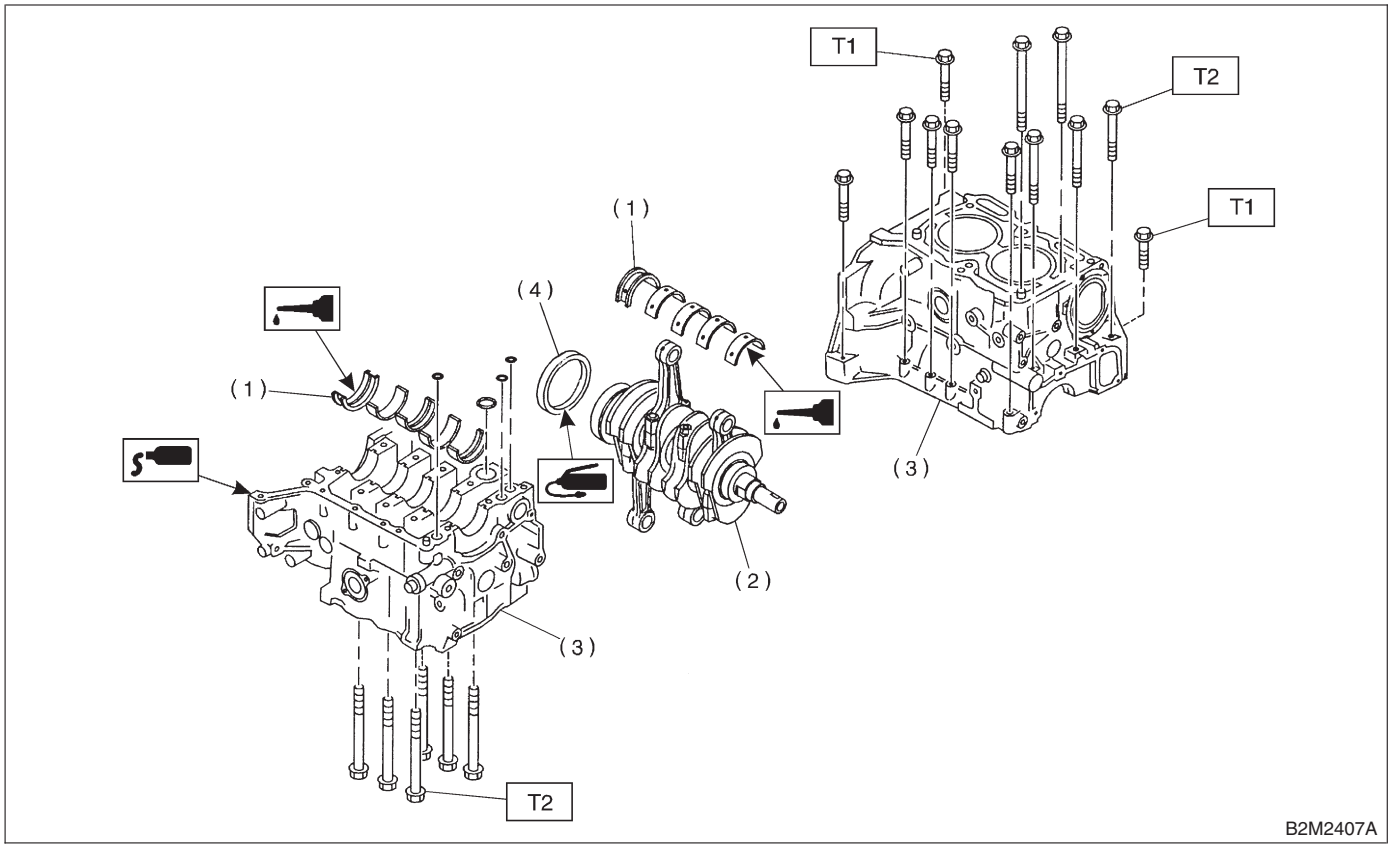


CAUTION:
Piston front mark faces towards the front of the engine.



E: INSTALLATION

1. CYLINDER BLOCK



(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal

Tightening torque: N·m (kg-m, ft-lb)
T1: 25±2 (2.5±0.2, 18.1±1.4)
T2: 47±3 (4.8±0.3, 34.7±2.2)

1) Install ST to cylinder block, then install crankshaft bearings.
ST 499817000 ENGINE STAND

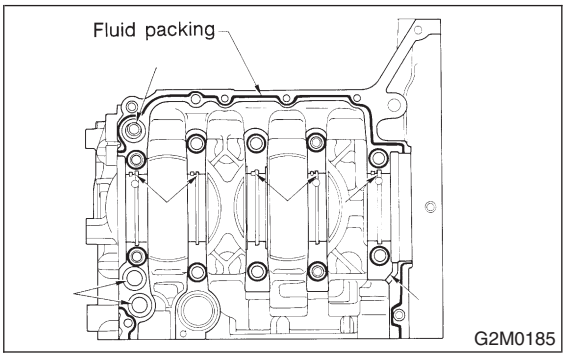
CAUTION:
Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

2) Position crankshaft on the #2 and #4 cylinder block.

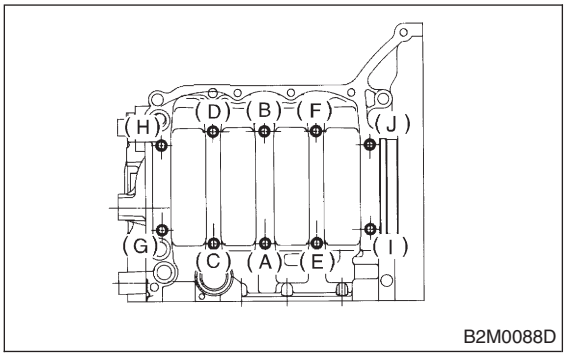
3) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

Fluid packing:
THREE BOND 1215 or equivalent

CAUTION:
Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.

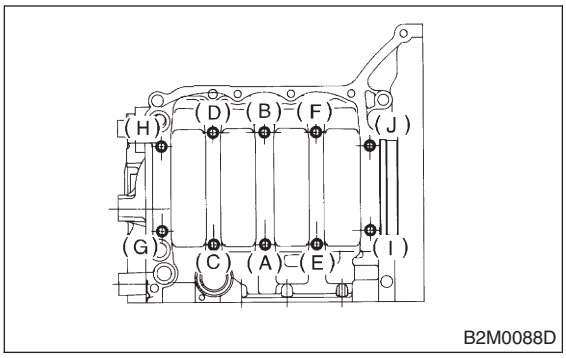


4) Temporarily tighten 10 mm cylinder block connecting bolts in alphabetical sequence shown in figure.



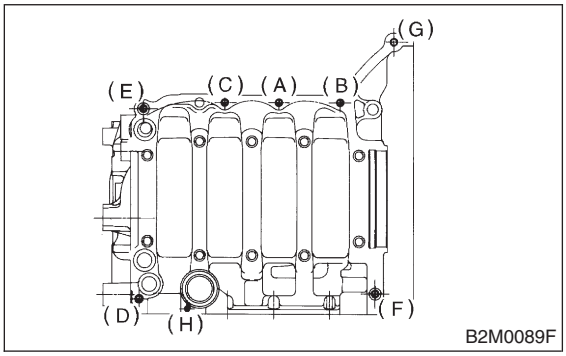
5) Tighten 10 mm cylinder block connecting bolts in alphabetical sequence.

Tightening torque:
47±3 N·m (4.8±0.3 kg-m, 34.7±2.2 ft-lb)

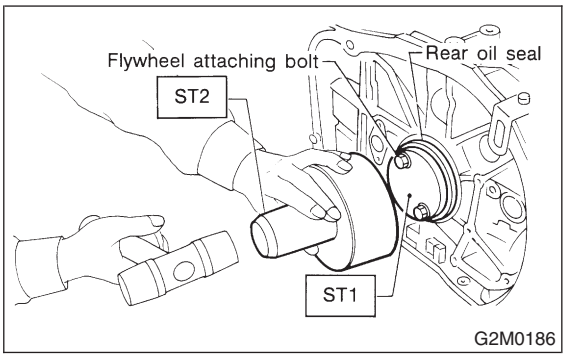


6) Tighten 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in figure.

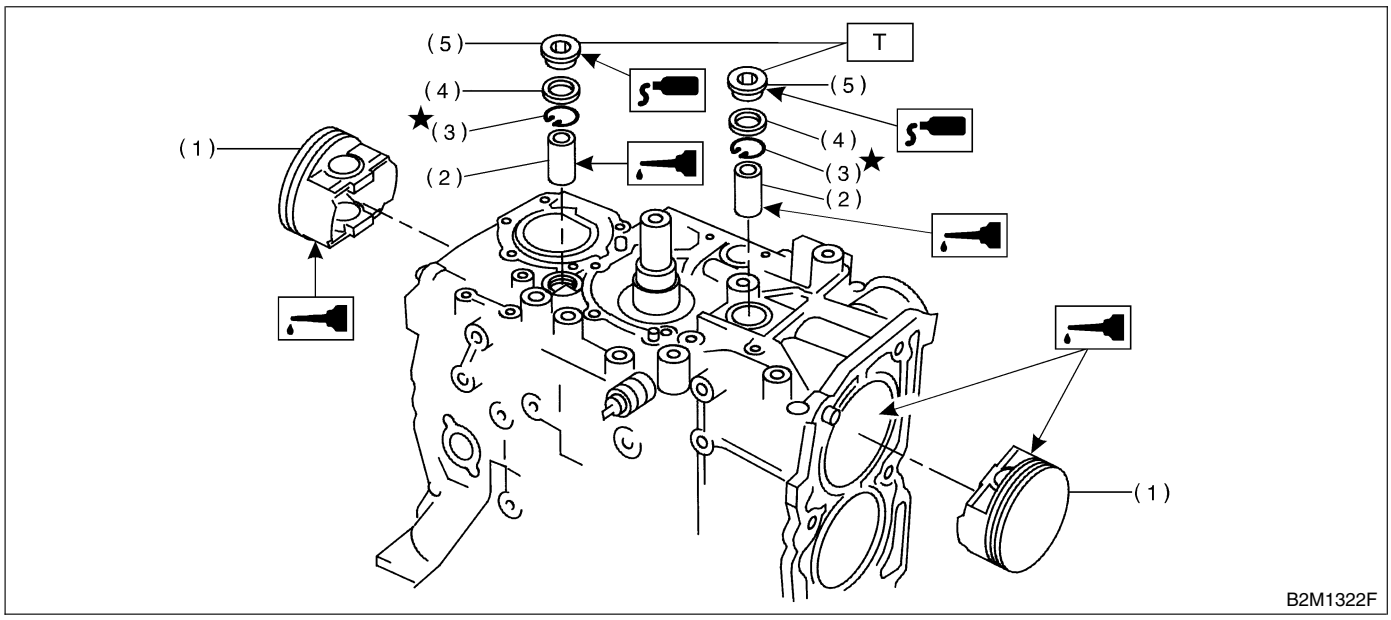
Tightening torque:
(A) — (G): 25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)
(H): 6.4 N·m (0.65 kg-m, 4.7 ft-lb)



7) Install rear oil seal using ST1 and ST2.
ST1 499597100 OIL SEAL GUIDE
ST2 499587200 OIL SEAL INSTALLER



2. PISTON AND PISTON PIN (#1 AND #2)



(1) Piston
(2) Piston pin
(3) Circlip
(4) Gasket
(5) Service hole plug

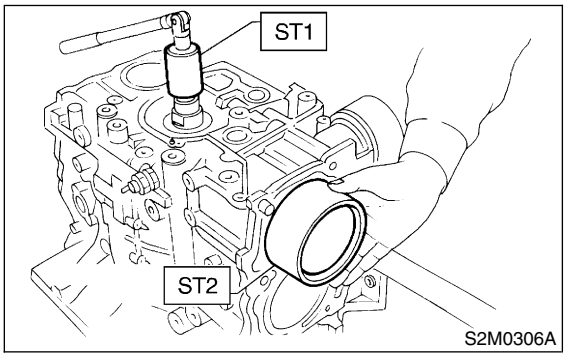
Tightening torque: N·m (kg-m, ft-lb)
T: 69±7 (7.0±0.7, 50.6±5.1)

1) Installing piston
(1) Turn cylinder block so that #1 and #2 cylinders face upward.
(2) Using ST1, turn crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to pistons and cylinders and insert pistons in their cylinders using ST2.

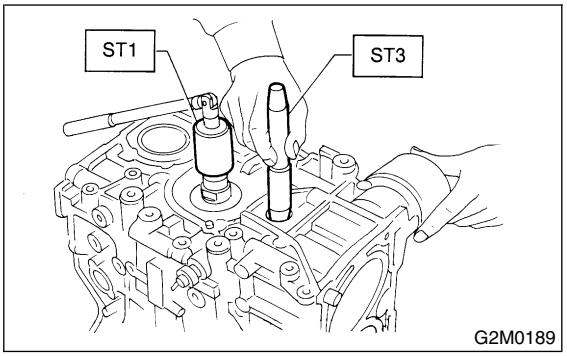
ST2 498747100 PISTON GUIDE



2) Installing piston pin
(1) Insert ST3 into service hole to align piston pin hole with connecting rod small end.

CAUTION:
Apply a coat of engine oil to ST3 before insertion.

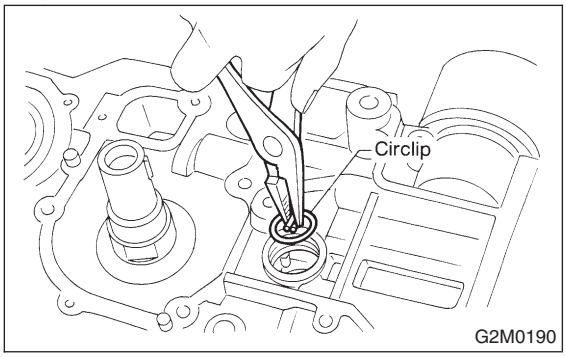
ST3 499017100 PISTON PIN GUIDE



(2) Apply a coat of engine oil to piston pin and insert piston pin into piston and connecting rod through service hole.

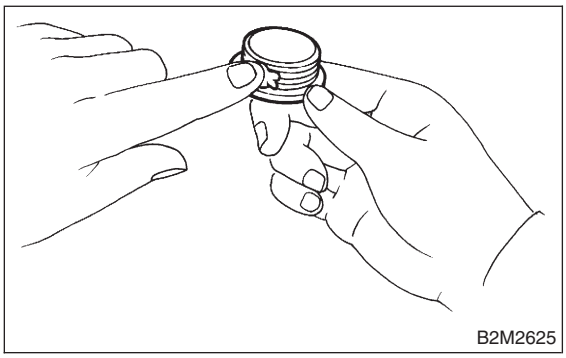
(3) Install circlip.

CAUTION:
Use new circlips.



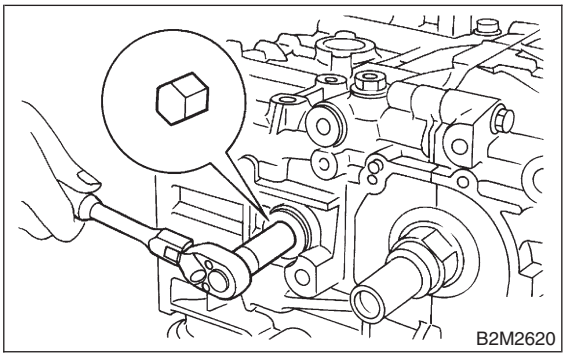
(4) Apply fluid packing around the service hole plug.

Fluid packing:
THREE BOND 1215 or equivalent

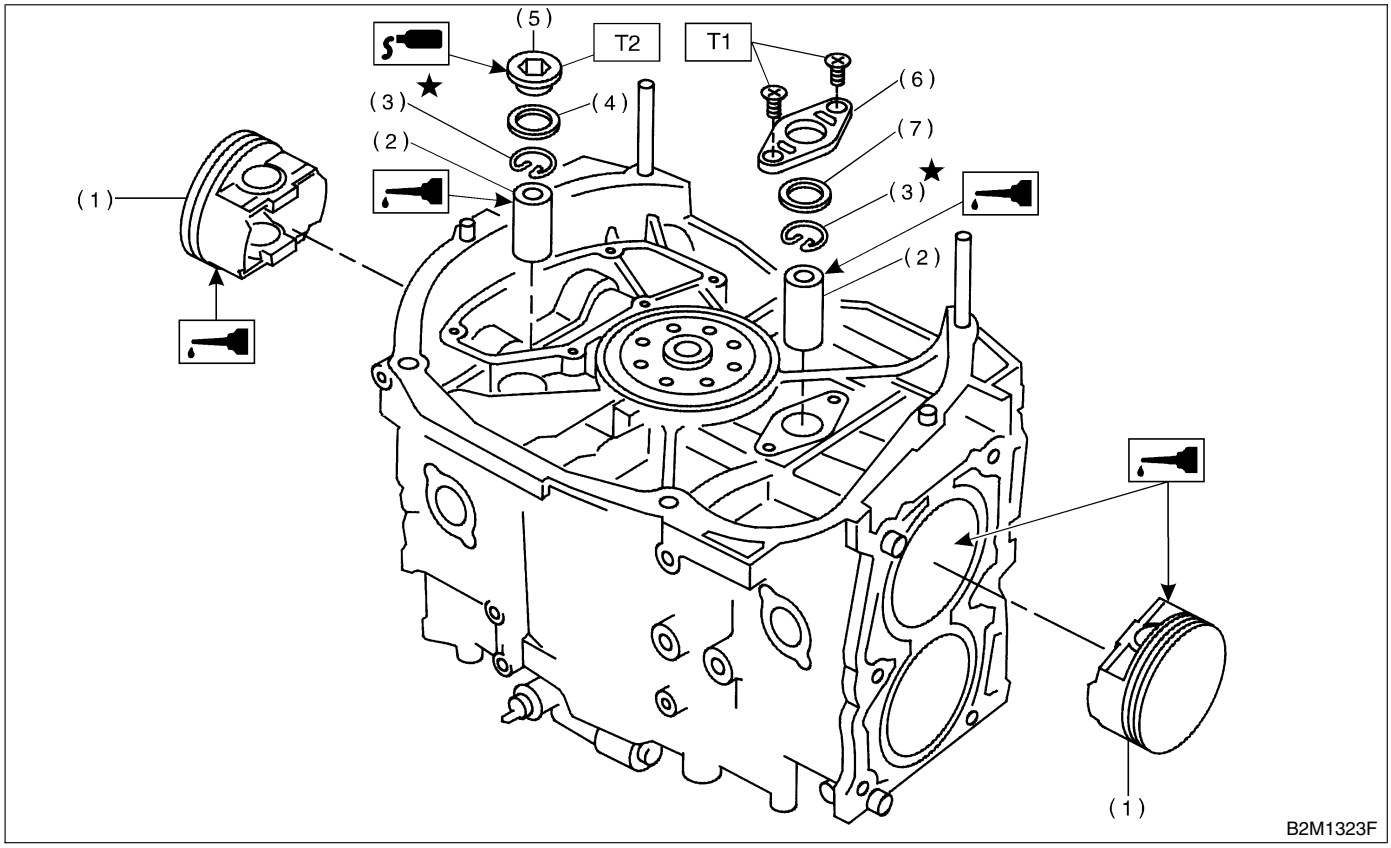


(5) Install service hole plug and gasket.

CAUTION:
Use a new gasket.



3. PISTON AND PISTON PIN (#3 AND #4)



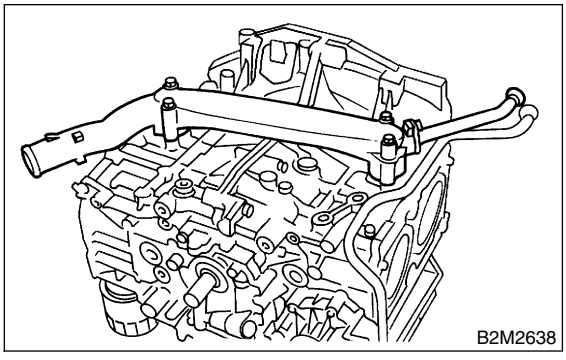
(1) Piston
(2) Piston pin
(3) Circlip
(4) Gasket
(5) Service hole plug
(6) Service hole cover
(7) O-ring

Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 69±7 (7.0±0.7, 50.6±5.1)

Turn cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install pistons and piston pins.

4. RELATED PARTS

1) Install water pipe. <Ref. to 2-5 [W7B0].>



2) Install baffle plate.

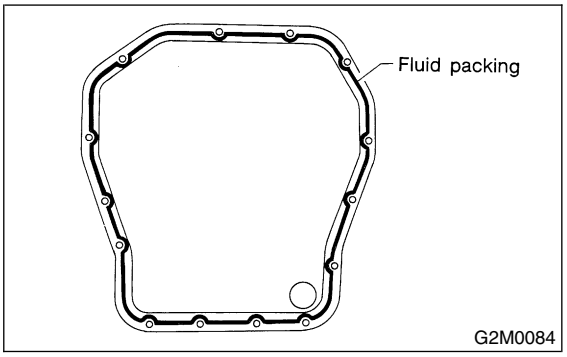
Tightening torque:
6.4 N·m (0.65 kg-m, 4.7 ft-lb)

3) Install oil strainer and O-ring.

Tightening torque:
10 N·m (1.0 kg-m, 7 ft-lb)

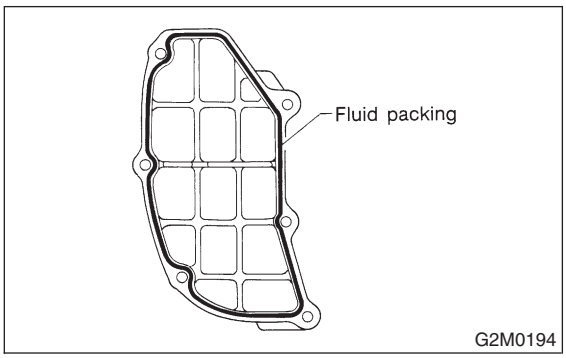
4) Install oil strainer stay.
5) Apply fluid packing to matching surfaces and install oil pan.

Fluid packing:
THREE BOND 1215 or equivalent



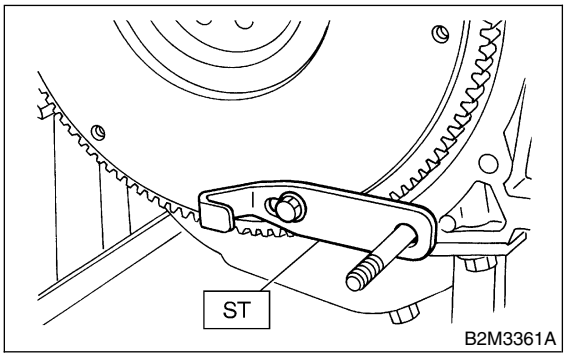
6) Apply fluid packing to matching surfaces and install oil separator cover.

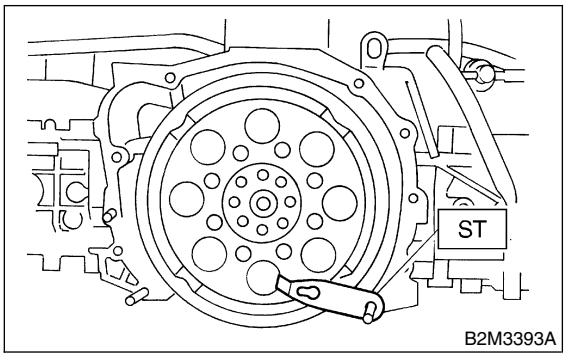
Fluid packing:
THREE BOND 1215 or equivalent



7) Install flywheel or drive plate.
To lock crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

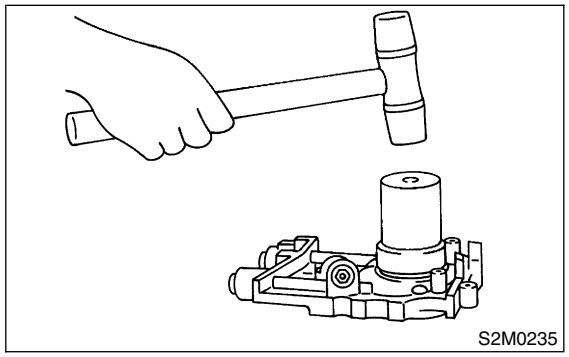
Tightening torque:
72±3 N·m (7.3±0.3 kg-m, 52.8±2.2 ft-lb)





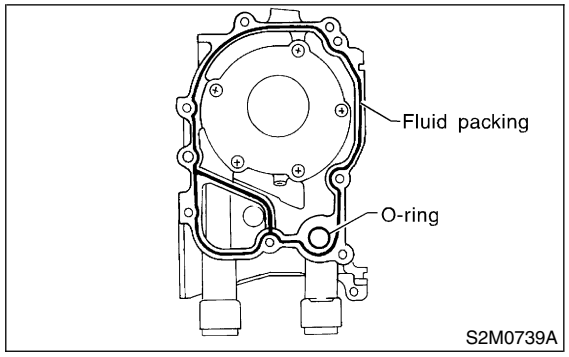
8) Install housing cover.

9) Installation of oil pump
(1) Discard front oil seal after removal. Replace with a new one using ST.
ST 499587100 OIL SEAL INSTALLER

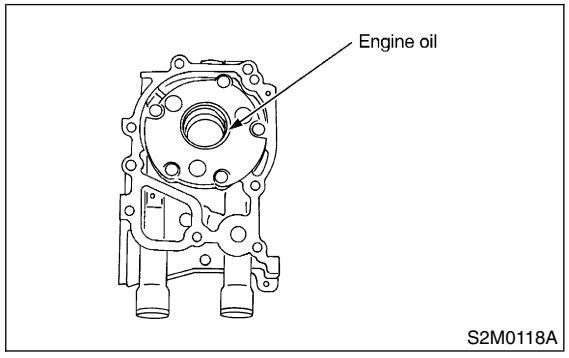


(2) Apply fluid packing to matching surface of oil pump.

Fluid packing:
THREE BOND 1215 or equivalent



(3) Apply a coat of engine oil to the inside of the oil seal.



(4) Install oil pump on cylinder block. Be careful not to damage oil seal during installation.

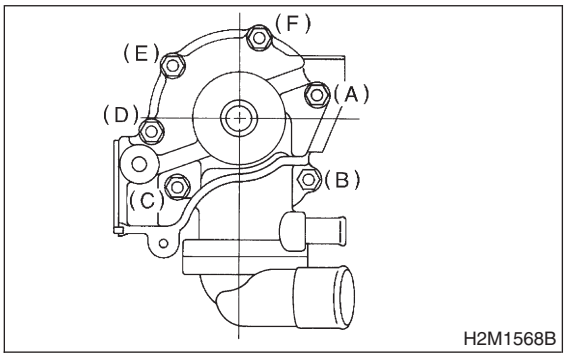
Tightening torque:
6.4 N·m (0.65 kg-m, 4.7 ft-lb)

CAUTION:
• Do not forget to install O-ring and seal when installing oil pump.
• Align flat surface of oil pump's inner rotor with crankshaft before installation.

10) Install water pump and gasket.

Tightening torque:
First; 12±2 N·m (1.2±0.2 kg-m, 8.7±1.4 ft-lb)
Second; 12±2 N·m (1.2±0.2 kg-m, 8.7±1.4 ft-lb)

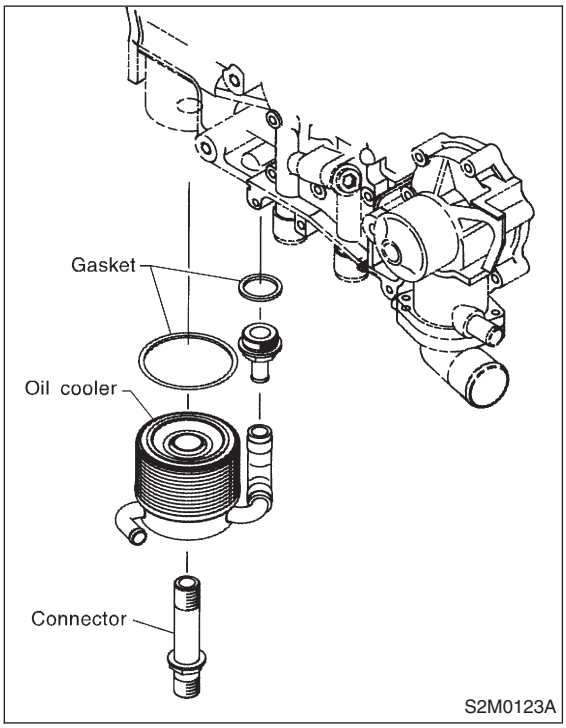
CAUTION:
• Be sure to use a new gasket.
• When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.



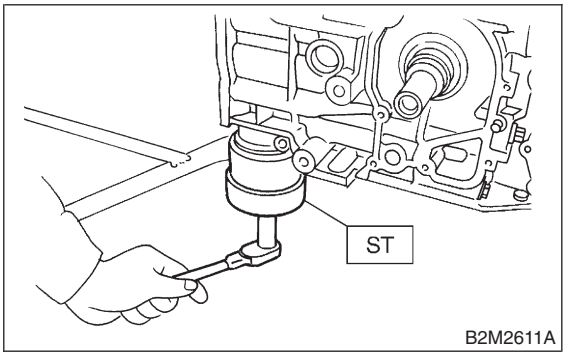
11) Install water by-pass pipe for heater.
12) Install oil cooler (AT vehicles only).

Tightening torque:
T: 54±5 N·m (5.5±0.5 kg-m, 39.8±3.6 ft-lb)

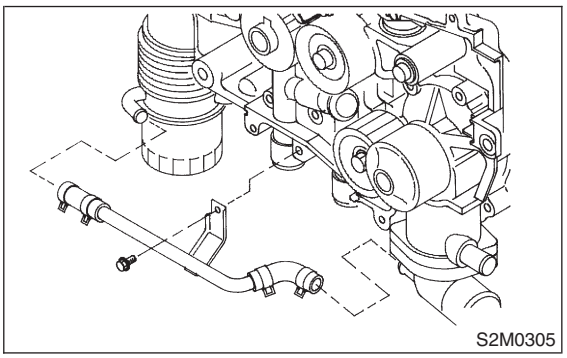
CAUTION:
Always use a new gasket.



13) Install oil filter using ST.
ST 498187300 OIL FILTER WRENCH



14) Install water by-pass pipe between oil cooler and water pump (AT vehicles only).

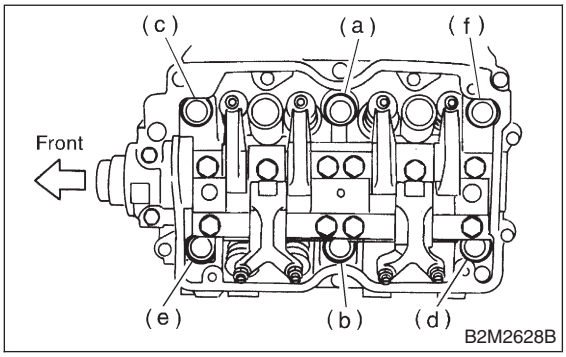


15) Tighten cylinder head bolts.
(1) Apply a coat of engine oil to washers and bolt threads.
(2) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb) in alphabetical sequence.
Then tighten all bolts to 69 N·m (7.0 kg-m, 51 ft-lb) in alphabetical sequence.
(3) Back off all bolts by 180° first; back them off by 180° again.
(4) Tighten bolts (a) and (b) to 34 N·m (3.5 kg-m, 25 ft-lb).
(5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kg-m, 11 ft-lb).
(6) Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:
Do not tighten bolts more than 90°.

(7) Further tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:
Ensure that the total "re-tightening angle" [in the former two steps], do not exceed 180°.



16) Install oil level gauge guide and tighten attaching bolt (left side only).
17) Install timing belt, camshaft sprocket and related parts.
<Ref. to 2-3 [W3C0].>
18) Install generator and A/C compressor brackets on cylinder head.
19) Install drive belts. <Ref. to 1-5 [G2A0].>
20) Install intake manifold. <Ref. to 2-7 [W3D0].>

1. Engine Trouble in General

NOTE:
"RANK" shown in the chart refer to the possibility of reason for the trouble in order ("Very often" to "Rarely")
A — Very often
B — Sometimes
C — Rarely

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	● Starter	● Defective battery-to-starter harness	B
		● Defective starter switch	C
		● Defective inhibitor switch or neutral switch	C
		● Defective starter	B
	● Battery	● Poor terminal connection	A
		● Run-down battery	A
		● Defective charging system	B
	● Friction	● Seizure of crankshaft and connecting rod bearing	C
		● Seized camshaft	C
		● Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	● Starter	● Defective starter	C
	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Fuel line	● Defective fuel pump and relay	A
		● Lack of or insufficient fuel	B
	● Belt	● Defective	B
		● Defective timing	B
	● Compression	● Incorrect valve clearance	C
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	C
		● Defective valve stem	C
		● Worn or broken valve spring	B
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	B
		● Improper engine oil (low viscosity)	B
3) Initial combustion occur.	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Defective intake manifold gasket	B
		● Defective throttle body gasket	B
	● Fuel line	● Defective fuel pump and relay	C
		● Clogged fuel line	C
		● Lack of or insufficient fuel	B
	● Belt	● Defective	B
		● Defective timing	B
	● Compression	● Incorrect valve clearance	C
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	C
		● Defective valve stem	C
		● Worn or broken valve spring	B
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	B
		● Improper engine oil (low viscosity)	B

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked intake duct	B
		● Loosened or cracked PCV hose	C
		● Loosened or cracked vacuum hose	C
		● Defective intake manifold gasket	B
		● Defective throttle body gasket	B
		● Dirty air cleaner element	C
	● Fuel line	● Clogged fuel line	C
		● Lack of or insufficient fuel	B
	● Belt	● Defective	B
		● Defective timing	B
	● Compression	● Incorrect valve clearance	C
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	C
		● Defective valve stem	C
		● Worn or broken valve spring	B
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	B
		● Improper engine oil (low viscosity)	B
2. Rough idle and engine stall	Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked intake duct	A
		● Loosened or cracked PCV hose	A
		● Loosened or cracked vacuum hose	A
		● Defective intake manifold gasket	B
		● Defective throttle body gasket	B
		● Defective PCV valve	C
		● Loosened oil filter cap	B
		● Dirty air cleaner element	C
	● Fuel line	● Defective fuel pump and relay	C
		● Clogged fuel line	C
		● Lack of or insufficient fuel	B
	● Belt	● Defective timing	C
	● Compression	● Incorrect valve clearance	B
		● Loosened spark plugs or defective gasket	B
		● Loosened cylinder head bolts or defective gasket	B
		● Improper valve seating	B
		● Defective valve stem	C
		● Worn or broken valve spring	B
		● Worn or stuck piston rings, cylinder and piston	B
		● Incorrect valve timing	A
		● Improper engine oil (low viscosity)	B
	● Lubrication system	● Incorrect oil pressure	B
		● Defective rocker cover gasket	C
	● Cooling system	● Overheating	C
	● Others	● Malfunction of evaporative emission control system	A
		● Stuck or damaged throttle valve	B
		● Accelerator cable out of adjustment	C

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked intake duct	A
		● Loosened or cracked PCV hose	A
		● Loosened or cracked vacuum hose	B
		● Defective intake manifold gasket	B
		● Defective throttle body gasket	B
		● Defective PCV valve	B
		● Loosened oil filter cap	B
		● Dirty air cleaner element	A
	● Fuel line	● Defective fuel pump and relay	B
		● Clogged fuel line	B
		● Lack of or insufficient fuel	C
	● Belt	● Defective timing	B
	● Compression	● Incorrect valve clearance	B
		● Loosened spark plugs or defective gasket	B
		● Loosened cylinder head bolts or defective gasket	B
		● Improper valve seating	B
		● Defective valve stem	C
		● Worn or broken valve spring	B
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	A
		● Improper engine oil (low viscosity)	B
	● Lubrication system	● Incorrect oil pressure	B
	● Cooling system	● Overheating	C
		● Over cooling	C
	● Others	● Malfunction of evaporative emission control system	A
4. Surging	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked intake duct	A
		● Loosened or cracked PCV hose	A
		● Loosened or cracked vacuum hose	A
		● Defective intake manifold gasket	B
		● Defective throttle body gasket	B
		● Defective PCV valve	B
		● Loosened oil filter cap	B
		● Dirty air cleaner element	B
	● Fuel line	● Defective fuel pump and relay	B
		● Clogged fuel line	B
		● Lack of or insufficient fuel	C
	● Belt	● Defective timing	B
	● Compression	● Incorrect valve clearance	B
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	C
		● Defective valve stem	C
		● Worn or broken valve spring	C
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	A
		● Improper engine oil (low viscosity)	B
	● Cooling system	● Overheating	B
	● Others	● Malfunction of evaporative emission control system	C

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked vacuum hose	A
	● Others	● Stuck or damaged throttle valve	A
		● Accelerator cable out of adjustment	B
6. Dieseling (Run-on)	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Cooling system	● Overheating	B
	● Others	● Malfunction of evaporative emission control system	B
7. After burning in exhaust system	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened or cracked intake duct	C
		● Loosened or cracked PCV hose	C
		● Loosened or cracked vacuum hose	B
		● Defective PCV valve	B
		● Loosened oil filler cap	C
	● Belt	● Defective timing	B
	● Compression	● Incorrect valve clearance	B
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	B
		● Defective valve stem	C
		● Worn or broken valve spring	C
		● Worn or stuck piston rings, cylinder and piston	C
		● Incorrect valve timing	A
	● Lubrication system	● Incorrect oil pressure	C
	● Cooling system	● Over cooling	C
	● Others	● Malfunction of evaporative emission control system	C
8. Knocking	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Loosened oil filter cap	B
	● Belt	● Defective timing	B
	● Compression	● Incorrect valve clearance	C
		● Incorrect valve timing	B
	● Cooling system	● Overheating	A
9. Excessive engine oil consumption	● Intake system	● Loosened or cracked PCV hose	A
		● Defective PCV valve	B
		● Loosened oil filter cap	C
	● Compression	● Defective valve stem	A
		● Worn or stuck piston rings, cylinder and piston	A
	● Lubrication system	● Loosened oil pump attaching bolts and defective gasket	B
		● Defective oil filter seal	B
		● Defective crankshaft oil seal	B
		● Defective rocker cover gasket	B
		● Loosened oil drain plug or defective gasket	B
		● Loosened oil pan fitting bolts or defective oil pan	B

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	● Fuel injection system <Ref. to 2-7 [T100].>		A
	● Intake system	● Dirty air cleaner element	A
	● Belt	● Defective timing	B
	● Compression	● Incorrect valve clearance	B
		● Loosened spark plugs or defective gasket	C
		● Loosened cylinder head bolts or defective gasket	C
		● Improper valve seating	B
		● Defective valve stem	C
		● Worn or broken valve spring	C
		● Worn or stuck piston rings, cylinder and piston	B
		● Incorrect valve timing	B
	● Lubrication system	● Incorrect oil pressure	C
	● Cooling system	● Over cooling	C
	● Others	● Accelerator cable out of adjustment	B

2. Engine Noise

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn valve rocker • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (big end)
	Oil pressure is normal.	• Loose flywheel mounting bolts • Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong spark plug • Improper gasoline
Clank when engine speed is medium (1,000 to 2,000 rpm).	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	• Worn crankshaft main bearing • Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	• Worn cylinder liner and piston ring • Broken or stuck piston ring • Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	• Unusually worn valve lifter • Worn cam gear • Worn camshaft journal bore in crankcase
Squeaky sound	—	• Insufficient generator lubrication
Rubbing sound	—	• Defective generator brush and rotor contact
Gear scream when starting engine	—	• Defective ignition starter switch • Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	• Loose drive belt • Defective engine coolant pump shaft
Hissing sound	—	• Loss of compression • Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	• Loose timing belt • Belt contacting case/adjacent part
Valve tappet noise	—	• Incorrect valve clearance

NOTE*:
When disconnecting fuel injector connector, Malfunction Indicator Light (CHECK ENGINE light) illuminates and trouble code is stored in ECM memory.
Therefore, carry out the CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].> after connecting fuel injector connector.

ENGINE LUBRICATION SYSTEM 2-4

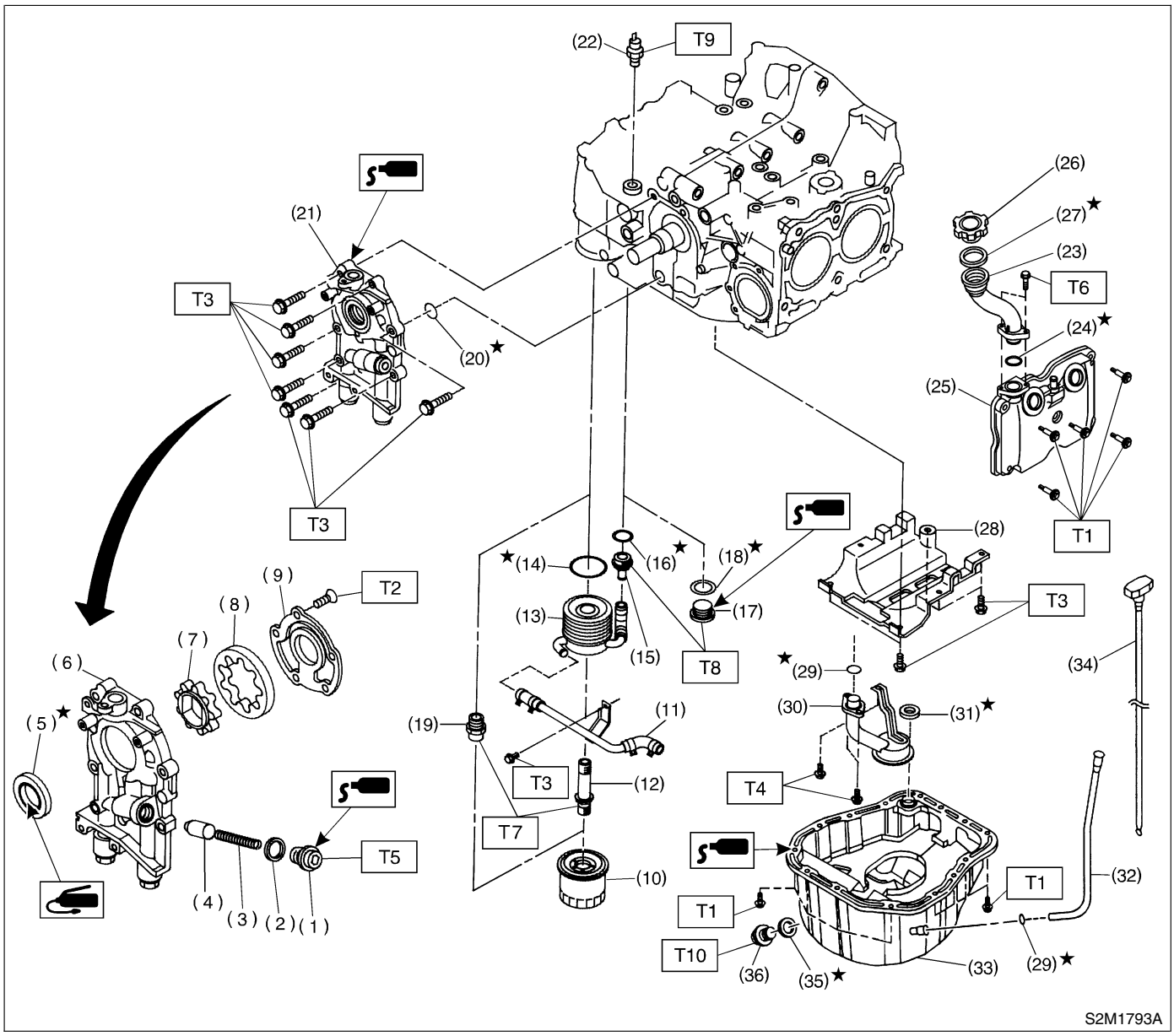
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W SERVICE PROCEDURE 5
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4. Oil Cooler (AT Vehicles Only) 15
K DIAGNOSTICS 18
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1. Specifications

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth		Inner rotor		9
			Outer rotor		10
	Outer rotor diameter × thickness				78 × 9 mm (3.07 × 0.35 in)
	Tip clearance between inner and outer rotor			STANDARD	0.04 — 0.14 mm (0.0016 — 0.0055 in)
				LIMIT	0.18 mm (0.0071 in)
	Side clearance between inner rotor and pump case			STANDARD	0.02 — 0.07 mm (0.0008 — 0.0028 in)
				LIMIT	0.15 mm (0.0059 in)
	Case clearance between outer rotor and pump case			STANDARD	0.10 — 0.175 mm (0.0039 — 0.0069 in)
				LIMIT	0.20 mm (0.0079 in)
	Capacity at 80°C (176°F)	600 rpm	Discharge	- pressure	98 kPa (1.0 kg/cm^2, 14 psi) or more
				- quantity	4.6 ℓ (4.9 US qt, 4.0 Imp qt)/min.
		5,000 rpm	Discharge	- pressure	294 kPa (3.0 kg/cm^2, 43 psi) or more
				- quantity	47.0 ℓ (12.4 US gal, 10.3 Imp gal)/min.
	Relief valve operation pressure				588 kPa (6.0 kg/cm^2, 85 psi)
Oil filter	Type				Full-flow filter type
	Filtration area				1,000 cm^2 (155 sq in)
	By-pass valve opening pressure				157 kPa (1.6 kg/cm^2, 23 psi)
	Outer diameter × width				80 × 70 mm (3.15 × 2.76 in)
	Oil filter to engine thread size				M 20 x 1.5
Relief valve (on rocker shaft) operation pressure					69 kPa (0.7 kg/cm^2, 10 psi)
Oil pressure switch	Type				Immersed contact point type
	Working voltage — wattage				12 V — 3.4 W or less
	Warning light activation pressure				14.7 kPa (0.15 kg/cm^2, 2.1 psi)
	Proof pressure				More than 981 kPa (10 kg/cm^2, 142 psi)
Oil pan capacity					4.0 ℓ (4.2 US qt, 3.5 Imp qt)

1. Lubrication System



COMPONENT PARTS

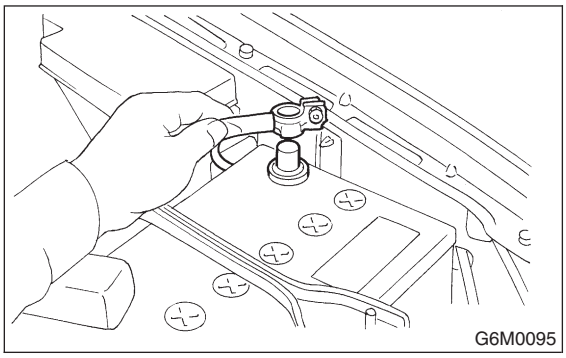
(1) Plug
(2) Washer
(3) Relief valve spring
(4) Relief valve
(5) Oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) Oil cooler pipe and hose ASSY (AT vehicles)
(12) Connector (AT vehicles)
(13) Oil cooler (AT vehicles)
(14) Gasket (AT vehicles)
(15) Nipple (AT vehicles)
(16) Gasket (AT vehicles)
(17) Oil cooler connector (MT vehicles)
(18) Gasket (MT vehicles)
(19) Oil filter connector (MT vehicles)
(20) O-ring
(21) Oil pump ASSY
(22) Oil pressure switch
(23) Oil filler duct
(24) O-ring
(25) Cylinder head cover
(26) Oil filler cap
(27) O-ring
(28) Baffle plate
(29) O-ring
(30) Oil strainer
(31) Gasket
(32) Oil level gauge guide
(33) Oil pan
(34) Oil level gauge
(35) Metal gasket
(36) Drain plug

Tightening torque: N·m (kg-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: $5^{+1}/_{-0}$ ($0.5^{+0.1}/_{-0}$, $3.6^{+0.7}/_{-0}$)
T3: 6.4 (0.65, 4.7)
T4: 10 (1.0, 7.0)
T5: 44.1±3.4 (4.5±0.35, 32.5±2.5)
T6: 6.4±0.5 (0.65±0.05, 4.7±0.4)
T7: 54±5 (5.5±0.5, 39.8±3.6)
T8: 69±7 (7.0±0.7, 50.6±5.1)
T9: 25±3 (2.5±0.3, 18.1±2.2)
T10: 44 (4.5, 33)

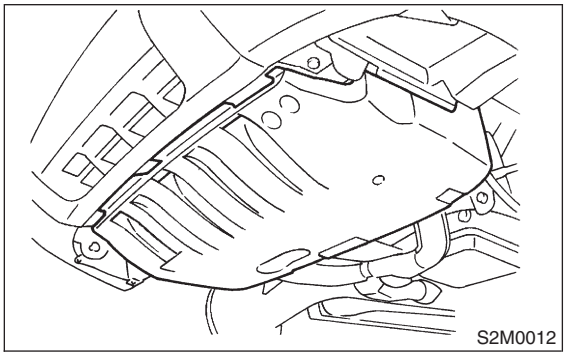
1. Oil Pump

A: REMOVAL

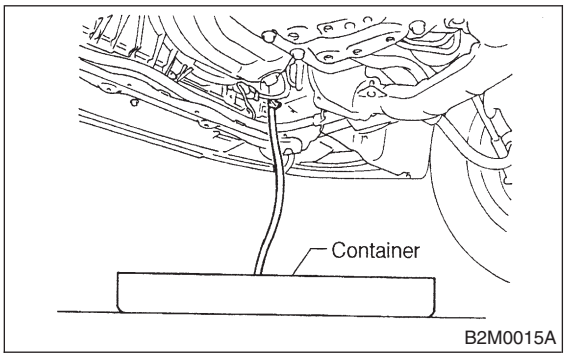
1) Disconnect battery ground cable.


G6M0095

2) Lift-up the vehicle.
3) Remove under cover.

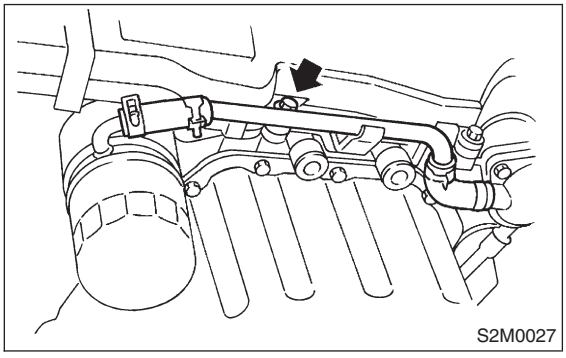

S2M0012

4) Drain coolant. <Ref. to 2-5 [W1A0].>

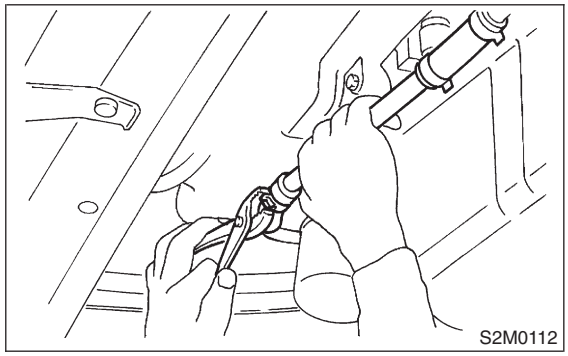


B2M0015A

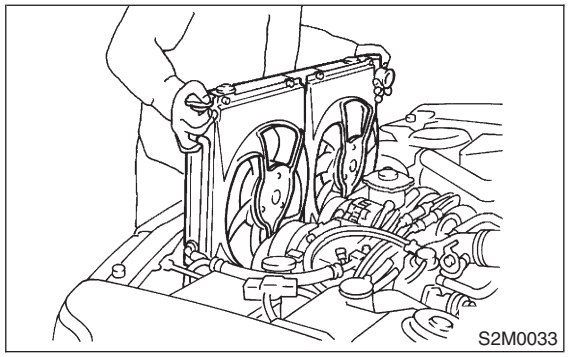
5) Remove bolts which install water pipe of oil cooler to oil pump. (AT vehicles only)


S2M0027

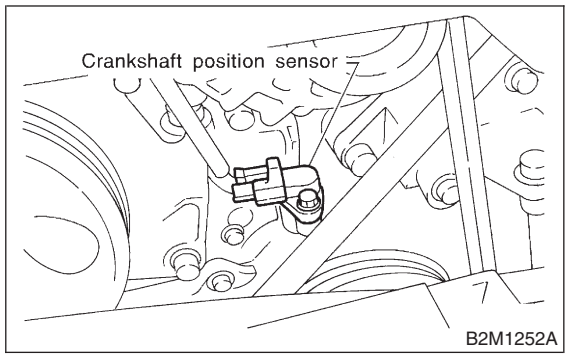
6) Remove water pipe and hoses between oil cooler and water pump. (AT vehicles only)


S2M0112

7) Remove radiator. <Ref. to 2-5 [W3A0].>

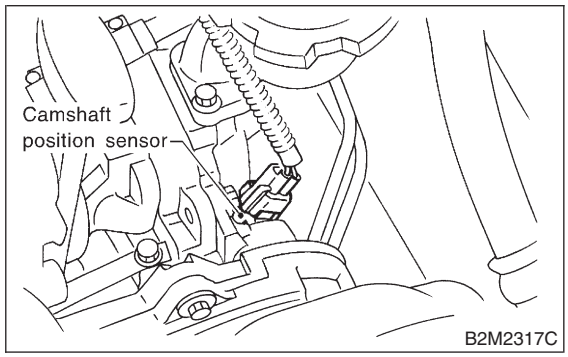

S2M0033

8) Lower the vehicle.
9) Remove crankshaft position sensor.



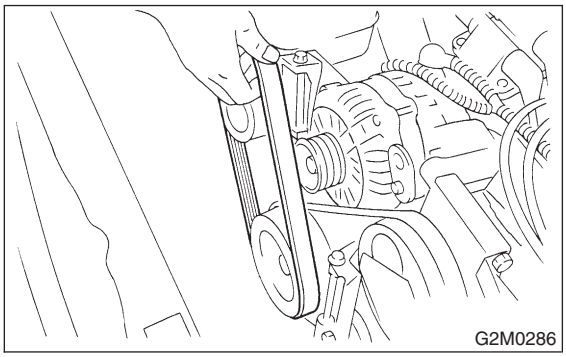
B2M1252A

10) Remove camshaft position sensor. <Ref. to 2-7 [W10A0].>

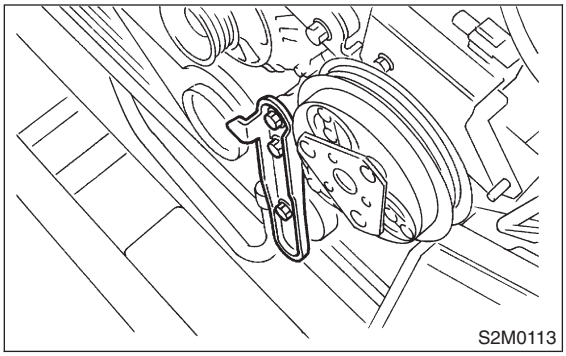


B2M2317C

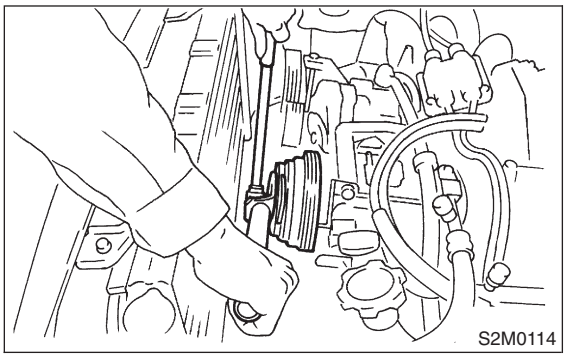
11) Remove V-belts. <Ref. to 1-5 [G2A0].>



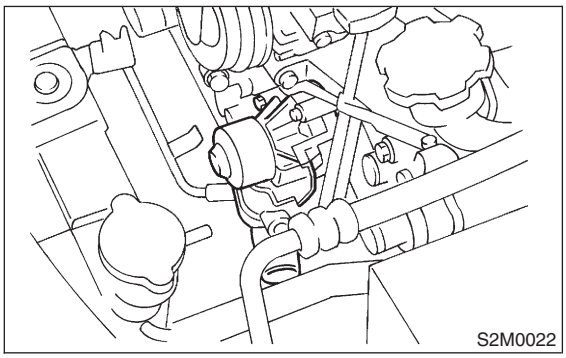
12) Remove rear side V-belt tensioner.



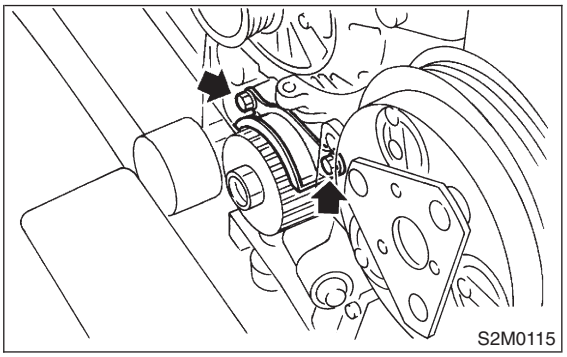
13) Remove crankshaft pulley using ST.
ST 499977100 CRANKSHAFT PULLEY WRENCH



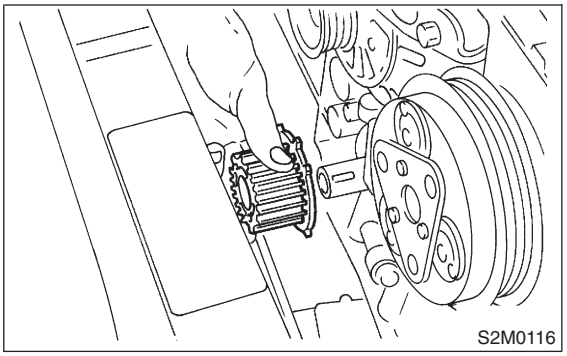
14) Remove water pump. <Ref. to 2-5 [W1A0].>



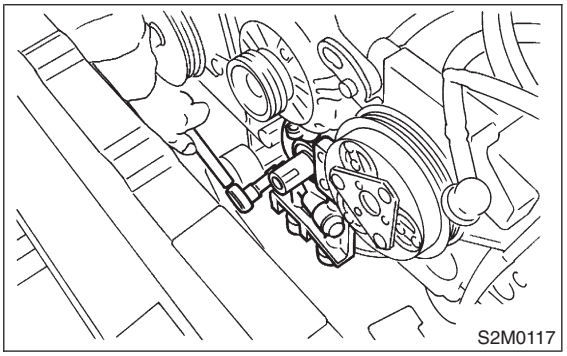
15) Remove timing belt guide. (MT vehicles only)



16) Remove crankshaft sprocket.

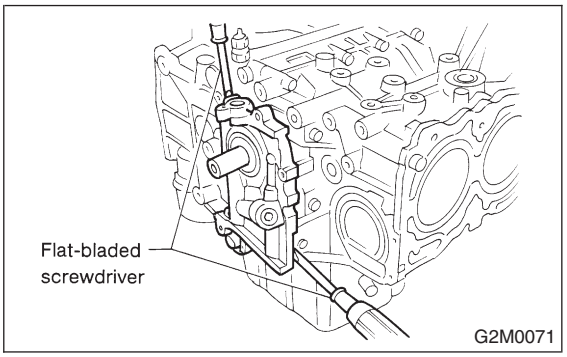


17) Remove bolts which install oil pump onto cylinder block.



18) Remove oil pump using flat bladed screwdriver.

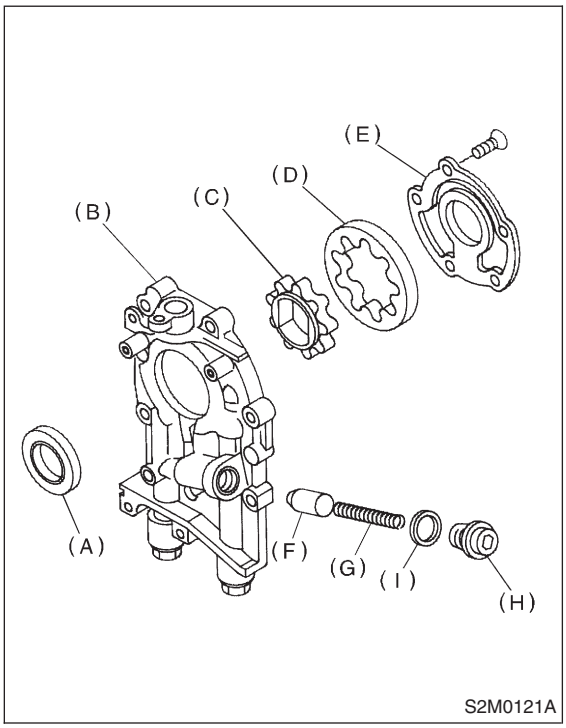
CAUTION:
Be careful not to scratch mating surfaces of cylinder block and oil pump.



B: DISASSEMBLY

Remove screws which secure oil pump cover and disassemble oil pump.
Inscribe alignment marks on inner and outer rotors so that they can be replaced in their original positions during reassembly.

CAUTION:
Before removing relief valve, loosen plug when removing oil pump from cylinder block.



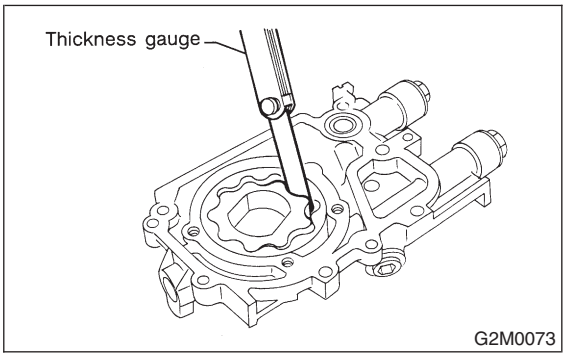
(A) Oil seal
(B) Pump case
(C) Inner rotor
(D) Outer rotor
(E) Pump cover
(F) Relief valve
(G) Relief spring
(H) Plug
(I) Washer

C: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a matched set.

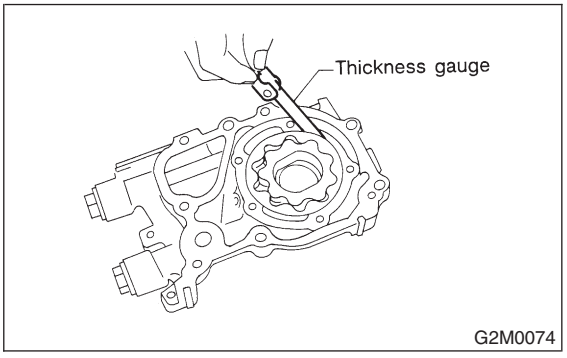
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.18 mm (0.0071 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and the cylinder block rotor housing. If the clearance exceeds the limit, replace the rotor.

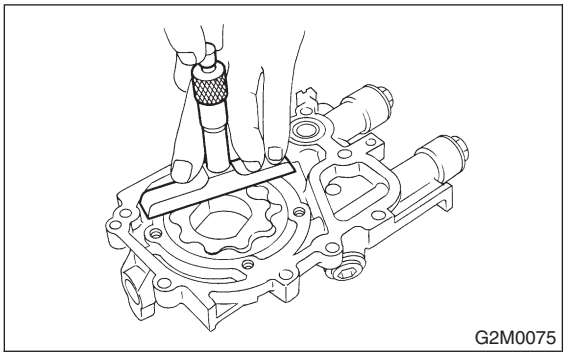
Case clearance:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)
Limit
0.20 mm (0.0079 in)



3. SIDE CLEARANCE

Measure clearance between oil pump inner rotor and pump cover. If the clearance exceeds the limit, replace rotor or pump body.

Side clearance:
Standard
0.02 — 0.07 mm (0.0008 — 0.0028 in)
Limit
0.15 mm (0.0059 in)


G2M0075

4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

Relief valve spring:
Free length; 71.8 mm (2.827 in)
Installed length; 54.7 mm (2.154 in)
Load when installed; 77.08 N (7.86 kg, 17.33 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

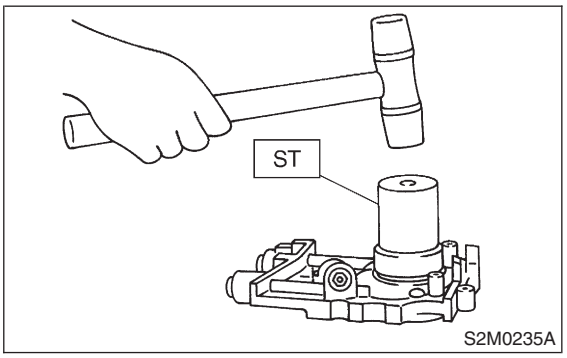
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

D: ASSEMBLY

1) Install front oil seal using ST.
ST 499587100 OIL SEAL INSTALLER

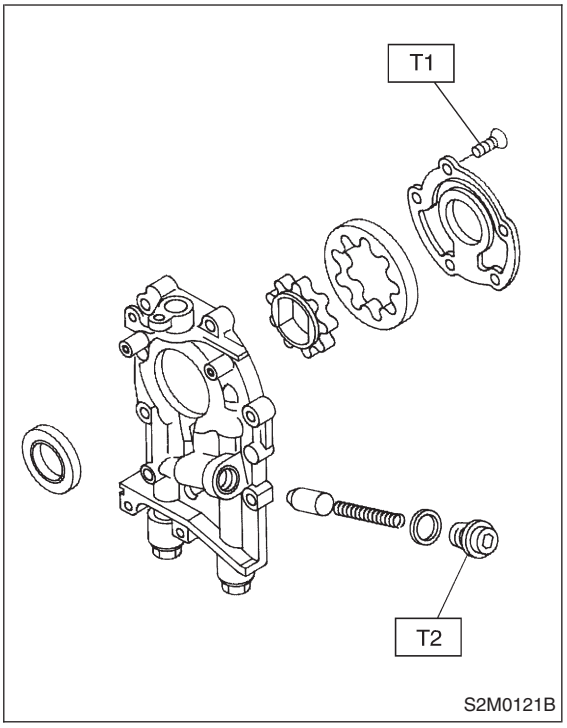
CAUTION:
Use a new oil seal.



S2M0235A

2) Install inner and outer rotors in their original positions.
3) Install oil relief valve and relief spring.
4) Install oil pump cover.

Tightening torque:
T1: 5 — 6 N·m (0.5 — 0.6 kg-m, 3.6 — 4.3 ft-lb)
T2: 40.7 — 47.5 N·m (4.15 — 4.84 kg-m, 30.0 — 35.0 ft-lb)

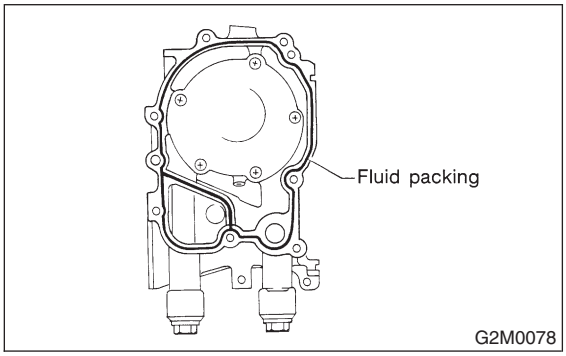


S2M0121B

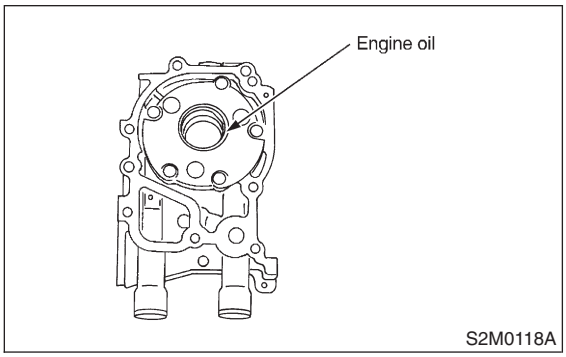
E: INSTALLATION

Installation is in the reverse order of removal.
Observe the following:
1) Apply fluid packing to matching surfaces of oil pump.

Fluid packing:
THREE BOND 1215 or equivalent



2) Replace O-ring with a new one.
3) Apply a coat of engine oil to the inside of the oil seal.

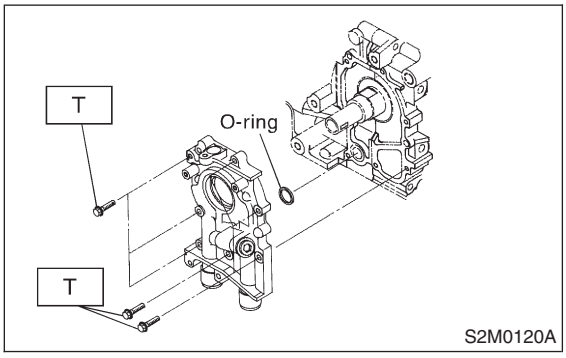


4) Be careful not to scratch oil seal when installing oil pump on cylinder block.
5) Position the oil pump, aligning the notched area with the crankshaft, and push the oil pump straight.

CAUTION:
Make sure the oil seal lip is not folded.

6) Install oil pump.

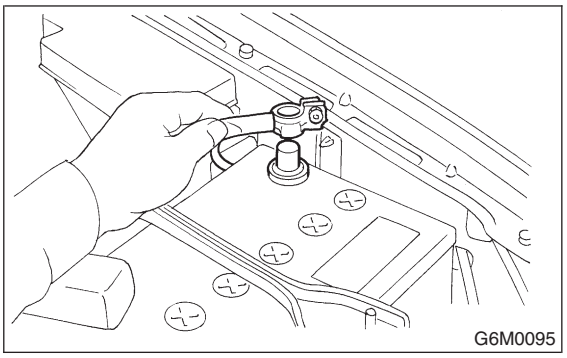
Tightening torque:
T: 6.4 N·m (0.65 kg-m, 4.7 ft-lb)



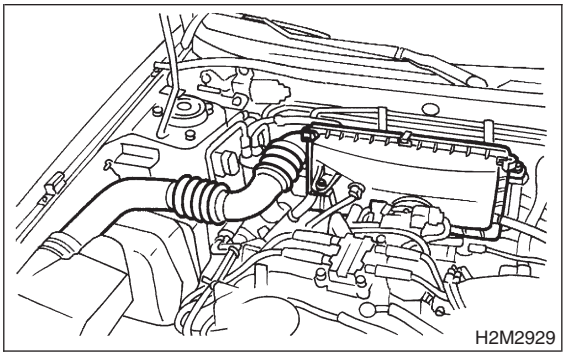
2. Oil Pan and Oil Strainer

A: REMOVAL

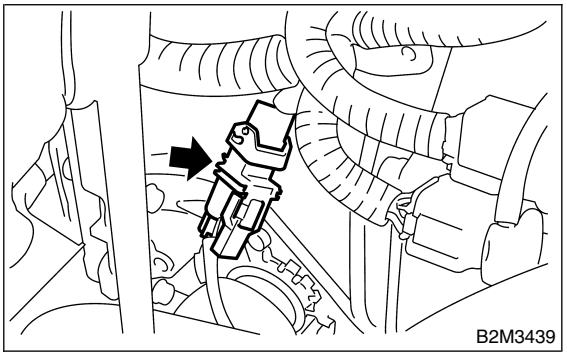
1) Disconnect battery ground cable.



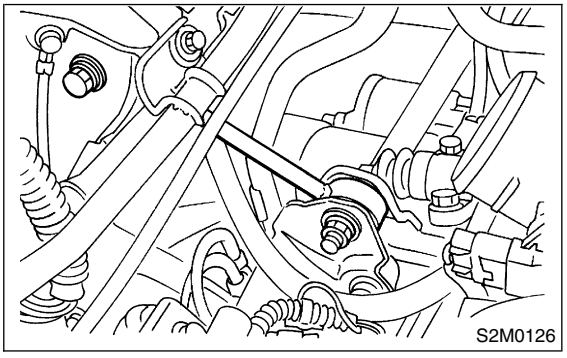
2) Remove air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>



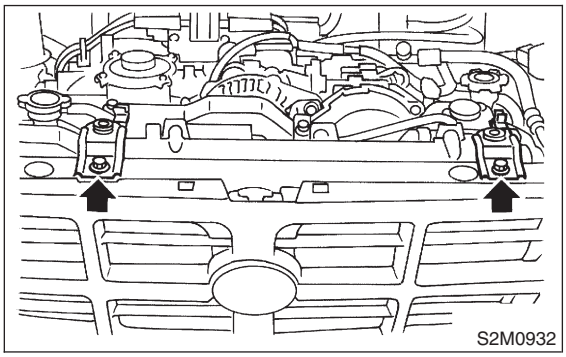
3) Disconnect front oxygen (A/F) sensor connector.



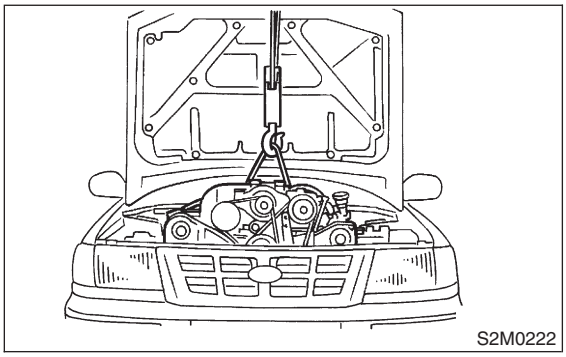
4) Remove pitching stopper.



5) Remove radiator upper bracket.


S2M0932

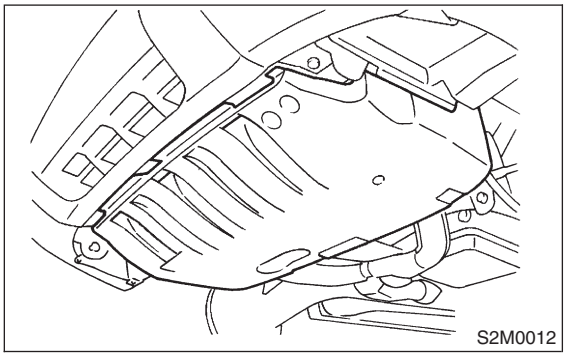
6) Support engine with a lifting device and wire ropes.


S2M0222

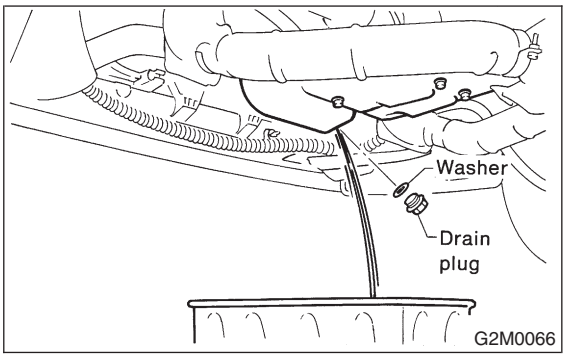
7) Lift-up the vehicle.

CAUTION:
At this time, raise up wire ropes.

8) Remove under cover.

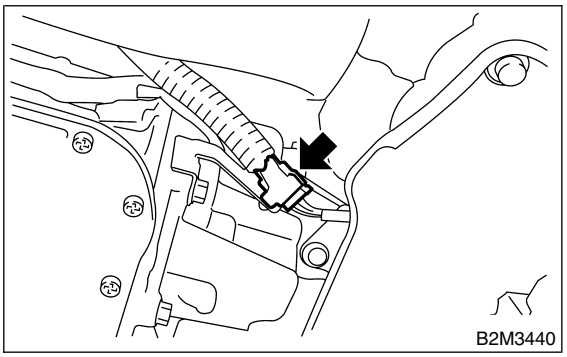

S2M0012

9) Drain engine oil.
Set container under the vehicle, and remove drain plug from oil pan.

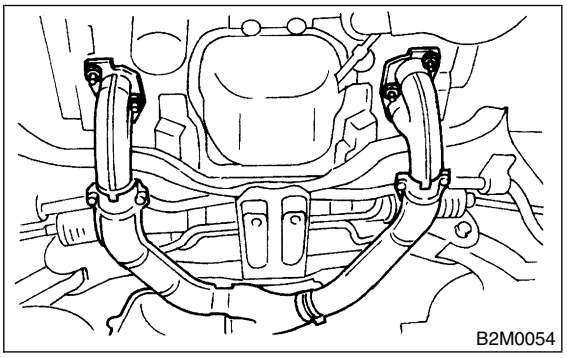


G2M0066

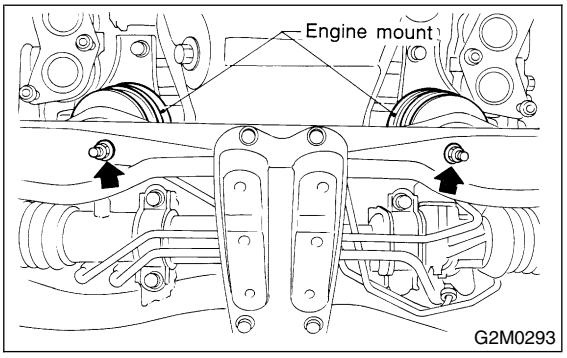
10) Disconnect connector from rear oxygen sensor.


B2M3440

11) Remove front and center exhaust pipe assembly. <Ref. to 2-9 [W1A0].>

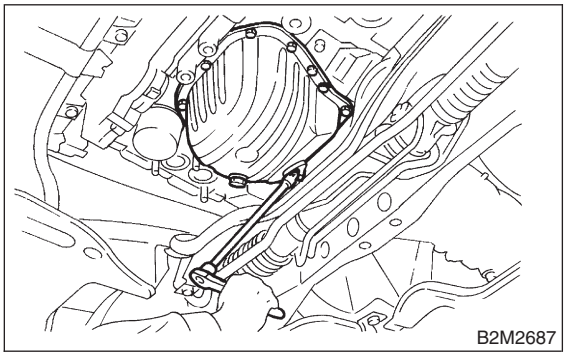

B2M0054

12) Remove nuts which install front cushion rubber onto front crossmember.



G2M0293

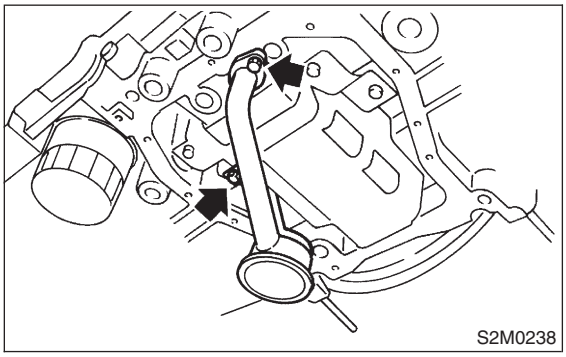
13) Remove bolts which install oil pan on cylinder block while raising up engine.


B2M2687

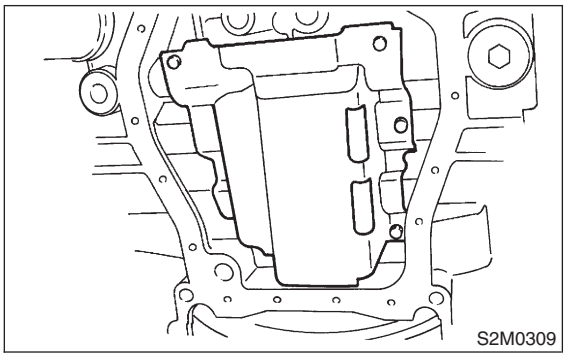
14) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.

15) Remove oil strainer.


S2M0238

16) Remove baffle plate.


S2M0309

B: INSPECTION

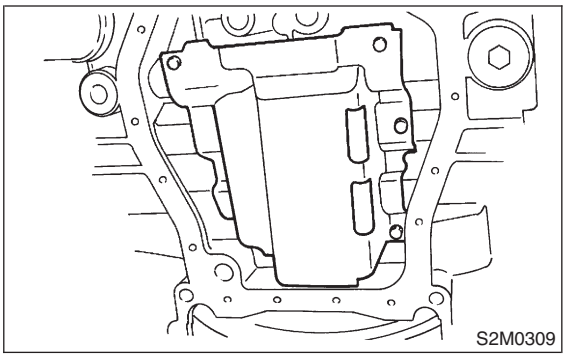
By visual check make sure oil pan, oil strainer and baffle plate are not damaged.

C: INSTALLATION

CAUTION:
Before installing oil pan, clean sealant from oil pan and engine block.

1) Install baffle plate.

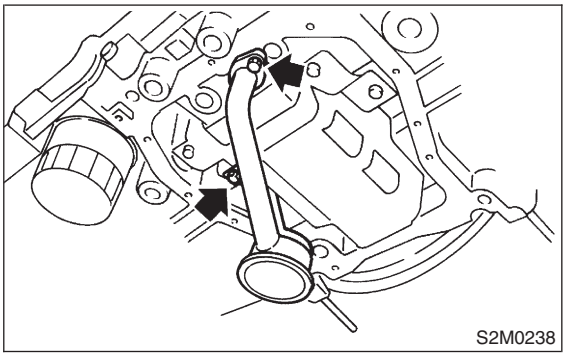
Tightening torque:
6.4 N·m (0.65 kg-m, 4.7 ft-lb)


S2M0309

2) Install oil strainer onto baffle plate.

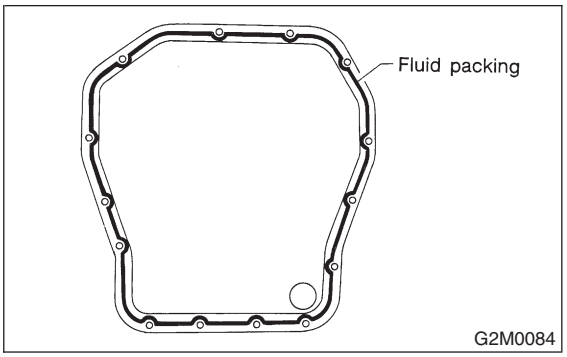
CAUTION:
Replace O-ring with a new one.

Tightening torque:
10 N·m (1.0 kg-m, 7 ft-lb)


S2M0238

3) Apply fluid packing to mating surfaces and install oil pan.

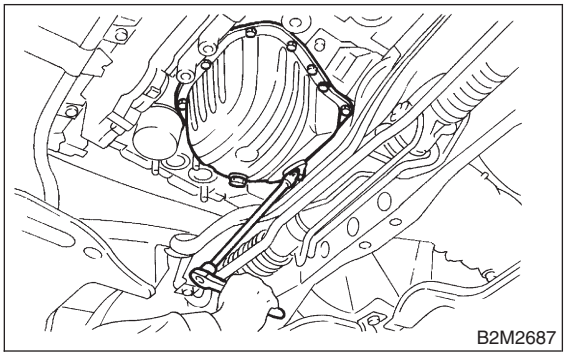
Fluid packing:
THREE BOND 1215 or equivalent



G2M0084

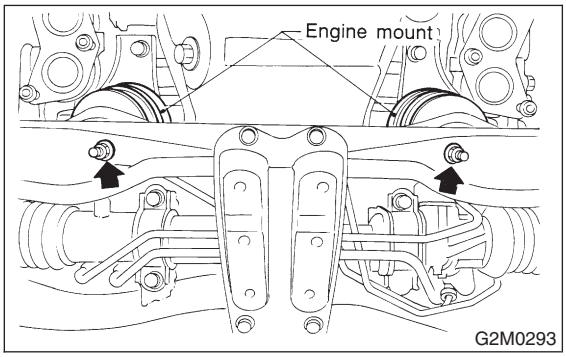
4) Tighten bolts which install oil pan onto engine block.

Tightening torque:
5 N·m (0.5 kg-m, 3.6 ft-lb)


B2M2687

5) Lower engine onto front crossmember.
6) Tighten nuts which install front cushion rubber onto front crossmember.

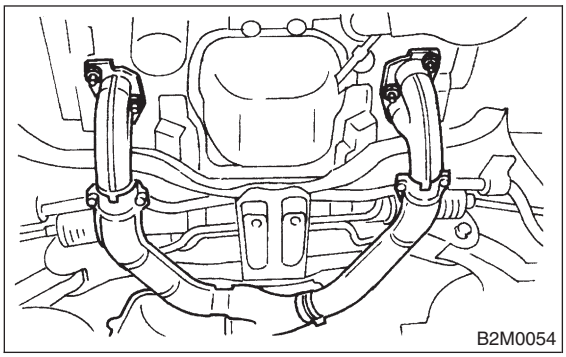
Tightening torque:
69±15 N·m (7.0±1.5 kg-m, 51±11 ft-lb)



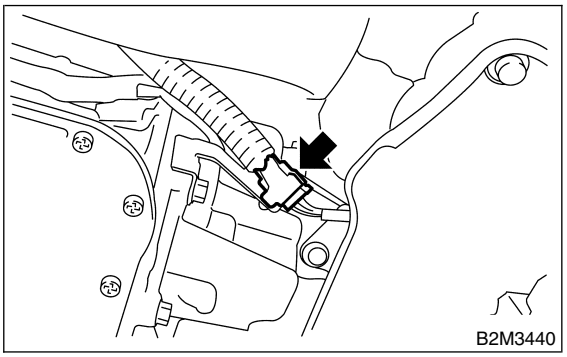
G2M0293

7) Install front and center exhaust pipe assembly. <Ref. to 2-9 [W1A0].>

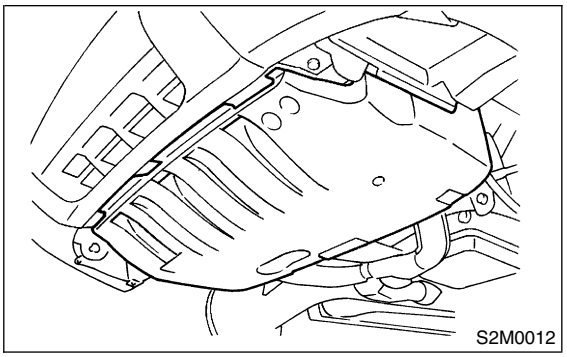
CAUTION:
Always use new gaskets.


B2M0054

8) Connect connector to rear oxygen sensor.


B2M3440

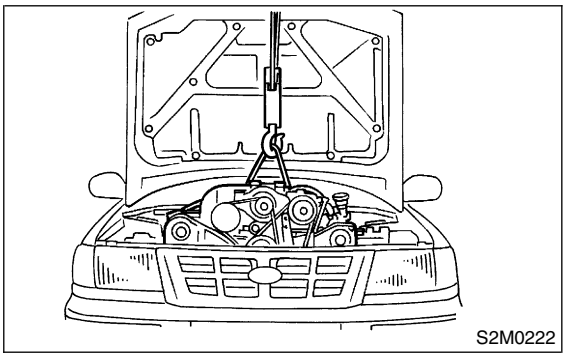
9) Install under cover.


S2M0012

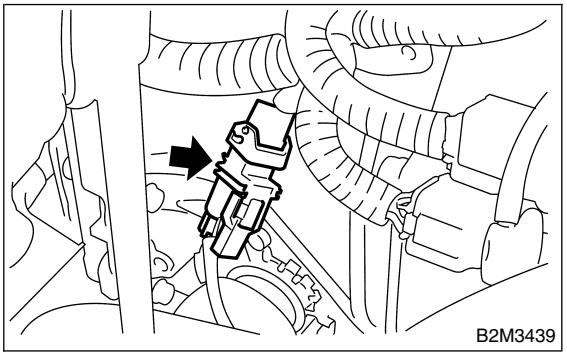
10) Lower the vehicle.

CAUTION:
At this time, lower lifting device and release steel cables.

11) Remove lifting device and steel cables.

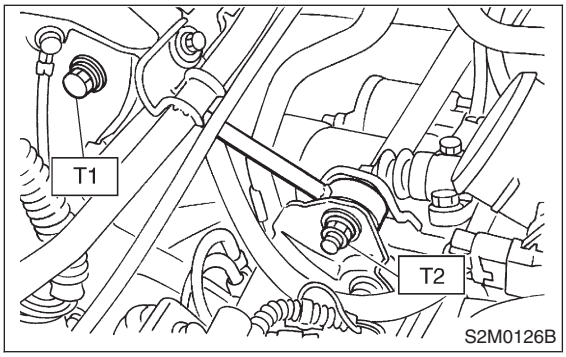

S2M0222

12) Connect connector to front oxygen (A/F) sensor.


B2M3439

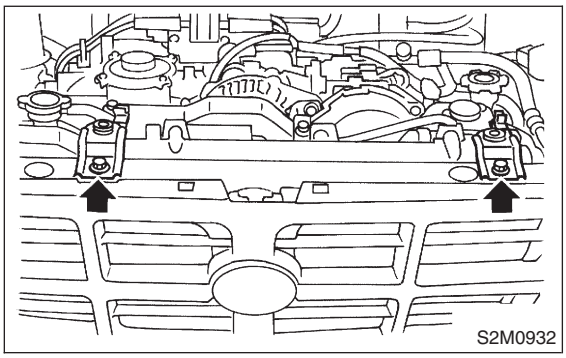
13) Install pitching stopper.

Tightening torque:
T1: 49±5 N·m (5.0±0.5 kg-m, 36.2±3.6 ft-lb)
T2: 57±10 N·m (5.8±1.0 kg-m, 42±7 ft-lb)

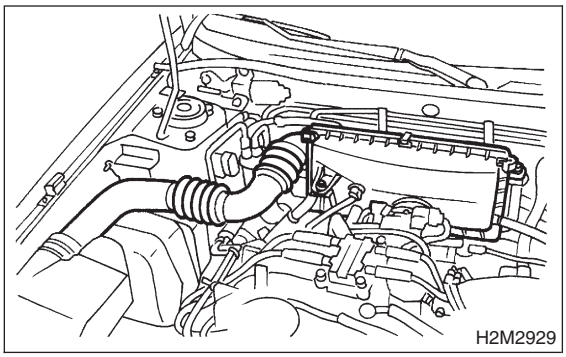


14) Install radiator upper brackets.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13±4 ft-lb)



15) Install air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>

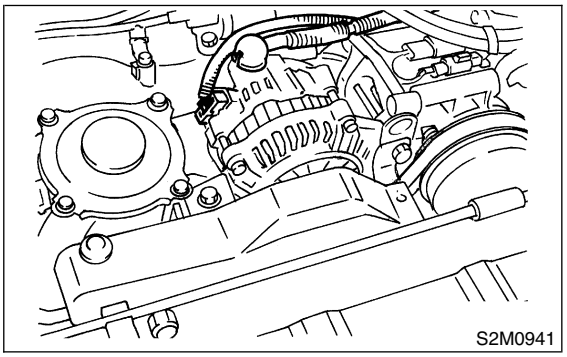


16) Fill engine oil through filler pipe up to upper point of level gauge. <Ref. to 1-5 [G4A0].>

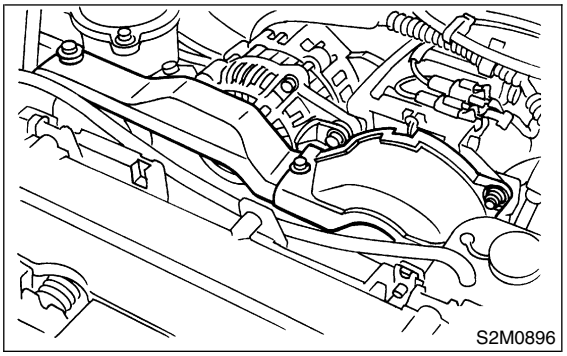
3. Oil Pressure Switch

A: REMOVAL

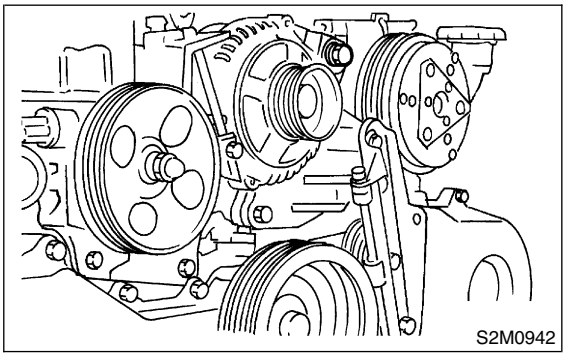
1) Remove alternator from bracket.
(1) Disconnect connector and terminal from generator.



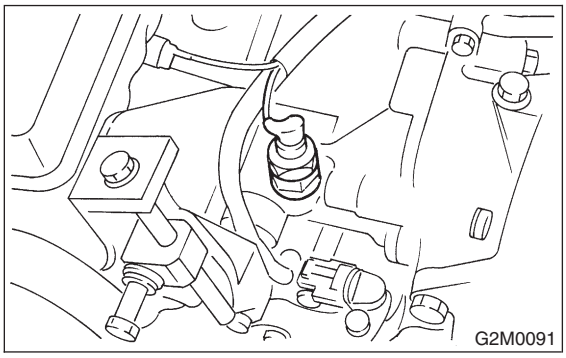
(2) Remove V-belt cover.



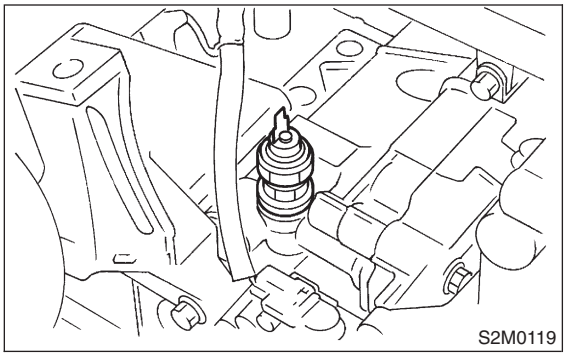
(3) Loosen lock bolt and slider bolt, and remove front side V-belt.
(4) Remove bolts which install generator on bracket.



2) Disconnect terminal from oil pressure switch.



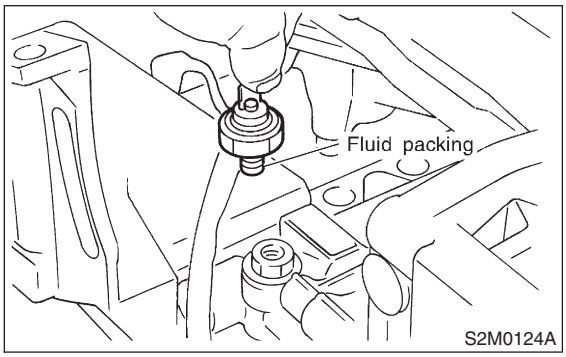
3) Remove oil pressure switch.



B: INSTALLATION

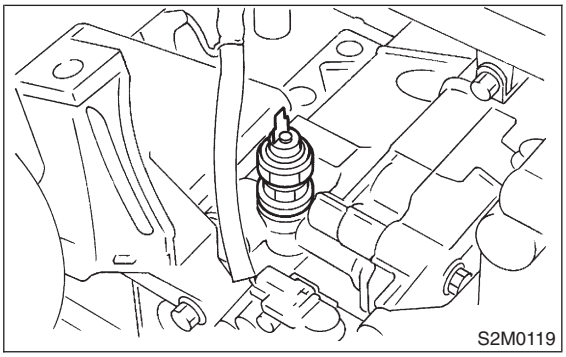
1) Apply fluid packing to oil pressure switch threads before installation.

Fluid packing:
THREE BOND 1215 or equivalent

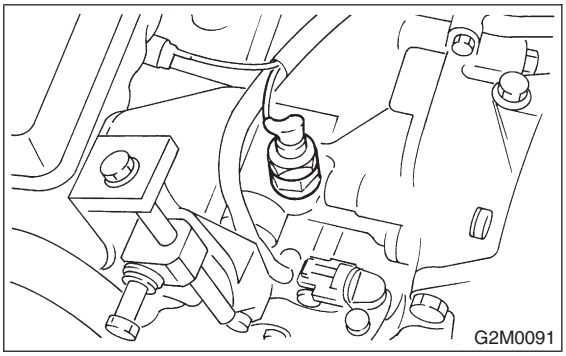


2) Install oil pressure switch onto engine block.

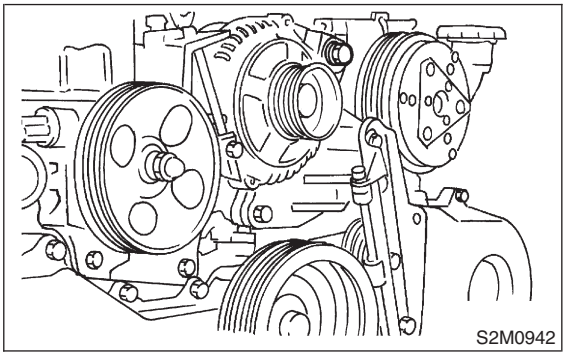
Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)



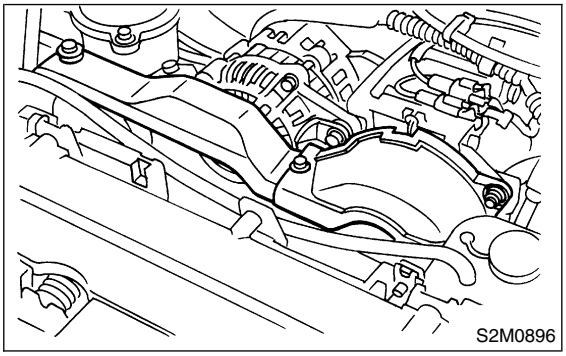
3) Connect terminal of oil pressure switch.



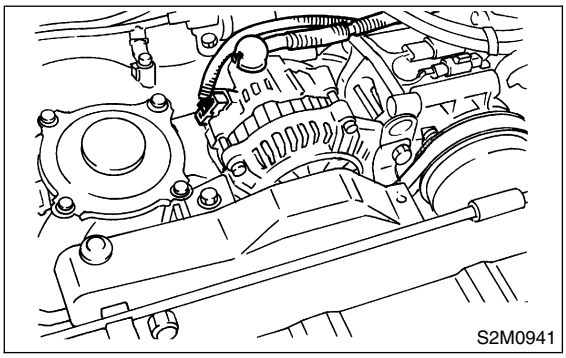
4) Install generator on bracket and temporary tighten installing bolts.



5) Install front side V-belt and adjust it. <Ref. to 1-5 [G2A0].>
6) Install V-belt cover.



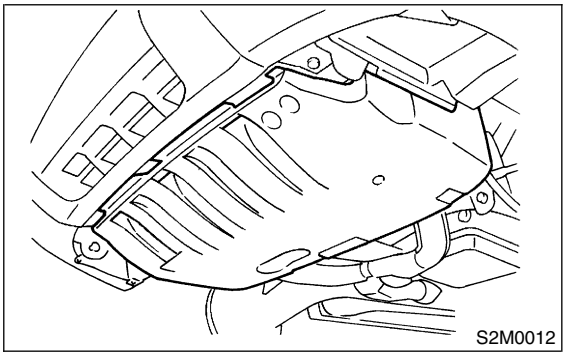
7) Connect connector and terminal to generator.



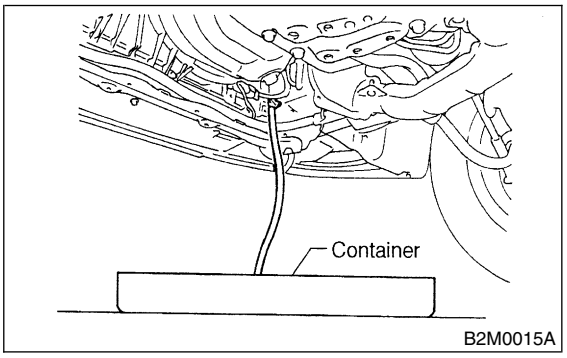
4. Oil Cooler (AT Vehicles Only)

A: REMOVAL

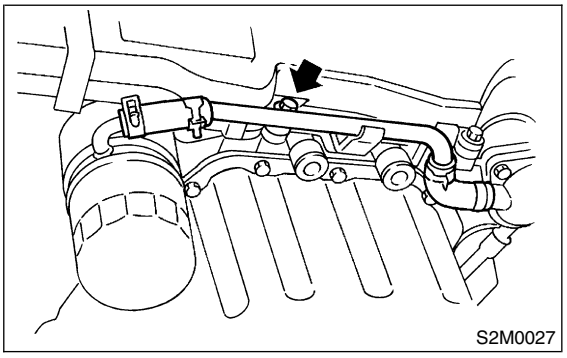
1) Lift-up the vehicle.
2) Remove under cover.



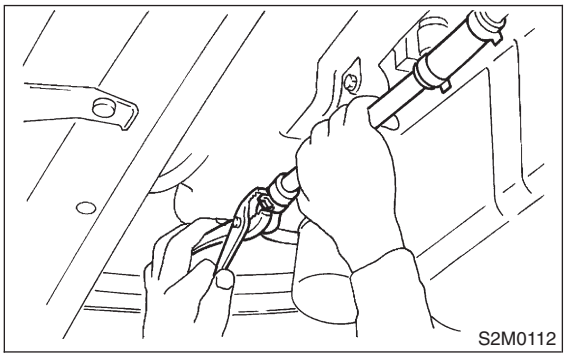
3) Drain engine coolant completely. <Ref. to 2-2 [W8A0].>



4) Remove bolt which installs water pipe to engine.

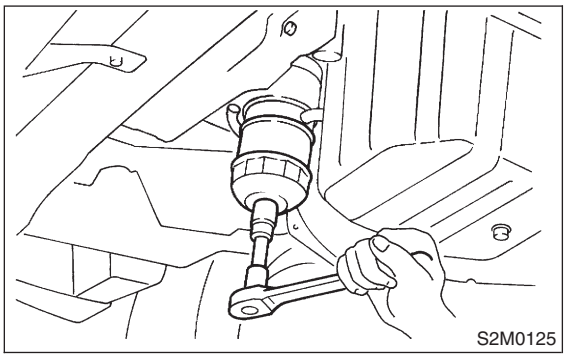


5) Disconnect water hose from oil cooler.

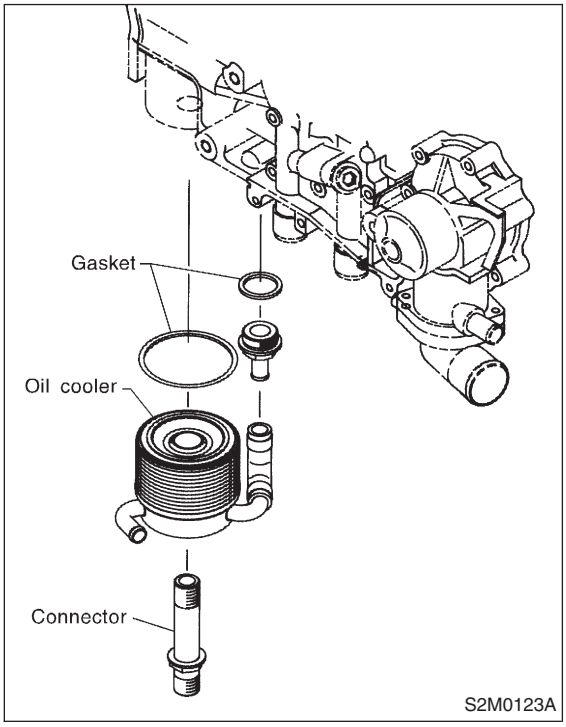


6) Remove oil filter using ST.
ST 49854700 OIL FILTER WRENCH

NOTE:
Set container under the vehicle.



7) Remove connector and remove oil cooler.



B: INSPECTION

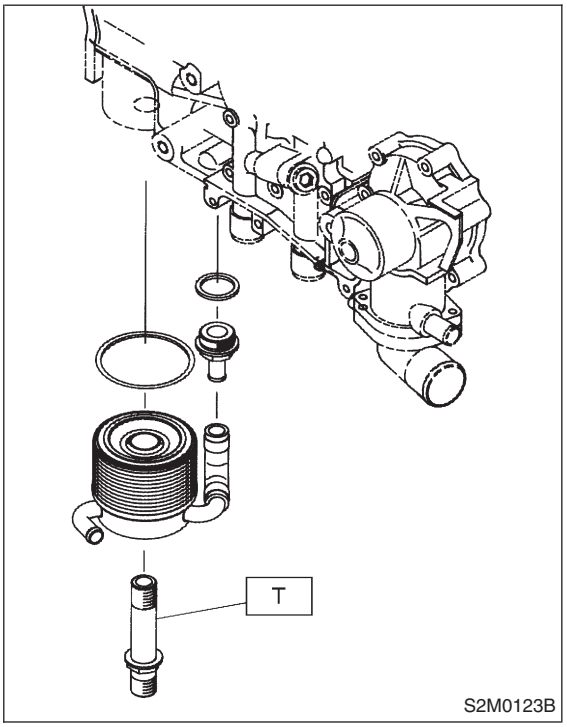
1) Check that coolant passages are not clogged using air blow method.
2) Check mating surfaces of cylinder block, O-ring groove and oil filter for damage.

C: INSTALLATION

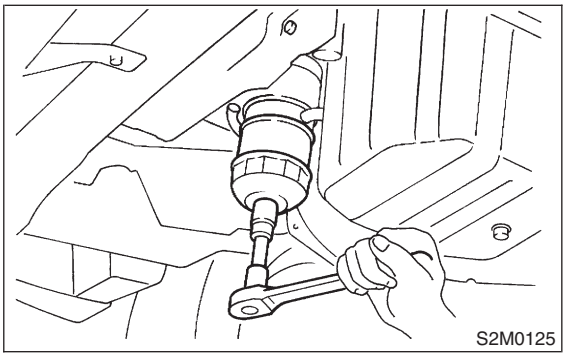
1) Install oil cooler on cylinder block with connector pipe.

Tightening torque:
T: 54±5 N·m (5.5±0.5 kg-m, 39.8±3.6 ft-lb)

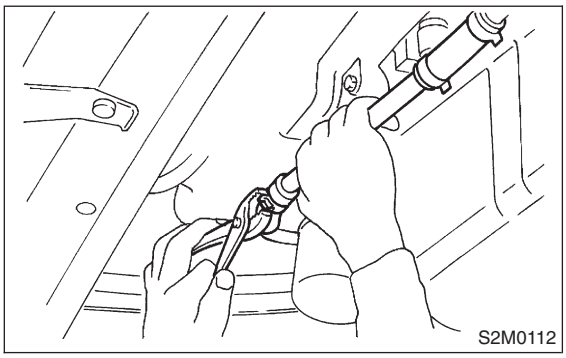
CAUTION:
Always use a new O-ring.



2) Install oil filter using ST.
ST 49854700 OIL FILTER WRENCH



3) Install water hose to oil cooler.



4) Check the amount of engine oil. If necessary, fill engine oil. <Ref. to 1-5 [G4A0].>
5) Fill engine coolant. <Ref. to 2-5 [W9B0].>

1. Engine Lubrication System Trouble in General

NOTE:
Before troubleshooting, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogged oil filter	Replace.
		Malfunction of oil by-pass valve of oil filter	Clean or replace.
		Malfunction of oil relief valve of oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not go on.	1) Burn-out bulb		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1.—2).

ENGINE COOLING SYSTEM 2-5

Page

S SPECIFICATIONS AND SERVICE DATA 2
1. Specifications 2
2. Service Data 2
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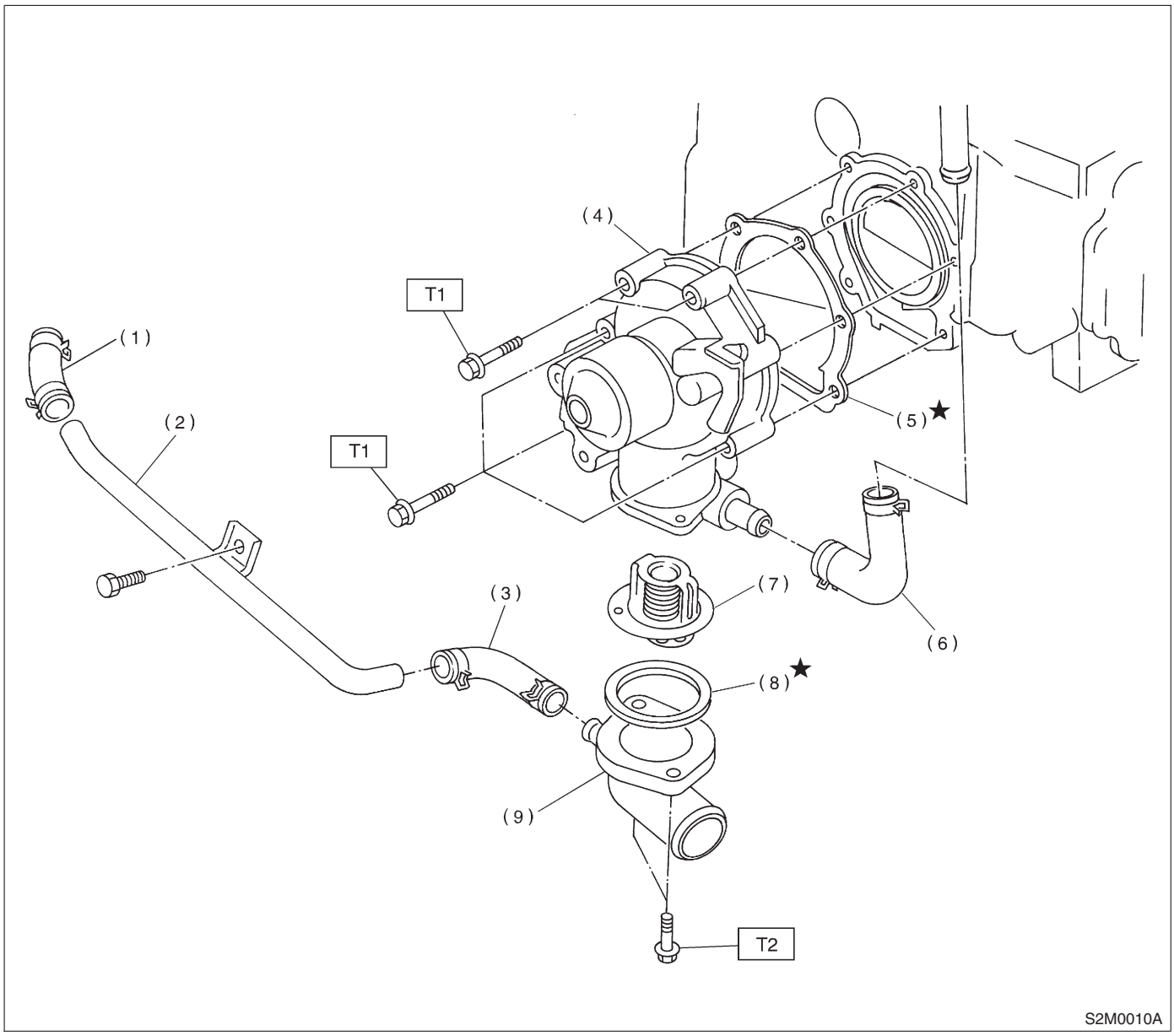
1. Specifications

Cooling system			Electric fan + Forced engine coolant circulation system
Total engine coolant capacity ℓ (US qt, Imp qt)			MT: Approx. 6.0 (6.3, 5.3) AT: Approx. 6.2 (6.6, 5.5)
Water pump	Type		Centrifugal impeller type
	Discharge performance I	Discharge	20 ℓ (5.3 US gal, 4.4 Imp gal)/min.
		Pump speed—total engine coolant head	760 rpm — 0.3 mAq (1.0 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance II	Discharge	100 ℓ (26.4 US gal, 22.0 Imp gal)/min.
		Pump speed—total engine coolant head	3,000 rpm — 5.0 mAq (16.4 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance III	Discharge	200 ℓ (52.8 US gal, 44.0 Imp gal)/min.
		Pump speed—total engine coolant head	6,000 rpm — 23.0 mAq (75.5 ftAq)
		Engine coolant temperature	85°C (185°F)
	Impeller diameter		76 mm (2.99 in)
	Number of impeller vanes		8
	Pump pulley diameter		60 mm (2.36 in)
Thermostat	Type		Wax pellet type
	Starts to open		76 — 80°C (169 — 176°F)
	Fully opened		91°C (196°F)
	Valve lift		9.0 mm (0.354 in) or more
	Valve bore		35 mm (1.38 in)
Radiator fan	Motor		70 W (main fan) 70 W (sub fan)
	Fan diameter × Blade		320 mm (12.60 in) × 5 (main fan) 320 mm (12.60 in) × 7 (sub fan)
Radiator	Type		Down flow, pressure type
	Core dimensions		691.5 × 340 × 16 mm (27.22 × 13.39 × 0.63 in)
	Pressure range in which cap valve is open		Above: 108±15 kPa (1.1±0.15 kg/cm^2, 16±2 psi) Below: –1.0 to –4.9 kPa (–0.01 to –0.05 kg/cm^2, –0.1 to –0.7 psi)
	Fins		Corrugated fin type
Reservoir tank	Capacity		0.45 ℓ (0.5 US qt, 0.4 Imp qt)

2. Service Data

Water pump	Clearance between impeller and case	Standard	0.5 — 0.7 mm (0.020 — 0.028 in)
		Limit	1.0 mm (0.039 in)
	“Thrust” runout of impeller end		0.5 mm (0.020 in)

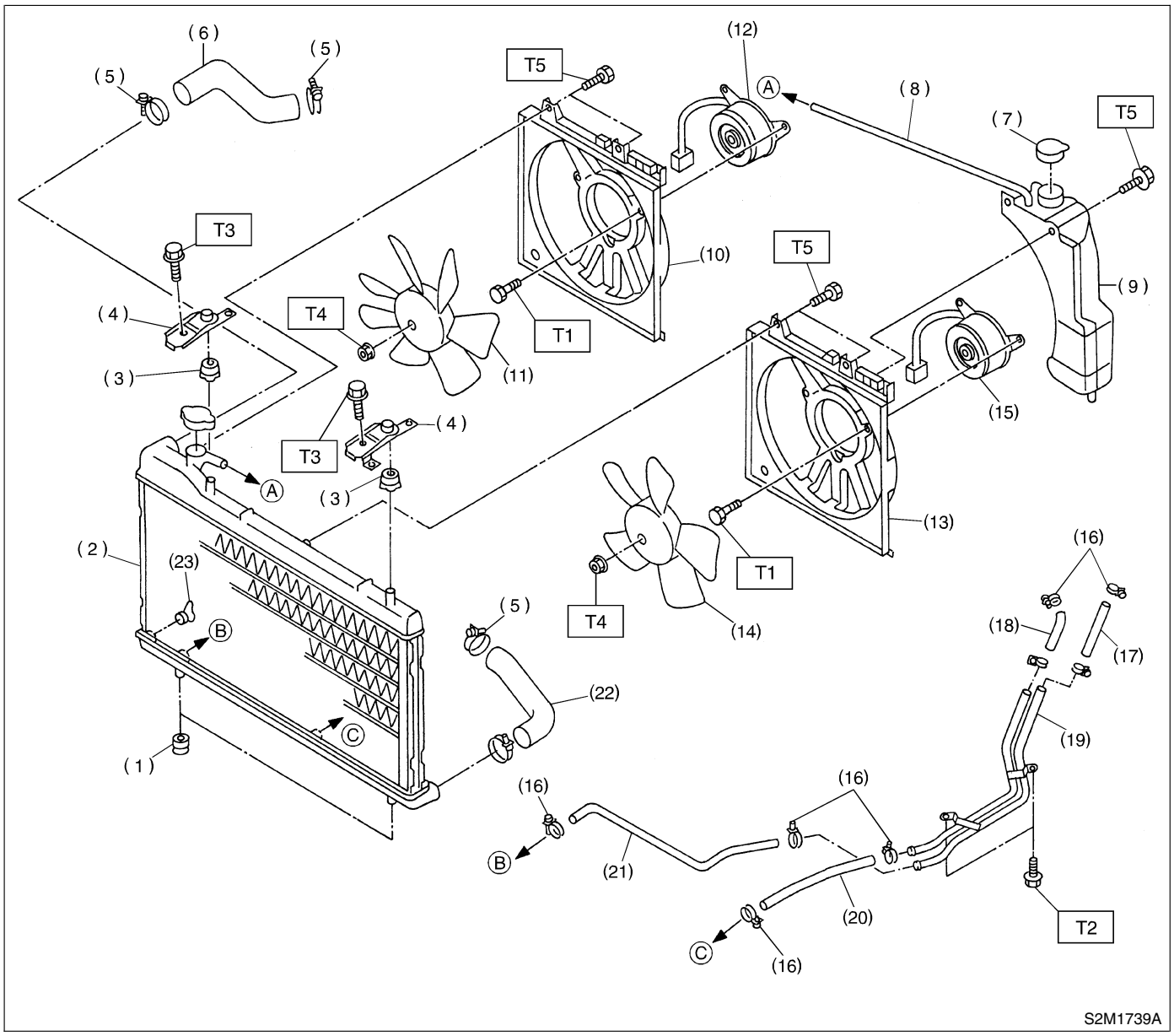
1. Water Pump



(1) Water by-pass hose A (AT vehicles)
(2) Water by-pass pipe (AT vehicles)
(3) Water by-pass hose B (AT vehicles)
(4) Water pump ASSY
(5) Gasket
(6) Heater hose
(7) Thermostat
(8) Gasket
(9) Thermostat cover

Tightening torque: N·m (kg-m, ft-lb)
T1:
First:
12±2 (1.2±0.2, 8.7±1.4)
Second:
12±2 (1.2±0.2, 8.7±1.4)
T2: 6.4±0.5 (0.65±0.05, 4.7±0.4)

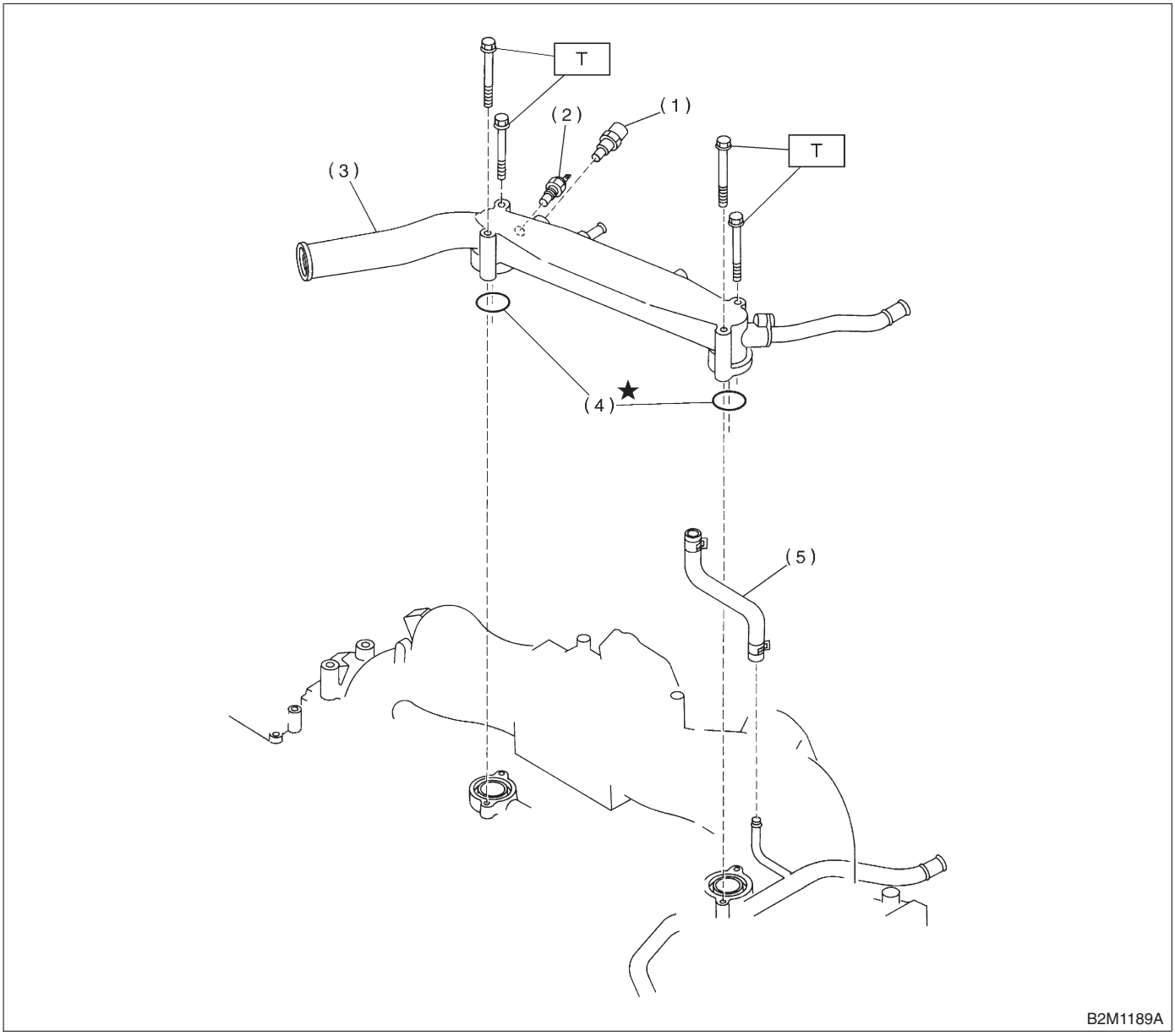
2. Radiator and Radiator Fan



(1) Radiator lower cushion
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clamp
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Over flow hose
(9) Engine coolant reservoir tank
(10) Sub fan shroud
(11) Radiator sub fan
(12) Radiator sub fan motor
(13) Main fan shroud
(14) Radiator main fan
(15) Radiator main fan motor
(16) ATF hose clamp (AT vehicles only)
(17) ATF inlet hose A (AT vehicles only)
(18) ATF outlet hose A (AT vehicles only)
(19) ATF pipe (AT vehicles only)
(20) ATF outlet hose B (AT vehicles only)
(21) ATF inlet hose B (AT vehicles only)
(22) Radiator outlet hose
(23) Radiator drain plug

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4±0.5 (0.45±0.05, 3.3±0.4)
T2: 12±3 (1.2±0.3, 8.7±2.2)
T3: 18±5 (1.8±0.5, 13.0±3.6)
T4: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T5: 4.9±1.5 (0.50±0.15, 3.6±1.1)

3. Water Pipe



(1) Engine coolant temperature sensor
(2) Engine coolant temperature gauge
(3) Water pipe
(4) O-ring
(5) By-pass hose

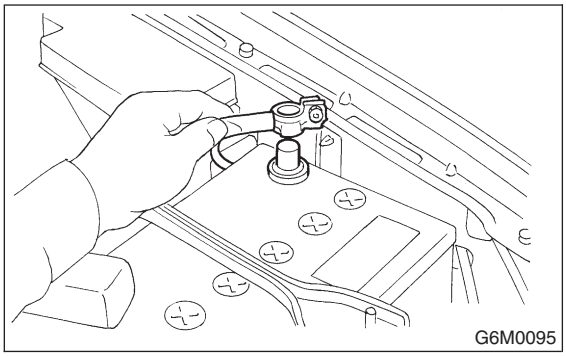
Tightening torque: N·m (kg-m, ft-lb)
T: 6.4±0.5 (0.65±0.05, 4.7±0.4)

1. Water Pump

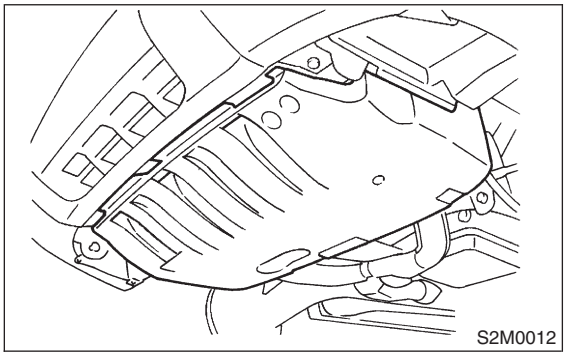
A: REMOVAL

WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

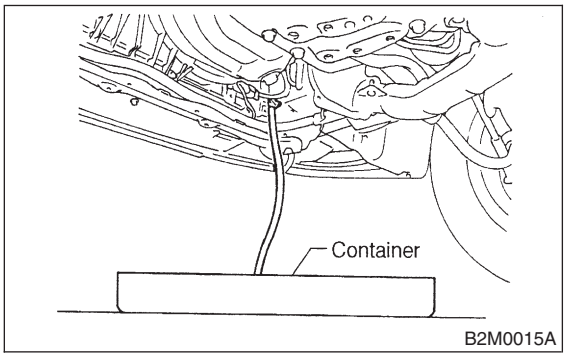
1) Disconnect ground cable from the battery.


G6M0095

2) Lift-up the vehicle.
3) Remove under cover.

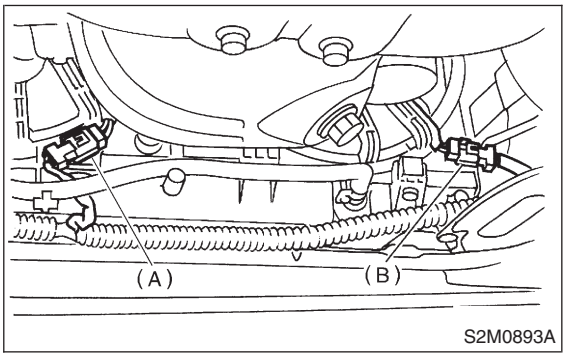

S2M0012

4) Drain engine coolant completely.
<Ref. to 2-5 [W9A0].>



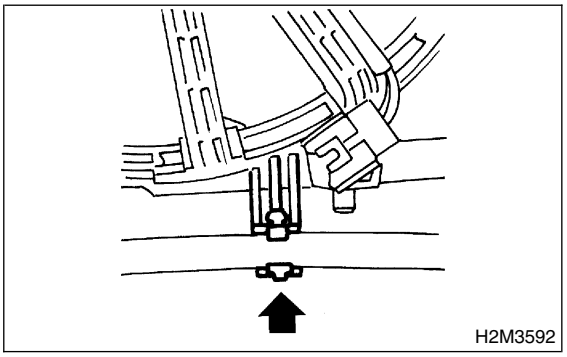
B2M0015A

5) Disconnect connectors from radiator main fan (A) and sub fan (B) motors.

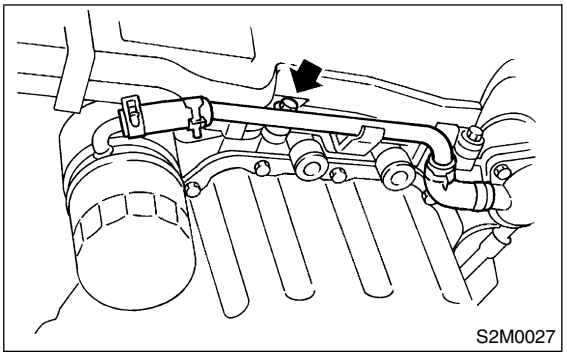


S2M0893A

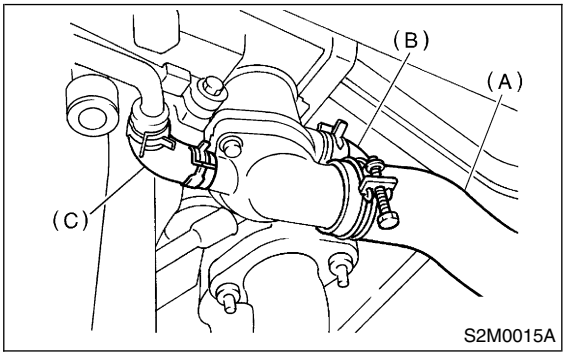
6) Detach ATF cooler hose attached to a clip under the radiator main fan shroud.


H2M3592

7) Remove bolt which installs water by-pass pipe of oil cooler onto oil pump. (AT vehicles only)

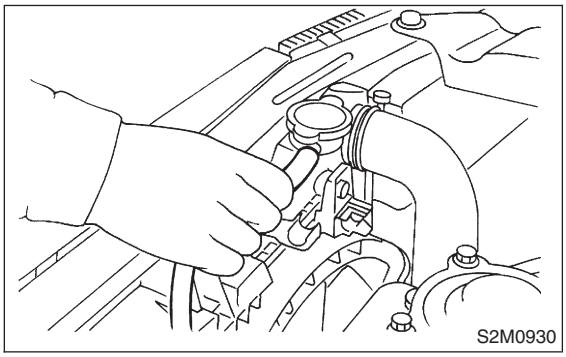

S2M0027

8) Disconnect radiator outlet hose (A) and heater hose (B) from water pump.
9) Disconnect water by-pass hose (C). (AT vehicles only)

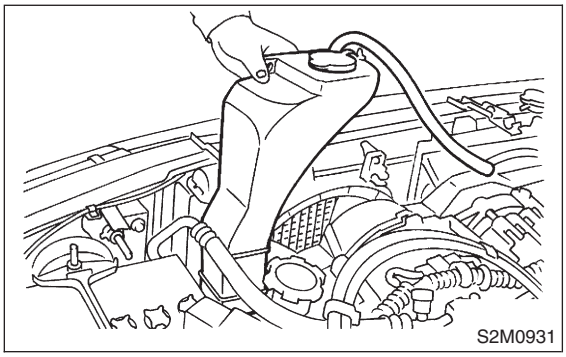


S2M0015A

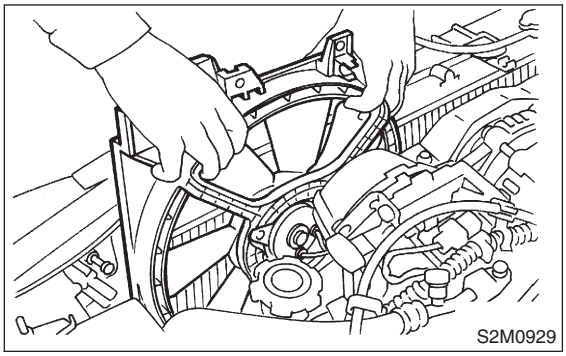
10) Lower the vehicle.
11) Disconnect over flow hose.


S2M0930

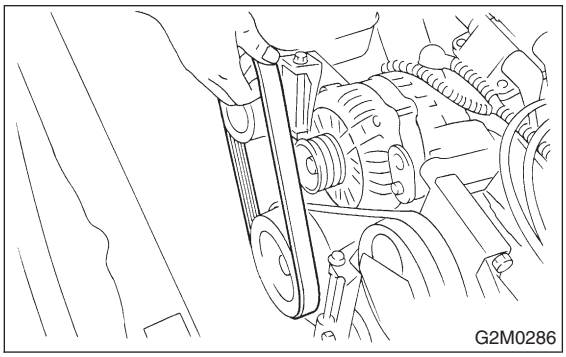
12) Remove reservoir tank.


S2M0931

13) Remove radiator main fan and sub fan assemblies. <Ref. to 2-5 [W5A0].> and <Ref. to 2-5 [W6A0].>

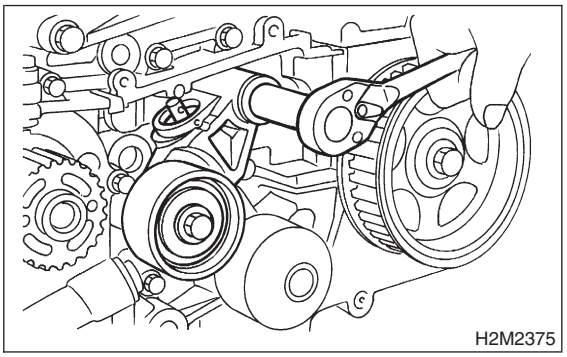

S2M0929

14) Remove V-belts.
<Ref. to 1-5 [G2B0].>

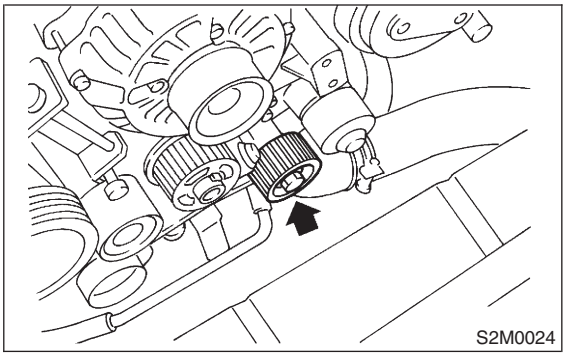

G2M0286

15) Remove timing belt.
<Ref. to 2-3 [W3A0].>

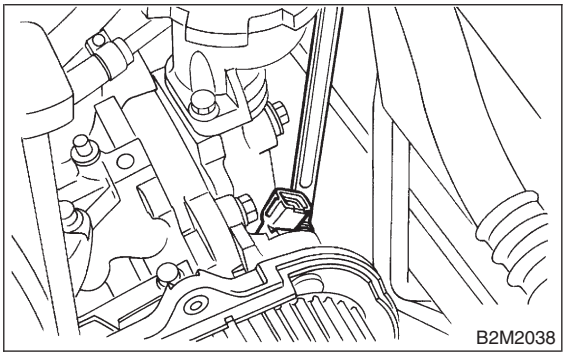
16) Remove automatic belt tension adjuster.


H2M2375

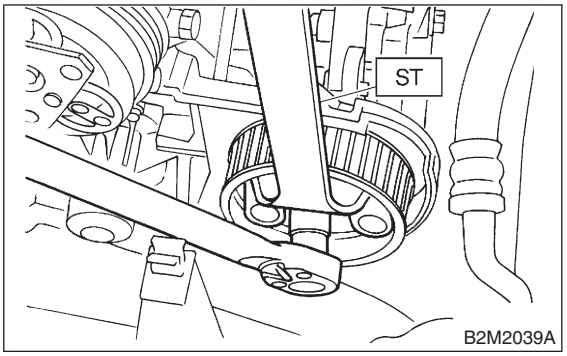
17) Remove belt idler No. 2.


S2M0024

18) Remove camshaft position sensor.
<Ref. to 2-7 [W6A0].>

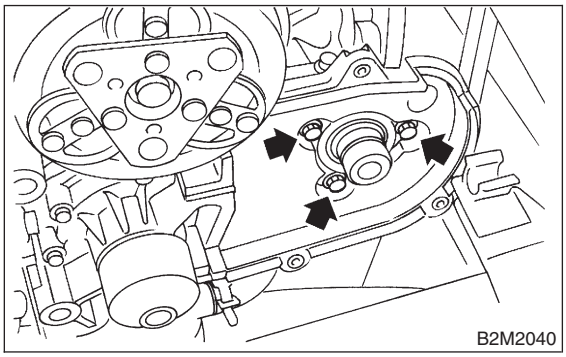

B2M2038

19) Remove left-hand camshaft sprocket by using ST.
ST 499207100 CAMSHAFT SPROCKET WRENCH

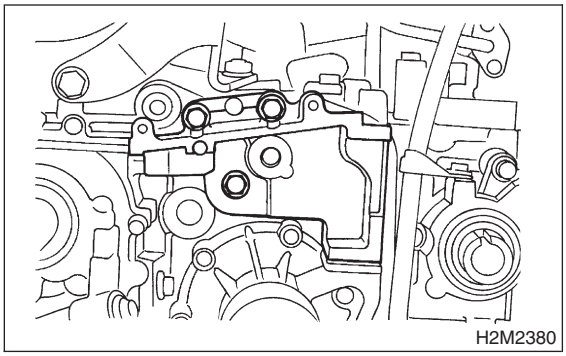


B2M2039A

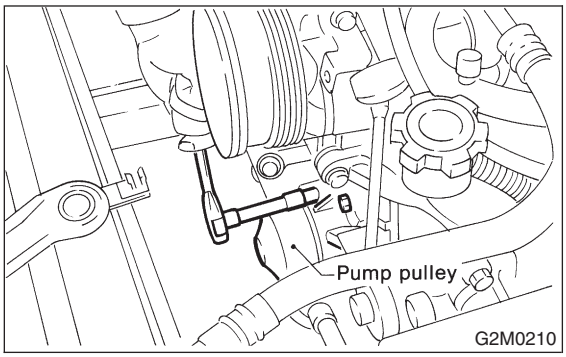
20) Remove left-hand belt cover No. 2.


B2M2040

21) Remove tensioner bracket.


H2M2380

22) Remove tensioner bracket.
23) Disconnect heater hose from water pump.
24) Remove water pump.



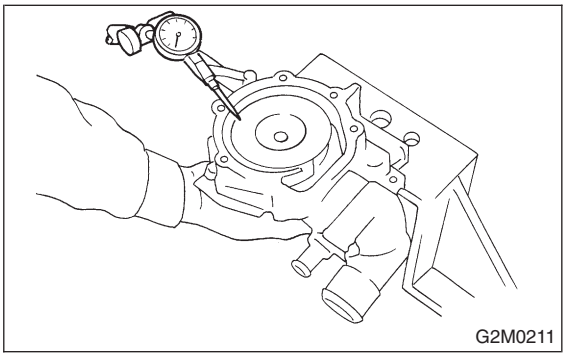
G2M0210

B: INSPECTION

1) Check water pump bearing for smooth rotation.
2) Check water pump pulley for abnormalities.

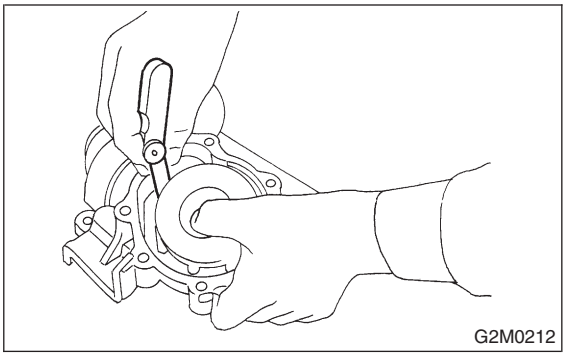
3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

"Thrust" runout limit:
0.5 mm (0.020 in)


G2M0211

4) Check clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 0.7 mm (0.020 — 0.028 in)
Limit
1.0 mm (0.039 in)


G2M0212

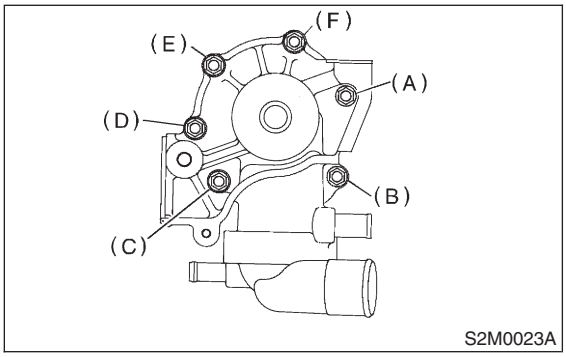
5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.

C: INSTALLATION

1) Install water pump onto left-hand cylinder head.

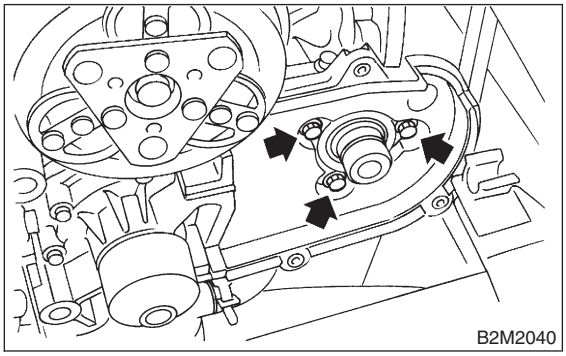
CAUTION:
- **Replace gasket with a new one.**
- **When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.**

Tightening torque:
First:
12±2 N·m (1.2±0.2 kg-m, 8.7±1.4 ft-lb)
Second:
12±2 N·m (1.2±0.2 kg-m, 8.7±1.4 ft-lb)



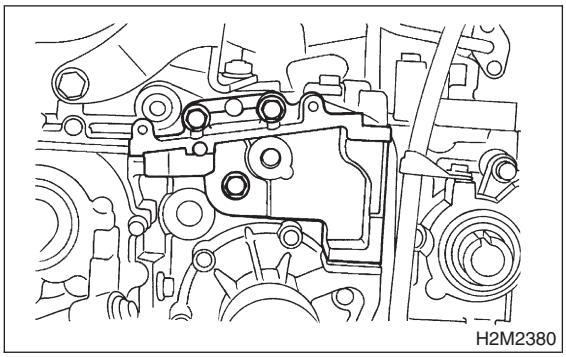
2) Install left-hand belt cover No. 2.

Tightening torque:
5±1 N·m (0.5±0.1 kg-m, 3.6±0.7 ft-lb)



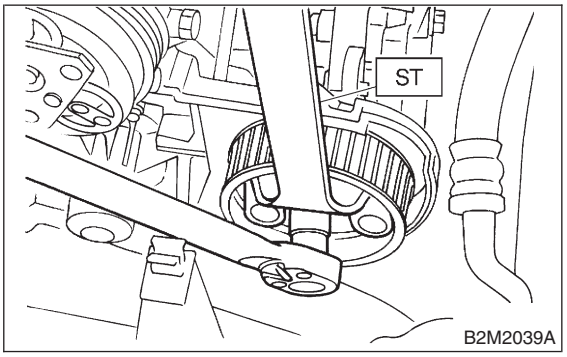
3) Install tensioner bracket.

Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)

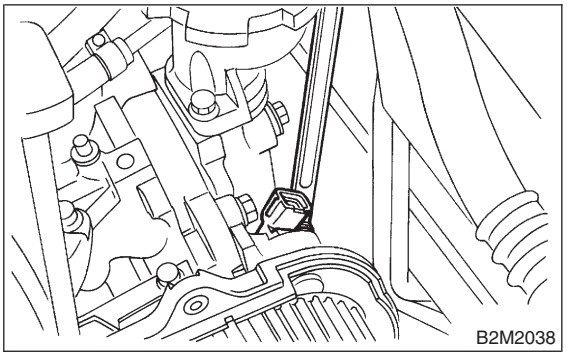


4) Install left-hand camshaft sprockets by using ST.
ST 4992707100 CAMSHAFT SPROCKET WRENCH

Tightening torque:
78±5 N·m (8.0±0.5 kg-m, 57.9±3.6 ft-lb)

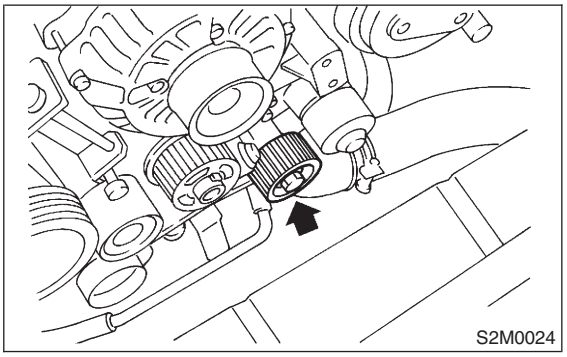


5) Install camshaft position sensor. <Ref. to 2-7 [W6A0].>

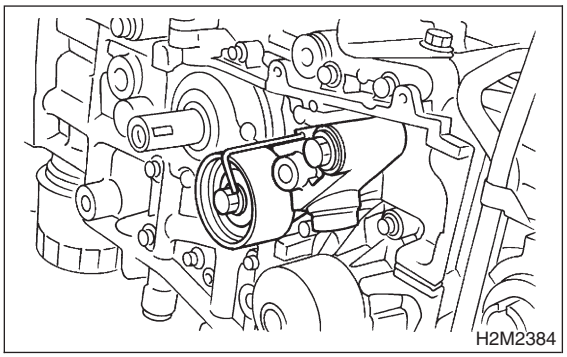


6) Install belt idler No. 2.

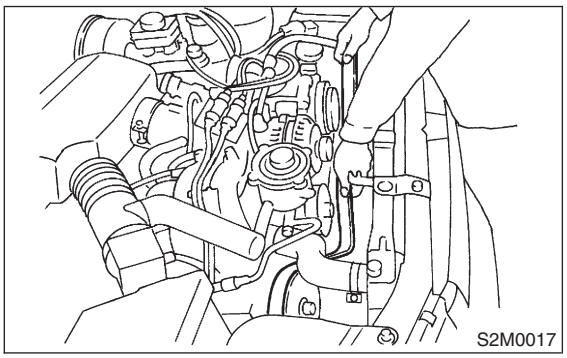
Tightening torque:
39±4 N·m (4.0±0.4 kg-m, 28.9±2.9 ft-lb)



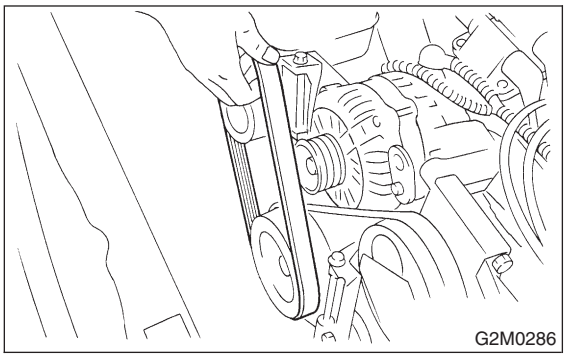
7) Install automatic belt tension adjuster which tension rod is holded with pin. <Ref. to 2-3 [W3C2].>


H2M2384

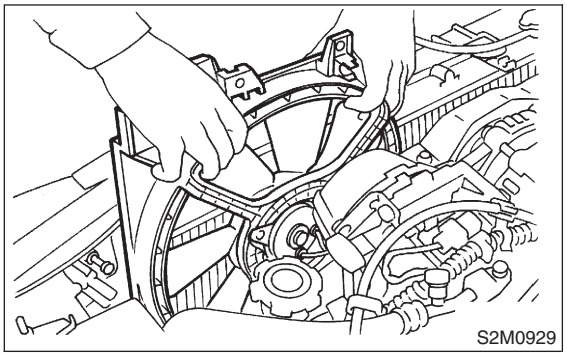
8) Install timing belt. <Ref. to 2-3 [W2C0].>


S2M0017

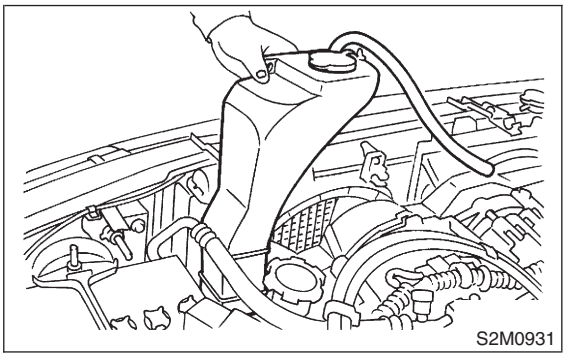
9) Install V-belts. <Ref. to 1-5 [G2B0].>


G2M0286

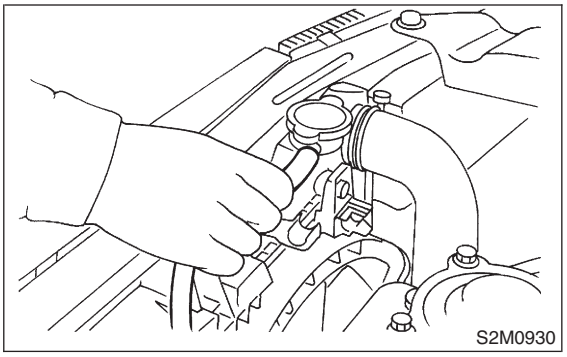
10) Install radiator main fan and sub fan motor assemblies. <Ref. to 2-5 [W5A0].> and <Ref. to 2-5 [W6A0].>


S2M0929

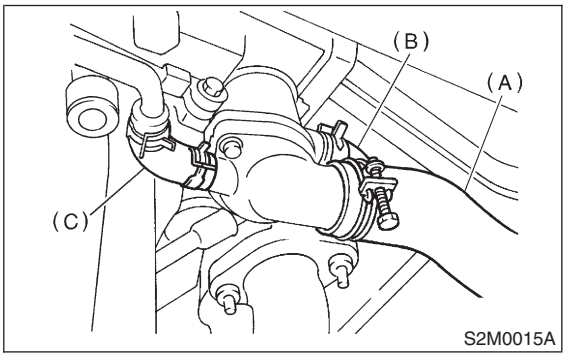
11) Install reservoir tank.


S2M0931

12) Connect over flow hose.

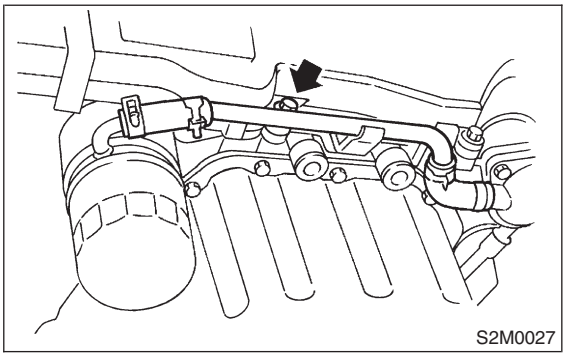

S2M0930

13) Lift-up the vehicle.
14) Connect radiator outlet hose (A) and heater hose (B) to water pump.
15) Connect water by-pass hose (C). (AT vehicles only)

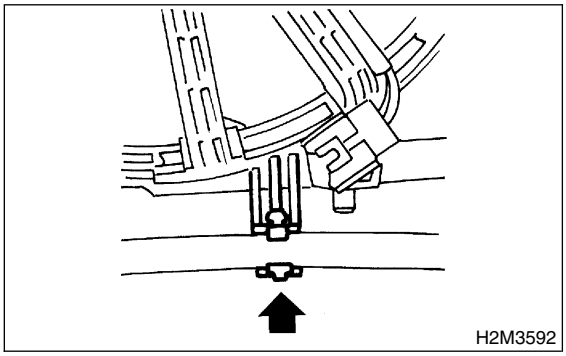


S2M0015A

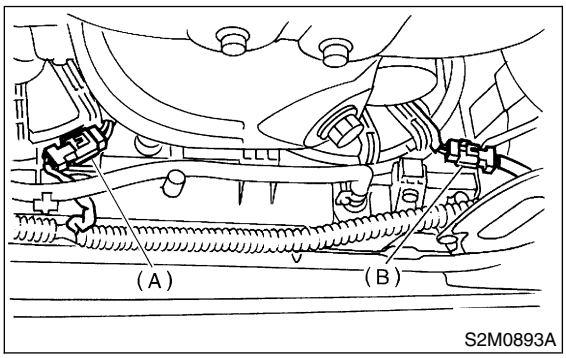
16) Install bolt which installs water by-pass pipe onto oil pump. (AT vehicles only)


S2M0027

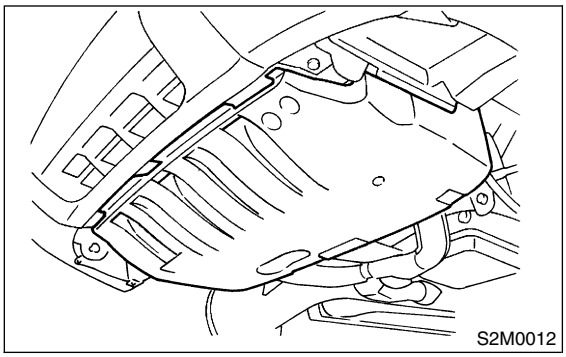
17) Attach ATF cooler hose to a clip under the radiator main fan shroud.



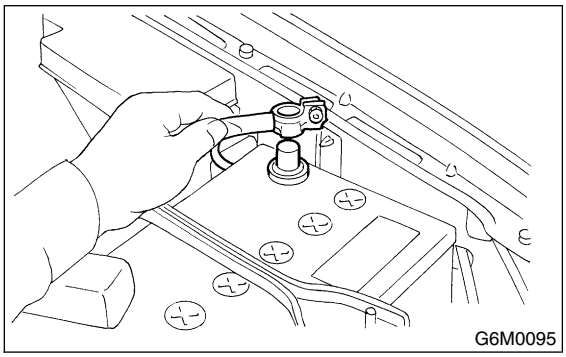
18) Connect connectors to radiator main fan (A) and sub fan (B) motors.



19) Install under cover.



20) Lower the vehicle.
21) Connect battery ground cable.



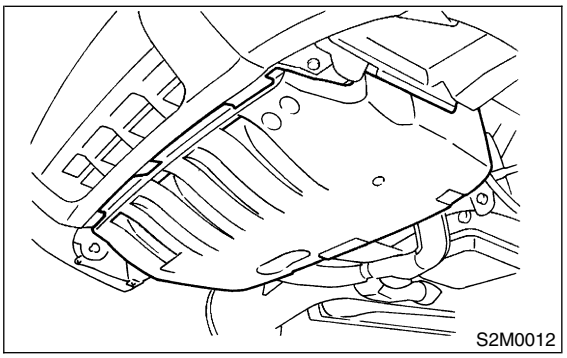
22) Fill coolant. <Ref. to 2-5 [W9B0].>

2. Thermostat

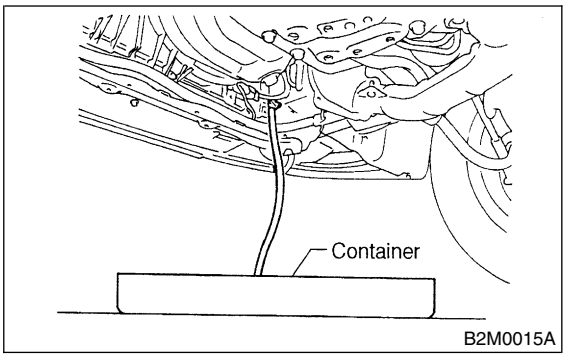
A: REMOVAL AND INSTALLATION

WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

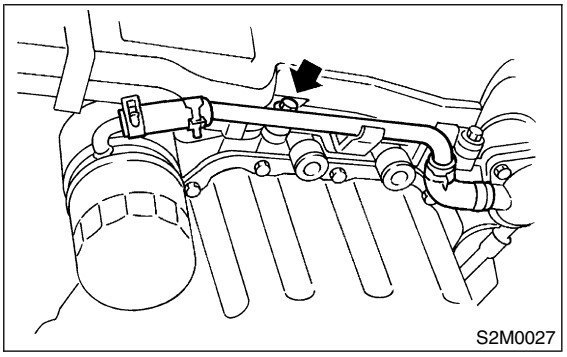
1) Lift-up the vehicle.
2) Remove under cover.



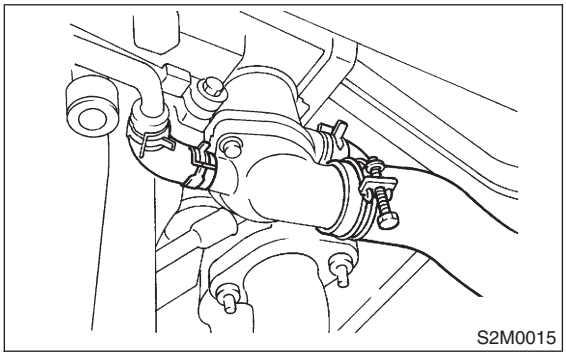
3) Drain engine coolant completely. <Ref. to 2-5 [W9A0].>



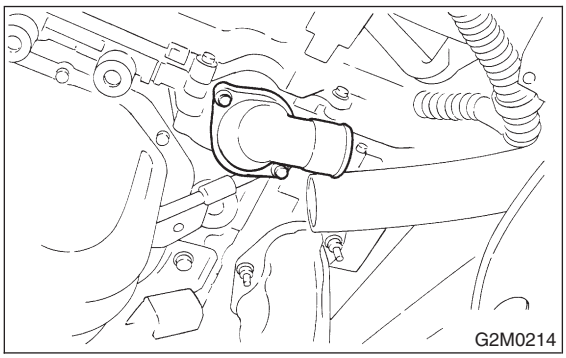
4) Remove bolt which installs water by-pass pipe of oil cooler onto oil pump. (AT vehicles only)



5) Disconnect radiator outlet hose and water bypass hose B (AT vehicles) from thermostat cover.


S2M0015

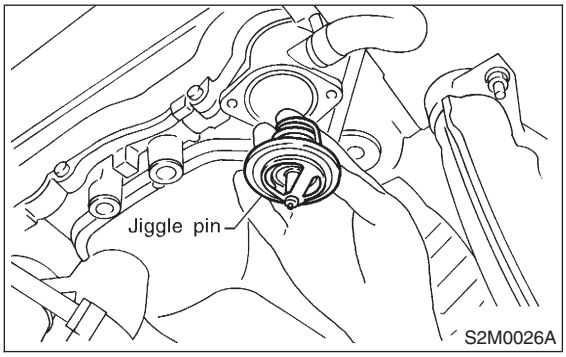
6) Remove thermostat cover and gasket, and pull out the thermostat.


G2M0214

7) Install the thermostat in the water pump, and install the thermostat cover together with a gasket.

CAUTION:
• When reinstalling the thermostat, use a new gasket.
• The thermostat must be installed with the jiggle pin facing to front side.
• At this time, set the jiggle pin of thermostat for front side.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



S2M0026A

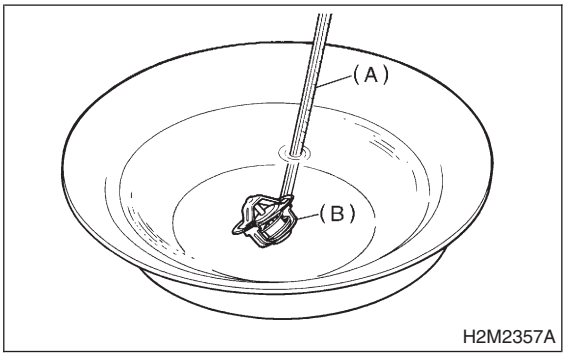
8) Fill coolant. <Ref. to 2-5 [W9B0].>

B: INSPECTION

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.
Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be to the specification.

Starts to open:
76.0 — 80.0°C (169 — 176°F)

Fully opens:
91°C (196°F)



H2M2357A

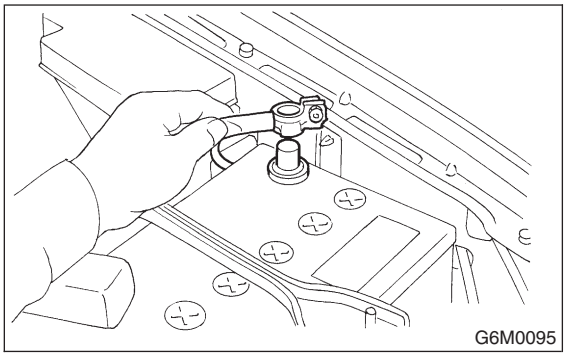
(A) Thermometer
(B) Thermostat

3. Radiator

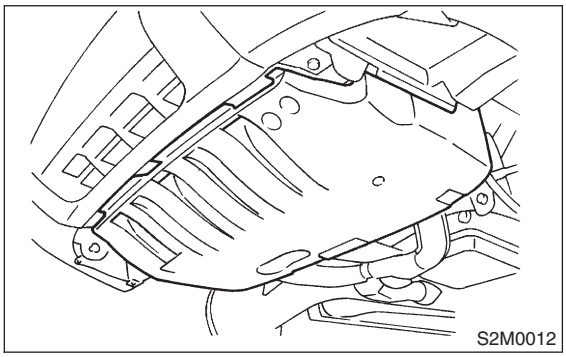
A: REMOVAL

WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

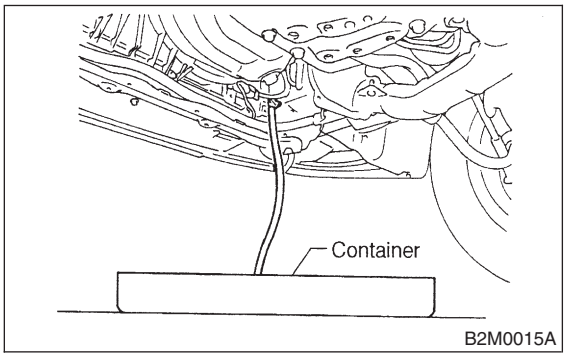
1) Disconnect battery ground cable.



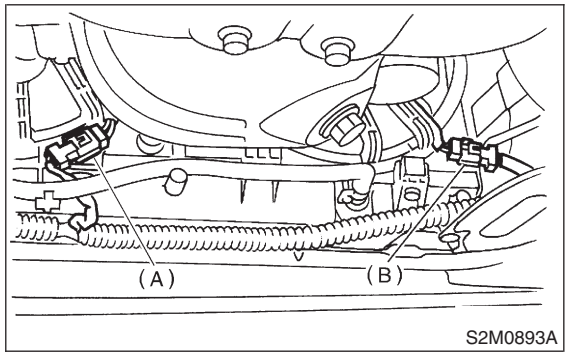
2) Lift-up the vehicle.
3) Remove under cover.



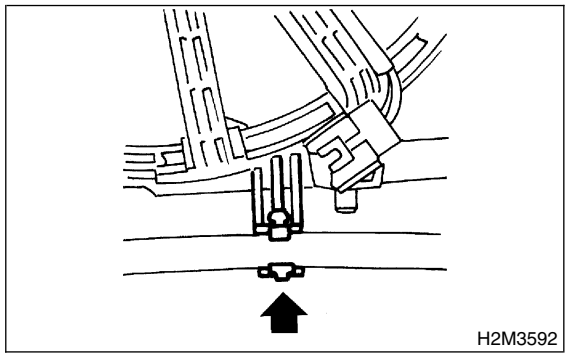
4) Drain engine coolant completely. <Ref. to 2-5 [W9A0].>



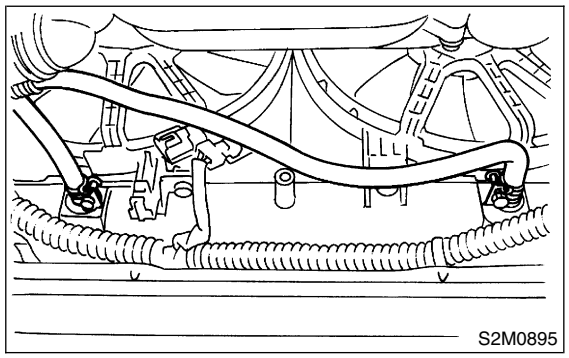
5) Disconnect connectors of radiator main fan (A) and sub fan (B) motor.



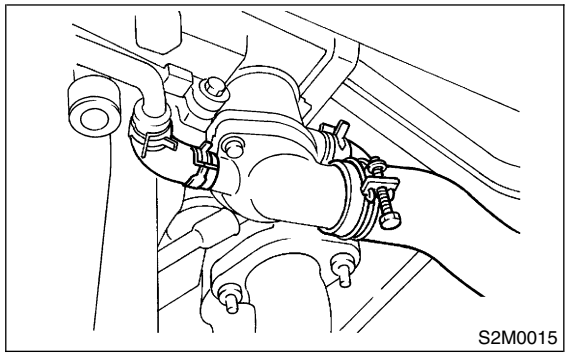
6) Detach ATF cooler hose attached to a clip under the radiator main fan shroud.



7) Disconnect ATF cooler hoses from radiator. (AT vehicles only)

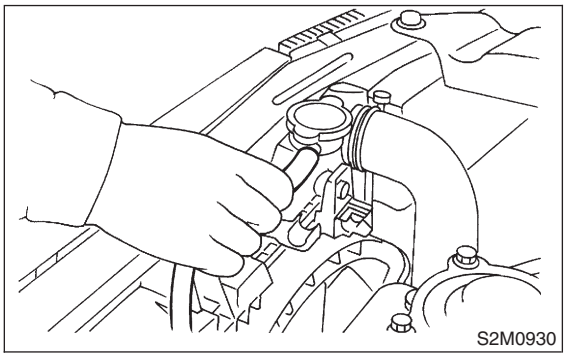


8) Disconnect radiator outlet hose from thermostat cover.

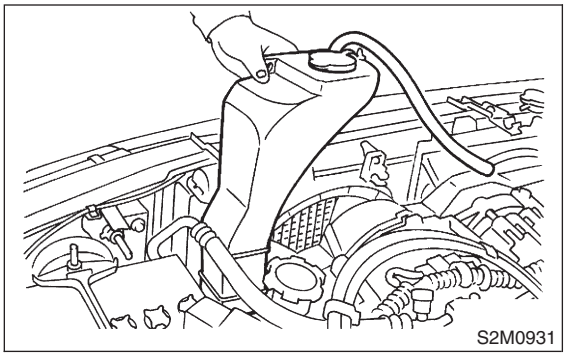


9) Lower the vehicle.

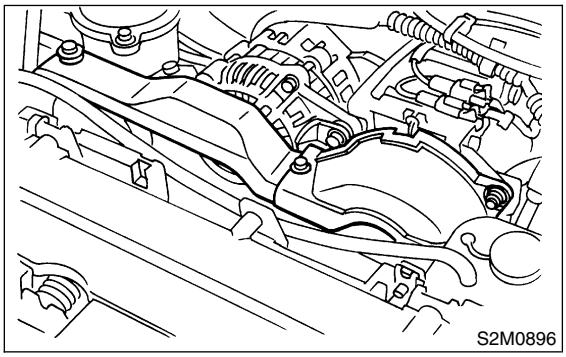
10) Disconnect over flow hose.



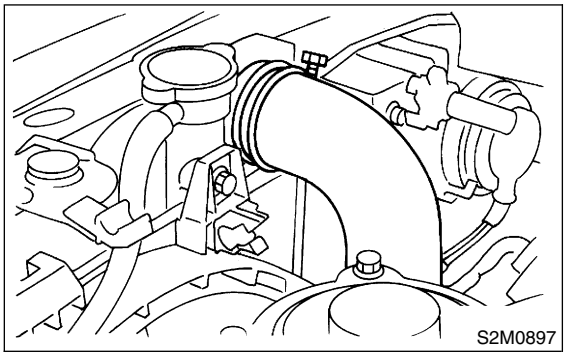
11) Remove reservoir tank.



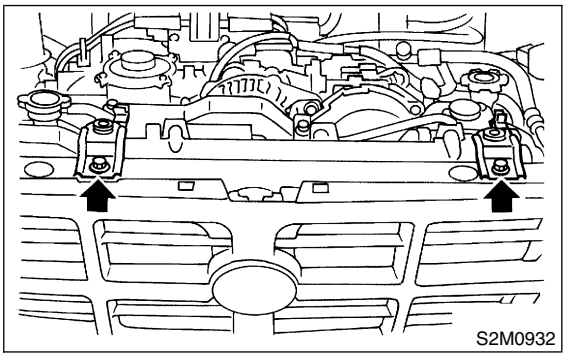
12) Remove V-belt covers.



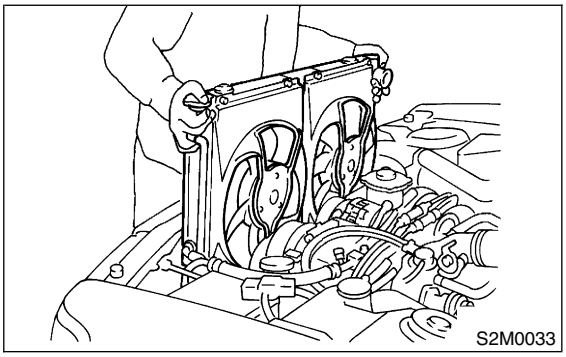
13) Disconnect radiator inlet hose from radiator.



14) Remove radiator upper brackets.

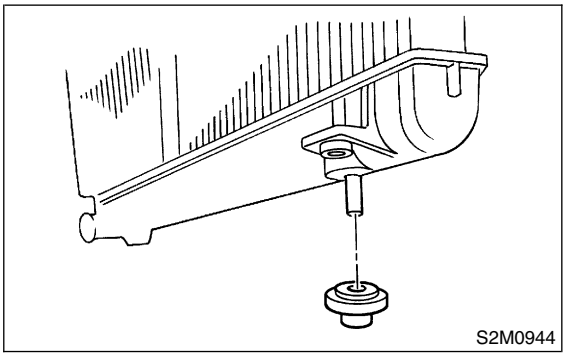


15) While slightly lifting radiator, slide it to left.
16) Lift radiator up and away from vehicle.



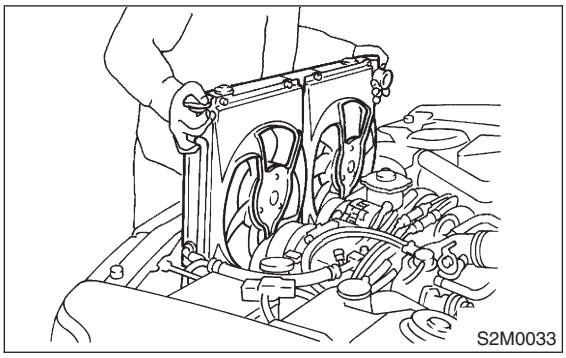
B: INSTALLATION

1) Attach radiator mounting cushions to pins on the lower side of radiator.



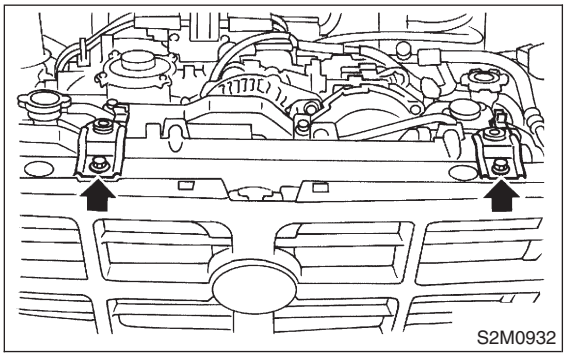
2) Install radiator while fitting radiator pins to cushions.

NOTE:
Fit cushion on lower side of radiator into holes on body side.

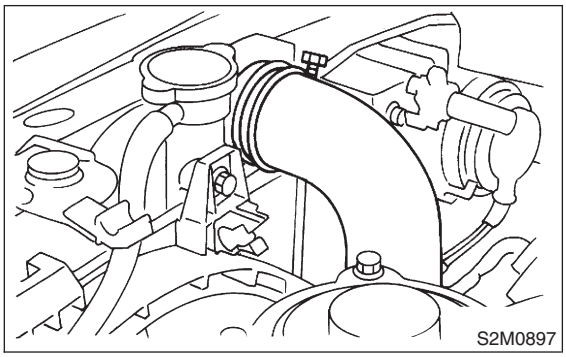

S2M0033

3) Install radiator brackets and tighten bolts.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

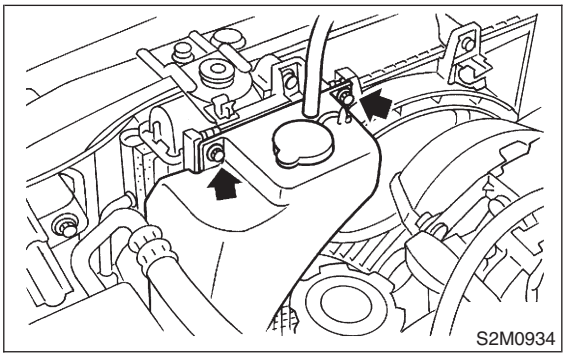

S2M0932

4) Connect radiator inlet hose.

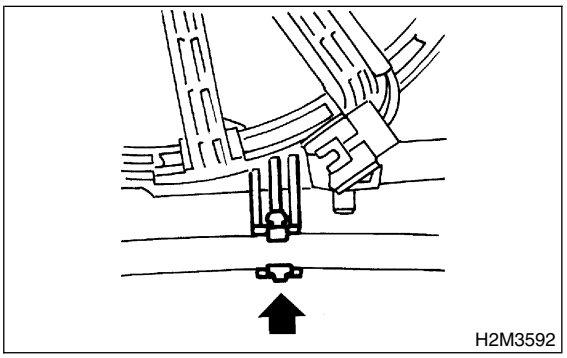

S2M0897

5) Install reservoir tank.

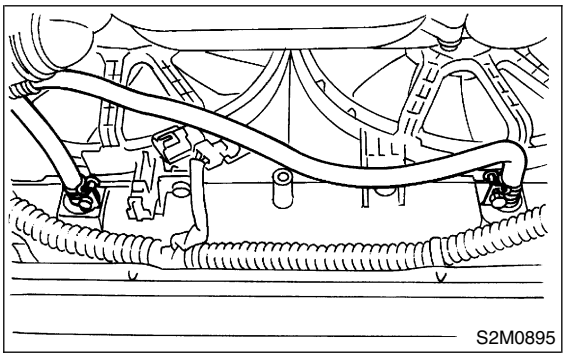
Tightening torque:
4.9±1.5 N·m (0.50±0.15 kg-m, 3.6±1.1 ft-lb)


S2M0934

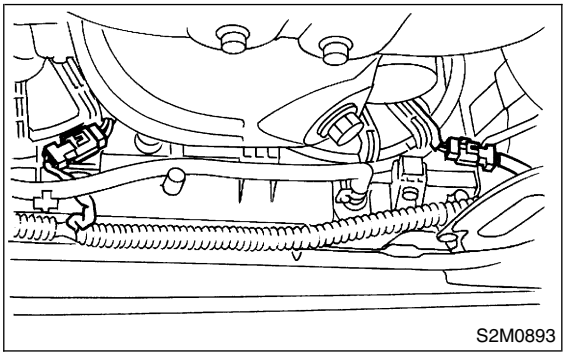
6) Lift-up the vehicle.
7) Attach ATF cooler hose to a clip under the radiator main fan shroud.


H2M3592

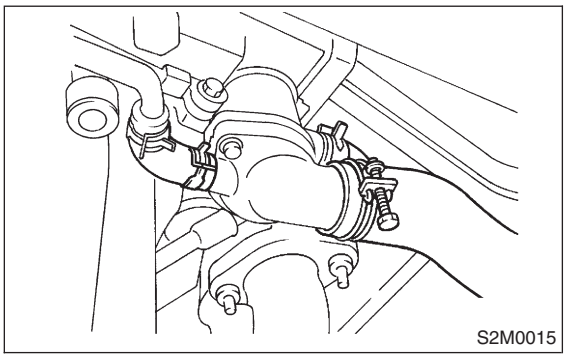
8) Connect ATF cooler hoses. (AT vehicles only)


S2M0895

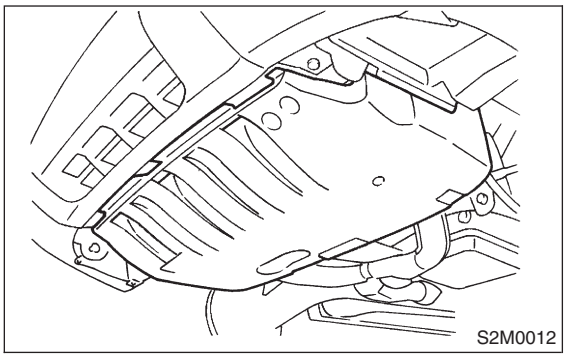
9) Connect connectors to radiator main fan motor and sub fan motor.


S2M0893

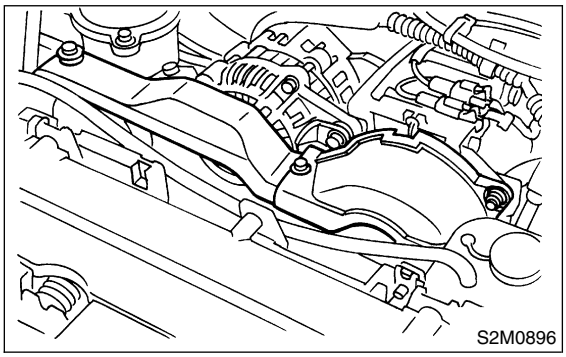
10) Connect radiator outlet hose.


S2M0015

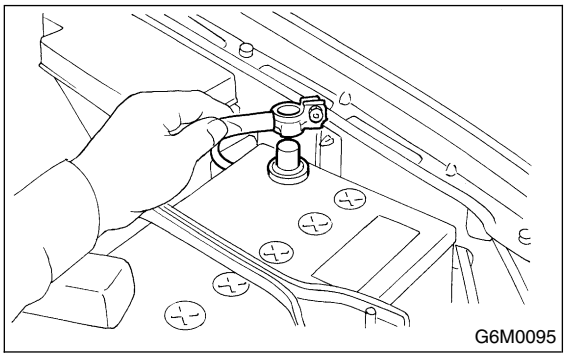
11) Install under cover.


S2M0012

12) Lower the vehicle.
13) Install V-belt covers.


S2M0896

14) Connect battery ground cable.

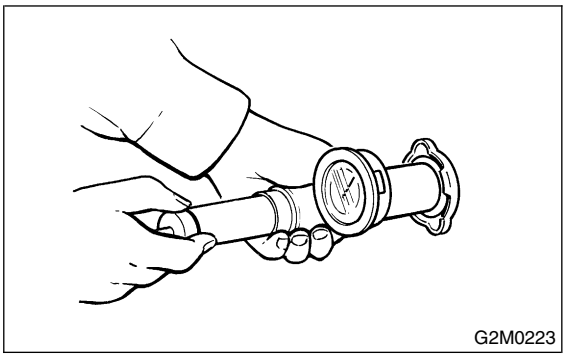

G6M0095

15) Fill coolant. <Ref. to 2-2 [W9B0].>

4. Radiator Cap

A: INSPECTION

1) Attach radiator cap to tester.


G2M0223

2) Increase pressure until tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds.

Standard pressure:
93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)

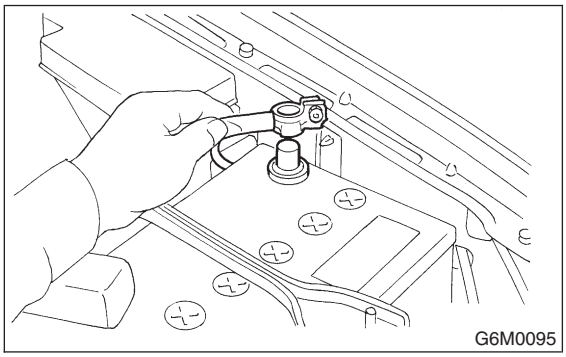
Service limit pressure:
83 kPa (0.85 kg/cm^2, 12 psi)

CAUTION:
Be sure to remove foreign matter and rust from the cap in advance; otherwise, results of pressure test will be incorrect.

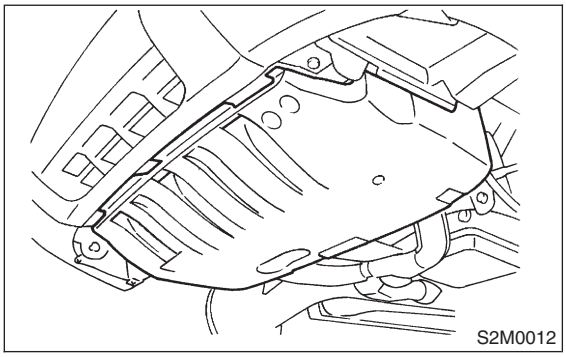
5. Radiator Main Fan and Fan Motor

A: REMOVAL AND INSTALLATION

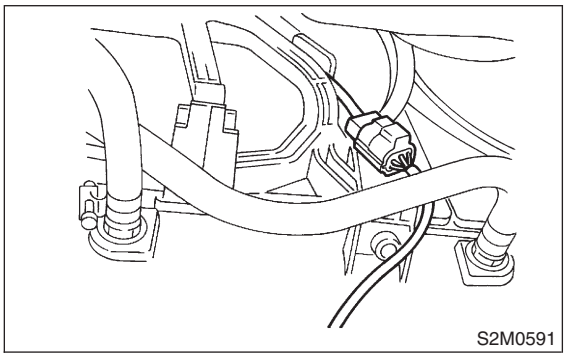
1) Disconnect battery ground cable.


G6M0095

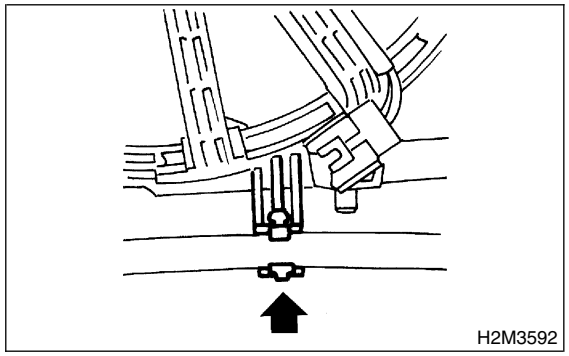
2) Lift-up the vehicle.
3) Remove under cover.


S2M0012

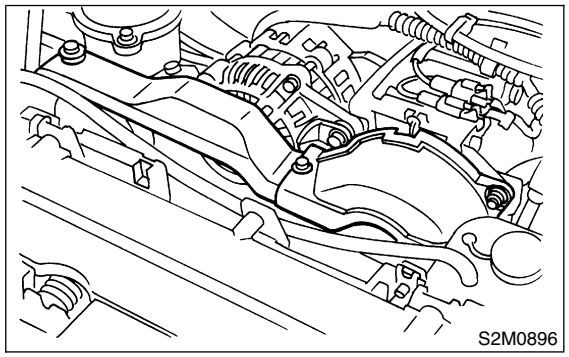
4) Disconnect connector of main fan motor.


S2M0591

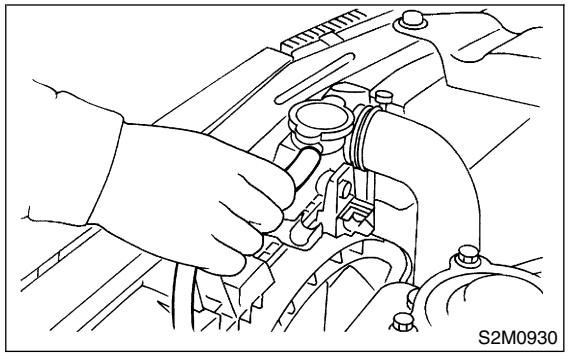
5) Detach ATF cooler hose attached to a clip under the radiator main fan shroud.


H2M3592

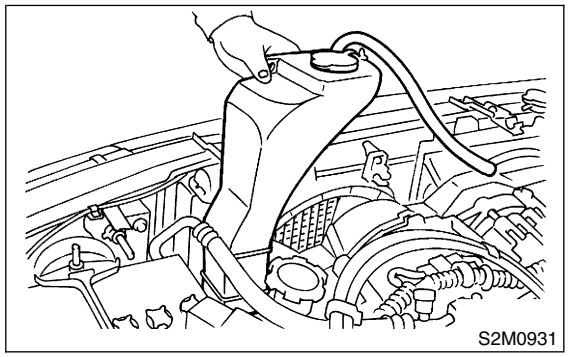
6) Lower the vehicle.
7) Remove V-belt covers.


S2M0896

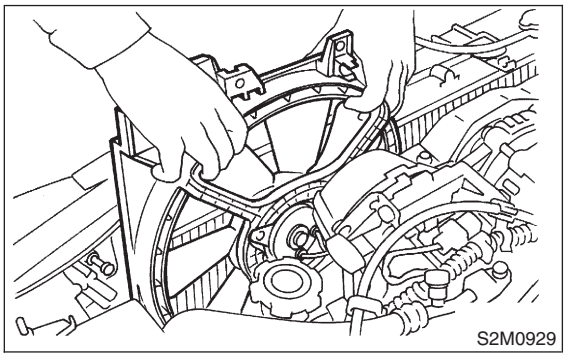
8) Disconnect over flow hose.


S2M0930

9) Remove reservoir tank.


S2M0931

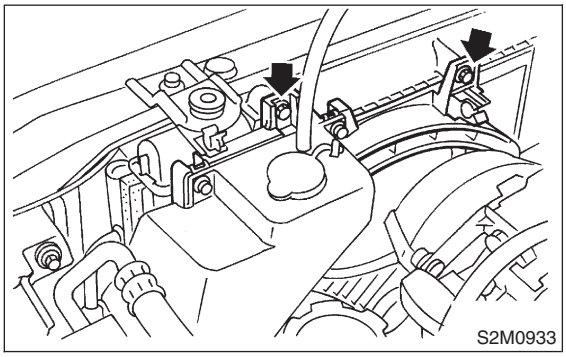
10) Remove radiator main fan motor assembly.


S2M0929

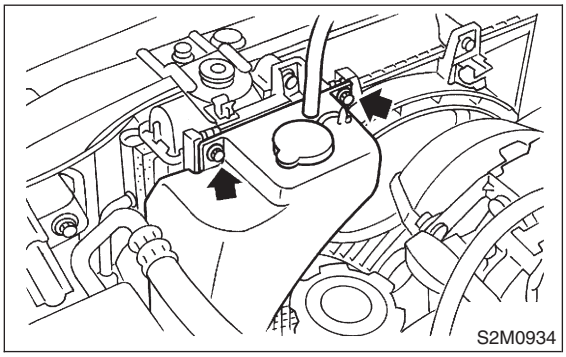
11) Installation is in the reverse order of removal.

NOTE:
When the main fan motor assembly cannot be installed as is, loosen the sub fan motor assembly securing bolts to install it. <Ref. to 2-5 [W6A0].>

Tightening torque:
4.9±1.5 N·m (0.50±0.15 kg-m, 3.6±1.1 ft-lb)

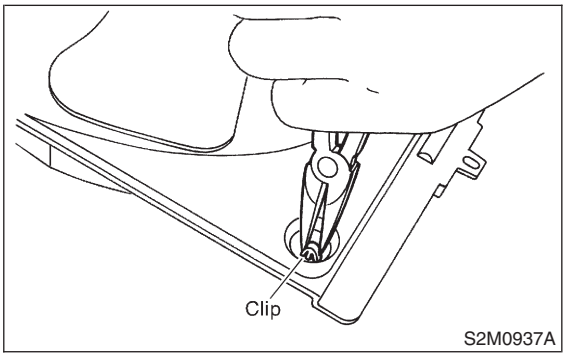

S2M0933

Tightening torque:
4.9±1.5 N·m (0.50±0.15 kg-m, 3.6±1.1 ft-lb)


S2M0934

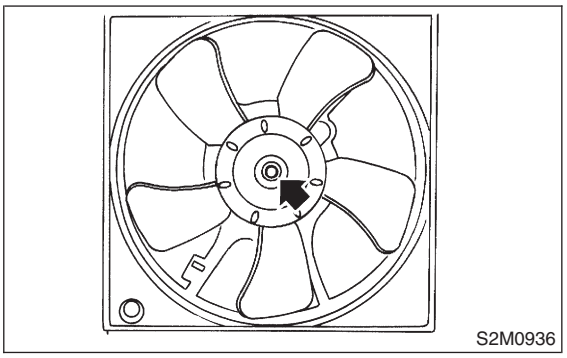
B: DISASSEMBLY AND ASSEMBLY

1) Remove clip which holds motor connector onto shroud.

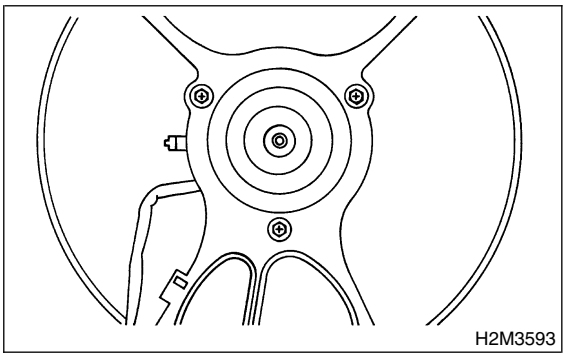


S2M0937A

2) Remove nut which holds fan itself onto fan motor and shroud assembly.

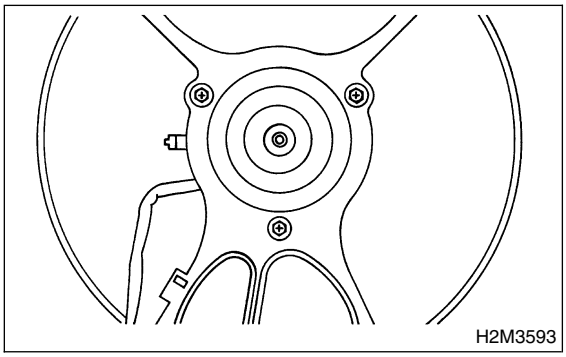

S2M0936

3) Remove bolts which install fan motor onto shroud.

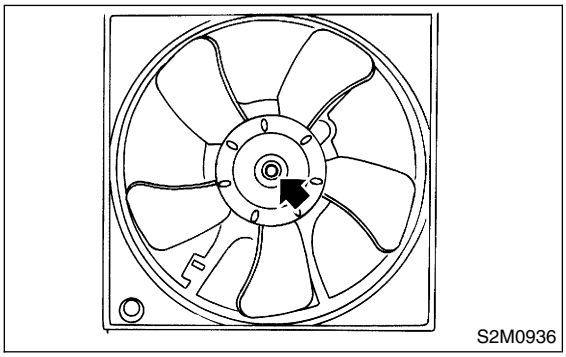

H2M3593

4) Installation is in the reverse order of removal.

Tightening torque:
4.4±0.5 N·m (0.45±0.05 kg-m, 3.3±0.4 ft-lb)



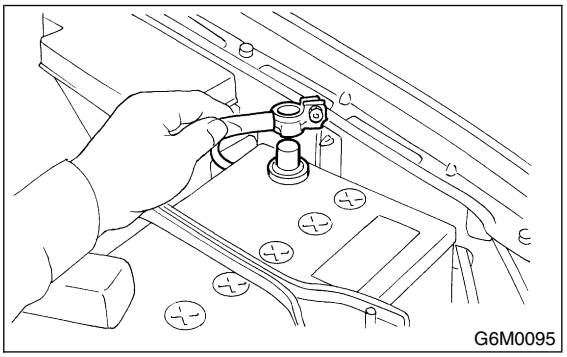
Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)



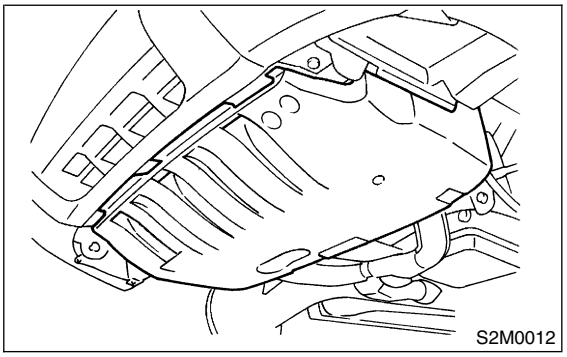
6. Radiator Sub Fan and Fan Motor

A: REMOVAL AND INSTALLATION

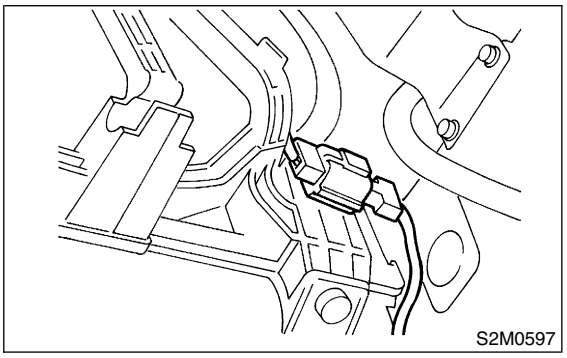
1) Disconnect battery ground cable.



2) Lift-up the vehicle.
3) Remove under cover.

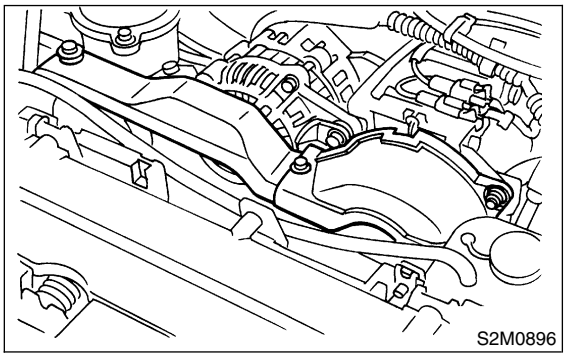


4) Disconnect connector of sub fan motor.

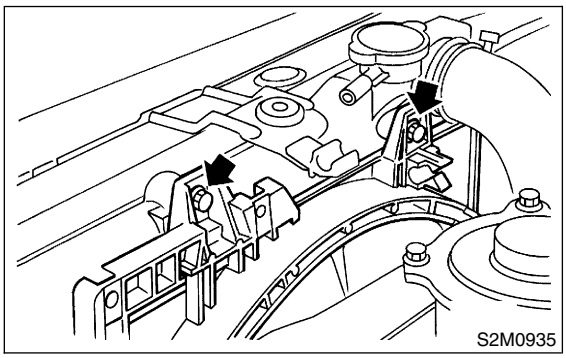


5) Lower the vehicle.

6) Remove V-belt covers.

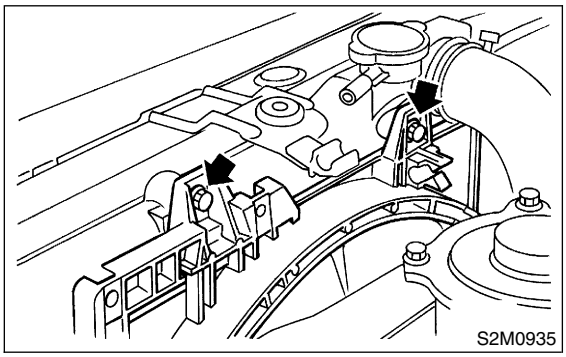

S2M0896

7) Remove bolts which hold sub fan shroud to radiator.
8) Remove radiator sub fan motor assembly.


S2M0935

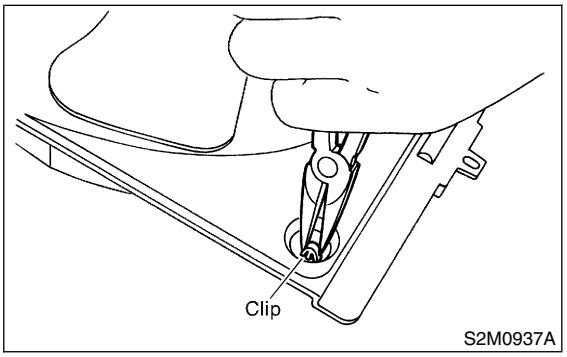
9) Installation is in the reverse order of removal.

Tightening torque:
4.9±1.5 N·m (0.50±0.15 kg-m, 3.6±1.1 ft-lb)


S2M0935

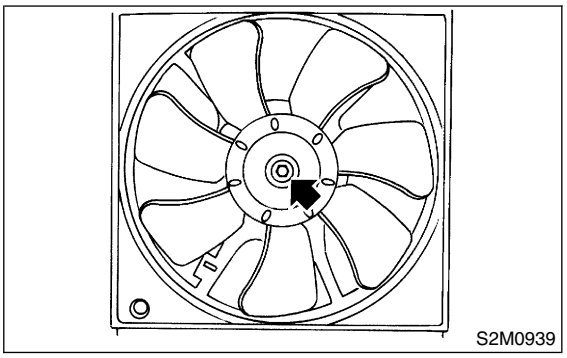
B: DISASSEMBLY AND ASSEMBLY

1) Remove clip which holds motor harness onto shroud.

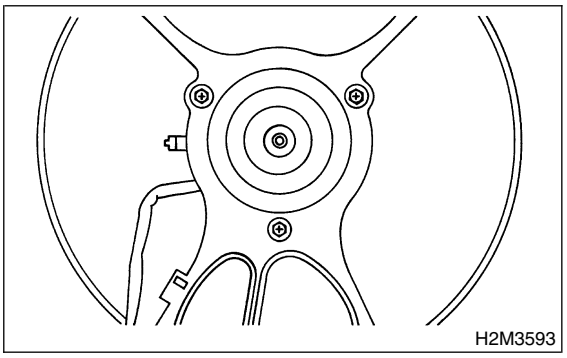


S2M0937A

2) Remove nut which holds fan itself onto fan motor and shroud assembly.

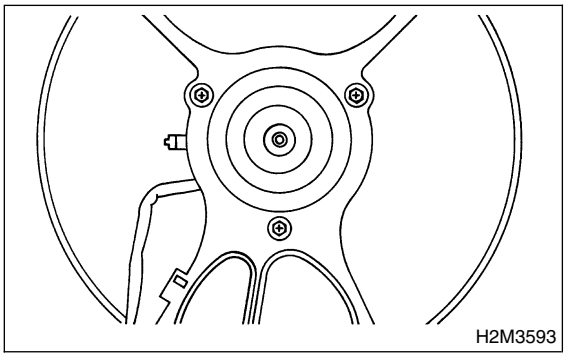

S2M0939

3) Remove bolts which install fan motor onto shroud.

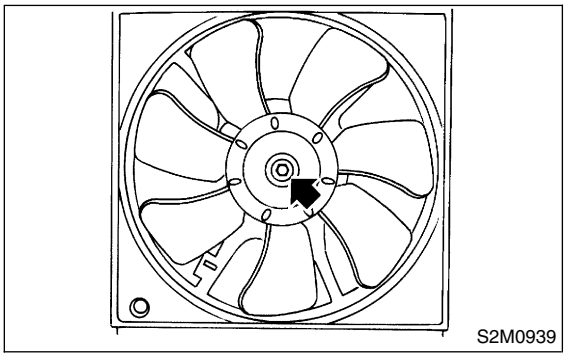

H2M3593

4) Installation is in the reverse order of removal.

Tightening torque:
4.4±0.5 N·m (0.45±0.05 kg-m, 3.3±0.4 ft-lb)


H2M3593

Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)

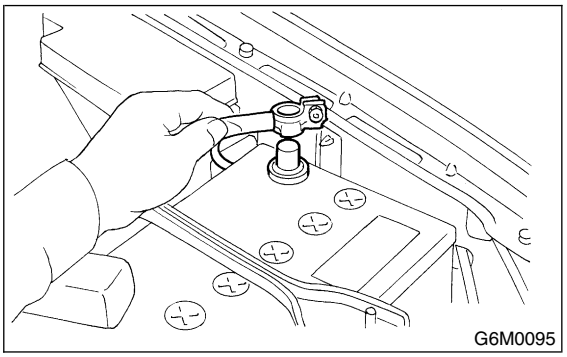

S2M0939

7. Water Pipe

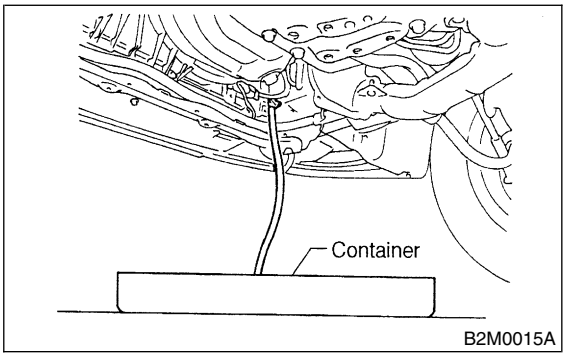
A: REMOVAL

WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

1) Release fuel pressure.
<Ref. to 2-8 [W1A0].>
2) Disconnect ground cable from the battery.

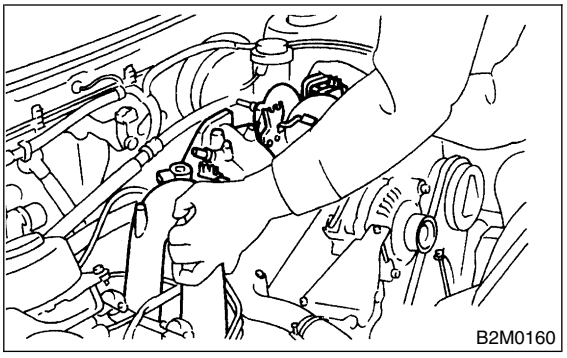

G6M0095

3) Drain engine coolant completely.
<Ref. to 2-5 [W9A0].>

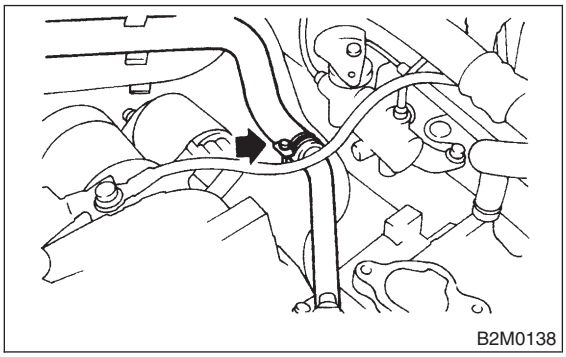


B2M0015A

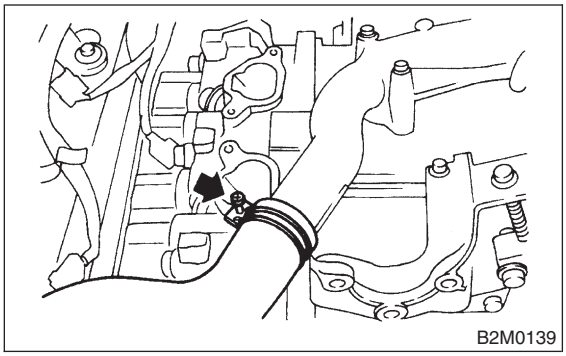
4) Remove intake manifold.
<Ref. to 2-7 [W3A0].>


B2M0160

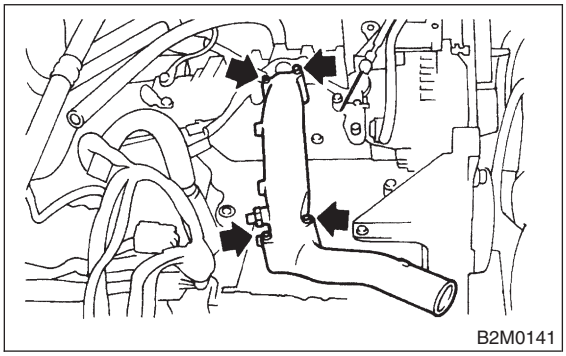
5) Disconnect heater inlet hose.



6) Disconnect radiator inlet hose from water pipe.



7) Remove bolts which install water pipe on cylinder block.

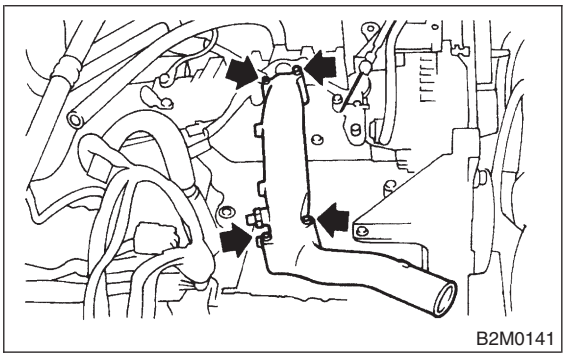


B: INSTALLATION

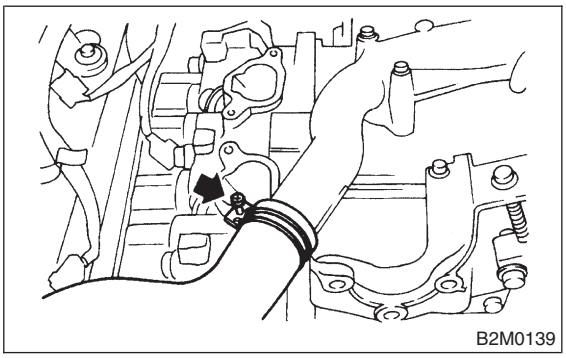
1) Install water pipe on cylinder block.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)

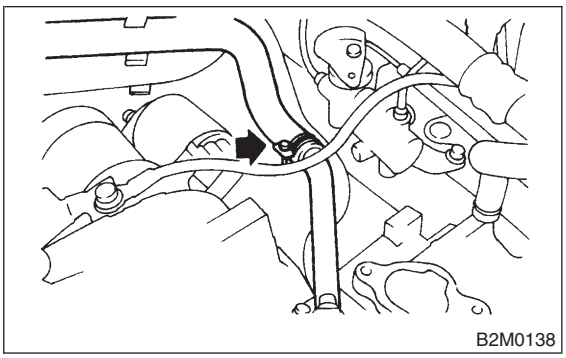
CAUTION:
Use a new O-ring.



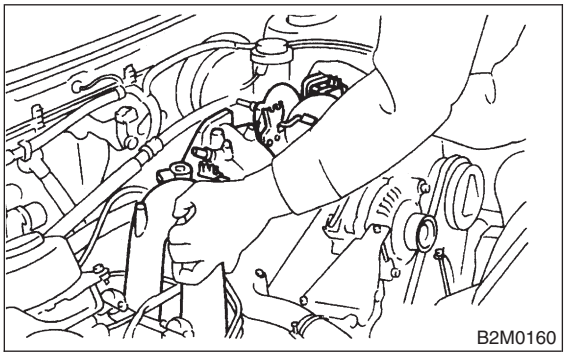
2) Connect radiator inlet hose.



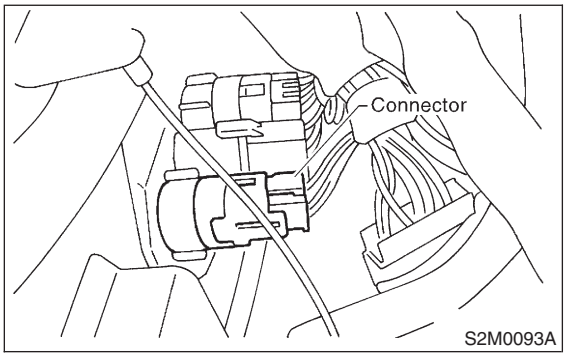
3) Connect heater inlet hose.



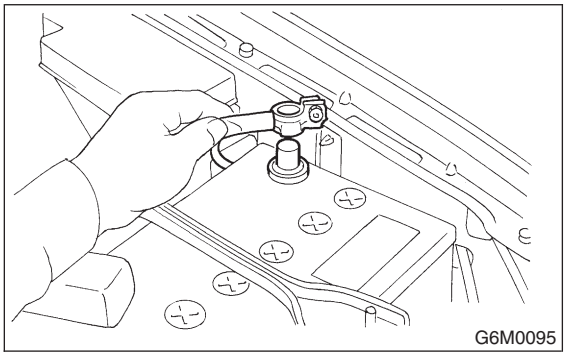
4) Install intake manifold.
<Ref. to 2-7 [W3D0].>



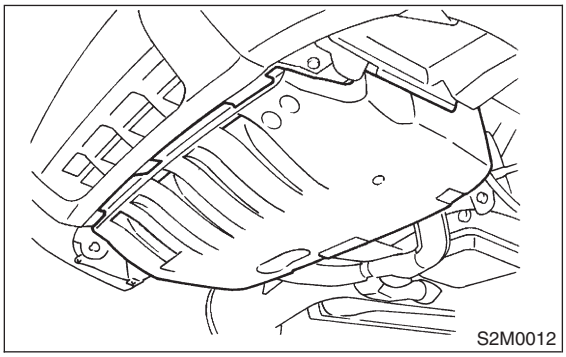
5) Connect connector to fuel pump relay.



6) Connect ground cable to battery.



7) Lift-up the vehicle.
8) Install under cover.

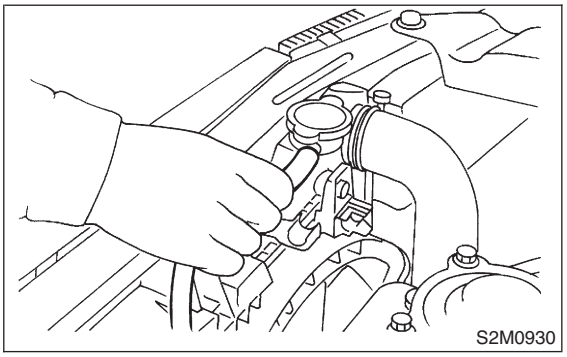


9) Lower the vehicle.
10) Fill coolant.
<Ref. to 2-5 [W9B0].>

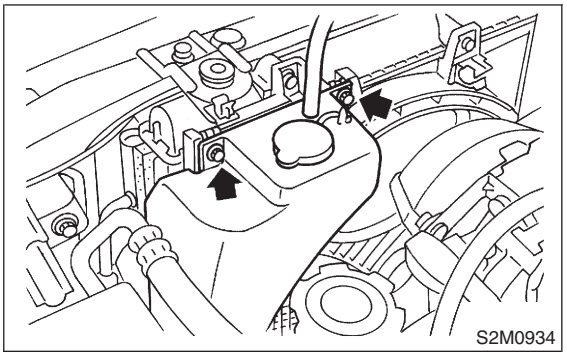
8. Reservoir Tank

A: REMOVAL AND INSTALLATION

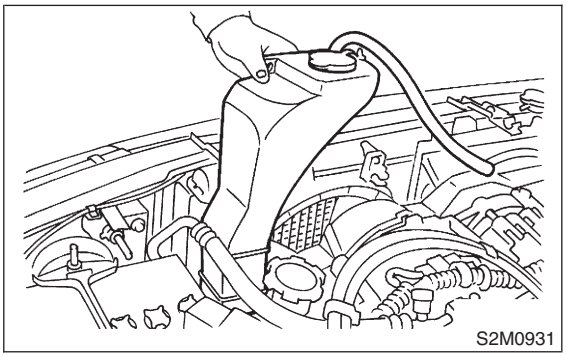
1) Disconnect over flow hose from radiator filler neck position.



2) Remove bolts which install reservoir tank onto radiator main fan shroud.

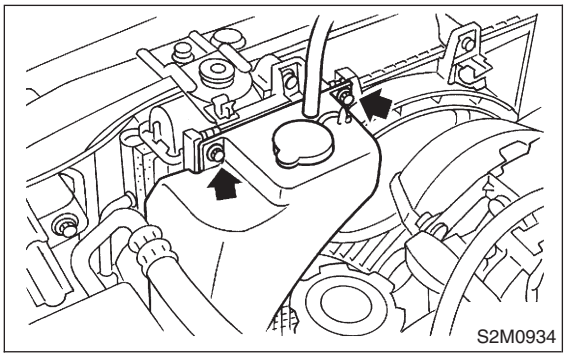


3) Remove reservoir tank.



4) Installation is in the reverse order of removal.

Tightening torque:
4.9±1.5 N·m (0.50±0.15 kg-m, 3.6±1.1 ft-lb)

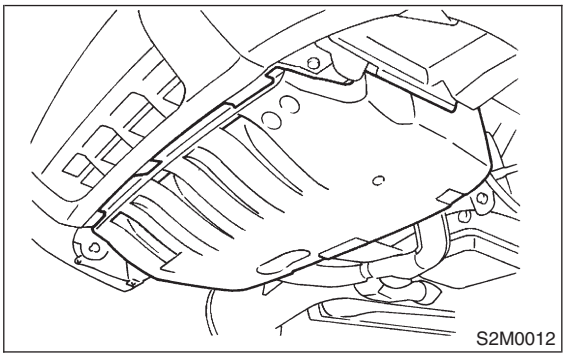


9. Engine Coolant

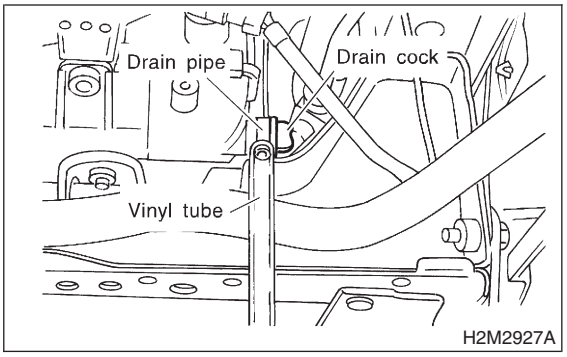
A: DRAINING OF ENGINE COOLANT

WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

1) Lift-up the vehicle.
2) Remove under cover.

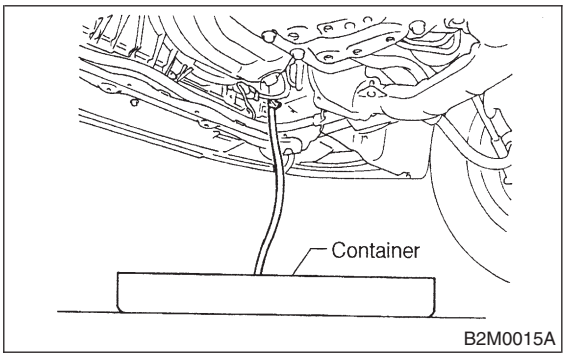


3) Fit vinyl tube to drain pipe.



4) Loosen drain cock to drain engine coolant into container.

NOTE:
Remove radiator cap so that engine coolant will drain faster.



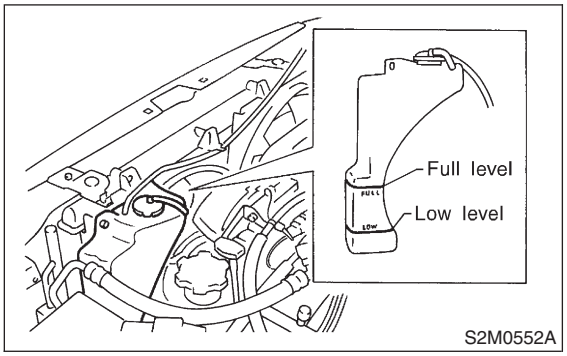
B: FILLING OF ENGINE COOLANT

1) Fill engine coolant into radiator up to filler neck position.

Coolant capacity (fill up to "FULL" level):
MT model;
Approx. 6.0 ℓ (6.3 US qt, 5.3 Imp qt)
AT model;
Approx. 6.2 ℓ (6.6 US qt, 5.5 Imp qt)

CAUTION:
The SUBARU Genuine Coolant containing anti-freeze and anti-rust agents is especially made for SUBARU engine, which has an aluminum crankcase. Always use SUBARU Genuine Coolant, since other coolant may cause corrosion.

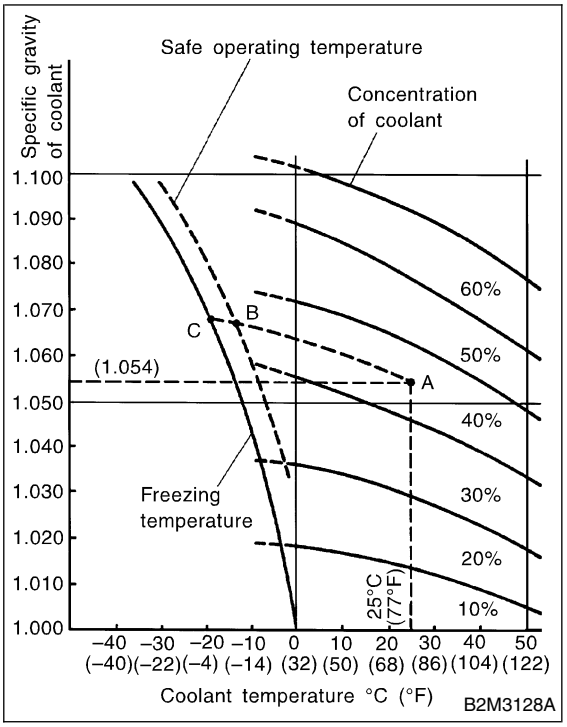
2) Fill engine coolant into reservoir tank up to upper level.



3) Attach radiator cap and reservoir tank cap properly.
4) Warm-up engine completely for more than five minutes at 2,000 to 3,000 rpm.
5) If engine coolant level drops in radiator, add engine coolant to filler neck position.
6) If engine coolant level drops from upper level of reservoir tank, add engine coolant to upper level.
7) Attach radiator cap and reservoir tank cap properly.

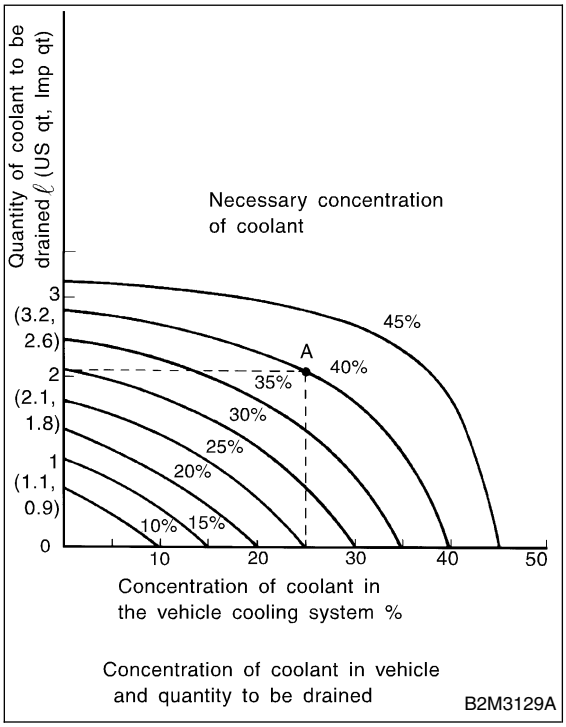
1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of the SUBARU coolant is shown in the diagram. Measuring the temperature and specific gravity of the coolant will provide this information.
[Example]
If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is –14°C (7°F) (point B), and the freezing temperature is –20°C (–4°F) (point C).



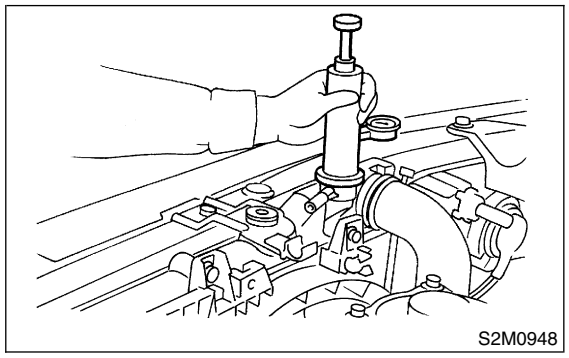
2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50).
The amount of coolant that should be replaced can be determined using the diagram.
[Example]
Assume that the coolant concentration must be increased form 25% to 40%. Find point A, where the 25% line of coolant concentration intersects with the 40% curve of the necessary coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 liters (2.2 US qt, 1.8 Imp qt). Drain 2.1 liters (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 liters (2.2 US qt, 1.8 Imp qt) of the undiluted solution of SUBARU coolant.
If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.



C: CHECKING OF COOLING SYSTEM

1) Remove radiator cap, top off radiator, and attach tester to radiator in place of cap.



2) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to radiator to check if:
(1) Engine coolant leaks at/around radiator.
(2) Engine coolant leaks at/around hoses or connections.

CAUTION:
- **Engine should be off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful to prevent engine coolant from spurting out when removing tester.**
- **Be careful also not to deform filler neck of radiator when installing or removing tester.**

1. Engine Cooling System Trouble in General

Trouble		Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to 2-7 [T700].> On-Board Diagnostics II System
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system. <Ref. to 2-7 [T700].> On-Board Diagnostics II System
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjust.
	o. Improper transmission oil	Replace.
	p. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks.	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and crank-case	Repair or replace.
	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

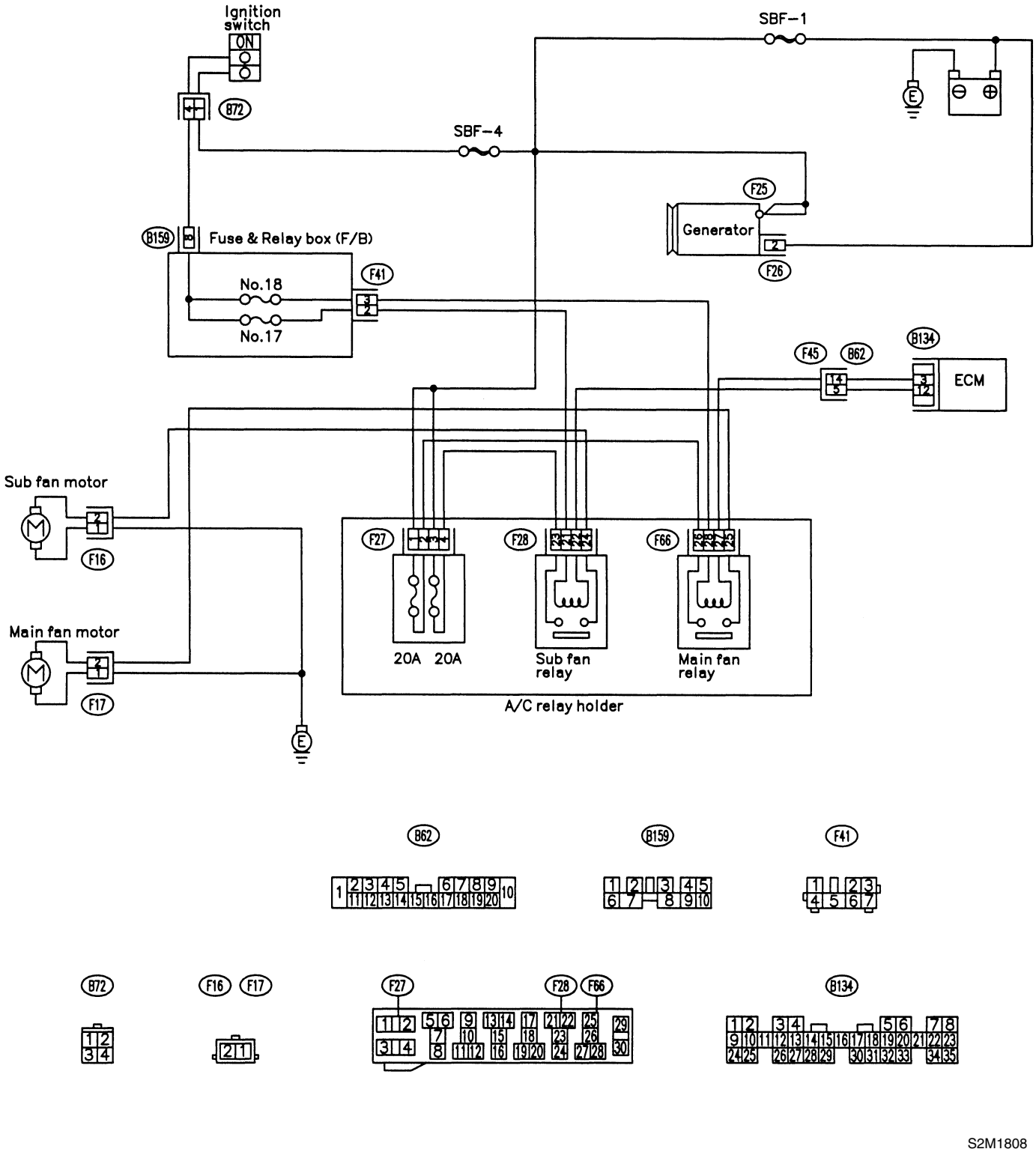
MEMO:

ENGINE COOLING SYSTEM 2-5

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1. Wiring Diagram



S2M1808

2. Radiator Main Fan

A: OPERATION

DETECTING CONDITION:

Condition:
- Engine coolant temperature is above 95°C (203°F).
- Vehicle speed is below 19 km/h (12 MPH).

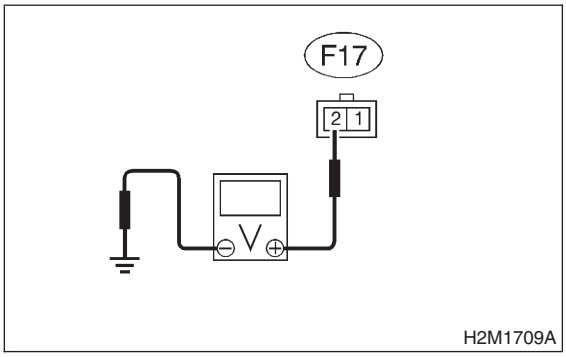
TROUBLE SYMPTOM:
- Radiator main fan does not rotate under the above conditions.

2A1 : CHECK POWER SUPPLY TO MAIN FAN MOTOR.

CAUTION:
Be careful not to overheat engine during repair.

1) Turn ignition switch to OFF.
2) Disconnect connector from main fan motor.
3) Start the engine, and warm it up until engine coolant temperature increases over 95°C (203°F).
4) Stop the engine and turn ignition switch to ON.
5) Measure voltage between main fan motor connector and chassis ground.

Connector & terminal
(F17) No. 2 (+) — Chassis ground (–):

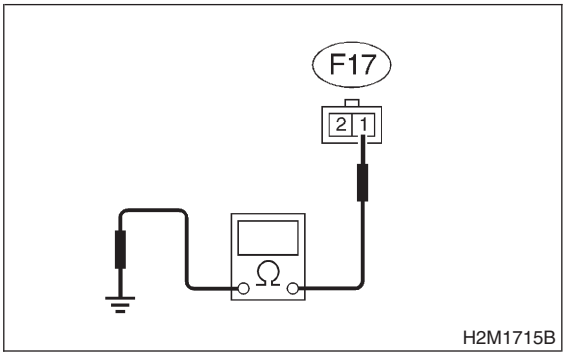


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **2A2**.
NO : Go to step **2A5**.

2A2 : CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between main fan motor connector and chassis ground.

Connector & terminal
(F17) No. 1 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **2A3**.
NO : Repair open circuit in harness between main fan motor connector and chassis ground.

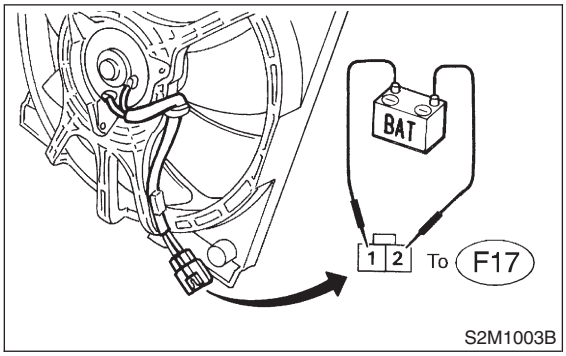
2A3 : CHECK POOR CONTACT.

Check poor contact in main fan motor connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in main fan motor connector?***
YES : Repair poor contact in main fan motor connector.
NO : Go to step **2A4**.

2A4 : CHECK MAIN FAN MOTOR.

Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of main fan motor connector.

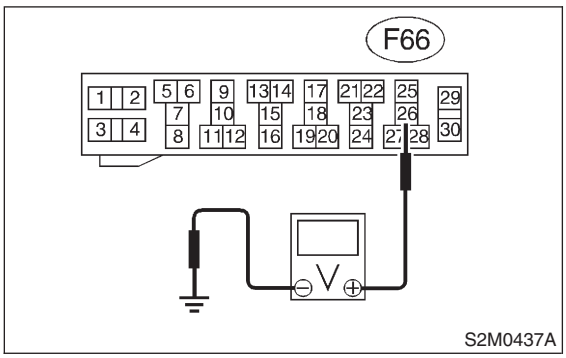


CHECK : ***Does the main fan rotate?***
YES : Repair poor contact in main fan motor connector.
NO : Replace main fan motor with a new one.

2A5 : CHECK POWER SUPPLY TO MAIN FAN RELAY.

1) Turn ignition switch to OFF.
2) Remove main fan relay from A/C relay holder.
3) Measure voltage between main fan relay terminal and chassis ground.

Connector & terminal
(F66) No. 26 (+) — Chassis ground (–):

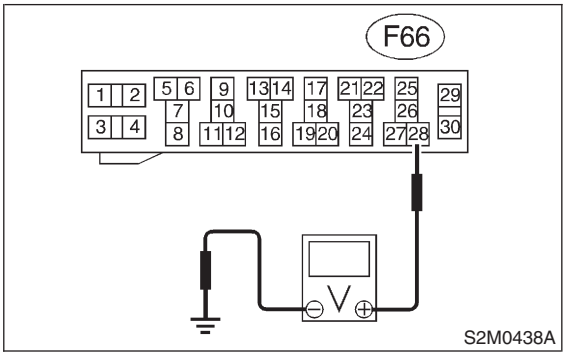


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **2A6**.
NO : Go to step **2A7**.

2A6 : CHECK POWER SUPPLY TO MAIN FAN RELAY.

1) Turn ignition switch to ON.
2) Measure voltage between main fan relay terminal and chassis ground.

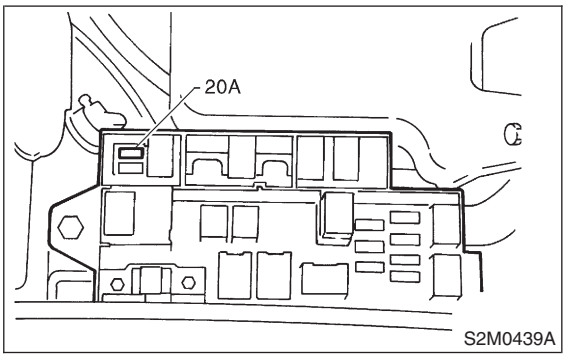
Connector & terminal
(F66) No. 28 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **2A10**.
NO : Go to step **2A9**.

2A7 : CHECK 20 A FUSE.

1) Remove 20 A fuse from A/C relay holder.
2) Check condition of fuse.

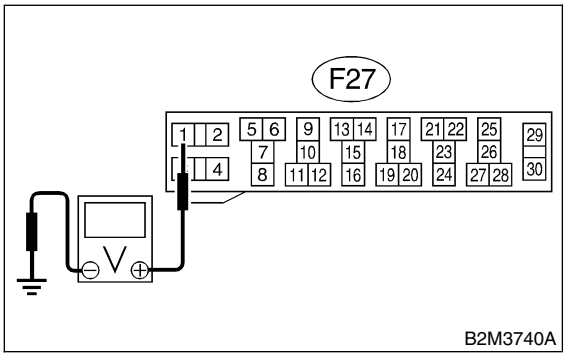


CHECK : ***Is the fuse blown-out?***
YES : Replace fuse.
NO : Go to step **2A8**.

2A8 : CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.

Measure voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground.

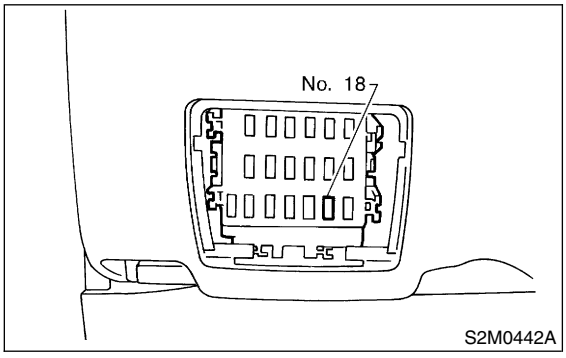
Connector & terminal
(F27) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Repair open circuit in harness between 20 A fuse and main fan relay terminal.
NO : Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.

2A9 : CHECK FUSE.

1) Turn ignition switch to OFF.
2) Remove fuse No. 18 from joint box.
3) Check condition of fuse.

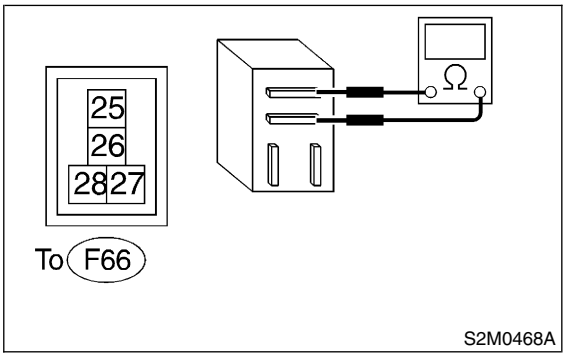


CHECK : ***Is the fuse blown-out?***
YES : Replace fuse.
NO : Repair open circuit in harness between main fan relay and ignition switch.

2A10 : CHECK MAIN FAN RELAY.

1) Turn ignition switch to OFF.
2) Measure resistance of main fan relay.

Terminal
No. 25 — No. 26:

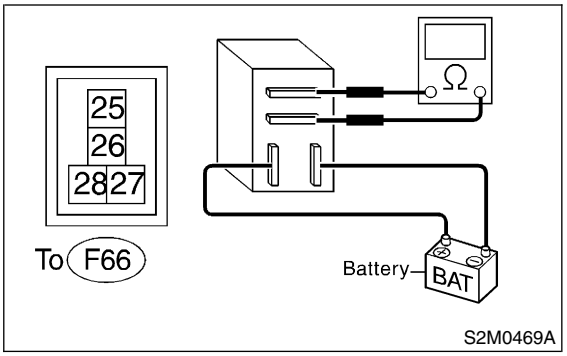


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **2A11**.
NO : Replace main fan relay.

2A11 : CHECK MAIN FAN RELAY.

1) Connect battery to terminals No. 27 and No. 28 of main fan relay.
2) Measure resistance of main fan relay.

Terminal
No. 25 — No. 26:

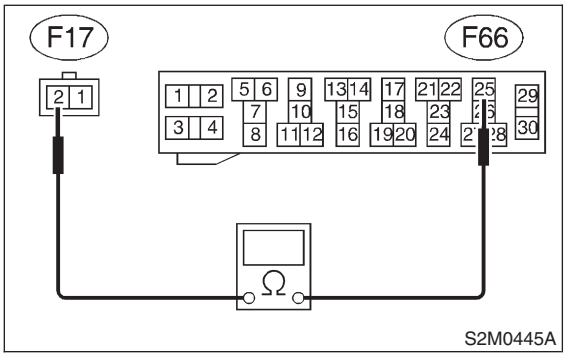


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **2A12**.
NO : Replace main fan relay.

2A12 : CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.

Measure resistance of harness between main fan motor connector and main fan relay terminal.

Connector & terminal
(F17) No. 2 — (F66) No. 25:

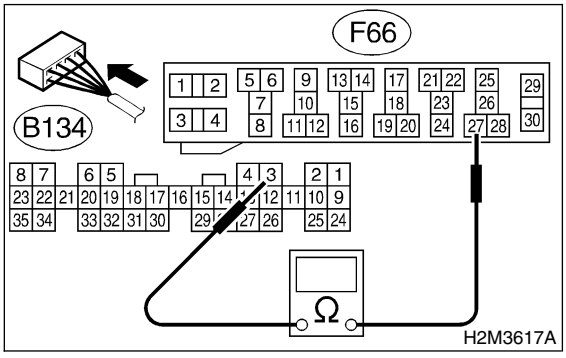


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **2A13**.
NO : Repair open circuit in harness between main fan motor connector and main fan relay terminal.

2A13 : CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between main fan relay connector and ECM ceonnector.

Connector & terminal
(F66) No. 27 — (B134) No. 3:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **2A14**.
NO : Repair open circuit in harness between main fan relay and ECM.

2A14 : CHECK POOR CONTACT.

Check poor contact in connector between main fan and ECM. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in connector between main fan motor and ECM?***
YES : Repair poor contact connector.
NO : Contact with your Subaru distributor.

NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

3. Radiator Sub Fan (With A/C model only)

A: OPERATION

DETECTING CONDITION:

Condition (1):
- Engine coolant temperature is below 95°C (203°F).
- A/C switch is turned ON.
- Vehicle speed is below 19 km/h (12 MPH).

Condition (2):
- Engine coolant temperature is above 100°C (212°F).
- A/C switch is turned OFF.
- Vehicle speed is below 19 km/h (12 MPH).

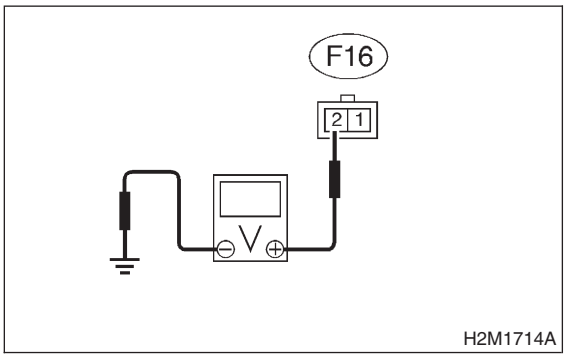
TROUBLE SYMPTOM:
- Radiator sub fan does not rotate under conditions (1) and (2) above.

3A1 : CHECK POWER SUPPLY TO SUB FAN MOTOR.

CAUTION:
Be careful not to overheat engine during repair.

1) Turn ignition switch to OFF.
2) Disconnect connector from sub fan motor and main fan motor.
3) Start the engine, and warm it up until engine coolant temperature increases over 100°C (212°F).
4) Stop the engine and turn ignition switch to ON.
5) Measure voltage between sub fan motor connector and chassis ground.

Connector & terminal
(F16) No. 2 (+) — Chassis ground (–):

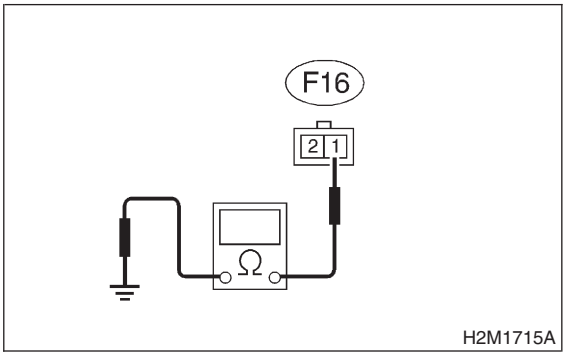


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **3A2**.
NO : Go to step **3A5**.

3A2 : CHECK GROUND CIRCUIT OF SUB FAN MOTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between sub fan motor connector and chassis ground.

Connector & terminal
(F16) No. 1 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **3A3**.
NO : Repair open circuit in harness between sub fan motor connector and chassis ground.

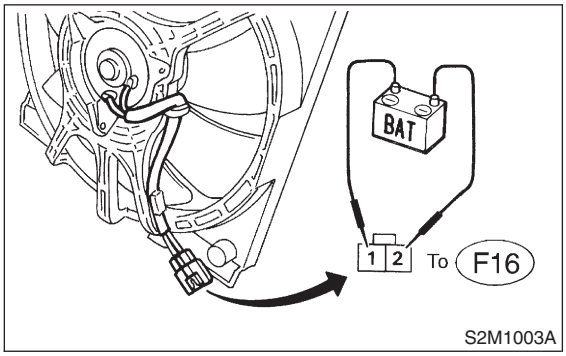
3A3 : CHECK POOR CONTACT.

Check poor contact in sub fan motor connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in sub fan motor connector?***
YES : Repair poor contact in sub fan motor connector.
NO : Go to step **3A4**.

3A4 : CHECK SUB FAN MOTOR.

Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of sub fan motor connector.

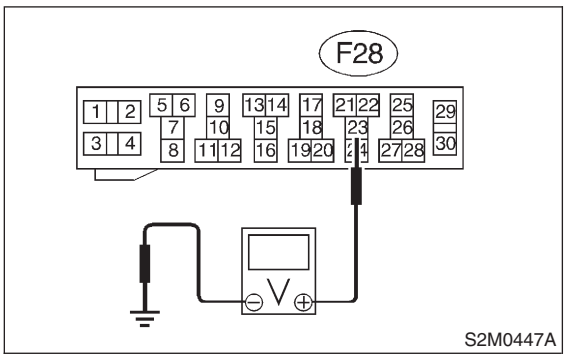


CHECK : ***Does the sub fan rotate?***
YES : Repair poor contact in sub fan motor connector.
NO : Replace sub fan motor with a new one.

3A5 : CHECK POWER SUPPLY TO SUB FAN RELAY.

1) Turn ignition switch to OFF.
2) Remove sub fan relay from A/C relay holder.
3) Measure voltage between sub fan relay terminal and chassis ground.

Connector & terminal
(F28) No. 23 (+) — Chassis ground (–):

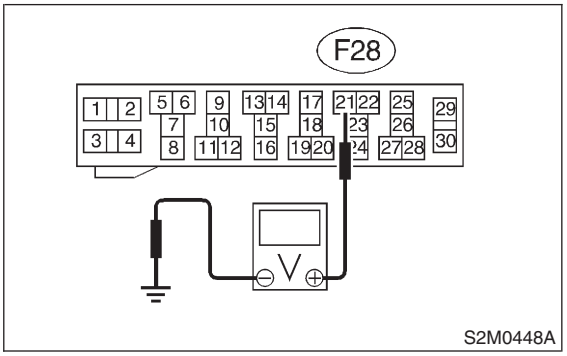


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **3A6**.
NO : Go to step **3A7**.

3A6 : CHECK POWER SUPPLY TO SUB FAN RELAY.

1) Turn ignition switch to ON.
2) Measure voltage between sub fan relay terminal and chassis ground.

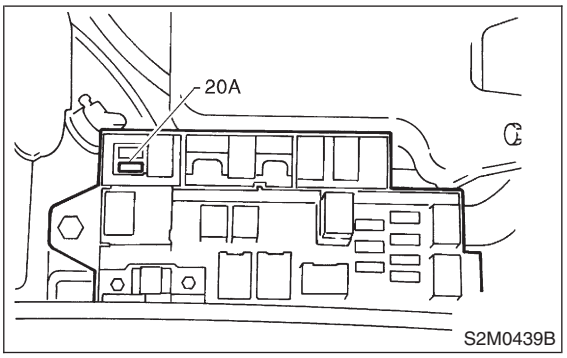
Connector & terminal
(F28) No. 21 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **3A10**.
NO : Go to step **3A9**.

3A7 : CHECK 20 A FUSE.

1) Remove 20 A fuse from A/C relay holder.
2) Check condition of fuse.

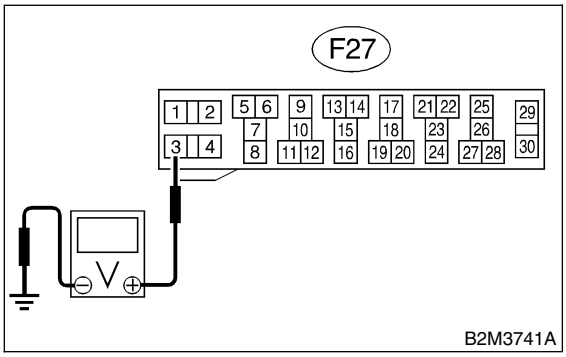


CHECK : ***Is the fuse blown-out?***
YES : Replace fuse.
NO : Go to step **3A8**.

3A8 : CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.

Measure voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground.

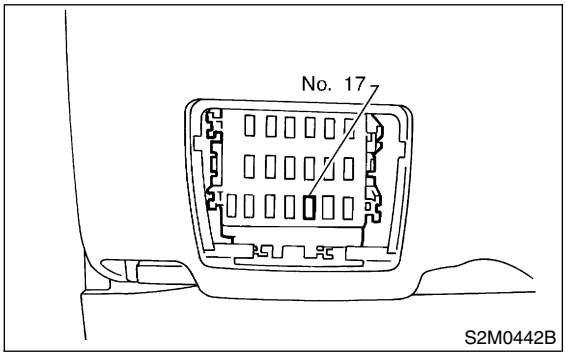
Connector & terminal
(F27) No. 3 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Repair open circuit in harness between 20 A fuse and sub fan relay terminal.
NO : Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.

3A9 : CHECK FUSE.

1) Turn ignition switch to OFF.
2) Remove fuse No. 17 from joint box.
3) Check condition of fuse.

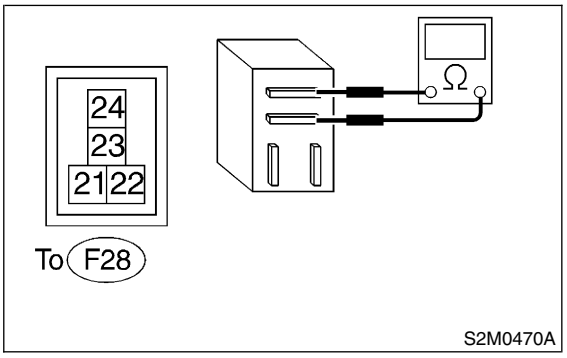


CHECK : ***Is the fuse blown-out?***
YES : Replace fuse.
NO : Repair open circuit in harness between sub fan relay and ignition switch.

3A10 : CHECK SUB FAN RELAY.

1) Turn ignition switch to OFF.
2) Measure resistance of sub fan relay.

Terminal
No. 23 — No. 24:

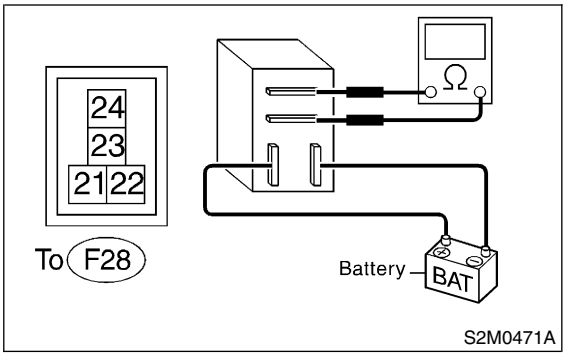


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **3A11**.
NO : Replace sub fan relay.

3A11 : CHECK SUB FAN RELAY.

1) Connect battery to terminals No. 21 and No. 22 of sub fan relay.
2) Measure resistance of sub fan relay.

Terminal
No. 23 — No. 24:

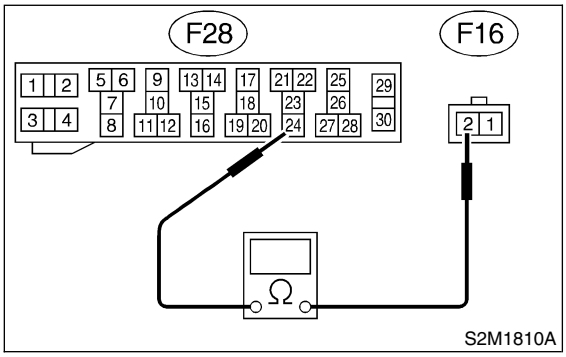


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **3A12**.
NO : Replace sub fan relay.

3A12 : CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.

Measure resistance of harness between sub fan motor connector and sub fan relay terminal.

Connector & terminal
(F16) No. 2 — (F28) No. 24:

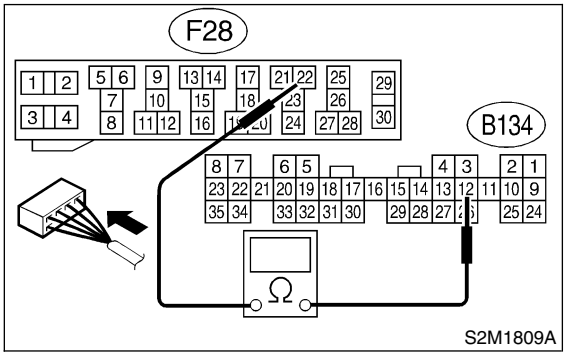


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **3A13**.
NO : Repair open circuit in harness between sub fan motor and sub fan relay connector.

3A13 : CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between sub fan relay connector and ECM connector.

Connector & terminal
(F28) No. 22 — (B134) No. 12:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **3A14**.
NO : Repair open circuit in harness between sub fan relay and ECM.

3A14 : CHECK POOR CONTACT.

Check poor contact in connnector between sub fan and ECM. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in connector between sub fan motor and ECM?***
YES : Repair poor contact connector.
NO : Contact with your Subaru distributor.

NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

MEMO:

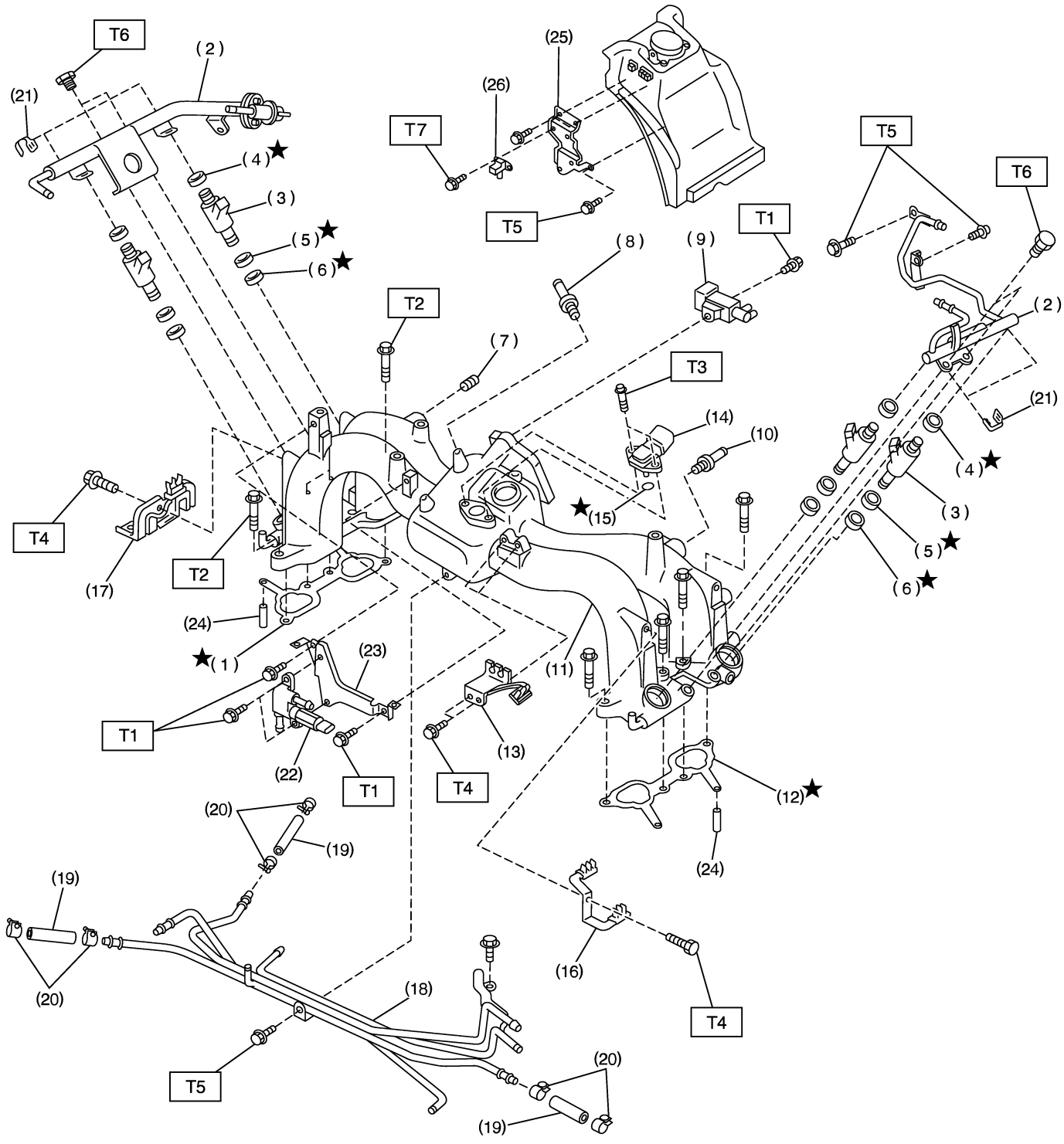
FUEL INJECTION SYSTEM 2-7

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1. Intake Manifold

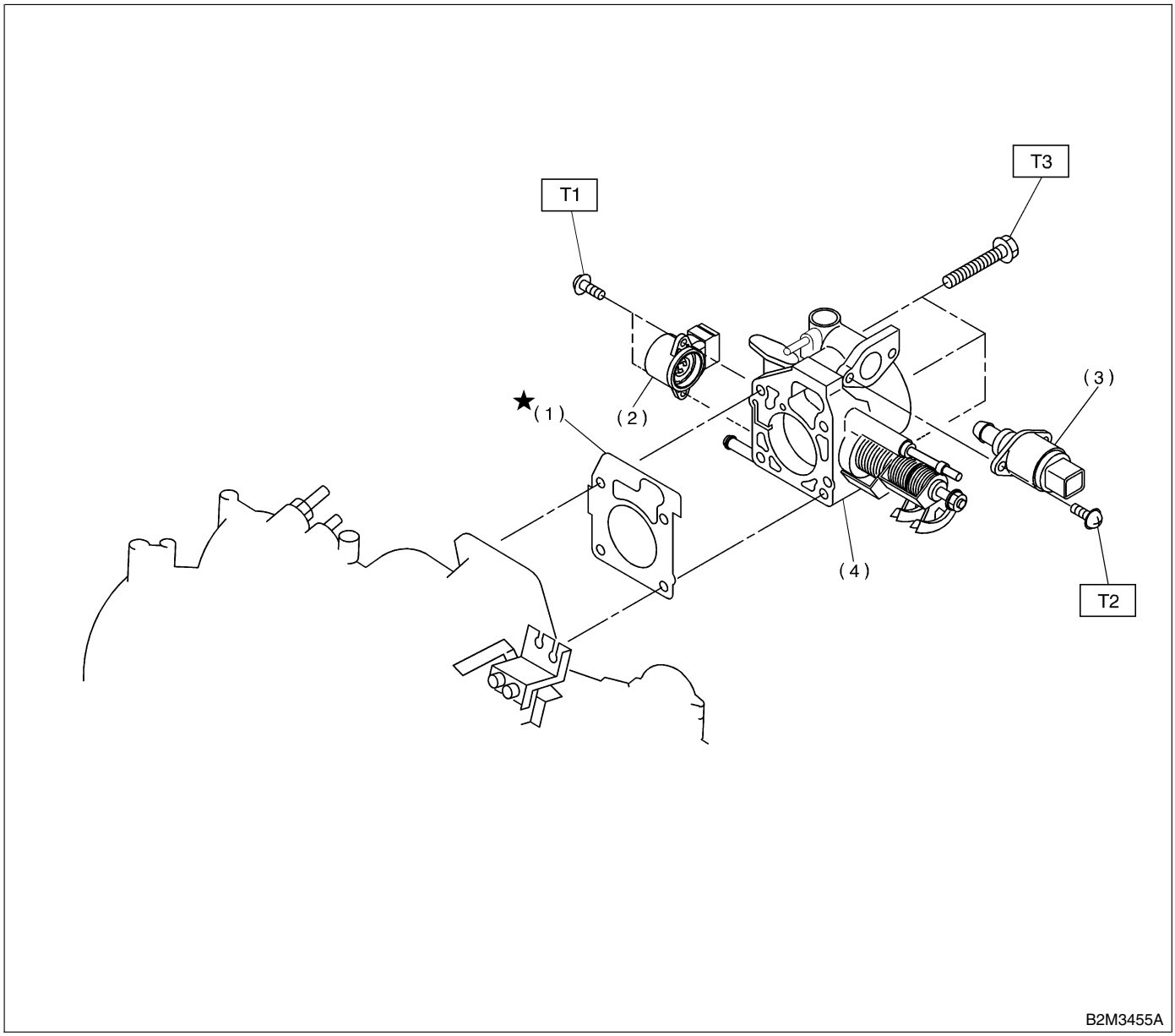


S2M1788A

(1) Intake manifold gasket RH
(2) Fuel injector pipe
(3) Fuel injector
(4) O-ring
(5) O-ring
(6) O-ring
(7) Plug
(8) PCV valve
(9) Purge control solenoid valve
(10) Nipple
(11) Intake manifold
(12) Intake manifold gasket LH
(13) Bracket
(14) Intake air temperature and pressure sensor
(15) O-ring
(16) Bracket LH
(17) Bracket RH
(18) Fuel pipe ASSY
(19) Fuel hose
(20) Clip
(21) Clip
(22) Air assist injector solenoid valve
(23) Air assist injector solenoid valve bracket
(24) Guide pin
(25) Atmospheric pressure sensor bracket
(26) Atmospheric pressure sensor

Tightening torque: N·m (kg-m, ft-lb)
T1: 16±1.5 (1.6±0.15, 11.6±1.1)
T2: 25±2 (2.5±0.2, 18.1±1.4)
T3: 2.0±0.4 (0.2±0.04, 1.4±0.3)
T4: 18.6±1.5 (1.9±0.15, 13.7±1.1)
T5: 4.9±0.5 (0.5±0.05, 3.6±0.4)
T6: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T7: 6.4±0.5 (0.65±0.05, 4.7±0.4)

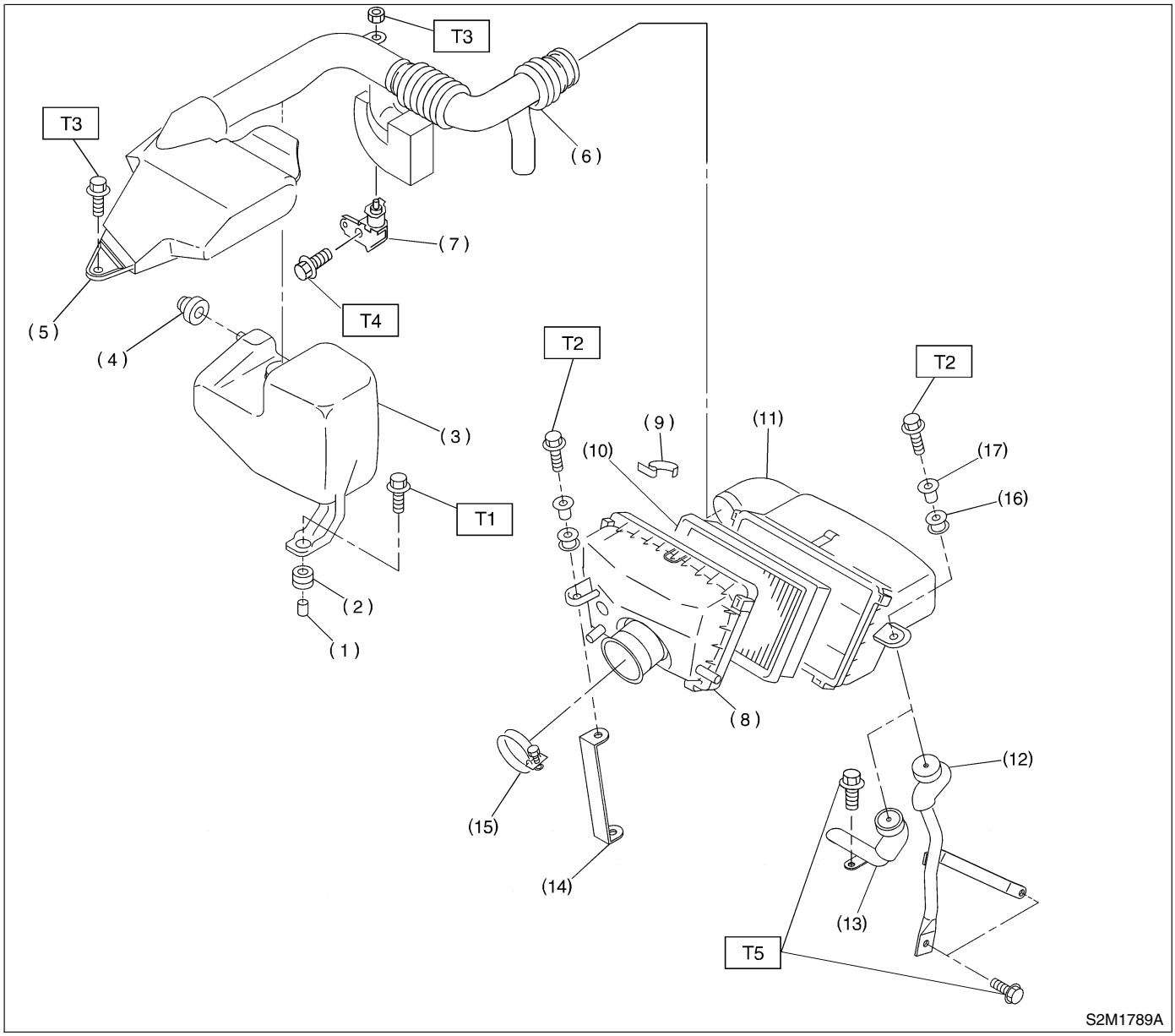
2. Air Intake System



(1) Gasket
(2) Throttle position sensor
(3) Idle air control solenoid valve
(4) Throttle body

Tightening torque: N·m (kg-m, ft-lb)
T1: 2.0±0.4 (0.2±0.04, 1.4±0.3)
T2: 6.0±0.8 (0.61±0.08, 4.4±0.6)
T3: 19±5 (1.9±0.5, 13.7±3.6)

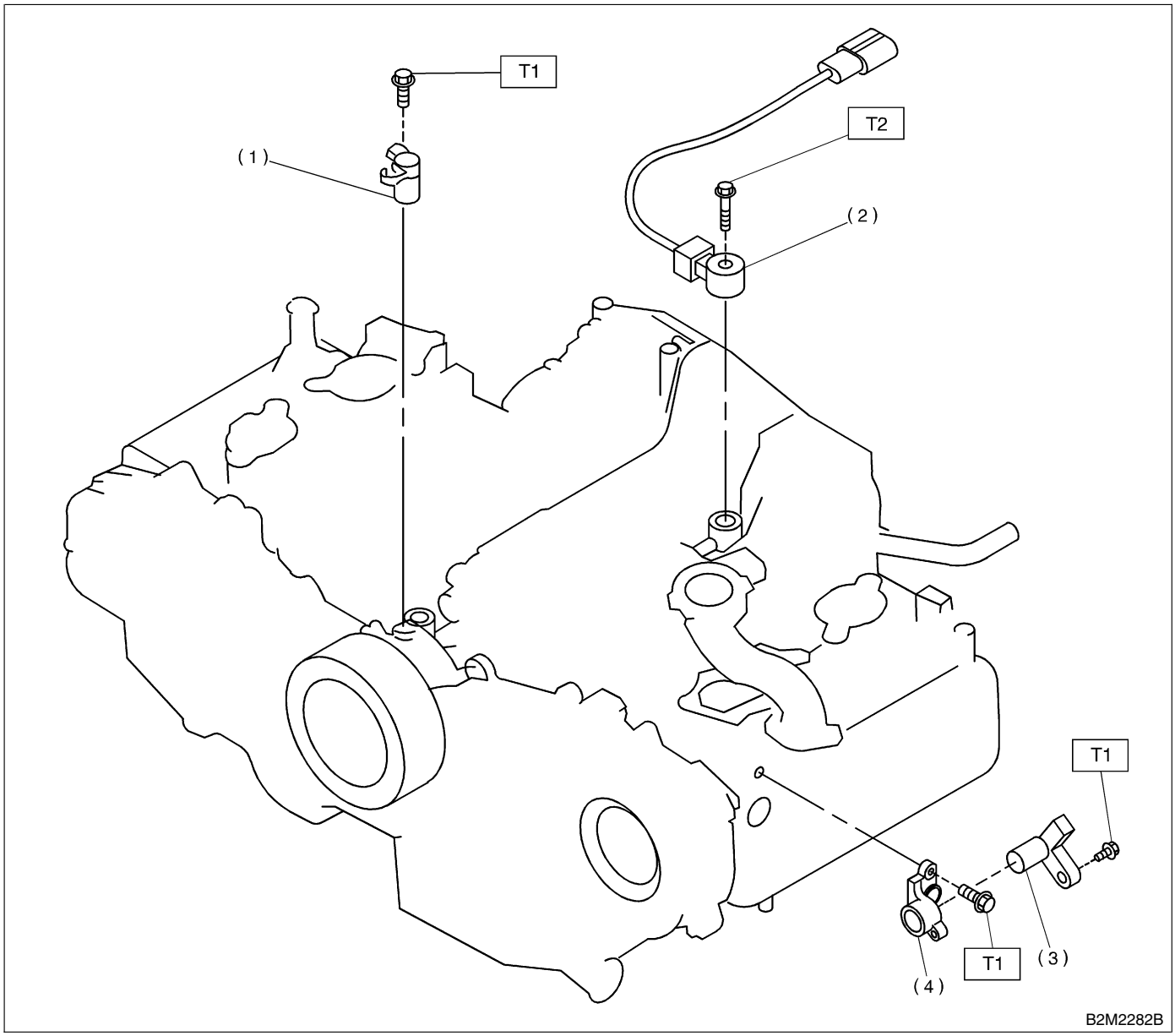
3. Air Cleaner



(1) Spacer
(2) Bush
(3) Air chamber
(4) Cushion rubber
(5) Air intake duct A
(6) Air intake duct B
(7) Holder
(8) Air cleaner case A
(9) Clip
(10) Air cleaner element
(11) Air cleaner case B
(12) Air cleaner case stay LH (MT vehicles)
(13) Air cleaner case stay LH (AT vehicles)
(14) Air cleaner case stay RH
(15) Clamp
(16) Bush
(17) Spacer

Tightening torque: N·m (kg-m, ft-lb)
T1: 33±10 (3.4±1.0, 25±7)
T2: 6.4±0.5 (0.65±0.05, 4.7±0.4)
T3: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T4: 14±4 (1.4±0.4, 10.1±2.9)
T5: 16±5 (1.6±0.5, 11.6±3.6)

4. Crankshaft Position, Camshaft Position and Knock Sensors



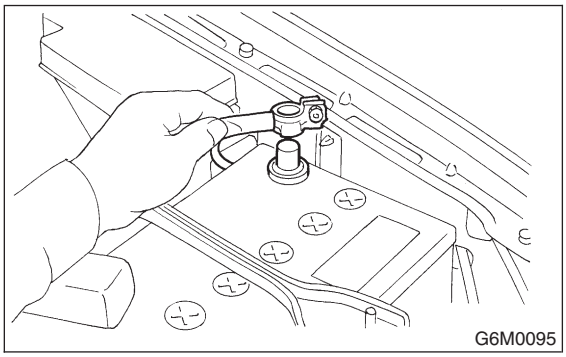
(1) Crankshaft position sensor
(2) Knock sensor
(3) Camshaft position sensor
(4) Camshaft position sensor support

Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4±0.5 (0.65±0.05, 4.7±0.4)
T2: 23.5±2.9 (2.4±0.3, 17.4±2.2)

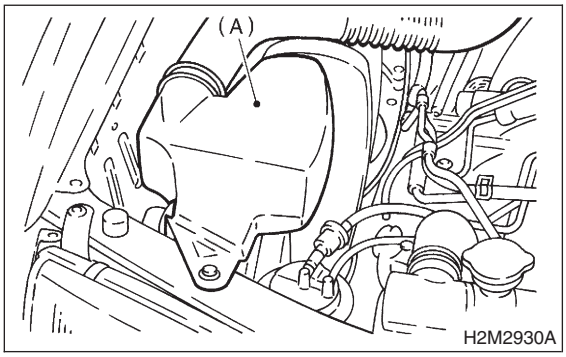
1. Air Cleaner Case and Air Intake Duct

A: REMOVAL AND INSTALLATION

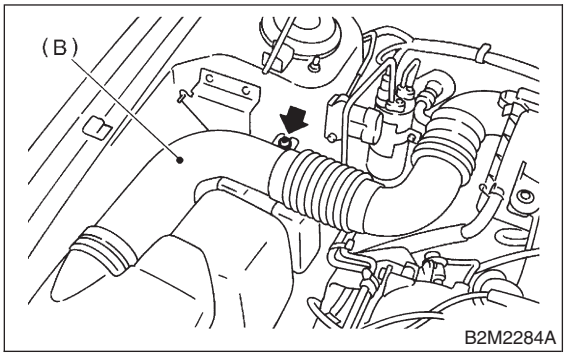
1) Disconnect battery ground cable.



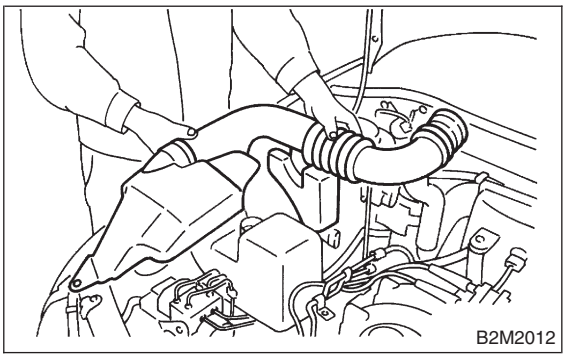
2) Remove bolt which installs air intake duct (A) on the front side of body.



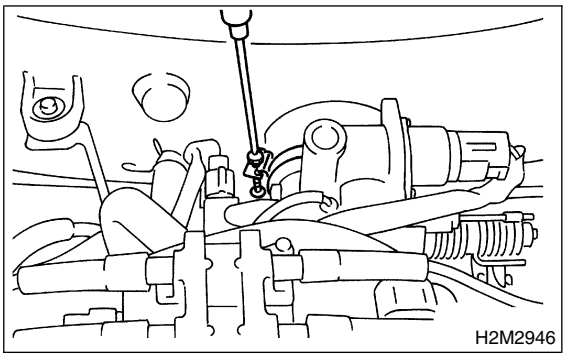
3) Remove bolt which installs air intake duct (B) on body.



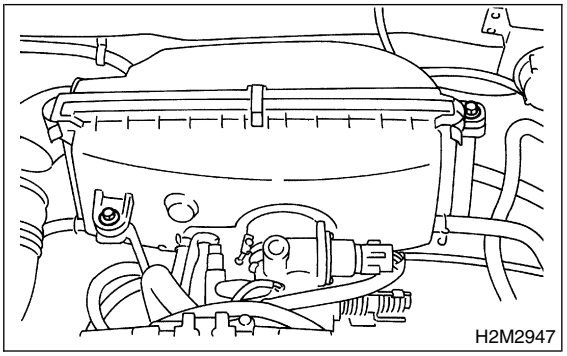
4) Remove air intake duct (A) and (B) as a unit.



5) Loosen clamp which connects air cleaner case to throttle body.



6) Disconnect hoses from air cleaner case.
7) Remove bolts which install air cleaner case to stays.

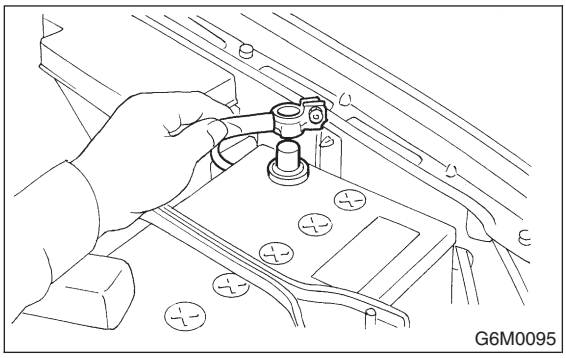


8) Remove air cleaner case.
9) Installation is in the reverse order of removal.

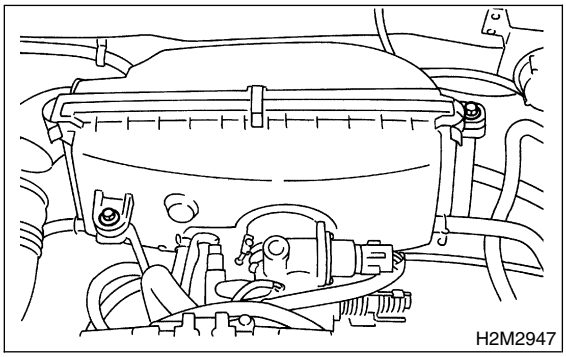
2. Throttle Body

A: REMOVAL AND INSTALLATION

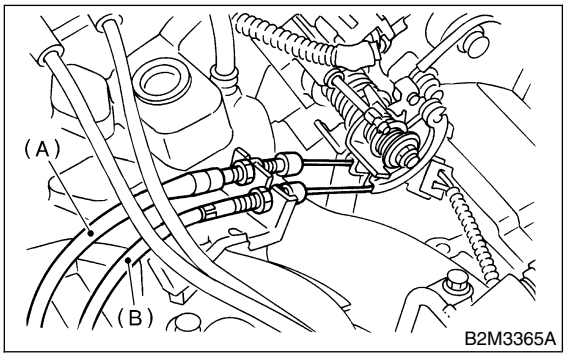
1) Disconnect battery ground cable.



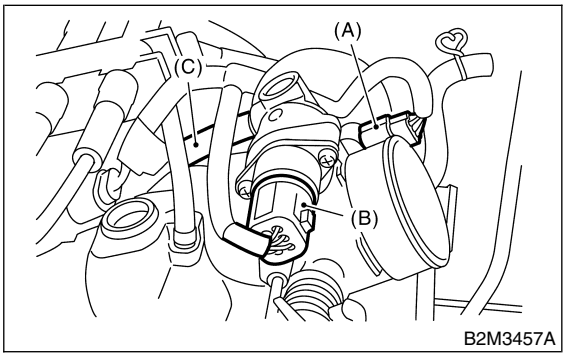
2) Remove air cleaner case.



3) Disconnect accelerator cable (A).
4) Disconnect cruise control cable (B). (With cruise control model)

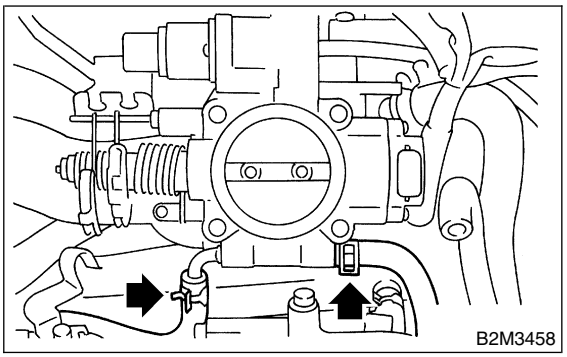


5) Disconnect connectors from idle air control solenoid valve, throttle position sensor.
6) Disconnect air by-pass hose from air assist injector solenoid valve.



(A) Throttle position sensor
(B) Idle air control solenoid valve
(C) Air by-pass hose from air assist injector solenoid valve

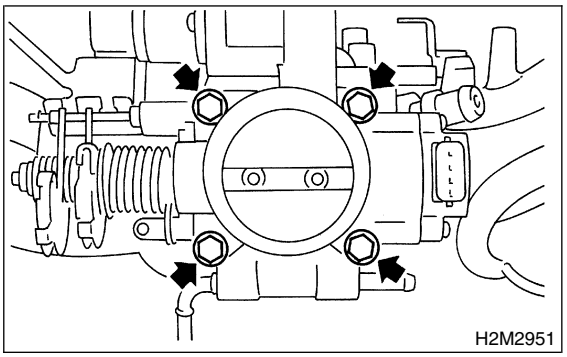
7) Disconnect engine coolant hoses from throttle body.



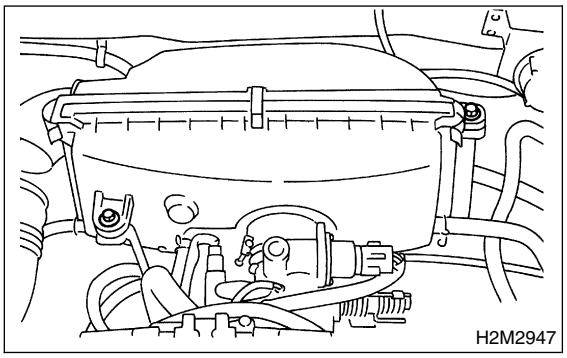
8) Remove bolts which install throttle body to intake manifold.
9) Installation is in the reverse order of removal.

CAUTION:
Always use a new gasket.

Tightening torque:
Throttle body;
22±2 N·m (2.2±0.2 kg-m, 15.9±1.4 ft-lb)



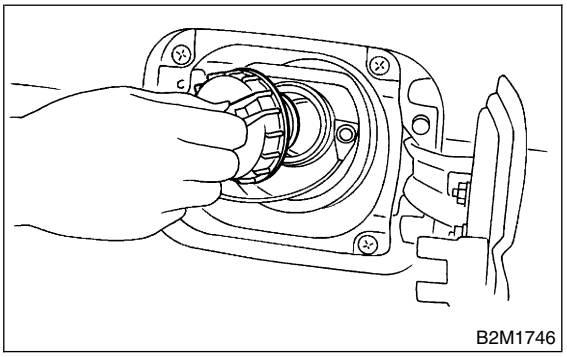
Tightening torque:
Air cleaner case;
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)


H2M2947

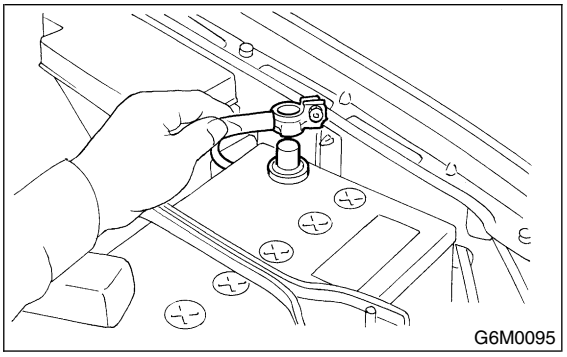
3. Intake Manifold

A: REMOVAL

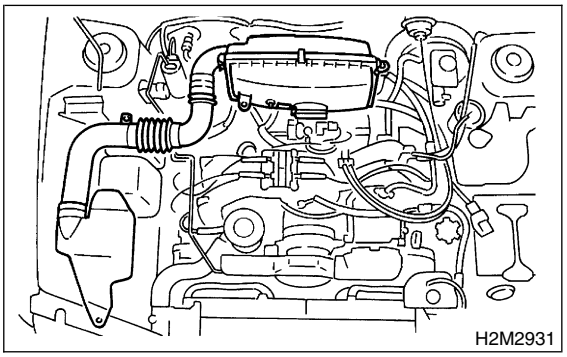
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.


B2M1746

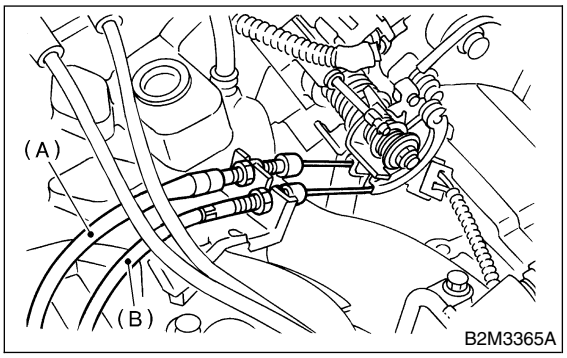
3) Disconnect battery ground cable.


G6M0095

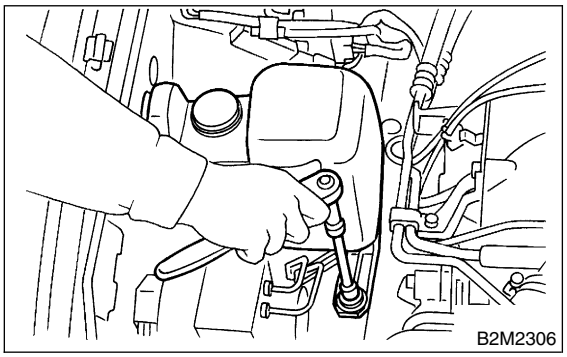
4) Remove air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>


H2M2931

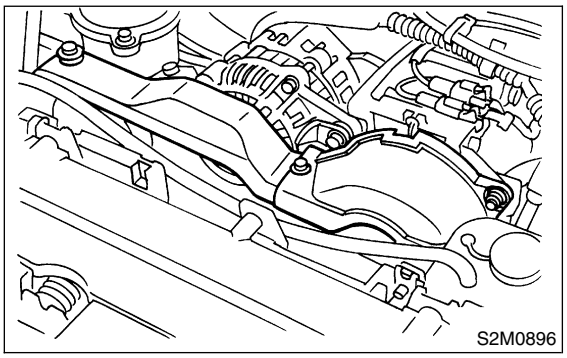
5) Disconnect accelerator cable (A).
6) Disconnect cruise control cable (B). (With cruise control model)



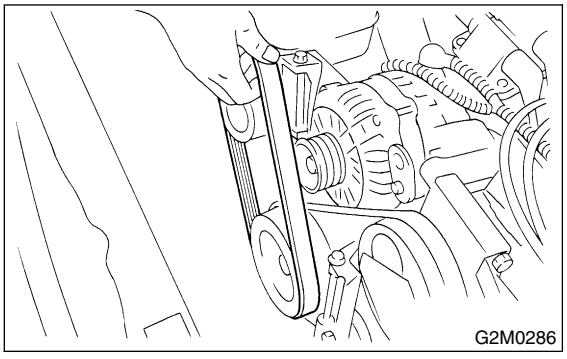
7) Remove power steering pump from bracket.
(1) Remove resonator chamber.



(2) Remove V-belt covers.

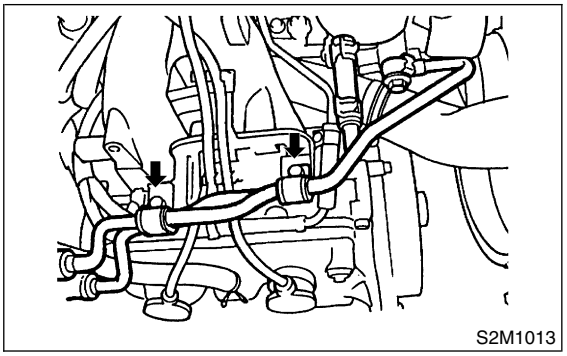


(3) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.

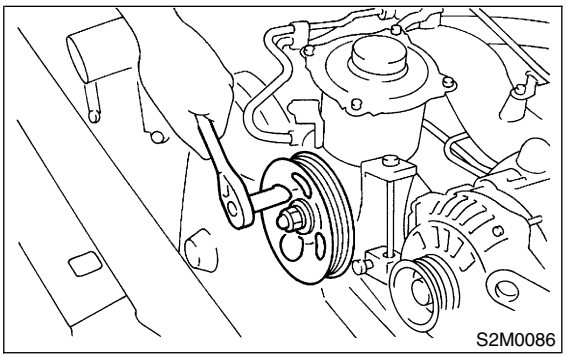


(4) Remove bolts which secure power steering pipe brackets to intake manifold.

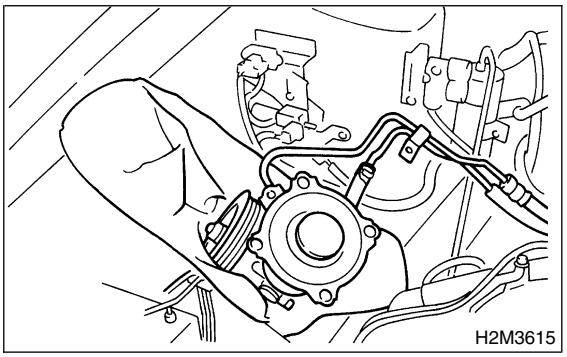
NOTE:
Do not disconnect power steering hose.



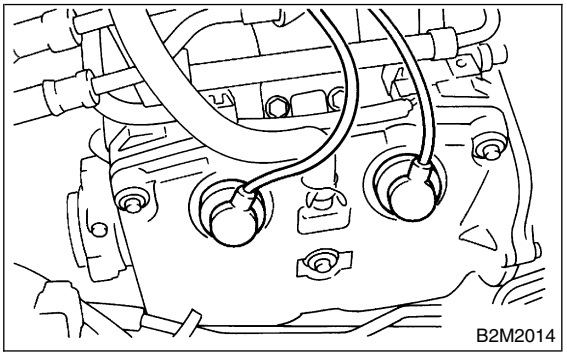
(5) Remove bolts which install power steering pump to bracket.



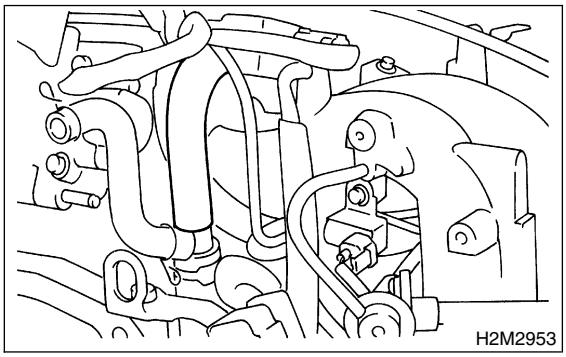
(6) Place power steering pump on the right side wheel apron.



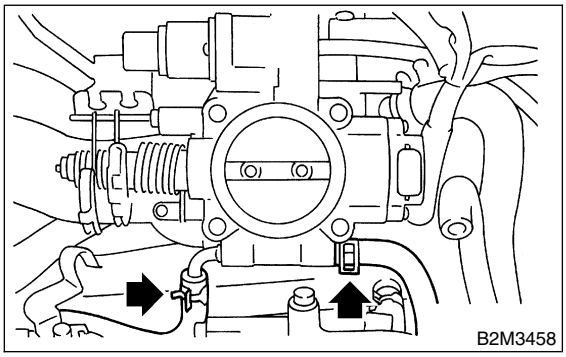
8) Disconnect spark plug cords from spark plugs.



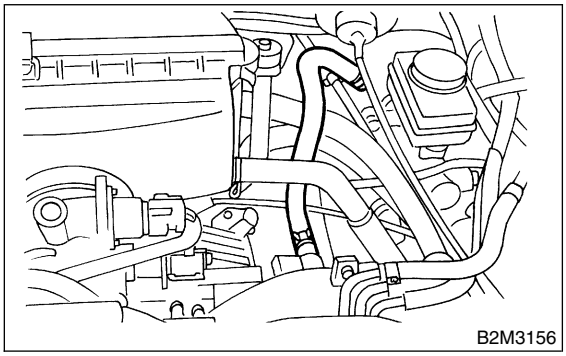
9) Disconnect PCV hose from intake manifold.



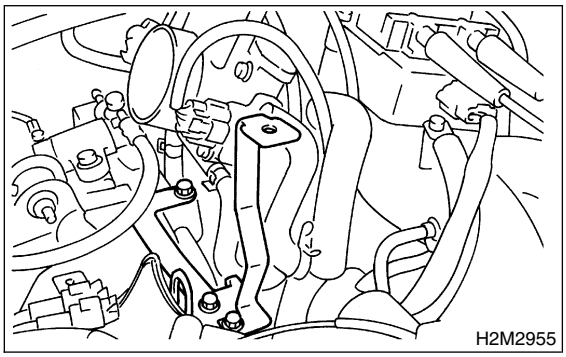
10) Disconnect engine coolant hose from throttle body.



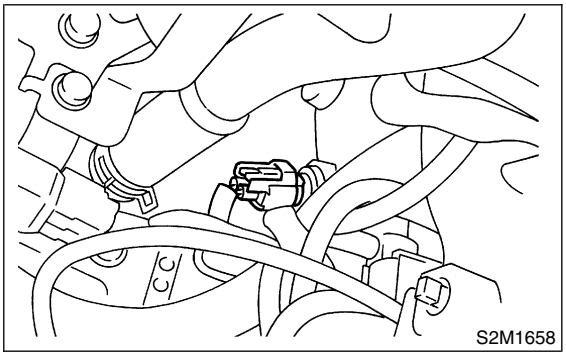
11) Disconnect brake booster hose.



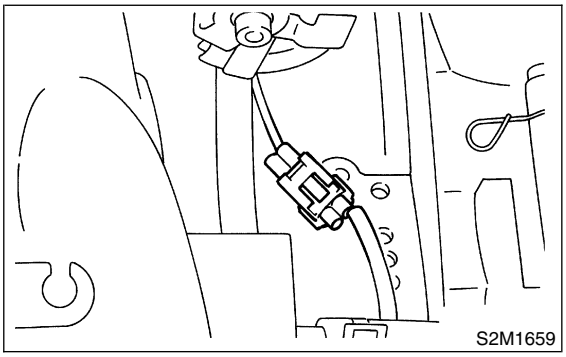
12) Remove air cleaner case stay RH and engine harness bracket, and disconnect engine harness connectors from bulkhead harness connectors.



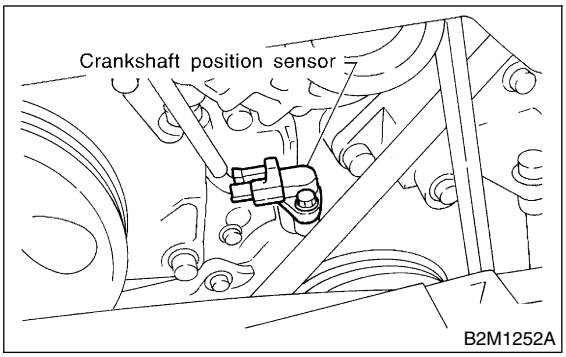
13) Disconnect connectors from engine coolant temperature sensor.



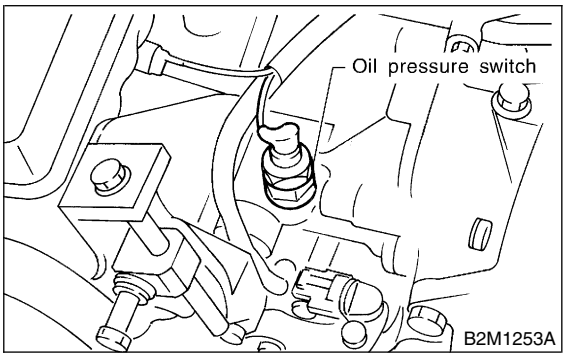
14) Disconnect knock sensor connector.



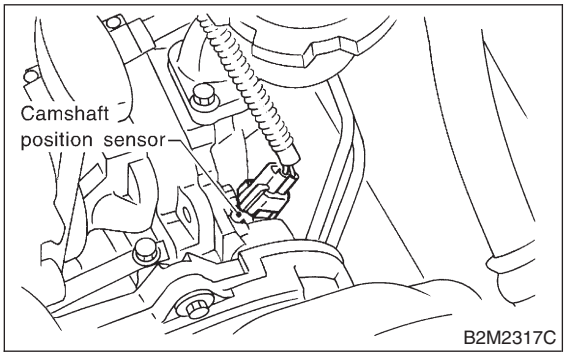
15) Disconnect connector from crankshaft position sensor.



16) Disconnect connector from oil pressure switch.

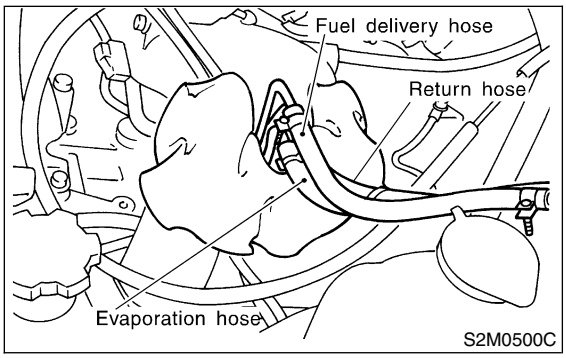


17) Disconnect connector from camshaft position sensor.

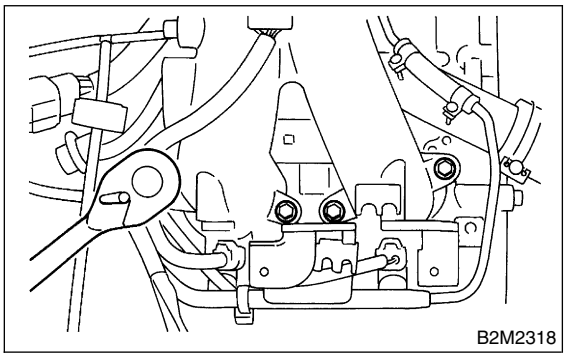


18) Disconnect fuel hoses from fuel pipes.

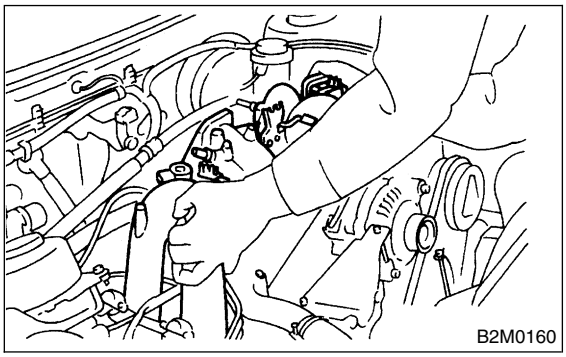
WARNING:
- **Do not spill fuel.**
- **Catch fuel from hoses in a container or cloth.**



19) Remove bolts which hold intake manifold onto cylinder heads.

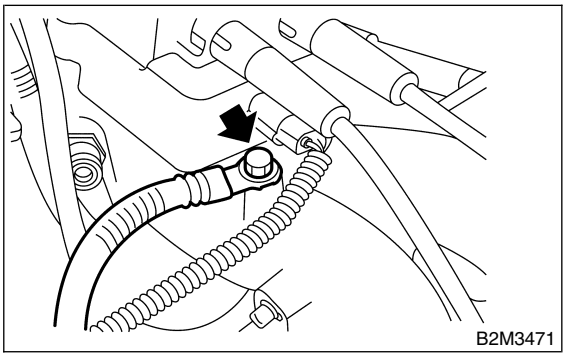


20) Remove intake manifold.

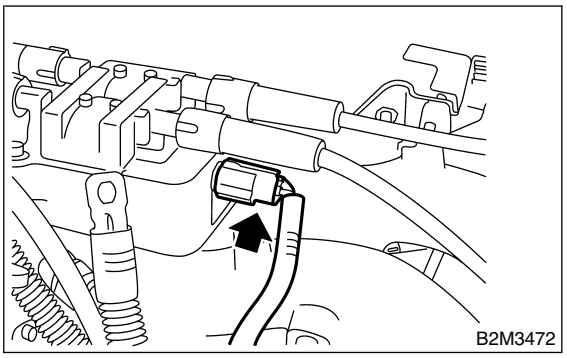


B: DISASSEMBLY

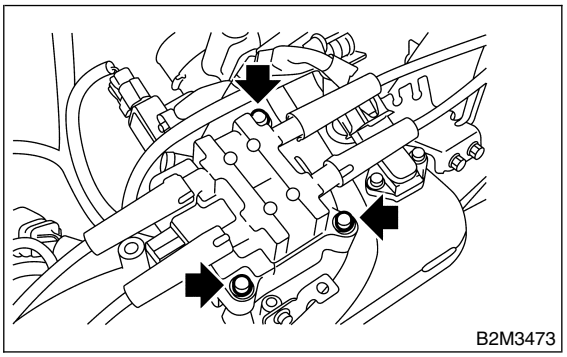
1) Disconnect engine ground terminal from intake manifold.



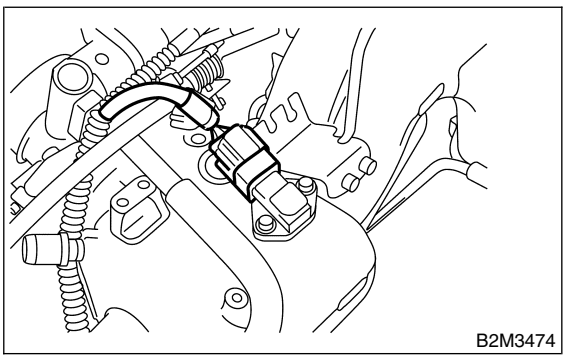
2) Disconnect connector from ignition coil and ignitor assembly.



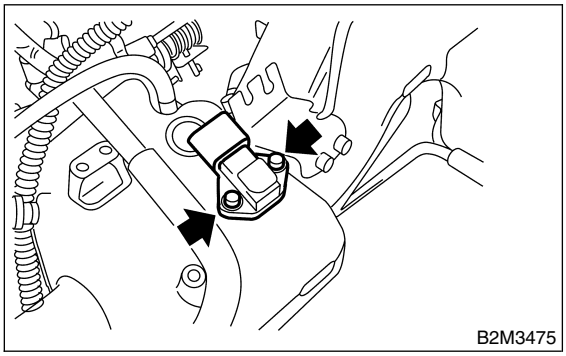
3) Remove ignition coil and ignitor assembly.



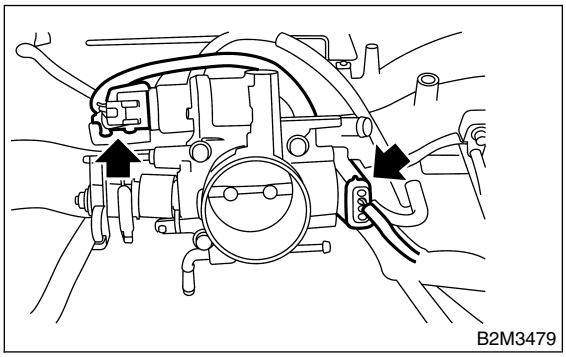
4) Disconnect connector from intake air temperature and pressure sensor.



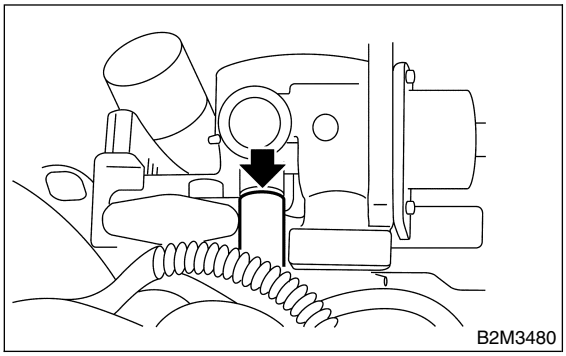
5) Remove intake air temperature and pressure sensor from intake manifold.



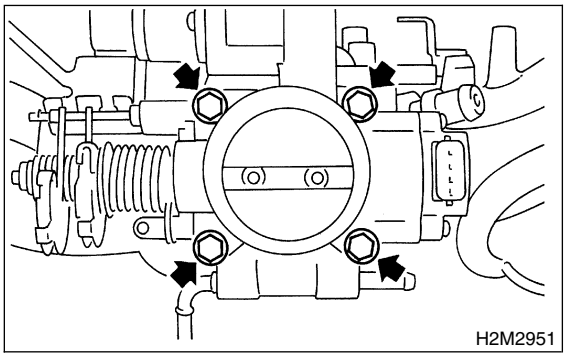
6) Disconnect connectors from throttle position sensor and idle air control solenoid valve.



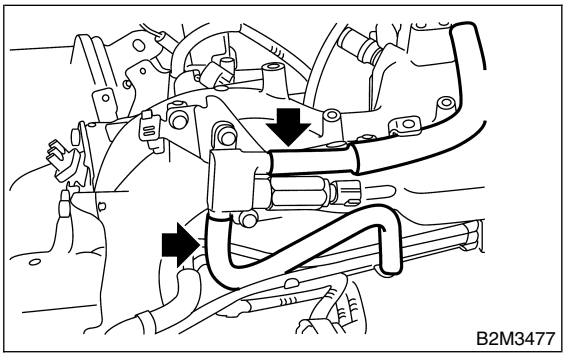
7) Disconnect air by-pass hose from throttle body.



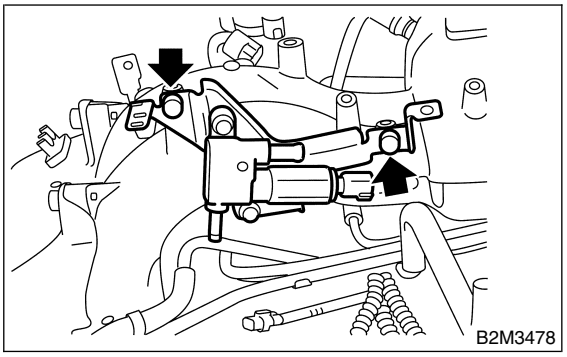
8) Remove throttle body.



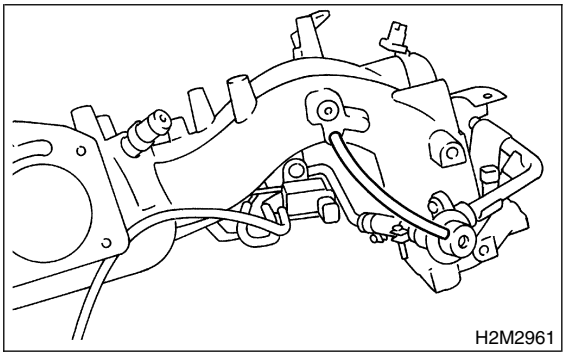
9) Disconnect connector from air assist injector solenoid valve.
10) Disconnect air by-pass hoses from air assist solenoid valve.



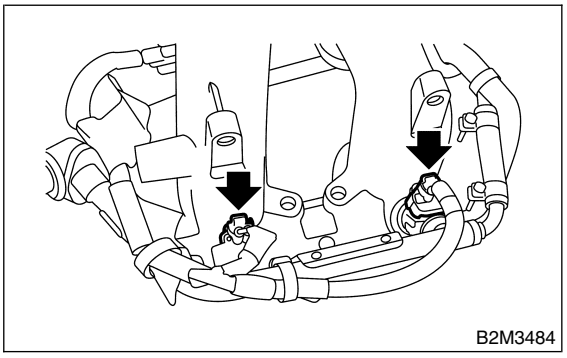
11) Remove air assist injector solenoid valve from intake manifold.



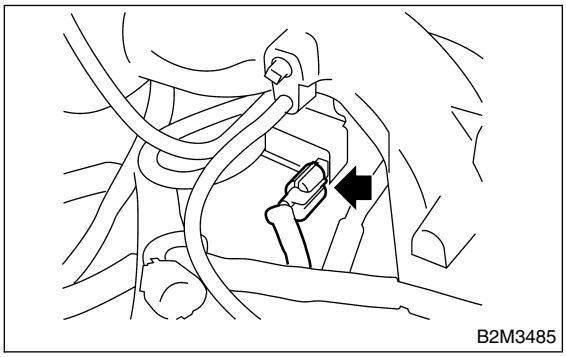
12) Disconnect pressure regulator vacuum hose from intake manifold.



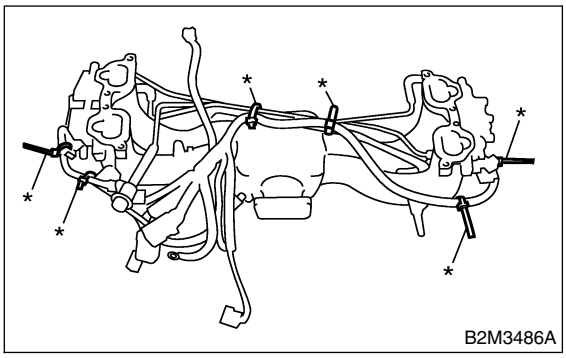
13) Disconnect connectors from fuel injectors.



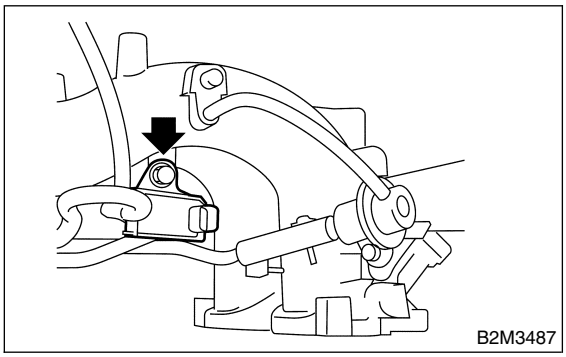
14) Disconnect connector from purge control solenoid valve.


B2M3485

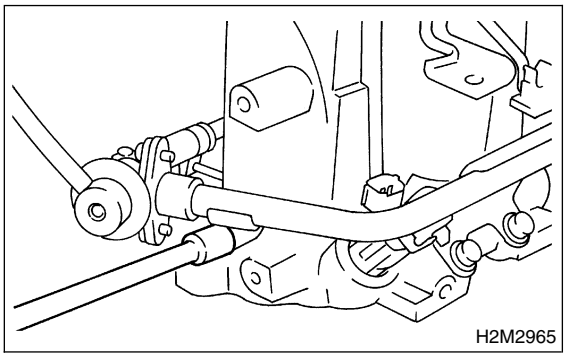
15) Disconnect air by-pass hose from purge control solenoid valve.
16) Remove harness bands (*) which hold engine harness onto intake manifold.


B2M3486A

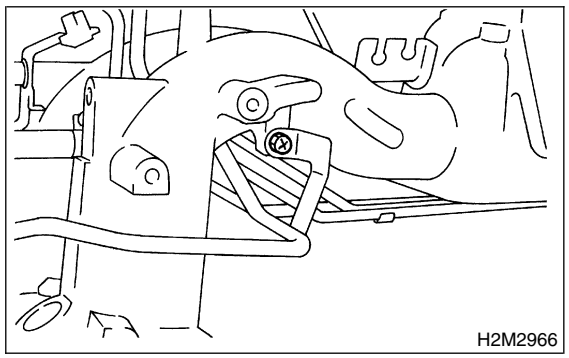
17) Remove engine harness from intake manifold.
18) Remove purge control solenoid valve.


B2M3487

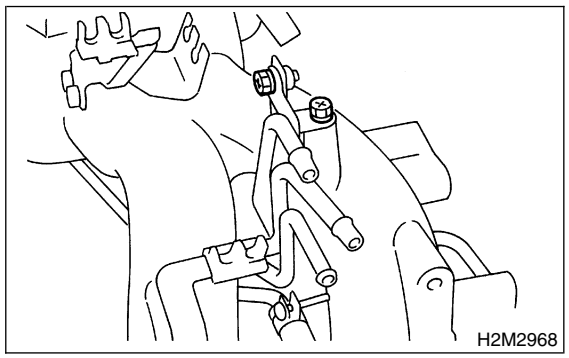
19) Remove bolt which installs injector pipe on intake manifold as shown in figure.


H2M2965

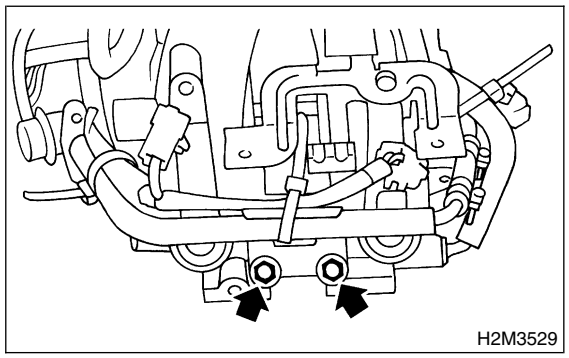
20) Remove bolt which installs injector pipe on intake manifold.


H2M2966

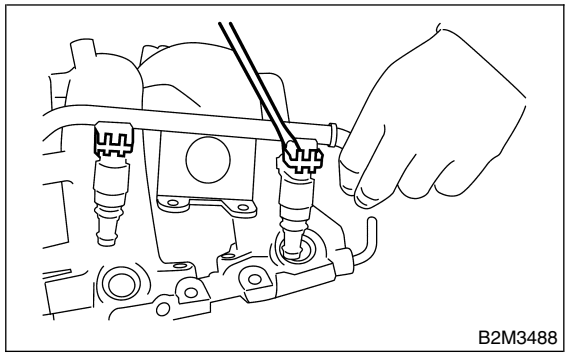
21) Remove two bolts which hold fuel pipes on the left side of intake manifold.


H2M2968

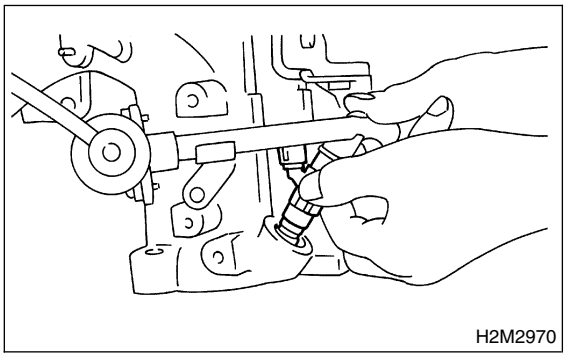
22) Remove bolt which installs injector pipe on intake manifold.


H2M3529

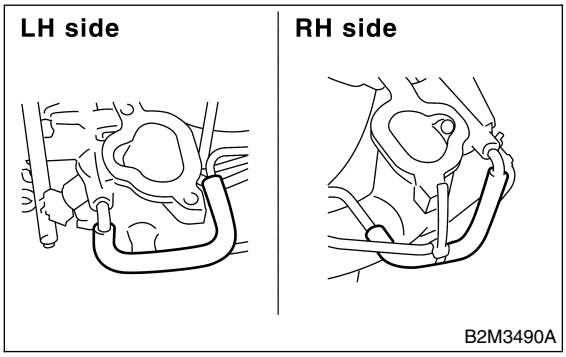
23) Remove fuel injectors.
(1) Remove fuel injector securing clip.


B2M3488

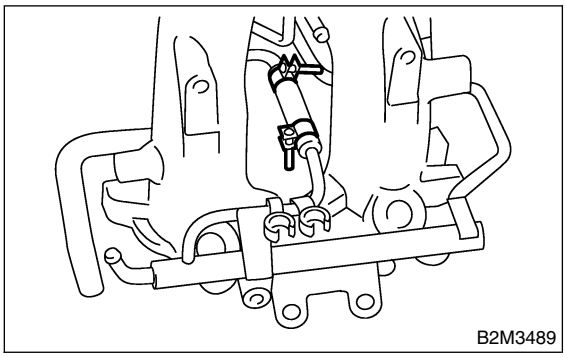
(2) Remove fuel injector while lifting up fuel injector pipe.



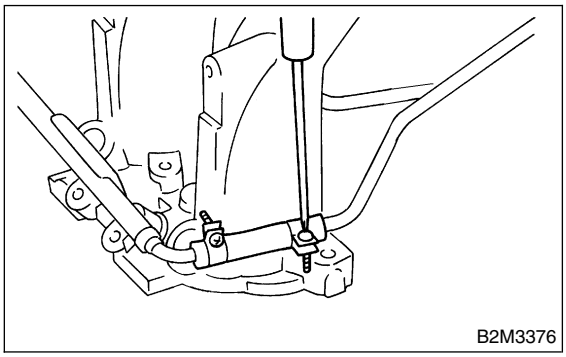
24) Disconnect air by-pass hoses from intake manifold.



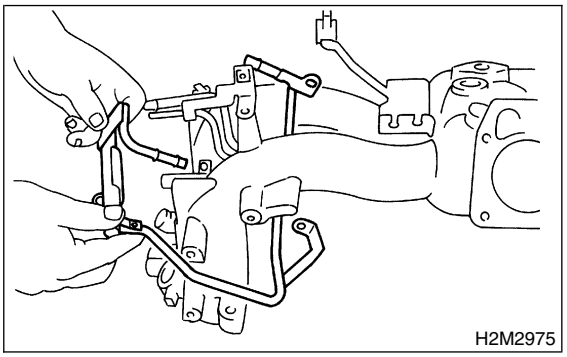
25) Loosen clamp which holds front left side fuel hose to injector pipe and remove the pipe from clamp.



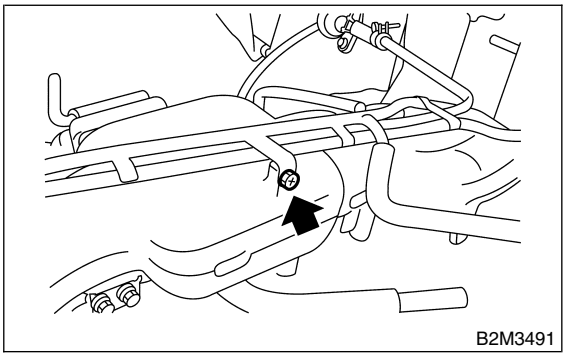
26) Loosen clamp which holds front right side fuel hose to injector pipe and remove the pipe from clamp.



27) Remove fuel injector pipe.



28) Remove bolt which installs fuel pipes on intake manifold.

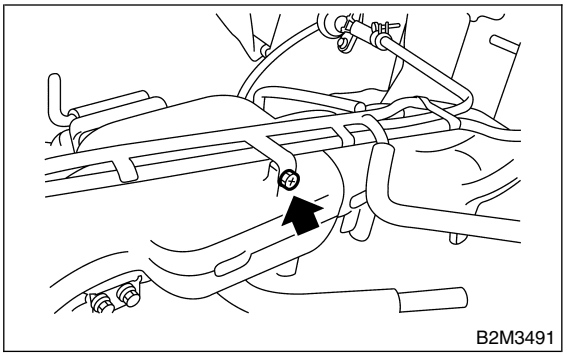


29) Remove fuel pipe assembly and pressure regulator, from intake manifold.

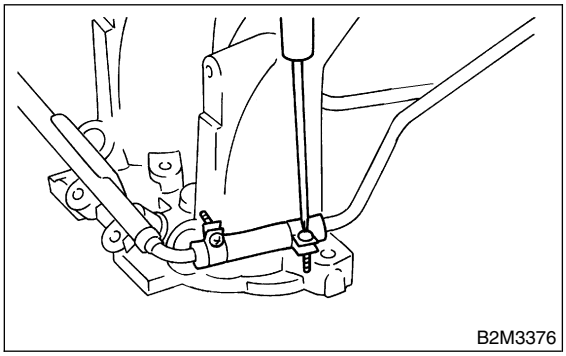
C: ASSEMBLY

1) Install fuel pipe assembly and pressure regulator, etc. to intake manifold.
2) Tighten bolt which installs fuel pipes on intake manifold.

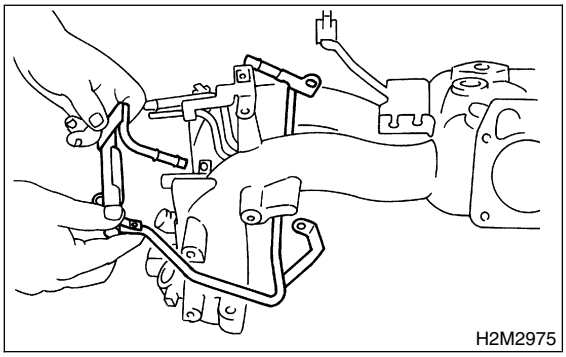
Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)



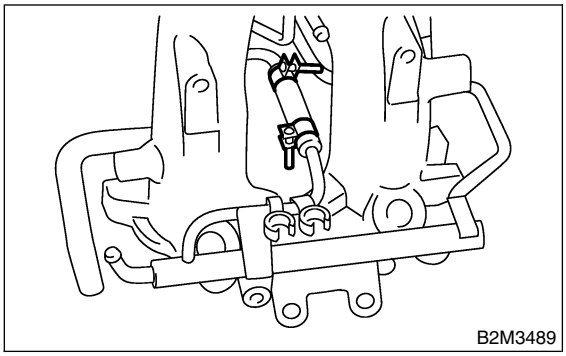
3) Connect right side fuel hose to injector pipe, and tighten clamp screw.


B2M3376

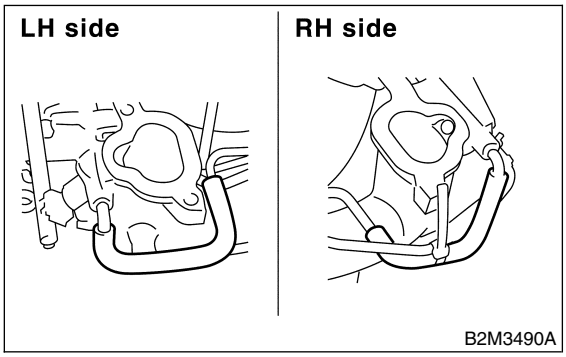
4) Install fuel injector pipe.


H2M2975

5) Connect left side fuel hose to injector pipe, and tighten clamp screw.


B2M3489

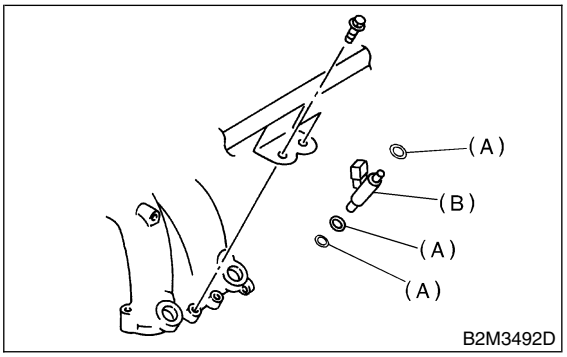
6) Connect air assist hoses.



B2M3490A

7) Install fuel injectors.

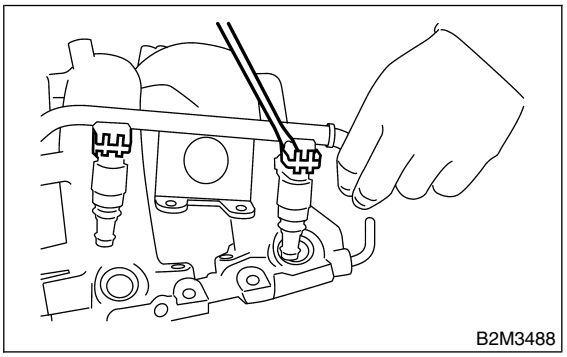
CAUTION:
Always use new o-rings.



B2M3492D

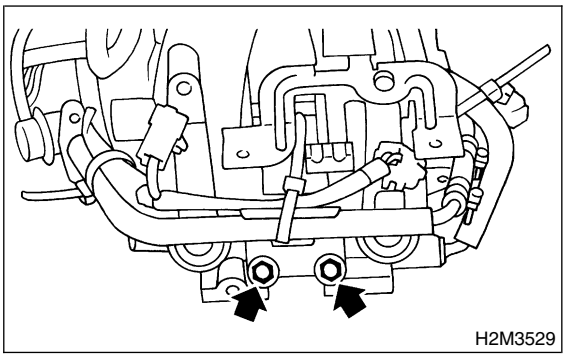
(A) O-ring
(B) Fuel injector

NOTE:
Do not forget to install the fuel injector securing clip.


B2M3488

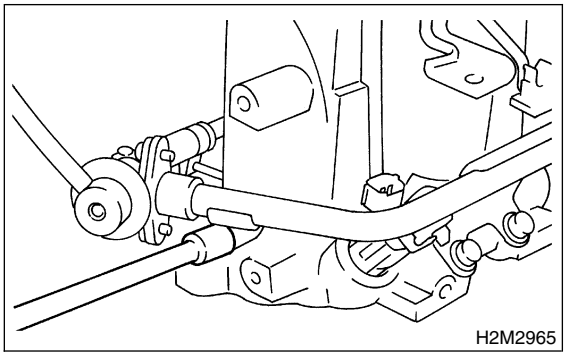
8) Tighten two bolts which install fuel injector pipe on intake manifold.

Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)


H2M3529

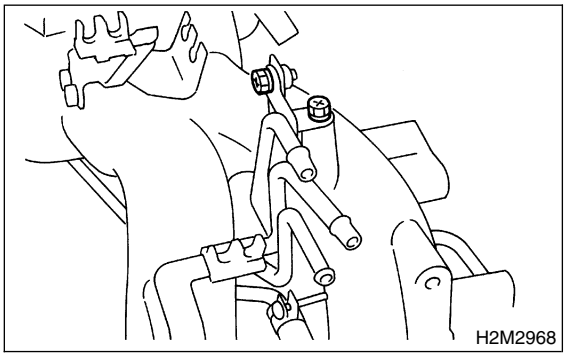
9) Tighten bolt which installs injector pipe on intake manifold.

Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)



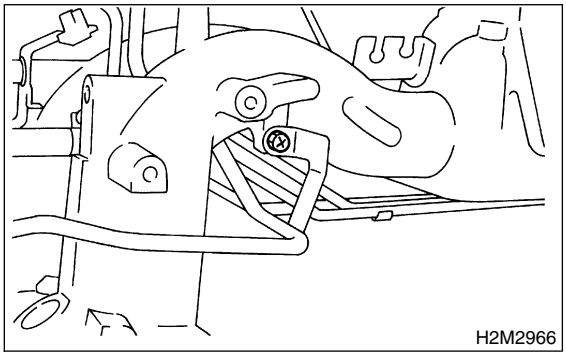
10) Tighten two bolts which install fuel pipes on the left side of intake manifold.

Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)

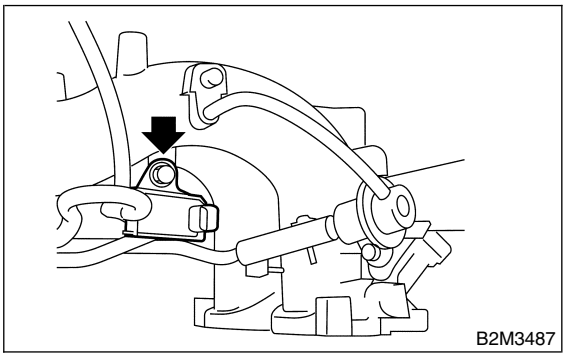


11) Tighten bolt which install injector pipe on intake manifold.

Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)

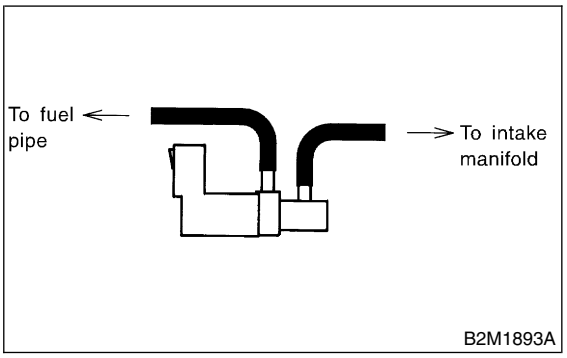


12) Install purge control solenoid valve.

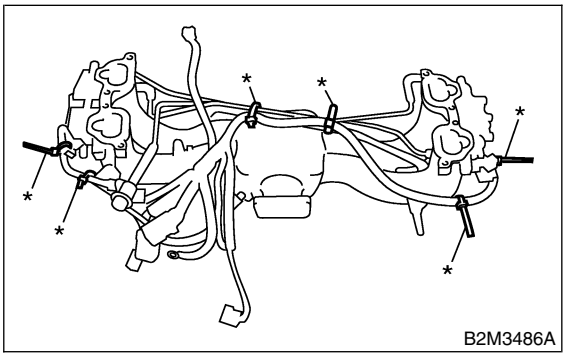


13) Connect hoses to purge control solenoid valve.

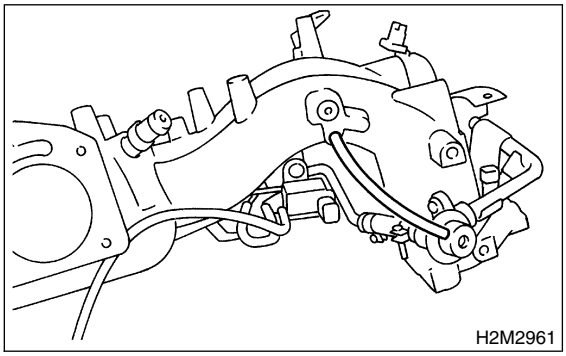
CAUTION:
Carefully connect the evaporation hoses.



14) Install engine harness onto intake manifold.
15) Connect connectors to fuel injectors and purge control solenoid valve.
16) Hold engine harness by harness band (*).

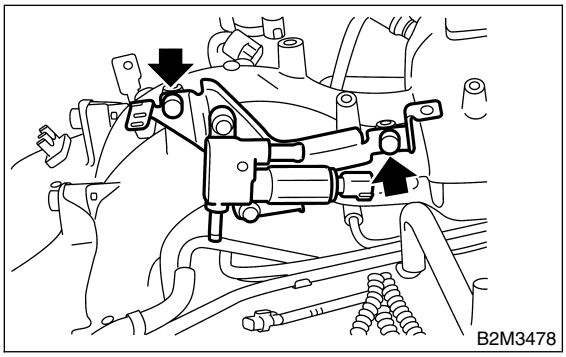


17) Connect pressure regulator vacuum hose to intake manifold.

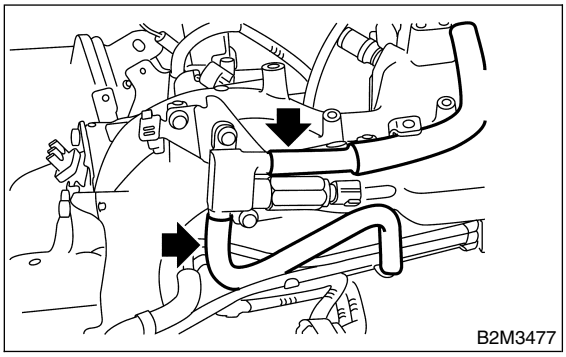

H2M2961

18) Install air assist injector solenoid valve to bracket.

Tightening torque:
16±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)


B2M3478

19) Connect air by-pass hoses to air assist solenoid valve.

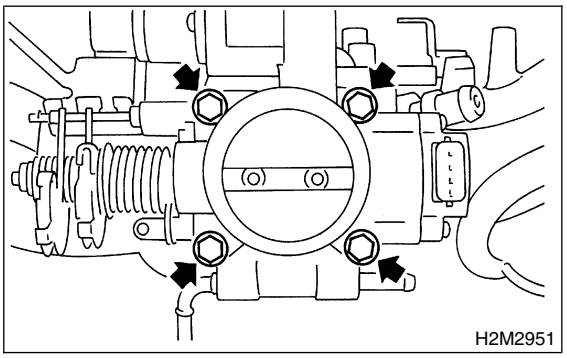

B2M3477

20) Connect connector to air assist solenoid valve.

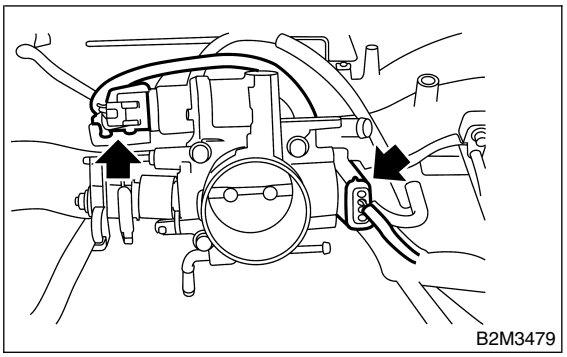
21) Install throttle body to intake manifold.

CAUTION:
Replace gasket with a new one.

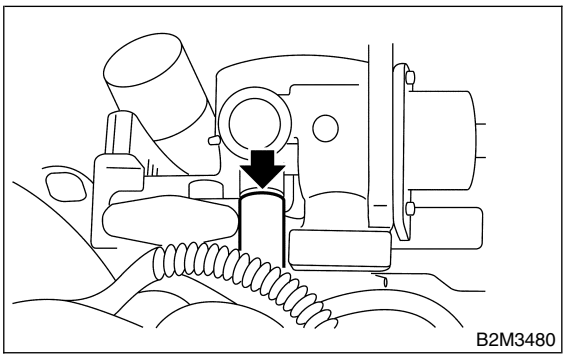
Tightening torque:
22±2 N·m (2.2±0.2 kg-m, 15.9±1.4 ft-lb)


H2M2951

22) Connect connector to throttle position sensor and idle air control solenoid valve.

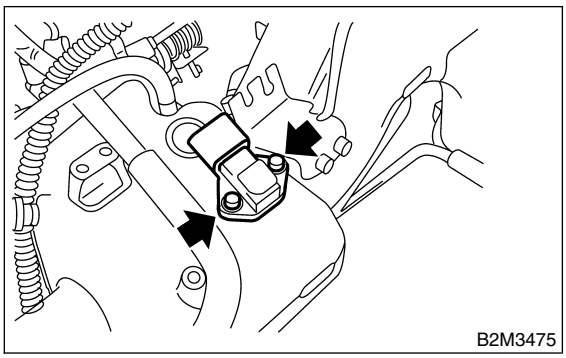

B2M3479

23) Connect air by-pass hose to throttle body.

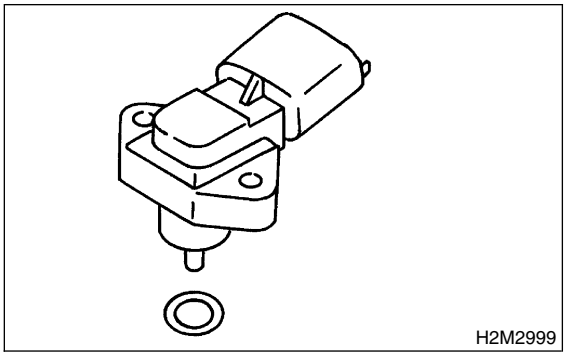

B2M3480

24) Install intake air temperature and pressure sensor.

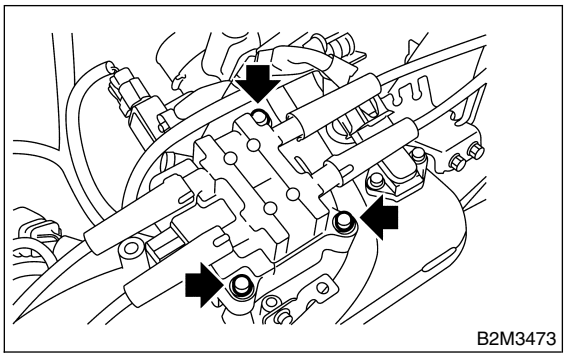
Tightening torque:
2.0±0.4 N·m (0.2±0.04 kg-m, 1.4±0.3 ft-lb)


B2M3475

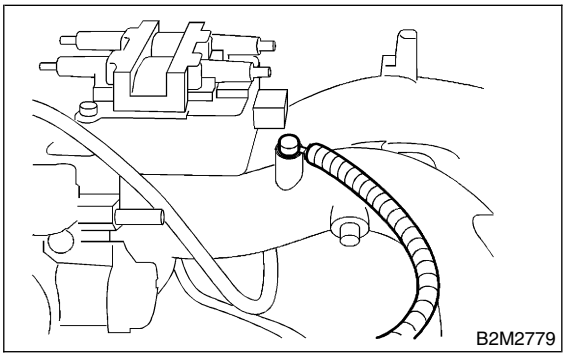
CAUTION:
Replace O-ring with new one.


H2M2999

25) Connect connector to intake air temperature and pressure sensor.
26) Install ignition coil and ignitor assembly.


B2M3473

27) Connect connector to ignition coil and ignitor assembly.
28) Install engine ground terminal to intake manifold.

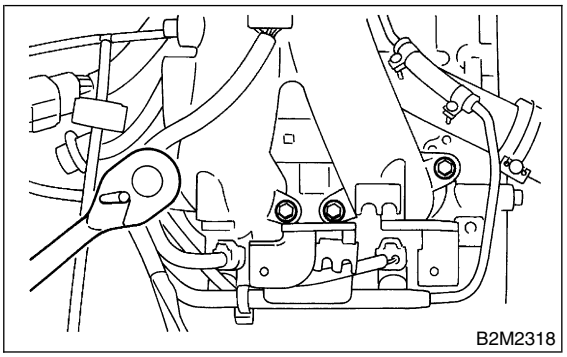

B2M2779

D: INSTALLATION

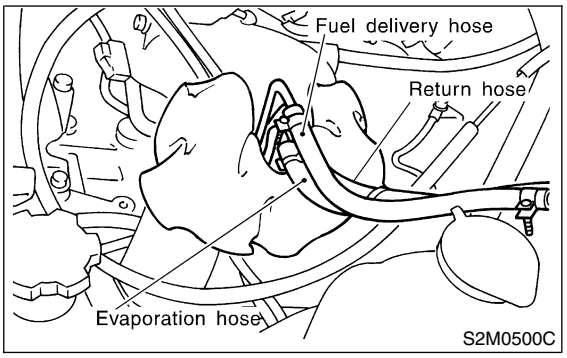
1) Install intake manifold onto cylinder heads.

CAUTION:
Always use new gaskets.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)

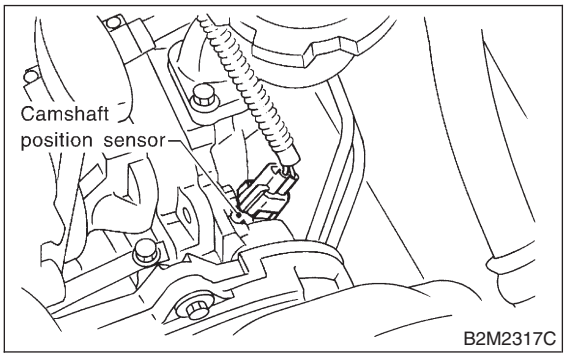

B2M2318

2) Connect fuel hoses.

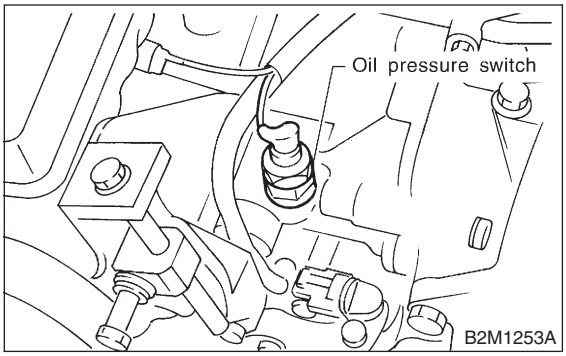


S2M0500C

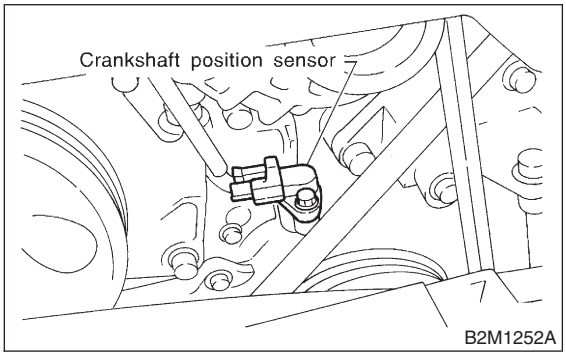
3) Connect connector to camshaft position sensor.



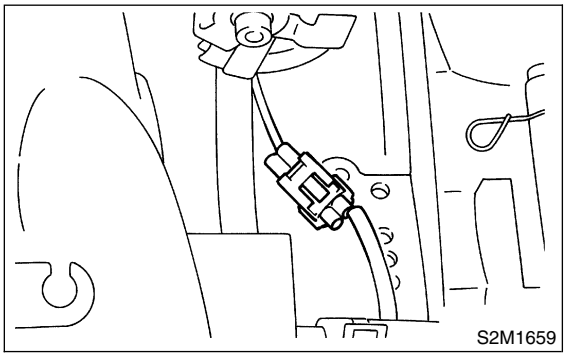
4) Connect connector to oil pressure switch.



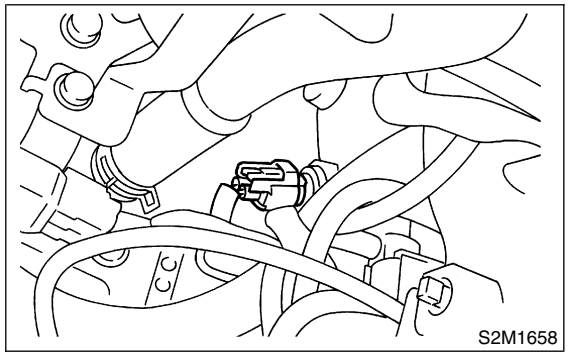
5) Connect connector to crankshaft position sensor.



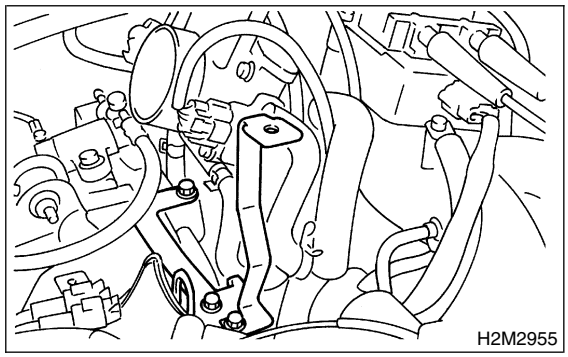
6) Connect knock sensor connector.



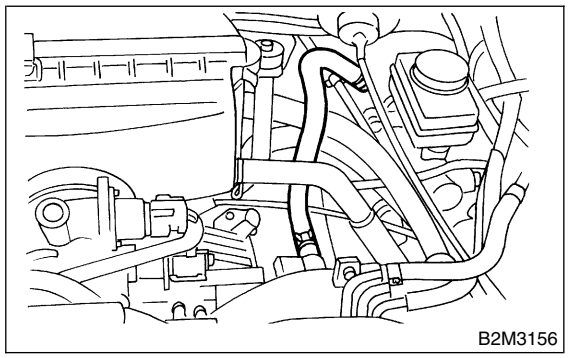
7) Connect connectors to engine coolant temperature sensor.



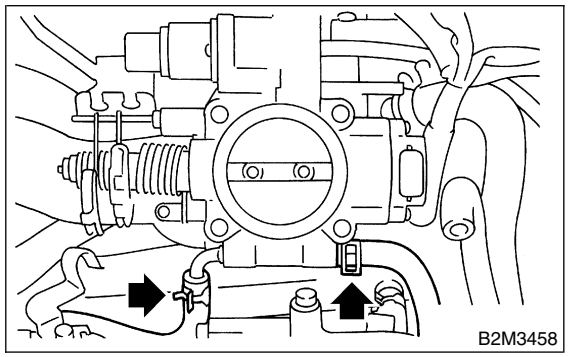
8) Install air cleaner case stay RH and engine harness bracket, and connect engine harness connectors to bulkhead connectors.



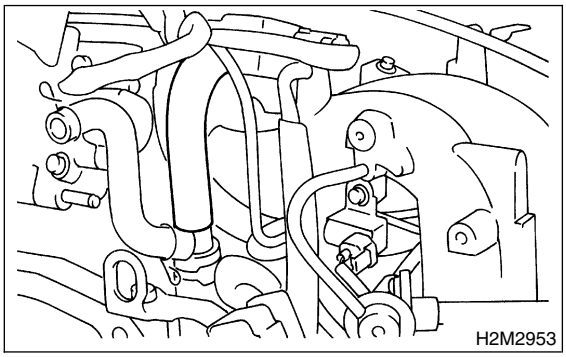
9) Connect brake booster hose.



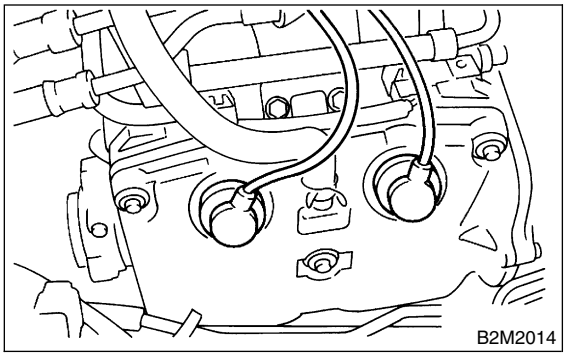
10) Connect engine coolant hose to throttle body.



11) Connect PCV hose to intake manifold.

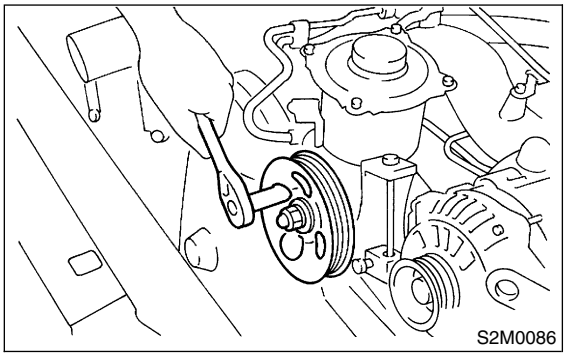

H2M2953

12) Connect spark plug cords to spark plugs.

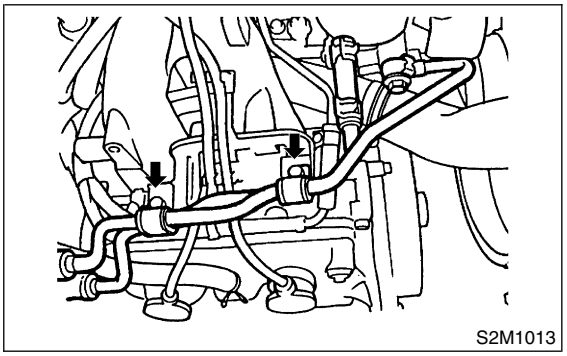

B2M2014

13) Install power steering pump on bracket.
(1) Install power steering pump on bracket, and tighten bolts.

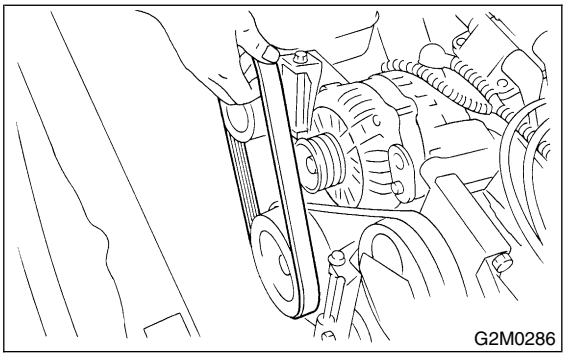
Tightening torque:
20.1±2.5 N·m (2.05±0.25 kg-m, 14.8±1.8 ft-lb)


S2M0086

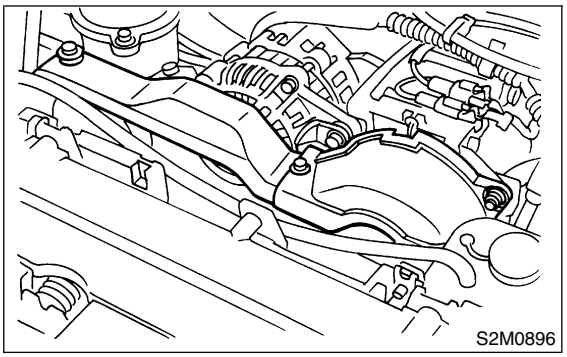
(2) Install power steering pipe brackets on the right side of intake manifold.


S2M1013

(3) Install power steering pump drive V-belt.

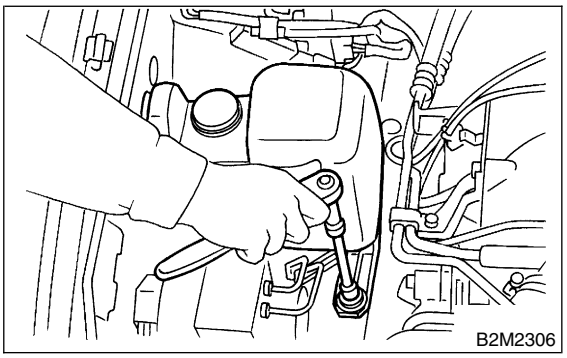

G2M0286

(4) Adjust V-belt. <Ref. to 1-5 [G2A0].>
(5) Install V-belt covers.

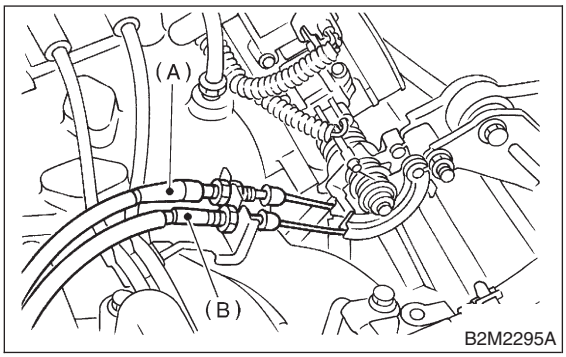

S2M0896

(6) Install resonator chamber.

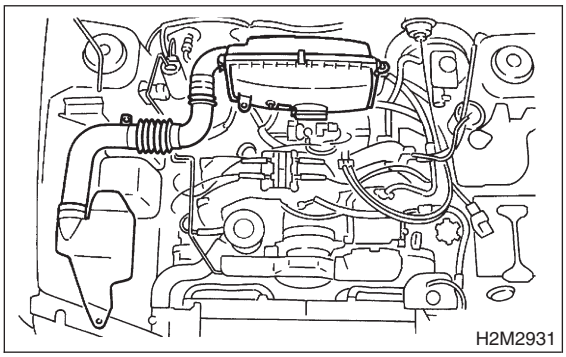
Tightening torque:
33±10 N·m (3.4±1.0 kg-m, 25±7 ft-lb)


B2M2306

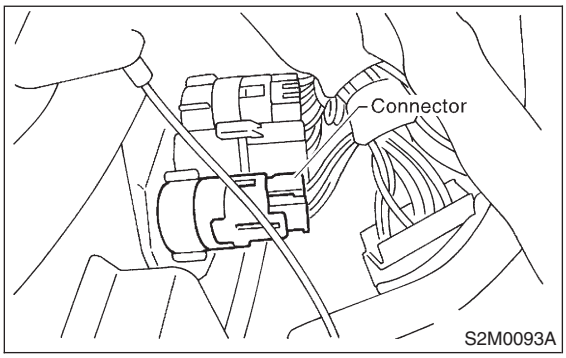
14) Connect accelerator cable (A).
15) Connect cruise control cable (B). (With cruise control models)



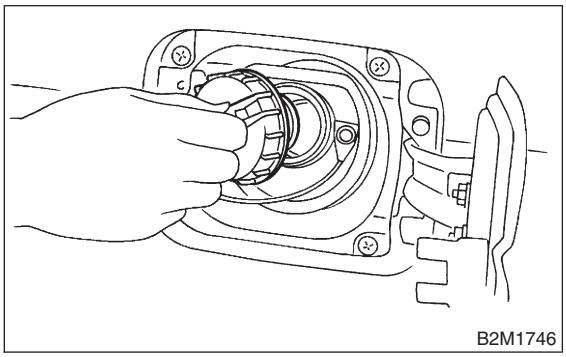
16) Install air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>



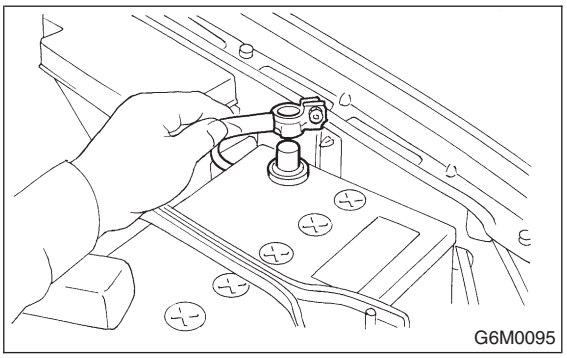
17) Connect connector to fuel pump relay.



18) Install fuel filler cap.



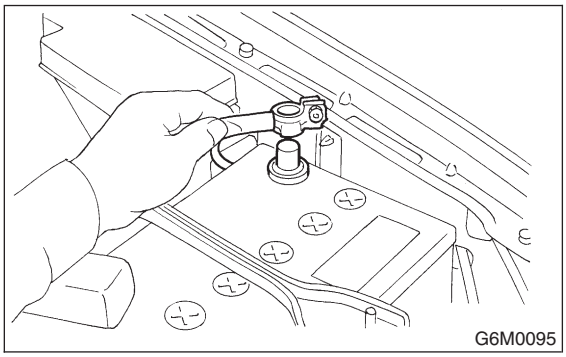
19) Connect battery ground cable.



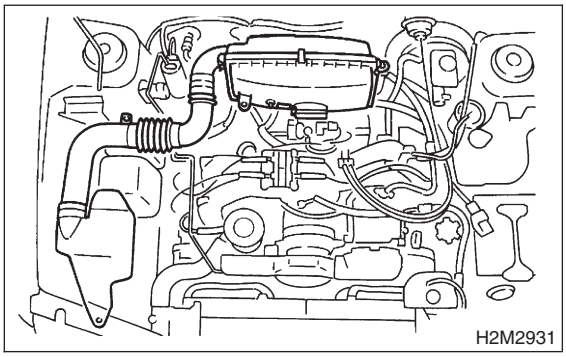
4. Engine Coolant Temperature Sensor

A: REMOVAL AND INSTALLATION

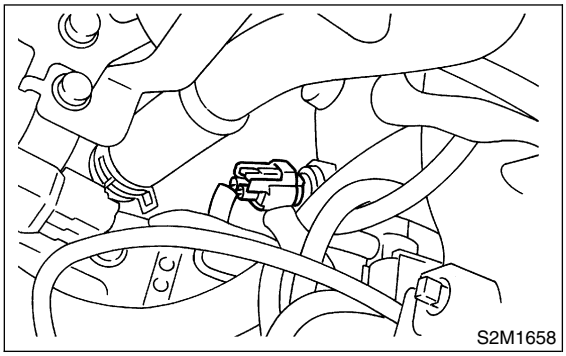
1) Disconnect battery ground cable.



2) Remove air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>

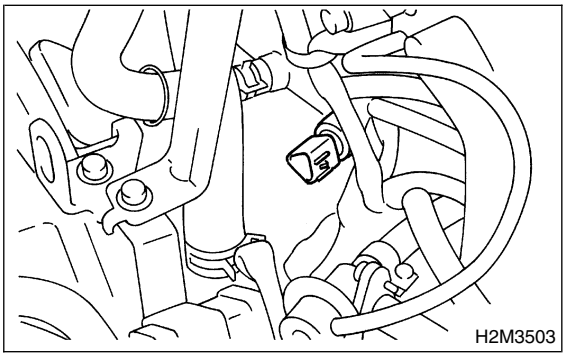


3) Disconnect connector from engine coolant temperature sensor.



4) Remove engine coolant temperature sensor.
5) Installation is in the reverse order of removal.

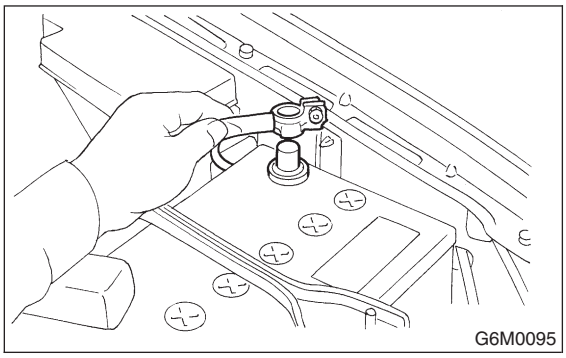
Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)



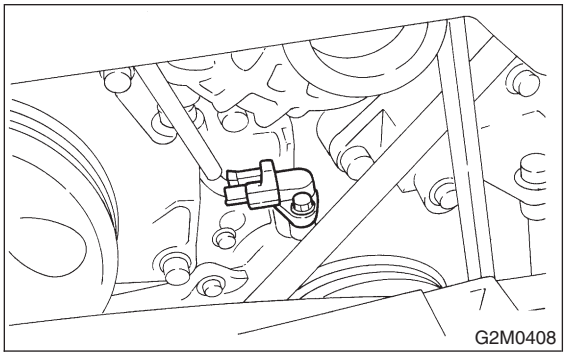
5. Crankshaft Position Sensor

A: REMOVAL AND INSTALLATION

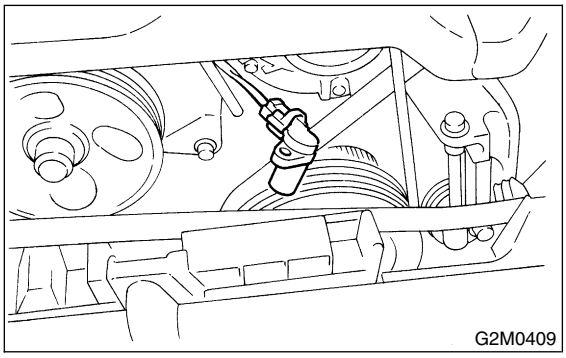
1) Disconnect battery ground cable.



2) Remove bolt which install crankshaft position sensor to cylinder block.

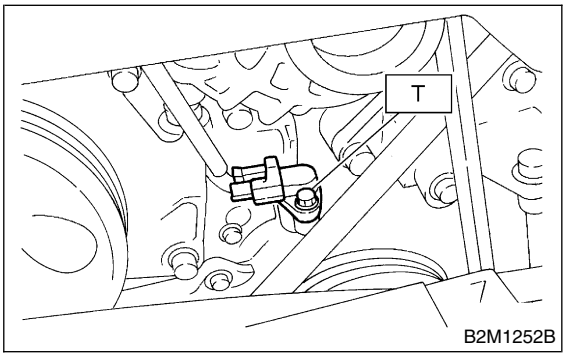


3) Remove crankshaft position sensor, and disconnect connector from it.



4) Installation is in the reverse order of removal.

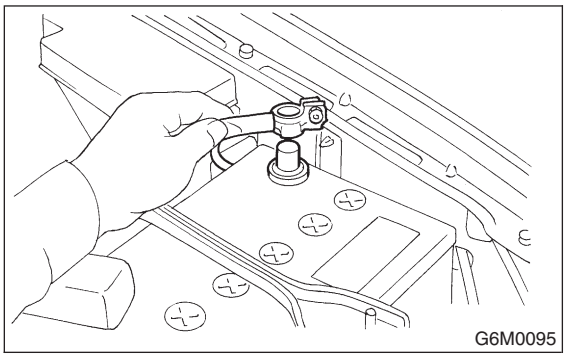
Tightening torque:
T: 6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



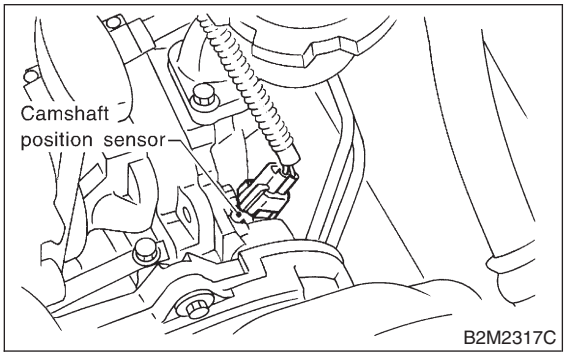
6. Camshaft Position Sensor

A: REMOVAL AND INSTALLATION

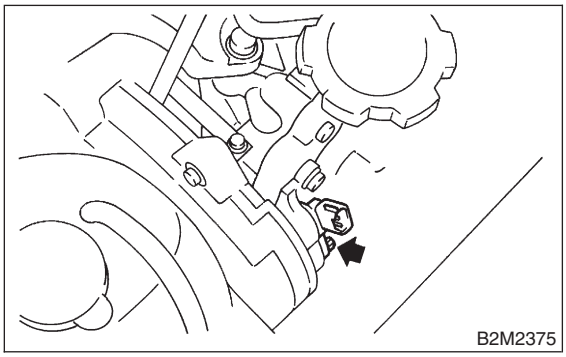
1) Disconnect battery ground cable.



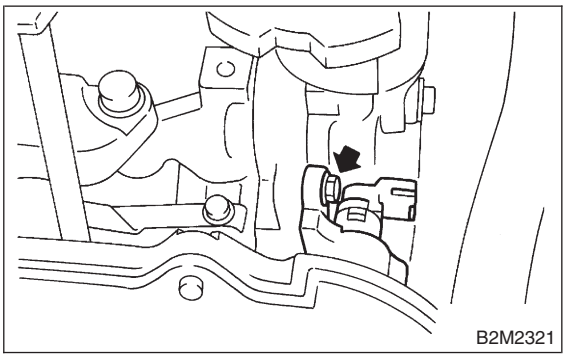
2) Disconnect connector from camshaft position sensor.



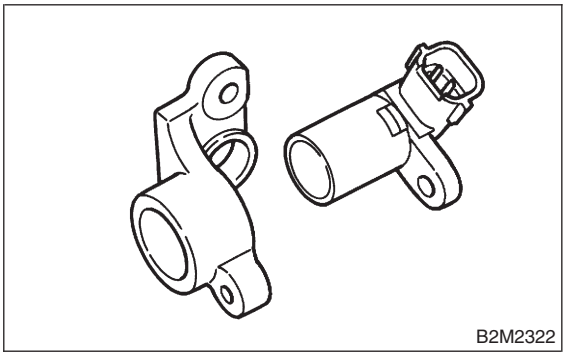
3) Remove bolt which installs camshaft position sensor to camshaft position sensor support.



4) Remove bolt which installs camshaft position sensor support to camshaft cap LH.



5) Remove camshaft position sensor and camshaft position sensor support as a unit.
6) Remove camshaft position sensor itself.



7) Installation is in the reverse order of removal.

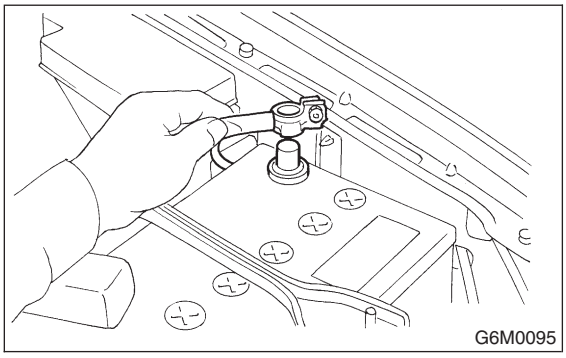
Tightening torque:

- ***Camshaft position sensor support; 6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)***
- ***Camshaft position sensor; 6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)***

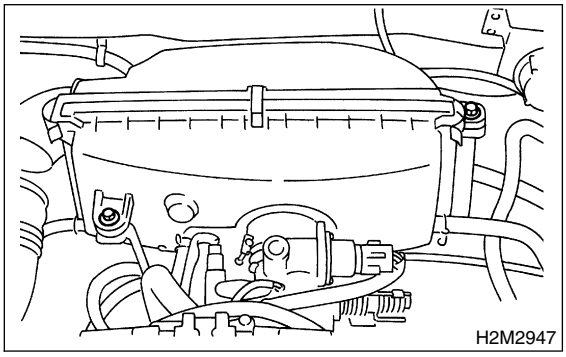
7. Knock Sensor

A: REMOVAL

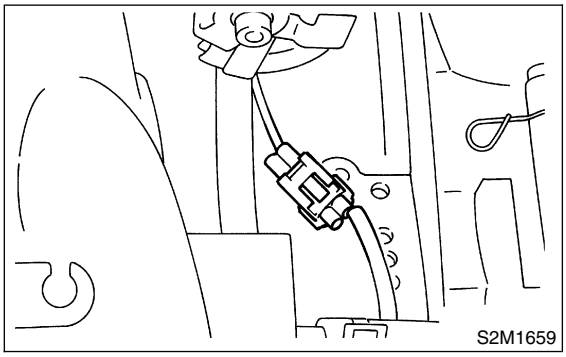
1) Disconnect battery ground cable from battery ground terminal.



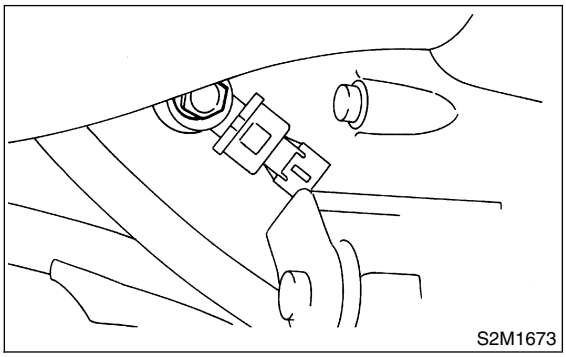
2) Remove air cleaner case.



3) Disconnect knock sensor connector.



4) Remove knock sensor from cylinder block.

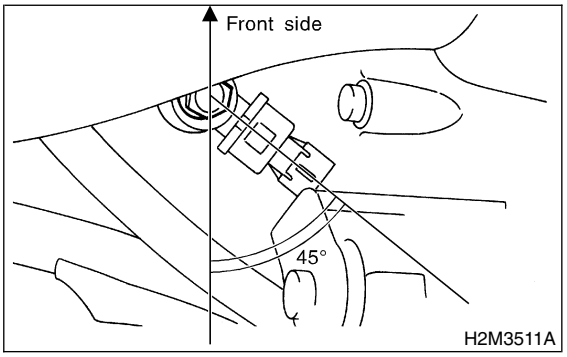


B: INSTALLATION

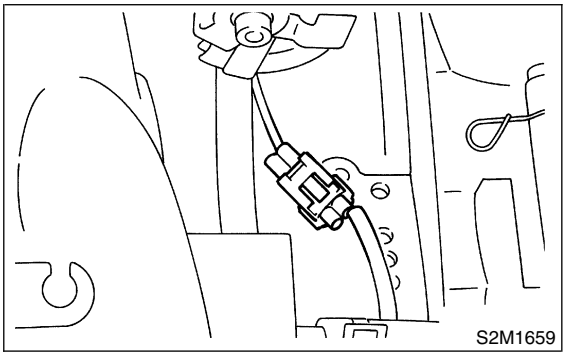
1) Install knock sensor to cylinder block.

Tightening torque:
23.5±2.9 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)

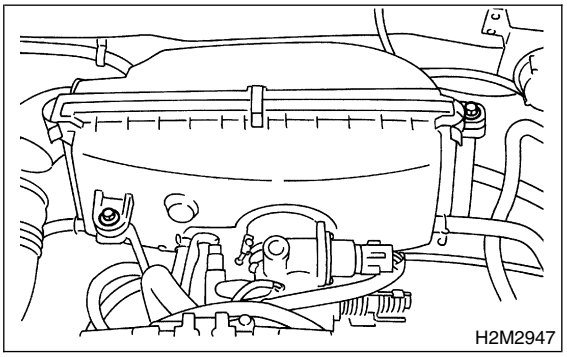
NOTE:
The extraction area of the knock sensor cord must be positioned at a 45° angle relative to the engine rear.



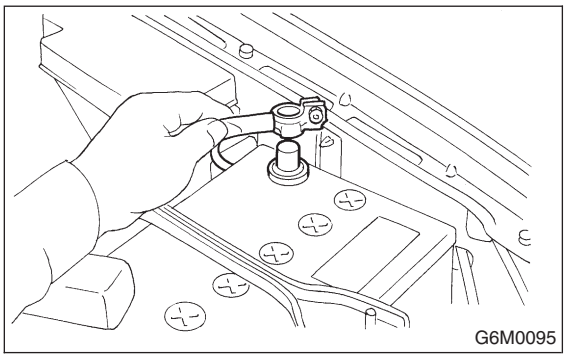
2) Connect knock sensor connector.



3) Install air cleaner case.



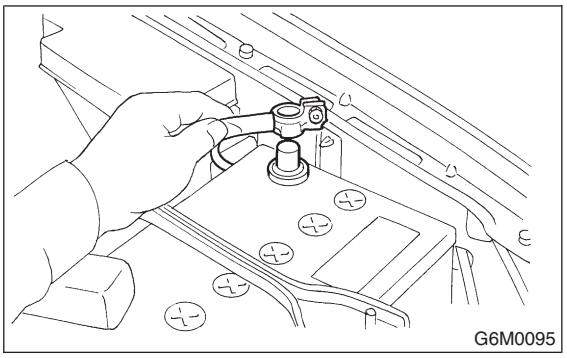
4) Connect battery ground cable.



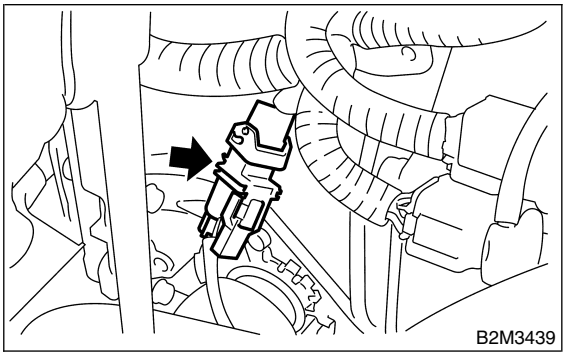
8. Front Oxygen (A/F) Sensor

A: REMOVAL

1) Disconnect battery ground cable.



2) Disconnect connector from front oxygen (A/F) sensor.

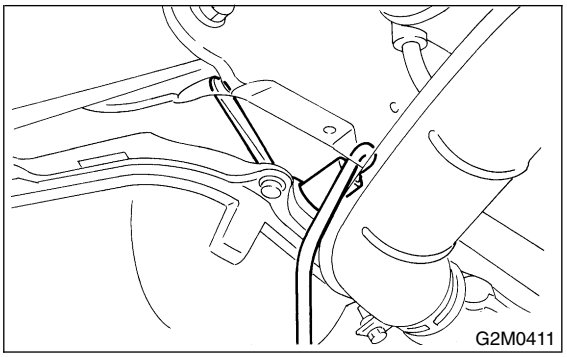


3) Lift-up the vehicle.
4) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

5) Remove front oxygen (A/F) sensor.

CAUTION:
When removing front oxygen (A/F) sensor, do not force front oxygen (A/F) sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.

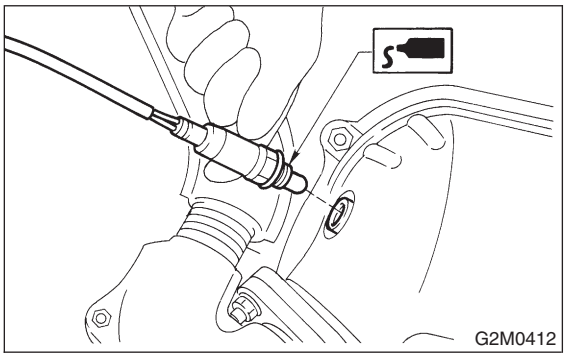


B: INSTALLATION

1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to threaded portion of front oxygen (A/F) sensor to make the next removal easier.

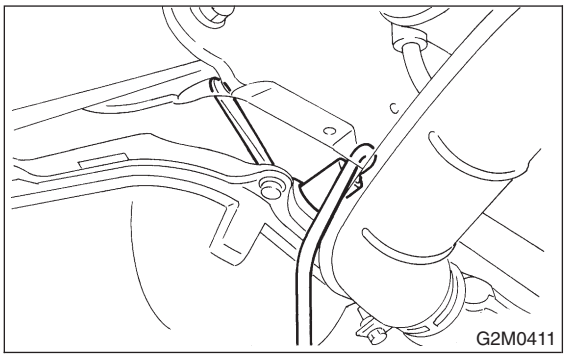
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.

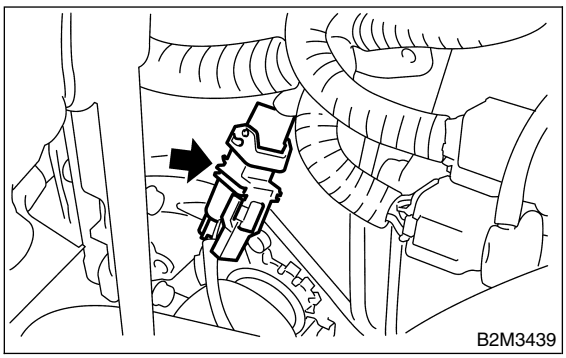

G2M0412

2) Install front oxygen (A/F) sensor.

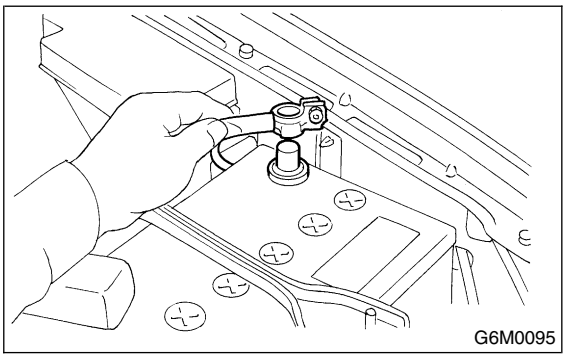
Tightening torque:
21±3 N·m (2.1±0.3 kg-m, 15.2±2.2 ft-lb)


G2M0411

3) Lower the vehicle.
4) Connect connector of front oxygen (A/F) sensor.


B2M3439

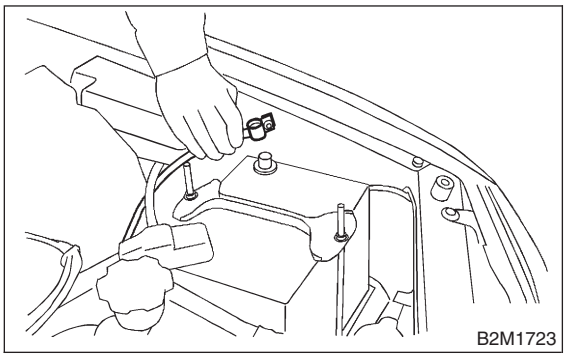
5) Connect battery ground cable.


G6M0095

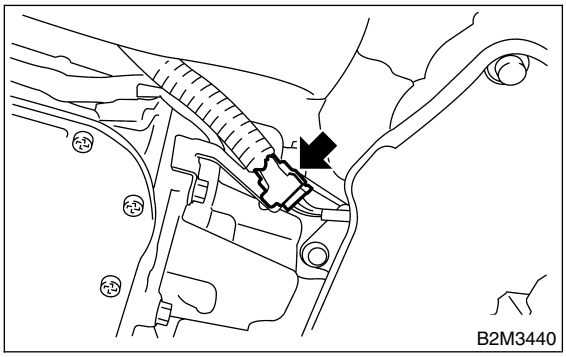
9. Rear Oxygen Sensor

A: REMOVAL

1) Disconnect battery ground cable.



2) Disconnect connector from rear oxygen sensor.

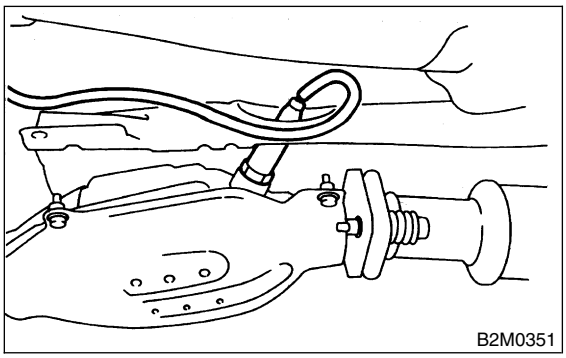


3) Lift-up the vehicle.
4) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

5) Remove rear oxygen sensor.

CAUTION:
When removing, do not force rear oxygen sensor in an unnatural way especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.

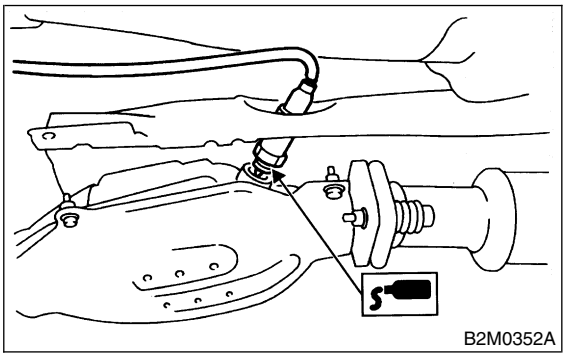


B: INSTALLATION

1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

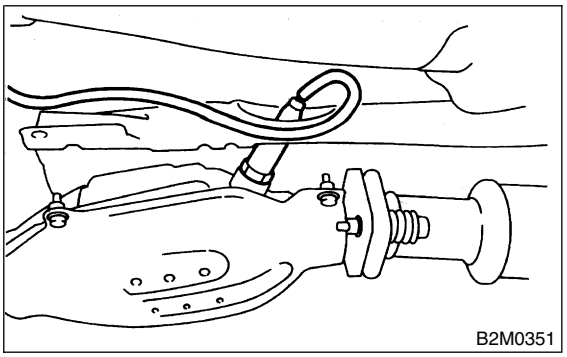
CAUTION:
Never apply anti-seize compound to protector of rear oxygen sensor.

Anti-seize compound:
SS-30 by JET LUBE

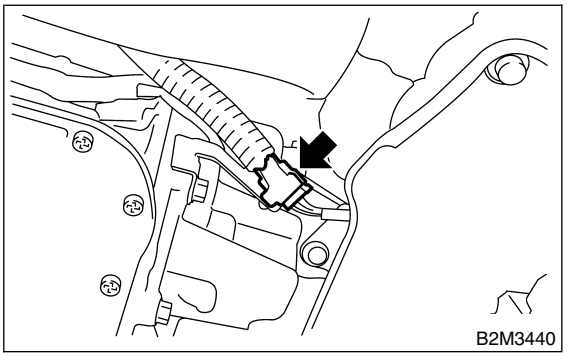


2) Install rear oxygen sensor.

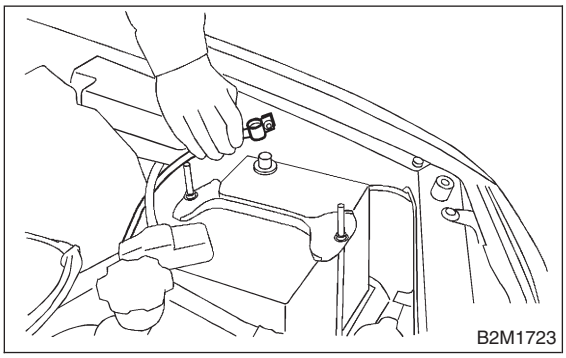
Tightening torque:
21±3 N·m (2.1±0.3 kg-m, 15.2±2.2 ft-lb)



3) Connect connector to rear oxygen sensor.



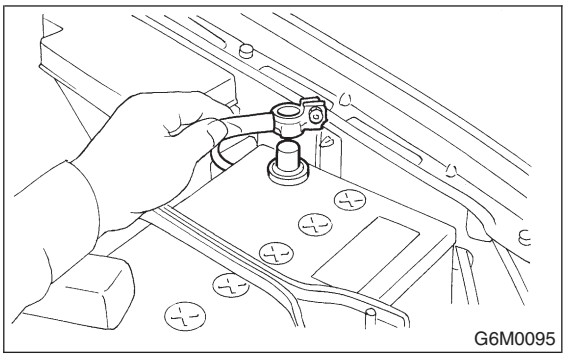
4) Lower the vehicle.
5) Connect battery ground cable.



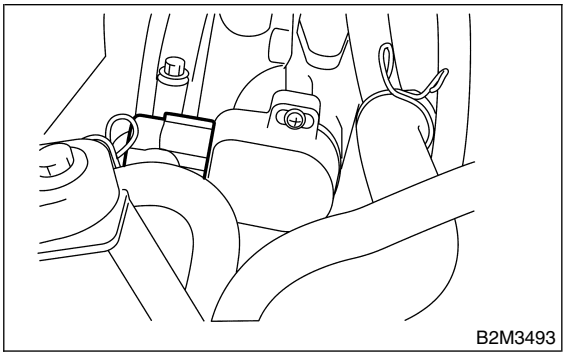
10. Throttle Position Sensor

A: REMOVAL AND INSTALLATION

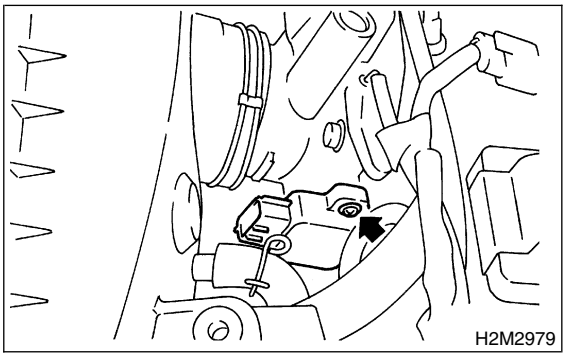
1) Disconnect battery ground cable.



2) Disconnect connector from throttle position sensor.



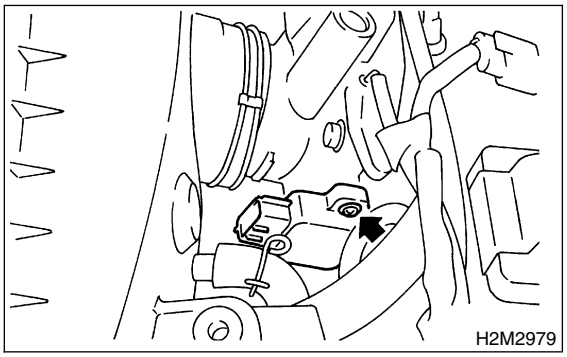
3) Remove throttle position sensor holding screws, and remove it.



4) Installation is in the reverse order of removal.

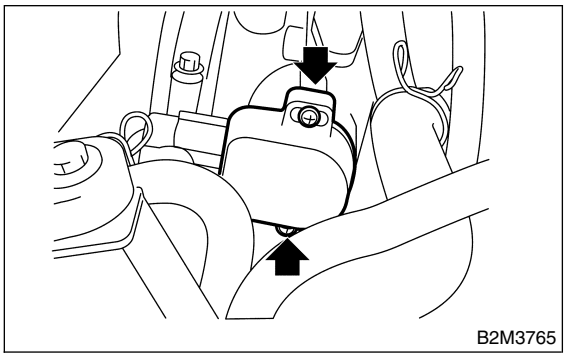
Tightening torque:
2.2±0.2 N·m (0.22±0.02 kg-m, 1.6±0.1 ft-lb)

CAUTION:
When installing throttle position sensor, adjust to the specified data.


H2M2979

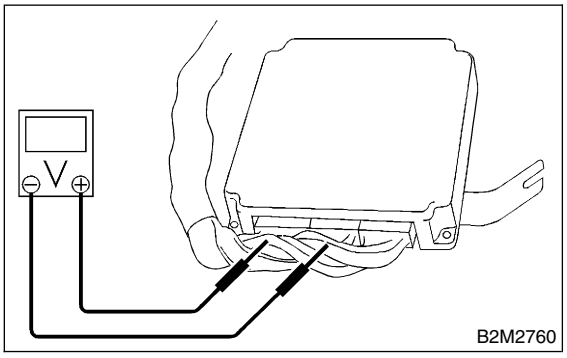
B: ADJUSTMENT

1) Turn ignition switch to OFF.
2) Loosen throttle position sensor holding screws.


B2M3765

3) When using voltage meter;
(1) Take out ECM.
(2) Turn ignition switch to ON.
(3) Adjust throttle position sensor to the proper position to allow the voltage signal to ECM to be in specification.

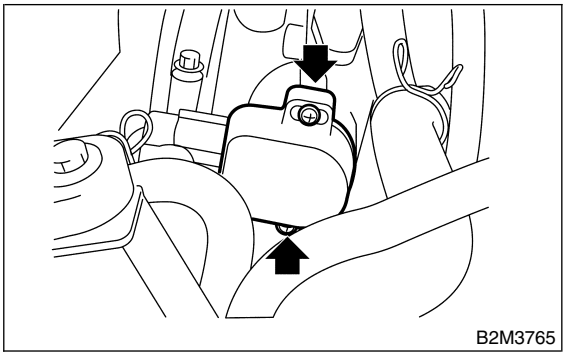
Connector & terminal / Specified voltage
(B136) No. 15 — (B136) No. 17 / 0.45 — 0.55 V
[Fully closed.]



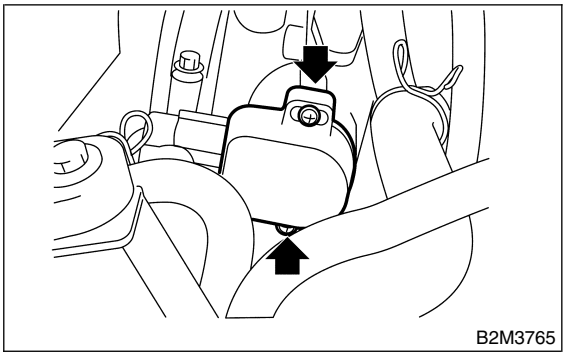
B2M2760

(4) Tighten throttle position sensor holding screws.

Tightening torque:
2.2±0.2 N·m (0.22±0.02 kg-m, 1.6±0.1 ft-lb)

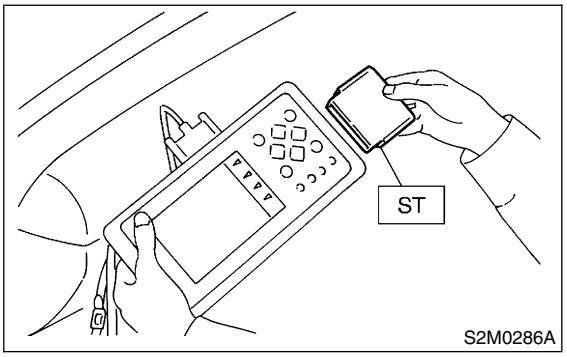

B2M3765

4) When using Subaru Select Monitor;
(1) Turn ignition switch to OFF.
(2) Loosen throttle position sensor holding screws.


B2M3765

NOTE:
For detailed operation procedures, refer to the Subaru Select Monitor Operation Manual.

(3) Insert the cartridge to Subaru Select Monitor.
<Ref. to 1-6 [G1100].>



S2M0286A

(4) Connect Subaru Select Monitor to the data link connector.
5) Turn ignition switch to ON, and Subaru Select Monitor switch to ON.
6) Select {2. Each System Check} in Main Menu.

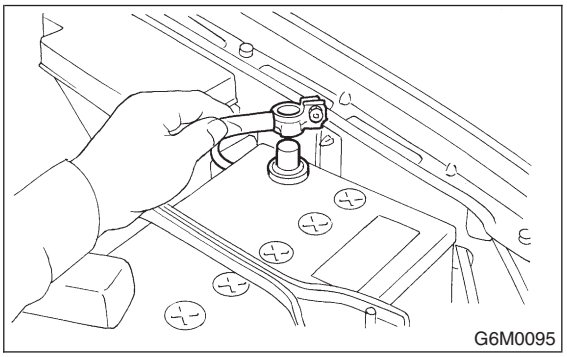
7) Select {Engine Control System} in Selection Menu.
8) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
9) Select {1.12 Data Display} in Data Display Menu.
10) Adjust throttle position sensor to the proper position to match with the following specifications.

Condition: Throttle fully closed
Throttle opening angle 0.00%
Throttle sensor voltage 0.50 V

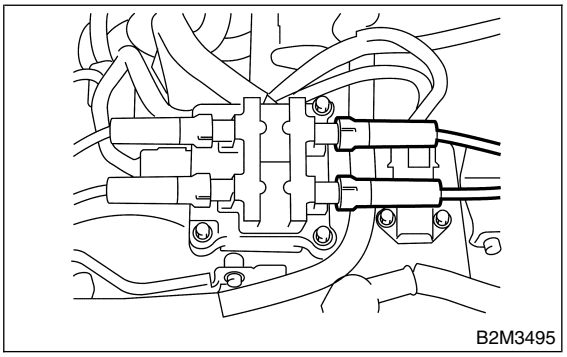
11. Intake Air Temperature and Pressure Sensor

A: REMOVAL AND INSTALLATION

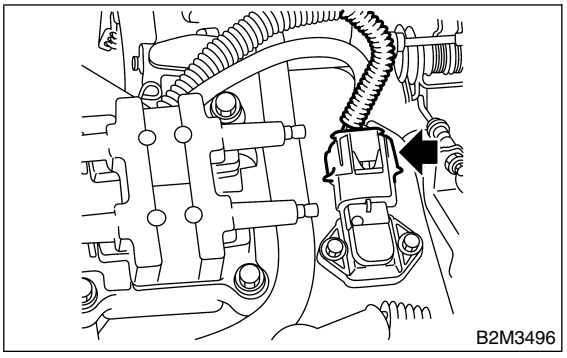
1) Disconnect battery ground cable.


G6M0095

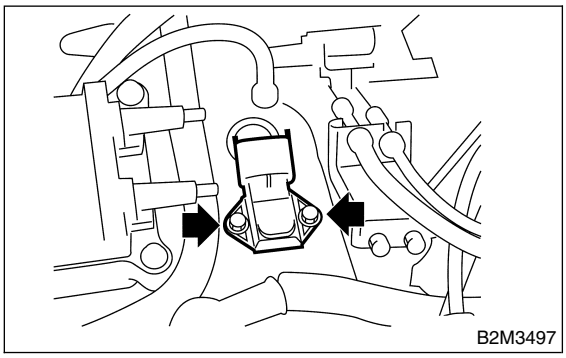
2) Disconnect spark plug cord from ignition coil and ignitor assembly.


B2M3495

3) Disconnect connector from intake air temperature and pressure sensor.

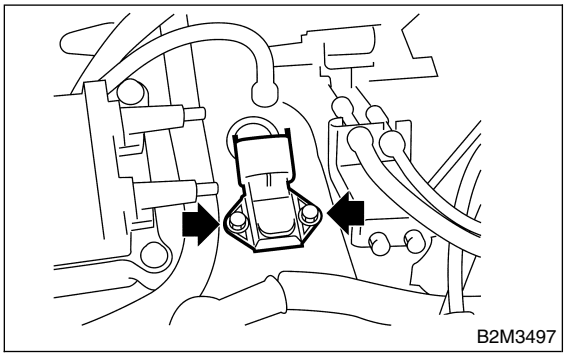

B2M3496

4) Remove intake air temperature and pressure sensor.

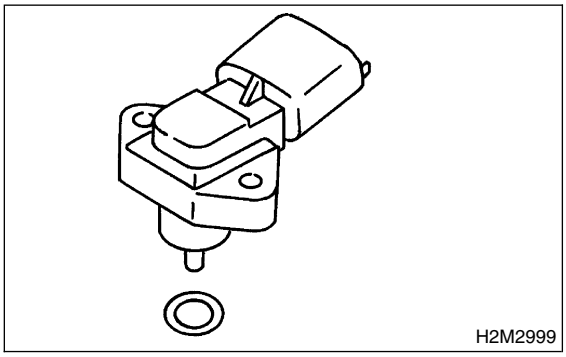


5) Installation is in the reverse order of removal.

Tightening torque:
2.0±0.4 N·m (0.2±0.04 kg-m, 1.4±0.3 ft-lb)



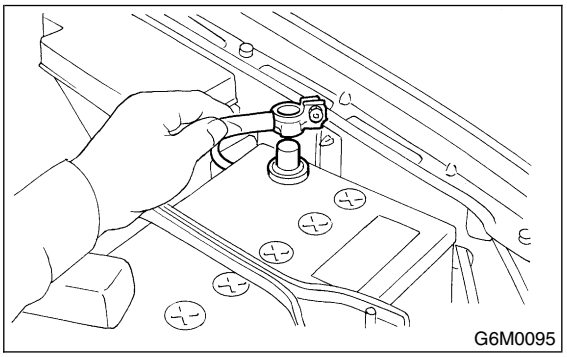
CAUTION:
Replace O-ring with new one.



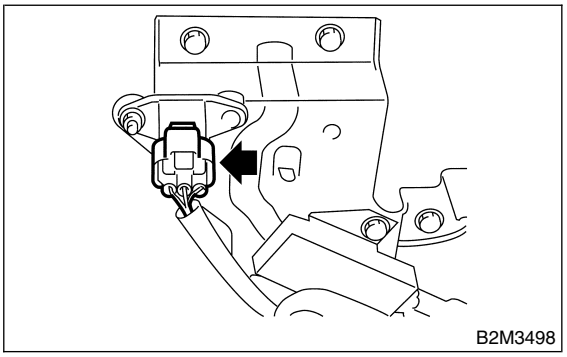
12. Atmospheric Pressure Sensor

A: REMOVAL AND INSTALLATION

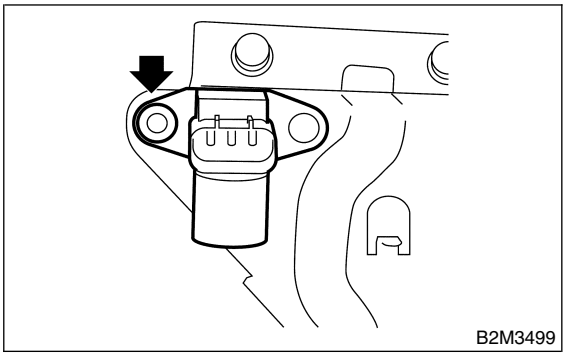
1) Disconnect battery ground cable.



2) Disconnect connector from atmospheric pressure sensor.

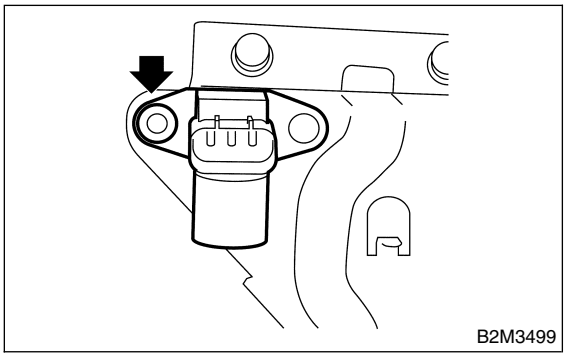


3) Remove atmospheric pressure sensor from bracket.



4) Installation is in the reverse order of removal.

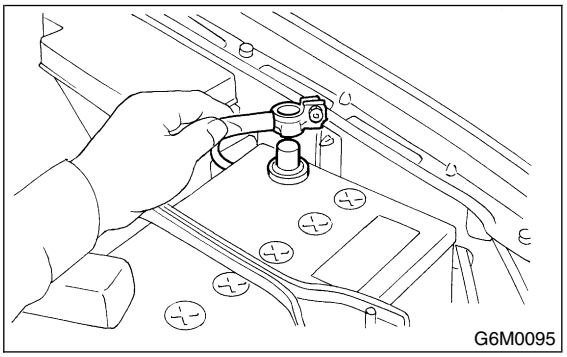
Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)


B2M3499

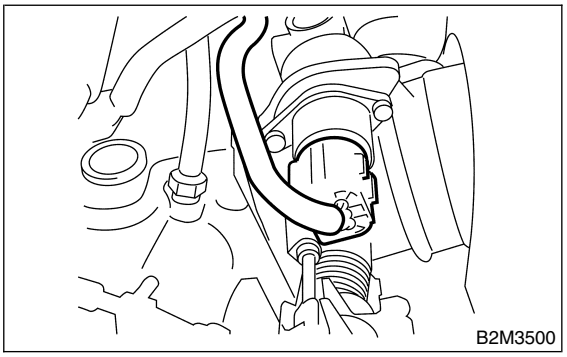
13. Idle Air Control Solenoid Valve

A: REMOVAL AND INSTALLATION

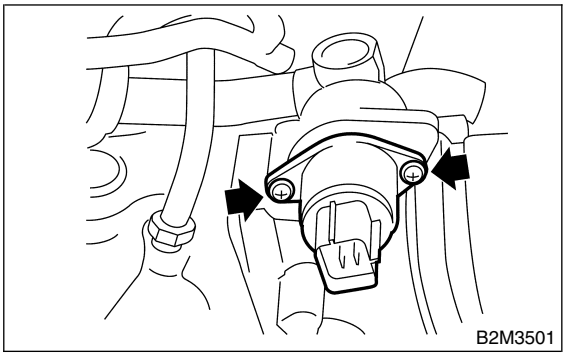
1) Disconnect battery ground cable.


G6M0095

2) Disconnect connector from idle air control solenoid valve.


B2M3500

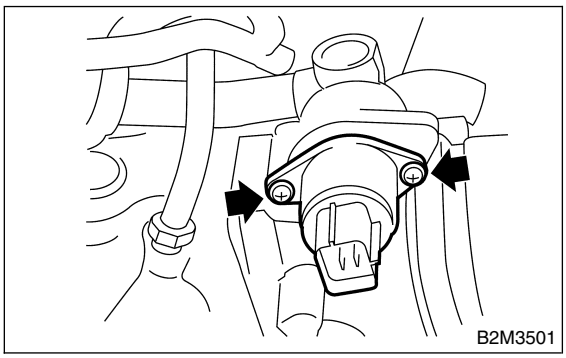
3) Remove idle air control solenoid valve from throttle body.


B2M3501

4) Installation is in the reverse order of removal.

CAUTION:
Always use new gasket.

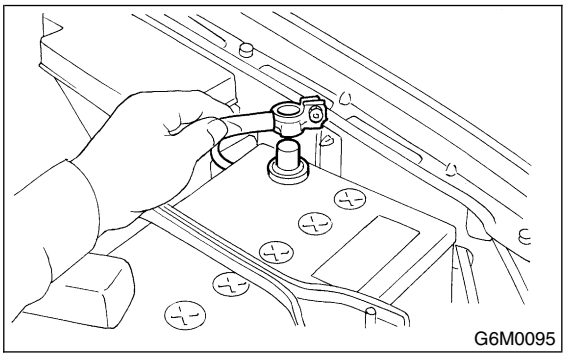
Tightening torque:
6.0±0.8 N·m (0.61±0.08 kg-m, 4.4±0.6 ft-lb)



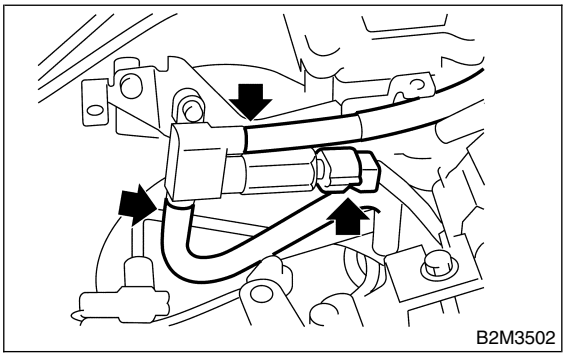
14. Air Assist Injector Solenoid Valve

A: REMOVAL AND INSTALLATION

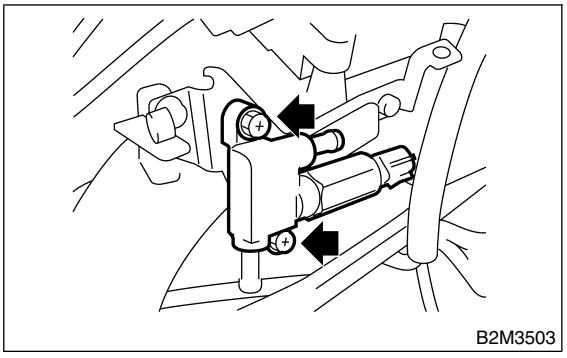
1) Disconnect battery ground cable.



2) Disconnect connector from air assist injector solenoid valve and disconnect air by-pass hoses.

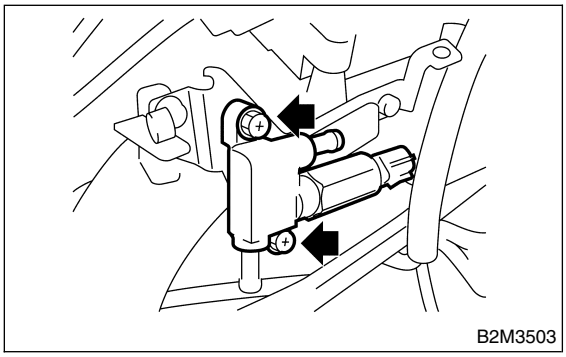


3) Remove air assist injector solenoid valve from intake manifold.



4) Installation is in the reverse order of removal.

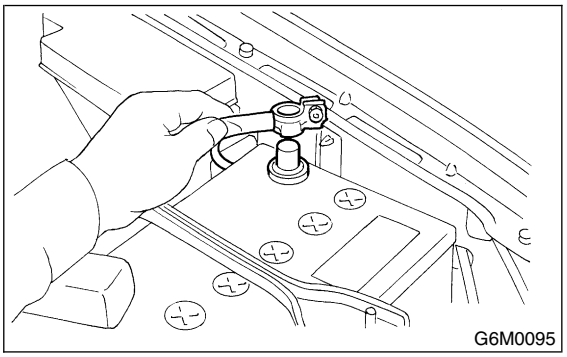
Tightening torque:
15.7±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)


B2M3503

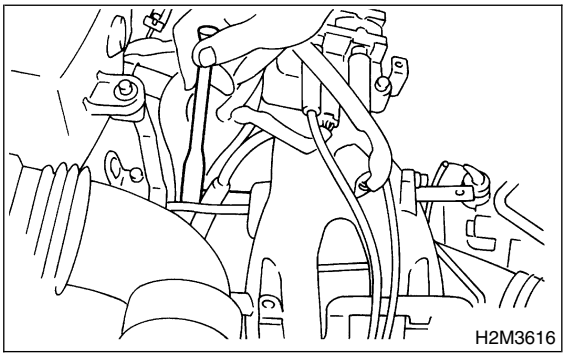
15. Purge Control Solenoid Valve

A: REMOVAL AND INSTALLATION

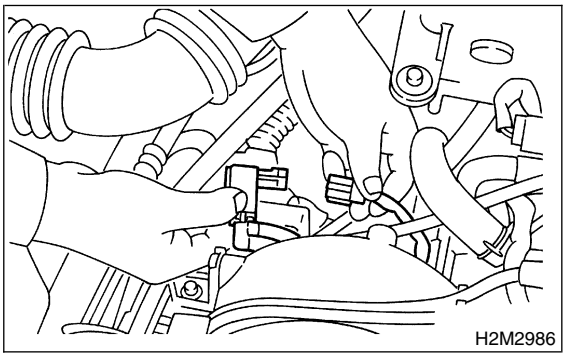
1) Disconnect battery ground cable.


G6M0095

2) Remove bolt which installs purge control solenoid valve onto intake manifold.

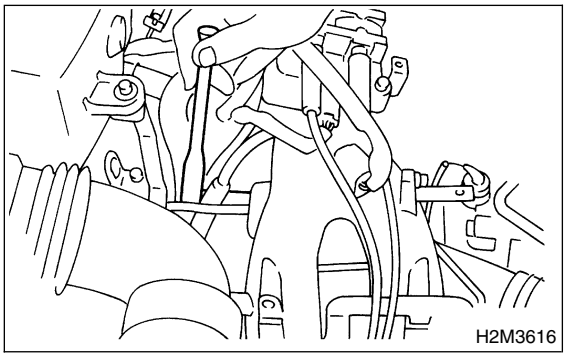

H2M3616

3) Take out purge control solenoid valve through the bottom of the intake manifold.
4) Disconnect connector and hoses from purge control solenoid valve.

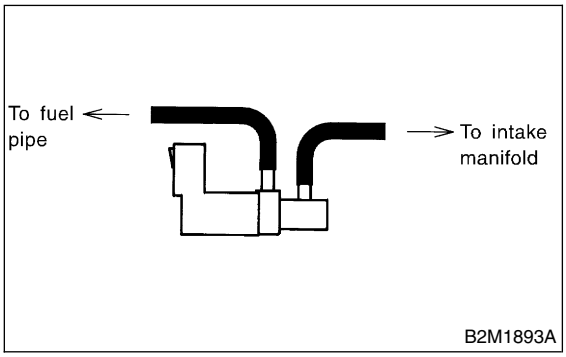

H2M2986

5) Installation is in the reverse order of removal.

Tightening torque:
16±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)


H2M3616

CAUTION:
Carefully connect the evaporation hoses.



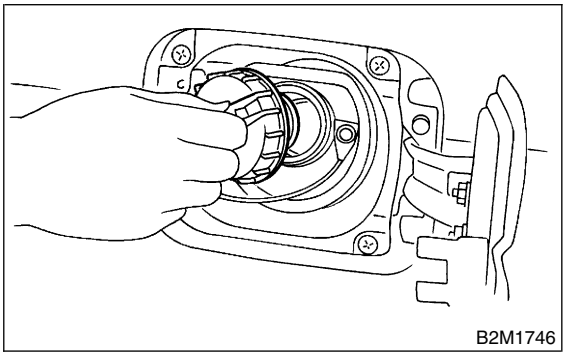
B2M1893A

16. Fuel Injector

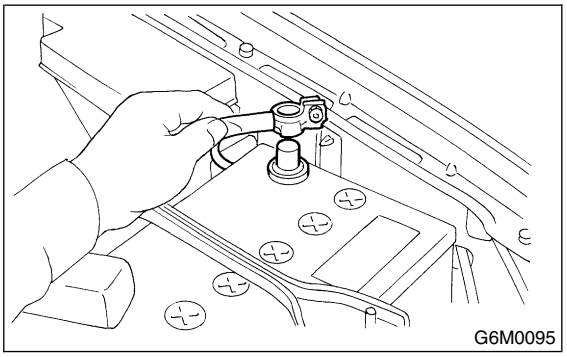
A: REMOVAL AND INSTALLATION

1. RH SIDE

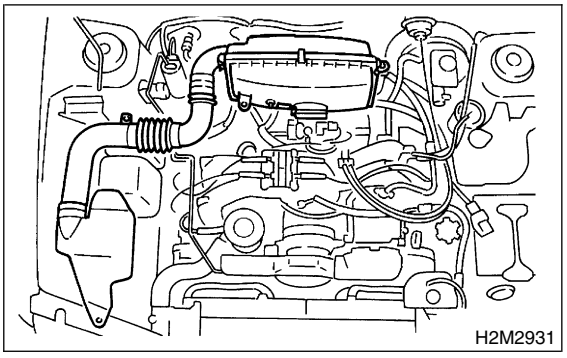
1) Release fuel pressure.
<Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.


B2M1746

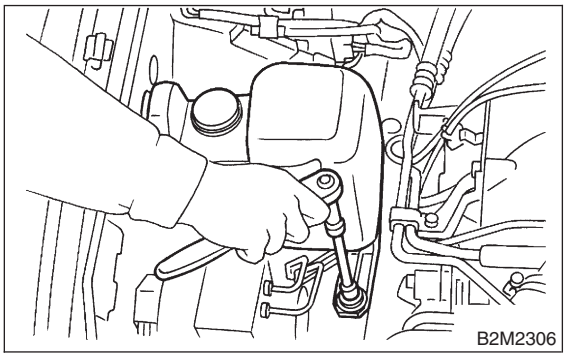
3) Disconnect battery ground cable.


G6M0095

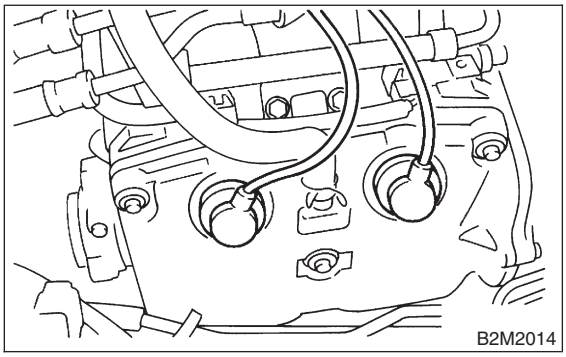
4) Remove air intake duct and air cleaner assembly. <Ref. to 2-7 [W1A0].>


H2M2931

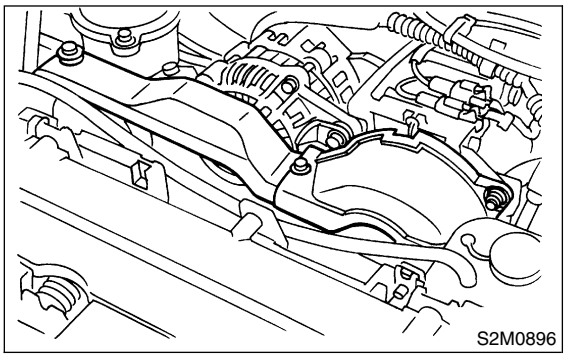
5) Remove resonator chamber.



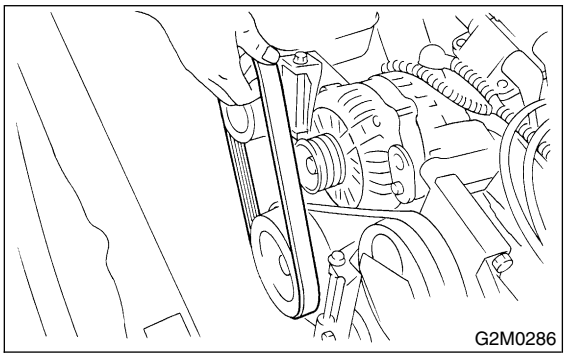
6) Remove spark plug cords from spark plugs (#1 and #3 cylinders).



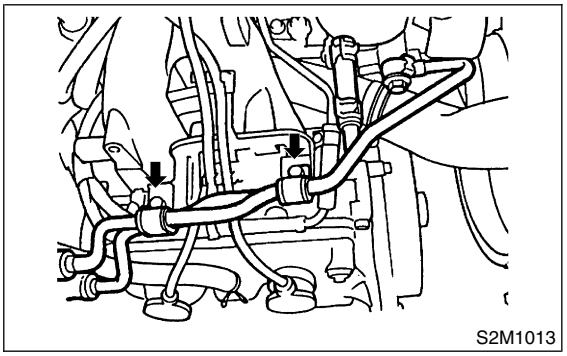
7) Remove power steering pump from bracket.
(1) Remove V-belt covers.



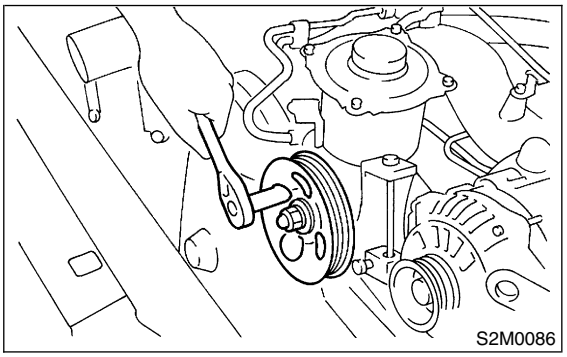
(2) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.



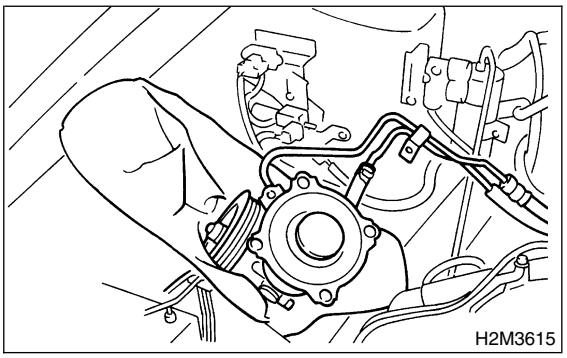
(3) Remove bolts which secure power steering pipe brackets to intake manifold.



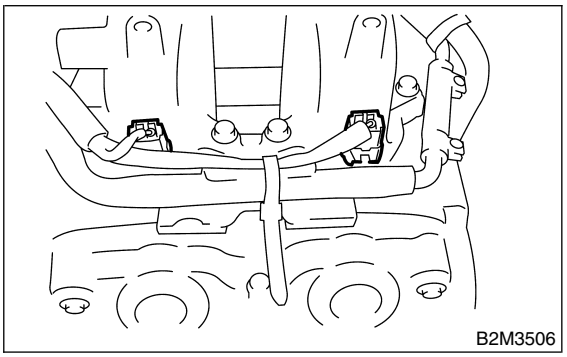
(4) Remove bolts which install power steering pump to bracket.



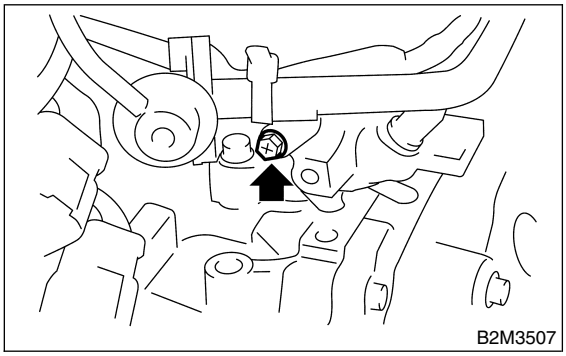
(5) Place power steering pump on the right side wheel apron.



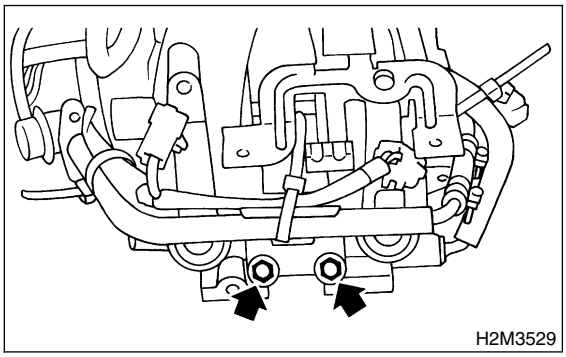
8) Disconnect connector from fuel injector.



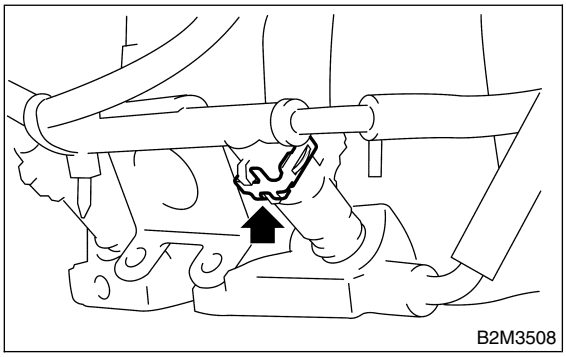
9) Remove bolt which install injector pipe to intake manifold.



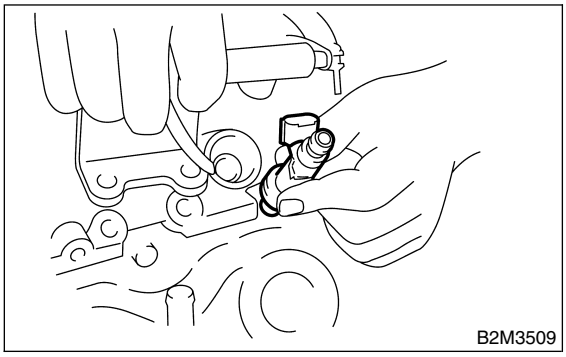
10) Remove two bolts which install injector pipe on intake manifold.



11) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip.

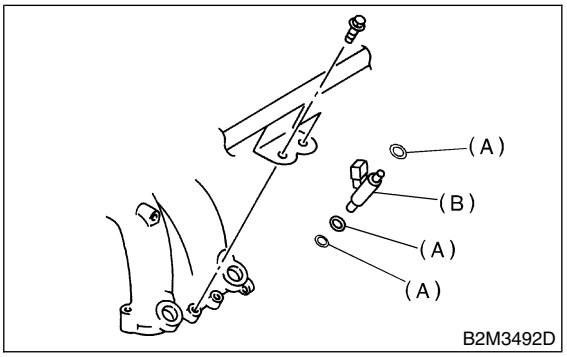


(2) Remove fuel injector while lifting up fuel injector pipe.



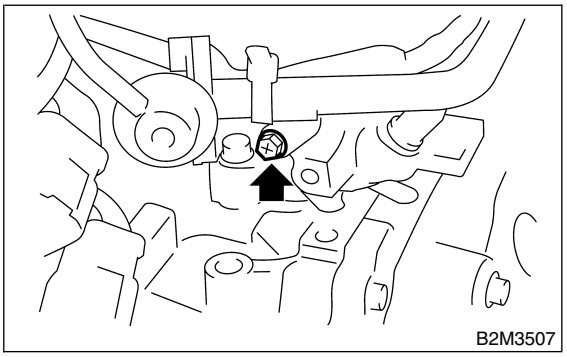
12) Installation is in the reverse order of removal.

CAUTION:
Replace O-rings with new ones.

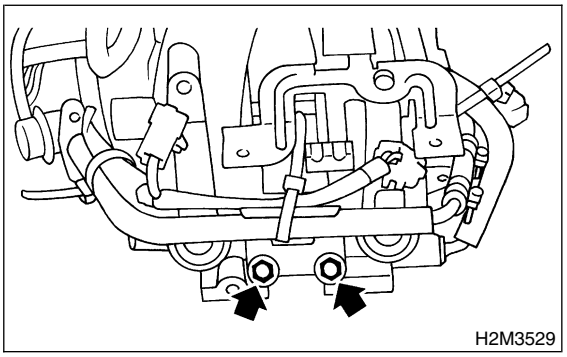


(A) O-ring
(B) Fuel injector

Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)

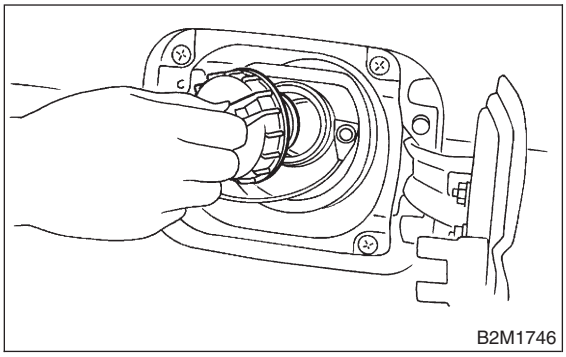


Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)

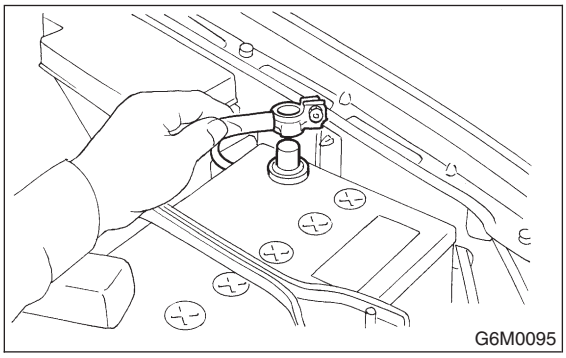


2. LH SIDE

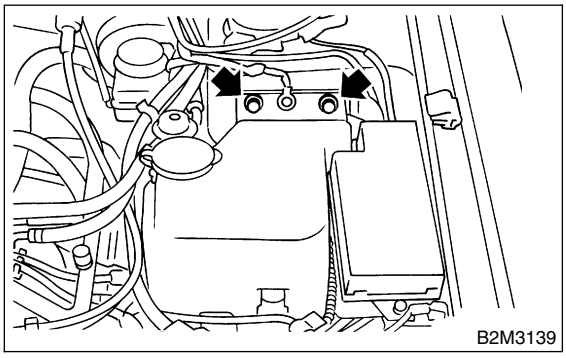
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.



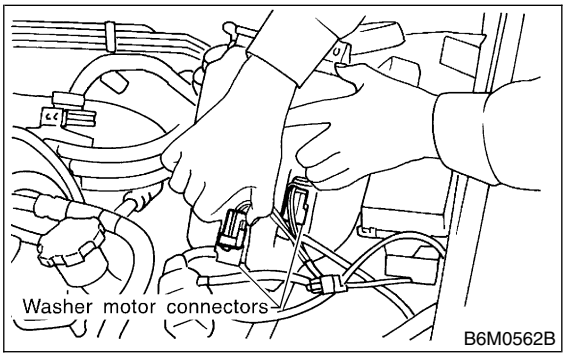
3) Disconnect battery ground cable.



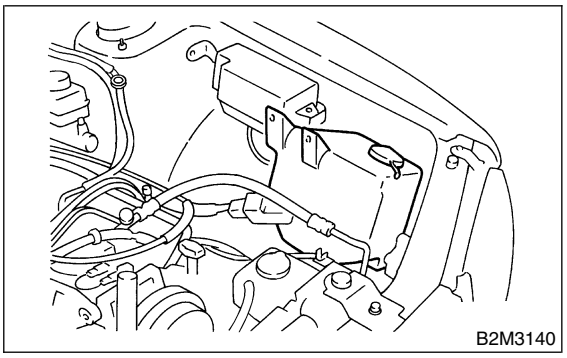
4) Remove two bolts which install washer tank on body.



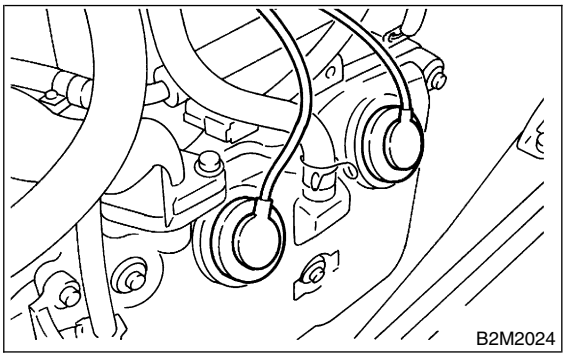
5) Disconnect connector from front window washer motor.
6) Disconnect connector from rear gate glass washer motor.



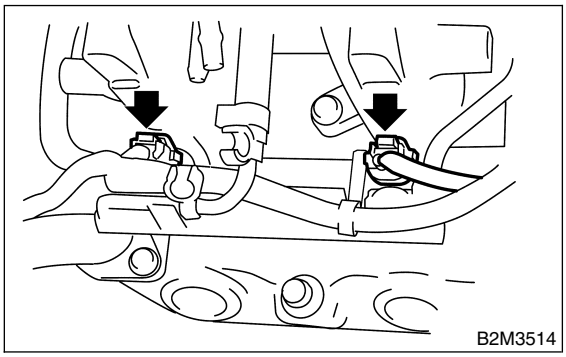
7) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
8) Move washer tank, and secure it away from working area.



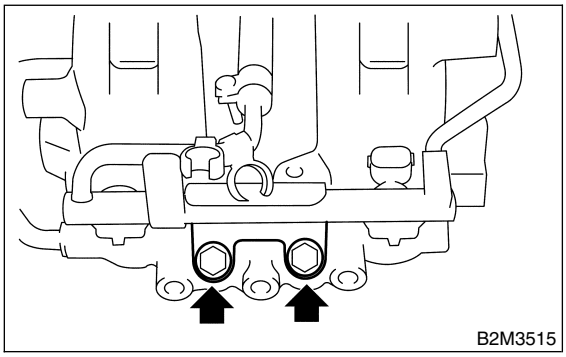
9) Remove spark plug cords from spark plugs (#2 and #4 cylinders).



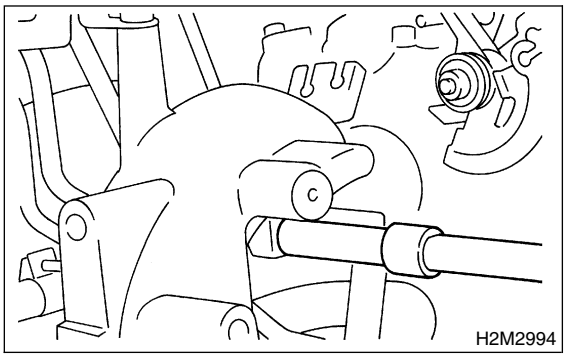
10) Disconnect connector from fuel injector.



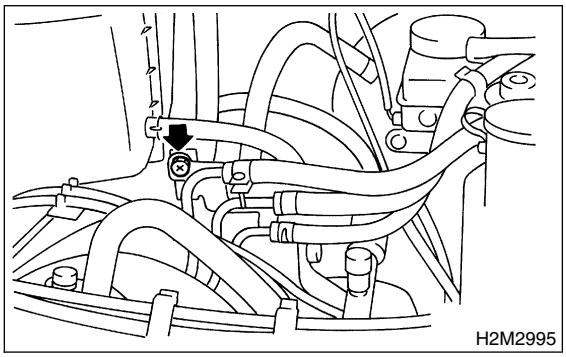
11) Remove bolt which holds injector pipe to intake manifold.



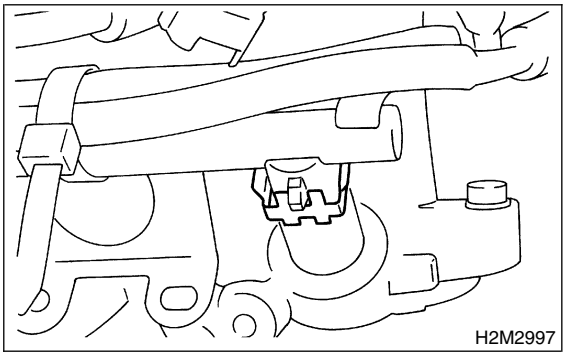
12) Remove bolt which installs injector pipe to intake manifold.



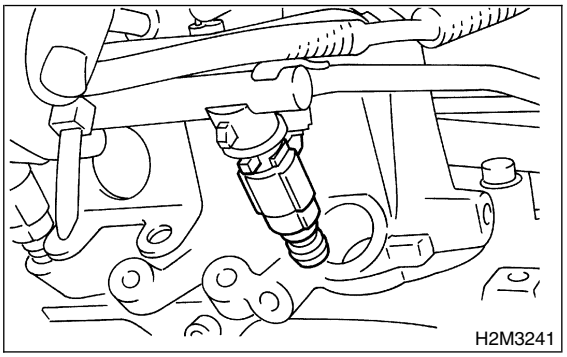
13) Remove bolt which holds fuel pipe on the left side intake manifold.



14) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip.

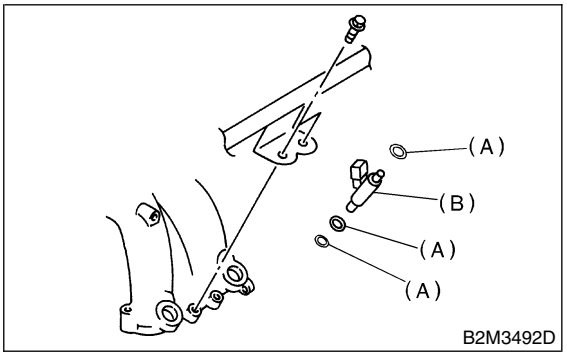


(2) Remove fuel injector while lifting up fuel injector pipe.



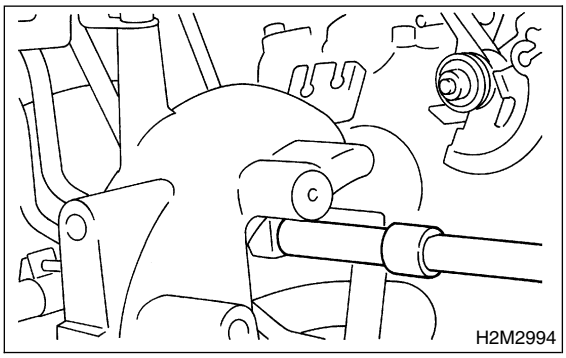
15) Installation is in the reverse order of removal.

CAUTION:
Replace O-rings with new ones.

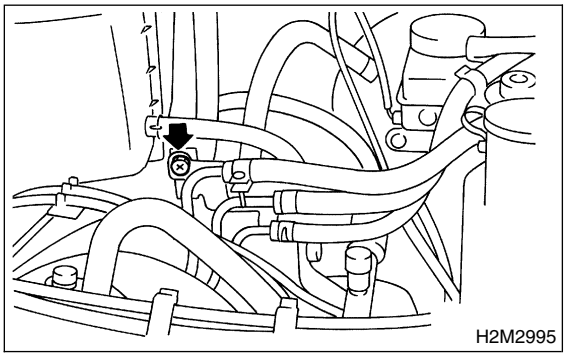


(A) O-ring
(B) Fuel injector

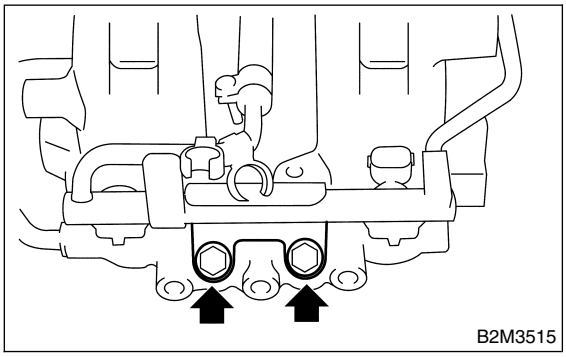
Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)



Tightening torque:
4.9±0.5 N·m (0.5±0.05 kg-m, 3.6±0.4 ft-lb)



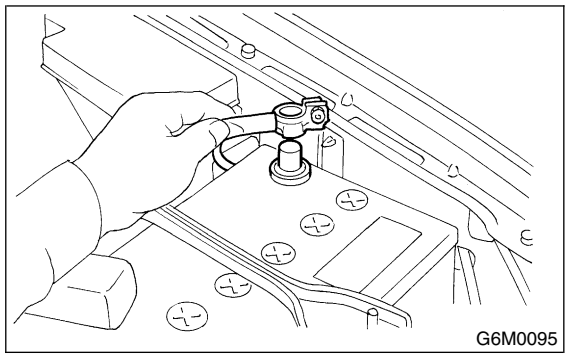
Tightening torque:
18.6±1.5 N·m (1.9±0.15 kg-m, 13.7±1.1 ft-lb)



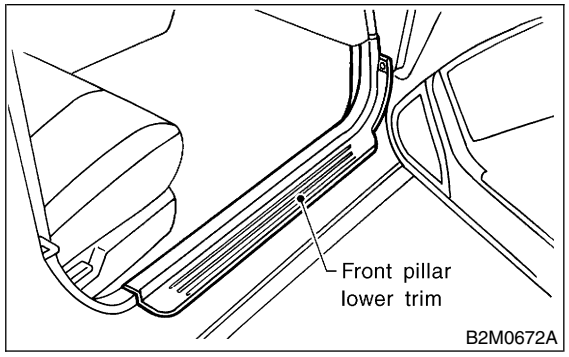
17. Engine Control Module

A: REMOVAL AND INSTALLATION

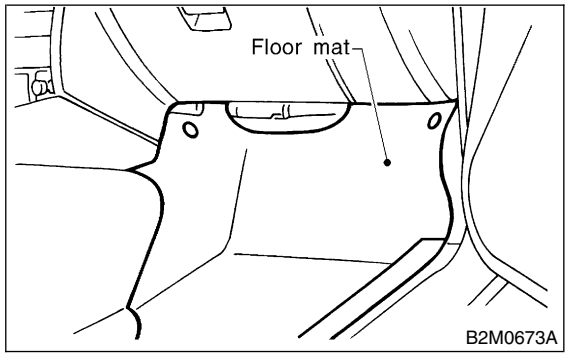
1) Disconnect battery ground cable.



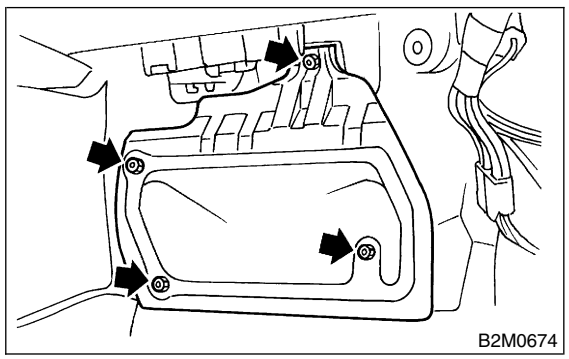
2) Remove side sill front cover.
<Ref. to 5-3 [W5A1].>



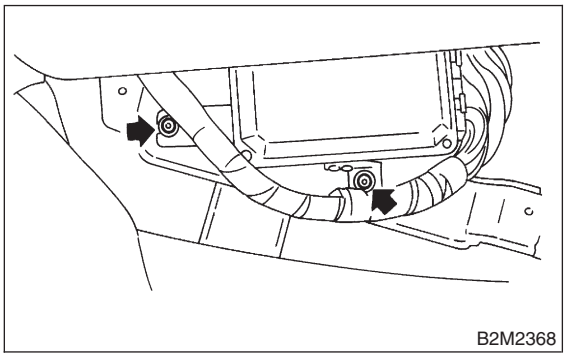
3) Detach floor mat of front passenger seat.



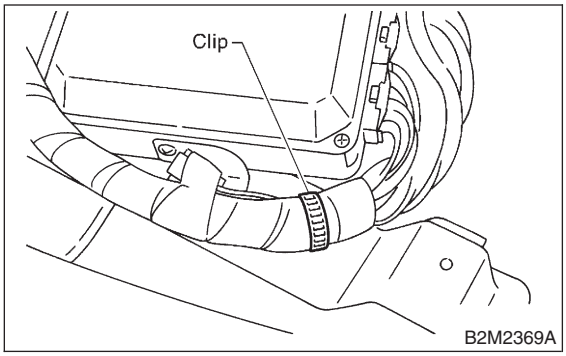
4) Remove protect cover.



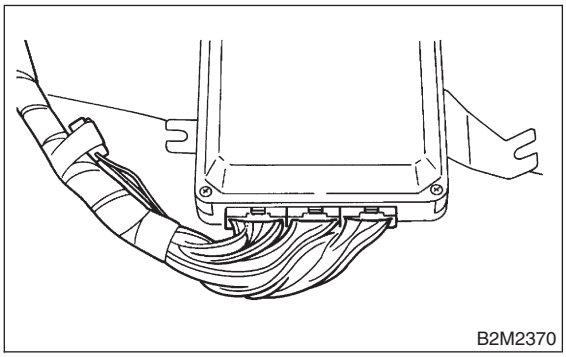
5) Remove nuts which hold ECM to bracket.



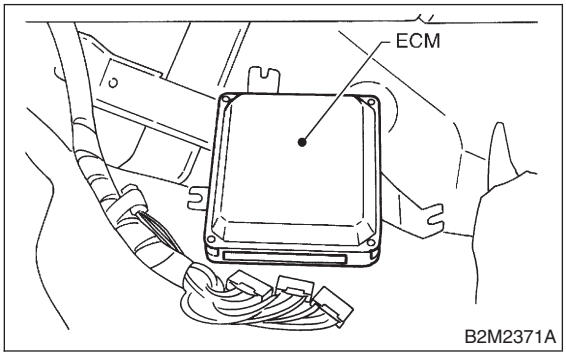
6) Remove clip from bracket.



7) Disconnect ECM connectors.



8) Take out ECM.



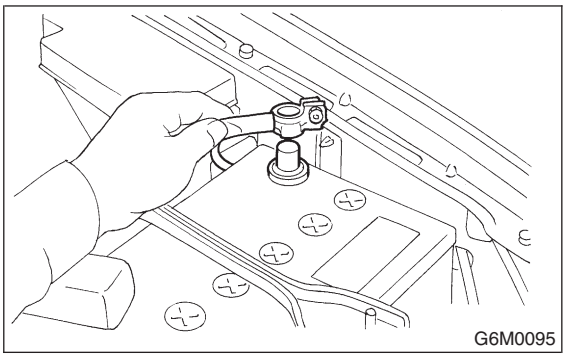
9) Installation is in the reverse order of removal.

CAUTION:
When replacing ECM, be careful not to use the wrong spec. ECM to avoid any damage to the fuel injection system.

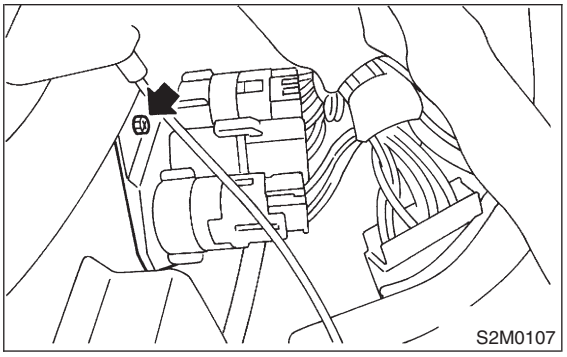
18. Main Relay

A: REMOVAL AND INSTALLATION

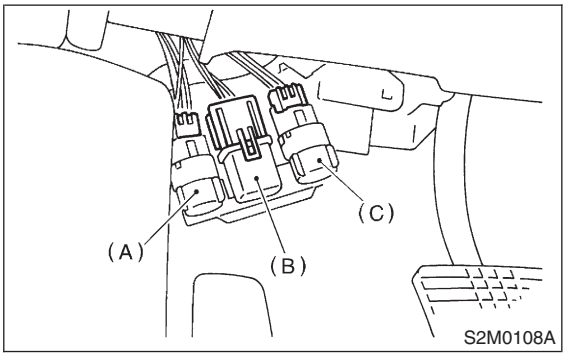
1) Disconnect battery ground cable.



2) Remove bolt which holds bracket of main relay and fuel pump relay.

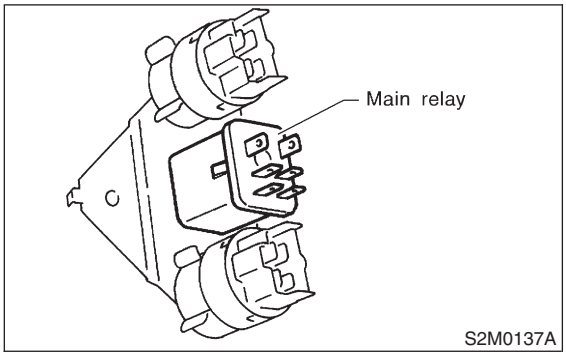


3) Disconnect connectors from relays.



(A) Rear accessory power supply relay
(B) Main relay
(C) Fuel pump relay

4) Remove main relay from mounting bracket.

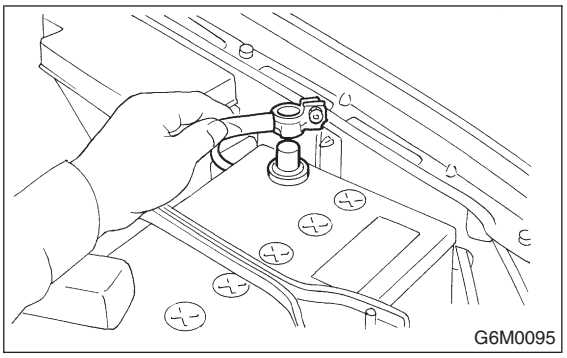


5) Installation is in the reverse order of removal.

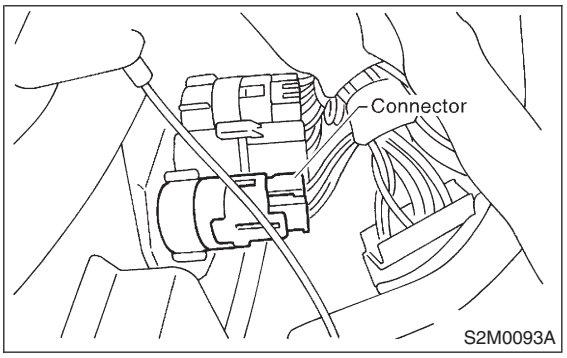
19. Fuel Pump Relay

A: REMOVAL AND INSTALLATION

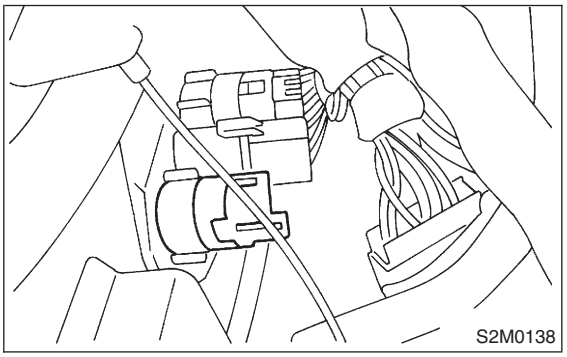
1) Disconnect battery ground cable.



2) Disconnect connector from fuel pump relay.



3) Remove fuel pump relay from mounting bracket.



4) Installation is in the reverse order of removal.

ON-BOARD DIAGNOSTICS II SYSTEM 2-7

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T DIAGNOSTICS AIRBAG 2
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1. General

A: GENERAL DESCRIPTION

● The on-board diagnostics (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter indicates occurrence of a fault or trouble.
● Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
● The OBD system incorporated with the vehicles within this engine family complies with Section 1968.1, California Code of Regulations (OBD-II regulation). The OBD system monitors the components and the system malfunction listed in Engine Section which affects on emissions.
● When the system decides that a malfunction occurs, MIL illuminates. At the same time of the MIL illumination or blinking, a diagnostic trouble code (DTC) and a freeze frame engine conditions are stored into on-board computer.
● The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer when it detects a malfunction first.
● If the OBD system detects the various malfunctions including the fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
● When the malfunction does not occur again for three consecutive driving cycles, MIL is turned off, but DTC remains at on-board computer.
● The OBD-II system is capable of communication with a general scan tool (OBD-II general scan tool) formed by ISO 9141 CARB.
● The OBD-II diagnostics procedure is different from the usual diagnostics procedure. When troubleshooting OBD-II vehicles, connect Subaru Select Monitor or the OBD-II general scan tool to the vehicle.

B: ENGINE

1. ENGINE AND EMISSION CONTROL SYSTEM

● The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.
With this system fuel, which is pressurized at a constant pressure, is injected into the intake air passage of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where the electro-magnetic injection valve (fuel injector) opens only for a short period of time, depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.
● Further, all the operating conditions of the engine are converted into electric signals, and this results in additional features of the system, such as large improved adaptability, easier addition of compensating element, etc.
The MFI system also has the following features:
- Reduced emission of harmful exhaust gases.
- Reduced in fuel consumption.
- Increased engine output.
- Superior acceleration and deceleration.
- Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.

C: AUTOMATIC TRANSMISSION

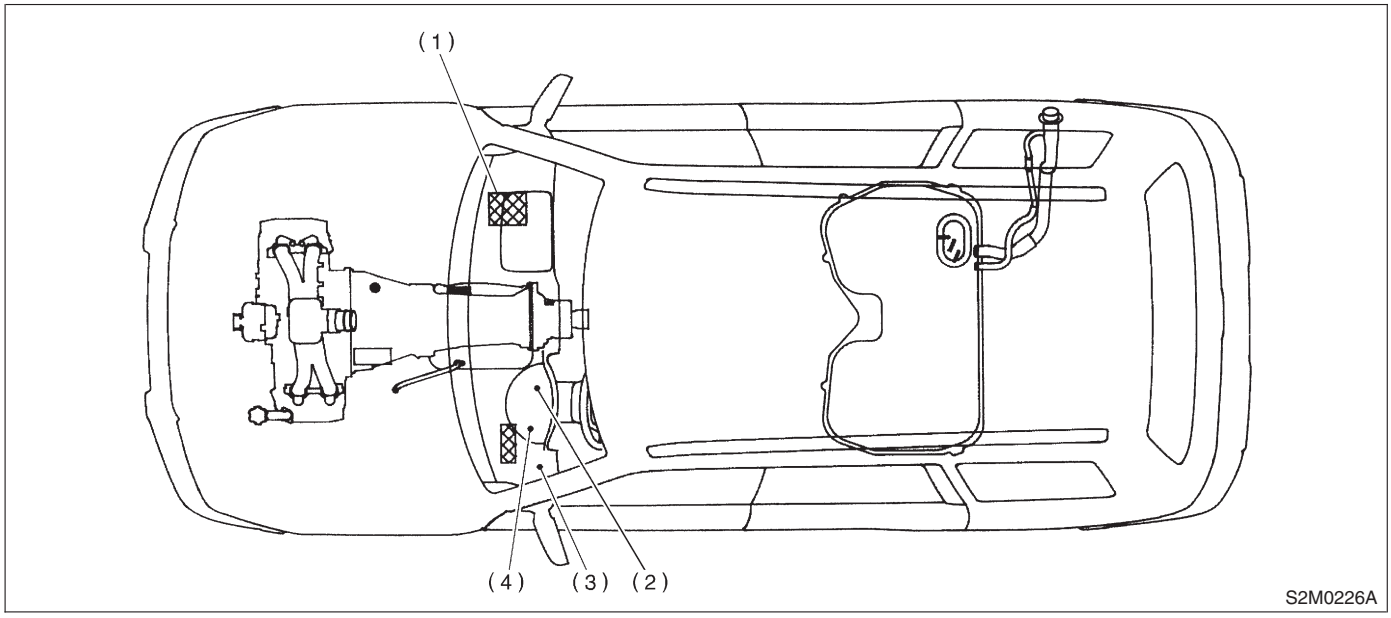
1. ELECTRONIC-HYDRAULIC CONTROL SYSTEM

The electronic-hydraulic control system consists of various sensors and switches, a transmission control module (TCM) and the hydraulic controller including solenoid valves. The system controls the transmission proper including shift control, lock-up control, overrunning clutch control, line pressure control and shift timing control. It also controls the AWD transfer clutch. In other words, the system detects various operating conditions from various input signals and sends output signals to shift solenoids 1, 2 and low clutch timing solenoid and 2-4 brake timing solenoid, line pressure duty solenoid, lock-up duty solenoid, transfer duty solenoid and 2-4 brake duty solenoid (a total of eight solenoids).

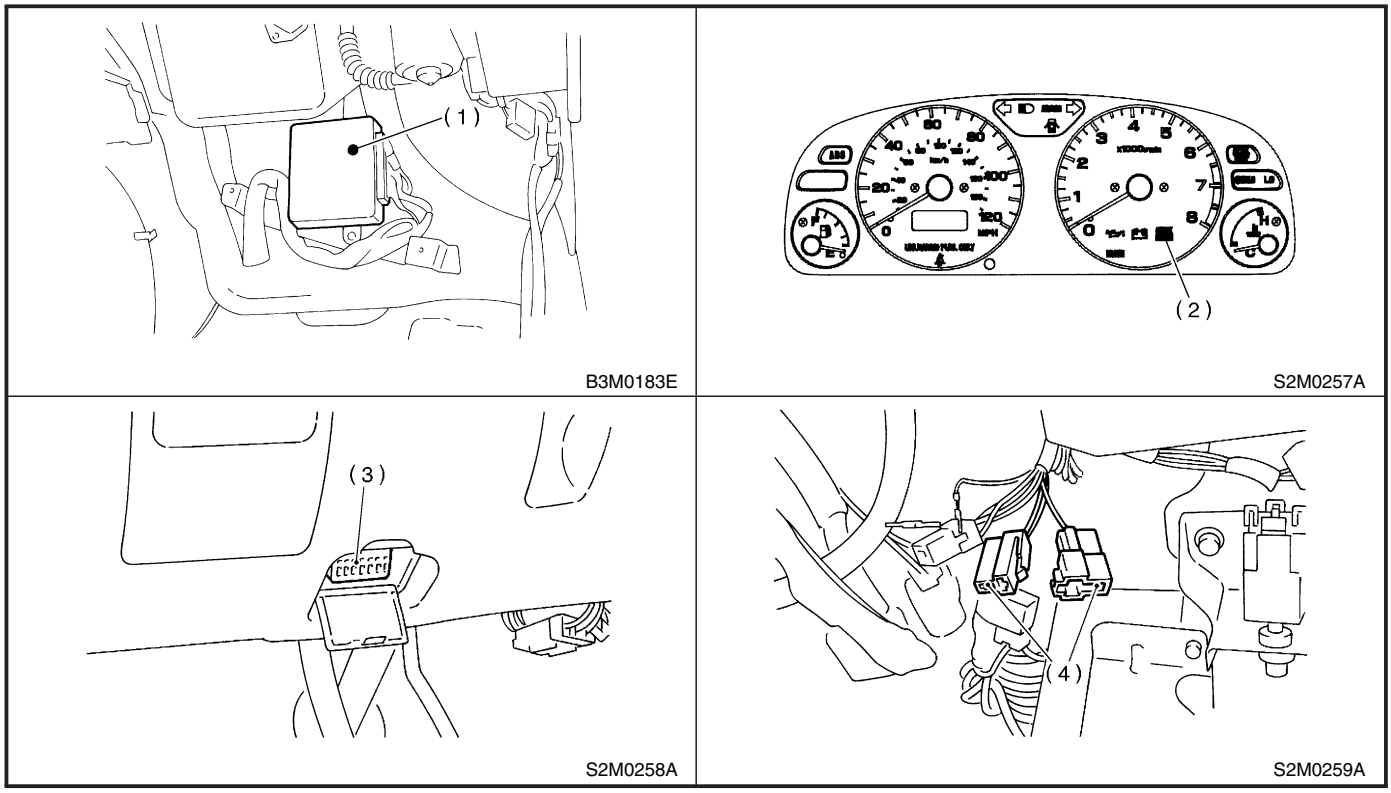
2. Electrical Components Location

A: ENGINE

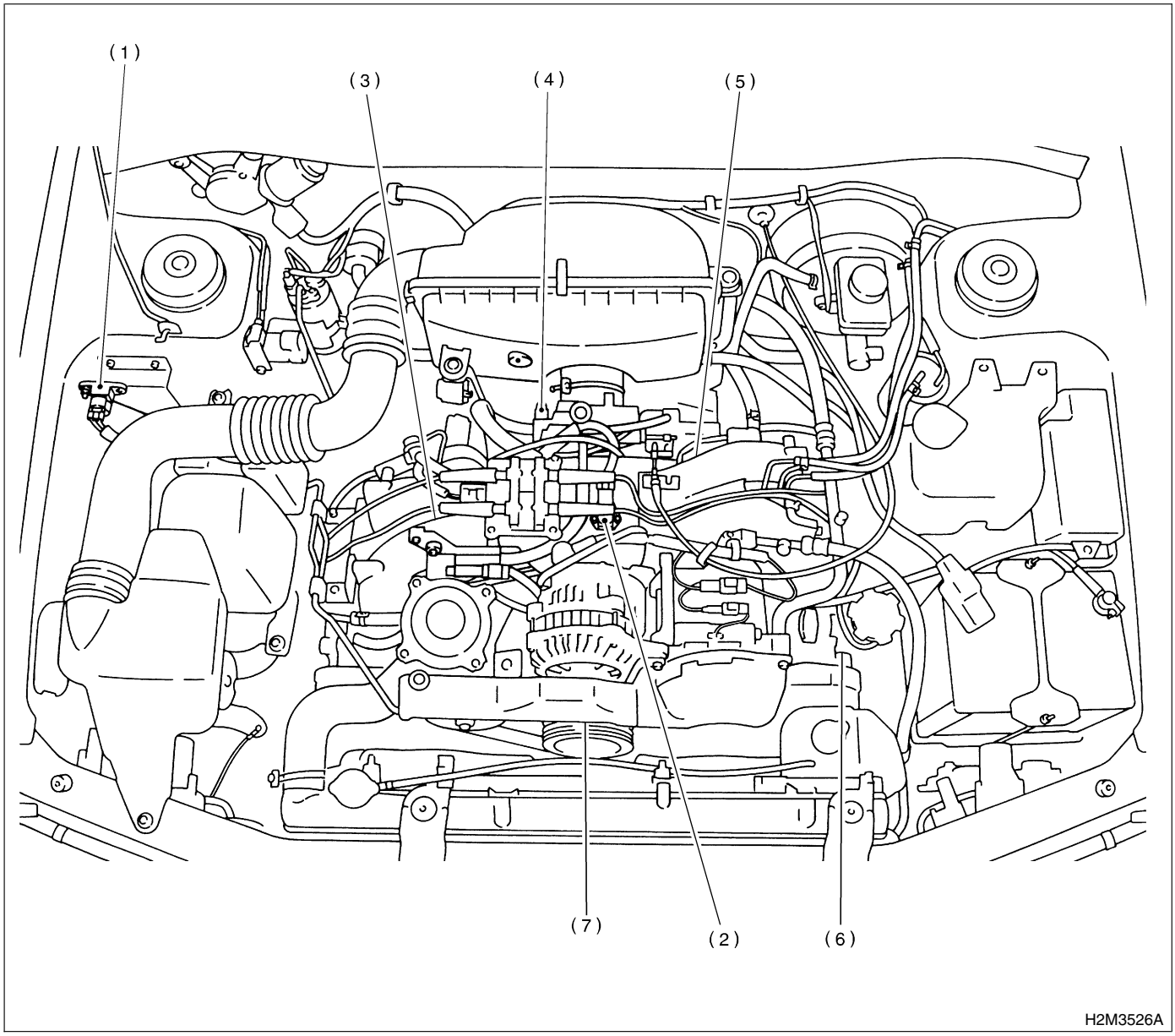
1. MODULE



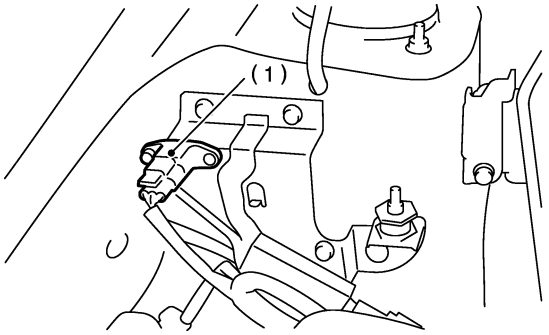
(1) Engine control module (ECM)
(2) CHECK ENGINE malfunction indicator lamp (MIL)
(3) Data link connector
(4) Test mode connector



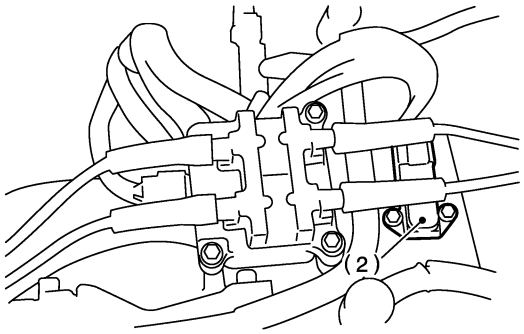
2. SENSOR



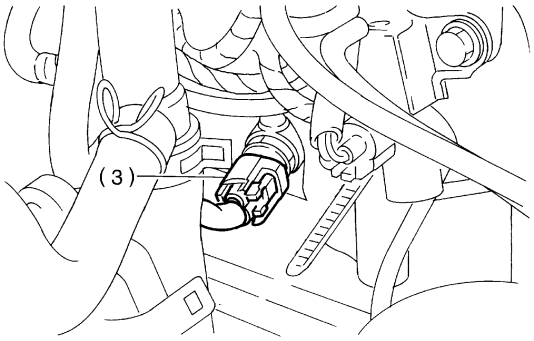
(1) Atmospheric pressure sensor
(2) Intake air temperature and pressure sensor
(3) Engine coolant temperature sensor
(4) Throttle position sensor
(5) Knock sensor
(6) Camshaft position sensor
(7) Crankshaft position sensor



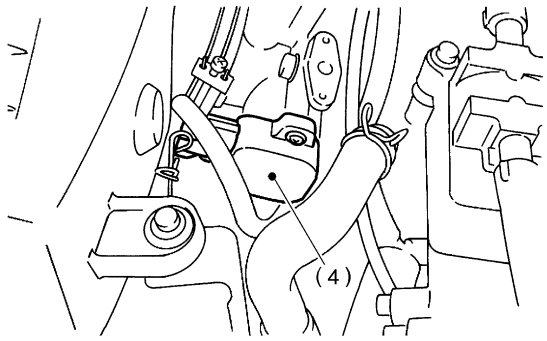
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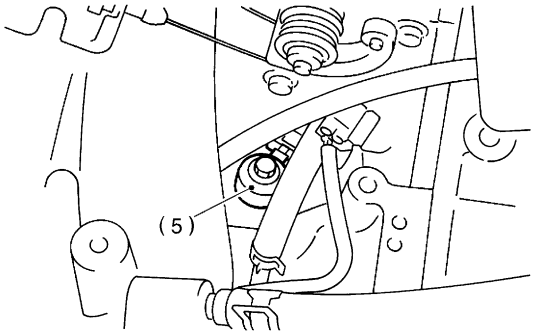
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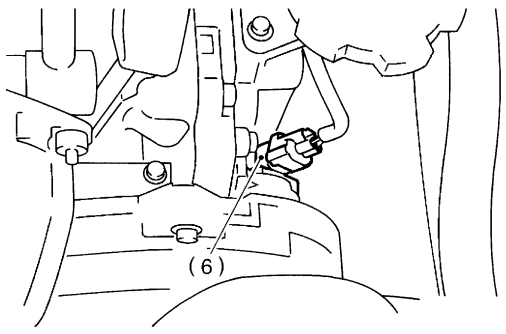
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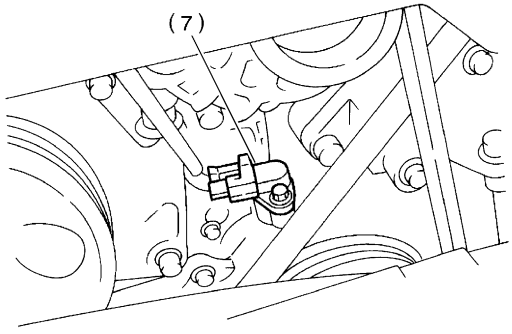
B2M2240A



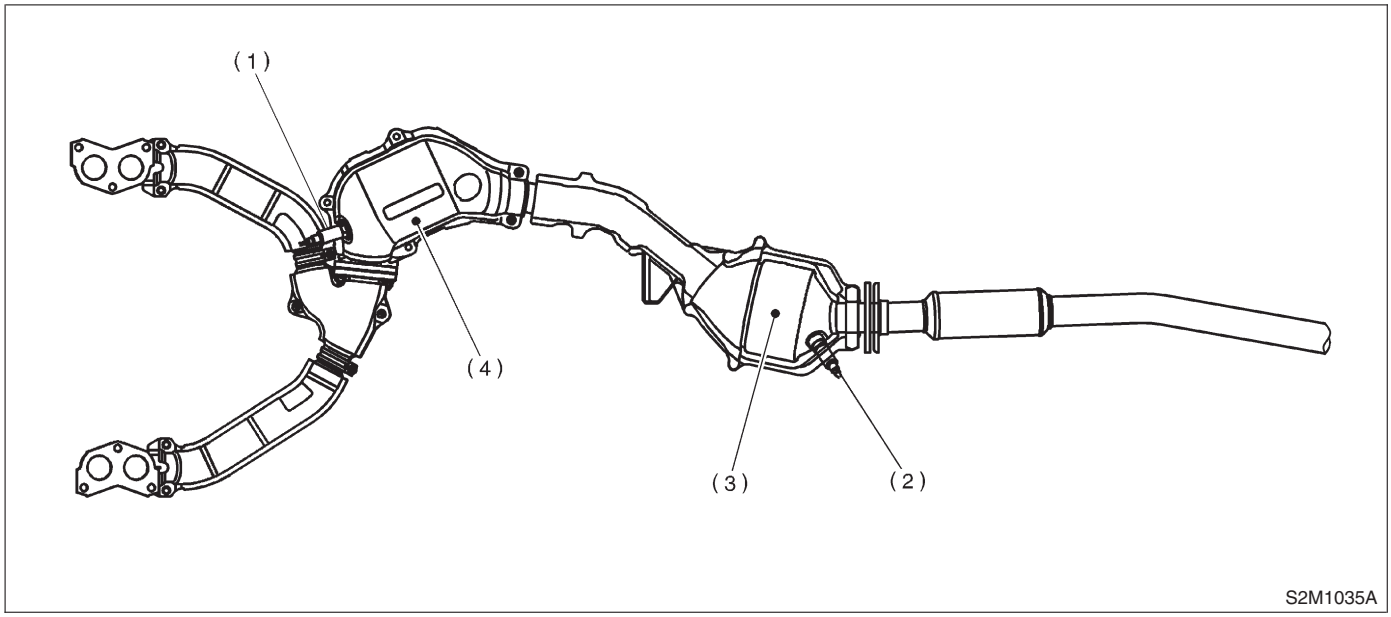
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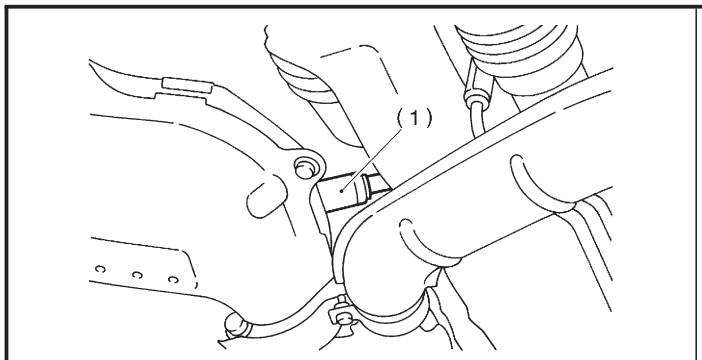
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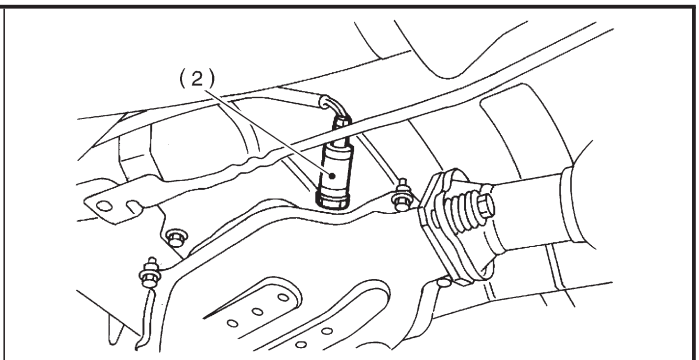


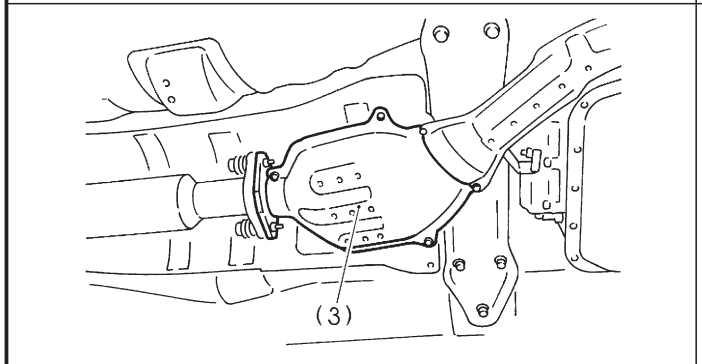
B2M0213J

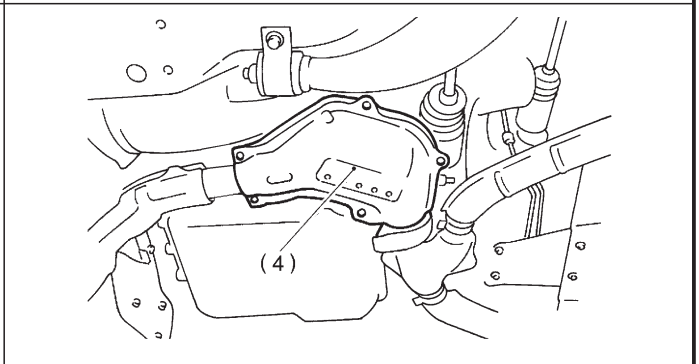


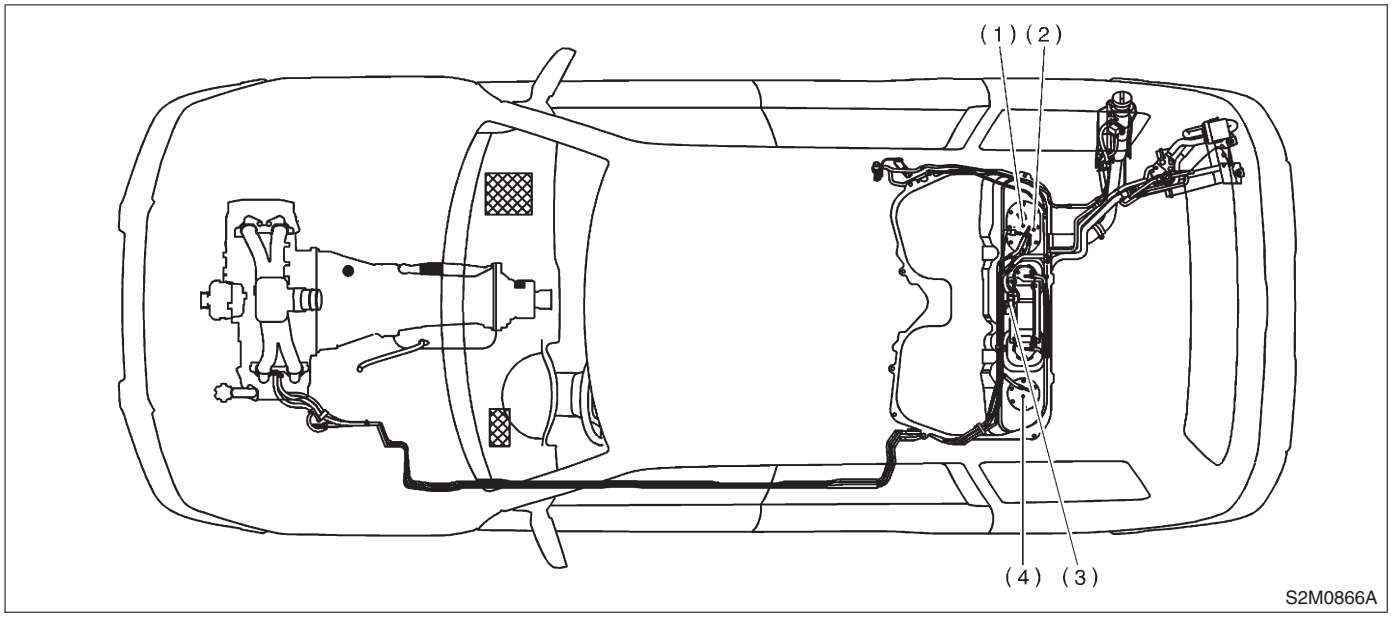
(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Rear catalytic converter
(4) Front catalytic converter



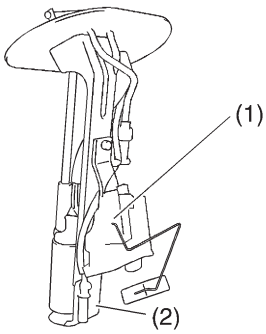


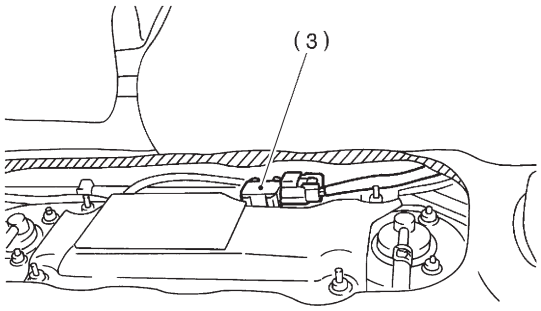


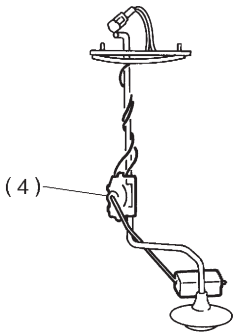




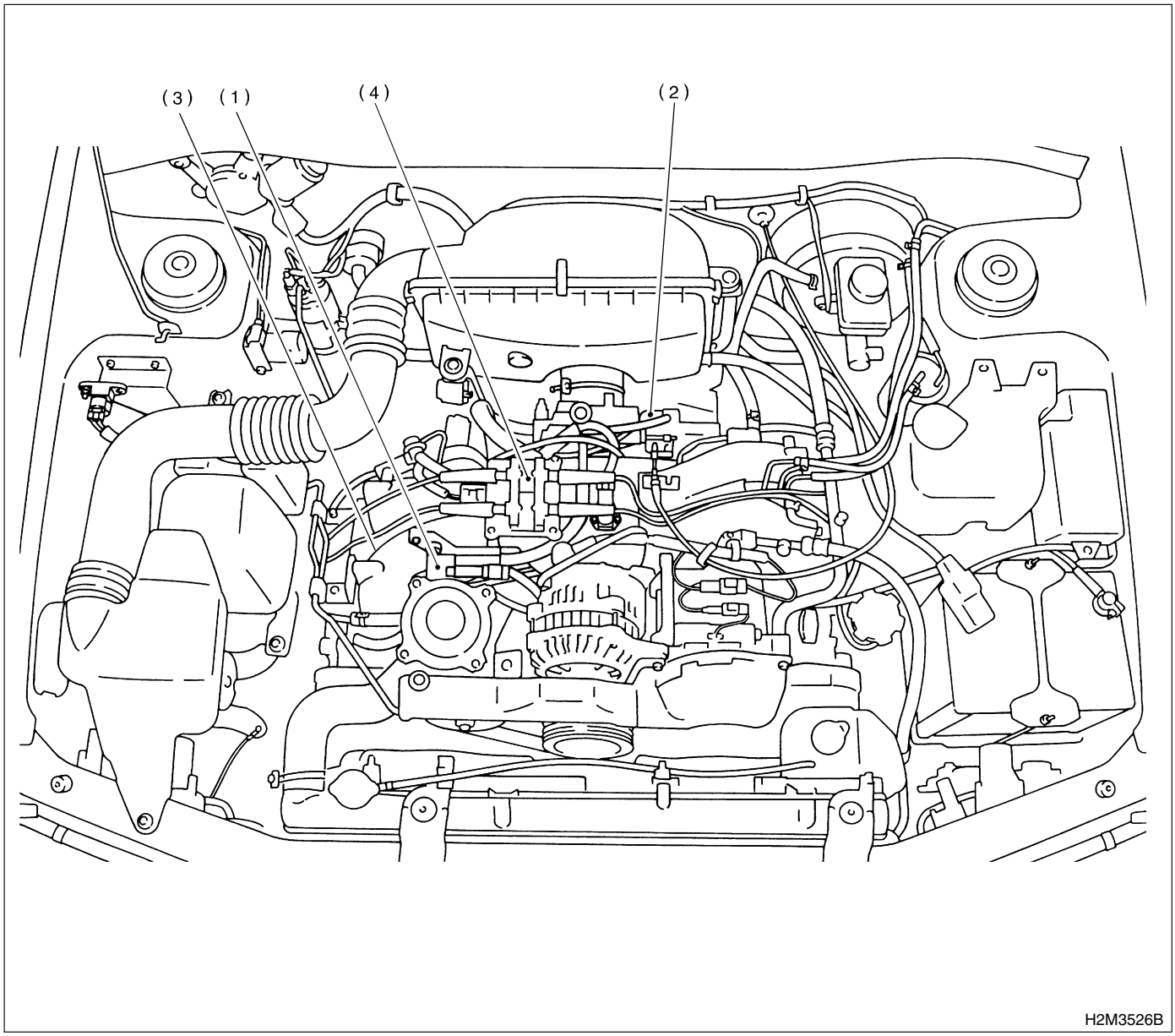
(1) Fuel level sensor (Main)
(2) Fuel temperature sensor
(3) Fuel tank pressure sensor
(4) Fuel level sensor (Sub)



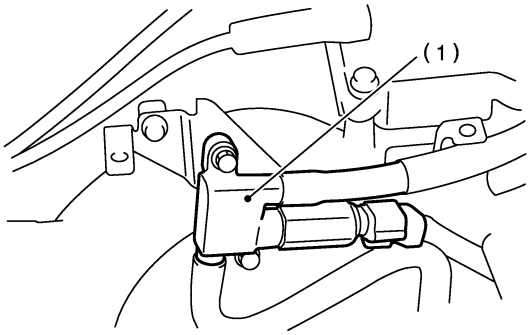




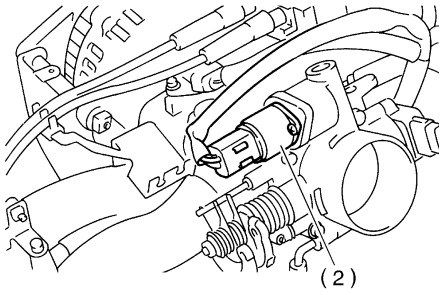
3. SOLENOID VALVE, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS



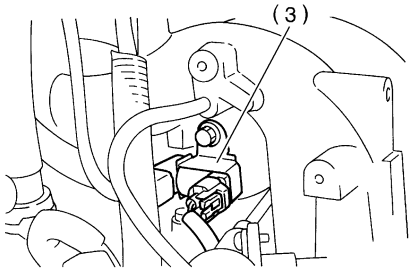
(1) Air assist injector solenoid valve
(2) Idle air control solenoid valve
(3) Purge control solenoid valve
(4) Ignition coil & ignitor ASSY



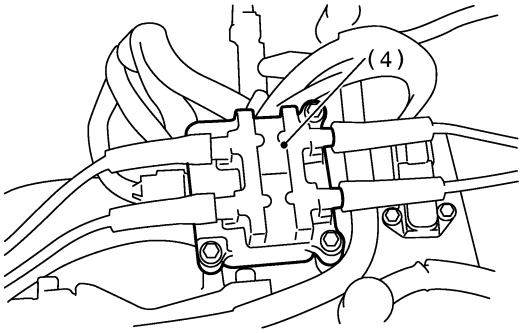
B2M3715A



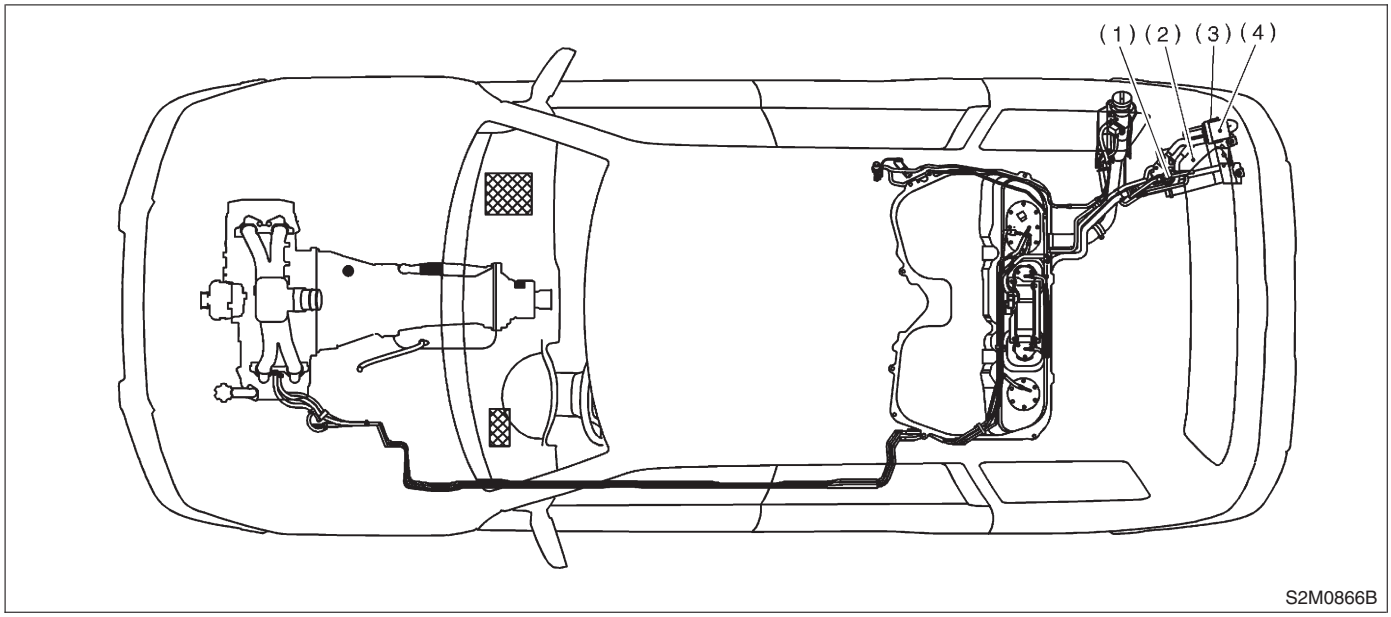
H2M3259A



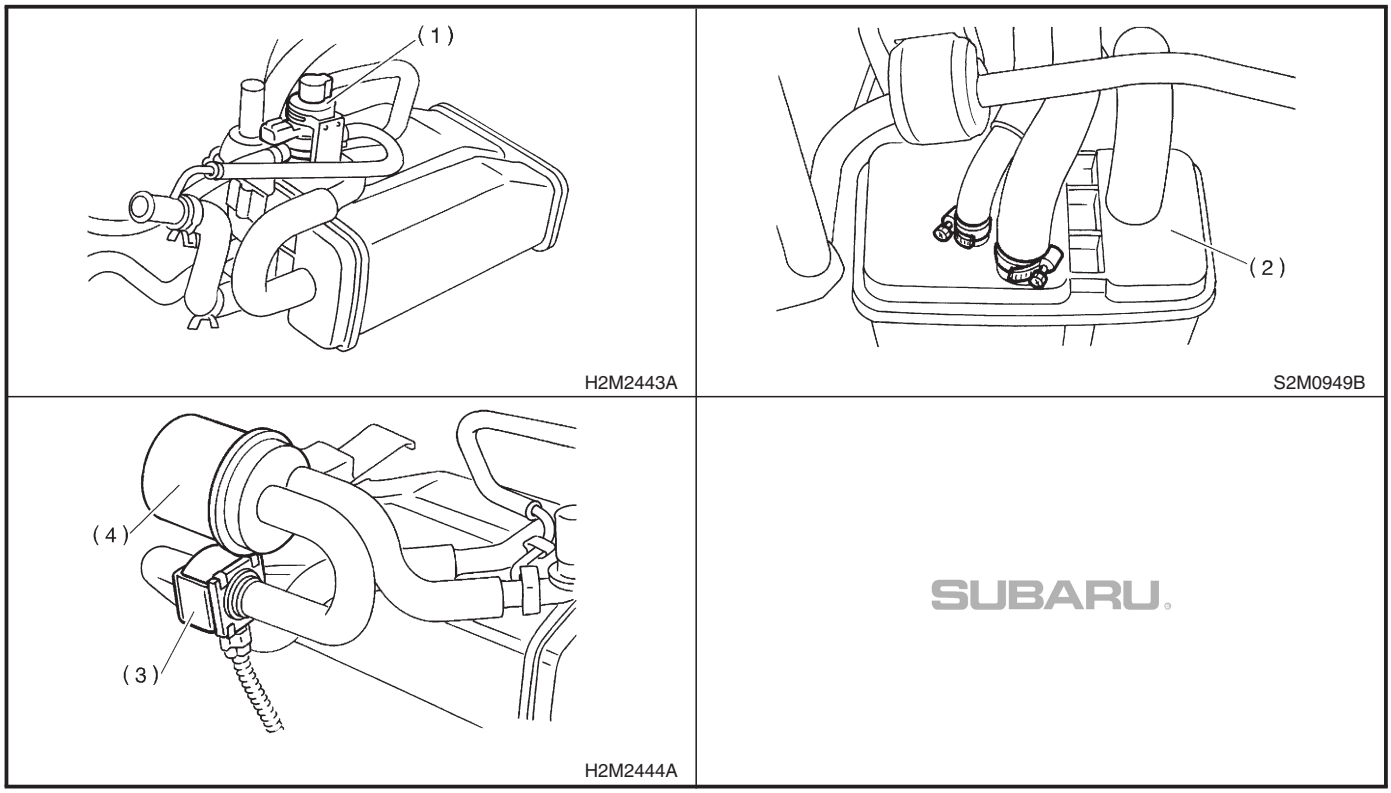
H2M3258B



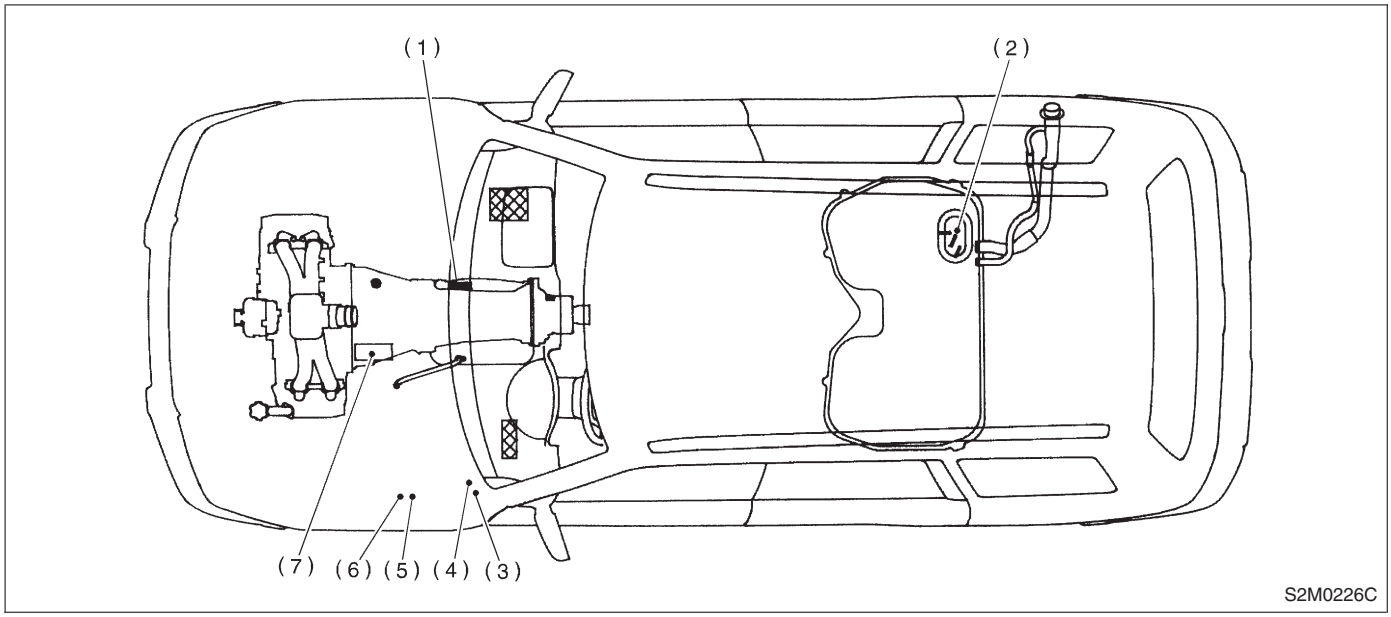
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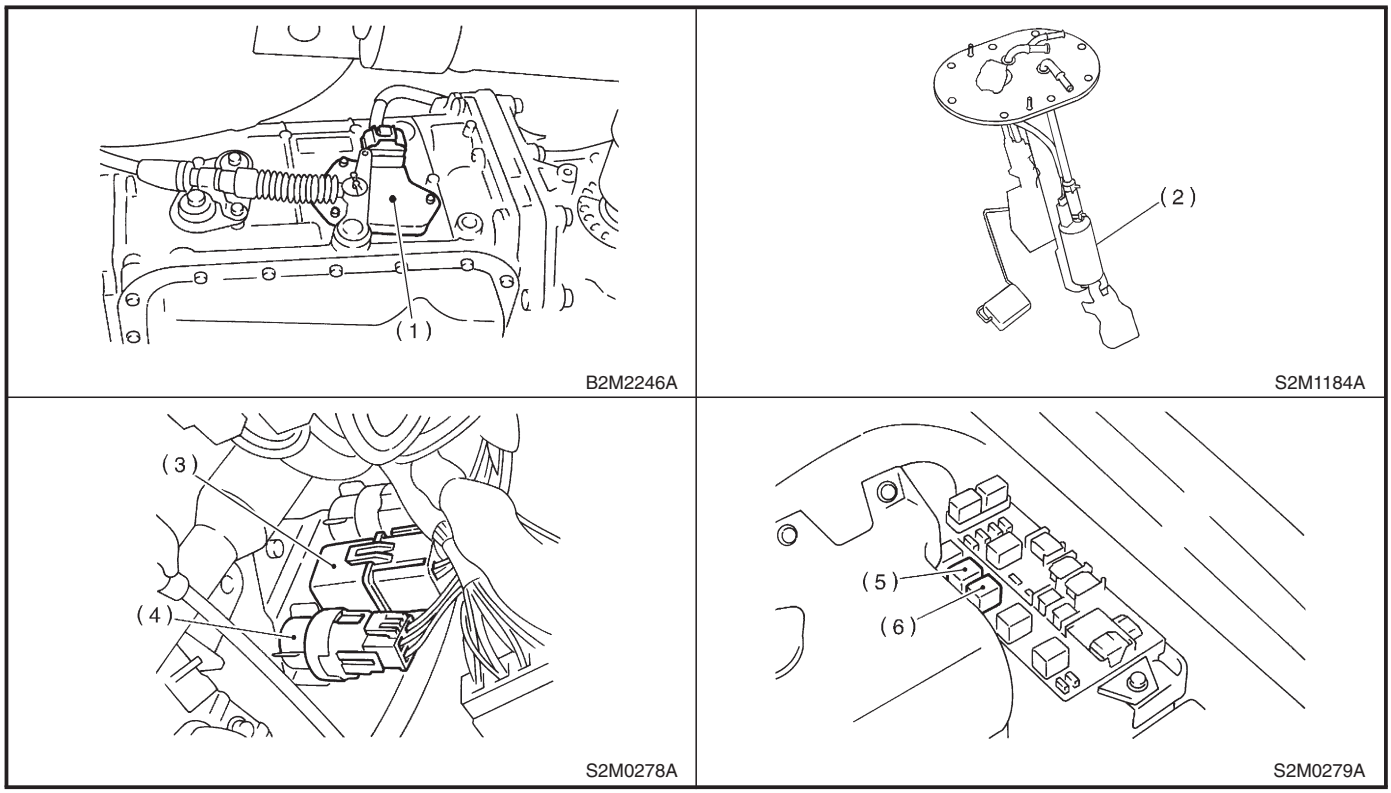
(1) Pressure control solenoid valve
(2) Canister
(3) Drain valve
(4) Air filter

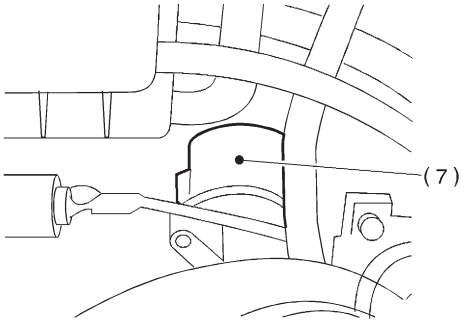


MEMO:



(1) Inhibitor switch
(2) Fuel pump
(3) Main relay
(4) Fuel pump relay
(5) Radiator cooling main fan relay
(6) Radiator cooling sub fan relay
(7) Starter

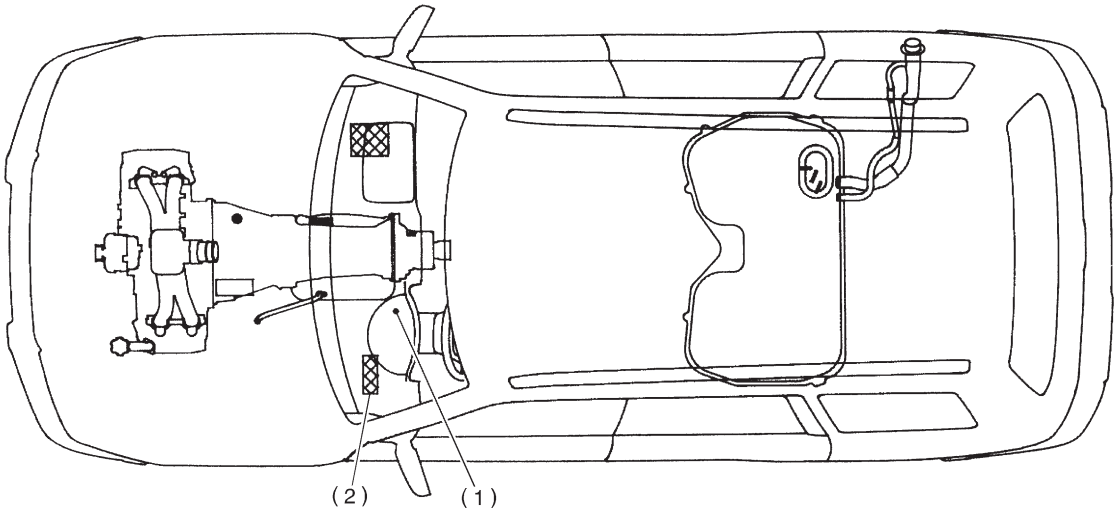




B2M2247B

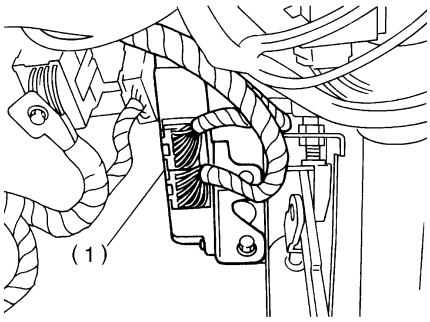
B: TRANSMISSION

1. MODULE

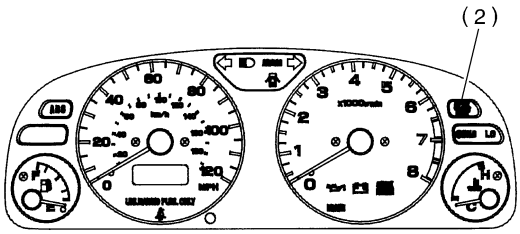


S2M0226D

(1) Transmission Control Module (TCM) (for AT vehicles)
(2) AT diagnostic indicator light (for AT vehicles)

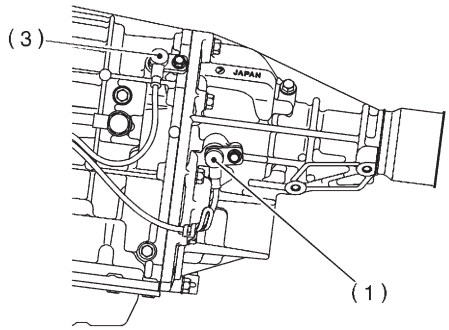


B3M1666D

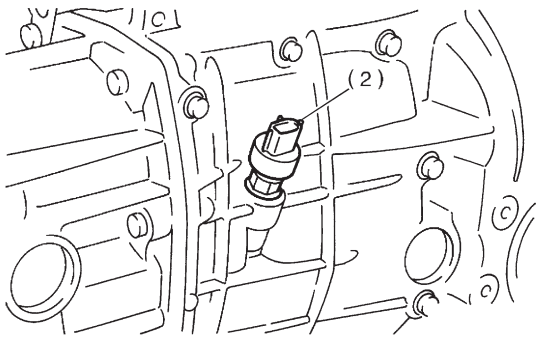


S2M0217C

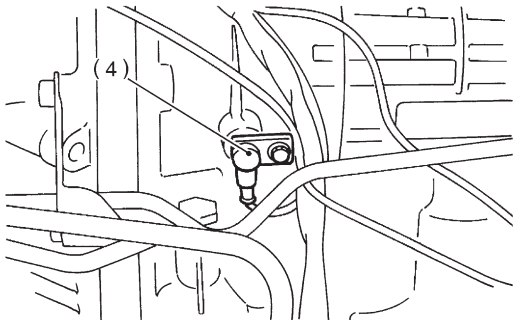
2. SENSOR



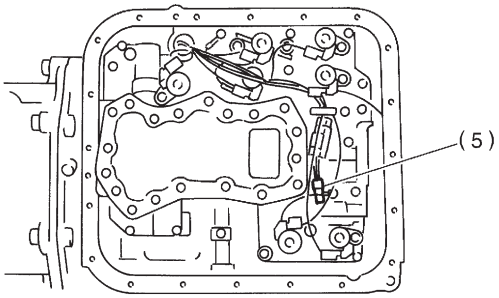
B2M2258A



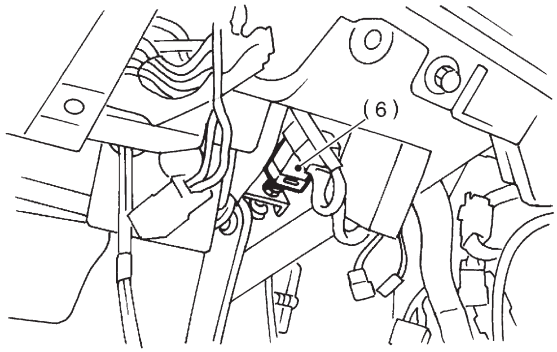
B2M2259A



B2M2260A



B2M2261A

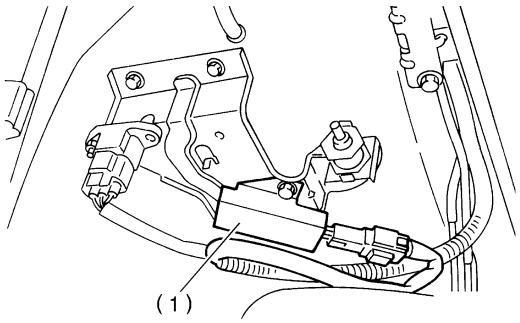


OBD0653B

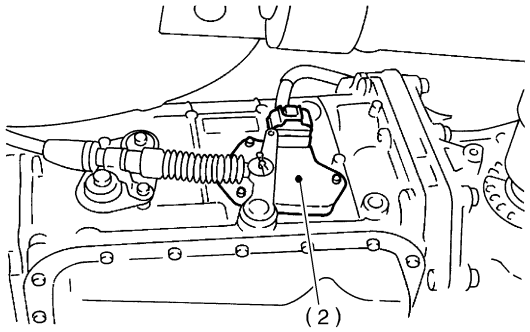
(1) Vehicle speed sensor 1 (for AT vehicles)
(2) Vehicle speed sensor 2 (for MT vehicles)
(3) Vehicle speed sensor 2 (for AT vehicles)
(4) Torque converter turbine speed sensor
(5) ATF temperature sensor (for AT vehicles)
(6) Brake light switch

3. SOLENOID VALVE AND RELAY

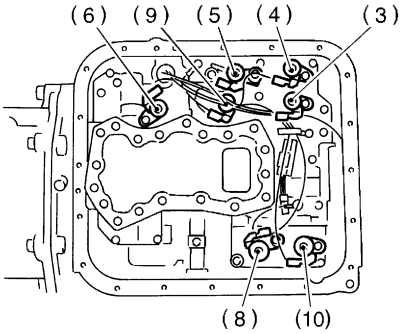
- **For AT vehicles**



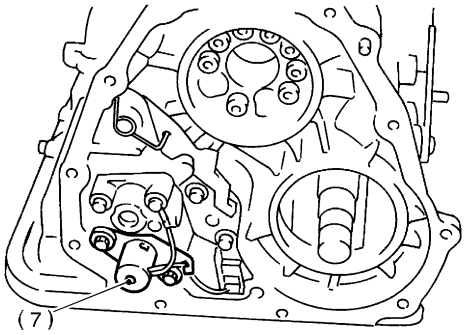
B3M1670C



B2M2246B



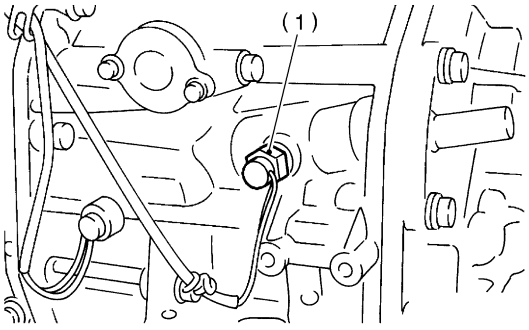
B2M2263A



B2M2264A

(1) Dropping resistor
(2) Inhibitor switch
(3) Shift solenoid valve 1
(4) Shift solenoid valve 2
(5) Line pressure duty solenoid
(6) Lock up duty solenoid
(7) Transfer duty solenoid
(8) 2-4 brake duty solenoid
(9) Low clutch timing solenoid valve
(10) 2-4 brake timing solenoid valve

- **For MT vehicles**



B2M2265A

(1) Neutral position switch

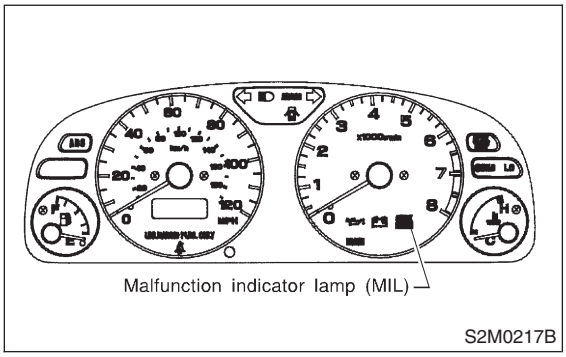
3. Diagnosis System

A: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL)

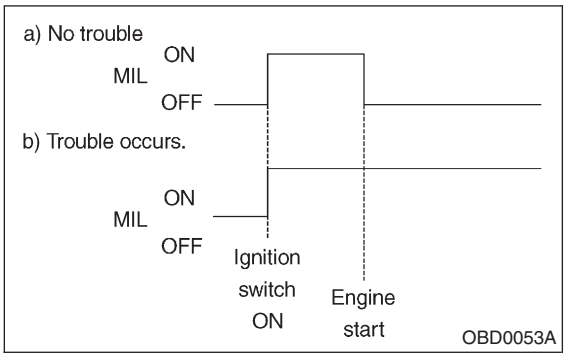
1. ACTIVATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL)

1) When ignition switch is turned to ON (engine off), the CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter illuminates.

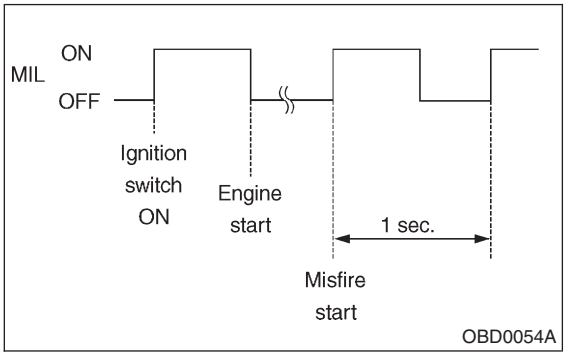
NOTE:
If the MIL does not illuminate, perform diagnostics of the CHECK ENGINE light circuit or the combination meter circuit. <Ref. to 2-7 [T700].>



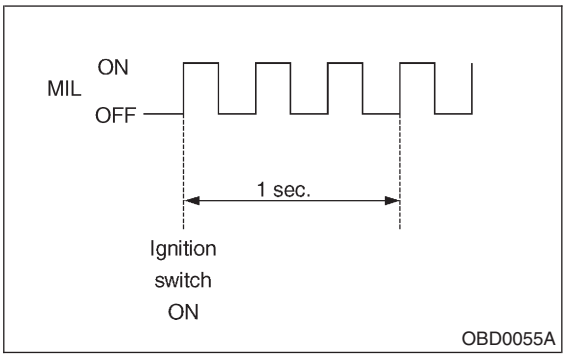
2) After starting the engine, the MIL goes out. If it does not, either the engine or the emission control system is malfunctioning.



3) If the diagnosis system senses a misfire which could damage the catalyzer, the MIL will blink at a cycle of 1 Hz.



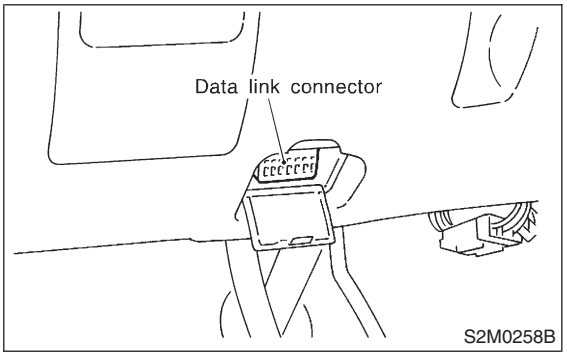
4) When ignition switch is turned to ON (engine off) or to “START” with the test mode connector connected, the MIL blinks at a cycle of 3 Hz.



B: OBD-II GENERAL SCAN TOOL

1. HOW TO USE OBD-II GENERAL SCAN TOOL

1) Prepare a general scan tool (OBD-II general scan tool) required by SAE J1978.
2) Open the cover and connect the OBD-II general scan tool to the data link connector located in the lower portion of the instrument panel (on the driver’s side).



3) Using the OBD-II general scan tool, call up diagnostic trouble code(s) and freeze frame data.
OBD-II general scan tool functions consist of:
(1) MODE $01: Current powertrain diagnostic data
(2) MODE $02: Powertrain freeze frame data
(3) MODE $03: Emission-related powertrain diagnostic trouble codes
(4) MODE $04: Clear/Reset emission-related diagnostic information

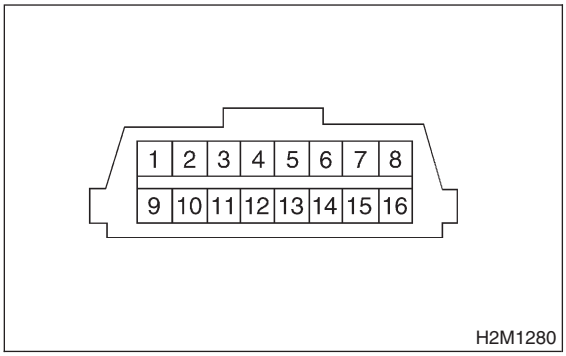
Read out data according to repair procedures. (For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual.)

NOTE:
For details concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST.
<Ref. to 2-7 [T10A0].>

2. DATA LINK CONNECTOR (FOR OBD-II GENERAL SCAN TOOL AND SUBARU SELECT MONITOR)

1) This connector is used both for OBD-II general scan tools and the Subaru Select Monitor.
2) Terminal No. 4 to No. 6 of the data link connector is used for the Subaru Select Monitor signal.

CAUTION:
Do not connect any scan tools other than the OBD-II general scan tools and the Subaru Select Monitor, because the circuit for the Subaru Select Monitor may be damaged.



Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	K line of ISO 9141 CARB
3	Blank	11	Blank
4	Subaru Select Monitor signal (ECM to Subaru Select Monitor)*	12	Ground
5	Subaru Select Monitor signal (Subaru Select Monitor to ECM)*	13	Ground
6	Blank	14	Blank
7	Blank	15	Blank
8	Blank	16	Blank

*: Circuit only for Subaru Select Monitor

3. CURRENT POWERTRAIN DIAGNOSTIC DATA (MODE $01)

Refers to data denoting the current operating condition of analog input/output, digital input/output and/or the powertrain system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
01	Number of emission-related powertrain trouble codes and MIL status	ON/OFF
03	Fuel system control status	—
04	Calculated engine load value	%
05	Engine coolant temperature	°C
06	Short term fuel trim	%
07	Long term fuel trim	%
0B	Intake manifold absolute pressure	kPa
0C	Engine revolution	rpm
0D	Vehicle speed	km/h
0E	Ignition timing advance	°
10	Air flow rate from pressure sensor	g/sec
11	Throttle valve opening angle	%
13	Check whether oxygen sensor is installed.	—
14	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor—bank 1	V and %
15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor—bank 2	V and %
1C	On-board diagnosis system	—

NOTE:
Refer to OBD-II general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE $01).

4. POWERTRAIN FREEZE FRAME DATA (MODE $02)

Refers to data denoting the operating condition when trouble is sensed by the on-board diagnosis system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
02	Trouble code that caused CARB required freeze frame data storage	—
03	Fuel system control status	—
04	Calculated engine load value	%
05	Engine coolant temperature	°C
06	Short term fuel trim	%
07	Long term fuel trim	%
0B	Intake manifold absolute pressure	kPa
0C	Engine revolution	rpm
0D	Vehicle speed	km/h

NOTE:
Refer to OBD-II general scan tool manufacturer's instruction manual to access freeze frame data (MODE $02).

5. EMISSION-RELATED POWERTRAIN DIAGNOSTIC TROUBLE CODE (MODE $03)

Refers to data denoting emission-related powertrain diagnostic trouble codes.
For details concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST. <Ref. to 2-7 [T10A0].>

NOTE:
Refer to OBD-II general scan tool manufacturer's instruction manual to access emission-related powertrain diagnostic trouble codes (MODE $03).

6. CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION (MODE $04)

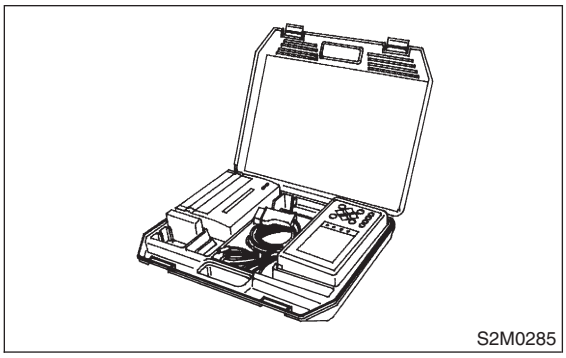
Refers to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

NOTE:
Refer to OBD-II general scan tool manufacturer's instruction manual to clear or reset emission-related diagnostic information (MODE $04).

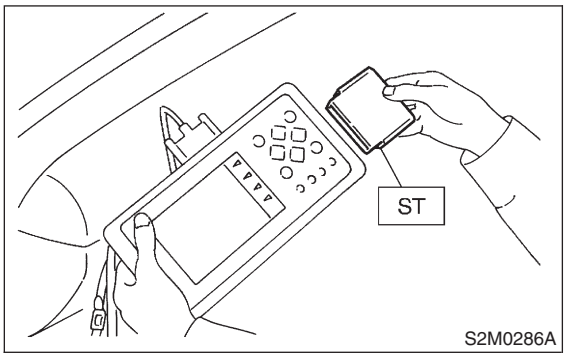
C: SUBARU SELECT MONITOR

1. HOW TO USE SUBARU SELECT MONITOR

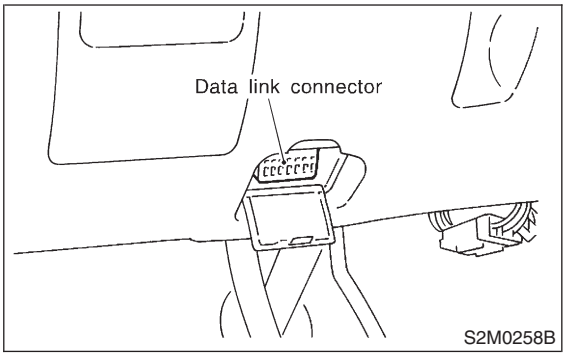
1) Prepare Subaru Select Monitor kit.



2) Connect diagnosis cable to Subaru Select Monitor.
3) Insert cartridge into Subaru Select Monitor. <Ref. to 1-6 [G1100].>



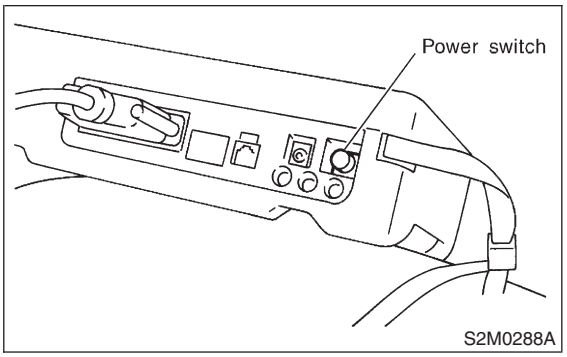
4) Connect Subaru Select Monitor to data link connector.
(1) Data link connector located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

CAUTION:
Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

5) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



6) Using Subaru Select Monitor, call up diagnostic trouble code(s) and various data, then record them.

2. READ DIAGNOSTIC TROUBLE CODE (DTC) SHOWN ON DISPLAY FOR ENGINE. (NORMAL MODE)

1) On the 「Main Menu」 display screen, select the {Each System Check} and press the [YES] key.
2) On the 「System Selection Menu」 display screen, select the {Engine Control System} and press the [YES] key.

3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {Diagnostic Code(s) Display} and press the [YES] key.
5) On the ┌Diagnostic Code(s) Display┘ display screen, select the {Current Diagnostic Code(s)} or {History Diagnostic Code(s)} and press the [YES] key.

NOTE:
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
● For detailed concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST.
<Ref. to 2-7 [T10A0].>

3. READ DIAGNOSTIC TROUBLE CODE (DTC) SHOWN ON DISPLAY FOR ENGINE. (OBD MODE)

1) On the ┌Main Menu┘ display screen, select the {2. Each System Check} and press the [YES] key.
2) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {OBD System} and press the [YES] key.
5) On the ┌OBD Menu┘ display screen, select the {Diagnosis Code(s) Display} and press the [YES] key.
6) Make sure that a diagnostic trouble code (DTC) is shown on the display screen.

NOTE:
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
● For detailed concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST.
<Ref. to 2-7 [T10A0].>

4. READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE. (NORMAL MODE)

1) On the ┌Main Menu┘ display screen, select the {Each System Check} and press the [YES] key.
2) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the ┌Data Display Menu┘ display screen, select the {Data Display} and press the [YES] key.
6) Using the scroll key, move the display screen up or down until the desired data is shown.

● A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Vehicle speed signal	Vehicle Speed	km/h or MPH
Engine speed signal	Engine Speed	rpm
Engine coolant temperature signal	Coolant Temp.	°C or °F
Ignition timing signal	Ignition Timing	deg
Throttle position signal	Throttle Opening Angle	%
Throttle position signal	Throttle Sensor Voltage	V
Injection pulse width	Fuel Injection #1 Pulse	ms
Idle air control signal	ISC Valve Step	STEP
Engine load data	Engine Load	%
Front oxygen (A/F) sensor output signal	A/F Sensor #1	—
Front oxygen (A/F) sensor resistance	A/F Sensor #1 Resistance	Ω
Rear oxygen sensor output signal	Rear O2 Sensor	V
Short term fuel trim	A/F Correction #1	%
Knock sensor signal	Knocking Correction	deg
Atmospheric absolute pressure signal	Atmosphere Pressure	mmHg or kPa or inHg or psi
Intake manifold relative pressure signal	Mani. Relative Pressure	mmHg or kPa or inHg or psi
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg or kPa or inHg or psi
A/F correction (short term fuel trim) by rear oxygen sensor	A/F Correction #3	%
Long term whole fuel trim	A/F Learning #1	%
Front oxygen (A/F) sensor heater current	A/F Heater #1	A
Rear oxygen sensor heater voltage	Rear O2 Heater Voltage	V
Canister purge control solenoid valve duty ratio	CPC Valve Duty Ratio	%
Fuel tank pressure signal	Fuel Tank Pressure	mmHg or kPa or inHg or psi
Fuel temperature signal	Fuel Temp.	°C or °F
Fuel level signal	Fuel Level	V
Intake air temperature signal	Intake Air Temp.	°C or °F
Learned ignition timing	Learned Ignition Timing	V
Ignition switch signal	Ignition Switch	ON or OFF
Test mode connector signal	Test Mode Signal	ON or OFF
Neutral position switch signal	Neutral Position Switch	ON or OFF
Air conditioning switch signal	A/C Switch	ON or OFF
Air conditioning relay signal	A/C Relay	ON or OFF
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF
Fuel pump relay signal	Fuel Pump Relay	ON or OFF
Knocking signal	Knocking Signal	ON or OFF
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF
Engine torque control signal #1	Torque Control Signal #1	ON or OFF

Contents	Display	Unit of measure
Engine torque control signal #2	Torque Control Signal #2	ON or OFF
Engine torque control permission signal	Torque Control Permit	ON or OFF
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF
Pressure control solenoid valve	PCV Solenoid Valve	ON or OFF
Drain valve	Vent. Solenoid Valve	ON or OFF
Starter switch signal	Starter Switch Signal	ON or OFF
Idle switch signal	Idle Switch Signal	ON or OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF
Rear defogger switch signal	Rear Defogger Switch	ON or OFF
Blower fan switch signal	Blower Fan Switch	ON or OFF
Small light switch signal	Small Light Switch	ON or OFF
Air assist injector solenoid valve signal	AAI Solenoid Valve	ON or OFF

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

5. READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE. (OBD MODE)

1) On the ┌Main Menu┘ display screen, select the {Each System Check} and press the [YES] key.
2) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {OBD System} and press the [YES] key.
5) On the ┌OBD Menu┘ display screen, select the {Current Data Display & Save} and press the [YES] key.
6) On the ┌Data Display Menu┘ display screen, select the {Data Display} and press the [YES] key.
7) Using the scroll key, move the display screen up or down until the desired data is shown.

● A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Number of diagnosis code	Number of Diagnosis Code	—
Malfunction indicator lamp status	MIL Status	ON or OFF
Monitoring test of misfire	Misfire monitoring	ON or OFF
Monitoring test of fuel system	Fuel system monitoring	ON or OFF
Monitoring test of comprehensive component	Component monitoring	ON or OFF
Test of catalyst	Catalyst Diagnosis	ON or OFF
Test of heated catalyst	Heated catalyst	ON or OFF
Test of evaporative emission purge control system	Evaporative purge system	ON or OFF
Test of secondary air system	Secondary air system	ON or OFF
Test of air conditioning system refrigerant	A/C system refrigerant	ON or OFF
Test of oxygen sensor	Oxygen sensor	ON or OFF
Test of oxygen sensor heater	Oxygen sensor heater	ON or OFF
Air fuel ratio control system for bank 1	Fuel System for Bank 1	ON or OFF
Engine load data	Engine Load	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg or kPa or inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing advance for #1 cylinder	Ignition timing adv. #1	°
Intake air temperature signal	Intake Air Temp.	°C or °F
Throttle position signal	Throttle Opening Angle	%
A/F sensor equipment	A/F sensor	ON or OFF
Rear oxygen sensor output signal	Oxygen Sensor #12	V
Air fuel ratio correction by rear oxygen sensor	Short term fuel trim #12	%
On-board diagnostic system	OBD System	—

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

6. READ FREEZE FRAME DATA SHOWN ON DISPLAY FOR ENGINE. (OBD MODE)

1) On the ┌Main Menu┘ display screen, select the {Each System Check} and press the [YES] key.
2) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {OBD System} and press the [YES] key.
5) On the ┌OBD Menu┘ display screen, select the {Freeze Frame Data} and press the [YES] key.
● A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Diagnostic trouble code (DTC) for freeze frame data	Freeze frame data	DTC
Air fuel ratio control system for bank 1	Fuel system for Bank1	ON or OFF
Engine load data	Engine Load	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg or kPa or inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

7. READ OXYGEN SENSOR MONITORING TEST RESULTS DATA SHOWN ON DISPLAY FOR ENGINE. (OBD MODE)

1) On the ┌Main Menu┘ display screen, select the {Each System Check} and press the [YES] key.
2) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ┌Engine Diagnosis┘ display screen, select the {OBD System} and press the [YES] key.
5) On the ┌OBD Menu┘ display screen, select the {O2 Sensor Monitor} and press the [YES] key.
6) On the ┌O2 Sensor Select┘ display screen, select the {Bank 1-Sensor1} or {Bank 1-Sensor2} and press the [YES] key.
● Bank 1-Sensor1 indicates the front oxygen or A/F sensor, and Bank 1-Sensor2 indicates the rear oxygen sensor.
● A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Oxygen sensor for monitoring test	<O2 Sensor Monitor (-------)>	—
Rich to lean oxygen sensor threshold voltage	Rich to lean sensor volt	V
Lean to rich oxygen sensor threshold voltage	Lean to rich sensor volt	V
Low oxygen sensor voltage for switch time calculation	Low sensor voltage	V
High oxygen sensor voltage for switch time calculation	High sensor voltage	V
Rich to lean oxygen sensor switch time	Rich to lean switch time	sec
Lean to rich oxygen sensor switch time	Lean to rich switch time	sec
Maximum oxygen sensor voltage for test cycle	Maximum sensor Voltage	V
Minimum oxygen sensor voltage for test cycle	Minimum sensor Voltage	V

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

8. LED OPERATION MODE FOR ENGINE

1) On the ⌜Main Menu⌟ display screen, select the {Each System Check} and press the [YES] key.
2) On the ⌜System Selection Menu⌟ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ⌜Engine Diagnosis⌟ display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the ⌜Data Display Menu⌟ display screen, select the {Data & LED Display} and press the [YES] key.
6) Using the scroll key, move the display screen up or down until the desired data is shown.

- A list of the support data is shown in the following table.

Contents	Display	Message	LED "ON" requirements
Ignition switch signal	Ignition Switch	ON or OFF	When ignition switch is turned ON.
Test mode connector signal	Test Mode Signal	ON or OFF	When test mode connector is connected.
Neutral position switch signal	Neutral Position Switch	ON or OFF	When neutral position signal is entered.
Air conditioning switch signal	A/C Switch	ON or OFF	When air conditioning switch is turned ON.
Air conditioning relay signal	A/C Relay	ON or OFF	When air conditioning relay is in function.
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF	When radiator main fan relay is in function.
Fuel pump relay signal	Fuel Pump Relay	ON or OFF	When fuel pump relay is in function.
Knocking signal	Knocking Signal	ON or OFF	When knocking signal is entered.
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF	When radiator sub fan relay is in function.
Engine torque control signal #1	Torque Control Signal #1	ON or OFF	When engine torque control signal 1 is entered.
Engine torque control signal #2	Torque Control Signal #2	ON or OFF	When engine torque control signal 2 is entered.
Engine torque control permission signal	Torque Control Permit	ON or OFF	When engine torque control permission signal is entered.
Front oxygen (A/F) sensor rich signal	Front O2 Rich Signal #1	ON or OFF	When front oxygen (A/F) sensor mixture ratio is rich.
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF	When rear oxygen sensor mixture ratio is rich.
Pressure control solenoid valve	PCV Solenoid Valve	ON or OFF	When pressure control solenoid valve is in function.
Drain valve	Vent. Solenoid Valve	ON or OFF	When drain valve is in function.
Starter switch signal	Starter Switch Signal	ON or OFF	When starter switch signal is entered.
Idle switch signal	Idle Switch Signal	ON or OFF	When idle switch signal is entered.
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF	When crankshaft position sensor signal is entered.
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF	When camshaft position sensor signal is entered.

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

9. READ CURRENT DATA SHOWN ON DISPLAY FOR AT.

1) On the ⌜Main Menu⌟ display screen, select the {Each System Check} and press the [YES] key.
2) On the ⌜System Selection Menu⌟ display screen, select the {Transmission Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of transmission type.
4) On the ⌜Transmission Diagnosis⌟ display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the ⌜Data Display Menu⌟ display screen, select the {Data Display} and press the [YES] key.
6) Using the scroll key, move the display screen up or down until the desired data is shown.

- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Vehicle speed sensor 1 signal	Vehicle Speed #1	km/h or MPH
Vehicle speed sensor 2 signal	Vehicle Speed #2	km/h or MPH
Engine speed signal	Engine Speed	rpm
Automatic transmission fluid temperature signal	ATF Temp.	°C or °F
Throttle position signal	Throttle Sensor Voltage	V
Gear position	Gear Position	—
Line pressure control duty ratio	Line Pressure Duty Ratio	%
Lock up clutch control duty ratio	Lock Up Duty Ratio	%
Transfer clutch control duty ratio	Transfer Duty Ratio	%
Power supply for throttle position sensor	Throttle Sensor Power	V
Torque converter turbine speed signal	AT Turbine Speed	rpm
2-4 brake timing pressure control duty ratio	2-4B Duty Ratio	%
Intake manifold pressure sensor voltage	Mani. Pressure Voltage	V
2 wheel drive switch signal	2WD Switch	ON or OFF
Kick down switch signal	Kick Down Switch	ON or OFF
Stop lamp switch signal	Stop Lamp Switch	ON or OFF
Anti lock brake system signal	ABS Signal	ON or OFF
Cruise control system signal	Cruise Control Signal	ON or OFF
Neutral/Parking range signal	N/P Range Signal	ON or OFF
Reverse range signal	R Range Signal	ON or OFF
Drive range signal	D Range Signal	ON or OFF
3rd range signal	3rd Range Signal	ON or OFF
2nd range signal	2nd Range Signal	ON or OFF
1st range signal	1st Range Signal	ON or OFF
Shift control solenoid A	Shift Solenoid #1	ON or OFF
Shift control solenoid B	Shift Solenoid #2	ON or OFF
Torque control output signal #1	Torque Control Signal #1	ON or OFF
Torque control output signal #2	Torque Control Signal #2	ON or OFF
Torque control cut signal	Torque Control Cut Sig.	ON or OFF
2-4 brake timing control solenoid valve	2-4 Brake Timing Sol.	ON or OFF
Low clutch timing control solenoid valve	Low Clutch Timing Sol.	ON or OFF
Automatic transmission diagnosis indicator lamp	AT Diagnosis Lamp	ON or OFF

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

D: CLEAR MEMORY MODE

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On the ⌜Main Menu⌟ display screen, select the {2. Each System Check} and press the [YES] key.
2) On the ⌜System Selection Menu⌟ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ⌜Engine Diagnosis⌟ display screen, select the {Clear Memory} and press the [YES] key.
5) When the 'Done' and 'Turn Ignition Switch OFF' are shown on the display screen, turn the Subaru Select Monitor and ignition switch to OFF.

NOTE:
● After the memory has been cleared, the ISC must be initialized. To do this, turn the ignition switch to the ON position. Wait 3 seconds before starting the engine.
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

2. SUBARU SELECT MONITOR (OBD MODE)

1) On the ⌜Main Menu⌟ display screen, select the {2. Each System Check} and press the [YES] key.
2) On the ⌜System Selection Menu⌟ display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the ⌜Engine Diagnosis⌟ display screen, select the {OBD System} and press the [YES] key.
5) On the ⌜OBD Menu⌟ display screen, select the {4. Diagnosis Code(s) Cleared} and press the [YES] key.
6) When the 'Clear Diagnostic Code?' is shown on the display screen, press the [YES] key.
7) Turn Subaru Select Monitor and ignition switch to OFF.

NOTE:
● After the memory has been cleared, the ISC must be initialized. To do this, turn the ignition switch to the ON position. Wait 3 seconds before starting the engine.
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

3. OBD-II GENERAL SCAN TOOL

For clear memory procedures using the OBD-II general scan tool, refer to the OBD-II General Scan Tool Instruction Manual.

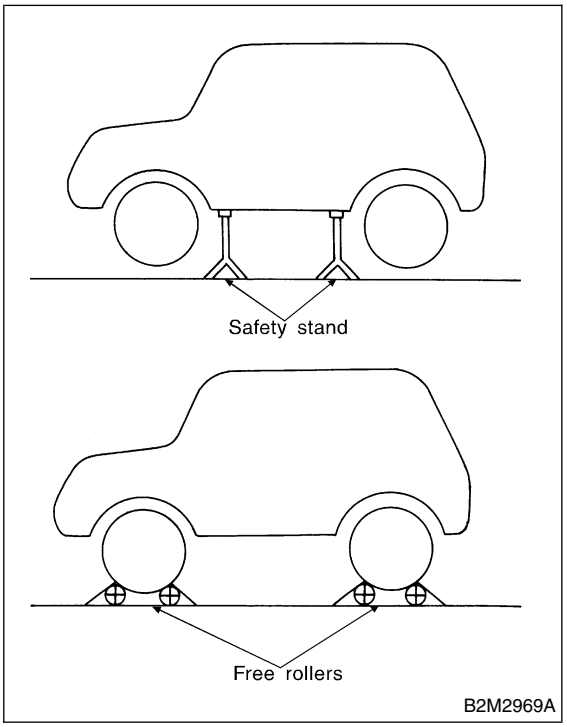
After the memory has been cleared, the ISC must be initialized. To do this, turn the ignition switch to the ON position. Wait 3 seconds before starting the engine.

E: INSPECTION MODE

1. PREPARATIONS FOR THE INSPECTION MODE

Raise the vehicle using a garage jack and place on safety stands or drive the vehicle onto free rollers.

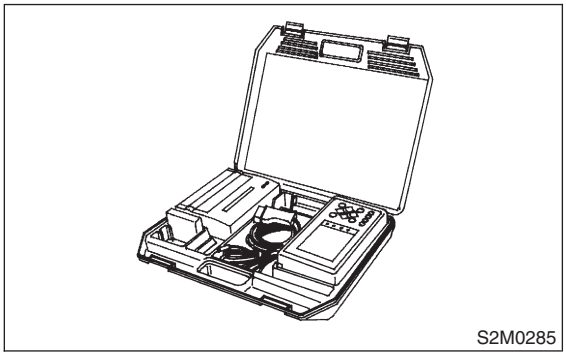
WARNING:
● Before raising the vehicle, ensure parking brakes are applied.
● Do not use a pantograph jack in place of a safety stand.
● Secure a rope or wire to the front and rear towing or tie-down hooks to prevent the lateral runout of front wheels.
● Do not abruptly depress/release clutch pedal or accelerator pedal during works even when engine is operating at low speeds since this may cause vehicle to jump off free rollers.
● In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the safety stands and the vehicle.
● Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



2. SUBARU SELECT MONITOR

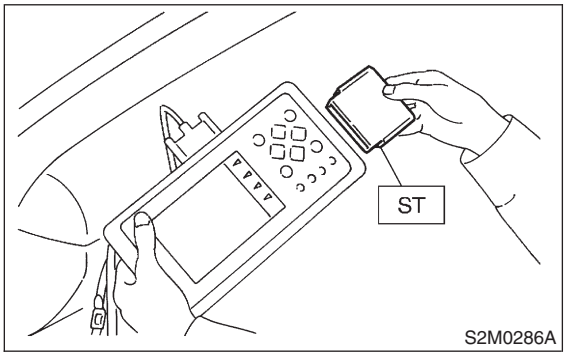
After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data.

1) Prepare Subaru Select Monitor kit.

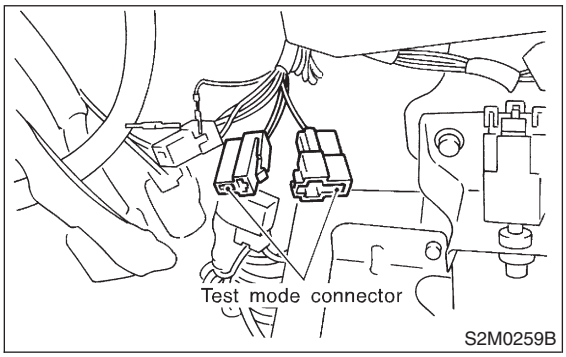


2) Connect diagnosis cable to Subaru Select Monitor.

3) Insert cartridge into Subaru Select Monitor. <Ref. to 1-6 [G1100].>

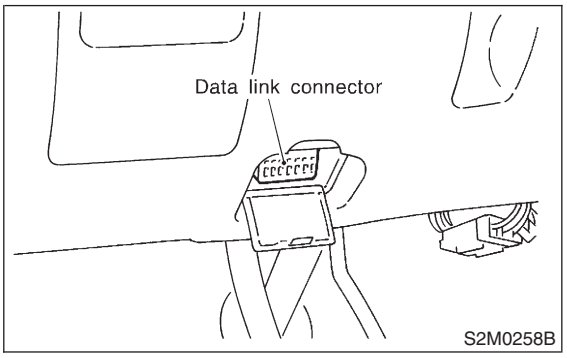


4) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



5) Connect Subaru Select Monitor to data link connector.

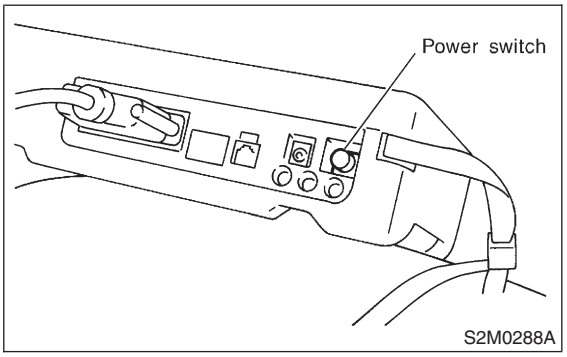
(1) Connect Subaru Select Monitor to data link connector located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

CAUTION:
Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

6) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



7) On the 「Main Menu」 display screen, select the {2. Each System Check} and press the [YES] key.

8) On the 「System Selection Menu」 display screen, select the {Engine Control System} and press the [YES] key.

9) Press the [YES] key after displayed the information of engine type.

10) On the 「Engine Diagnosis」 display screen, select the {Dealer Check Mode Procedure} and press the [YES] key.

11) When the "Perform Inspection (Dealer Check) Mode?" is shown on the display screen, press the [YES] key.

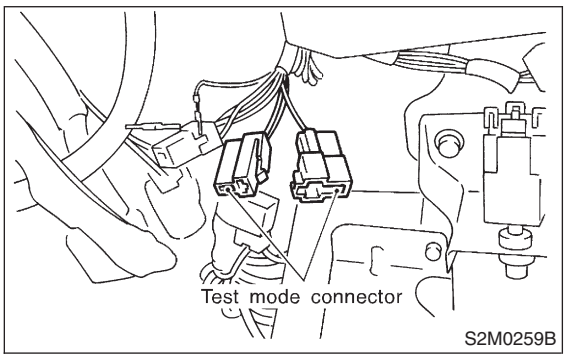
12) Perform subsequent procedures as instructed on the display screen.

● If trouble still remains in the memory, the corresponding diagnostic trouble code (DTC) appears on the display screen.

NOTE:
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
● For detailed concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST.
<Ref. to 2-7 [T10A0].>
● Release the parking brake.
● The speed difference between front and rear wheels may light either the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

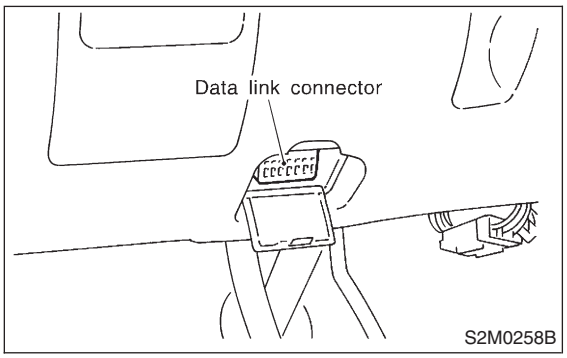
3. OBD-II GENERAL SCAN TOOL

After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data:
1) Connect test mode connector at the lower side of the instrument panel (on the driver's side), to the side of the center console box.



2) Connect the OBD-II general scan tool to its data link connector in the lower portion of the instrument panel (on the driver's side).

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and OBD-II general scan tool.



3) Start the engine.

NOTE:
● Ensure the selector lever is placed in the "P" position before starting. (AT vehicles)
● Depress clutch pedal when starting the engine. (MT vehicles)

4) Using the selector lever or shift lever, turn the "P" position switch and the "N" position switch to ON.
5) Depress the brake pedal to turn the brake switch ON. (AT vehicles)
6) Keep engine speed in the 2,500 — 3,000 rpm range for 40 seconds.

NOTE:
On models without tachometer, use the tachometer (Secondary pickup type).

7) Place the selector lever or shift lever in the "D" position (AT vehicles) or "1st" gear (MT vehicles) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
● On AWD vehicles, release the parking brake.
● The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

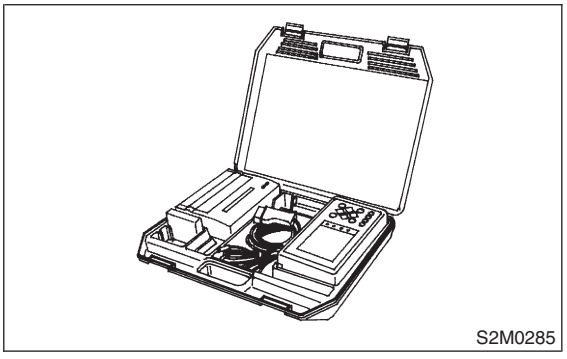
8) Using the OBD-II general scan tool, check for diagnostic trouble code(s) and record the result(s).

NOTE:
● For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.
● For detailed concerning diagnostic trouble codes, refer to the DIAGNOSTIC TROUBLE CODE (DTC) LIST.
<Ref. to 2-7 [T10A0].>

F: COMPULSORY VALVE OPERATION CHECK MODE

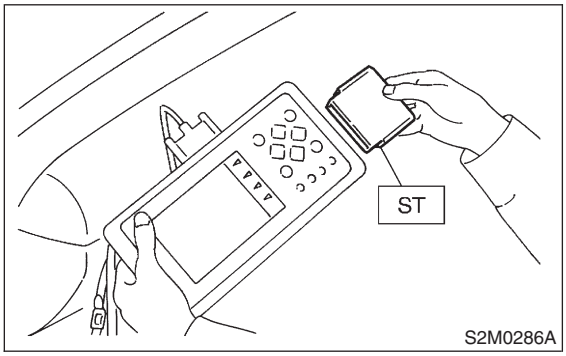
1. SUBARU SELECT MONITOR

1) Prepare Subaru Select Monitor kit.

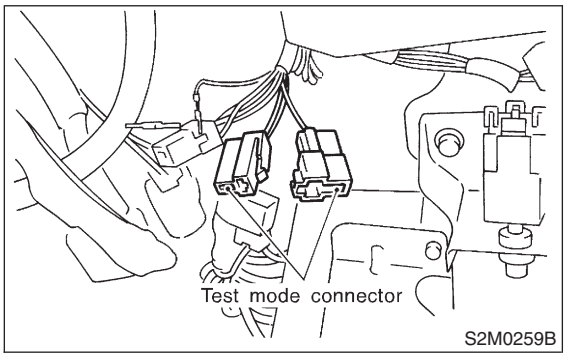


2) Connect diagnosis cable to Subaru Select Monitor.

3) Insert cartridge into Subaru Select Monitor. <Ref. to 1-6 [G1100].>

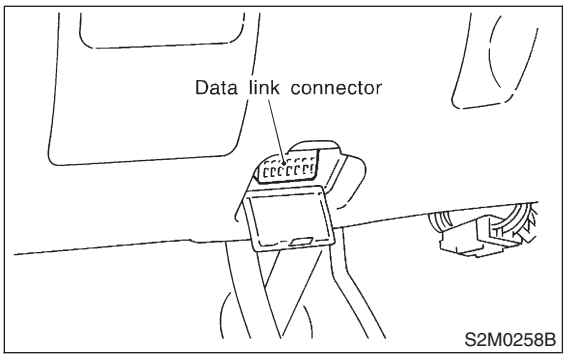


4) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



5) Connect Subaru Select Monitor to data link connector.

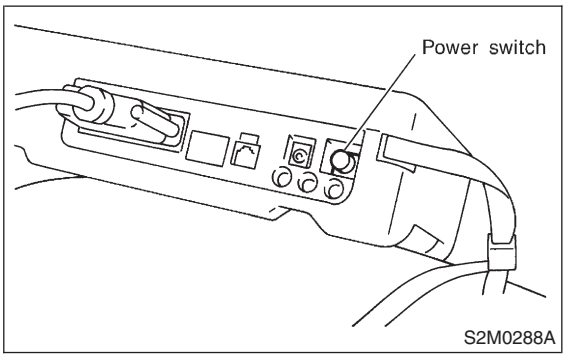
(1) Connect Subaru Select Monitor to data link connector located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

CAUTION:
Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

6) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



7) On the ┌Main Menu┘ display screen, select the {2. Each System Check} and press the [YES] key.
8) On the ┌System Selection Menu┘ display screen, select the {Engine Control System} and press the [YES] key.
9) Press the [YES] key after displayed the information of engine type.
10) On the ┌Engine Diagnosis┘ display screen, select the {System Operation Check Mode} and press the [YES] key.
11) On the ┌System Operation Check Mode┘ display screen, select the {Actuator ON/OFF Operation} and press the [YES] key.
12) Select the desired compulsory actuator on the ┌Actuator ON/OFF Operation┘ display screen and press the [YES] key.
13) Pressing the [NO] key completes the compulsory operation check mode. The display will then return to the ┌Actuator ON/OFF Operation┘ screen.

● A list of the support data is shown in the following table.

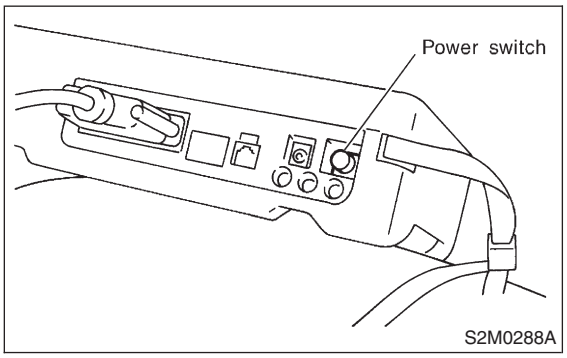
Contents	Display
Compulsory fuel pump relay operation check	Fuel Pump Relay
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Relay
Compulsory pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory drain valve operation check	Vent Control Solenoid Valve

NOTE:
● Because ASV solenoid valve, FICD solenoid valve and air injection system diagnosis solenoid valve are not installed, ASV Solenoid Valve, FICD Solenoid Valve and Pressure Switching Sol.2 will be displayed but non-functional.
● For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

G: FINISHING DIAGNOSIS OPERATION

1. SUBARU SELECT MONITOR

1) Turn ignition switch to OFF.
2) Turn Subaru Select Monitor switch to OFF.



3) Disconnect test mode connector at the lower portion of instrument panel (on the driver's side).
4) Disconnect Subaru Select Monitor from its data link connector.

4. Cautions

A: SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the engine control module (ECM), main relay and fuel pump relay.

CAUTION:
● All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
● Be careful not to damage Airbag system wiring harness when servicing the engine control module (ECM), transmission control module (TCM), main relay and fuel pump relay.

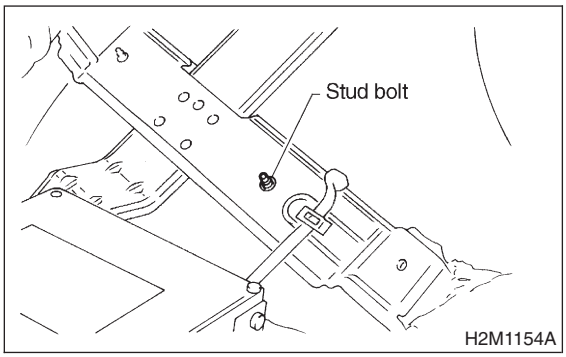
B: PRECAUTIONS

1) Never connect the battery in reverse polarity.
● The ECM will be destroyed instantly.
● The fuel injector and other part will be damaged in just a few minutes more.
2) Do not disconnect the battery terminals while the engine is running.
● A large counter electromotive force will be generated in the alternator, and this voltage may damage electronic parts such as ECM, etc.
3) Before disconnecting the connectors of each sensor and the ECM, be sure to turn OFF the ignition switch.
4) Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.
5) Before removing ECM from the located position, disconnect two cables on battery.
● Otherwise, the ECM may be damaged.

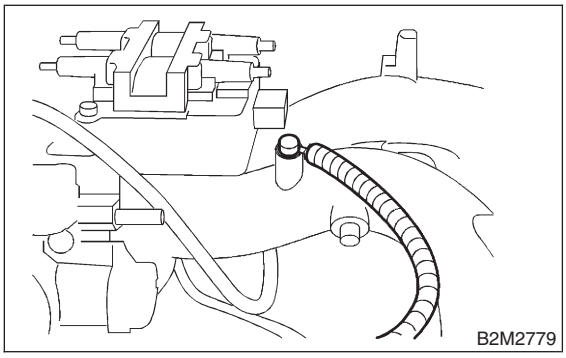
CAUTION:
When replacing ECM, be careful not to use the wrong spec. ECM to avoid any damage on fuel injection system.

6) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on a rainy day.

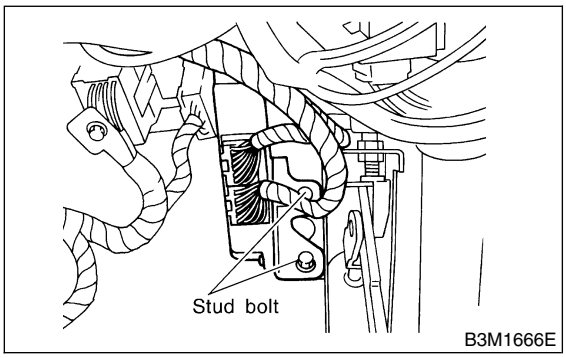
7) Use ECM mounting stud bolts at the body head grounding point when measuring voltage and resistance inside the passenger compartment.



8) Use engine grounding terminal or engine proper as the grounding point to the body when measuring voltage and resistance in the engine compartment.



9) Use TCM mounting stud bolts at the body head grounding point when measuring voltage and resistance inside the passenger compartment.



10) Every MFI-related part is a precision part. Do not drop them.
11) Observe the following cautions when installing a radio in MFI equipped models.

CAUTION:
• The antenna must be kept as far apart as possible from the control unit.
(The ECM is located under the steering column, inside of the instrument panel lower trim panel.)
• The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.
• Carefully adjust the antenna for correct matching.
• When mounting a large power type radio, pay special attention to the three items above mentioned.
• Incorrect installation of the radio may affect the operation of the ECM.

12) Before disconnecting the fuel hose, disconnect the fuel pump connector and crank the engine for more than five seconds to release pressure in the fuel system. If engine starts during this operation, run it until it stops.
13) Problems in the electronic-controlled automatic transmission may be caused by failure of the engine, the electronic control system, the transmission proper, or by a combination of these. These three causes must be distinguished clearly when performing diagnostics.
14) Diagnostics should be conducted by rotating with simple, easy operations and proceeding to complicated, difficult operations. The most important thing in diagnostics is to understand the customer's complaint, and distinguish between the three causes.
15) In AT vehicles, do not continue the stall for more than five seconds at a time (from closed throttle, fully open throttle to stall engine speed).
16) On ABS vehicle, when performing driving test in jacked-up or lifted-up position, sometimes the warning light may be lit, but this is not a malfunction of the system. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clearance procedure of self-diagnosis system.

C: PRE-INSPECTION

Before performing diagnostics, check the following items which might affect engine problems:

1. POWER SUPPLY

1) Measure battery voltage and specific gravity of electrolyte.

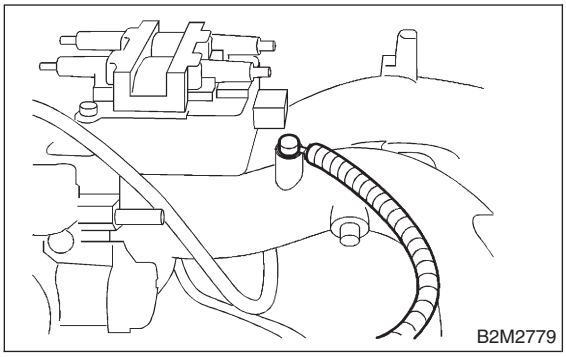
Standard voltage: 12 V

Specific gravity: Above 1.260

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

2. ENGINE GROUNDING

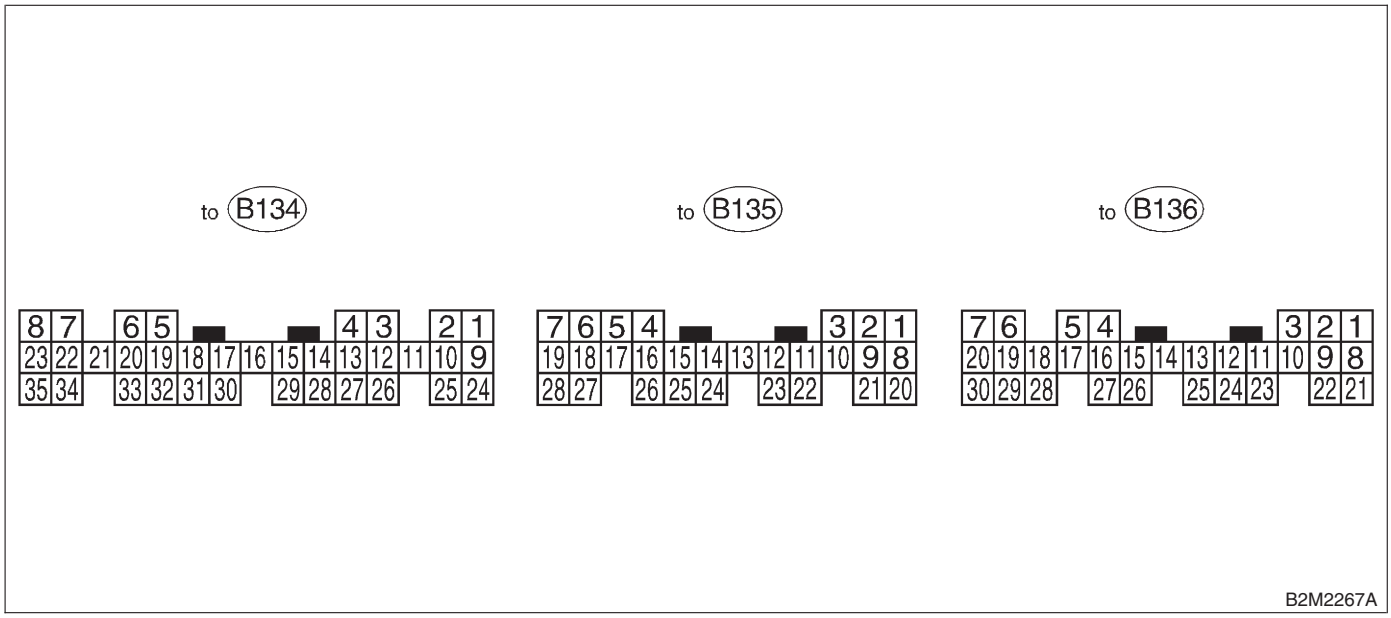
Make sure the engine grounding terminal is properly connected to the engine.



MEMO:

5. Specified Data

A: ENGINE CONTROL MODULE (ECM) I/O SIGNAL



Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crankshaft position sensor	Signal (+)	B135	1	0	–7 — +7	Sensor output waveform
	Signal (–)	B135	8	0	0	—
	Shield	B135	10	0	0	—
Camshaft position sensor	Signal (+)	B135	2	0	–7 — +7	Sensor output waveform
	Signal (–)	B135	9	0	0	—
	Shield	B135	10	0	0	—
Throttle position sensor	Signal	B136	17	Fully closed: 0.2 — 1.0 Fully opened: 4.2 — 4.7		—
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	16	0	0	—
Rear oxygen sensor	Signal	B136	18	0	0 — 0.9	—
	Shield	B136	24	0	0	—
	GND (sensor)	B136	16	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B134	22	0 — 1.0	0 — 1.0	—
	Signal 2	B134	23	0 — 1.0	0 — 1.0	—
Rear oxygen sensor heater signal		B134	21	0 — 1.0	0 — 1.0	—
Engine coolant temperature sensor	Signal	B136	14	1.0 — 1.4	1.0 — 1.4	After warm-up the engine.
	GND (sensor)	B136	16	0	0	After warm-up the engine.
Vehicle speed signal		B135	24	0 or 5	0 or 5	“5” and “0” are repeatedly displayed when vehicle is driven.
Starter switch		B135	28	0	0	Cranking: 8 — 14
A/C switch		B135	27	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Ignition switch		B135	7	10 — 13	13 — 14	—
Neutral position switch (MT)		B136	26	ON: 12±0.5 OFF: 0		Switch is ON when gear is in neutral position.
Neutral position switch (AT)		B135	26	ON: 0 OFF: 12±0.5		Switch is ON when shift is in “N” or “P” position.
Test mode connector		B135	14	5	5	When connected: 0
Knock sensor	Signal	B136	4	2.8	2.8	—
	Shield	B136	25	0	0	—
Back-up power supply		B136	9	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power supply		B136	1	10 — 13	13 — 14	—
		B136	2	10 — 13	13 — 14	—
Sensor power supply		B136	15	5	5	—
Line end check 1		B135	20	0	0	—
Ignition control	#1, #2	B134	25	0	1 — 3.4	Waveform
	#3, #4	B134	26	0	1 — 3.4	Waveform
Fuel injector	#1	B134	4	10 — 13	1 — 14	Waveform
	#2	B134	13	10 — 13	1 — 14	Waveform
	#3	B134	14	10 — 13	1 — 14	Waveform
	#4	B134	15	10 — 13	1 — 14	Waveform
Idle air control solenoid valve	Signal 1	B134	5	—	1 — 13	Waveform
	Signal 2	B134	6	—	1 — 13	Waveform
	Signal 3	B134	19	—	1 — 13	Waveform
	Signal 4	B134	20	—	1 — 13	Waveform
	Power supply	B136	2	10 — 13	13 — 14	—
Fuel pump relay control		B134	16	ON: 0.5, or less OFF: 10 — 13	0.5, or less	—
A/C relay control		B134	17	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 1 control		B134	3	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 2 control		B134	2	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	With A/C vehicles only
Self-shutoff control		B135	19	10 — 13	13 — 14	—
Malfunction indicator lamp		B134	11	—	—	Light “ON”: 1, or less Light “OFF”: 10 — 14
Engine speed output		B134	30	—	0 — 13, or more	Waveform
Torque control 1 signal		B135	16	5	5	—
Torque control 2 signal		B135	17	5	5	—
Torque control cut signal		B134	31	8	8	—
Purge control solenoid valve		B134	2	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Atmospheric pressure sensor	Signal	B136	29	3.9 — 4.1	2.0 — 2.3	—
	Power supply	B136	15	5	5	
	GND (sensor)	B136	16	0	0	
Fuel temperature sensor		B136	26	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Fuel level sensor		B136	27	0.12 — 4.75	0.12 — 4.75	—

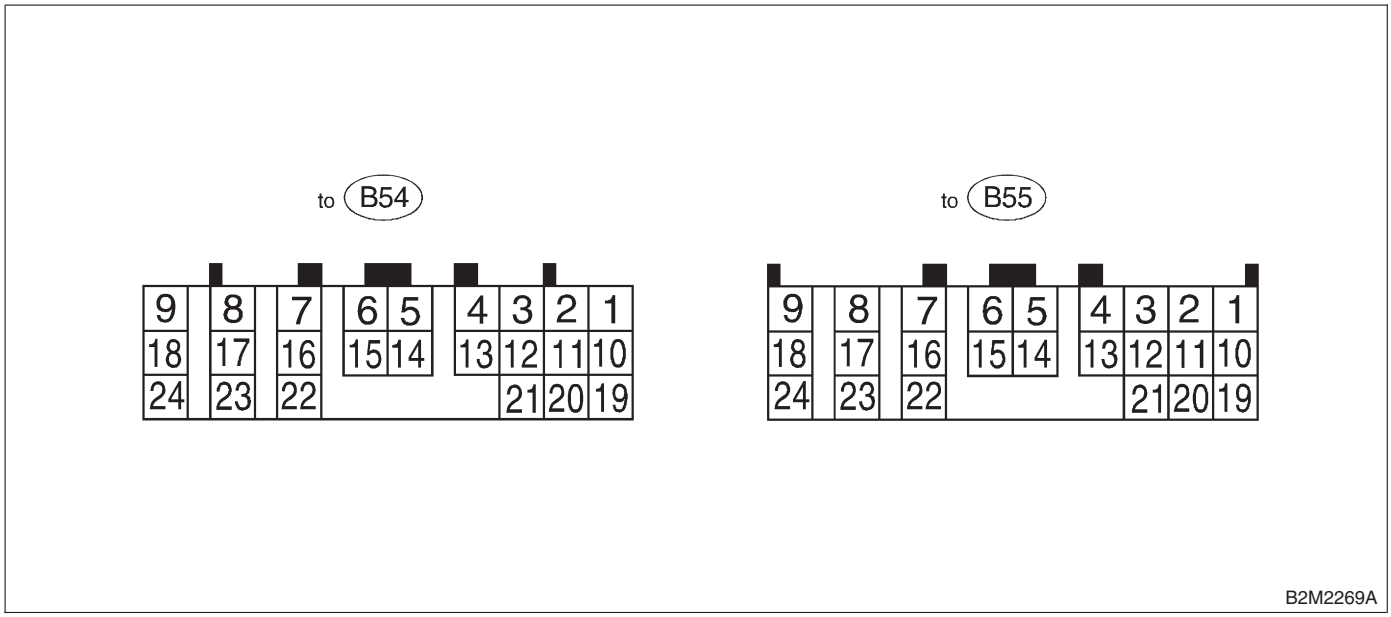
Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Fuel tank pressure sensor	Signal	B136	12	2.3 — 2.7	2.3 — 2.7	The value obtained after the fuel filler cap was removed once and recapped.
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	16	0	0	—
Fuel tank pressure control solenoid valve		B134	1	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Drain valve		B134	10	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
AT diagnosis input signal		B135	4	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	Waveform
Small light switch		B136	3	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Blower fan switch		B136	30	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Rear defogger switch		B135	21	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sensor signal 1		B136	19	2.8 — 3.2	2.8 — 3.2	—
Front oxygen (A/F) sensor signal 2		B136	6	2.4 — 2.7	2.4 — 2.7	—
Front oxygen (A/F) sensor signal 3		B136	7	0.2 — 4.9	0.2 — 4.9	—
Front oxygen (A/F) sensor signal 4		B136	20	0.2 — 4.9	0.2 — 4.9	—
Pressure sensor		B136	5	2.4 — 4.8	0.4 — 1.8	—
Intake air temperature sensor		B136	13	2.3 — 2.5	1.4 — 1.6	—
SSM/GST communication line		B135	3	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	—
GND (sensors)		B136	16	0	0	—
GND (injectors)		B134	7	0	0	—
GND (ignition system)		B134	27	0	0	—
GND (power supply)		B134	8	0	0	—
GND (control systems)		B136	21	0	0	—
		B136	22	0	0	—
GND (oxygen sensor heater 1)		B134	35	0	0	—
GND (oxygen sensor heater 2)		B134	34	0	0	—

B: ENGINE CONDITION DATA

Content	Specified data
Engine load	1.6 — 2.9 (%): Idling
	6.4 — 12.8 (%): 2,500 rpm racing

Measuring condition:
- After warm-up the engine.
- Gear position is in “N” or “P” position.
- A/C is turned OFF.
- All accessory switches are turned OFF.

C: TRANSMISSION CONTROL MODULE (TCM) I/O SIGNAL



NOTE:
Check with ignition switch ON.

Content		Connector No.	Terminal No.	Measuring conditions	Voltage (V)
Back-up power supply		B55	6	Ignition switch OFF	10 — 16
Ignition power supply		B54	23	Ignition switch ON (with engine OFF)	10 — 16
		B54	24		
Inhibitor switch	“P” range switch	B55	23	Selector lever in “P” range	Less than 1
				Selector lever in any other than “P” range	More than 8
	“N” range switch	B55	22	Selector lever in “N” range	Less than 1
				Selector lever in any other than “N” range	More than 8
	“R” range switch	B55	17	Selector lever in “R” range	Less than 1
				Selector lever in any other than “R” range	More than 9.5
	“D” range switch	B55	8	Selector lever in “D” range	Less than 1
				Selector lever in any other than “D” range	More than 9.5
	“3” range switch	B55	18	Selector lever in “3” range	Less than 1
				Selector lever in any other than “3” range	More than 9.5
	“2” range switch	B54	10	Selector lever in “2” range	Less than 1
				Selector lever in any other than “2” range	More than 9.5
	“1” range switch	B54	1	Selector lever in “1” range	Less than 1
				Selector lever in any other than “1” range	More than 9.5
Brake switch		B55	24	Brake pedal depressed	More than 10.5
				Brake pedal released	Less than 1
ABS signal		B54	19	ABS switch ON	Less than 1
				ABS switch OFF	More than 6.5

Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
Throttle position sensor	B55	1	Throttle fully closed.	0.3 — 0.7	—
			Throttle fully open.	4.3 — 4.9	
Throttle position sensor power supply	B55	2	Ignition switch ON (with engine OFF)	4.8 — 5.3	—
ATF temperature sensor	B55	11	ATF temperature 20°C (68°F)	2.9 — 4.0	2.1 k — 2.9 k
			ATF temperature 80°C (176°F)	1.0 — 1.4	275 — 375
Vehicle speed sensor 1	B55	3	Vehicle stopped.	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Vehicle speed sensor 2	B55	5	Vehicle speed at most 10 km/h (6 MPH)	Less than 1←→More than 4	—
Torque converter turbine speed sensor	B55	12	Vehicle stopped.	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Vehicle speed output signal	B55	13	Vehicle speed at most 10 km/h (6 MPH)	Less than 1←→More than 4	—
Engine speed signal	B55	4	Ignition switch ON (with engine OFF).	More than 10.5	—
			Ignition switch ON (with engine ON).	8 — 11	
Cruise set signal	B54	11	When cruise control is set (SET lamp ON).	Less than 1	—
			When cruise control is not set (SET lamp OFF).	More than 6.5	
Torque control 1 signal	B54	13	Ignition switch ON (with engine ON)	More than 9	—
Torque control 2 signal	B54	21	Ignition switch ON (with engine ON)	More than 9	—
Torque control cut signal	B54	2	Ignition switch ON	8	—
AT load signal	B55	20	Engine idling after warm-up	1.2 — 1.8	—
Shift solenoid 1	B54	7	1st or 4th gear	More than 9	10 — 16
			2nd or 3rd gear	Less than 1	
Shift solenoid 2	B54	6	1st or 2nd gear	More than 9	10 — 16
			3rd or 4th gear	Less than 1	
Line pressure duty solenoid	B54	9	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Dropping resistor	B54	18	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Lock-up duty solenoid	B54	16	When lock up occurs.	More than 8.5	10 — 17
			When lock up is released.	Less than 0.5	
Transfer duty solenoid	B54	15	Fuse on FWD switch	More than 8.5	10 — 17
			Fuse removed from FWD switch (with throttle fully open and with select lever in 1st gear).	Less than 0.5	

Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
2-4 brake duty solenoid	B54	8	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake duty solenoid resistor	B54	17	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake timing solenoid	B54	5	3rd gear	More than 9	10 — 16
			1st gear	Less than 1	
Low clutch timing solenoid	B54	14	2nd gear	Less than 1	10 — 16
			4th gear	More than 9	
Sensor ground line 1	B55	10	—	0	Less than 1
Sensor ground line 2	B55	21	—	0	Less than 1
System ground line	B55	9	—	0	Less than 1
		19			
FWD switch	B55	14	Fuse removed.	6 — 9.1	—
			Fuse installed.	Less than 1	
FWD indicator lamp	B54	12	Fuse on FWD switch	Less than 1	—
			Fuse removed from FWD switch.	More than 9	
Data link signal (Subaru Select Monitor)	B55	7	—	—	—
		16	—	—	
AT diagnosis signal	B54	4	Ignition switch ON	Less than 1 ←→ More than 4	—

6. Basic Diagnostic Procedure

A: BASIC DIAGNOSTIC PROCEDURE FOR ENGINE

6A1 : CHECK ENGINE START FAILURE.

1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to 2-7 [T6C0].>
2) Start the engine.

CHECK : ***Does the engine start?***
YES : Go to step **6A2**.
NO : Inspection using “Diagnostics for Engine Start Failure”. <Ref. to 2-7 [T800].>

6A2 : CHECK ILLUMINATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).

CHECK : ***Does CHECK ENGINE malfunction indicator lamp illuminate?***
YES : Go to step **6A3**.
NO : Inspection using “9. General Diagnostics Table”. <Ref. to 2-7 [T900].>

6A3 : CHECK INDICATION OF DTC ON DISPLAY.

1) Turn ignition switch to OFF.
2) Connect the Subaru Select Monitor or the OBD-II general scan tool to data link connector.
3) Turn ignition switch to ON and the Subaru Select Monitor or OBD-II general scan tool switch to ON.
4) Read DTC on the Subaru Select Monitor or OBD-II general scan tool.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?***
YES : Go to step **6A4**.
NO : Repair the related parts.

NOTE:
If DTC is not shown on display although the MIL illuminates, perform diagnostics of MIL (CHECK ENGINE malfunction indicator lamp) circuit or combination meter. <Ref. to 2-7 [T700].>

6A4 : PERFORM THE DIAGNOSIS.

1) Inspect using “Diagnostics Chart with Trouble Code (DTC)”.
<Ref. to 2-7 [T10A0].>

NOTE:
Carry out the basic check, only when DTC about automatic transmission is shown on display. <Ref. to 2-7 [T6B0].>

2) Repair the trouble cause.
3) Perform the clear memory mode. <Ref. to 2-7 [T3D0].>
4) Perform the inspection mode. <Ref. to 2-7 [T3E0].>

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?***
YES : Inspect using “Diagnostics Chart with Trouble Code (DTC)”. <Ref. to 2-7 [T10A0].>
NO : Complete the diagnosis.

B: BASIC CHECK ITEMS FOR AT

When trouble code about automatic transmission is shown on display, carry out the following basic check. After that, carry out the replacement or repair work.
1) ATF level check <Ref. to 3-2 [W1B1].>
2) Differential gear oil level check <Ref. to 3-2 [W1B2].>
3) ATF leak check <Ref. to 3-2 [W1B3].>
4) Differential gear oil leak check <Ref. to 3-2 [W1B3].>
5) Stall test <Ref. to 3-2 [W8A0].>
6) Line pressure test <Ref. to 3-2 [W10A0].>
7) Transfer clutch pressure test <Ref. to 3-2 [W11A0].>
8) Time lag test <Ref. to 3-2 [W9A0].>
9) Road test <Ref. to 3-2 [W7A0].>
10) Shift characteristics <Ref. to 3-2 [W7A0].>

C: CHECK LIST FOR INTERVIEW

1. CHECK LIST NO. 1

Check the following items when problem has occurred.

NOTE:
Use copies of this page for interviewing customers.

Customer's name		Engine no.	
Date of sale		Fuel brand	
Date of repair		Odometer reading	km
Vin no.			miles
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others:		
Outdoor temperature	°F (°C)		
	☐ Hot ☐ Warm ☐ Cool ☐ Cold		
Place	☐ Highway ☐ Suburbs ☐ Inner city ☐ Uphill ☐ Downhill ☐ Rough road ☐ Others:		
Engine temperature	☐ Cold ☐ Warming-up ☐ After warming-up ☐ Any temperature ☐ Others:		
Engine speed	rpm		
Vehicle speed	MPH		
Driving conditions	☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH)		
Headlight	☐ ON/☐ OFF	Rear defogger	☐ ON/☐ OFF
Blower	☐ ON/☐ OFF	Radio	☐ ON/☐ OFF
A/C compressor	☐ ON/☐ OFF	CD/Cassette	☐ ON/☐ OFF
Cooling fan	☐ ON/☐ OFF	Car phone	☐ ON/☐ OFF
Front wiper	☐ ON/☐ OFF	CB	☐ ON/☐ OFF
Rear wiper	☐ ON/☐ OFF		

2. CHECK LIST NO. 2

Check the following items about the vehicle's state when MIL turns on.

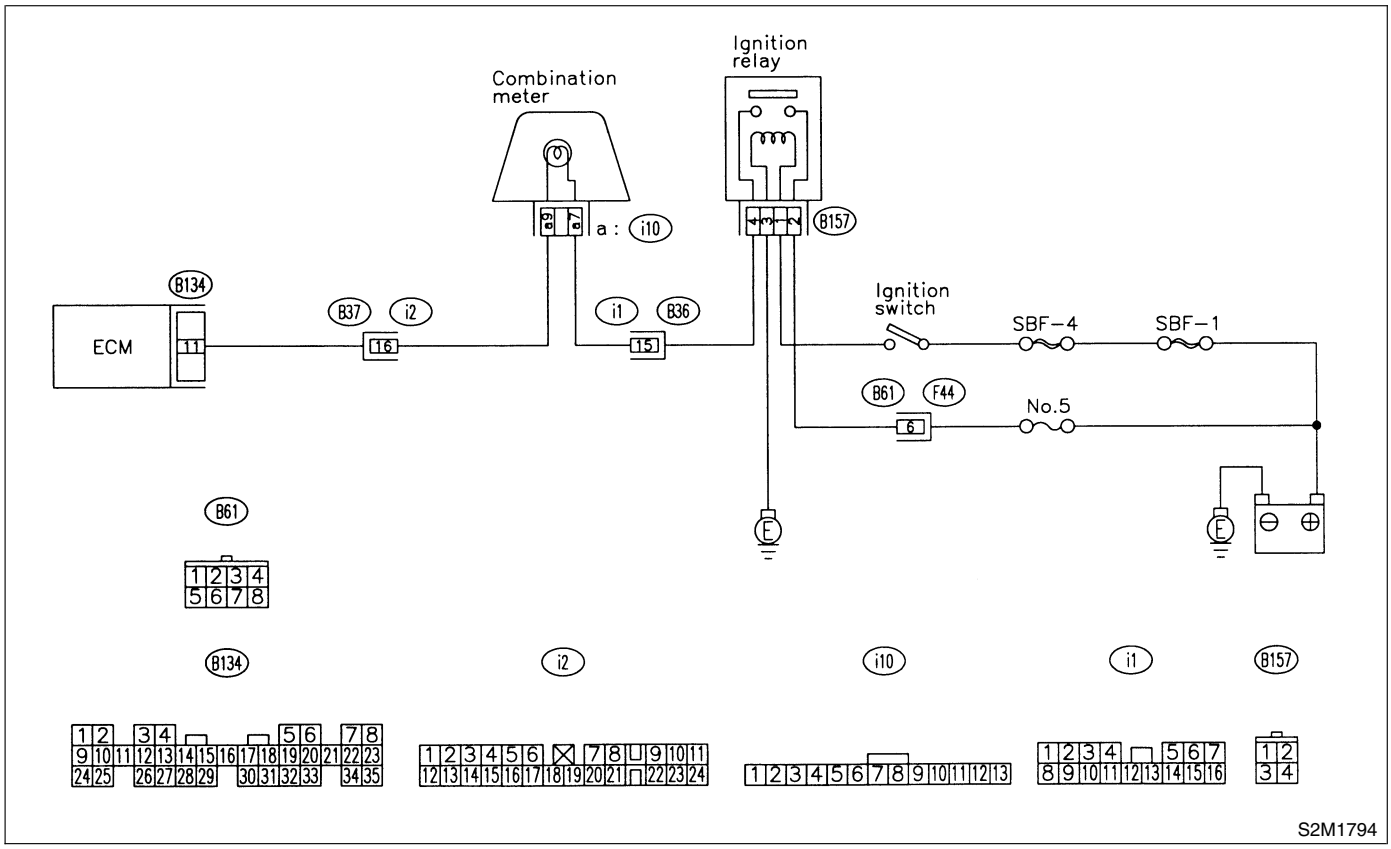
NOTE:
Use copies of this page for interviewing customers.

a) Other warning lights or indicators turn on. ☐ Yes/☐ No
☐ Low fuel warning light ☐ Charge indicator light ☐ AT diagnostics indicator light ☐ ABS warning light ☐ TCS warning light ☐ Engine oil pressure warning light
b) Fuel level
• Lack of gasoline: ☐ Yes/☐ No • Indicator position of fuel gauge:
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: ☐ Yes/☐ No
• What:
d) Intentional connecting or disconnecting of hoses: ☐ Yes/☐ No
• What:
e) Installing of parts other than genuine parts: ☐ Yes/☐ No
• What: • Where:
f) Occurrence of noise: ☐ Yes/☐ No
• From where: • What kind:
g) Occurrence of smell: ☐ Yes/☐ No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: ☐ Yes/☐ No
i) Troubles occurred
☐ Engine does not start. ☐ Engine stalls during idling. ☐ Engine stalls while driving. ☐ Engine speed decreases. ☐ Engine speed does not decrease. ☐ Rough idling ☐ Poor acceleration ☐ Back fire ☐ After fire ☐ No shift ☐ Excessive shift shock

7. Diagnostics for CHECK ENGINE Malfunction Indicator Lamp (MIL)

A: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON.

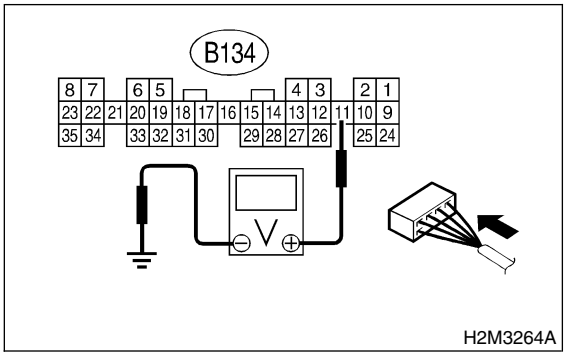
- **DIAGNOSIS:**
  - The CHECK ENGINE malfunction indicator lamp (MIL) circuit is open or shorted.
- **TROUBLE SYMPTOM:**
  - When ignition switch is turned ON (engine OFF), MIL does not come on.
- **WIRING DIAGRAM:**



7A1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 11 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **7A4**.
NO : Go to step **7A2**.

7A2 : CHECK POOR CONTACT.

CHECK : ***Does the MIL come on when shaking or pulling ECM connector and harness?***
YES : Repair poor contact in ECM connector.
NO : Go to step **7A3**.

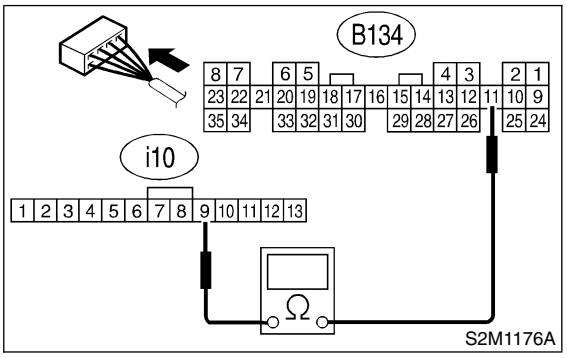
7A3 : CHECK ECM CONNECTOR.

CHECK : ***Is ECM connector correctly connected?***
YES : Replace ECM. <Ref. to 2-7 [W17A0].>
NO : Repair connection of ECM connector.

7A4 : CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Remove combination meter. <Ref. to 6-2 [W8A0].>
3) Disconnect connector from ECM and combination meter.
4) Measure resistance of harness between ECM and combination meter connector.

Connector & terminal
(B134) No. 11 — (i10) No. 9:



CHECK : ***Is resistance less than 1 Ω?***
YES : Go to step **7A5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and combination meter connector
- Poor contact in coupling connector (i2)

7A5 : CHECK POOR CONTACT.

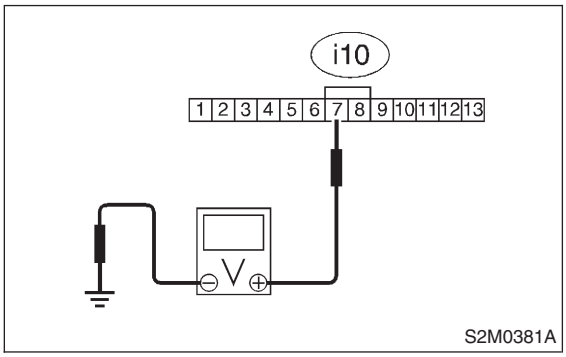
Check poor contact in combination meter connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in combination meter connector?***
YES : Repair poor contact in combination meter connector.
NO : Go to step **7A6**.

7A6 : CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between combination meter connector and chassis ground.

Connector & terminal
(i10) No. 7 (+) — Chassis ground (–):



CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7A7**.
NO : Check the following and repair if necessary.

NOTE:
- Broken down ignition relay.
- Blown out fuse (No. 5).
- If replaced fuse (No. 5) blows easily, check the harness for short circuit of harness between fuse (No. 5) and ignition relay connector.
- Open or short circuit in harness between fuse (No. 5) and battery terminal
- Open circuit in harness between fuse (No. 5) and ignition relay connector
- Poor contact in ignition relay connector
- Poor contact in ignition switch connector

7A7 : CHECK LAMP BULB.

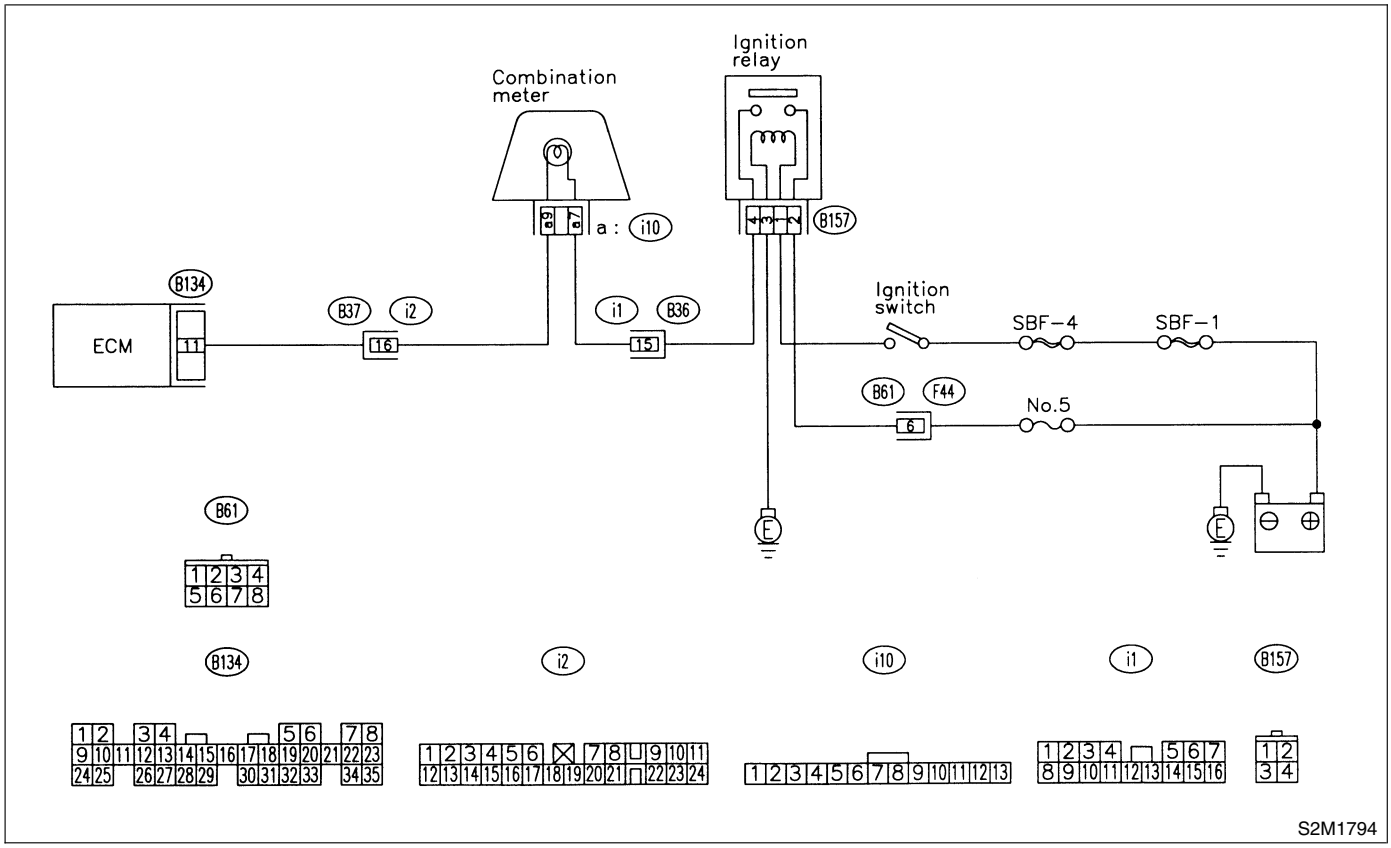
Remove engine malfunction indicator lamp bulb.

CHECK : ***Is lamp bulb condition OK?***
YES : Repair combination meter connector.
NO : Replace lamp bulb.

MEMO:

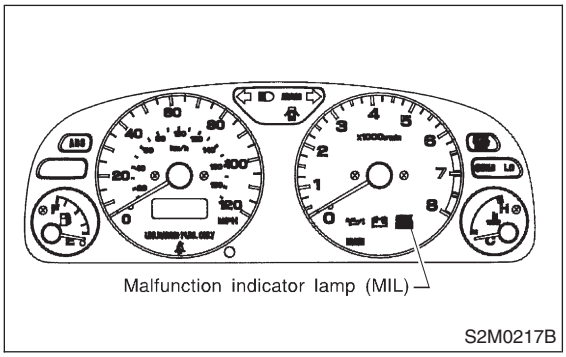
B: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT GO OFF.

- **DIAGNOSIS:**
  - The CHECK ENGINE malfunction indicator lamp (MIL) circuit is shorted.
- **TROUBLE SYMPTOM:**
  - Although MIL comes on when engine runs, trouble code is not shown on Subaru select monitor or OBD-II general scan tool display.
- **WIRING DIAGRAM:**



7B1 : CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.

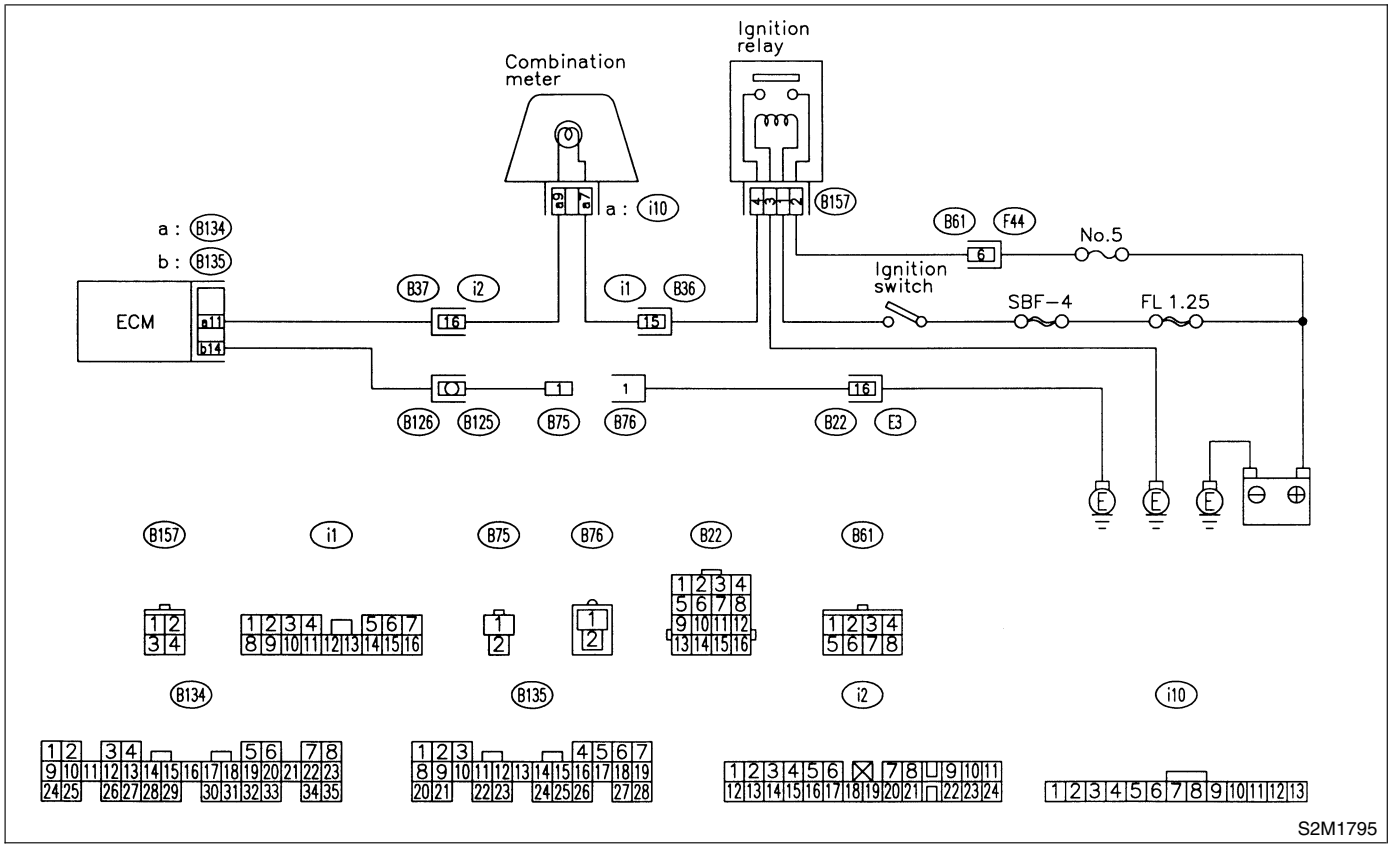
1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Turn ignition switch to ON.



CHECK : ***Does the MIL come on?***
YES : Repair short circuit in harness between combination meter and ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

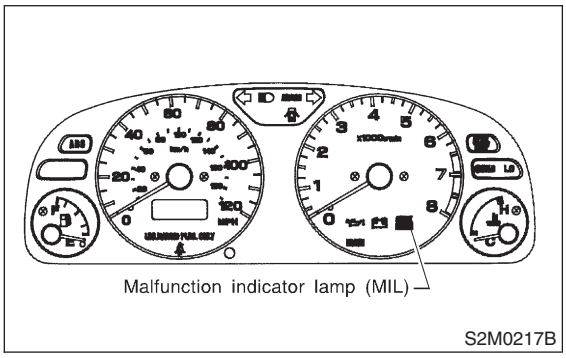
C: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT BLINK AT A CYCLE OF 3 Hz.

- **DIAGNOSIS:**
  - The CHECK ENGINE malfunction indicator lamp (MIL) circuit is open or shorted.
  - Test mode connector circuit is in open.
- **TROUBLE SYMPTOM:**
  - When inspection mode, MIL does not blink at a cycle of 3 Hz.
- **WIRING DIAGRAM:**



7C1 : CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).

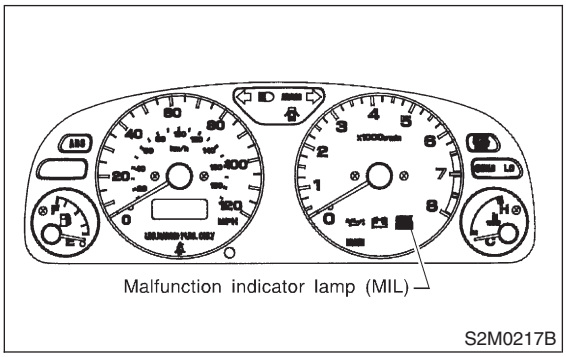
1) Turn ignition switch to OFF.
2) Disconnect test mode connector.
3) Turn ignition switch to ON. (engine OFF)



CHECK : ***Does the MIL come on?***
YES : Go to step **7C2**.
NO : Repair the MIL circuit. <Ref. to 2-7 [T7A0].>

7C2 : CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Turn ignition switch to ON.

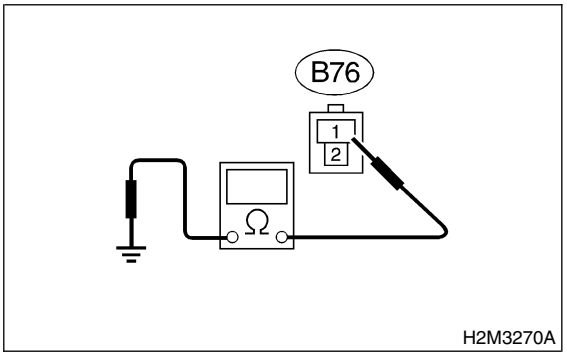


CHECK : ***Does the MIL come on?***
YES : Repair ground short circuit in harness between combination meter and ECM connector.
NO : Go to step **7C3**.

7C3 : CHECK HARNESS BETWEEN TEST MODE CONNECTOR AND CHASSIS GROUND.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between test mode connector and chassis ground.

Connector & terminal
(B76) No. 1 — Chassis ground:



CHECK : ***Is resistance less than 1 Ω?***
YES : Go to step **7C4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between test mode connector and chassis ground

7C4 : CHECK POOR CONTACT.

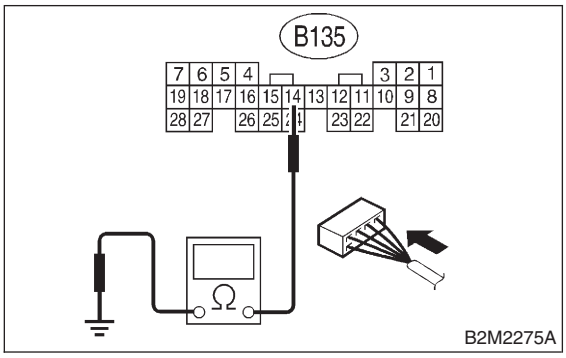
Check poor contact in ECM connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Go to step **7C5**.

7C5 : CHECK HARNESS BETWEEN ECM AND TEST MODE CONNECTOR.

1) Connect test mode connector.
2) Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B135) No. 14 — Chassis ground:



CHECK : ***Is resistance less than 1 Ω?***
YES : Go to step **7C6**.
NO : Repair open circuit in harness between ECM and test mode connector.

7C6 : CHECK POOR CONTACT.

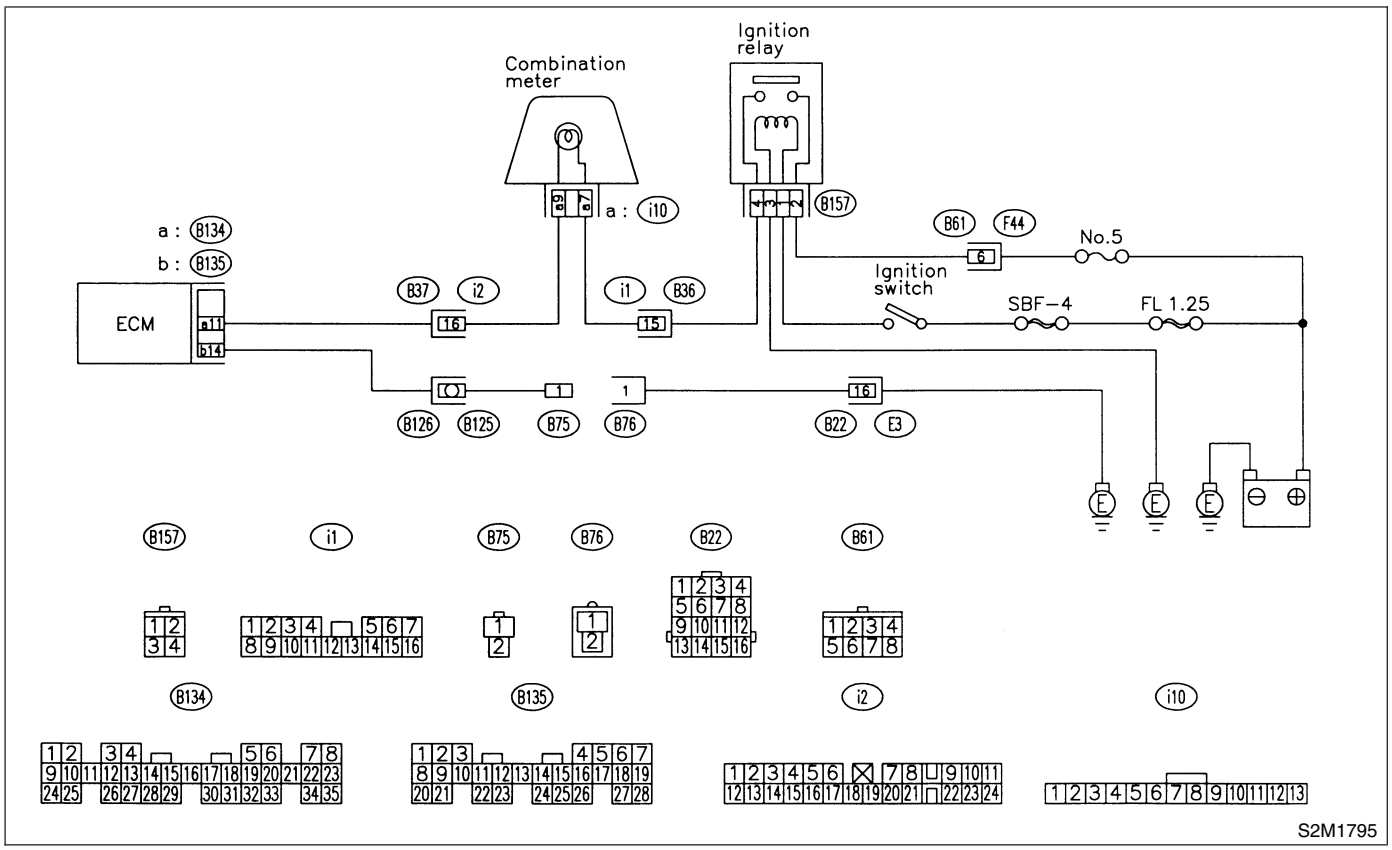
Check poor contact in ECM connector.
<Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

MEMO:

D: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 Hz.

- **DIAGNOSIS:**
  - Test mode connector circuit is shorted.
- **TROUBLE SYMPTOM:**
  - MIL blinks at a cycle of 3 Hz when ignition switch is turned to ON.
- **WIRING DIAGRAM:**



7D1 : CHECK TEST MODE CONNECTOR.

1) Disconnect test mode connector.
2) Turn ignition switch to ON.

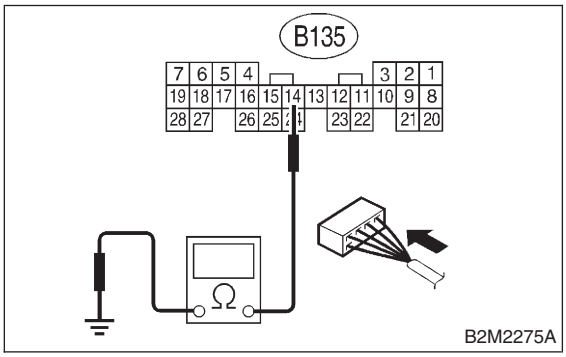
CHECK : ***Does MIL flash on and off?***
YES : Go to step **7D2**.
NO : System is in good order.

NOTE:
MIL blinks at a cycle of 3 Hz when test mode connector is connected.

7D2 : CHECK HARNESS BETWEEN ECM CONNECTOR AND ENGINE GROUNDING TERMINAL.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B135) No. 14 — Chassis ground:



CHECK : ***Is resistance less than 5 Ω?***
YES : Repair short circuit in harness between ECM and test mode connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

MEMO:

8. Diagnostics for Engine Starting Failure

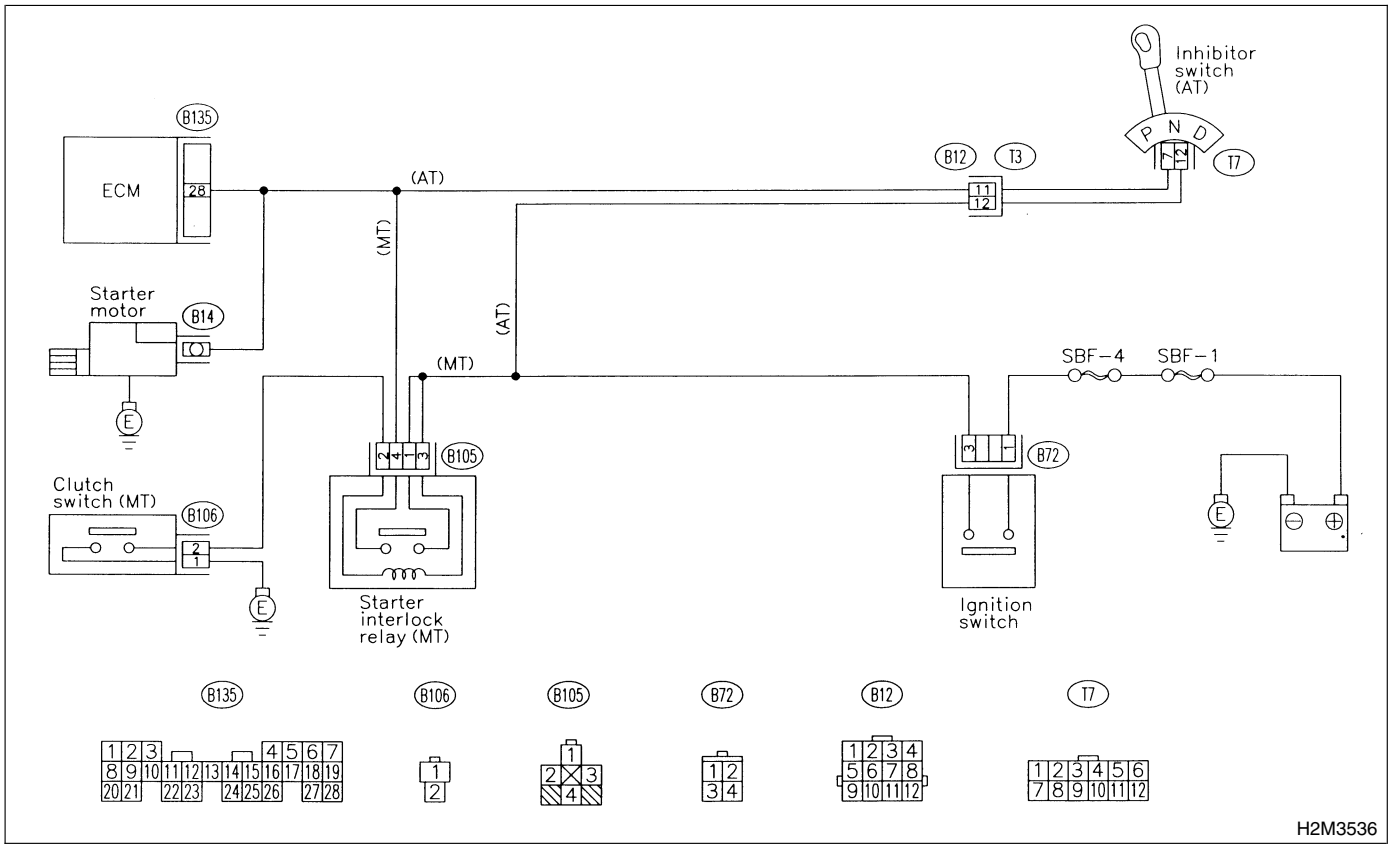
A: BASIC DIAGNOSTICS CHART

1. Inspection of starter motor circuit. <Ref. to 2-7 [T8B0].>
↓
2. Inspection of ECM power supply and ground line. <Ref. to 2-7 [T8C0].>
↓
3. Inspection of ignition control system. <Ref. to 2-7 [T8D0].>
↓
4. Inspection of fuel pump circuit. <Ref. to 2-7 [T8E0].>
↓
5. Inspection of fuel injector circuit. <Ref. to 2-7 [T8F0].>
↓
6. Inspection of crankshaft position sensor circuit. <Ref. to 2-7 [T8G0].>
↓
7. Inspection of camshaft position sensor circuit. <Ref. to 2-7 [T8H0].>
↓
8. Inspection using Subaru Select Monitor or OBD-II general scan tool <Ref. to 2-7 [T10A0].> or inspection using “9. General Diagnostics Table”. <Ref. to 2-7 [T900].>

B: STARTER MOTOR CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



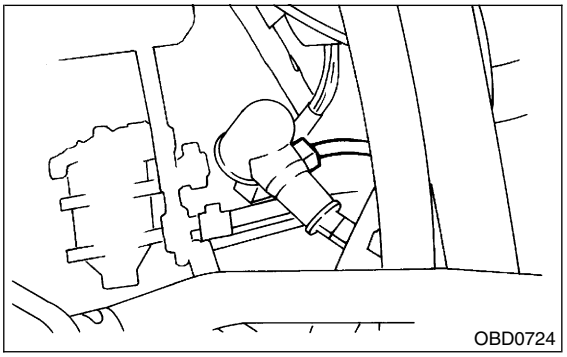
8B1 : CHECK BATTERY.

CHECK : ***Is the voltage more than 12 V?***
YES : Go to step **8B2**.
NO : Charge or replace battery.

8B2 : CHECK INPUT SIGNAL FOR STARTER MOTOR.

1) Turn ignition switch to OFF.

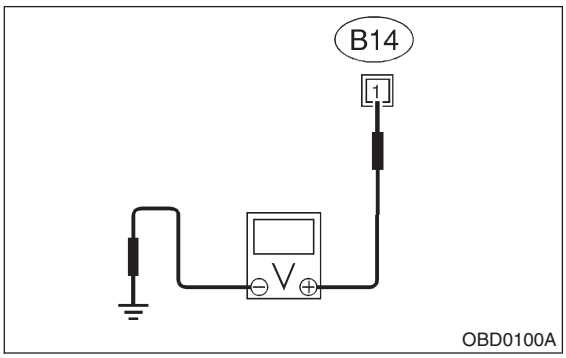
2) Disconnect connector from starter motor.



3) Turn ignition switch to ST.

4) Measure power supply voltage between starter motor connector terminal and engine ground.

Connector & terminal
(B14) No. 1 (+) — Engine ground (–):



NOTE:
- On AT vehicles, place the selector lever in the "P" or "N" position.
- On MT vehicles, depress the clutch pedal.

CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8B3**.
NO : Go to step **8B4**.

8B3 : CHECK GROUND CIRCUIT OF STARTER MOTOR.

1) Turn ignition switch to OFF.
2) Disconnect terminal from starter motor.



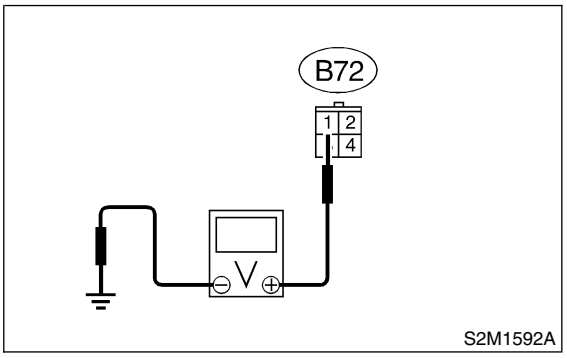
3) Measure resistance of ground cable between ground cable terminal and engine ground.

CHECK : ***Is resistance less than 5 Ω?***
YES : Check starter motor. <Ref. to 6-1 [K100].>
NO : Repair open circuit of ground cable.

8B4 : CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.

1) Disconnect connector from ignition switch.
2) Measure power supply voltage between ignition switch connector and chassis ground.

Connector & terminal
(B72) No. 1 (+) — Chassis ground (–):

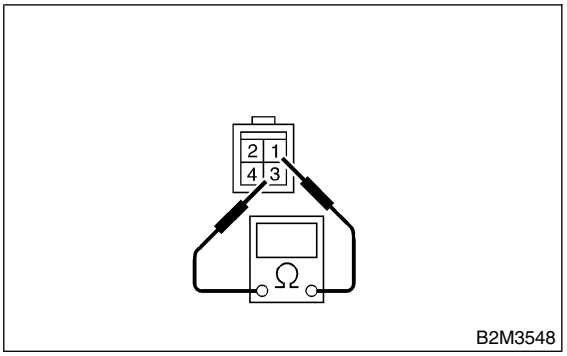


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8B6**.
NO : Repair open circuit in harness between ignition switch and battery, and check fuse SBF No. 4 and SBF No.1.

8B5 : CHECK IGNITION SWITCH.

1) Disconnect connector from ignition switch.
2) Measure resistance between ignition switch terminals while turning ignition switch to the "ST" position.

Terminals
No. 1 — No. 3:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8B6**.
NO : Replace ignition switch.

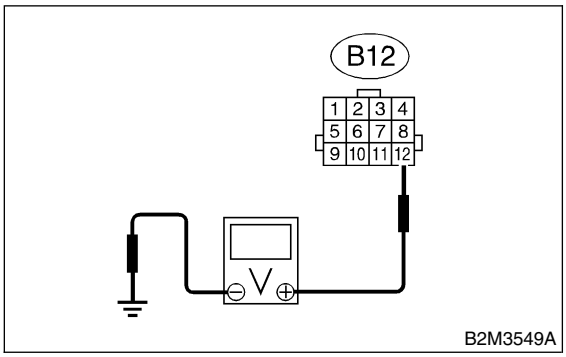
8B6 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **8B7**.
NO : Go to step **8B11**.

8B7 : CHECK INPUT VOLTAGE OF INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from inhibitor switch.
3) Connect connector to ignition switch.
4) Measure input voltage between inhibitor switch connector terminal and engine ground while turning ignition switch to ST.

Connector & terminal
(B12) No. 12 (+) — Engine ground (–):

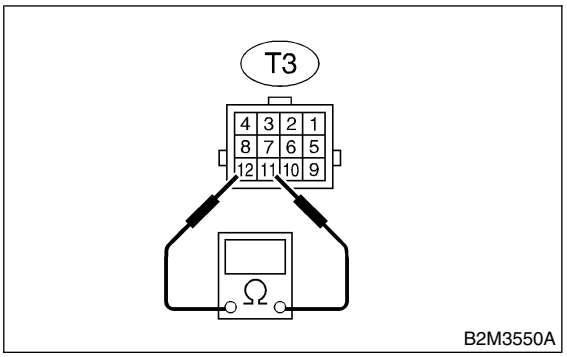


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8B8**.
NO : Repair open or ground short circuit in harness between inhibitor switch and ignition switch.

8B8 : CHECK INHIBITOR SWITCH.

1) Place the selector lever in the “P” or “N” position.
2) Measure resistance between inhibitor switch terminals.

Connector & terminal
(T3) No. 11 — No. 12:

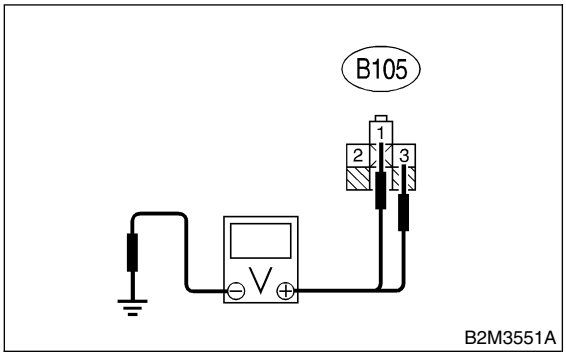


CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair open or ground short circuit in harness between inhibitor switch and starter motor.
NO : Replace inhibitor switch. <Ref. to 3-2 [W2C0].>

8B9 : CHECK INPUT VOLTAGE OF STARTER INTERLOCK RELAY.

1) Turn ignition switch to OFF.
2) Disconnect connector from starter interlock relay.
3) Connect connector to ignition switch.
4) Measure input voltage between starter interlock relay connector and chassis ground while turning ignition switch to ST.

Connector & terminal
(B105) No. 1 (+) — Chassis ground (–):
(B105) No. 3 (+) — Chassis ground (–):

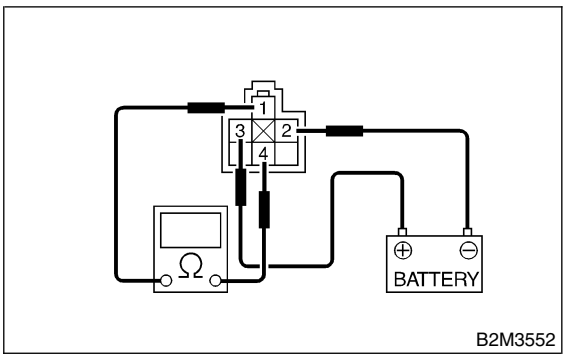


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8B10**.
NO : Repair open or ground short circuit in harness between starter interlock relay and ignition switch.

8B10 : CHECK STARTER INTERLOCK RELAY.

1) Connect battery to starter interlock relay terminals No. 2 and No. 3.
2) Measure resistance between starter interlock relay terminals.

Terminals
No. 1 — No. 4:

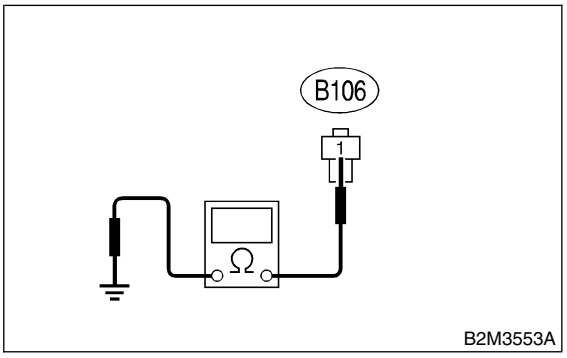


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8B11**.
NO : Replace starter interlock relay.

8B11 : CHECK GROUND CIRCUIT OF CLUTCH SWITCH.

1) Disconnect connector from clutch switch.
2) Measure resistance between clutch switch connector and chassis ground.

Connector & terminal
(B106) No. 1 — Chassis ground:

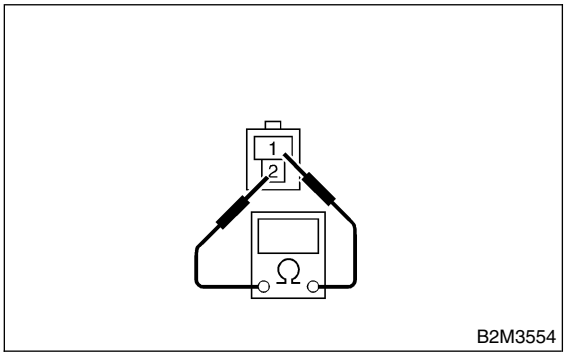


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8B12**.
NO : Repair open circuit of ground cable.

8B12 : CHECK CLUTCH SWITCH.

1) Measure resistance between clutch switch terminal while depressing the clutch pedal.

Terminals
No. 1 — No. 2:

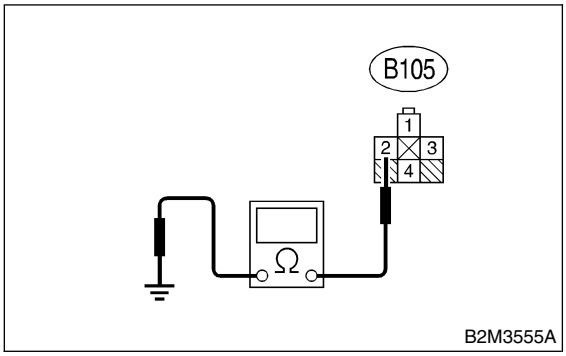


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8B13**.
NO : Replace clutch switch. <Ref. to 6-2 [T100].>

8B13 : CHECK CLUTCH SWITCH CIRCUIT.

1) Connect connector to clutch switch.
2) Measure resistance between starter interlock relay connector and chassis ground while depressing the clutch pedal.

Connector & terminal
(B105) No. 2 — Chassis ground:



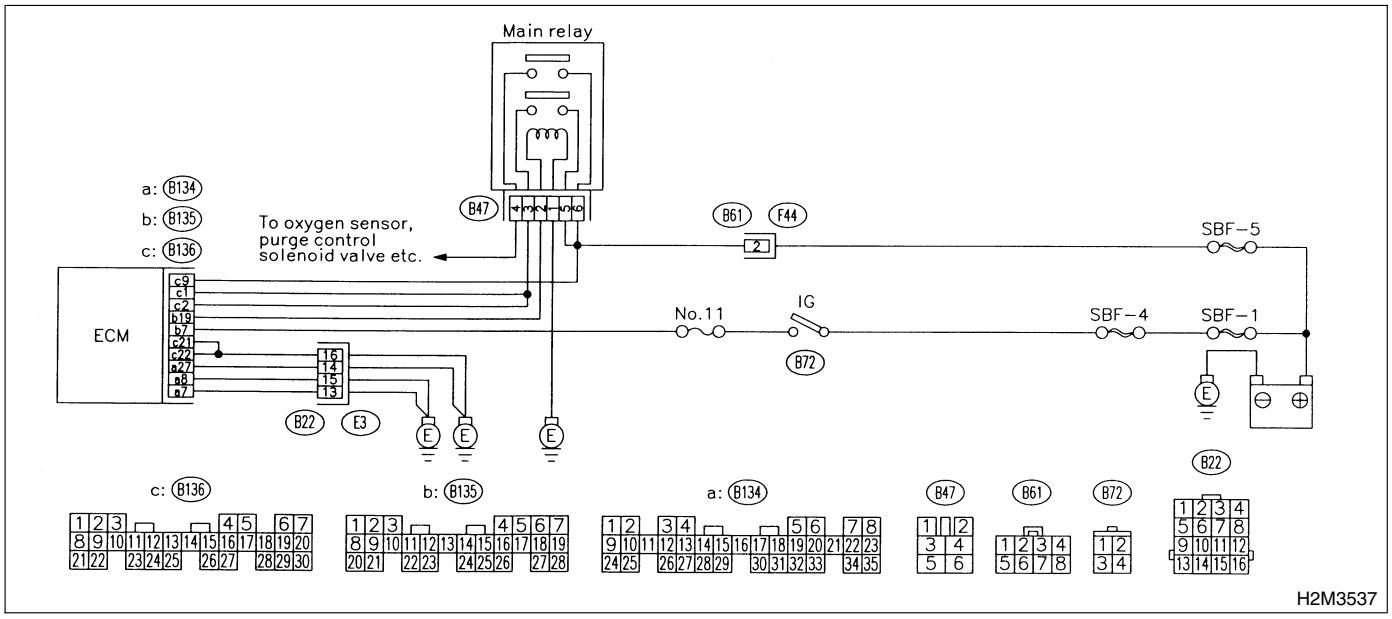
CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair open or ground short circuit in harness between starter interlock relay and starter motor.
NO : Repair open circuit in harness between starter interlock relay and clutch switch.

MEMO:

C: CONTROL MODULE POWER SUPPLY AND GROUND LINE

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE. <Ref. to 2-7 [T3E0].>

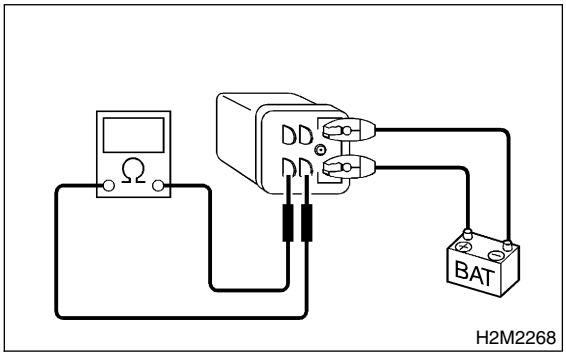
- **WIRING DIAGRAM:**



8C1 : CHECK MAIN RELAY.

1) Turn the ignition switch to OFF.
2) Remove main relay.
3) Connect battery to main relay terminals No. 1 and No. 2.
4) Measure resistance between main relay terminals.

Terminals
No. 3 — No. 5:

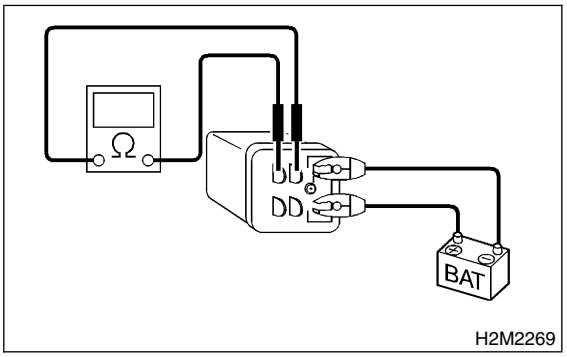


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8C2**.
NO : Replace main relay.

8C2 : CHECK MAIN RELAY.

Measure resistance between main relay terminals.

Terminals
No. 4 — No. 6:

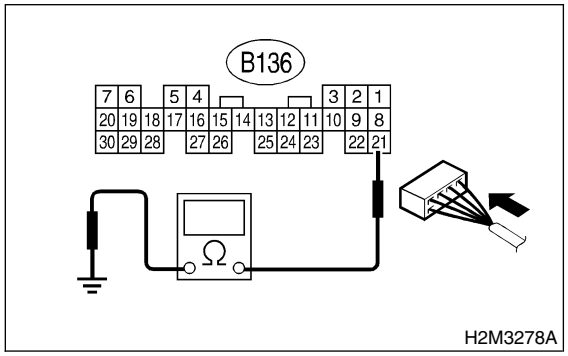


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8C3**.
NO : Replace main relay.

8C3 : CHECK GROUND CIRCUIT OF ECM.

1) Disconnect connector from ECM.
2) Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B136) No. 21 — Chassis ground:

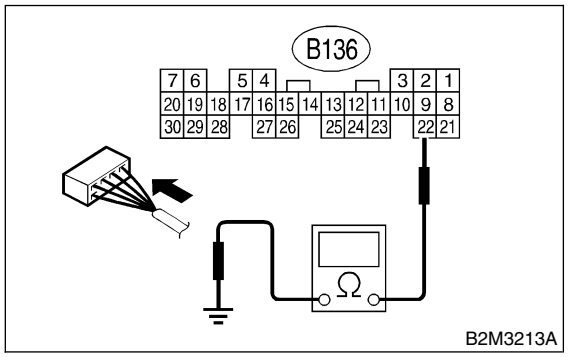


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C4**.
NO : Repair open circuit in harness between ECM connector and engine grounding terminal.

8C4 : CHECK GROUND CIRCUIT OF ECM.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B136) No. 22 — Chassis ground:

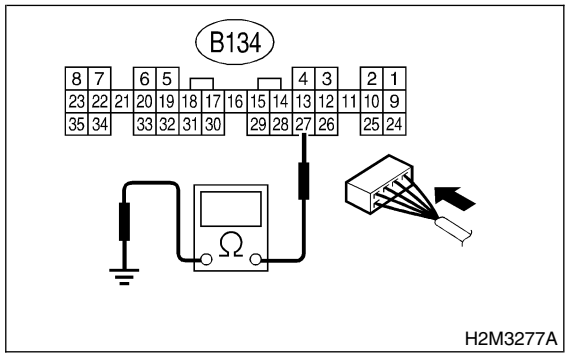


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C5**.
NO : Repair open circuit in harness between ECM connector and engine grounding terminal.

8C5 : CHECK GROUND CIRCUIT OF ECM.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B134) No. 27 — Chassis ground:

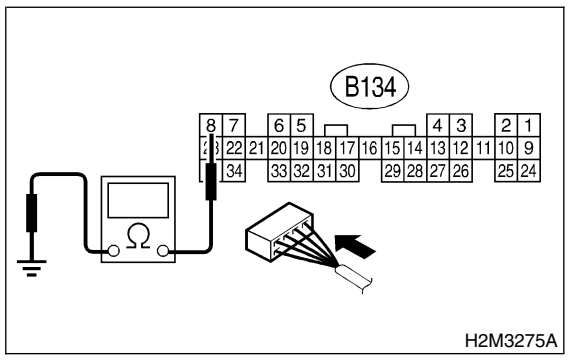


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C6**.
NO : Repair open circuit in harness between ECM connector and engine grounding terminal.

8C6 : CHECK GROUND CIRCUIT OF ECM.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B134) No. 8 — Chassis ground:

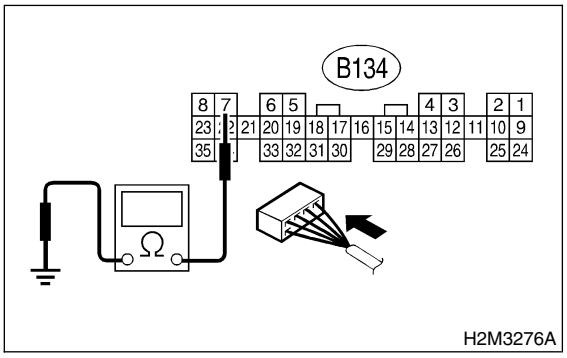


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C7**.
NO : Repair open circuit in harness between ECM connector and engine grounding terminal.

8C7 : CHECK GROUND CIRCUIT OF ECM.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B134) No. 7 — Chassis ground:

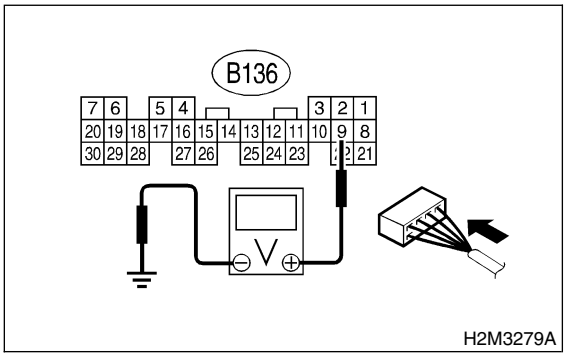


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C8**.
NO : Repair open circuit in harness between ECM connector and engine ground terminal.

8C8 : CHECK INPUT VOLTAGE OF ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 9 (+) — Chassis ground (–):

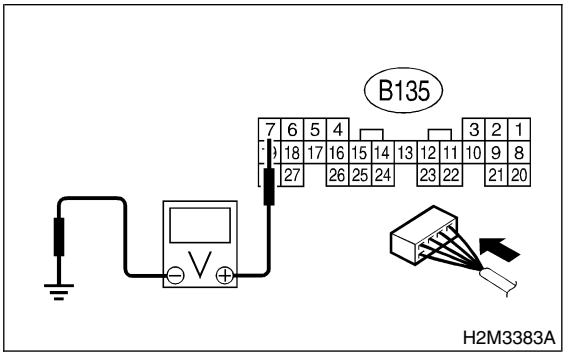


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C9**.
NO : Repair open or ground short circuit of power supply circuit.

8C9 : CHECK INPUT VOLTAGE OF ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B135) No. 7 (+) — Chassis ground (–):

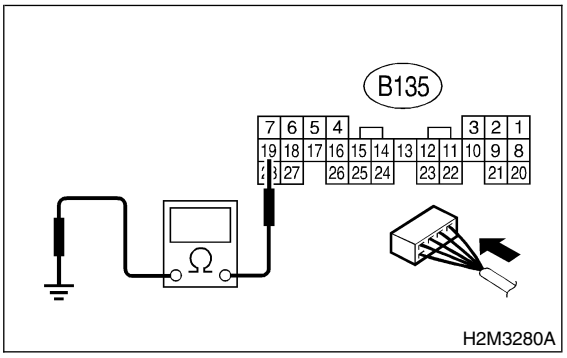


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C10**.
NO : Repair open or ground short circuit of power supply circuit.

8C10 : CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ECM and chassis ground.

Connector & terminal
(B135) No. 19 — Chassis ground:

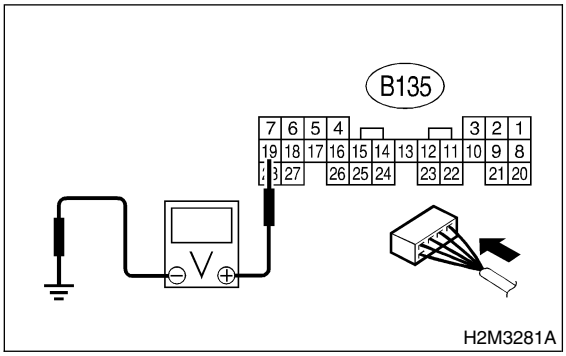


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8C11**.
NO : Repair ground short circuit in harness between ECM connector and main relay connector, then replace ECM.

8C11 : CHECK OUTPUT VOLTAGE FROM ECM.

1) Connect connector to ECM.
2) Turn ignition switch to ON.
3) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B135) No. 19 (+) — Chassis ground (–):

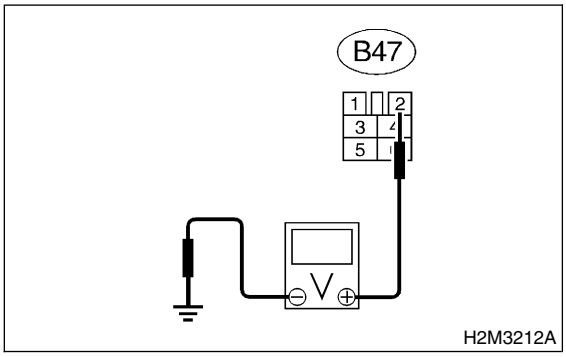


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C12**.
NO : Replace ECM.

8C12 : CHECK INPUT VOLTAGE OF MAIN RELAY.

Check voltage between main relay connector and chassis ground.

Connector & terminal
(B47) No. 2 (+) — Chassis ground (–):

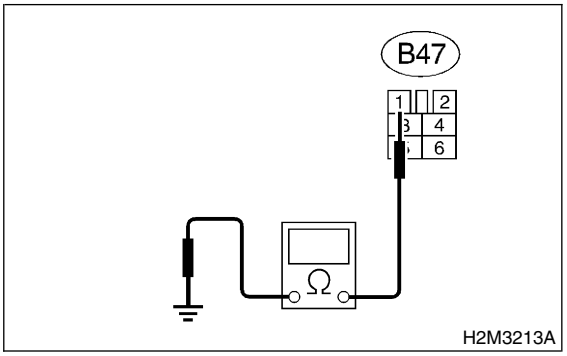


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C13**.
NO : Repair open circuit in harness between ECM connector and main relay connector.

8C13 : CHECK GROUND CIRCUIT OF MAIN RELAY.

1) Turn ignition switch to OFF.
2) Measure resistance between main relay connector and chassis ground.

Connector & terminal
(B47) No. 1 — Chassis ground:

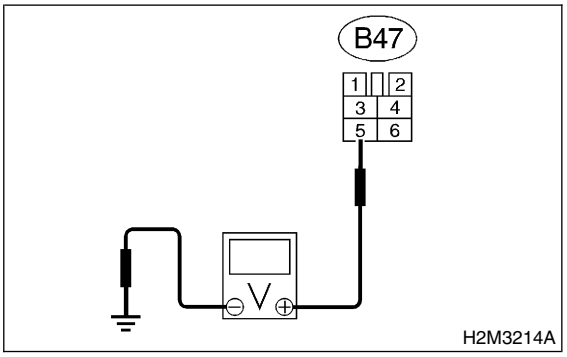


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8C14**.
NO : Repair open circuit between main relay and chassis ground.

8C14 : CHECK INPUT VOLTAGE OF MAIN RELAY.

Measure voltage between main relay connector and chassis ground.

Connector & terminal
(B47) No. 5 (+) — Chassis ground (–):

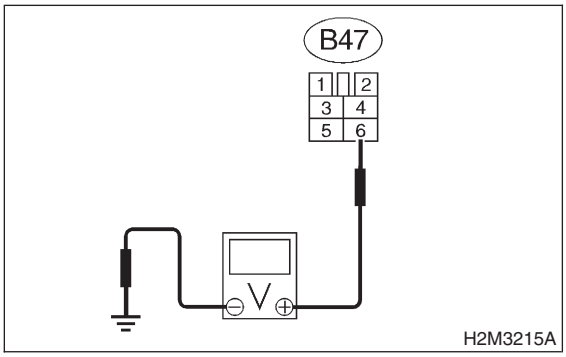


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C15**.
NO : Repair open or ground short circuit in harness of power supply circuit.

8C15 : CHECK INPUT VOLTAGE OF MAIN RELAY.

Measure voltage between main relay connector and chassis ground.

Connector & terminal
(B47) No. 6 (+) — Chassis ground (–):

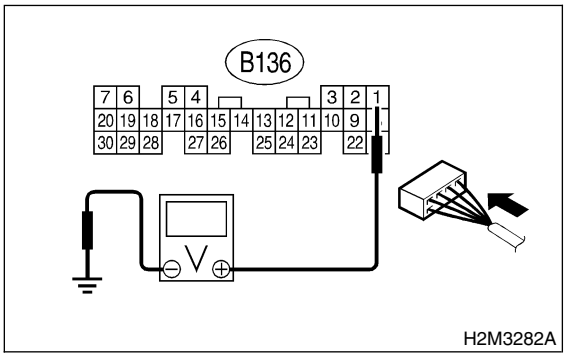


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C16**.
NO : Repair open or ground short circuit in harness of power supply circuit.

8C16 : CHECK INPUT VOLTAGE OF ECM.

1) Connect main relay connector.
2) Turn ignition switch to ON.
3) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 1 (+) — Chassis ground (–):

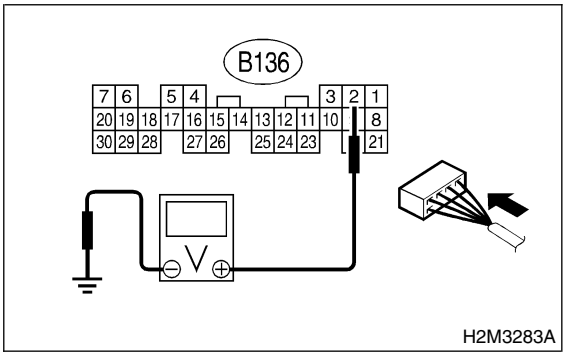


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8C17**.
NO : Repair open or ground short circuit in harness between ECM connector and main relay connector.

8C17 : CHECK INPUT VOLTAGE OF ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 2 (+) — Chassis ground (–):



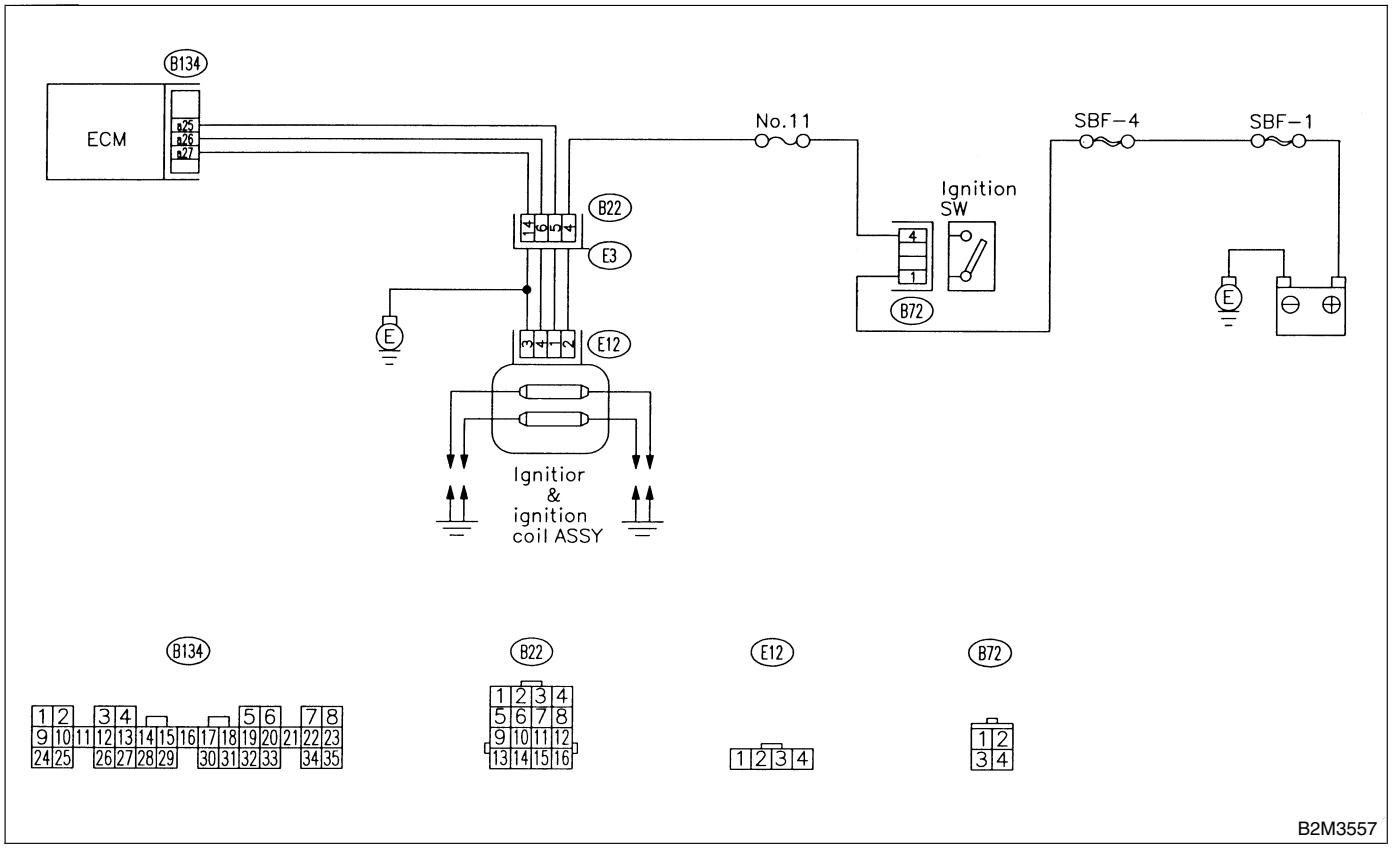
CHECK : ***Is the voltage more than 10 V?***
YES : Check ignition control system. <Ref. to 2-7 [T8D0].>
NO : Repair open or ground short circuit in harness between ECM connector and main relay connector.

MEMO:

D: IGNITION CONTROL SYSTEM

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**

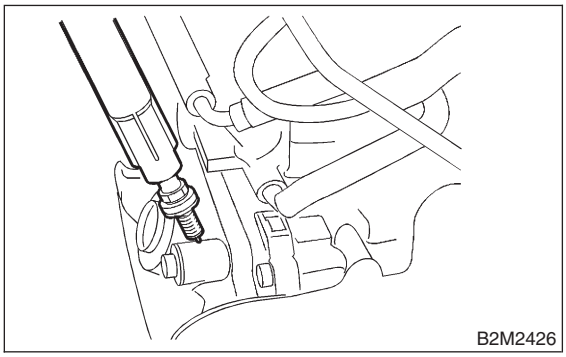


8D1 : CHECK IGNITION SYSTEM FOR SPARKS.

1) Remove plug cord cap from each spark plug.
2) Install new spark plug on plug cord cap.

CAUTION:
Do not remove spark plug from engine.

3) Contact spark plug's thread portion on engine.
4) While opening throttle valve fully, crank engine to check that spark occurs at each cylinder.

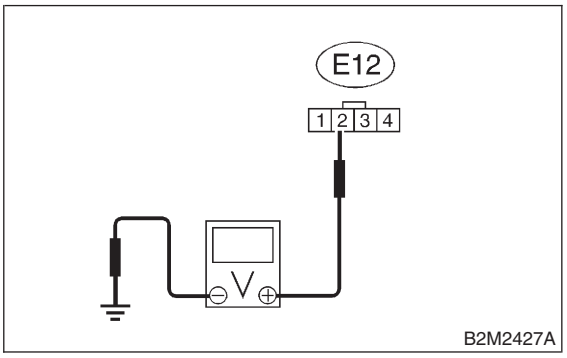


CHECK : ***Does spark occur at each cylinder?***
YES : Check fuel pump system. <Ref. to 2-7 [T8E0].>
NO : Go to step **8D2**.

8D2 : CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSEMBLY.

1) Turn ignition switch to OFF.
2) Disconnect connector from ignition coil & ignitor assembly.
3) Turn ignition switch to ON.
4) Measure power supply voltage between ignition coil & ignitor assembly connector and engine ground.

Connector & terminal
(E12) No. 2 (+) — Engine ground (–):



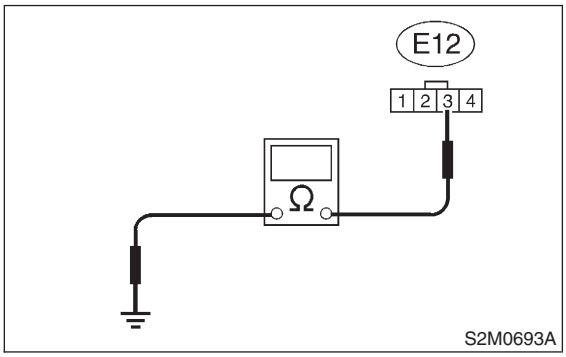
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8D3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ignition coil & ignitor assembly, and ignition switch connector
- Poor contact in coupling connectors (B22)

8D3 : CHECK HARNESS OF IGNITION COIL & IGNITOR ASSEMBLY GROUND CIRCUIT.

1) Turn ignition switch to OFF.
2) Measure resistance between ignition coil & ignitor assembly connector and engine ground.

Connector & terminal
(E12) No. 3 — Engine ground:



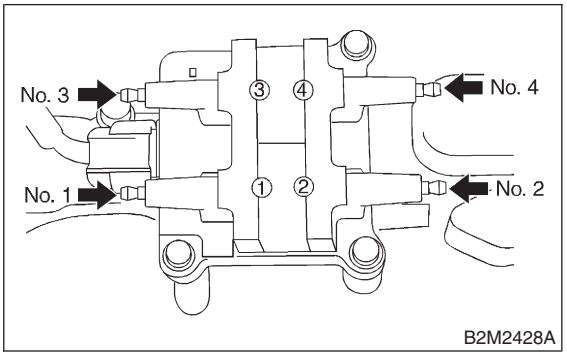
CHECK : ***Is the resistance between less than 5 Ω?***
YES : Go to step **8D4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ignition coil & ignitor assembly connector and engine grounding terminal

8D4 : CHECK IGNITION COIL & IGNITOR ASSEMBLY.

1) Remove spark plug cords.
2) Measure resistance between spark plug cord contact portions to check secondary coil.

Terminals
No. 1 — No. 2:

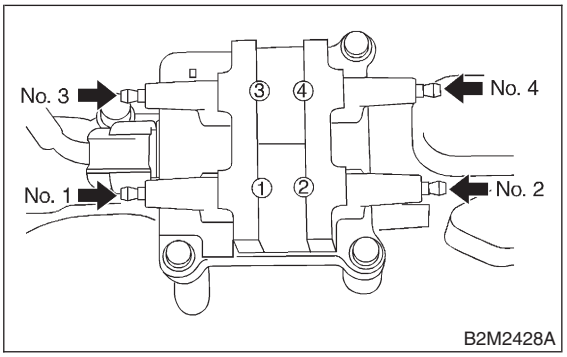


CHECK : ***Is the resistance between 10 and 15 kΩ?***
YES : Go to step **8D5**.
NO : Replace ignition coil & ignitor assembly. <Ref. to 6-1 [W4A0].>

8D5 : CHECK IGNITION COIL & IGNITOR ASSEMBLY.

Measure resistance between spark plug cord contact portions to check secondary coil.

Terminals
No. 3 — No. 4:

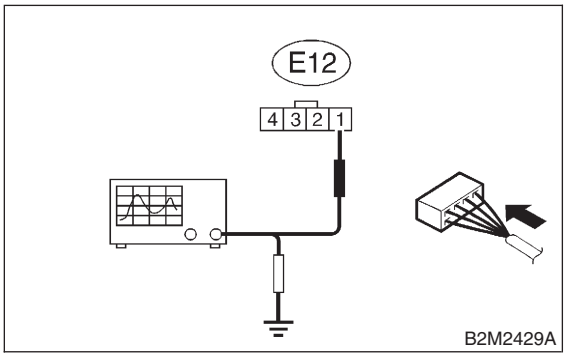


CHECK : ***Is the resistance between 10 and 15 kΩ?***
YES : Go to step **8D6**.
NO : Replace ignition coil & ignitor assembly. <Ref. to 6-1 [W4A0].>

8D6 : CHECK INPUT SIGNAL FOR IGNITION COIL & IGNITOR ASSEMBLY.

1) Connect connector to ignition coil & ignitor assembly.
2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil & ignitor assembly connector and engine ground.

Connector & terminal
(E12) No. 1 (+) — Engine ground (–):

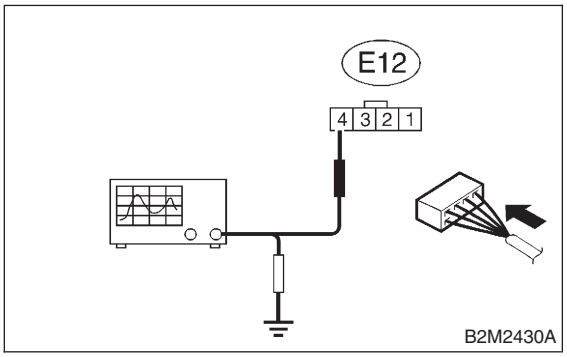


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8D7**.
NO : Replace ignition coil & ignitor assembly. <Ref. to 6-1 [W4A0].>

8D7 : CHECK INPUT SIGNAL FOR IGNITION COIL & IGNITOR ASSEMBLY.

Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil & ignitor assembly connector and engine ground.

Connector & terminal
(E12) No. 4 (+) — Engine ground (–):

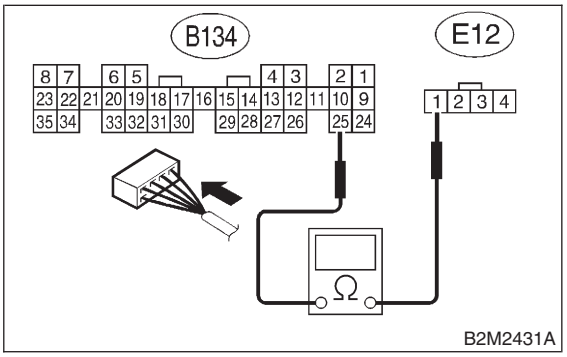


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8D8**.
NO : Replace ignition coil & ignitor assembly. <Ref. to 6-1 [W4A0].>

8D8 : CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Disconnect connector from ignition coil & ignitor assembly.
4) Measure resistance of harness between ECM and ignition coil & ignitor assembly connector.

Connector & terminal
(B134) No. 25 — (E12) No. 1:



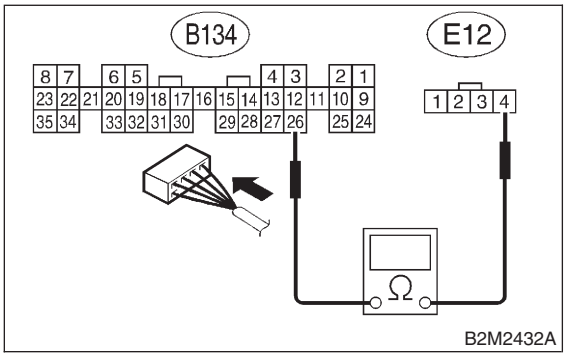
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D9**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and ignition coil & ignitor assembly connector
- Poor contact in coupling connector (B22)

8D9 : CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.

Measure resistance of harness between ECM and ignition coil & ignitor assembly connector.

Connector & terminal
(B134) No. 26 — (E12) No. 4:



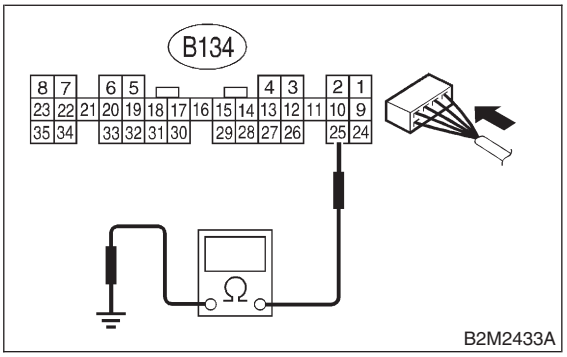
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D10**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and ignition coil & ignitor assembly connector
- Poor contact in coupling connector (B22)

8D10 : CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.

Measure resistance of harness between ECM and engine ground.

Connector & terminal:
(B134) No. 25 — Engine ground:

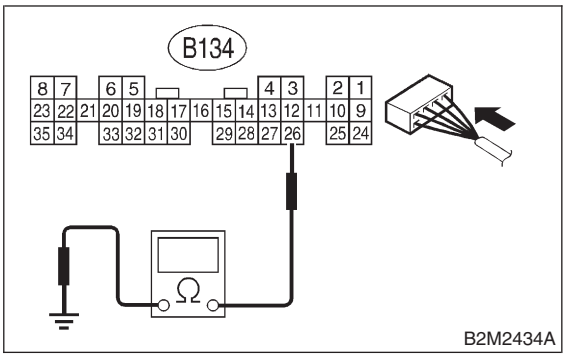


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8D11**.
NO : Repair ground short circuit in harness between ECM and ignition coil & ignitor assembly connector.

8D11 : CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.

Measure resistance of harness between ECM and engine ground.

Connector & terminal
(B134) No. 26 — Engine ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8D12**.
NO : Repair ground short circuit in harness between ECM and ignition coil & ignitor assembly connector.

8D12 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***

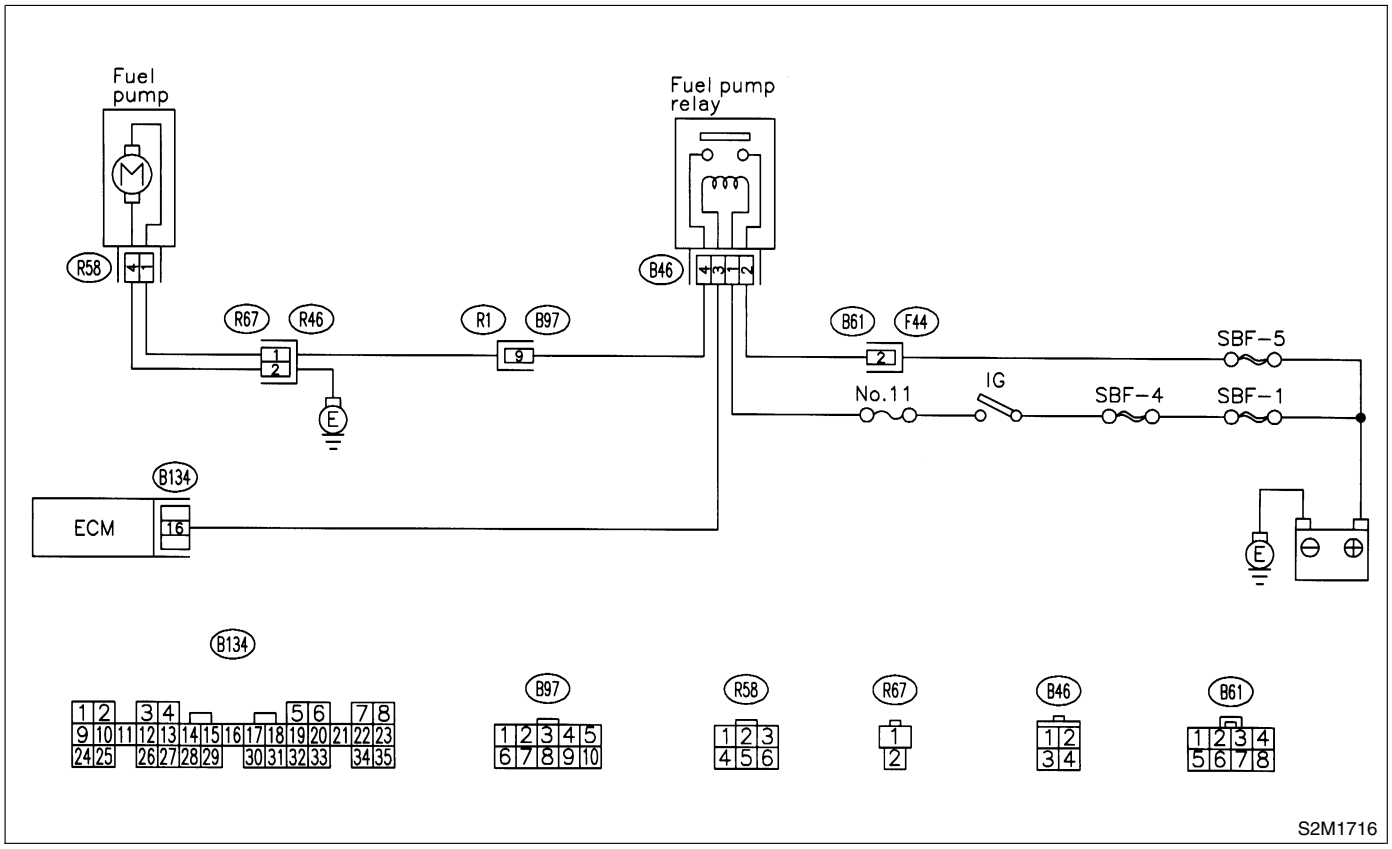
YES : Repair poor contact in ECM connector.

NO : Check fuel pump circuit. <Ref. to 2-7 [T8E0].>

E: FUEL PUMP CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



8E1 : CHECK OPERATING SOUND OF FUEL PUMP.

Make sure that fuel pump is in operation for two seconds when turning ignition switch to ON.

NOTE:
Fuel pump operation can also be executed using Subaru Select Monitor (Function mode: FD01).
For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

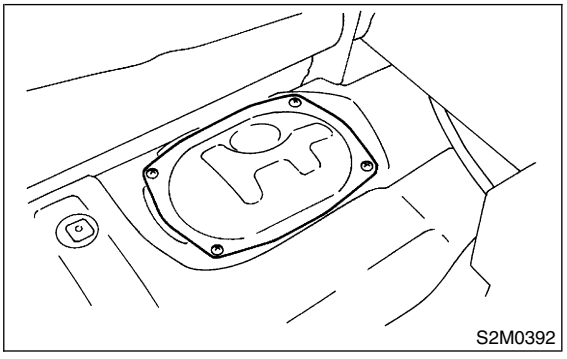
CHECK : ***Does fuel pump produce operating sound?***

YES : Check fuel injector circuit. <Ref. to 2-7 [T8G0].>

NO : Go to step **8E2**.

8E2 : CHECK GROUND CIRCUIT OF FUEL PUMP.

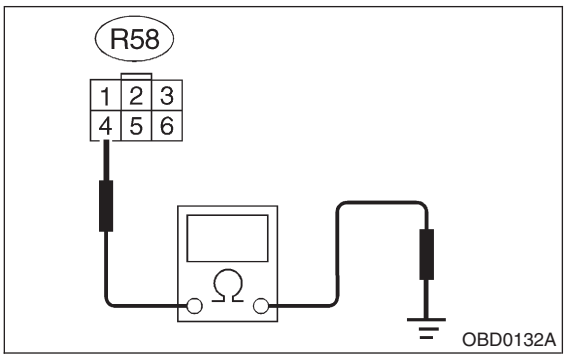
1) Turn ignition switch to OFF.
2) Remove fuel pump access hole lid located on the right rear of luggage compartment floor.



3) Disconnect connector from fuel pump.

4) Measure resistance of harness connector between fuel pump and chassis ground.

Connector & terminal
(R58) No. 4 — Chassis ground:



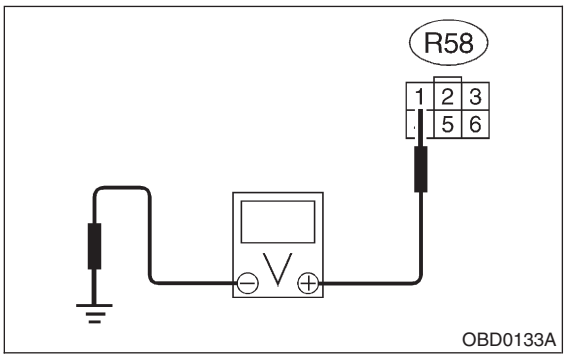
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **8E3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between fuel pump connector and chassis grounding terminal
- Poor contact in coupling connector (R67)

8E3 : CHECK POWER SUPPLY TO FUEL PUMP.

1) Turn ignition switch to ON.
2) Measure voltage of power supply circuit between fuel pump connector and chassis ground.

Connector & terminal
(R58) No. 1 (+) — Chassis ground (–):

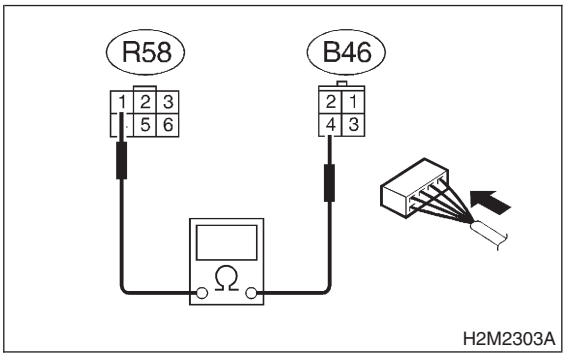


CHECK : ***Is the voltage more than 10 V?***
YES : Replace fuel pump. <Ref. to 2-8 [W3A0].>
NO : Go to step **8E4**.

8E4 : CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance of harness connector between fuel pump and fuel pump relay.

Connector & terminal
(R58) No. 1 — (B46) No. 4:



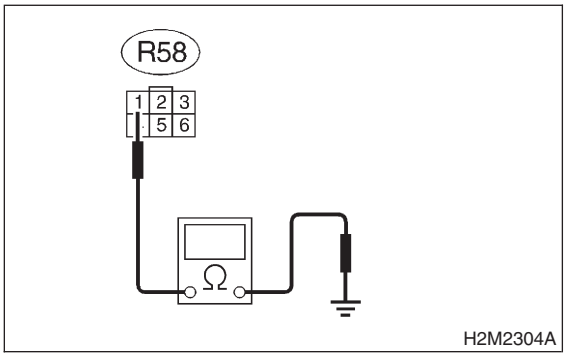
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8E5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between fuel pump connector and chassis grounding terminal
- Poor contact in coupling connectors (R67 and B97)

8E5 : CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.

Measure resistance of harness between fuel pump and fuel pump relay connector.

Connector & terminal
(R58) No. 1 — Chassis ground:

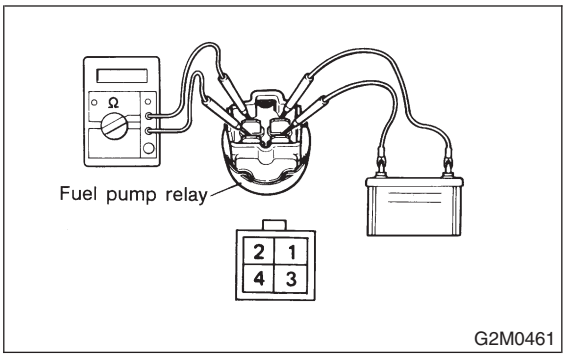


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8E6**.
NO : Repair short circuit in harness between fuel pump and fuel pump relay connector.

8E6 : CHECK FUEL PUMP RELAY.

1) Disconnect connectors from fuel pump relay and main relay.
2) Remove fuel pump relay and main relay with bracket.
3) Connect battery to fuel pump relay connector terminals No. 1 and No. 3.
4) Measure resistance between connector terminals of fuel pump relay.

Terminals
No. 2 — No. 4:

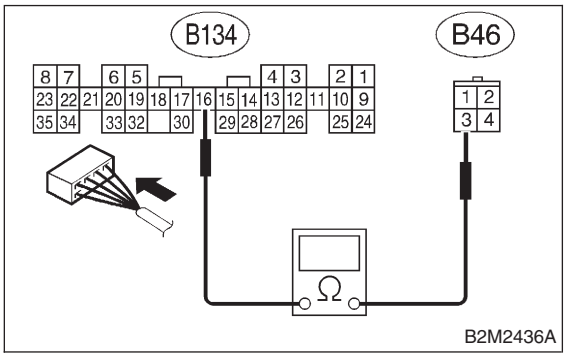


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8E7**.
NO : Replace fuel pump relay. <Ref. to 2-7 [W19A0].>

8E7 : CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.

1) Disconnect connectors from ECM.
2) Measure resistance of harness between ECM and fuel pump relay connector.

Connector & terminal
(B134) No. 16 — (B46) No. 3:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8E8**.
NO : Repair open circuit in harness between ECM and fuel pump relay connector.

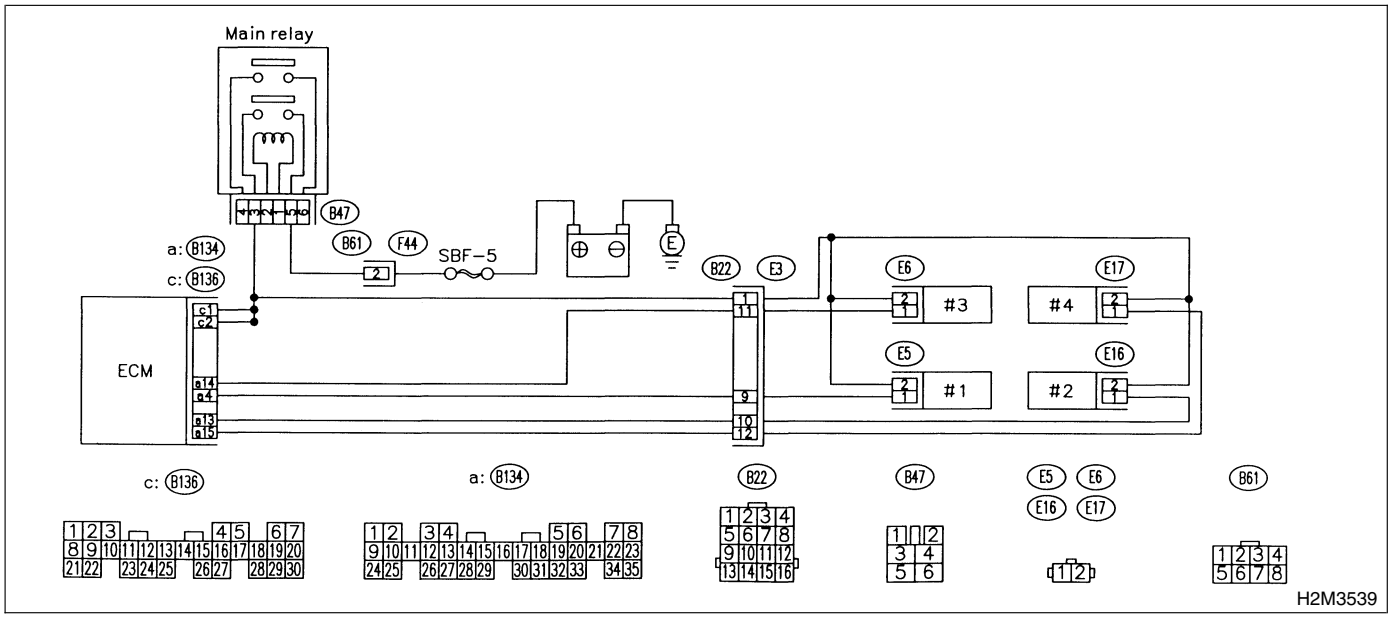
8E8 : CHECK POOR CONTACT.

Check poor contact in ECM connector.
<Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Check fuel injector circuit. <Ref. to 2-7 [T8G0].>

F: FUEL INJECTOR CIRCUIT

CAUTION:
- **Check or repair only faulty parts.**
- **After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE. <Ref. to 2-7 [T3E0].>**
- **WIRING DIAGRAM:**



8F1 : CHECK OPERATION OF EACH FUEL INJECTOR.

While cranking the engine, check that each fuel injector emits “operating” sound. Use a sound scope or attach a screwdriver to injector for this check.

CHECK : ***Is the fuel injector emits “operating” sound?***

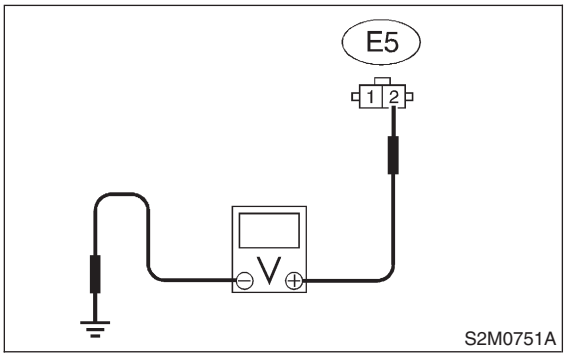
YES : Check fuel pressure. <Ref. to 2-2 [W7A0].>

NO : Go to step **8F2**.

8F2 : CHECK POWER SUPPLY TO EACH FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from #1 cylinder fuel injector.
3) Turn ignition switch to ON.
4) Measure power supply voltage between the fuel injector terminal and engine ground.

Connector & terminal
#1 (E5) No. 2 (+) — Engine ground (–):



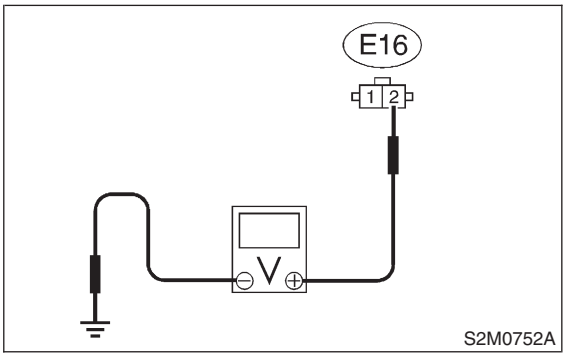
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8F3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel injector connector
- Poor contact in main relay connector
- Poor contact in coupling connector (B22)
- Poor contact in fuel injector connector

8F3 : CHECK POWER SUPPLY TO EACH FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from #2 cylinder fuel injector.
3) Turn ignition switch to ON.
4) Measure power supply voltage between the fuel injector terminal and engine ground.

Connector & terminal
#2 (E16) No. 2 (+) — Engine ground (–):



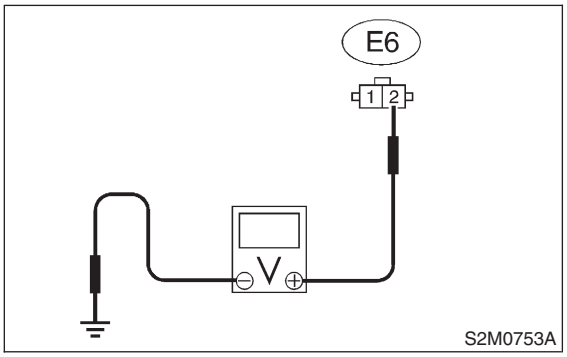
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8F4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel injector connector
- Poor contact in main relay connector
- Poor contact in coupling connector (B22)
- Poor contact in fuel injector connector

8F4 : CHECK POWER SUPPLY TO EACH FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from #3 cylinder fuel injector.
3) Turn ignition switch to ON.
4) Measure power supply voltage between the fuel injector terminal and engine ground.

Connector & terminal
#3 (E6) No. 2 (+) — Engine ground (–):



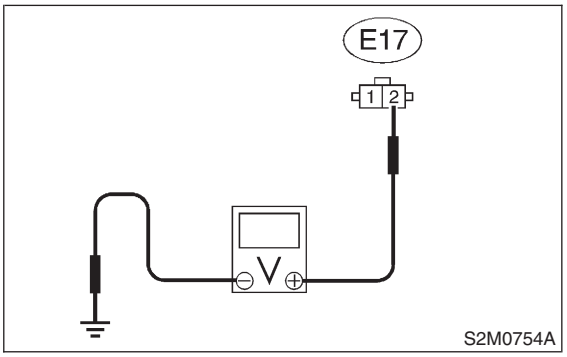
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8F5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel injector connector
- Poor contact in main relay connector
- Poor contact in coupling connectors (B22)
- Poor contact in fuel injector connector

8F5 : CHECK POWER SUPPLY TO EACH FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from #4 cylinder fuel injector.
3) Turn ignition switch to ON.
4) Measure power supply voltage between the fuel injector terminal and engine ground.

Connector & terminal
#4 (E17) No. 2 (+) — Engine ground (–):



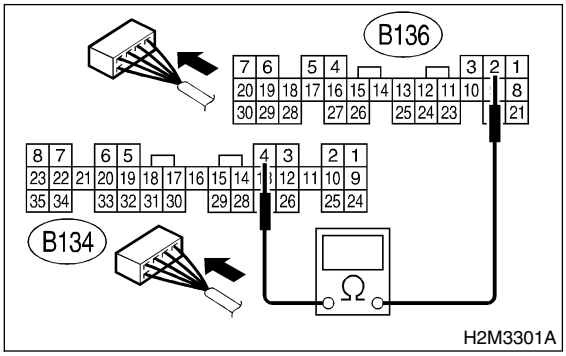
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8F6**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel injector connector
- Poor contact in main relay connector
- Poor contact in coupling connectors (B22)
- Poor contact in fuel injector connector

8F6 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

1) Disconnect connector from ECM.
2) Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 4 — (B136) No. 2:



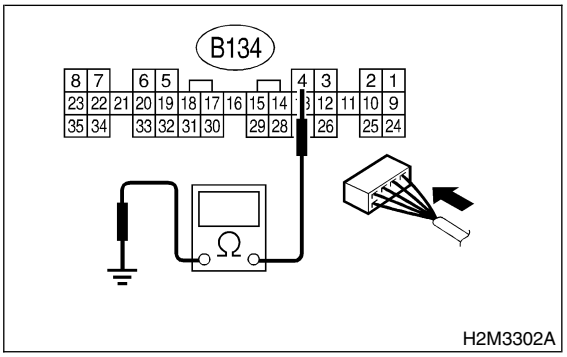
CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **8F7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel injector connector
- Poor contact in coupling connector (B22)

8F7 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 4 — Chassis ground:

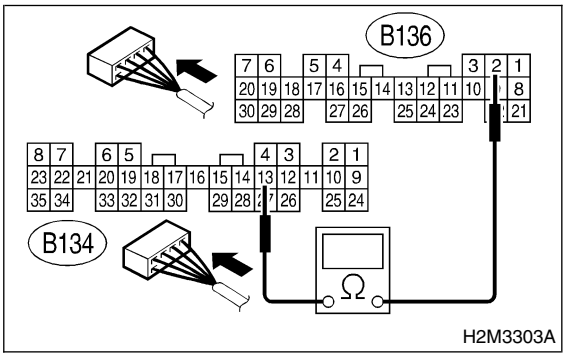


CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair ground short circuit in harness between ECM and fuel injector connector.
NO : Go to step **8F8**.

8F8 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 13 — (B136) No. 2:



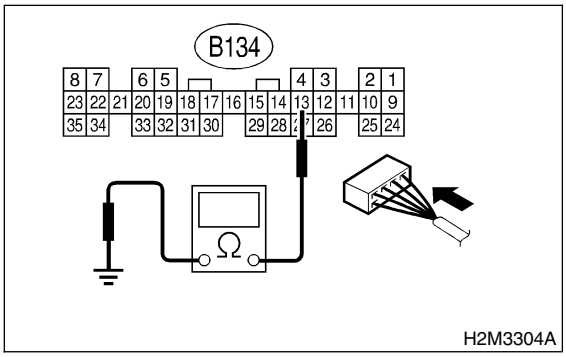
CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **8F9**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel injector connector
- Poor contact in coupling connector (B22)

8F9 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 13 — Chassis ground:

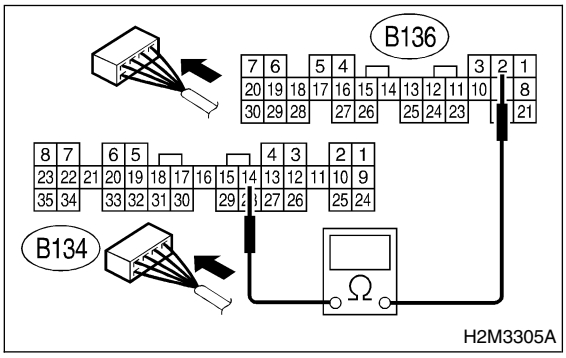


CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair ground short circuit in harness between ECM and fuel injector connector.
NO : Go to step **8F10**.

8F10 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 14 — (B136) No. 2:



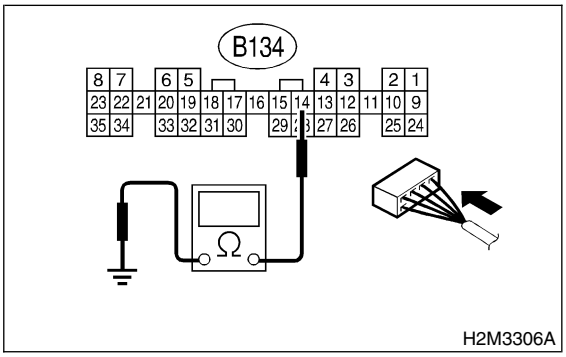
CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **8F11**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel injector connector
- Poor contact in coupling connector (B22)

8F11 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 14 — Chassis ground:

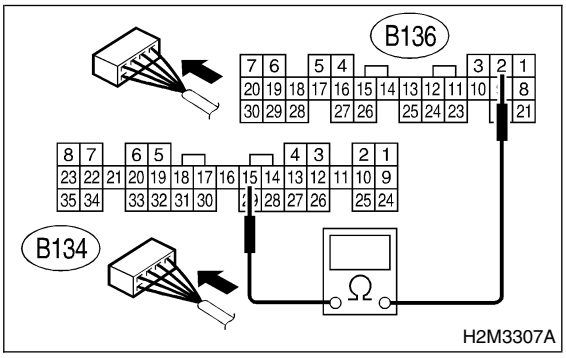


CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair ground short circuit in harness between ECM and fuel injector connector.
NO : Go to step **8F12**.

8F12 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 15 — (B136) No. 2:



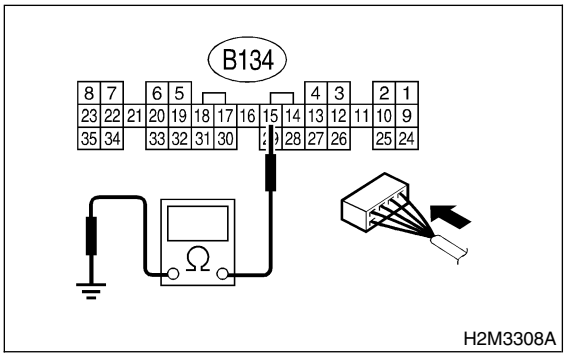
CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **8F13**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel injector connector
- Poor contact in coupling connector (B22)

8F13 : CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.

Measure resistance of harness between ECM and fuel injector connector.

Connector & terminal
(B134) No. 15 — Chassis ground:

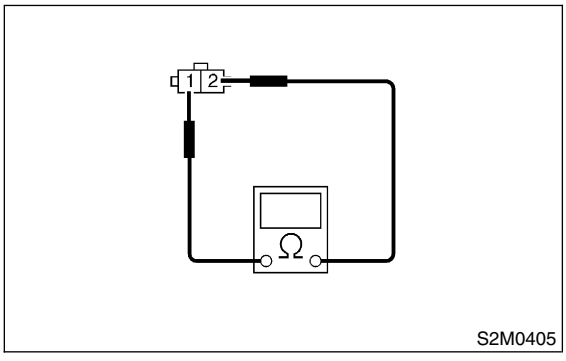


CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair ground short circuit in harness between ECM and fuel injector connector.
NO : Go to step **8F14**.

8F14 : CHECK EACH FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between each fuel injector terminals.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **8F15**.
NO : Replace faulty fuel injector.

8F15 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Check crankshaft position sensor circuit. <Ref. to 2-7 [T8G0].>

G: CRANKSHAFT POSITION SENSOR CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check crankshaft position sensor circuit.
<Ref. to 2-7 [T10AD0].>

H: CAMSHAFT POSITION SENSOR CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check camshaft position sensor circuit.
<Ref. to 2-7 [T10AF0].>

9. General Diagnostic Table

A: GENERAL DIAGNOSTICS TABLE WITH NON-CONFORMITY SYMPTOM FOR ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to 2-3 [K100].>

Symptom	Problem parts
1. Engine stalls during idling.	1) Idle air control solenoid valve 2) Intake air temperature and pressure sensor 3) Ignition parts (*1) 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4)
2. Rough idling	1) Idle air control solenoid valve 2) Intake air temperature and pressure sensor 3) Engine coolant temperature sensor (*2) 4) Ignition parts (*1) 5) Air intake system (*5) 6) Fuel injection parts (*4) 7) Throttle position sensor 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Idle air control solenoid valve 2) Engine coolant temperature sensor 3) Accelerator cable (*6) 4) Throttle position sensor 5) Intake air temperature and pressure sensor
4. Poor acceleration	1) Intake air temperature and pressure sensor 2) Throttle position sensor 3) Fuel injection parts (*4) 4) Fuel pump and fuel pump relay 5) Engine coolant temperature sensor (*2) 6) Crankshaft position sensor (*3) 7) Camshaft position sensor (*3) 8) A/C switch and A/C cut relay 9) Engine torque control signal circuit 10) Ignition parts (*1)
5. Engine stalls or engine sags or hesitates at acceleration.	1) Intake air temperature and pressure sensor 2) Engine coolant temperature sensor (*2) 3) Crankshaft position sensor (*3) 4) Camshaft position sensor (*3) 5) Purge control solenoid valve 6) Fuel injection parts (*4) 7) Throttle position sensor 8) Fuel pump and fuel pump relay
6. Surge	1) Intake air temperature and pressure sensor 2) Engine coolant temperature sensor (*2) 3) Crankshaft position sensor (*3) 4) Camshaft position sensor (*3) 5) Fuel injection parts (*4) 6) Throttle position sensor 7) Fuel pump and fuel pump relay

Symptom	Problem parts
7. Spark knock	1) Intake air temperature and pressure sensor 2) Engine coolant temperature sensor 3) Knock sensor 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay
8. After burning in exhaust system	1) Intake air temperature and pressure sensor 2) Engine coolant temperature sensor (*2) 3) Fuel injection parts (*4) 4) Fuel pump and fuel pump relay

*1: Check ignition coil & ignitor assembly and spark plug.
*2: Indicate the symptom occurring only in cold temperatures.
*3: Ensure the secure installation.
*4: Check fuel injector, fuel pressure regulator and fuel filter.
*5: Inspect air leak in air intake system.
*6: Adjust accelerator cable.

B: GENERAL DIAGNOSTICS TABLE WITH NON-CONFORMITY SYMPTOM FOR AUTOMATIC TRANSMISSION

NOTE:
Check general diagnostics table with non-conformity symptom for automatic transmission. <Ref. to 3-2 [T1000].>

MEMO:

10. Diagnostics Chart with Trouble Code

A: DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC No.	Item	Index
P0106	Pressure sensor circuit range/performance problem	<Ref. to 2-7 [T10B0].>
P0107	Pressure sensor circuit low input	<Ref. to 2-7 [T10C0].>
P0108	Pressure sensor circuit high input	<Ref. to 2-7 [T10D0].>
P0111	Intake air temperature sensor circuit range/performance problem	<Ref. to 2-7 [T10E0].>
P0112	Intake air temperature sensor circuit low input	<Ref. to 2-7 [T10F0].>
P0113	Intake air temperature sensor circuit high input	<Ref. to 2-7 [T10G0].>
P0116	Engine coolant temperature sensor circuit low input	<Ref. to 2-7 [T10H0].>
P0117	Engine coolant temperature sensor circuit high input	<Ref. to 2-7 [T10I0].>
P0121	Throttle position sensor circuit range/performance problem (high input)	<Ref. to 2-7 [T10J0].>
P0122	Throttle position sensor circuit low input	<Ref. to 2-7 [T10K0].>
P0123	Throttle position sensor circuit high input	<Ref. to 2-7 [T10L0].>
P0125	Insufficient coolant temperature for closed loop fuel control	<Ref. to 2-7 [T10M0].>
P0130	Front oxygen (A/F) sensor circuit range/performance problem	<Ref. to 2-7 [T10N0].>
P0133	Front oxygen (A/F) sensor circuit slow response	<Ref. to 2-7 [T10O0].>
P0136	Rear oxygen sensor circuit malfunction	<Ref. to 2-7 [T10P0].>
P0139	Rear oxygen sensor circuit slow response	<Ref. to 2-7 [T10Q0].>
P0141	Rear oxygen sensor heater circuit malfunction	<Ref. to 2-7 [T10R0].>
P0170	Fuel trim malfunction	<Ref. to 2-7 [T10S0].>
P0181	Fuel temperature sensor A circuit range/performance problem	<Ref. to 2-7 [T10T0].>
P0182	Fuel temperature sensor A circuit low input	<Ref. to 2-7 [T10U0].>
P0183	Fuel temperature sensor A circuit high input	<Ref. to 2-7 [T10V0].>
P0301	Cylinder 1 misfire detected	<Ref. to 2-7 [T10W0].>
P0302	Cylinder 2 misfire detected	<Ref. to 2-7 [T10X0].>
P0303	Cylinder 3 misfire detected	<Ref. to 2-7 [T10Y0].>
P0304	Cylinder 4 misfire detected	<Ref. to 2-7 [T10Z0].>

DTC No.	Item	Index
P0325	Knock sensor circuit high input	<Ref. to 2-7 [T10AA0].>
P0335	Crankshaft position sensor circuit malfunction	<Ref. to 2-7 [T10AB0].>
P0336	Crankshaft position sensor circuit range/performance problem	<Ref. to 2-7 [T10AC0].>
P0340	Camshaft position sensor circuit malfunction	<Ref. to 2-7 [T10AD0].>
P0341	Camshaft position sensor circuit range/performance problem	<Ref. to 2-7 [T10AE0].>
P0420	Catalyst system efficiency below threshold	<Ref. to 2-7 [T10AF0].>
P0440	Evaporative emission control system malfunction	<Ref. to 2-7 [T10AG0].>
P0442	Evaporative emission control system malfunction	<Ref. to 2-7 [T10AH0].>
P0443	Evaporative emission control system purge control valve circuit low input	<Ref. to 2-7 [T10AI0].>
P0446	Evaporative emission control system vent control low input	<Ref. to 2-7 [T10AJ0].>
P0451	Evaporative emission control system pressure sensor range/performance problem	<Ref. to 2-7 [T10AK0].>
P0452	Evaporative emission control system pressure sensor low input	<Ref. to 2-7 [T10AL0].>
P0453	Evaporative emission control system pressure sensor high input	<Ref. to 2-7 [T10AM0].>
P0461	Fuel level sensor circuit range/performance problem	<Ref. to 2-7 [T10AN0].>
P0462	Fuel level sensor circuit low input	<Ref. to 2-7 [T10AO0].>
P0463	Fuel level sensor circuit high input	<Ref. to 2-7 [T10AP0].>
P0480	Cooling fan relay 1 circuit low input	<Ref. to 2-7 [T10AQ0].>
P0483	Cooling fan function problem	<Ref. to 2-7 [T10AR0].>
P0500	Vehicle speed sensor malfunction	<Ref. to 2-7 [T10AS0].>
P0506	Idle control system RPM lower than expected	<Ref. to 2-7 [T10AT0].>
P0507	Idle control system RPM higher than expected	<Ref. to 2-7 [T10AU0].>
P0601	Internal control module memory check sum error	<Ref. to 2-7 [T10AV0].>
P0703	Brake switch input malfunction	<Ref. to 2-7 [T10AW0].>
P0705	Transmission range sensor circuit malfunction	<Ref. to 2-7 [T10AX0].>
P0710	Transmission fluid temperature sensor circuit malfunction	<Ref. to 2-7 [T10AY0].>
P0715	Torque converter turbine speed sensor circuit malfunction	<Ref. to 2-7 [T10AZ0].>
P0720	Output speed sensor (vehicle speed sensor 2) circuit malfunction	<Ref. to 2-7 [T10BA0].>

DTC No.	Item	Index
P0725	Engine speed input circuit malfunction	<Ref. to 2-7 [T10BB0].>
P0731	Gear 1 incorrect ratio	<Ref. to 2-7 [T10BC0].>
P0732	Gear 2 incorrect ratio	<Ref. to 2-7 [T10BD0].>
P0733	Gear 3 incorrect ratio	<Ref. to 2-7 [T10BE0].>
P0734	Gear 4 incorrect ratio	<Ref. to 2-7 [T10BF0].>
P0740	Torque converter clutch system malfunction	<Ref. to 2-7 [T10BG0].>
P0743	Torque converter clutch system (Lock-up duty solenoid) electrical	<Ref. to 2-7 [T10BH0].>
P0748	Pressure control solenoid (Line pressure duty solenoid) electrical	<Ref. to 2-7 [T10BI0].>
P0753	Shift solenoid A (Shift solenoid 1) electrical	<Ref. to 2-7 [T10BJ0].>
P0758	Shift solenoid B (Shift solenoid 2) electrical	<Ref. to 2-7 [T10BK0].>
P1100	Starter switch circuit low input	<Ref. to 2-7 [T10BL0].>
P1101	Neutral position switch circuit low input [MT vehicles] or Neutral position switch circuit high input [AT vehicles]	<Ref. to 2-7 [T10BM0].>
P1103	Engine torque control signal 1 circuit malfunction	<Ref. to 2-7 [T10BN0].>
P1106	Engine torque control signal 2 circuit malfunction	<Ref. to 2-7 [T10BO0].>
P1110	Atmospheric pressure sensor circuit low input	<Ref. to 2-7 [T10BP0].>
P1111	Atmospheric pressure sensor circuit high input	<Ref. to 2-7 [T10BQ0].>
P1112	Atmospheric pressure sensor range/performance problem	<Ref. to 2-7 [T10BR0].>
P1115	Engine torque control cut signal circuit high input	<Ref. to 2-7 [T10BS0].>
P1116	Engine torque control cut signal circuit low input	<Ref. to 2-7 [T10BT0].>
P1120	Starter switch circuit high input	<Ref. to 2-7 [T10BU0].>
P1121	Neutral position switch circuit high input [MT vehicles] or Neutral position switch circuit low input [AT vehicles]	<Ref. to 2-7 [T10BV0].>
P1130	Front oxygen (A/F) sensor circuit malfunction (open circuit)	<Ref. to 2-7 [T10BW0].>
P1131	Front oxygen (A/F) sensor circuit malfunction (short circuit)	<Ref. to 2-7 [T10BX0].>
P1132	Front oxygen (A/F) sensor heater circuit low input	<Ref. to 2-7 [T10BY0].>
P1133	Front oxygen (A/F) sensor heater circuit high input	<Ref. to 2-7 [T10BZ0].>
P1142	Throttle position sensor circuit range/performance problem (low input)	<Ref. to 2-7 [T10CA0].>
P1151	Rear oxygen sensor heater circuit high input	<Ref. to 2-7 [T10CB0].>

DTC No.	Item	Index
P1207	Air assist injector solenoid valve circuit low input	<Ref. to 2-7 [T10CC0].>
P1208	Air assist injector solenoid valve circuit high input	<Ref. to 2-7 [T10CD0].>
P1325	Knock sensor circuit low input	<Ref. to 2-7 [T10CE0].>
P1400	Fuel tank pressure control solenoid valve circuit low input	<Ref. to 2-7 [T10CF0].>
P1420	Fuel tank pressure control solenoid valve circuit high input	<Ref. to 2-7 [T10CG0].>
P1422	Evaporative emission control system purge control valve circuit high input	<Ref. to 2-7 [T10CH0].>
P1423	Evaporative emission control system vent control high input	<Ref. to 2-7 [T10CI0].>
P1442	Fuel level sensor circuit range/performance problem 2	<Ref. to 2-7 [T10CJ0].>
P1443	Evaporative emission control system vent control function problem	<Ref. to 2-7 [T10CK0].>
P1445	Air assist injector solenoid valve malfunction	<Ref. to 2-7 [T10CL0].>
P1490	Thermostat malfunction	<Ref. to 2-7 [T10CM0].>
P1507	Idle control system malfunction (fail-safe)	<Ref. to 2-7 [T10CN0].>
P1510	Idle air control solenoid valve signal 1 circuit low input	<Ref. to 2-7 [T10CO0].>
P1511	Idle air control solenoid valve signal 1 circuit high input	<Ref. to 2-7 [T10CP0].>
P1512	Idle air control solenoid valve signal 2 circuit low input	<Ref. to 2-7 [T10CQ0].>
P1513	Idle air control solenoid valve signal 2 circuit high input	<Ref. to 2-7 [T10CR0].>
P1514	Idle air control solenoid valve signal 3 circuit low input	<Ref. to 2-7 [T10CS0].>
P1515	Idle air control solenoid valve signal 3 circuit high input	<Ref. to 2-7 [T10CT0].>
P1516	Idle air control solenoid valve signal 4 circuit low input	<Ref. to 2-7 [T10CU0].>
P1517	Idle air control solenoid valve signal 4 circuit high input	<Ref. to 2-7 [T10CV0].>
P1520	Cooling fan relay 1 circuit high input	<Ref. to 2-7 [T10CW0].>
P1540	Vehicle speed sensor malfunction 2	<Ref. to 2-7 [T10CX0].>
P1560	Back-up voltage circuit malfunction	<Ref. to 2-7 [T10CY0].>
P1700	Throttle position sensor circuit malfunction for automatic transmission	<Ref. to 2-7 [T10CZ0].>
P1701	Cruise control set signal circuit malfunction for automatic transmission	<Ref. to 2-7 [T10DA0].>
P1702	Automatic transmission diagnosis input signal circuit low input	<Ref. to 2-7 [T10DB0].>
P1703	Low clutch timing control solenoid valve circuit malfunction	<Ref. to 2-7 [T10DC0].>

DTC No.	Item	Index
P1704	2-4 brake timing control solenoid valve circuit malfunction	<Ref. to 2-7 [T10DD0].>
P1705	2-4 brake pressure control solenoid valve (2-4 brake duty solenoid) circuit malfunction	<Ref. to 2-7 [T10DE0].>
P1722	Automatic transmission diagnosis input signal circuit high input	<Ref. to 2-7 [T10DF0].>
P1742	Automatic transmission diagnosis input signal circuit malfunction	<Ref. to 2-7 [T10DG0].>

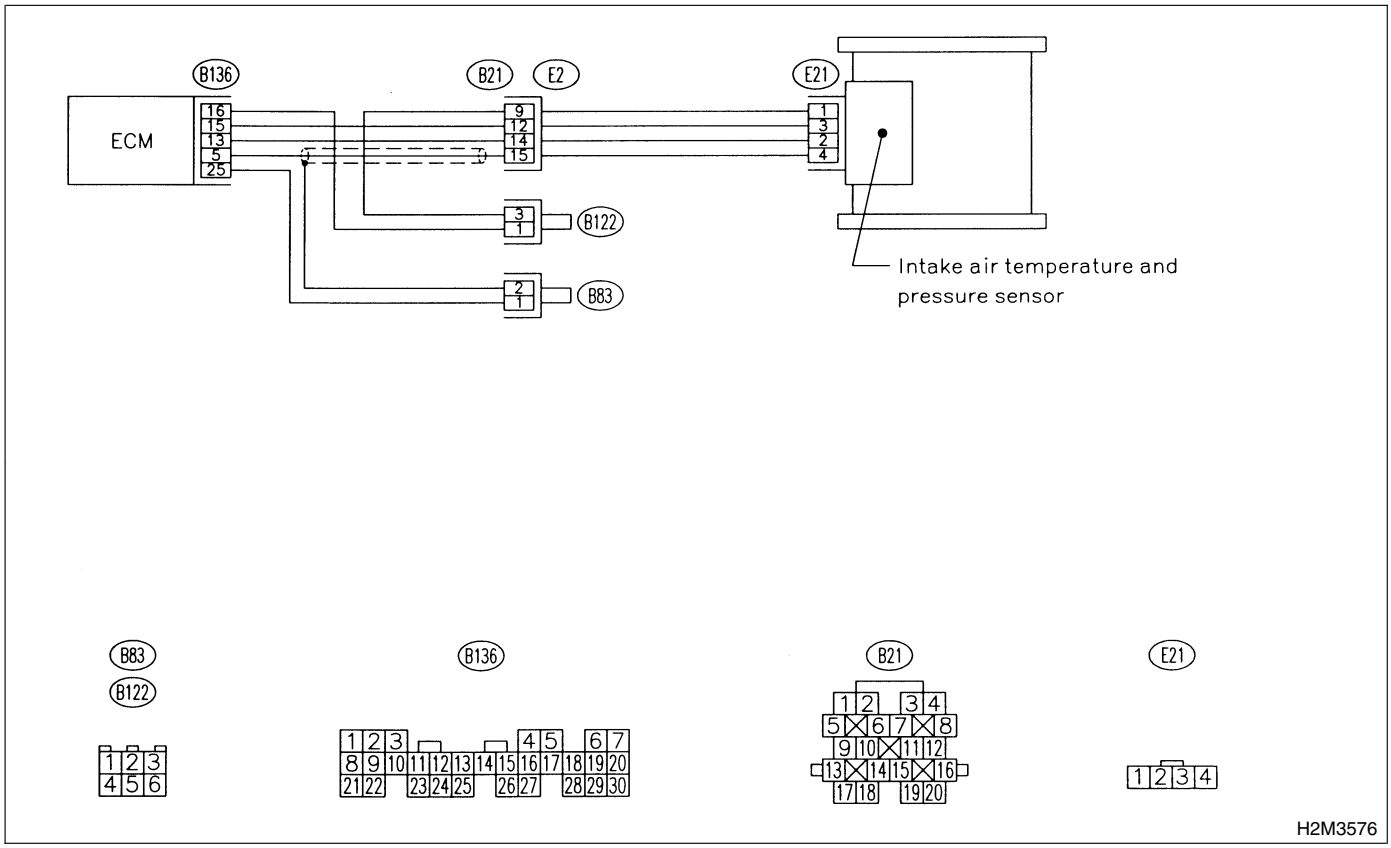
MEMO:

B: DTC P0106 — PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10B1 : CHECK ANY OTHER DTC ON DISPLAY.

NOTE:
In this case, it is not necessary to inspect DTC P0106.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0107, P0108 or P1112?***

YES : Inspect DTC P0107, P0108 or P1112 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NO : Go to step **10B2**.

10B2 : CHECK AIR INTAKE SYSTEM.

CHECK : ***Are there holes, loose bolts or disconnection of hose on air intake system?***

YES : Repair air intake system.

NO : Go to step **10B3**.

10B3 : CHECK PRESSURE SENSOR.

1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F).
2) Place the shift lever in the selector lever in “N” or “P” position.
3) Turn A/C switch to OFF.
4) Turn all accessory switches to OFF.
5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the “READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE”. <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

Specification:
● Intake manifold absolute pressure

Engine speed	Specified value
Ignition ON	73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)
Idling	20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg)

CHECK : ***Is the value within the specifications?***
YES : Go to step **10B4**.
NO : Replace intake air temperature sensor and pressure sensor. <Ref. to 2-7 [W13A0].>

10B4 : CHECK THROTTLE POSITION.

Read data of throttle position signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the “READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE”. <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is throttle positioning ratio equal to or less than 5% when throttle is fully closed?***
YES : Go to step **10B5**.
NO : Adjust or replace throttle position sensor. <Ref. to 2-7 [W10A0].>

10B5 : CHECK THROTTLE POSITION.

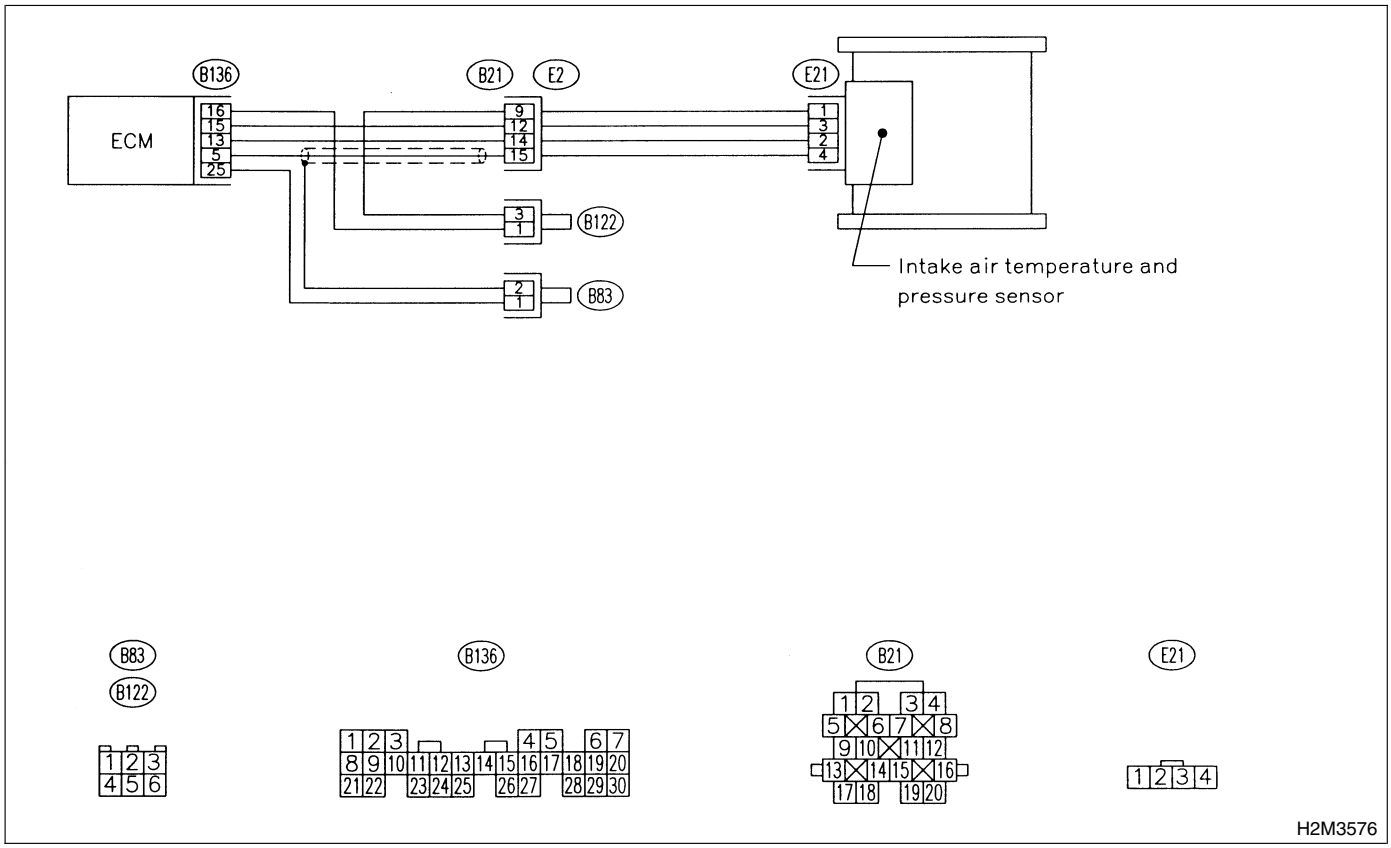
CHECK : ***Is throttle positioning ratio equal to or more than 85% when throttle is fully open?***
YES : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

C: DTC P0107 — PRESSURE SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10C1 : CHECK CURRENT DATA.

1) Start engine.
2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value less than 13.3 kPa (100 mmHg, 3.94 inHg)?***
YES : Go to step **10C3**.
NO : Go to step **10C2**.

10C2 : CHECK POOR CONTACT.

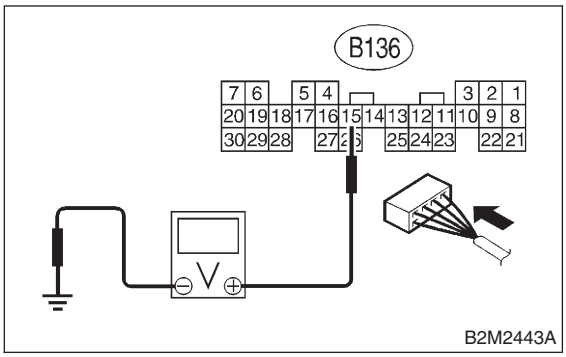
Check poor contact in ECM and pressure sensor connector. <Ref. to 2-7 [T3C8].>

CHECK : ***Is there poor contact in ECM or pressure sensor connector?***
YES : Repair poor contact in ECM or pressure sensor connector.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time.

10C3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

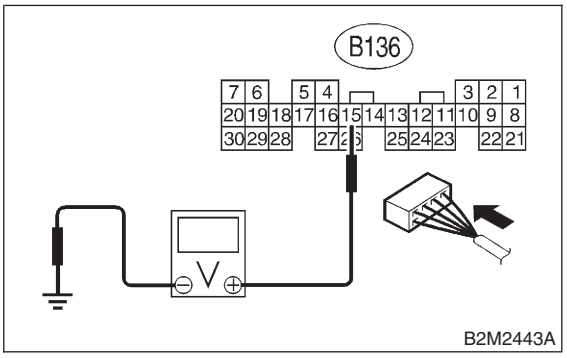


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10C5**.
NO : Go to step **10C4**.

10C4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



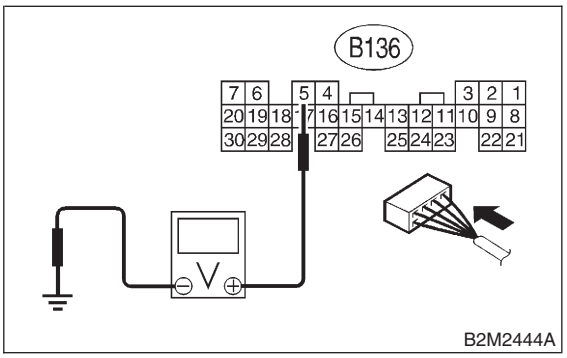
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10C5 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 5 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10C7**.
NO : Go to step **10C6**.

10C6 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of atmospheric absolute pressure signal using Subaru Select Monitor.

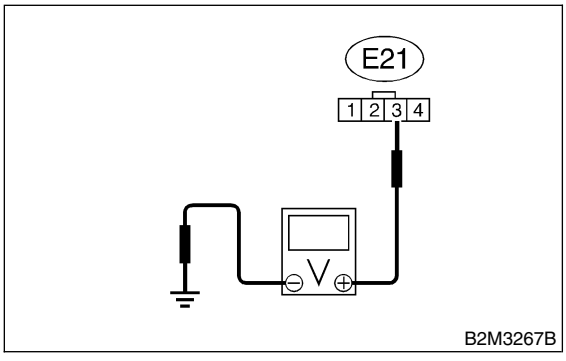
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10C7**.

10C7 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from intake air temperature and pressure sensor.
3) Turn ignition switch to ON.
4) Measure voltage between intake air temperature sensor and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 3 (+) — Engine ground (–):

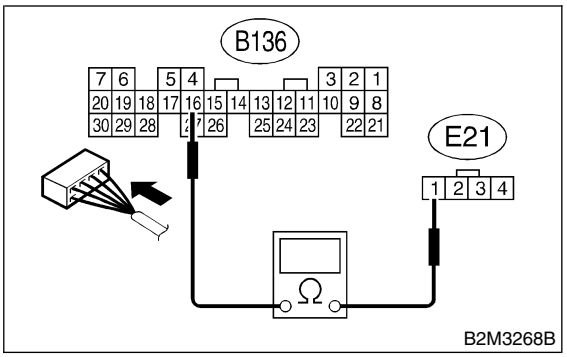


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10C8**.
NO : Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

10C8 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and intake air temperature and pressure sensor connector.

Connector & terminal
(B136) No. 16 — (E21) No. 1:

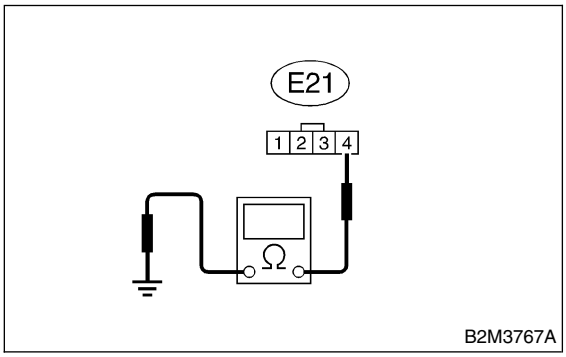


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10C9**.
NO : Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

10C9 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

Measure resistance of harness between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 4 — Engine ground:



CHECK : ***Is the resistance more than 500 kΩ?***
YES : Go to step **10C10**.
NO : Repair ground short circuit in harness between ECM and intake air temperature and pressure sensor connector.

10C10 : CHECK POOR CONTACT.

Check poor contact in intake manifold pressure sensor connector. <Ref. to FOREWORD [T3C1].>

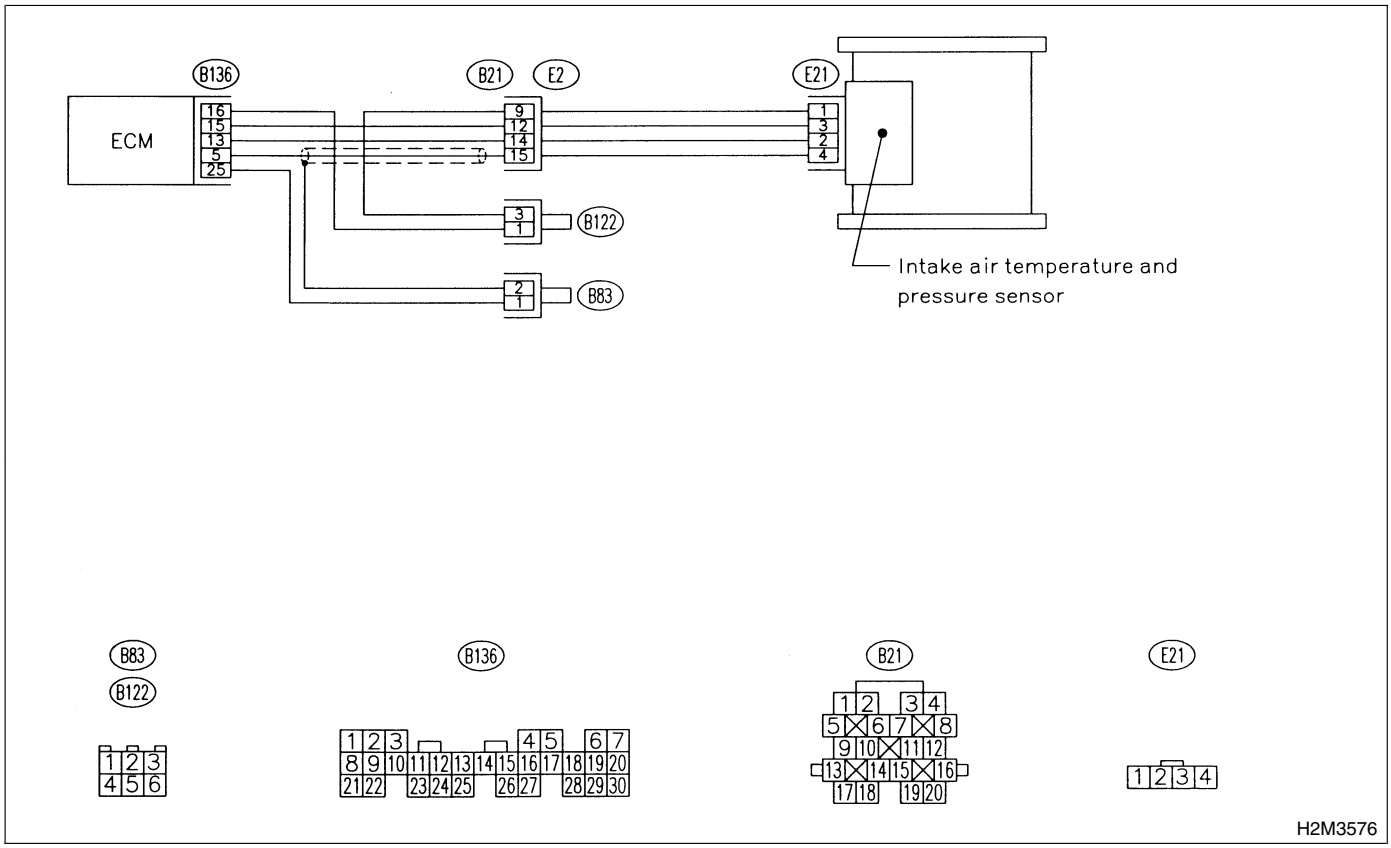
CHECK : ***Is there poor contact in intake manifold pressure sensor connector?***
YES : Repair poor contact in intake air temperature and pressure sensor connector.
NO : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>

D: DTC P0108 — PRESSURE SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10D1 : CHECK CURRENT DATA.

1) Start engine.
2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

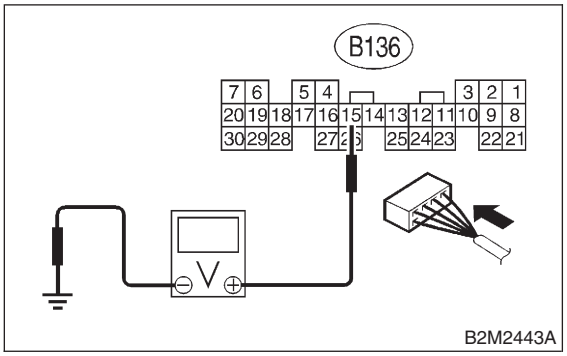
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?***
YES : Go to step **10D10**.
NO : Go to step **10D2**.

10D2 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

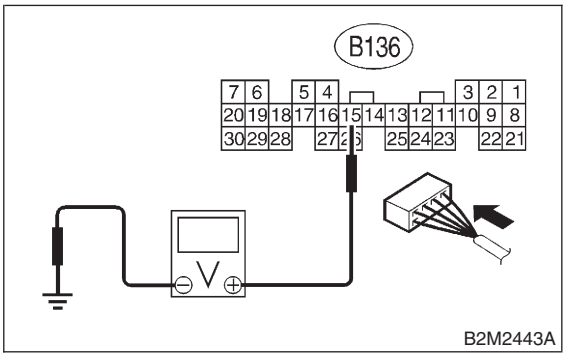


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10D4**.
NO : Go to step **10D3**.

10D3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



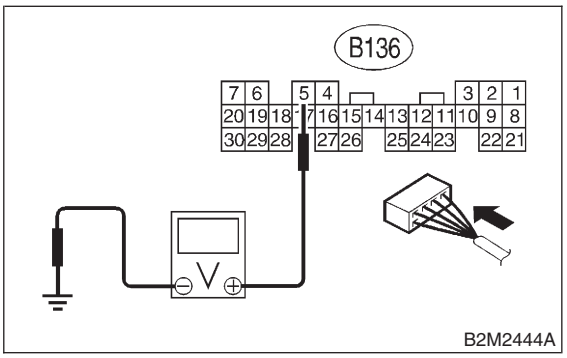
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10D4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 5 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10D6**.
NO : Go to step **10D5**.

10D5 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of atmospheric absolute pressure signal using Subaru Select Monitor.

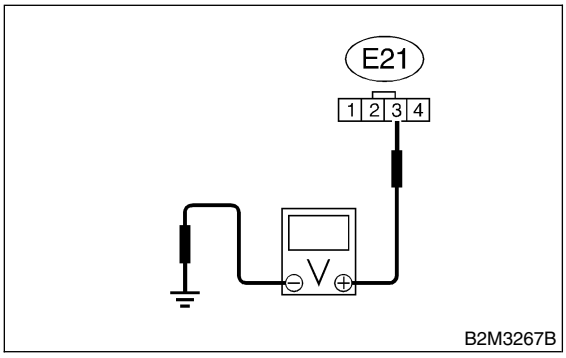
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10D6**.

10D6 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from intake air temperature and pressure sensor.
3) Turn ignition switch to ON.
4) Measure voltage between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 3 (+) — Engine ground (–):

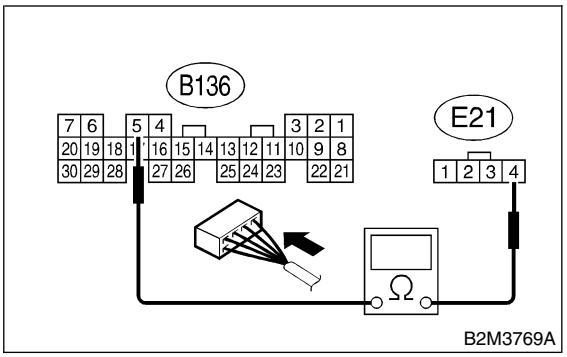


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10D7**.
NO : Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

10D7 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and intake air temperature and pressure sensor connector.

Connector & terminal
(B136) No. 5 — (E21) No. 4:

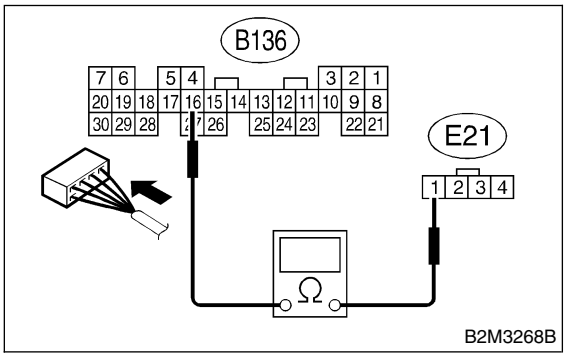


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10D8**.
NO : Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

10D8 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

Measure resistance of harness between ECM and intake air temperature and pressure sensor connector.

Connector & terminal
(B136) No. 16 — (E21) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10D9**.
NO : Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

10D9 : CHECK POOR CONTACT.

Check poor contact in intake air temperature and pressure sensor connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in intake manifold pressure sensor connector?***
YES : Repair poor contact in intake air temperature and pressure sensor connector.
NO : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>

10D10 : CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF and Subaru Select Monitor or the OBD-II general scan tool switch to OFF.
2) Disconnect connector from intake air temperature and pressure sensor.
3) Turn ignition switch to ON and Subaru Select Monitor or the OBD-II general scan tool switch to ON.
4) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the “READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE”. <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?***
YES : Repair battery short circuit in harness between ECM and intake air temperature and pressure sensor connector.
NO : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>

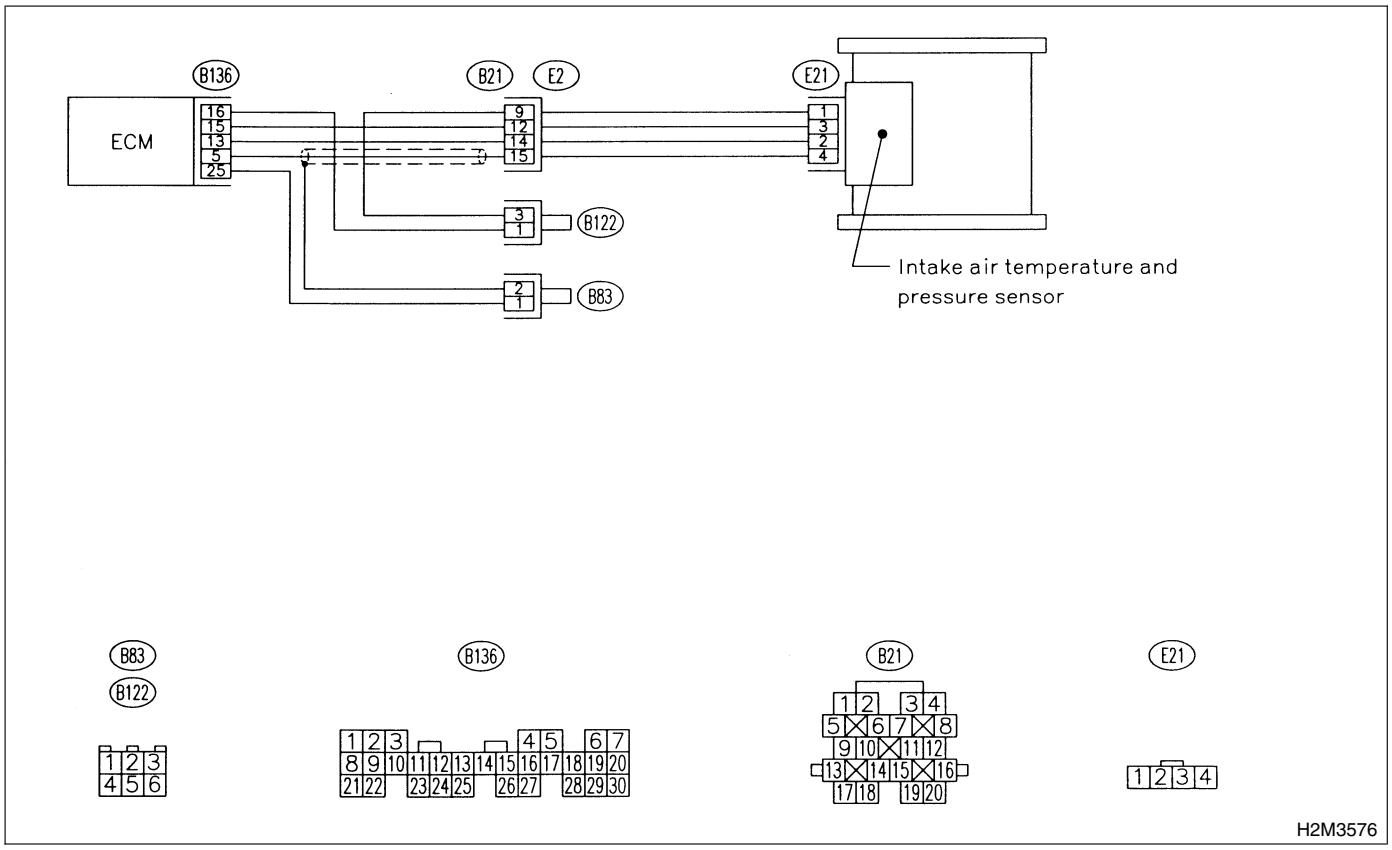
E: DTC P0111 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT RANGE/ PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10E1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0112, P0113, P0116, P0117 or P0125?***

YES : Inspect DTC P0112, P0113, P0116, P0117 or P0125 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0111.

NO : Go to step **10E2**.

10E2 : CHECK ENGINE COOLANT TEMPERATURE.

1) Start the engine and warm it up completely.
2) Measure engine coolant temperature using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
- Subaru Select Monitor

For detailed operation procedure, refer to the “READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE”. <Ref. to 2-7 [T3C4].>
- OBD-II general scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the engine coolant temperature between 75°C (167°F) and 95°C (203°F)?***

YES : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>

NO : Inspect DTC P0125 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

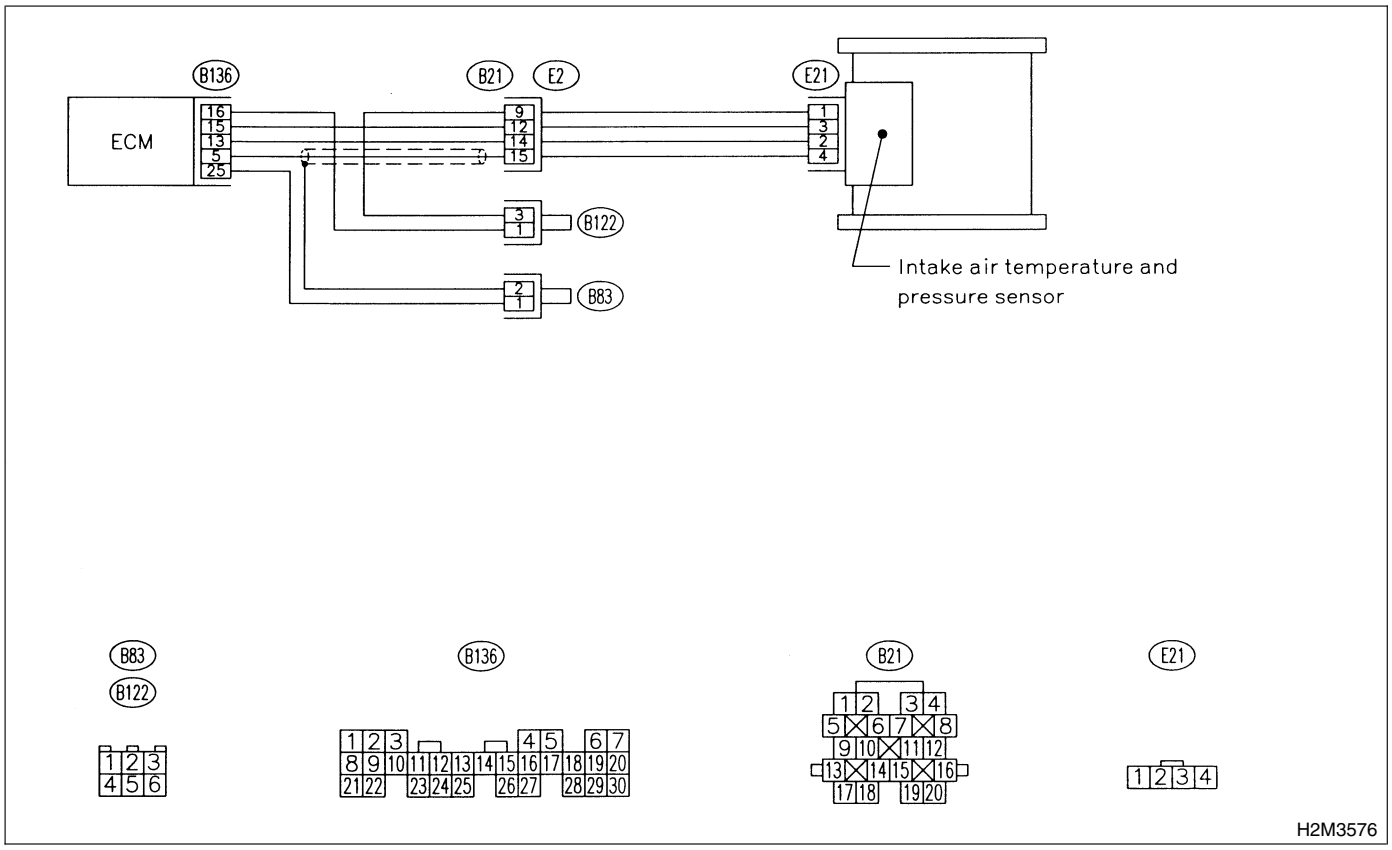
F: DTC P0112 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10F1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value greater than 120°C (248°F)?***
YES : Go to step **10F2**.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
● Poor contact in intake air temperature and pressure sensor
● Poor contact in ECM
● Poor contact in coupling connector (B21)
● Poor contact in joint connector (B83 and B122)

10F2 : CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from intake air temperature and pressure sensor.
3) Turn ignition switch to ON.
4) Read data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>
NO : Repair ground short circuit in harness between intake air temperature sensor and ECM connector.

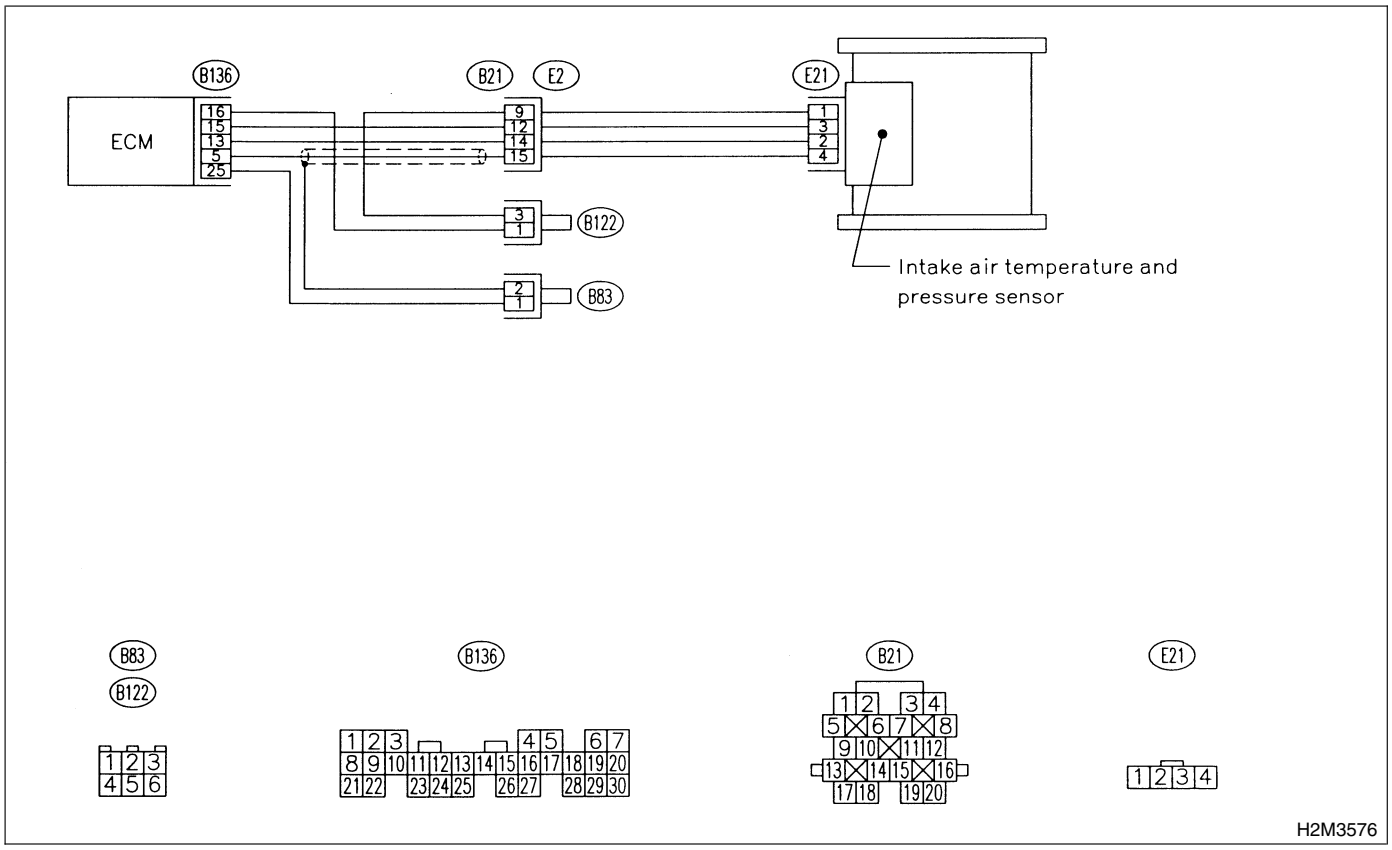
G: DTC P0113 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10G1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

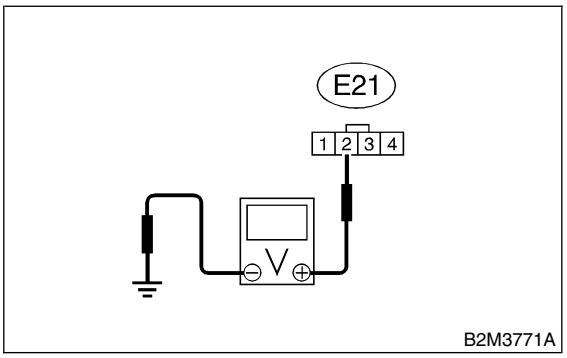
CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Go to step **10G2**.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
● Poor contact in intake air temperature and pressure sensor
● Poor contact in ECM
● Poor contact in coupling connector (B21)
● Poor contact in joint connector (B83 and B122)

10G2 : CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from intake air temperature and pressure sensor.
3) Measure voltage between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 2 (+) — Engine ground (–):

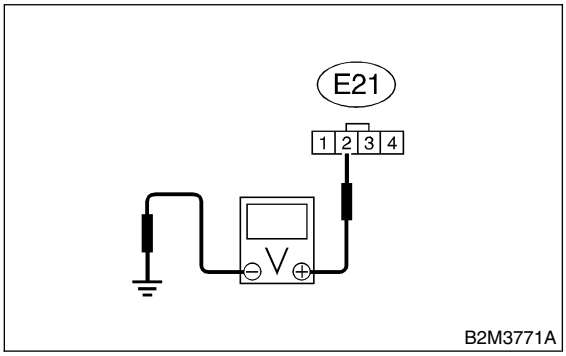


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between intake air temperature and pressure sensor and ECM connector.
NO : Go to step **10G3**.

10G3 : CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 2 (+) — Engine ground (–):

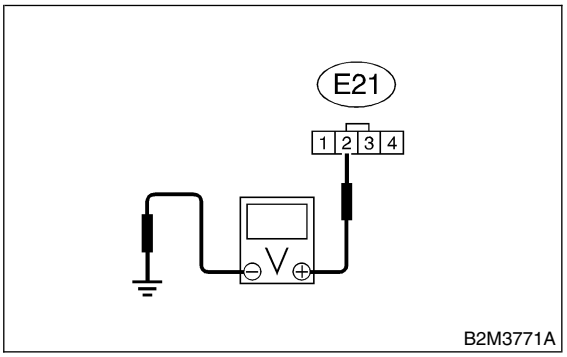


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between intake air temperature and pressure sensor and ECM connector.
NO : Go to step **10G4**.

10G4 : CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR.

Measure voltage between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 2 (+) — Engine ground (–):



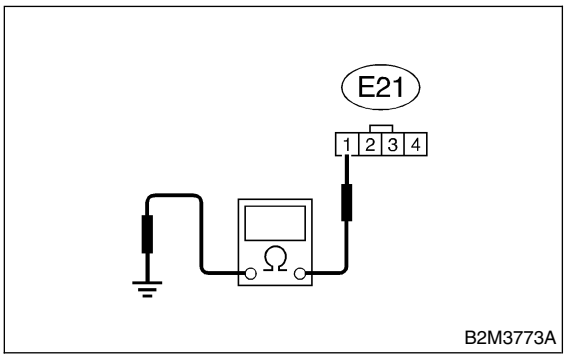
CHECK : ***Is the voltage more than 3 V?***
YES : Go to step **10G5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between intake air temperature and pressure sensor and ECM connector
- Poor contact in intake air temperature and pressure sensor
- Poor contact in ECM
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B83 and B122)

10G5 : CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance of harness between intake air temperature and pressure sensor connector and engine ground.

Connector & terminal
(E21) No. 1 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W13A0].>
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between intake air temperature and pressure sensor and ECM connector
- Poor contact in intake air temperature and pressure sensor
- Poor contact in ECM
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B83 and B122)

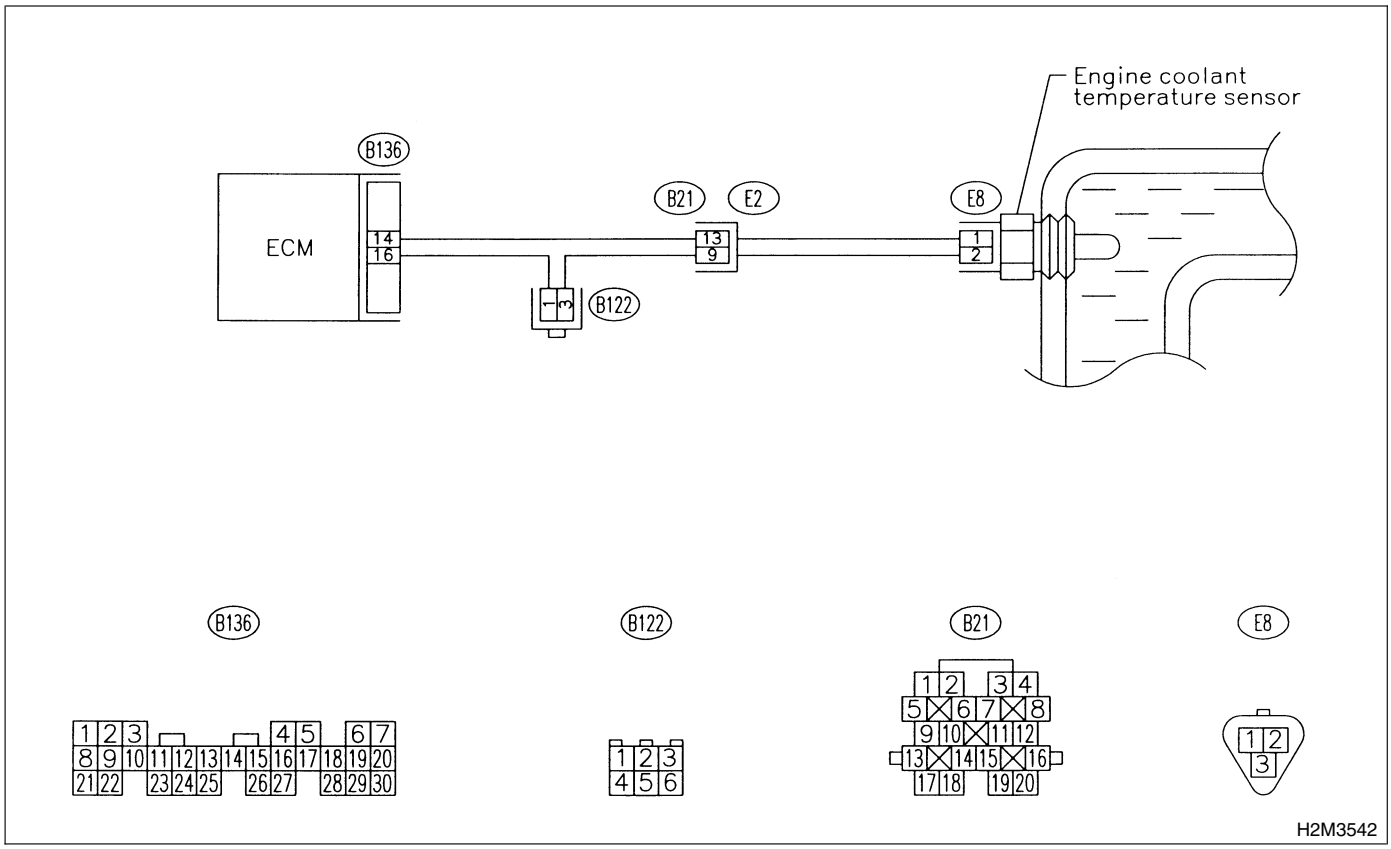
H: DTC P0116 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Hard to start
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10H1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value greater than 150°C (302°F)?***
YES : Go to step **10H2**.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
● Poor contact in engine coolant temperature sensor
● Poor contact in ECM
● Poor contact in coupling connector (B21)
● Poor contact in joint connector (B122)

10H2 : CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from engine coolant temperature sensor.
3) Turn ignition switch to ON.
4) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

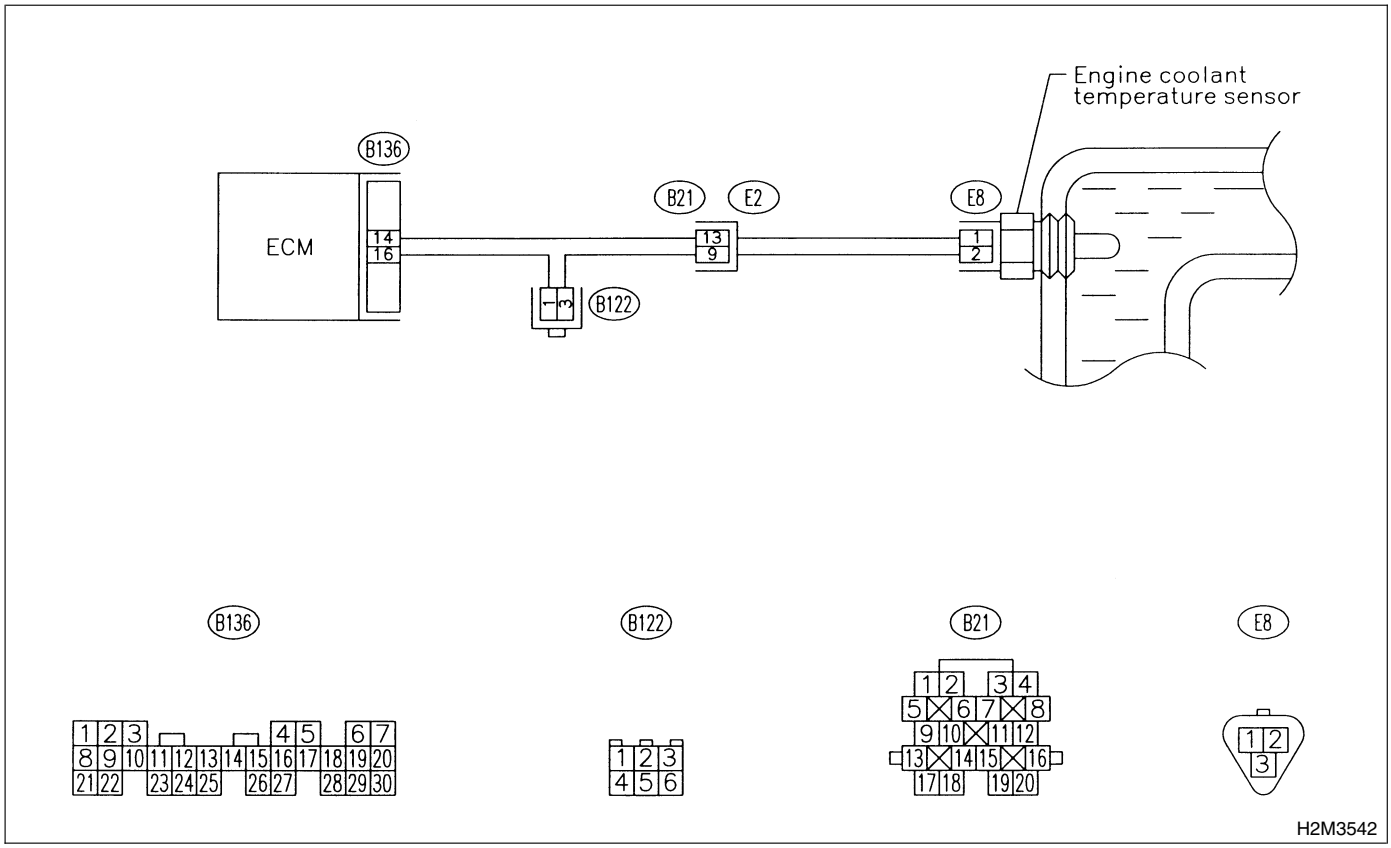
CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Replace engine coolant temperature sensor. <Ref. to 2-7 [W4A0].>
NO : Repair ground short circuit in harness between engine coolant temperature sensor and ECM connector.

I: DTC P0117 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Hard to start
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10I1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

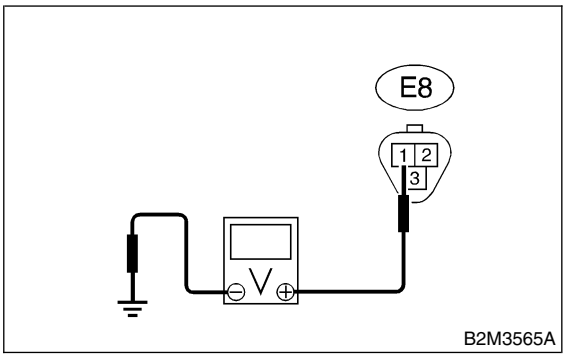
CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Go to step **10I2**.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
● Poor contact in engine coolant temperature sensor
● Poor contact in ECM
● Poor contact in coupling connector (B21)
● Poor contact in joint connector (B122)

10I2 : CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from engine coolant temperature sensor.
3) Measure voltage between engine coolant temperature sensor connector and engine ground.

Connector & terminal
(E8) No. 1 (+) — Engine ground (–):

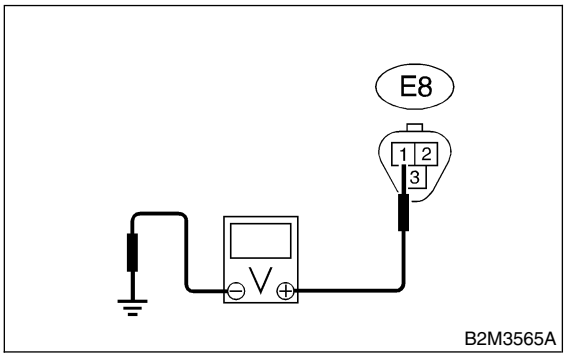


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.
NO : Go to step **10I3**.

10I3 : CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between engine coolant temperature sensor connector and engine ground.

Connector & terminal
(E8) No. 1 (+) — Engine ground (–):

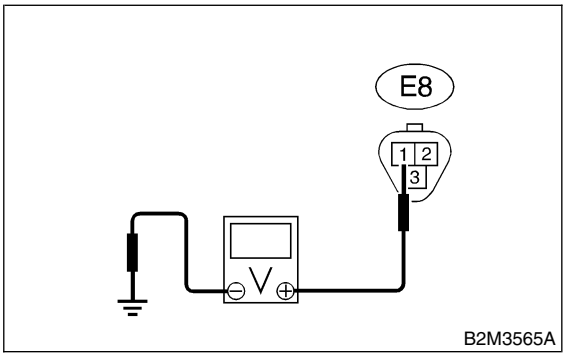


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.
NO : Go to step **10I4**.

10I4 : CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.

Measure voltage between engine coolant temperature sensor connector and engine ground.

Connector & terminal
(E8) No. 1 (+) — Engine ground (–):



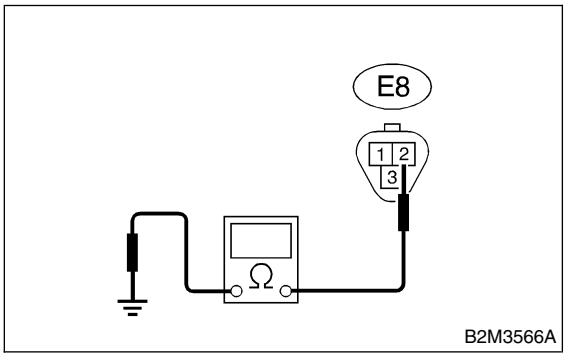
CHECK : ***Is the voltage more than 4 V?***
YES : Go to step **10I5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine coolant temperature sensor connector
- Poor contact in engine coolant temperature sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B122)

10I5 : CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance of harness between engine coolant temperature sensor connector and engine ground.

Connector & terminal
(E8) No. 2 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Replace engine coolant temperature sensor. <Ref. to 2-7 [W4A0].>
NO : Repair harness and connector.

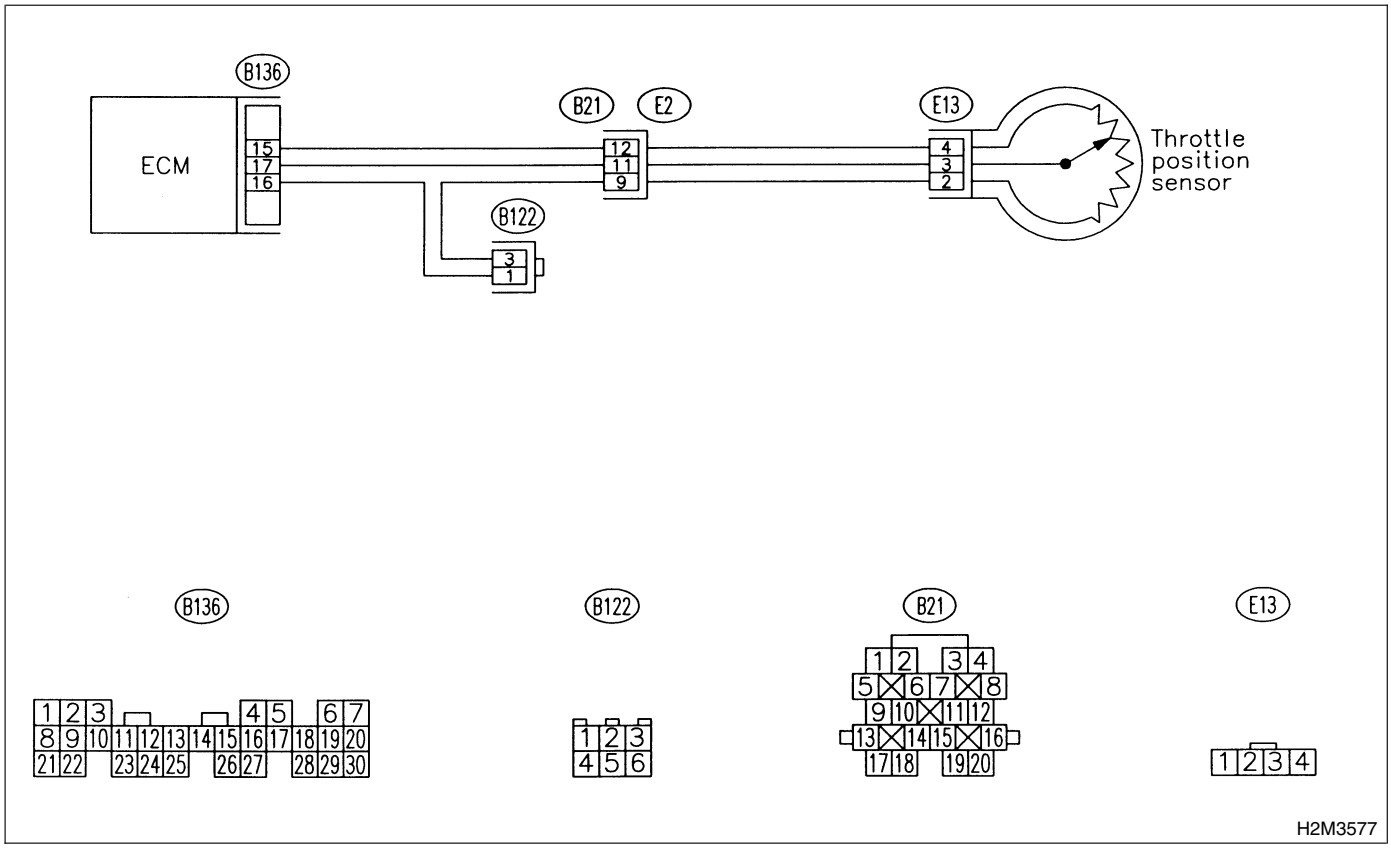
NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine coolant temperature sensor connector
- Poor contact in engine coolant temperature sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B122)

J: DTC P0121 — THROTTLE POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10J1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0122 or P0123?***

YES : Inspect DTC P0122 or P0123 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0121.

NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

MEMO:

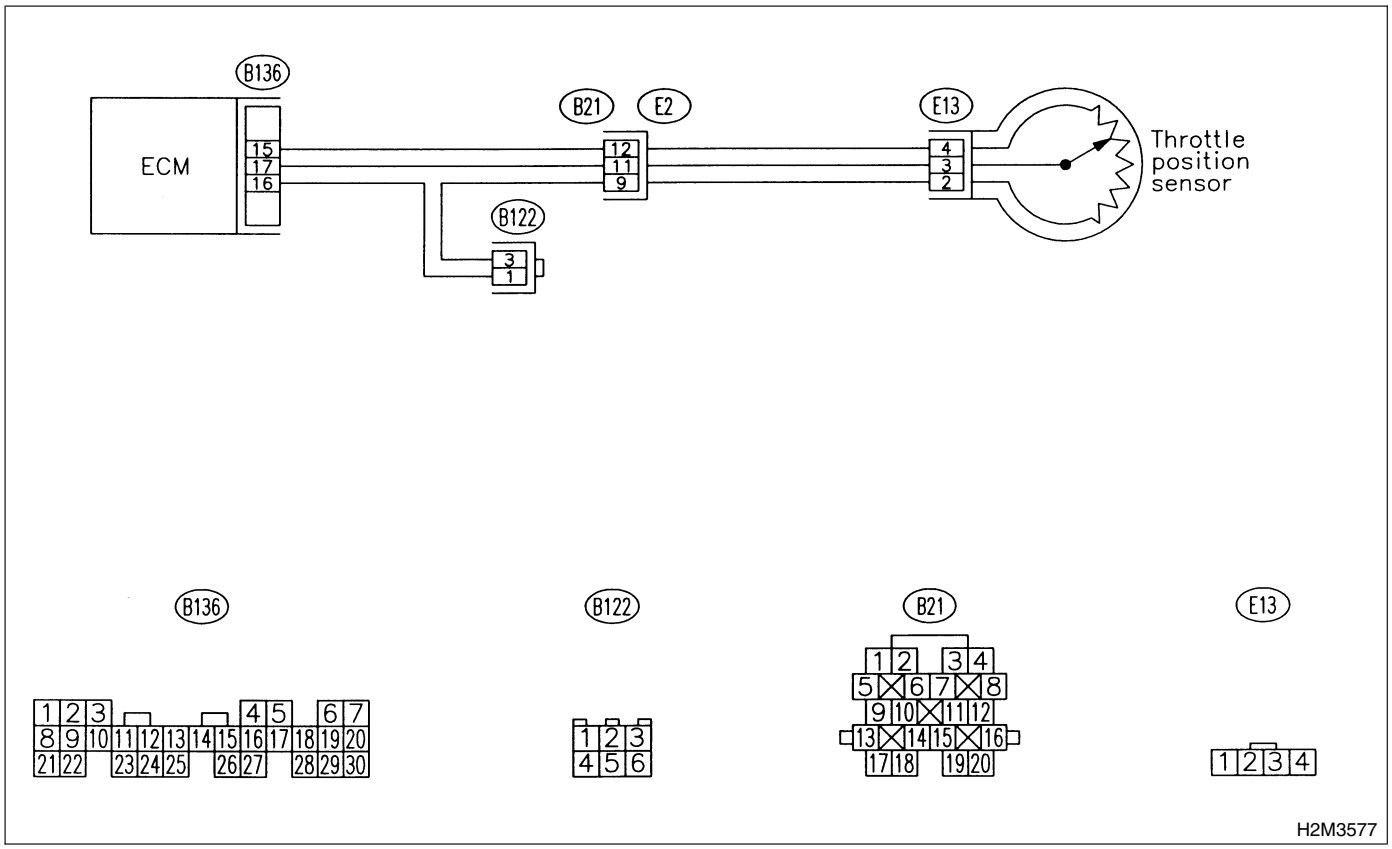
K: DTC P0122 — THROTTLE POSITION SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10K1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
- Subaru Select Monitor

For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
- OBD-II general scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

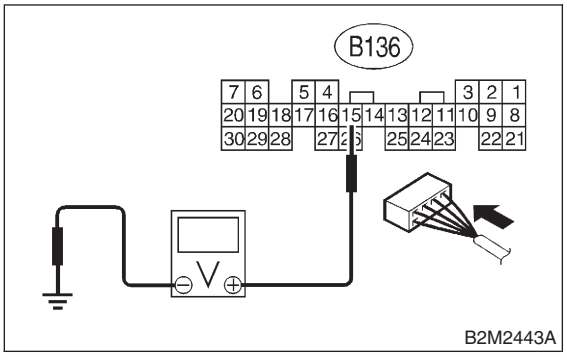
CHECK : ***Is the value less than 0.1 V?***
YES : Go to step **10K2**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.

NOTE:
In this case, repair the following:
- Poor contact in throttle position sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B122)

10K2 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground while throttle valve is fully closed.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

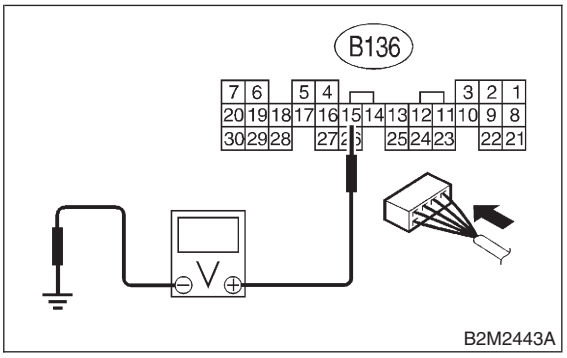


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10K4**.
NO : Go to step **10K3**.

10K3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



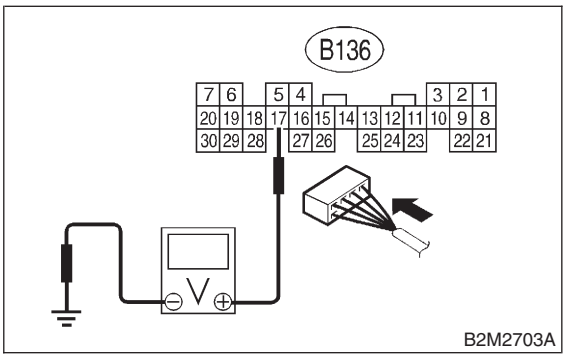
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10K4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 17 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.1 V?***
YES : Go to step **10K6**.
NO : Go to step **10K5**.

10K5 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

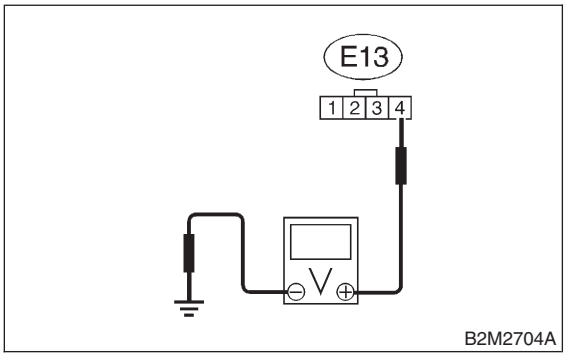
Measure voltage between ECM connector and chassis ground.

CHECK : ***Does the voltage change more than 0.1 V by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10K6**.

10K6 : CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from throttle position sensor.
3) Turn ignition switch to ON.
4) Measure voltage between throttle position sensor connector and engine ground.

Connector & terminal
(E13) No. 4 (+) — Engine ground (–):



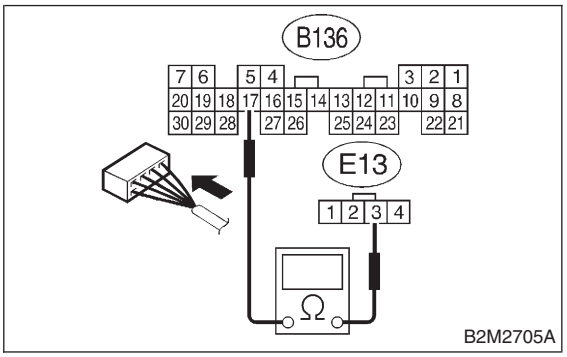
CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10K7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between throttle position sensor and ECM connector
- Poor contact in throttle position sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B122)

10K7 : CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance of harness between ECM connector and throttle position sensor connector.

Connector & terminal
(B136) No. 17 — (E13) No. 3:



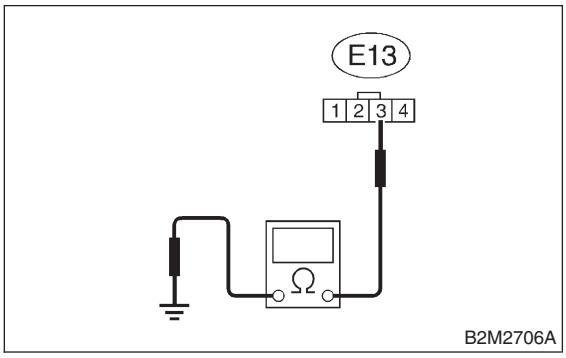
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10K8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between throttle position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in throttle position sensor connector
- Poor contact in coupling connector (B21)

10K8 : CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR.

Measure resistance of harness between throttle position sensor connector and engine ground.

Connector & terminal
(E13) No. 3 — Engine ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between throttle position sensor and ECM connector.
NO : Go to step **10K9**.

10K9 : CHECK POOR CONTACT.

Check poor contact in throttle position sensor connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in throttle position sensor connector?***
YES : Repair poor contact in throttle position sensor connector.
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

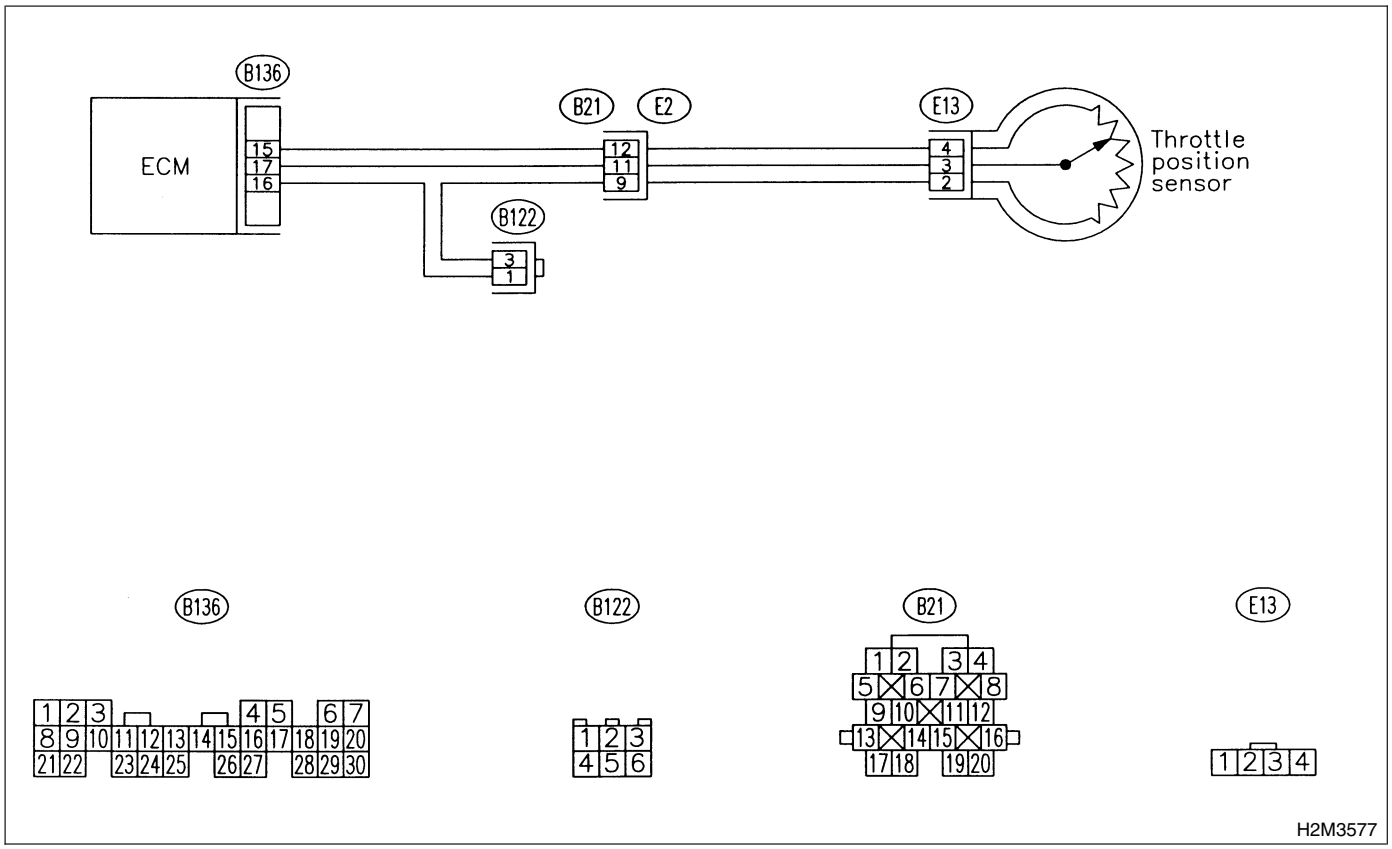
L: DTC P0123 — THROTTLE POSITION SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10L1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
- Subaru Select Monitor

For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
- OBD-II general scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

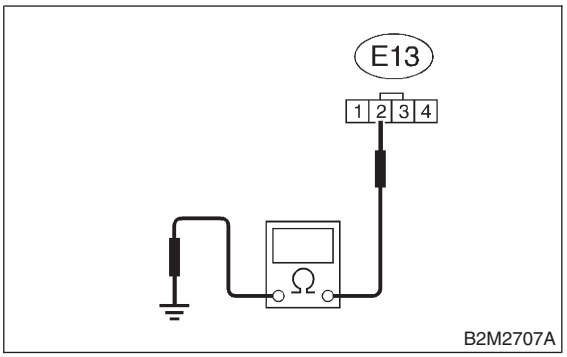
CHECK : ***Is the value more than 4.9 V?***
YES : Go to step **10L2**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.

NOTE:
In this case, repair the following:
- Poor contact in throttle position sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

10L2 : CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from throttle position sensor.
3) Measure resistance of harness between throttle position sensor connector and engine ground.

Connector & terminal
(E13) No. 2 — Engine ground:



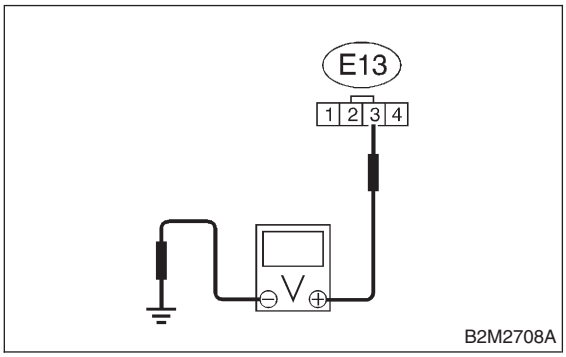
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10L3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between throttle position sensor and ECM connector
- Poor contact in coupling connector (B21)
- Poor contact in joint connector (B122)

10L3 : CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between throttle position sensor connector and engine ground.

Connector & terminal
(E13) No. 3 (+) — Engine ground (–):



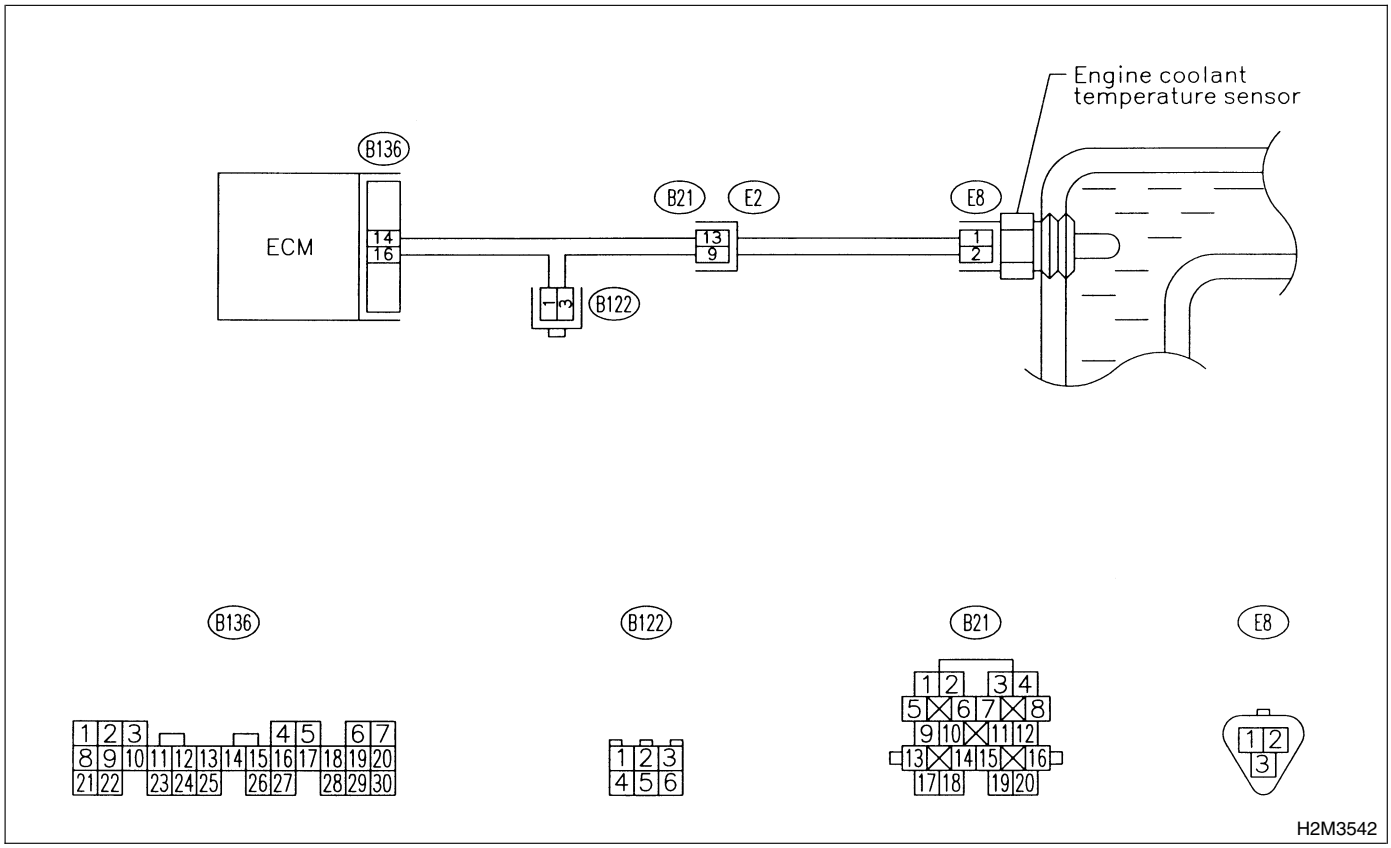
CHECK : ***Is the voltage more than 4.9 V?***
YES : Repair battery short circuit in harness between throttle position sensor and ECM connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

M: DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine would not return to idling.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10M1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0116 or P0117?***

YES : Inspect DTC P0116 or P0117 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0125.

NO : Go to step **10M2**.

10M2 : CHECK THERMOSTAT.

CHECK : ***Does thermostat remain opened?***

YES : Replace thermostat. <Ref. to 2-5 [W2A0].>

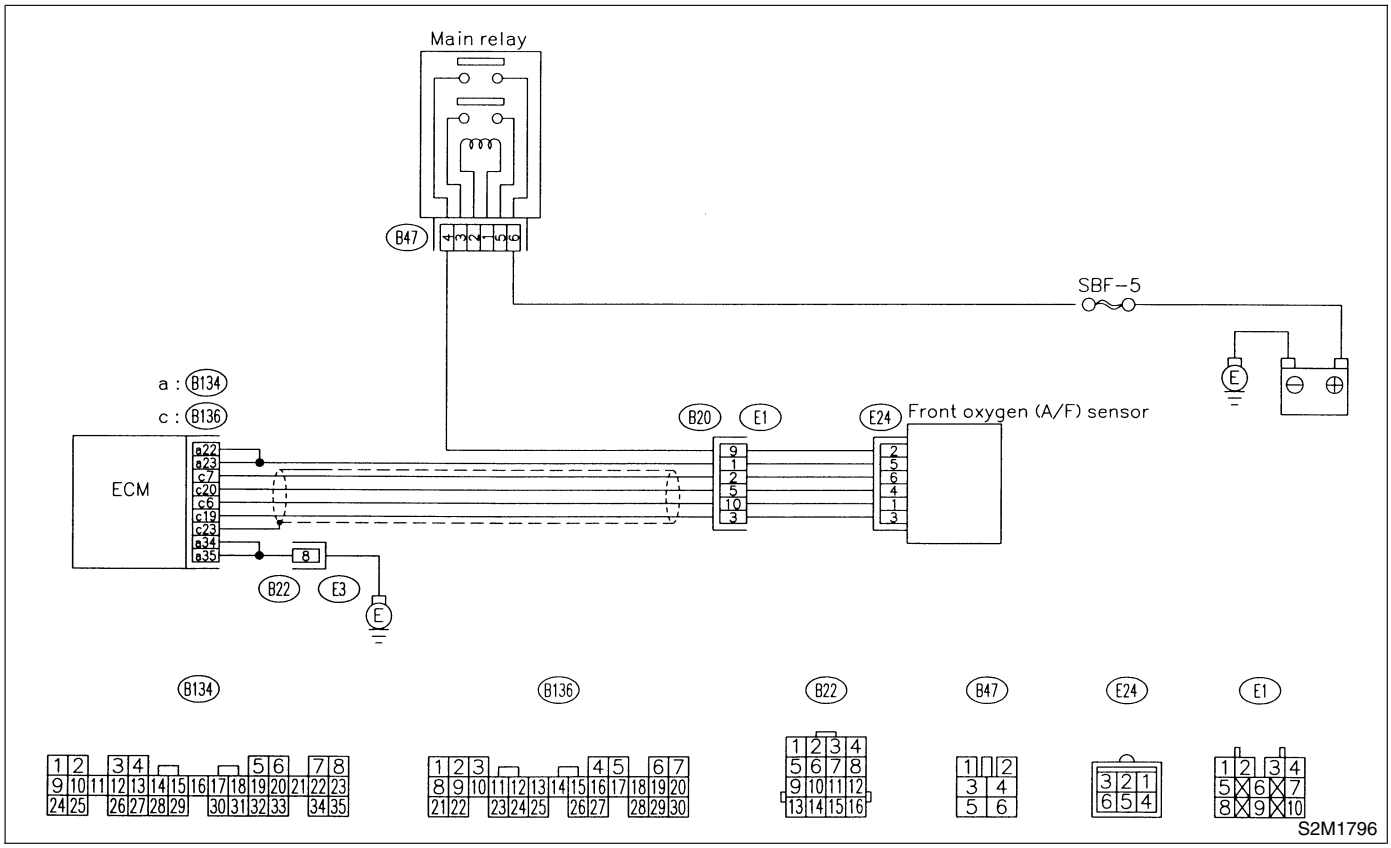
NO : Replace engine coolant temperature sensor. <Ref. to 2-7 [W4A0].>

N: DTC P0130 — FRONT OXYGEN (A/F) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10N1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1130, P1131, P1132 or P1133?***

YES : Inspect DTC P1130, P1131, P1132 or P1133 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NO : Go to step **10N2**.

10N2 : CHECK FRONT OXYGEN (A/F) SENSOR DATA.

1) Start engine.
2) While observing the Subaru Select Monitor or OBD-II general scan tool screen, warm-up the engine until coolant temperature is above 70°C (160°F).
If the engine is already warmed-up, operate at idle speed for at least 1 minute.
3) Read data of front oxygen (A/F) sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value equal to or more than 0.85 and equal to less than 1.15 in idling?***
YES : Go to step **10N3**.
NO : Go to step **10N4**.

10N3 : CHECK FRONT OXYGEN (A/F) SENSOR DATA.

Race engine at speeds from idling to 5,000 rpm for a total of 5 cycles.

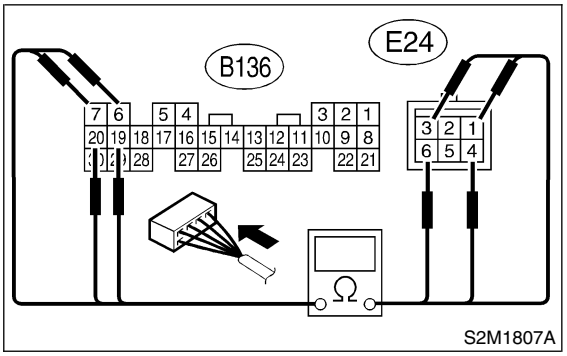
NOTE:
To increase engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approximately 5 seconds, and quickly release accelerator pedal to decrease engine speed.

CHECK : ***Is the value more than 1.1 for a moment?***
YES : Go to step **10N6**.
NO : Go to step **10N4**.

10N4 : CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM and front oxygen (A/F) sensor connector.
3) Measure resistance between ECM and front oxygen (A/F) sensor.

Connector & terminals
(B136) No. 6 — (E24) No. 1:
(B136) No. 7 — (E24) No. 6:
(B136) No. 19 — (E24) No. 3:
(B136) No. 20 — (E24) No. 4:



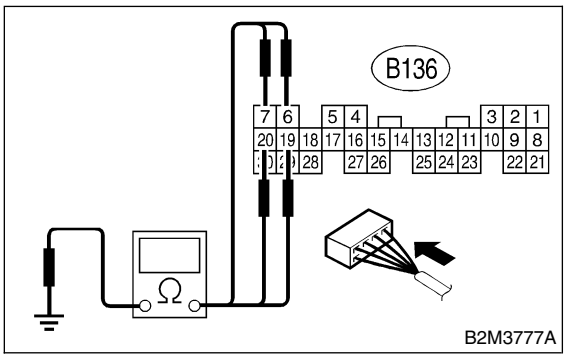
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10N5**.
NO : Repair open circuit between ECM and front oxygen (A/F) sensor.

10N5 : CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.

Measure resistance between ECM and chassis ground.

Connector & terminals

(B136) No. 6 — Chassis ground:
(B136) No. 7 — Chassis ground:
(B136) No. 19 — Chassis ground:
(B136) No. 20 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10N6**.
NO : Repair ground short circuit between ECM and front oxygen (A/F) sensor.

10N6 : CHECK EXHAUST SYSTEM.

Check exhaust system parts.

NOTE:
Check the following items.
- Loose installation of portions
- Damage (crack, hole etc.) of parts
- Looseness of front oxygen (A/F) sensor
- Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor

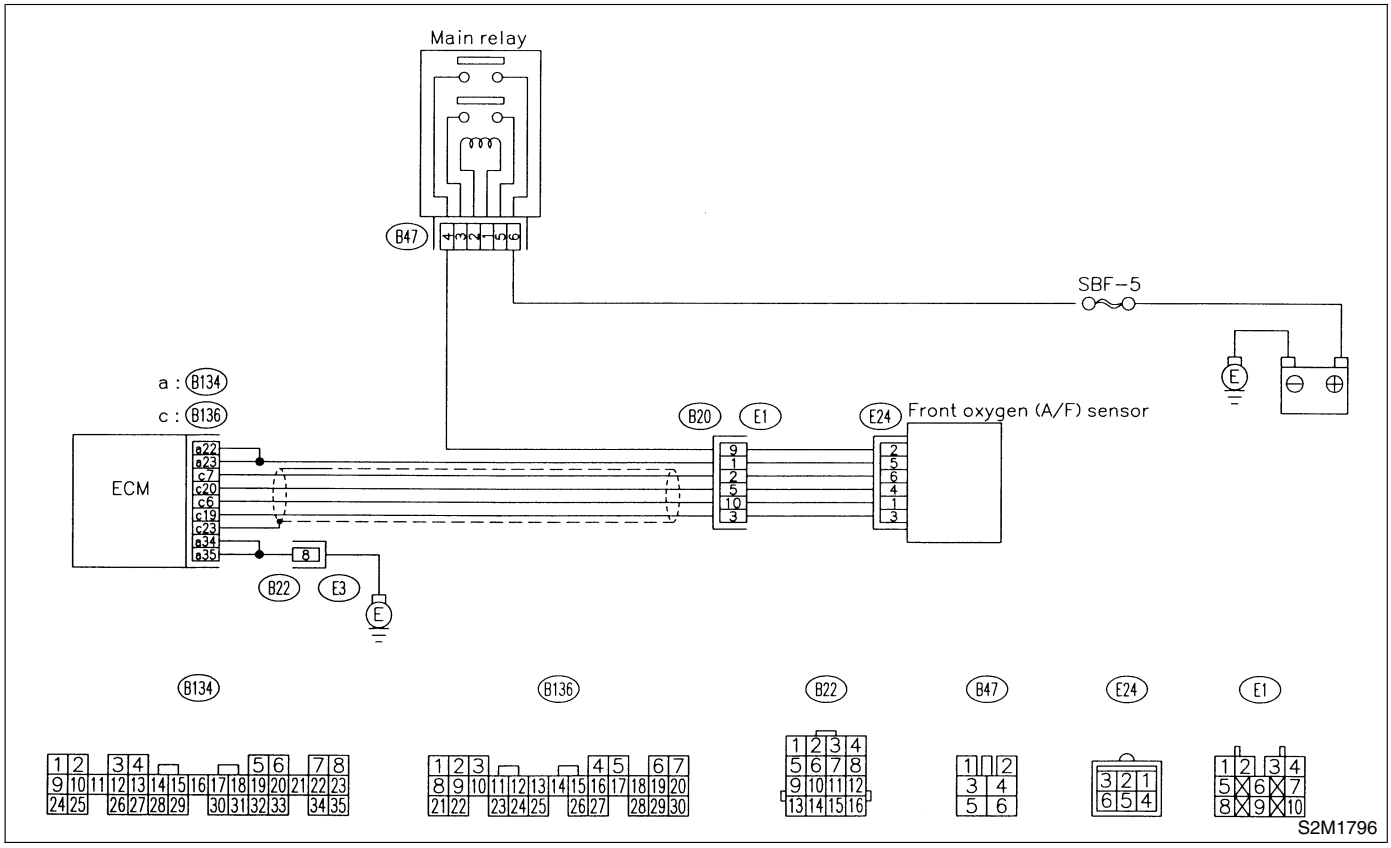
CHECK : ***Is there a fault in exhaust system?***
YES : Repair or replace faulty parts.
NO : Replace front oxygen (A/F) sensor. <Ref. to 2-7 [W8A0].>

O: DTC P0133 — FRONT OXYGEN (A/F) SENSOR CIRCUIT SLOW RESPONSE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10O1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1130, P1131, P1132 or P1133?***

YES : Inspect DTC P1130, P1131, P1132 or P1133 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0133.

NO : Go to step **10O2**.

10O2 : CHECK EXHAUST SYSTEM.

NOTE:
Check the following items.
- Loose installation of front portion of exhaust pipe onto cylinder heads
- Loose connection between front exhaust pipe and front catalytic converter
- Damage of exhaust pipe resulting in a hole

CHECK : ***Is there a fault in exhaust system?***

YES : Repair exhaust system.

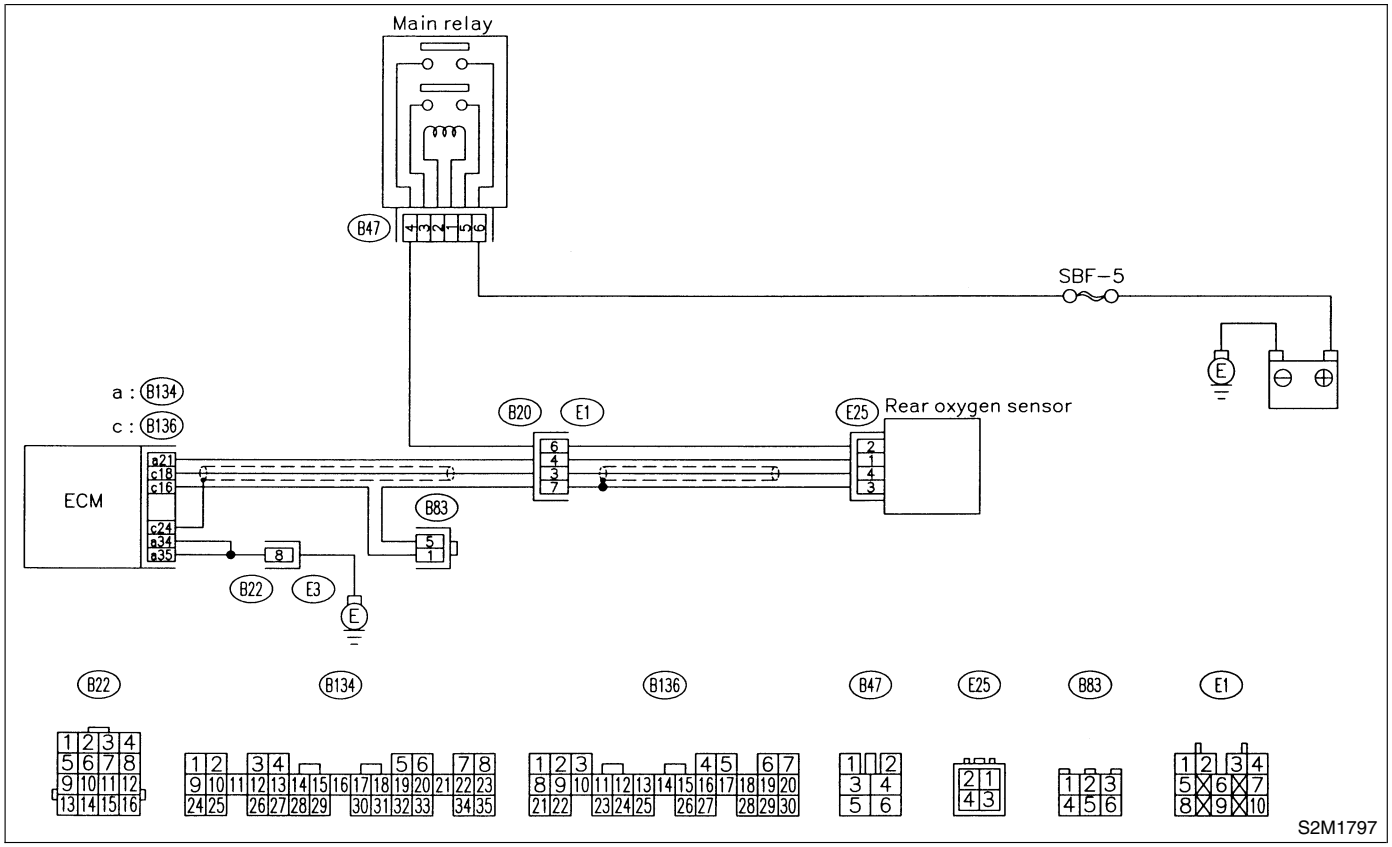
NO : Replace front oxygen (A/F) sensor. <Ref. to 2-7 [W8A0].>

P: DTC P0136 — REAR OXYGEN SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10P1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1130 or P1131?***

YES : Go to step **10P2**.

NO : Go to step **10P3**.

10P2 : CHECK FAILURE CAUSE OF P0130.

Inspect DTC P1130 or P1131 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

CHECK : ***Is the failure cause of P1130 or P1131 in the fuel system?***

YES : Check fuel system.

NOTE:
In this case, it is not necessary to inspect DTC P0136.

NO : Go to step **10P3**.

10P3 : CHECK REAR OXYGEN SENSOR DATA.

1) Warm-up the engine until engine coolant temperature is above 70°C (160°F), and keep the engine speed at 2,000 rpm to 3,000 rpm for two minutes.
2) Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Does the value fluctuate?***
YES : Go to step **10P7**.
NO : Go to step **10P4**.

10P4 : CHECK REAR OXYGEN SENSOR DATA.

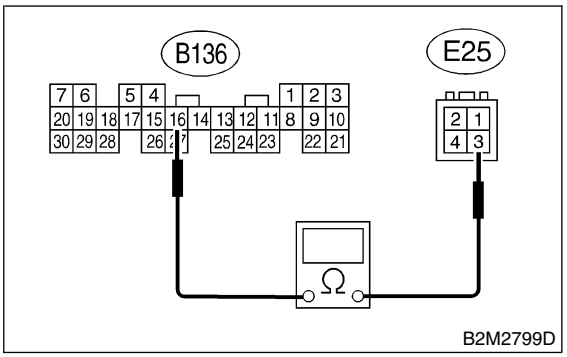
Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II General Scan Tool.

CHECK : ***Is the value fixed between 0.2 and 0.4 V?***
YES : Go to step **10P5**.
NO : Replace rear oxygen sensor. <Ref. to 2-7 [W9A0].>

10P5 : CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and rear oxygen sensor.
3) Measure resistance of harness between ECM and rear oxygen sensor connector.

Connector & terminal
(B136) No. 16 — (E25) No. 3:

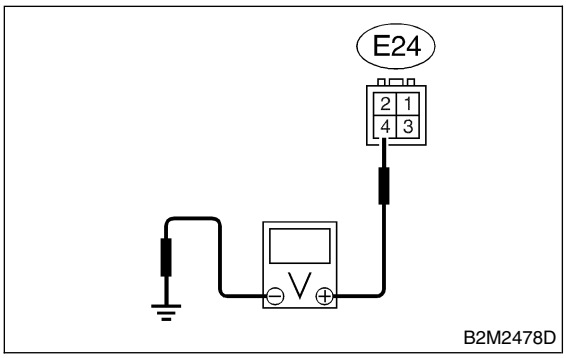


CHECK : ***Is the resistance more than 3 Ω?***
YES : Repair open circuit in harness between ECM and rear oxygen sensor connector.
NO : Go to step **10P6**.

10P6 : CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from rear oxygen sensor.
3) Turn ignition switch to ON.
4) Measure voltage between rear oxygen sensor harness connector and engine ground or chassis ground.

Connector & terminal
(E24) No. 4 (+) — Engine ground (–):



CHECK : ***Is the voltage more than 0.2 V?***
YES : Replace rear oxygen sensor. <Ref. to 2-7 [W9A0].>
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between rear oxygen sensor and ECM connector
- Poor contact in rear oxygen sensor connector
- Poor contact in ECM connector

10P7 : CHECK EXHAUST SYSTEM.

Check exhaust system parts.

NOTE:
Check the following items.
- Loose installation of portions
- Damage (crack, hole etc.) of parts
- Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor

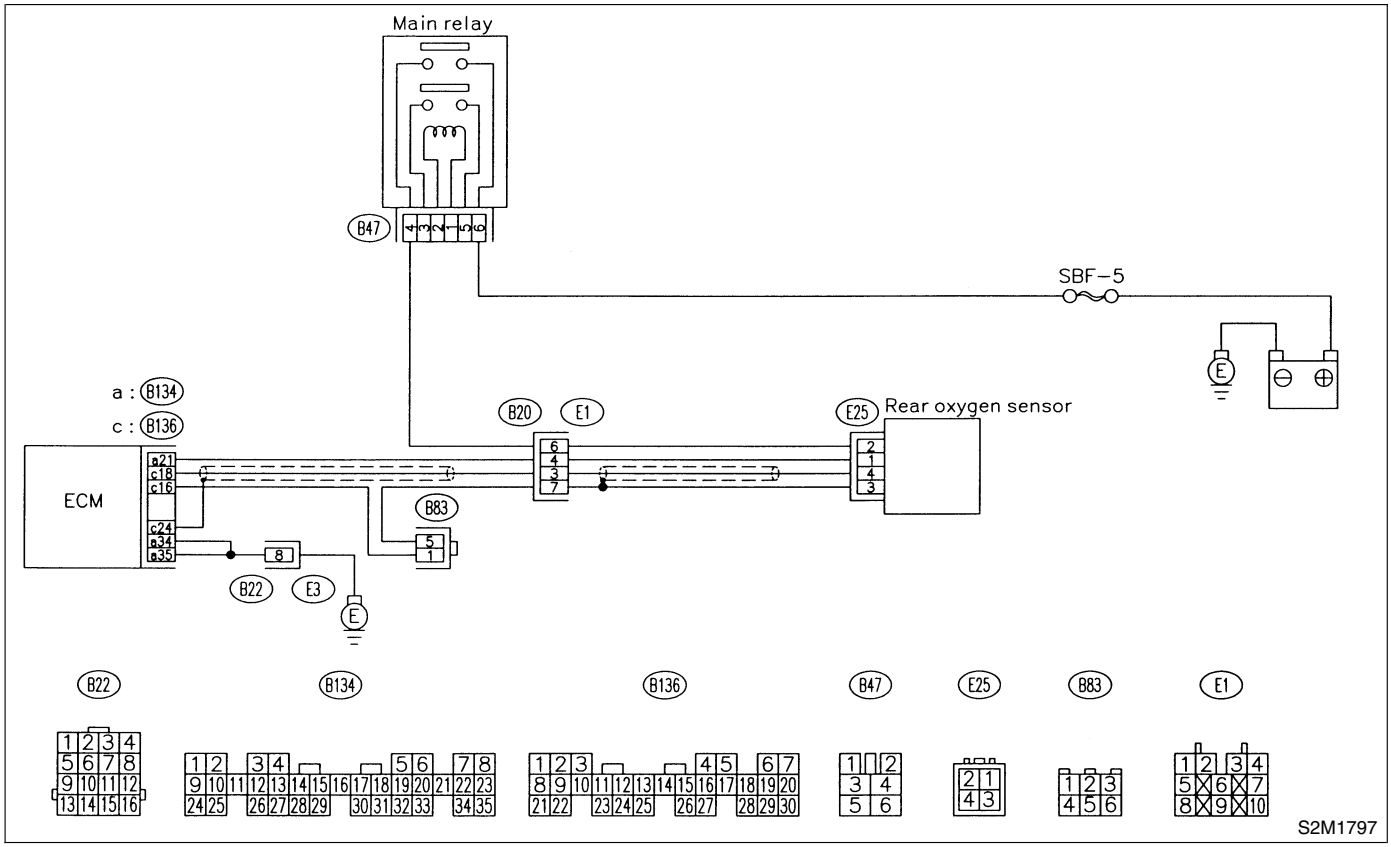
CHECK : ***Is there a fault in exhaust system?***
YES : Repair or replace faulty parts.
NO : Replace rear oxygen sensor. <Ref. to 2-7 [W9A0].>

Q: DTC P0139 — REAR OXYGEN SENSOR CIRCUIT SLOW RESPONSE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10Q1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0136?***

YES : Inspect DTC P0136 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0139.

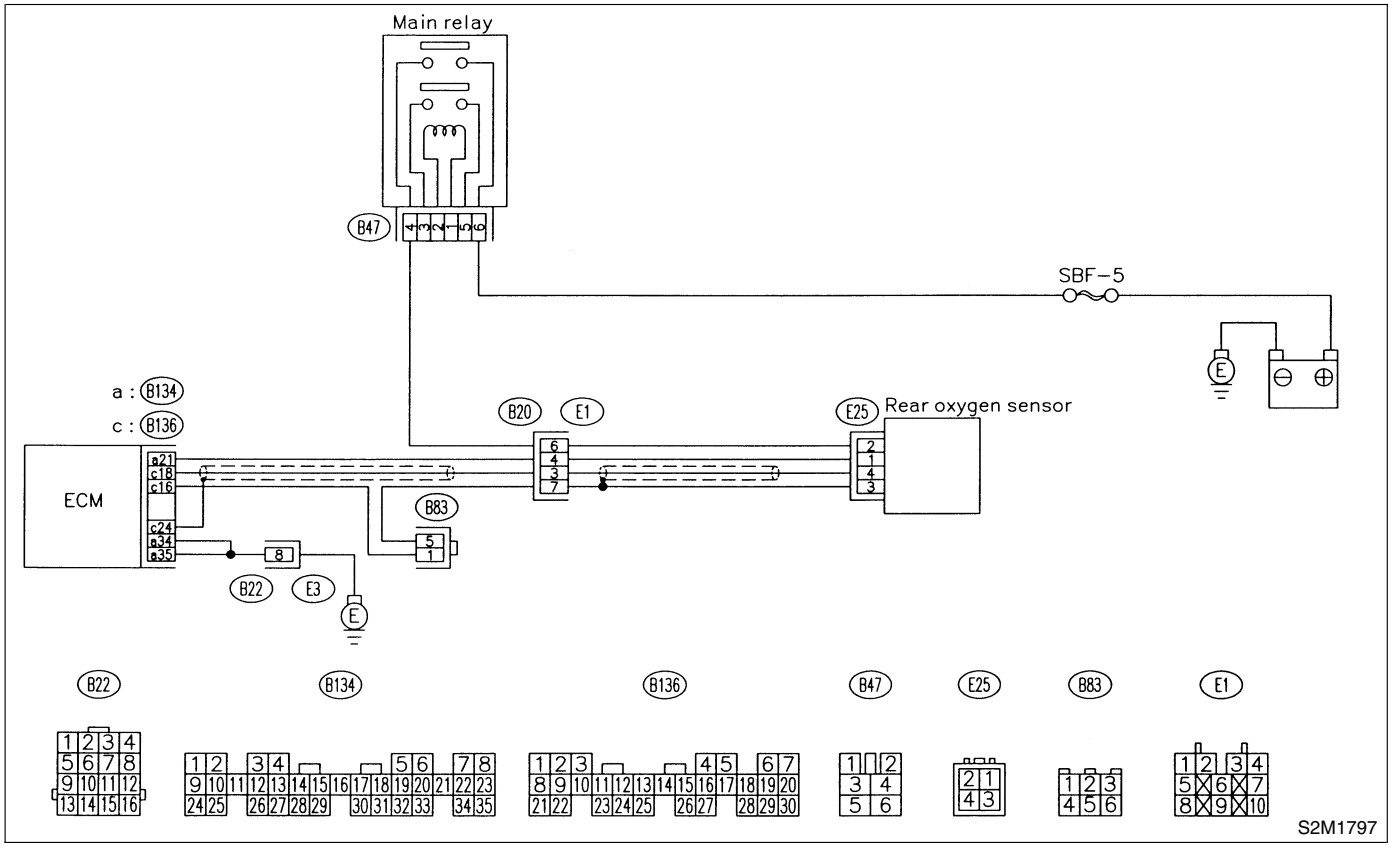
NO : Replace rear oxygen sensor. <Ref. to 2-7 [W9A0].>

R: DTC P0141 — REAR OXYGEN SENSOR HEATER CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

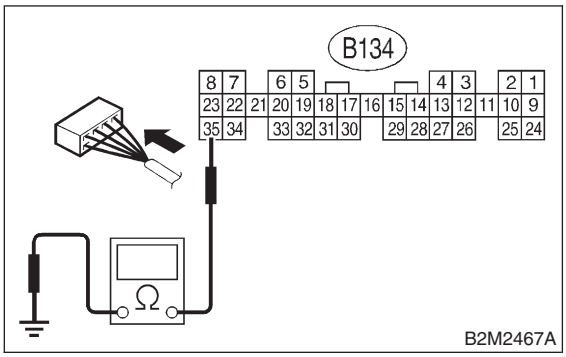
- **WIRING DIAGRAM:**



10R1 : CHECK GROUND CIRCUIT OF ECM.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B134) No. 35 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10R3**.
NO : Go to step **10R2**.

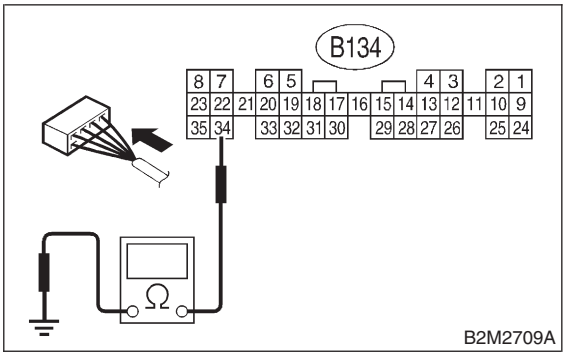
10R2 : CHECK GROUND CIRCUIT OF ECM.

1) Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine ground terminal
- Poor contact in ECM connector
- Poor contact in coupling connector (B22)

2) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B134) No. 34 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10R3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine ground terminal
- Poor contact in ECM connector
- Poor contact in coupling connector (B22)

10R3 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of rear oxygen sensor heater current using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 0.2 A?***
YES : Repair connector.

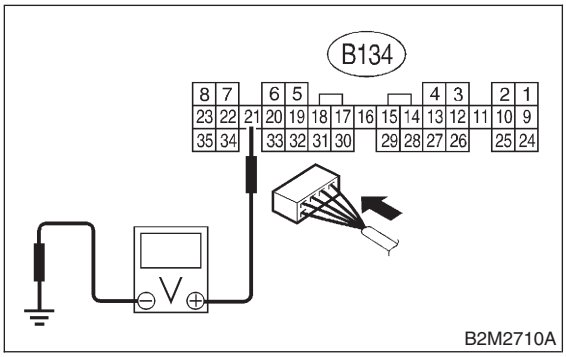
NOTE:
In this case, repair the following:
● Poor contact in rear oxygen sensor connector
● Poor contact in rear oxygen sensor connecting harness connector
● Poor contact in ECM connector

NO : Go to step **10R4**.

10R4 : CHECK OUTPUT SIGNAL FROM ECM.

1) Start and idle the engine.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 21 (+) — Chassis ground (–):

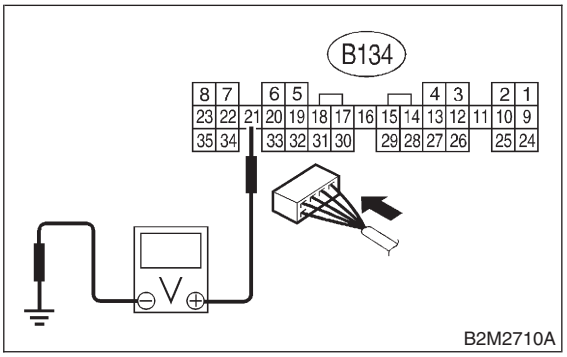


CHECK : ***Is the voltage less than 1.0 V?***
YES : Go to step **10R7**.
NO : Go to step **10R5**.

10R5 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 21 (+) — Chassis ground (–):

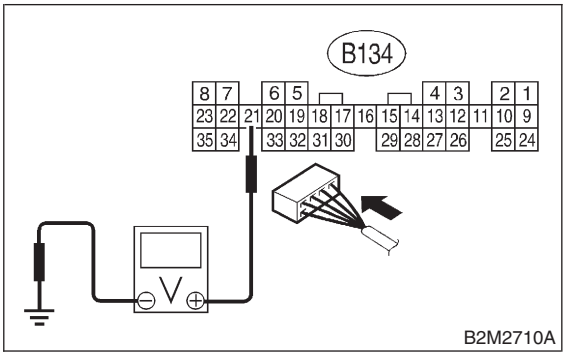


CHECK : ***Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10R6**.

10R6 : CHECK OUTPUT SIGNAL FROM ECM.

1) Disconnect connector from rear oxygen sensor.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 21 (+) — Chassis ground (–):

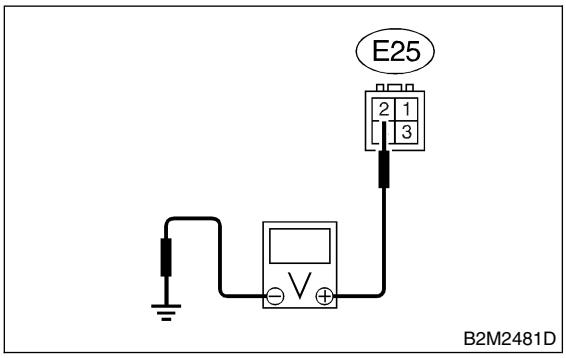


CHECK : ***Is the voltage less than 1.0 V?***
YES : Replace ECM. <Ref. to 2-7 [W17A0].>
NO : Repair battery short circuit in harness between ECM and rear oxygen sensor connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>

10R7 : CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from rear oxygen sensor.
3) Turn ignition switch to ON.
4) Measure voltage between rear oxygen sensor connector and engine ground or chassis ground.

Connector & terminal
(E25) No. 2 (+) — Chassis ground (–):



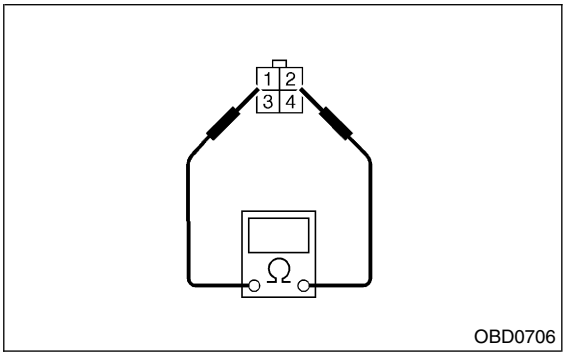
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10R8**.
NO : Repair power supply line.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and rear oxygen sensor connector
- Poor contact in rear oxygen sensor connector
- Poor contact in coupling connector (E1)

10R8 : CHECK REAR OXYGEN SENSOR.

1) Turn ignition switch to OFF.
2) Measure resistance between rear oxygen sensor connector terminals.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance less than 30 Ω?***
YES : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between rear oxygen sensor and ECM connector
- Poor contact in rear oxygen sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (E1)

NO : Replace rear oxygen sensor. <Ref. to 2-7 [W9A0].>

S: DTC P0170 — FUEL TRIM MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

10S1 : CHECK EXHAUST SYSTEM.

CHECK : ***Are there holes or loose bolts on exhaust system?***
YES : Repair exhaust system.
NO : Go to step **10S2**.

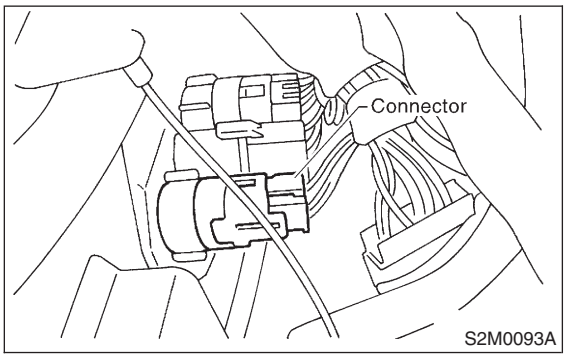
10S2 : CHECK AIR INTAKE SYSTEM.

CHECK : ***Are there holes, loose bolts or disconnection of hose on air intake system?***
YES : Repair air intake system.
NO : Go to step **10S3**.

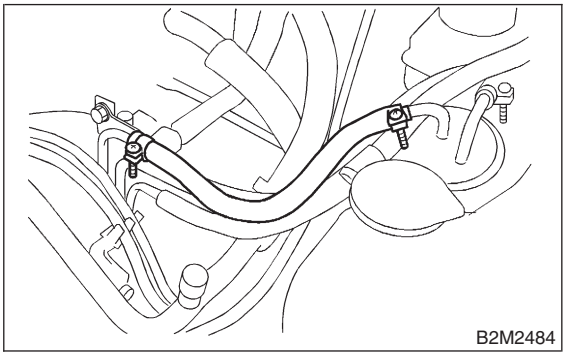
10S3 : CHECK FUEL PRESSURE.

WARNING:
• Place "NO FIRE" signs near the working area.
• Be careful not to spill fuel on the floor.

1) Release fuel pressure.
   (1) Disconnect connector from fuel pump relay.



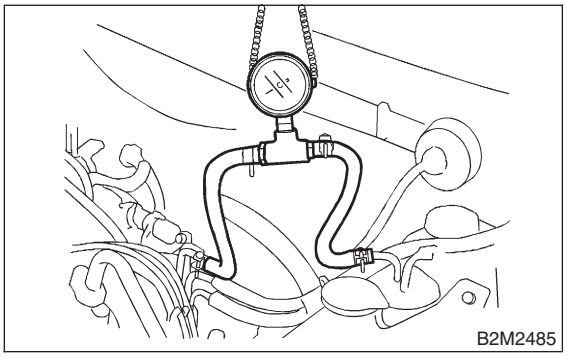
   (2) Start the engine and run it until it stalls.
   (3) After the engine stalls, crank it for five more seconds.
   (4) Turn ignition switch to OFF.
2) Connect connector to fuel pump relay.
3) Disconnect fuel delivery hose from fuel filter, and connect fuel pressure gauge.



4) Install fuel filler cap.
5) Start the engine and idle while gear position is neutral.
6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

WARNING:
Before removing fuel pressure gauge, release fuel pressure.

NOTE:
If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.



CHECK : ***Is fuel pressure between 284 and 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)?***
YES : Go to step **10S4**.
NO : Repair the following items.

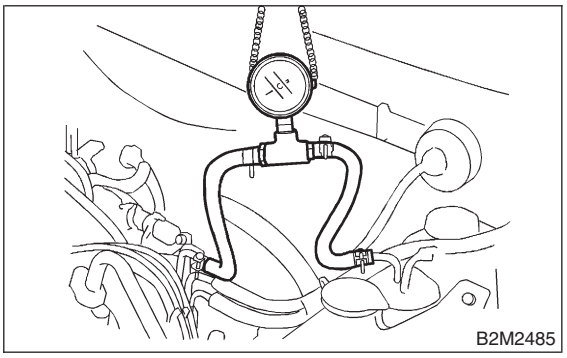
Fuel pressure too high	● Clogged fuel return line or bent hose
Fuel pressure too low	● Improper fuel pump discharge ● Clogged fuel supply line

10S4 : CHECK FUEL PRESSURE.

After connecting pressure regulator vacuum hose, measure fuel pressure.

WARNING:
Before removing fuel pressure gauge, release fuel pressure.

NOTE:
● If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.
● If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose.



CHECK : ***Is fuel pressure between 206 and 235 kPa (2.1 — 2.4 kg/cm^2, 30 — 34 psi)?***
YES : Go to step **10S5**.
NO : Repair the following items.

Fuel pressure too high	● Faulty pressure regulator ● Clogged fuel return line or bent hose
Fuel pressure too low	● Faulty pressure regulator ● Improper fuel pump discharge ● Clogged fuel supply line

10S5 : CHECK ENGINE COOLANT TEMPERATURE SENSOR.

1) Start the engine and warm-up completely.
2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is temperature between 70°C (158°F) and 100°C (212°F)?***
YES : Go to step **10S6**.
NO : Replace engine coolant temperature sensor. <Ref. to 2-7 [W4A0].>

10S6 : CHECK INTAKE MANIFOLD PRESSURE SENSOR SIGNAL.

1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F).
2) Place the selector lever in "N" or "P" position.
3) Turn A/C switch to OFF.
4) Turn all accessory switches to OFF.
5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

Specification:

Engine speed	Specified value
Idling	24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 41.3 inHg)
Ignition ON	73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)

CHECK : ***Is the voltage within the specifications?***
YES : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

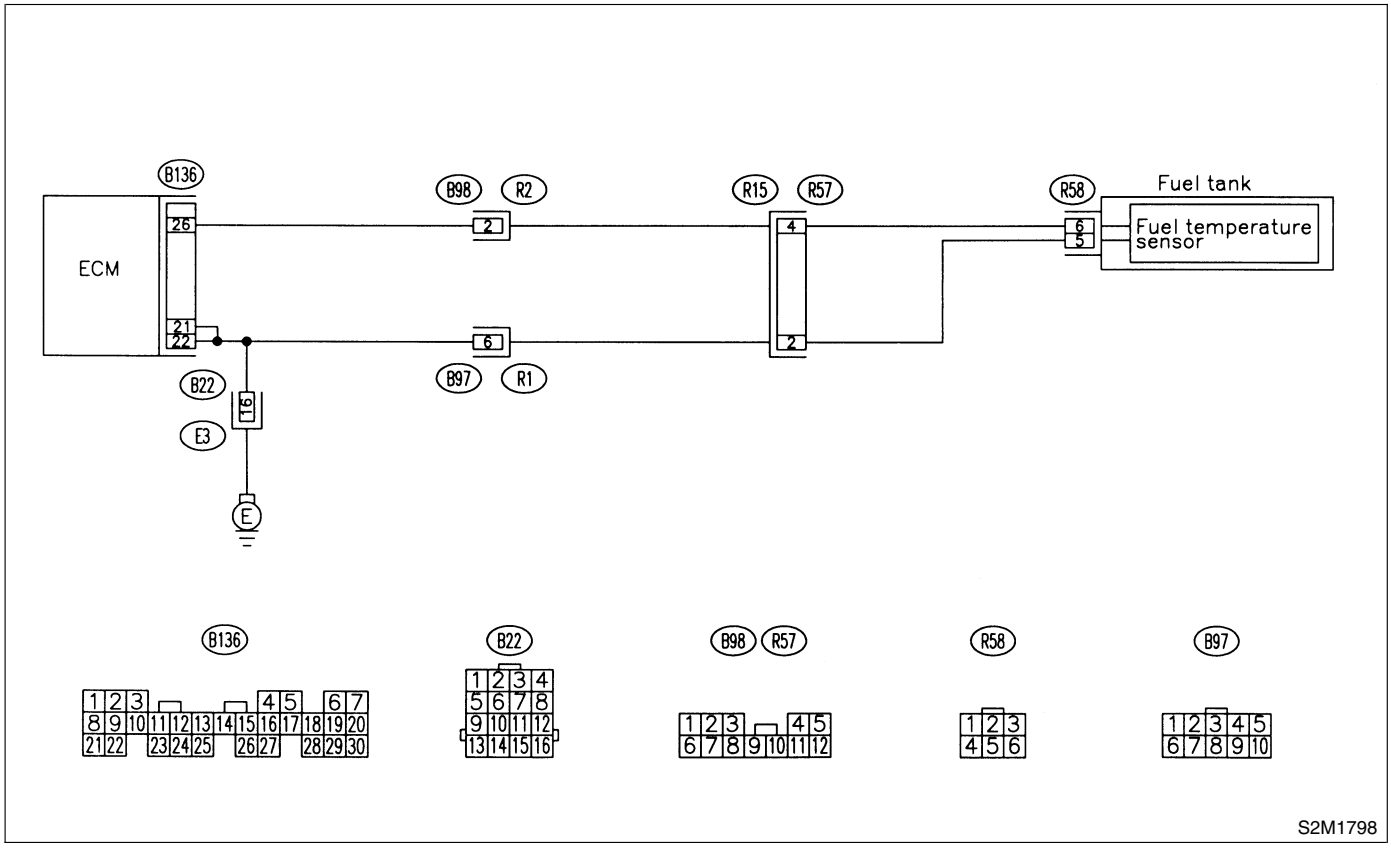
NO : Replace intake air temperature and pressure sensor. <Ref. to 2-7 [W11A0].>

T: DTC P0181 — FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10T1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0182 or P0183?***

YES : Inspect DTC P0182 or P0183 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0181.

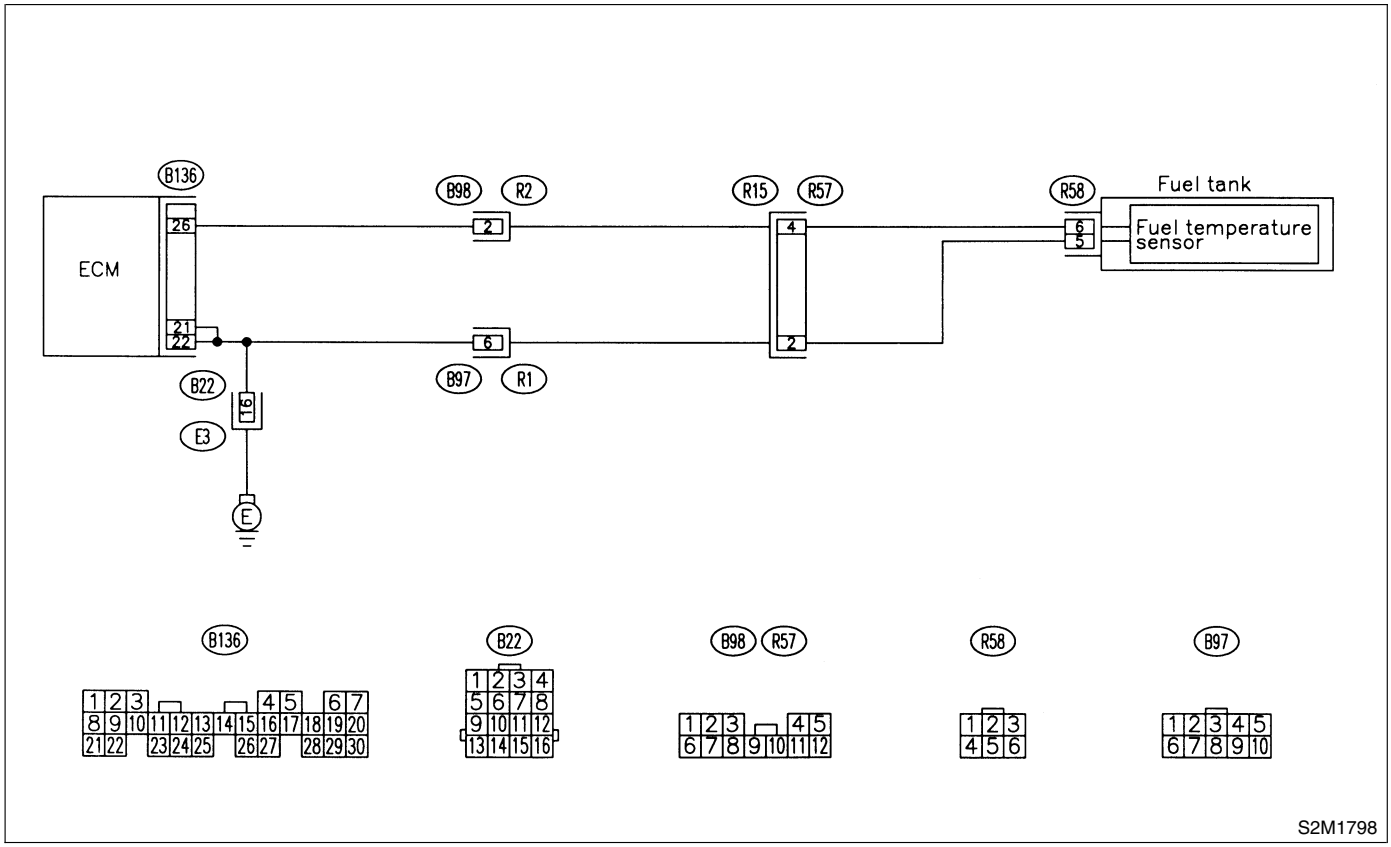
NO : Replace fuel temperature sensor. <Ref. to 2-1 [W6A0].>

U: DTC P0182 — FUEL TEMPERATURE SENSOR A CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10U1 : CHECK CURRENT DATA.

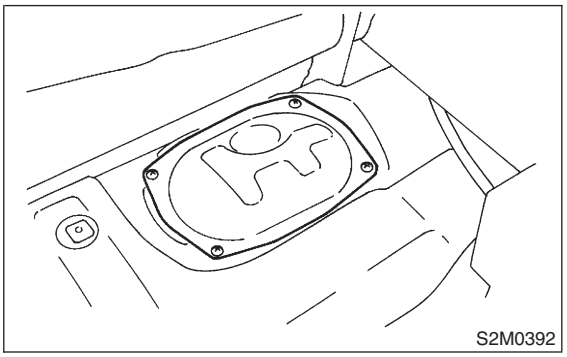
1) Start engine.
2) Read data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value greater than 150°C (302°F)?***
YES : Go to step **10U2**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time.

10U2 : CHECK CURRENT DATA.

1) Turn ignition switch to OFF.
2) Remove access hole lid.


S2M0392

3) Disconnect connector from fuel pump.
4) Turn ignition switch to ON.
5) Read data of fuel temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

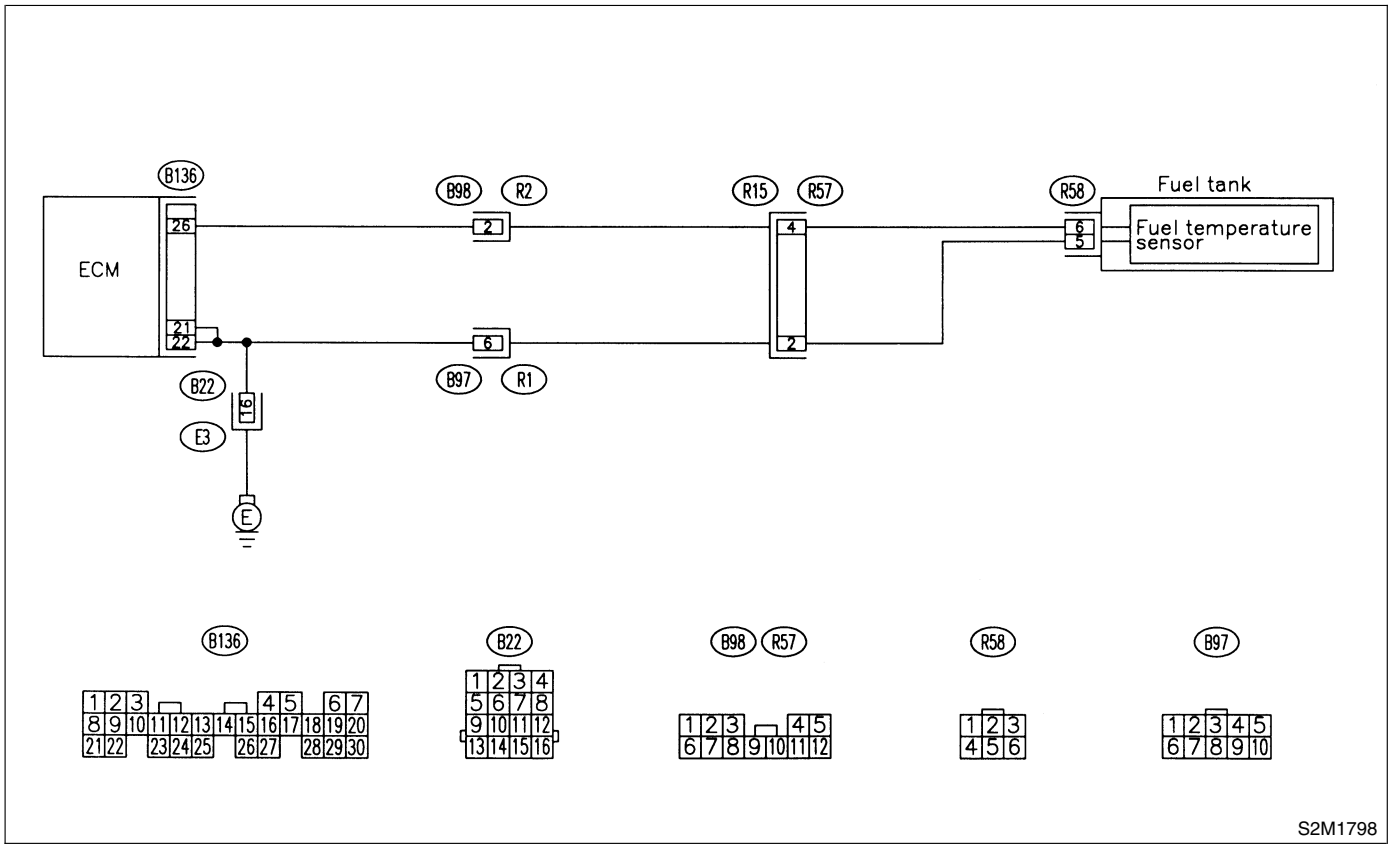
CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Replace fuel temperature sensor. <Ref. to 2-1 [W6A0].>
NO : Repair ground short circuit in harness between fuel pump and ECM connector.

V: DTC P0183 — FUEL TEMPERATURE SENSOR A CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10V1 : CHECK CURRENT DATA.

1) Start engine.
2) Read data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool.

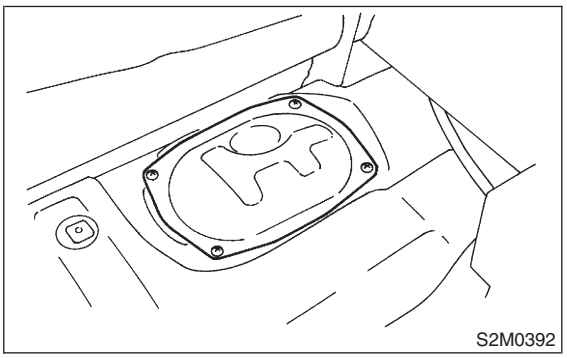
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value less than –40°C (–40°F)?***
YES : Go to step **10V2**.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
● Poor contact in fuel pump connector
● Poor contact in ECM connector
● Poor contact in coupling connectors (B22, B99, B98 and R57)

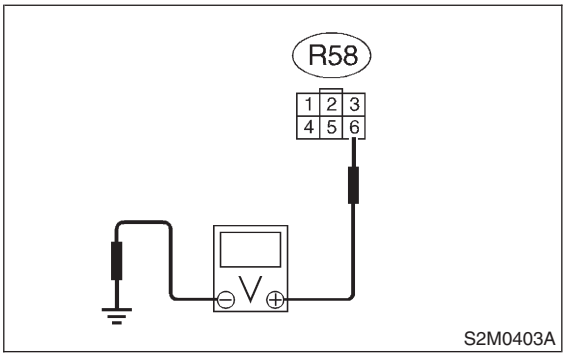
10V2 : CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Remove access hole lid.


S2M0392

3) Disconnect connector from fuel pump.
4) Measure voltage between fuel pump connector and chassis ground.

Connector & terminal
(R58) No. 6 (+) — Chassis ground (–):



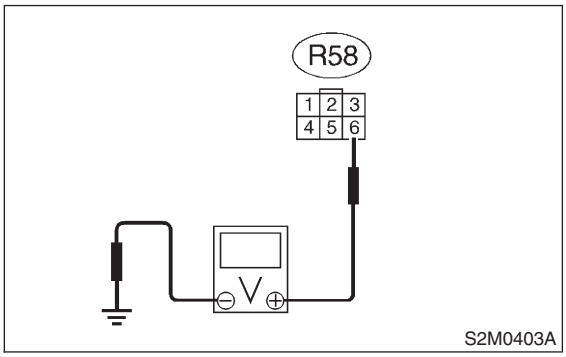
S2M0403A

CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and fuel pump connector.
NO : Go to step **10V3**.

10V3 : CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between fuel pump connector and chassis ground.

Connector & terminal
(R58) No. 6 (+) — Chassis ground (–):

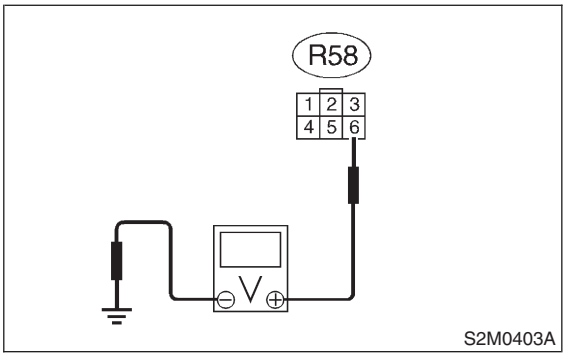


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and fuel pump connector.
NO : Go to step **10V4**.

10V4 : CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.

Measure voltage between fuel pump connector and chassis ground.

Connector & terminal
(R58) No. 6 (+) — Chassis ground (–):



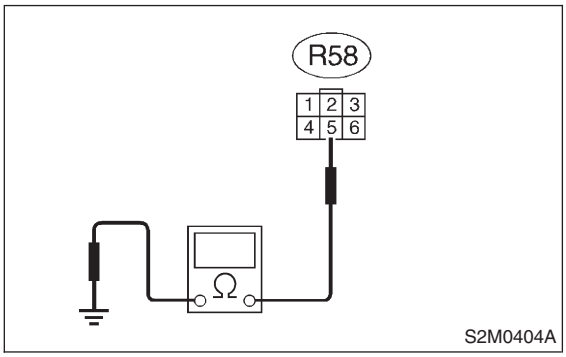
CHECK : ***Is the voltage more than 4 V?***
YES : Go to step **10V5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel pump connector
- Poor contact in fuel pump connector
- Poor contact in ECM connector
- Poor contact in coupling connectors (B98 and R57)

10V5 : CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance of harness between fuel pump connector and chassis ground.

Connector & terminal
(R58) No. 5 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Replace fuel temperature sensor. <Ref. to 2-1 [W6A0].>
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel pump connector
- Poor contact in fuel pump connector
- Poor contact in ECM connector
- Poor contact in coupling connectors (B22, B97 and R57)

W: DTC P0301 — CYLINDER 1 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to 2-7 [T11Z0].>

X: DTC P0302 — CYLINDER 2 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to 2-7 [T11Z0].>

Y: DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

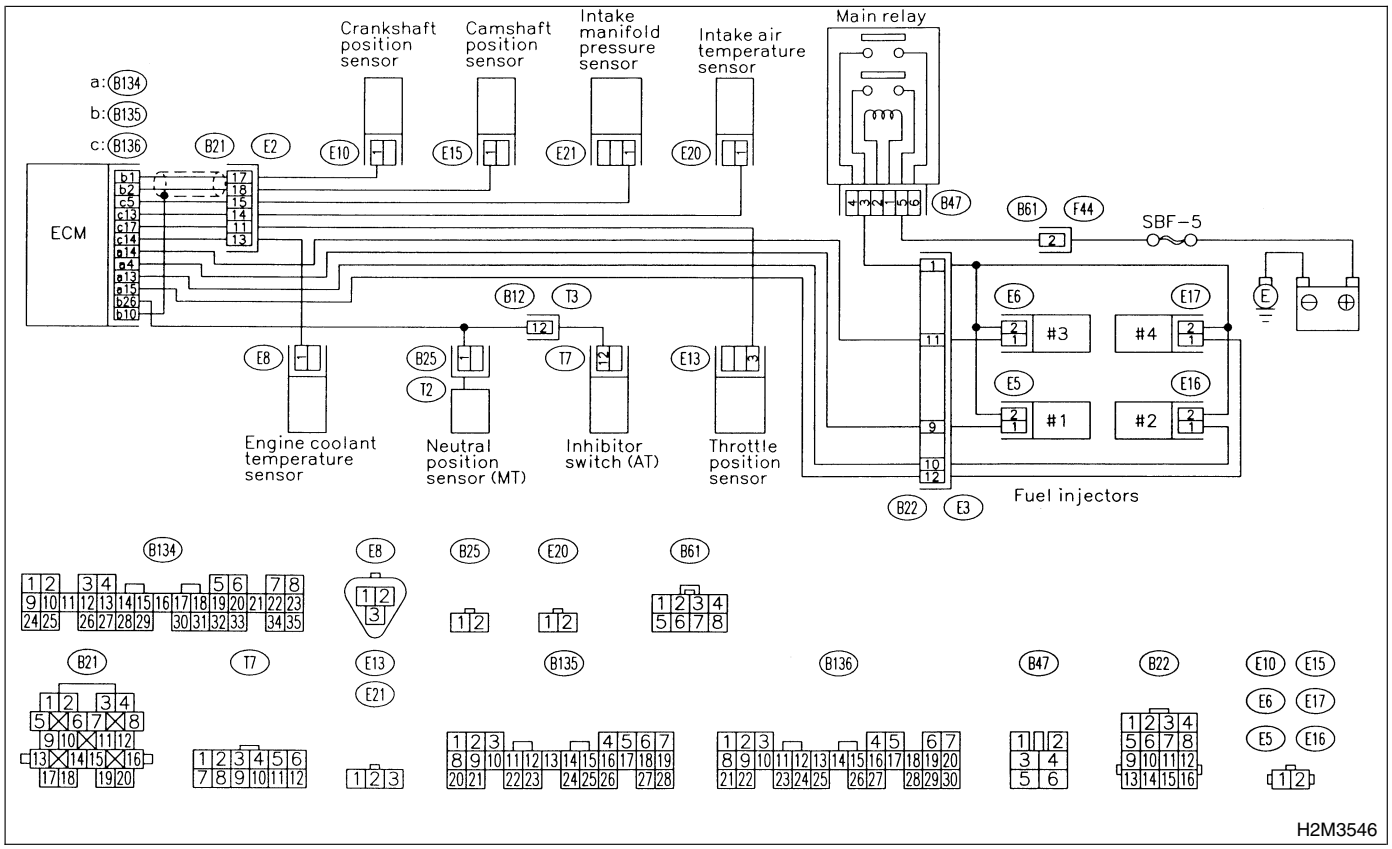
NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to 2-7 [T11Z0].>

Z: DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Erroneous idling
  - Rough driving

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10Z1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0106, P0107, P0108, P0116, P0117 or P0125?***

YES : Inspect DTC P0106, P0107, P0108, P0116, P0117 or P0125 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

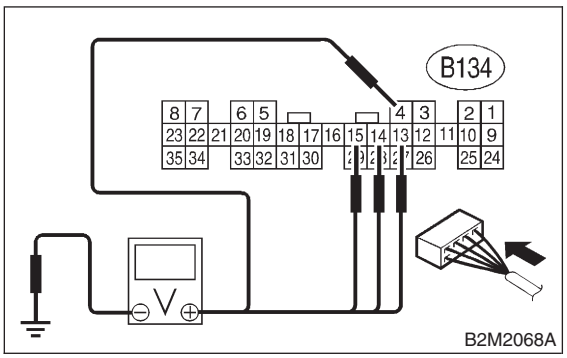
NOTE:
In this case, it is not necessary to inspect DTC P0301, P0302, P0303 and P0304.

NO : Go to step **10Z2**.

10Z2 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM connector and chassis ground on faulty cylinders.

Connector & terminal
#1 (B134) No. 4 (+) — Chassis ground (–):
#2 (B134) No. 13 (+) — Chassis ground (–):
#3 (B134) No. 14 (+) — Chassis ground (–):
#4 (B134) No. 15 (+) — Chassis ground (–):

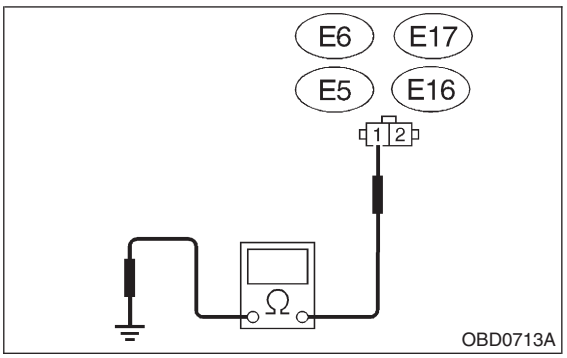


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10Z7**.
NO : Go to step **10Z3**.

10Z3 : CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from fuel injector on faulty cylinders.
3) Measure voltage between ECM connector and engine ground on faulty cylinders.

Connector & terminal
#1 (E5) No. 1 — Engine ground:
#2 (E16) No. 1 — Engine ground:
#3 (E6) No. 1 — Engine ground:
#4 (E17) No. 1 — Engine ground:



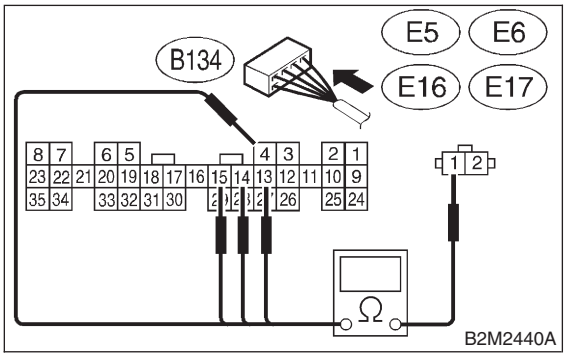
CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between fuel injector and ECM connector.
NO : Go to step **10Z4**.

10Z4 : CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR.

Measure resistance of harness connector between ECM connector and fuel injector on faulty cylinders.

Connector & terminal

#1 (B134) No. 4 — (E5) No. 1:
#2 (B134) No. 13 — (E16) No. 1:
#3 (B134) No. 14 — (E6) No. 1:
#4 (B134) No. 15 — (E17) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10Z5**.
NO : Repair harness and connector.

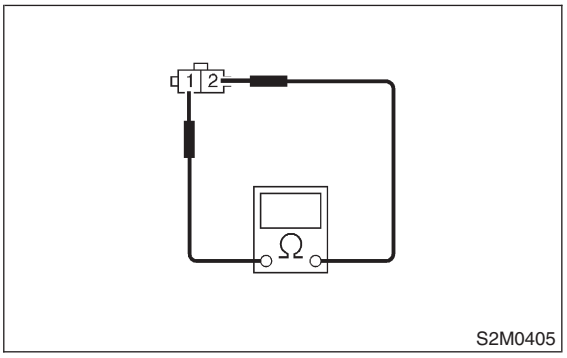
NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and fuel injector connector
- Poor contact in coupling connector (B22)

10Z5 : CHECK FUEL INJECTOR.

Measure resistance between fuel injector terminals on faulty cylinder.

Terminals

No. 1 — No. 2:



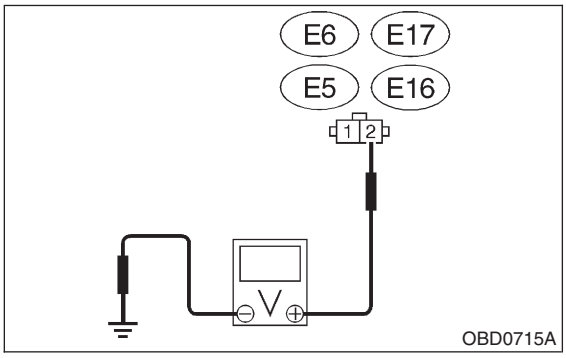
CHECK : ***Is the resistance between 5 and 20 Ω?***
YES : Go to step **10Z6**.
NO : Replace faulty fuel injector. <Ref. to 2-7 [W16A0].>

10Z6 : CHECK POWER SUPPLY LINE.

1) Turn ignition switch to ON.
2) Measure voltage between fuel injector and engine ground on faulty cylinders.

Connector & terminal

#1 (E5) No. 2 (+) — Engine ground (–):
#2 (E16) No. 2 (+) — Engine ground (–):
#3 (E6) No. 2 (+) — Engine ground (–):
#4 (E17) No. 2 (+) — Engine ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Repair poor contact in all connectors in fuel injector circuit.
NO : Repair harness and connector.

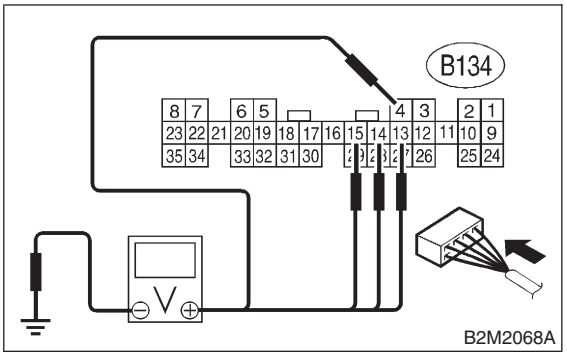
NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel injector connector on faulty cylinders
- Poor contact in coupling connector (B22)
- Poor contact in main relay connector
- Poor contact in fuel injector connector on faulty cylinders

10Z7 : CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from fuel injector on faulty cylinder.
3) Turn ignition switch to ON.
4) Measure voltage between ECM connector and chassis ground on faulty cylinders.

Connector & terminal

#1 (B134) No. 4 (+) — Chassis ground (–):
#2 (B134) No. 13 (+) — Chassis ground (–):
#3 (B134) No. 14 (+) — Chassis ground (–):
#4 (B134) No. 15 (+) — Chassis ground (–):

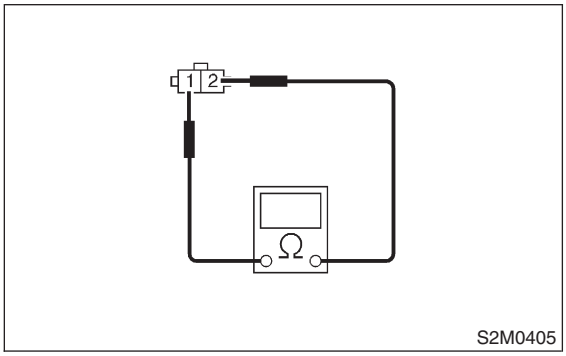


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and fuel injector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **10Z8**.

10Z8 : CHECK FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between fuel injector terminals on faulty cylinder.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace faulty fuel injector <Ref. to 2-7 [W16A0].> and ECM <Ref. to 2-7 [W17A0].>.
NO : Go to step **10Z9**.

10Z9 : CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/ CRANKSHAFT POSITION SENSOR.

CHECK : ***Is camshaft position sensor or crankshaft position sensor loosely installed?***
YES : Tighten camshaft position sensor or crankshaft position sensor.
NO : Go to step **10Z10**.

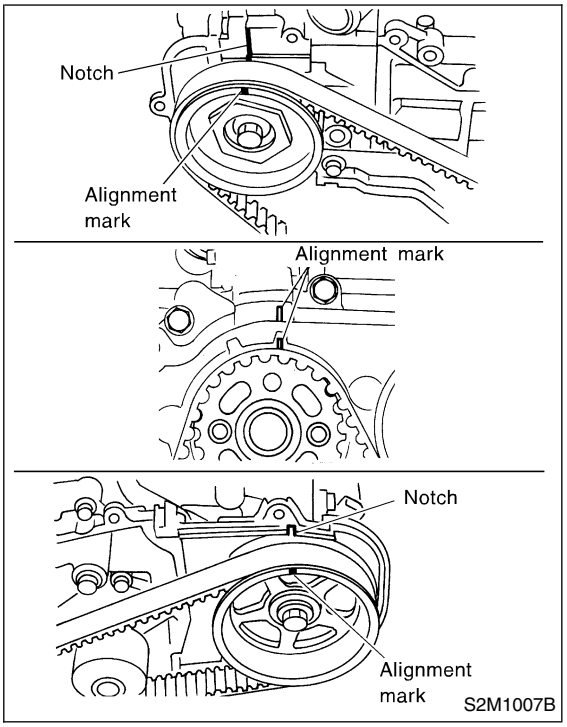
10Z10 : CHECK CRANKSHAFT SPROCKET.

Remove timing belt cover.

CHECK : ***Is crankshaft sprocket rusted or does it have broken teeth?***
YES : Replace crankshaft sprocket. <Ref. to 2-3 [W3A4].>
NO : Go to step **10Z11**.

10Z11 : CHECK INSTALLATION CONDITION OF TIMING BELT.

Turn crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.
ST 499987500 CRANKSHAFT SOCKET



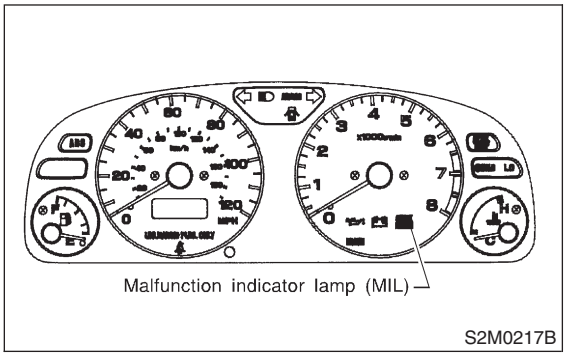
CHECK : ***Is timing belt dislocated from its proper position?***
YES : Repair installation condition of timing belt. <Ref. to 2-3 [W3A0].>
NO : Go to step **10Z12**.

10Z12 : CHECK FUEL LEVEL.

CHECK : ***Is the fuel meter indication higher than the "Lower" level?***
YES : Go to step **10Z13**.
NO : Replenish fuel so fuel meter indication is higher than the "Lower" level. After replenishing fuel, Go to step **10Z13**.

10Z13 : CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).

1) Clear memory using Subaru Select Monitor. <Ref. to 2-7 [T3D0].>
2) Start engine, and drive the vehicle more than 10 minutes.



CHECK : ***Is the MIL coming on or blinking?***
YES : Go to step **10Z15**.
NO : Go to step **10Z14**.

10Z14 : CHECK CAUSE OF MISFIRE DIAGNOSED.

CHECK : ***Was the cause of misfire diagnosed when the engine is running?***
YES : Finish diagnostics operation, if the engine has no abnormality.

NOTE:
Ex. Remove spark plug cord, etc.
NO : Repair poor contact.

NOTE:
In this case, repair the following:
- Poor contact in ignitor connector
- Poor contact in ignition coil connector
- Poor contact in fuel injector connector on faulty cylinders
- Poor contact in ECM connector
- Poor contact in coupling connector (B22)

10Z15 : CHECK AIR INTAKE SYSTEM.

CHECK : ***Is there a fault in air intake system?***
YES : Repair air intake system.

NOTE:
Check the following items:
- Are there air leaks or air suction caused by loose or dislocated nuts and bolts?
- Are there cracks or any disconnection of hoses?

NO : Go to step **10Z16**.

10Z16 : CHECK MISFIRE SYMPTOM.

1) Turn ignition switch to ON.
2) Read diagnostic trouble code (DTC).
- Subaru Select Monitor
<Ref. to 2-7 [T3C2].>
- OBD-II general scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual.

NOTE:
Perform diagnosis according to the items listed below.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate only one DTC?***
YES : Go to step **10Z21**.
NO : Go to step **10Z17**.

10Z17 : CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0301 and P0302?***
YES : Go to step **10Z22**.
NO : Go to step **10Z18**.

10Z18 : CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0303 and P0304?***
YES : Go to step **10Z23**.
NO : Go to step **10Z19**.

10Z19 : CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0301 and P0303?***
YES : Go to step **10Z24**.
NO : Go to step **10Z20**.

10Z20 : CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0302 and P0304?***
YES : Go to step **10Z25**.
NO : Go to step **10Z26**.

10Z21 : ONLY ONE CYLINDER

CHECK : ***Is there a fault in that cylinder?***
YES : Repair or replace faulty parts.

NOTE:
Check the following items.
- Spark plug
- Spark plug cord
- Fuel injector
- Compression ratio

NO : Go to DTC P0170. <Ref. to 2-7 [T10S0].>

10Z22 : GROUP OF #1 AND #2 CYLINDERS

CHECK : ***Are there faults in #1 and #2 cylinders?***
YES : Repair or replace faulty parts.

NOTE:
- Check the following items.
  - Spark plugs
  - Fuel injectors
  - Ignition coil
  - Compression ratio
- If no abnormal is discovered, check for “8. D: IGNITION CONTROL SYSTEM” of #1 and #2 cylinders side. <Ref. to 2-7 [T8D0].>

NO : Go to DTC P0170. <Ref. to 2-7 [T10S0].>

10Z23 : GROUP OF #3 AND #4 CYLINDERS

CHECK : ***Are there faults in #3 and #4 cylinders?***
YES : Repair or replace faulty parts.

NOTE:
- Check the following items.
  - Spark plugs
  - Fuel injectors
  - Ignition coil
- If no abnormal is discovered, check for “8. D: IGNITION CONTROL SYSTEM” of #3 and #4 cylinders side. <Ref. to 2-7 [T8D0].>

NO : Go to DTC P0170. <Ref. to 2-7 [T10S0].>

10Z24 : GROUP OF #1 AND #3 CYLINDERS

CHECK : ***Are there faults in #1 and #3 cylinders?***
YES : Repair or replace faulty parts.

NOTE:
Check the following items.
- Spark plugs
- Fuel injectors
- Skipping timing belt teeth

NO : Go to DTC P0170. <Ref. to 2-7 [T10S0].>

10Z25 : GROUP OF #2 AND #4 CYLINDERS

CHECK : ***Are there faults in #2 and #4 cylinders?***
YES : Repair or replace faulty parts.

NOTE:
Check the following items.
- Spark plugs
- Fuel injectors
- Compression ratio
- Skipping timing belt teeth

NO : Go to DTC P0170. <Ref. to 2-7 [T10S0].>

10Z26 : CYLINDER AT RANDOM

CHECK : ***Is the engine idle rough?***
YES : Go to DTC P0170. <Ref. to 2-7 [T10S0].>
NO : Repair or replace faulty parts.

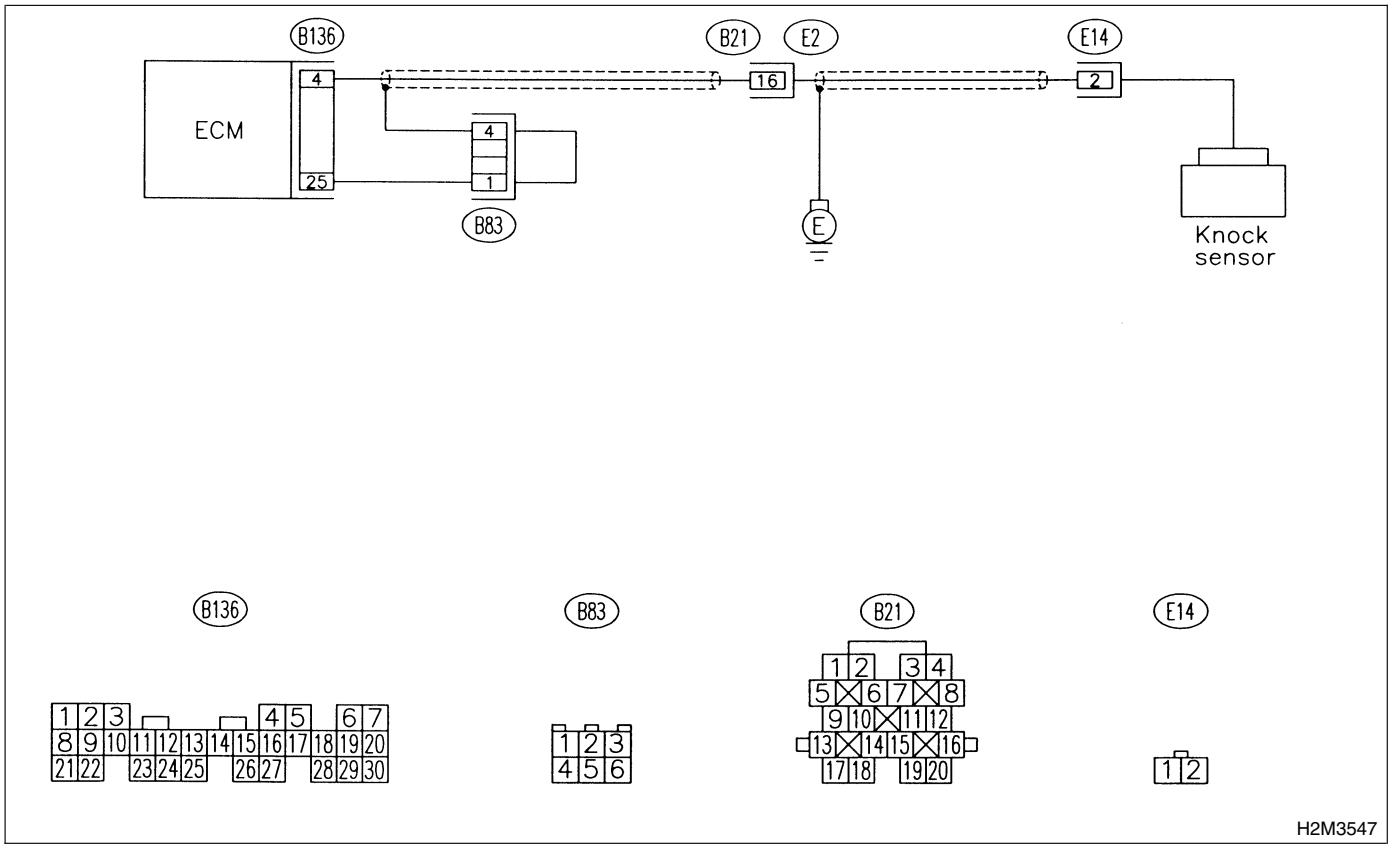
NOTE:
Check the following items.
- Spark plugs
- Fuel injectors
- Compression ratio

AA: DTC P0325 — KNOCK SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Poor driving performance
  - Knocking occurs.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

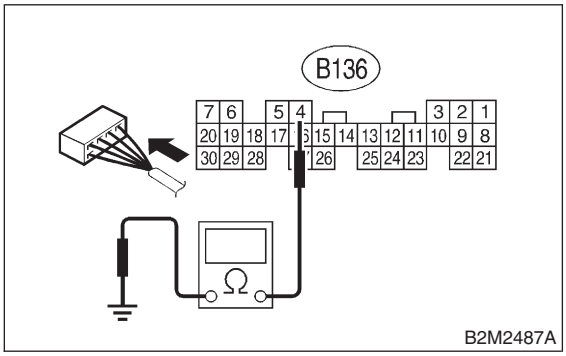
- **WIRING DIAGRAM:**



10AA1 : CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance between ECM harness connector and chassis ground.

Connector & terminal
(B136) No. 4 — Chassis ground:

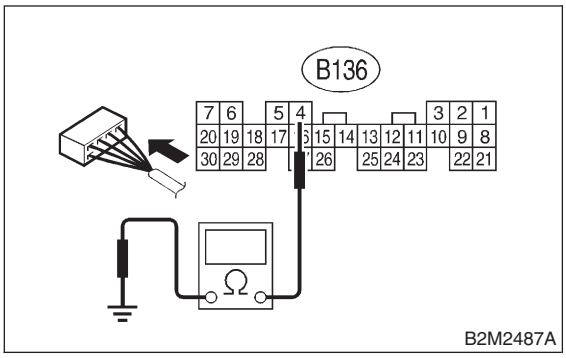


CHECK : ***Is the resistance more than 700 kΩ?***
YES : Go to step **10AA3**.
NO : Go to step **10AA2**.

10AA2 : CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.

Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B136) No. 4 — Chassis ground:

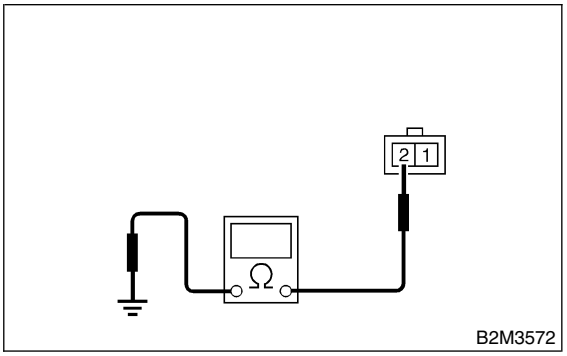


CHECK : ***Is the resistance less than 400 kΩ?***
YES : Go to step **10AA5**.
NO : Go to step **10AA6**.

10AA3 : CHECK KNOCK SENSOR.

1) Disconnect connector from knock sensor.
2) Measure resistance between knock sensor connector terminal and engine ground.

Terminal
No. 2 — Engine ground:



CHECK : ***Is the resistance more than 700 kΩ?***
YES : Go to step **10AA4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between knock sensor and ECM connector
- Poor contact in knock sensor connector
- Poor contact in coupling connector (B21)

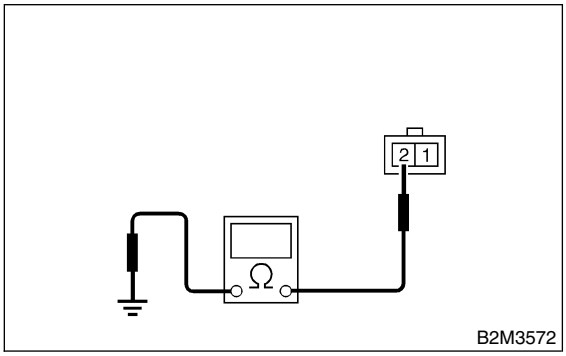
10AA4 : CHECK CONDITION OF KNOCK SENSOR INSTALLATION.

CHECK : ***Is the knock sensor installation bolt tightened securely?***
YES : Replace knock sensor. <Ref. to 2-7 [W7A0].>
NO : Tighten knock sensor installation bolt securely.

10AA5 : CHECK KNOCK SENSOR.

1) Disconnect connector from knock sensor.
2) Measure resistance between knock sensor connector terminal and engine ground.

Terminal
No. 2 — Engine ground:



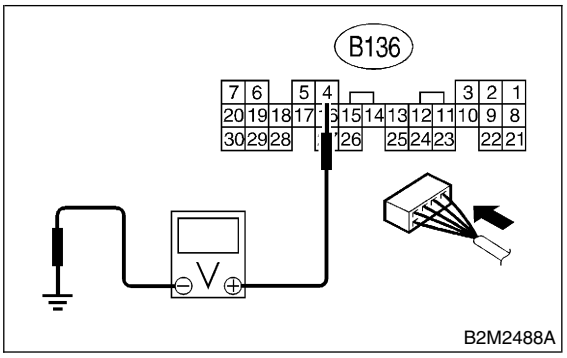
CHECK : ***Is the resistance less than 400 kΩ?***
YES : Replace knock sensor. <Ref. to 2-7 [W7A0].>
NO : Repair ground short circuit in harness between knock sensor connector and ECM connector.

NOTE:
The harness between both connectors is shielded. Repair short circuit of harness together with shield.

10AA6 : CHECK INPUT SIGNAL FOR ECM.

1) Connect connectors to ECM and knock sensor.
2) Turn ignition switch to ON.
3) Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 2 V?***
YES : Even if MIL lights up, the circuit has returned to a normal condition at this time. (However, the possibility of poor contact still remains.)

NOTE:
In this case, repair the following:
- Poor contact in knock sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

NO : Repair poor contact in ECM connector.

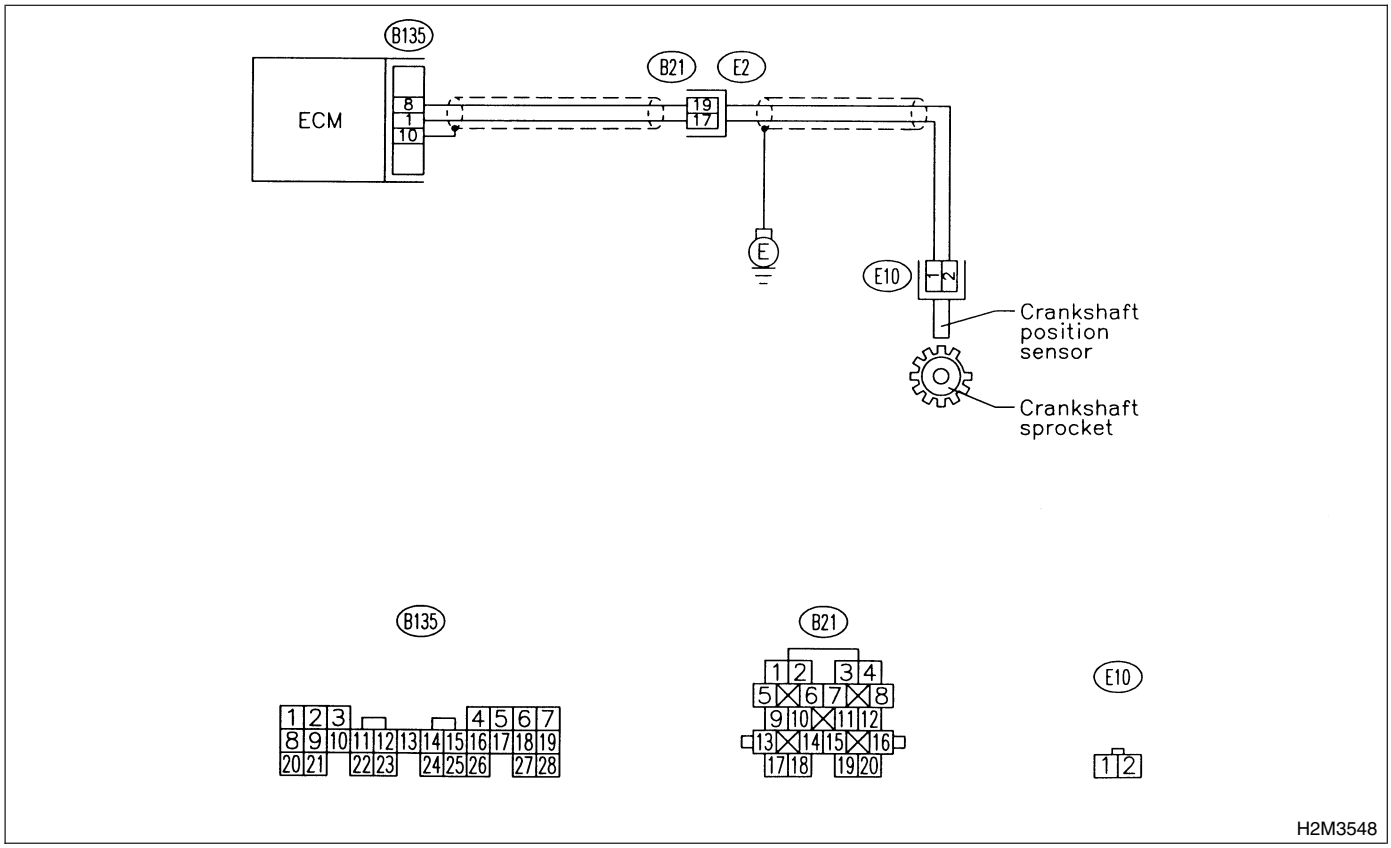
MEMO:

AB: DTC P0335 — CRANKSHAFT POSITION SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

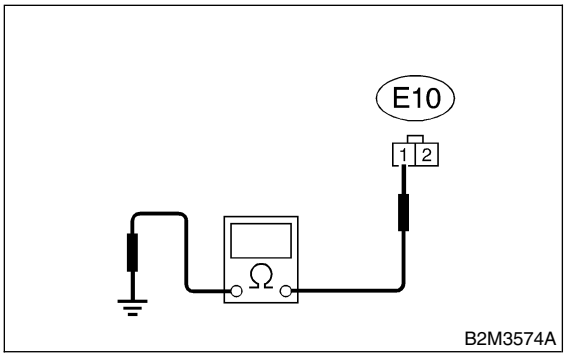
- **WIRING DIAGRAM:**



10AB1 : CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from crankshaft position sensor.
3) Measure resistance of harness between crankshaft position sensor connector and engine ground.

Connector & terminal
(E10) No. 1 — Engine ground:



CHECK : ***Is the resistance more than 100 kΩ?***
YES : Repair harness and connector.

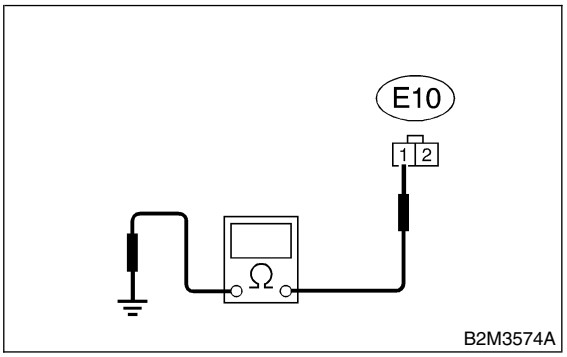
NOTE:
In this case, repair the following:
- Open circuit in harness between crankshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

NO : Go to step **10AB2**.

10AB2 : CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between crankshaft position sensor connector and engine ground.

Connector & terminal
(E10) No. 1 — Engine ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between crankshaft position sensor and ECM connector.

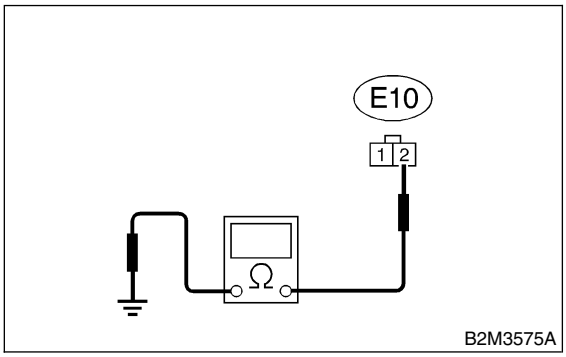
NOTE:
The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.

NO : Go to step **10AB3**.

10AB3 : CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between crankshaft position sensor connector and engine ground.

Connector & terminal
(E10) No. 2 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10AB4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between crankshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

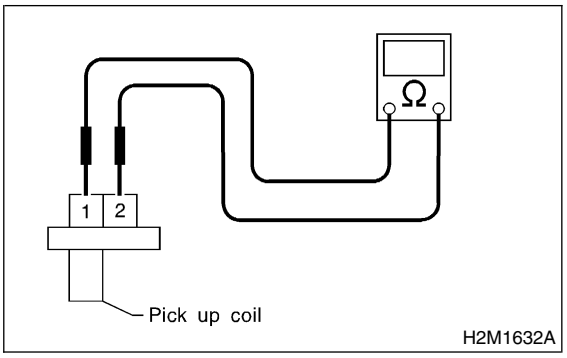
10AB4 : CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.

CHECK : ***Is the crankshaft position sensor installation bolt tightened securely?***
YES : Go to step **10AB5**.
NO : Tighten crankshaft position sensor installation bolt securely.

10AB5 : CHECK CRANKSHAFT POSITION SENSOR.

1) Remove crankshaft position sensor.
2) Measure resistance between connector terminals of crankshaft position sensor.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance between 1 and 4 kΩ?***
YES : Repair poor contact in crankshaft position sensor connector.
NO : Replace crankshaft position sensor. <Ref. to 2-7 [W5A0].>

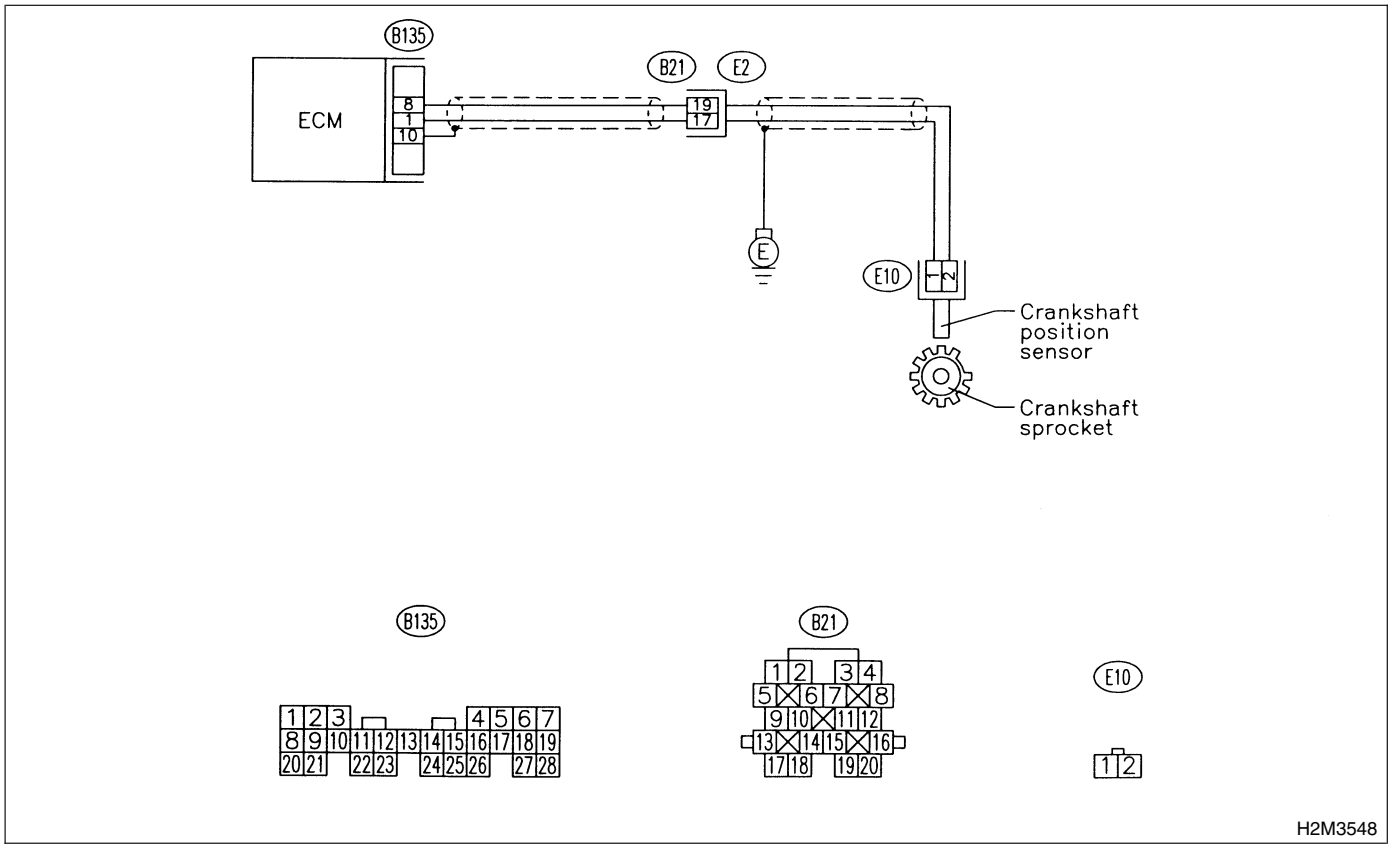
MEMO:

AC: DTC P0336 — CRANKSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AC1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0335?***

YES : Inspect DTC P0335 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NO : Go to step **10AC2**.

10AC2 : CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.

Turn ignition switch to OFF.

CHECK : ***Is the crankshaft position sensor installation bolt tightened securely?***

YES : Go to step **10AC3**.

NO : Tighten crankshaft position sensor installation bolt securely.

10AC3 : CHECK CRANKSHAFT SPROCKET.

Remove front belt cover.

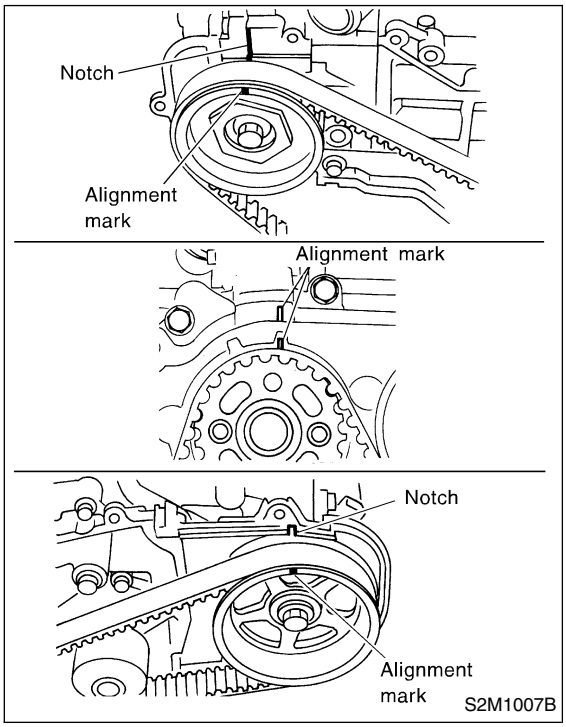
CHECK : ***Are crankshaft sprocket teeth cracked or damaged?***

YES : Replace crankshaft sprocket. <Ref. to 2-3 [W3A0].>

NO : Go to step **10AC4**.

10AC4 : CHECK INSTALLATION CONDITION OF TIMING BELT.

Turn crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.
ST 499987500 CRANKSHAFT SOCKET



CHECK : ***Is timing belt dislocated from its proper position?***

YES : Repair installation condition of timing belt. <Ref. to 2-3 [W3A0].>

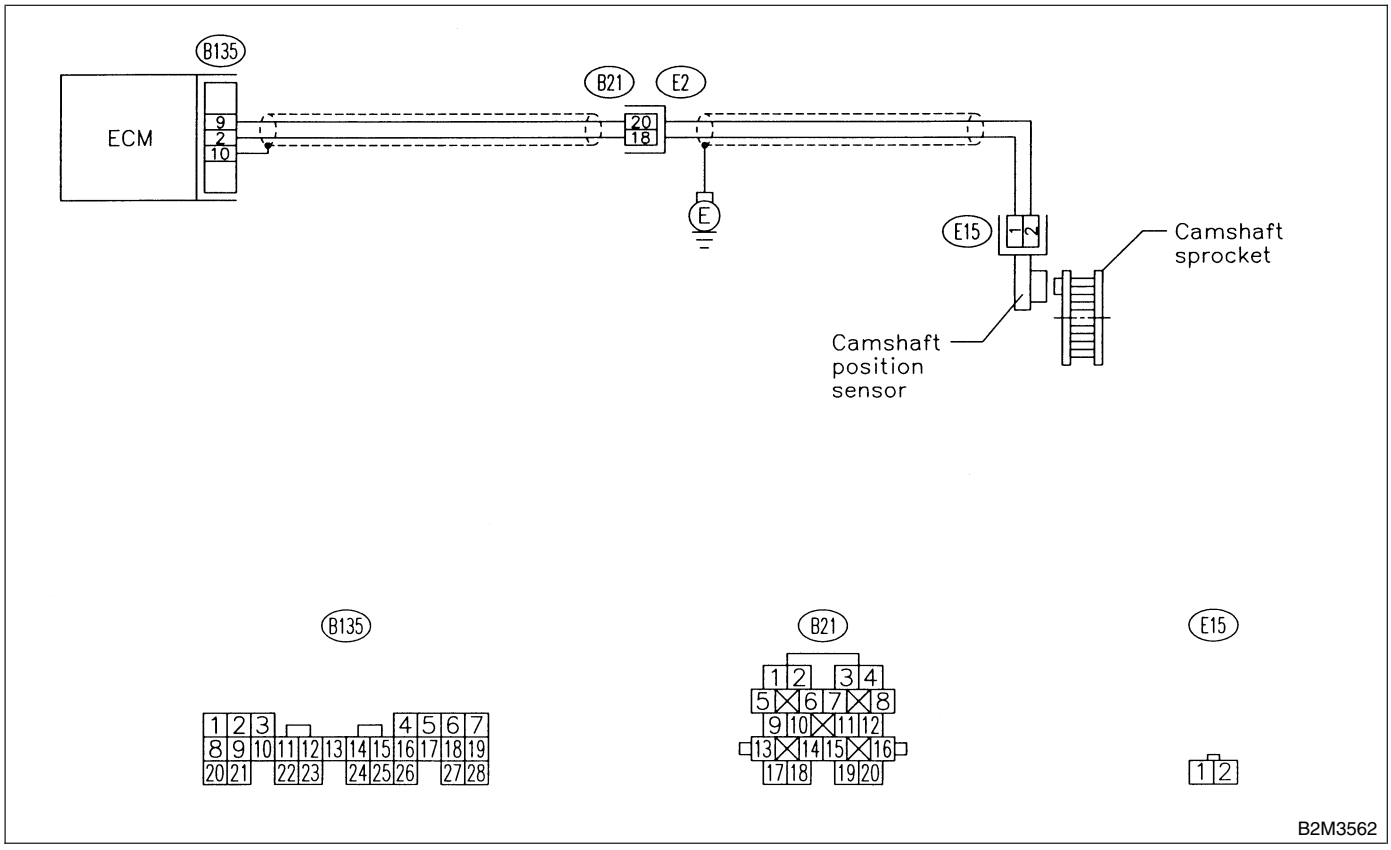
NO : Replace crankshaft position sensor. <Ref. to 2-7 [W5A0].>

AD: DTC P0340 — CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

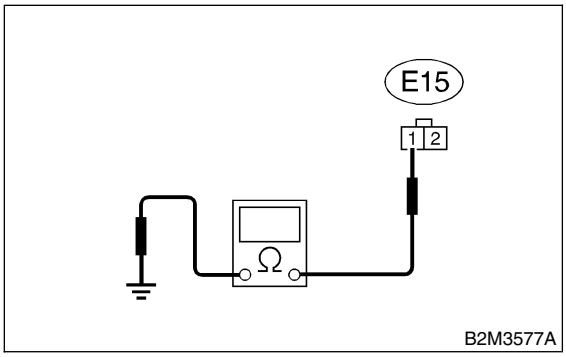
- **WIRING DIAGRAM:**



10AD1 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from camshaft position sensor.
3) Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 1 — Engine ground:



CHECK : ***Is the resistance more than 100 kΩ?***
YES : Repair harness and connector.

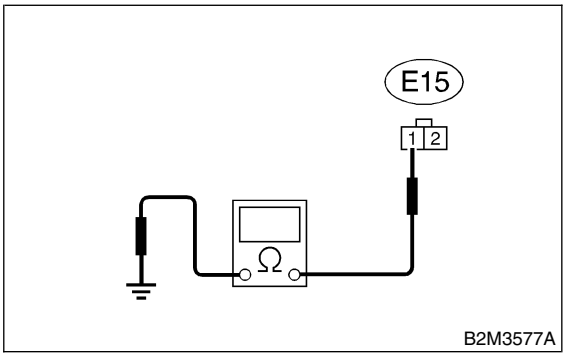
NOTE:
In this case, repair the following:
- Open circuit in harness between camshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

NO : Go to step **10AD2**.

10AD2 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 1 — Engine ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between camshaft position sensor and ECM connector.

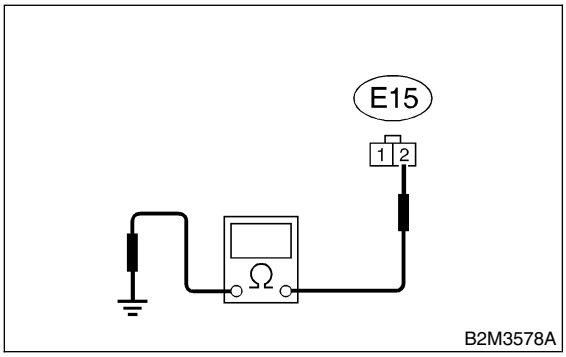
NOTE:
The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.

NO : Go to step **10AD3**.

10AD3 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 2 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10AD4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between camshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

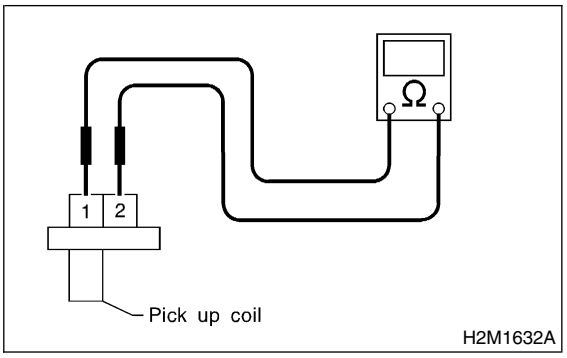
10AD4 : CHECK CONDITION OF CAMSHAFT POSITION SENSOR.

CHECK : ***Is the camshaft position sensor installation bolt tightened securely?***
YES : Go to step **10AD5**.
NO : Tighten camshaft position sensor installation bolt securely.

10AD5 : CHECK CAMSHAFT POSITION SENSOR.

1) Remove camshaft position sensor.
2) Measure resistance between connector terminals of camshaft position sensor.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance between 1 and 4 kΩ?***
YES : Repair poor contact in camshaft position sensor connector.
NO : Replace camshaft position sensor. <Ref. to 2-7 [W6A0].>

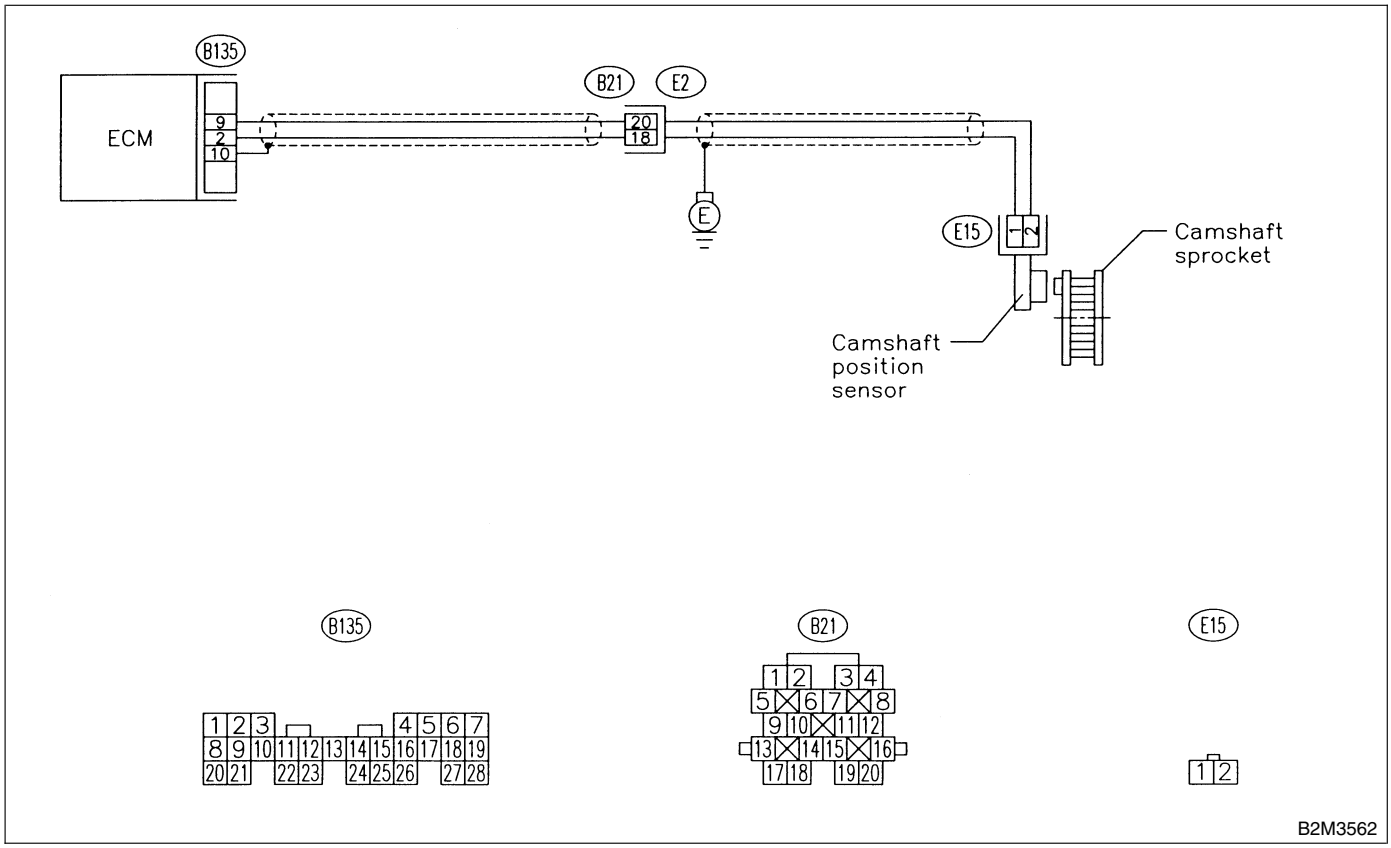
MEMO:

AE: DTC P0341 — CAMSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AE1 :	CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0340?***

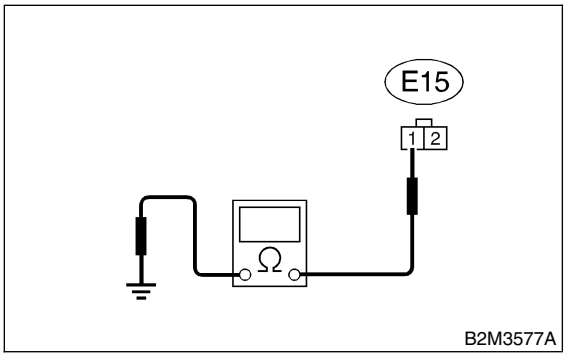
YES : Inspect DTC P0340 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NO : Go to step **10AE2**.

10AE2 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from camshaft position sensor.
3) Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 1 — Engine ground:



CHECK : ***Is the resistance more than 100 kΩ?***
YES : Repair harness and connector.

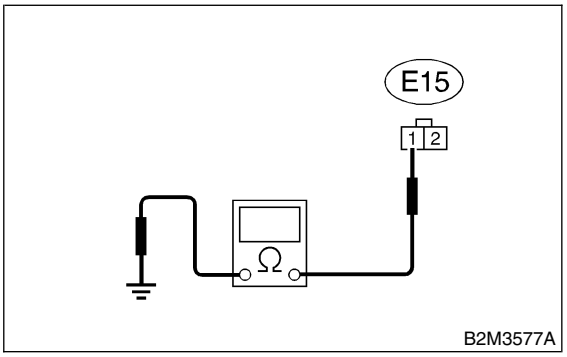
NOTE:
In this case, repair the following:
- Open circuit in harness between camshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

NO : Go to step **10AE3**.

10AE3 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 1 — Engine ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between camshaft position sensor and ECM connector.

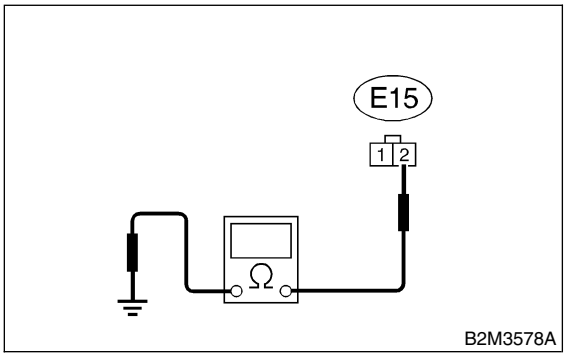
NOTE:
The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.

NO : Go to step **10AE4**.

10AE4 : CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.

Measure resistance of harness between camshaft position sensor connector and engine ground.

Connector & terminal
(E15) No. 2 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10AE5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between camshaft position sensor and ECM connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

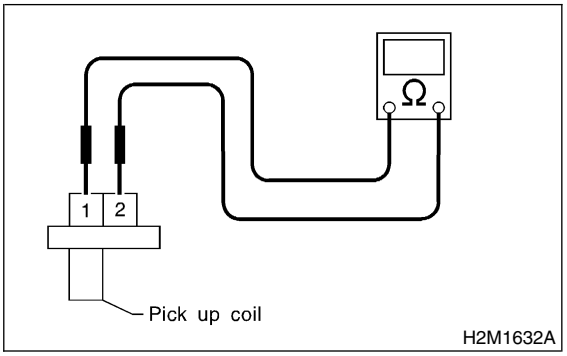
10AE5 : CHECK CONDITION OF CAMSHAFT POSITION SENSOR.

CHECK : ***Is the camshaft position sensor installation bolt tightened securely?***
YES : Go to step **10AE6**.
NO : Tighten camshaft position sensor installation bolt securely.

10AE6 : CHECK CAMSHAFT POSITION SENSOR.

1) Remove camshaft position sensor.
2) Measure resistance between connector terminals of camshaft position sensor.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance between 1 and 4 kΩ?***
YES : Go to step **10AE7**.
NO : Replace camshaft position sensor. <Ref. to 2-7 [W6A0].>

10AE7 : CHECK CONDITION OF CAMSHAFT POSITION SENSOR.

Turn ignition switch to OFF.

CHECK : ***Is the camshaft position sensor installation bolt tightened securely?***
YES : Go to step **10AE8**.
NO : Tighten camshaft position sensor installation bolt securely.

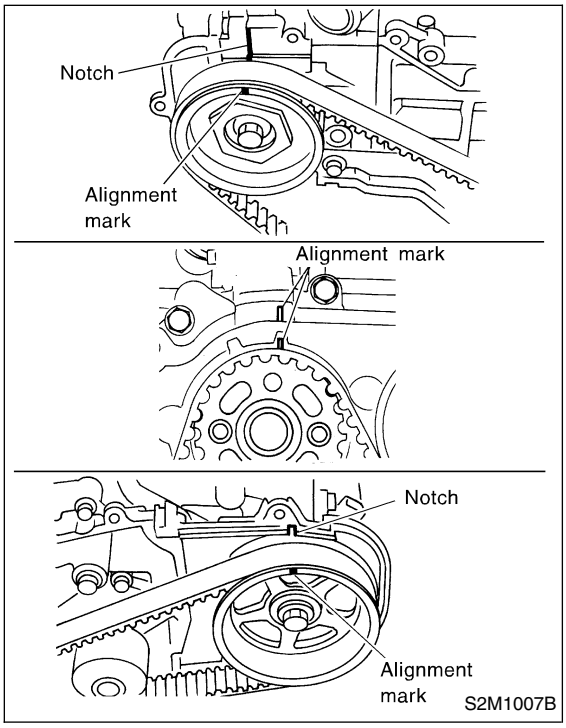
10AE8 : CHECK CAMSHAFT SPROCKET.

Remove front belt cover. <Ref. to 2-3 [W3A0].>

CHECK : ***Are camshaft sprocket teeth cracked or damaged?***
YES : Replace camshaft sprocket. <Ref. to 2-3 [W3A0].>
NO : Go to step **10AE9**.

10AE9 : CHECK INSTALLATION CONDITION OF TIMING BELT.

Turn camshaft using ST, and align alignment mark on camshaft sprocket with alignment mark on timing belt cover LH.
ST 499207100 CAMSHAFT SPROCKET WRENCH



CHECK : ***Is timing belt dislocated from its proper position?***

YES : Repair installation condition of timing belt. <Ref. to 2-3 [W3A0].>

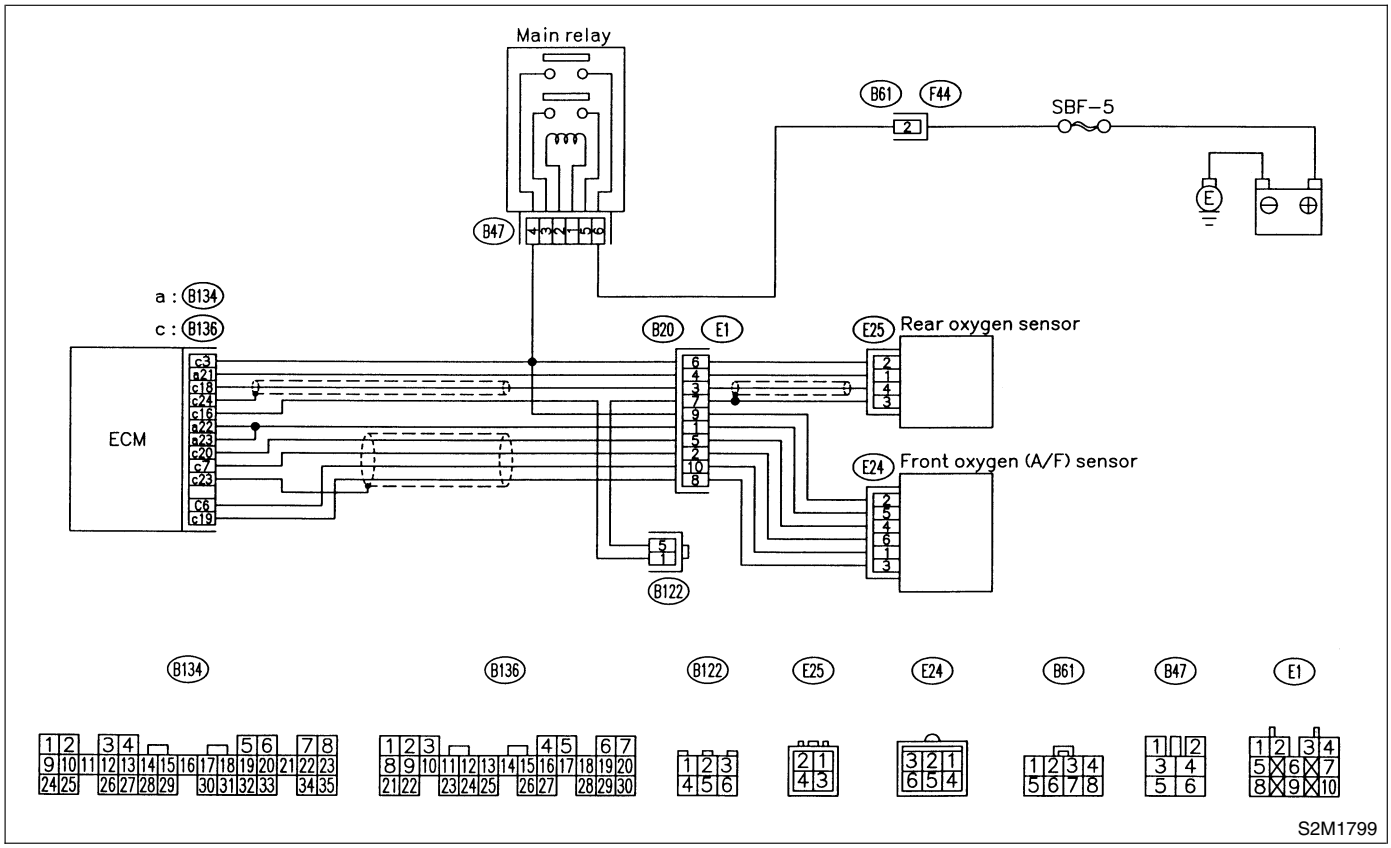
NO : Replace camshaft position sensor. <Ref. to 2-7 [W6A0].>

AF: DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Idle mixture is out of specifications.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AF1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0130, P0133, P0136, P0139, P0141, P0301, P0302, P0303, P0304, P1130, P1131, P1132, P1133 and P1151?***

YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0420.

NO : Go to step **10AF2**.

10AF2 : CHECK EXHAUST SYSTEM.

Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes.

NOTE:
Check the following positions.
- Between cylinder head and front exhaust pipe
- Between front exhaust pipe and front catalytic converter
- Between front catalytic converter and rear catalytic converter

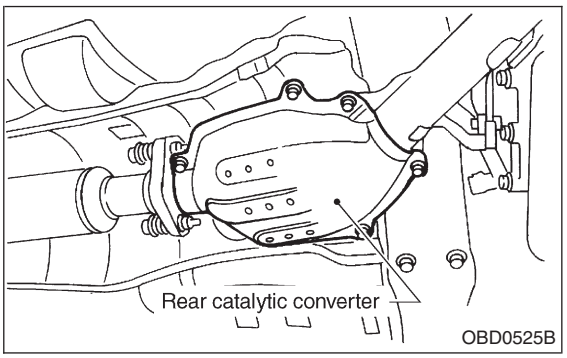
CHECK : ***Is there a fault in exhaust system?***

YES : Repair or replace exhaust system. <Ref. to 2-9 [W1A0].>

NO : Go to step **10AF3**.

10AF3 : CHECK REAR CATALYTIC CONVERTER.

Separate rear catalytic converter from rear exhaust pipe.



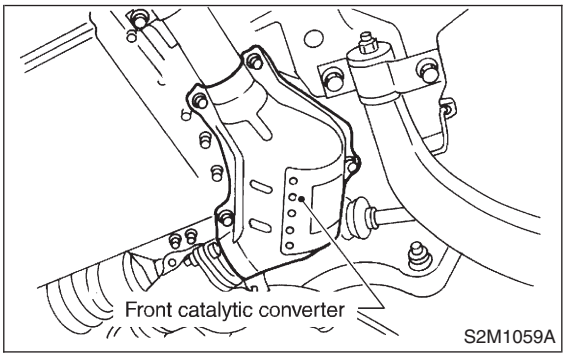
CHECK : ***Is there damage at rear face of rear catalyst?***

YES : Replace front catalytic converter <Ref. to 2-1 [W1A0].> and rear catalytic converter <Ref. to 2-1 [W2A0].>.

NO : Go to step **10AF4**.

10AF4 : CHECK FRONT CATALYTIC CONVERTER.

Remove front catalytic converter.



CHECK : ***Is there damage at rear face or front face of front catalyst?***

YES : Replace front catalytic converter. <Ref. to 2-1 [W1A0].>

NO : Contact with SOA service.

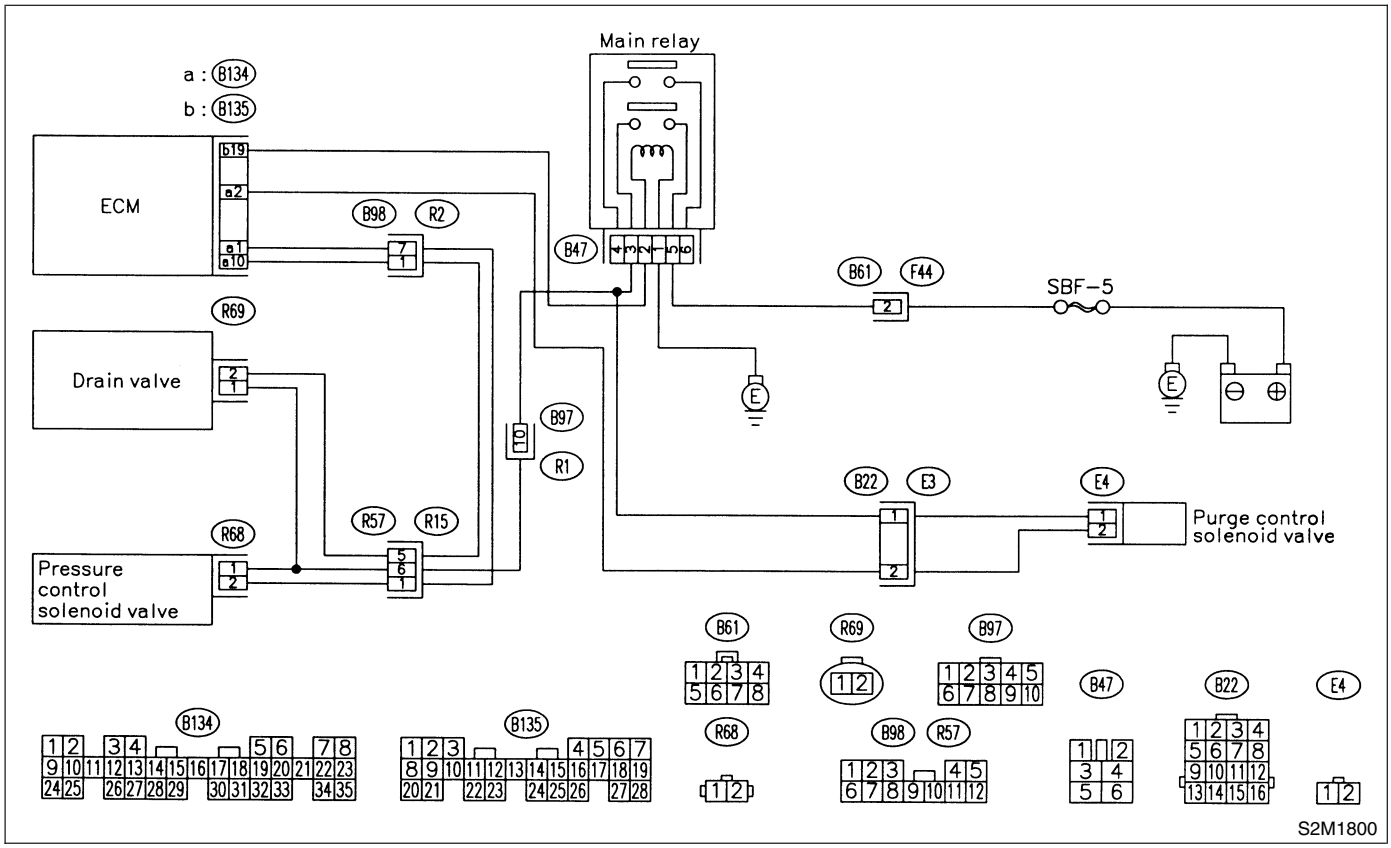
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AG: DTC P0440 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Gasoline smell
  - There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AG1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***
YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10AG2**.

10AG2 : CHECK FUEL FILLER CAP.

1) Turn ignition switch to OFF.
2) Check the fuel filler cap.

NOTE:
The DTC code is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.

CHECK : ***Is the fuel filler cap tightened securely?***
YES : Go to step **10AG3**.
NO : Tighten fuel filler cap securely.

10AG3 : CHECK FUEL FILLER PIPE PACKING.

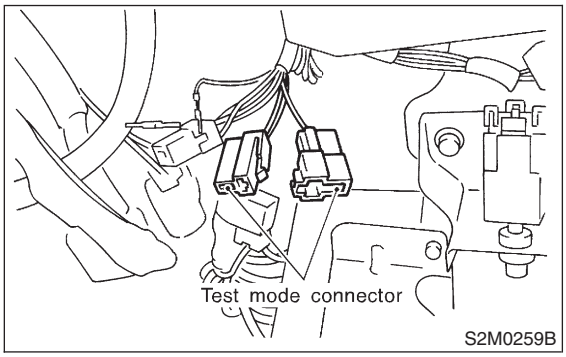
CHECK : ***Is there any damage to the seal between fuel filler cap and fuel filler pipe?***

YES : Repair or replace fuel filler cap and fuel filler pipe. <Ref. to 2-8 [W2A0].>

NO : Go to step **10AG4**.

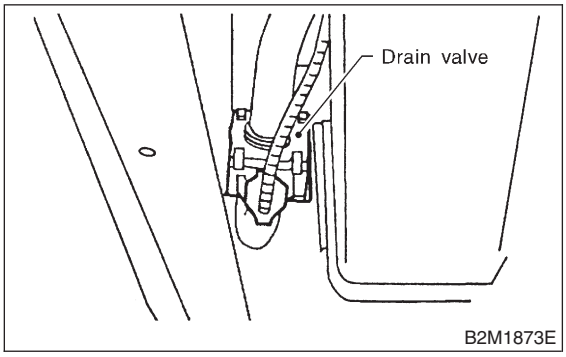
10AG4 : CHECK DRAIN VALVE.

1) Connect test mode connector.



2) Turn ignition switch to ON.
3) Operate drain valve.

NOTE:
Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does drain valve produce operating sound?***

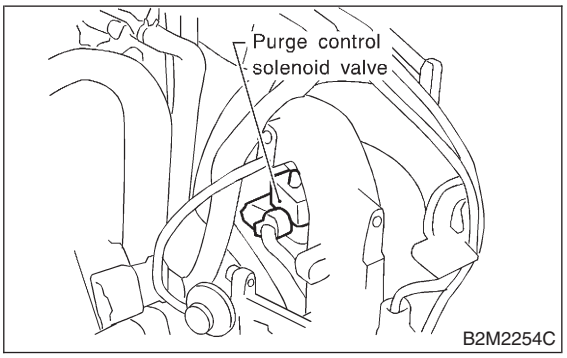
YES : Go to step **10AG5**.

NO : Replace drain valve. <Ref. to 2-1 [W13A0].>

10AG5 : CHECK PURGE CONTROL SOLENOID VALVE.

Operate purge control solenoid valve.

NOTE:
Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does purge control solenoid valve produce operating sound?***

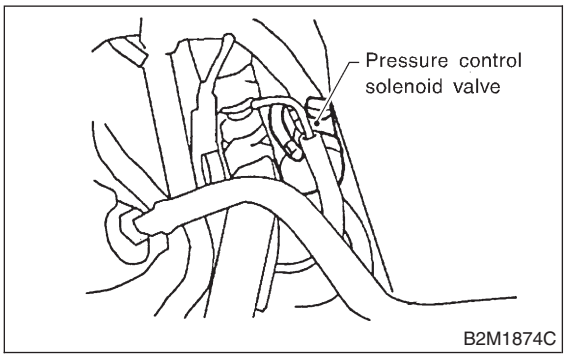
YES : Go to step **10AG6**.

NO : Replace purge control solenoid valve. <Ref. to 2-1 [W4A0].>

10AG6 : CHECK PRESSURE CONTROL SOLENOID VALVE.

Operate pressure control solenoid valve.

NOTE:
Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does pressure control solenoid valve produce operating sound?***
YES : Go to step **10AG7**.
NO : Replace pressure control solenoid valve. <Ref. to 2-1 [W9A0].>

10AG7 : CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.

Turn ignition switch to OFF.

CHECK : ***Is there a hole of more than 1.0 mm (0.04 in) dia. on fuel line?***
YES : Repair or replace fuel line. <Ref. to 2-8 [W8A0].>
NO : Go to step **10AG8**.

10AG8 : CHECK CANISTER.

CHECK : ***Is canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?***
YES : Repair or replace canister. <Ref. to 2-1 [W3A0].>
NO : Go to step **10AG9**.

10AG9 : CHECK FUEL TANK.

Remove fuel tank. <Ref. to 2-8 [W1C0].>

CHECK : ***Is fuel tank damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?***
YES : Repair or replace fuel tank. <Ref. to 2-8 [W1C0].>
NO : Go to step **10AG10**.

10AG10 : CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.

CHECK : ***Are there holes of more than 1.0 mm (0.04 in) dia., cracks, clogging or disconnections of hoses or pipes in evaporative emission control system?***
YES : Repair or replace hoses or pipes.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

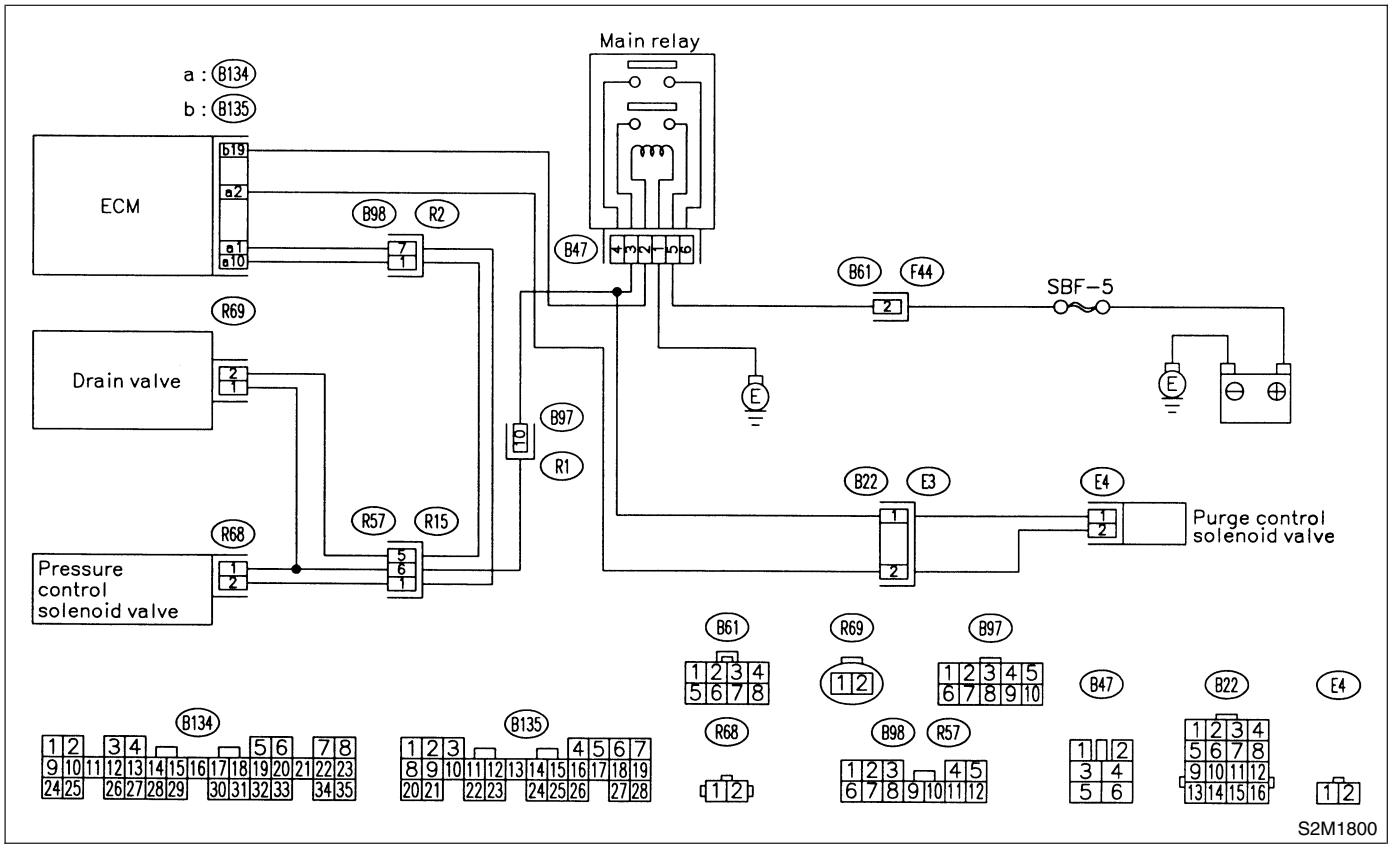
MEMO:

AH: DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Gasoline smell
  - There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AH1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***
YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10AH2**.

10AH2 : CHECK FUEL FILLER CAP.

1) Turn ignition switch to OFF.
2) Check the fuel filler cap.

NOTE:
The DTC code is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.

CHECK : ***Is the fuel filler cap tightened securely?***
YES : Go to step **10AH3**.
NO : Tighten fuel filler cap securely.

10AH3 : CHECK FUEL FILLER PIPE PACKING.

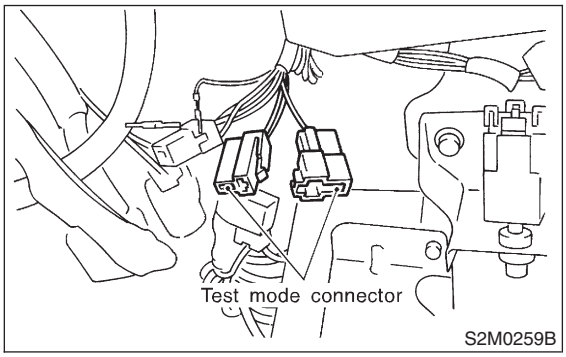
CHECK : ***Is there any damage to the seal between fuel filler cap and fuel filler pipe?***

YES : Repair or replace fuel filler cap and fuel filler pipe. <Ref. to 2-8 [W2A0].>

NO : Go to step **10AH4**.

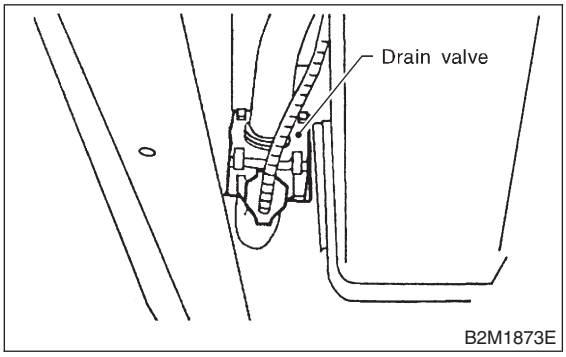
10AH4 : CHECK DRAIN VALVE.

1) Connect test mode connector.



2) Turn ignition switch to ON.
3) Operate drain valve.

NOTE:
Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does drain valve produce operating sound?***

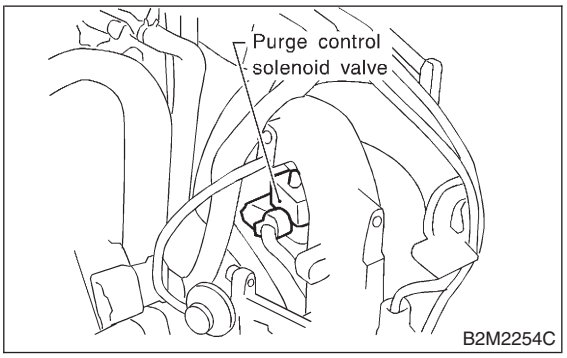
YES : Go to step **10AH5**.

NO : Replace drain valve. <Ref. to 2-1 [W13A0].>

10AH5 : CHECK PURGE CONTROL SOLENOID VALVE.

Operate purge control solenoid valve.

NOTE:
Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does purge control solenoid valve produce operating sound?***

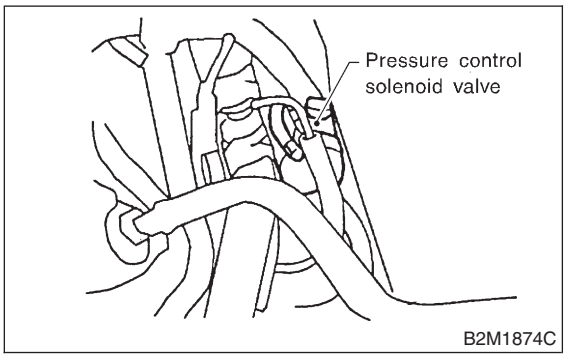
YES : Go to step **10AH6**.

NO : Replace purge control solenoid valve. <Ref. to 2-1 [W4A0].>

10AH6 : CHECK PRESSURE CONTROL SOLENOID VALVE.

Operate pressure control solenoid valve.

NOTE:
Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>



CHECK : ***Does pressure control solenoid valve produce operating sound?***
YES : Go to step **10AH7**.
NO : Replace pressure control solenoid valve. <Ref. to 2-1 [W9A0].>

10AH7 : CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.

Turn ignition switch to OFF.

CHECK : ***Is there a hole of more than 0.5 mm (0.020 in) dia. on fuel line?***
YES : Repair or replace fuel line. <Ref. to 2-8 [W8A0].>
NO : Go to step **10AH8**.

10AH8 : CHECK CANISTER.

CHECK : ***Is canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?***
YES : Repair or replace canister. <Ref. to 2-1 [W3A0].>
NO : Go to step **10AH9**.

10AH9 : CHECK FUEL TANK.

Remove fuel tank. <Ref. to 2-8 [W1C0].>

CHECK : ***Is fuel tank damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?***
YES : Repair or replace fuel tank. <Ref. to 2-8 [W1C0].>
NO : Go to step **10AH10**.

10AH10 : CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.

CHECK : ***Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging or disconnections of hoses or pipes in evaporative emission control system?***
YES : Repair or replace hoses or pipes.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

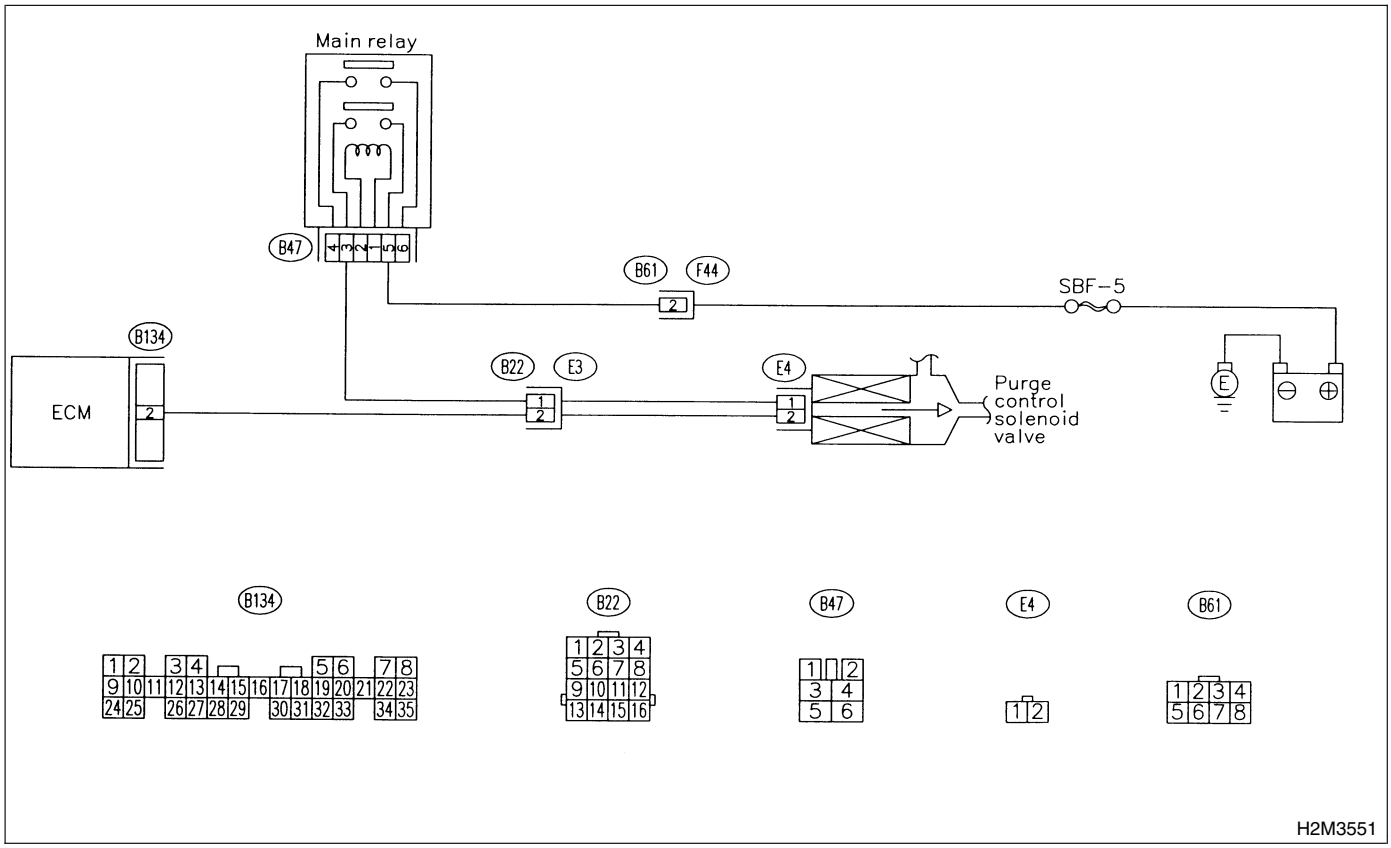
MEMO:

AI: DTC P0443 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

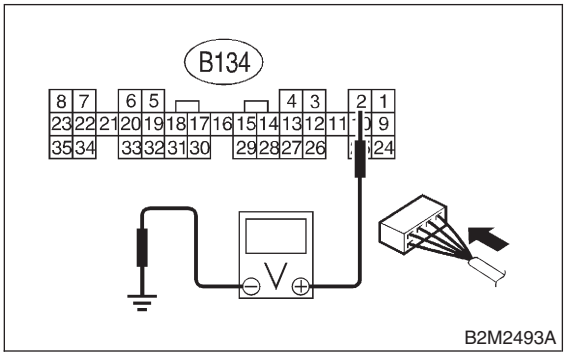
- **WIRING DIAGRAM:**



10AI1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 2 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Even if MIL lights up, the circuit has returned to a normal condition at this time. Contact with SOA service.

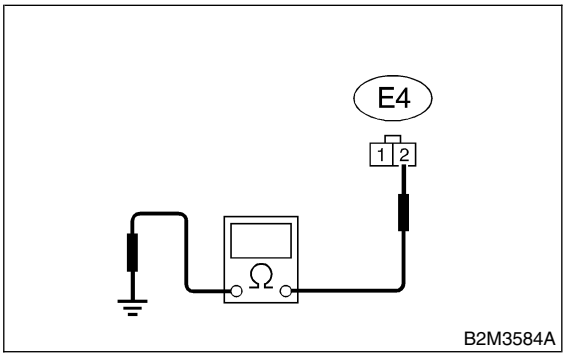
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

NO : Go to step **10AI2**.

10AI2 : CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from purge control solenoid valve and ECM.
3) Measure resistance of harness between purge control solenoid valve connector and engine ground.

Connector & terminal
(E4) No. 2 — Engine ground:



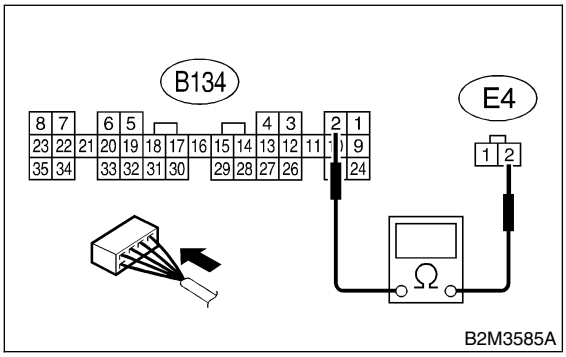
CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and purge control solenoid valve connector.

NO : Go to step **10AI3**.

10AI3 : CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

Measure resistance of harness between ECM and purge control solenoid valve of harness connector.

Connector & terminal
(B134) No. 2 — (E4) No. 2:



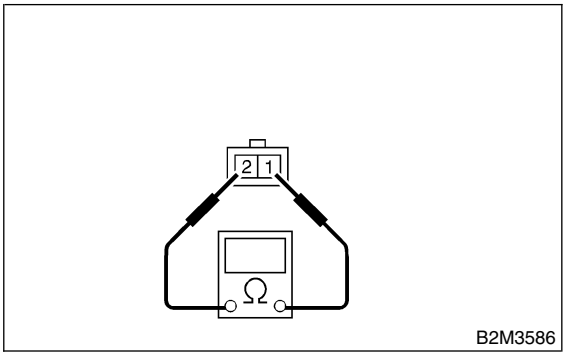
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AI4**.
NO : Repair open circuit in harness between ECM and purge control solenoid valve connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and purge control solenoid valve connector
- Poor contact in coupling connector (B22)

10AI4 : CHECK PURGE CONTROL SOLENOID VALVE.

1) Remove purge control solenoid valve.
2) Measure resistance between purge control solenoid valve terminals.

Terminals
No. 1 — No. 2:

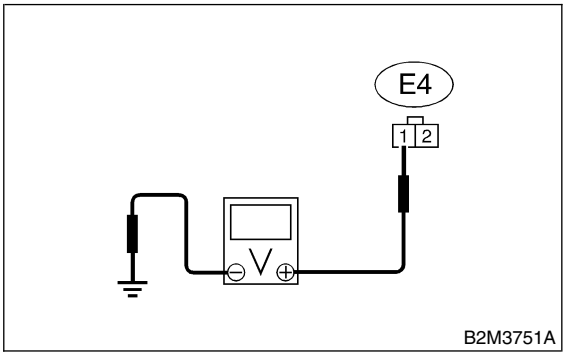


CHECK : ***Is the resistance between 10 and 100 Ω?***
YES : Go to step **10AI5**.
NO : Replace purge control solenoid valve. <Ref. to 2-1 [W4A0].>

10AI5 : CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.

1) Turn ignition switch to ON.
2) Measure voltage between purge control solenoid valve and engine ground.

Connector & terminal
(E4) No. 1 (+) — Engine ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10AI6**.
NO : Repair open circuit in harness between main relay and purge control solenoid valve connector.

10AI6 : CHECK POOR CONTACT.

Check poor contact in purge control solenoid valve connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in purge control solenoid valve connector?***

YES : Repair poor contact in purge control solenoid valve connector.

NO : Contact with SOA service.

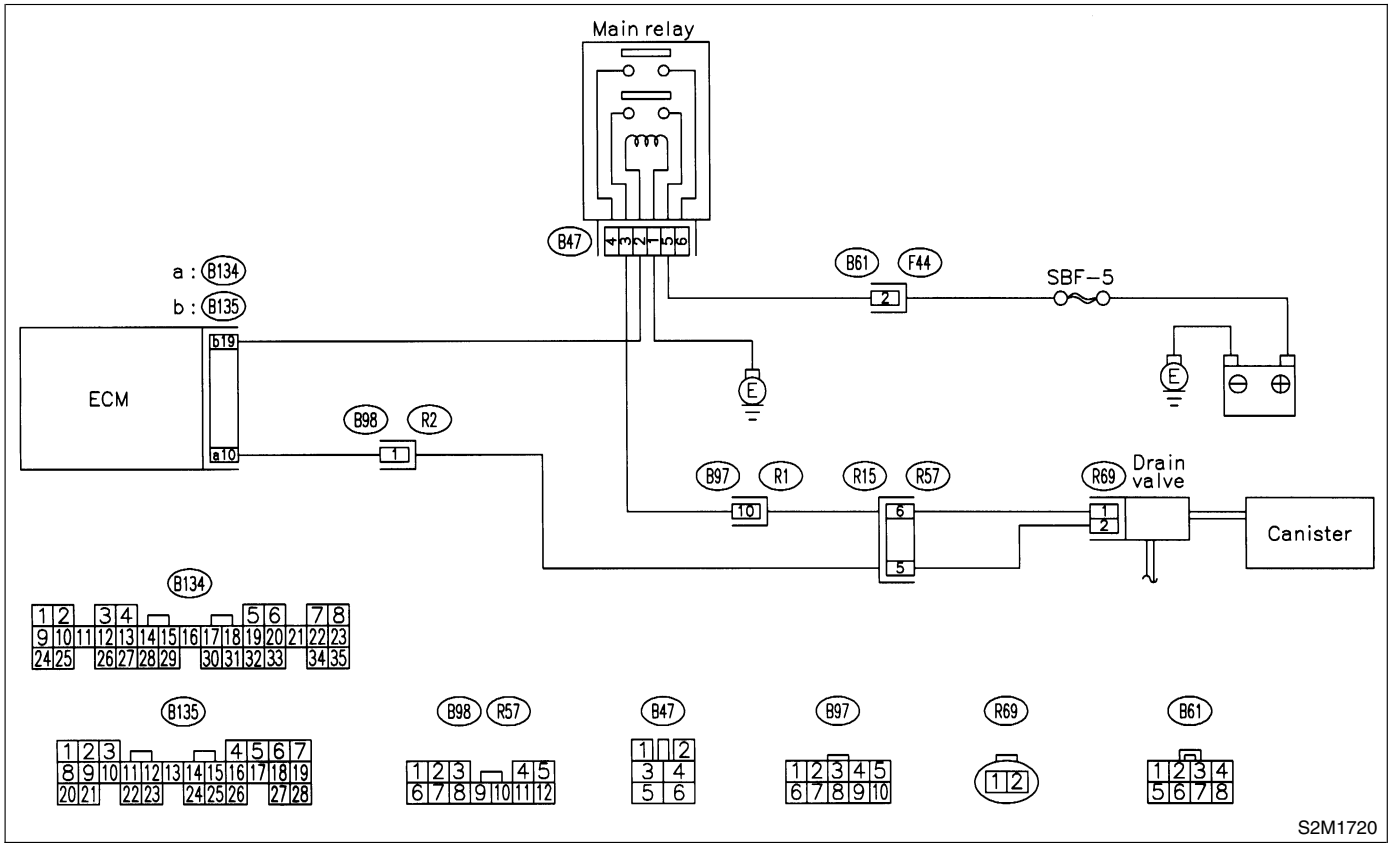
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AJ: DTC P0446 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

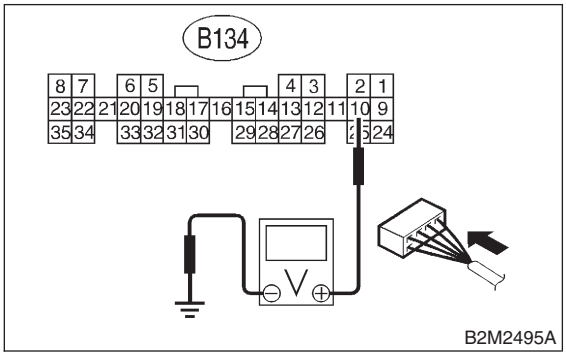
- **WIRING DIAGRAM:**



10AJ1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 10 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10AJ2**.
NO : Go to step **10AJ3**.

10AJ2 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

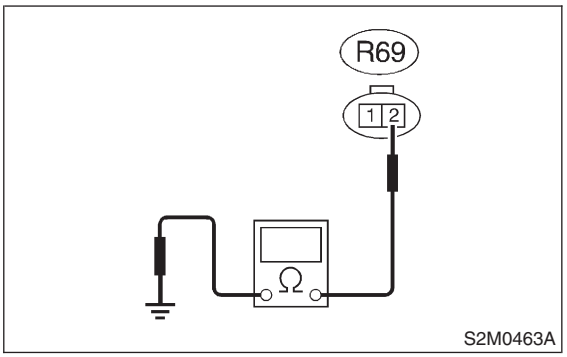
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time. (However, the possibility of poor contact still remains.)

NOTE:
In this case, repair the following:
- Poor contact in drain valve connector
- Poor contact in ECM connector
- Poor contact in coupling connectors (B98 and R57)

10AJ3 : CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from drain valve and ECM.
3) Measure resistance of harness between drain valve connector and chassis ground.

Connector & terminal
(R69) No. 2 — Chassis ground:

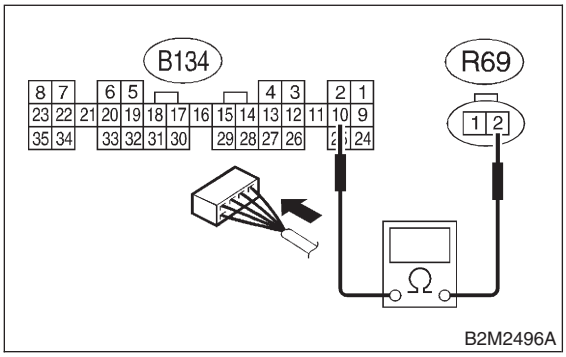


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and drain valve connector.
NO : Go to step **10AJ4**.

10AJ4 : CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.

Measure resistance of harness between ECM and drain valve connector.

Connector & terminal
(B134) No. 10 — (R69) No. 2:



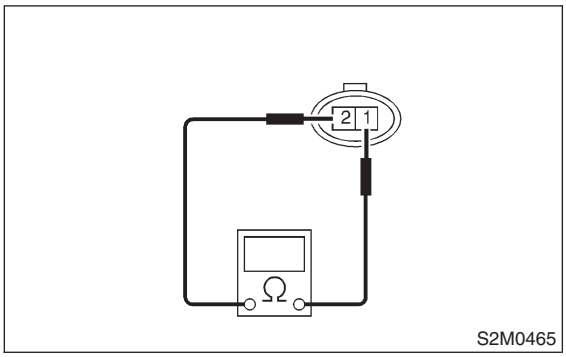
CHECK : ***Is the voltage less than 1 Ω?***
YES : Go to step **10AJ5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and drain valve connector
- Poor contact in coupling connectors (B98 and R57)

10AJ5 : CHECK DRAIN VALVE.

Measure resistance between drain valve terminals.

Terminals
No. 1 — No. 2:

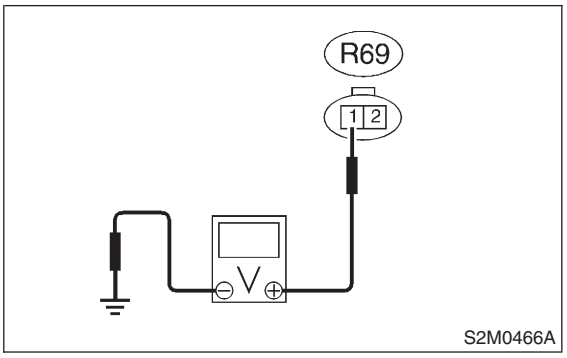


CHECK : ***Is the resistance between 10 and 100 Ω?***
YES : Go to step **10AJ6**.
NO : Replace drain valve. <Ref. to 2-1 [W13A0].>

10AJ6 : CHECK POWER SUPPLY TO DRAIN VALVE.

1) Turn ignition switch to ON.
2) Measure voltage between drain valve and chassis ground.

Connector & terminal
(R69) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10AJ7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and drain valve
- Poor contact in coupling connectors (B97 and R57)
- Poor contact in main relay connector

10AJ7 : CHECK POOR CONTACT.

Check poor contact in drain valve connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in drain valve connector?***
YES : Repair poor contact in drain valve connector.
NO : Contact with SOA service.

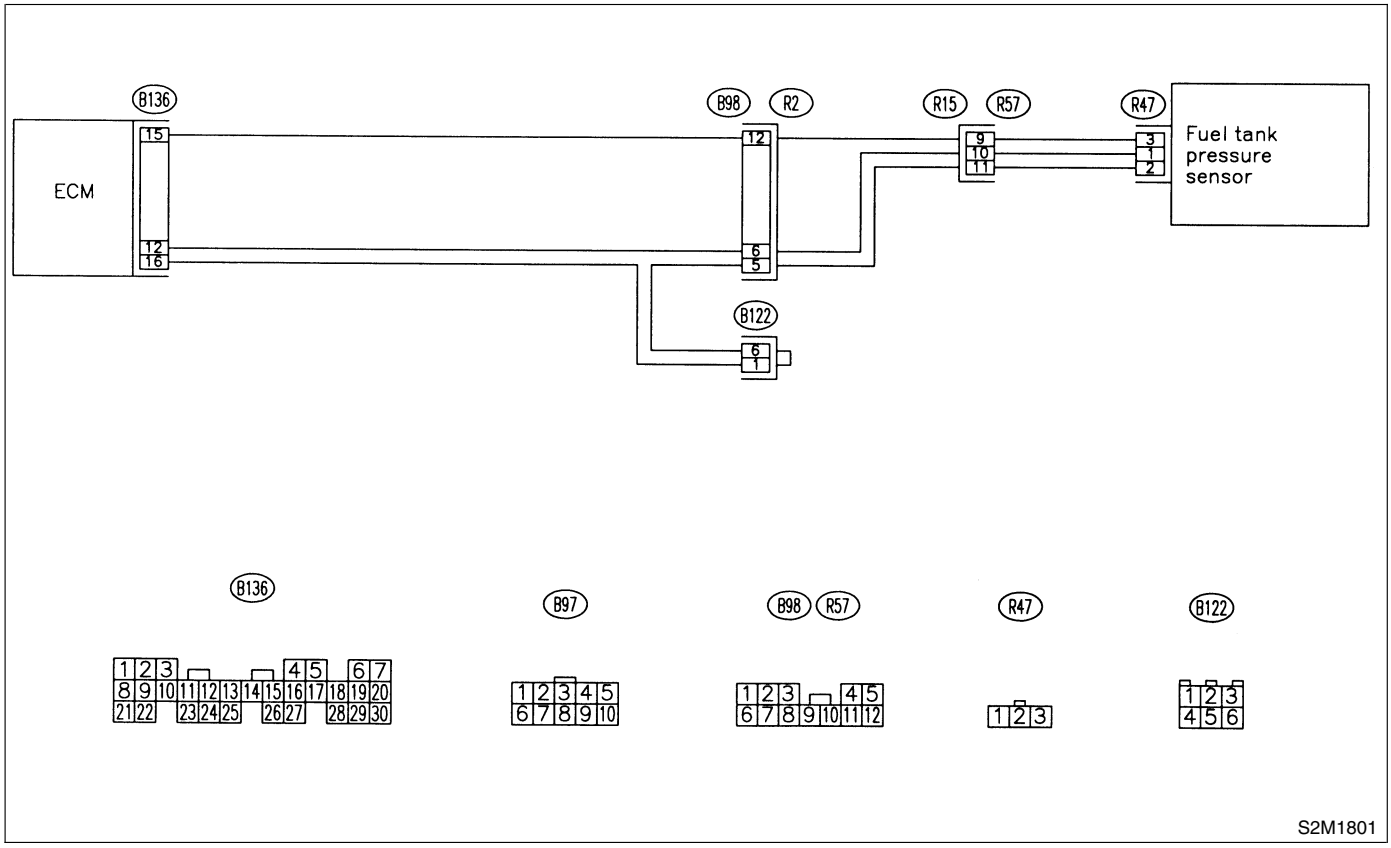
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AK: DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AK1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any DTC on display?***
YES : Inspect the relevant DTC using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>
NO : Go to step **10AK2**.

10AK2 : CHECK FUEL FILLER CAP.

1) Turn ignition switch to OFF.
2) Open the fuel flap.

CHECK : ***Is the fuel filler cap tightened securely?***
YES : Go to step **10AK3**.
NO : Tighten fuel filler cap securely.

10AK3 : CHECK PRESSURE/VACUUM LINE.

NOTE:
Check the following items.
- Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank
- Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank

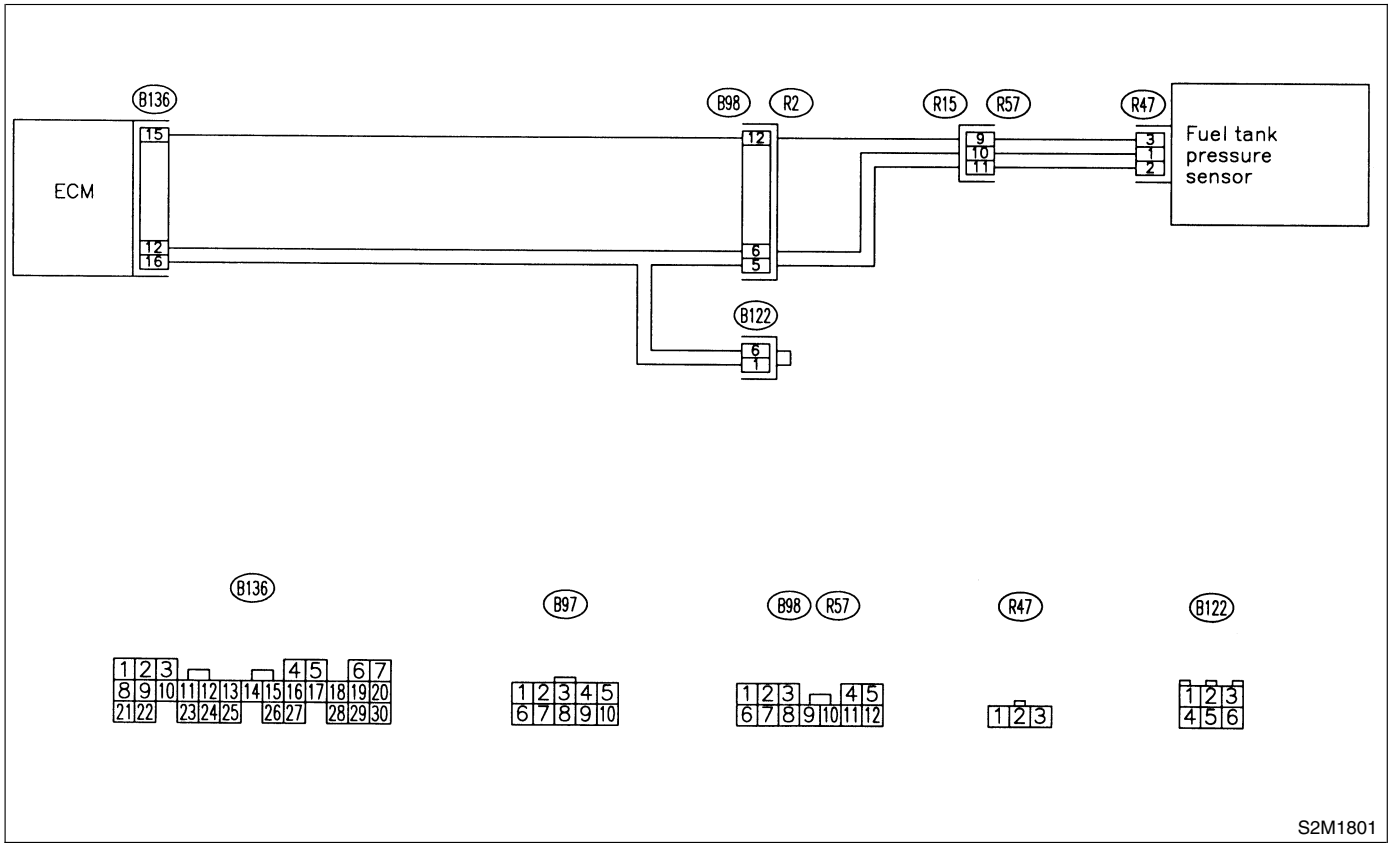
CHECK : ***Is there a fault in pressure/vacuum line?***
YES : Repair or replace hoses and pipes.
NO : Replace fuel tank pressure sensor. <Ref. to 2-1 [W8A0].>

AL: DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AL1 : CHECK CURRENT DATA.

1) Turn ignition switch to OFF.
2) Remove fuel filler cap.
3) Install fuel filler cap.
4) Turn ignition switch to ON.
5) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

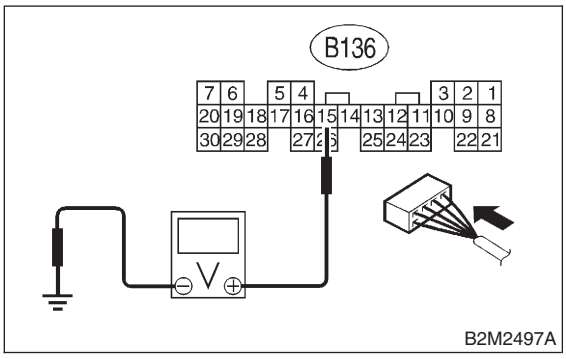
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value less than –2.8 kPa (–21.0 mmHg, –0.827 inHg)?***
YES : Go to step **10AL2**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time.

10AL2 : CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

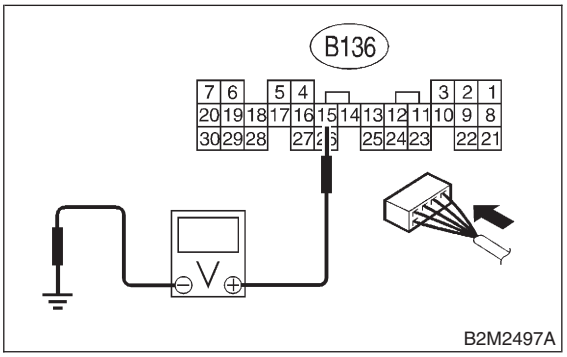


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10AL4**.
NO : Go to step **10AL3**.

10AL3 : CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



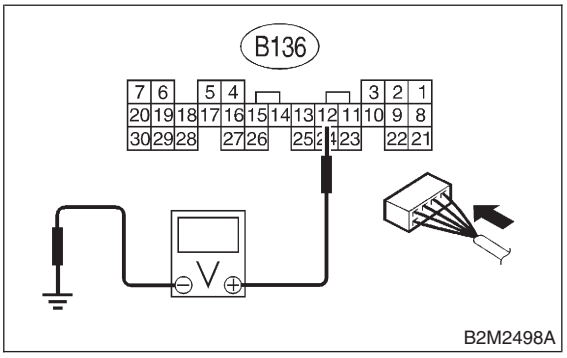
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10AL4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 12 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10AL6**.
NO : Go to step **10AL5**.

10AL5 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of fuel tank pressure sensor signal using Subaru Select Monitor.

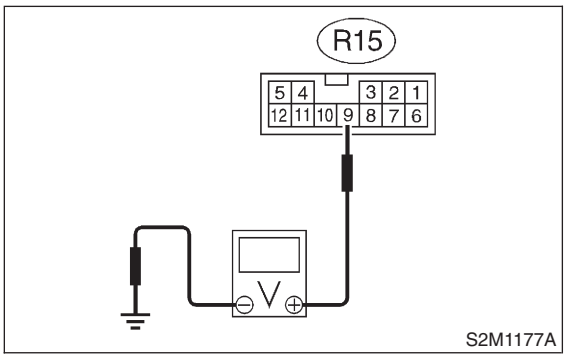
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than –2.8 kPa (–21.0 mmHg, –0.827 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10AL6**.

10AL6 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Remove rear seat cushion (Wagon).
3) Separate rear wiring harness and fuel tank cord.
4) Turn ignition switch to ON.
5) Measure voltage between rear wiring harness connector and chassis ground.

Connector & terminal
(R15) No. 9 (+) — Chassis ground (–):



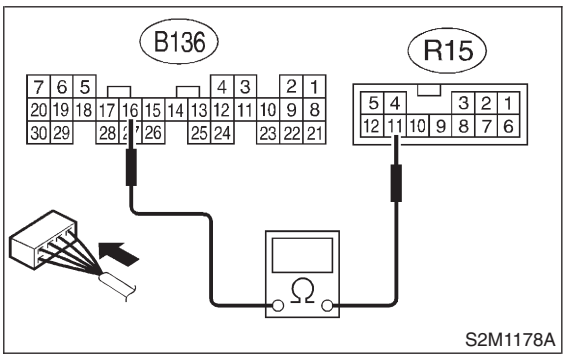
CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10AL7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and rear wiring harness connector (R15)
● Poor contact in coupling connector (B98)

10AL7 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and rear wiring harness connector.

Connector & terminal
(B136) No. 16 — (R15) No. 11:



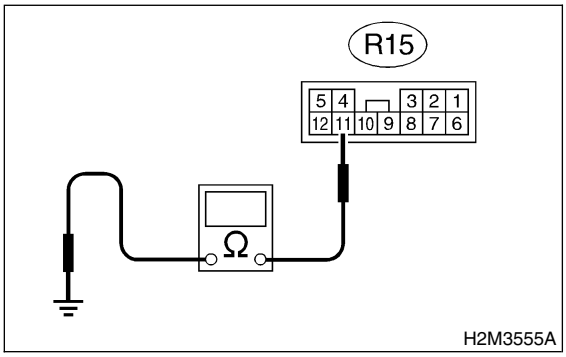
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AL8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and rear wiring harness connector (R15)
● Poor contact in coupling connector (B98)
● Poor contact in joint connector (B122)

10AL8 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

Measure resistance of harness between rear wiring harness connector and chassis ground.

Connector & terminal
(R15) No. 11 — Chassis ground:

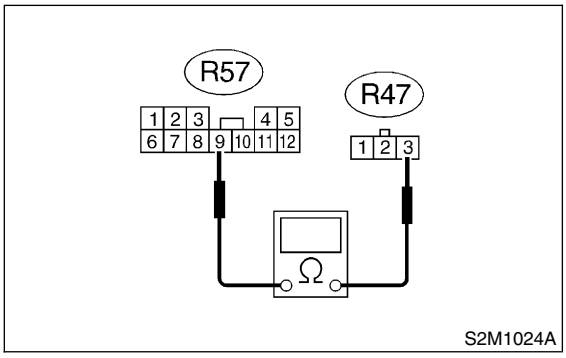


CHECK : ***Is the resistance more than 500 kΩ?***
YES : Go to step **10AL9**.
NO : Repair ground short circuit in harness between ECM and rear wiring harness connector (R15).

10AL9 : CHECK FUEL TANK CORD.

1) Disconnect connector from fuel tank pressure sensor.
2) Measure resistance of fuel tank cord.

Connector & terminal
(R57) No. 9 — (R47) No. 3:

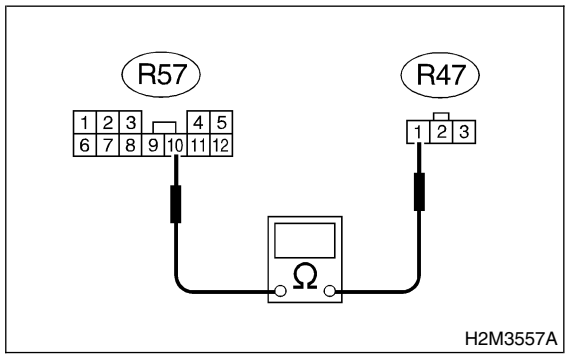


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AL10**.
NO : Repair open circuit in fuel tank cord.

10AL10 : CHECK FUEL TANK CORD.

Measure resistance of fuel tank cord.

Connector & terminal
(R57) No. 10 — (R47) No. 1:

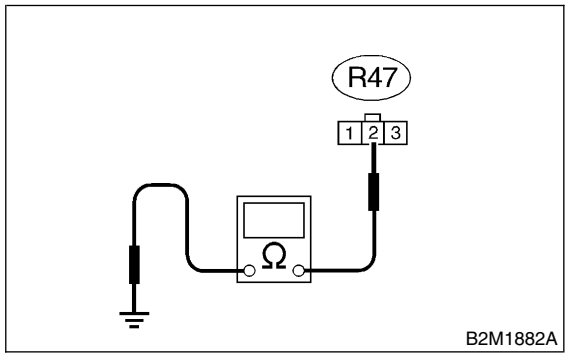


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AL11**.
NO : Repair open circuit in fuel tank cord.

10AL11 : CHECK FUEL TANK CORD.

Measure resistance of harness between fuel tank pressure sensor connector and chassis ground.

Connector & terminal
(R47) No. 2 — Chassis ground:



CHECK : ***Is the resistance more than 500 kΩ?***
YES : Go to step **10AL12**.
NO : Repair ground short circuit in fuel tank cord.

10AL12 : CHECK POOR CONTACT.

Check poor contact in fuel tank pressure sensor connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in fuel tank pressure sensor connector?***

YES : Repair poor contact in fuel tank pressure sensor connector.

NO : Replace fuel tank pressure sensor. <Ref. to 2-1 [W8A0].>

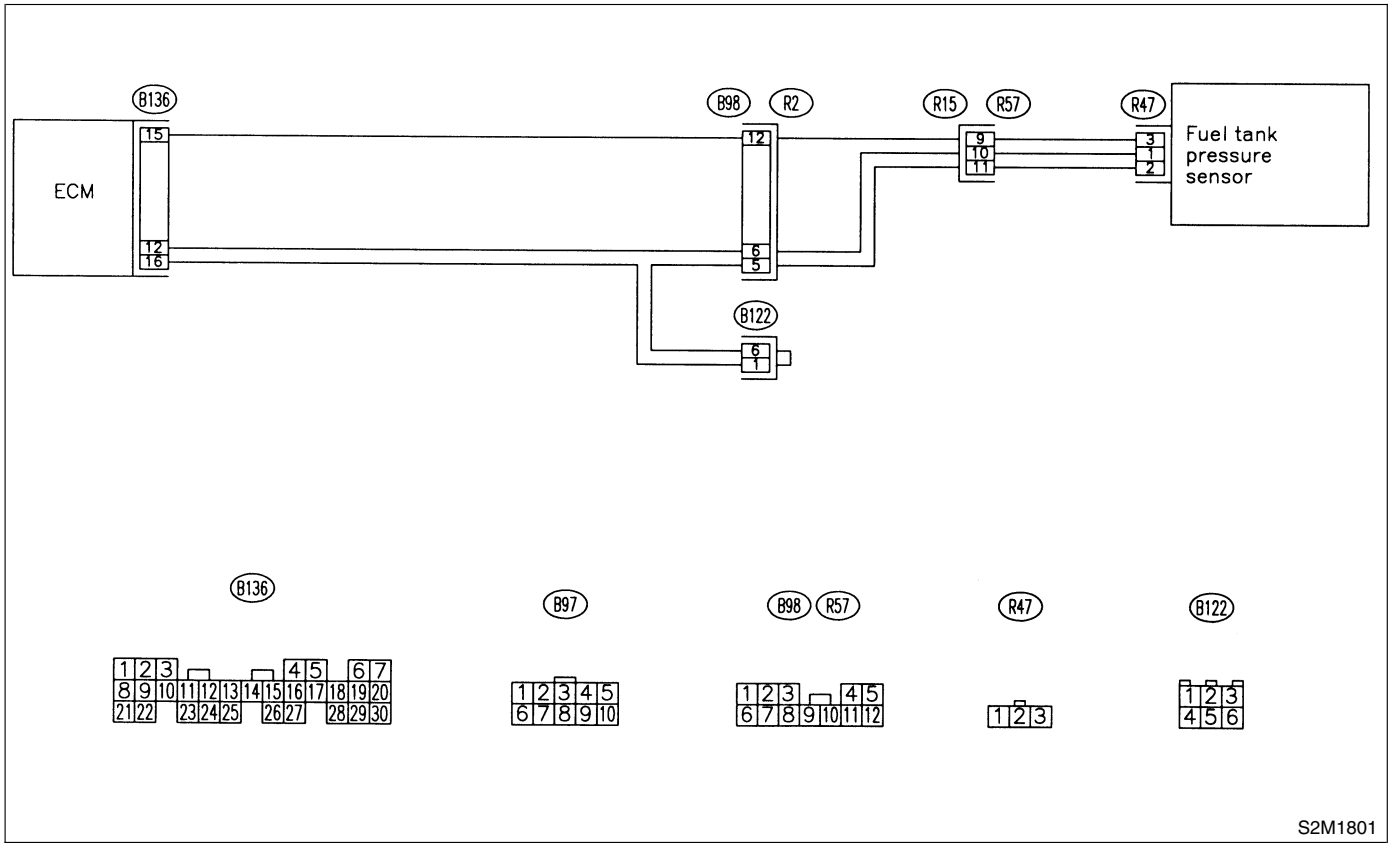
MEMO:

AM: DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AM1 : CHECK CURRENT DATA.

1) Turn ignition switch to OFF.
2) Remove fuel filler cap.
3) Install fuel filler cap.
4) Turn ignition switch to ON.
5) Read data of fuel tank pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool.

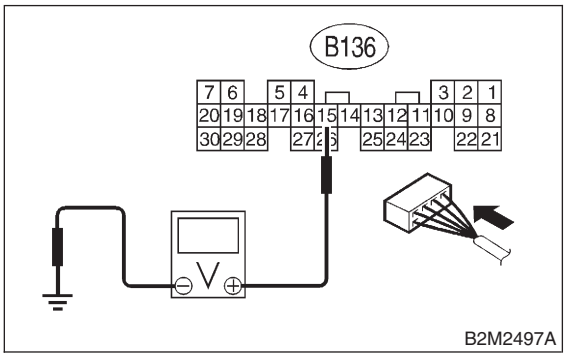
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?***
YES : Go to step **10AM12**.
NO : Go to step **10AM2**.

10AM2 : CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

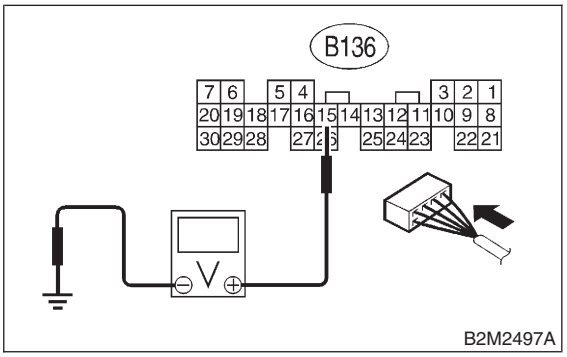


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10AM4**.
NO : Go to step **10AM3**.

10AM3 : CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

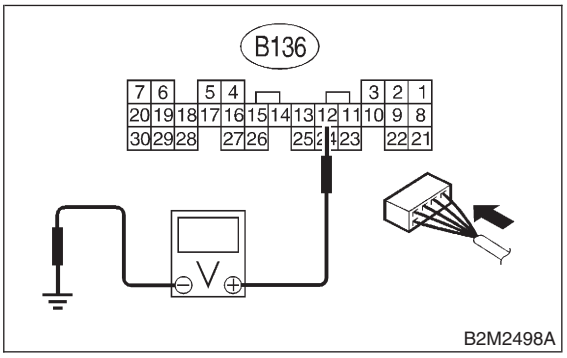


CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10AM4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 12 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10AM6**.
NO : Go to step **10AM5**.

10AM5 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of fuel tank pressure sensor signal using Subaru Select Monitor.

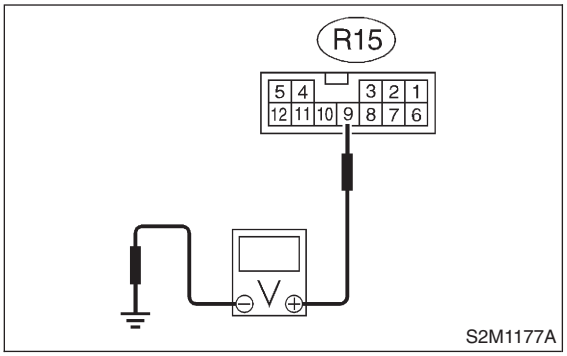
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than –2.8 kPa (–21.0 mmHg, –0.827 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10AM6**.

10AM6 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Remove rear seat cushion (Sedan) or move rear seat cushion (Wagon).
3) Separate rear wiring harness and fuel tank cord.
4) Turn ignition switch to ON.
5) Measure voltage between rear wiring harness connector and chassis ground.

Connector & terminal
(R15) No. 9 (+) — Chassis ground (–):



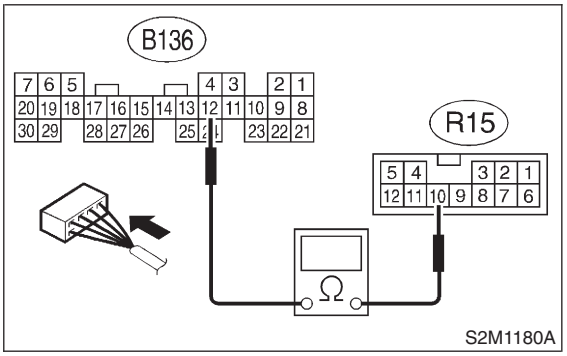
CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10AM7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and rear wiring harness connector (R15)
● Poor contact in coupling connector (B98)

10AM7 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and rear wiring harness connector.

Connector & terminal
(B136) No. 12 — (R15) No. 10:



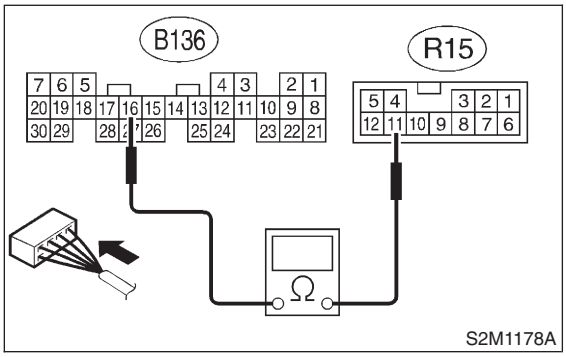
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AM8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and rear wiring harness connector (R15)
● Poor contact in coupling connector (B98)

10AM8 : CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.

Measure resistance of harness between rear wiring harness connector and chassis ground.

Connector & terminal
(B136) No. 16 — (R15) No. 11:

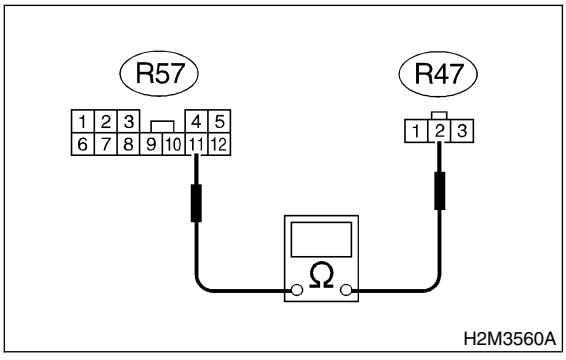


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AM9**.
NO : Repair ground short circuit in harness between ECM and rear wiring harness connector (R15).

10AM9 : CHECK FUEL TANK CORD.

1) Disconnect connector from fuel tank pressure sensor.
2) Measure resistance of fuel tank cord.

Connector & terminal
(R57) No. 11 — (R47) No. 2:

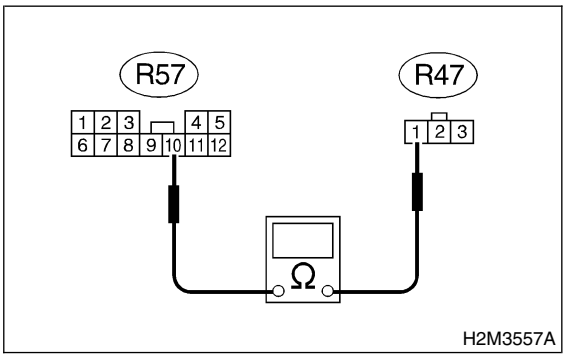


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AM10**.
NO : Repair open circuit in fuel tank cord.

10AM10 : CHECK FUEL TANK CORD.

Measure resistance of fuel tank cord.

Connector & terminal
(R57) No. 10 — (R47) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AM11**.
NO : Repair open circuit in fuel tank cord.

10AM11 : CHECK POOR CONTACT.

Check poor contact in fuel tank pressure sensor connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in fuel tank pressure sensor connector?***
YES : Repair poor contact in fuel tank pressure sensor connector.
NO : Replace fuel tank pressure sensor. <Ref. to 2-1 [W8A0].>

10AM12 : CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from fuel tank pressure sensor.
3) Turn ignition switch to ON.
4) Read data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?***

YES : Repair battery short circuit in harness between ECM and fuel tank pressure sensor connector.

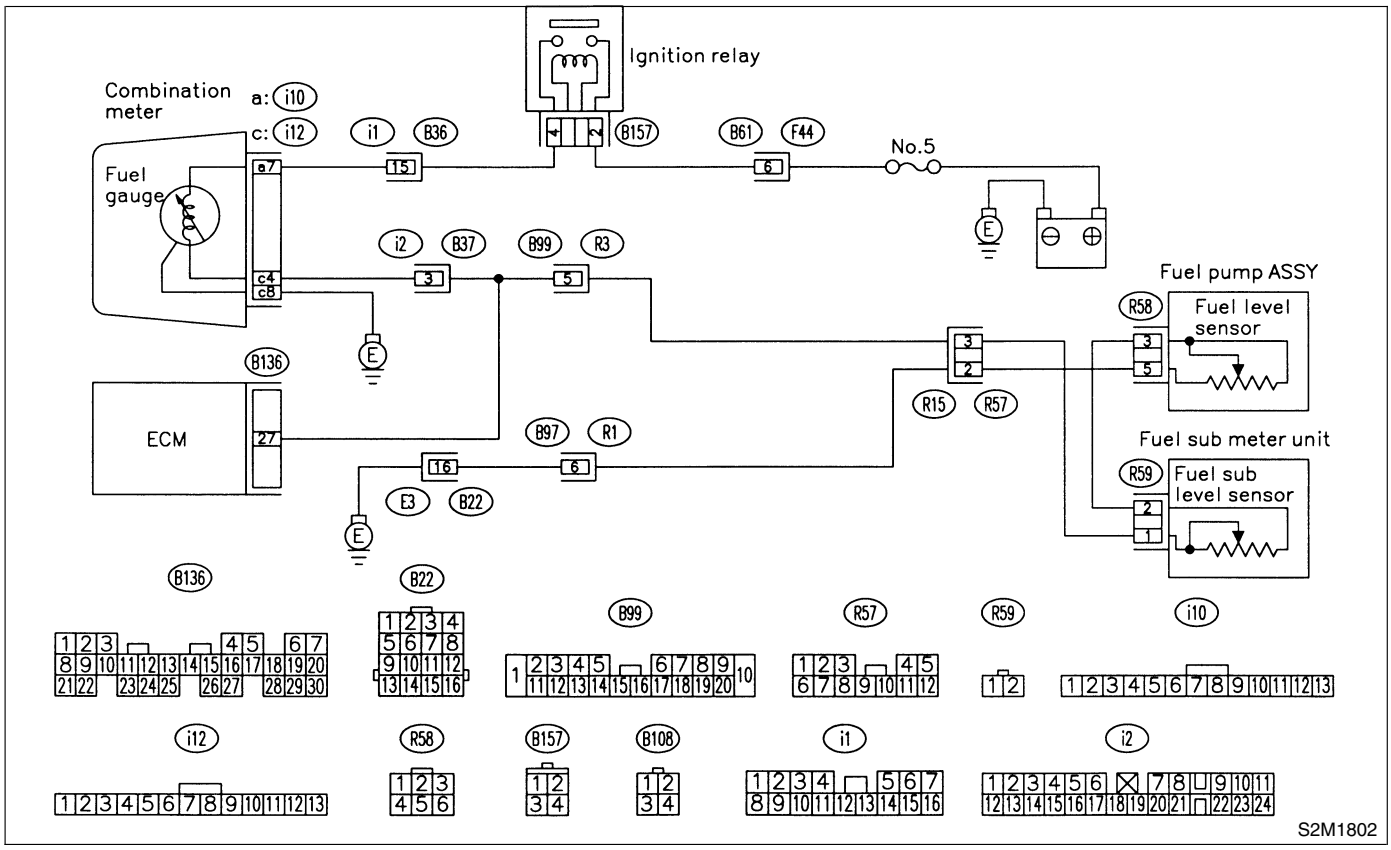
NO : Replace fuel tank pressure sensor. <Ref. to 2-1 [W8A0].>

AN: DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AN1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0462 or P0463?***

YES : Inspect DTC P0462 or P0463 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect this trouble.

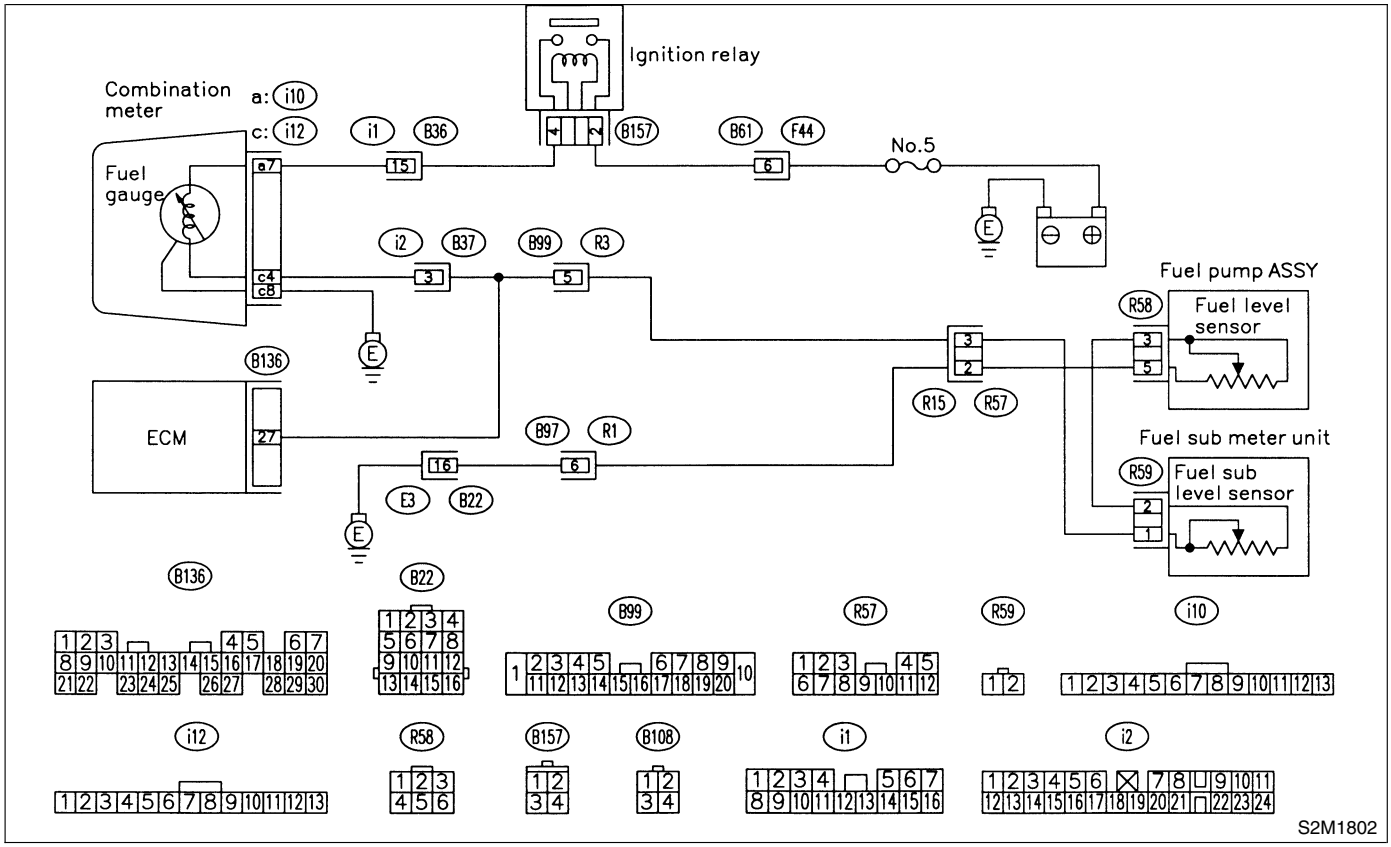
NO : Replace fuel sending unit <Ref. to 2-1 [W5A0].> and fuel sub level sensor <Ref. to 2-1 [W7A0].>.

AO: DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AO1 :	CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.

CHECK : ***Does speedometer and tachometer operate normally?***

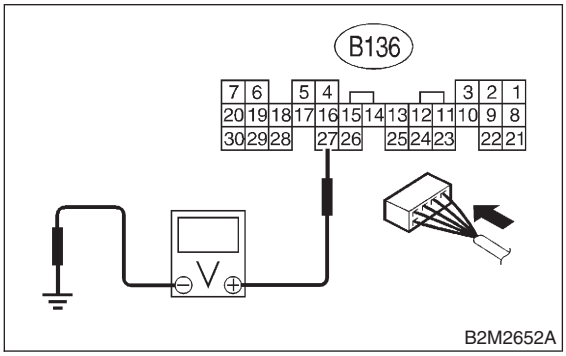
YES : Go to step **10AO2**.

NO : Repair or replace combination meter.

10AO2 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON. (Engine OFF)
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 27 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.12 V?***
YES : Go to step **10AO6**.
NO : Go to step **10AO3**.

10AO3 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of fuel level sensor signal using Subaru Select Monitor.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

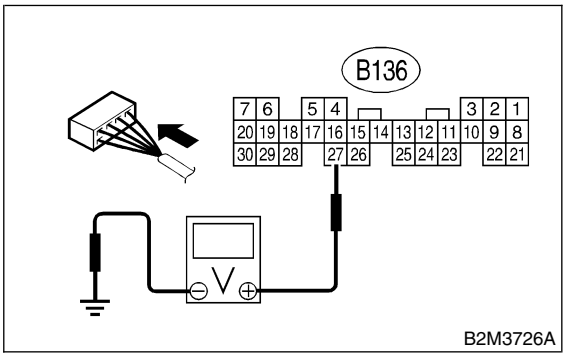
CHECK : ***Does the value change less than 0.12 V by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?***
YES : Repair poor contact in ECM connector.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.

NOTE:
In this case, repair the following:
● Poor contact in combination meter connector
● Poor contact in ECM connector
● Poor contact in coupling connectors (B99 and R57)

10AO4 : CHECK INPUT VOLTAGE OF ECM.

1) Turn ignition switch to OFF.
2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15).
3) Turn ignition switch to ON.
4) Measure voltage of harness between ECM connector and chassis ground.

Connector & terminal
(B136) No. 27 (+) — Chassis ground (–):

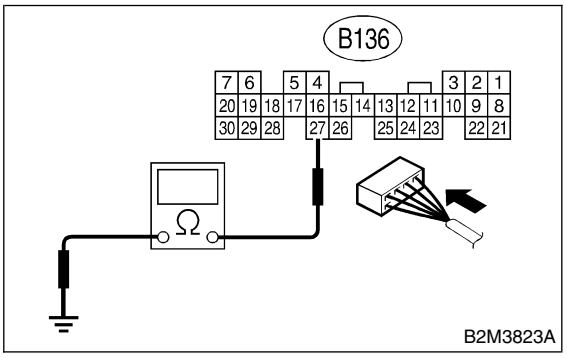


CHECK : ***Is the voltage more than 0.12 V?***
YES : Go to step **10AO4**.
NO : Go to step **10AO7**.

10AO5 : CHECK HARNESS BETWEEN ECM AND COMBINATION METER.

1) Turn ignition switch to OFF.
2) Disconnect connector from connector (i10) and ECM connector.
3) Measure resistance between ECM and chassis ground.

Connector & terminal
(B136) No. 27 — Chassis ground:

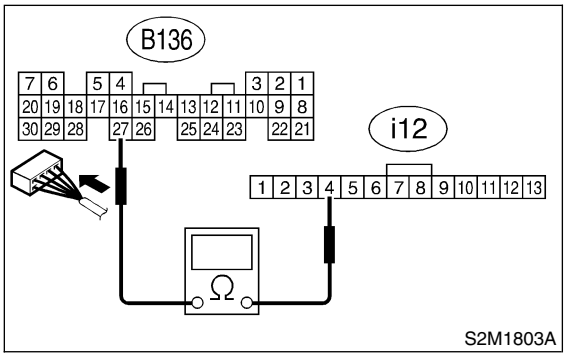


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AO6**.
NO : Repair ground short circuit in harness between ECM and combination meter connector.

10AO6 : CHECK HARNESS BETWEEN ECM AND COMBINATION METER.

Measure resistance between ECM and combination meter connector.

Connector & terminal
(B136) No. 27 — (i12) No. 4:



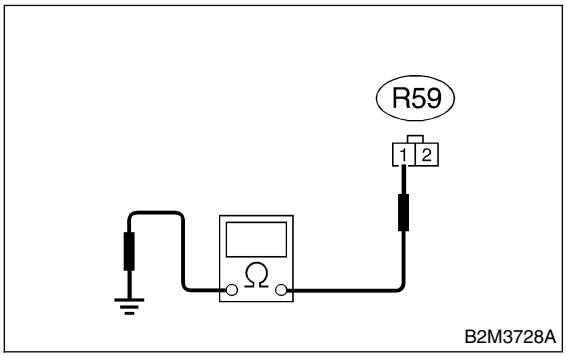
CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair or replace combination meter. <Ref. to 6-2 [W8A0].>
NO : Repair open circuit between ECM and combination meter connector.

NOTE:
In this case, repair the following:
Poor contact in coupling connector (R98)

10AO7 : CHECK FUEL TANK CORD.

1) Turn ignition switch to OFF.
2) Disconnect connector from fuel sub level sensor.
3) Measure resistance between fuel sub level sensor and chassis ground.

Connector & terminal
(R59) No. 1 — Chassis ground:

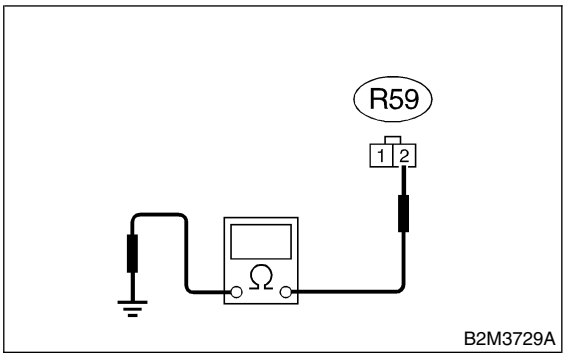


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AO8**.
NO : Repair ground short circuit in fuel tank cord.

10AO8 : CHECK FUEL TANK CORD.

1) Disconnect connector from fuel pump assembly.
2) Measure resistance between fuel pump assembly and chassis ground.

Connector & terminal
(R59) No. 2 — Chassis ground:



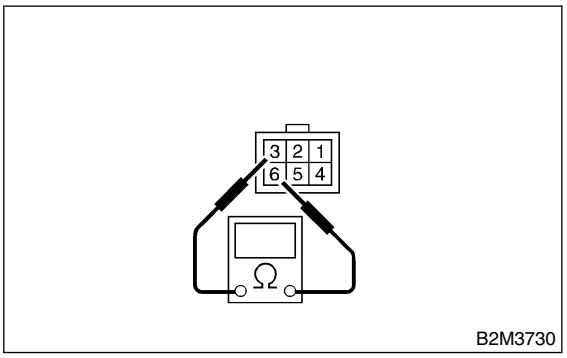
CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AO9**.
NO : Repair ground short circuit in fuel tank cord.

10AO9 : CHECK FUEL LEVEL SENSOR.

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

1) Remove fuel pump assembly. <Ref. to 2-8 [W3A0].>
2) Measure resistance between fuel level sensor and terminals with its float set to the full position.

Terminals
No. 3 — No. 6:



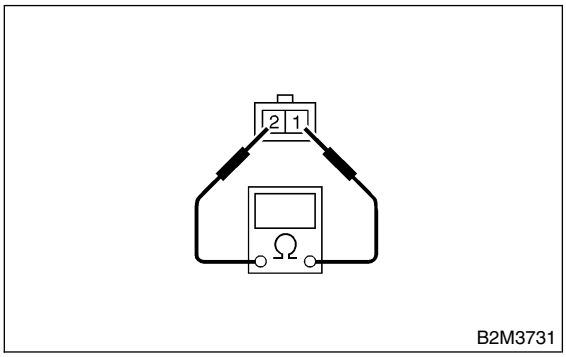
CHECK : ***Is the resistance between 0.5 and 2.5 Ω?***
YES : Go to step **10AO10**.
NO : Replace fuel level sensor.

10AO10 :	CHECK FUEL SUB LEVEL SENSOR.

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

1) Remove fuel sub level sensor. <Ref. to 2-8 [W6A0].>
2) Measure resistance between fuel sub level sensor and terminals with its float set to the full position.

Terminals
No. 1 — No. 2:



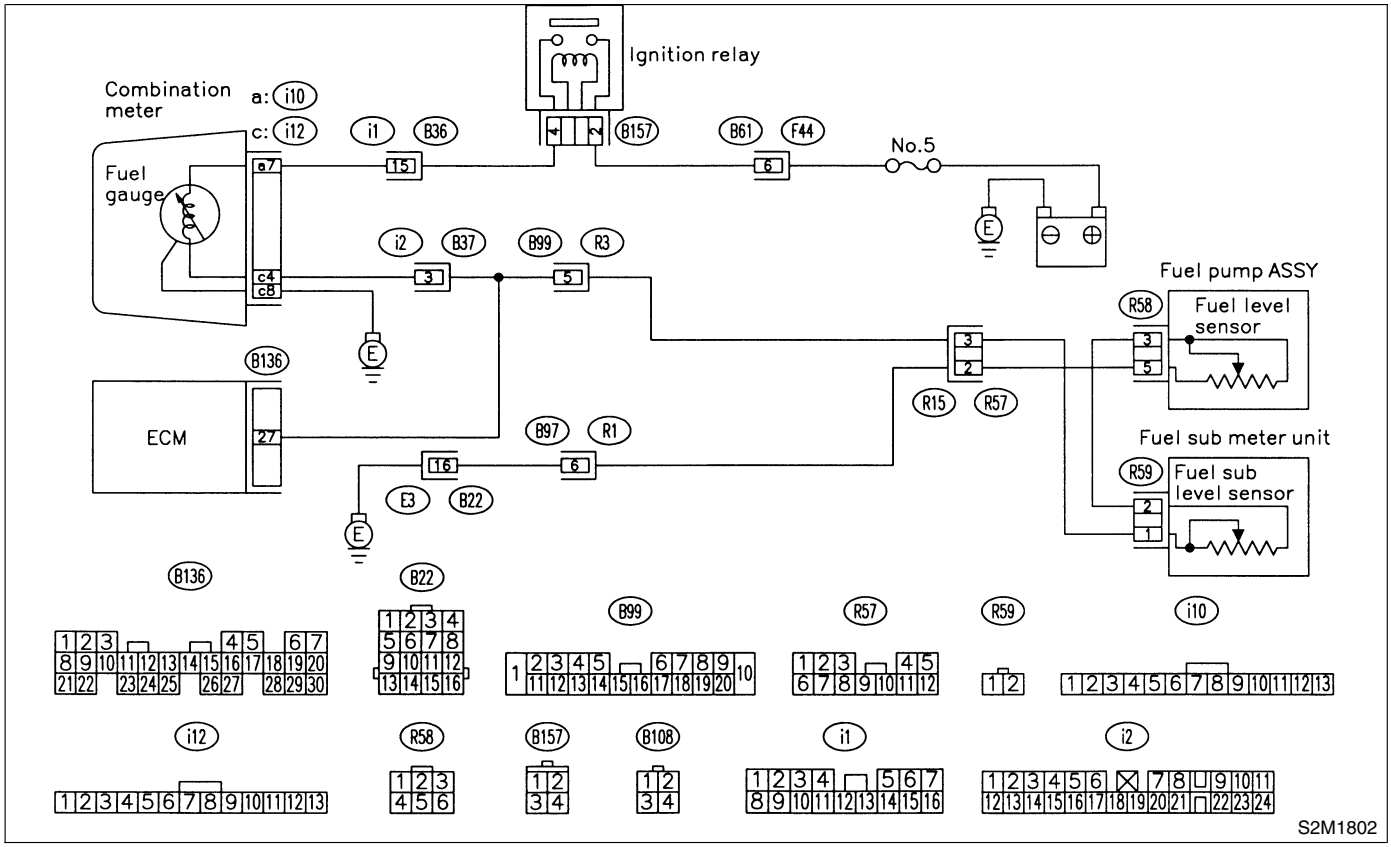
CHECK : ***Is the resistance between 0.5 and 2.5 Ω?***
YES : Repair poor contact in harness between ECM and combination meter connector.
NO : Replace fuel sub level sensor.

AP: DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AP1 :	CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.

CHECK : ***Does speedometer and tachometer operate normally?***

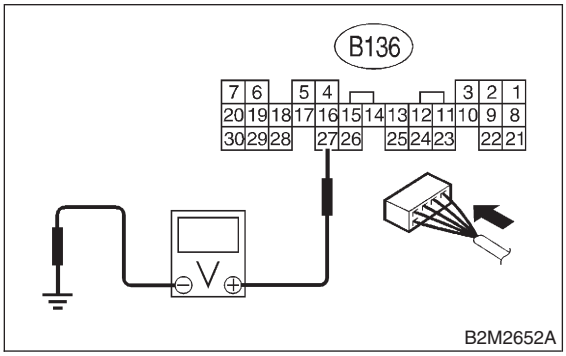
YES : Go to step **10AP2**.

NO : Repair or replace combination meter. <Ref. to 6-2 [W8A0].>

10AP2 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON. (Engine OFF)
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 27 (+) — Chassis ground (–):



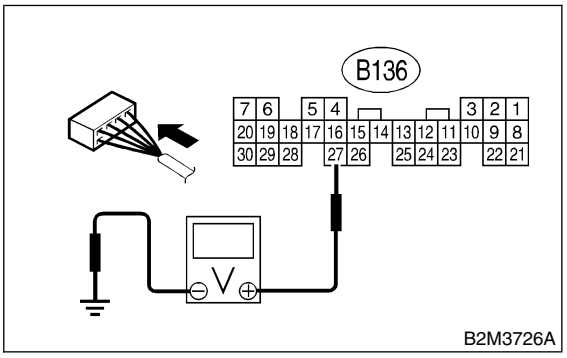
CHECK : ***Is the voltage more than 4.75 V?***
YES : Go to step **10AP3**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.

NOTE:
In this case, repair the following:
- Poor contact in fuel pump connector
- Poor contact in coupling connector (B22, R97, B99 and R57)

10AP3 : CHECK INPUT VOLTAGE OF ECM.

1) Turn ignition switch to OFF.
2) Disconnect combination meter connector (i10) and ECM connector.
3) Turn ignition switch to ON.
4) Measure voltage of harness between ECM and chassis ground.

Connector & terminal
(B136) No. 27 (+) — Chassis ground (–):

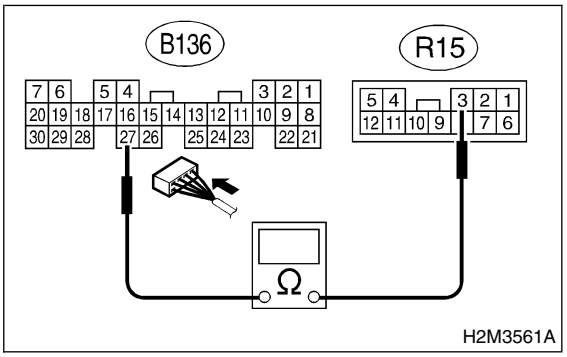


CHECK : ***Is the voltage more than 4.75 V?***
YES : Go to step **10AP4**.
NO : Repair battery short circuit between ECM and combination meter connector.

10AP4 : CHECK HARNESS BETWEEN ECM AND FUEL TANK CORD.

1) Turn ignition switch to OFF.
2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15).
3) Measure resistance between ECM and fuel tank cord.

Connector & terminal
(B136) No. 27 — (R15) No. 3:

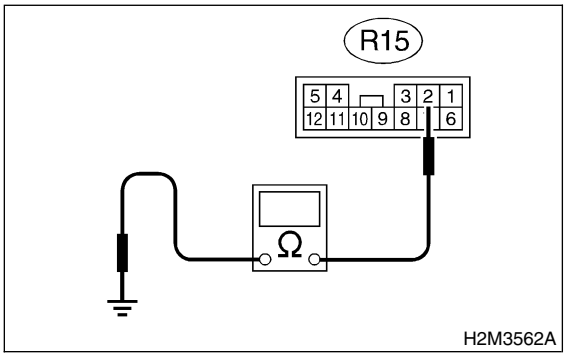


CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10AP5**.
NO : Repair open circuit between ECM and fuel tank cord.

10AP5 : CHECK HARNESS BETWEEN FUEL TANK CORD AND CHASSIS GROUND.

Measure resistance between fuel tank cord and chassis ground.

Connector & terminal
(R15) No. 2 — Chassis ground:



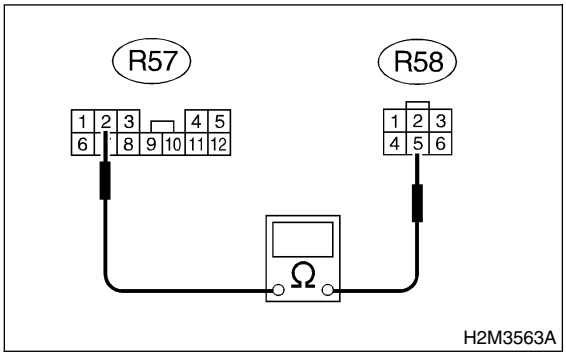
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10AP6**.
NO : Repair open circuit between fuel tank cord and chassis ground.

NOTE:
In this case, repair the following:
Poor contact in coupling connectors (B22 and B99)

10AP6 : CHECK FUEL TANK CORD.

1) Disconnect connector from fuel level sensor.
2) Measure resistance between fuel level sensor and coupling connector.

Connector & terminal
(R57) No. 2 — (R58) No. 5:

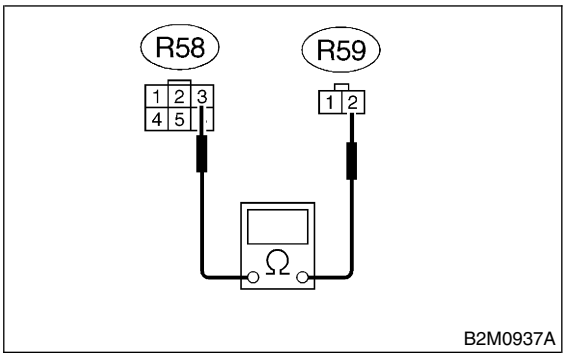


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **10AP7**.
NO : Repair open circuit between coupling connector and fuel level sensor.

10AP7 : CHECK FUEL TANK CORD.

1) Disconnect connector from fuel sub level sensor.
2) Measure resistance between fuel level sensor and fuel sub level sensor.

Connector & terminal
(R58) No. 3 — (R59) No. 2:

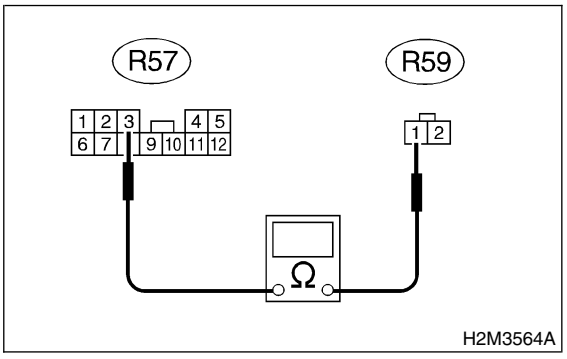


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **10AP8**.
NO : Repair open circuit between fuel level sensor and fuel sub level sensor.

10AP8 : CHECK FUEL TANK CORD.

Measure resistance between fuel sub level sensor and coupling connector.

Connector & terminal
(R57) No. 3 — (R59) No. 1:



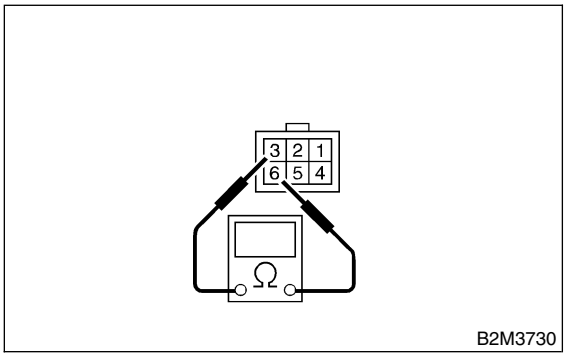
CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **10AP9**.
NO : Repair open circuit between coupling connector and fuel sub level sensor.

10AP9 : CHECK FUEL LEVEL SENSOR.

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

1) Remove fuel pump assembly. <Ref. to 2-8 [W3A0].>
2) While moving fuel level sensor float up and down, measure resistance between fuel level sensor terminals.

Terminals
No. 3 — No. 6:



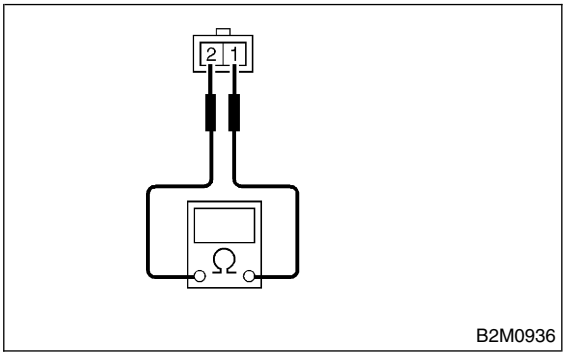
CHECK : ***Is the resistance more than 54.5 Ω?***
YES : Replace fuel level sensor. <Ref. to 2-8 [W3A0].>
NO : Go to step **10AP10**.

10AP10 : CHECK FUEL SUB LEVEL SENSOR.

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

1) Remove fuel sub level sensor. <Ref. to 2-8 [W6A0].>
2) While moving fuel sub level sensor float up and down, measure resistance between fuel sub level sensor terminals.

Terminals
No. 1 — No. 2:



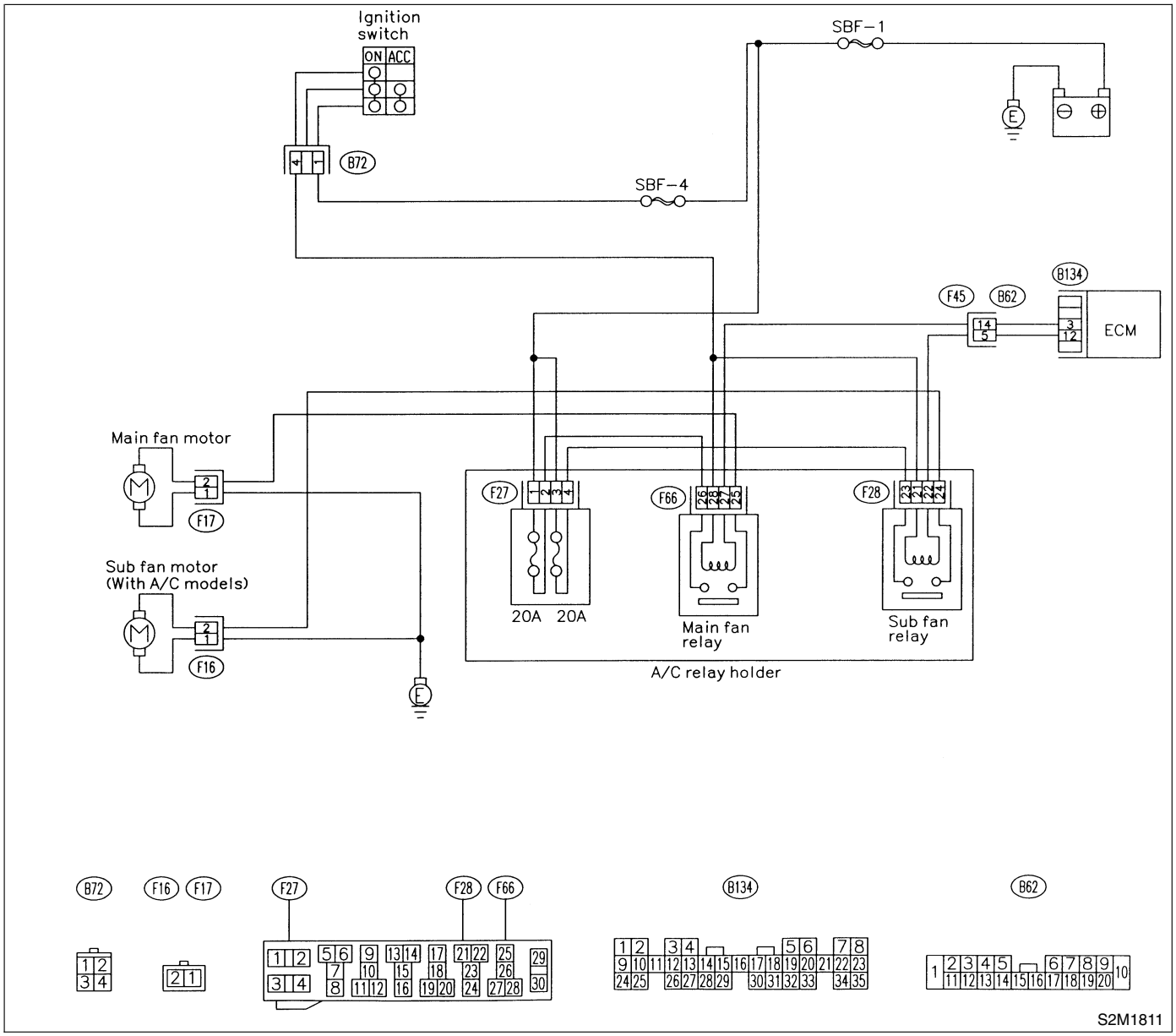
CHECK : ***Is the resistance more than 41.5 Ω?***
YES : Replace fuel sub level sensor. <Ref. to 2-8 [W6A0].>
NO : Replace combination meter. <Ref. to 6-2 [W13A1].>

AQ: DTC P0480 — COOLING FAN RELAY 1 CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Radiator fan does not operate properly.
  - Overheating

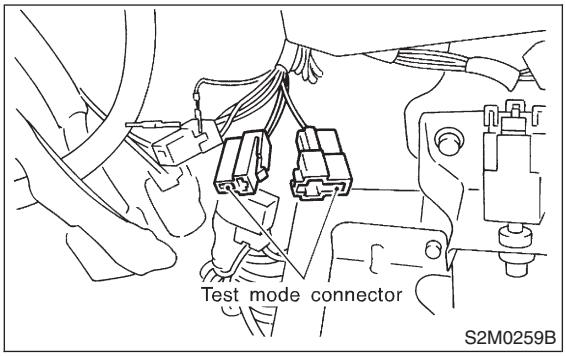
CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AQ1 : CHECK OUTPUT SIGNAL FROM ECM.

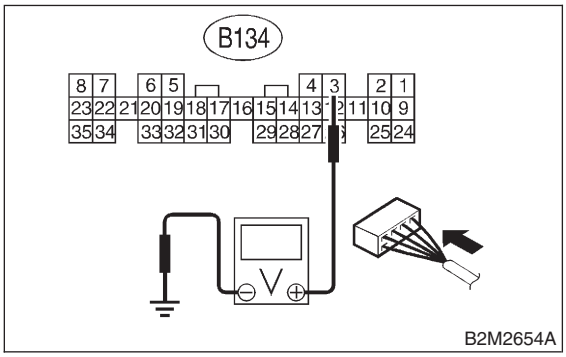
1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) While operating radiator fan relay, measure voltage between ECM terminal and ground.

NOTE:
Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

Connector & terminal
(B134) No. 3 (+) — Chassis ground (–):

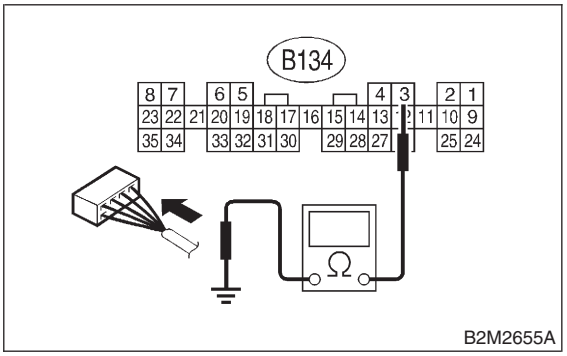


CHECK : ***Does voltage change between 0 and 10 V?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10AQ2**.

10AQ2 : CHECK GROUND SHORT CIRCUIT IN RADIATOR FAN RELAY 1 CONTROL CIRCUIT.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM.
3) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B134) No. 3 — Chassis ground:

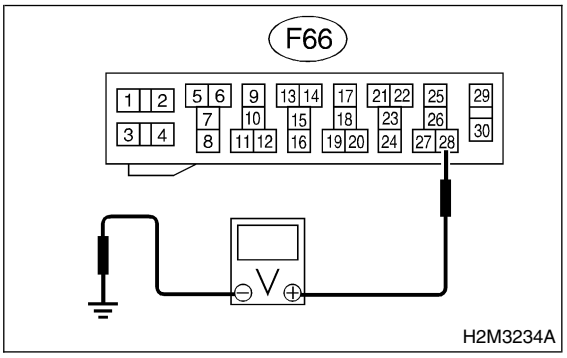


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in radiator fan relay 1 control circuit.
NO : Go to step **10AQ3**.

10AQ3 : CHECK POWER SUPPLY FOR RELAY.

1) Remove main fan relay from A/C relay holder.
2) Turn ignition switch to ON.
3) Measure voltage between fuse and relay box (F/B) connector and chassis ground.

Connector & terminal
(F66) No. 28 (+) — Chassis ground (–):

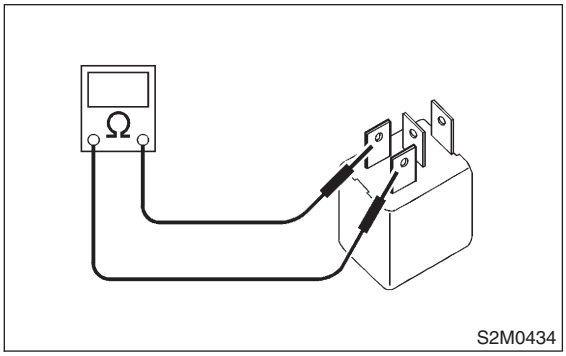


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10AQ4**.
NO : Repair open circuit in harness between ignition switch and fuse and relay box (F/B) connector.

10AQ4 : CHECK MAIN FAN RELAY.

1) Turn ignition switch to OFF.
2) Measure resistance between main fan relay terminals.

Terminal
No. 5 — No. 6:

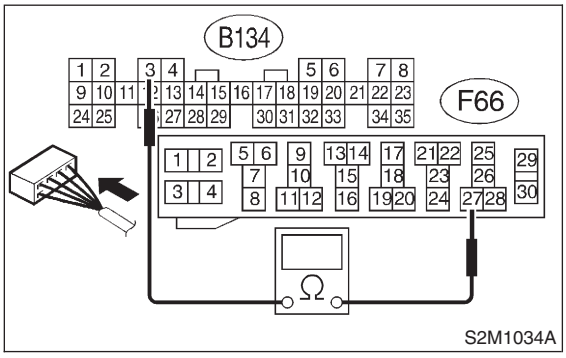


CHECK : ***Is the resistance between 87 and 107 Ω?***
YES : Go to step **10AQ5**.
NO : Replace main fan relay.

10AQ5 : CHECK OPEN CIRCUIT IN MAIN FAN RELAY CONTROL CIRCUIT.

Measure resistance of harness between ECM and main fan relay connector.

Connector & terminal
(B134) No. 3 — (F66) No. 27:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AQ6**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and main fan relay connector
- Poor contact in coupling connector (F45)

10AQ6 : CHECK POOR CONTACT.

Check poor contact in ECM or main fan relay connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM or main fan relay connector?***
YES : Repair poor contact in ECM or main fan relay connector.
NO : Contact with SOA service.

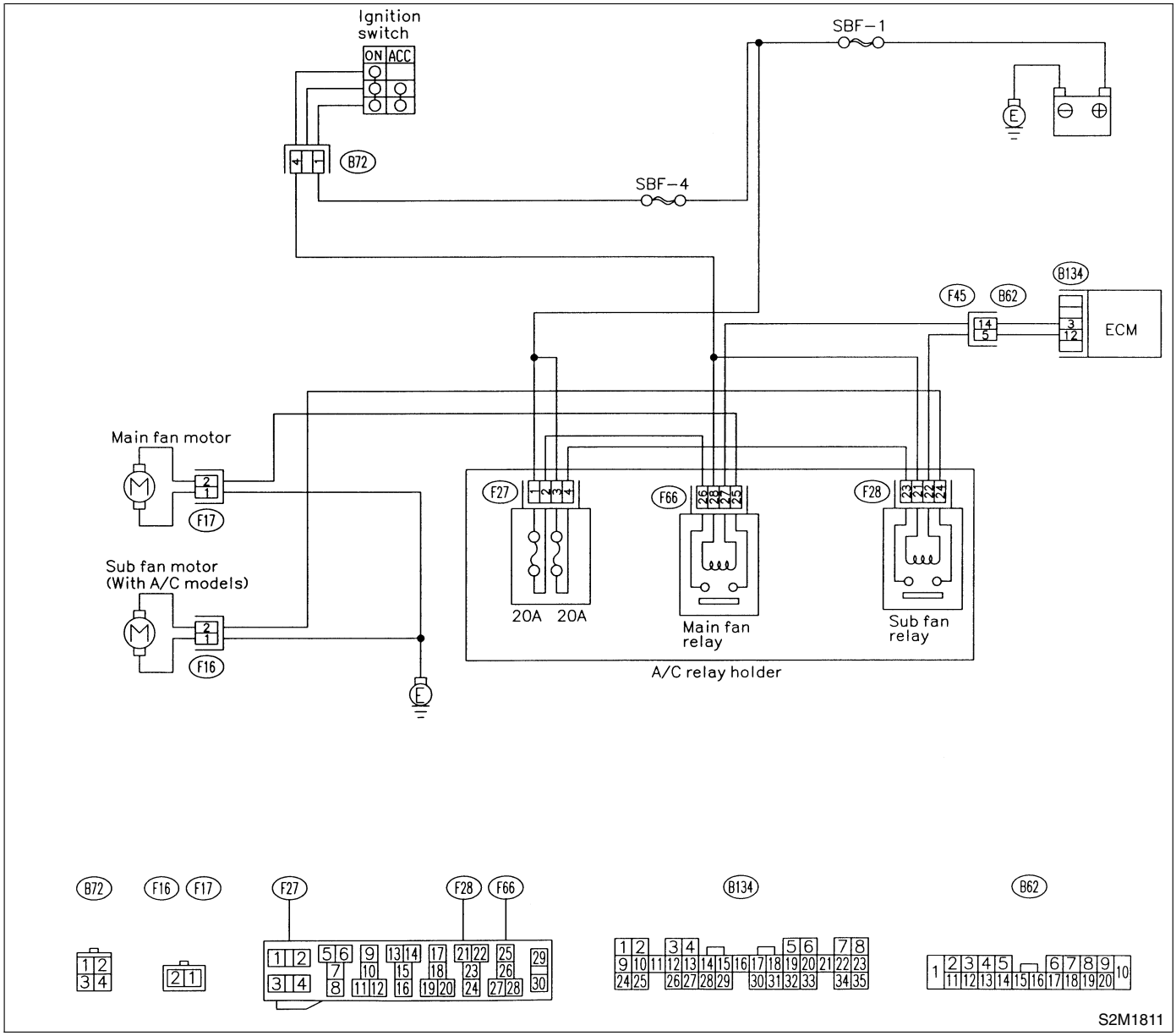
AR: DTC P0483 — COOLING FAN FUNCTION PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Occurrence of noise
  - Overheating

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
If the vehicle, with the engine idling, is placed very close to a wall or another vehicle, preventing normal cooling function, the OBD system may detect malfunction.

- **WIRING DIAGRAM:**



10AR1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***

YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NO : Check engine cooling system. <Ref. to 2-5 [T100].>

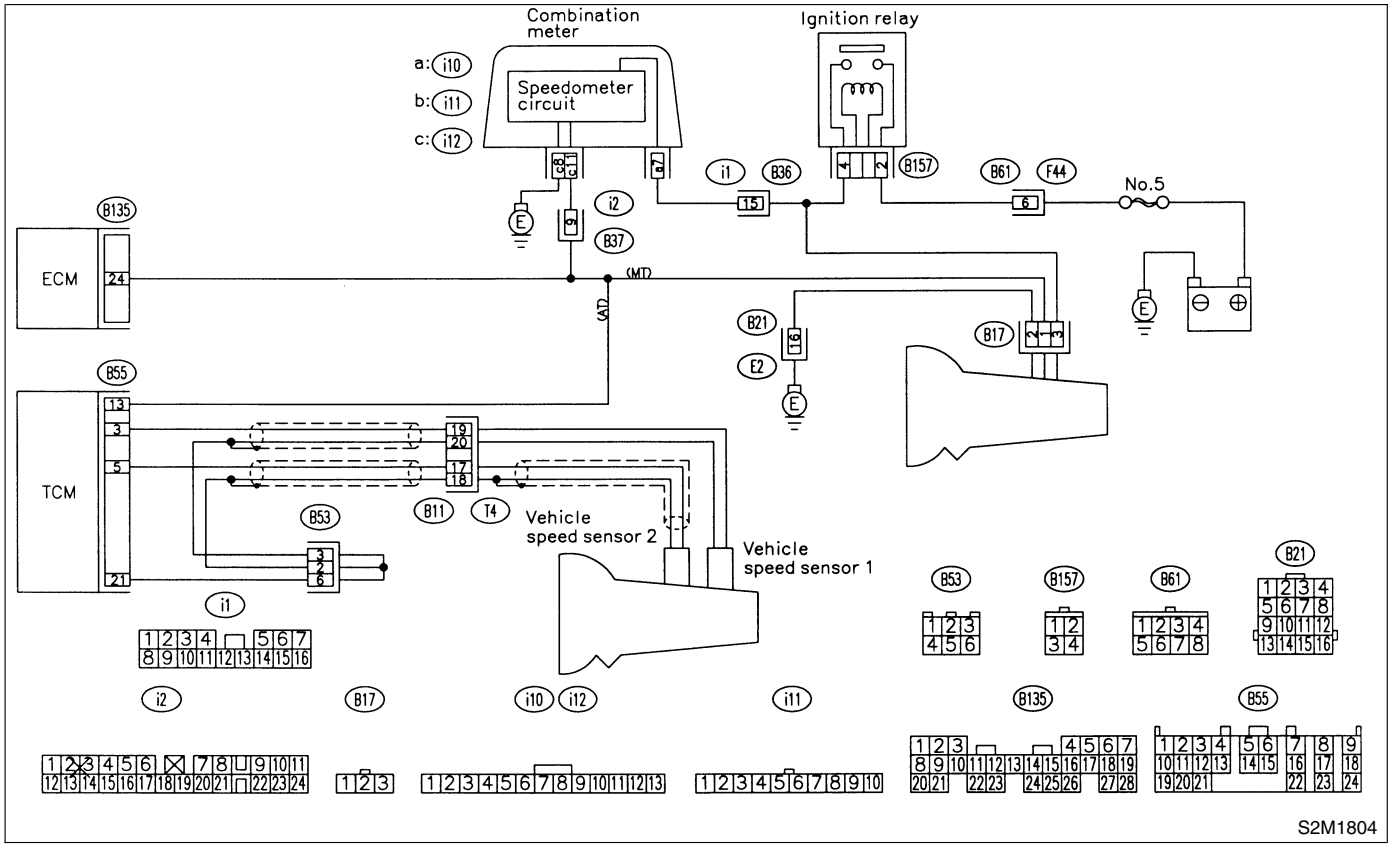
MEMO:

AS: DTC P0500 — VEHICLE SPEED SENSOR MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AS1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **10AS2**.
NO : Go to step **10AS3**.

10AS2 : CHECK DTC P0720 ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?***
YES : Check vehicle speed sensor 2 signal circuit. <Ref. to 3-2 [T8F0].>
NO : Go to step **10AS3**.

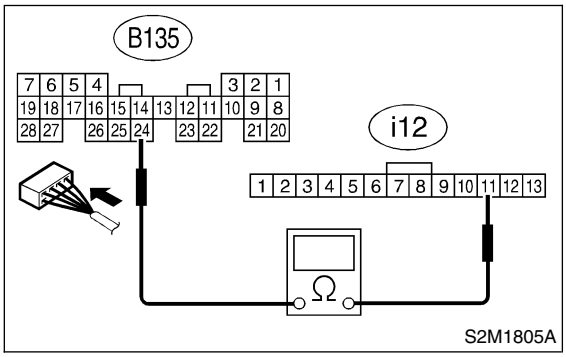
10AS3 : CHECK SPEEDOMETER OPERATION IN COMBINATION METER.

CHECK : ***Does speedometer operate normally?***
YES : Go to step **10AS4**.
NO : Check speedometer and vehicle speed sensor. <Ref. to 6-2 [K3A0].>

10AS4 : CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from combination meter.
3) Measure resistance between ECM and combination meter.

Connector & terminal
(B135) No. 24 — (i12) No. 11:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair poor contact in ECM connector.
NO : Repair harness and connector.

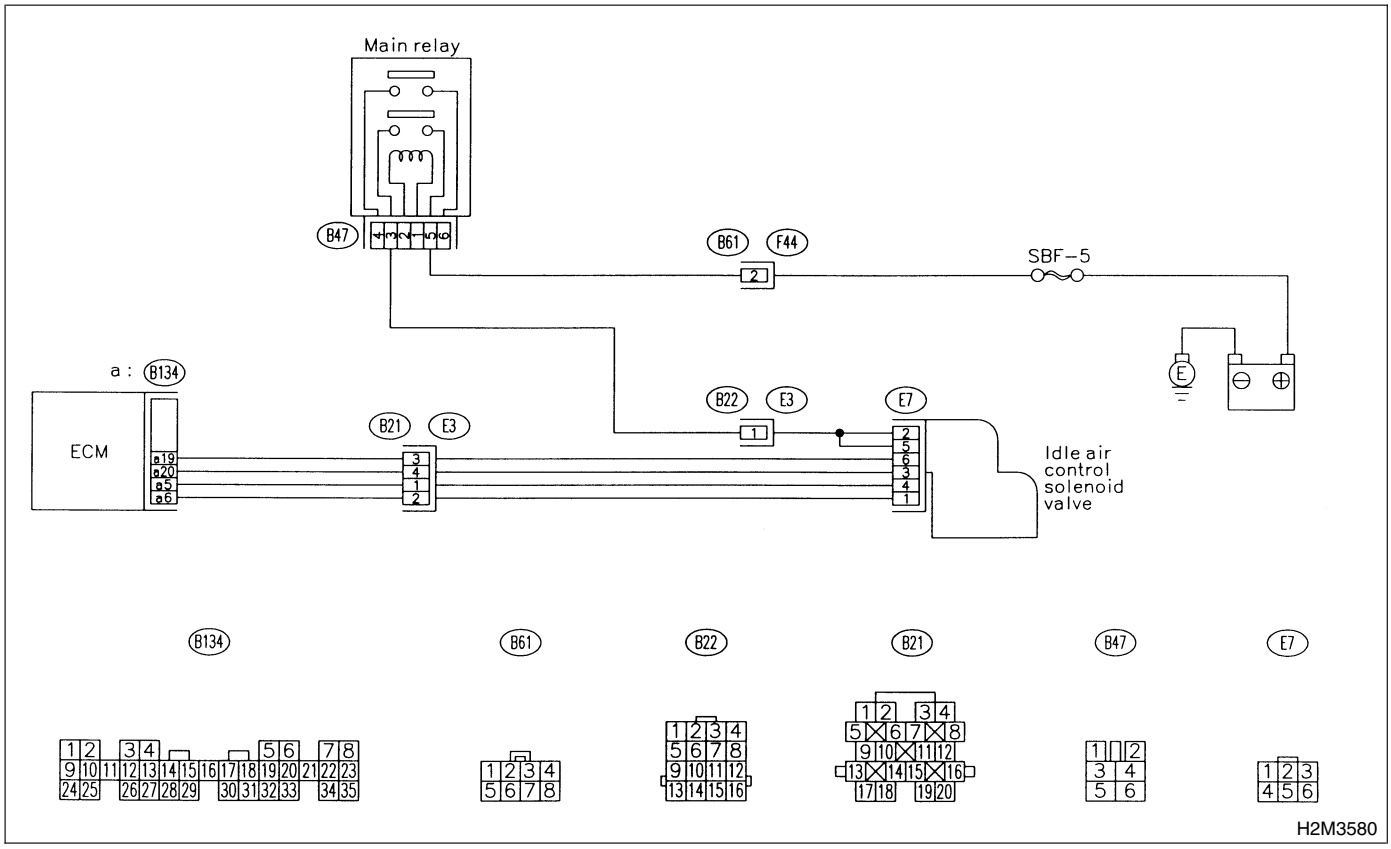
NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and combination meter connector
- Poor contact in ECM connector
- Poor contact in combination meter connector

AT: DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine is difficult to start.
  - Engine does not start.
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AT1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517?***

YES : Inspect DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0506.

NO : Go to step **10AT2**.

10AT2 : CHECK AIR BY-PASS LINE.

1) Turn ignition switch to OFF.
2) Remove idle air control solenoid valve from throttle body. <Ref. to 2-7 [W13A0].>
3) Remove throttle body from intake manifold. <Ref. to 2-7 [W2A0].>
4) Using an air gun, force air into idle air control solenoid valve installation area. Confirm that forced air subsequently escapes from throttle body interior.

CHECK : ***Does air flow out?***

YES : Replace idle air control solenoid valve. <Ref. to 2-7 [W13A0].>

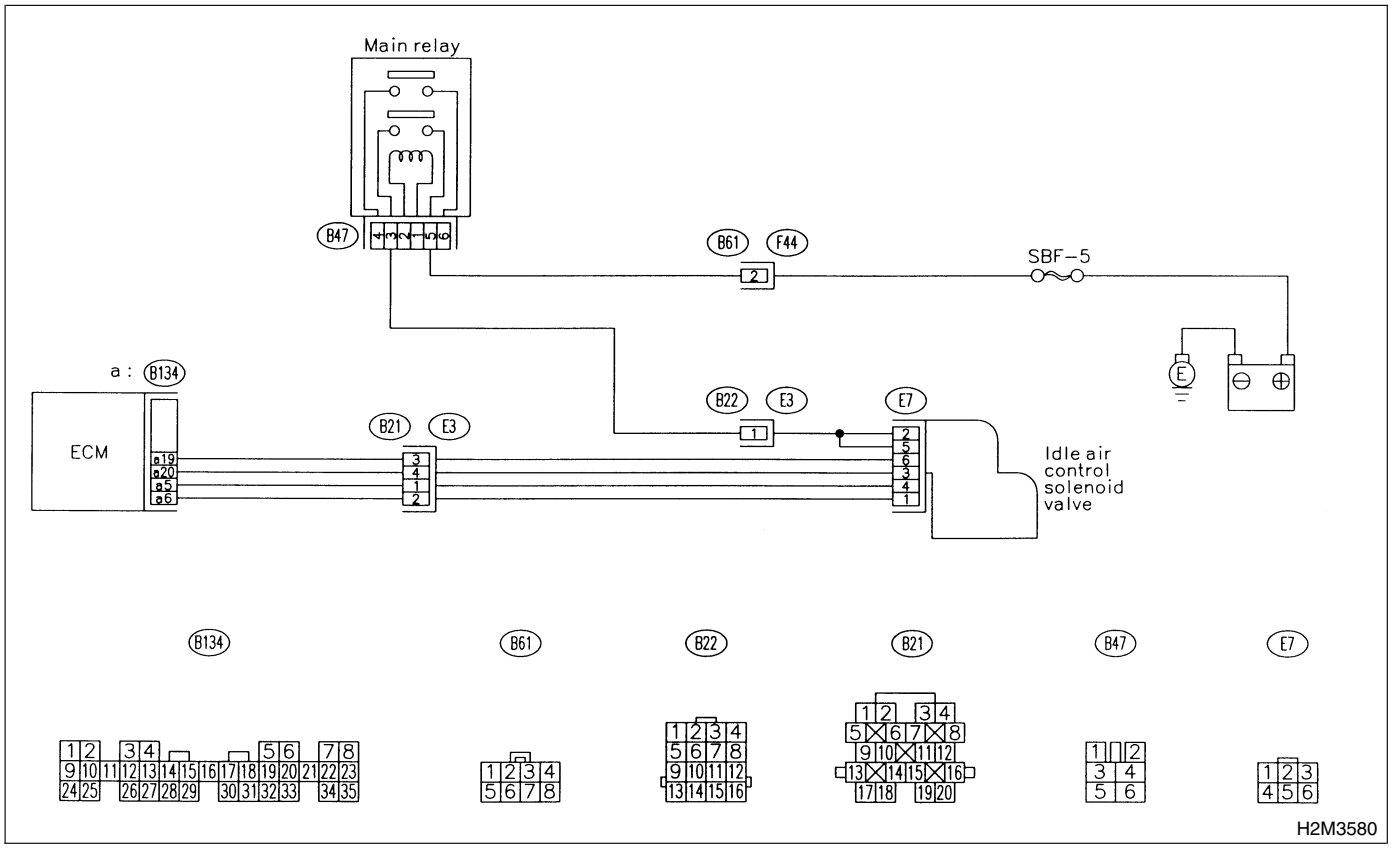
NO : Replace throttle body. <Ref. to 2-7 [W2A0].>

AU: DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine keeps running at higher revolution than specified idling revolution.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AU1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517?***

YES : Inspect DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0507.

NO : Go to step **10AU2**.

10AU2 : CHECK AIR INTAKE SYSTEM.

1) Turn ignition switch to ON.
2) Start engine, and idle it.
3) Check the following items.

- Loose installation of intake manifold, idle air control solenoid valve and throttle body
- Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket
- Disconnections of vacuum hoses

CHECK : ***Is there a fault in air intake system?***

YES : Repair air suction and leaks.

NO : Go to step **10AU3**.

10AU3 : CHECK THROTTLE CABLE.

CHECK : ***Does throttle cable have play for adjustment?***
YES : Go to step **10AU4**.
NO : Adjust throttle cable. <Ref. to 4-5 [W1A3].>

10AU4 : CHECK AIR BY-PASS LINE.

1) Turn ignition switch to OFF.
2) Remove idle air control solenoid valve from throttle body. <Ref. to 2-7 [W13A0].>
3) Confirm that there are no foreign particles in by-pass air line.

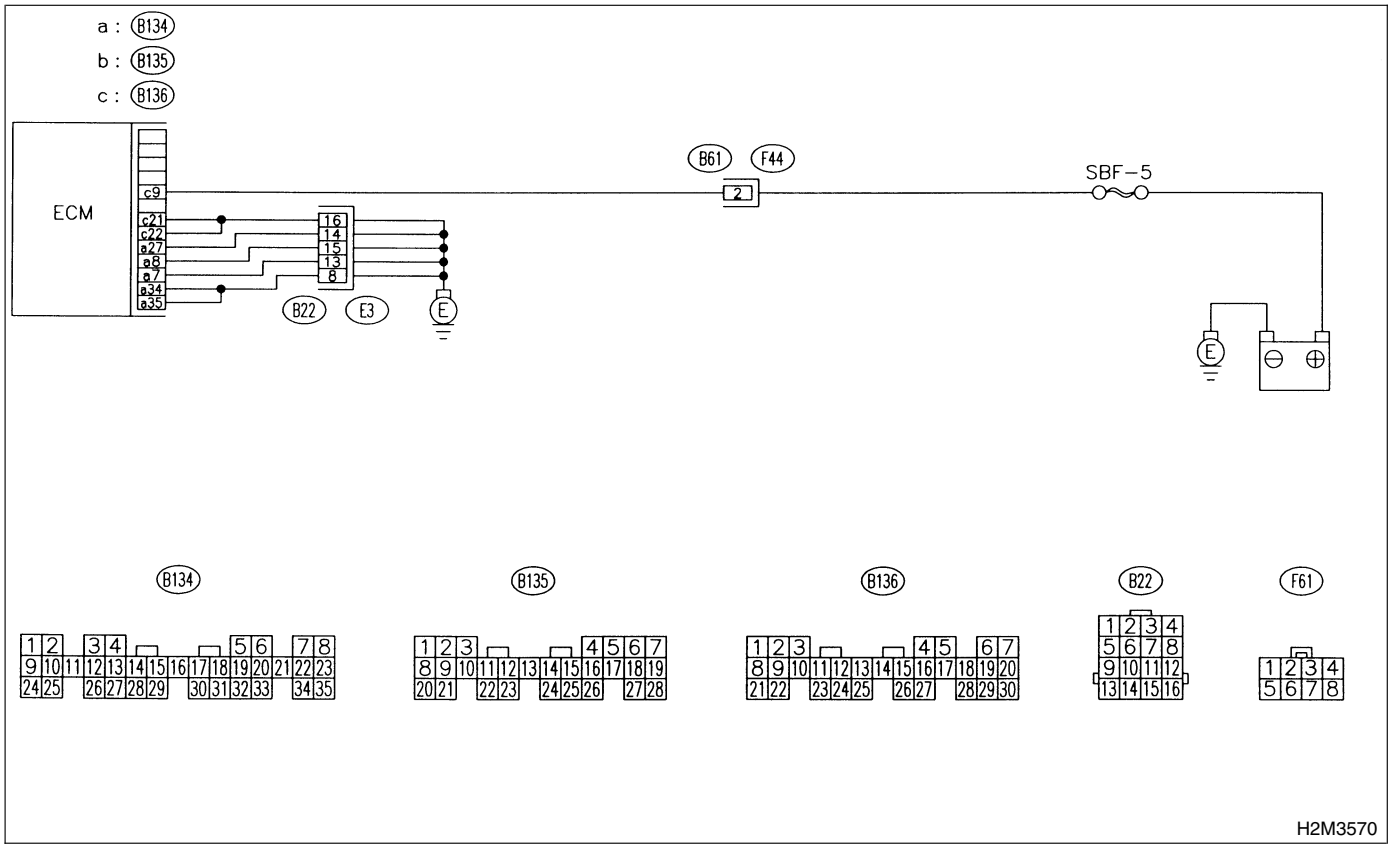
CHECK : ***Are foreign particles in by-pass air line?***
YES : Remove foreign particles from by-pass air line.
NO : Replace idle air control solenoid valve. <Ref. to 2-7 [W13A0].>

AV: DTC P0601 — INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine does not start.
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AV1 :	CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0601?***

YES : Replace ECM. <Ref. to 2-7 [W17A0].>

NO : It is not necessary to inspect DTC P0601.

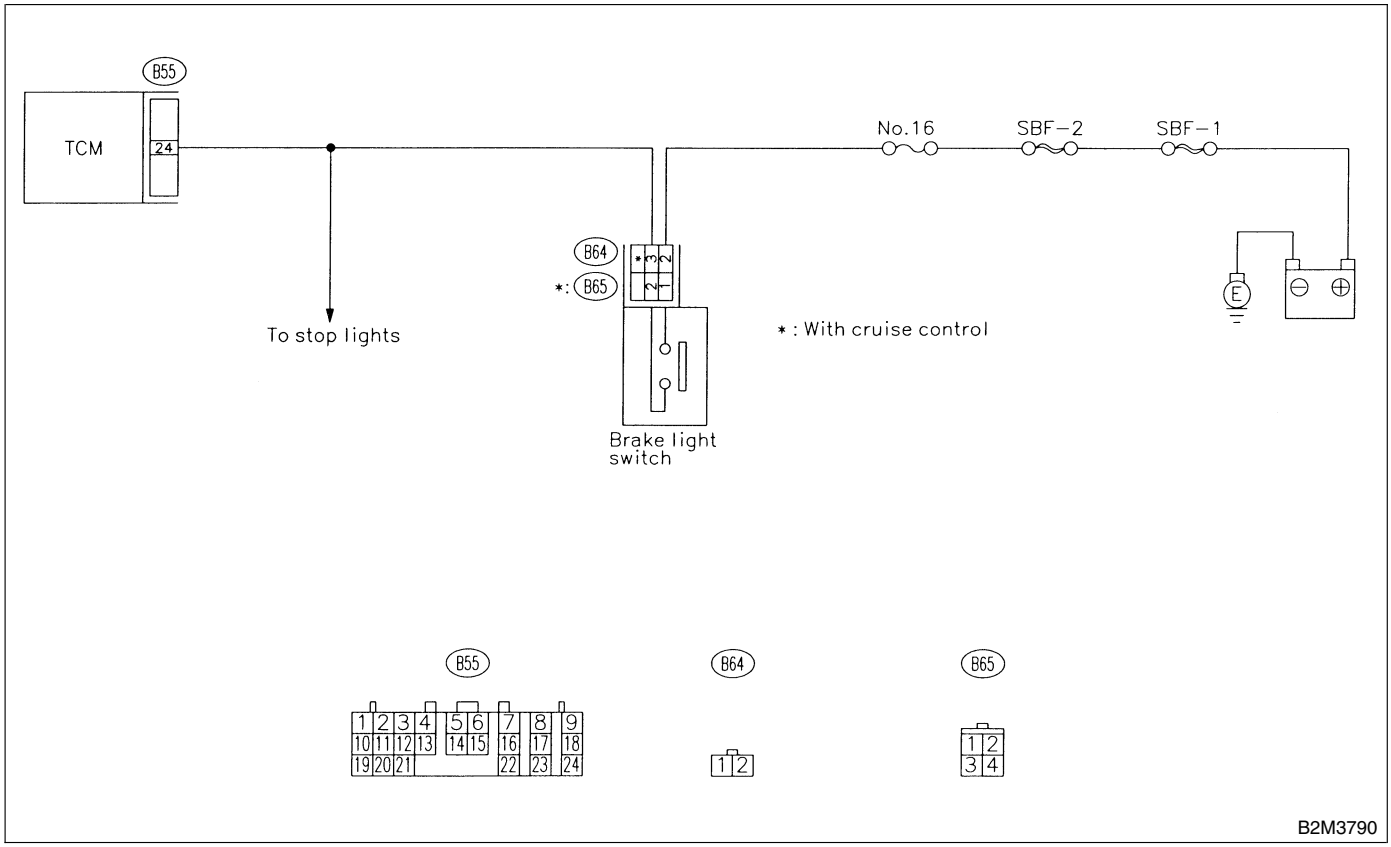
MEMO:

AW: DTC P0703 — BRAKE SWITCH INPUT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10AW1 : CHECK OPERATION OF BRAKE LIGHT.

CHECK : ***Does brake light come on when depressing the brake pedal?***

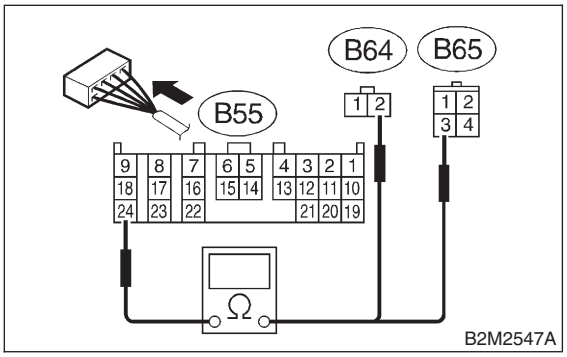
YES : Go to step **10AW2**.

NO : Repair or replace brake light circuit.

10AW2 : CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR.

1) Disconnect connectors from TCM and brake light switch.
2) Measure resistance of harness between TCM and brake light switch connector.

Connector & terminal
(B55) No. 24 — (B64) No. 2:
(B55) No. 24 — (B65) No. 3 (With cruise control):



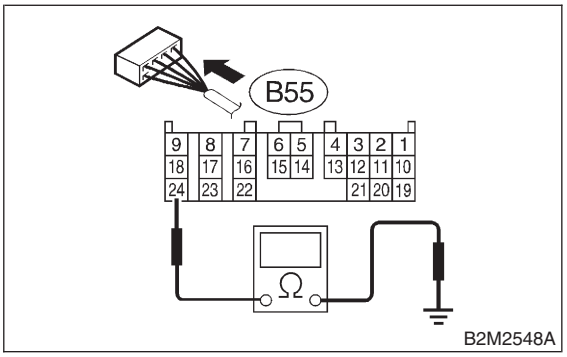
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10AW3**.
NO : Repair or replace harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between TCM and brake light switch connector
- Poor contact in TCM connector
- Poor contact in brake light switch connector

10AW3 : CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 24 — Chassis ground:

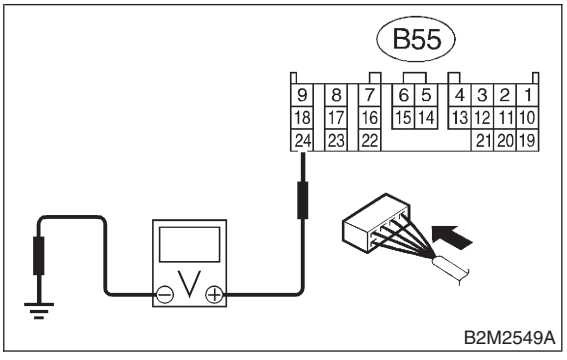


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AW4**.
NO : Repair ground short circuit in harness between TCM and brake light switch connector.

10AW4 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM and brake light switch.
2) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 24 (+) — Chassis ground (–):

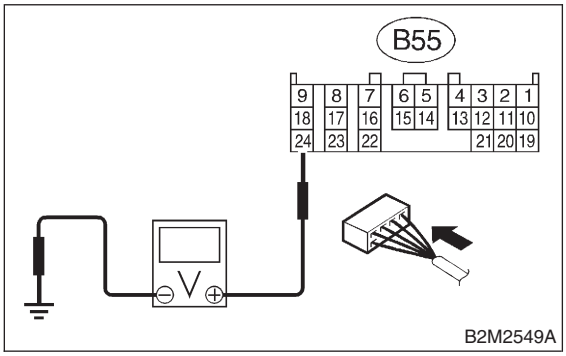


CHECK : ***Is the voltage less than 1 V when releasing the brake pedal?***
YES : Go to step **10AW5**.
NO : Adjust or replace brake light switch. <Ref. to 4-5 [W1A1].>

10AW5 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 24 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V when depressing the brake pedal?***
YES : Go to step **10AW6**.
NO : Adjust or replace brake light switch. <Ref. to 4-5 [W1A1].>

10AW6 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in TCM connector?***
YES : Repair poor contact in TCM connector.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

AX: DTC P0705 — TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Starter does not rotate when selector lever is in “P” or “N” range.
  - Starter rotates when selector lever is in “R”, “D”, “3”, “2” or “1” range.
  - Engine brake is not effected when selector lever is in “3” range.
  - Shift characteristics are erroneous.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

AY: DTC P0710 — TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No shift up to 4th speed (after engine warm-up)
  - No lock-up (after engine warm-up)
  - Excessive shift shock

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check ATF temperature sensor circuit. <Ref. to 3-2 [T8D0].>

AZ: DTC P0715 — TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check torque converter turbine speed sensor circuit. <Ref. to 3-2 [T8G0].>

BA: DTC P0720 — OUTPUT SPEED SENSOR (VEHICLE SPEED SENSOR 2) CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No shift or excessive tight corner “braking”

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check vehicle speed sensor 2 circuit. <Ref. to 3-2 [T8F0].>

BB: DTC P0725 — ENGINE SPEED INPUT CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No lock-up (after engine warm-up)
  - AT diagnostic indicator light (AT OIL TEMP indicator light) remains on when vehicle speed is “0”.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check engine speed input signal circuit. <Ref. to 3-2 [T8C0].>

BC: DTC P0731 — GEAR 1 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to 2-7 [T10BF0].>

BD: DTC P0732 — GEAR 2 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to 2-7 [T10BF0].>

BE: DTC P0733 — GEAR 3 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to 2-7 [T10BF0].>

BF: DTC P0734 — GEAR 4 INCORRECT RATIO —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Shift point too high or too low; engine brake not effected in "3" range; excessive shift shock; excessive tight corner "braking"

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

10BF1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***
YES : Inspect relevant DTC using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>
NO : Go to step **10BF2**.

10BF2 : CHECK THROTTLE POSITION SENSOR CIRCUIT.

Check throttle position sensor circuit. <Ref. to 3-2 [T8E0].>

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit.
NO : Go to step **10BF3**.

10BF3 : CHECK VEHICLE SPEED SENSOR 2 CIRCUIT.

Check vehicle speed sensor 2 circuit. <Ref. to 3-2 [T8F0].>

CHECK : ***Is there any trouble in vehicle speed sensor 2 circuit?***
YES : Repair or replace vehicle speed sensor 2 circuit.
NO : Go to step **10BF4**.

10BF4 : CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT.

Check torque converter turbine speed sensor circuit. <Ref. to 3-2 [T8G0].>

CHECK : ***Is there any trouble in torque converter turbine speed sensor circuit?***
YES : Repair or replace torque converter turbine speed sensor circuit.
NO : Go to step **10BF5**.

10BF5 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in TCM connector?***
YES : Repair poor contact in TCM connector.
NO : Go to step **10BF6**.

10BF6 : CHECK MECHANICAL TROUBLE.

Check mechanical trouble in automatic transmission.

CHECK : ***Is there any mechanical trouble in automatic transmission?***
YES : Repair or replace automatic transmission. <Ref. to 3-2 [W100].>
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

BG: DTC P0740 — TORQUE CONVERTER CLUTCH SYSTEM MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No lock-up (after engine warm-up)
  - No shift or excessive tight corner “braking”

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

10BG1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***
YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10BG2**.

10BG2 : CHECK DUTY SOLENOID B CIRCUIT.

Check duty solenoid B circuit. <Ref. to 3-2 [T8P0].>

CHECK : ***Is there any trouble in duty solenoid B circuit?***
YES : Repair or replace duty solenoid B circuit.
NO : Go to step **10BG3**.

10BG3 : CHECK THROTTLE POSITION SENSOR CIRCUIT.

Check throttle position sensor circuit. <Ref. to 3-2 [T8E0].>

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit.
NO : Go to step **10BG4**.

10BG4 : CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT.

Check torque converter turbine speed sensor circuit. <Ref. to 3-2 [T8G0].>

CHECK : ***Is there any trouble in torque converter turbine speed sensor circuit?***
YES : Repair or replace torque converter turbine speed sensor circuit.
NO : Go to step **10BG5**.

10BG5 : CHECK ENGINE SPEED INPUT CIRCUIT.

Check engine speed input circuit. <Ref. to 3-2 [T8C0].>

CHECK : ***Is there any trouble in engine speed input circuit?***
YES : Repair or replace engine speed input circuit.
NO : Go to step **10BG6**.

10BG6 : CHECK INHIBITOR SWITCH CIRCUIT.

Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

CHECK : ***Is there any trouble in inhibitor switch circuit?***
YES : Repair or replace inhibitor switch circuit.
NO : Go to step **10BG7**.

10BG7 : CHECK BRAKE LIGHT SWITCH CIRCUIT.

Check brake light switch circuit. <Ref. to 2-7 [T10AW0].>

CHECK : ***Is there any trouble in brake light switch circuit?***

YES : Repair or replace brake light switch circuit.

NO : Go to step **10BG8**.

10BG8 : CHECK ATF TEMPERATURE SENSOR CIRCUIT.

Check ATF temperature sensor circuit. <Ref. to 3-2 [T8D0].>

CHECK : ***Is there any trouble in ATF temperature sensor circuit?***

YES : Repair or replace ATF temperature sensor circuit.

NO : Go to step **10BG9**.

10BG9 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in TCM connector?***

YES : Repair poor contact in TCM connector.

NO : Go to step **10BG10**.

10BG10 : CHECK MECHANICAL TROUBLE.

Check mechanical trouble in automatic transmission.

CHECK : ***Is there any mechanical trouble in automatic transmission?***

YES : Repair or replace automatic transmission. <Ref. to 3-2 [W100].>

NO : Replace TCM. <Ref. to 3-2 [W23A0].>

BH: DTC P0743 — TORQUE CONVERTER CLUTCH SYSTEM (LOCK-UP DUTY SOLENOID) ELECTRICAL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No lock-up (after engine warm-up)

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check lock-up duty solenoid circuit. <Ref. to 3-2 [T8R0].>

BI: DTC P0748 — PRESSURE CONTROL SOLENOID (LINE PRESSURE DUTY SOLENOID) ELECTRICAL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Excessive shift shock

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check line pressure duty solenoid circuit. <Ref. to 3-2 [T8N0].>

BJ: DTC P0753 — SHIFT SOLENOID A (SHIFT SOLENOID 1) ELECTRICAL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No shift

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check shift solenoid 1 circuit. <Ref. to 3-2 [T8J0].>

BK: DTC P0758 — SHIFT SOLENOID B (SHIFT SOLENOID 2) ELECTRICAL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - No shift

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

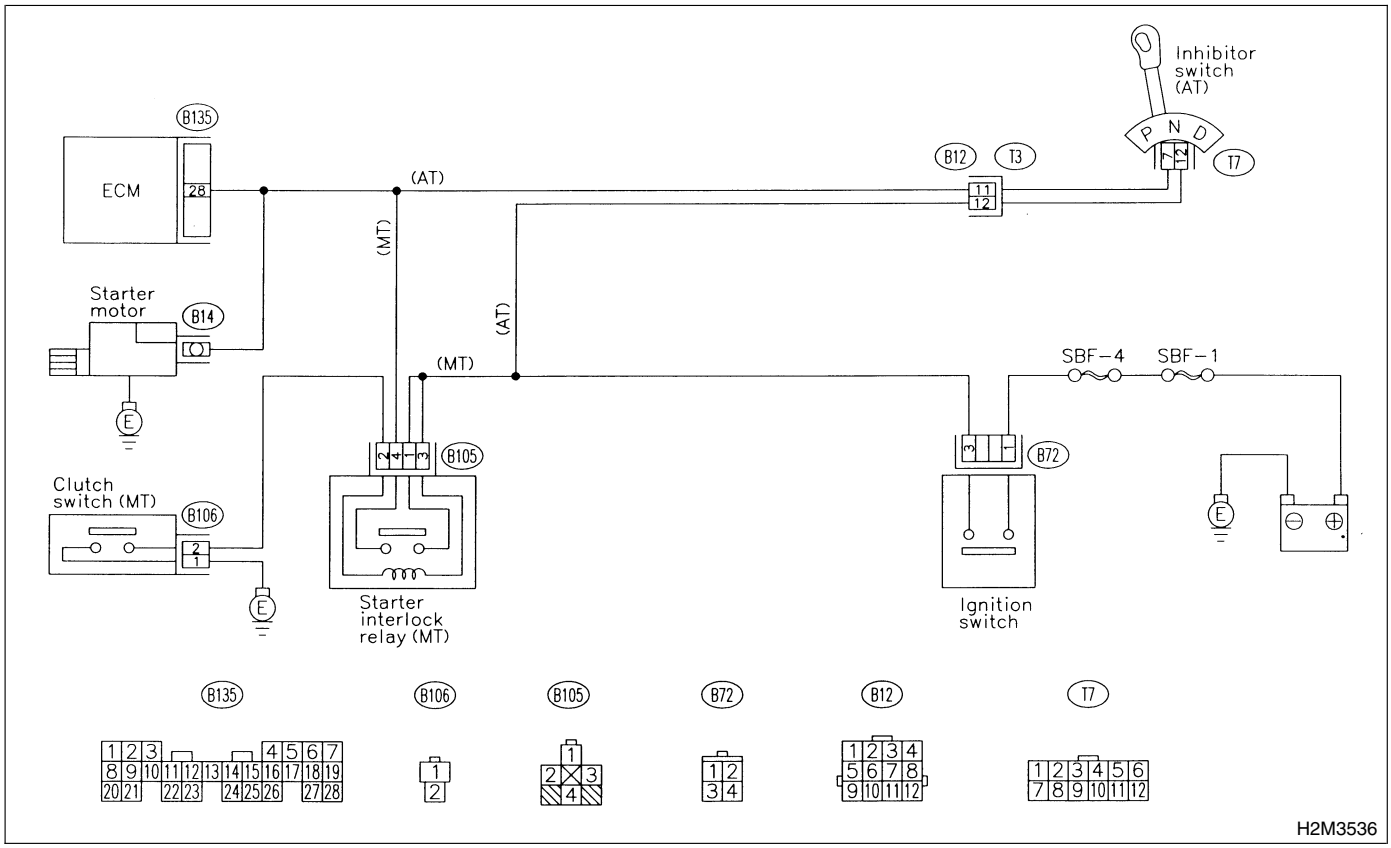
NOTE:
Check shift solenoid 2 circuit. <Ref. to 3-2 [T8K0].>

BL: DTC P1100 — STARTER SWITCH CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BL1 :	CHECK OPERATION OF STARTER MOTOR.

NOTE:
- On AT vehicles, place the inhibitor switch in the "P" or "N" position.
- On MT vehicles, depress the clutch pedal.

CHECK : ***Does starter motor operate when ignition switch to "ST"?***

YES : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open or ground short circuit in harness between ECM and starter motor connector.
- Poor contact in ECM connector.

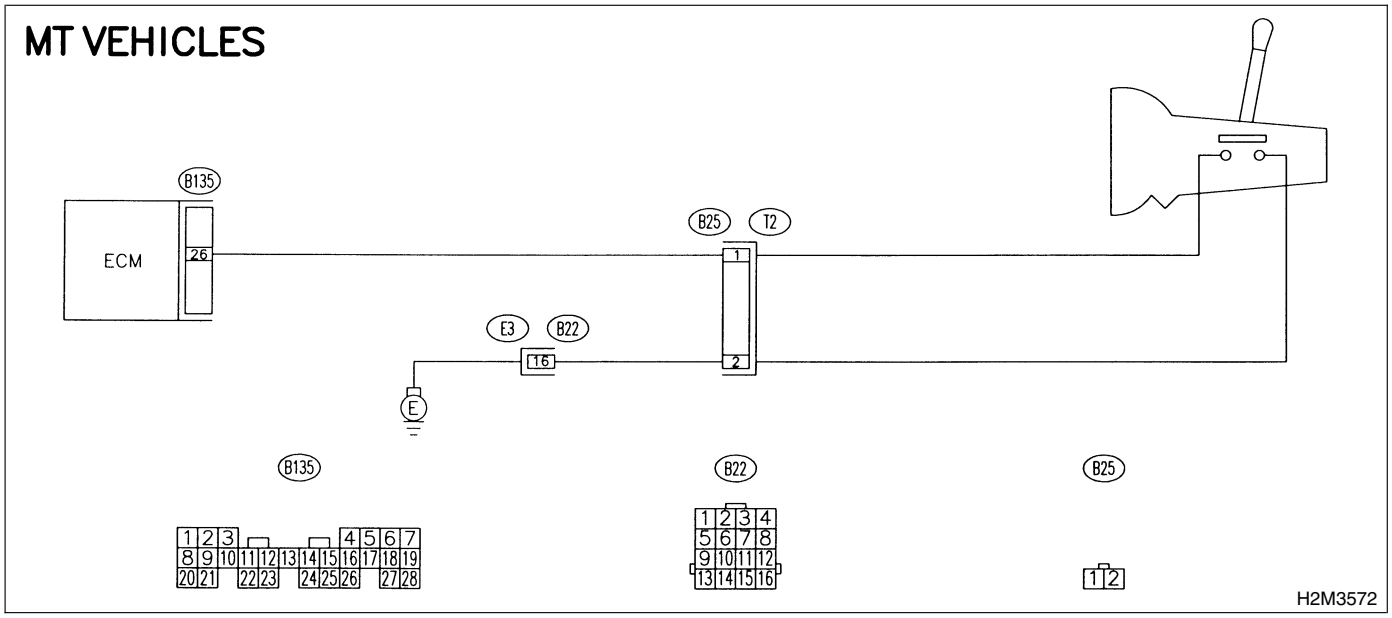
NO : Check starter motor circuit. <Ref. to 2-7 [T8B0].>

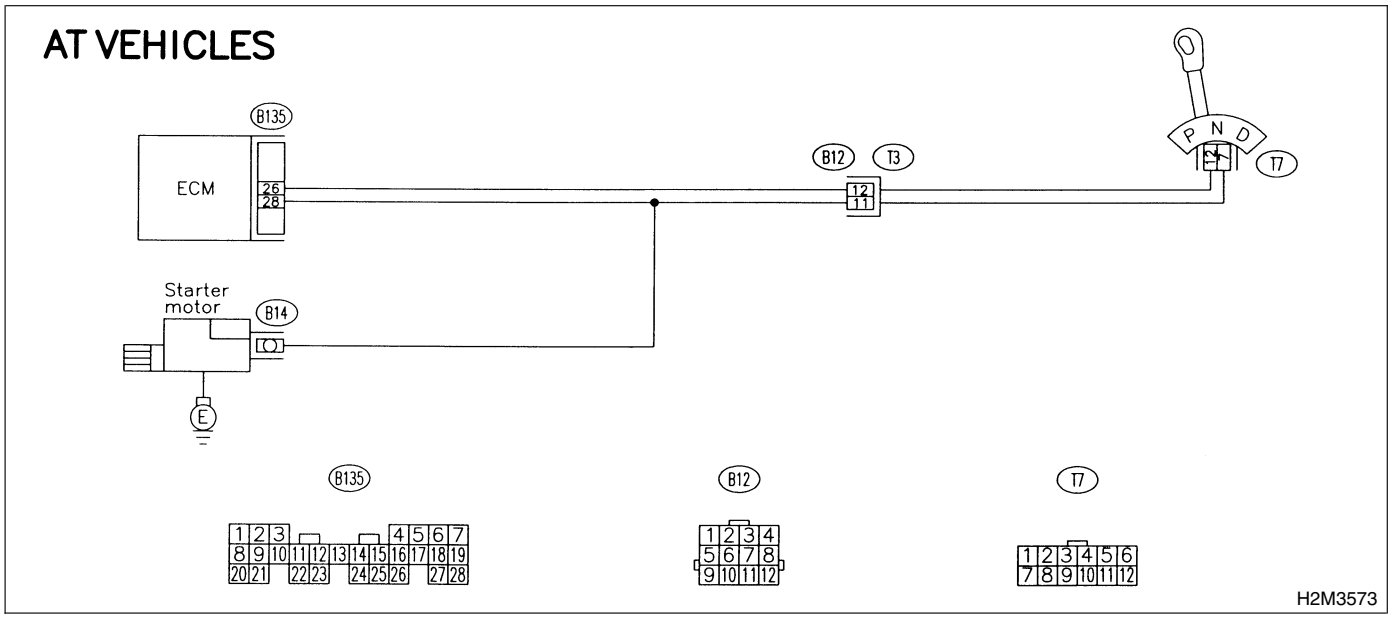
BM: DTC P1101 — NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT [MT VEHICLES] OR NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT [AT VEHICLES] —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**





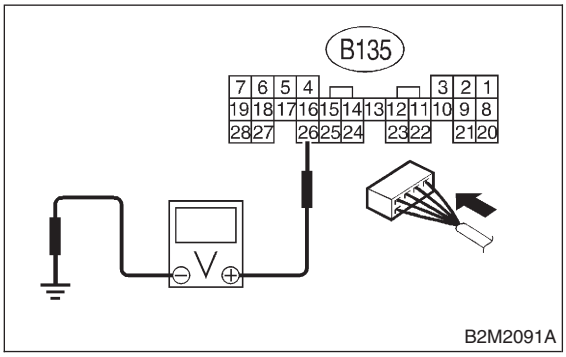
10BM1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type MT?***
YES : Go to step **10BM2**.
NO : Go to step **10BM8**.

10BM2 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):

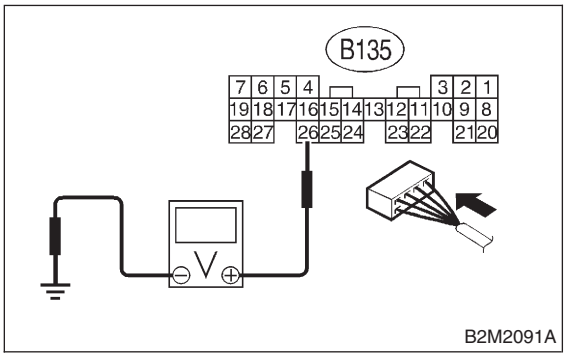


CHECK : ***Is the voltage more than 10 V in neutral position?***
YES : Go to step **10BM3**.
NO : Go to step **10BM5**.

10BM3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V in other positions?***
YES : Go to step **10BM4**.
NO : Go to step **10BM5**.

10BM4 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

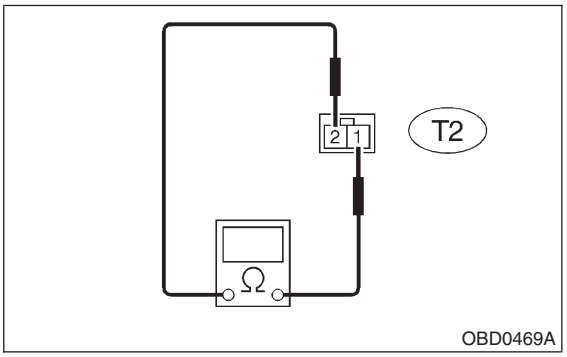
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10BM5 : CHECK NEUTRAL POSITION SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission harness.
3) Measure resistance between transmission harness and connector terminals.

Connector & terminal
(T2) No. 1 — No. 2:

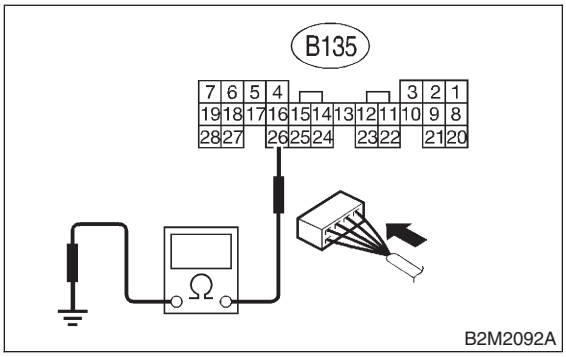


CHECK : ***Is the resistance more than 1 MΩ in neutral position?***
YES : Go to step **10BM6**.
NO : Repair short circuit in transmission harness or replace neutral position switch.

10BM6 : CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.

Measure resistance between ECM and chassis ground.

Connector & terminal
(B135) No. 26 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and transmission harness connector.
NO : Go to step **10BM7**.

10BM7 : CHECK POOR CONTACT.

Check poor contact in transmission harness connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in transmission harness connector?***
YES : Repair poor contact in transmission harness connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

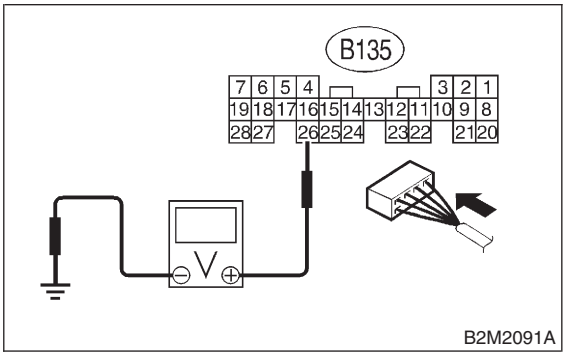
10BM8 : CHECK DTC P0705 ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0705?***
YES : Inspect DTC P0705 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10BM9**.

10BM9 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground in selector lever “N” and “P” positions.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):

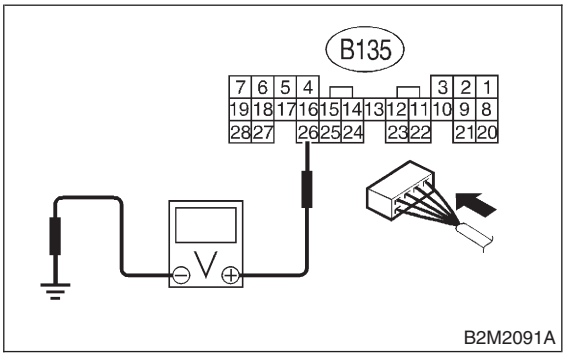


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10BM10**.
NO : Go to step **10BM12**.

10BM10 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground in selector lever except for “N” and “P” positions.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 4.5 and 5.5 V?***
YES : Go to step **10BM11**.
NO : Go to step **10BM12**.

10BM11 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***

YES : Repair poor contact in ECM connector.

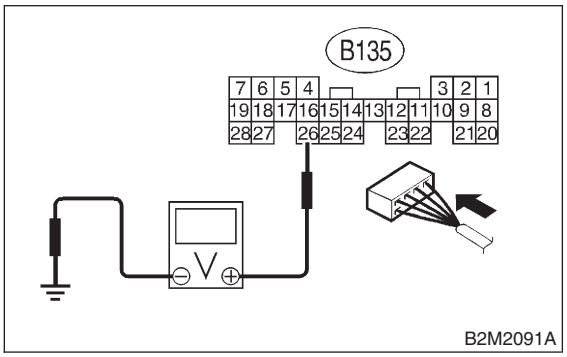
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10BM12 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***

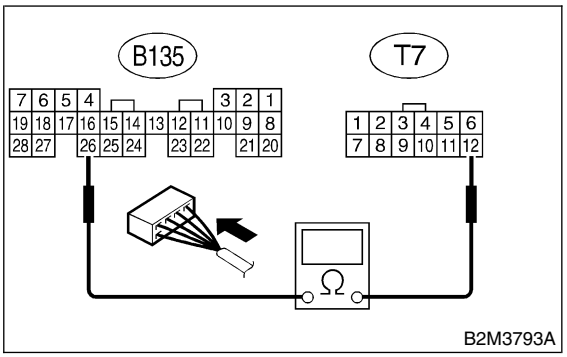
YES : Repair battery short circuit in harness between ECM and inhibitor switch connector.

NO : Go to step **10BM13**.

10BM13 : CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and inhibitor switch.
3) Measure resistance of harness between ECM and inhibitor switch connector.

Connector & terminal
(B135) No. 26 — (T7) No. 12:



CHECK : ***Is the resistance less than 1 Ω?***

YES : Go to step **10BM14**.

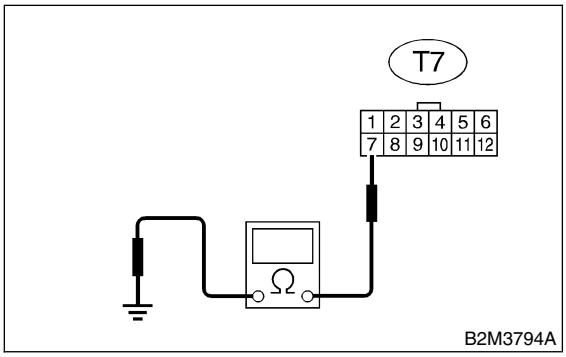
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and inhibitor switch connector
- Poor contact in coupling connector (B12)
- Poor contact in inhibitor switch connector
- Poor contact in ECM connector

10BM14 : CHECK INHIBITOR SWITCH GROUND LINE.

Measure resistance of harness between inhibitor switch connector and engine ground.

Connector & terminal
(T7) No. 7 — Engine ground:



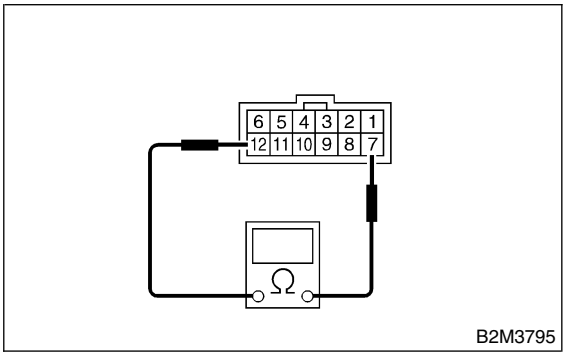
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10BM15**.
NO : Repair open circuit in harness between inhibitor switch connector and starter motor ground line.

NOTE:
In this case, repair the following:
- Open circuit in harness between inhibitor switch connector and starter motor ground line
- Poor contact in starter motor connector
- Poor contact in starter motor ground
- Starter motor

10BM15 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals in selector lever "N" and "P" positions.

Terminals
No. 7 — No. 12:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BM16**.
NO : Replace inhibitor switch. <Ref. to 3-2 [W2C0].>

10BM16 : CHECK SELECTOR CABLE CONNECTION.

CHECK : ***Is there any fault in selector cable connection to inhibitor switch?***
YES : Repair selector cable connection. <Ref. to 3-2 [W2A0].>
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

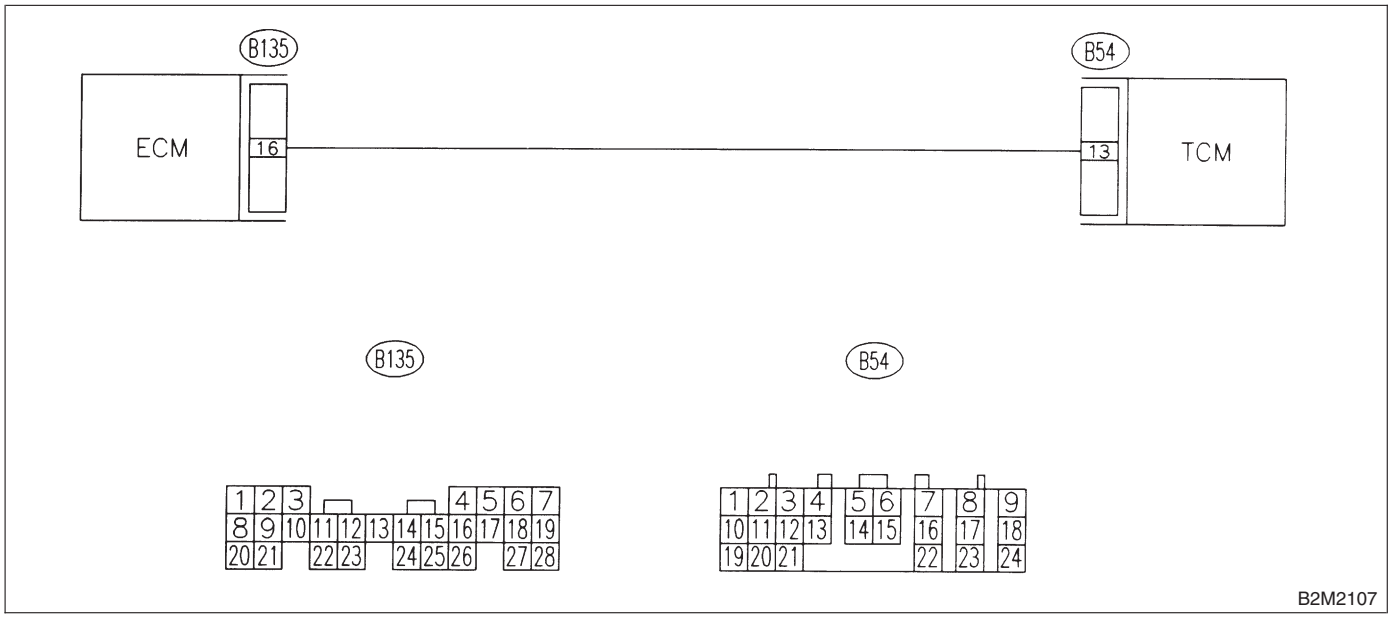
MEMO:

BN: DTC P1103 — ENGINE TORQUE CONTROL SIGNAL 1 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Excessive shift shock

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

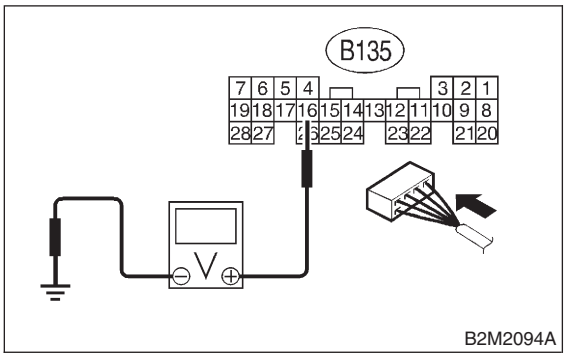
- **WIRING DIAGRAM:**



10BN1 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 16 (+) — Chassis ground (–):

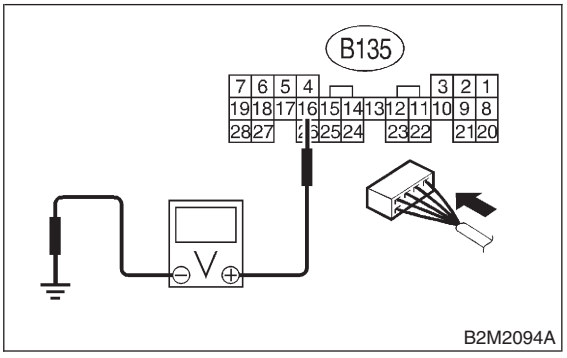


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BN2**.
NO : Go to step **10BN4**.

10BN2 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 16 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and TCM connector.
NO : Go to step **10BN3**.

10BN3 : CHECK POOR CONTACT.

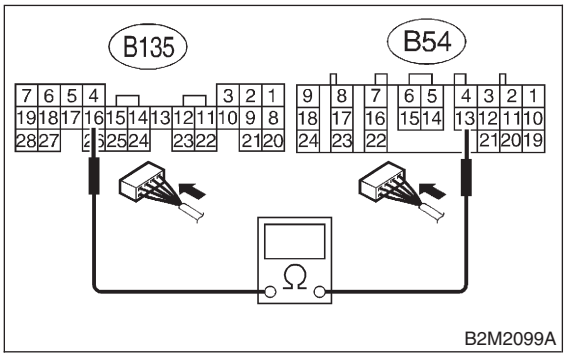
Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10BN4 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and TCM.
3) Measure resistance of harness between ECM and TCM connector.

Connector & terminal
(B135) No. 16 — (B54) No. 13:

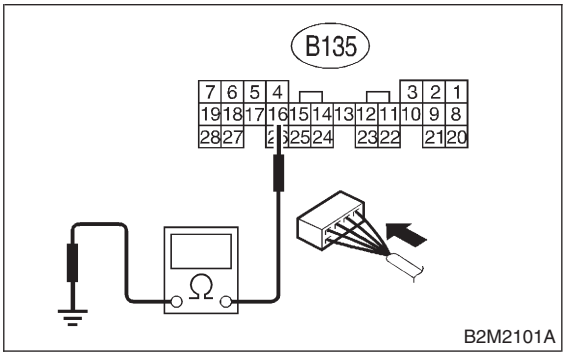


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BN5**.
NO : Repair open circuit in harness between ECM and TCM connector.

10BN5 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B135) No. 16 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and TCM connector.
NO : Go to step **10BN6**.

10BN6 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

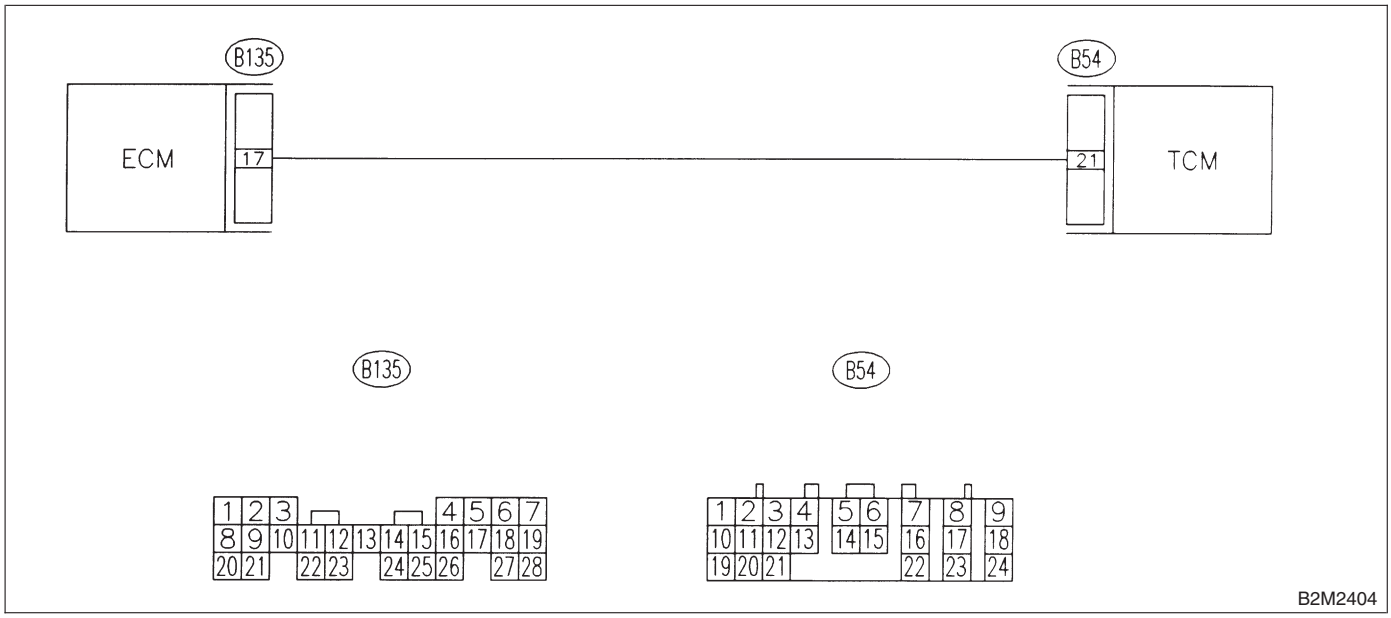
CHECK : ***Is there poor contact in TCM connector?***
YES : Repair poor contact in TCM connector.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

BO: DTC P1106 — ENGINE TORQUE CONTROL SIGNAL 2 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Excessive shift shock

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

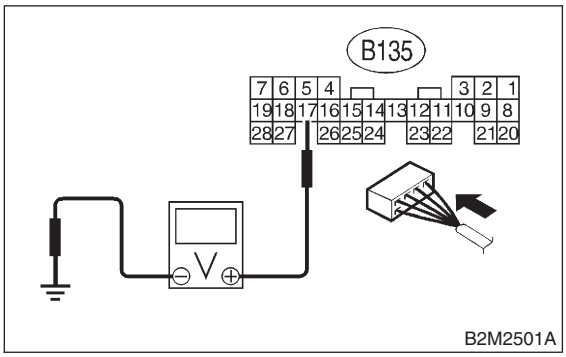
- **WIRING DIAGRAM:**



10BO1 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 17 (+) — Chassis ground (–):

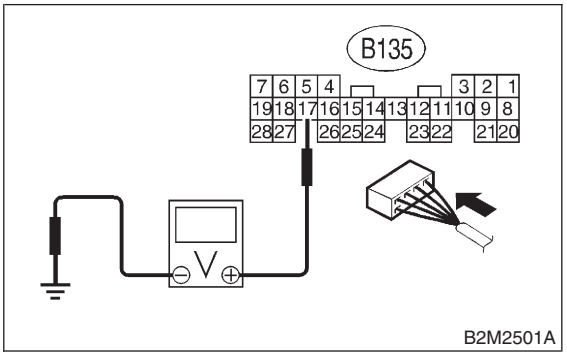


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BO2**.
NO : Go to step **10BO4**.

10BO2 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 17 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and TCM connector.
NO : Go to step **10BO3**.

10BO3 : CHECK POOR CONTACT.

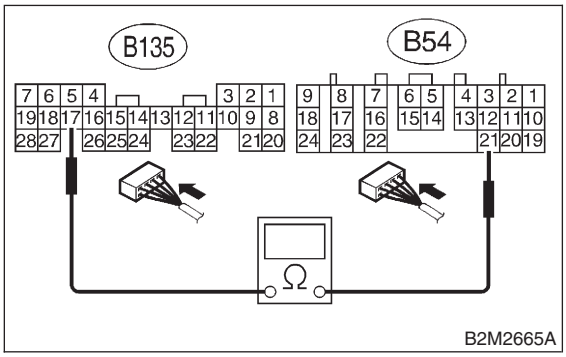
Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10BO4 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and TCM.
3) Measure resistance of harness between ECM and TCM connector.

Connector & terminal
(B135) No. 17 — (B54) No. 21:

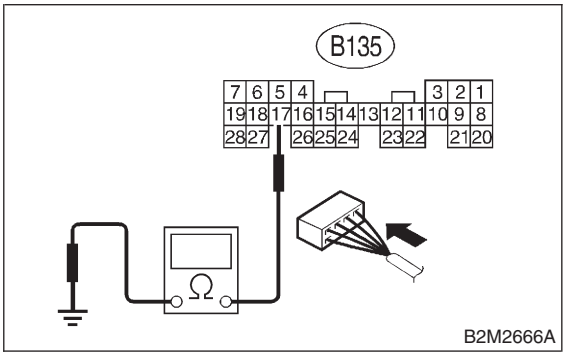


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BO5**.
NO : Repair open circuit in harness between ECM and TCM connector.

10BO5 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B135) No. 17 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and TCM connector.
NO : Go to step **10BO6**.

10BO6 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

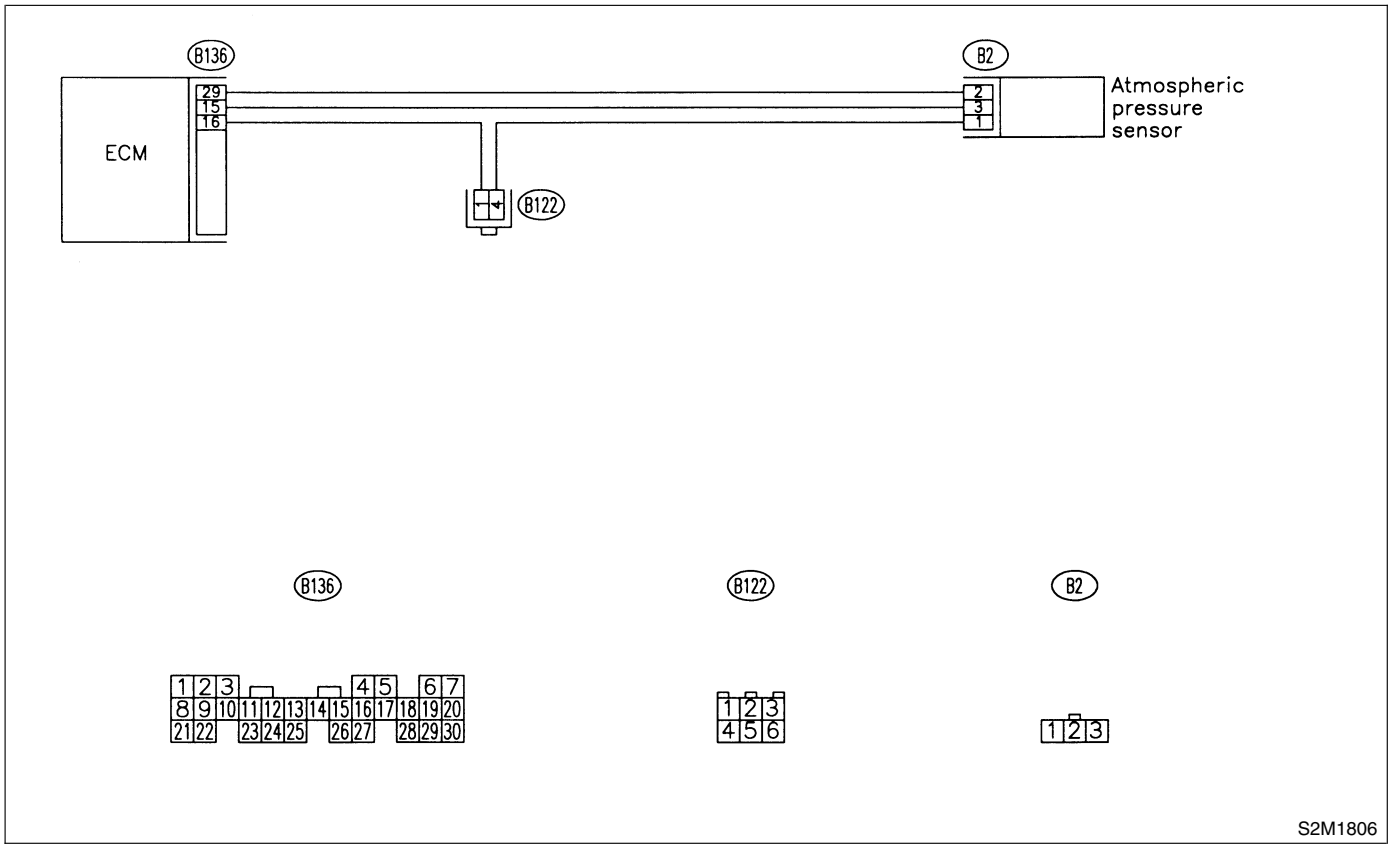
CHECK : ***Is there poor contact in TCM connector?***
YES : Repair poor contact in TCM connector.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

BP: DTC P1110 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BP1 : CHECK CURRENT DATA.

1) Start engine.
2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value less than 0 kPa (0 mmHg, 0 inHg)?***
YES : Go to step **10BP3**.
NO : Go to step **10BP2**.

10BP2 : CHECK POOR CONTACT.

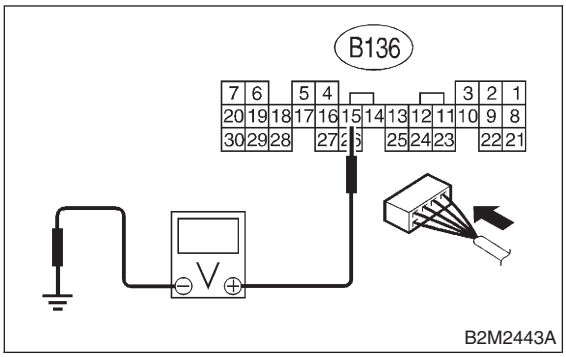
Check poor contact in ECM and pressure sensor connector. <Ref. to 2-7 [T3C8].>

CHECK : ***Is there poor contact in ECM or pressure sensor connector?***
YES : Repair poor contact in ECM or atmospheric pressure sensor connector.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time.

10BP3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

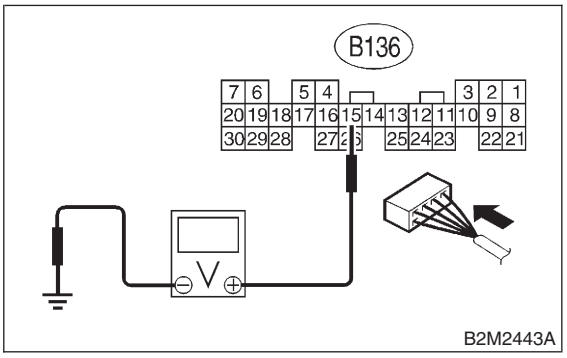


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BP5**.
NO : Go to step **10BP4**.

10BP4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



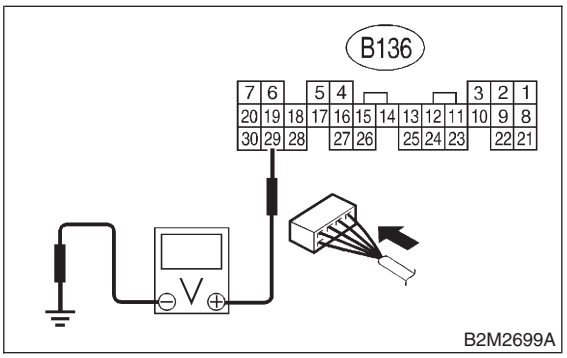
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10BP5 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 29 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10BP7**.
NO : Go to step **10BP6**.

10BP6 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of atmospheric absolute pressure signal using Subaru Select Monitor.

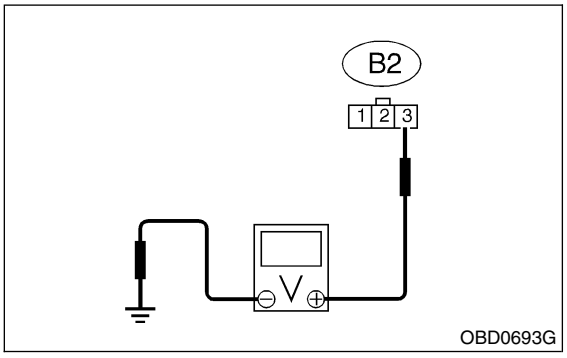
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than 0 kPa (0 mmHg, 0 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru select monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10BP7**.

10BP7 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from atmospheric pressure sensor.
3) Turn ignition switch to ON.
4) Measure voltage between atmospheric pressure sensor connector and engine ground.

Connector & terminal
(B2) No. 3 (+) — Engine ground (–):



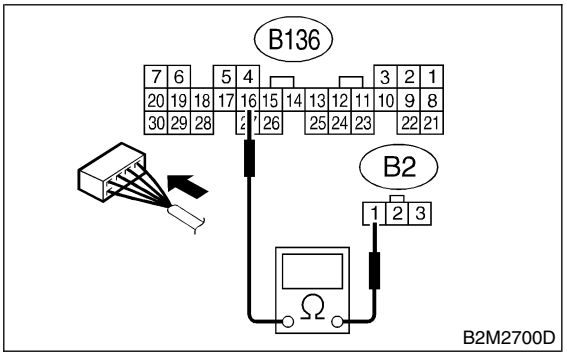
CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BP8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and atmospheric pressure sensor connector
● Poor contact in joint connector (B122)

10BP8 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and pressure sensor connector.

Connector & terminal
(B136) No. 16 — (B2) No. 1:



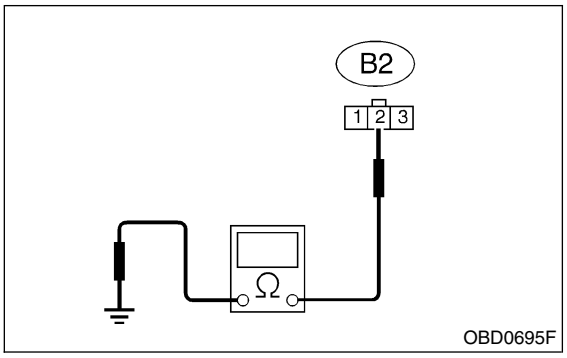
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BP9**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and pressure sensor connector

10BP9 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

Measure resistance of harness between pressure sensor connector and engine ground.

Connector & terminal
(B2) No. 2 — Engine ground:



CHECK : ***Is the resistance more than 500 kΩ?***
YES : Go to step **10BP10**.
NO : Repair ground short circuit in harness between ECM and pressure sensor connector.

10BP10 : CHECK POOR CONTACT.

Check poor contact in pressure sensor connector. <Ref. to FOREWORD [T3C1].>

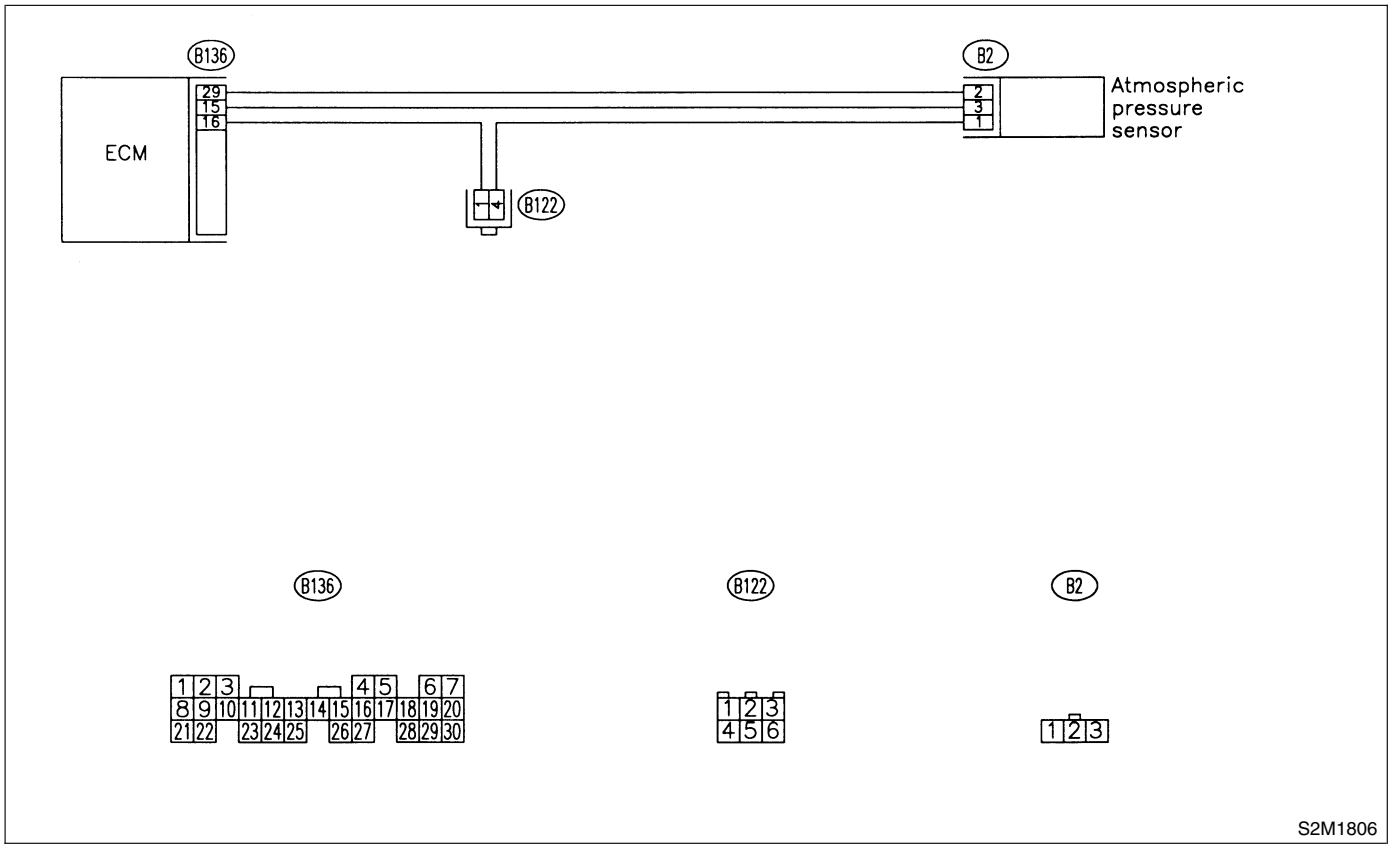
CHECK : ***Is there poor contact in pressure sensor connector?***
YES : Repair poor contact in atmospheric pressure sensor connector.
NO : Replace atmospheric pressure sensor. <Ref. to 2-7 [W12A0].>

BQ: DTC P1111 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BQ1 : CHECK CURRENT DATA.

1) Start engine.
2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

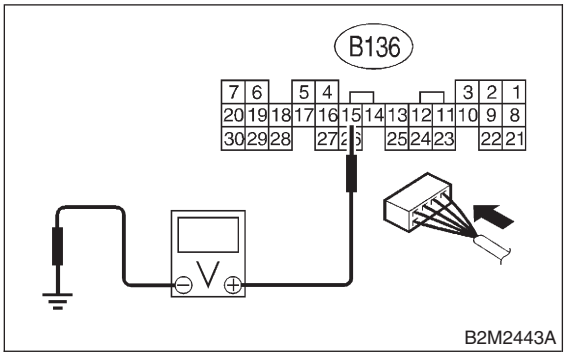
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 140 kPa (1,050 mmHg, 41.34 inHg)?***
YES : Go to step **10BQ10**.
NO : Go to step **10BQ2**.

10BQ2 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):

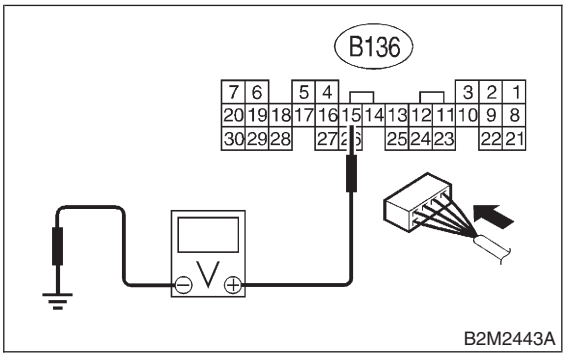


CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BQ4**.
NO : Go to step **10BQ3**.

10BQ3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 15 (+) — Chassis ground (–):



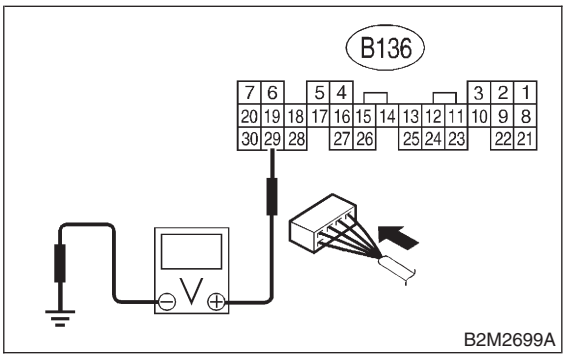
CHECK : ***Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10BQ4 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B136) No. 29 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 0.2 V?***
YES : Go to step **10BQ6**.
NO : Go to step **10BQ5**.

10BQ5 : CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)

Read data of atmospheric absolute pressure signal using Subaru Select Monitor.

NOTE:
- Subaru Select Monitor

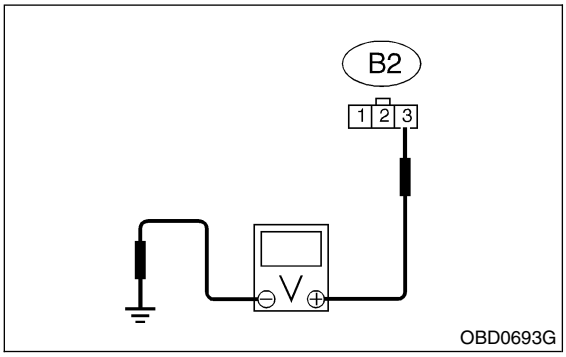
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>

CHECK : ***Does the value change more than 0 kPa (0 mmHg, 0 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru select monitor?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10BQ6**.

10BQ6 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from atmospheric pressure sensor.
3) Turn ignition switch to ON.
4) Measure voltage between atmospheric pressure sensor connector and engine ground.

Connector & terminal
(B2) No. 3 (+) — Engine ground (–):



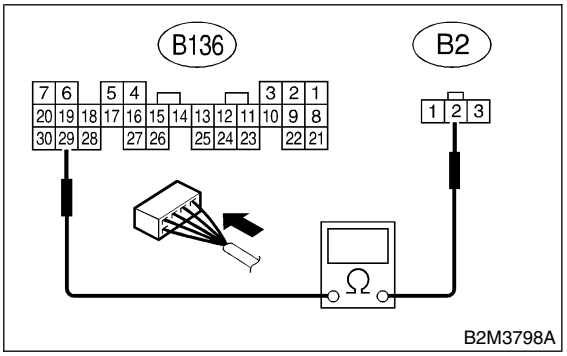
CHECK : ***Is the voltage more than 4.5 V?***
YES : Go to step **10BQ7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and atmospheric pressure sensor connector
- Poor contact in joint connector (B122)

10BQ7 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and atmospheric pressure sensor connector.

Connector & terminal
(B136) No. 29 — (B2) No. 2:



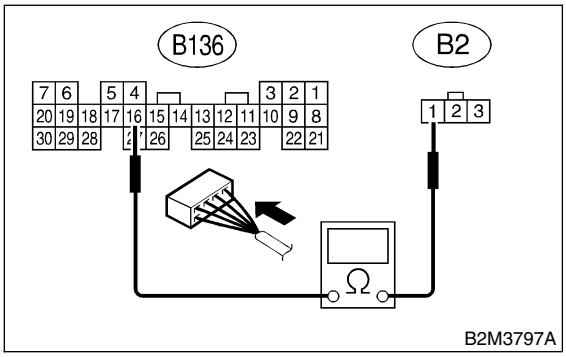
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BQ8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and pressure sensor connector
- Poor contact in joint connector (B122)

10BQ8 : CHECK HARNESS BETWEEN ECM AND ATMOSPHERIC PRESSURE SENSOR CONNECTOR.

Measure resistance of harness between ECM and pressure sensor connector.

Connector & terminal
(B136) No. 16 — (B2) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BQ9**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and atmospheric pressure sensor connector
- Poor contact in joint connector (B122)

10BQ9 : CHECK POOR CONTACT.

Check poor contact in pressure sensor connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in pressure sensor connector?***
YES : Repair poor contact in atmospheric pressure sensor connector.
NO : Replace atmospheric pressure sensor. <Ref. to 2-7 [W12A0].>

10BQ10 : CHECK CURRENT DATA.

1) Turn ignition switch to OFF.
2) Disconnect connector from atmospheric pressure sensor.
3) Turn ignition switch to ON.
4) Read data of intake manifold absolute pressure signal using Subaru select monitor or OBD-II general scan tool.

NOTE:
- Subaru Select Monitor

For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
- OBD-II general scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

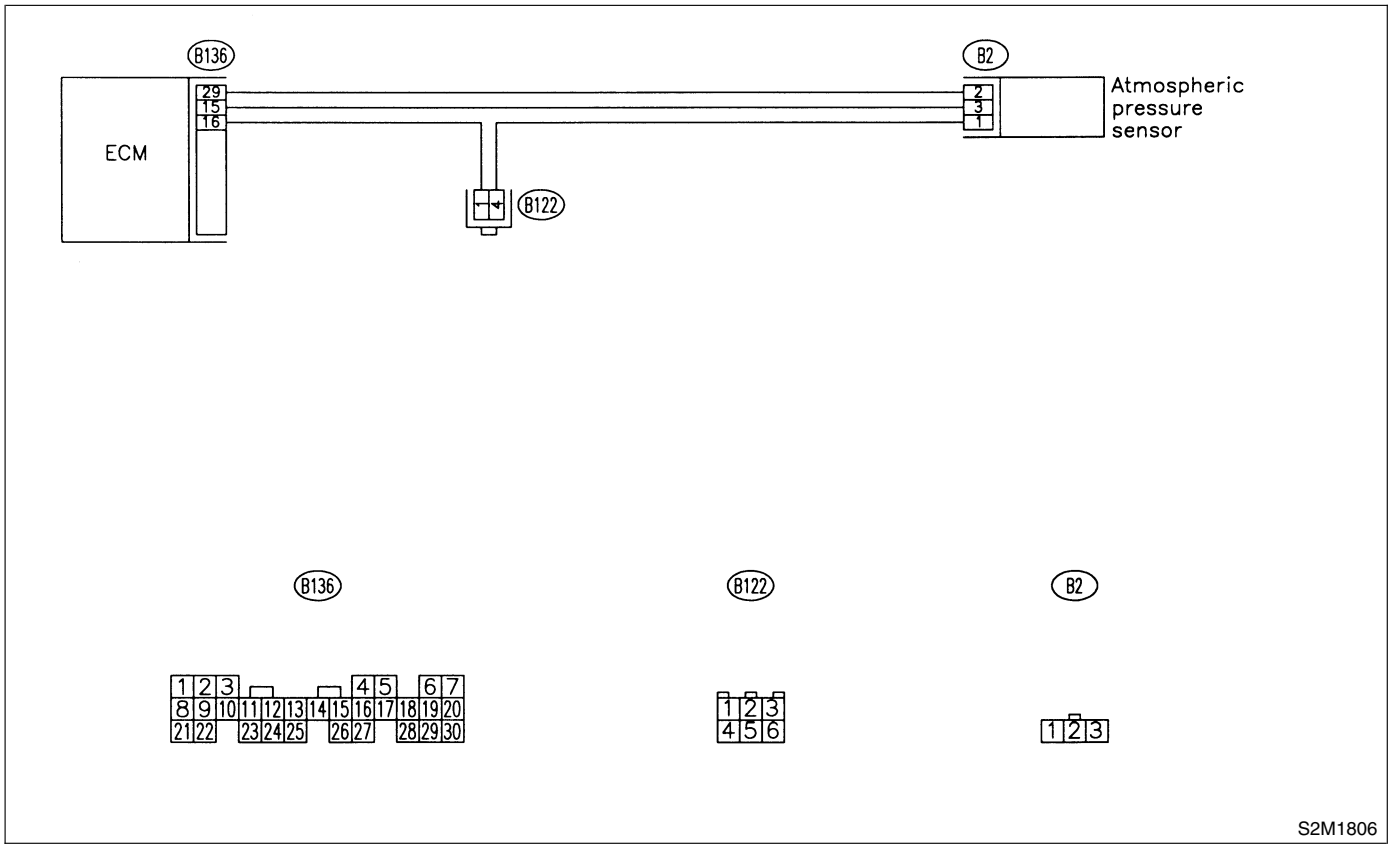
CHECK : ***Is the value more than 140 kPa (1,050 mmHg, 41.34 inHg)?***
YES : Repair battery short circuit in harness between ECM and atmospheric pressure sensor connector.
NO : Replace atmospheric pressure sensor. <Ref. to 2-7 [W12A0].>

BR: DTC P1112 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/ PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BR1 : CHECK ANY OTHER DTC ON DISPLAY.

NOTE:
In this case, it is not necessary to inspect DTC P0106.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0106, P0107, P0108, P1110 or P1111?***

YES : Inspect DTC P0106, P0107, P0108, P1110 or P1111 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NO : Go to step **10BR2**.

10BR2 : CHECK ATMOSPHERIC PRESSURE SENSOR FILTER.

1) Turn ignition switch to OFF.
2) Disconnect connector from atmospheric pressure sensor.
3) Remove atmospheric pressure sensor.
4) Check atmospheric pressure sensor filter.

CHECK : ***Is atmospheric pressure sensor filter non-functional? (Check for contamination, damage, water leakage, etc.)***

YES : Replace atmospheric pressure sensor filter.

NO : Go to step **10BR3**.

10BR3 : CHECK CURRENT DATA.

1) Turn ignition switch to ON.
2) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value between 73.3 kPa (550 mmHg, 21.65 inHg) and 106.6 kPa (800 mmHg, 31.50 inHg)?***

YES : Replace atmospheric pressure sensor. <Ref. to 2-7 [W12A0].>

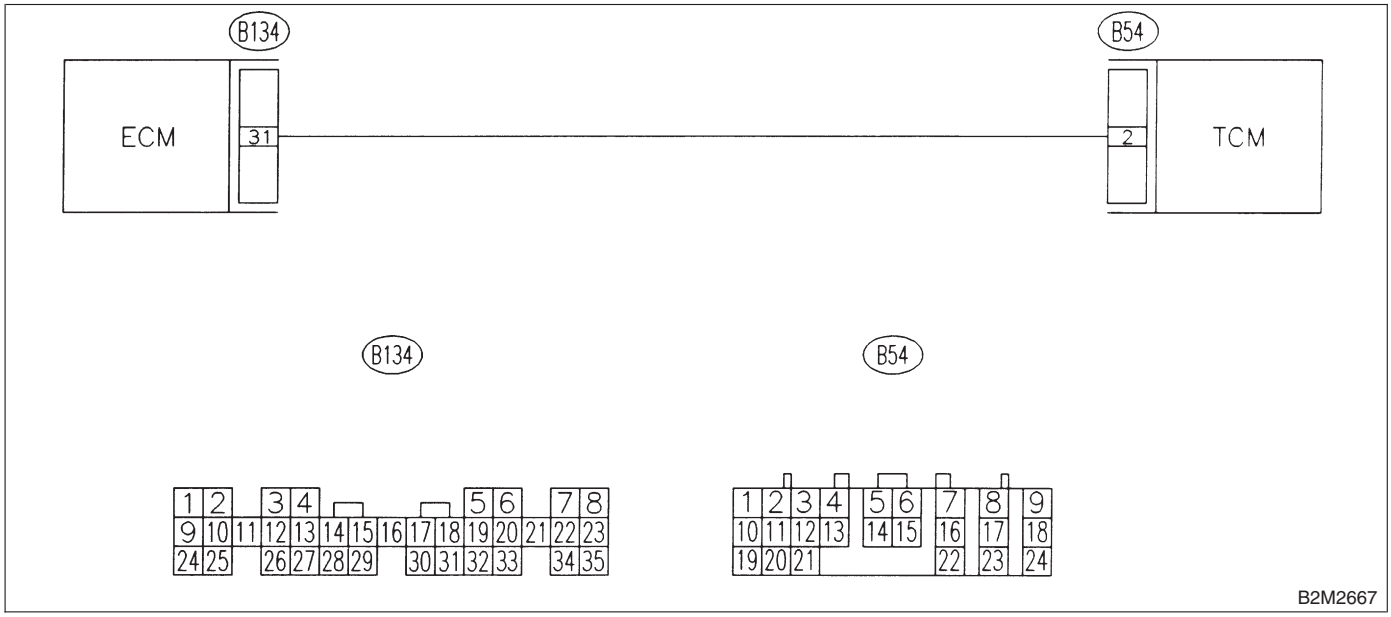
NO : Replace intake air temperature and pressure. <Ref. to 2-7 [W11A0].>

BS: DTC P1115 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

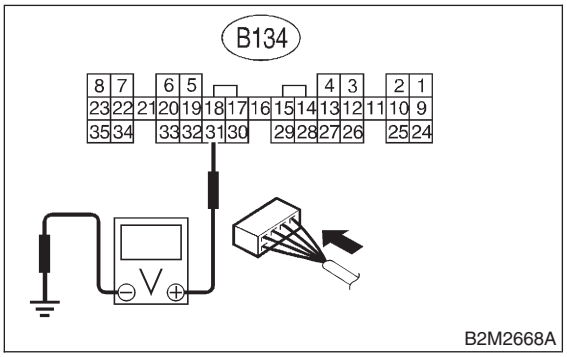
- **WIRING DIAGRAM:**



10BS1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Start engine, and warm-up the engine.
2) Turn ignition switch to OFF.
3) Disconnect connector from TCM.
4) Turn ignition switch to ON.
5) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 31 (+) — Chassis ground (–):

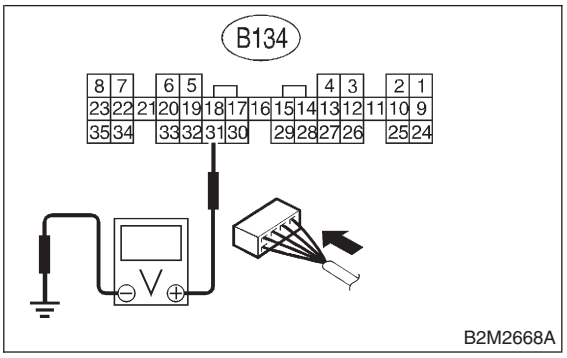


CHECK : ***Is the voltage less than 3 V?***
YES : Go to step **10BS2**.
NO : Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>

10BS2 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 31 (+) — Chassis ground (–):



CHECK : ***Does the voltage change more than 10 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Contact with SOA service.

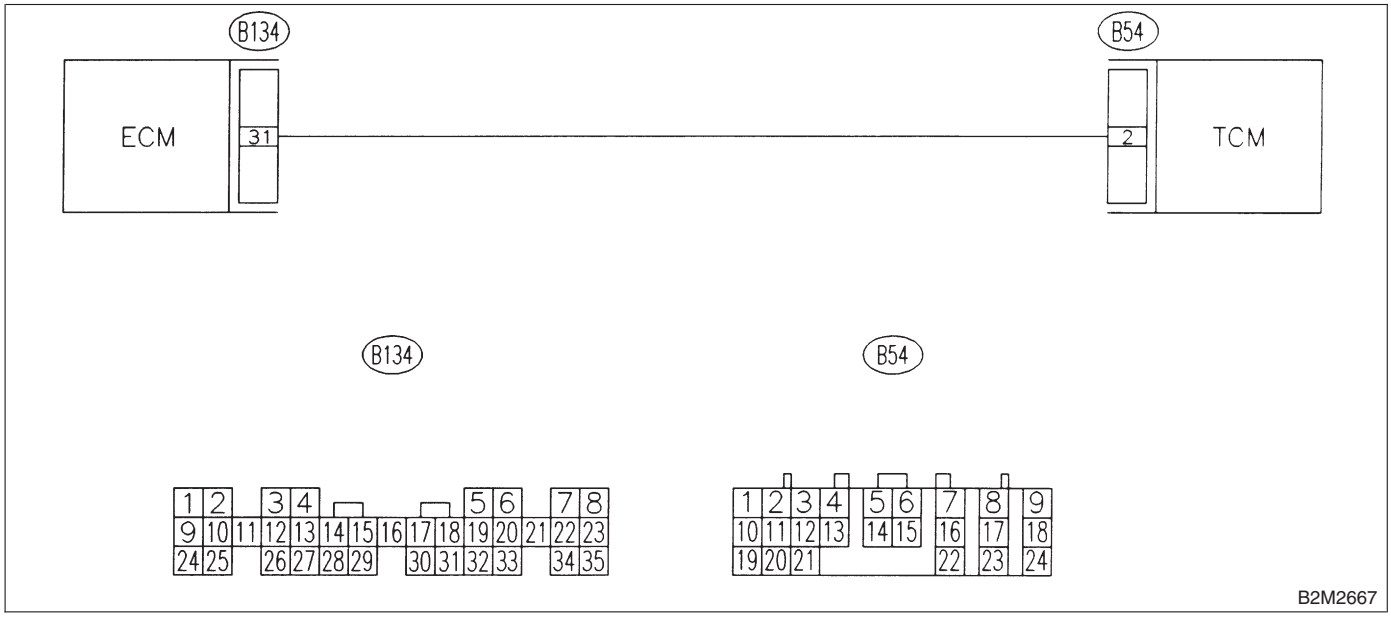
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BT: DTC P1116 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

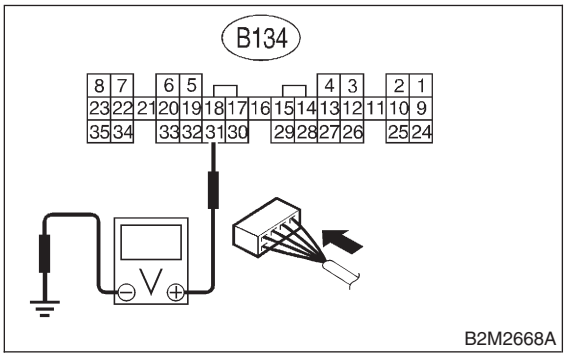
- **WIRING DIAGRAM:**



10BT1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Start engine, and warm-up the engine.
2) Turn ignition switch to OFF.
3) Turn ignition switch to ON.
4) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 31 (+) — Chassis ground (–):

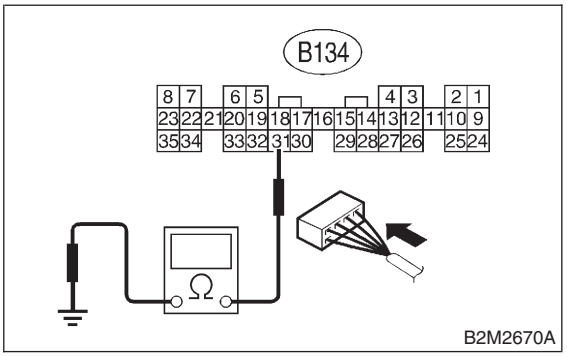


CHECK : ***Is the voltage more than 3 V?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10BT2**.

10BT2 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and TCM.
3) Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B134) No. 31 — Chassis ground:

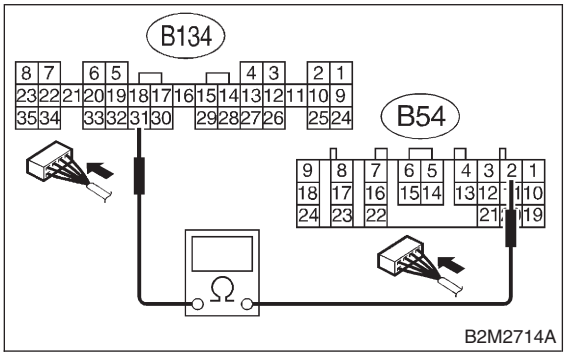


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and TCM connector.
NO : Go to step **10BT3**.

10BT3 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure resistance of harness between ECM and TCM connector.

Connector & terminal
(B134) No. 31 — (B54) No. 2:



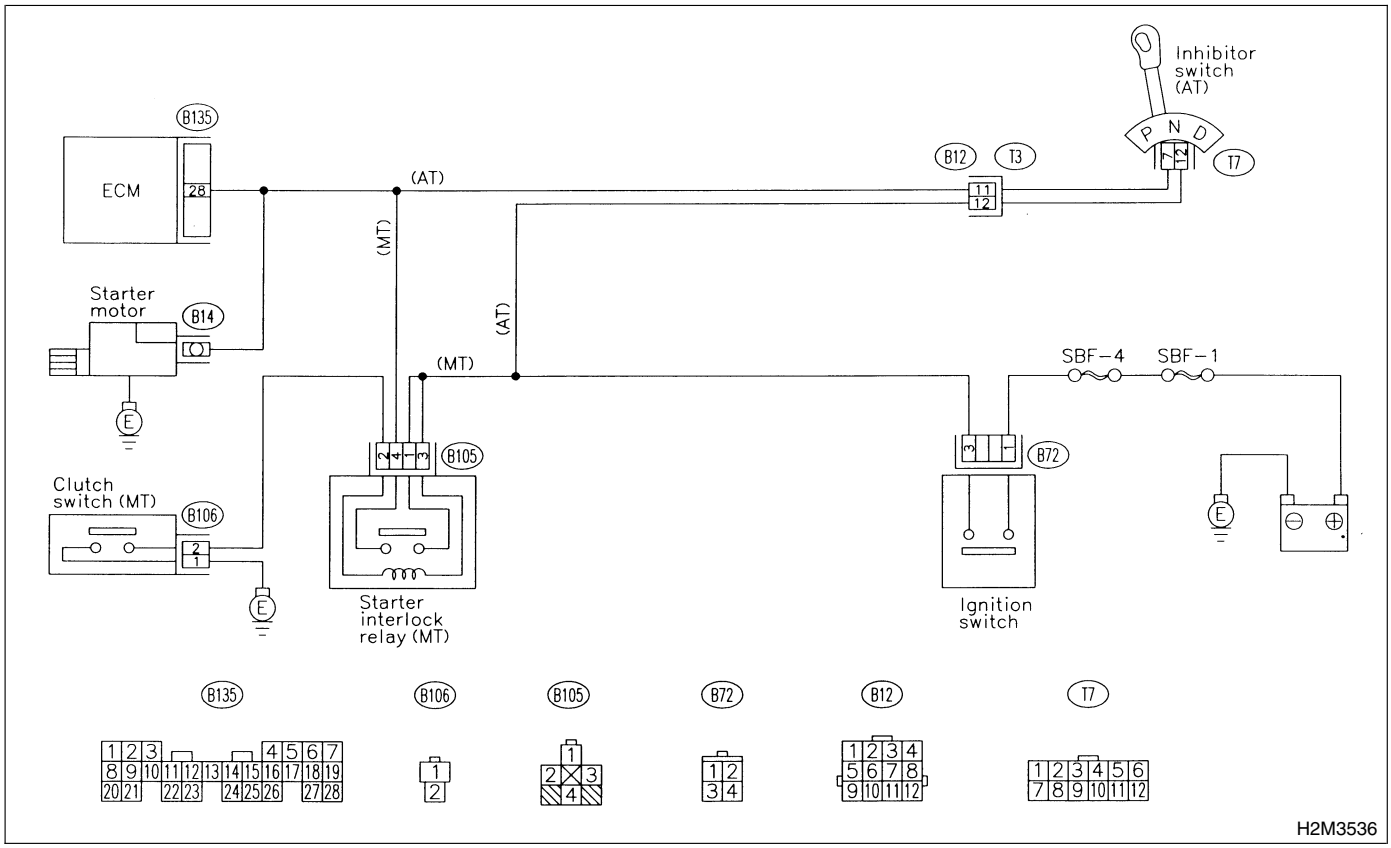
CHECK : ***Is the resistance less than 1 Ω?***
YES : Repair poor contact in ECM or TCM connector.
NO : Repair open circuit in harness between ECM and TCM connector.

BU: DTC P1120 — STARTER SWITCH CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Failure of engine to start

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BU1 : CHECK OPERATION OF STARTER MOTOR.

NOTE:
- ON AT vehicles, place the inhibitor switch in each position.
- On MT vehicles, depress or release the clutch pedal.

CHECK : ***Does starter motor operate when ignition switch to "ON"?***

YES : Repair battery short circuit in starter motor circuit. After repair, replace ECM. <Ref. to 2-7 [W17A0].>

NO : Check starter motor circuit. <Ref. to 2-7 [T8B0].>

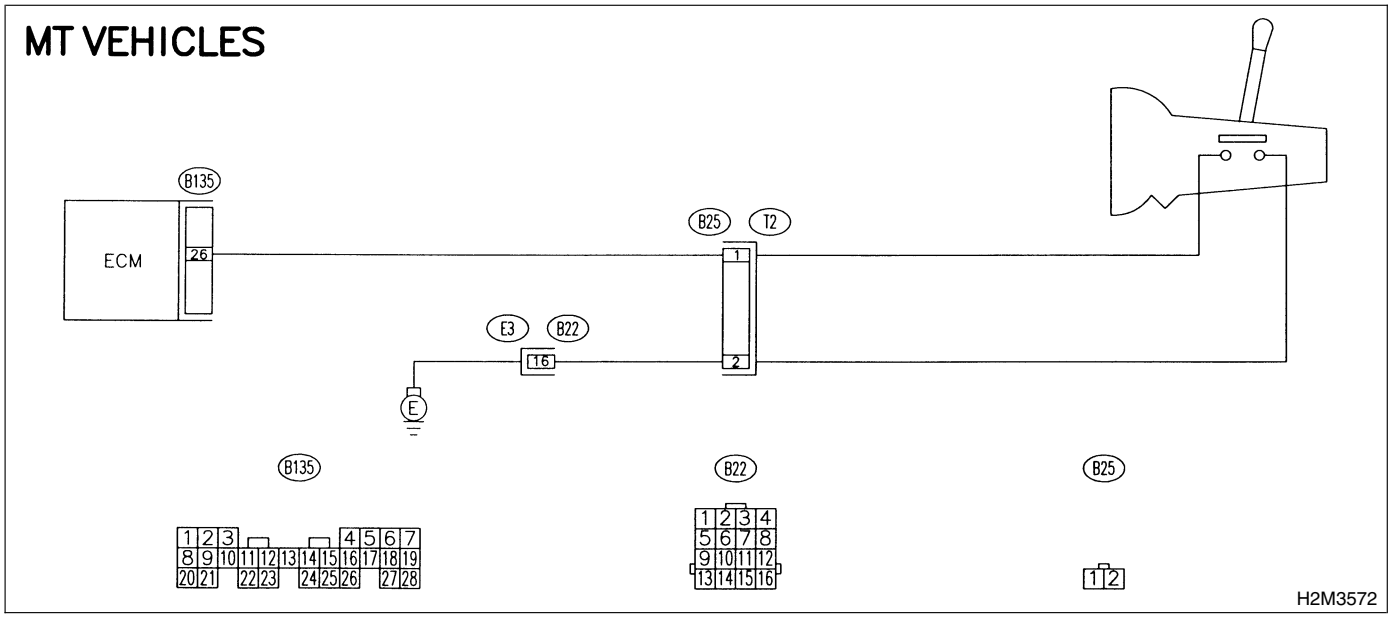
MEMO:

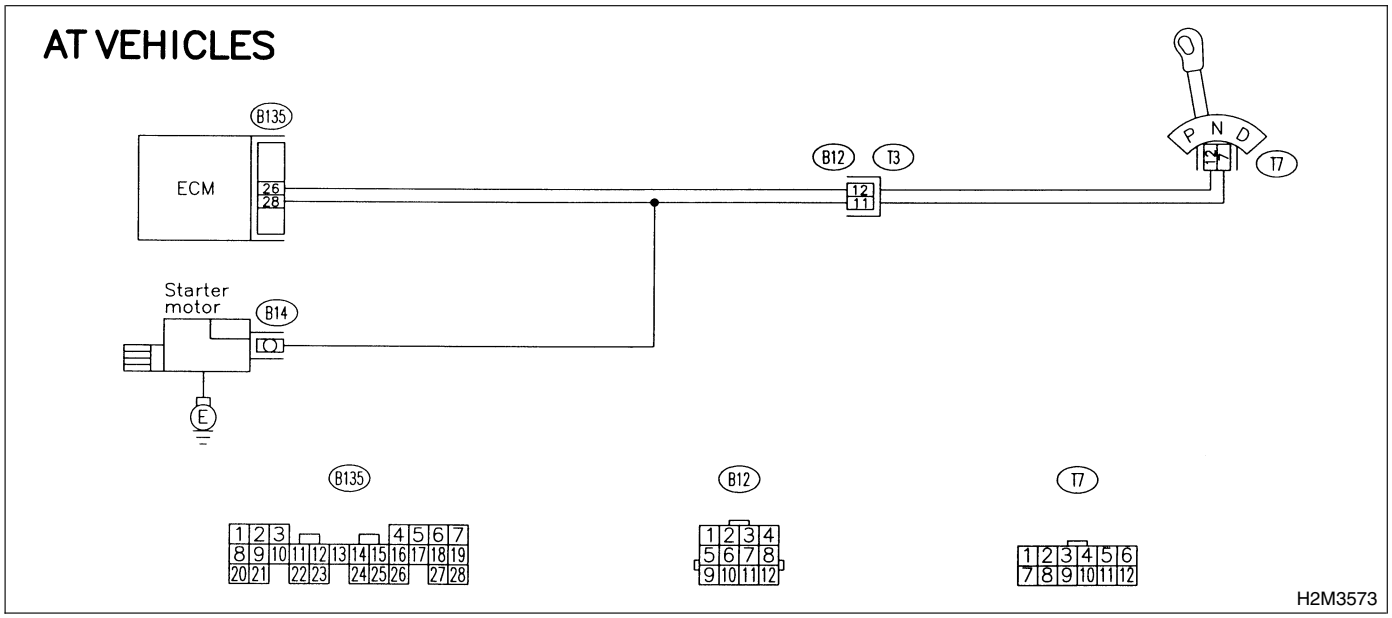
BV: DTC P1121 — NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT [MT VEHICLES] OR NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT [AT VEHICLES] —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**





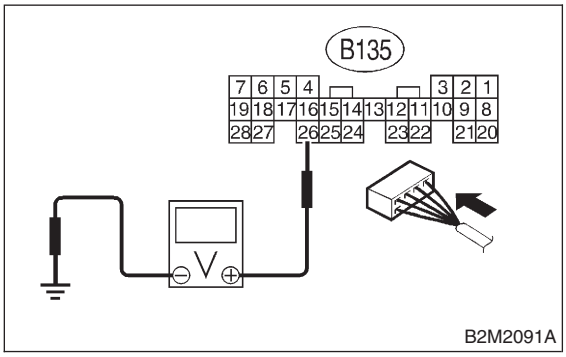
10BV1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type MT?***
YES : Go to step **10BV2**.
NO : Go to step **10BV9**.

10BV2 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):

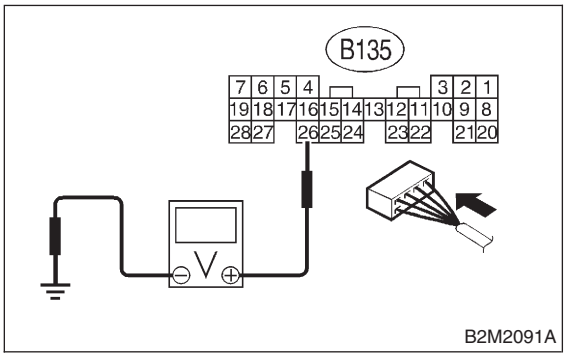


CHECK : ***Is the voltage more than 10 V in neutral position?***
YES : Go to step **10BV3**.
NO : Go to step **10BV5**.

10BV3 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V in other positions?***
YES : Go to step **10BV4**.
NO : Go to step **10BV6**.

10BV4 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

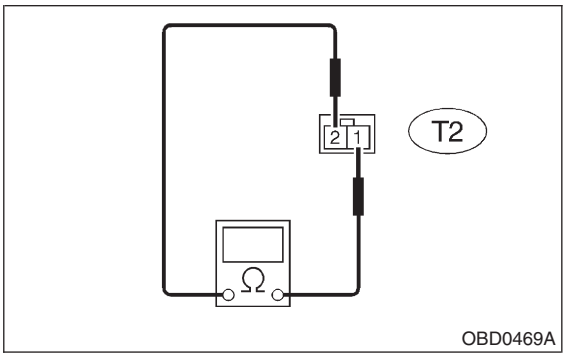
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10BV5 : CHECK NEUTRAL POSITION SWITCH.

Measure resistance between transmission harness connector terminals.

Connector & terminal
(T2) No. 1 — No. 2:

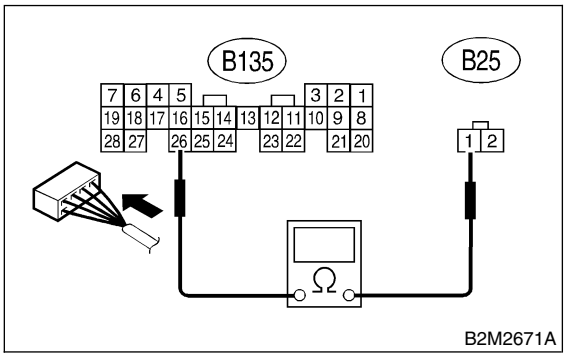


CHECK : ***Is the resistance less than 1 Ω in other positions?***
YES : Go to step **10BV6**.
NO : Repair open circuit in transmission harness or replace neutral position switch.

10BV6 : CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.

1) Disconnect connector from ECM.
2) Measure resistance of harness between ECM and transmission harness connector.

Connector & terminal
(B135) No. 26 — (B25) No. 1:

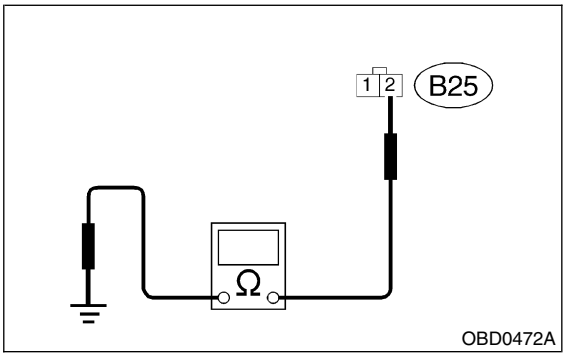


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BV7**.
NO : Repair open circuit in harness between ECM and transmission harness connector.

10BV7 : CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.

Measure resistance of harness between transmission harness connector and engine ground.

Connector & terminal
(B25) No. 2 — Engine ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10BV8**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between transmission harness connector and engine grounding terminal
- Poor contact in coupling connector (B22)

10BV8 : CHECK POOR CONTACT.

Check poor contact in transmission harness connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in transmission harness connector?***
YES : Repair poor contact in transmission harness connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

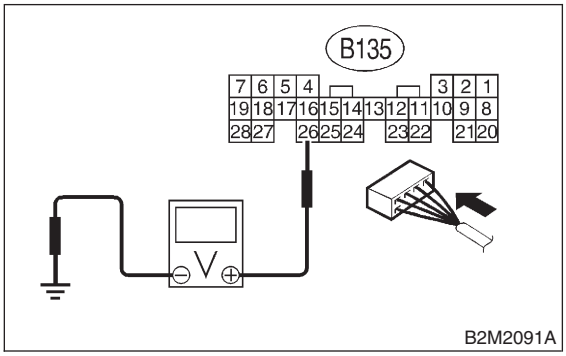
10BV9 : CHECK DTC P0705 ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0705?***
YES : Inspect DTC P0705 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10BV10**.

10BV10 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 26 (+) — Chassis ground (–):

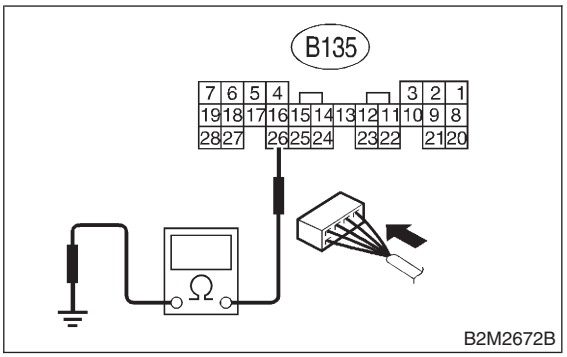


CHECK : ***Is the voltage between 4.5 and 5.5 V at except "N" and "P" positions?***
YES : Even if MIL lights up, the circuit has returned to a normal condition at this time.
NO : Go to step **10BV11**.

10BV11 : CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and transmission harness connector (T3).
3) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B135) No. 26 — Chassis ground:

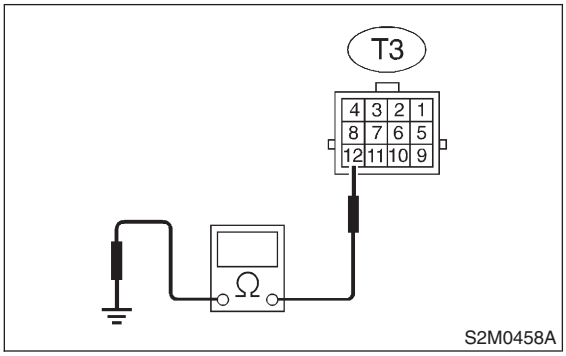


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and transmission harness connector.
NO : Go to step **10BV12**.

10BV12 : CHECK TRANSMISSION HARNESS CONNECTOR.

1) Disconnect connector from inhibitor switch.
2) Measure resistance of harness between transmission harness connector and engine ground.

Connector & terminal
(T3) No. 12 — Engine ground:

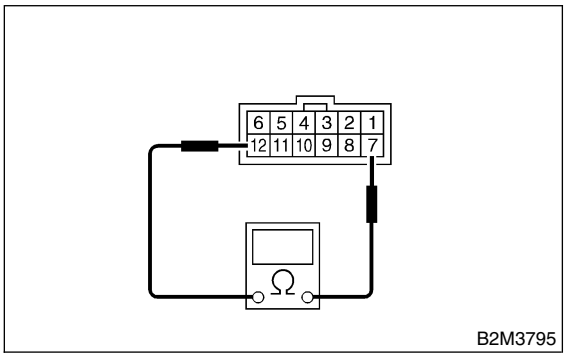


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between transmission harness and inhibitor switch connector.
NO : Go to step **10BV13**.

10BV13 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals in selector lever except for "N" position.

Terminals
No. 7 — No. 12:



CHECK : ***Is the resistance more than 1 MΩ at except "N" and "P" positions?***
YES : Go to step **10BV14**.
NO : Replace inhibitor switch. <Ref. to 3-2 [W2C0].>

10BV14 : CHECK SELECTOR CABLE CONNECTION.

CHECK : ***Is there any fault in selector cable connection to inhibitor switch?***
YES : Repair selector cable connection. <Ref. to 3-2 [W2A0].>
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

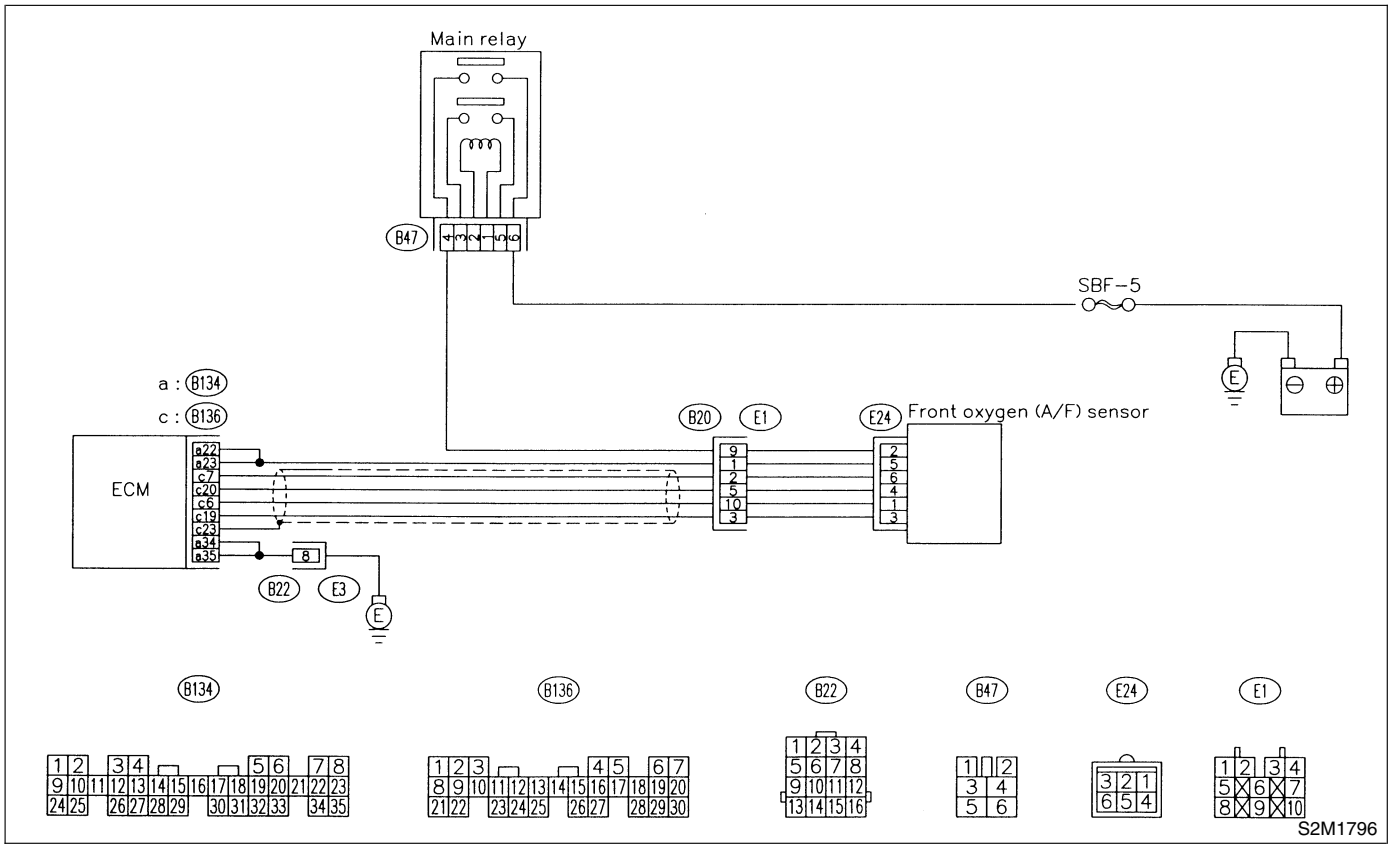
MEMO:

BW: DTC P1130 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (OPEN CIRCUIT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

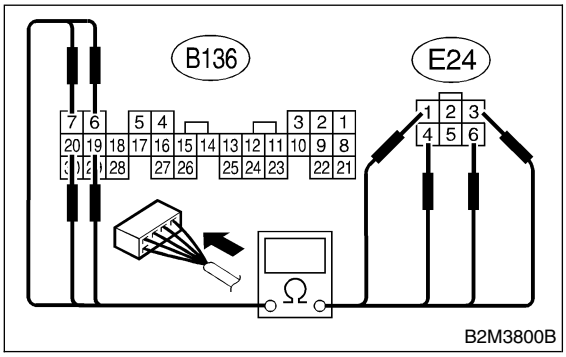
- **WIRING DIAGRAM:**



10BW1 : CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from ECM and front oxygen (A/F) sensor connector.
3) Measure resistance of harness between ECM and front oxygen (A/F) sensor connector.

Connector & terminal
(B136) No. 6 — (E24) No. 1:
(B136) No. 7 — (E24) No. 6:
(B136) No. 19 — (E24) No. 3:
(B136) No. 20 — (E24) No. 4:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10BW2**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and front oxygen (A/F) sensor connector
- Poor contact in front oxygen (A/F) sensor connector
- Poor contact in ECM connector

10BW2 : CHECK POOR CONTACT.

Check poor contact in front oxygen (A/F) sensor connector. <Ref. to FOREWORD [T3C1].>

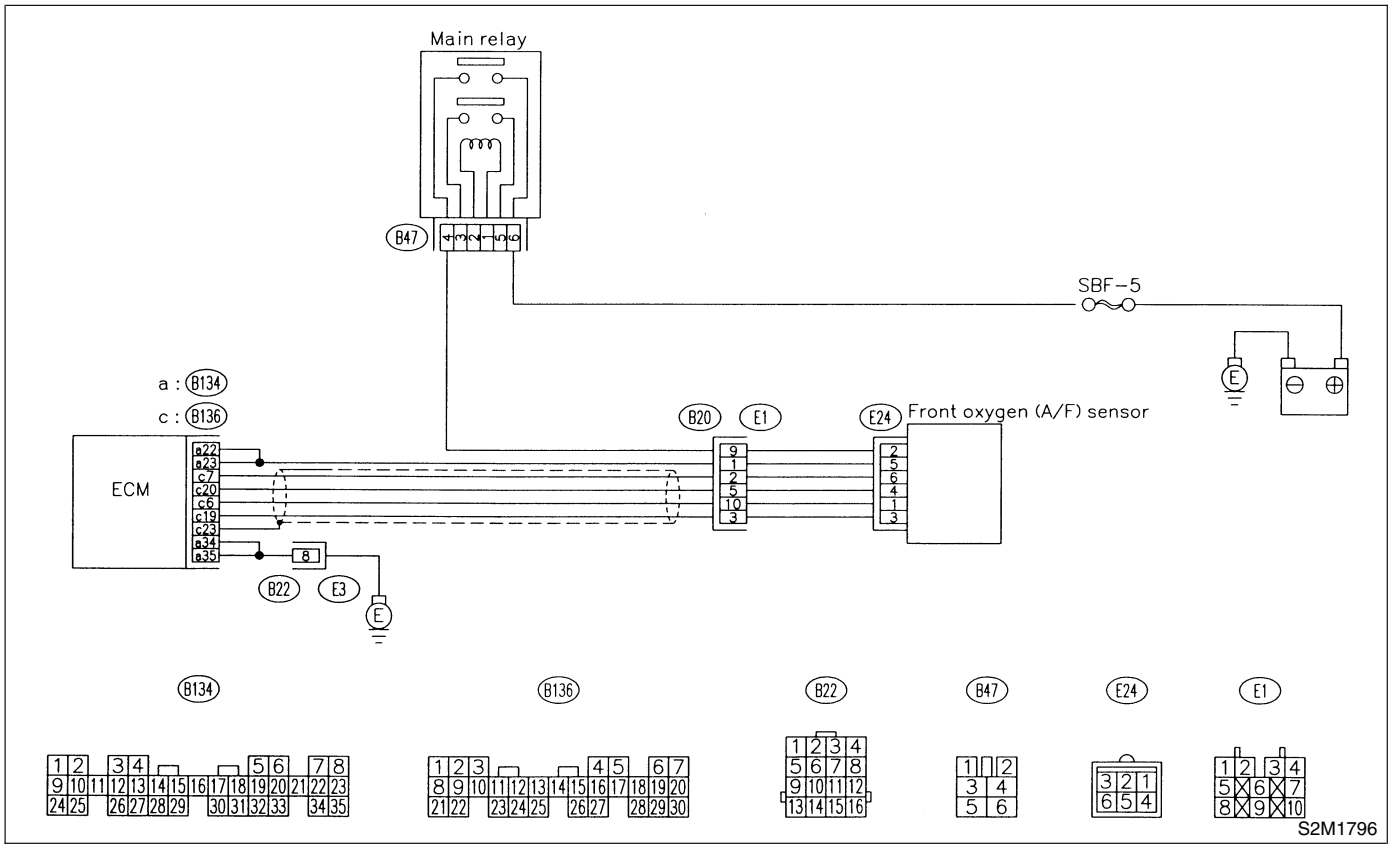
CHECK : ***Is there poor contact in front oxygen (A/F) sensor connector?***
YES : Repair poor contact in front oxygen (A/F) sensor connector.
NO : Replace front oxygen (A/F) sensor. <Ref. to 2-7 [W8A0].>

BX: DTC P1131 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (SHORT CIRCUIT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

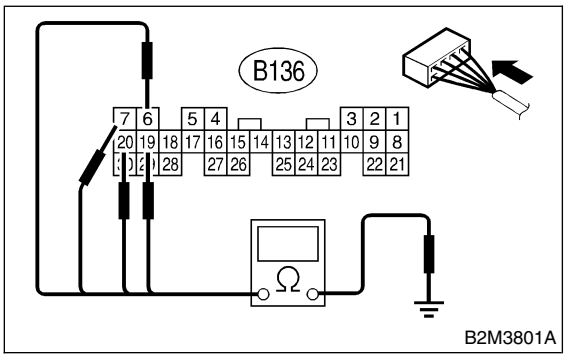
- **WIRING DIAGRAM:**



10BX1 : CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B136) No. 6 — Chassis ground:
(B136) No. 7 — Chassis ground:
(B136) No. 19 — Chassis ground:
(B136) No. 20 — Chassis ground:



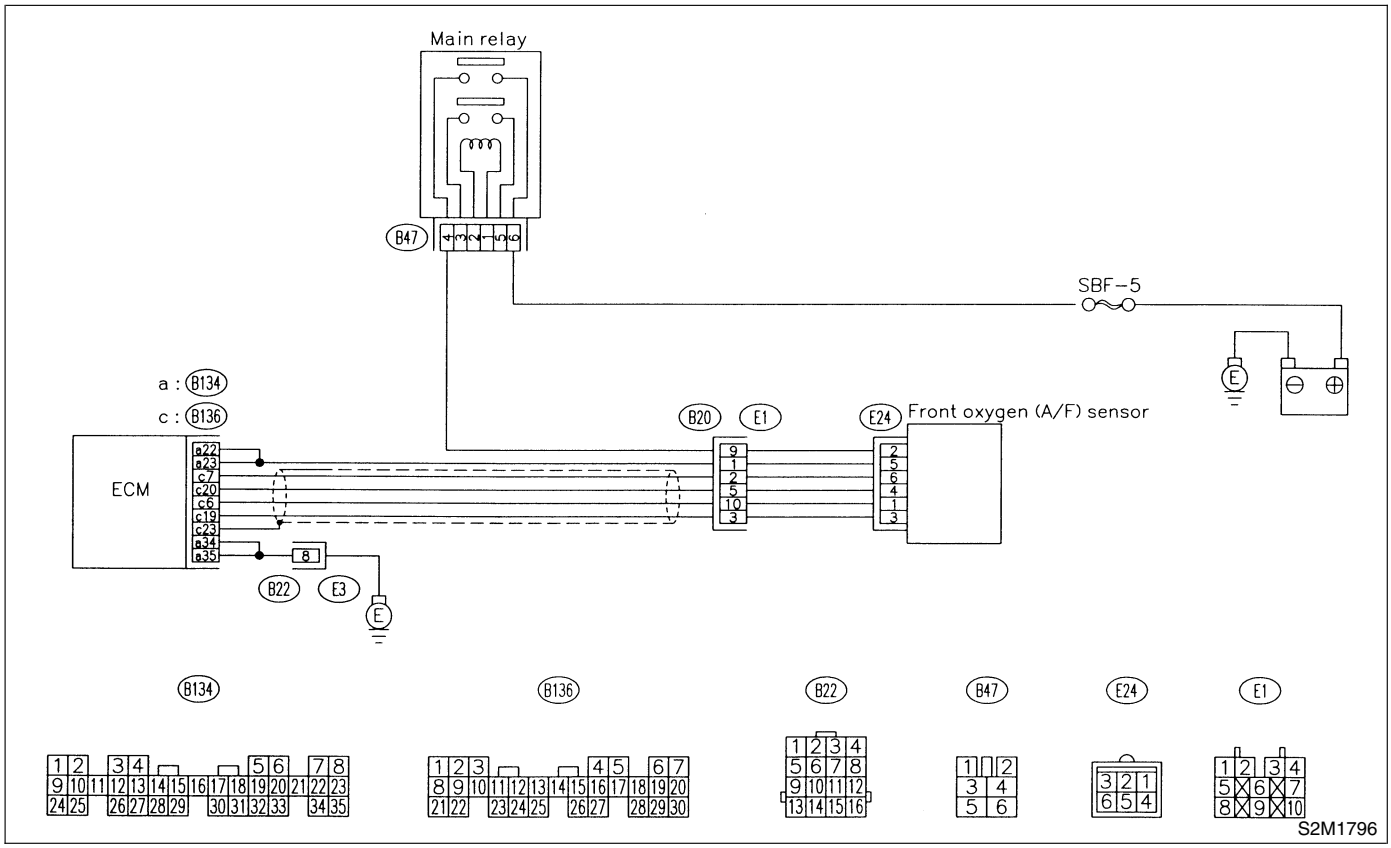
CHECK : ***Is the resistance more than 10 Ω?***
YES : Replace front oxygen (A/F) sensor. <Ref. to 2-7 [W8A0].>
NO : Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

BY: DTC P1132 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10BY1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1132 and P0141 at the same time?***

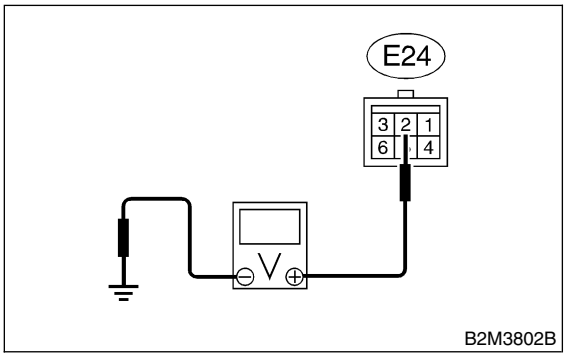
YES : Go to step **10BY2**.

NO : Go to step **10BY5**.

10BY2 : CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from front oxygen (A/F) sensor.
3) Turn ignition switch to ON.
4) Measure voltage between front oxygen (A/F) sensor connector and engine ground.

Connector & terminal
(E24) No. 2 (+) — Engine ground (–):



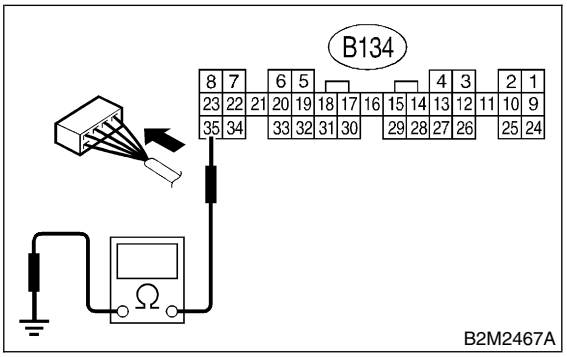
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10BY3**.
NO : Repair power supply line.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and front oxygen (A/F) sensor connector
- Poor contact in front oxygen (A/F) sensor connector
- Poor contact in main relay connector

10BY3 : CHECK GROUND CIRCUIT OF ECM.

Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B134) No. 35 — Chassis ground:



CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10BY4**.
NO : Repair harness and connector.

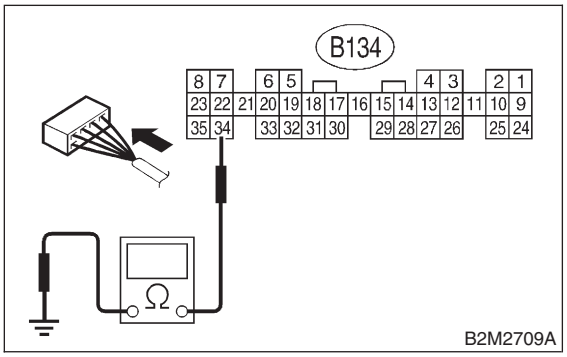
NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine ground terminal
- Poor contact in ECM connector

Poor contact in coupling connector (B22)

10BY4 : CHECK GROUND CIRCUIT OF ECM.

1) Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B134) No. 34 — Chassis ground:



CHECK : ***Is there resistance less than 5 Ω?***
YES : Go to step **10BY5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and engine ground terminal
- Poor contact in ECM connector

Poor contact in coupling connector (B22)

10BY5 : CHECK CURRENT DATA.

1) Start the engine.
2) Read data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or OBD-II general scan tool.

NOTE:
- Subaru Select Monitor

For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
- OBD-II scan tool

For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 0.2 A?***
YES : Repair poor contact in connector.

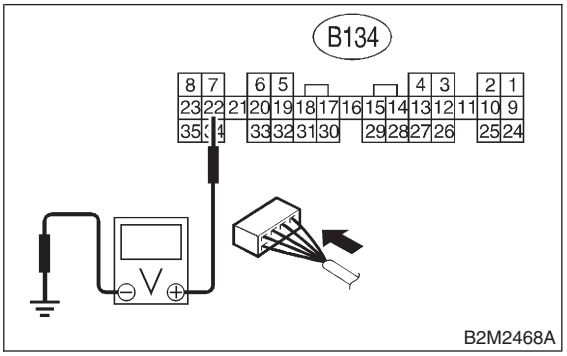
NOTE:
In this case, repair the following:
- Poor contact in front oxygen (A/F) sensor connector
- Poor contact in ECM connector

NO : Go to step **10BY6**.

10BY6 : CHECK OUTPUT SIGNAL FROM ECM.

1) Start and idle the engine.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 22 (+) — Chassis ground (–):

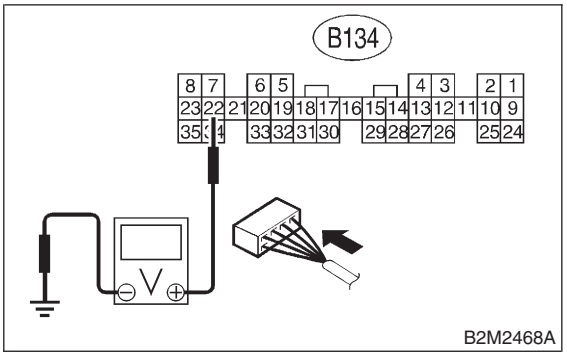


CHECK : ***Is the voltage less than 1.0 V?***
YES : Go to step **10BY8**.
NO : Go to step **10BY7**.

10BY7 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 22 (+) — Chassis ground (–):

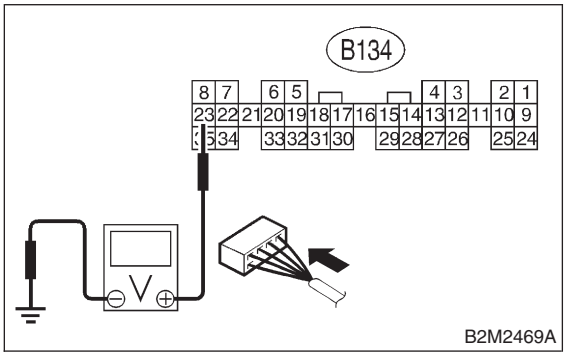


CHECK : ***Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10BY8**.

10BY8 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 23 (+) — Chassis ground (–):

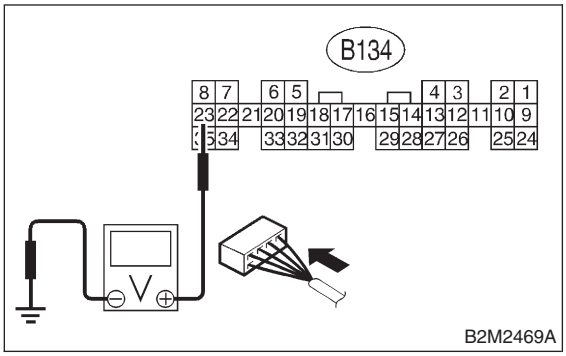


CHECK : ***Is the voltage less than 1.0 V?***
YES : Go to step **10BY10**.
NO : Go to step **10BY9**.

10BY9 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 23 (+) — Chassis ground (–):

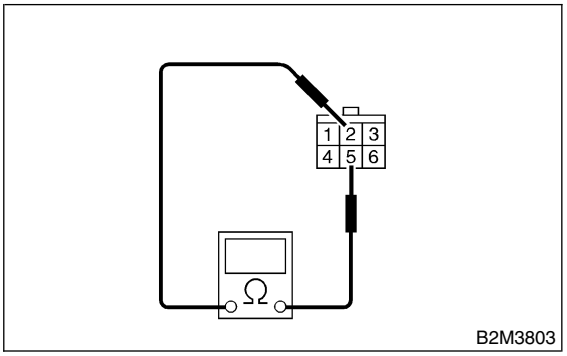


CHECK : ***Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10BY10**.

10BY10 : CHECK FRONT OXYGEN (A/F) SENSOR.

1) Turn ignition switch to OFF.
2) Measure resistance between front oxygen (A/F) sensor connector terminals.

Terminals
No. 2 — No. 5:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open or ground short circuit in harness between front oxygen (A/F) sensor and ECM connector
- Poor contact in front oxygen (A/F) sensor connector
- Poor contact in ECM connector

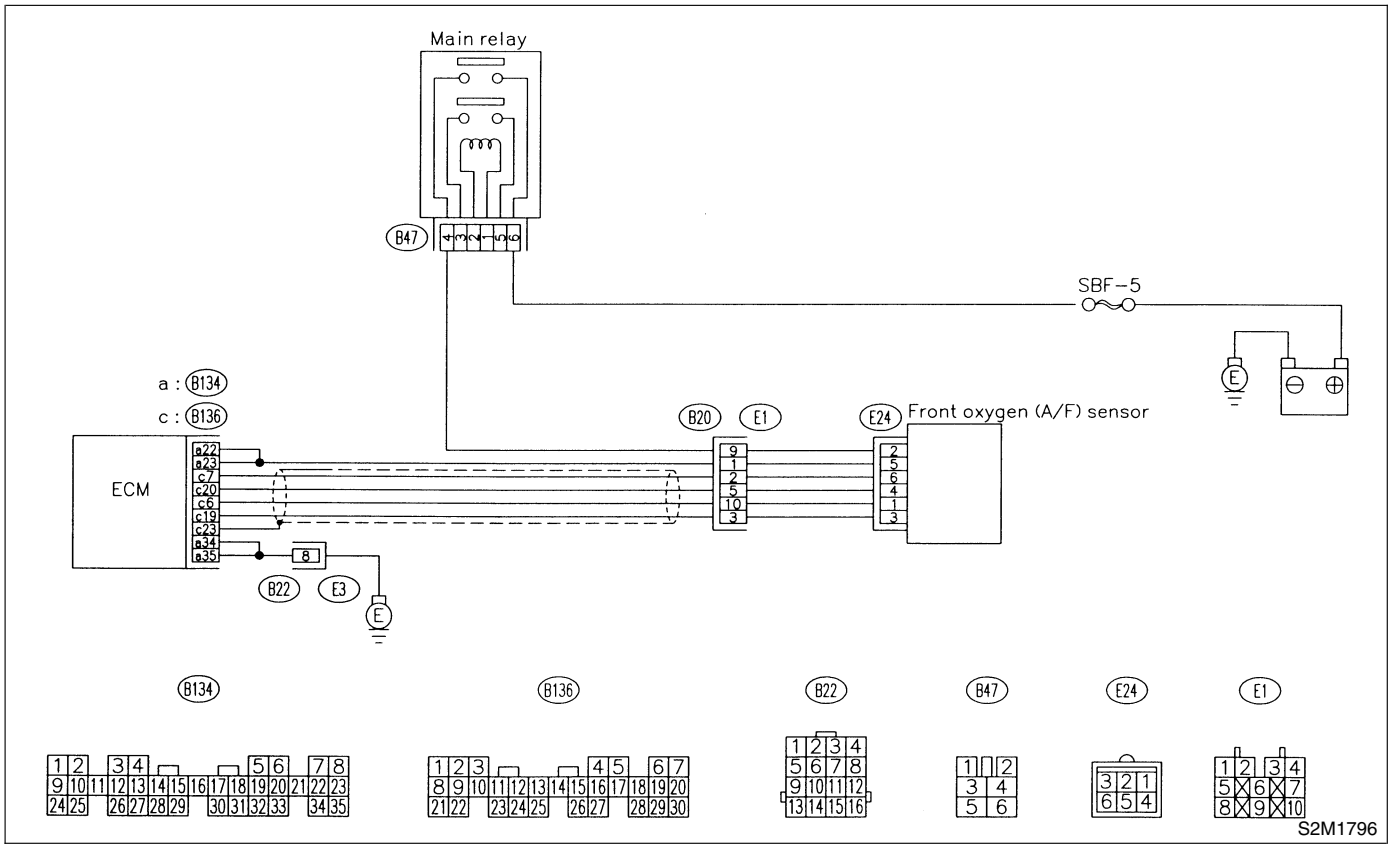
NO : Replace front oxygen (A/F) sensor. <Ref. to 2-7 [W8A0].>

BZ: DTC P1133 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

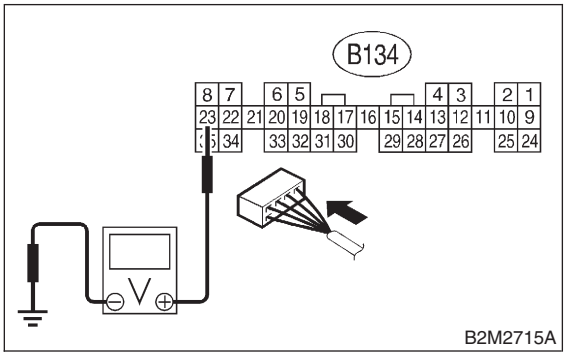
- **WIRING DIAGRAM:**



10BZ1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 23 (+) — Chassis ground (–):

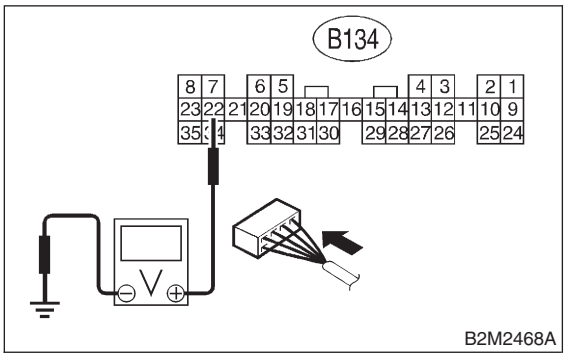


CHECK : ***Is the voltage more than 8 V?***
YES : Go to step **10BZ3**.
NO : Go to step **10BZ2**.

10BZ2 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 22 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 8 V?***
YES : Go to step **10BZ3**.
NO : Go to step **10BZ4**.

10BZ3 : CHECK FRONT OXYGEN (A/F) SENSOR HEATER CURRENT.

1) Turn ignition switch to OFF.
2) Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.
3) Turn ignition switch to ON.
4) Read data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or the OBD-II general scan tool.

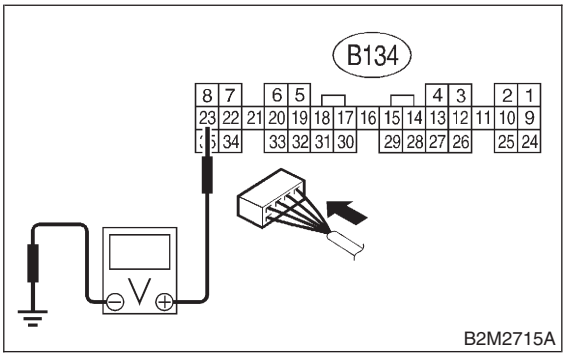
NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 2.3 A?***
YES : Replace ECM. <Ref. to 2-7 [W17A0].>
NO : END

10BZ4 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 23 (+) — Chassis ground (–):

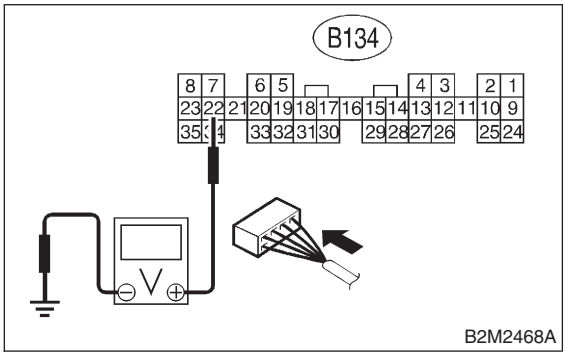


CHECK : ***Does the voltage change more than 8 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***
YES : Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.
NO : Go to step **10BZ5**.

10BZ5 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 22 (+) — Chassis ground (–):



CHECK : ***Does the voltage change more than 8 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***

YES : Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.

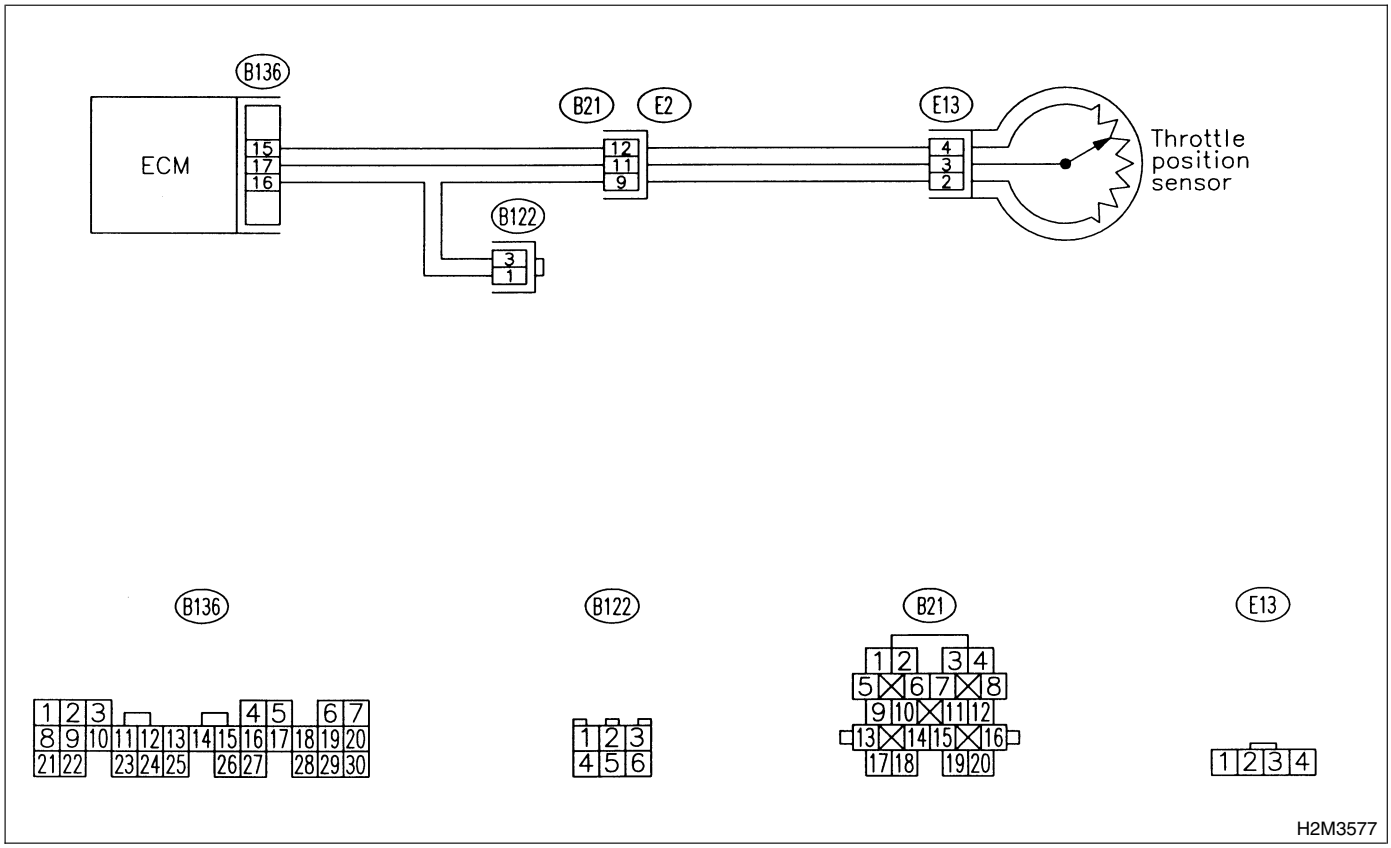
NO : END

CA: DTC P1142 — THROTTLE POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (LOW INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CA1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0122 or P0123?***

YES : Inspect DTC P0122 or P0123 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P1142.

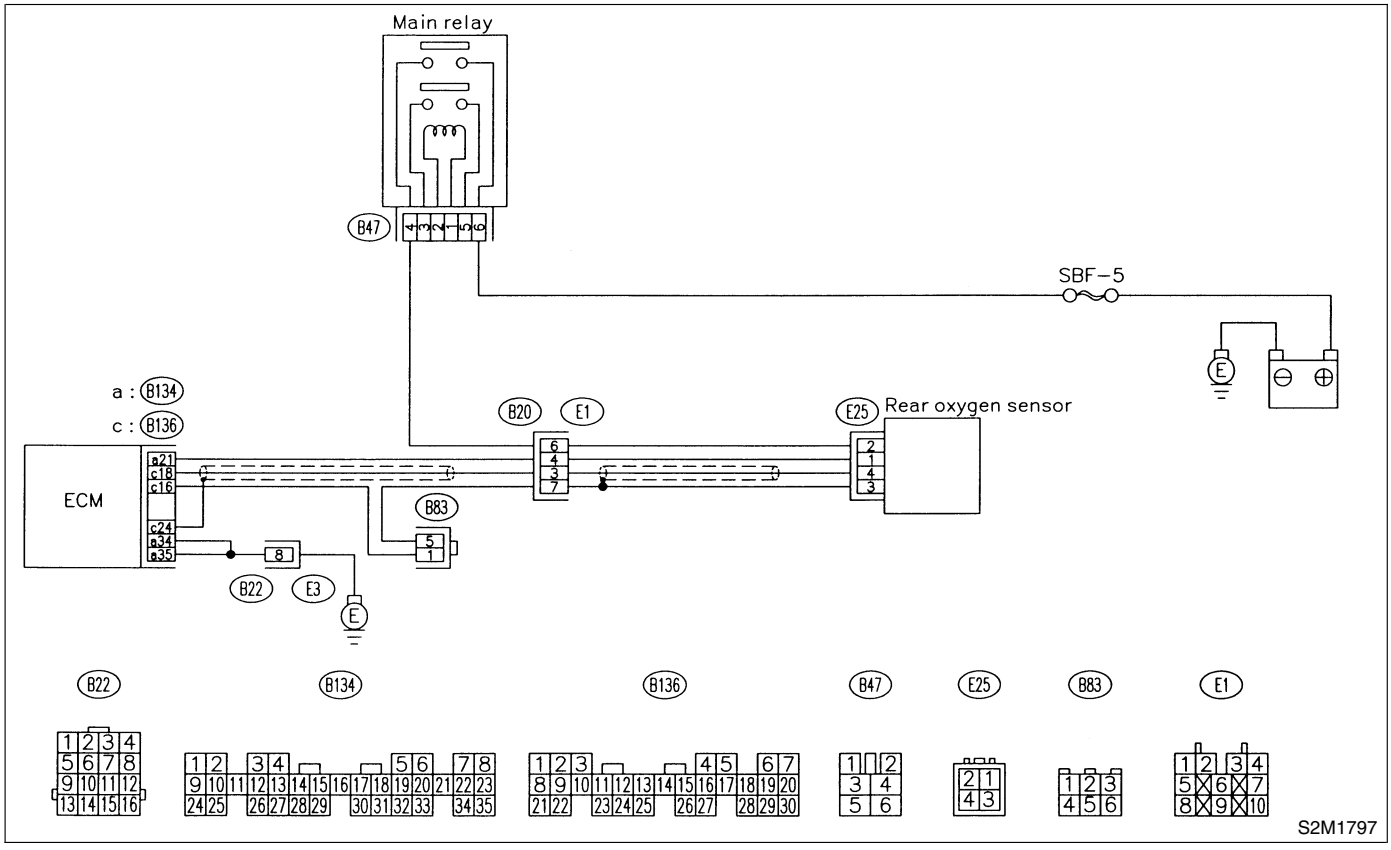
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

CB: DTC P1151 — REAR OXYGEN SENSOR HEATER CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

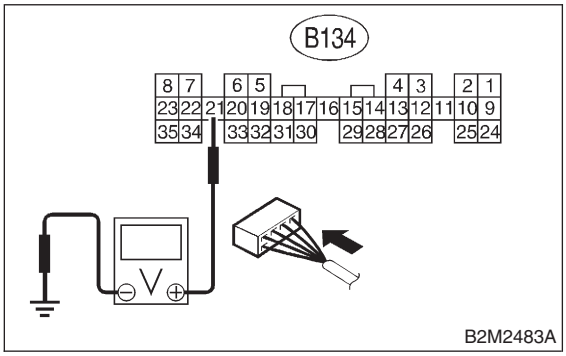
- **WIRING DIAGRAM:**



10CB1 : CHECK INPUT SIGNAL FOR ECM.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B134) No. 21 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 8 V?***
YES : Go to step **10CB2**.
NO : Go to step **10CB3**.

10CB2 : CHECK CURRENT DATA.

1) Turn ignition switch to OFF.
2) Repair battery short circuit in harness between ECM and rear oxygen sensor connector.
3) Turn ignition switch to ON.
4) Read data of rear oxygen sensor heater current using Subaru Select Monitor or the OBD-II general scan tool.

NOTE:
● Subaru Select Monitor
For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to 2-7 [T3C4].>
● OBD-II general scan tool
For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.

CHECK : ***Is the value more than 7 A?***
YES : Replace ECM. <Ref. to 2-7 [W17A0].>
NO : END

10CB3 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

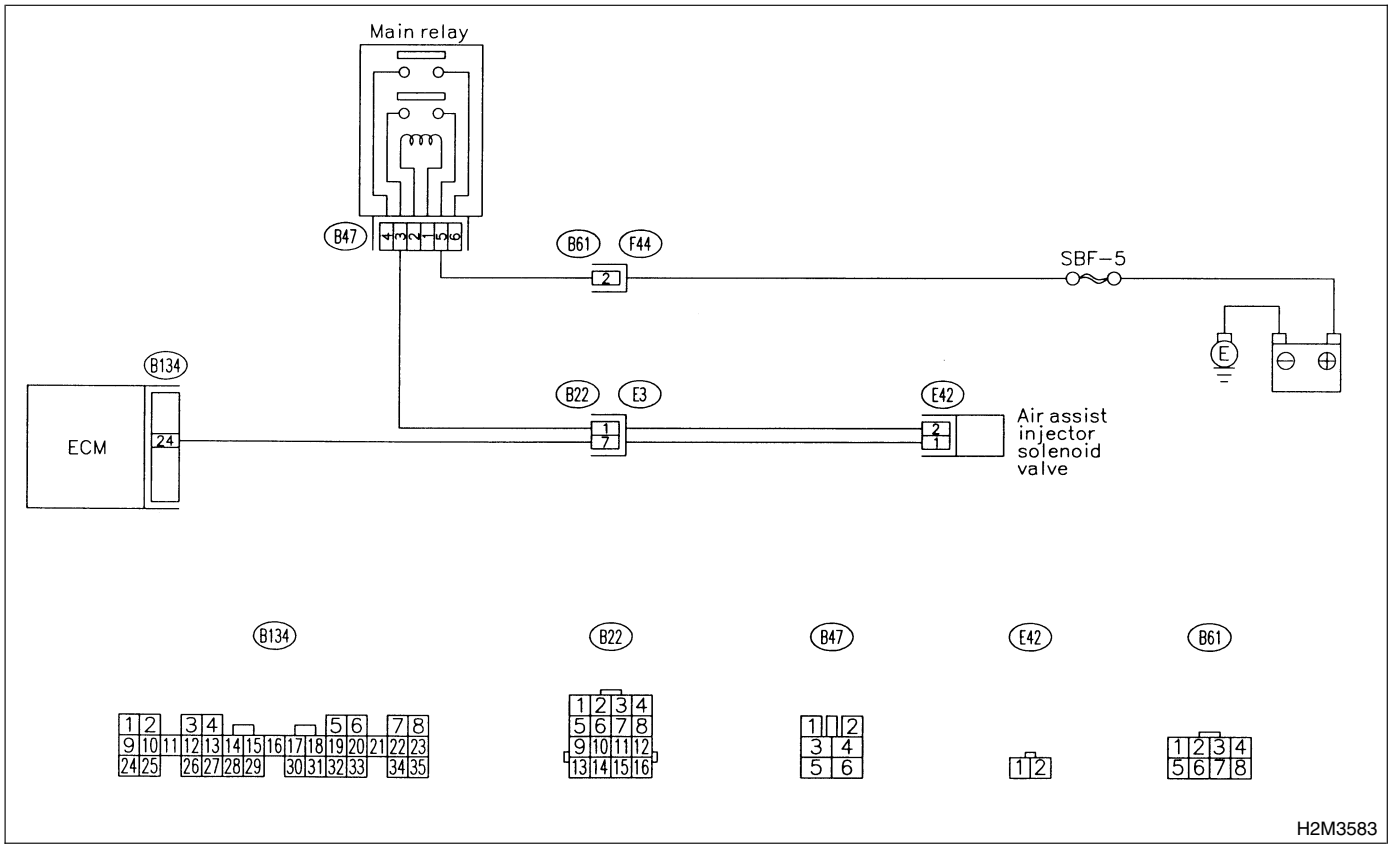
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : END

CC: DTC P1207 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

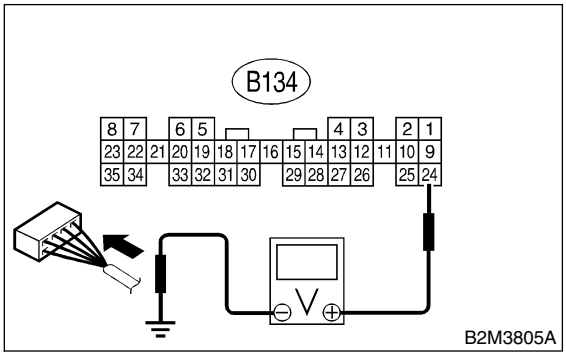
- **WIRING DIAGRAM:**



10CC1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 24 (+) — Chassis ground (–):

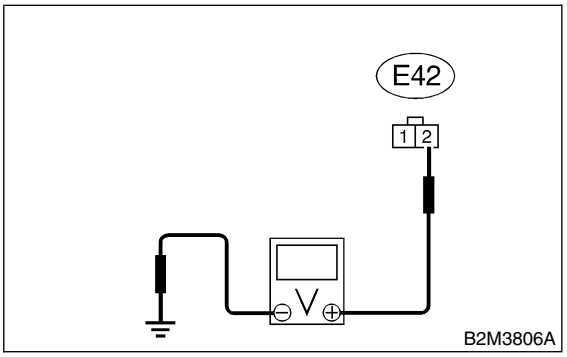


CHECK : ***Is the voltage more than 10 V?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10CC2**.

10CC2 : CHECK POWER SUPPLY TO AIR ASSIST INJECTOR SOLENOID VALVE.

1) Turn ignition switch to OFF.
2) Disconnect connector from air assist injector solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between air assist injector solenoid valve and engine ground.

Connector & terminal
(E42) No. 2 (+) — Engine ground (–):



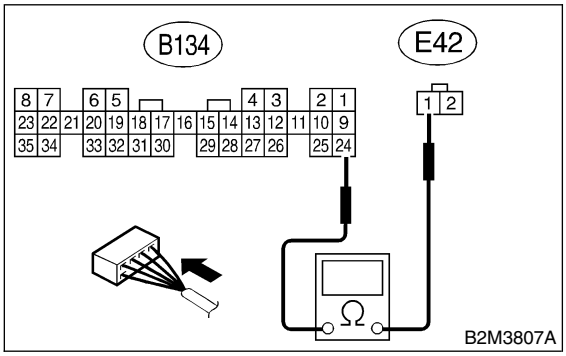
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CC3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between air assist injector solenoid valve and main relay connector
- Poor contact in coupling connector (B22)

10CC3 : CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance of harness between ECM and air assist injector solenoid valve connector.

Connector & terminal
(B134) No. 24 — (E42) No. 1:



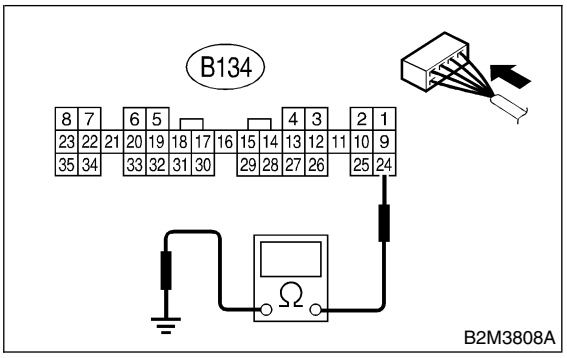
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10CC4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and air assist injector solenoid valve connector
- Poor contact in coupling connector (B22)

10CC4 : CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR.

Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B134) No. 24 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and air assist injector solenoid valve connector.
NO : Go to step **10CC5**.

10CC5 : CHECK POOR CONTACT.

Check poor contact in ECM and air assist injector solenoid valve connectors. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM and air assist injector solenoid valve connectors?***
YES : Repair poor contact in ECM and air assist injector solenoid valve connectors.
NO : Replace air assist injector solenoid valve. <Ref. to 2-7 [W14A0].>

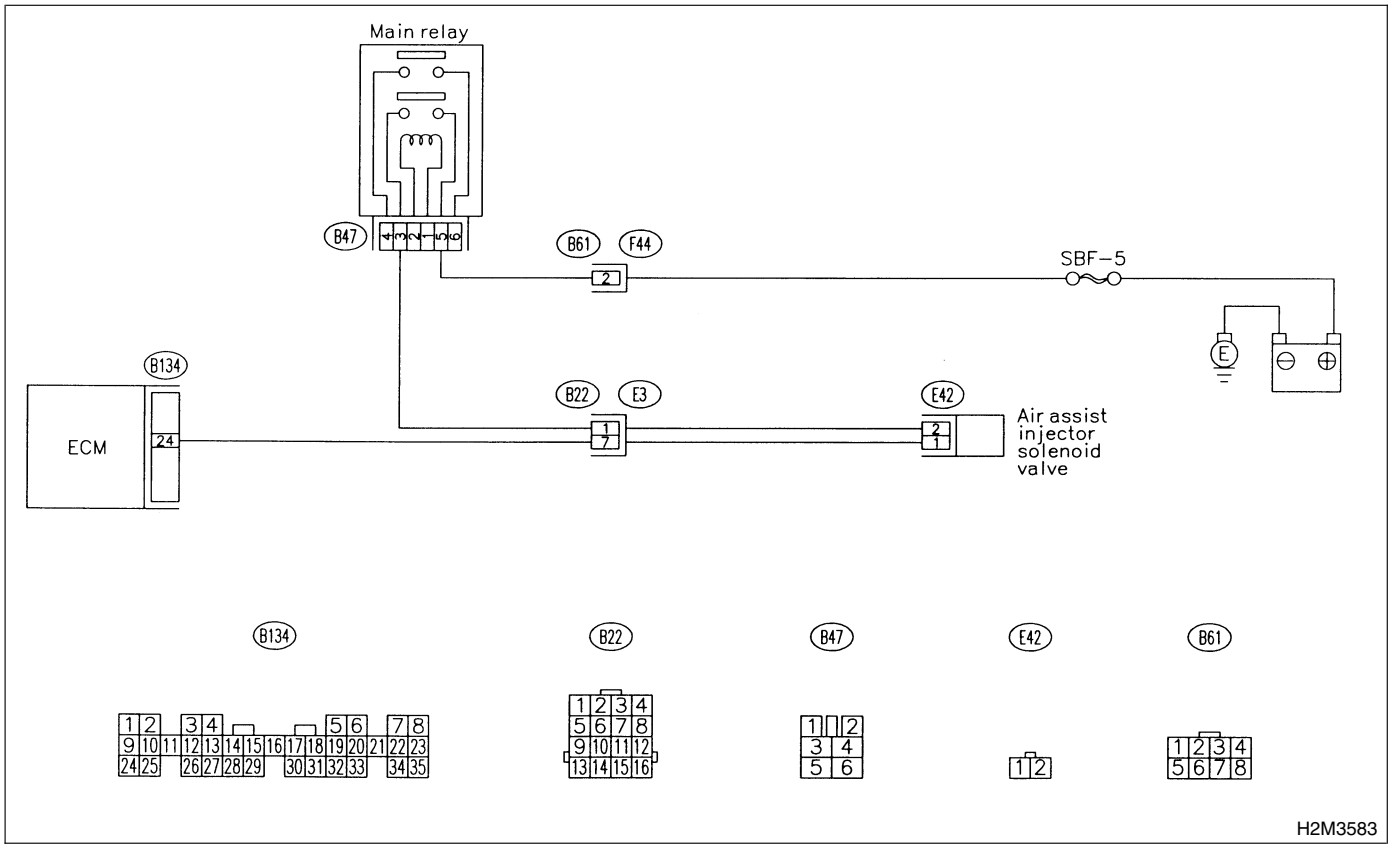
MEMO:

CD: DTC P1208 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

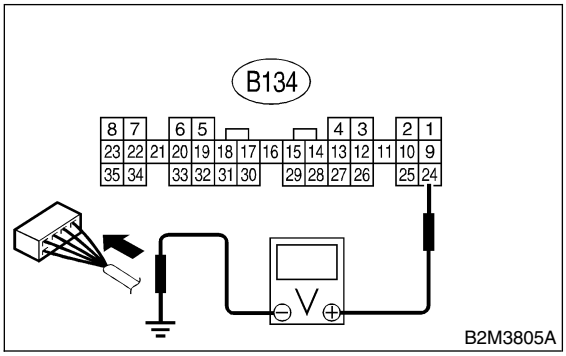
- **WIRING DIAGRAM:**



10CD1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 24 (+) — Chassis ground (–):

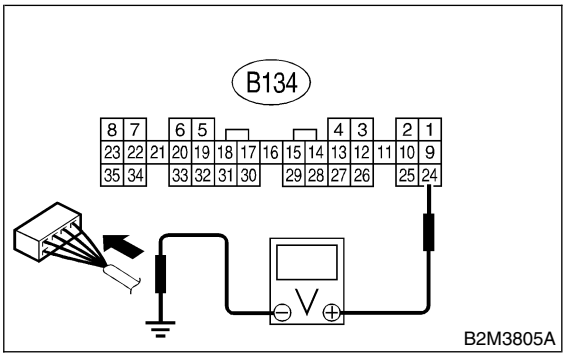


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CD2**.
NO : Go to step **10CD3**.

10CD2 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to OFF.
2) Disconnect connector from air assist injector solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 24 (+) — Chassis ground (–):

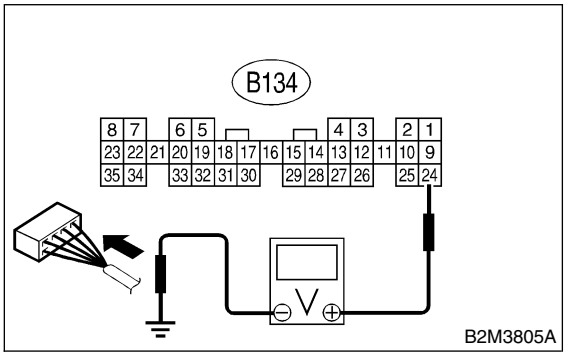


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Replace air assist injector solenoid valve <Ref. to 2-7 [W14A0].> and ECM <Ref. to 2-7 [W17A0].>.

10CD3 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 24 (+) — Chassis ground (–):



CHECK : ***Does the voltage change more than 10 V by shaking harness and connector of ECM while monitoring the value with voltage meter?***

YES : Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>

NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

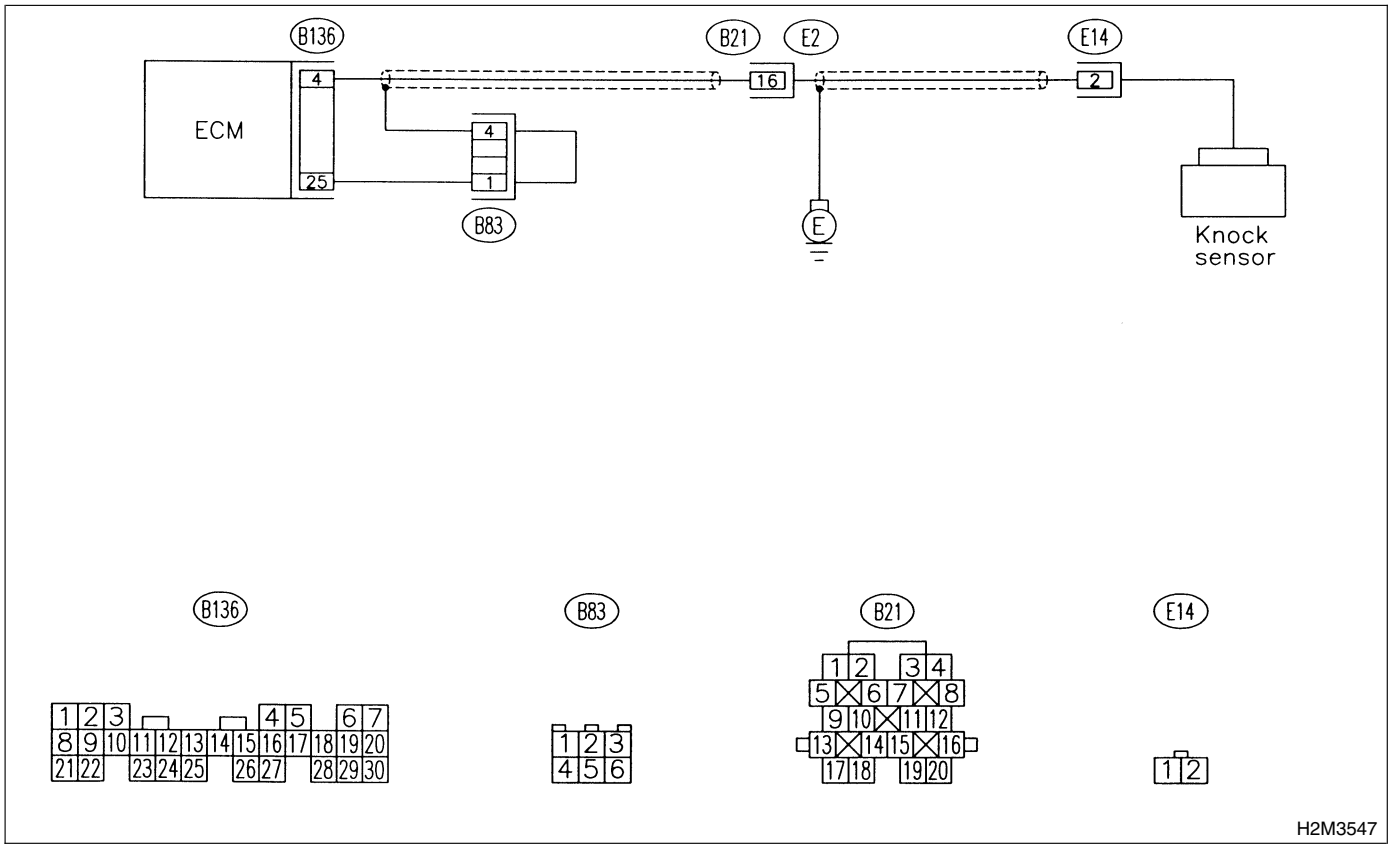
MEMO:

CE: DTC P1325 — KNOCK SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Poor driving performance
  - Knocking occurs.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

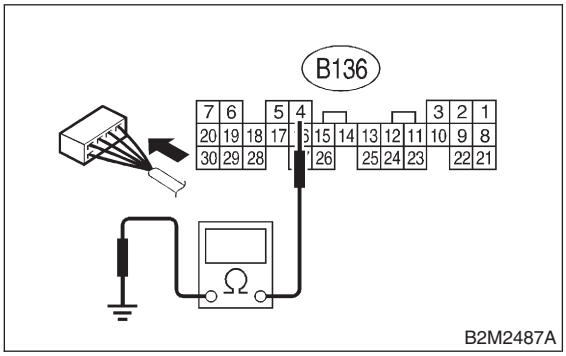
- **WIRING DIAGRAM:**



10CE1 : CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM.
3) Measure resistance between ECM harness connector and chassis ground.

Connector & terminal
(B136) No. 4 — Chassis ground:

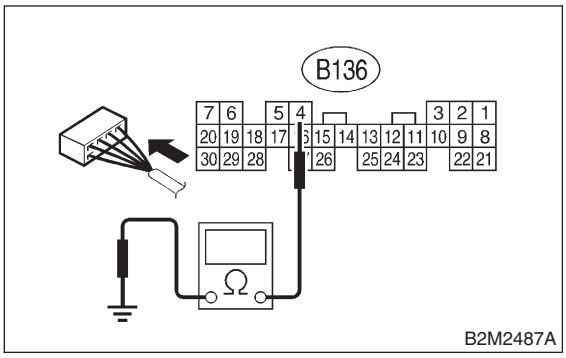


CHECK : ***Is the resistance more than 700 kΩ?***
YES : Go to step **10CE3**.
NO : Go to step **10CE2**.

10CE2 : CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.

Measure resistance of harness between ECM connector and chassis ground.

Connector & terminal
(B136) No. 4 — Chassis ground:

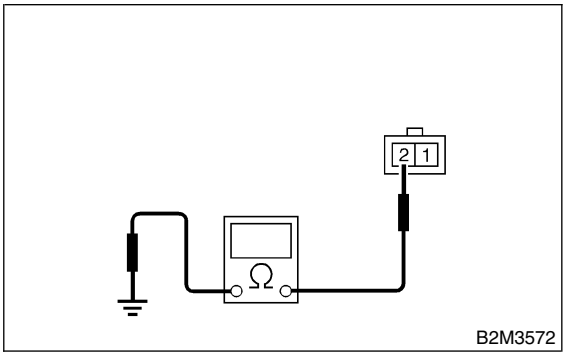


CHECK : ***Is the resistance less than 400 kΩ?***
YES : Go to step **10CE5**.
NO : Go to step **10CE6**.

10CE3 : CHECK KNOCK SENSOR.

1) Disconnect connector from knock sensor.
2) Measure resistance between knock sensor connector terminal and engine ground.

Terminal
No. 2 — Engine ground:



CHECK : ***Is the resistance more than 700 kΩ?***
YES : Go to step **10CE4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between knock sensor and ECM connector
- Poor contact in knock sensor connector
- Poor contact in coupling connector (B21)

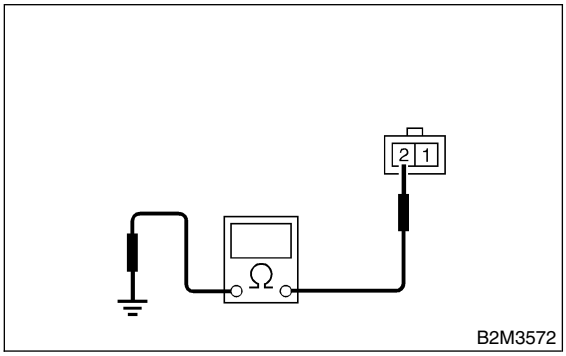
10CE4 : CHECK CONDITION OF KNOCK SENSOR INSTALLATION.

CHECK : ***Is the knock sensor installation bolt tightened securely?***
YES : Replace knock sensor. <Ref. to 2-7 [W7A0].>
NO : Tighten knock sensor installation bolt securely.

10CE5 : CHECK KNOCK SENSOR.

1) Disconnect connector from knock sensor.
2) Measure resistance between knock sensor connector terminal and engine ground.

Terminal
No. 2 — Engine ground:



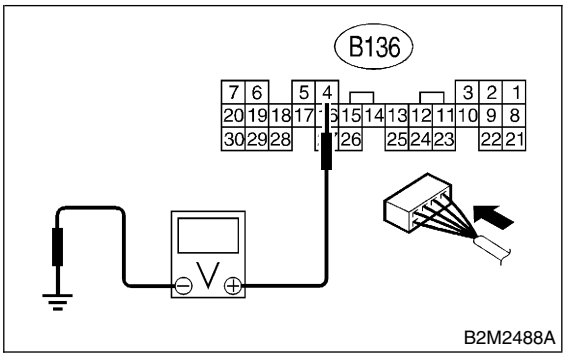
CHECK : ***Is the resistance less than 400 kΩ?***
YES : Replace knock sensor. <Ref. to 2-7 [W7A0].>
NO : Repair ground short circuit in harness between knock sensor connector and ECM connector.

NOTE:
The harness between both connectors is shielded. Repair short circuit of harness together with shield.

10CE6 : CHECK INPUT SIGNAL FOR ECM.

1) Connect connectors to ECM and knock sensor.
2) Turn ignition switch to ON.
3) Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 2 V?***
YES : Even if MIL lights up, the circuit has returned to a normal condition at this time. (However, the possibility of poor contact still remains.)

NOTE:
In this case, repair the following:
- Poor contact in knock sensor connector
- Poor contact in ECM connector
- Poor contact in coupling connector (B21)

NO : Repair poor contact in ECM connector.

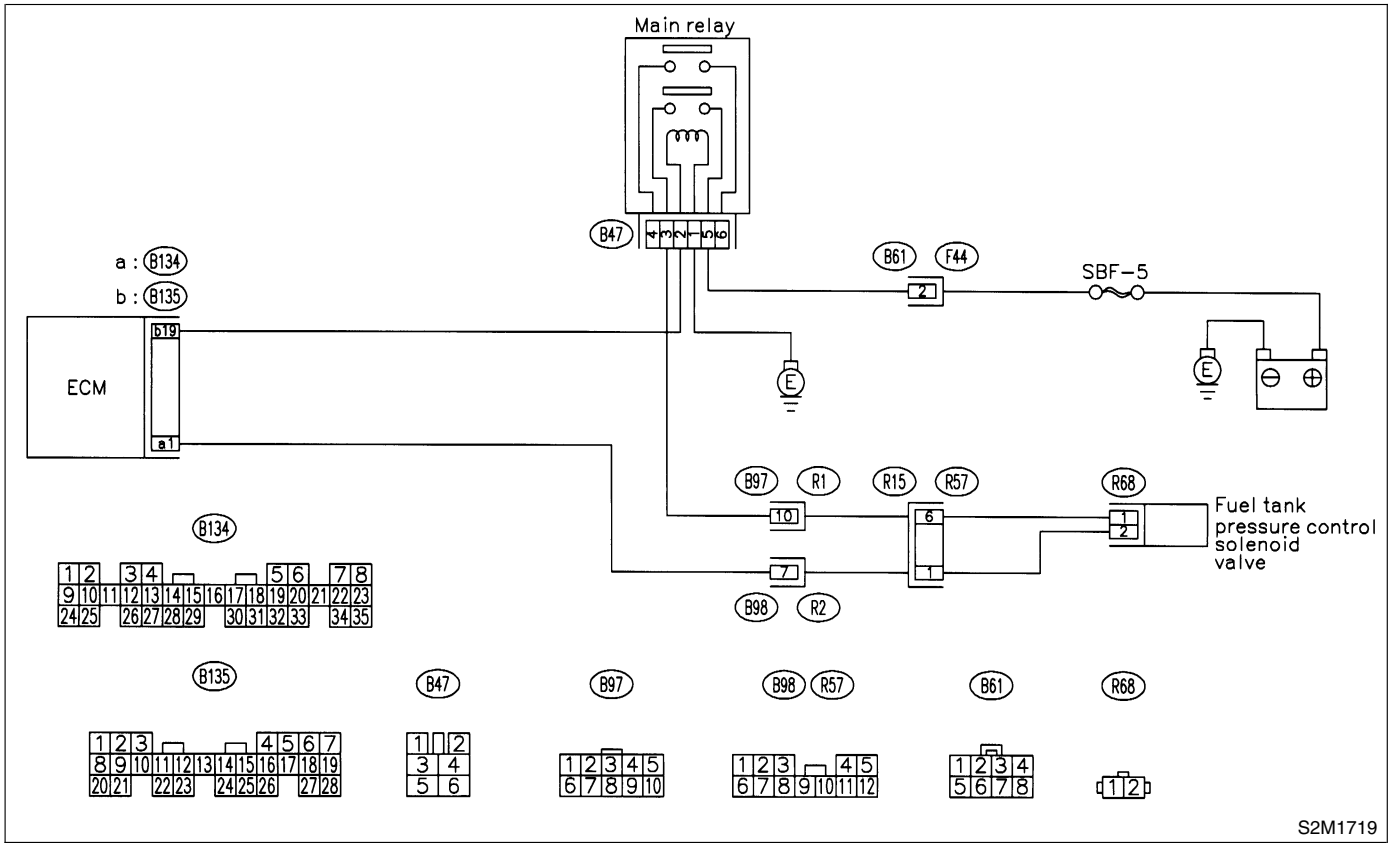
MEMO:

CF: DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

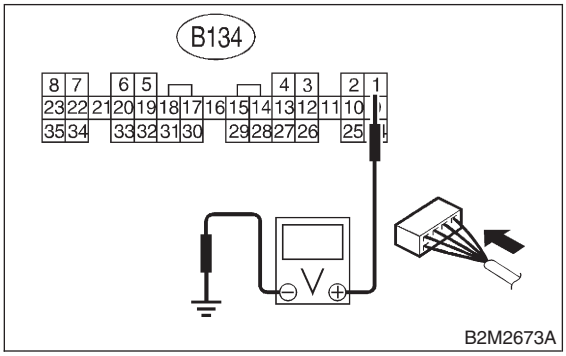
- **WIRING DIAGRAM:**



10CF1 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CF2**.
NO : Go to step **10CF3**.

10CF2 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

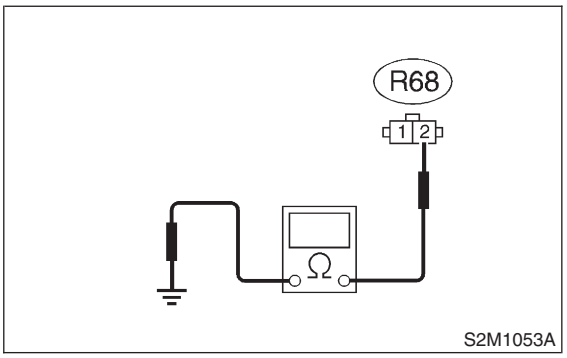
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10CF3 : CHECK HARNESS BETWEEN FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from fuel tank pressure control solenoid valve and ECM.
3) Measure resistance of harness between fuel tank pressure control solenoid valve connector and chassis ground.

Connector & terminal
(R68) No. 2 — Chassis ground:

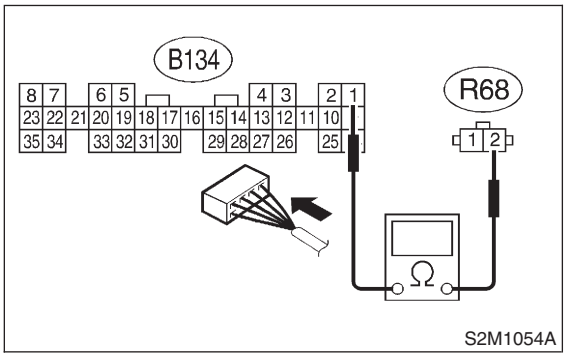


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and fuel tank pressure control solenoid valve connector.
NO : Go to step **10CF4**.

10CF4 : CHECK HARNESS BETWEEN FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

Measure resistance of harness between ECM and fuel tank pressure control solenoid valve connector.

Connector & terminal
(B134) No. 1 — (R68) No. 2:



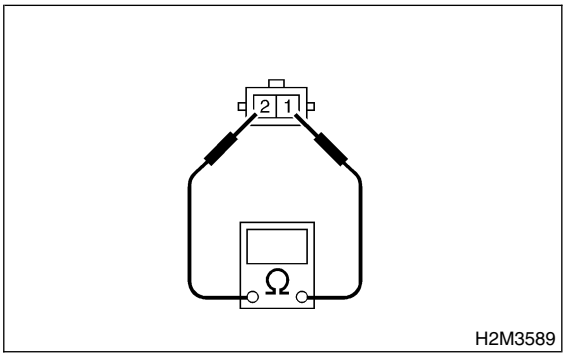
CHECK : ***Is the voltage less than 1 Ω?***
YES : Go to step **10CF5**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between ECM and fuel tank pressure control solenoid valve connector
● Poor contact in coupling connectors (R57 and B98)

10CF5 : CHECK FUEL TANK PRESSURE CONTROL SOLENOID VALVE.

Measure resistance between fuel tank pressure control solenoid valve terminals.

Terminals
No. 1 — No. 2:

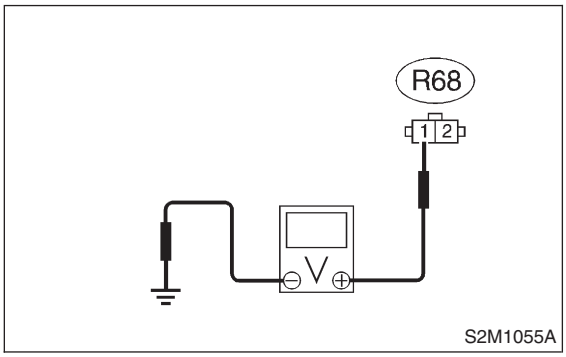


CHECK : ***Is the resistance between 10 and 100 Ω?***
YES : Go to step **10CF6**.
NO : Replace fuel tank pressure control solenoid valve. <Ref. to 2-1 [W9A0].>

10CF6 : CHECK POWER SUPPLY TO FUEL TANK PRESSURE CONTROL SOLENOID VALVE.

1) Turn ignition switch to ON.
2) Measure voltage between fuel tank pressure control solenoid valve and chassis ground.

Connector & terminal
(R68) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CF7**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between main relay and fuel tank pressure control solenoid valve connector
- Poor contact in coupling connectors (R57 and B97)
- Poor contact in main relay connector

10CF7 : CHECK POOR CONTACT.

Check poor contact in fuel tank pressure control solenoid valve connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in fuel tank pressure control solenoid valve connector?***
YES : Repair poor contact in fuel tank pressure control solenoid valve connector.
NO : Contact with SOA service.

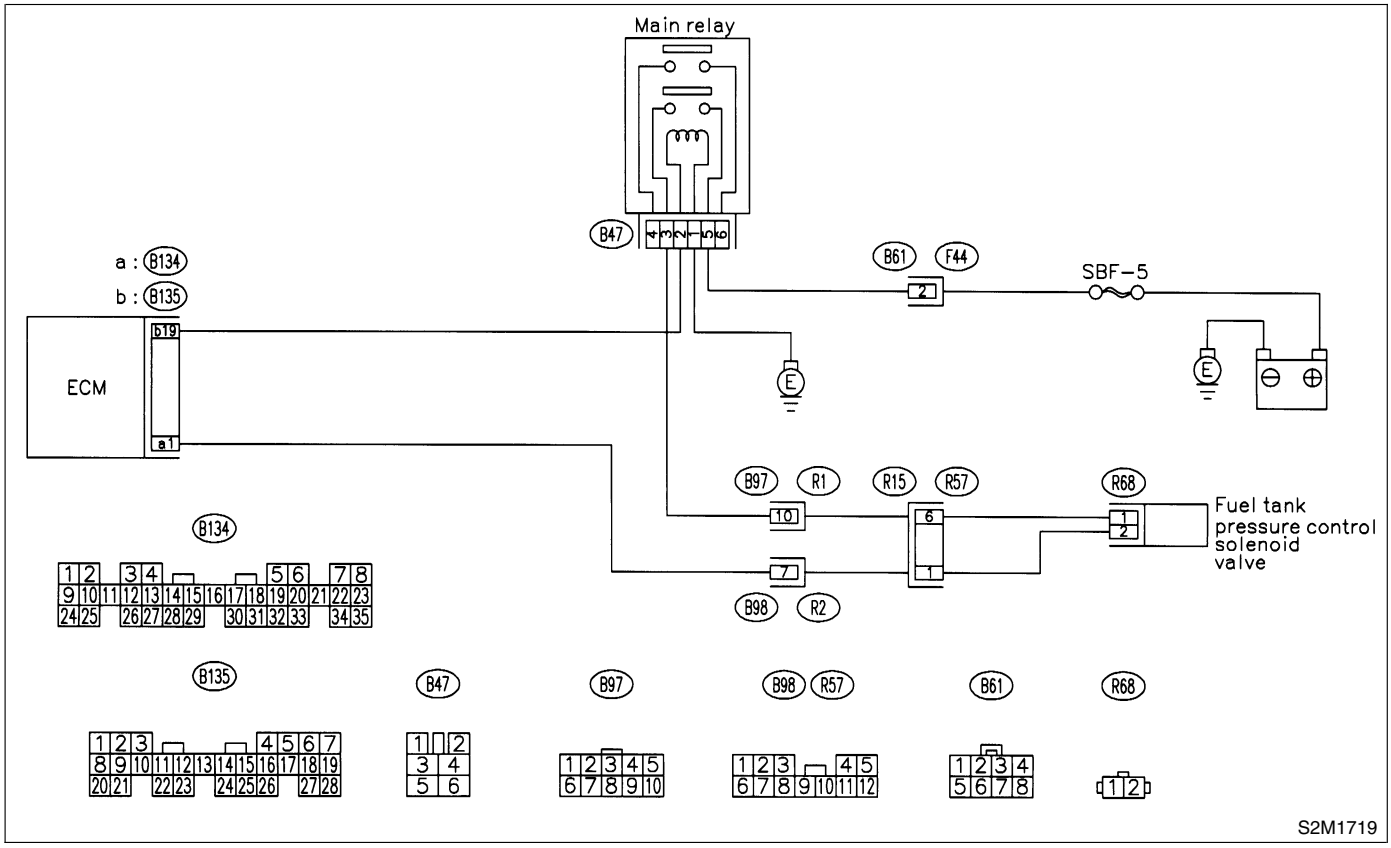
NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

CG: DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

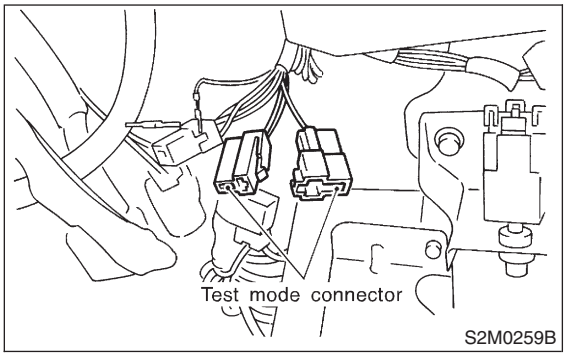
CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CG1 : CHECK OUTPUT SIGNAL FROM ECM.

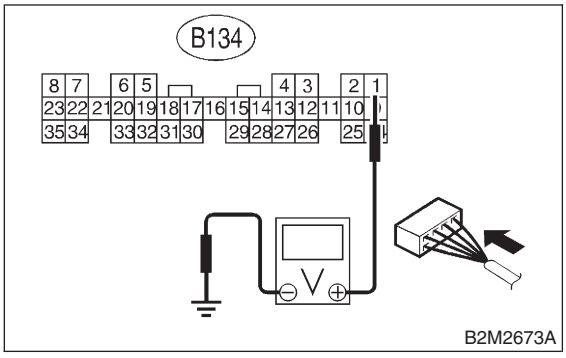
1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) While operating fuel tank pressure control solenoid valve, measure voltage between ECM and chassis ground.

NOTE:
Fuel tank pressure control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

Connector & terminal
(B134) No. 1 (+) — Chassis ground (–):

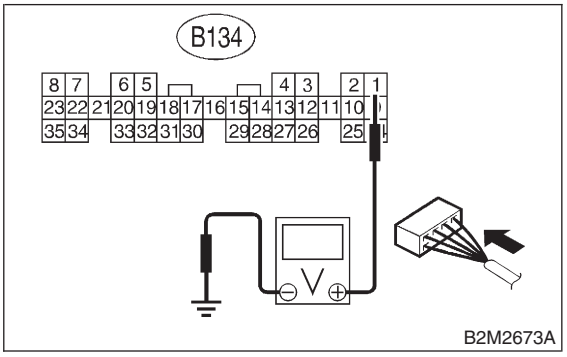


CHECK : ***Does voltage change between 0 and 10 V?***
YES : Go to step **10CG2**.
NO : Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.

10CG2 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CG4**.
NO : Go to step **10CG3**.

10CG3 : CHECK POOR CONTACT.

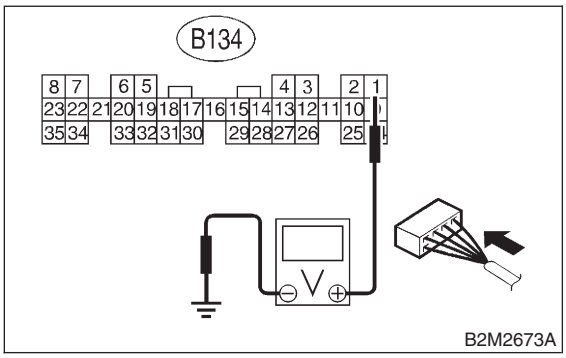
Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10CG4 : CHECK HARNESS BETWEEN FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from fuel tank pressure control solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 1 (+) — Chassis ground (–):

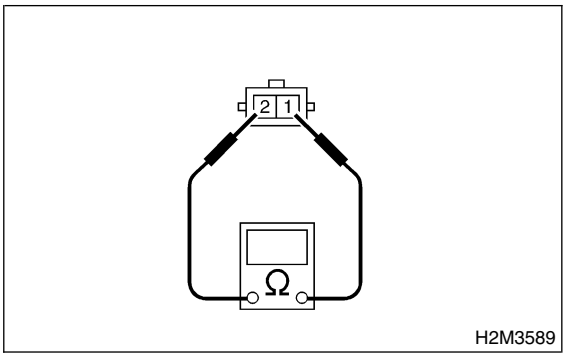


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and fuel tank pressure control solenoid valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **10CG5**.

10CG5 : CHECK FUEL TANK PRESSURE CONTROL SOLENOID VALVE.

1) Turn ignition switch to OFF.
2) Measure resistance between fuel tank pressure control solenoid valve terminals.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace fuel tank pressure control solenoid valve <Ref. to 2-1 [W9A0].> and ECM <Ref. to 2-7 [W17A0].>.
NO : Go to step **10CG6**.

10CG6 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

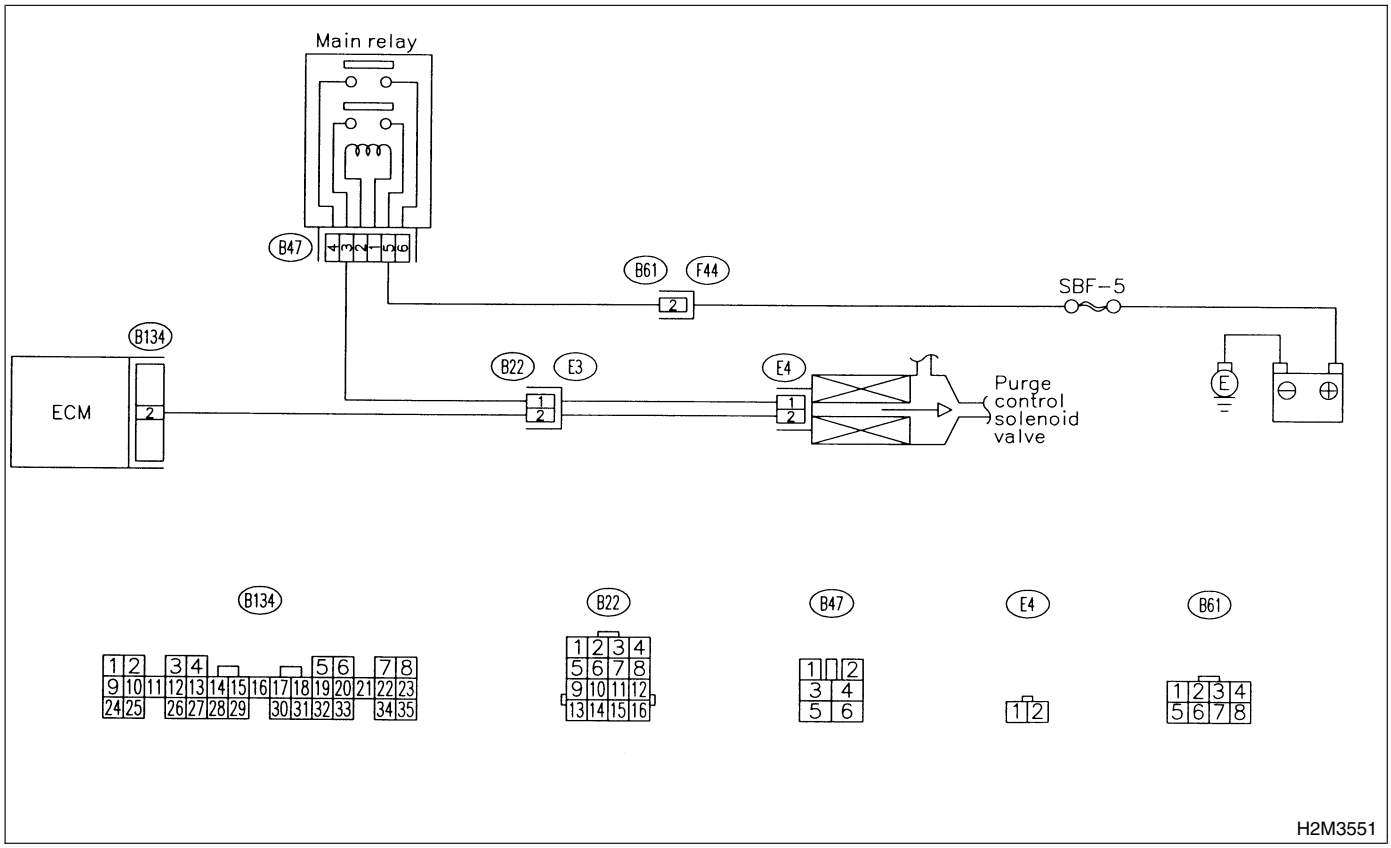
MEMO:

CH: DTC P1422 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Erroneous idling

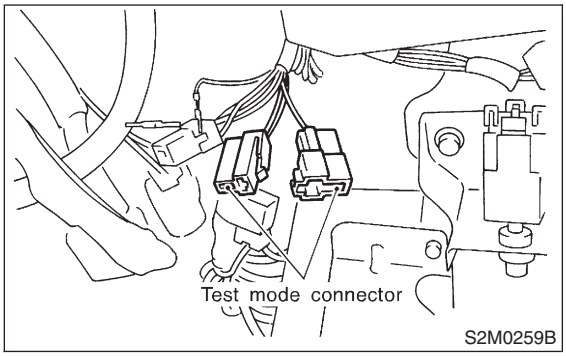
CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CH1 : CHECK OUTPUT SIGNAL FROM ECM.

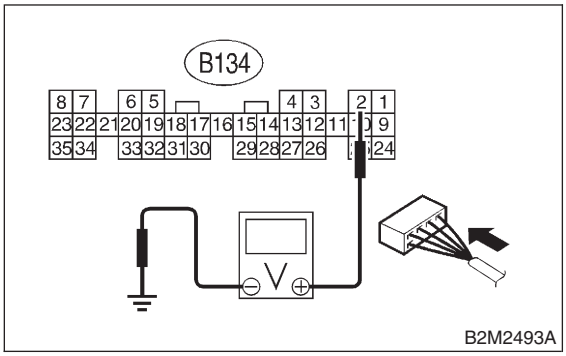
1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) While operating purge control solenoid valve, measure voltage between ECM and chassis ground.

NOTE:
Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

Connector & terminal
(B134) No. 2 (+) — Chassis ground (–):

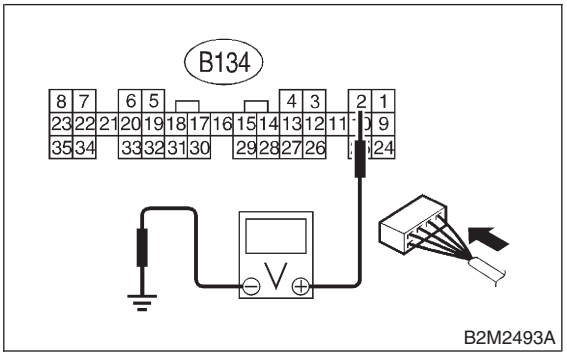


CHECK : ***Does voltage change between 0 and 10 V?***
YES : Go to step **10CH2**.
NO : Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.

10CH2 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 2 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CH4**.
NO : Go to step **10CH3**.

10CH3 : CHECK POOR CONTACT.

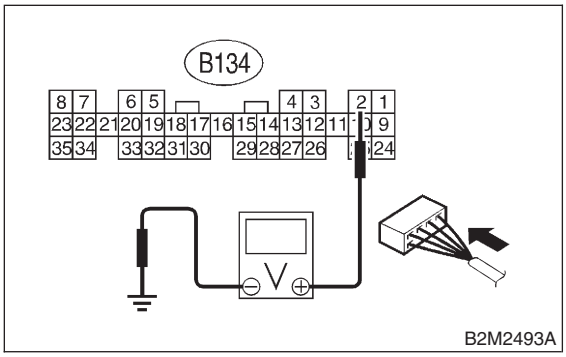
Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10CH4 : CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from purge control solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 2 (+) — Chassis ground (–):

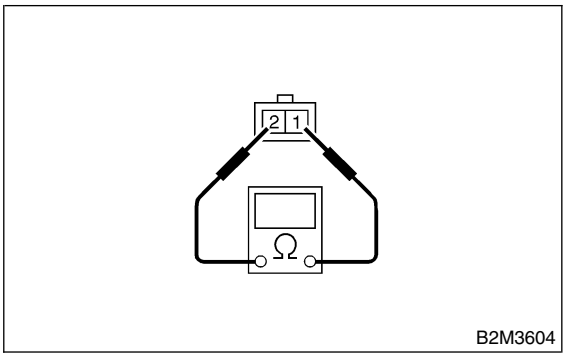


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and purge control solenoid valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **10CH5**.

10CH5 : CHECK PURGE CONTROL SOLENOID VALVE.

1) Turn ignition switch to OFF.
2) Measure resistance between purge control solenoid valve terminals.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace purge control solenoid valve <Ref. to 2-1 [W17A0].> and ECM <Ref. to 2-7 [W17A0].>.
NO : Go to step **10CH6**.

10CH6 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

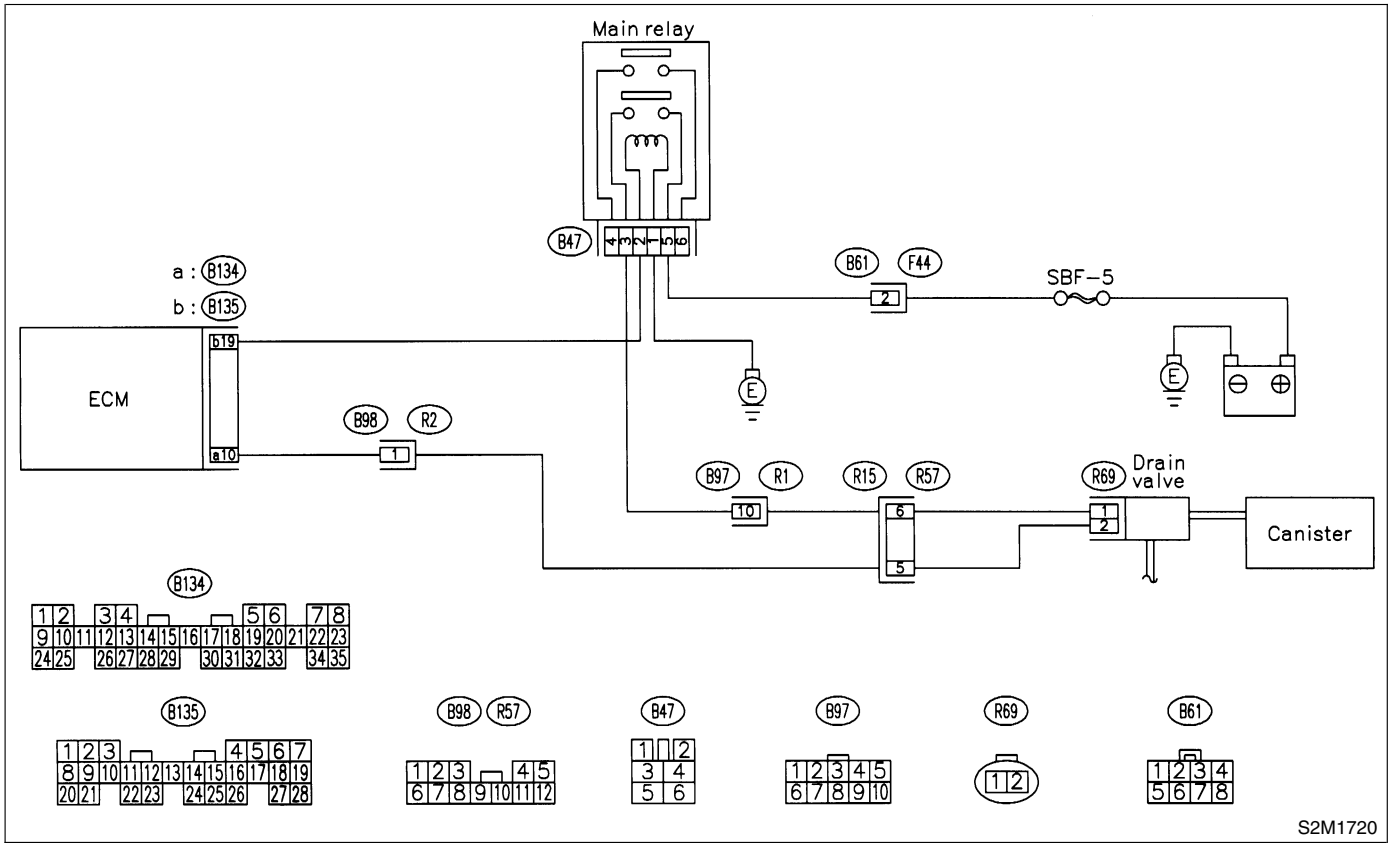
MEMO:

CI: DTC P1423 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

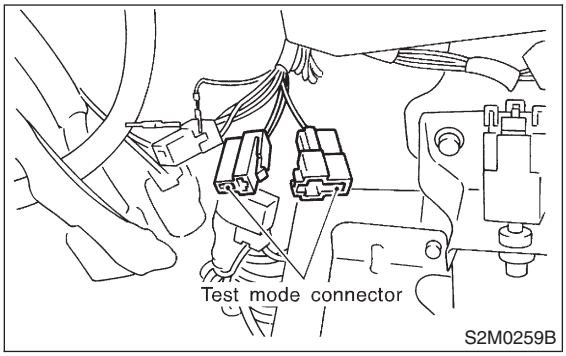
CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CI1 : CHECK OUTPUT SIGNAL FROM ECM.

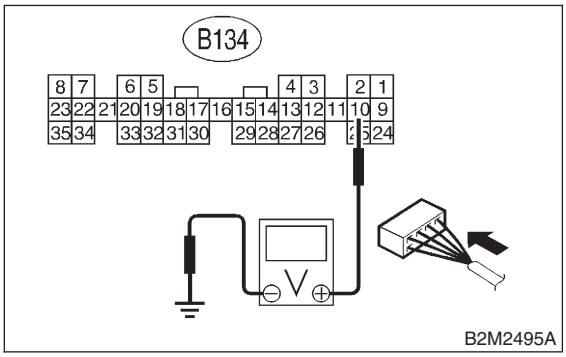
1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) While operating drain valve, measure voltage between ECM and chassis ground.

NOTE:
Drain valve operation can be executed using Subaru Select Monitor. For procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

Connector & terminal
(B134) No. 10 (+) — Chassis ground (–):

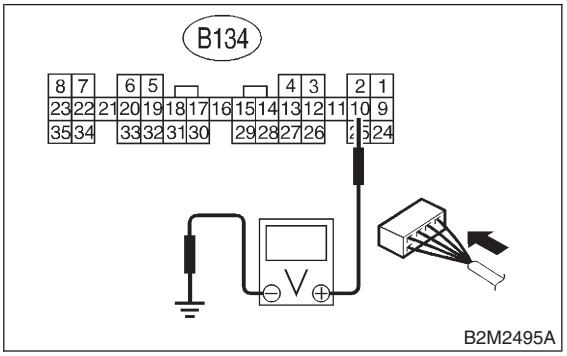


CHECK : ***Does voltage change between 0 and 10 V?***
YES : Go to step **10CI2**.
NO : Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.

10CI2 : CHECK OUTPUT SIGNAL FROM ECM.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 10 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CI4**.
NO : Go to step **10CI3**.

10CI3 : CHECK POOR CONTACT.

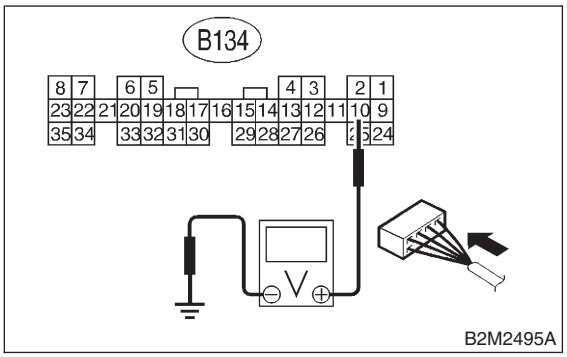
Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

10CI4 : CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from drain valve.
3) Turn ignition switch to ON.
4) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 10 (+) — Chassis ground (–):

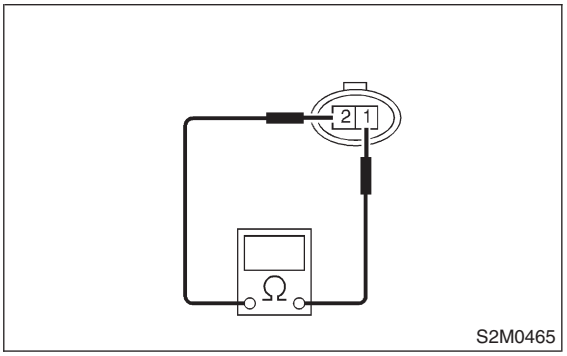


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and drain valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **10CI5**.

10CI5 : CHECK DRAIN VALVE.

1) Turn ignition switch to OFF.
2) Measure resistance between drain valve terminals.

Terminals
No. 1 — No. 2:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace drain valve <Ref. to 2-1 [W13A0].> and ECM <Ref. to 2-7 [W17A0].>.
NO : Go to step **10CI6**.

10CI6 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

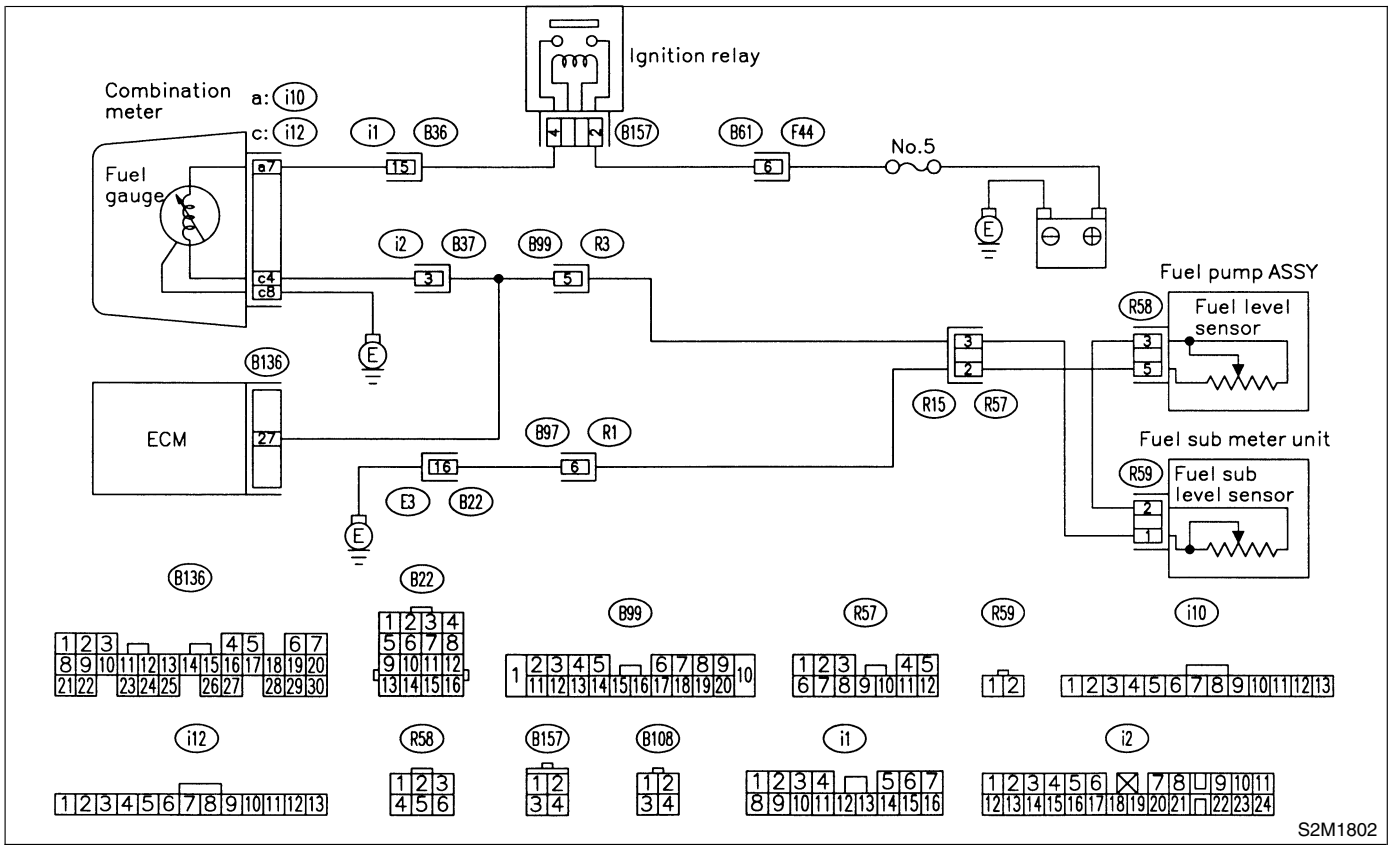
CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

CJ: DTC P1442 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM 2 —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CJ1 :	CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0461, P0462 or P0463?***

YES : Inspect DTC P0461, P0462 or P0463 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect this trouble.

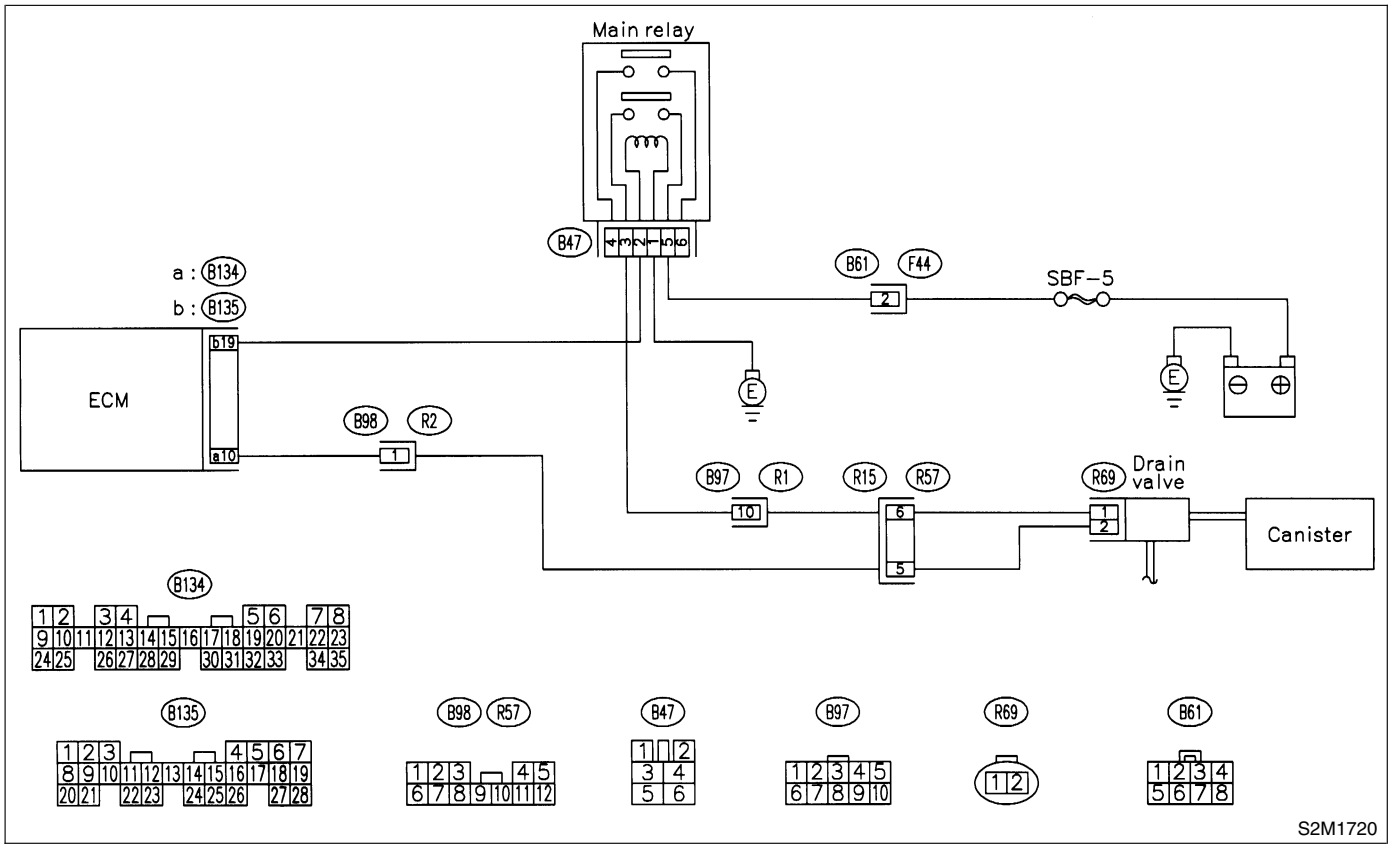
NO : Replace fuel level sensor <Ref. to 2-8 [W5A0].> and fuel sub level sensor. <Ref. to 2-8 [W6A0].>

CK: DTC P1443 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL FUNCTION PROBLEM —

- **DTC DETECTING CONDITION:**
  - Immediately after fault occurrence
- **TROUBLE SYMPTOM:**
  - Improper fuel supply

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CK1 : CHECK ANY OTHER DTC ON DISPLAY.

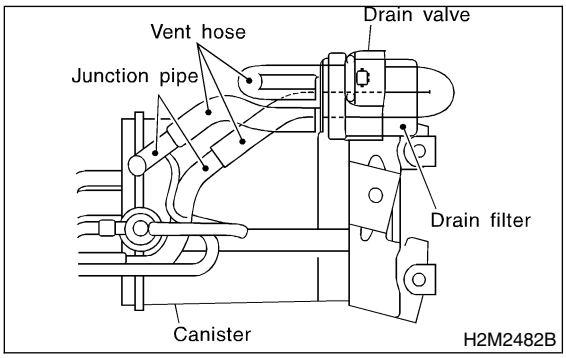
CHECK : ***Is there any other DTC on display?***

YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

NO : Go to step **10CK2**.

10CK2 : CHECK VENT LINE HOSES.

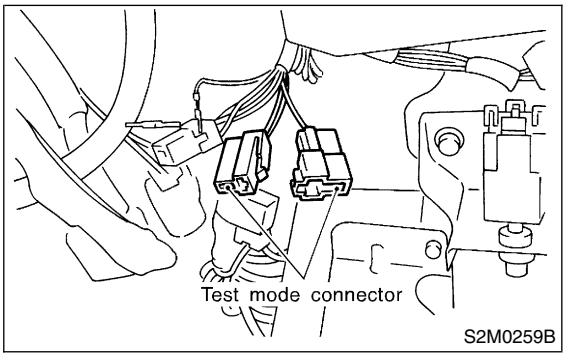
Check the following items.
- Clogging of vent hoses between canister and drain valve
- Clogging of vent hose between drain valve and drain filter
- Clogging of vent hose between drain filter and junction pipe
- Clogging of junction pipe
- Clogging of drain filter



CHECK : ***Is there a fault in vent line?***
YES : Repair or replace the faulty part.
NO : Go to step **10CK3**.

10CK3 : CHECK DRAIN VALVE OPERATION.

1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) Operate drain valve.

NOTE:
Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to the "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

CHECK : ***Does drain valve produce operating sound?***
YES : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

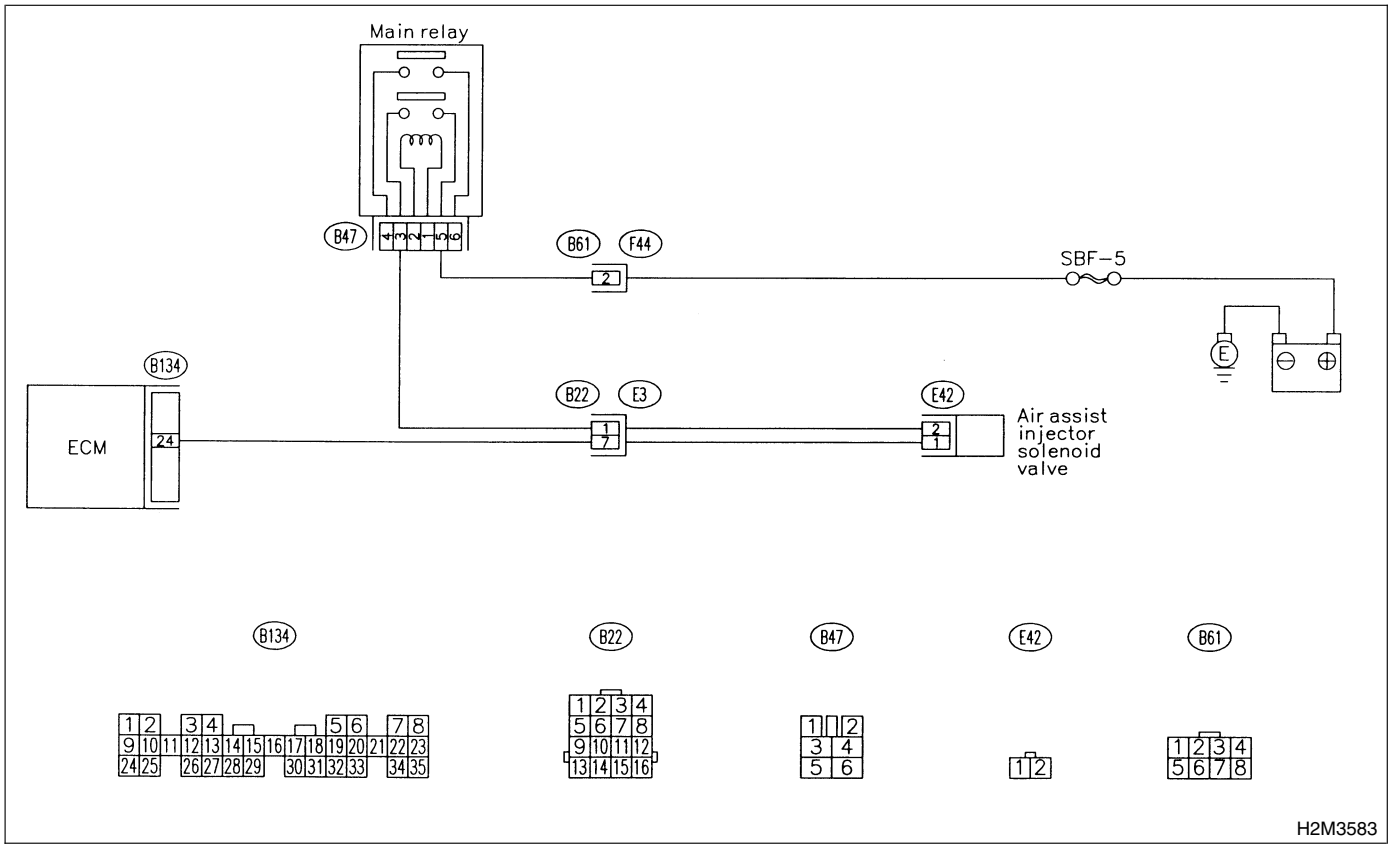
NO : Replace drain valve. <Ref. to 2-1 [W13A0].>

CL: DTC P1445 — AIR ASSIST INJECTOR SOLENOID VALVE MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately after fault occurrence
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**

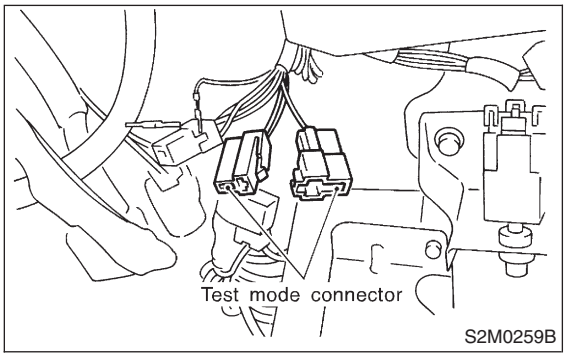


10CL1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Is there any other DTC on display?***
YES : Inspect the relevant DTC using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>
NO : Go to step **10CL2**.

10CL2 : CHECK AIR ASSIST INJECTOR SOLENOID VALVE OPERATION.

1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) Operate air assist injector solenoid valve.

NOTE:
Air assist injector solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to the "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

CHECK : ***Does air assist injector solenoid valve operating sound?***
YES : Go to step **10CL3**.
NO : Replace air assist injector solenoid valve. <Ref. to 2-1 [W14A0].>

10CL3 : CHECK AIR BY-PASS HOSES.

Use your mouth to blow through air by-pass hose to make sure that there is a smooth air flow (no clogging).

CHECK : ***Is air by-pass hose damaged?***
YES : Repair or replace air by-pass hoses.
NO : Go to step **10CL4**.

10CL4 : CHECK FUEL INJECTOR.

1) Turn ignition switch to OFF.
2) Remove fuel injector. <Ref. to 2-7 [W16A0].>
3) Check for clogged fuel injectors.

CHECK : ***Is fuel injector clogged?***
YES : Replace fuel injector. <Ref. to 2-7 [W16A0].>
NO : Replace air assist injector solenoid valve. <Ref. to 2-7 [W14A0].>

CM: DTC P1490 — THERMOSTAT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Thermostat remains open.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

10CM1 : CHECK VEHICLE CONDITION.

CHECK : ***Has engine operated at idle or has vehicle been driven with part of engine submerged under water?***

YES : In this case, it is not necessary to inspect DTC P1490.

NO : Go to step **10CM2**.

10CM2 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0125, P0301, P0302, P0303 and P0304 at same time?***

YES : Go to step **10CM3**.

NO : Inspect DTC P0125, P0301, P0302, P0303 and P0304 using “10. Diagnostics Chart with Trouble Code”. <Ref. to 2-7 [T10A0].>

10CM3 : CHECK ENGINE COOLANT.

CHECK : ***Are coolant level and mixture ratio of cooling water to anti-freeze solution correct?***

YES : Go to step **10CM4**.

NO : Replace engine coolant. <Ref. to 2-5 [W9A0].>

10CM4 : CHECK RADIATOR FAN.

1) Start the engine.
2) Check radiator fan operation.

CHECK : ***Does radiator fan continuously rotate for more than 3 minutes during idling?***

YES : Repair radiator fan circuit. <Ref. to 2-5 [T100].>

NO : Replace thermostat. <Ref. to 2-5 [W2A0].>

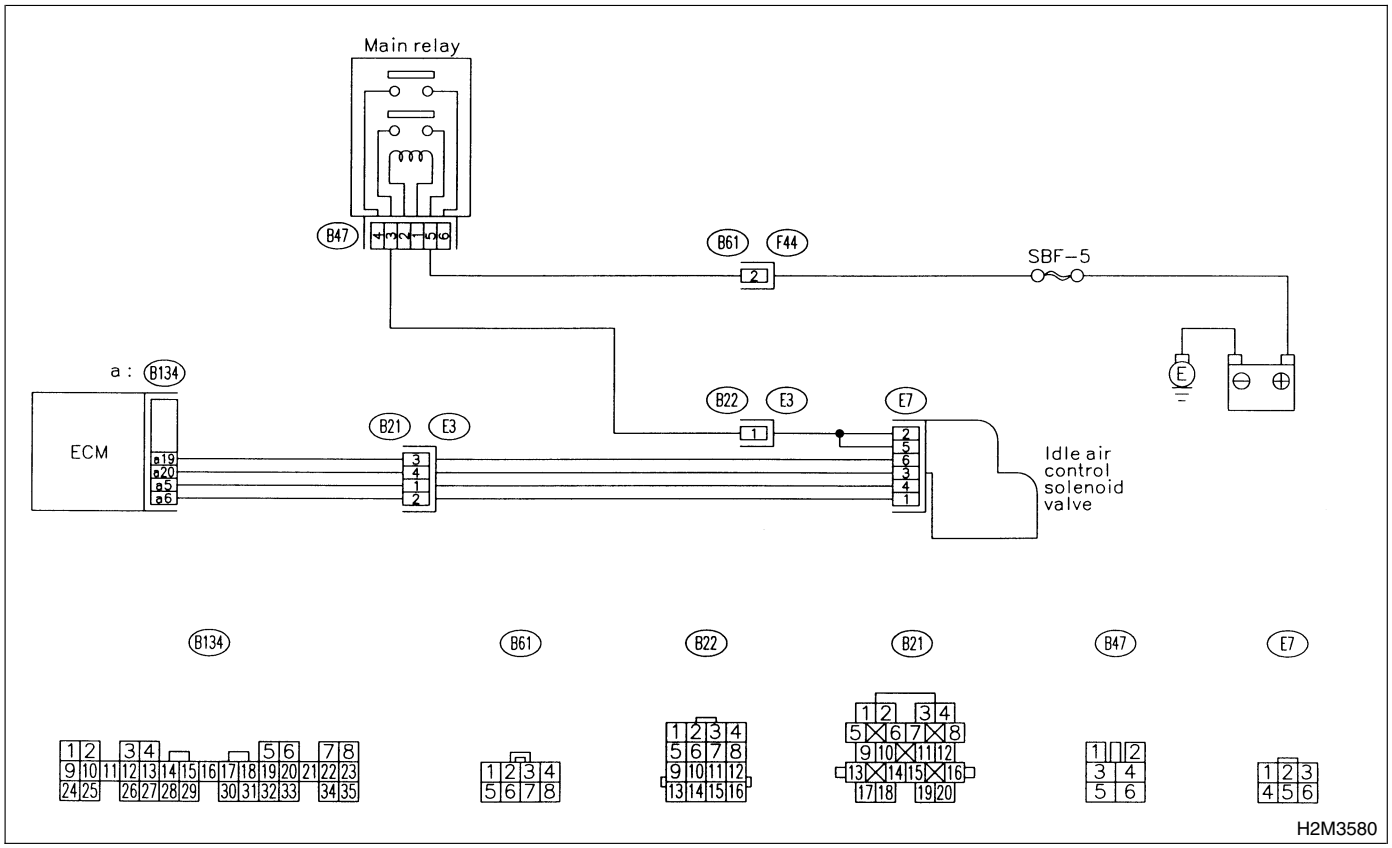
MEMO:

CN: DTC P1507 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Engine keeps running at higher revolution than specified idling revolution.

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CN1 : CHECK ANY OTHER DTC ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517?***

YES : Inspect DTC P1510, P1511, P1512, P1513, P1514, P1515, P1516 or P1517 using "10. Diagnostics Chart with Trouble Code". <Ref. to 2-7 [T10A0].>

NOTE:
In this case, it is not necessary to inspect DTC P0507.

NO : Go to step **10CN2**.

10CN2 : CHECK AIR INTAKE SYSTEM.

1) Turn ignition switch to ON.
2) Start engine, and idle it.
3) Check the following items.

- Loose installation of intake manifold, idle air control solenoid valve and throttle body
- Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket
- Disconnections of vacuum hoses

CHECK : ***Is there a fault in air intake system?***

YES : Repair air suction and leaks.

NO : Go to step **10CN3**.

10CN3 : CHECK THROTTLE CABLE.

CHECK : ***Does throttle cable have play for adjustment?***
YES : Go to step **10CN4**.
NO : Adjust throttle cable. <Ref. to 4-5 [W1A3].>

10CN4 : CHECK AIR BY-PASS LINE.

1) Turn ignition switch to OFF.
2) Remove idle air control solenoid valve from throttle body. <Ref. to 2-7 [W15A2].>
3) Confirm that there are no foreign particles in by-pass air line.

CHECK : ***Are foreign particles in by-pass air line?***
YES : Remove foreign particles from by-pass air line.
NO : Replace idle air control solenoid valve. <Ref. to 2-7 [W13A0].>

MEMO:

CO: DTC P1510 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1 CIRCUIT LOW INPUT —

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to 2-7 [T10CU0].>

CP: DTC P1511 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1 CIRCUIT HIGH INPUT —

NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to 2-7 [T10CV0].>

CQ: DTC P1512 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2 CIRCUIT LOW INPUT —

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to 2-7 [T10CU0].>

CR: DTC P1513 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2 CIRCUIT HIGH INPUT —

NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to 2-7 [T11CV0].>

CS: DTC P1514 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3 CIRCUIT LOW INPUT —

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to 2-7 [T11CU0].>

CT: DTC P1515 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3 CIRCUIT HIGH INPUT —

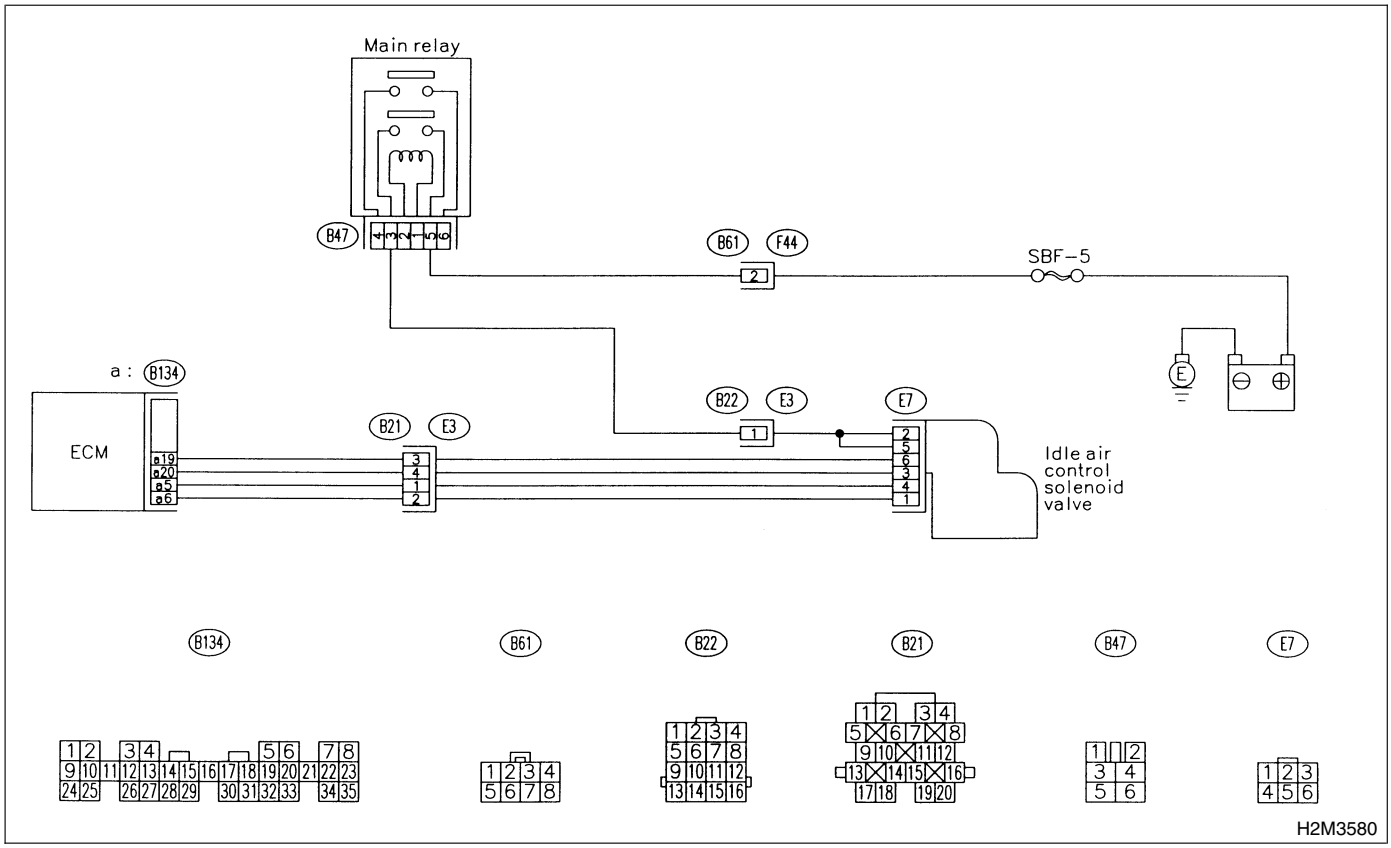
NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to 2-7 [T10CV0].>

CU: DTC P1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Engine breathing

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

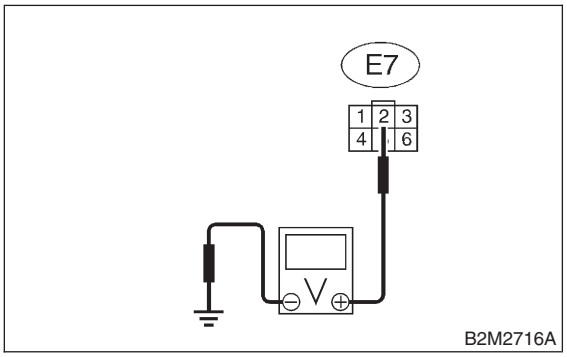
- **WIRING DIAGRAM:**



10CU1 : CHECK POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE.

1) Turn ignition switch to OFF.
2) Disconnect connector from idle air control solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between idle air control solenoid valve connector and engine ground.

Connector & terminal
(E7) No. 2 (+) — Engine ground (–):



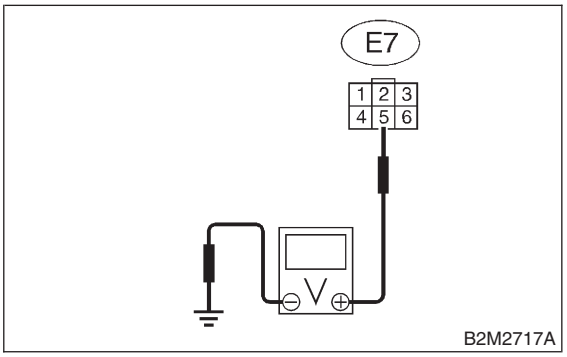
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CU2**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between idle air control solenoid valve and main relay connector
- Poor contact in coupling connector (B22)

10CU2 : CHECK POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE.

Measure voltage between idle air control solenoid valve connector and engine ground.

Connector & terminal
(E7) No. 5 (+) — Engine ground (–):



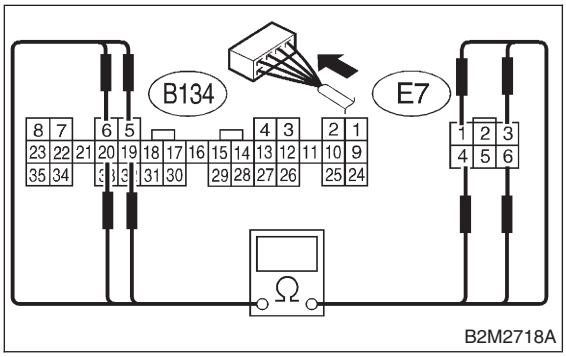
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **10CU3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between idle air control solenoid valve and main relay connector
- Poor contact in coupling connector (B22)

10CU3 : CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ECM and idle air control solenoid valve connector.

Connector & terminal
DTC P1510; (B134) No. 5 — (E7) No. 3:
DTC P1512; (B134) No. 6 — (E7) No. 1:
DTC P1514; (B134) No. 19 — (E7) No. 6:
DTC P1516; (B134) No. 20 — (E7) No. 4:



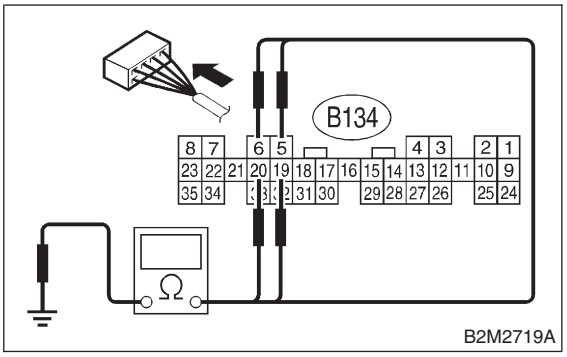
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10CU4**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and idle air control solenoid valve connector
- Poor contact in coupling connector (B21)

10CU4 : CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR.

1) Disconnect connector from ECM.
2) Measure resistance between ECM connector and chassis ground.

Connector & terminal
DTC P1510; (B134) No. 5 — Chassis ground:
DTC P1512; (B134) No. 6 — Chassis ground:
DTC P1514; (B134) No. 19 — Chassis ground:
DTC P1516; (B134) No. 20 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and idle air control solenoid valve connector.
NO : Go to step **10CU5**.

10CU5 : CHECK POOR CONTACT.

Check poor contact in ECM connector and idle air control solenoid valve connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector or idle air control solenoid valve connector?***

YES : Repair poor contact in ECM connector or idle air control solenoid valve connector.

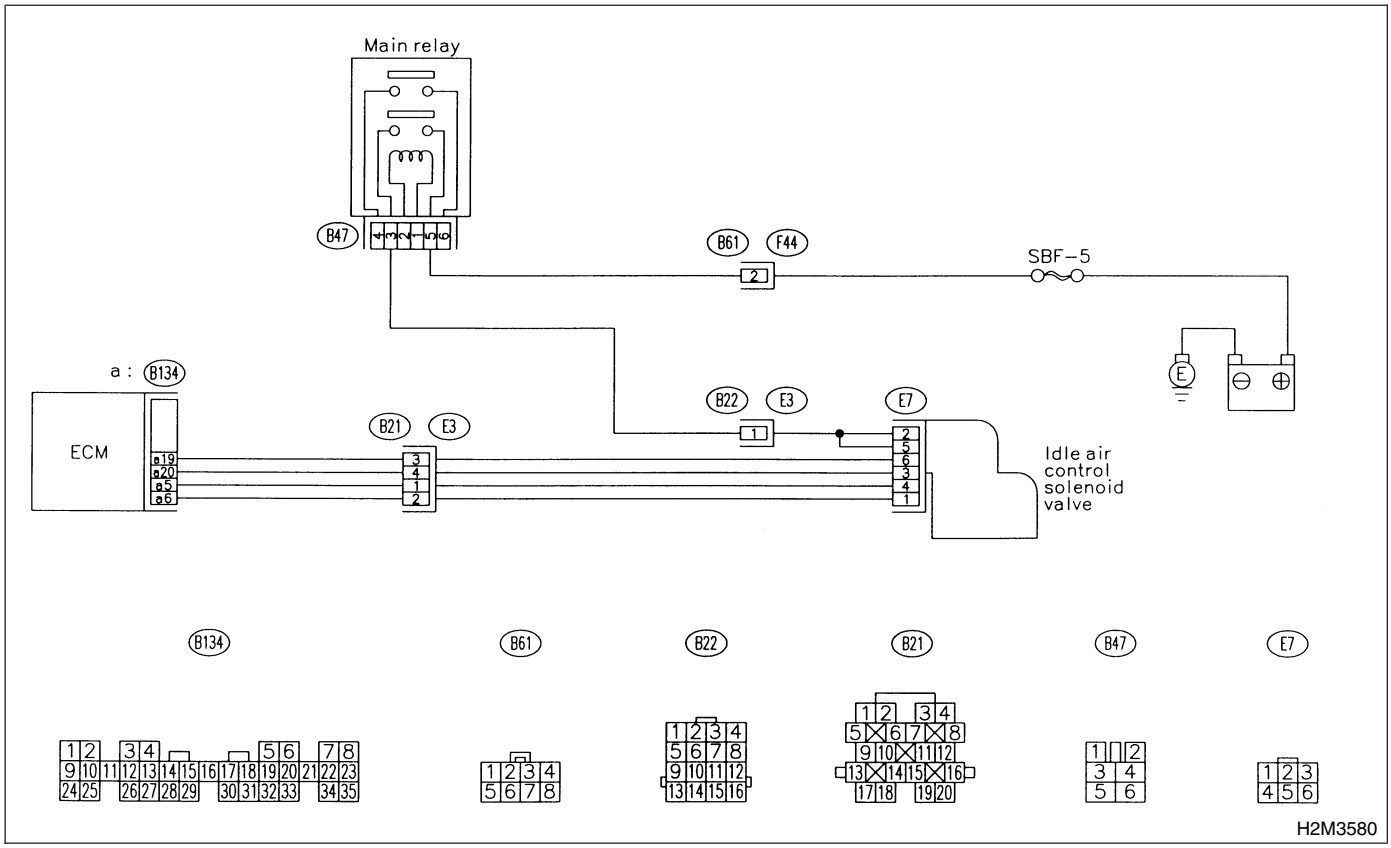
NO : Replace idle air control solenoid valve. <Ref. to 2-7 [W13A0].>

CV: DTC P1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Engine breathing

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CV1 :	**CHECK ANY OTHER DTC ON DISPLAY.**

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1511, P1513, P1515 and P1517 at same time?***

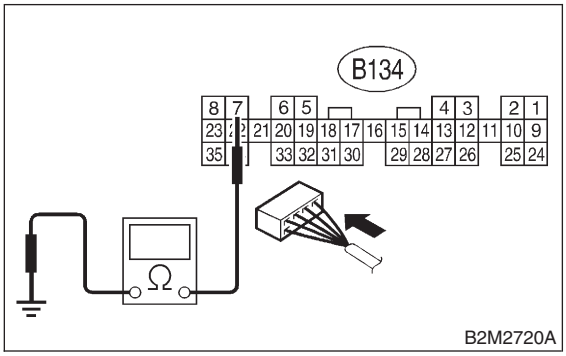
YES : Go to step **10CV2**.

NO : Go to step **10CV3**.

10CV2 : CHECK GROUND CIRCUIT FOR ECM.

1) Turn ignition switch to OFF.
2) Measure resistance between ECM connector and chassis ground.

Connector & terminal
(B134) No. 7 — Chassis ground:



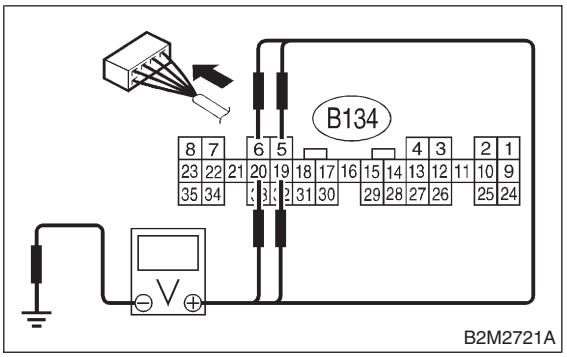
CHECK : ***Is the resistance less than 5 Ω?***
YES : Go to step **10CV3**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM connector and engine ground terminal
- Poor contact in ECM connector
- Poor contact in coupling connector (B22)

10CV3 : CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from idle air control solenoid valve.
3) Turn ignition switch to ON.
4) Measure voltage between ECM connector and chassis ground.

Connector & terminal
DTC P1511; (B134) No. 5 (+) — Chassis ground (–):
DTC P1513; (B134) No. 6 (+) — Chassis ground (–):
DTC P1515; (B134) No. 19 (+) — Chassis ground (–):
DTC P1517; (B134) No. 20 (+) — Chassis ground (–):



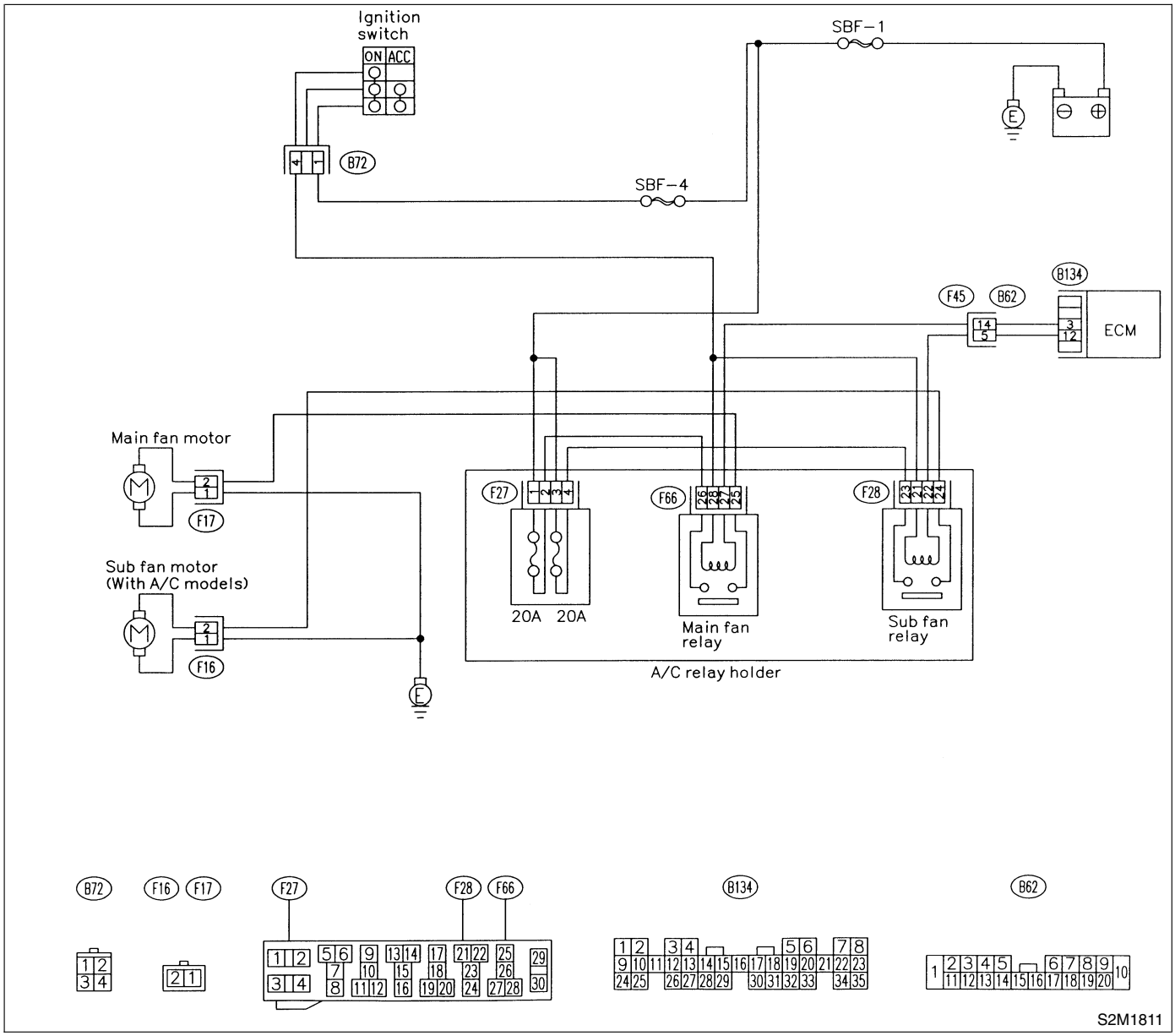
CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and idle air control solenoid valve connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

CW: DTC P1520 — COOLING FAN RELAY 1 CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Radiator fan does not operate properly.
  - Overheating

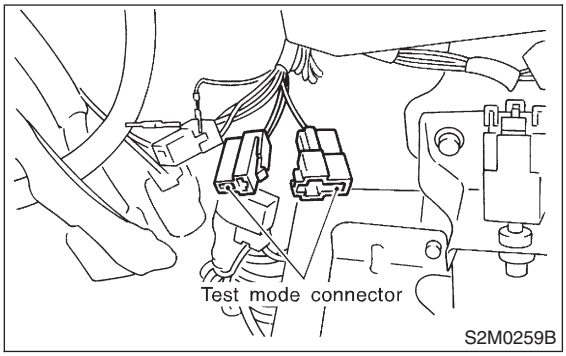
CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CW1 : CHECK OUTPUT SIGNAL FROM ECM.

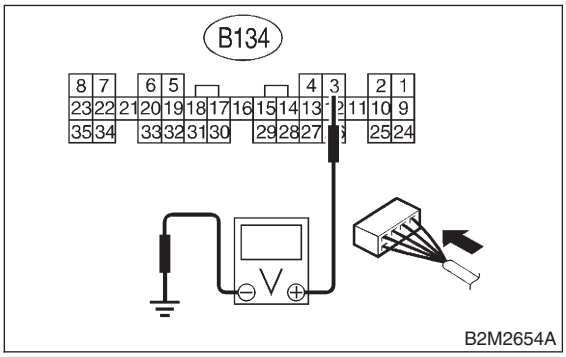
1) Turn ignition switch to OFF.
2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



3) Turn ignition switch to ON.
4) While operating radiator fan relay, measure voltage between ECM and chassis ground.

NOTE:
Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "COMPULSORY VALVE OPERATION CHECK MODE". <Ref. to 2-7 [T3F0].>

Connector & terminal
(B134) No. 3 (+) — Chassis ground (–):



CHECK : ***Does voltage change between 0 and 10 V?***

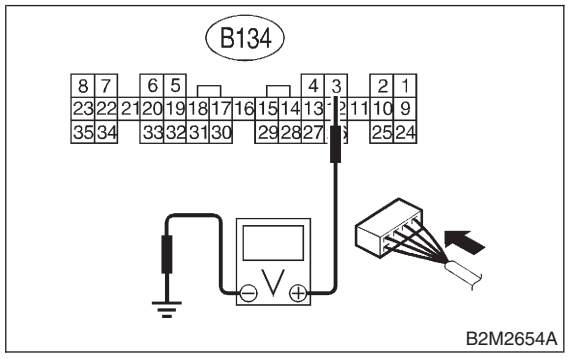
YES : Even if MIL lights up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.

NO : Go to step **10CW2**.

10CW2 : CHECK SHORT CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT.

1) Turn ignition switch to OFF.
2) Remove main fan relay and sub fan relay. (with A/C models)
3) Disconnect test mode connector.
4) Turn ignition switch to ON.
5) Measure voltage between ECM and chassis ground.

Connector & terminal
(B134) No. 3 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V?***

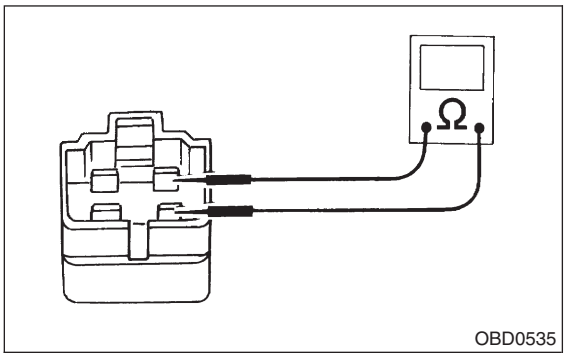
YES : Repair battery short circuit in radiator fan relay control circuit. After repair, replace ECM. <Ref. to 2-7 [W17A0].>

NO : Go to step **10CW3**.

10CW3 : CHECK MAIN FAN RELAY.

1) Turn ignition switch to OFF.
2) Remove main fan relay.
3) Measure resistance between main fan relay terminals.

Terminal
No. 1 — No. 3:

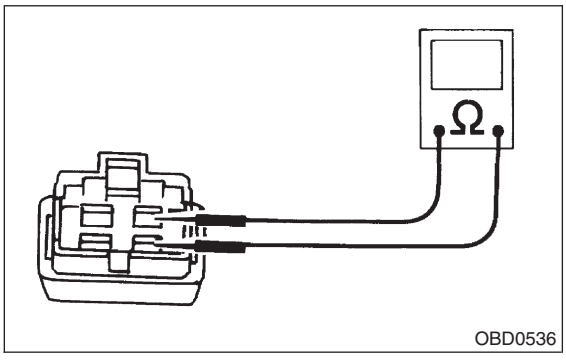


CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace main fan relay and ECM <Ref. to 2-7 [W17A0].>
NO : Go to step **10CW4**.

10CW4 : CHECK SUB FAN RELAY.

1) Remove sub fan relay.
2) Measure resistance between sub fan relay terminals.

Terminal
No. 1 — No. 3



CHECK : ***Is the resistance less than 1 Ω?***
YES : Replace sub fan relay and ECM <Ref. to 2-7 [W17A0].>
NO : Go to step **10CW5**.

10CW5 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

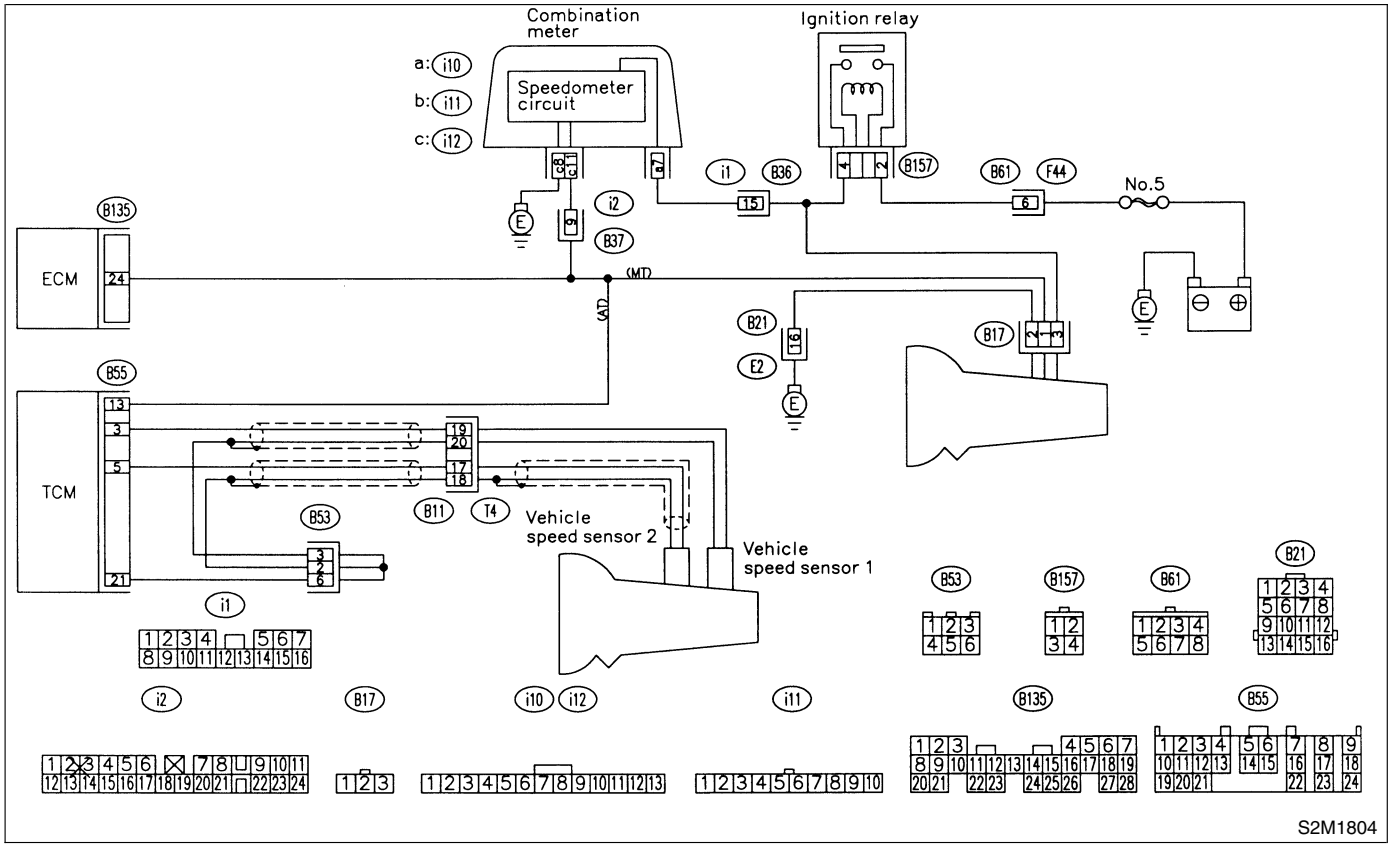
MEMO:

CX: DTC P1540 — VEHICLE SPEED SENSOR MALFUNCTION 2 —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10CX1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **10CX2**.
NO : Go to step **10CX3**.

10CX2 : CHECK DTC P0720 ON DISPLAY.

CHECK : ***Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?***
YES : Check vehicle speed sensor 2 signal circuit. <Ref. to 3-2 [T8F0].>
NO : Go to step **10CX3**.

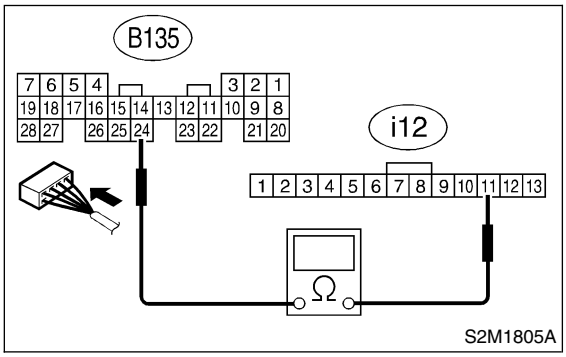
10CX3 : CHECK SPEEDOMETER OPERATION IN COMBINATION METER.

CHECK : ***Does speedometer operate normally?***
YES : Go to step **10CX4**.
NO : Check speedometer and vehicle speed sensor. <Ref. to 6-2 [K3A0].>

10CX4 : CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from combination meter.
3) Measure resistance between ECM and combination meter.

Connector & terminal
(B135) No. 24 — (i12) No. 11:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair poor contact in ECM connector.
NO : Repair harness and connector.

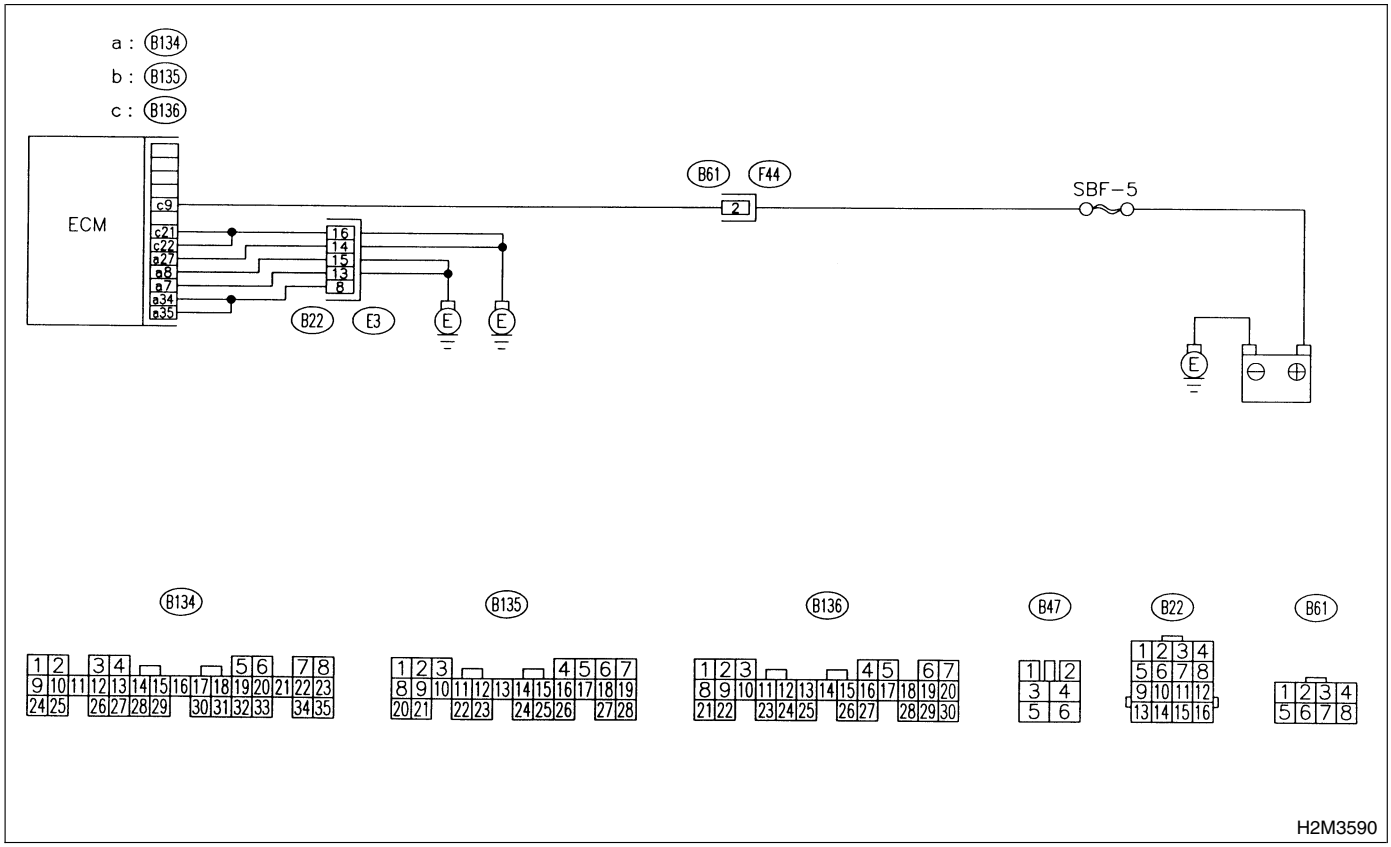
NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and combination meter connector
- Poor contact in ECM connector
- Poor contact in combination meter connector
- Poor contact in coupling connector (i2)

CY: DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

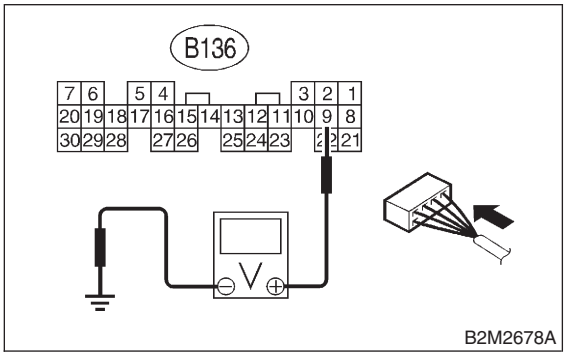
- **WIRING DIAGRAM:**



10CY1 : CHECK INPUT SIGNAL FOR ECM.

1) Turn ignition switch to OFF.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B136) No. 9 (+) — Chassis ground (–):

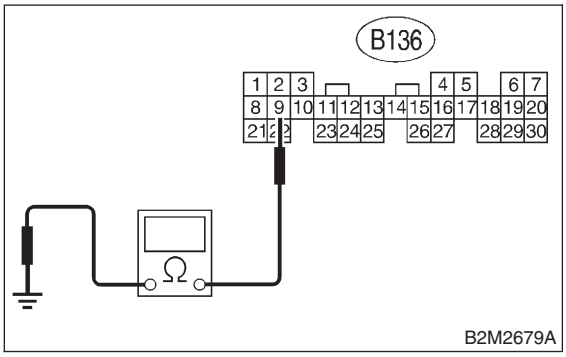


CHECK : ***Is the voltage more than 10 V?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10CY2**.

10CY2 : CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.

1) Disconnect connector from ECM.
2) Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B136) No. 9 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM connector and battery terminal.
NO : Go to step **10CY3**.

10CY3 : CHECK FUSE SBF-5.

CHECK : ***Is fuse blown?***
YES : Replace fuse. <Ref. to 6-3 [D6A0].>
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM and battery
- Poor contact in ECM connector
- Poor contact in battery terminal

CZ: DTC P1700 — THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AUTOMATIC TRANSMISSION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
  - Shift point too high or too low; engine brake not effected in “3” range; excessive shift shock; excessive tight corner “braking”

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check throttle position sensor circuit. <Ref. to 3-2 [T8F0].>

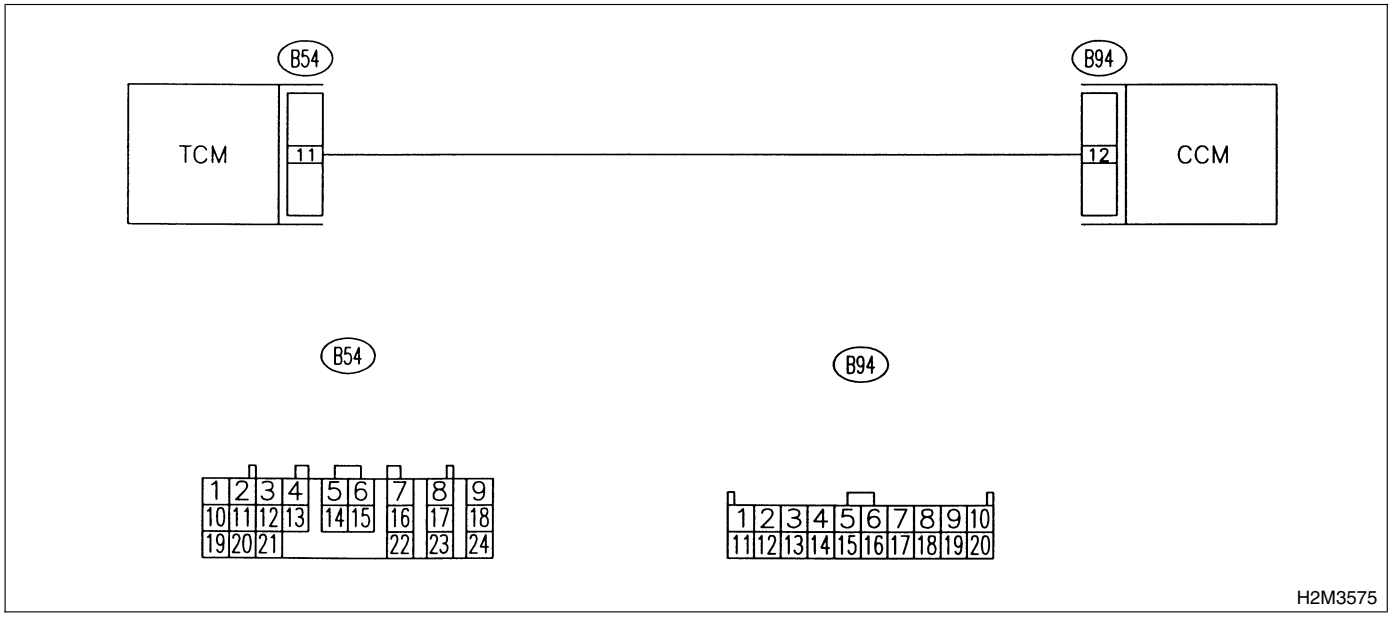
MEMO:

DA: DTC P1701 — CRUISE CONTROL SET SIGNAL CIRCUIT MALFUNCTION FOR AUTOMATIC TRANSMISSION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

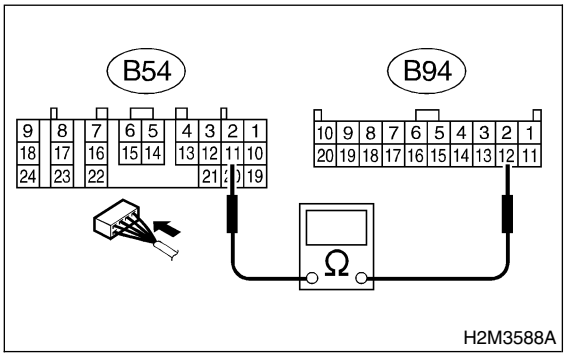
- **WIRING DIAGRAM:**



10DA1 : CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and CCM.
3) Measure resistance of harness between TCM and CCM connector.

Connector & terminal
(B54) No. 11 — (B94) No. 12:

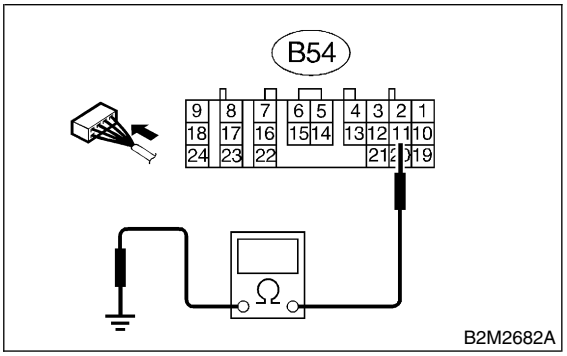


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **10DA2**.
NO : Repair open circuit in harness between TCM and CCM connector.

10DA2 : CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B54) No. 11 — Chassis ground:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair short circuit in harness between TCM and CCM connector.
NO : Go to step **10DA3**.

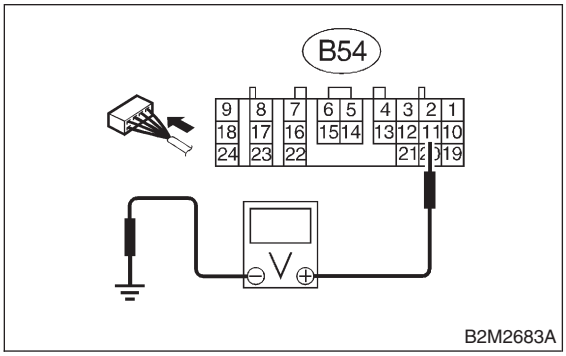
10DA3 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connector to TCM and CCM.
2) Lift-up the vehicle or set the vehicle on free rollers.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine.
4) Cruise control main switch to ON.
5) Move selector lever to “D” and slowly increase vehicle speed to 50 km/h (31 MPH).
6) Cruise control set switch to ON.
7) Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 11 (+) — Chassis ground (–):



CHECK : ***Is the resistance less than 1 V?***
YES : Go to step **10DA4**.
NO : Check cruise control set circuit. <Ref. to 6-2 [T7A0].>

10DA4 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

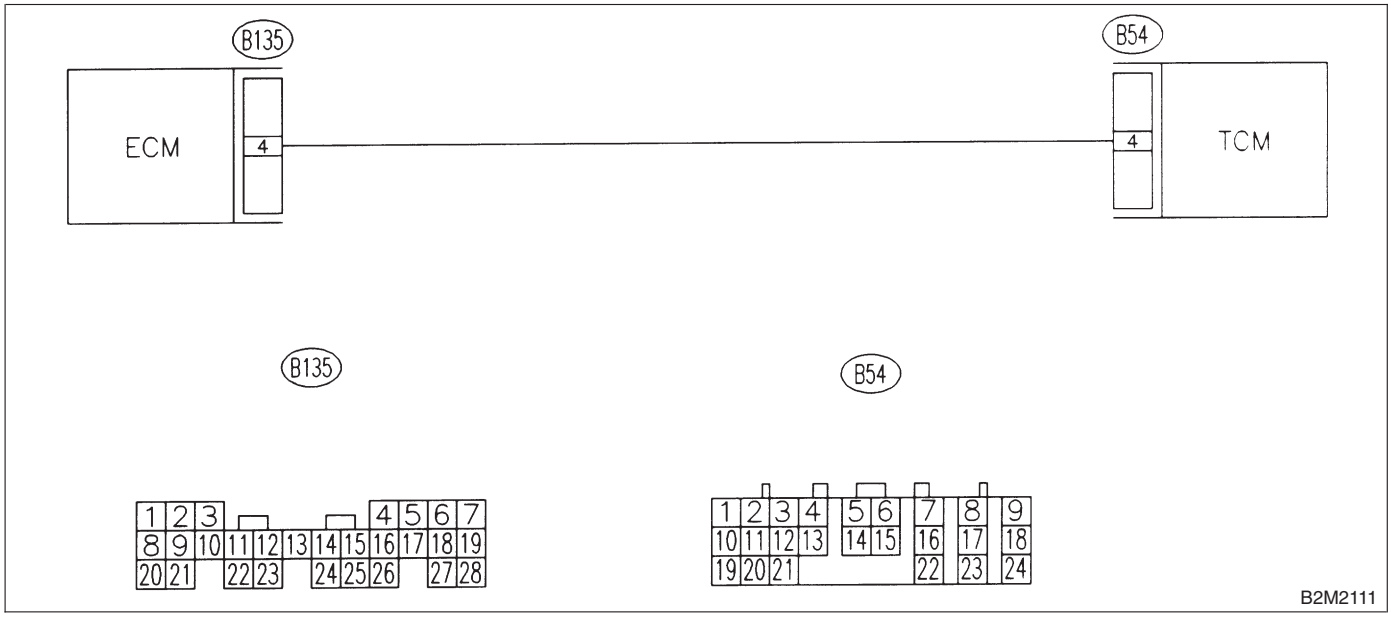
CHECK : ***Is there poor contact in TCM connector?***
YES : Repair poor contact in TCM connector.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

DB: DTC P1702 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



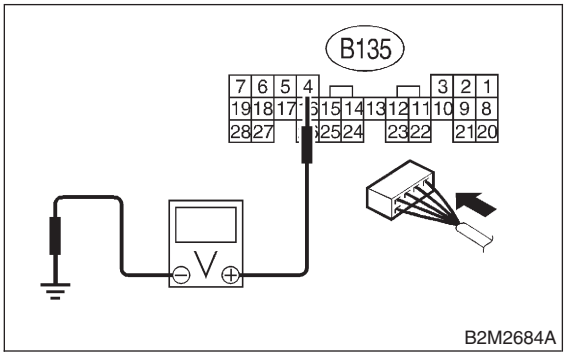
10DB1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **10DB2**.
NO : Check AT/MT identification circuit. <Ref. to 2-7 [T10DH0].>

10DB2 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):



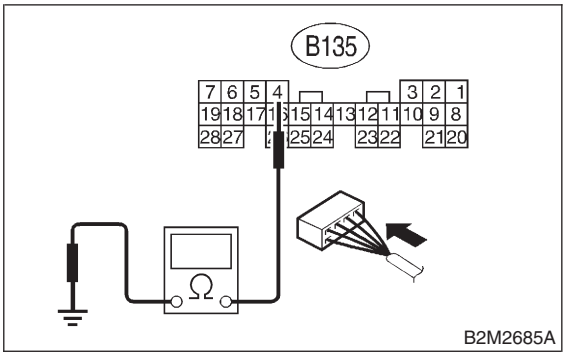
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10DB3**.
NO : Even if MIL lights up, the circuit has returned to a normal condition at this time.

NOTE:
In this case, repair the following:
- Poor contact in ECM connector
- Poor contact in TCM connector

10DB3 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ECM and TCM.
3) Measure resistance of harness between ECM and chassis ground.

Connector & terminal
(B135) No. 4 — Chassis ground:

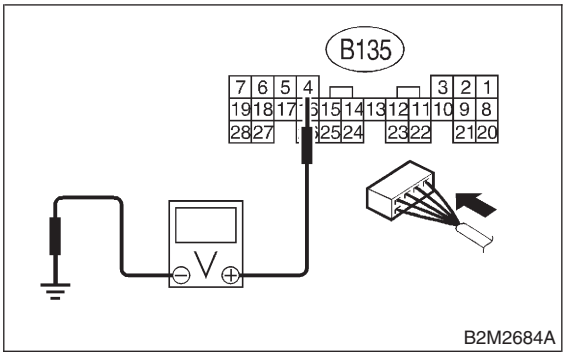


CHECK : ***Is the resistance less than 10 Ω?***
YES : Repair ground short circuit in harness between ECM and TCM connector.
NO : Go to step **10DB4**.

10DB4 : CHECK OUTPUT SIGNAL FOR ECM.

1) Connect connector to ECM.
2) Turn ignition switch to ON.
3) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 5 V?***
YES : Go to step **10DB5**.
NO : Repair poor contact in ECM connector.

10DB5 : CHECK TROUBLE CODE FOR AUTOMATIC TRANSMISSION.

Read trouble code for automatic transmission. <Ref. to 3-2 [T8A0].>

CHECK : ***Does trouble code appear for automatic transmission?***

YES : Inspect trouble code for automatic transmission. <Ref. to 3-2 [T8A0].>

NO : Replace TCM. <Ref. to 3-2 [W23A0].>

DC: DTC P1703 — LOW CLUTCH TIMING CONTROL SOLENOID VALVE CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check low clutch timing control solenoid valve circuit. <Ref. to 3-2 [T8L0].>

DD: DTC P1704 — 2-4 BRAKE TIMING CONTROL SOLENOID VALVE CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

NOTE:
Check 2-4 brake timing control solenoid valve circuit. <Ref. to 3-2 [T8M0].>

DE: DTC P1705 — 2-4 BRAKE PRESSURE CONTROL SOLENOID VALVE (2-4 BRAKE DUTY SOLENOID) CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

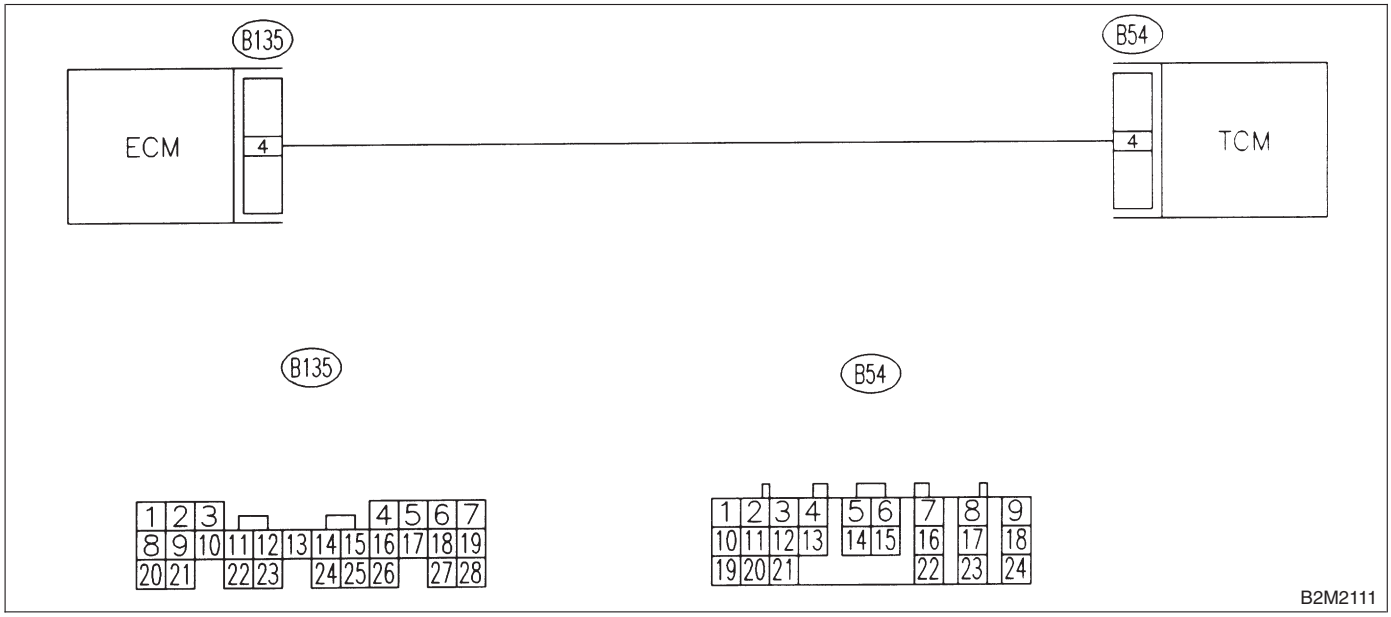
NOTE:
Check 2-4 brake duty solenoid circuit. <Ref. to 3-2 [T8O0].>

DF: DTC P1722 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



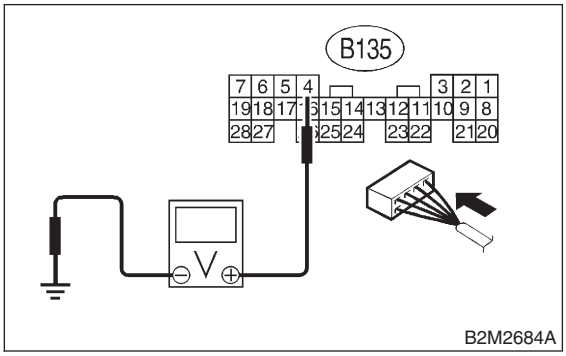
10DF1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **10DF2**.
NO : Check AT/MT identification circuit. <Ref. to [T10DH0].>

10DF2 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):

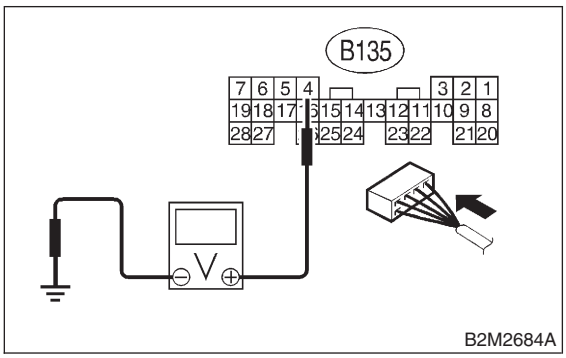


CHECK : ***Is the voltage more than 10 V?***
YES : Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **10DF3**.

10DF3 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):

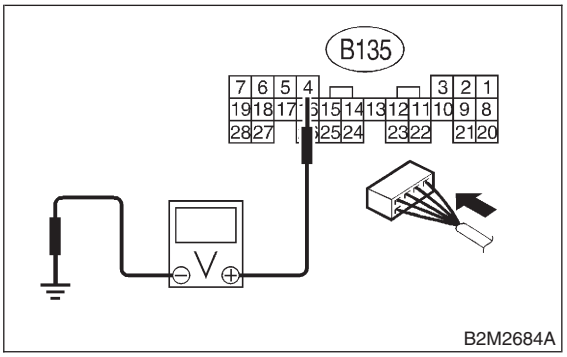


CHECK : ***Is the voltage more than 4 V?***
YES : Go to step **10DF6**.
NO : Go to step **10DF4**.

10DF4 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure voltage between ECM connector and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):

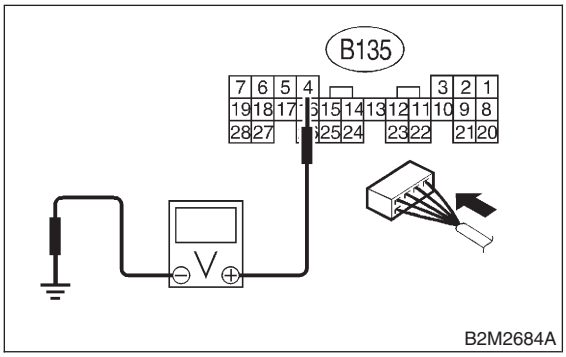


CHECK : ***Is the voltage less than 1 V?***
YES : Repair poor contact in ECM connector.
NO : Go to step **10DF5**.

10DF5 : CHECK OUTPUT SIGNAL FROM ECM.

Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 4 (+) — Chassis ground (–):



CHECK : ***Does the voltage change from 1 V to 4 V while monitoring the value with voltage meter?***

YES : Even if MIL lights up, the circuit has returned to a normal condition at this time.

NOTE:
In this case, repair the following:
- Poor contact in ECM connector
- Poor contact in TCM connector

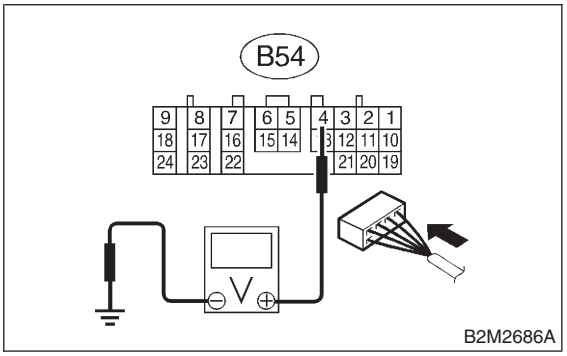
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

10DF6 : CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 4 V?***

YES : Go to step **10DF7**.

NO : Repair open circuit in harness between ECM and TCM connector.

10DF7 : CHECK POOR CONTACT.

Check poor contact in TCM connector. <Ref. to FOREWORD [T3C1].>

CHECK : ***Is there poor contact in TCM connector?***

YES : Repair poor contact in TCM connector.

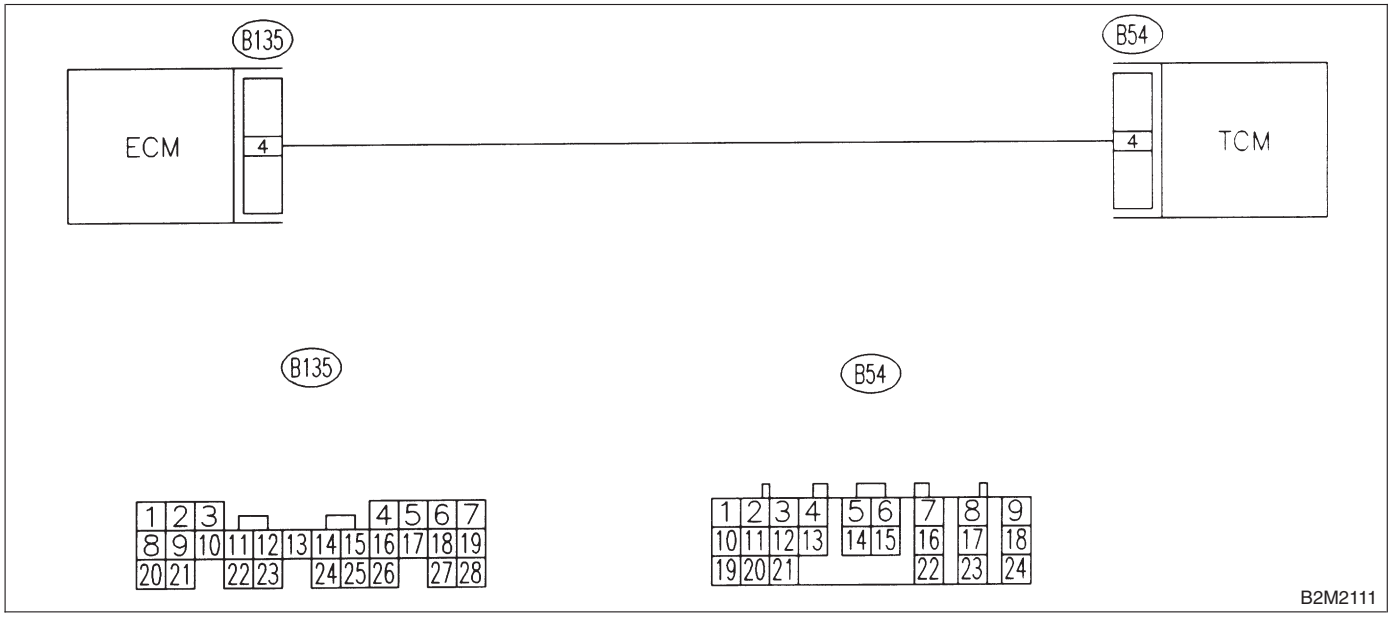
NO : Check TCM power supply line and grounding line.

DG: DTC P1742 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

- **WIRING DIAGRAM:**



10DG1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is transmission type AT?***
YES : Go to step **10DG2**.
NO : Check AT/MT identification circuit. <Ref. to 2-7 [T10DH0].>

10DG2 : CHECK DRIVING CONDITION.

1) Start and warm-up the engine until the radiator fan makes one complete rotation.
2) Drive the vehicle.

CHECK : ***Is AT shift control functioning properly?***
YES : Go to step **10DG3**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

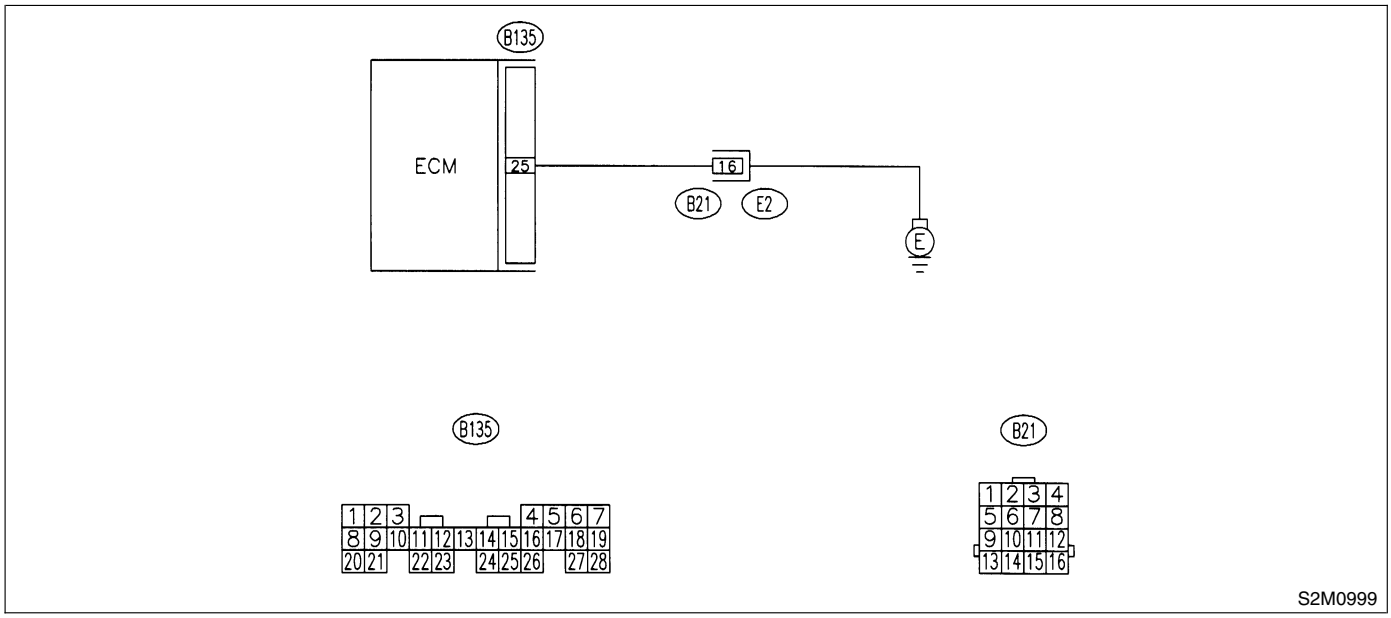
10DG3 : CHECK ACCESSORY.

CHECK : ***Are car phone and/or CB installed on vehicle?***
YES : Repair grounding line of car phone or CB system.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

DH: — AT/MT IDENTIFICATION CIRCUIT MALFUNCTION [MT VEHICLES] —

CAUTION:
After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to 2-7 [T3D0].> and INSPECTION MODE <Ref. to 2-7 [T3E0].>.

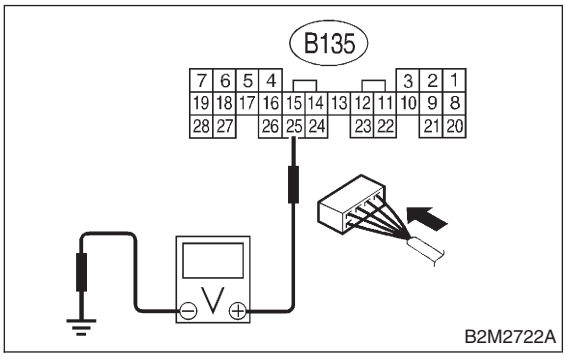
- **WIRING DIAGRAM:**



10DH1 : CHECK HARNESS BETWEEN ECM CONNECTOR AND ENGINE GROUNDING TERMINAL.

1) Turn ignition switch to ON.
2) Measure voltage between ECM and chassis ground.

Connector & terminal
(B135) No. 25 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 2 V?***
YES : Repair harness and connector.

NOTE:
In this case, repair the following:
- Open circuit in harness between ECM connector and engine grounding terminal
- Poor contact in engine grounding terminal
- Poor contact in coupling connector (B21)

NO : Go to step **10DH2**.

10DH2 : CHECK POOR CONTACT.

Check poor contact in ECM connector. <Ref. to FOREWORD [W3C1].>

CHECK : ***Is there poor contact in ECM connector?***
YES : Repair poor contact in ECM connector.
NO : Contact with SOA service.

NOTE:
Inspection by DTM is required, because probable cause is deterioration of multiple parts.

MEMO:

FUEL SYSTEM 2-8

Page

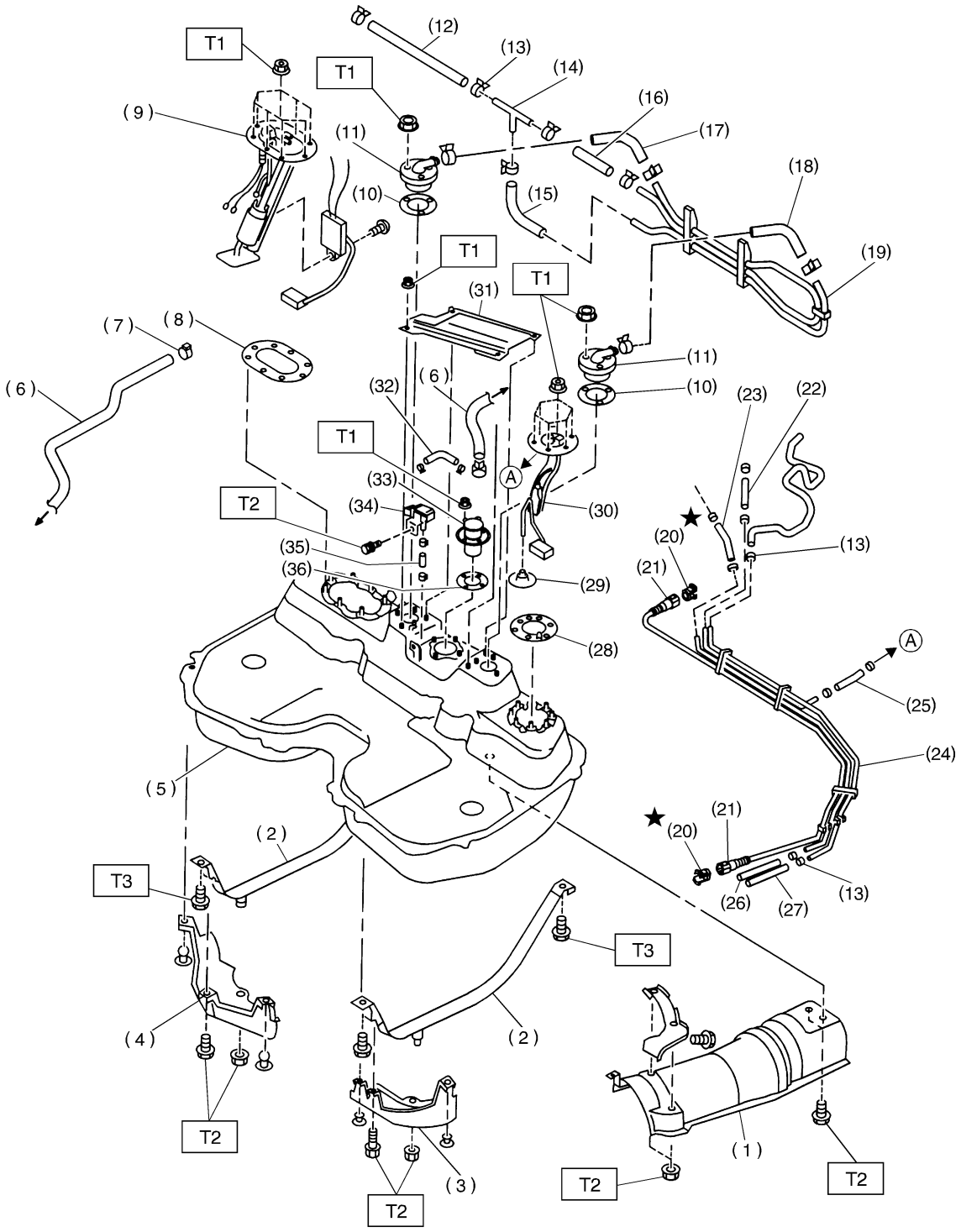
S SPECIFICATIONS AND SERVICE DATA 2
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1. Fuel Tank 8
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1. Fuel System

Fuel tank	Capacity	60 ℓ (15.9 US gal, 13.2 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Discharge pressure	299.1 kPa (3.05 kg/cm^2, 43.4 psi)
	Discharge flow	More than 65 ℓ (17.2 US gal, 14.3 Imp gal)/h [12 V at 300 kPa (3.06 kg/cm^2, 43.5 psi)]
Fuel filter		Cartridge type

MEMO:

1. Fuel Tank

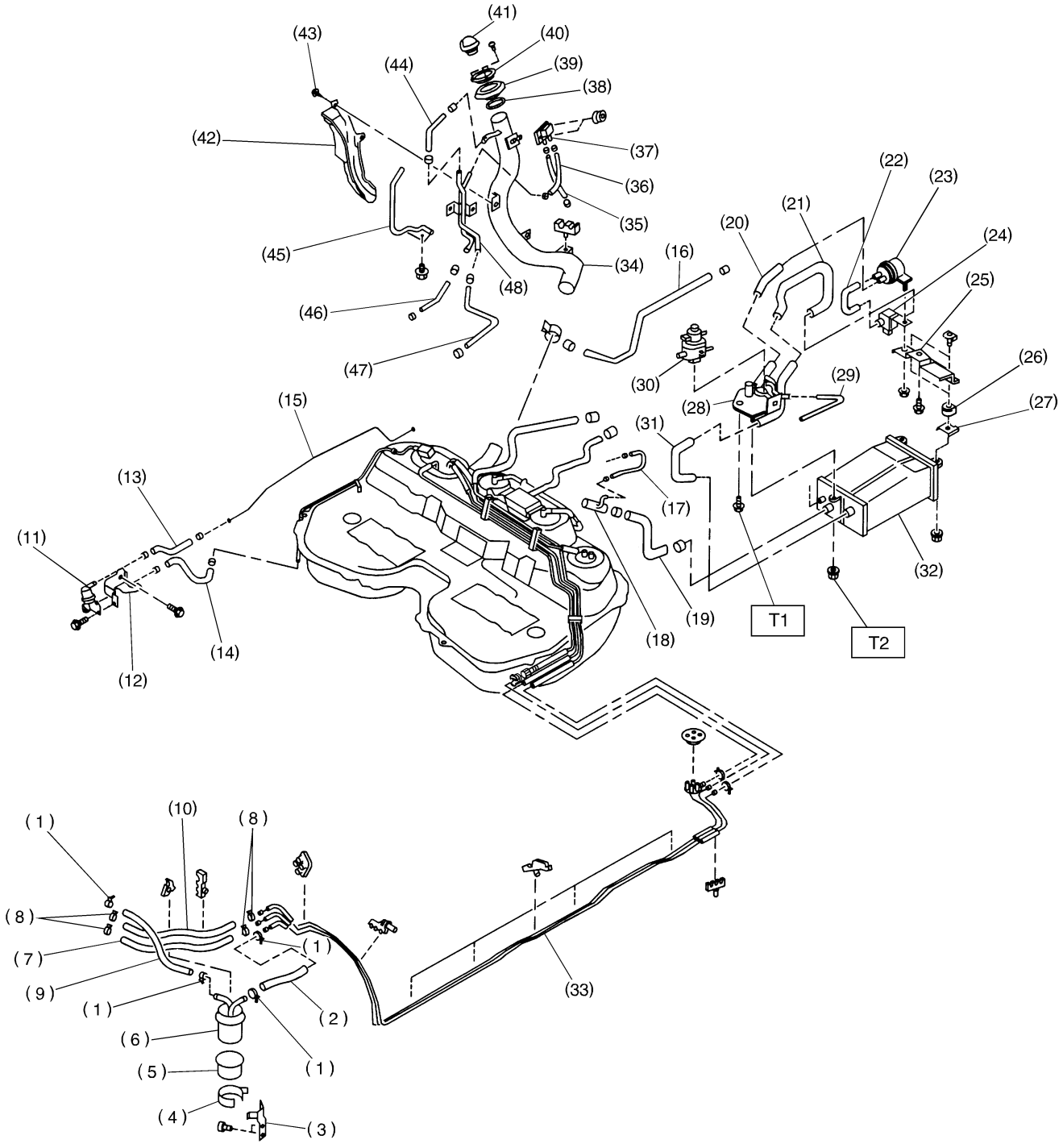


H2M3594A

(1) Heat sealed cover
(2) Fuel tank band
(3) Protector LH
(4) Protector RH
(5) Fuel tank
(6) Canister hose A
(7) Clamp
(8) Fuel pump gasket
(9) Fuel pump ASSY
(10) Fuel cut valve gasket
(11) Fuel cut valve
(12) Evaporation hose A
(13) Clip
(14) Joint pipe
(15) Evaporation hose C
(16) Evaporation hose B
(17) Evaporation hose D
(18) Evaporation hose E
(19) Evaporation pipe ASSY
(20) Retainer
(21) Quick connector
(22) Jet pump hose A
(23) Fuel return hose A
(24) Fuel pipe ASSY
(25) Jet pump hose B
(26) Fuel return hose B
(27) Evaporation hose F
(28) Fuel sub level sensor gasket
(29) Jet pump filter
(30) Fuel sub level sensor
(31) Protector cover
(32) Vent valve hose
(33) Vent valve
(34) Fuel tank pressure sensor
(35) Fuel tank pressure sensor hose
(36) Vent valve gasket

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4±1.5 (0.45±0.15, 3.3±1.1)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T3: 33±10 (3.4±1.0, 25±7)

2. Fuel Line



H2M3595A

(1) Clamp
(2) Fuel delivery hose A
(3) Fuel filter bracket
(4) Fuel filter holder
(5) Fuel filter cup
(6) Fuel filter
(7) Evaporation hose
(8) Clip
(9) Fuel delivery hose B
(10) Fuel return hose
(11) Roll over valve
(12) Roll over valve bracket
(13) Evaporation hose H
(14) Evaporation hose I
(15) Evaporation pipe B
(16) Evaporation hose J
(17) Evaporation hose K
(18) Joint pipe
(19) Canister hose A
(20) Air filter hose A
(21) Drain valve hose
(22) Air filter hose B
(23) Drain filter
(24) Drain valve
(25) Canister upper bracket
(26) Cushion rubber
(27) Canister lower bracket
(28) Canister holder
(29) Evaporation hose L
(30) Pressure control solenoid valve
(31) Canister hose B
(32) Canister
(33) Fuel pipe ASSY
(34) Fuel filler pipe
(35) Evaporation hose M
(36) Evaporation hose N
(37) Shut valve
(38) Packing
(39) Ring A
(40) Ring B
(41) Fuel filler cap
(42) Fuel filler pipe protector
(43) Tapping screw
(44) Evaporation hose O
(45) Joint pipe
(46) Evaporation hose P
(47) Evaporation hose Q
(48) Evaporation pipe

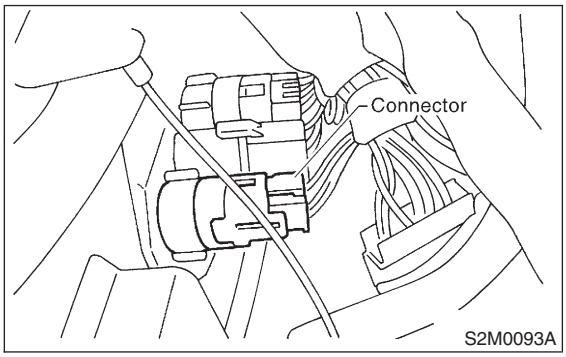
Tightening torque: N·m (kg-m, ft-lb)
T1: 17.7±5 (1.8±0.5, 13.0±3.6)
T2: 23±7 (2.3±0.7, 16.6±5.1)

1. Fuel Tank

A: RELEASING OF FUEL PRESSURE

WARNING:
- **Place "No fire" signs near the working area.**
- **Disconnect ground terminal from battery.**
- **Be careful not to spill fuel on the floor.**

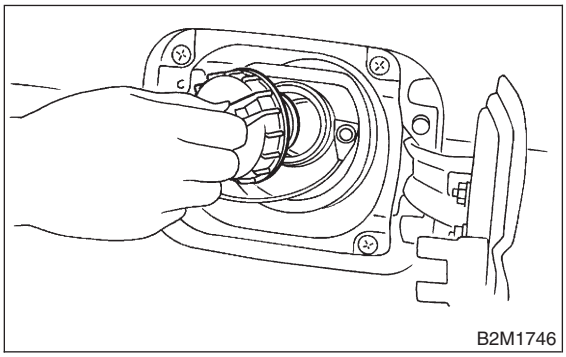
1) Disconnect connector from fuel pump relay.



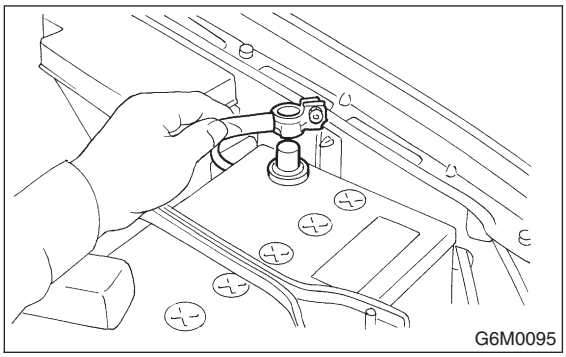
2) Start the engine, and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn ignition switch OFF.

B: DRAINING OF FUEL

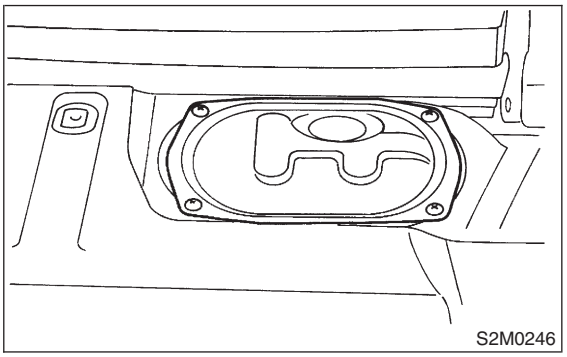
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.



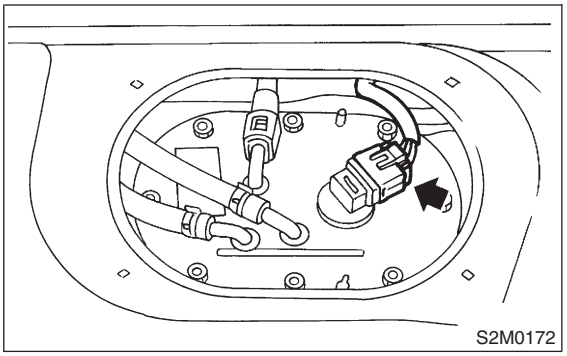
3) Disconnect battery ground cable.



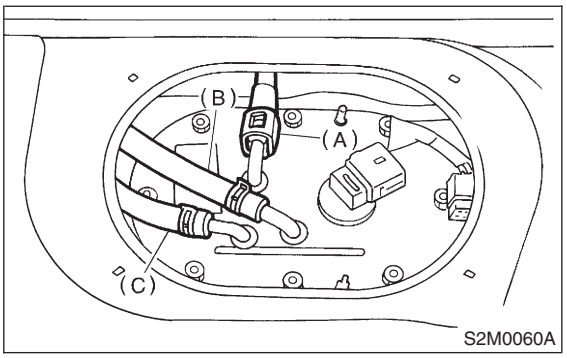
4) Remove access hole lid.



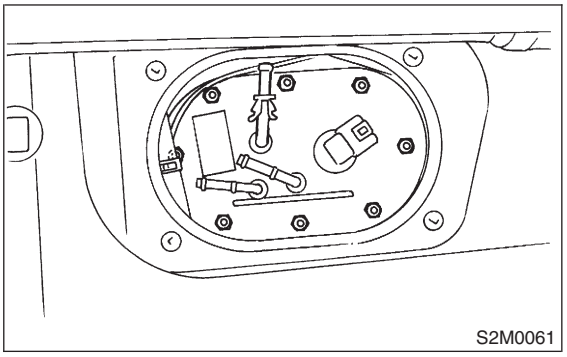
5) Disconnect connector from fuel pump.



6) Disconnect quick connector, and then disconnect fuel delivery hose (A). <Ref. to 2-8 [W9A0].>
7) Move clips, and then disconnect fuel return hose (B) and jet pump hose (C).



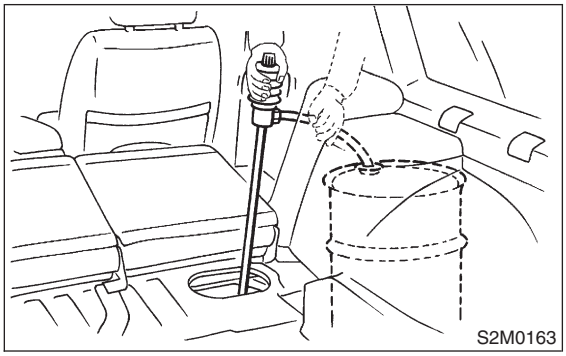
8) Remove nuts which install fuel pump assembly onto fuel tank.



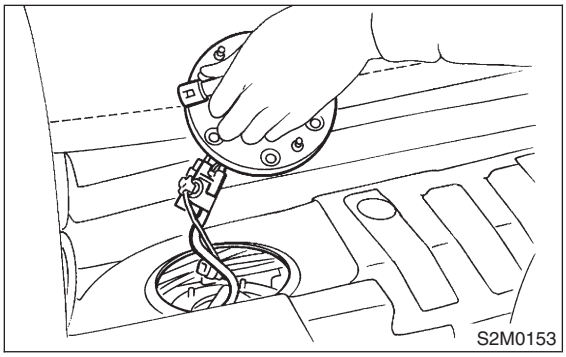
9) Take off fuel pump from fuel tank.

10) Drain fuel from fuel tank by using a hand pump.

WARNING:
Do not use a motor pump when draining fuel.

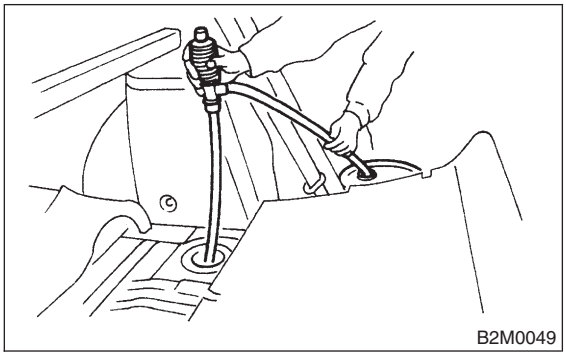

S2M0163

11) Remove fuel sub level sensor. <Ref. to 2-8 [W5A0].>


S2M0153

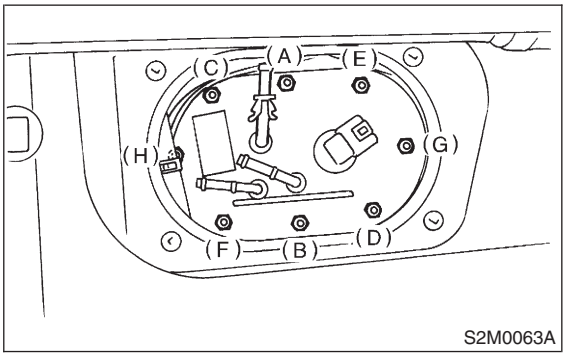
12) Drain fuel from there.

WARNING:
Do not use a motor pump when draining fuel.

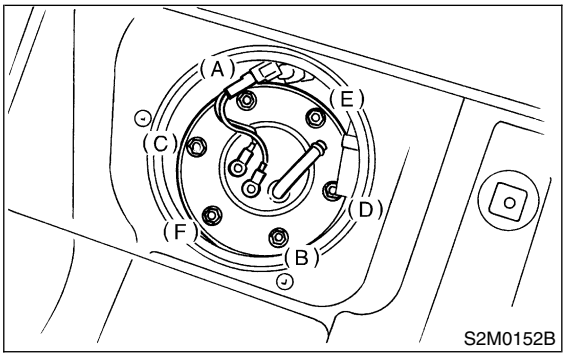

B2M0049

13) After draining fuel, reinstall fuel pump and fuel sub level sensor.
Tighten nuts of fuel pump in alphabetical sequence shown in figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



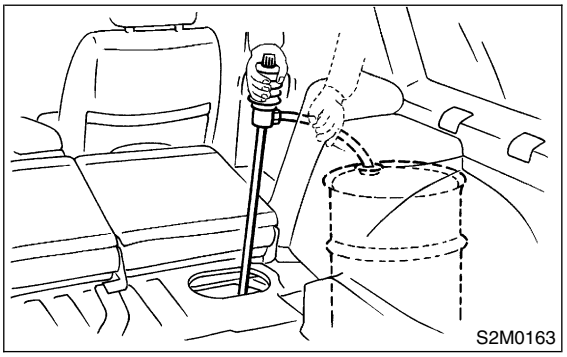
S2M0063A



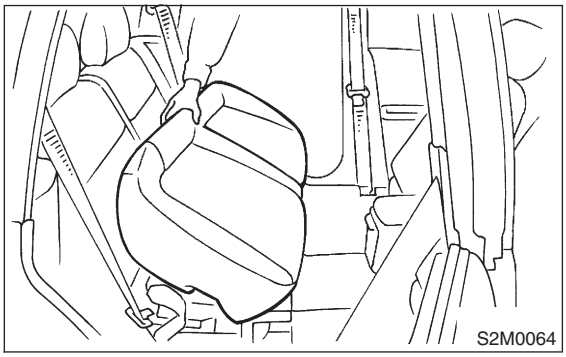
S2M0152B

C: REMOVAL

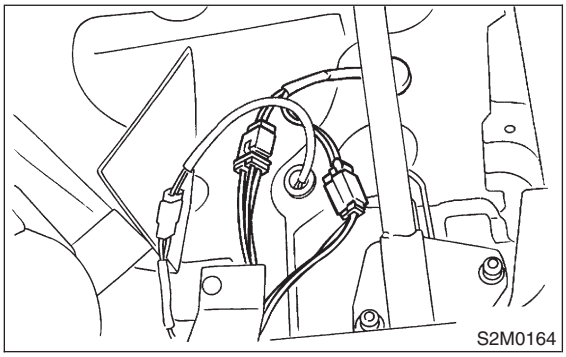
1) Set the vehicle on the lift.
2) Drain fuel from fuel tank. <Ref. to 2-8 [W1B0].>


S2M0163

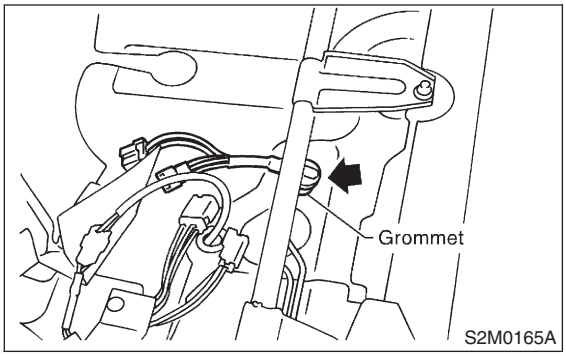
3) Remove rear seat cushion and turn up cover.



4) Disconnect connector of fuel tank cord from rear harness.



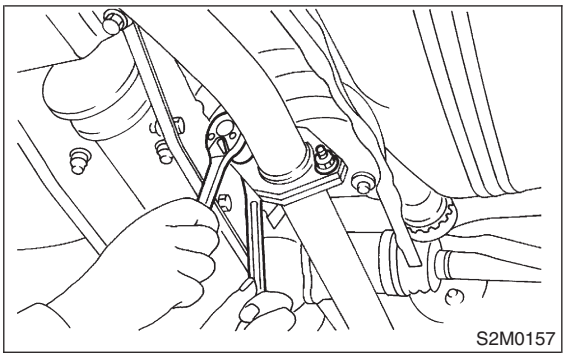
5) Push grommet which holds fuel tank cord on floor panel into the body side.



6) Lift-up the vehicle.

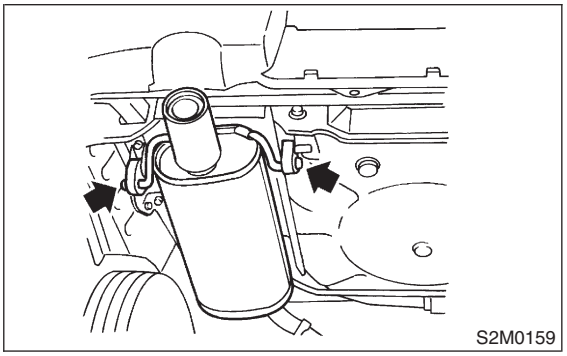
7) Remove rear exhaust pipe. <Ref. to 2-9 [W2A0].>

NOTE:
To facilitate the removal of parts, apply a coat of SUBARU CRC5-56 (Part No. 004301003).

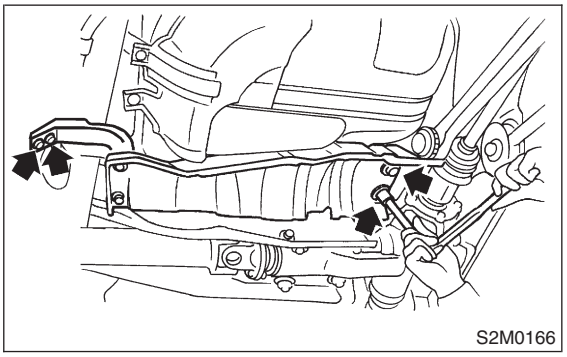


8) Remove muffler assembly.
<Ref. to 2-9 [W3A0].>

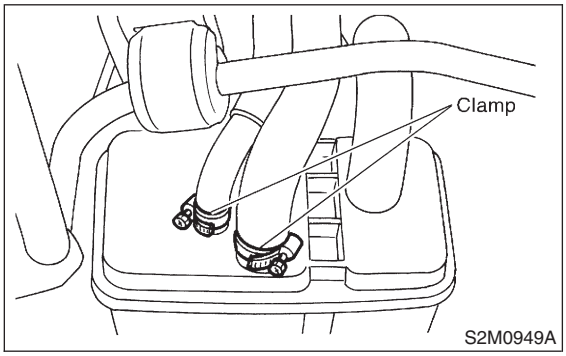
NOTE:
To facilitate the removal of parts, apply a coat of SUBARU CRC5-56 (Part No. 004301003).



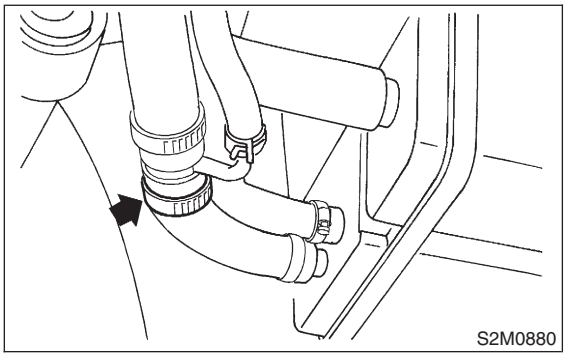
9) Remove heat sealed cover.



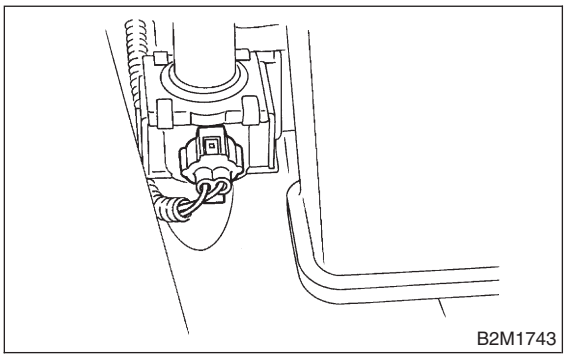
10) Move clamp, and disconnect evaporation hose from canister.



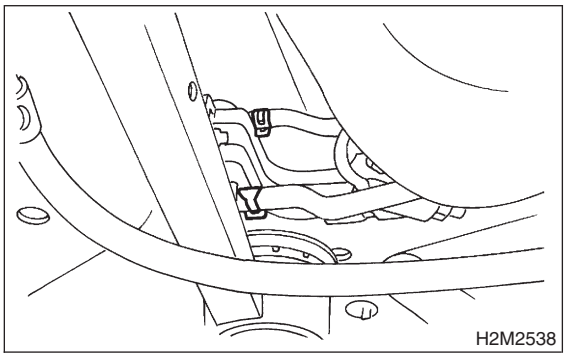
11) Disconnect hose from joint pipe.



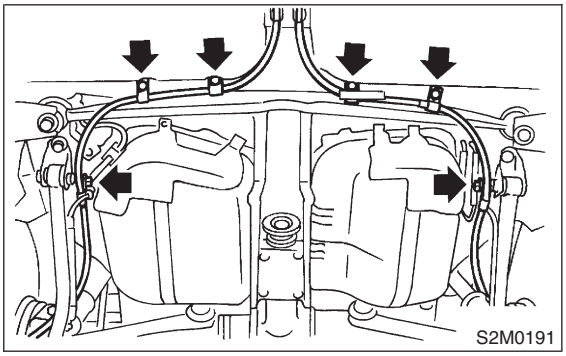
12) Disconnect connector from pressure control solenoid valve.
13) Disconnect connector from drain valve.



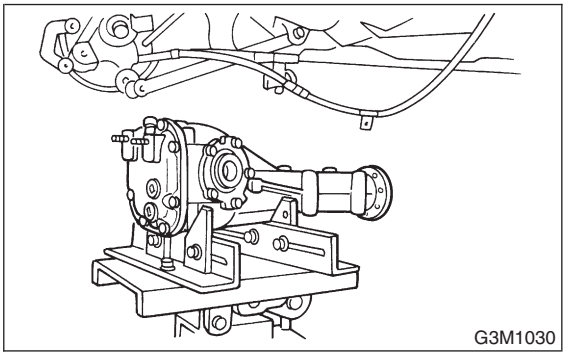
14) Disconnect hoses from roll over valve.



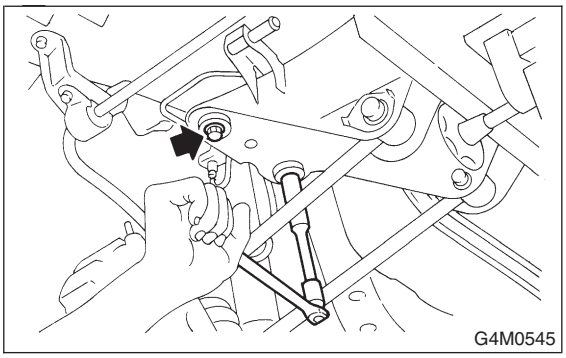
15) Remove bolts which hold parking brake cable holding bracket.



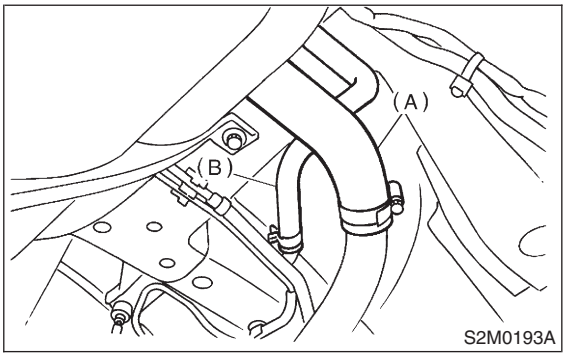
16) Remove rear differential assembly.
<Ref. to 3-4 [W2B0].>



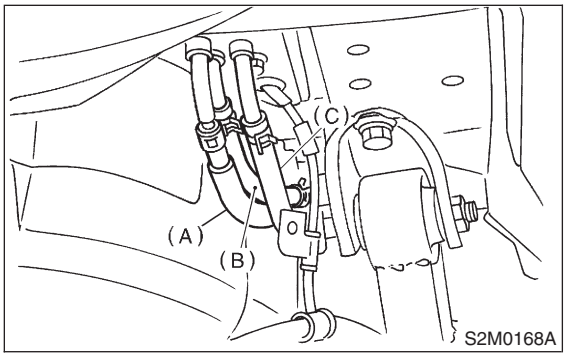
17) Remove rear crossmember.
<Ref. to 4-1 [W10A0].>



18) Loosen clamp, and disconnect fuel filler hose (A) and air vent hose (B) from fuel filler pipe and air vent pipe.

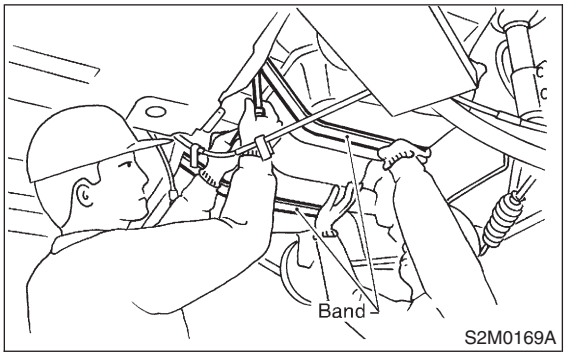


19) Move clips, and disconnect fuel return hose (B) and evaporation hose (C).
20) Disconnect quick connector, and then disconnect fuel delivery hose (A).



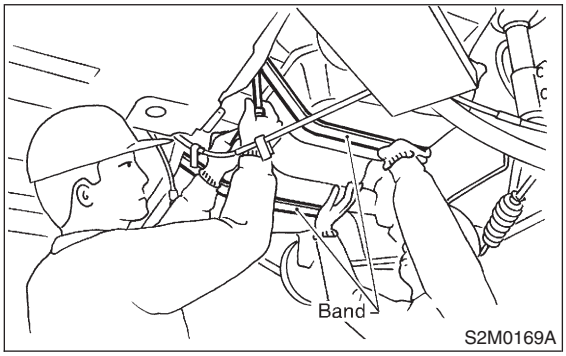
21) While holding fuel tank, remove bolts from bands and dismount fuel tank.

WARNING:
A helper is required to perform this work.



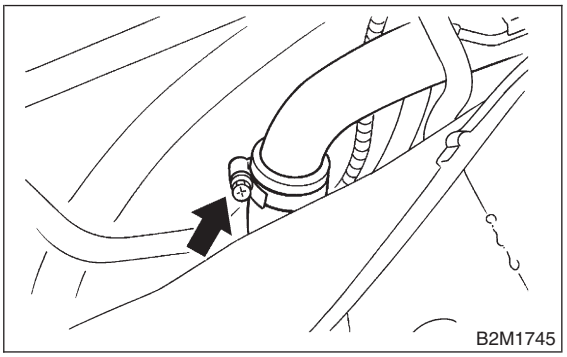
D: INSTALLATION

1) While a helper holds fuel tank, push fuel tank harness into access hole with grommet.



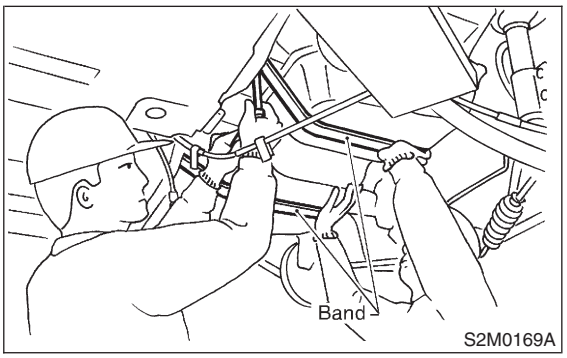
2) Set fuel tank, and temporary tighten bolts in order to install fuel tank bands.

3) Connect fuel filler hose, and tighten clamp.

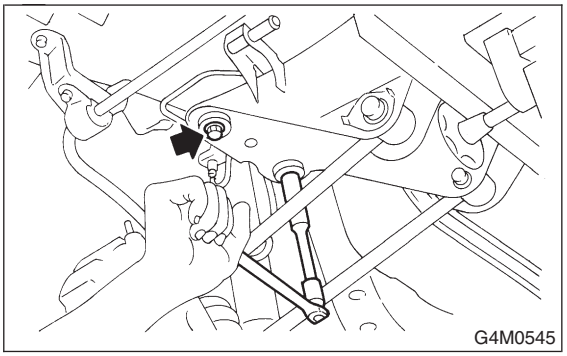


4) Connect fuel hoses, and hold then with clips and quick connector. <Ref. to 2-8 [W9A0].>
5) Tighten band mounting bolts.

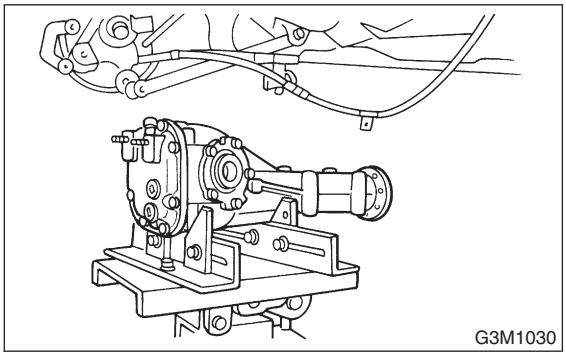
Tightening torque:
33±10 N·m (3.4±1.0 kg-m, 25±7 ft-lb)



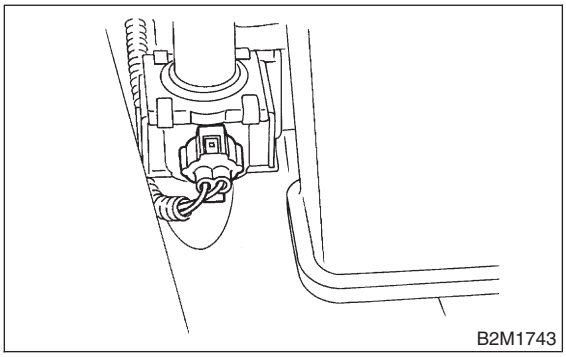
6) Install rear crossmember. <Ref. to 4-1 [W10C0].>



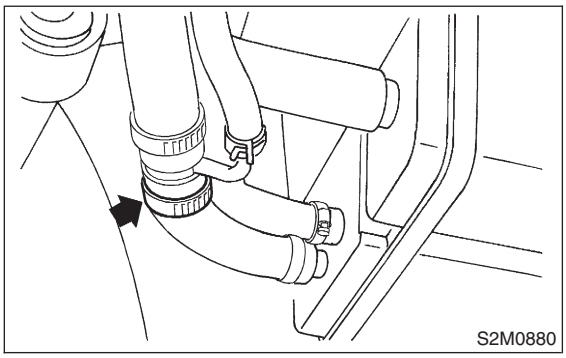
7) Install rear differential assembly. <Ref. to 3-4 [W2F0].>


G3M1030

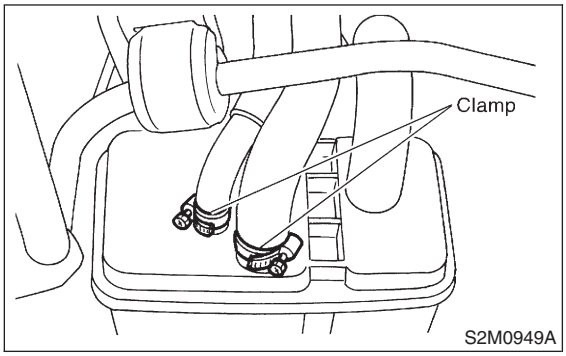
8) Connect connector to drain valve.


B2M1743

9) Connect connector to pressure control solenoid valve.
10) Connect hose to joint pipe.

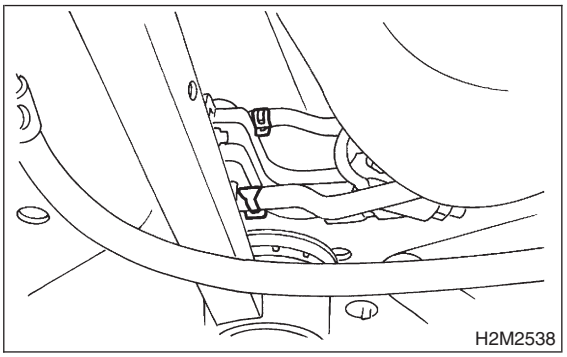

S2M0880

11) Connect evaporation hose to canister, and hold them with clamp.

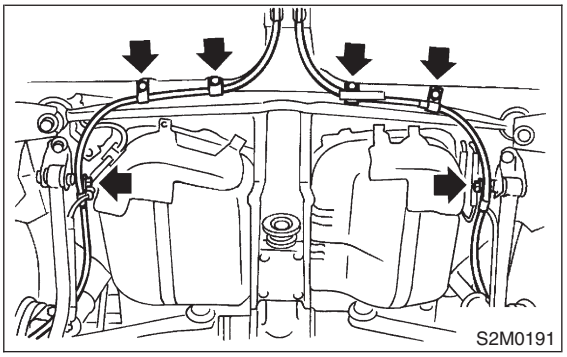


S2M0949A

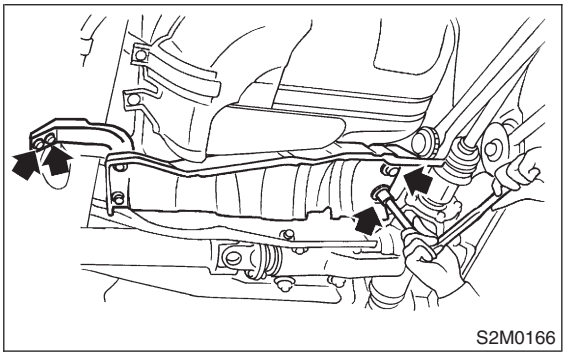
12) Connect hoses to roll over valve.


H2M2538

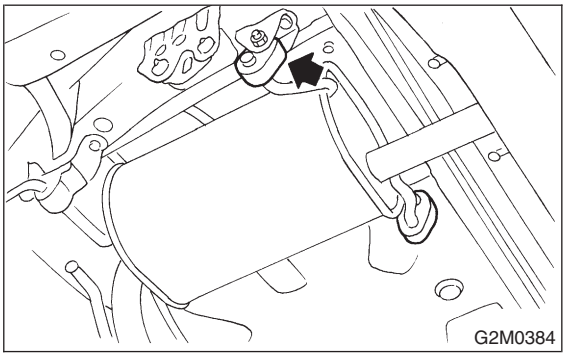
13) Install bolts which hold parking brake holding bracket.


S2M0191

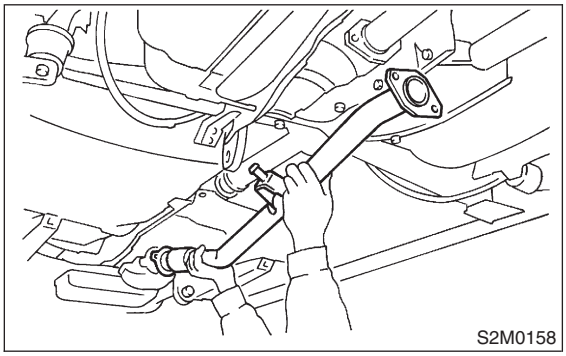
14) Install heat sealed cover.


S2M0166

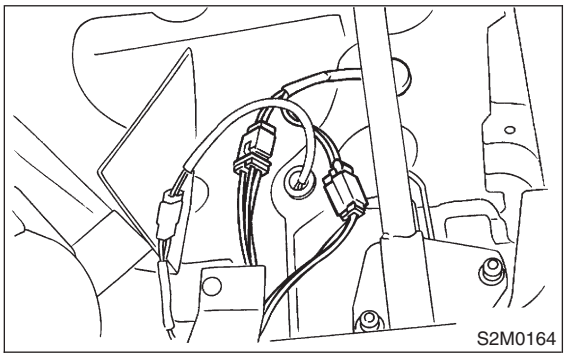
15) Install muffler assembly. <Ref. to 2-9 [W3A0].>


G2M0384

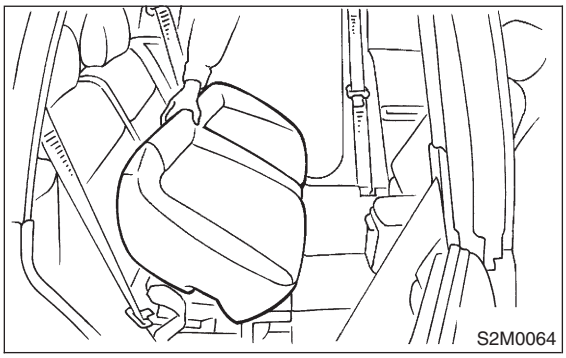
16) Install rear exhaust pipe. <Ref. to 2-9 [W2B0].>


S2M0158

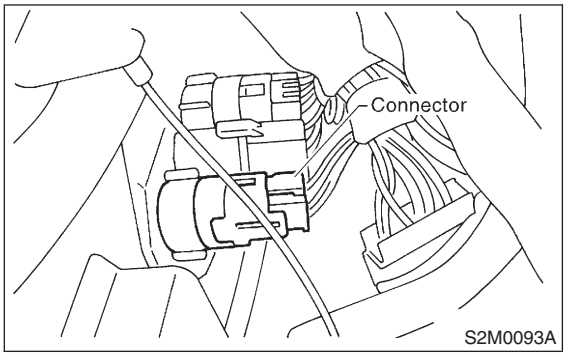
17) Lower the vehicle.
18) Connect connectors to fuel tank harness, and plug access hole with grommet.


S2M0164

19) Install rear seat cushion.

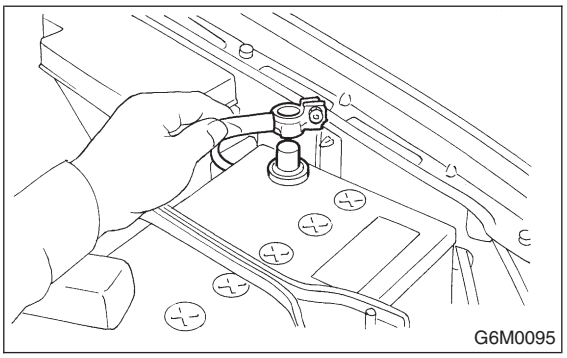

S2M0064

20) Install fuel filler cap.
21) Connect connector to fuel pump relay.



S2M0093A

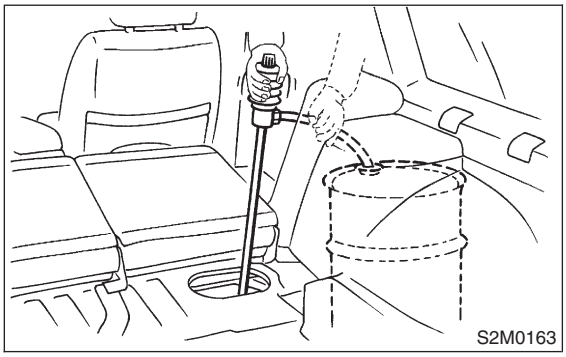
22) Connect battery ground cable.


G6M0095

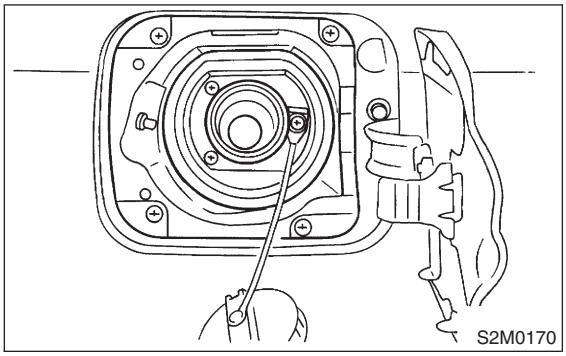
2. Fuel Filler Pipe

A: REMOVAL

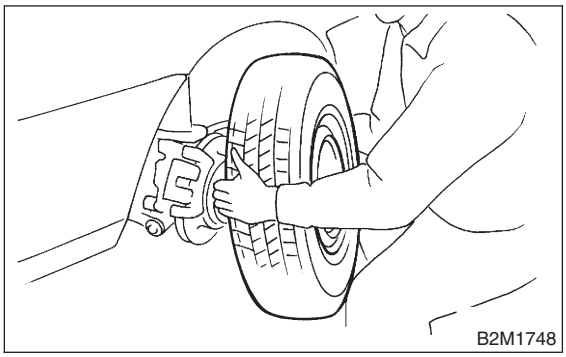
1) Set the vehicle on the lift.
2) Drain fuel from fuel tank. <Ref. to 2-8 [W1B0].>


S2M0163

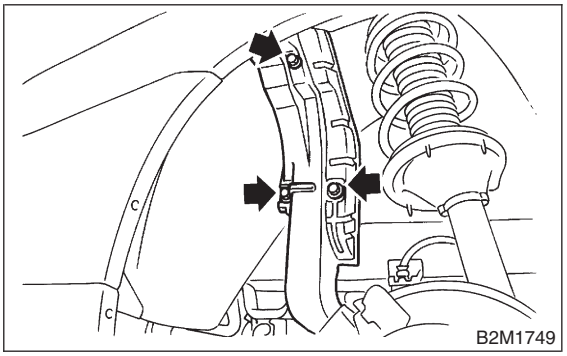
3) Remove screws which install fuel filler pipe on filler lid open.


S2M0170

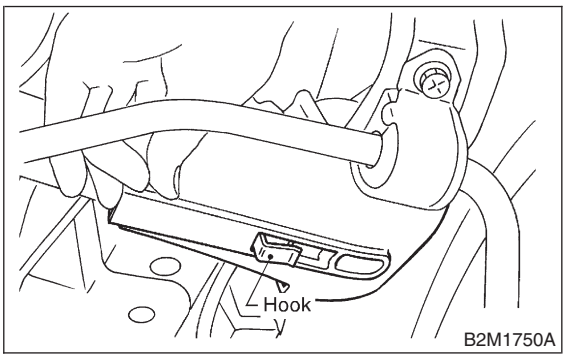
4) Remove wheel nuts of rear right side.
5) Lift-up the vehicle.
6) Remove rear right side wheel.


B2M1748

7) Remove bolts which install protector cover on body.

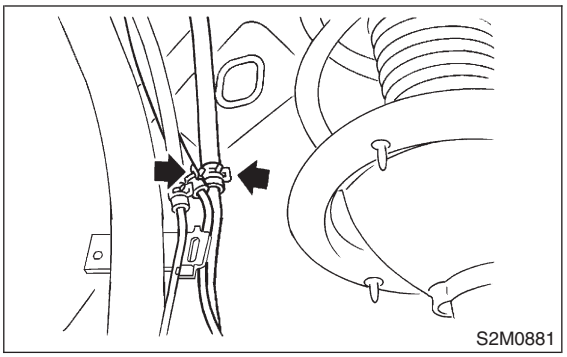

B2M1749

8) While releasing the under side of protector cover from hook, remove it.

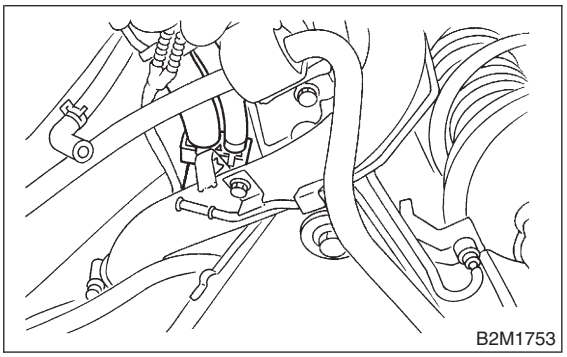


B2M1750A

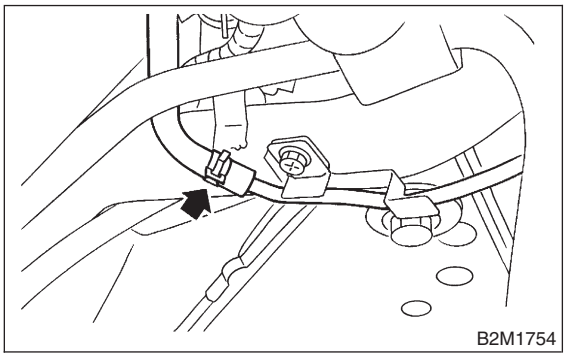
9) Disconnect evaporation hoses from pipes.


S2M0881

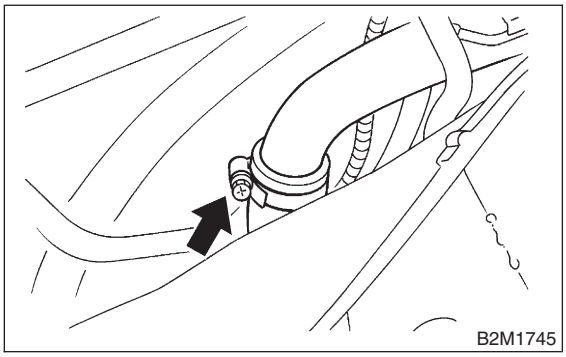
10) Lift-up the vehicle more.
11) Remove two evaporation hoses from clip.


B2M1753

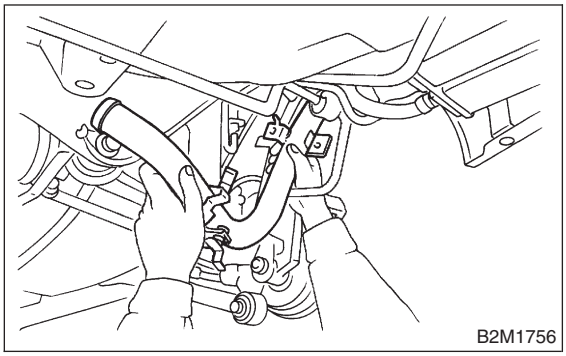
12) Disconnect evaporation hose from joint pipe.



13) Loosen clamp, and disconnect fuel filler hose from fuel filler pipe.

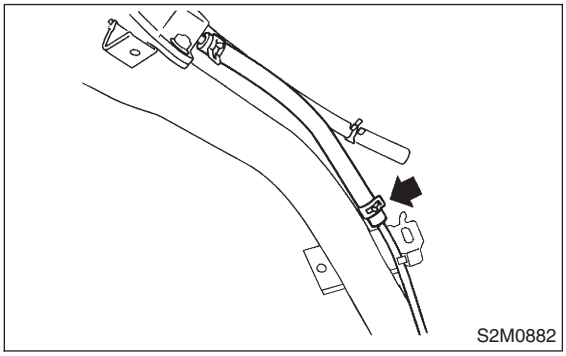


14) Remove fuel filler pipe to under side of vehicle.

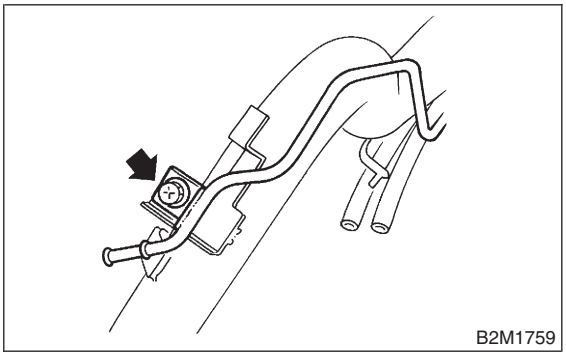


B: DISASSEMBLY

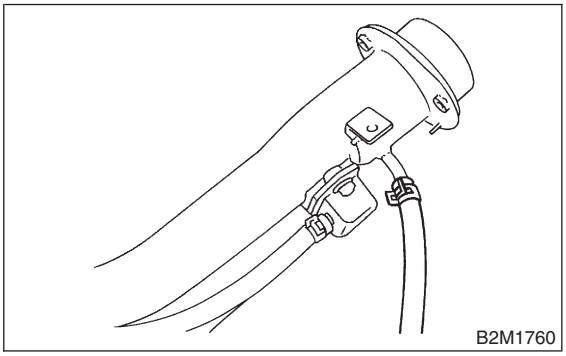
1) Move clip, and disconnect evaporation hose from joint pipe.



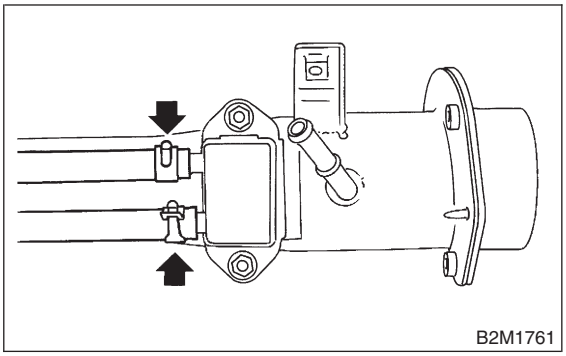
2) Remove bolt which installs joint pipe on fuel filler pipe.



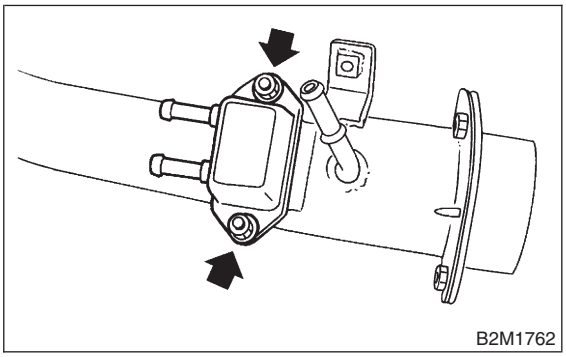
3) Disconnect evaporation hose from fuel filler pipe.



4) Disconnect evaporation hoses from shut valve.



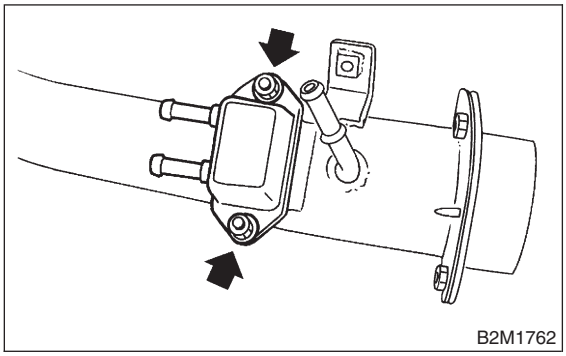
5) Remove shut valve from fuel filler pipe.



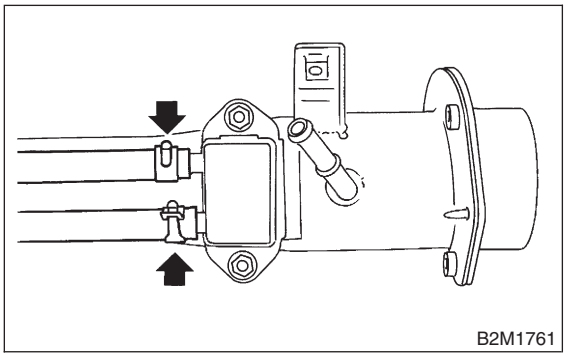
C: ASSEMBLY

1) Install shut valve on fuel filler pipe.

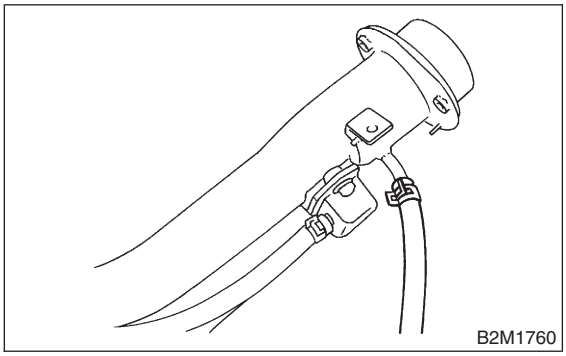
Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



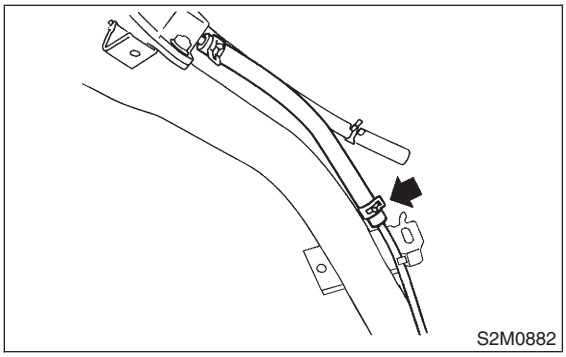
2) Connect evaporation hoses to shut valve.



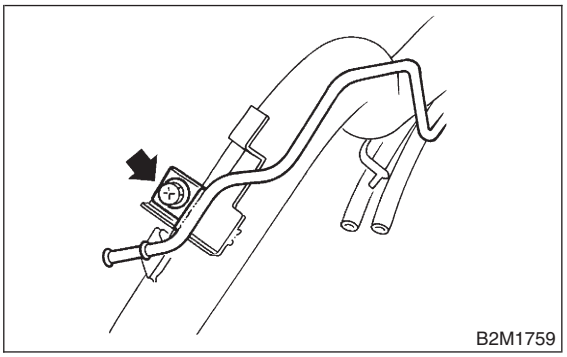
3) Connect evaporation hose to fuel filler pipe.



4) Connect evaporation hose to evaporation pipe.

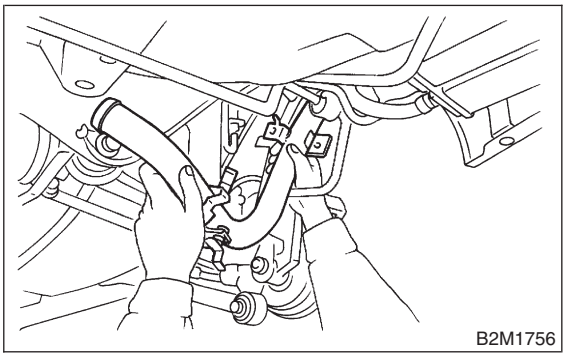


5) Install evaporation pipe to fuel filler pipe.

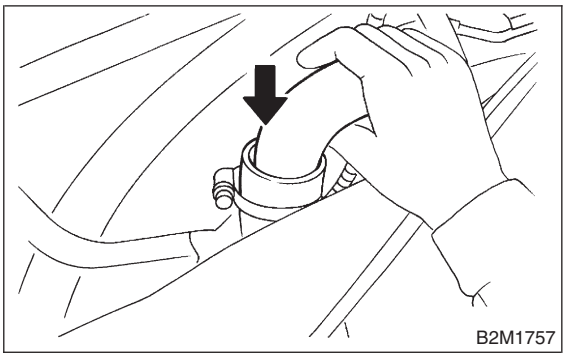


D: INSTALLATION

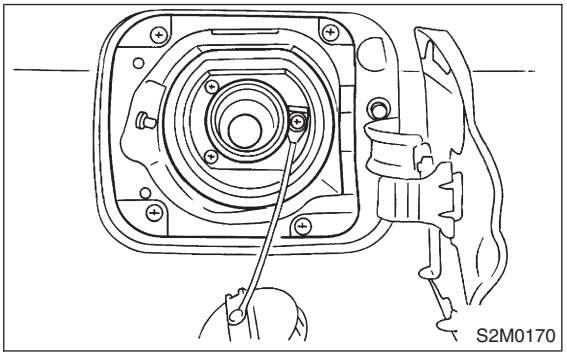
1) Set fuel filler pipe from under side of vehicle, and hold it on fuel filler flap open.



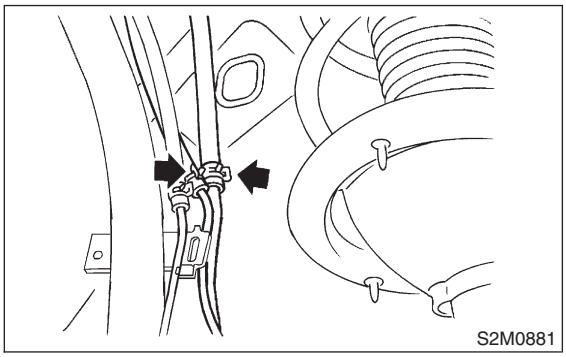
2) Connect fuel filler pipe into fuel filler hose.



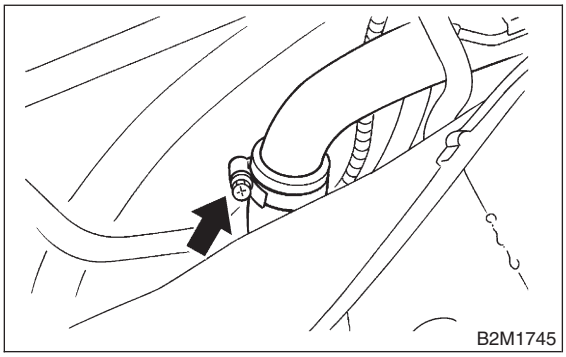
3) Lower the vehicle.
4) Temporarily tighten screws which install fuel filler pipe on filler lid open.



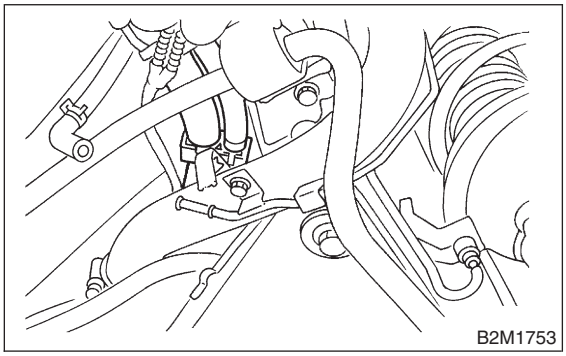
5) Connect evaporation hoses to pipes.



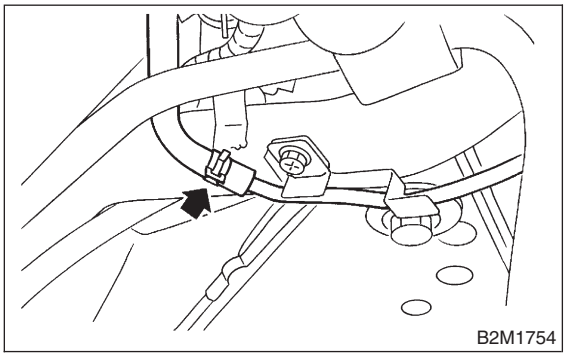
6) Lift-up the vehicle.
7) Tighten clamp bolt which holds fuel filler hose.



8) Install two evaporation hoses to clip.

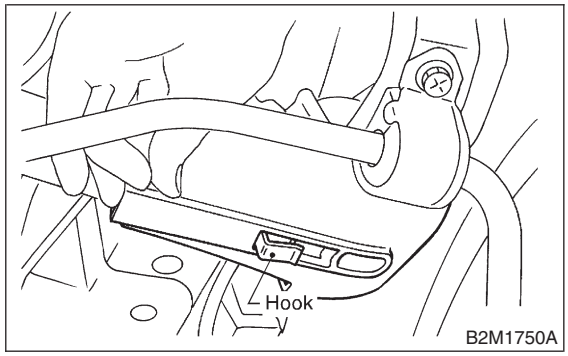


9) Connect evaporation hose to joint pipe.

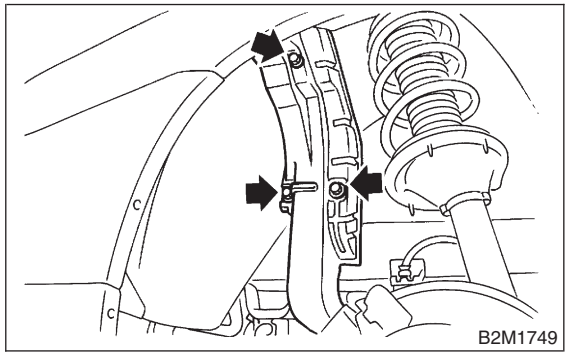


10) Lower the vehicle.

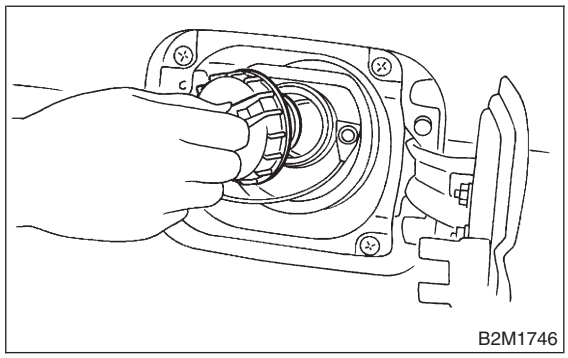
11) While holding the under side of protector cover on bracket, install it.



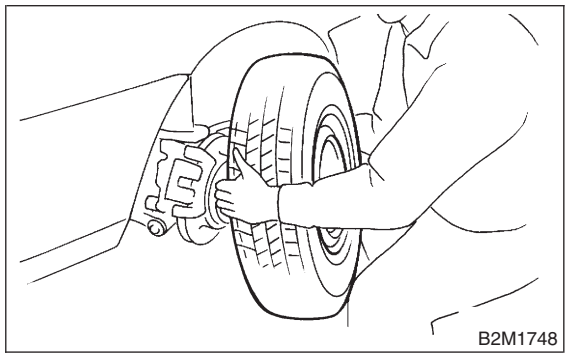
12) Tighten bolts which install protector cover on body.



13) Tighten screws which install fuel filler pipe on filler lid open.

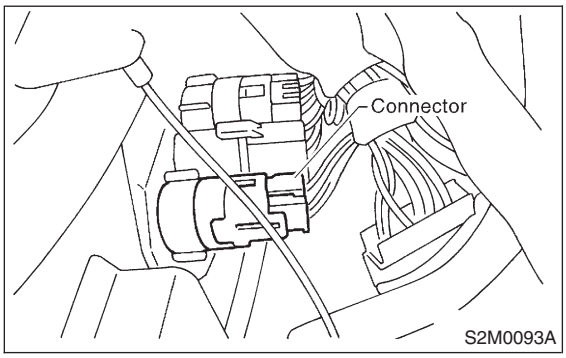


14) Install rear right wheel.

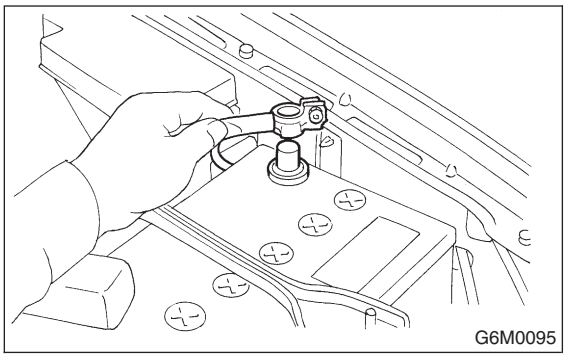


15) Install fuel filler cap.

16) Connect connector to fuel pump relay.



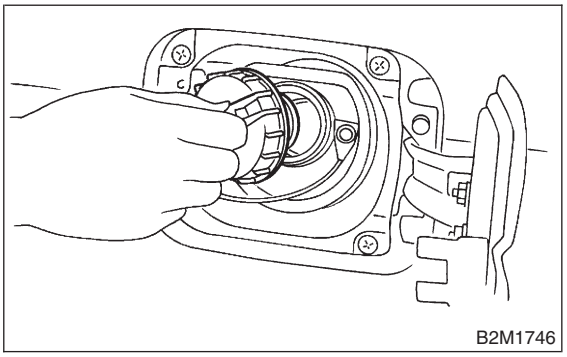
17) Connect battery ground terminal.



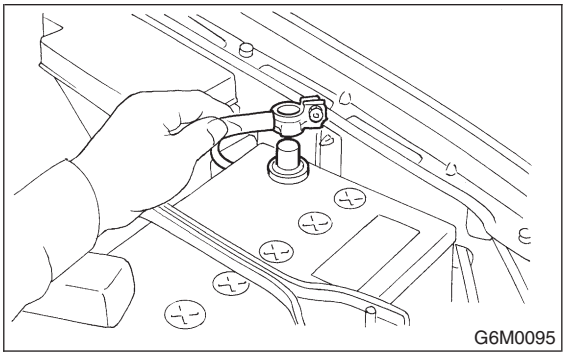
3. Fuel Pump

A: REMOVAL

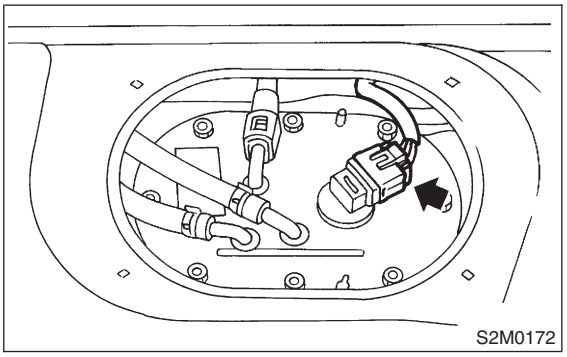
1) Release fuel pressure. <Ref. to 2-8 [W1B0].>
2) Open fuel flap lid, and remove fuel filler cap.



3) Disconnect battery ground cable.

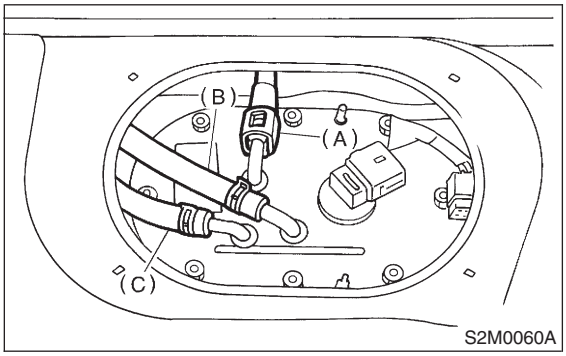


4) Disconnect connector from fuel pump.

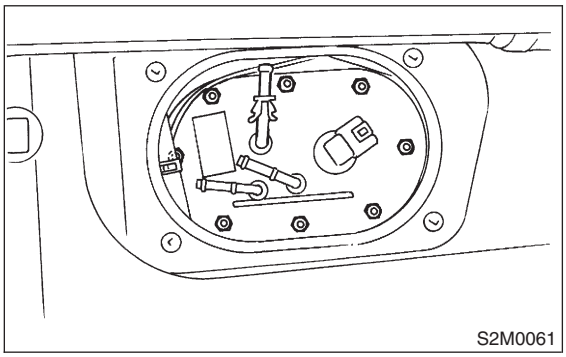


5) Move clips, and then disconnect fuel delivery hose (A), return hose (B) and jet pump hose (C).

6) Disconnect quick connector, and then disconnect fuel delivery hose (A). <Ref. to 2-8 [W7A0].>



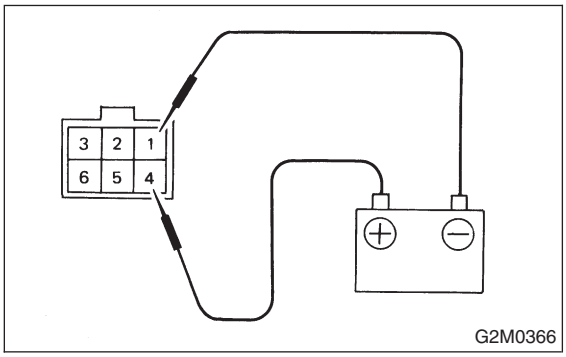
7) Remove nuts which install fuel pump assembly onto fuel tank.
8) Take off fuel pump from fuel tank.



B: INSPECTION

Connect lead harness to connector terminal of fuel pump, and apply battery power supply to check whether the pump operate.

WARNING:
- **Wipe off the fuel completely.**
- **Be sure to turn the battery supply ON and OFF on the battery side.**
- **Do not run fuel pump for a long time under non-load condition.**

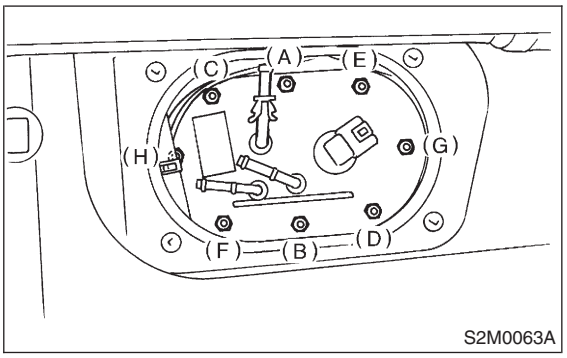


C: INSTALLATION

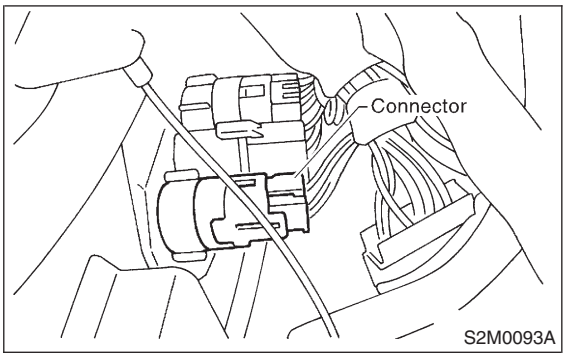
Installation is in the reverse order of removal. Do the following:

(1) Always use new gaskets.
(2) Ensure sealing portion is free from fuel or foreign particles before installation.
(3) Tighten nuts in numerical sequence shown in Figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



(4) Connect connector to fuel pump relay.

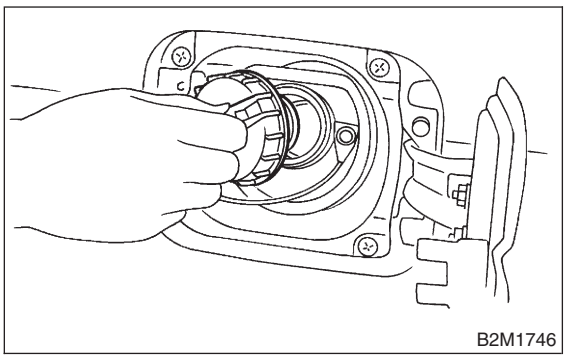


4. Fuel Level Sensor

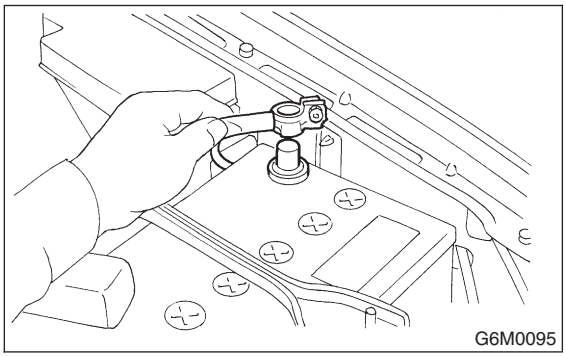
A: REMOVAL

NOTE:
Fuel level sensor is built in fuel pump assembly.

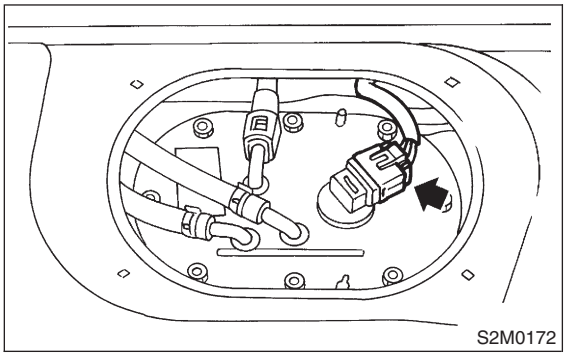
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Open fuel flap lid, and remove fuel filler cap.


B2M1746

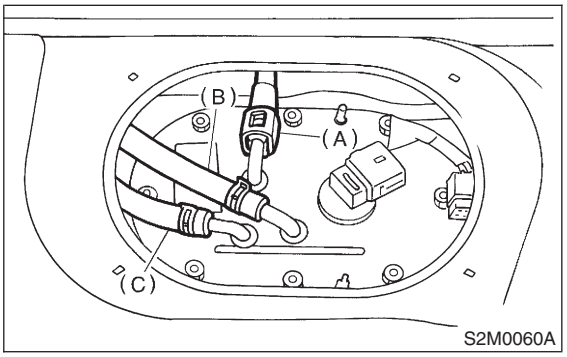
3) Disconnect battery ground cable.


G6M0095

4) Disconnect connector from fuel pump.

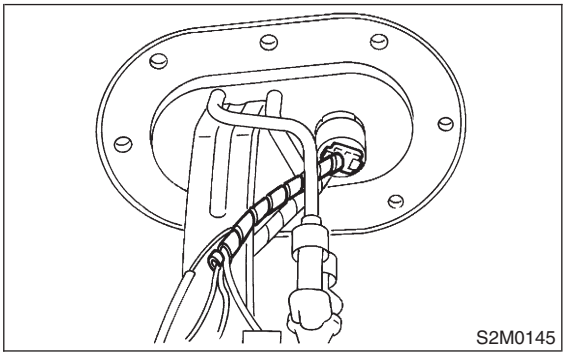

S2M0172

5) Move clips, and then disconnect fuel return hose (B) and jet pump hose (C).
6) Disconnect quick connector, and then disconnect fuel delivery hose (A). <Ref. to 2-8 [W9A0].>

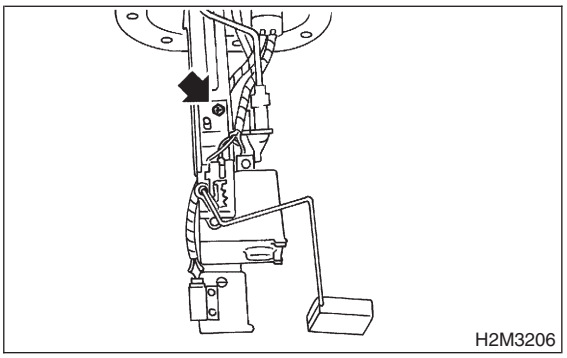


S2M0060A

7) Remove nuts which install fuel pump assembly onto fuel tank.
8) Take off fuel pump assembly.
9) Disconnect connector from fuel pump bracket.

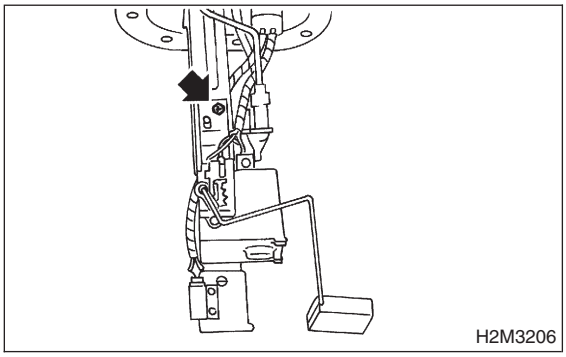

S2M0145

10) Remove bolt which installs fuel level sensor on mounting bracket.


H2M3206

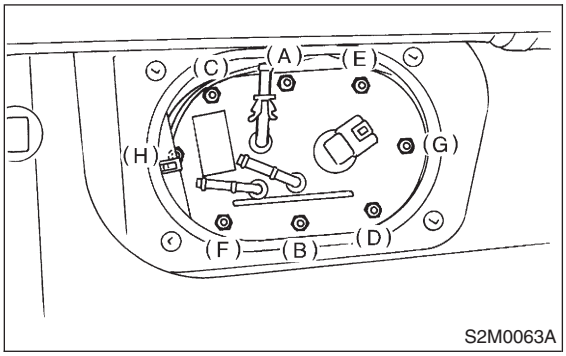
B: INSTALLATION

Installation is in the reverse order of removal. Do the following:
(1) Install the fuel level sensor on mounting bracket.

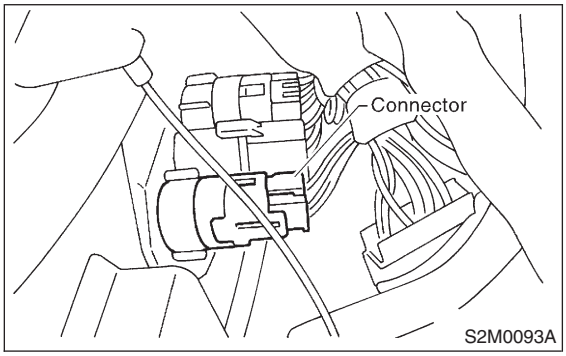


(2) Always use new gaskets.
(3) Ensure sealing portion is free from fuel or foreign particles before installation.
(4) Tighten nuts in alphabetical sequence shown in Figure to specified torque.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



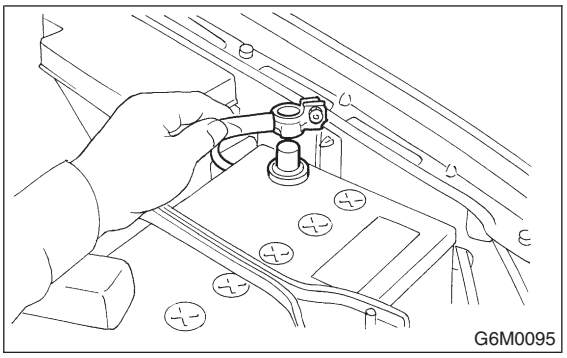
(5) Connect connector to fuel pump relay.



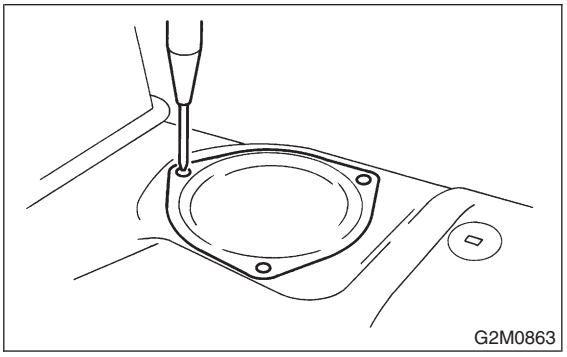
5. Fuel Sub Level Sensor

A: REMOVAL AND INSTALLATION

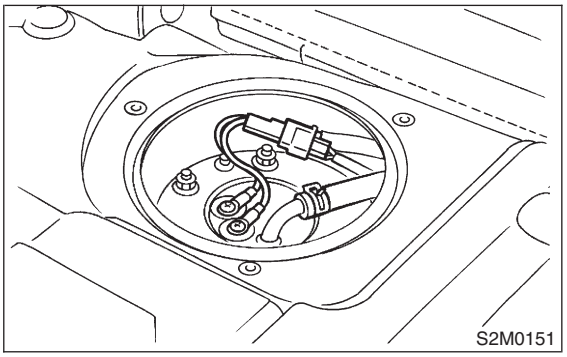
1) Disconnect battery ground cable.



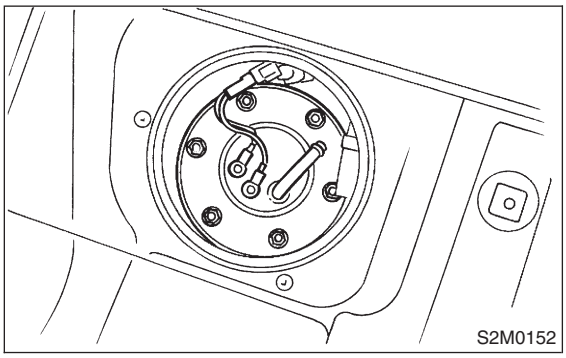
2) Remove fuel filler cap.
3) Remove service hole cover.



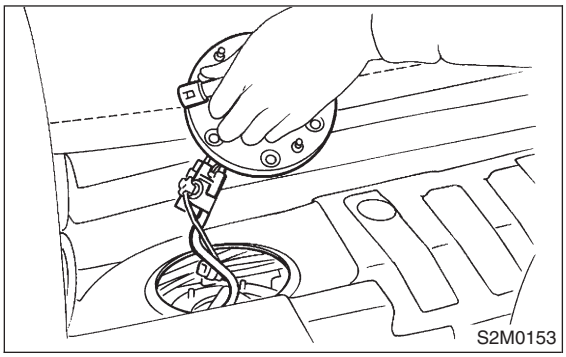
4) Disconnect connector from fuel sub level sensor, and disconnect jet pump hose.



5) Remove bolts which install fuel sub level sensor on fuel tank.

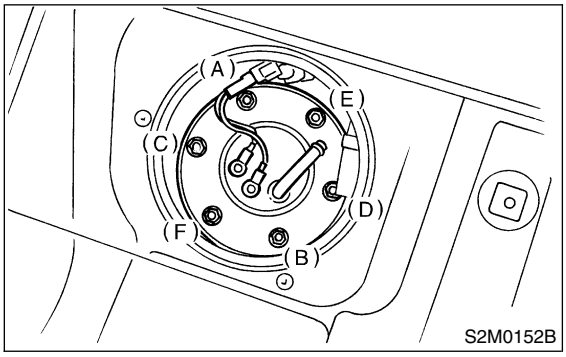


6) Remove fuel sub level sensor.



7) Installation is in the reverse order of removal.

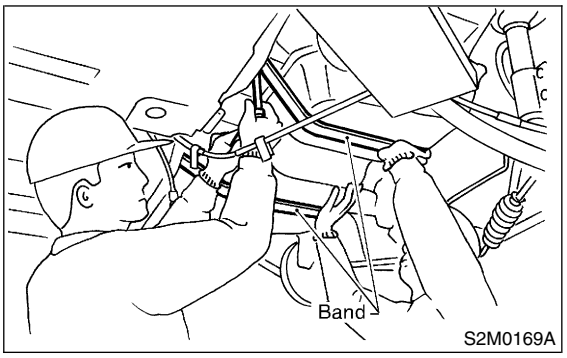
Tightening torque:
T: 4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)



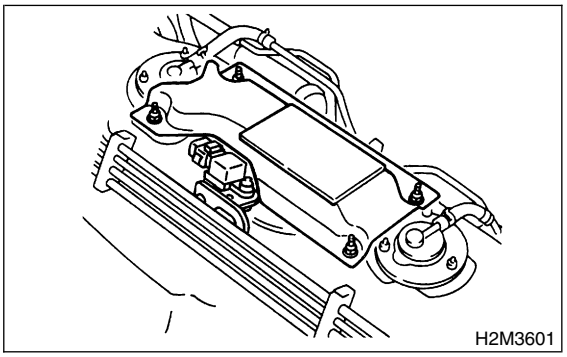
6. Fuel Cut Valve

A: REMOVAL AND INSTALLATION

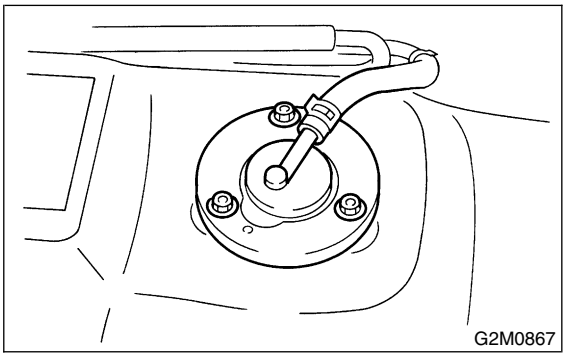
1) Remove fuel tank. <Ref. to 2-8 [W1C0].>



2) Remove protect cover.

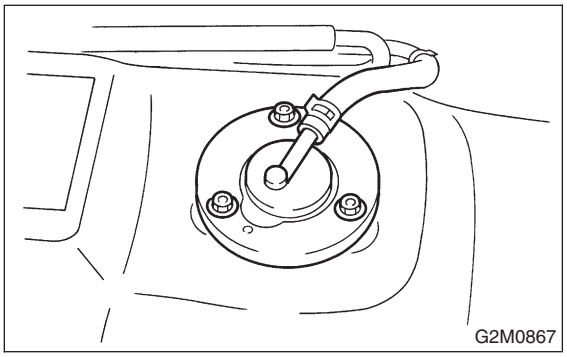


3) Disconnect evaporation hose from fuel cut valve.
4) Remove fuel cut valve.



5) Installation is in the reverse order of removal procedure.

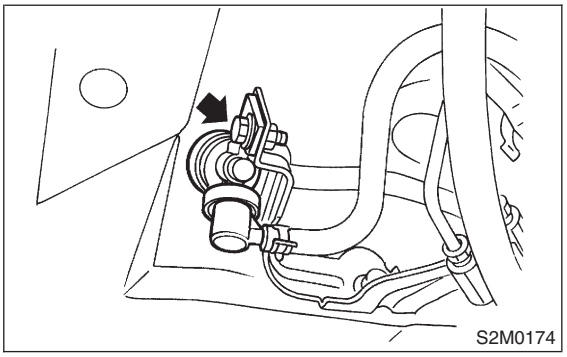
Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)


G2M0867

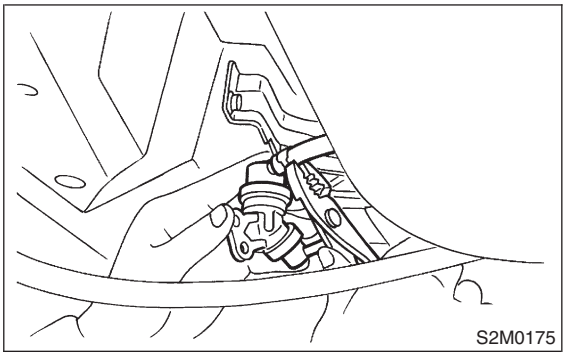
7. Roll Over Valve

A: REMOVAL AND INSTALLATION

1) Lift-up the vehicle.
2) Remove roll over valve from bracket.

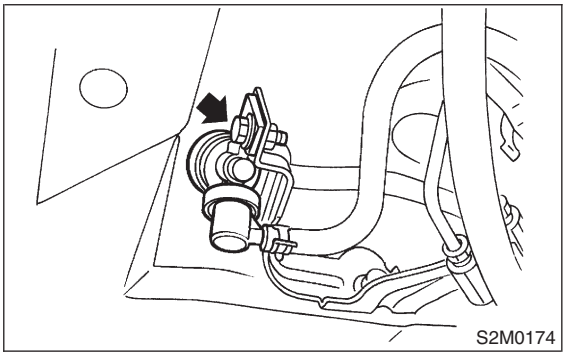

S2M0174

3) Disconnect hoses from roll over valve, and remove it from bracket.


S2M0175

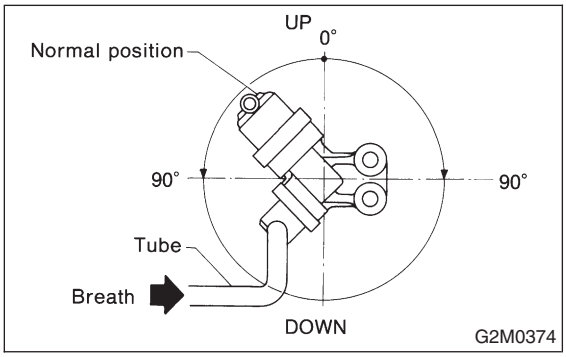
4) Installation is in the reverse order of removal.

CAUTION:
- **Do not install top side of valve down.**
- **Before installing bracket on body, securely fit concave part of bracket to hole in body.**


S2M0174

B: INSPECTION

1) Connect hoses to roll over valve as shown in Figure.

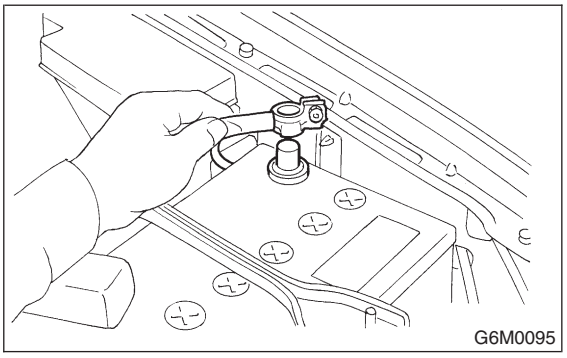


2) While blowing through open end of hose, tilt valve at least 90° left and right from normal position.
3) Ensure that there is no air flow when hose is tilted greater than 90°.

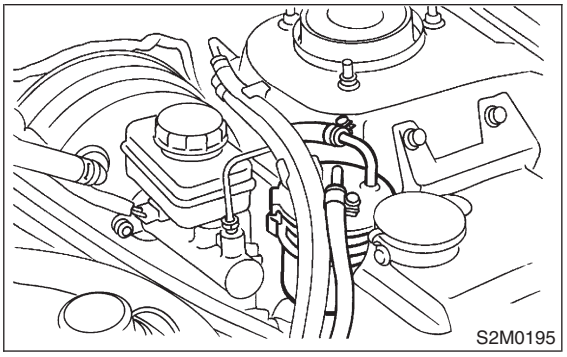
8. Fuel Filter

A: REMOVAL

1) Release fuel pressure. <Ref. to 2-8 [W1A0].>
2) Disconnect battery ground cable.



3) Disconnect fuel delivery hoses from fuel filter.



4) Remove filter from holder.

B: INSPECTION

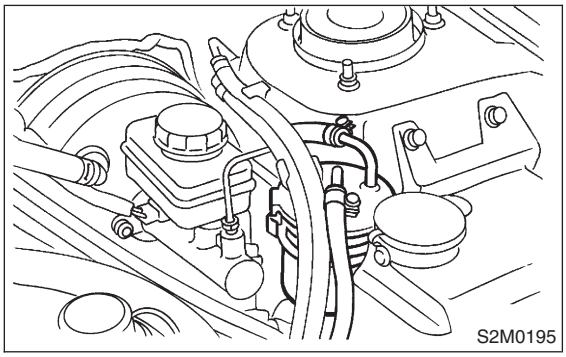
1) Check the inside of fuel filter for dirt and water sediment.
2) If it is clogged, or if replacement interval has been reached, replace it.
3) If water is found in it, shake and expel the water from inlet port.

C: INSTALLATION

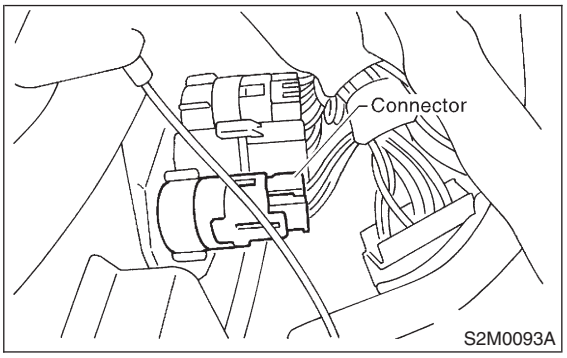
CAUTION:
• If fuel hoses are damaged at the connecting portion, replace it with a new one.
• If clamps are badly damaged, replace with new ones.

1) Installation is in the reverse order of removal.
2) Tighten hose clamp screws.

Tightening torque:
1.0 $^{+0.5}/_{-0}$ N·m (0.1$^{+0.05}/_{-0}$ kg-m, 0.7$^{+0.4}/_{-0}$ ft-lb)


S2M0195

3) Connect connector to fuel pump relay.



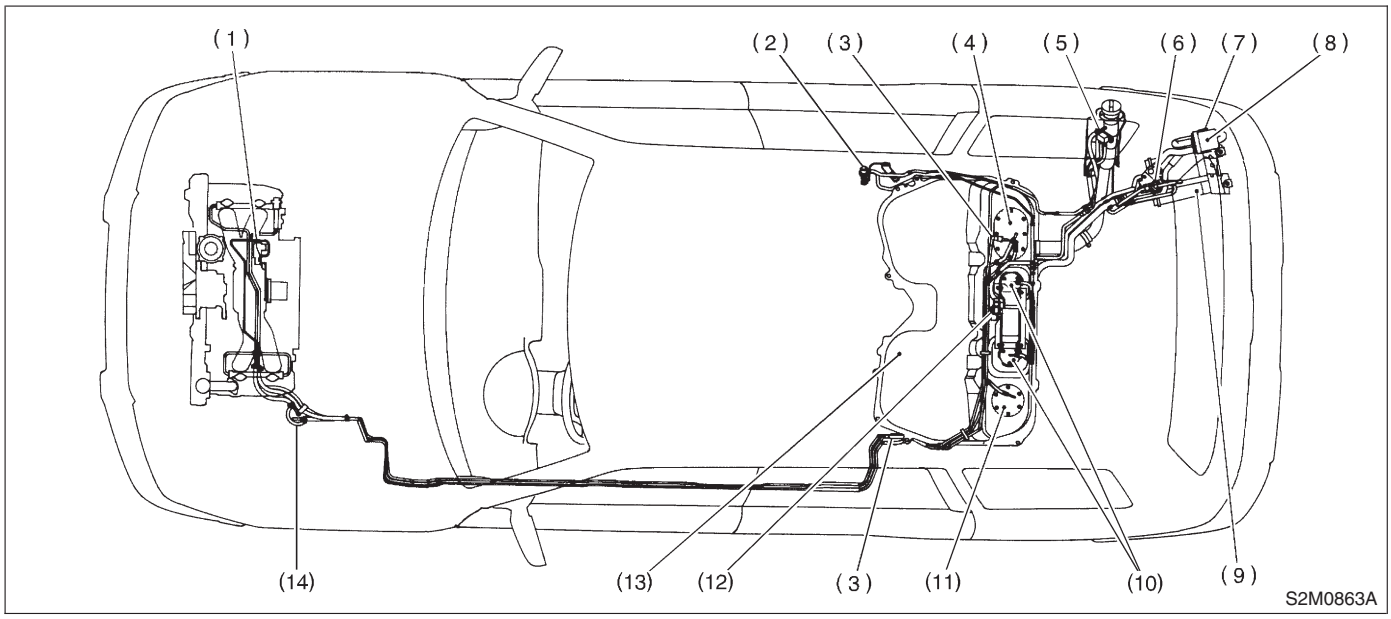
S2M0093A

9. Fuel Delivery, Return and Evaporation Lines

A: REMOVAL

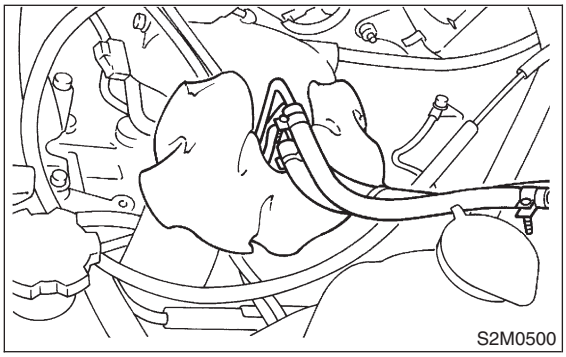
1) Release fuel pressure. <Ref. to 2-8 [W1A0].>

2) Remove fuel filler cap.
3) Remove inner trim, insulator and rear seat.
4) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, and evaporation pipes and hoses.



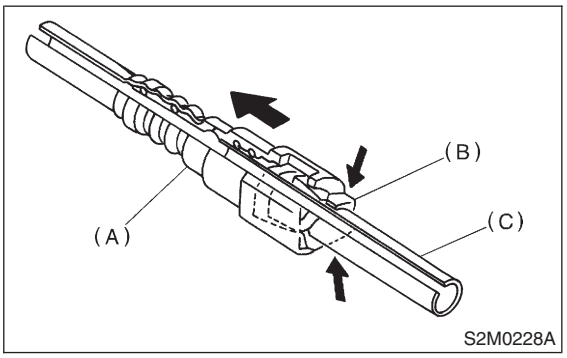
(1) Purge control solenoid valve
(2) Roll over valve
(3) Quick connector
(4) Fuel pump
(5) Shut valve
(6) Pressure control solenoid valve
(7) Drain valve
(8) Drain filter
(9) Canister
(10) Fuel cut valve
(11) Fuel sub level sensor
(12) Fuel tank pressure sensor
(13) Fuel tank
(14) Fuel filter

5) In engine compartment, detach fuel delivery hose, return hose and evaporation hose.



6) Separate quick connector on fuel delivery line.
(1) Clean pipe and connector, if they are covered with dust.
(2) Hold connector (A) and push retainer (B) down.
(3) Pull out connector (A) from retainer (B).

CAUTION:
Replace retainer with new ones.

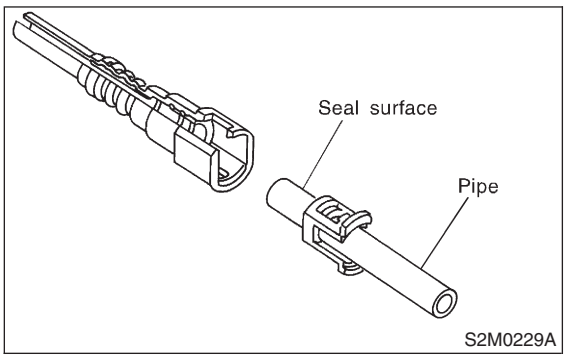


(A) Connector
(B) Retainer
(C) Pipe

B: INSTALLATION

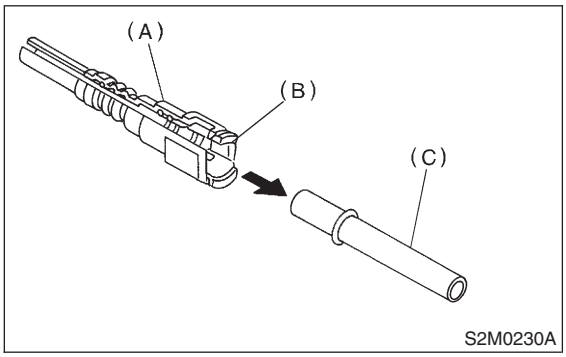
Installation is in the reverse order of removal.
1) Connect quick connector on fuel delivery line.

CAUTION:
● Always use a new retainer.
● Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface of pipe.



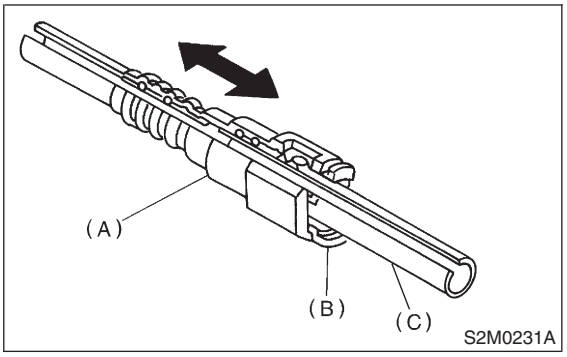
(1) Set new retainer (B) to connector (A).
(2) Push pipe into connector completely.

NOTE:
At this time, two clicking sounds are heard.



(A) Connector
(B) Retainer
(C) Pipe

CAUTION:
● Pull the connector to ensure it is connected securely.
● Ensure the two retainer pawls are engaged in their mating positions in the connector.
● Be sure to inspect hoses and their connections for any leakage of fuel.

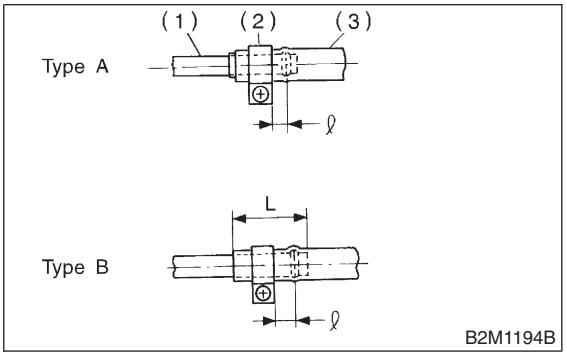


(A) Connector
(B) Retainer
(C) Pipe

2) Connect fuel delivery hose to pipe in engine compartment with an overlap of 20 to 25 mm (0.79 to 0.98 in).
Type A: When fitting length is specified.
Type B: When fitting length is not specified.

ℓ : 1.0 — 4.0 mm (0.039 — 0.157 in)

L: 20 — 25 mm (0.79 — 0.98 in)



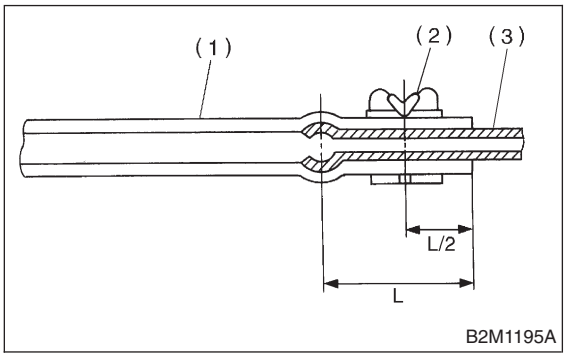
(1) Fitting
(2) Clamp
(3) Hose

3) Connect return hose and evaporation hose to pipe by approx. 15 mm (0.59 in) from hose end.

Fuel return hose:
L = 20 — 25 mm (0.79 — 0.98 in)

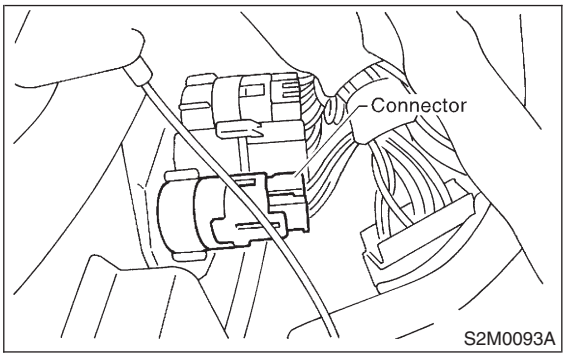
Fuel evaporation hose:
L = 15 — 20 mm (0.59 — 0.79 in)

CAUTION:
Be sure to inspect hoses and their connections for any leakage of fuel.



(1) Hose
(2) Clip
(3) Pipe

4) Connect connector to fuel pump relay.



1. Fuel System Trouble in General

Trouble and possible cause			Corrective action
1. Insufficient fuel supply to the injector			
1)	Fuel pump will not operate.		
	○	Defective terminal contact.	Inspect connections, especially ground, and tighten securely.
	○	Trouble in electromagnetic or electronic circuit parts.	Replace fuel pump.
2)		Lowering of fuel pump function.	Replace fuel pump.
3)		Clogged dust or water in the fuel filter.	Replace fuel filter, clean or replace fuel tank.
4)		Clogged or bent fuel pipe or hose.	Clean, correct or replace fuel pipe or hose.
5)		Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)		Clogged or bent breather tube or pipe.	Clean, correct or replace air breather tube or pipe.
7)		Damaged diaphragm of pressure regulator.	Replace.
2. Leakage or blow out fuel			
1)		Loosened joints of the fuel pipe.	Retightening.
2)		Cracked fuel pipe, hose and fuel tank.	Replace.
3)		Defective welding part on the fuel tank.	Replace.
4)		Defective drain packing of the fuel tank.	Replace.
5)		Clogged or bent air breather tube or air vent tube.	Clean, correct or replace air breather tube or air vent tube.
3. Gasoline smell inside of compartment			
1)		Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retightening.
2)		Defective packing air tightness on the fuel saucer.	Correct or replace packing.
3)		Cracked fuel separator.	Replace separator.
4)		Inoperable fuel pump modulator or circuit.	Replace.
4. Defective fuel meter indicator			
1)		Defective operation of fuel meter unit.	Replace.
2)		Defective operation of fuel meter.	Replace.
5. Noise			
1)		Large operation noise or vibration of fuel pump.	Replace.

NOTE:
When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank.
(1) To prevent water condensation:
- Top off the fuel tank or drain the fuel completely.
- Drain water condensation from the fuel filter.

(2) Refilling the fuel tank:
Refill the fuel tank while there is still some fuel left in the tank.
(3) Protecting the fuel system against freezing and water condensation:
- Cold areas

In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use an anti-freeze solution in the cooling system. Refueling will also complement the effect of anti-freeze solution each time the fuel level drops to about one-half. After the winter season, drain water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under Affected areas below.
- Affected areas

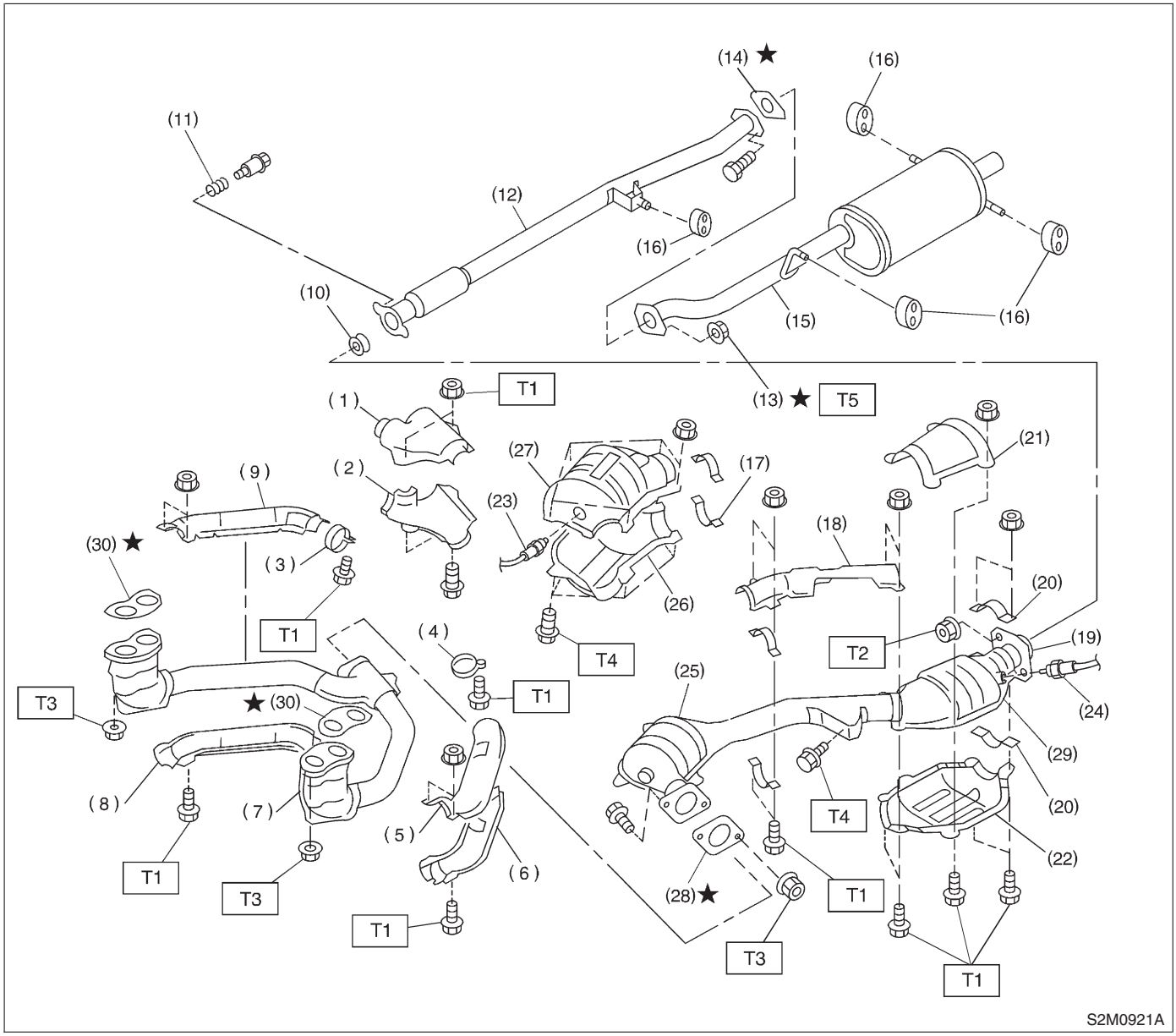
When water condensation is notched in the fuel filter, drain water from both the fuel filter and fuel tank or use a water removing agent (or anti-freeze solution) in the fuel tank.
(4) Observe the instructions, notes, etc., indicated on the label affixed to the anti-freeze solution (water removing agent) container before use.

EXHAUST SYSTEM 2-9

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C COMPONENT PARTS 2
1. Exhaust System 2
W SERVICE PROCEDURE 3
1. Front and Center Exhaust Pipe Assembly 3
2. Rear Exhaust Pipe 5
3. Muffler 6

1. Exhaust System



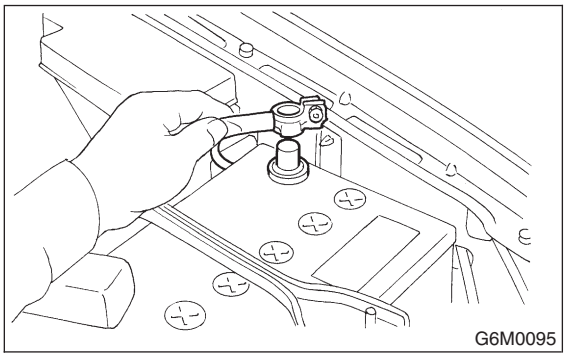
(1) Upper front exhaust pipe cover CTR
(2) Lower front exhaust pipe cover CTR
(3) Band RH
(4) Band LH
(5) Upper front exhaust pipe cover LH
(6) Lower front exhaust pipe cover LH
(7) Front exhaust pipe
(8) Lower front exhaust pipe cover RH
(9) Upper front exhaust pipe cover RH
(10) Gasket
(11) Spring
(12) Rear exhaust pipe
(13) Self-locking nut
(14) Gasket
(15) Muffler
(16) Cushion rubber
(17) Clamp
(18) Upper center exhaust pipe cover
(19) Center exhaust pipe
(20) Clamp B
(21) Upper rear catalytic converter cover
(22) Lower rear catalytic converter cover
(23) Front oxygen (A/F) sensor
(24) Rear oxygen sensor
(25) Front catalytic converter
(26) Lower front catalytic converter cover
(27) Upper front catalytic converter cover
(28) Gasket
(29) Rear catalytic converter
(30) Gasket

Tightening torque: N·m (kg-m, ft-lb)
T1: 13±3 (1.3±0.3, 9.4±2.2)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 30±5 (3.1±0.5, 22.4±3.6)
T4: 35±5 (3.6±0.5, 26.0±3.6)
T5: 48±5 (4.9±0.5, 35.4±3.6)

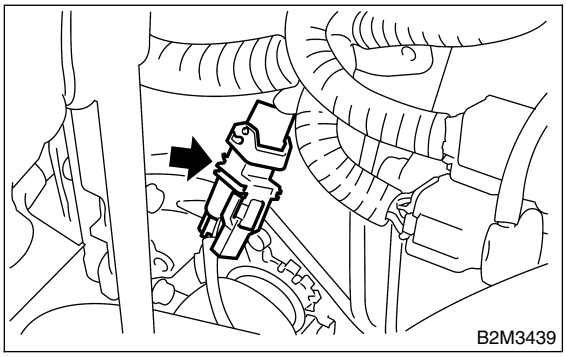
1. Front and Center Exhaust Pipe Assembly

A: REMOVAL

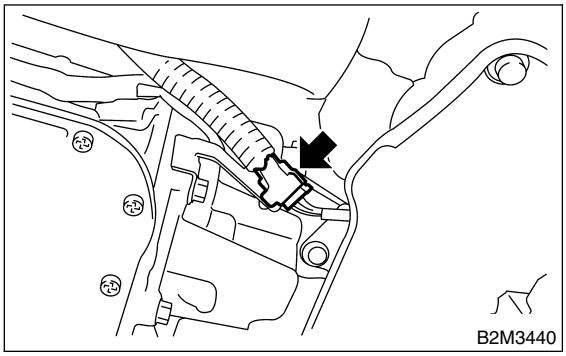
1) Disconnect battery ground cable.



2) Disconnect front oxygen (A/F) sensor connector.

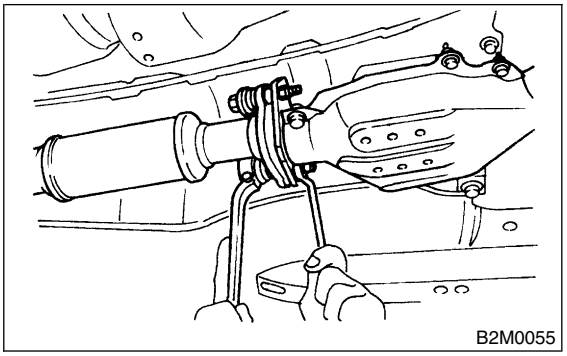


3) Lift-up the vehicle.
4) Disconnect rear oxygen sensor connector.



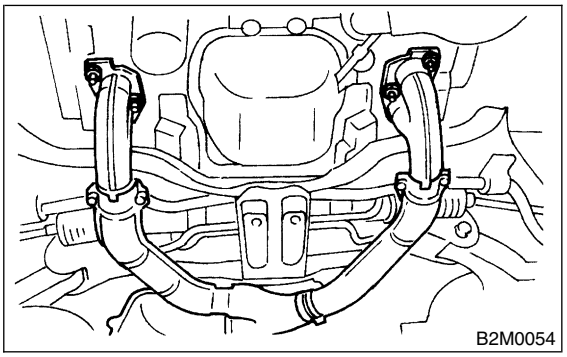
5) Separate front and center exhaust pipe assembly from rear exhaust pipe.

WARNING:
Be careful, exhaust pipe is hot.

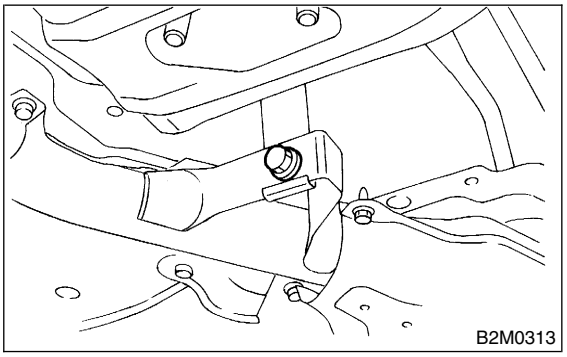


6) Remove bolts which hold front exhaust pipe onto cylinder heads.

CAUTION:
Be careful not to pull down front and center exhaust pipe assembly.



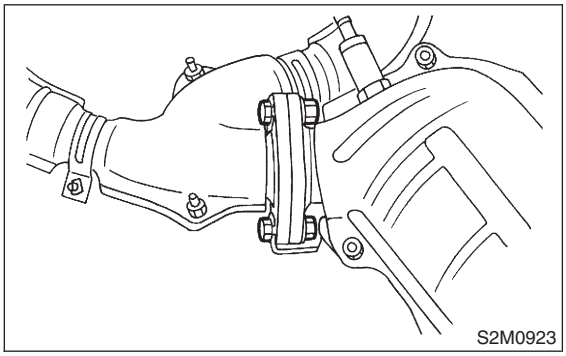
7) Remove bolt which installs front and center exhaust pipe assembly to hanger bracket.



8) Remove front and center exhaust pipe assembly from the vehicle.

CAUTION:
• Be careful not to let front and center exhaust pipe assembly fall off when removing as it is quite heavy.
• After removing front and center exhaust assembly, do not apply excessive pulling force on rear exhaust pipe.

9) Separate front exhaust pipe from front catalytic converter and center exhaust pipe assembly.

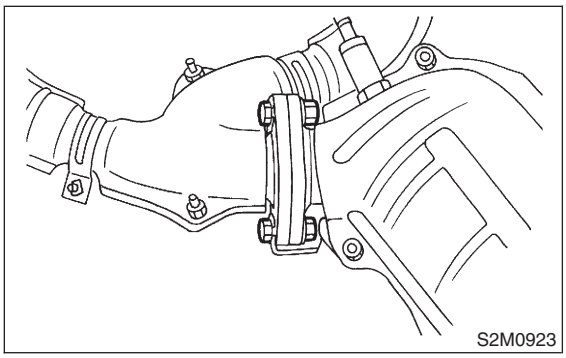

S2M0923

B: INSTALLATION

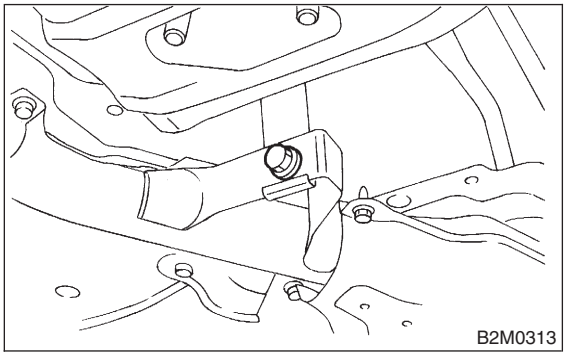
1) Install front exhaust pipe to front catalytic converter and center exhaust pipe assembly.

CAUTION:
Replace gaskets with new ones.

Tightening torque:
30±5 N·m (3.1±0.5 kg-m, 22.4±3.6 ft-lb)

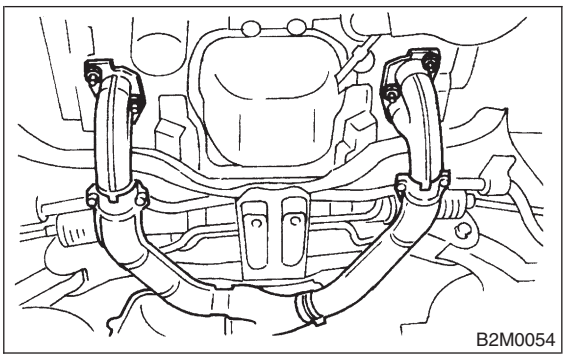

S2M0923

2) Install front and center exhaust pipe assembly to the vehicle.
3) Temporarily tighten bolt which installs front and center exhaust pipe assembly to hanger bracket.


B2M0313

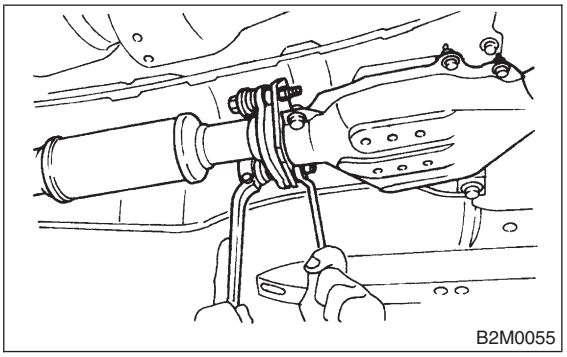
4) Tighten bolts which hold front exhaust pipe onto cylinder heads.

Tightening torque:
30±5 N·m (3.1±0.5 kg-m, 22.4±3.6 ft-lb)


B2M0054

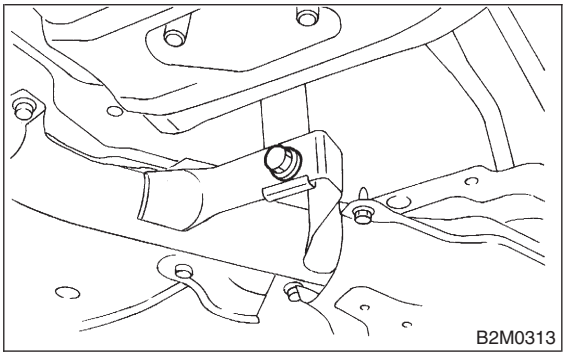
5) Tighten bolts which install front and center exhaust pipe assembly to rear exhaust pipe.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

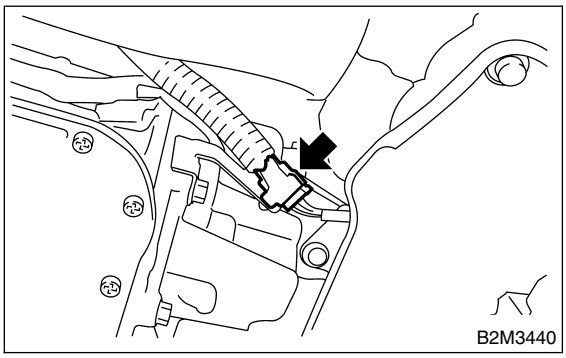

B2M0055

6) Tighten bolt which holds front and center exhaust pipe assembly to hanger bracket.

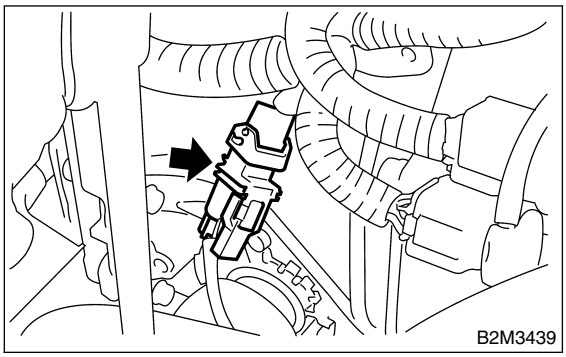
Tightening torque:
35±5 N·m (3.6±0.5 kg-m, 26.0±3.6 ft-lb)


B2M0313

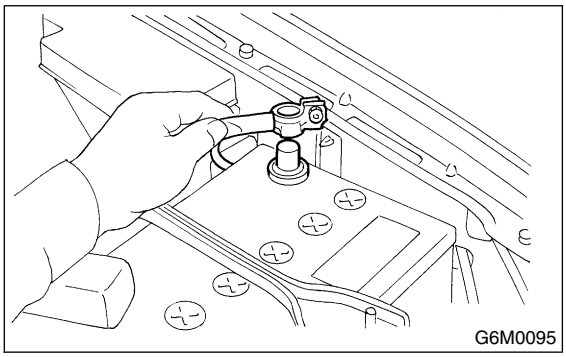
7) Connect rear oxygen sensor connector.



8) Lower the vehicle.
9) Connect front oxygen (A/F) sensor connector.



10) Connect battery ground cable.

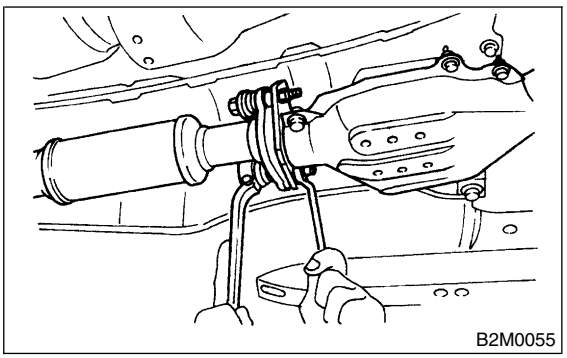


2. Rear Exhaust Pipe

A: REMOVAL

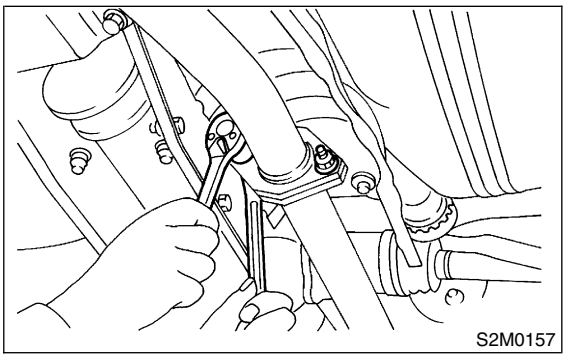
1) Separate rear exhaust pipe from center exhaust pipe.

WARNING:
Be careful, exhaust pipe is hot.



2) Separate rear exhaust pipe from muffler.

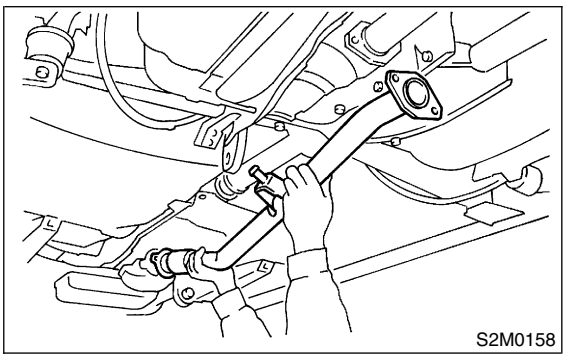
CAUTION:
Be careful not to pull down rear exhaust pipe.



3) Remove rear exhaust pipe bracket from rubber cushion.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC or equivalent to pipe bracket in advance.

SUBARU CRC (Part No. 004301003)



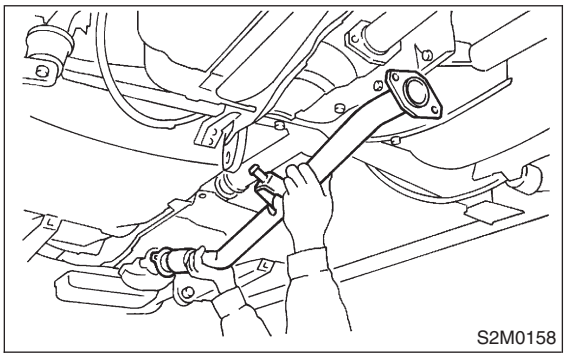
B: INSTALLATION

CAUTION:
Replace gaskets with new ones.

1) Install rear exhaust pipe bracket to rubber cushion.

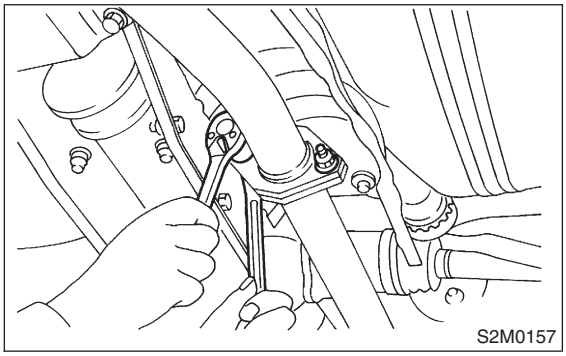
NOTE:
To facilitate installation, apply a coat of SUBARU CRC or equivalent to mating area of rubber cushion in advance.

SUBARU CRC (Part No. 004301003)


S2M0158

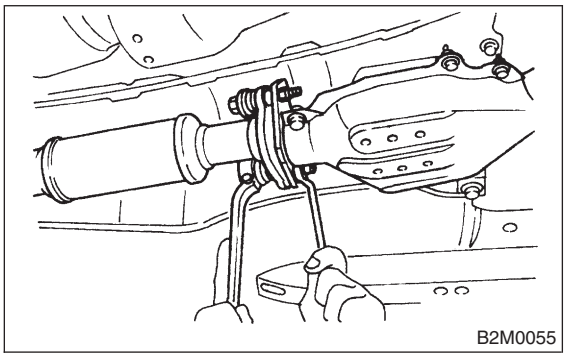
2) Install rear exhaust pipe to muffler.

Tightening torque:
48±5 N·m (4.9±0.5 kg-m, 35.4±3.6 ft-lb)


S2M0157

3) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

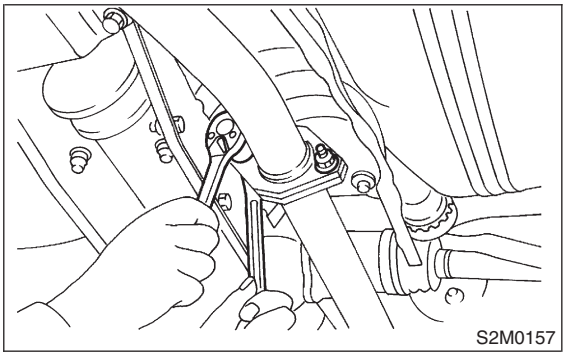

B2M0055

3. Muffler

A: REMOVAL AND INSTALLATION

WARNING:
Be careful, exhaust pipe is hot.

1) Separate muffler from rear exhaust pipe.

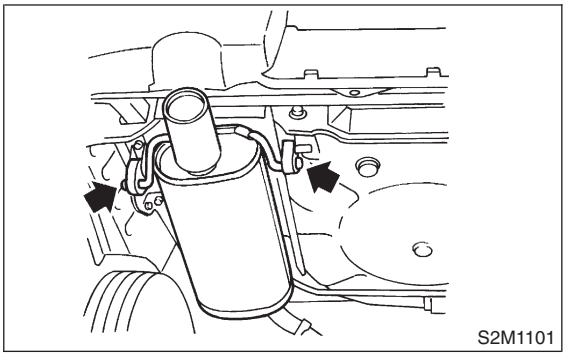

S2M0157

2) Remove left and right rubber cushions.

CAUTION:
Be careful not to pull down muffler.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC or equivalent to mating area of rubber cushions in advance.

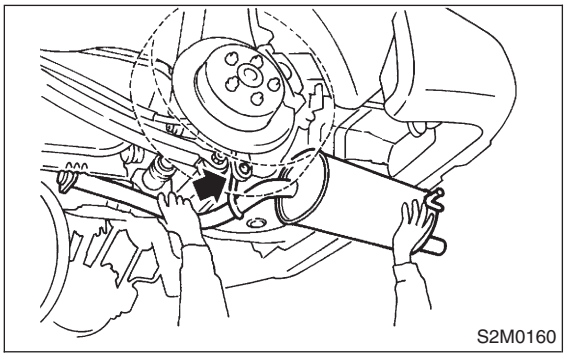
SUBARU CRC (Part No. 004301003)


S2M1101

3) Remove front rubber cushion, and detach muffler assembly.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC or equivalent to mating area of rubber cushion in advance.

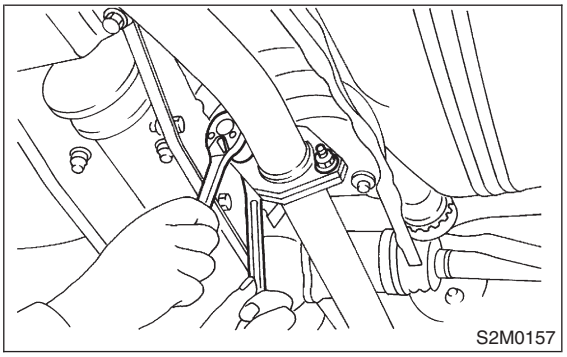
SUBARU CRC (Part No. 004301003)



4) Installation is in the reverse order of removal.

CAUTION:
Replace gasket with a new one.

Tightening torque:
48±5 N·m (4.9±0.5 kg-m, 35.4±3.6 ft-lb)



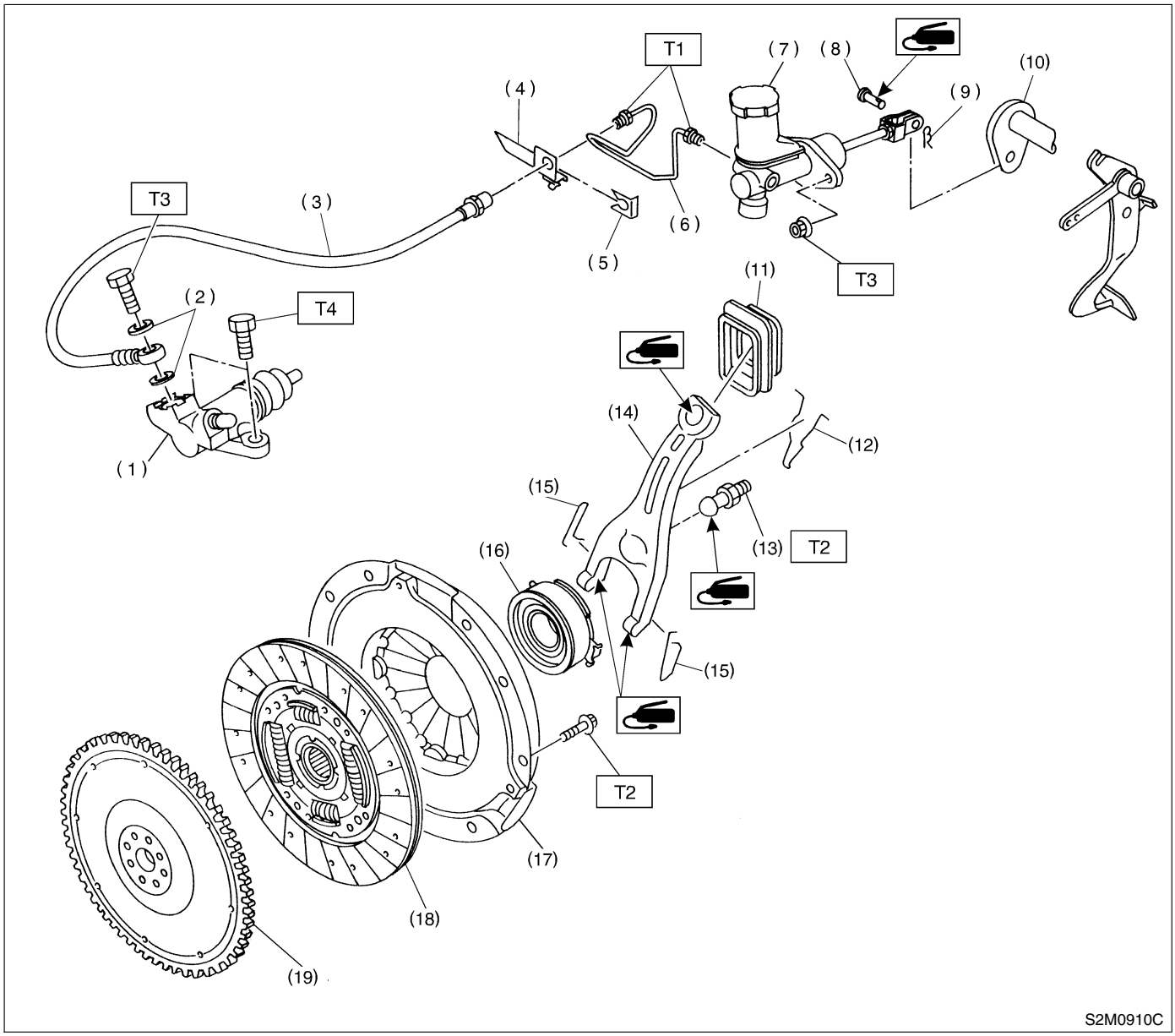
MEMO:

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1. Clutch System....3
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1. Clutch System....15

1. Clutch System

			2500 cc
Clutch cover	Diaphragm set load kg (lb)		580 (1,279)
Clutch disc	Facing material		Woven
	O.D. × I.D. × thickness mm (in)		225 × 150 × 3.5 (8.86 × 5.91 × 0.138)
	Spline O.D. (No. of teeth) mm (in)		25.2 (0.992) (24)
	Depth of rivet head mm (in)	Limit of sinking	0.3 (0.012)
	Limit for runout mm (in)		1.0 (0.039) at R = 107 (4.21)
Clutch release lever ratio			1.6
Clutch release bearing			Grease-packed self-aligning
Clutch release lever	Stroke mm (in)		12 — 13.6 (0.472 — 0.535)
Clutch pedal	Full stroke mm (in)		130 — 135 (5.12 — 5.31)

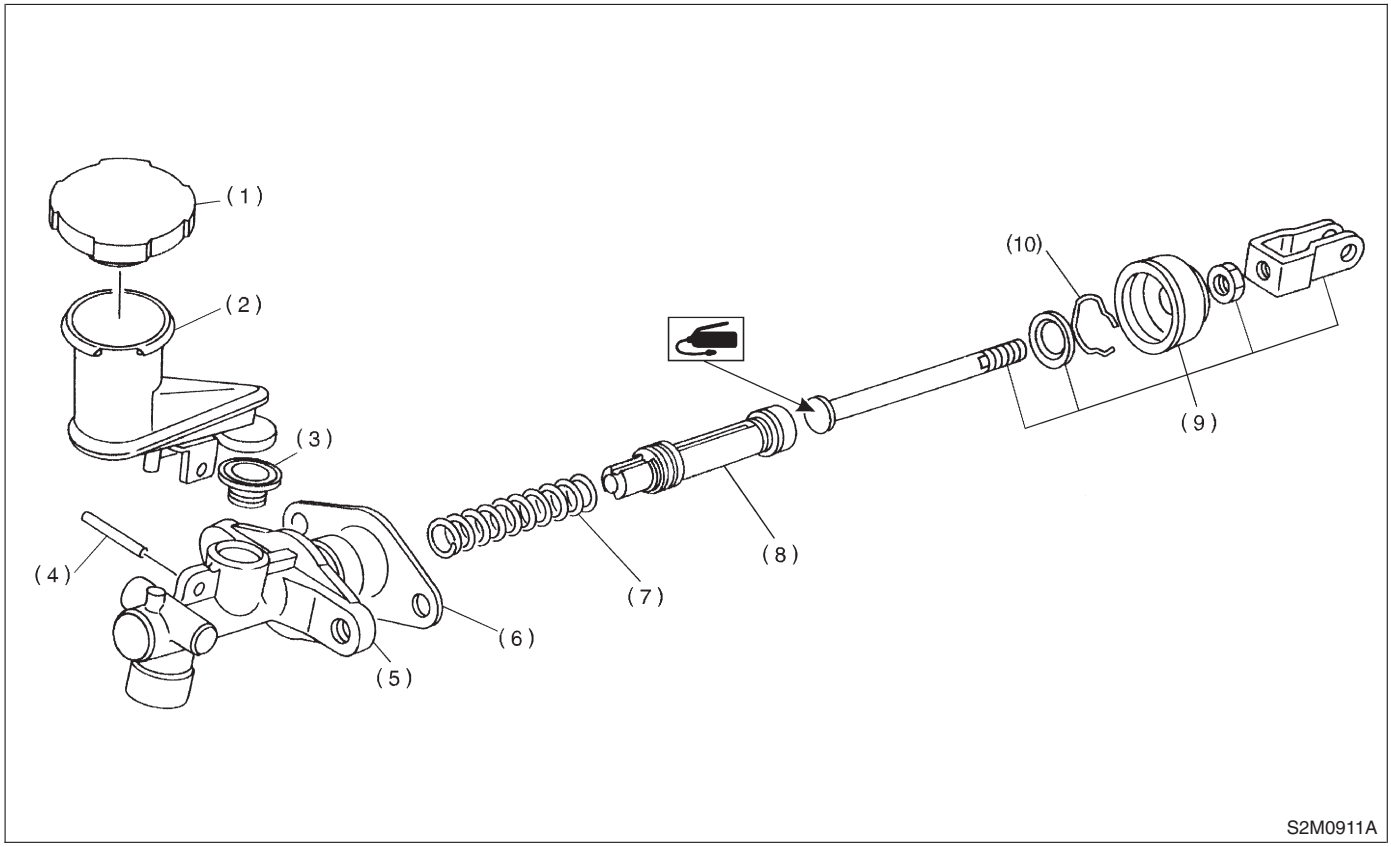
1. Clutch System



(1) Operating cylinder
(2) Washer
(3) Clutch hose
(4) Bracket
(5) Clip
(6) Pipe
(7) Master cylinder ASSY
(8) Clevis pin
(9) Snap pin
(10) Lever
(11) Clutch release lever sealing
(12) Retainer spring
(13) Pivot
(14) Clutch release lever
(15) Clip
(16) Clutch release bearing
(17) Clutch cover
(18) Clutch disc
(19) Flywheel

Tightening torque: N·m (kg-m, ft-lb)
T1: 15^{+3}_{-2} ($1.5^{+0.3}_{-0.2}$, $10.8^{+2.2}_{-1.4}$)
T2: 15.7±1.5 (1.6±0.15, 11.6±1.1)
T3: 18±3 (1.8±0.3, 13.0±2.2)
T4: 37±3 (3.8±0.3, 27.5±2.2)

2. Master Cylinder and Reservoir Tank



(1) Reservoir cap
(2) Reservoir tank
(3) Oil seal
(4) Straight pin
(5) Master cylinder
(6) Seat
(7) Return spring
(8) Piston
(9) Push rod
(10) Piston stop ring

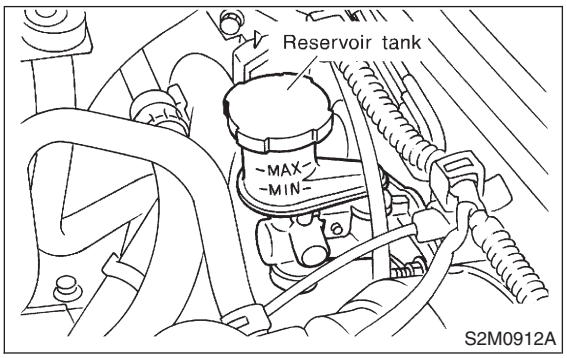
1. General

A: PRECAUTION

When servicing clutch system, pay attention to the following items.
1) Check fluid level using a scale on outside of reservoir tank. If the level is below “MIN”, add brake fluid to bring it up to “MAX”.

Recommended brake fluid:
FMVSS No. 116, fresh DOT3 or DOT4 brake fluid

CAUTION:
• Avoid mixing different brakes of brake fluid to prevent degradation of the fluid.
• Be careful not to allow dirt or dust to get into the reservoir tank.
• Use fresh DOT3 or DOT4 brake fluid when refilling fluid.



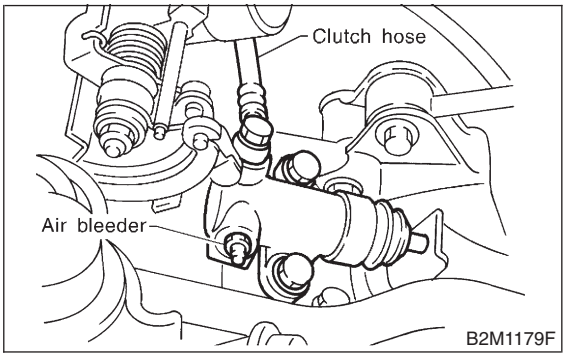
2) Make sure that brake fluid does not leak from master cylinder, operating cylinder and piping.
3) Apply grease sufficiently to the clutch release lever pinion.
4) Check for proper clutch disengagement and clutch pedal return ability.

2. On-car Service

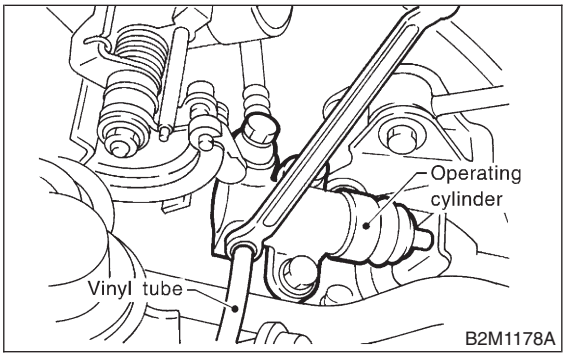
A: ADJUSTMENT

NOTE:
Bleed air from oil line with the help of a co-worker.

1) Remove air cleaner case.
2) Fit one end of a vinyl tube into the air bleeder of operating cylinder and put the other end into a brake fluid container.



3) Slowly depress the clutch pedal and keep it depressed. Then open the air bleeder to discharge air together with the fluid.
Release the air bleeder for 1 or 2 seconds. Next, with the bleeder closed, slowly release the clutch pedal.

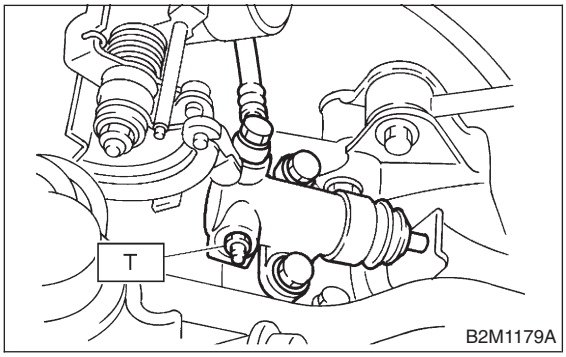


4) Repeat these steps until there are no more air bubbles in the vinyl tube.

CAUTION:
Cover bleeder with waste cloth when loosening it, to prevent brake fluid from being splashed over surrounding parts.

5) Tighten air bleeder.

Tightening torque:
T: 8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)



6) After depressing the clutch pedal, make sure that there are no leaks evident in the entire system.
7) After bleeding air from system, ensure that clutch operates properly.

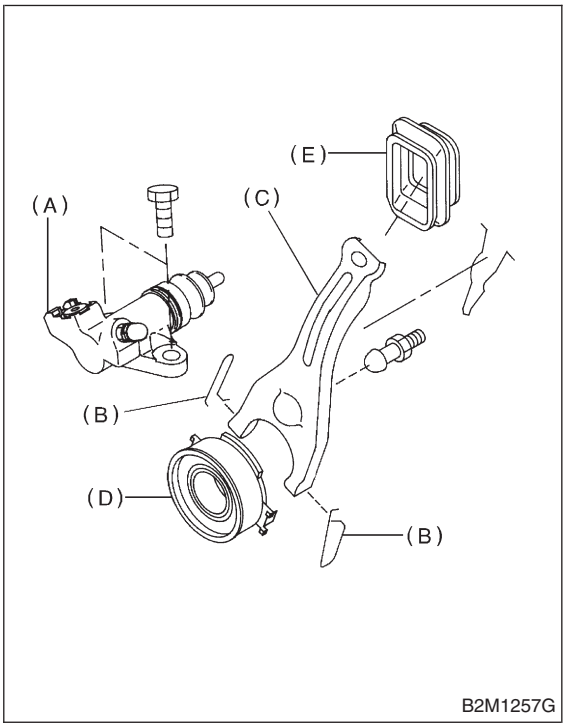
3. Clutch Release Bearing and Lever

A: REMOVAL

1) Remove transmission assembly from vehicle body.
<Ref. to 2-11 [W2B0].>
2) Remove operating cylinder.
<Ref. to 2-10 [W5A0].>
3) Remove the two clips from clutch release lever and remove clutch release bearing.

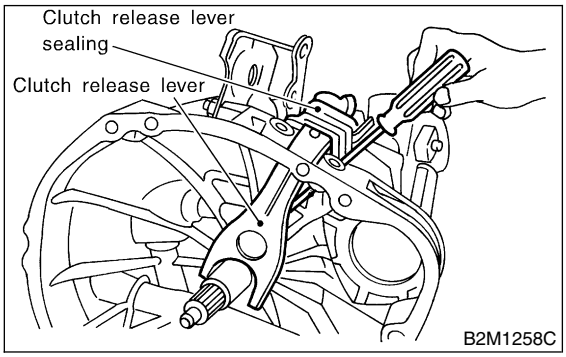
CAUTION:
Be careful not to deform clips.

4) Remove clutch release lever sealing.



(A) Operating cylinder
(B) Clip
(C) Clutch release lever
(D) Clutch release bearing
(E) Clutch release lever sealing

5) Remove clutch release lever retainer spring from clutch release lever pivot with a screwdriver by accessing it through clutch housing clutch release lever hole. Then remove clutch release lever.



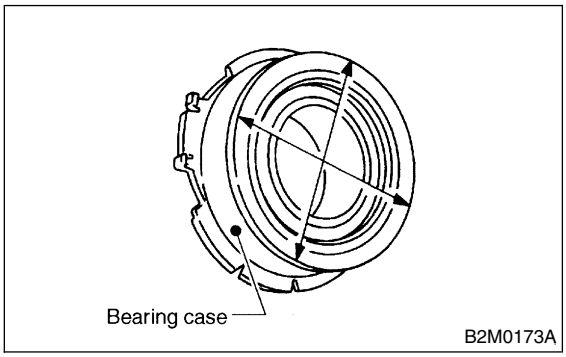
B: INSPECTION

1. CLUTCH RELEASE BEARING

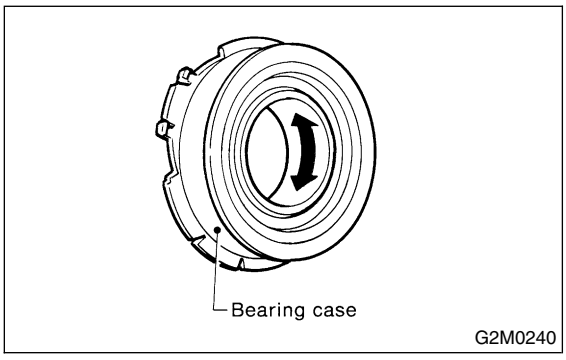
CAUTION:
Since this bearing is grease sealed and is of a non-lubrication type, do not wash with gasoline or any solvent when servicing the clutch.

1) Check the bearing for smooth movement by applying force in the radial direction.

Radial direction stroke:
1.4 mm (0.055 in)



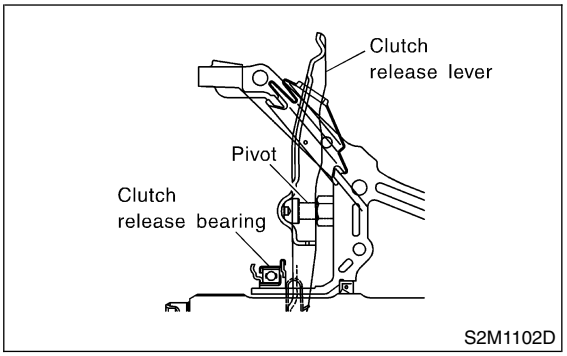
2) Check the bearing for smooth rotation by applying pressure in the thrust direction.



3) Check wear and damage of bearing case surface contacting with lever.

2. CLUTCH RELEASE LEVER

1) Check lever pivot portion and the point of contact with release bearing case for wear.



C: INSTALLATION

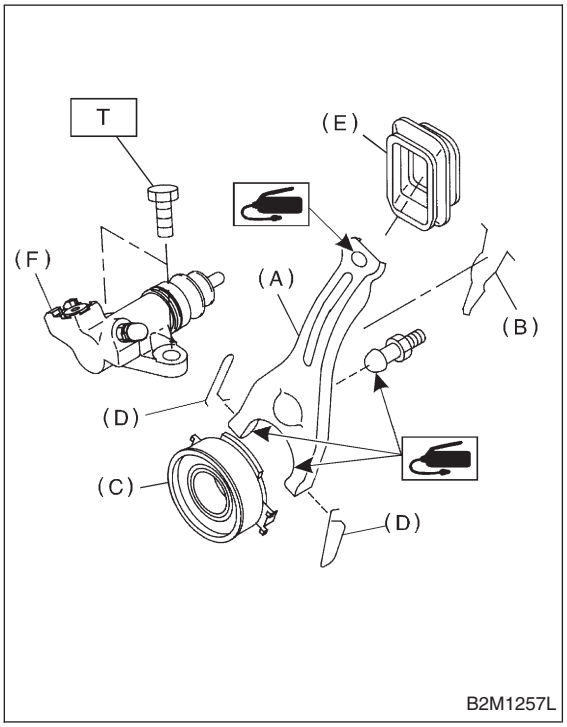
CAUTION:
Before or during assembling, lubricate the following points with a light coat of grease.
- **Contact surface of lever and pivot**
- **Contact surface of lever and bearing**
- **Transmission main shaft spline (Use grease containing molybdenum disulphide.)**

1) While pushing clutch release lever to pivot and twisting it to both sides, fit retainer spring onto the constricted portion of pivot.

NOTE:
● Apply grease (SUNLIGHT 2: P/N 003602010) to contact point of clutch release lever and operating cylinder.
● Confirm that retainer spring is securely fitted by observing it through the main case hole.

2) Install clutch release bearing and fasten it with two clips.
3) Install clutch release lever sealing.
4) Install operating cylinder.

Tightening torque:
T: 37±3 N·m (3.8±0.3 kg-m, 27.5±2.2 ft-lb)



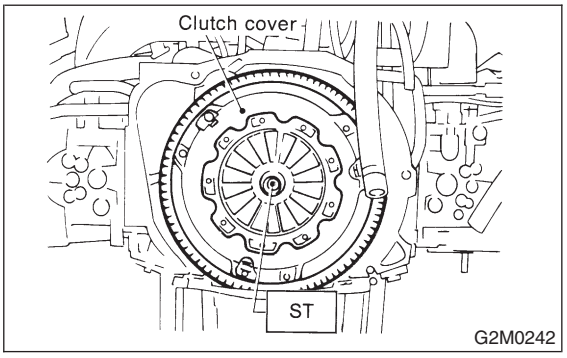
(A) Clutch release lever
(B) Retainer spring
(C) Clutch release bearing
(D) Clip
(E) Clutch release lever sealing
(F) Operating cylinder

5) After remounting engine and transmission on body.
<Ref. to 2-11 [W2B0].>
6) Bleed air from oil line with the help of a co-worker.
<Ref. to 2-10 [W2A0].>

4. Clutch Disc and Cover

A: REMOVAL

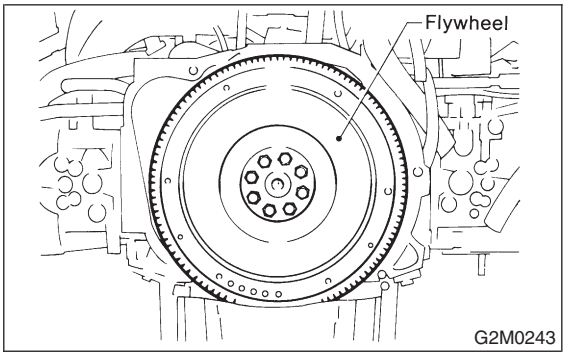
1) Install ST on flywheel.
ST 498497100 CRANKSHAFT STOPPER



2) Remove clutch cover and clutch disc.

CAUTION:
● Take care not to allow oil on the clutch disc facing.
● Do not disassemble either clutch cover or clutch disc.

3) Remove flywheel.



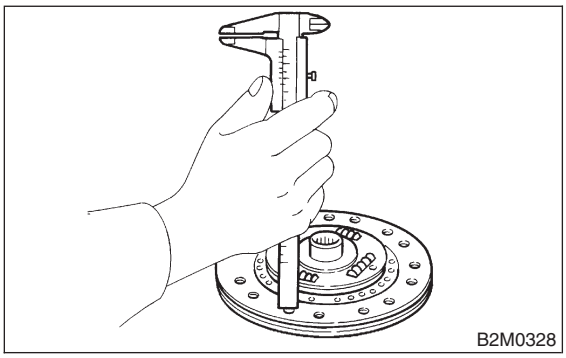
B: INSPECTION

1. CLUTCH DISC

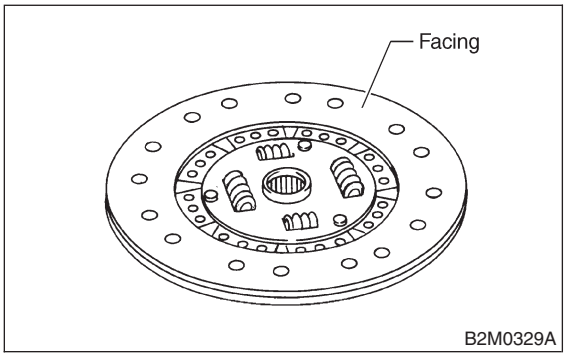
1) Facing wear
Measure the depth of rivet head from the surface of facing. Replace if facings are worn locally or worn down to less than the specified value.

Depth of rivet head:
Limit of sinking
0.3 mm (0.012 in)

CAUTION:
Do not wash clutch disc with any cleaning fluid.


B2M0328

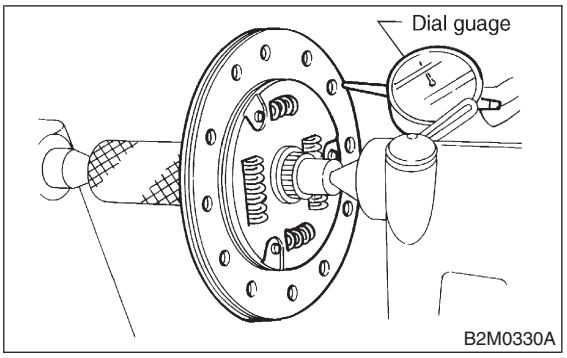
2) Hardened facing
Correct by using emery paper or replace.
3) Oil soakage on facing
Replace clutch disc and inspect transmission front oil sealing, transmission case mating surface, engine rear oil sealing and other points for oil leakage.



B2M0329A

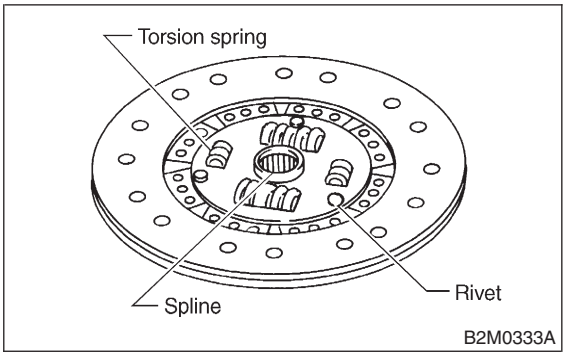
4) Deflection on facing
If deflection exceeds the specified value at the outer circumference of facing, repair or replace.

Limit for runout:
1.0 mm (0.039 in) at R = 107 mm (4.21 in)



B2M0330A

5) Worn spline, loose rivets and torsion spring failure
Replace defective parts.

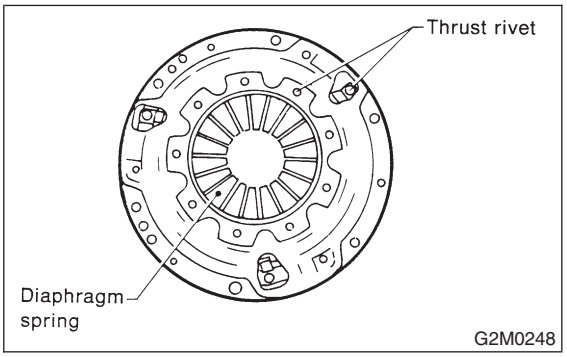


B2M0333A

2. CLUTCH COVER

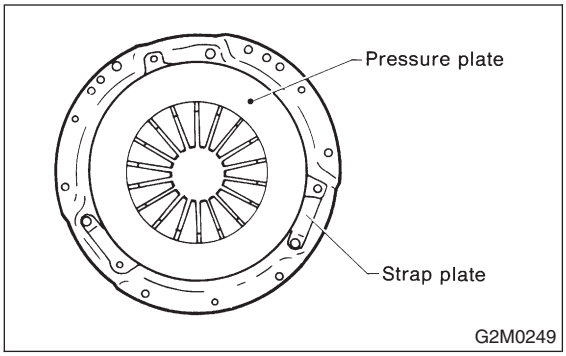
NOTE:
Visually check for the following items without disassembling, and replace or repair if defective.

1) Loose thrust rivet.
2) Damaged or worn bearing contact area at center of diaphragm spring.



G2M0248

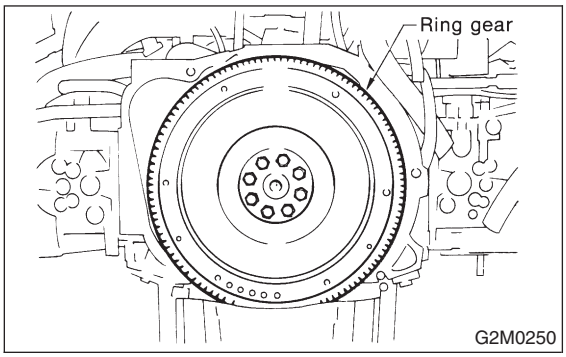
3) Damaged or worn disc contact surface of pressure plate.
4) Loose strap plate setting bolt.
5) Worn diaphragm sliding surface.



3. FLYWHEEL

CAUTION:
Since this bearing is grease sealed and is of a non-lubrication type, do not wash with gasoline or any solvent.

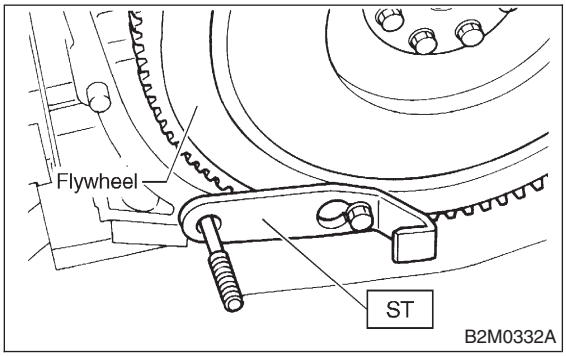
1) Damage of facing and ring gear
If defective, replace flywheel.



2) Smoothness of rotation
Rotate ball bearing applying pressure in thrust direction.
3) If noise or excessive play is noted, replace flywheel.

C: INSTALLATION

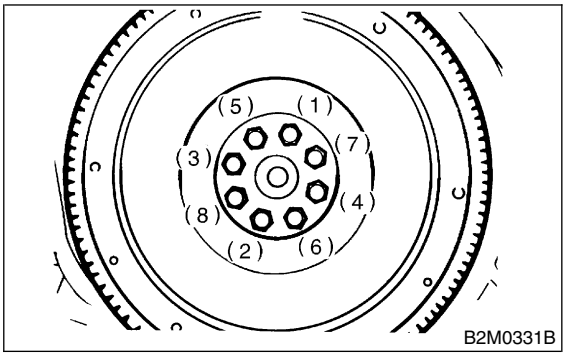
1) Install flywheel and ST.
ST 498497100 CRANKSHAFT STOPPER



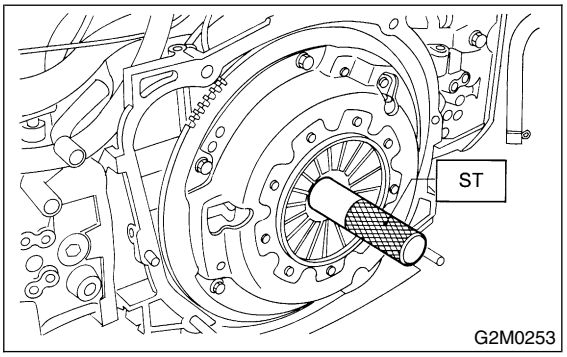
2) Tighten the flywheel attaching bolts to the specified torque.

NOTE:
Tighten flywheel installing bolts gradually. Each bolt should be tightened to the specified torque in a crisscross fashion.

Tightening torque:
72±3 N·m (7.3±0.3 kg-m, 52.8±2.2 ft-lb)



3) Insert ST into the clutch disc and install them on the flywheel by inserting the ST end into the pilot bearing.
ST 499747100 CLUTCH DISC GUIDE

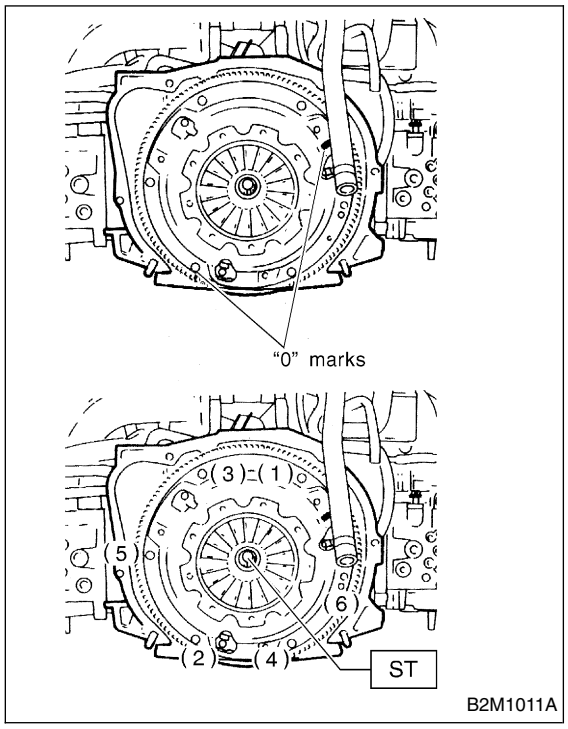


4) Install clutch cover on flywheel and tighten bolts to the specified torque.

NOTE:
● When installing the clutch cover on the flywheel, position the clutch cover so that there is a gap of 120° or more between "0" marks on the flywheel and clutch cover. ("0" marks indicate the directions of residual unbalance.)
● Note the front and rear of the clutch disc when installing.
● Tighten clutch cover installing bolts gradually. Each bolt should be tightened to the specified torque in a crisscross fashion.

Tightening torque:
15.7±1.5 N·m (1.6±0.15 kg-m, 11.6±1.1 ft-lb)

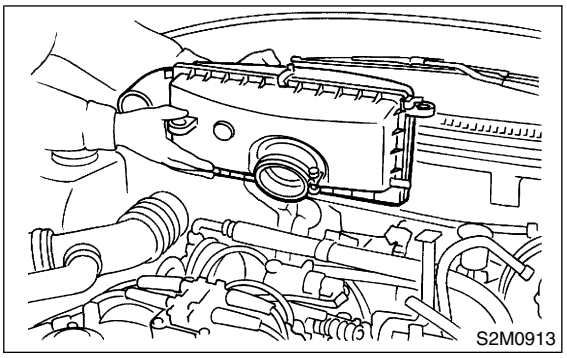
5) Remove ST.
ST 499747100 CLUTCH DISC GUIDE



5. Operating Cylinder

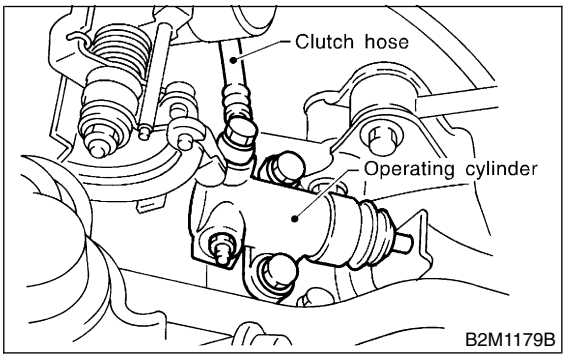
A: REMOVAL AND INSTALLATION

1) Remove air cleaner case.

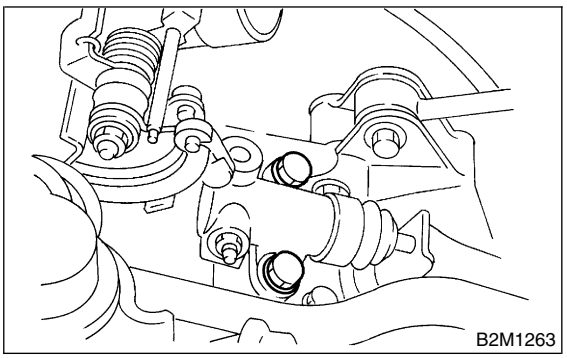


2) Remove clutch hose from operating cylinder.

CAUTION:
Cover hose joint to prevent clutch fluid from flowing out.



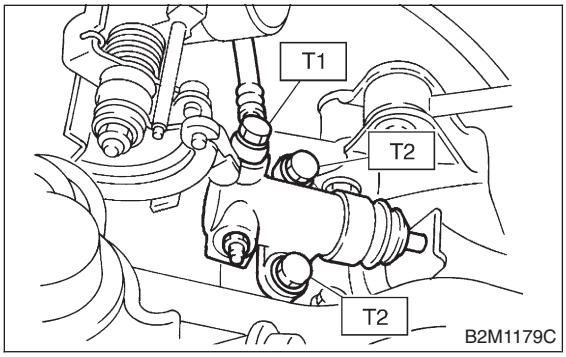
3) Remove operating cylinder from transmission.



4) Installation is in the reverse order of removal.

NOTE:
Before installing operating cylinder, apply grease (SUNLIGHT 2: P/N 003602010) to contact point of clutch release lever and operating cylinder.

Tightening torque:
T1: 18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)
T2: 37±3 N·m (3.8±0.3 kg-m, 27.5±2.2 ft-lb)

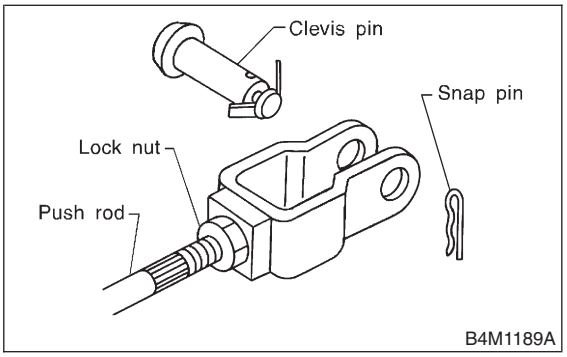


5) After bleeding air from operating cylinder, ensure that clutch operates properly.
<Ref. to 2-10 [W2A0].>

6. Master Cylinder and Reservoir Tank

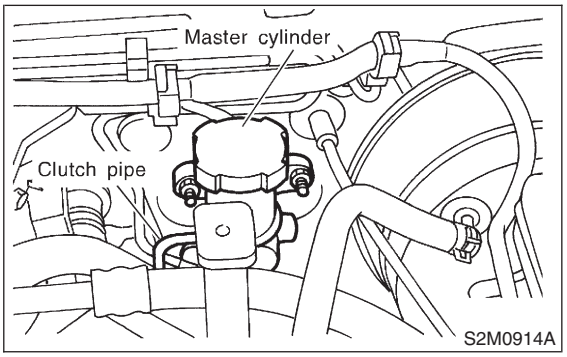
A: REMOVAL

1) Thoroughly drain brake fluid from reservoir tank.
2) Remove snap pin, clevis pin and separate push rod of master cylinder from clutch pedal.



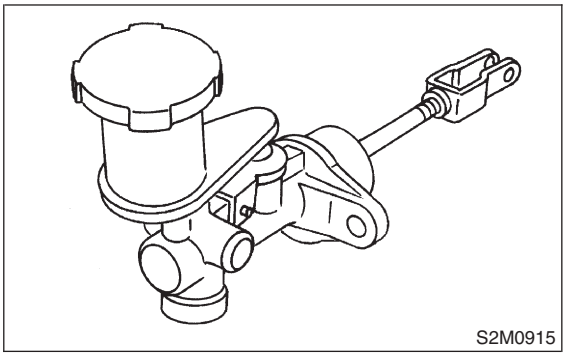
3) Remove clutch pipe from master cylinder.
4) Remove master cylinder with reservoir tank.

CAUTION:
Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the paint surface; wipe it off quickly if spilt.

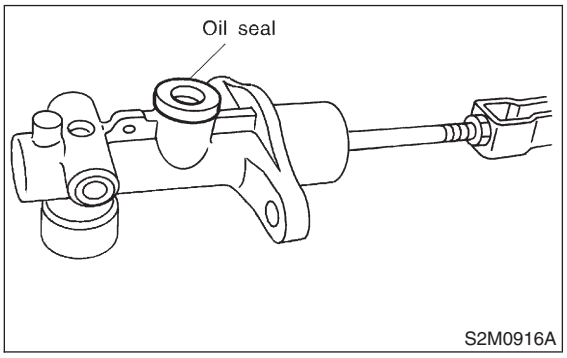


B: DISASSEMBLY

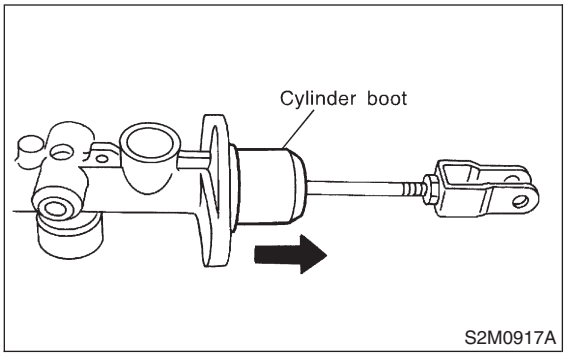
1) Remove straight pin and reservoir tank.



2) Remove oil sealing.



3) Move the cylinder boot backward.

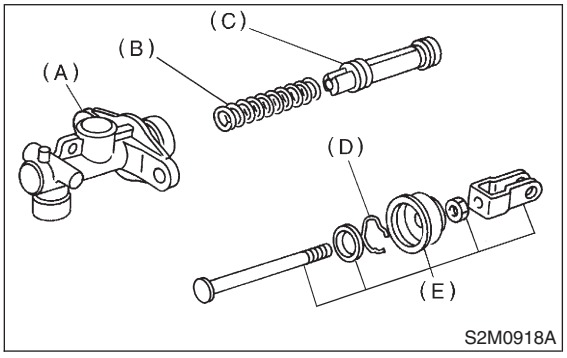


4) Remove snap ring.

CAUTION:
Be careful when removing the snap ring to prevent the rod, washer, piston and return spring from flying out.

C: INSPECTION

If any damage, deformation, wear, swelling, rust or other faults are found on the cylinder, piston, push rod, fluid reservoir, return spring and gasket, replace the faulty part.

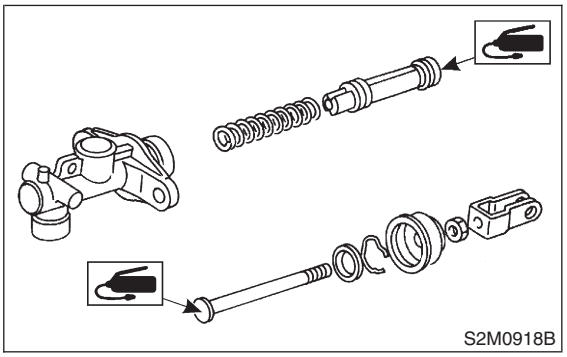


(A) Master cylinder body
(B) Return spring
(C) Piston
(D) Snap ring
(E) Rod ASSY

D: ASSEMBLY

1) Apply a coat of grease to the contacting surfaces of the push rod and piston before installation.

Grease:
SILICONE GREASE G40M (Part No. 004404003)



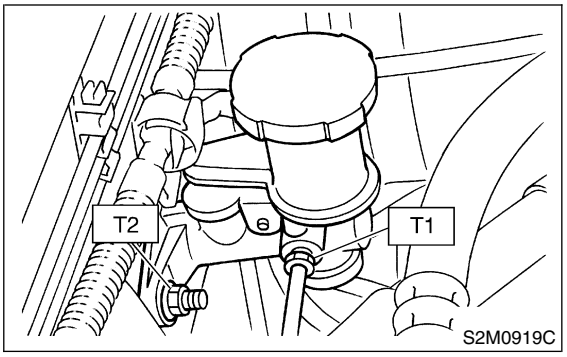
2) To assemble the master cylinder reverse the sequence of disassembly procedure.

E: INSTALLATION

1) Install master cylinder to body, and install clutch pipe to master cylinder.

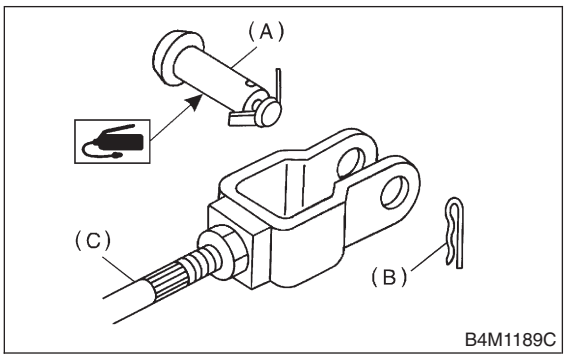
CAUTION:
Check that pipe is routed properly.

Tightening torque:
T1: 15^{+3}_{-2} N·m ($1.5^{+0.3}_{-0.2}$ kg-m, $10.8^{+2.2}_{-1.4}$ ft-lb)
T2: 18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)



2) Connect push rod of master cylinder to clutch pedal, and install clevis pin and snap pin.

NOTE:
Apply grease to clevis pin.



(A) Clevis pin
(B) Snap pin
(C) Push rod

3) After bleeding air from system, ensure that clutch operates properly.
<Ref. to 2-10 [W2A0].>

7. Brake Fluid

A: REPLACEMENT

CAUTION:
● The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
● Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
● Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
● Be careful not to allow dirt or dust to get into the reservoir tank.

NOTE:
● During bleeding operation, keep the clutch reservoir tank filled with brake fluid to eliminate entry of air.
● Clutch pedal operating must be very slow.
● For convenience and safety, it is advisable to have two men working.
● The amount of brake fluid required is approximately 70 mℓ (2.4 US fl oz, 2.5 Imp fl oz) for total clutch system.

1) Either jack-up vehicle and place a safety stand under it, or lift-up vehicle.
2) Remove both front and rear wheels.
3) Draw out the brake fluid from reservoir tank with syringe.
4) Refill reservoir tank with recommended brake fluid.

Recommended brake fluid:
FMVSS No. 116, fresh DOT3 or 4 brake fluid

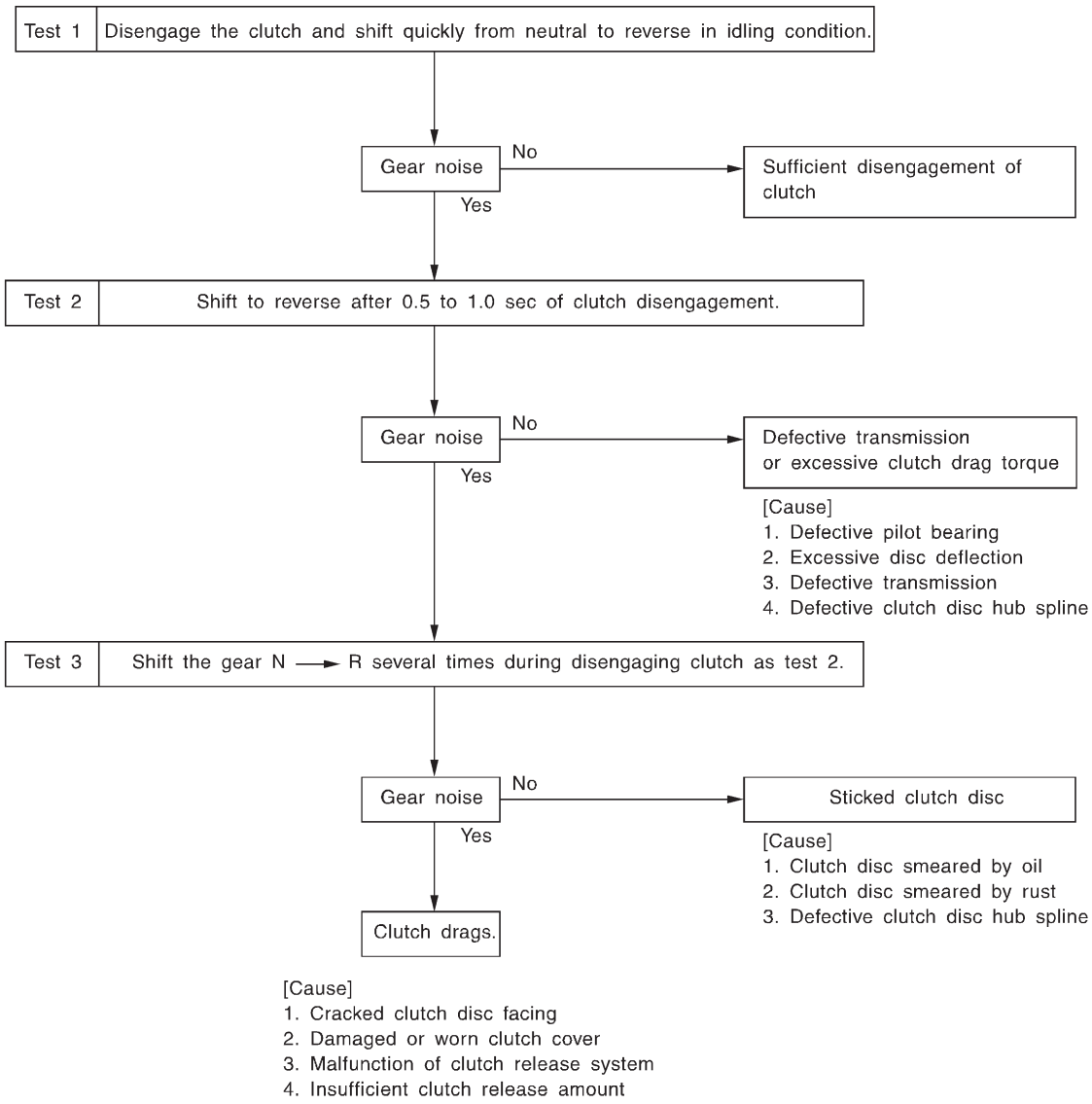
5) Bleed air from oil line with the help of a coworker.
<Ref. to 2-10 [W2A0].>

1. Clutch System

Symptom	Possible cause	Corrective
1. Clutch slippage. It is hard to perceive clutch slippage in the early stage, but pay attention to the following symptoms ● Engine speed up when shifting. ● High speed driving is impossible; especially rapid acceleration impossible and vehicle speed does not increase in proportion to an increase in engine speed. ● Power falls, particularly when ascending a slope, and there is a smell of burning of the clutch facing. ● Method of testing: Put the vehicle in stationary condition with parking brake fully applied. Disengage the clutch and shift the transmission gear into the first. Gradually allow the clutch to engage while gradually increasing the engine speed. The clutch function is satisfactory if the engine stalls. However, the clutch is slipping if the vehicle does not start off and the engine does not stall.	(a) Clutch facing smeared by oil	Replace.
	(b) Worn clutch facing	Replace.
	(c) Deteriorated diaphragm spring	Replace.
	(d) Distorted pressure plate or flywheel	Correct or replace.
	(e) Defective clutch release bearing holder	Correct or replace.
2. Clutch drags. As a symptom of this trouble, a harsh scratching noise develops and control becomes quite difficult when shifting gears. The symptom becomes more apparent when shifting into the first gear. However, because much trouble of this sort is due to defective synchronization mechanism, carry out the test as described after. ● Method of testing: <Ref. to 2-10 [K1A0].> It may be judged as insufficient disengagement of clutch if any noise occurs during this test.	(a) Worn or rusty clutch disc hub spline	Replace clutch disc.
	(b) Excessive deflection of clutch disc facing	Correct or replace.
	(c) Seized crankshaft pilot needle bearing	Replace.
	(d) Cracked clutch disc facing	Replace.
	(e) Sticked clutch disc (smeared by oil or water)	Replace.
3. Clutch chatters. Clutch chattering is an unpleasant vibration to the whole body when the vehicle is just started with clutch partially engaged.	(a) Adhesion of oil on the facing	Replace clutch disc.
	(b) Weak or broken torsion spring	Replace clutch disc.
	(c) Defective facing contact or excessive disc	Replace clutch disc defection.
	(d) Warped pressure plate or flywheel	Correct or replace.
	(e) Loose disc rivets	Replace clutch disc.
	(f) Loose engine mounting	Retighten or replace mounting.
	(g) Improper adjustment of pitching stopper	Adjustment.
4. Noisy clutch Examine whether the noise is generated when the clutch is disengaged, engaged, or partially engaged.	(a) Broken, worn or unlubricated clutch release bearing	Replace clutch release bearing.
	(b) Insufficient lubrication of pilot bearing	Apply grease.
	(c) Loose clutch disc hub	Replace clutch disc.
	(d) Loose torsion spring retainer	Replace clutch disc.
	(e) Deteriorated or broken torsion spring	Replace clutch disc.

Symptom	Possible cause	Corrective
5. Clutch grabs. When starting the vehicle with the clutch partially engaged, the clutch engages suddenly and the vehicle jumps instead of making a smooth start.	(a) Grease or oil on facing	Replace clutch disc.
	(b) Deteriorated cushioning spring	Replace clutch disc.
	(c) Worn or rusted spline of clutch disc or main shaft	Take off rust, apply grease or replace clutch disc or main shaft.
	(d) Deteriorated or broken torsion spring	Replace clutch disc.
	(e) Loose engine mounting	Retighten or replace mounting.
	(f) Deteriorated diaphragm spring	Replace.

A: DIAGNOSTIC DIAGRAM OF CLUTCH DRAG



B2M1012B

MEMO:

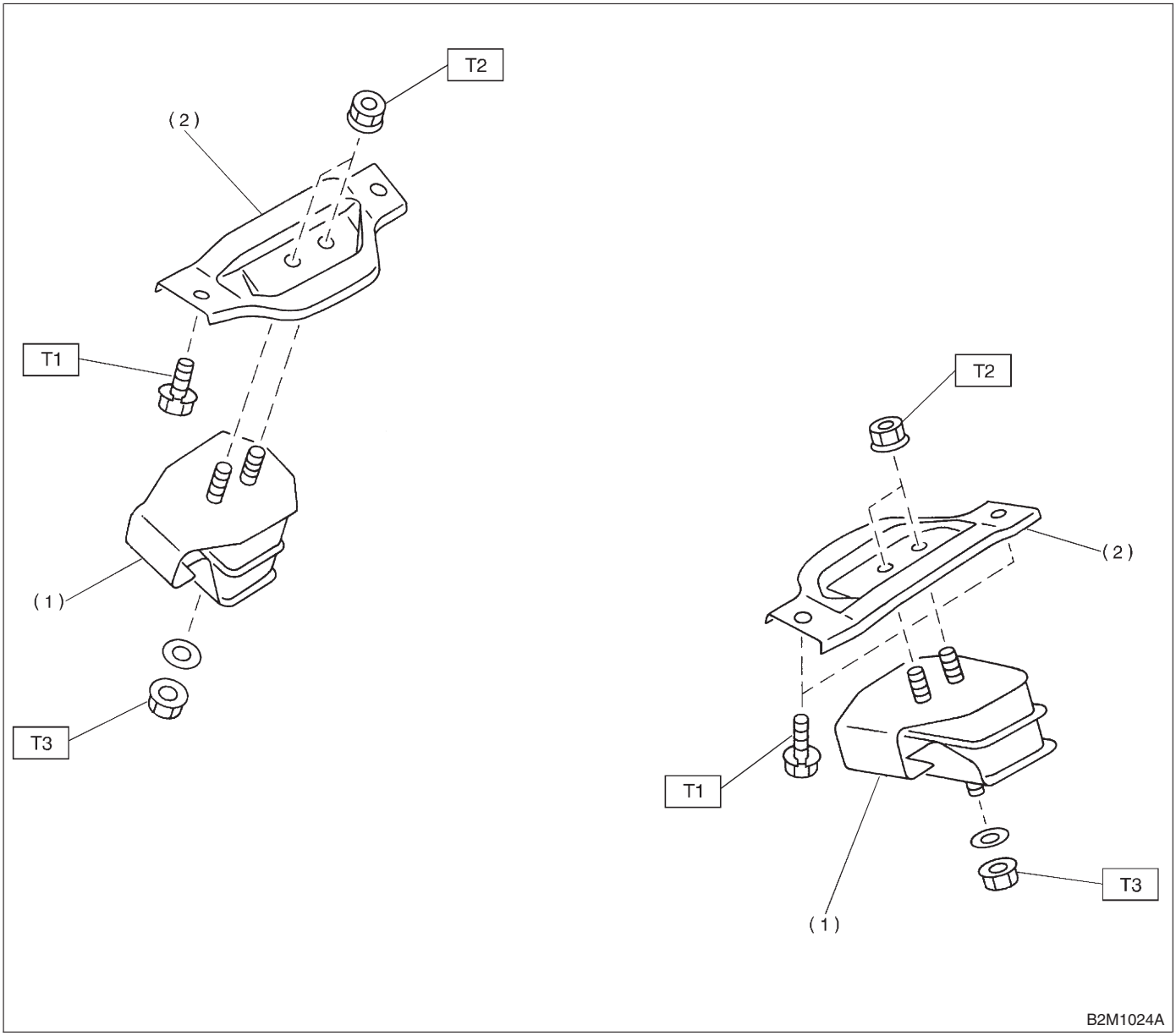
ENGINE AND TRANSMISSION MOUNTING SYSTEM 2-11

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C **COMPONENT PARTS** 2
1. Engine Mounting 2
2. Transmission Mounting 3

W **SERVICE PROCEDURE** 5
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2. Transmission 14

1. Engine Mounting

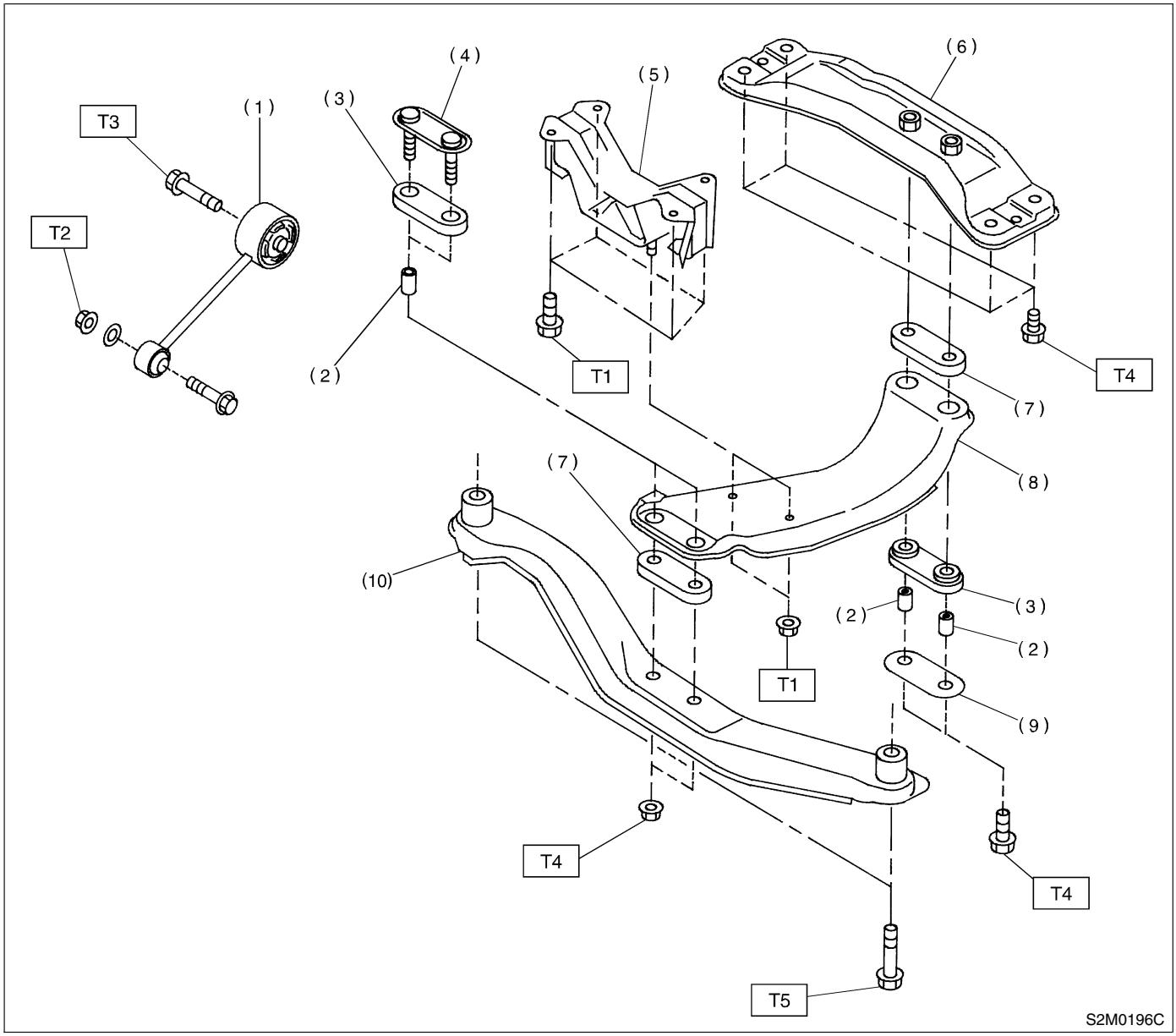


(1) Front cushion rubber
(2) Front engine mounting bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 34±5 (3.5±0.5, 25.3±3.6)
T2: 41±10 (4.2±1.0, 30±7)
T3: 83±15 (8.5±1.5, 61±11)

2. Transmission Mounting

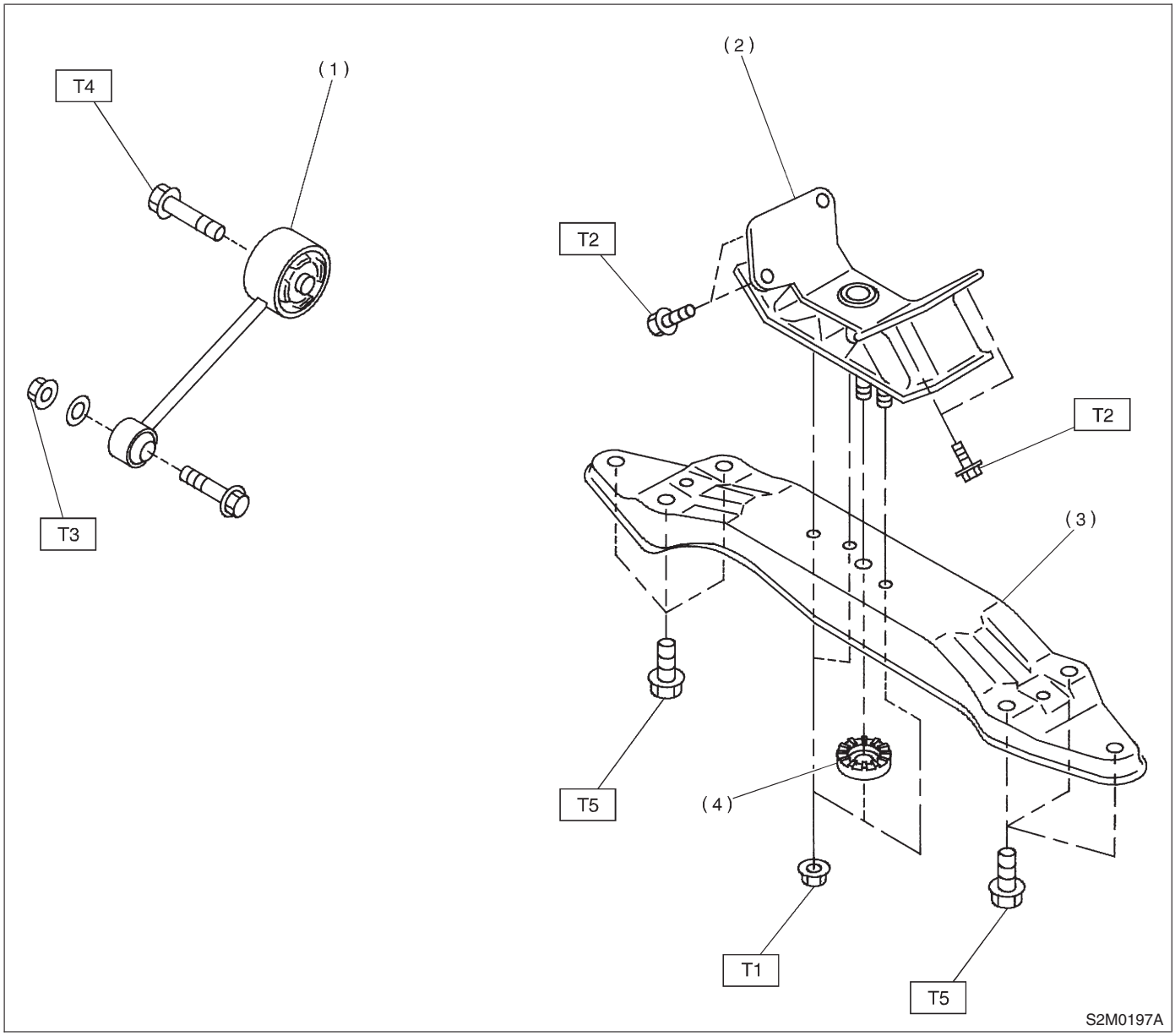
A: MT MODEL



(1) Pitching stopper
(2) Spacer
(3) Cushion C
(4) Front plate
(5) Rear cushion rubber
(6) Rear crossmember
(7) Cushion D
(8) Center crossmember
(9) Rear plate
(10) Front crossmember

Tightening torque: N·m (kg-m, ft-lb)
T1: 34±5 (3.5±0.5, 25.3±3.6)
T2: 49±5 (5.0±0.5, 36.2±3.6)
T3: 57±10 (5.8±1.0, 42±7)
T4: 69±15 (7.0±1.5, 51±11)
T5: 137±20 (14±2, 101±14)

B: AT MODEL



(1) Pitching stopper
(2) Rear cushion rubber
(3) Crossmember
(4) Stopper

Tightening torque: N·m (kg-m, ft-lb)
T1: 34±5 (3.5±0.5, 25.3±3.6)
T2: 38±15 (3.9±1.5, 28±11)
T3: 49±5 (5.0±0.5, 36.2±3.6)
T4: 57±10 (5.8±1.0, 42±7)
T5: 69±15 (7.0±1.5, 51±11)

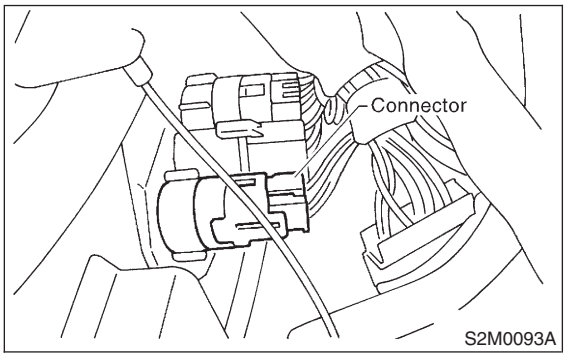
1. Engine

A: GENERAL PRECAUTION

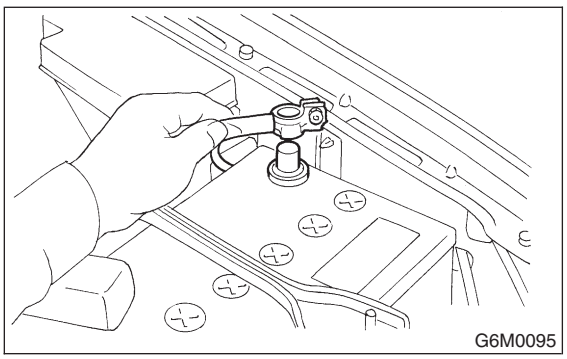
(1) Remove or install engine in an area where chain hoists, lifting devices, etc. are available for ready use.
(2) Be sure not to damage coated surfaces of body panels with tools or stain seats and windows with coolant or oil. Place a cover over fenders, as required, for protection.
(3) Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
(4) Lift-up or lower the vehicle when necessary. Make sure to support the correct positions. <Ref. to 1-3 [G7B0].>

B: REMOVAL

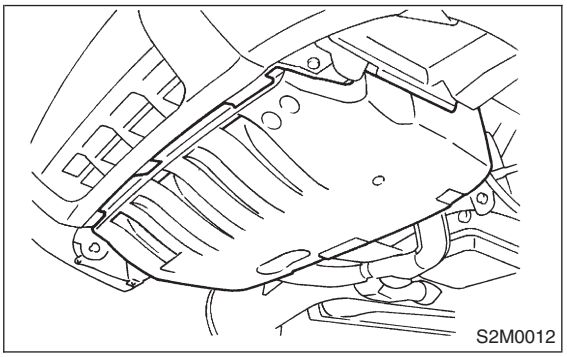
1) Set the vehicle on lift arms.
2) Open front hood and support with a stay.
3) Release fuel pressure.
   (1) Disconnect fuel pump relay connector.



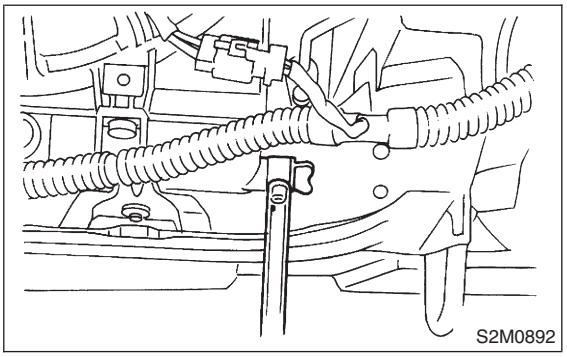
   (2) Start the engine, and run until it stalls.
   (3) After the engine stalls, crank it for five seconds more.
   (4) Turn ignition switch to “OFF”.
   (5) Remove filler cap.
4) Disconnect battery ground terminal.



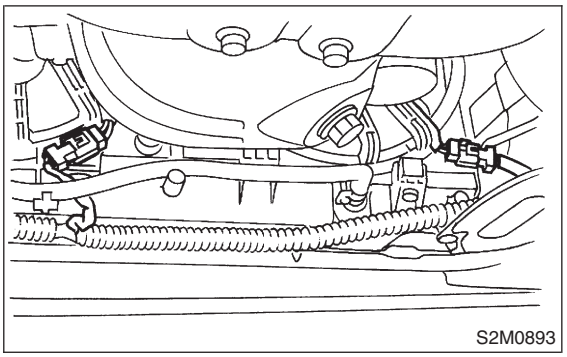
5) Remove under cover.



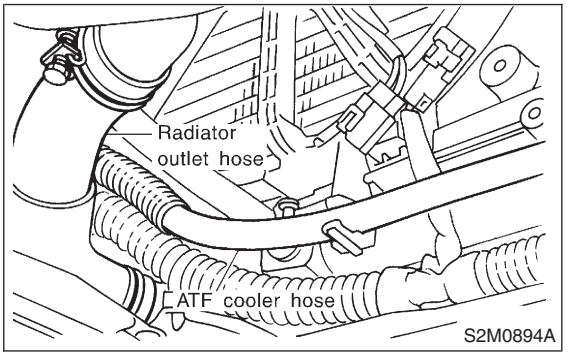
6) Drain coolant.
Set container under the vehicle, and loose drain cock from radiator.



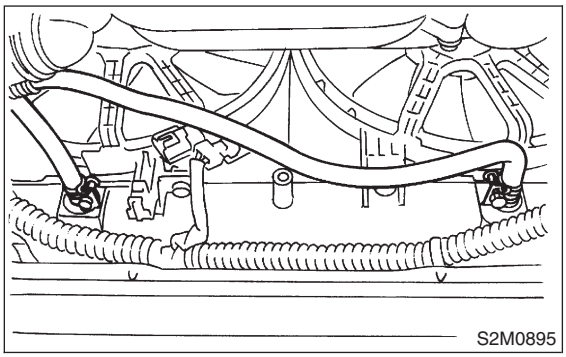
7) Remove cooling system.
   (1) Disconnect connectors from radiator main fan and sub fan motors.



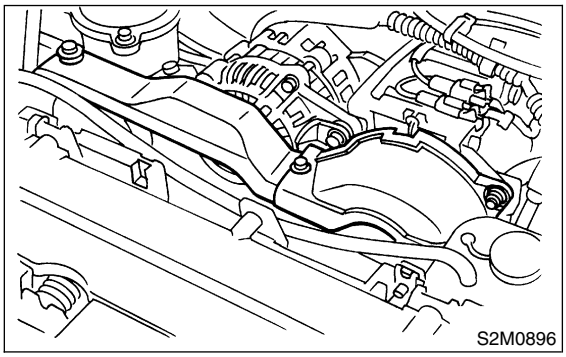
   (2) Disconnect radiator outlet hose from thermostat cover, and remove ATF cooler hose from clip of radiator.



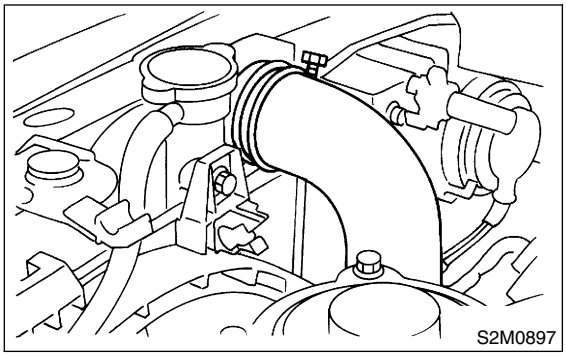
(3) Lower the vehicle.
(4) Disconnect ATF cooler hoses from radiator. (AT vehicles)


S2M0895

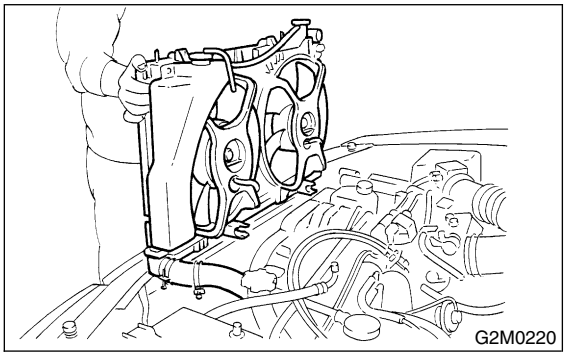
(5) Remove V-belt covers.


S2M0896

(6) Disconnect radiator inlet hose from radiator.

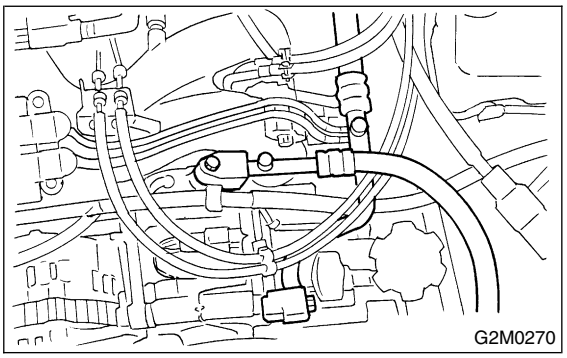

S2M0897

(7) Remove radiator upper bracket, and remove radiator assembly from vehicle.

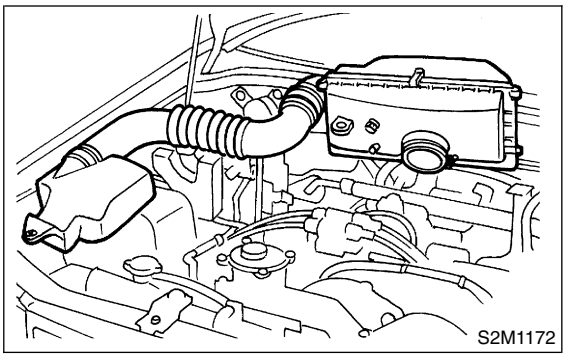

G2M0220

8) Collect refrigerant, and remove flexible hoses. (With A/C)

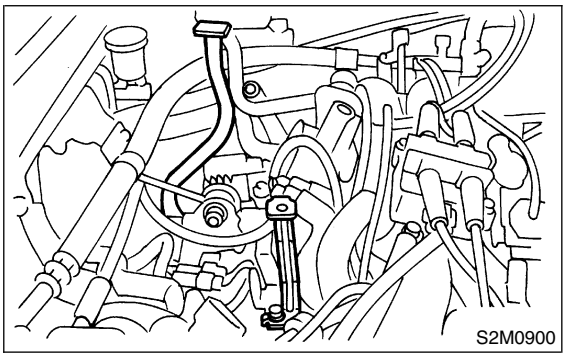
(1) Place and connect the attachment hose to the refrigerant recycle system.
(2) Collect refrigerant from A/C system.
(3) Disconnect A/C flexible hoses from A/C compressor.


G2M0270

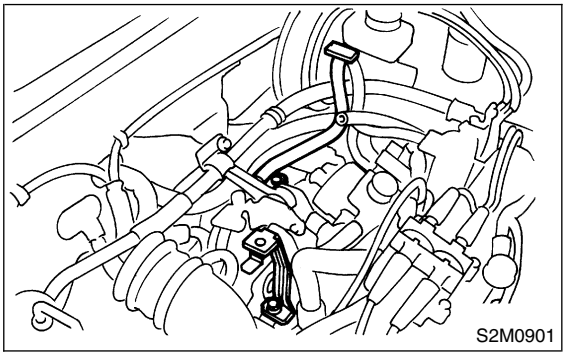
9) Remove air intake system.
Remove air intake duct with air cleaner case.


S2M1172

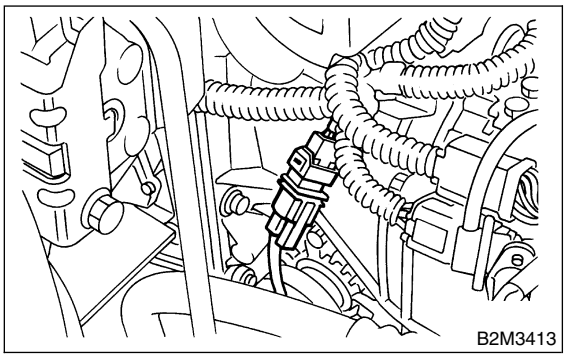
10) Remove air cleaner case stay.
- MT vehicles


S2M0900

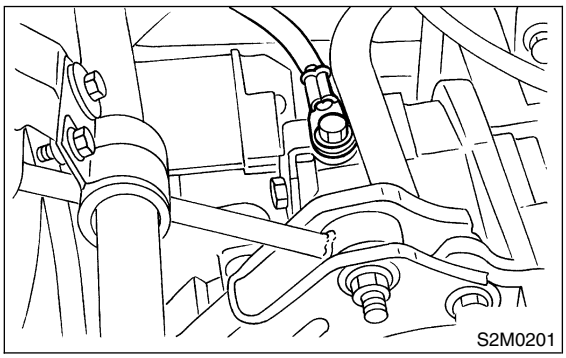
- AT vehicles


S2M0901

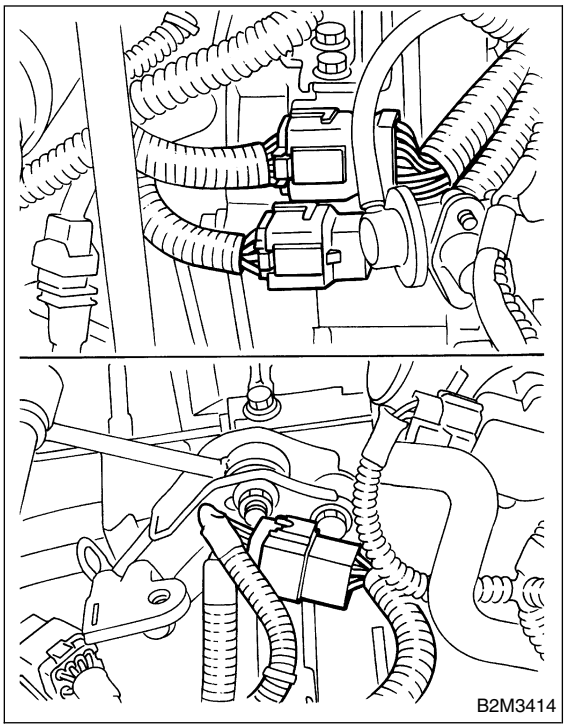
11) Disconnect the following connectors and cables.
(1) Front oxygen sensor connector


B2M3413

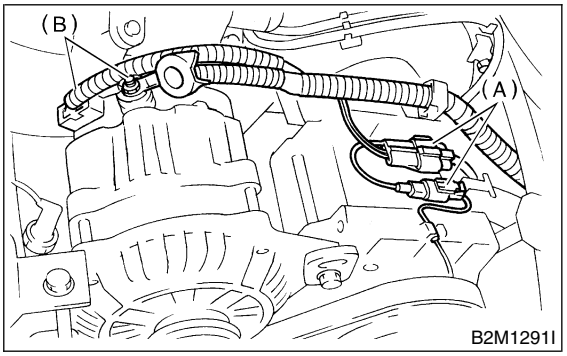
(2) Engine ground terminal


S2M0201

(3) Engine harness connector


B2M3414

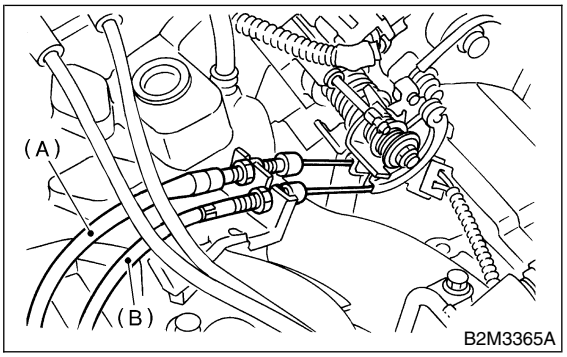
(4) Alternator connector, terminal and A/C compressor connectors (With A/C)



B2M1291I

(A) A/C compressor connectors
(B) Alternator connector and terminal

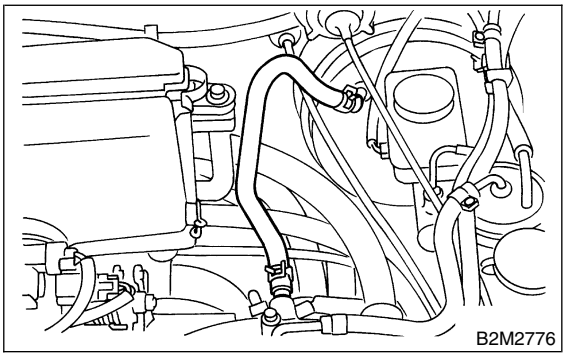
(5) Accelerator cable and cruise control cable



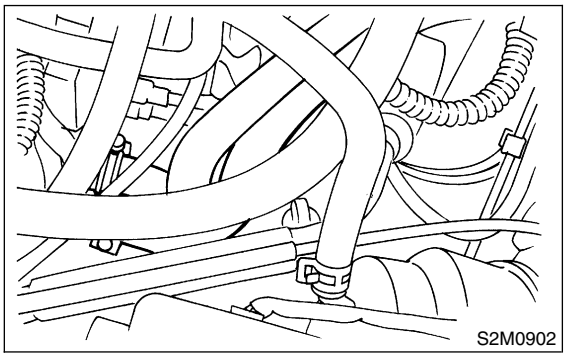
B2M3365A

(A) Accelerator cable
(B) Cruise control cable

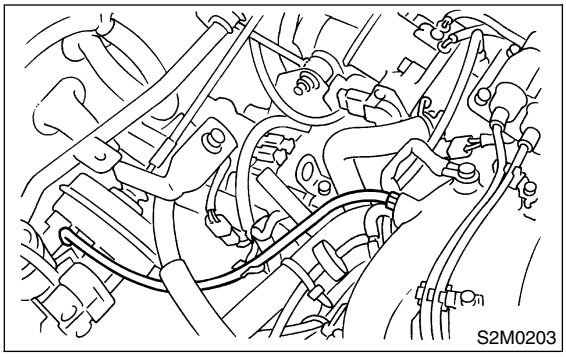
12) Disconnect the following hoses.
(1) Brake booster vacuum hose


B2M2776

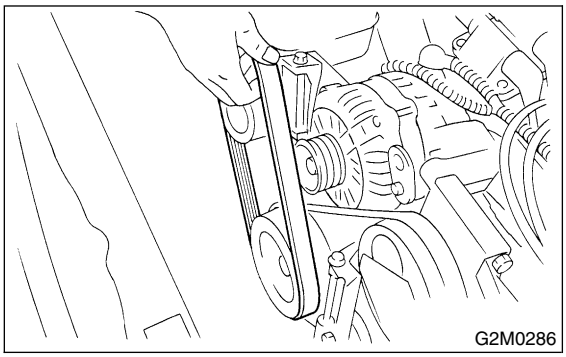
(2) Heater inlet and outlet hoses



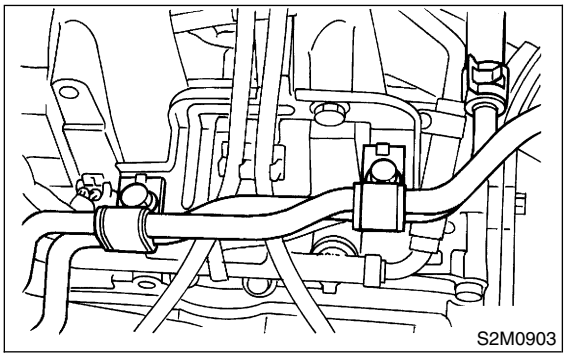
(3) Cruise control vacuum hose



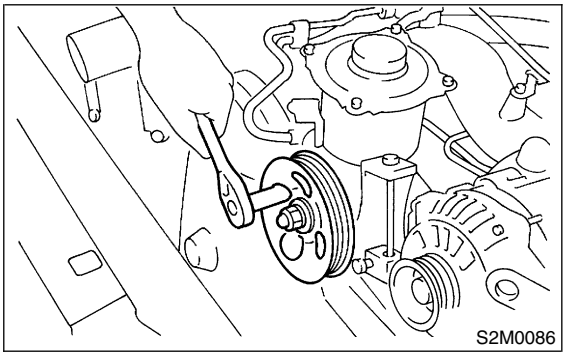
13) Remove power steering pump from bracket.
(1) Loosen lock bolt and slider bolt, and remove front side V-belt.



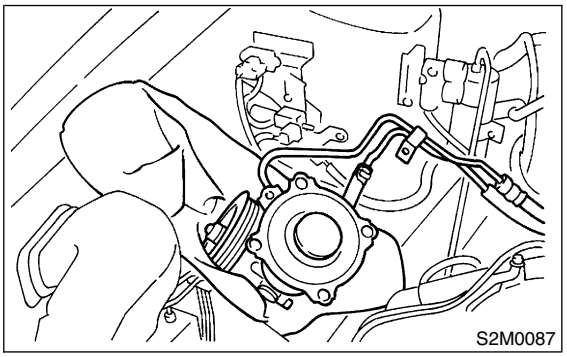
(2) Remove power steering pump bracket.



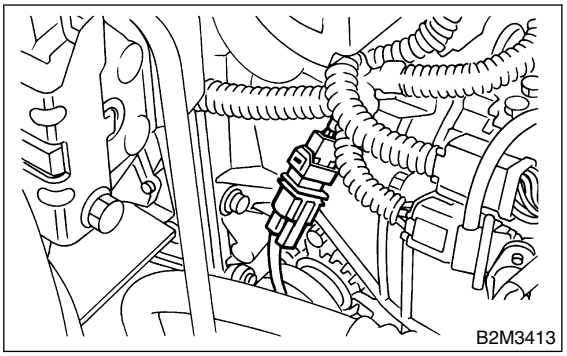
(3) Remove bolts which install power steering pump from bracket.



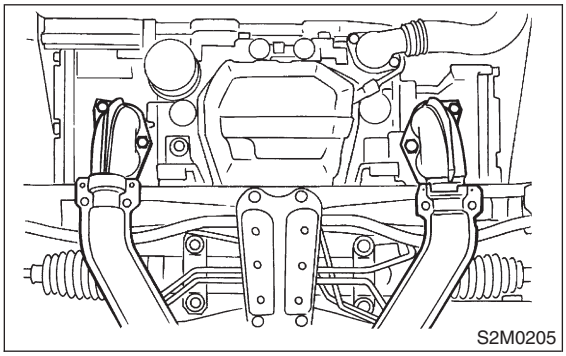
(4) Place power steering pump on the right side wheel apron.



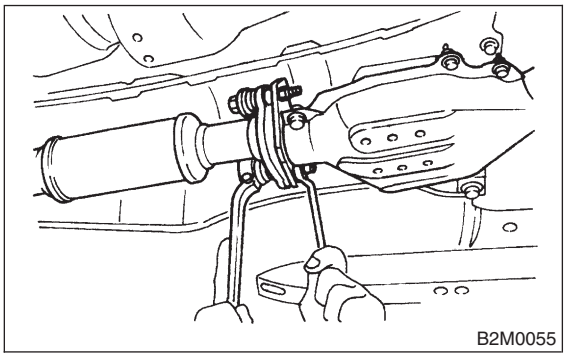
14) Remove front exhaust pipe and center exhaust pipe.
(1) Lift-up the vehicle.
(2) Disconnect connector from rear oxygen sensor.



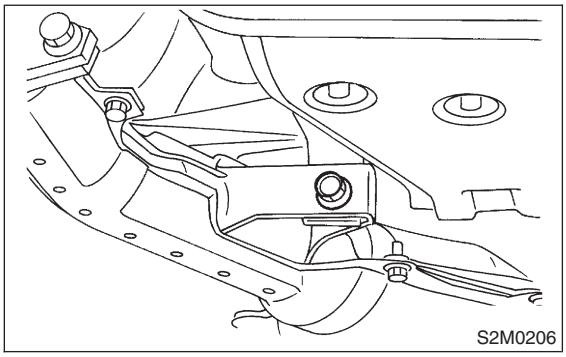
(3) Remove nuts which install front exhaust pipe onto engine.


S2M0205

(4) Separate center exhaust pipe from rear exhaust pipe.


B2M0055

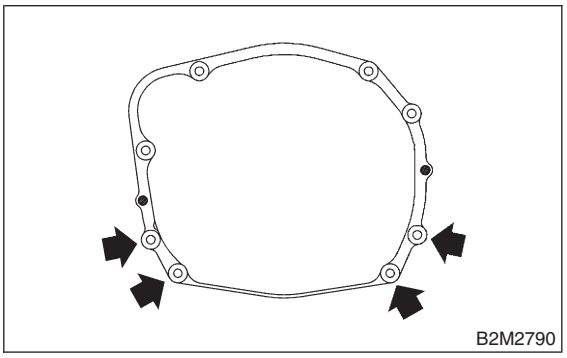
(5) Remove bolt which installs center exhaust pipe on hunger bracket.


S2M0206

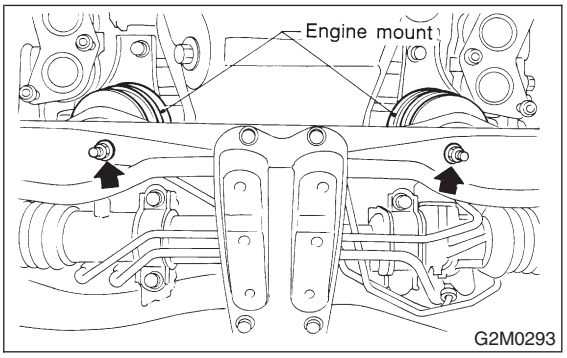
(6) Take off front and center exhaust pipes.

CAUTION:
Exhaust pipe will drop when all bolts are removed. So, hold it when removing the last bolt.

15) Remove nuts which hold lower side of transmission to engine.

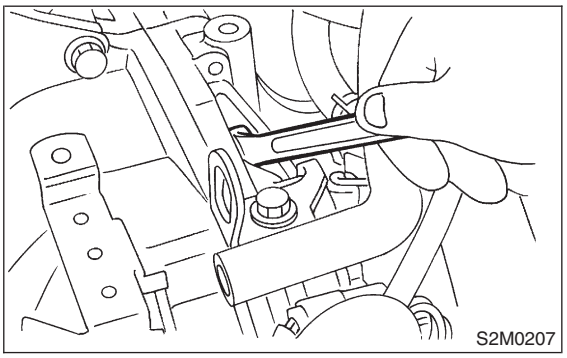

B2M2790

16) Remove nuts which install front cushion rubber onto front crossmember.



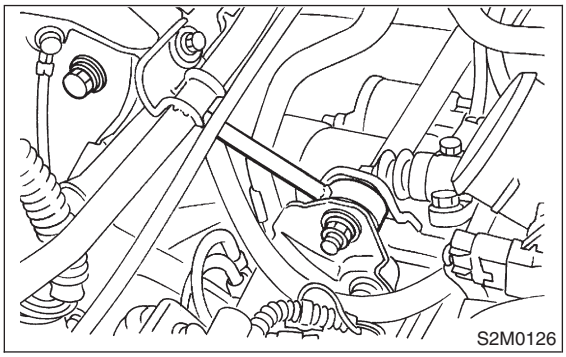
G2M0293

17) Separate torque converter from drive plate. (AT vehicles)
(1) Lower the vehicle.
(2) Remove service hole plug.
(3) Remove bolts which hold torque converter to drive plate.


S2M0207

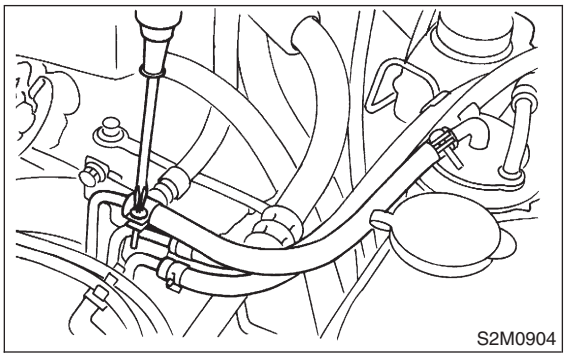
(4) Remove other bolts while rotating the engine using ST.
ST 499977100 CRANK PULLEY WRENCH

18) Remove pitching stopper.

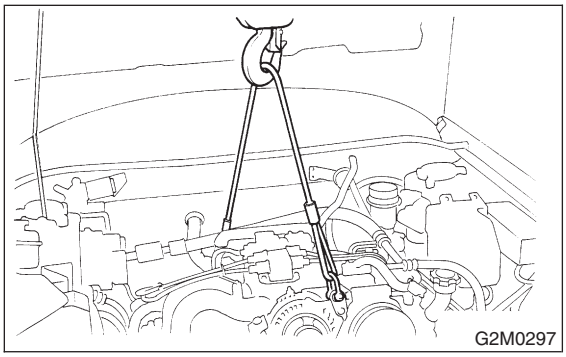

S2M0126

19) Disconnect fuel delivery hose, return hose and evaporation hose.

CAUTION:
• Disconnect hose with its end wrapped with cloth to prevent fuel from splashing.
• Catch fuel from hose into container.

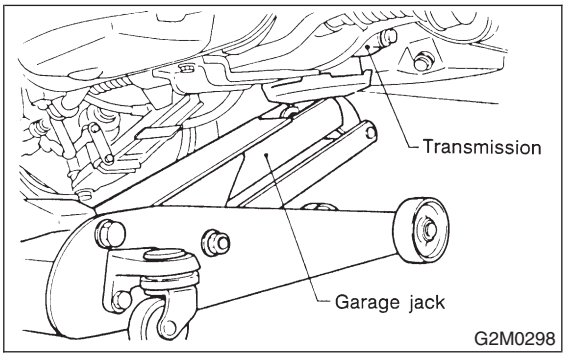

S2M0904

20) Support engine with a lifting device and wire ropes.


G2M0297

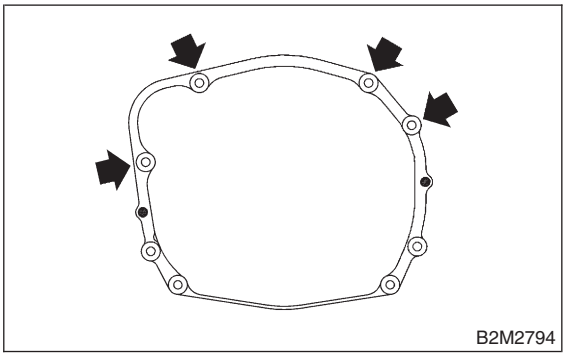
21) Support transmission with a garage jack.

CAUTION:
Before moving engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because transmission lowers under its own weight.



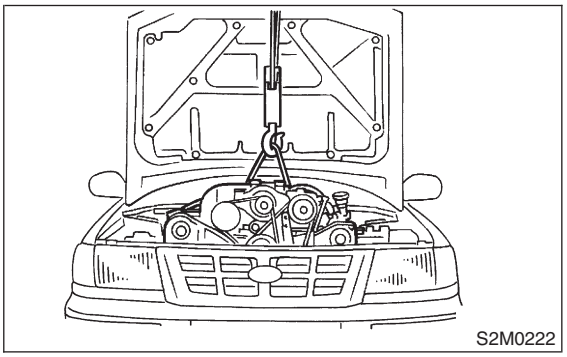
G2M0298

22) Remove bolts which hold upper side of transmission to engine.


B2M2794

23) Remove engine from vehicle
(1) Slightly raise engine.
(2) Raise transmission with garage jack.
(3) Move engine horizontally until mainshaft is withdrawn from clutch cover.
(4) Slowly move engine away from engine compartment.

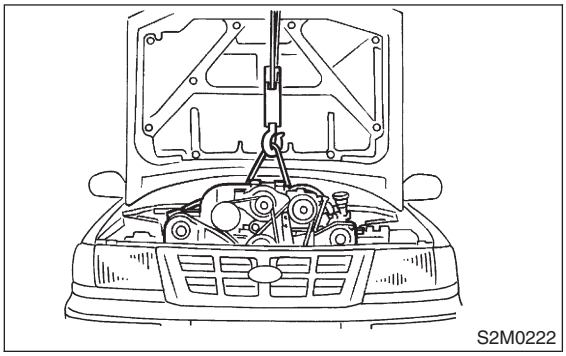
CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil pressure gauge, etc.


S2M0222

C: INSTALLATION

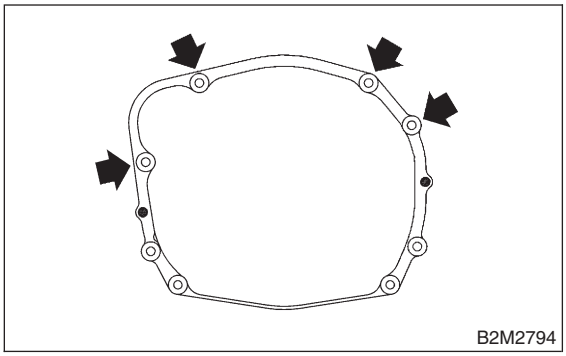
1) Install engine onto transmission.
   (1) Position engine in engine compartment and align it with transmission.

CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil pressure gauge, etc.

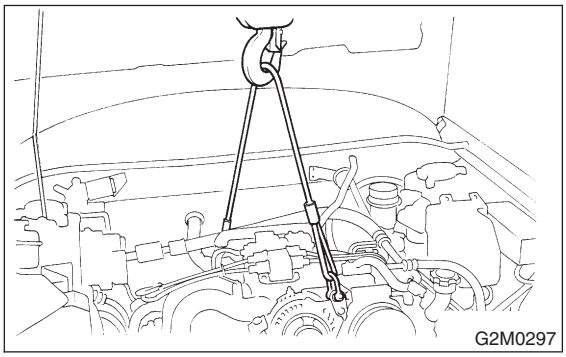

S2M0222

   (2) Apply a small amount of grease to spline of mainshaft.
2) Tighten bolts which hold upper side of transmission to engine.

Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 36.9±2.9 ft-lb)

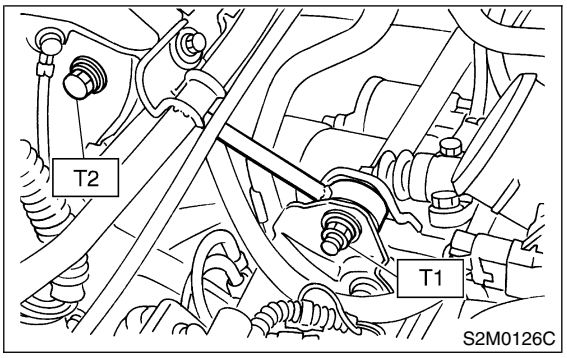

B2M2794

3) Remove lifting device and wire ropes.


G2M0297

4) Remove garage jack.
5) Install pitching stopper.

Tightening torque:
T1: 49±5 N·m (5.0±0.5 kg-m, 36.2±3.6 ft-lb)
T2: 57±10 N·m (5.8±1.0 kg-m, 42±7 ft-lb)



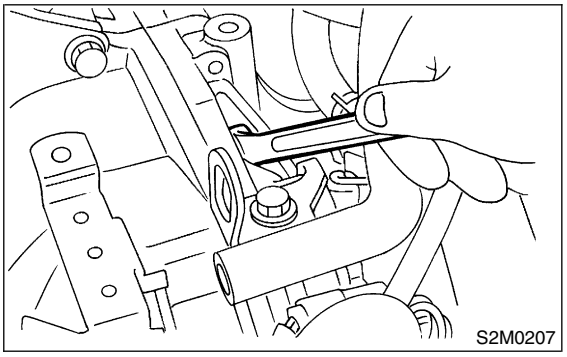
S2M0126C

6) Install torque converter onto drive plate. (AT vehicles)
   (1) Tighten bolts which hold torque converter to drive plate.
   (2) Tighten other bolts while rotating the engine by using ST.

ST 499977100 CRANK PULLEY WRENCH

CAUTION:
Be careful not to drop bolts into torque converter housing.

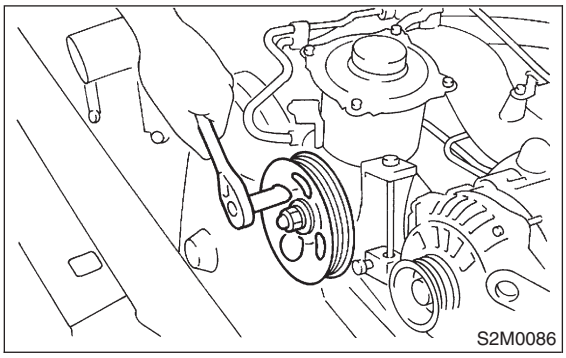
Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)


S2M0207

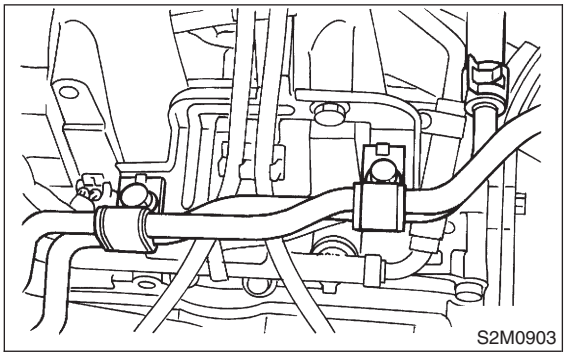
   (3) Clog plug onto service hole.

7) Install power steering pump on bracket.
(1) Install power steering pump on bracket, and tighten bolts.

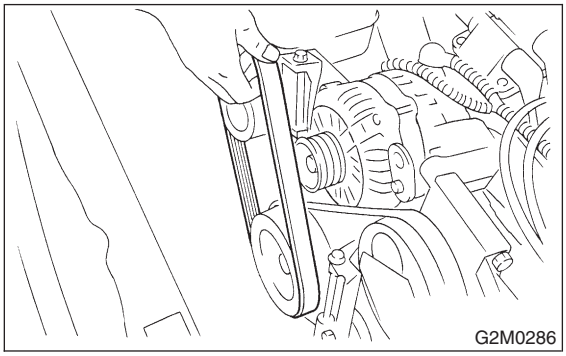
Tightening torque:
39±10 N·m (4.0±1.0 kg-m, 29±7 ft-lb)


S2M0086

(2) Install power steering pipe bracket on right side intake manifold, and install spark plug codes.

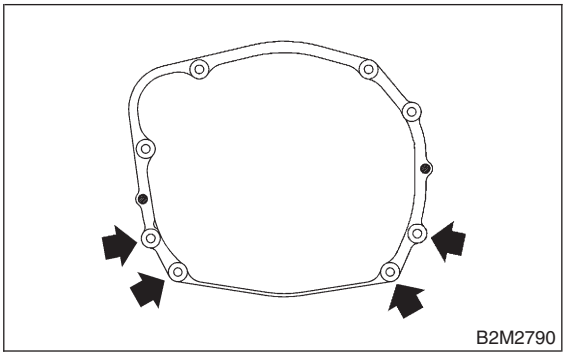

S2M0903

(3) Install front side V-belt, and adjust it. <Ref. to 1-5 [G200].>


G2M0286

8) Tighten nuts which hold lower side of transmission to engine.

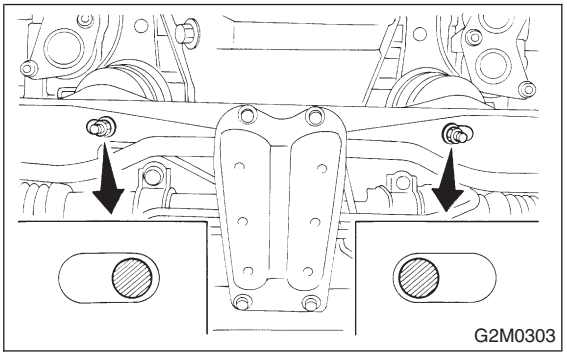
Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 36.9±2.9 ft-lb)


B2M2790

9) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:
83±15 N·m (8.5±1.5 kg-m, 61±11 ft-lb)

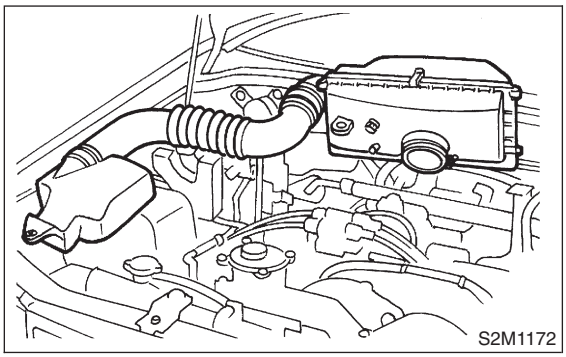
CAUTION:
Be sure to tighten front cushion rubber mounting bolts in the innermost elliptical hole in the front crossmember.


G2M0303

10) Install front exhaust pipe and center exhaust pipe. <Ref. to 2-9 [W1B0].>
11) Connect rear oxygen sensor connector.
12) Connect the following hoses.
(1) Fuel delivery hose, return hose and evaporation hose
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose
(4) Cruise control vacuum hose
13) Connect the following connectors.
(1) Engine ground terminal
(2) Engine harness connectors
(3) Front oxygen sensor connector
(4) Alternator connector and terminal
(5) A/C compressor connectors (With A/C)
14) Connect the following cables.
(1) Accelerator cable
(2) Cruise control cables (With cruise control)

CAUTION:
After connecting each cable, adjust them.

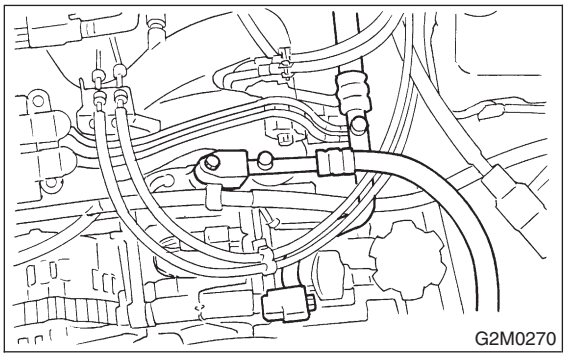
15) Install air intake system.
(1) Install air cleaner case stay.
(2) Install air intake duct with air cleaner case.


S2M1172

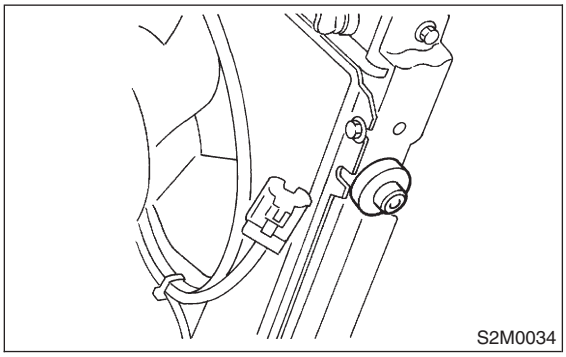
16) Install A/C flexible hoses. (With A/C)
<Ref. to 4-7 [W16A0].>

CAUTION:
Use new O-rings.

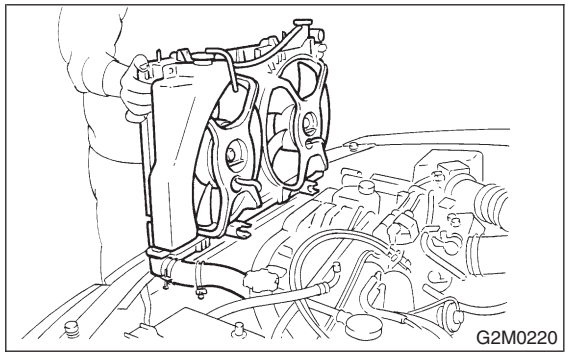
Tightening torque:
25±7 N·m (2.5±0.7 kg-m, 18.1±5.1 ft-lb)


G2M0270

17) Install cooling system.
(1) Attach radiator lower cushions to radiator.

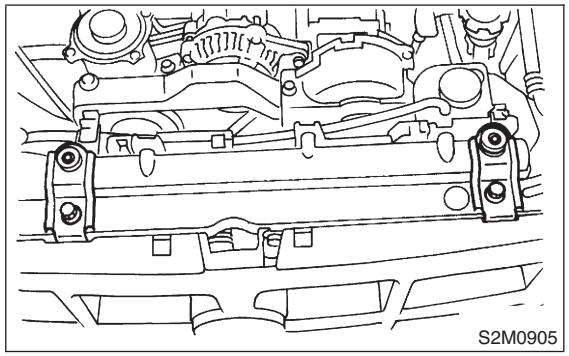

S2M0034

(2) Install radiator while fitting radiator pins to cushions.

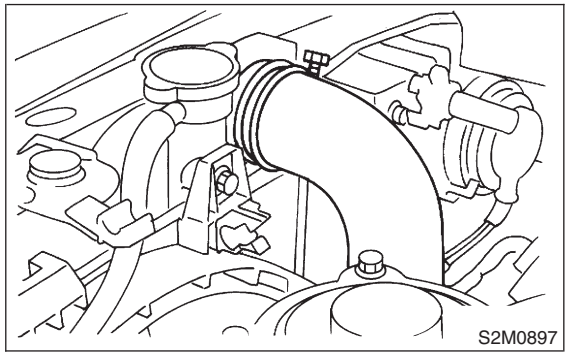

G2M0220

(3) Install radiator brackets and tighten bolts.

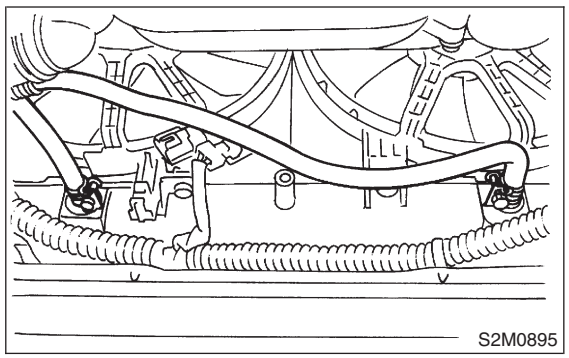
Tightening torque:
12±3 N·m (1.2±0.3 kg-m, 8.7±2.2 ft-lb)


S2M0905

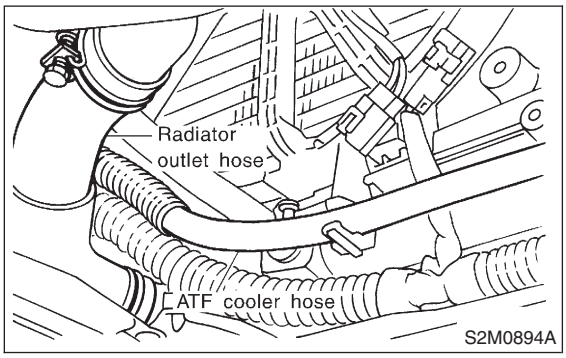
(4) Connect radiator inlet hose.


S2M0897

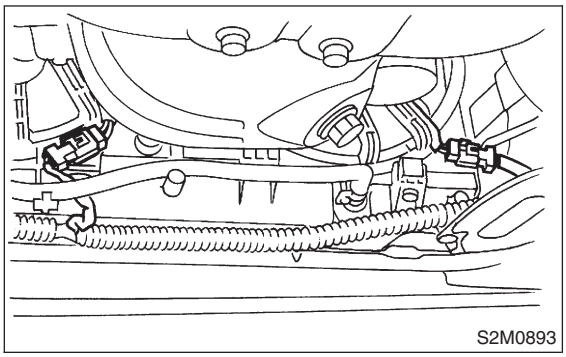
(5) Connect ATF cooler hoses. (AT vehicles)


S2M0895

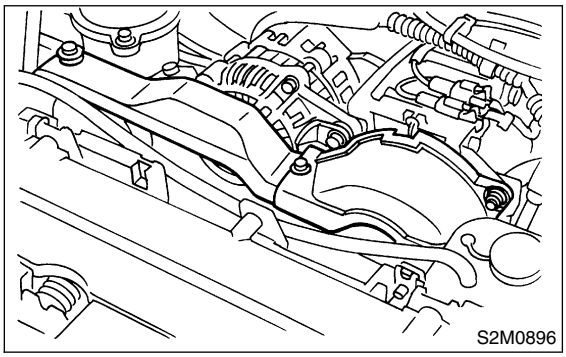
(6) Connect radiator outlet hose to thermostat cover.



(7) Connect radiator fan motor connector.



(8) Install V-belt covers.



18) Install battery in the vehicle, and connect terminal.
19) Fill coolant.
<Ref. to 2-5 [W9B0].>
20) Check ATF level and correct if necessary. (AT vehicles)
<Ref. to 3-2 [W1B1].>
21) Charge A/C system with refrigerant.
<Ref. to 4-7 [W7H0].>
22) Remove front hood stay, and close front hood.
23) Take off the vehicle from lift arms.

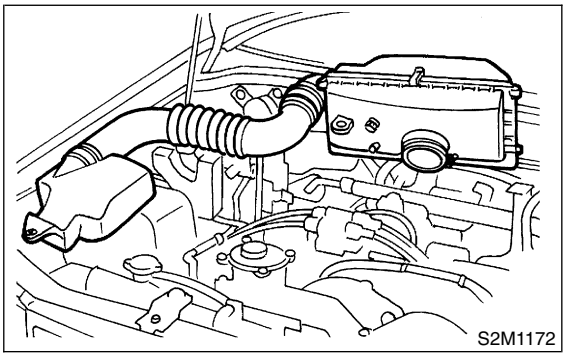
2. Transmission

A: GENERAL PRECAUTION

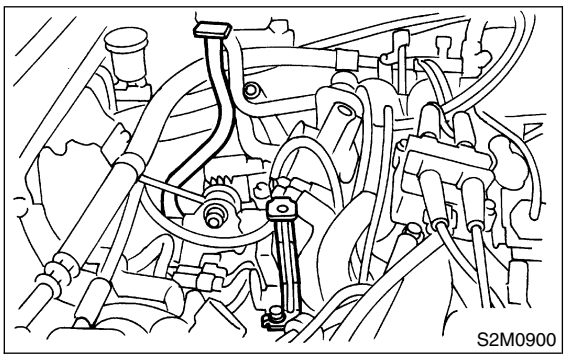
(1) Remove or install transmission in an area where chain hoists, lifting devices, etc. are available for ready use.
(2) Be sure not to damage coated surfaces of body panels with tools or stain seats and windows with coolant or oil. Place a cover over fenders, as required, for protection.
(3) Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
(4) Lift-up or lower the vehicle when necessary. Make sure to support the correct positions. <Ref. to 1-3 [G7B0].>

B: REMOVAL

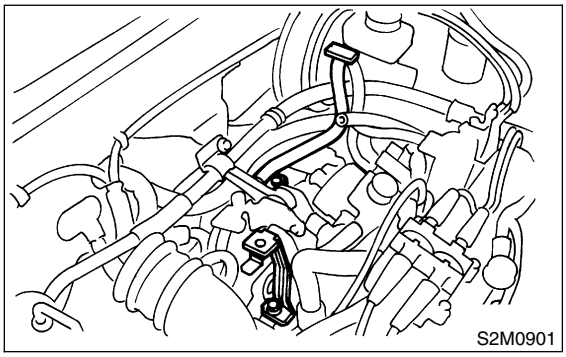
1) Open front hood fully, and support with stay.
2) Disconnect battery ground terminal.
3) Remove air intake duct and air cleaner case.



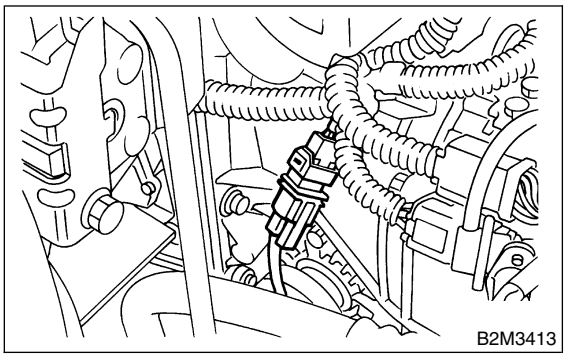
4) Remove air cleaner case stay.
- MT vehicles


S2M0900

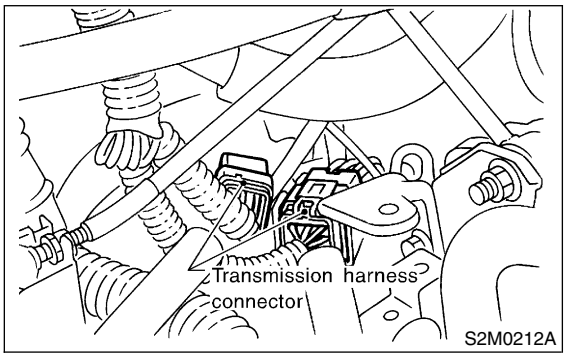
- AT vehicles


S2M0901

5) Disconnect the following connectors.
(1) Front oxygen sensor connector


B2M3413

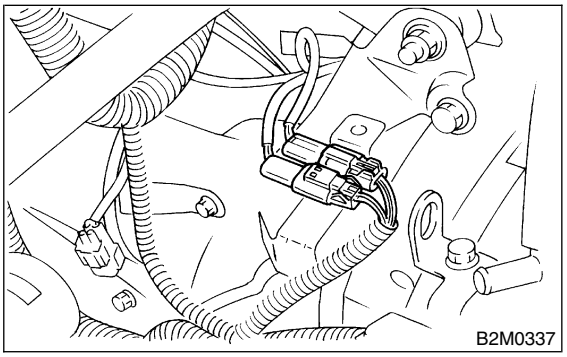
(2) Transmission harness connector (AT vehicles)



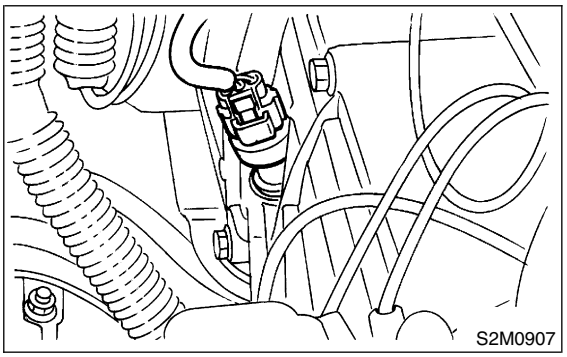
S2M0212A

(3) Transmission ground terminal

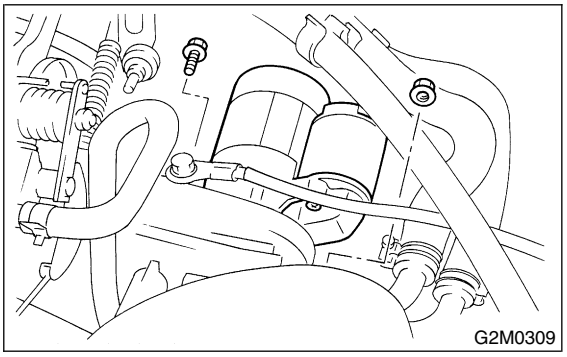
(4) Neutral position switch connector (MT vehicles)
(5) Back-up light switch connector (MT vehicles)


B2M0337

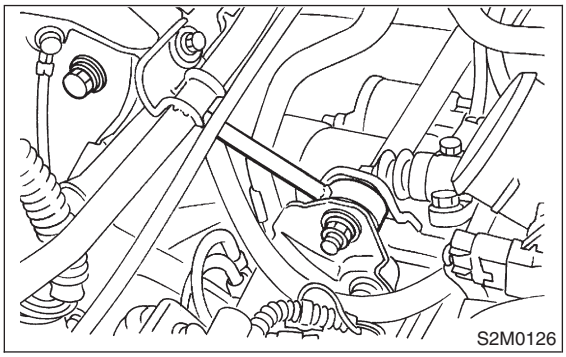
(6) Vehicle speed sensor (MT vehicles)


S2M0907

6) Remove starter.
(1) Disconnect connectors and terminal from starter.
(2) Remove bolt which installs upper side of starter.
(3) Remove nut which installs lower side of starter, and remove starter from transmission.


G2M0309

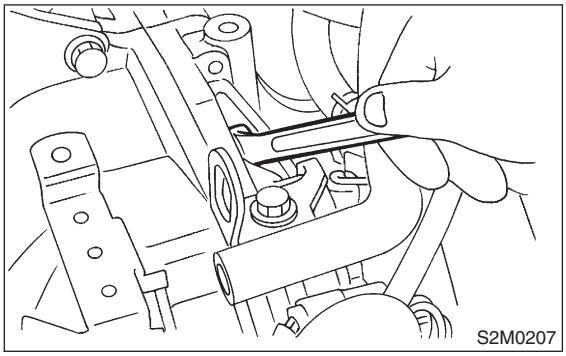
7) Remove pitching stopper.



8) Separate torque converter from drive plate. (AT vehicles)
(1) Remove service hole plug.
(2) Remove bolts which hold torque converter to drive plate.
(3) While rotating the engine, remove other bolts using ST.

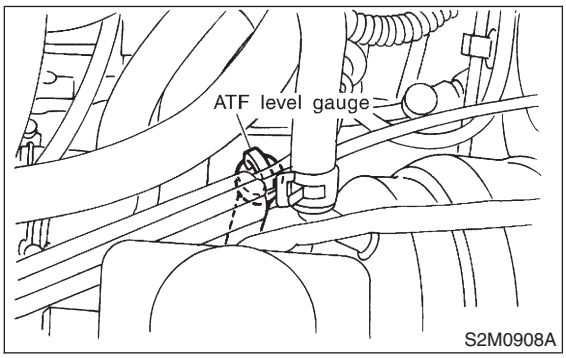
ST 499977100 CRANK PULLEY WRENCH

CAUTION:
Be careful not to drop bolts into torque converter housing.

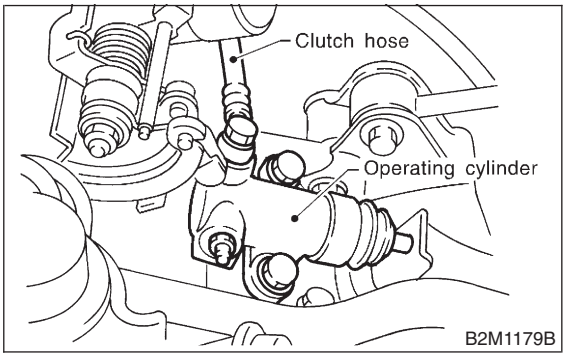


9) Remove ATF level gauge. (AT vehicles)

CAUTION:
Plug opening to prevent entry of foreign particles into transmission fluid.



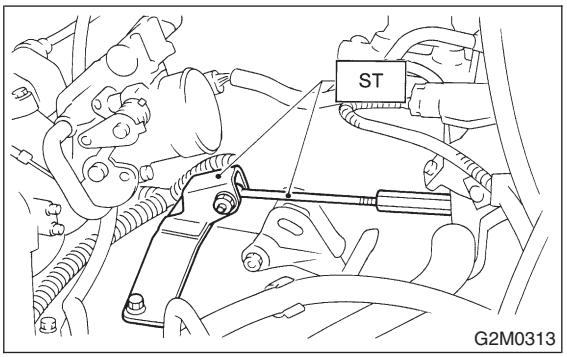
10) Remove operating cylinder. (MT vehicles)



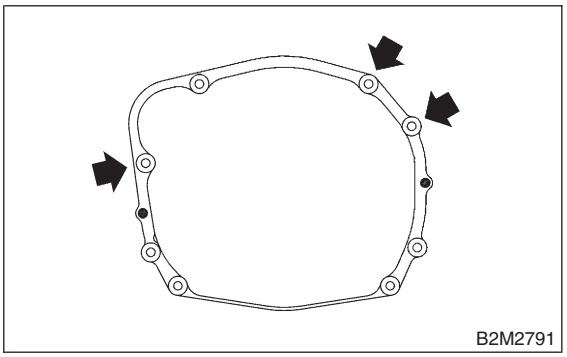
11) Set ST.

ST 41099AA020 ENGINE SUPPORT ASSY

NOTE:
Also is available Part No. 927670000.

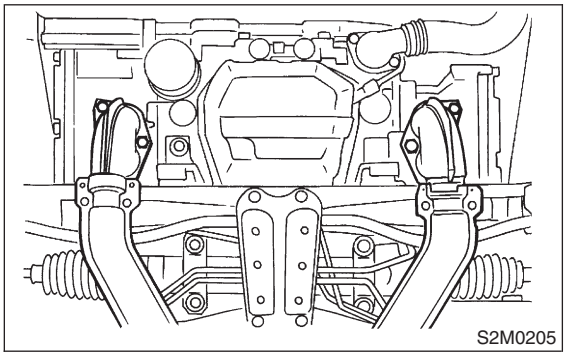


12) Remove bolt which holds right upper side of transmission to engine.

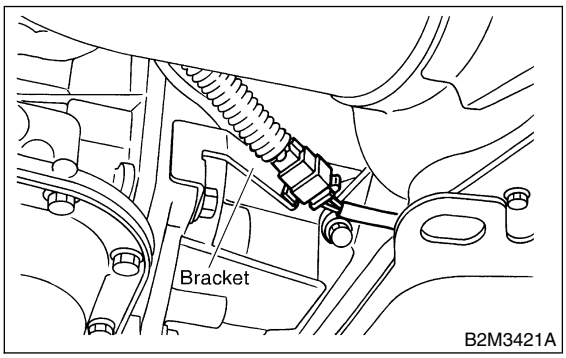


13) Remove exhaust system.
(1) Lift-up the vehicle.

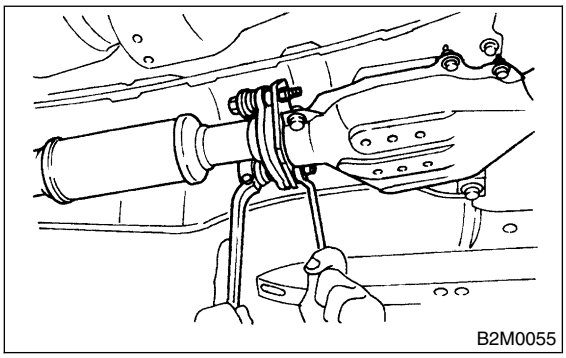
(2) Remove nuts which install front exhaust pipe onto engine.



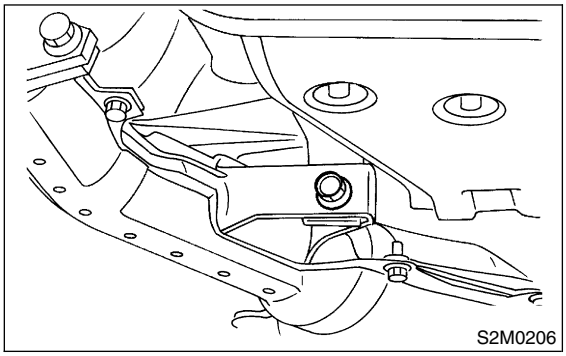
(3) Disconnect connector from rear oxygen sensor.



(4) Separate center exhaust pipe from rear exhaust pipe.



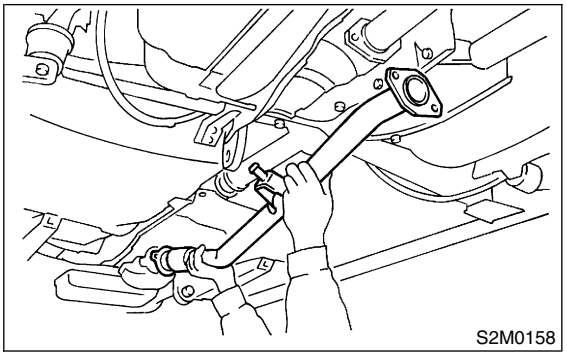
(5) Remove bolt which installs center exhaust pipe to hanger bracket.



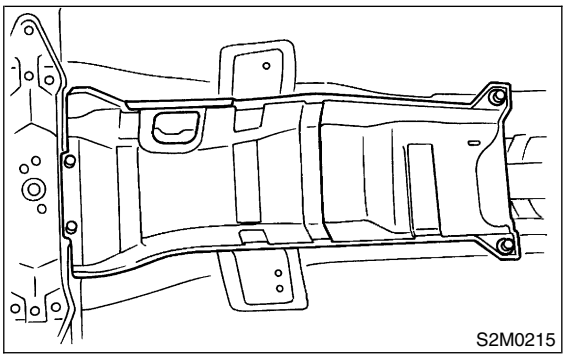
(6) Take off front and center exhaust pipes.

(7) Remove rear exhaust pipe.

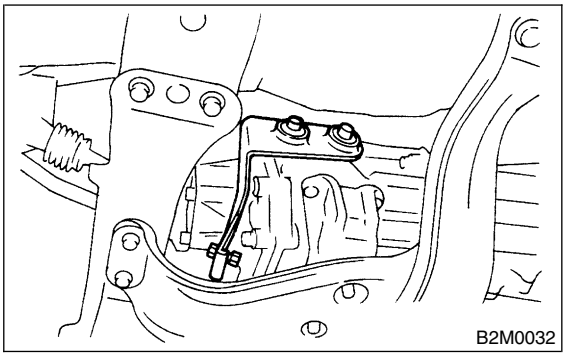
CAUTION:
When removing exhaust pipes, be careful each exhaust pipe does not drop out.



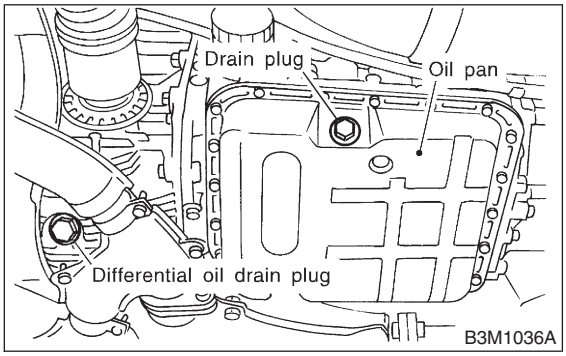
(8) Remove heat shield cover of rear exhaust pipe.



(9) Remove hanger bracket from right side of transmission.

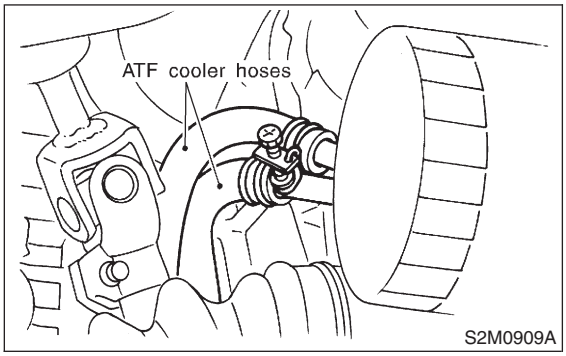


14) Drain ATF to remove ATF drain plug. (AT vehicles)

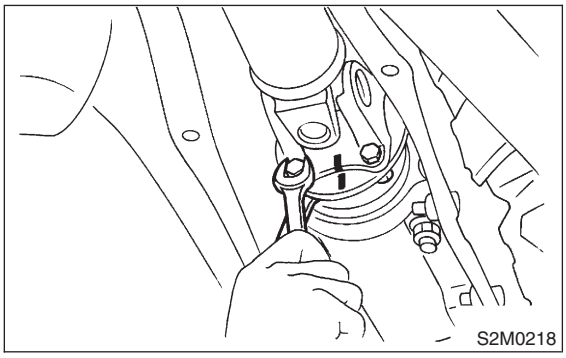


(A) Front differential oil drain plug
(B) ATF drain plug

15) Disconnect ATF cooler hoses from pipes of transmission side, and remove ATF level gauge guide. (AT vehicles)

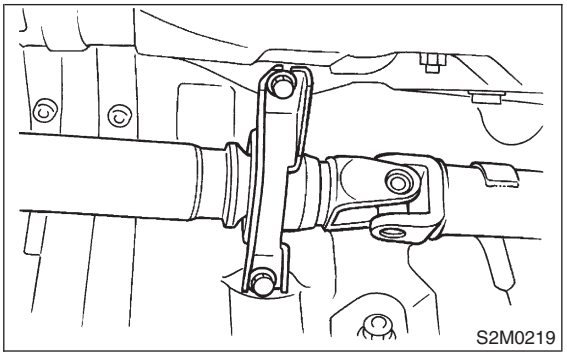


16) Remove propeller shaft.
(1) Remove front cover of rear differential mount.
(2) Separate propeller shaft from rear differential.



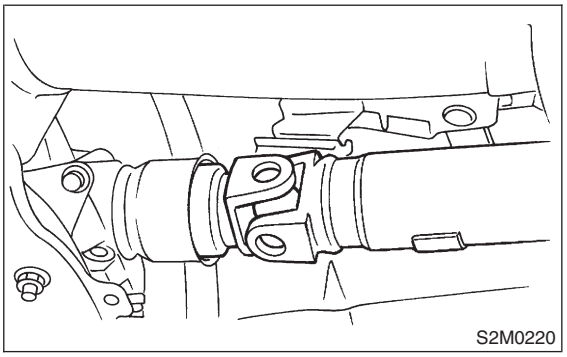
(3) Remove bolts which hold center bearing onto body.

CAUTION:
Be careful not to drop propeller shaft.

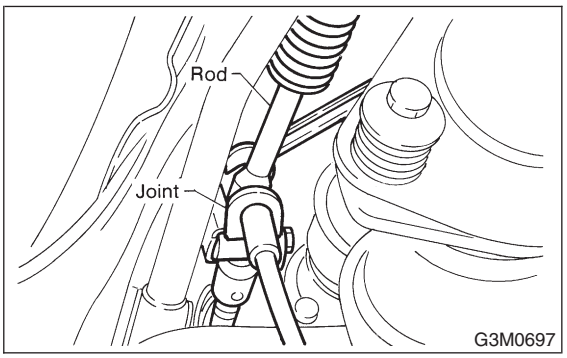


(4) Remove propeller shaft from transmission.

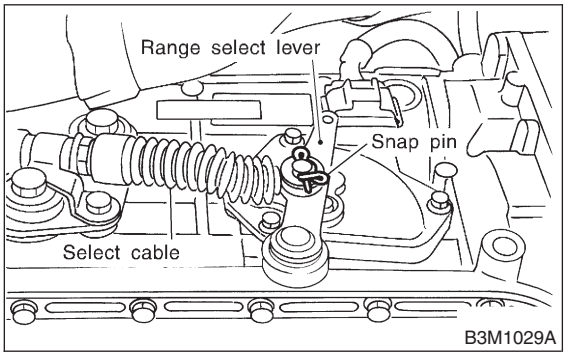
CAUTION:
● Be sure to use an empty container to catch oil flowing out when removing propeller shaft.
● Be sure not to damage oil seals and the frictional surface of sleeve yoke.
● Be sure to plug the opening in transmission after removal of propeller shaft.



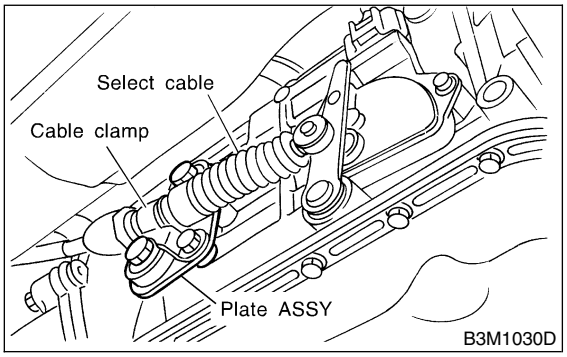
17) Remove gear shift rod and stay from transmission. (MT vehicles)
(1) Disconnect stay from transmission.
(2) Disconnect rod from transmission.



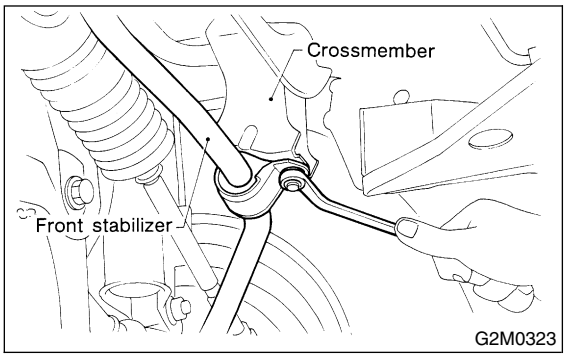
18) Remove shift selector cable. (AT vehicles)
(1) Remove snap pin from range select lever.



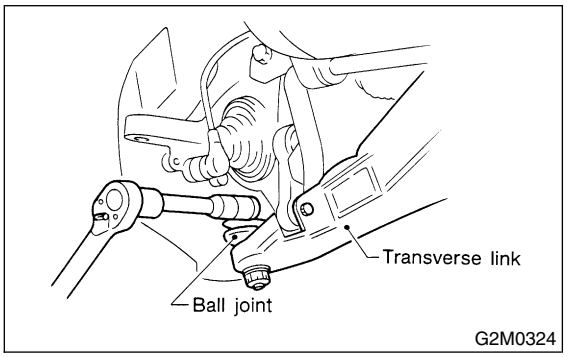
(2) Remove select cable from plate assembly.



19) Remove bolts which install stabilizer clamps onto crossmember.

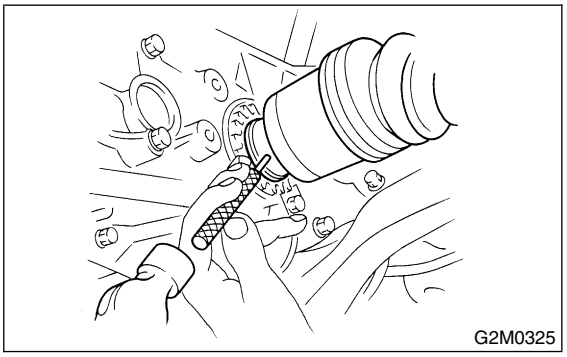


20) Remove front drive shafts from transmission.
(1) Remove transverse link from housing.

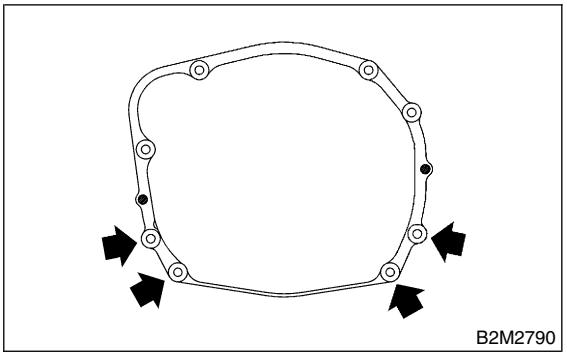


(2) Lower transverse link.
(3) Remove spring pins and separate front drive shafts from each side of the transmission.

CAUTION:
Discard removing spring pin. Replace with a new one.

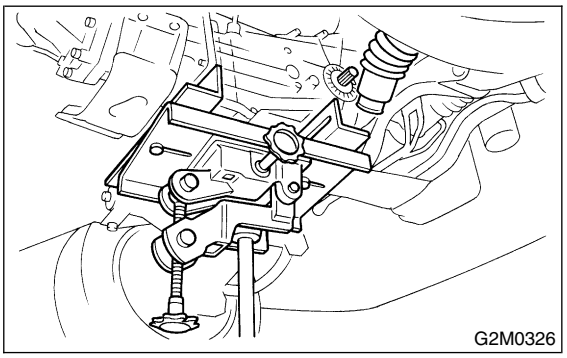


21) Remove nuts which hold lower side of transmission to engine.

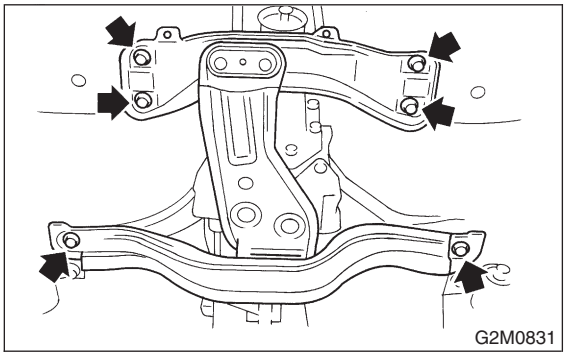


22) Place transmission jack under transmission.

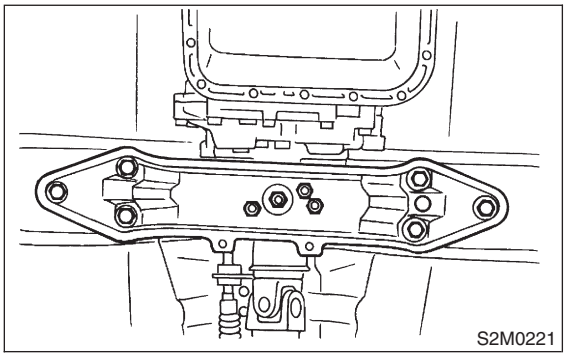
CAUTION:
- **Always support transmission case with a transmission jack.**
- **On AT vehicles, make sure that the support plates of transmission jack don't touch the oil pan.**



23) Remove transmission rear crossmember.
● MT vehicles

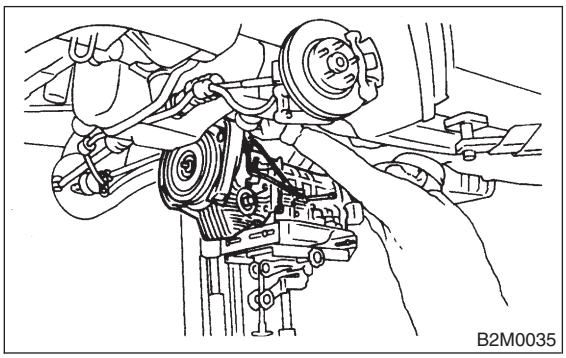

G2M0831

● AT vehicles


S2M0221

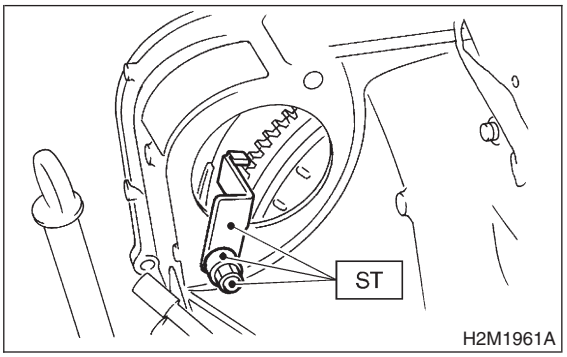
24) Remove transmission.

CAUTION:
● Move transmission jack toward rear until mainshaft is withdrawn from clutch cover. (MT vehicles)
● Move transmission and torque converter as a unit away from engine. (AT vehicles)


B2M0035

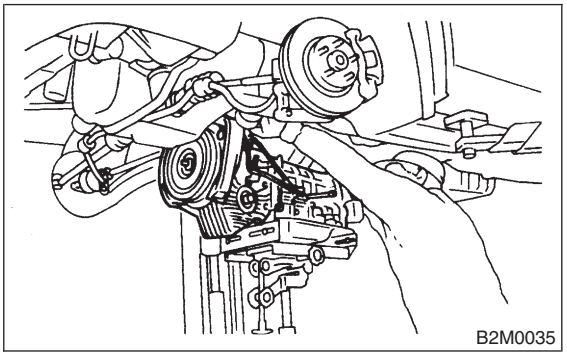
C: INSTALLATION

1) Install ST to torque converter clutch case. (AT vehicles)
ST 498277200 STOPPER SET



H2M1961A

2) Install transmission to engine.
(1) Gradually raise transmission with transmission jack.

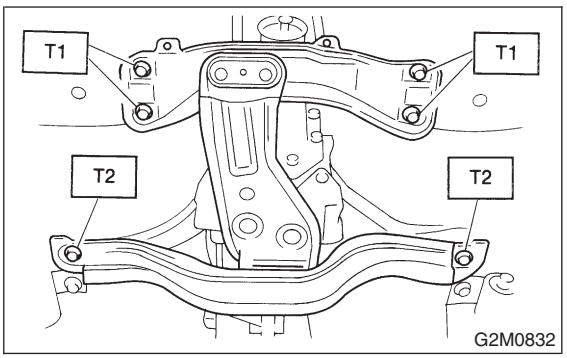

B2M0035

(2) Engage them at splines.

CAUTION:
Be careful not to strike mainshaft against clutch cover. (MT vehicles)

3) Install transmission rear crossmember.
● MT vehicles

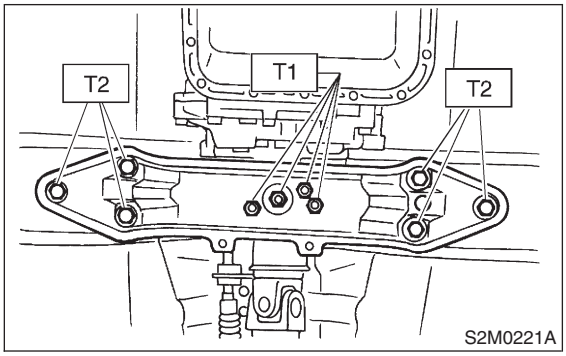
Tightening torque:
T1: 69±15 N·m (7.0±1.5 kg-m, 51±11 ft-lb)
T2: 137±20 N·m (14±2 kg-m, 101±14 ft-lb)



G2M0832

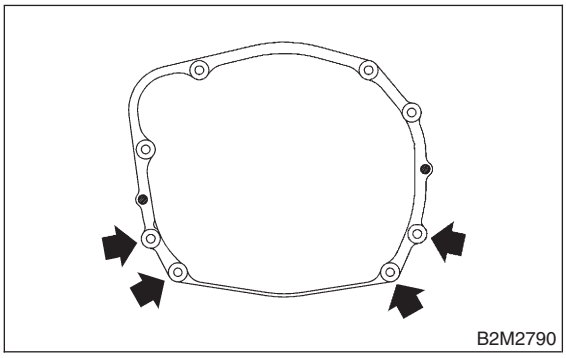
● AT vehicles

Tightening torque:
T1: 34±5 N·m (3.5±0.5 kg-m, 25.3±3.6 ft-lb)
T2: 69±15 N·m (7.0±1.5 kg-m, 51±11 ft-lb)



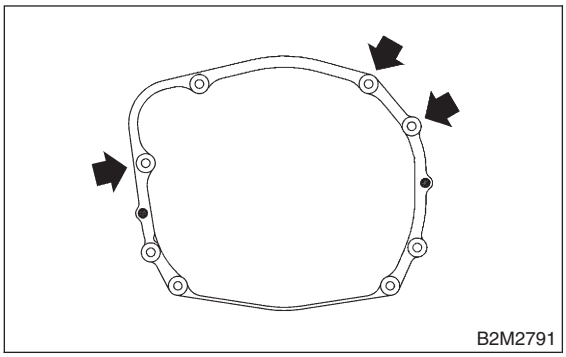
4) Take off transmission jack.
5) Tighten nuts which hold lower side of transmission to engine.

Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 36.9±2.9 ft-lb)



6) Tighten bolt which holds right upper side of transmission to engine.

Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 36.9±2.9 ft-lb)

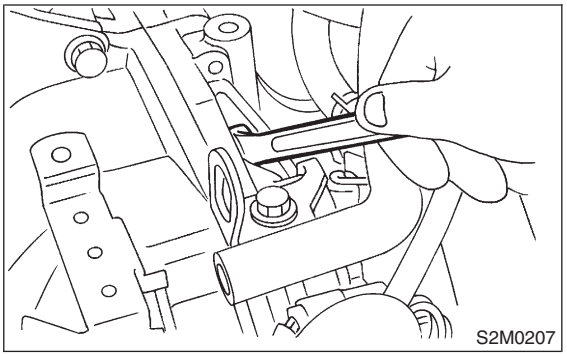


7) Install torque converter to drive plate. (AT vehicles)
(1) Tighten bolts which hold torque converter to drive plate.
(2) Tighten other bolts while rotating the engine by using ST.

ST 499977100 CRANK PULLEY WRENCH

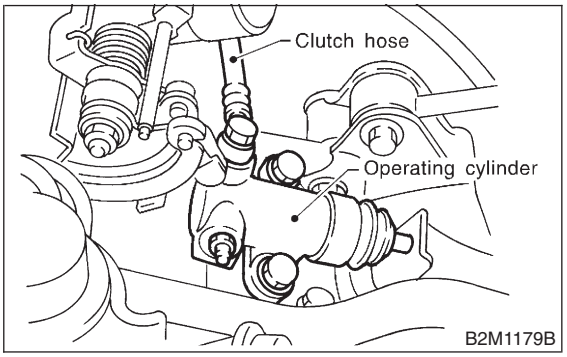
CAUTION:
Be careful not to drop bolts into torque converter housing.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)

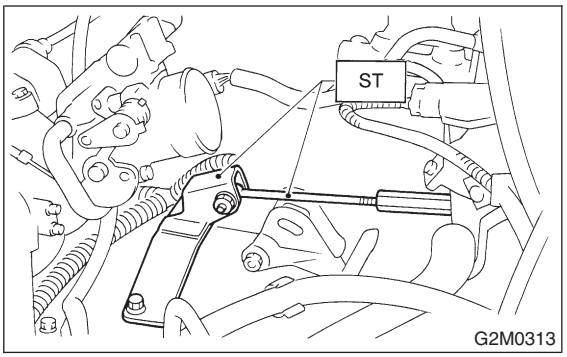


(3) Clog plug onto service hole.
8) Install operating cylinder. (MT vehicles)

Tightening torque:
37±3 N·m (3.8±0.3 kg-m, 27.5±2.2 ft-lb)

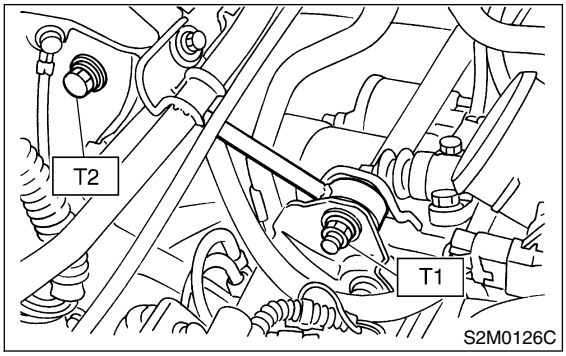


9) Remove special tools.



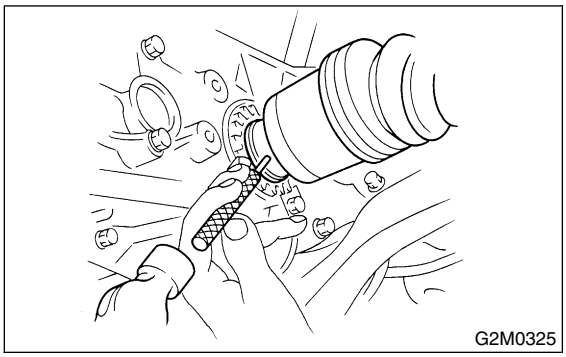
10) Install pitching stopper.

Tightening torque:
T1: 49±5 N·m (5.0±0.5 kg-m, 36.2±3.6 ft-lb)
T2: 57±10 N·m (5.8±1.0 kg-m, 42±7 ft-lb)



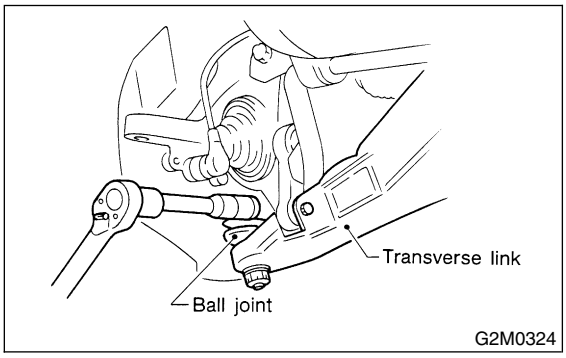
11) Install front drive shafts into transmission.
(1) Lift-up the vehicle.
(2) Install front drive shaft into transmission.
(3) Drive spring pin into chamfered hole of drive shaft.

CAUTION:
Always use a new spring pin.



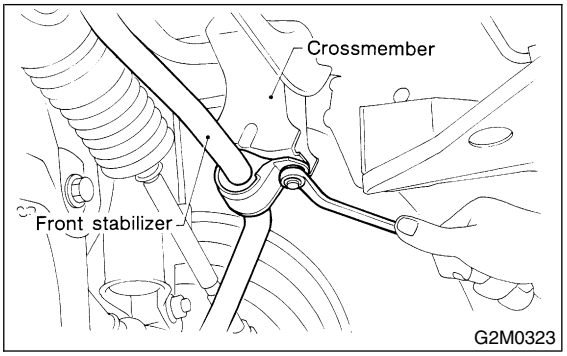
(4) Install ball joints of lower arm into knuckle arm of housing, and tighten installing bolts.

Tightening torque:
49±10 N·m (5.0±1.0 kg-m, 36±7 ft-lb)



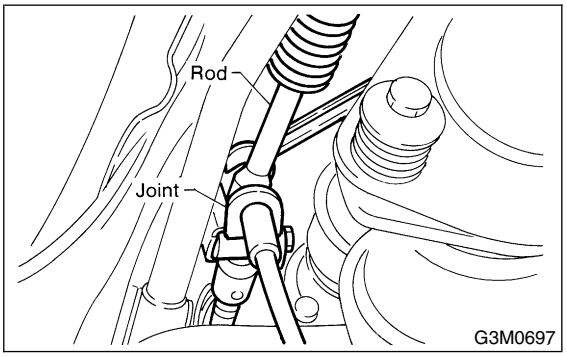
12) Install stabilizer clamps onto front crossmember.

Tightening torque:
25±4 N·m (2.5±0.4 kg-m, 18.1±2.9 ft-lb)



13) Install gear shift rod and stay. (MT vehicles)
(1) Install gear shift rod onto transmission.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

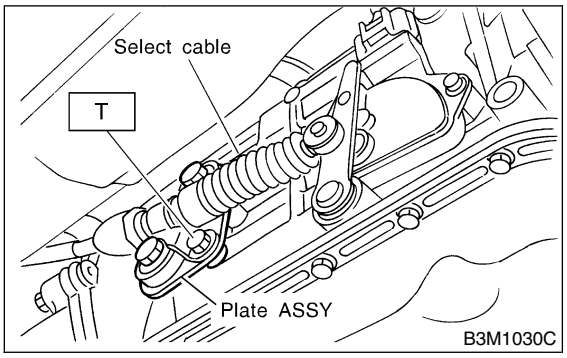


(2) Install stay onto transmission.

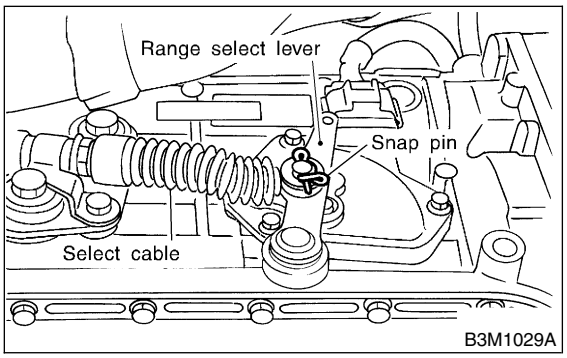
Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

14) Install shift selector cable onto selector lever. (AT vehicles)
(1) Install select cable to plate assembly.

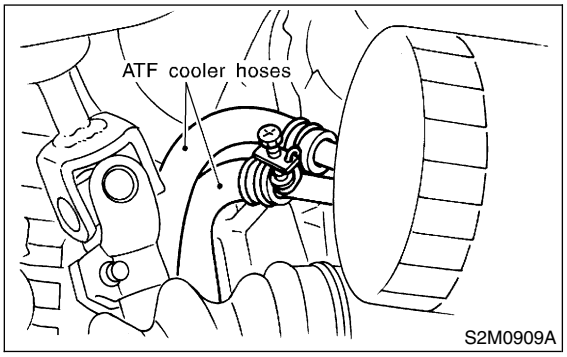
Tightening torque:
T: 33±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)



(2) Install snap pin to range select lever.

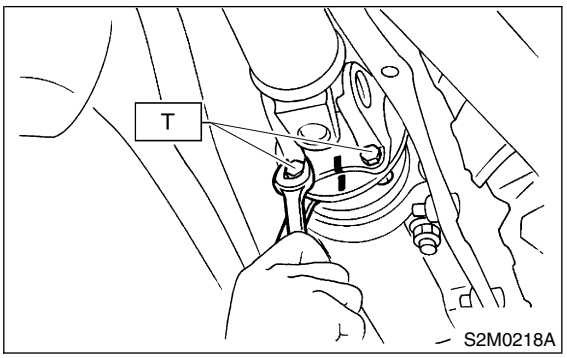


15) Install ATF level gauge guide, and ATF cooler hoses onto pipe. (AT vehicles)



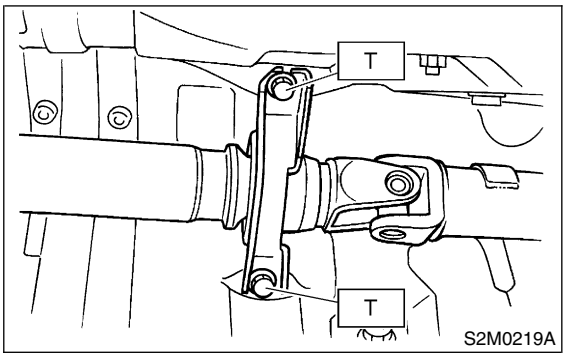
16) Install propeller shaft.
(1) Install propeller shaft into transmission.
(2) Tighten bolts which install propeller shaft onto companion flange of rear differential.

Tightening torque:
T: 31±8 N·m (3.2±0.8 kg-m, 23.1±5.8 ft-lb)

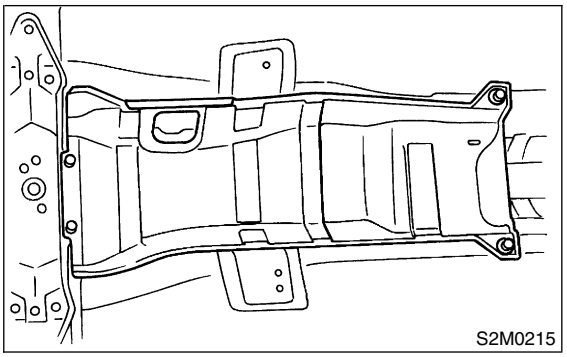


(3) Install center bearing bracket on body.

Tightening torque:
T: 52±5 N·m (5.3±0.5 kg-m, 38.3±3.6 ft-lb)

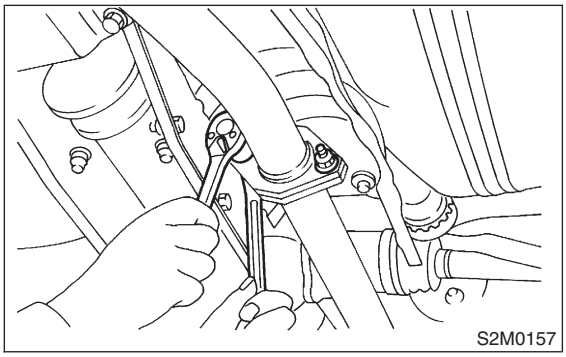


17) Install exhaust system.
(1) Install heat shield cover.

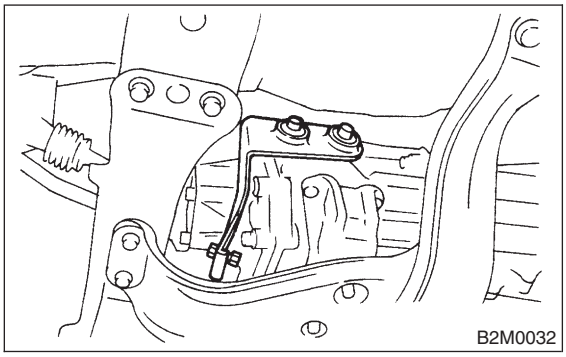


(2) Install rear exhaust pipe to muffler.

Tightening torque:
48±5 N·m (4.9±0.5 kg-m, 35.4±3.6 ft-lb)

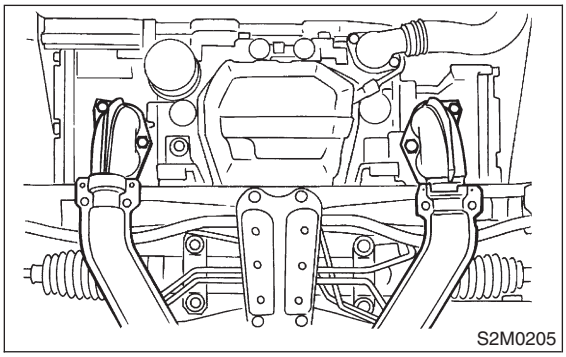

S2M0157

(3) Install hanger bracket on right side of transmission.


B2M0032

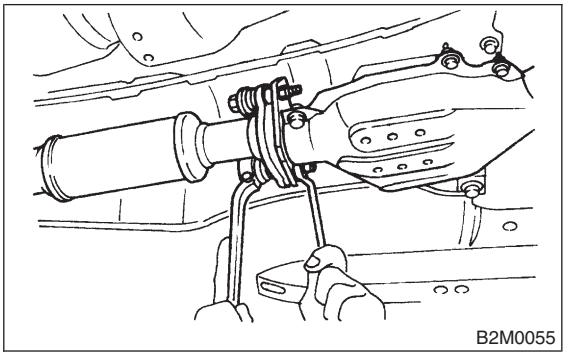
(4) Install front exhaust pipe onto engine.

Tightening torque:
30±5 N·m (3.1±0.5 kg-m, 22.4±3.6 ft-lb)


S2M0205

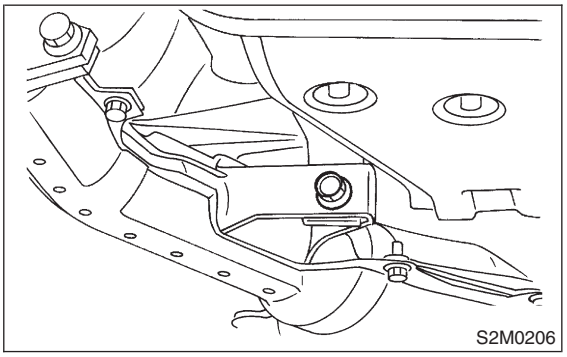
(5) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

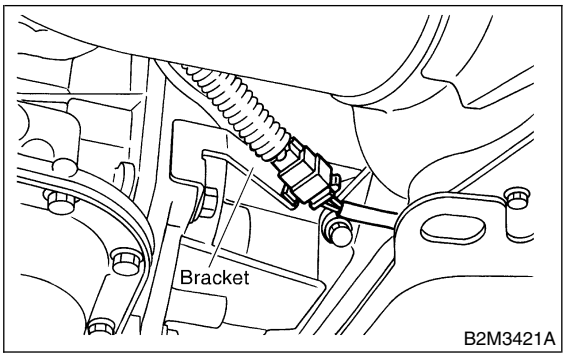

B2M0055

(6) Tighten bolt which installs center exhaust pipe to hanger bracket.

Tightening torque:
35±5 N·m (3.6±0.5 kg-m, 26.0±3.6 ft-lb)

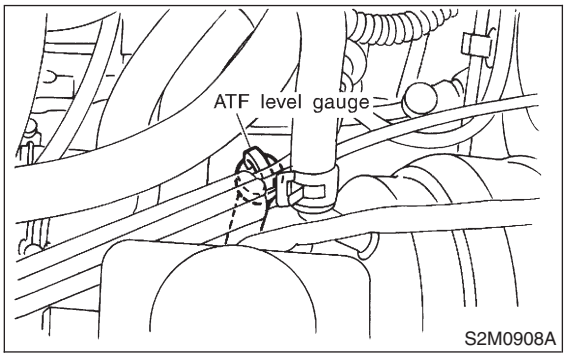

S2M0206

(7) Connect connector to rear oxygen sensor.

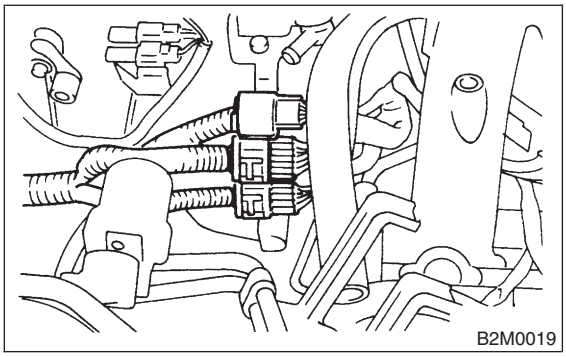


B2M3421A

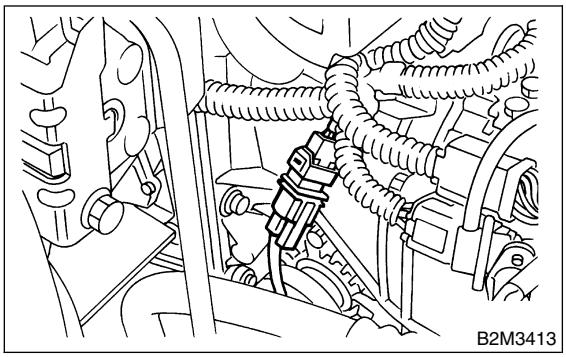
18) Install ATF level gauge. (AT vehicles)



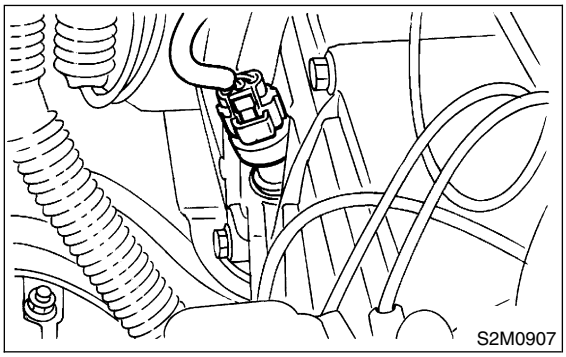
19) Connect the following connectors.
(1) Transmission harness connectors



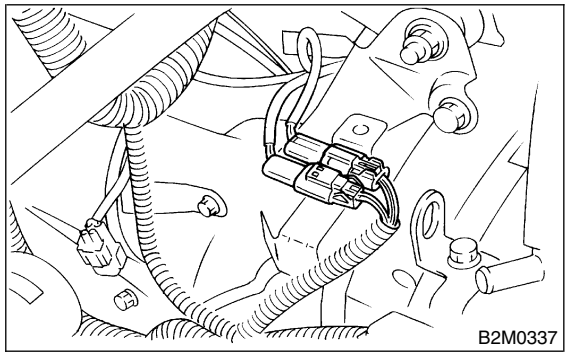
(2) Transmission ground terminal
(3) Front oxygen sensor connector



(4) Vehicle speed sensor (MT vehicles)

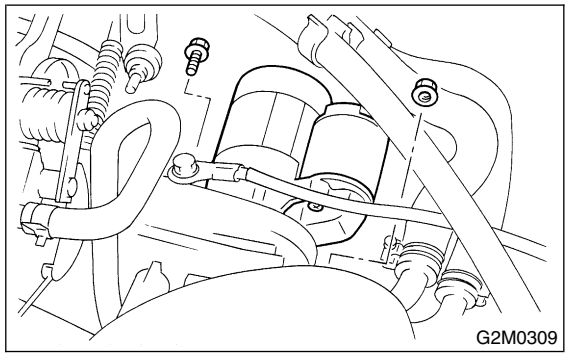


(5) Neutral position switch and back-up light switch connector (MT vehicles)

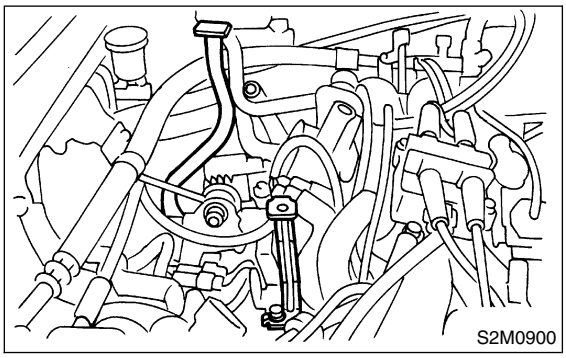


20) Install starter.
(1) Install starter onto transmission case, and connect connectors and terminals.
(2) Tighten bolt and nut which install starter onto transmission.

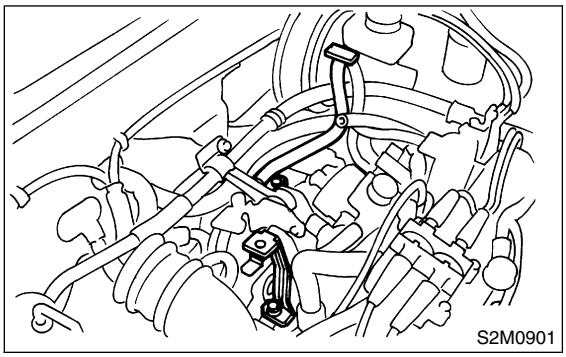
Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 36.9±2.9 ft-lb)



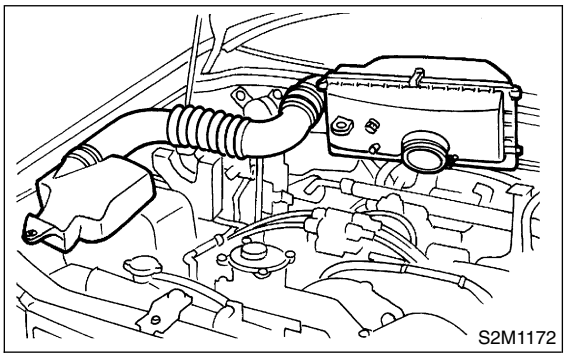
21) Install air cleaner case stay.
- MT vehicles



- AT vehicles



22) Install air intake duct and air cleaner case.



23) Connect battery ground terminal.
24) Fill ATF up to the middle of the “COLD” side on level gauge by using the gauge hole. (AT vehicles)

Recommended fluid:
Dexron IIE or Dexron III type automatic transmission fluid

Fluid capacity:
9.3 — 9.6 ℓ (9.8 — 10.1 US qt, 8.2 — 8.4 Imp qt)

25) Check selector lever operation. (AT vehicles) <Ref. to 3-2 [T2C0].>
26) Take off vehicle from lift arms.
27) Run the vehicle until ATF temperature rises from 60 to 80°C (140 to 176°F) and check the ATF level of the “HOT” side on level gauge. (AT vehicles)
28) Check the vehicle on road tester. (AT vehicles) <Ref. to 3-2 [W7A0].>

TRANSMISSION AND DIFFERENTIAL SECTION

FOREWORD

This portion of the service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of both the fully qualified and the less-experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

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1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into six volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- ENGINE SECTION
- TRANSMISSION AND DIFFERENTIAL SECTION
- MECHANICAL COMPONENTS SECTION
- BODY AND ELECTRICAL SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following six types of areas.

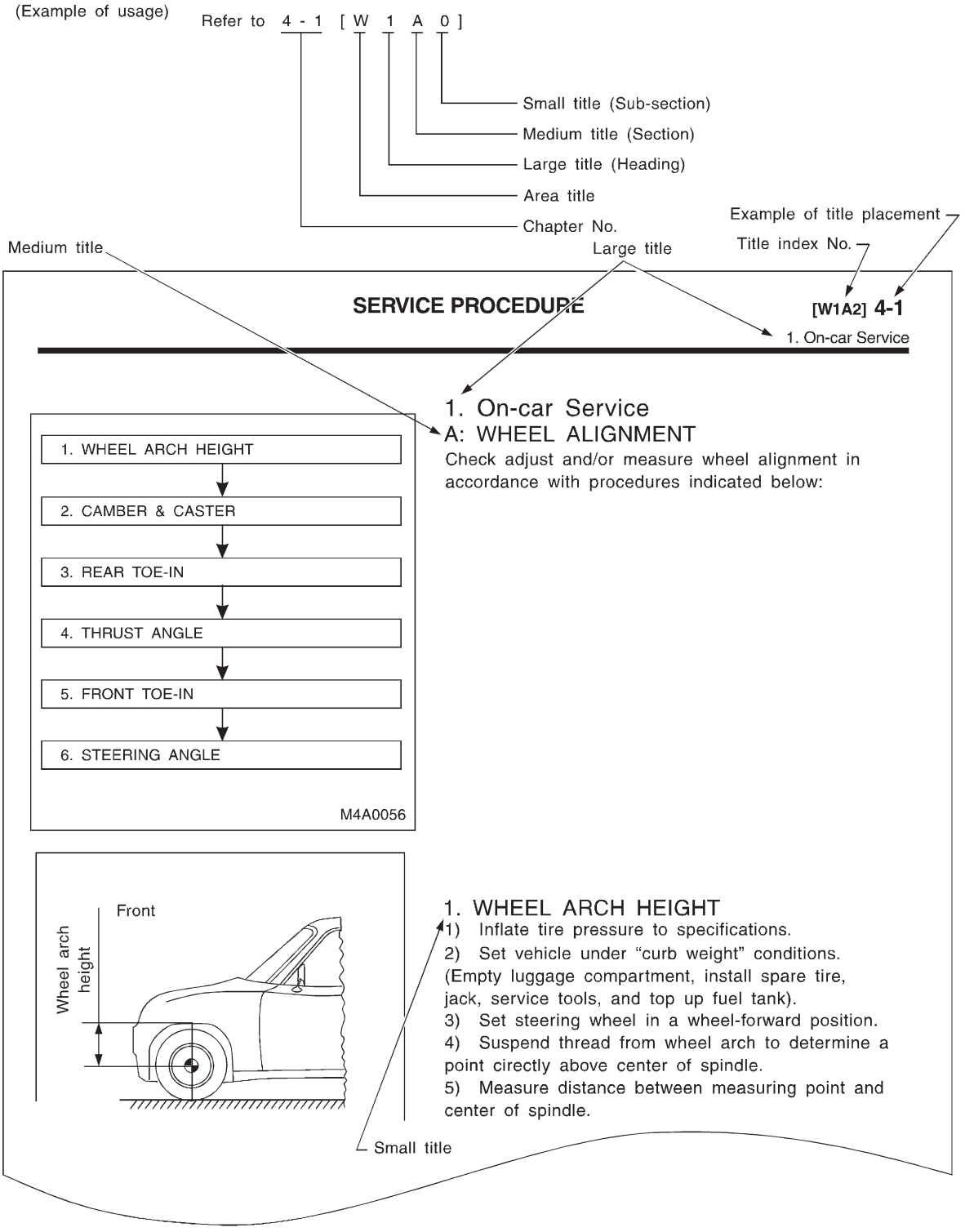
S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS (MECHANICAL)
T	DIAGNOSTICS (ELECTRICAL)
D	WIRING DIAGRAM

● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the six types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

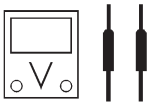
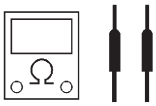
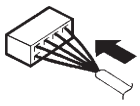
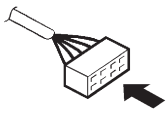
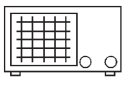
● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.



H0M0010

- In this manual, the following symbols are used.

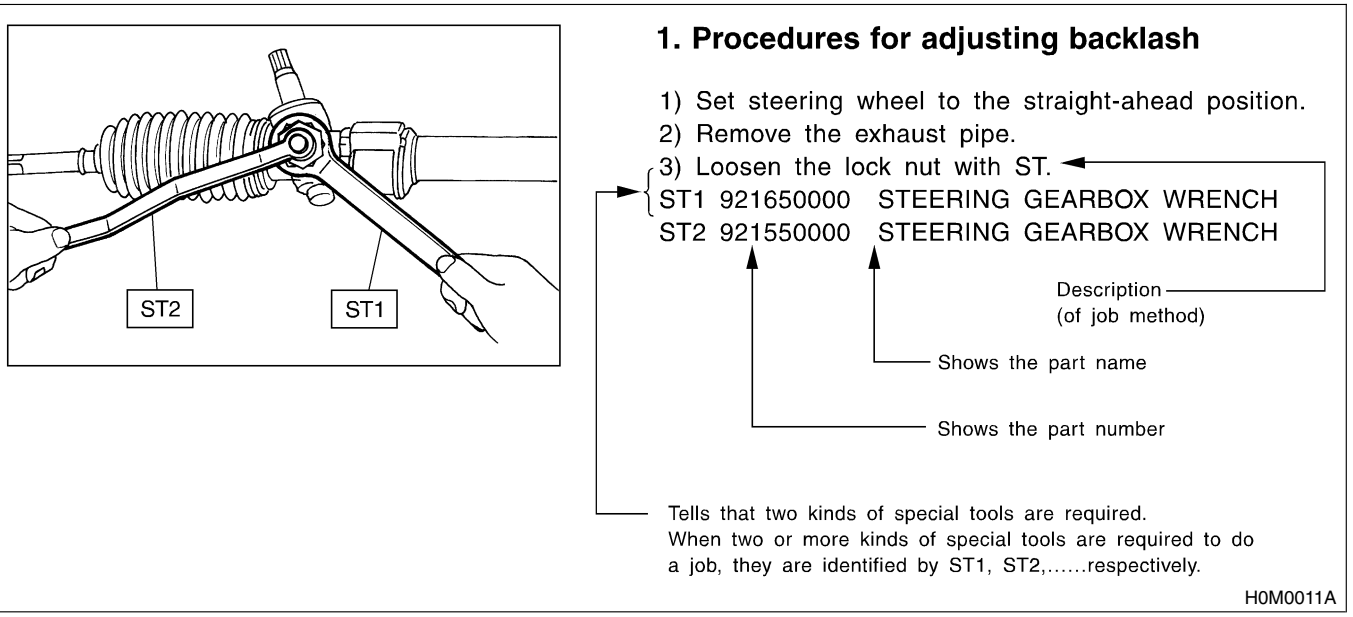
Symbol	Description
*	Selective part
★	Replacement part
 S0M0001	Should be lubricated with oil.
 S0M0002	Should be lubricated with grease.
 S0M0003	Sealing point
T S0M0004	Tightening torque

Character	Description
 B0M0002	Circuit tester ● Voltage measurement
 B0M0003	Circuit tester ● Resistance measurement
 B0M0004	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0005	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0006	Oscilloscope
B0M0007	Oscilloscope positive probe
B0M0008	Oscilloscope earth head

● **WARNING, CAUTION,** NOTE

WARNING:	Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
CAUTION:	Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
NOTE:	Indicates the hints, knacks, etc. which make the maintenance job easier.

● SPECIAL TOOLS
When any special tool is required to perform the job, it is identified by “ST” in the applicable illustration and its part number is shown in the manual.

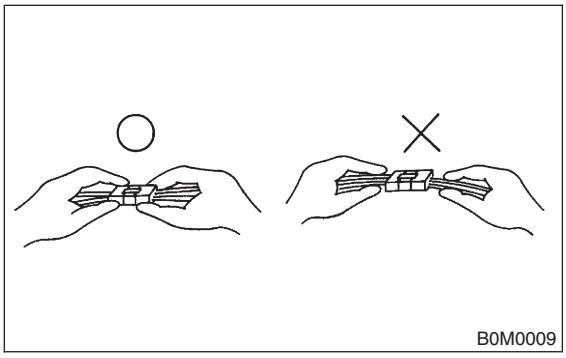


3. Basic Checks for Diagnostics

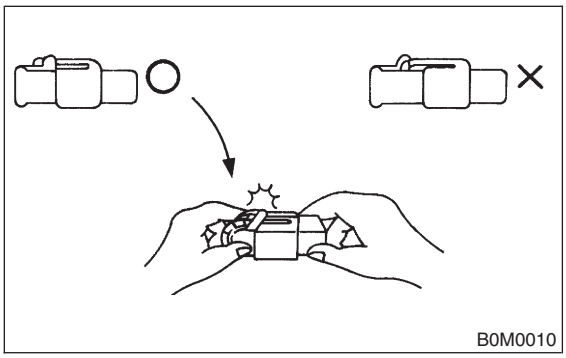
A: DISCONNECTING CONNECTORS

- Always hold the connector itself.

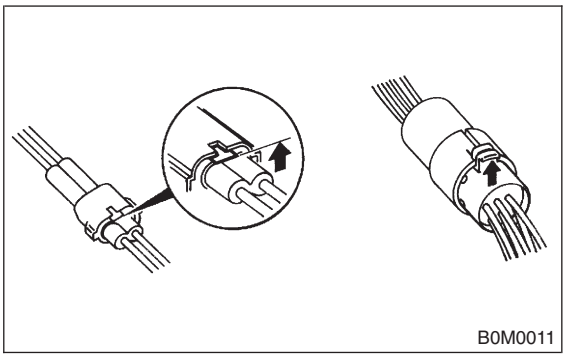
CAUTION:
Don't pull the harness.



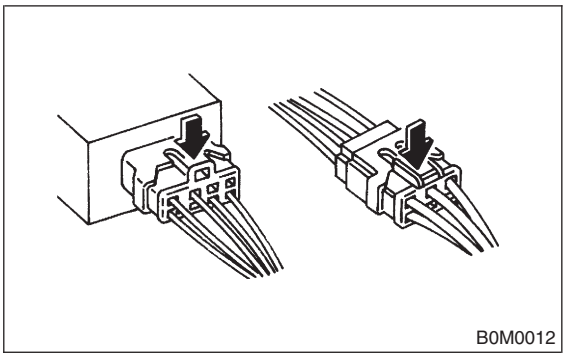
- Inspect a connector by pushing it all the way in. If the connector is equipped with a locking device, push it in until a clicking sound is heard.



- To disconnect a locking connector, first release the lock, then pull the connector off.
<Unlock by pulling the locking tab.>



<Unlock by pushing the locking tab.>

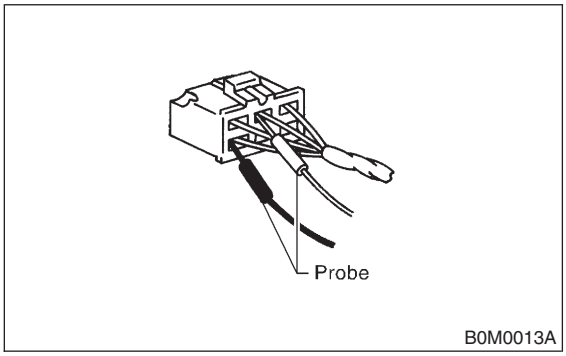


NOTE:
- After disconnecting connectors, visually check for contamination, distortion, or damage of connectors before reconnecting them. Also, check for loose or missing terminals.
- If there are any contamination, or water droplets on the contact points of the terminals, wipe them off using an air gun or a waste cloth. Never polish the contact points using sandpaper. If polished with sandpaper, the surface plating may peel off.
- Avoid excessive impact and twisting force to connectors when connecting. Otherwise, connector housings or terminals may be damaged.
- When disconnecting waterproof connectors, be sure to prevent the inner waterproof seal from collapsing.

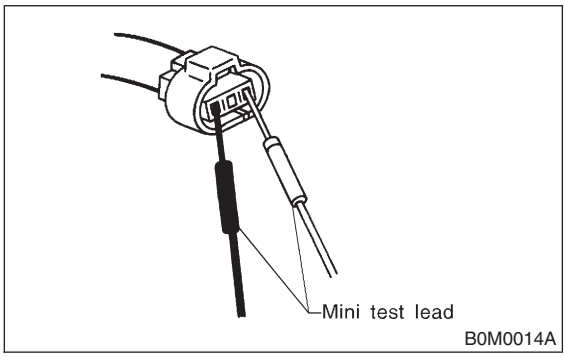
B: INSERTING A PROBE

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

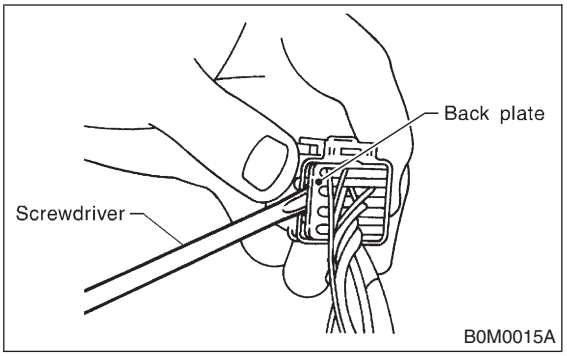
- Generally, probes are inserted into connectors from the rear side (wire side).
- When removing the shock protector take care not to deform it; this also applies to waterproof connectors, which cannot be tested from the wire side.



- Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.



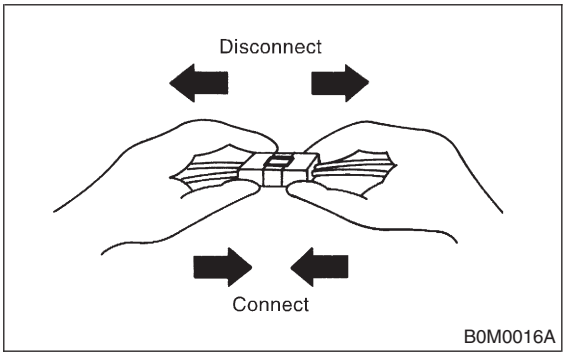
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, since the terminals might brake off.)



C: CHECKING FOR POOR CONTACT ON PLUG-IN CONNECTORS

1. POOR CONTACT

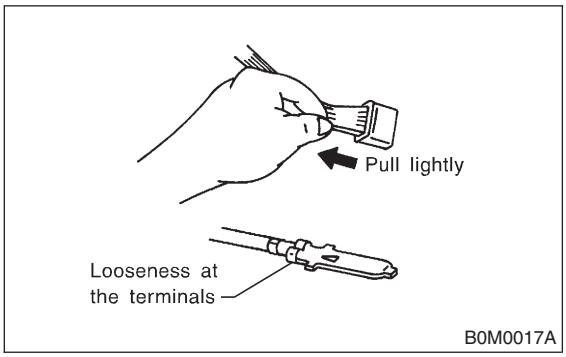
Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. Quite often a plug with poor contact will work perfectly again after it has been pulled off and reconnected. If harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of trouble.



2. VISUAL INSPECTION

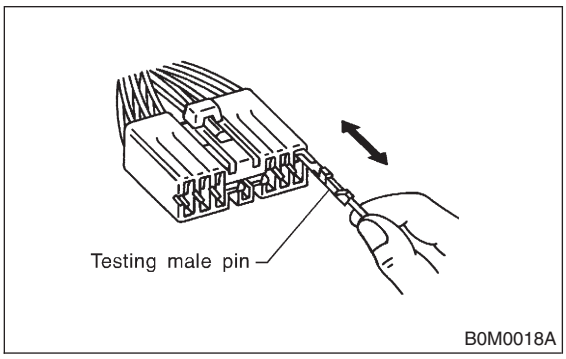
1) Disconnect the two connector halves.
2) Check the connector pins for signs of corrosion or foreign material.
3) Check the connector for loose and damaged terminals, and make sure they are set correctly in the connector.

NOTE:
When the harness is pulled lightly, the terminals should not come out.

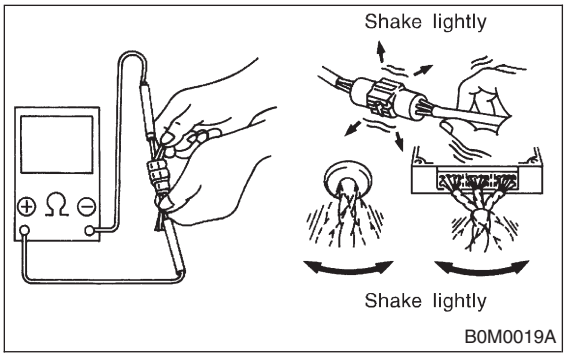


4) Insert the male pin of the connector into the female pin, then pull it out.

NOTE:
If one of the pins allows to pull out easily, it is a likely source of a malfunction.



5) Shake lightly the connector and the harness, and check for sudden changes in voltage or resistance.



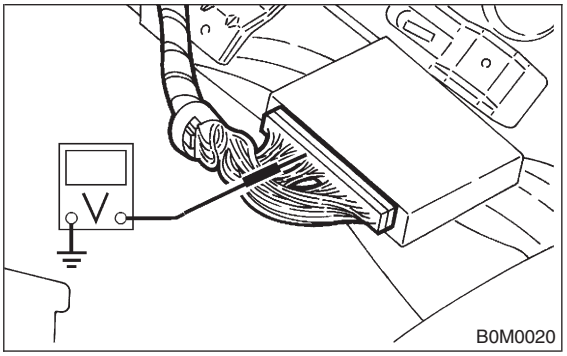
4. Diagnosis and Checking Procedure Using Instruments

A: USING A CIRCUIT TESTER

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

1. VOLTAGE CHECK (range set to DC V)

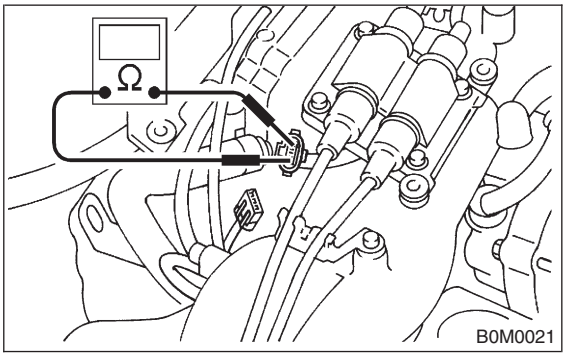
Connect the positive probe to the terminal to be tested, and the negative probe to body ground. (or the ground terminal of the ECM)



2. CHECKING THE CONNECTION (range set to Ω)

Measure the resistance and check for open or shorted wire in the harness or the connector.

NOTE:
This check must be carried out with both connectors disconnected.
(This avoids by-passing the connection through other circuits.)



1) Check for open circuit. (range: Ω × 1K)
Measure the resistance between the respective pins in both connectors.

Specified resistance:
More than 1 MΩ (No continuity) Open circuit
Less than 10 Ω (Continuity) O.K.

2) Check for correct insulation value. (range: Ω × 1K)
Measure the resistance between the pins in both connectors, as well as between the suspected pin and the body. (body short)

Specified resistance:
More than 1 MΩ (No continuity) O.K.
Less than 10 Ω (Continuity) Short circuit

3) Resistance measurement (range set to Ω)
Measuring the internal resistance of sensors, solenoid valves etc. to check the operating condition of components.

NOTE:
● Select the appropriate range for measuring the internal resistance, or the measurement will result in an incorrect reading.
● Before changing the measurement range the gauge must be reset to zero.

B: USING A SUBARU SELECT MONITOR

With this testing procedure the defective component can be determined by directly monitoring input/output signals of the ECM or the trouble codes.

1. FEATURES

● A variety of data can be checked without movements from the drivers seat, passenger's seat or from outside the vehicle.
● This unit allows the identification of the type of malfunction, for example whether the cause is an open or shorted wire in the input/output signal line, or whether the breakdown of a component is caused by a lack of maintenance.

2. DIAGNOSIS

● Refer to the reference values for input/output and control data to determine whether the malfunction is caused by a worn out component, an open wire, a short etc.
● Perform the diagnostics procedure as described in chapter "Check based on trouble codes" by monitoring the trouble codes.

NOTE:
It will be easier to determine a malfunction if the vehicle data for normal conditions are available for comparison.

C: USING AN OSCILLOSCOPE

A malfunction can be determined by displaying the waveforms of input/output signals on the oscilloscope.

1. DIAGNOSIS

A simple comparison of the waveforms may lead to an incorrect diagnosis. To exactly determine the sources of the malfunction it will be necessary to determine them under consideration about information other than waveforms.

2. APPLYING INPUT/OUTPUT SIGNALS

Connect the probe directly with the terminal of the signal.

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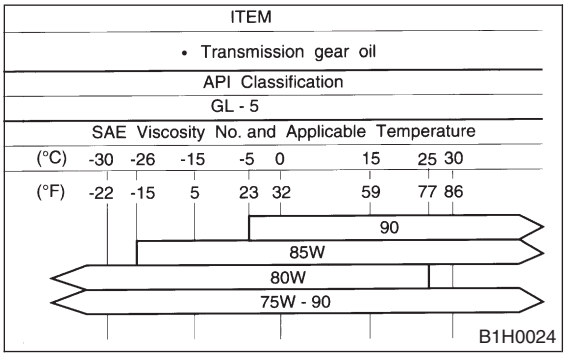
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1. Manual Transmission and Differential

Item			Model
			AWD
			2500 cc
Type			5-forward speeds with synchromesh and 1-reverse
Transmission gear ratio		1st	3.545
		2nd	2.111
		3rd	1.448
		4th	1.088
		5th	0.780
		Reverse	3.333
Front reduction gear	Final	Type of gear	Hypoid
		Gear ratio	4.111
Rear reduction gear	Transfer	Type of gear	Helical
		Gear ratio	1.000
	Final	Type of gear	Hypoid
		Gear ratio	4.111
Front differential	Type and number of gear		Straight bevel gear (Bevel pinion: 2, Bevel gear: 2)
Center differential	Type and number of gear		Straight bevel gear (Bevel pinion: 2, Bevel gear: 2 and viscous coupling)
Transmission gear oil			GL-5
Transmission oil capacity			3.5 ℓ (3.7 US qt, 3.1 Imp qt)

2. Transmission Gear Oil

Recommended oil



3. Transmission Case Assembly

Drive pinion shim adjustment
Hypoid gear backlash
0.13 — 0.18 mm (0.0051 — 0.0071 in)

Drive pinion shim			
Part No.	Thickness mm (in)	Part No.	Thickness mm (in)
32295AA031	0.150 (0.0059)	32295AA071	0.250 (0.0098)
32295AA041	0.175 (0.0069)	32295AA081	0.275 (0.0108)
32295AA051	0.200 (0.0079)	32295AA091	0.300 (0.0118)
32295AA061	0.225 (0.0089)	32295AA101	0.500 (0.0197)

Selection of main shaft rear plate

Main shaft rear plate		
Dimension “A” mm (in)	Part No.	Mark
4.00 — 4.13 (0.1575 — 0.1626)	32294AA041	1
3.87 — 3.99 (0.1524 — 0.1571)	32294AA051	2

4. Drive Pinion Assembly

Preload adjustment of thrust bearing
Starting torque
0.3 — 0.8 N·m (0.03 — 0.08 kg-m, 0.2 — 0.6 ft-lb)

Adjusting washer No. 1	
Part No.	Thickness mm (in)
803025051	3.925 (0.1545)
803025052	3.950 (0.1555)
803025053	3.975 (0.1565)
803025054	4.000 (0.1575)
803025055	4.025 (0.1585)
803025056	4.050 (0.1594)
803025057	4.075 (0.1604)

Adjusting washer No. 2	
Part No.	Thickness mm (in)
803025059	3.850 (0.1516)
803025054	4.000 (0.1575)
803025058	4.150 (0.1634)

5. Reverse Idler Gear

Adjustment of reverse idler gear position
Reverse idler gear to transmission case (LH) wall clearance
6.0 — 7.5 mm (0.236 — 0.295 in)

Reverse shifter lever		
Part No.	Mark	Remarks
32820AA070	7	Further from case wall
32820AA080	8	Standard
32820AA090	9	Closer to the case wall

After installing a suitable reverse shifter lever, adjust reverse idler gear to transmission case wall clearance to within 0 to 0.5 mm (0 to 0.020 in) using washers.

Washer (20.5 × 26 × t)			
Part No.	Thickness mm (in)	Part No.	Thickness mm (in)
803020151	0.4 (0.016)	803020154	1.9 (0.075)
803020152	1.1 (0.043)	803020155	2.3 (0.091)
803020153	1.5 (0.059)	—	—

6. Shifter Fork and Rod

Select suitable shifter forks so that both coupling sleeve and reverse driven gear are positioned in the center of their synchromesh mechanisms.
Rod end clearance
A: 1st-2nd — 3rd-4th
0.4 — 1.4 mm (0.016 — 0.055 in)
B: 3rd-4th — 5th
0.5 — 1.3 mm (0.020 — 0.051 in)

1st-2nd shifter fork		
Part No.	Mark	Remarks
32804AA060	1	Approach to 1st gear by 0.2 mm (0.008 in)
32804AA070	No mark	Standard
32804AA080	3	Approach to 2nd gear by 0.2 mm (0.008 in)

3rd-4th shifter fork		
Part No.	Mark	Remarks
32810AA061	1	Approach to 4th gear by 0.2 mm (0.008 in)
32810AA071	No mark	Standard
32810AA101	3	Approach to 3rd gear by 0.2 mm (0.008 in)

5th shifter fork		
Part No.	Mark	Remarks
32812AA201	7	Approach to 5th gear by 0.2 mm (0.008 in)
32812AA211	No mark	Standard
32812AA221	9	Become distant from 5th gear by 0.2 mm (0.008 in)

7. Transfer Case

Neutral position adjustment

Adjustment shim	
Part No.	Thickness mm (in)
32190AA000	0.15 (0.0059)
32190AA010	0.30 (0.0118)

Reverse accent shaft		
Part No.	Mark	Remarks
32188AA090	X	Neutral position is closer to 1st gear.
32188AA100	Y	Standard
32188AA110	Z	Neutral position is closer to reverse gear.

Reverse check plate adjustment

Reverse check plate			
Part No.	Mark	Angle θ	Remarks
32189AA000	0	28°	Arm stops closer to 5th gear.
32189AA010	1	31°	Arm stops closer to 5th gear.
33189AA020	2	34°	Arm stops in the center.
32189AA030	3	37°	Arm stops closer to reverse gear.
32189AA040	4	40°	Arm stops closer to reverse gear.

8. Extension Assembly

Thrust washer (52 × 61 × t) to ball bearing side clearance
0.05 — 0.30 mm (0.0020 — 0.0118 in)

Thrust washer (52 × 61 × t)	
Part No.	Thickness mm (in)
803052021	0.50 (0.0197)
803052022	0.75 (0.0295)
803052023	1.00 (0.0394)

Thrust washer to center differential side clearance
0.15 — 0.35 mm (0.0059 — 0.0138 in)

Thrust washer	
Part No.	Thickness mm (in)
803036050	0.9 (0.035)
803036054	1.0 (0.039)
803036051	1.1 (0.043)
803036055	1.2 (0.047)
803036052	1.3 (0.051)
803036056	1.4 (0.055)
803036053	1.5 (0.059)
803036057	1.6 (0.063)
803036058	1.7 (0.067)

9. Front Differential

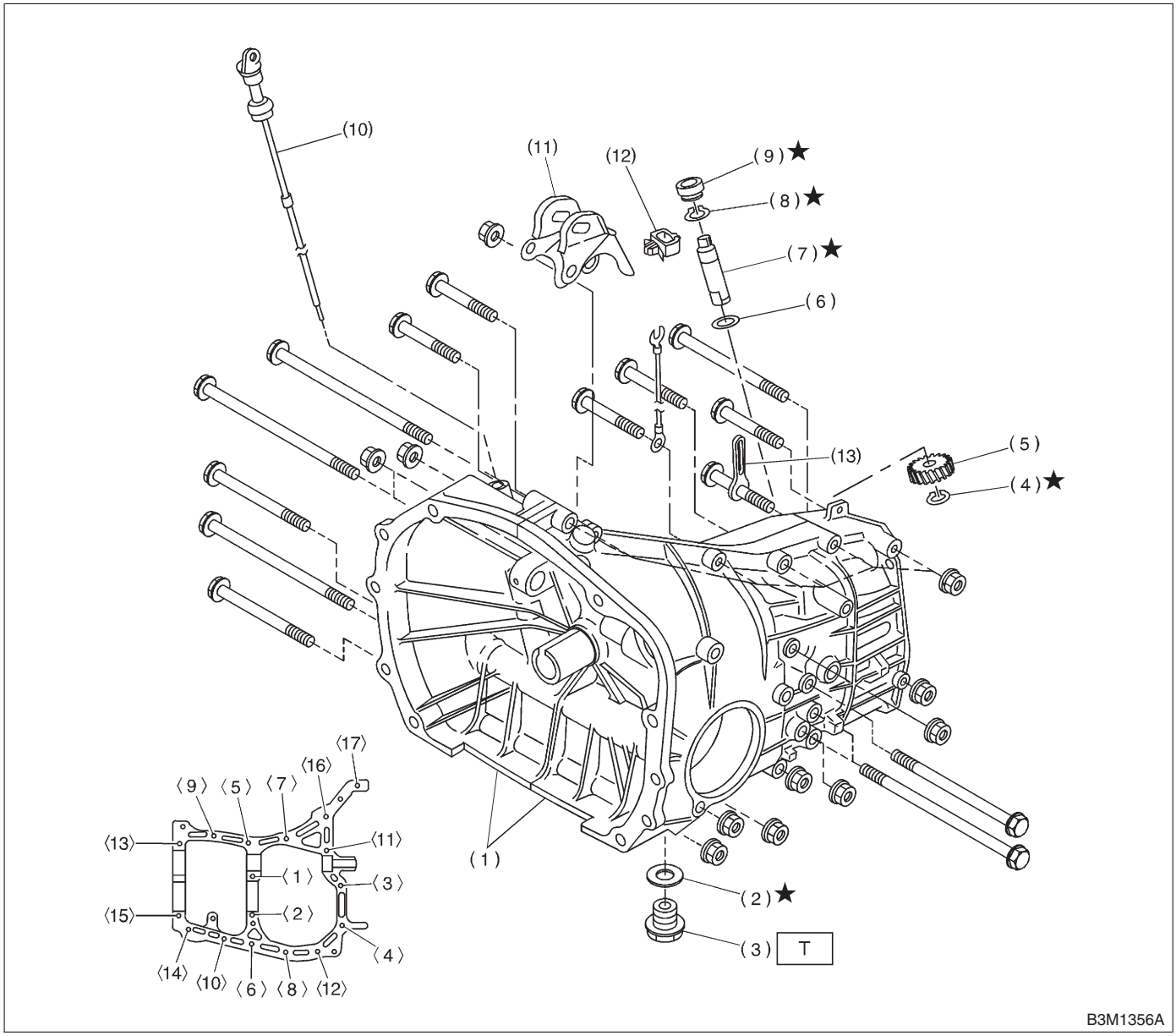
Bevel gear to pinion backlash
0.13 — 0.18 mm (0.0051 — 0.0071 in)

Washer (38.1 × 50 × t)			
Part No.	Thickness mm (in)	Part No.	Thickness mm (in)
803038021	0.925 — 0.950 (0.0364 — 0.0374)	803038023	1.025 — 1.050 (0.0404 — 0.0413)
803038022	0.975 — 1.000 (0.0384 — 0.0394)	—	—

Pinion shaft to axle drive shaft clearance
0 — 0.25 mm (0 — 0.0098 in)

Snap ring (Outer-28)			
Part No.	Thickness mm (in)	Part No.	Thickness mm (in)
805028011	1.05 (0.0413)	805028012	1.20 (0.0472)

1. Transmission Case

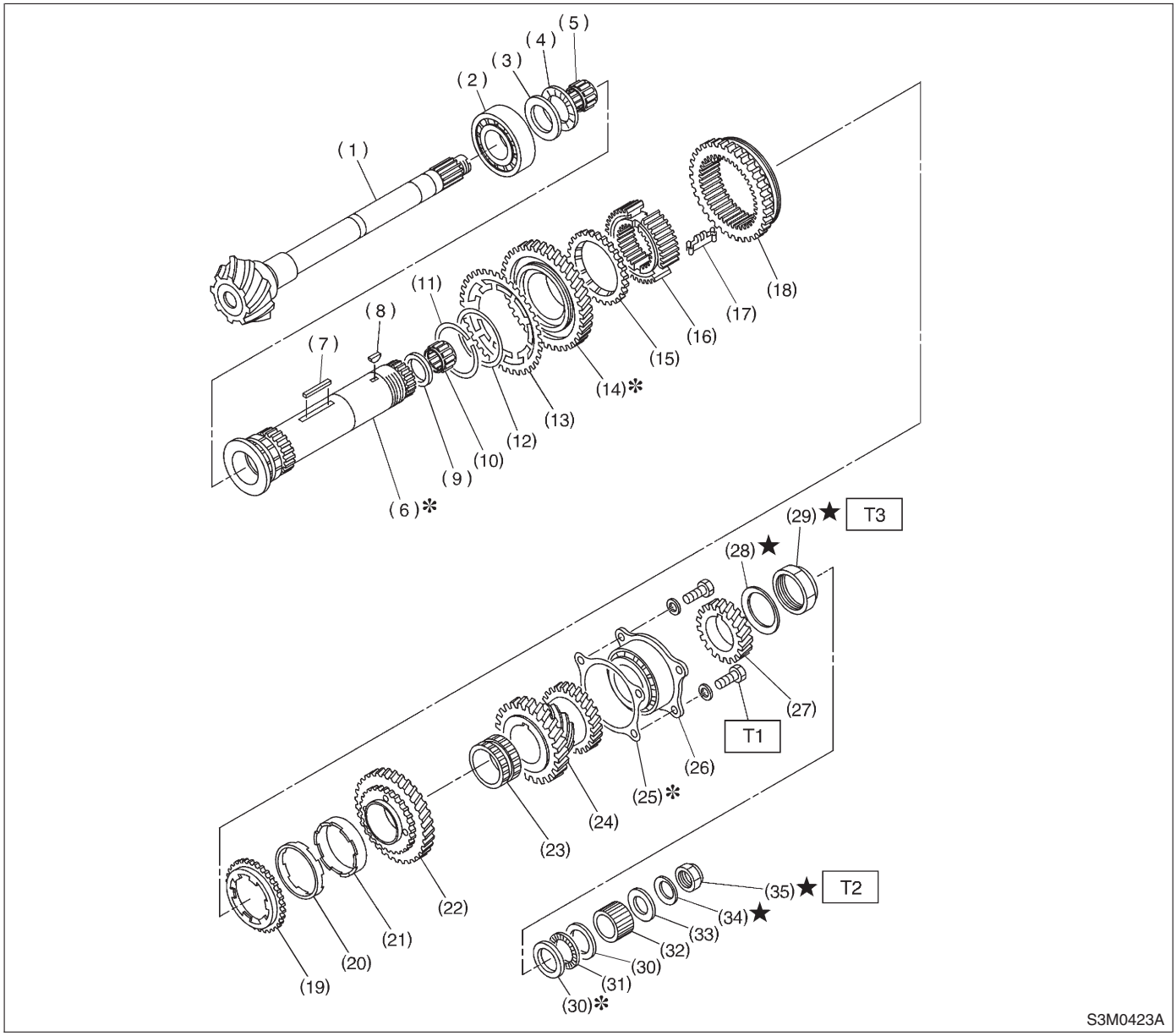


(1) Transmission case ASSY
(2) Gasket
(3) Drain plug
(4) Snap ring (Outer)
(5) Speedometer driven gear
(6) Washer
(7) Speedometer shaft
(8) Snap ring (Outer)
(9) Oil seal
(10) Oil level gauge
(11) Pitching stopper bracket
(12) Clamp
(13) Clip

Tightening torque: N·m (kg-m, ft-lb)
T: 44±3 (4.5±0.3, 32.5±2.2)

Size	All models	Torque
8 mm bolt	<5> — <15>	25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)
10 mm bolt	<1> — <4> <16> — <17>	39±3 N·m (4.0±0.3 kg-m, 28.9±2.2 ft-lb)

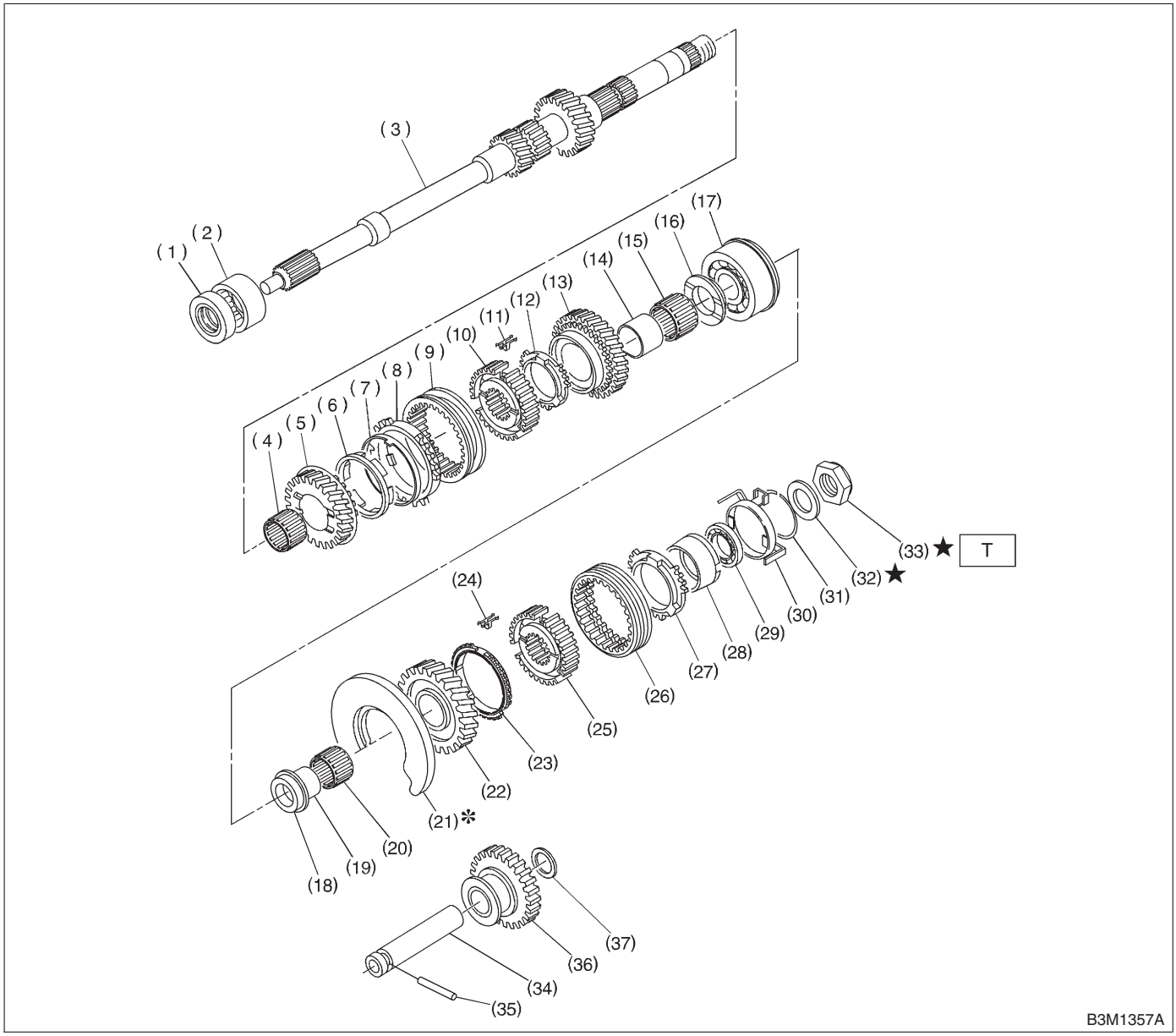
2. Drive Pinion Assembly



(1) Drive pinion shaft
(2) Roller bearing
(3) Washer
(4) Thrust bearing
(5) Needle bearing
(6) Driven shaft
(7) Key
(8) Woodruff key
(9) Drive pinion collar
(10) Needle bearing
(11) Snap ring (Outer)
(12) Washer
(13) Sub gear
(14) 1st driven gear
(15) Baulk ring
(16) 1st-2nd synchronizer hub
(17) Insert key
(18) Reverse driven gear
(19) Outer baulk ring
(20) Synchro cone
(21) Inner baulk ring
(22) 2nd driven gear
(23) 2nd driven gear bush
(24) 3rd-4th driven gear
(25) Driven pinion shim
(26) Roller bearing
(27) 5th driven gear
(28) Lock washer
(29) Lock nut
(30) Washer
(31) Thrust bearing
(32) Differential bevel gear sleeve
(33) Washer
(34) Lock washer
(35) Lock nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 29±3 (3.0±0.3, 21.7±2.2)
T2: 118±8 (12.0±0.8, 86.8±5.8)
T3: 265±10 (27±1, 195±7)

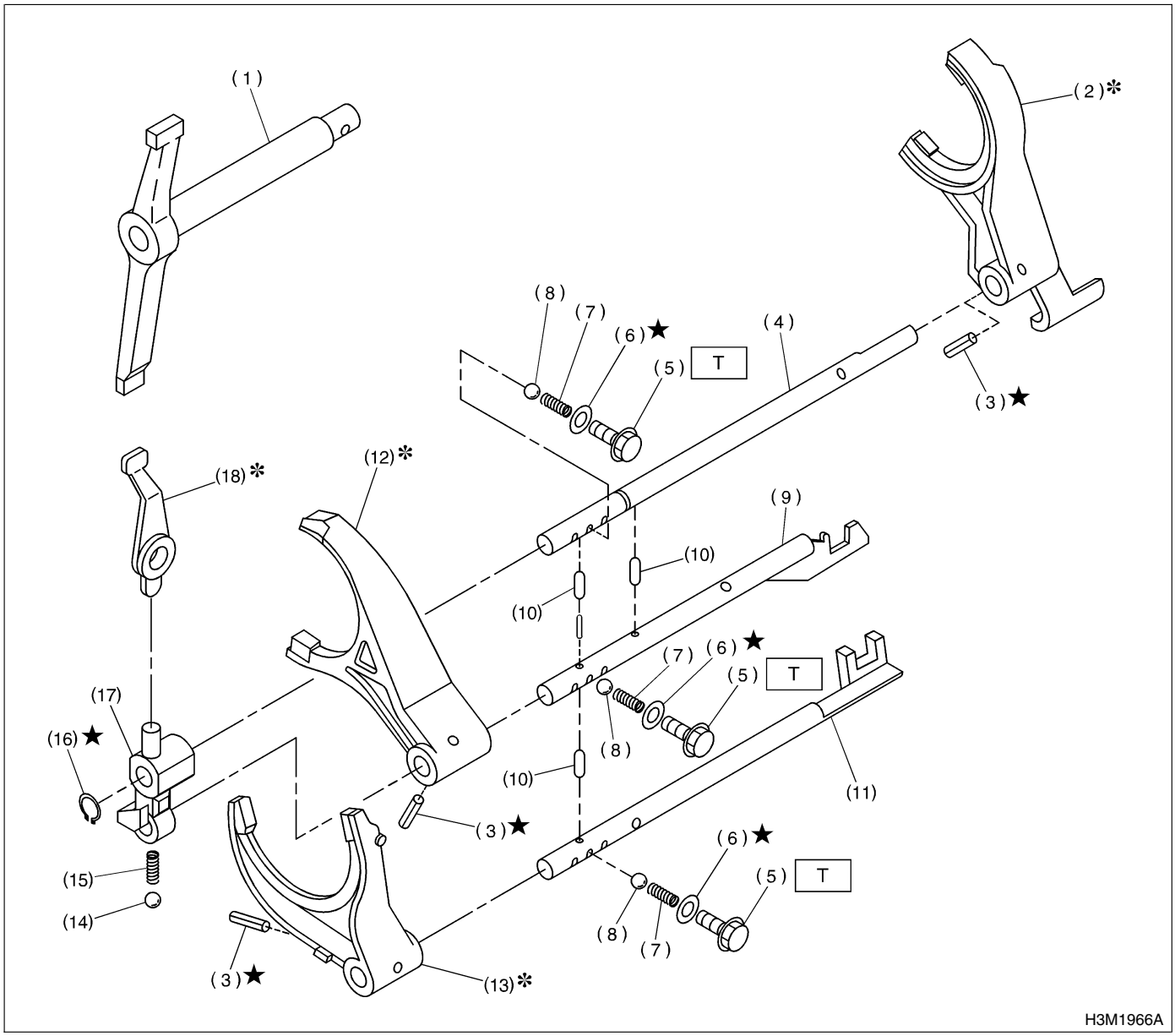
3. Main Shaft Assembly



(1) Oil seal
(2) Needle bearing
(3) Transmission main shaft
(4) Needle bearing
(5) 3rd drive gear
(6) Inner baulk ring
(7) Synchro cone (3rd)
(8) Outer baulk ring
(9) Coupling sleeve (3rd-4th)
(10) Synchronizer hub (3rd-4th)
(11) Shifting insert key (3rd-4th)
(12) 4th baulk ring
(13) 4th drive gear
(14) 4th needle bearing race
(15) Needle bearing
(16) 4th gear thrust washer
(17) Ball bearing
(18) 5th gear thrust washer
(19) 5th needle bearing race
(20) Needle bearing
(21) Main shaft rear plate
(22) 5th drive gear
(23) 5th baulk ring
(24) Shifting insert key (5th-Rev)
(25) Synchronizer hub (5th-Rev)
(26) Coupling sleeve (5th-Rev)
(27) Rev baulk ring
(28) Synchro cone (Rev)
(29) Ball bearing
(30) Synchro cone stopper
(31) Snap ring
(32) Lock washer
(33) Lock nut
(34) Reverse idler gear shaft
(35) Straight pin
(36) Reverse idler gear
(37) Washer

Tightening torque: N·m (kg-m, ft-lb)
T: 118±6 (12.0±0.6, 86.8±4.3)

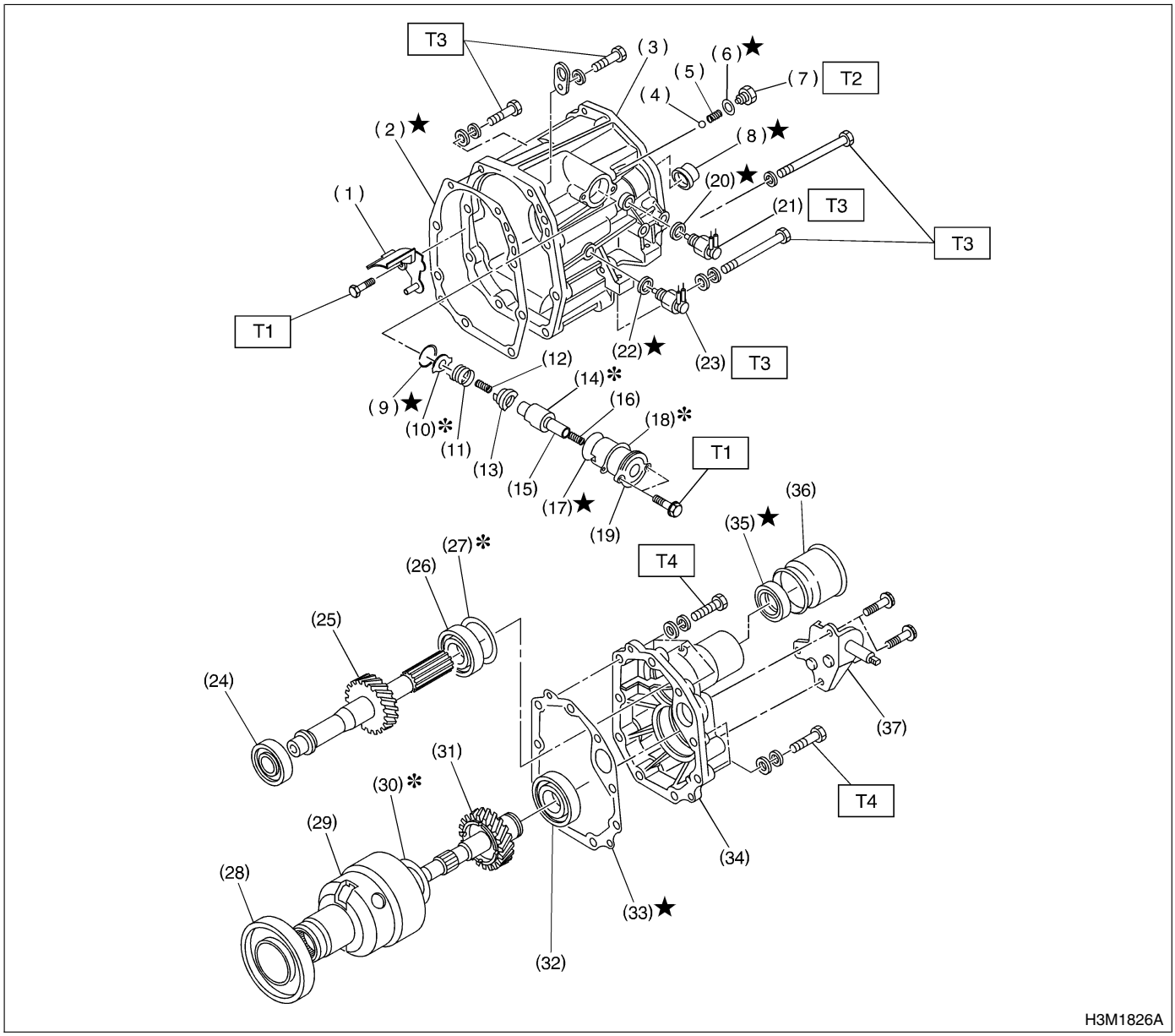
4. Shifter Fork and Shifter Rod



(1) Shifter arm
(2) 5th shifter fork
(3) Straight pin
(4) Reverse fork rod
(5) Checking ball plug
(6) Gasket
(7) Checking ball spring
(8) Ball
(9) 3rd-4th fork rod
(10) Interlock plunger
(11) 1st-2nd fork rod
(12) 3rd-4th shifter fork
(13) 1st-2nd shifter fork
(14) Ball
(15) Spring
(16) Snap ring (Outer)
(17) Reverse fork rod arm
(18) Reverse shifter lever

Tightening torque: N·m (kg-m, ft-lb)
T: 19.6±1.5 (2.00±0.15, 14.5±1.1)

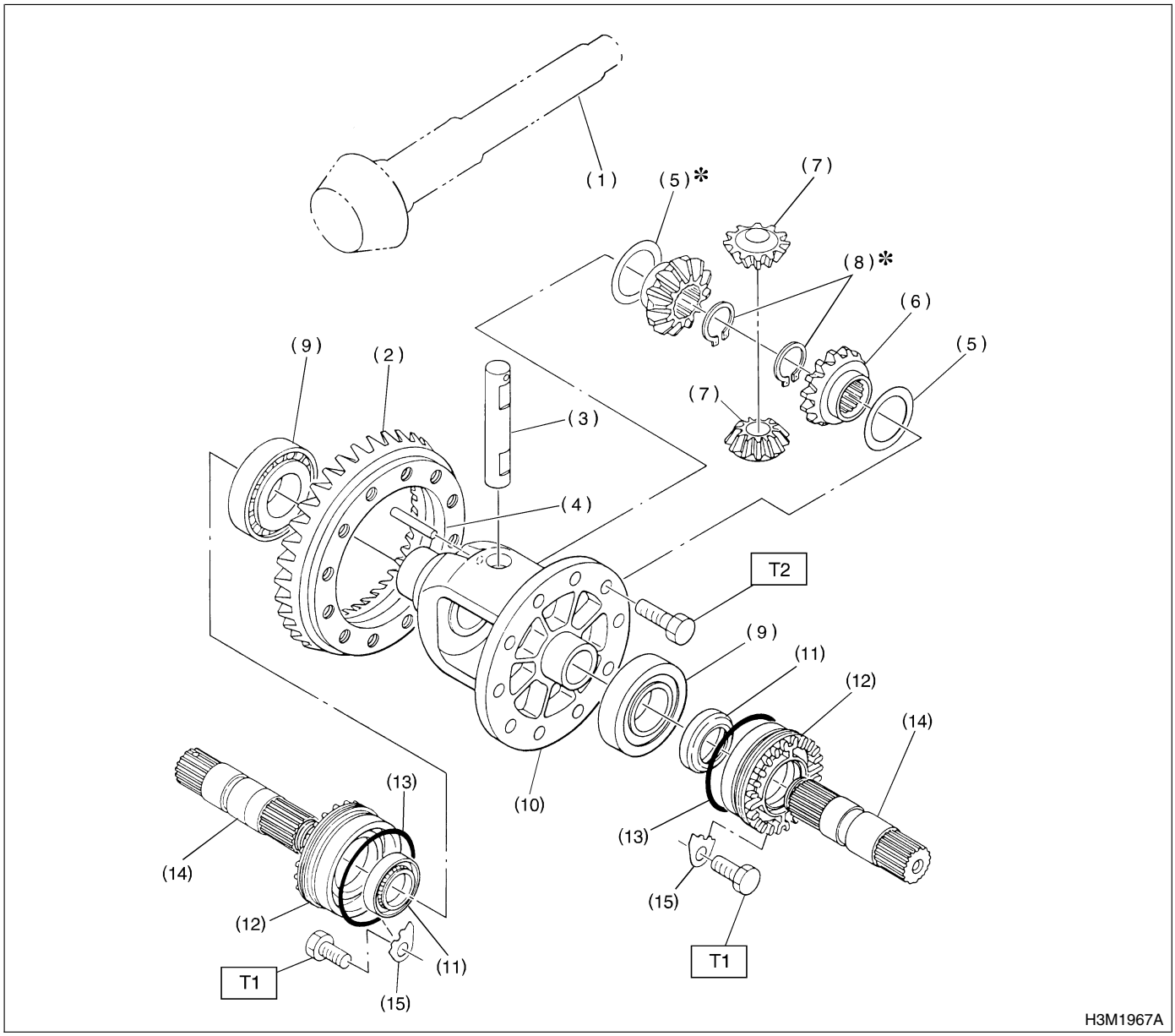
5. Transfer Case and Extension



(1) Oil guide
(2) Gasket
(3) Transfer case
(4) Ball
(5) Reverse accent spring
(6) Gasket
(7) Plug
(8) Oil seal
(9) Snap ring (Inner)
(10) Reverse check plate
(11) Reverse check spring
(12) Reverse return spring
(13) Reverse check cam
(14) Reverse accent shaft
(15) Return spring cap
(16) Return spring
(17) O-ring
(18) Adjusting select shim
(19) Reverse check sleeve
(20) Gasket
(21) Neutral switch
(22) Gasket
(23) Back-up light switch
(24) Ball bearing
(25) Transfer driven gear
(26) Ball bearing
(27) Adjusting washer
(28) Ball bearing
(29) Center differential
(30) Adjusting washer
(31) Transfer drive gear
(32) Ball bearing
(33) Gasket
(34) Extension
(35) Oil seal
(36) Dust cover
(37) Shift bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 5±1 (0.5±0.1, 3.6±0.7)
T2: 10±1 (1.0±0.1, 7.2±0.7)
T3: 25±2 (2.5±0.2, 18.1±1.4)
T4: 37±3 (3.8±0.3, 27.5±2.2)

6. Front Differential



(1) Drive pinion shaft
(2) Hypoid driven gear
(3) Pinion shaft
(4) Straight pin
(5) Washer
(6) Differential bevel gear
(7) Differential bevel pinion
(8) Snap ring (Outer)
(9) Roller bearing
(10) Differential case
(11) Oil seal
(12) Differential side retainer
(13) O-ring
(14) Axle drive shaft
(15) Retainer lock plate

Tightening torque: N·m (kg-m, ft-lb)
T1: 25±3 (2.5±0.3, 18.1±2.2)
T2: 62±5 (6.3±0.5, 45.6±3.6)

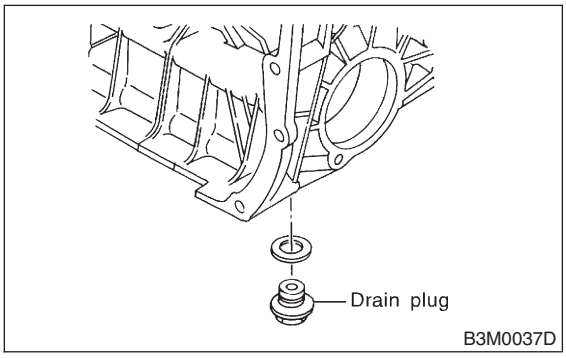
1. General

A: PRECAUTIONS

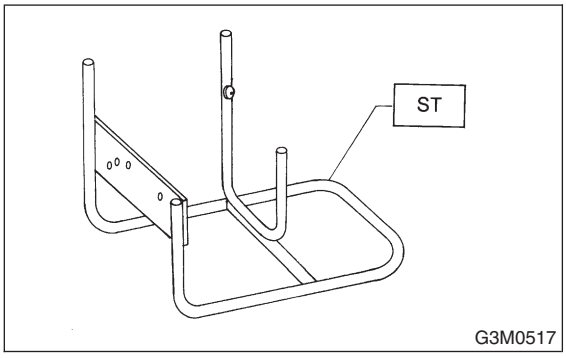
1) Clean oil, grease, dirt and dust from transmission.
2) Remove drain plug to drain oil. After draining, retighten it as before.

CAUTION:
Replace gasket with a new one.

Tightening torque:
44±3 N·m (4.5±0.3 kg-m, 32.5±2.2 ft-lb)



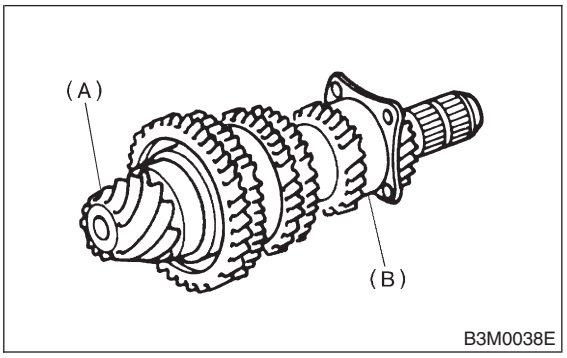
3) Attach transmission to ST.
ST 499937100 TRANSMISSION STAND SET



4) Rotating parts should be coated with oil prior to assembly.
5) All disassembled parts, if to be reused, should be reinstalled in the original positions and directions.
6) Gaskets, lock washers and lock nut must be replaced with new ones.
7) Liquid gasket should be used where specified to prevent leakage.

B: INSPECTION

Disassembled parts should be washed clean first and then inspected carefully.
1) Bearings
Replace bearings in the following cases:
● Bearings whose balls, outer races and inner races are broken or rusty.
● Worn bearings
● Bearings that fail to turn smoothly or make abnormal noise when turned after gear oil lubrication.
● The ball bearing on the rear side of the drive pinion shaft should be checked for smooth rotation before the drive pinion assembly is disassembled. In this case, because a preload is working on the bearing, its rotation feels like it is slightly dragging unlike the other bearings.

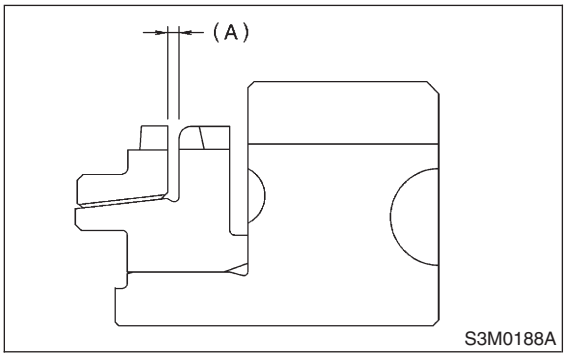


(A) Drive pinion shaft
(B) Ball bearing

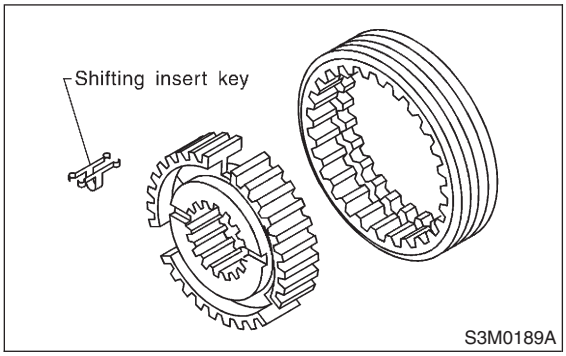
● Bearings having other defects
2) Bushing (each gear)
Replace the bushing in the following cases:
● When the sliding surface is damaged or abnormally worn.
● When the inner wall is abnormally worn.
3) Gears
● Replace gears with new ones if their tooth surfaces are broken, damaged, or excessively worn.
● Correct or replace if the cone that contacts the baulk ring is rough or damaged.
● Correct or replace if the inner surface or end face is damaged.
4) Baulk ring
Replace the ring in the following cases:
● When the inner surface and end face are damaged.

● When the ring inner surface is abnormally or partially worn down.
● If the gap between the end faces of the ring and the gear splined part is excessively small when the ring is pressed against the cone.

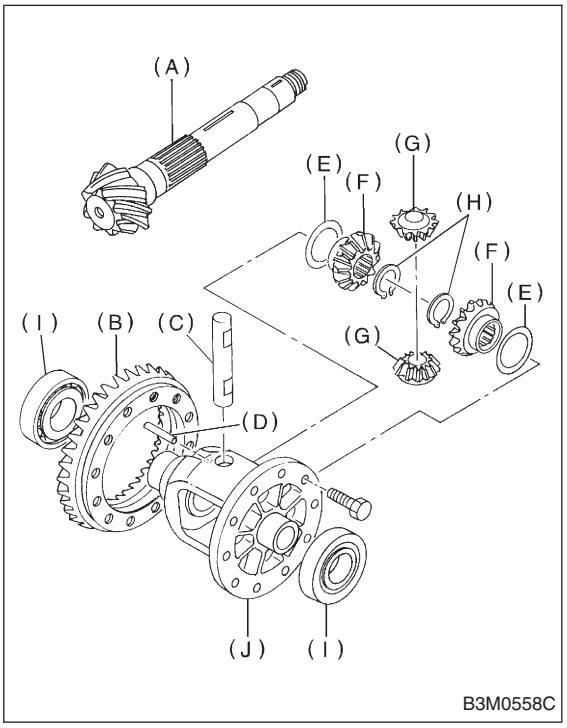
Clearance (A):
0.5 — 1.0 mm (0.020 — 0.040 in)



● When the contact surface of the synchronizer ring insert is scored or abnormally worn down.
5) Shifting insert key
Replace the insert if deformed, excessively worn, or defective in any way.



6) Oil seal
Replace the oil seal if the lip is deformed, hardened, damaged, worn, or defective in any way.
7) O-ring
Replace the O-ring if the sealing face is deformed, hardened, damaged, worn, or defective in any way.
8) Gearshift mechanism
Repair or replace the gearshift mechanism if excessively worn, bent, or defective in any way.
9) Differential gear
Repair or replace the differential gear in the following cases:
● The hypoid drive gear and drive pinion shaft tooth surface are damaged, excessively worn, or seized.
● The roller bearing on the drive pinion shaft has a worn or damaged roller path.
● There is damage, wear, or seizure of the differential bevel pinion, differential bevel gear, washer, pinion shaft, and straight pin.
● The differential case has worn or damaged sliding surfaces.

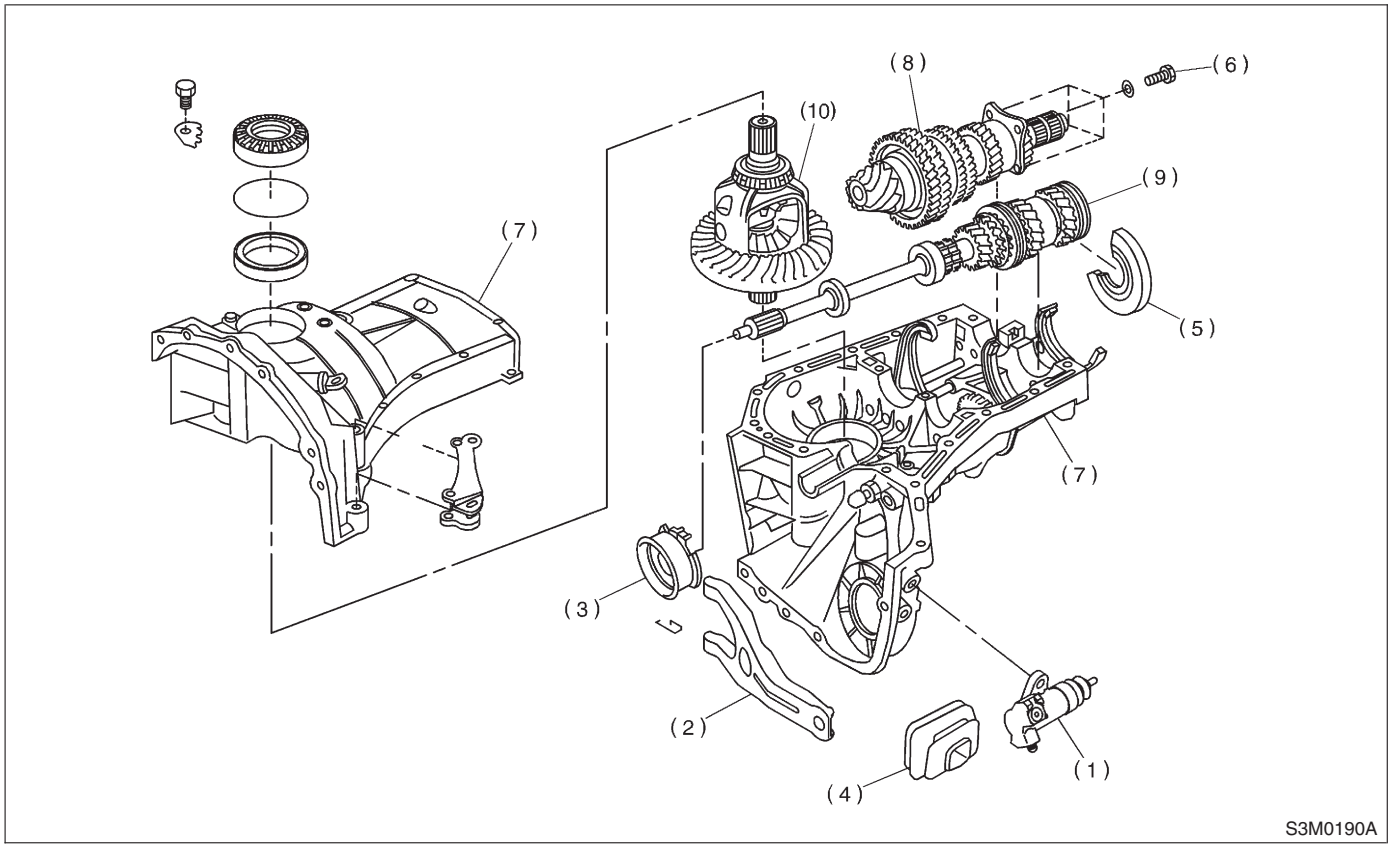


(A) Drive pinion shaft
(B) Hypoid driven gear
(C) Pinion shaft
(D) Straight pin
(E) Washer
(F) Differential bevel gear
(G) Differential bevel pinion
(H) Snap ring
(I) Roller bearing
(J) Differential case

2. Transmission Case

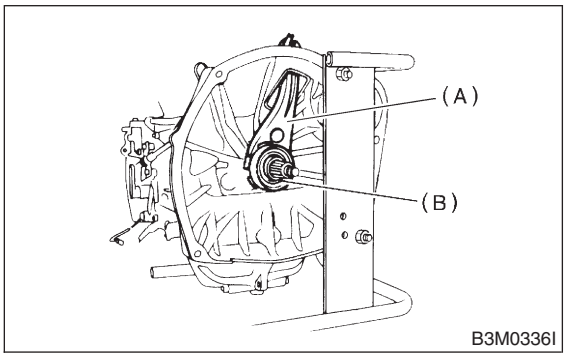
A: DISASSEMBLY

1. SEPARATION OF TRANSMISSION



(1) Operating cylinder
(2) Release lever
(3) Release bearing
(4) Release lever sealing
(5) Main shaft rear plate
(6) Bolt
(7) Transmission case
(8) Drive pinion ASSY
(9) Main shaft ASSY
(10) Front differential

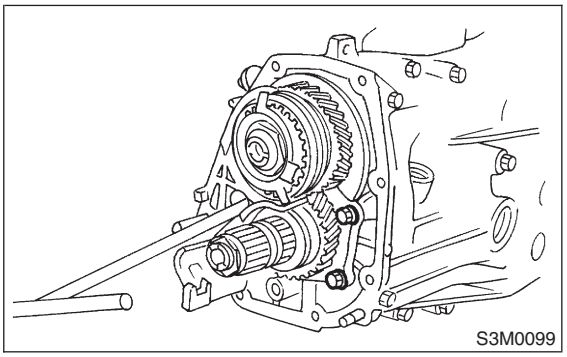
1) Remove clutch release lever. <Ref. to 2-10 [W3A0].>



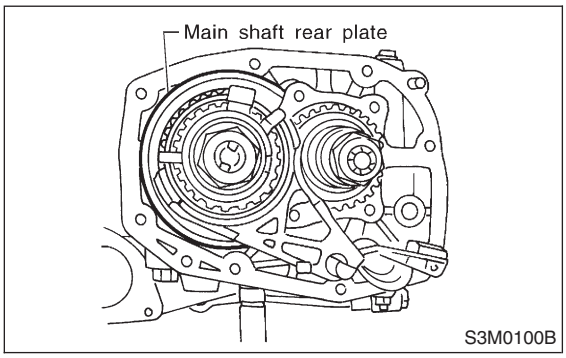
(A) Clutch release lever
(B) Release bearing

2) Remove transfer case assembly. <Ref. to 3-1 [W5A0].>

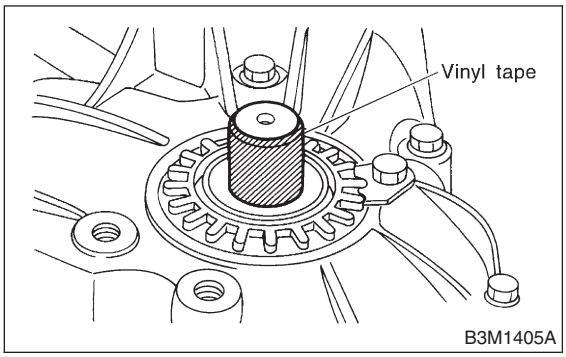
3) Remove bearing mounting bolts.



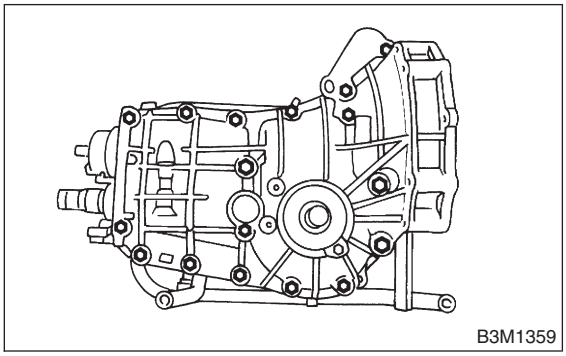
4) Remove main shaft rear plate.



5) Put vinyl tape around splines of right and left axle drive shafts to prevent damage to oil seals.

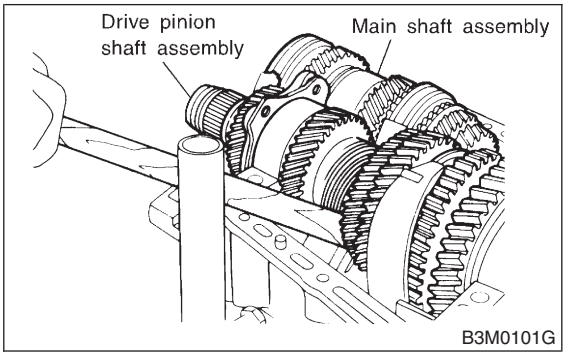


6) Separate transmission case into right and left cases by loosening seventeen coupling bolts and nuts.



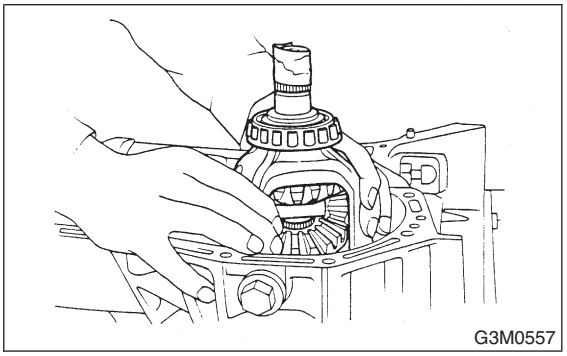
7) Remove drive pinion shaft assembly from left side transmission case.

NOTE:
Use a hammer handle, etc. to remove if too tight.

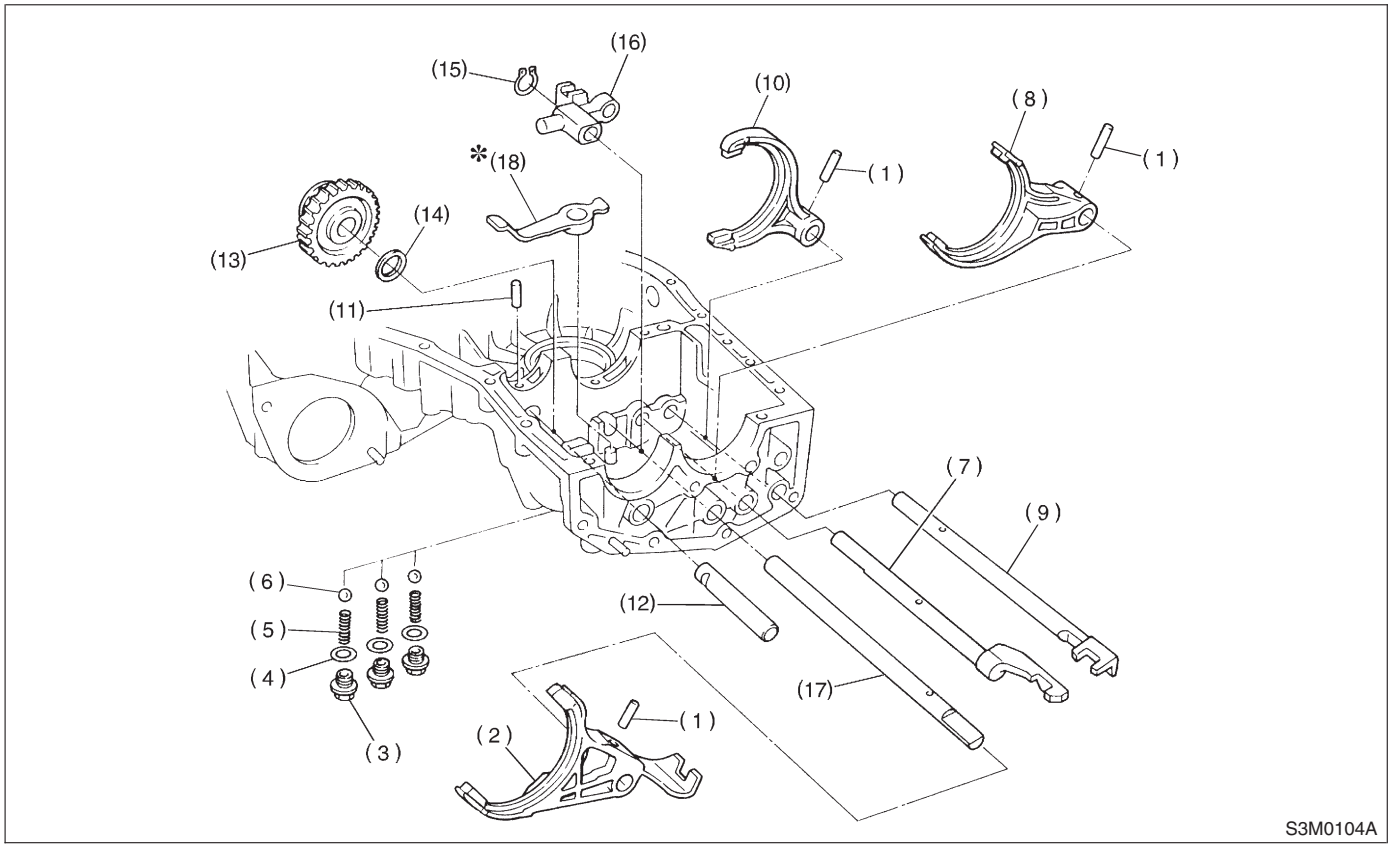


8) Remove main shaft assembly.
9) Remove differential assembly.

CAUTION:
- **Be careful not to confuse right and left roller bearing outer races.**
- **Be careful not to damage retainer oil seal.**

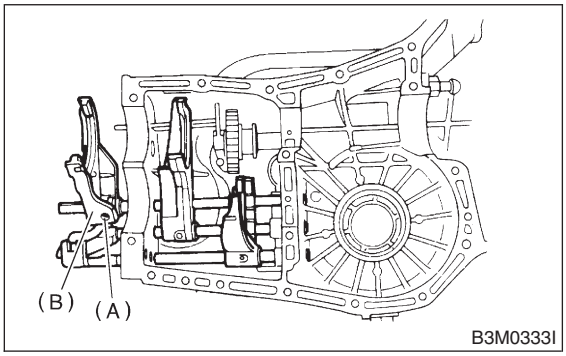


2. TRANSMISSION CASE



(1) Straight pin
(2) 5th shifter fork
(3) Checking ball plug
(4) Gasket
(5) Checking ball spring
(6) Ball
(7) 3rd-4th fork rod
(8) 3rd-4th shifter fork
(9) 1st-2nd fork rod
(10) 1st-2nd shifter fork
(11) Straight pin
(12) Reverse idler gear shaft
(13) Reverse idler gear
(14) Washer
(15) Snap ring
(16) Reverse fork rod arm
(17) Reverse fork rod
(18) Reverse shifter lever

1) Drive out straight pin with ST, and remove 5th shifter fork.
ST 398791700 STRAIGHT PIN REMOVER

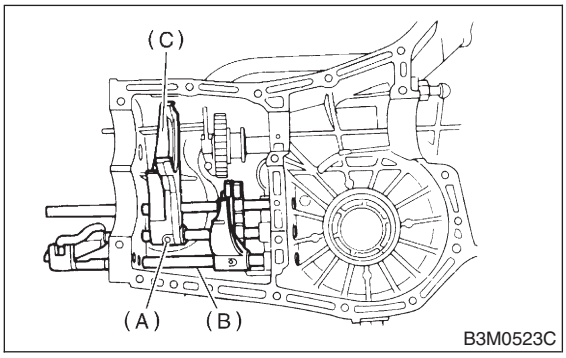


(A) Straight pin
(B) 5th shifter fork

2) Remove plugs, springs and checking balls.

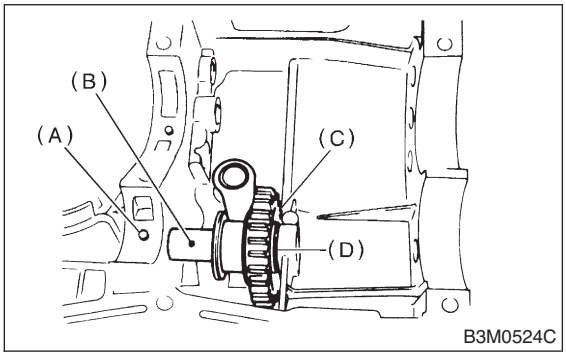
3) Drive out straight pin, and pull out 3-4 fork rod and shifter fork.

NOTE:
When removing rod, keep other rods in neutral. Also, when pulling out straight pin, remove it toward inside of case so that it may not hit against case.



(A) Straight pin
(B) 3-4 fork rod
(C) Shifter fork

4) Drive out straight pin, and pull out 1-2 fork rod and shifter fork.
5) Pull out straight pin, and remove idler gear shaft, reverse idler gear and washer.

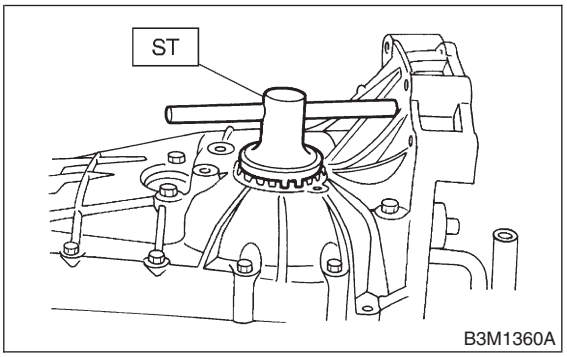


(A) Straight pin
(B) Idler gear shaft
(C) Idler gear
(D) Washer

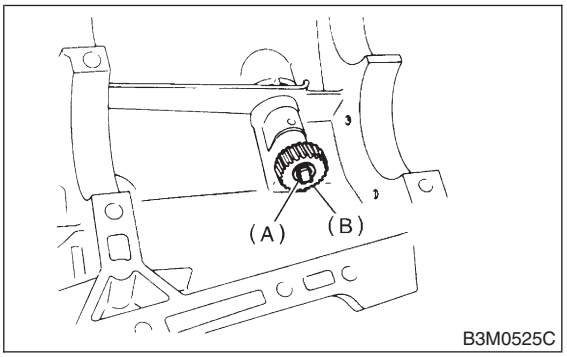
6) Remove outer snap ring, and pull out reverse shifter rod arm from reverse fork rod. Then take out ball, spring and interlock plunger from rod.
And then remove rod.

NOTE:
When pulling out reverse shifter rod arm, be careful not to let ball pop out of arm.

7) Remove reverse shifter lever.
8) Remove differential side retainers using ST.
ST 499787000 WRENCH ASSY



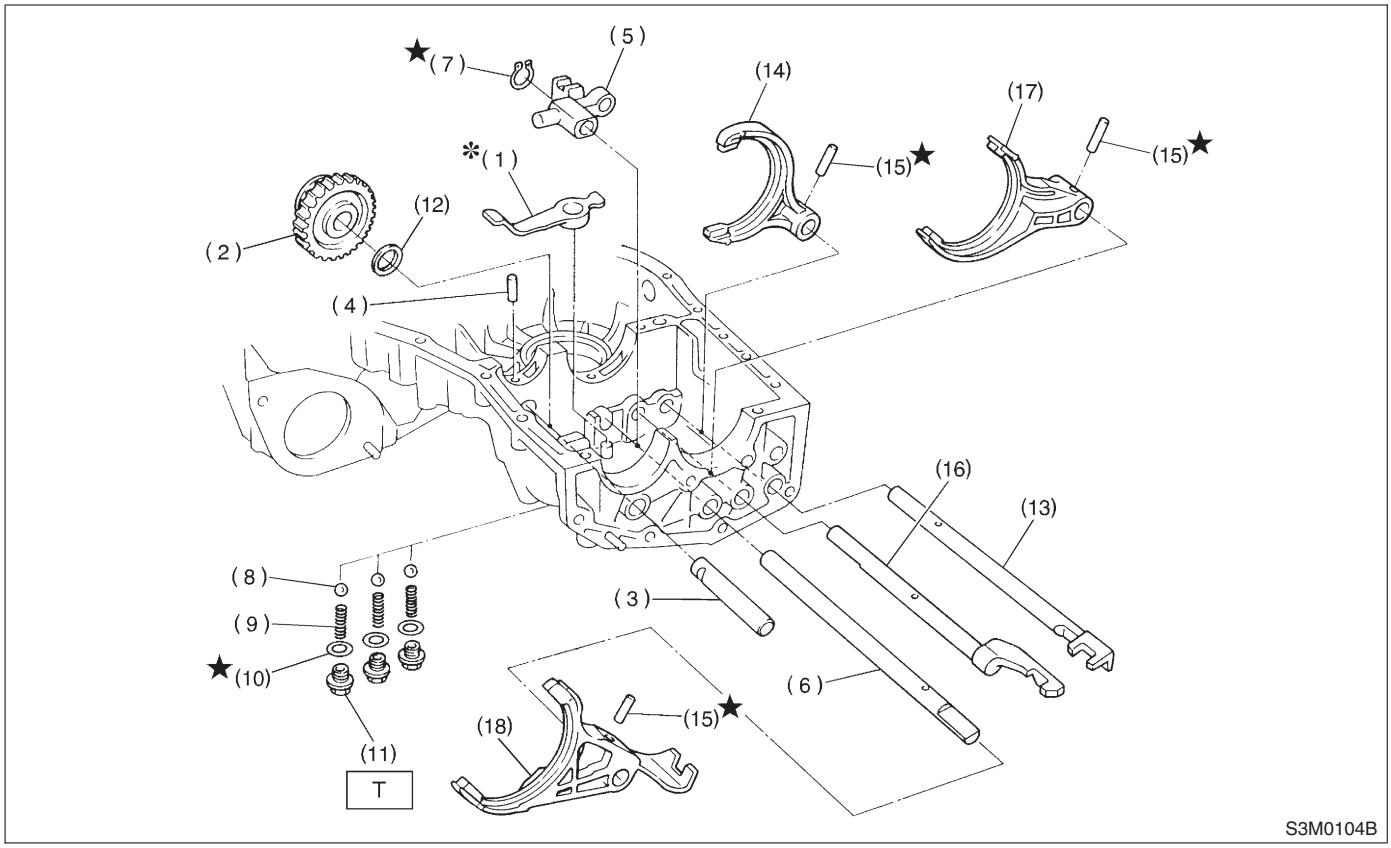
9) Remove outer snap ring and pull out speedometer driven gear. Next, remove vehicle speed sensor 2, oil seal, speedometer shaft and washer.



(A) Outer snap ring
(B) Speedometer driven gear

B: ASSEMBLY

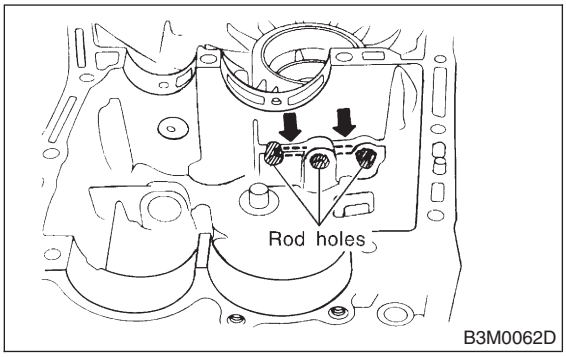
1. TRANSMISSION CASE



(1) Reverse shifter lever
(2) Reverse idler gear
(3) Reverse idler gear shaft
(4) Straight pin
(5) Reverse fork rod arm
(6) Reverse fork rod
(7) Snap ring
(8) Ball
(9) Checking ball spring
(10) Gasket
(11) Checking ball plug
(12) Washer
(13) 1st-2nd fork rod
(14) 1st-2nd shifter fork
(15) Straight pin
(16) 3rd-4th fork rod
(17) 3rd-4th shifter fork
(18) 5th shifter fork

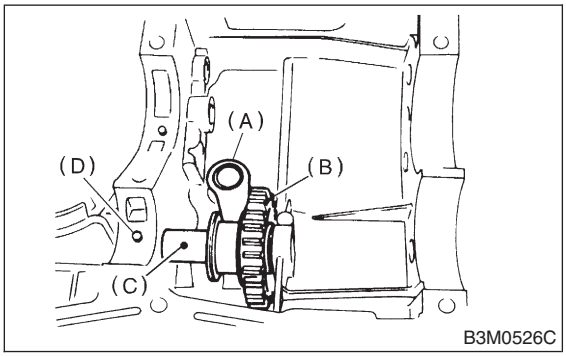
Tightening torque: N·m (kg-m, ft-lb)
T: 19.6±0.1
(2.00±0.015, 14.5±0.1)

1) Position interlock plungers (5.56 × 19.6), one plunger in hole between 1-2 and 3-4 fork rod holes, and one plunger in hole between 3-4 and reverse fork rod holes.



2) Install reverse shifter lever, reverse idler gear and reverse idler gear shaft, and secure with straight pin.

NOTE:
Be sure to install reverse idler shaft from the rear side.



(A) Reverse shifter lever
(B) Reverse idler gear
(C) Reverse idler gear shaft
(D) Straight pin

3) Install reverse arm fork spring, ball and interlock plunger (5.56 × 19.6) to reverse fork rod arm. Insert reverse fork rod into hole in reverse fork rod arm, and hold it with outer snap ring using ST.

CAUTION:
Apply grease to plunger to prevent it from falling.

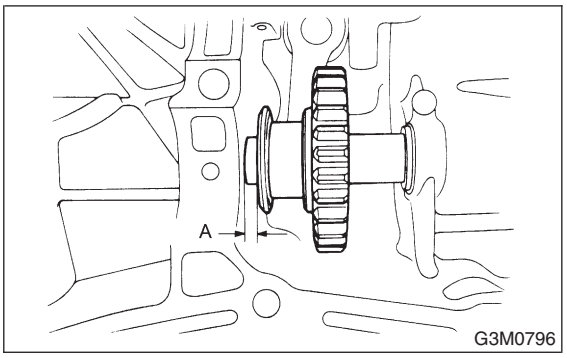
ST 399411700 ACCENT BALL INSTALLER

4) Position ball (7.1438), spring and gasket in reverse shifter rod hole, on left side transmission case, and tighten checking ball plug.

CAUTION:
Replace gasket with a new one.

5) Move reverse shifter rod toward REV side. Adjust clearance between reverse idler gear and transmission case wall, using reverse shifter lever.

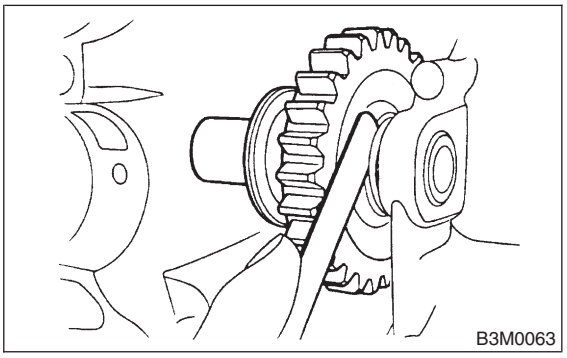
Clearance A:
6.0 — 7.5 mm (0.236 — 0.295 in)



Reverse shifter lever		
Part No.	No.	Remarks
32820AA070	7	Further from case wall
32820AA080	8	Standard
32820AA090	9	Closer to case wall

6) After installing a suitable reverse shifter lever, shift into neutral. Using a thickness gauge, measure clearance between reverse idler gear and transmission case wall and adjust with washer(s).

Clearance:
0 — 0.5 mm (0 — 0.020 in)



Washer (20.5 × 26 × t)	
Part No.	Thickness mm (in)
803020151	0.4 (0.016)
803020152	1.1 (0.043)
803020153	1.5 (0.059)
803020154	1.9 (0.075)
803020155	2.3 (0.091)

7) Install 1-2 fork rod into 1-2 shifter fork via the hole on the rear of transmission case.

8) Align the holes in rod and fork, and drive straight pin (6 × 22) into these holes using ST.
ST 398791700 STRAIGHT PIN REMOVER

CAUTION:
Replace straight pin with a new one.

NOTE:
- Set other rods to neutral.
- Make sure interlock plunger (5.56 × 19.6) is on the 3-4 fork rod side.

9) Install interlock plunger (3 × 11.9) onto 3-4 fork rod.

CAUTION:
Apply a coat of grease to plunger to prevent it from falling.

10) Install 3-4 fork rod into 3-4 shifter fork via the hole on the rear of transmission case.
11) Align the holes in rod and fork, and drive straight pin (6 × 22) into these holes.
ST 398791700 STRAIGHT PIN REMOVER

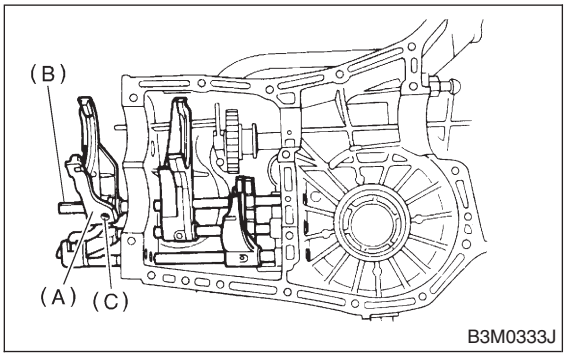
CAUTION:
Replace straight pin with a new one.

NOTE:
- Set reverse fork rod to neutral.
- Make sure interlock plunger (installed before) is on the reverse fork rod side.

12) Install 5th shifter fork onto the rear of reverse fork rod. Align holes in the two parts and drive straight pin into place.

CAUTION:
Replace straight pin with a new one.

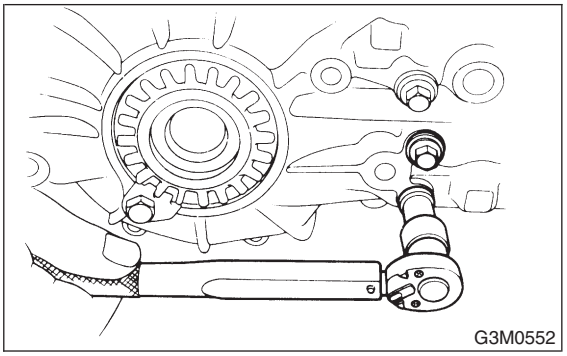
ST 398791700 STRAIGHT PIN REMOVER



(A) 5th shifter fork
(B) Reverse fork rod
(C) Straight pin

13) Position balls, checking ball springs and gaskets into 3-4 and 1-2 rod holes, and install plugs.

CAUTION:
Replace gasket with a new one.



14) Install washer and speedometer shaft, and press fit oil seal with ST.

CAUTION:
Use new oil seal, if it has been removed.

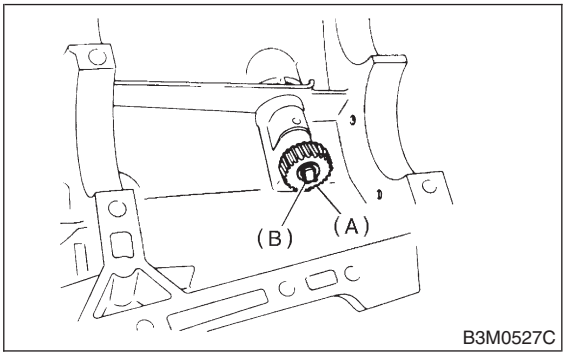
ST 899824100 or 499827000 PRESS
15) Install vehicle speed sensor 2.

CAUTION:
Use new vehicle speed sensor 2, if it has been removed.

Tightening torque:
5.9±1.5 N·m (0.6±0.15 kg-m, 4.3±1.1 ft-lb)

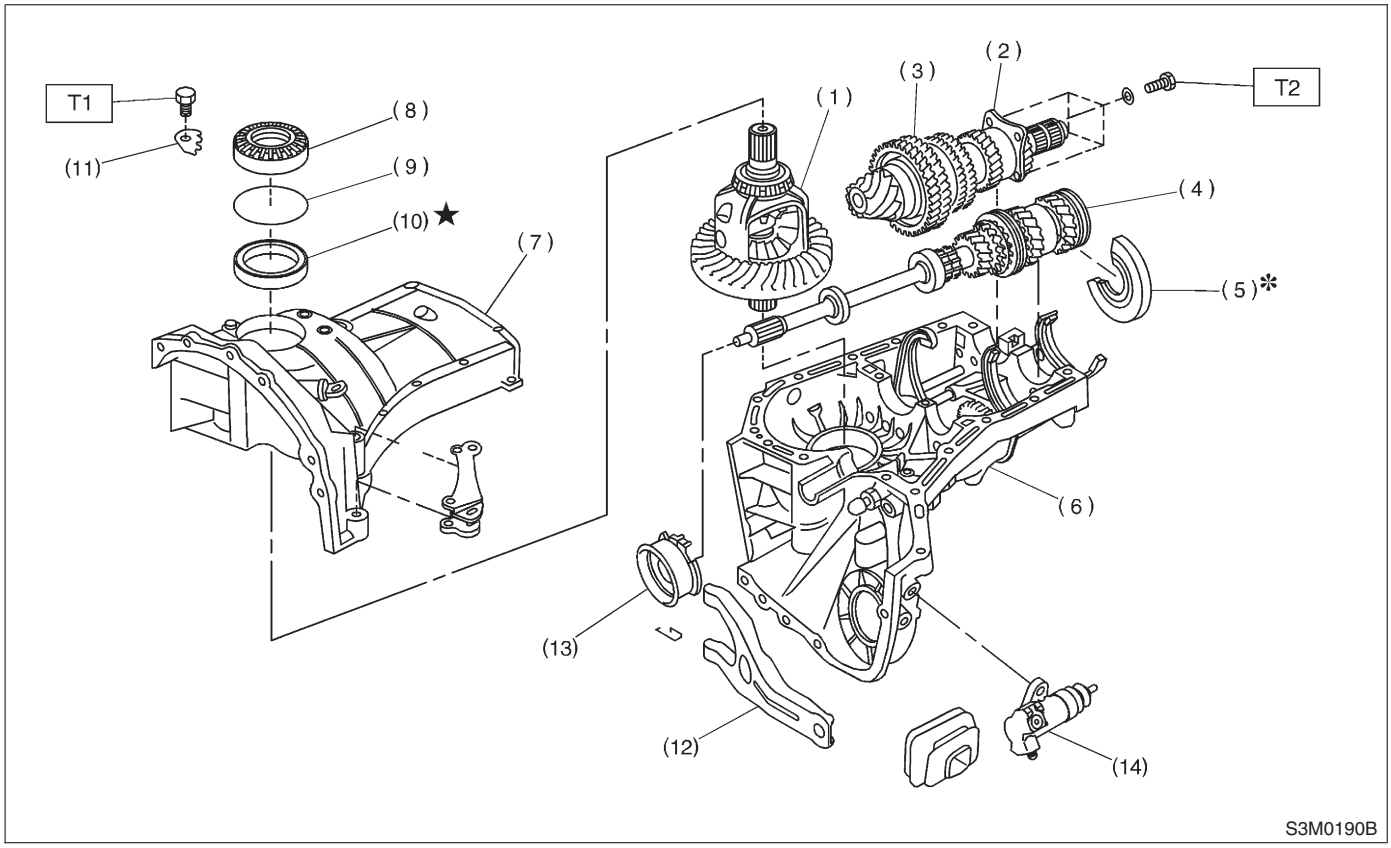
16) Install speedometer driven gear and snap ring.

CAUTION:
Use a new snap ring, if it has been removed.



(A) Speedometer driven gear
(B) Snap ring

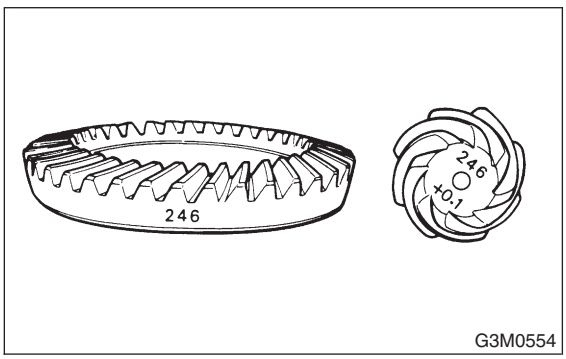
2. COMBINATION OF TRANSMISSION CASE



(1) Differential ASSY
(2) Drive pinion shim
(3) Drive pinion ASSY
(4) Main shaft ASSY
(5) Main shaft rear plate
(6) Transmission case (LH)
(7) Transmission case (RH)
(8) Differential side retainer
(9) O-ring
(10) Oil seal
(11) Retainer lock plate
(12) Clutch release lever
(13) Clutch release bearing
(14) Operating cylinder

Tightening torque: N·m (kg-m, ft-lb)
T1: 25 (2.5, 18)
T2: 29±3 (3.0±0.3, 21.7±2.2)

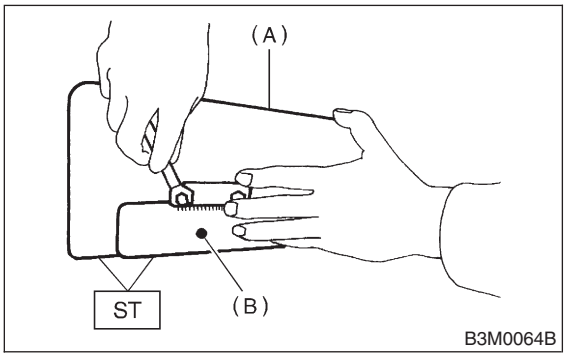
1) Alignment marks/numbers on hypoid gear set
The upper number on driven pinion is the match number for combining it with hypoid driven gear. The lower number is for shim adjustment. If no lower number is shown, the value is zero. The number on hypoid driven gear indicates a number for combination with drive pinion.



2) Place drive pinion shaft assembly on right hand transmission main case without shim and tighten bearing mounting bolts.

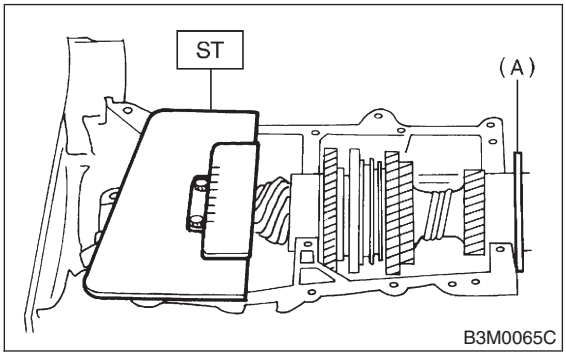
3) Inspection and adjustment of ST

NOTE:
● Loosen the two bolts and adjust so that the scale indicates 0.5 correctly when the plate end and the scale end are on the same level.
● Tighten the two bolts.
ST 499917500 DRIVE PINION GAUGE ASSY



(A) Plate
(B) Scale

4) Position the ST by inserting the knock pin of ST into the knock hole in the transmission case.
ST 499917500 DRIVE PINION GAUGE ASSY
5) Slide the drive pinion gauge scale with finger tip and read the value at the point where it matches with the end face of drive pinion.
ST 499917500 DRIVE PINION GAUGE ASSY



(A) Adjust clearance to zero without shim.

6) The thickness of shim shall be determined by adding the value indicated on drive pinion to the value indicated on the ST. (Add if the number on drive pinion is prefixed by + and subtract if the number is prefixed by –.)
ST 499917500 DRIVE PINION GAUGE ASSY

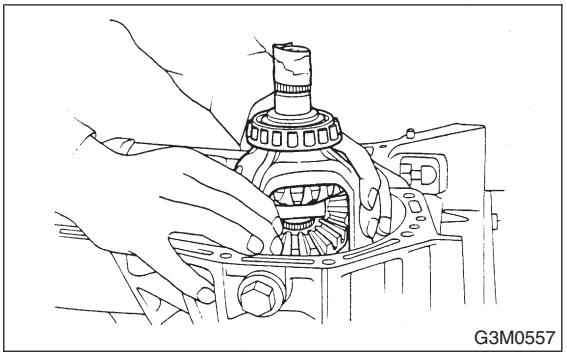
7) Select one to three shims from the next table for the value determined as described above and take a shim thickness which is closest to the said value.

Drive pinion shim	
Part No.	Thickness mm (in)
32295AA031	0.150 (0.0059)
32295AA041	0.175 (0.0069)
32295AA051	0.200 (0.0079)
32295AA061	0.225 (0.0089)
32295AA071	0.250 (0.0098)
32295AA081	0.275 (0.0108)
32295AA091	0.300 (0.0118)
32295AA101	0.500 (0.0197)

8) Install differential assembly on left hand transmission case.

CAUTION:
Be careful not to fold the sealing lip of oil seal.

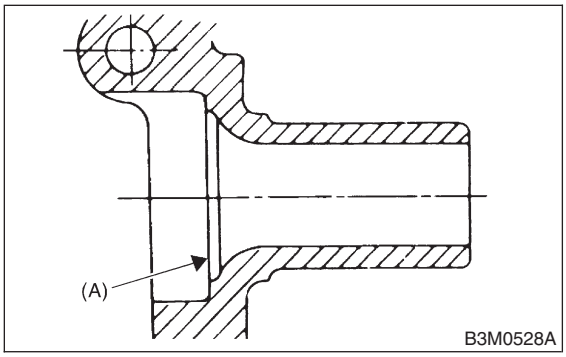
NOTE:
Wrap the left and right splined sections of axle shaft with vinyl tape to prevent scratches.



9) Install needle bearing and oil seal onto the front of transmission main shaft assembly, and position in left side transmission case.

CAUTION:
● Wrap clutch splined section with vinyl tape to prevent damage to oil seal.
● Apply grease (Unilube #2 or equivalent) to the sealing lip of oil seal.
● Use a new oil seal.

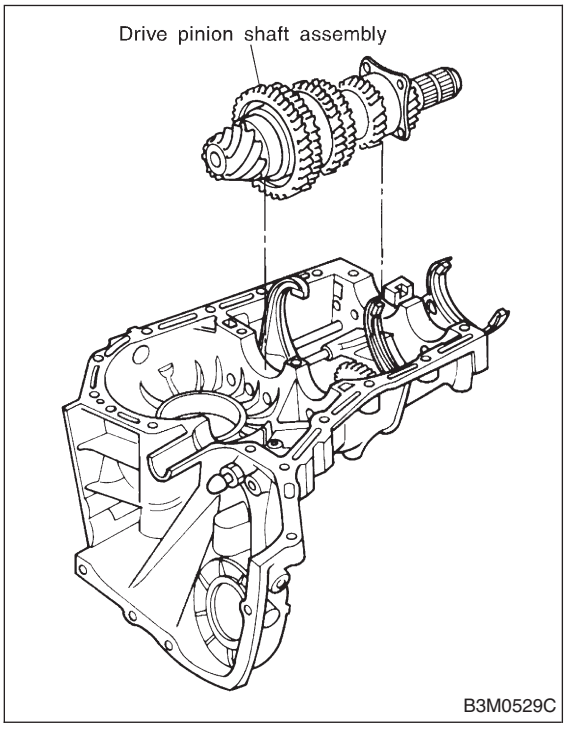
NOTE:
● Align the end face of seal with surface A of left side transmission main case when installing oil seal.



● Be careful not to drop oil seal when installing right side transmission main case.
● Make sure straight pin is positioned in hole in needle bearing's outer race.

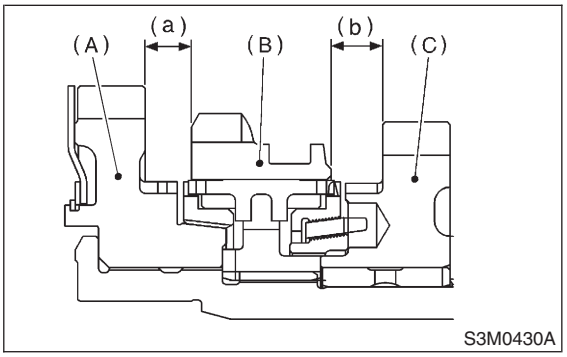
10) Install drive pinion shaft assembly with shims selected before into transmission case.

NOTE:
Ensure that the knock pin of the case is fitted into the hole in the bearing outer race.



11) Set transmission main shaft assembly and drive pinion shaft assembly in position (so there is no clearance between the two when moved all the way to the front). Select suitable 1st-2nd, 3rd-4th and 5th shifter fork so that coupling sleeve and reverse driven gear are positioned in the center of their synchronizing mechanisms.

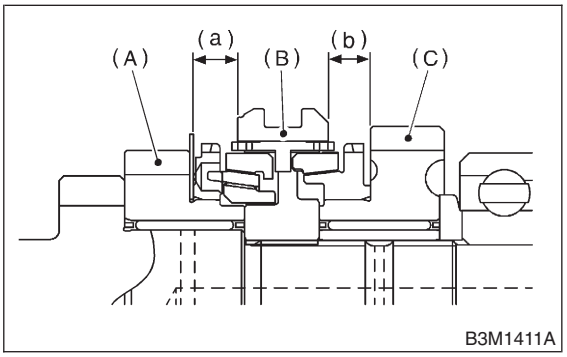
1st driven gear to reverse driven gear
Clearance (a): 9.5 mm (0.374 in)
Reverse driven gear to 2nd driven gear
Clearance (b): 9.5 mm (0.374 in)



(A) 1st driven gear
(B) Reverse drive gear
(C) 2nd drive gear

1st-2nd shifter fork		
Part No.	No.	Remarks
32804AA060	1	Approach to 1st gear by 0.2 mm (0.008 in)
32804AA070	No mark	Standard
32804AA080	3	Approach to 2nd gear by 0.2 mm (0.008 in)

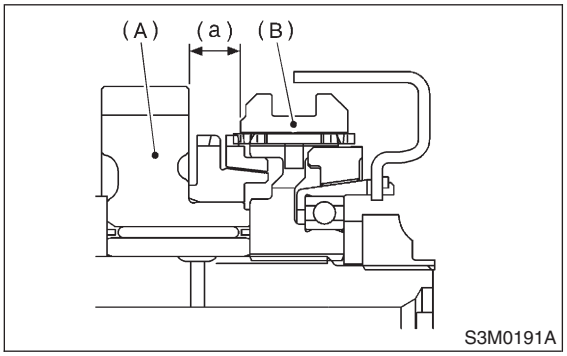
3rd-4th gear to coupling sleeve
Clearance (a): 9.3 mm (0.366 in)
Coupling sleeve to 4th driven gear
Clearance (b): 9.3 mm (0.366 in)



(A) 3rd drive gear
(B) Coupling sleeve
(C) 4th drive gear

3rd-4th shifter fork		
Part No.	No.	Remarks
32810AA061	1	Approach to 4th gear by 0.2 mm (0.008 in)
32810AA071	No mark	Standard
32810AA101	3	Approach to 3rd gear by 0.2 mm (0.008 in)

5th drive gear to coupling sleeve
Clearance (a): 9.3 mm (0.366 in)

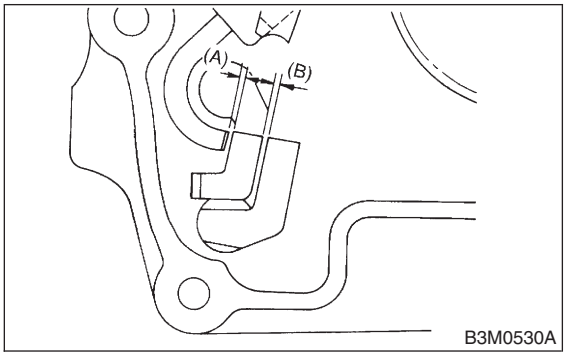


(A) 5th drive gear
(B) Coupling sleeve

5th shifter fork		
Part No.	No.	Remarks
32812AA201	7	Approach to 5th gear by 0.2 mm (0.008 in)
32812AA211	No mark	Standard
32812AA221	9	Become distant from 5th gear by 0.2 mm (0.008 in)

12) Measure rod end clearances (A) and (B). If any clearance is not within specifications, replace rod or fork as required.

(A): 1st-2nd to 3rd-4th	0.4 — 1.4 mm (0.016 — 0.055 in)
(B): 3rd-4th to 5th	0.5 — 1.3 mm (0.020 — 0.051 in)



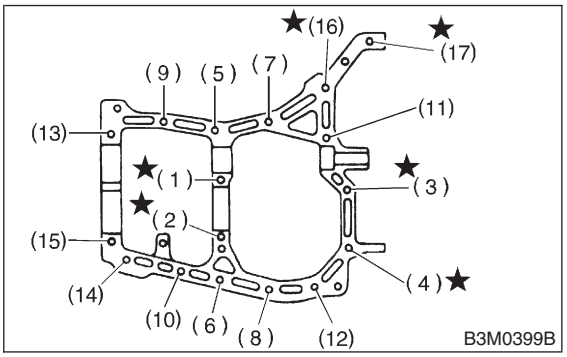
13) Wipe off grease, oil and dust on the mating surfaces of transmission cases with white gasoline, and apply liquid gasket, and then put case right side and left side together.

Liquid gasket:
THREE BOND 1215 or equivalent

14) Tighten 17 bolts with bracket, clip, etc. as shown in the figure.

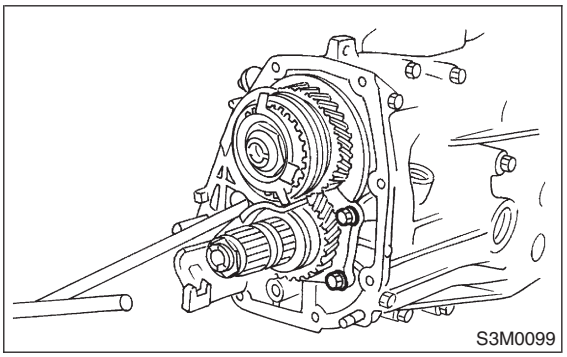
NOTE:
- Insert bolts from the bottom and tighten nuts at the top.
- Put cases together so that drive pinion shim and input shaft holder shim are not caught up in between.
- Confirm that speedometer gear is meshed.

Tightening torque:
8 mm bolt
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)
★ ***10 mm bolt***
39±3 N·m (4.0±0.3 kg-m, 28.9±2.2 ft-lb)



15) Tighten ball bearing attachment bolts.

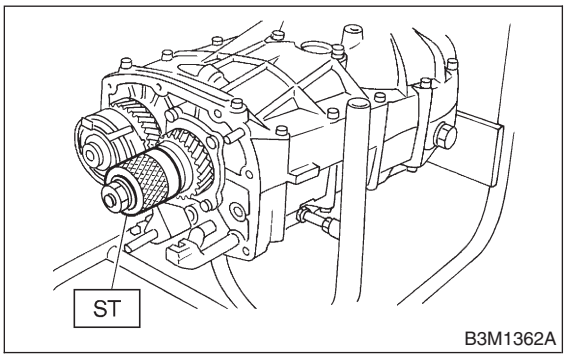
Tightening torque:
29±3 N·m (3.0±0.3 kg-m, 21.7±2.2 ft-lb)



16) Backlash adjustment of hypoid gear and preload adjustment of roller bearing

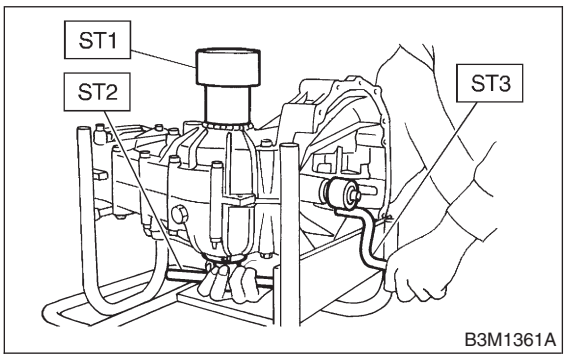
NOTE:
Support drive pinion assembly with ST.

ST 498427100 STOPPER



17) Place the transmission with case left side facing downward and put ST1 on bearing cup.
18) Screw retainer assembly into left case from the bottom with ST2. Fit ST3 on the transmission main shaft. Shift gear into 4th or 5th and turn the shaft several times. Screw in the retainer while turning ST3 until a slight resistance is felt on ST2. This is the contact point of hypoid gear and drive pinion shaft. Repeat the above sequence several times to ensure the contact point.

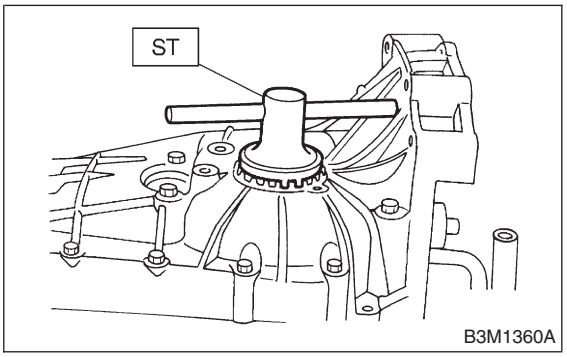
ST1 399780104 WEIGHT
ST2 499787000 WRENCH ASSY
ST3 499927100 HANDLE



19) Remove weight and screw in retainer without O-ring on the upper side and stop at the point where slight resistance is felt.

NOTE:
At this point, the backlash between the hypoid gear and drive pinion shaft is zero.

ST 499787000 WRENCH ASSY



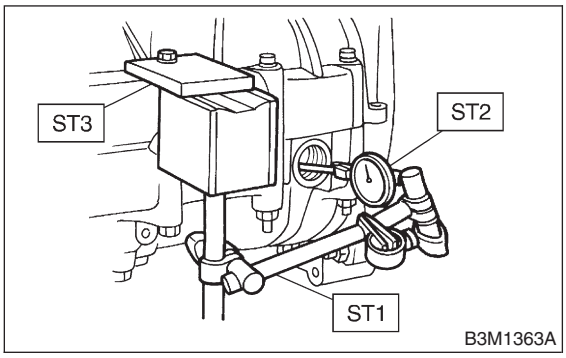
20) Fit lock plate. Loosen the retainer on the lower side by 1-1/2 notches of lock plate and turn in the retainer on the upper side by the same amount in order to obtain the backlash.

NOTE:
The notch on the lock plate moves by 1/2 notch if the plate is turned upside down.

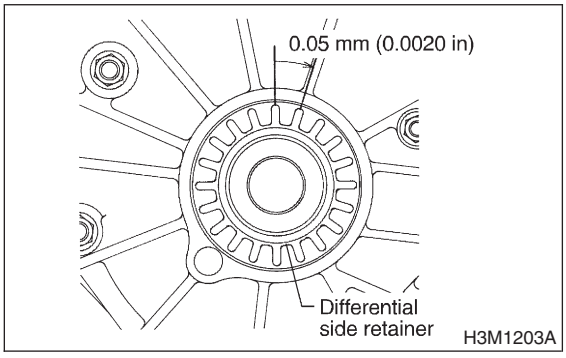
21) Turn in the retainer on the upper side additionally by 1 notch in order to apply preload on taper roller bearing.
22) Tighten temporarily both the upper and lower lock plates and mark both holder and lock plate for later readjustment.
23) Turn transmission main shaft several times while tapping around retainer lightly with plastic hammer.

24) Set ST1 and ST2. Insert the needle through transmission oil drain plug hole so that the needle comes in contact with the tooth surface at a right angle and check the backlash.
ST1 498247001 MAGNET BASE
ST2 498247100 DIAL GAUGE
ST3 498255400 PLATE

Backlash:
0.13 — 0.18 mm (0.0051 — 0.0071 in)

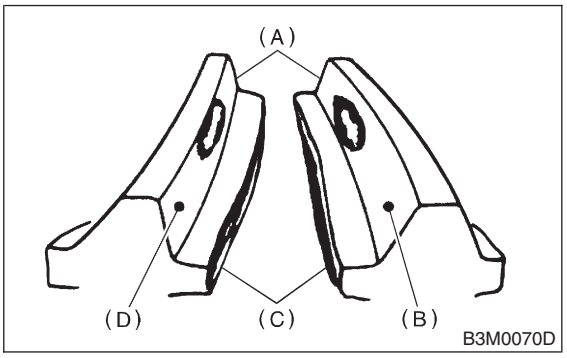


NOTE:
● If backlash is outside specified range, adjust it by turning holder in right side case.
● Each time holder rotates one tooth, backlash changes by 0.05 mm (0.0020 in).



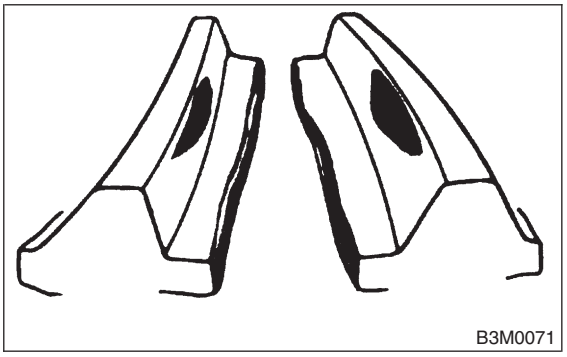
25) Check tooth contact of hypoid gear as follows: Apply a uniform thin coat of red lead on both tooth surfaces of 3 or 4 teeth of the hypoid gear. Move the hypoid gear back and forth by turning the transmission main shaft until a definite contact pattern is developed on hypoid gear, and judge whether face contact is correct. If it is incorrect, make the following correction.

● Tooth contact is correct.

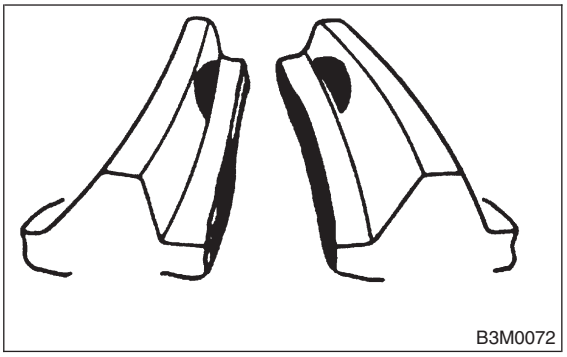


(A) Toe
(B) Coast side
(C) Heel
(D) Drive side

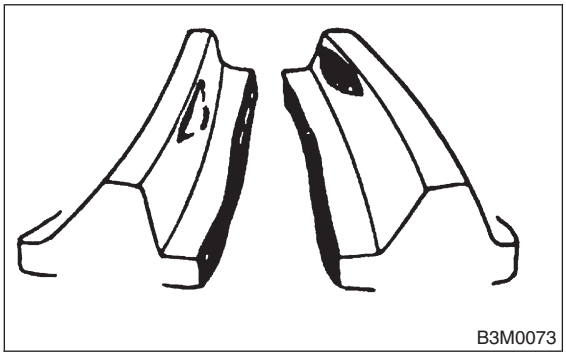
● Backlash is excessive.
To reduce backlash, loosen holder on the upper side (case right side) and turn in the holder on the lower side (case left side) by the same amount.



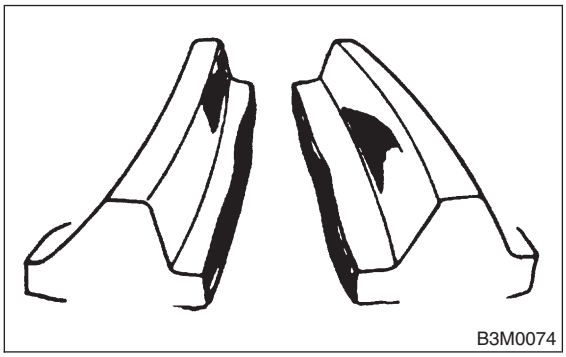
● Backlash is insufficient.
To increase backlash, loosen holder on the lower side (case left side) and turn in the holder on the upper side (case right side) by the same amount.



● The drive pinion shim selected before is too thick. Reduce its thickness.


B3M0073

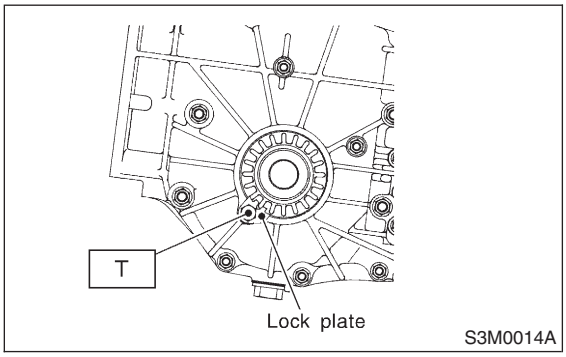
● The drive pinion shim selected before is too thin. Increase its thickness.


B3M0074

26) After checking the tooth contact of hypoid gears, remove the lock plate. Then loosen retainer until the O-ring groove appears. Fit O-ring into the groove and tighten retainer into the position where retainer has been tightened in.
Tighten lock plate.

NOTE:
Carry out this job on both upper and lower retainers.

Tightening torque:
T: 25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)



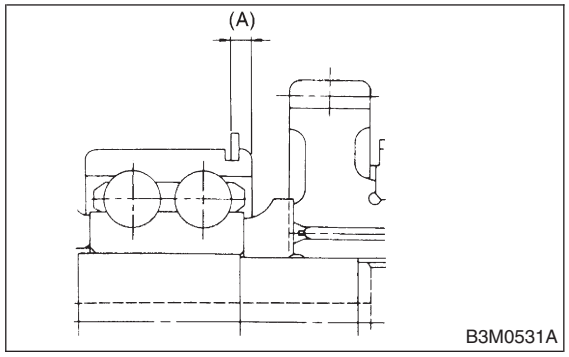
S3M0014A

27) Selecting of main shaft rear plate
Using ST, measure the amount (A) of ball bearing protrusion from transmission main case surface and select the proper plate in the following table:

NOTE:
Before measuring, tap the end of main shaft with a plastic hammer lightly in order to make the clearance zero between the main case surface and the moving flange of bearing.

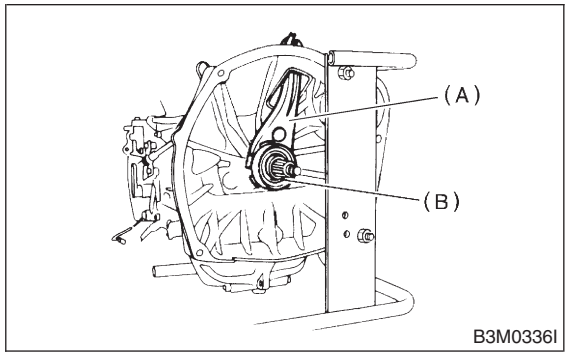
ST 498147000 DEPTH GAUGE

Dimension (A) mm (in)	Part No.	Mark
4.00 — 4.13 (0.1575 — 0.1626)	32294AA041	1
3.87 — 3.99 (0.1524 — 0.1571)	32294AA051	2



B3M0531A

28) Install clutch release lever and bearing. <Ref. to 2-10 [W3C0].>



B3M0336I

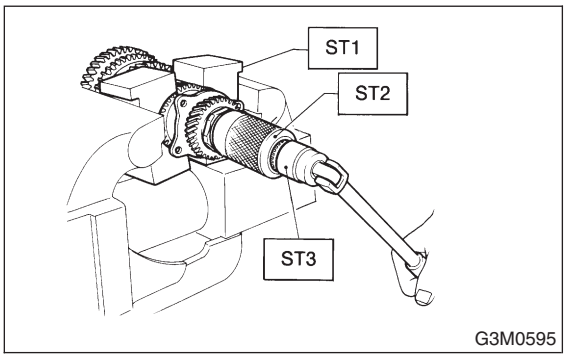
(A) Clutch release lever
(B) Release bearing

3. Drive Pinion Assembly

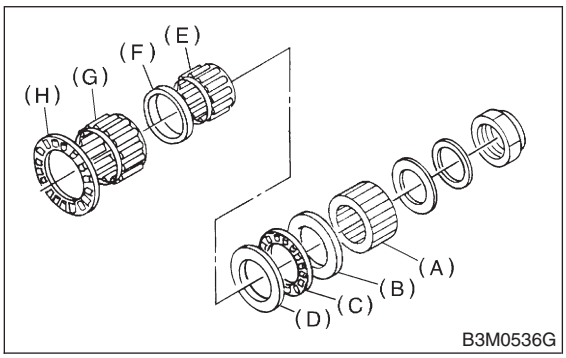
A: DISASSEMBLY

1. DRIVE PINION SHAFT

1) Straighten lock nut at staked portion. Remove the lock nut using ST1, ST2 and ST3.
ST1 899884100 HOLDER
ST2 498427100 STOPPER
ST3 899988608 SOCKET WRENCH



2) Withdraw drive pinion from driven shaft.
Remove differential bevel gear sleeve, adjusting washer No. 1, adjusting washer No. 2, thrust bearing, needle bearing, drive pinion collar, needle bearing and thrust bearing.

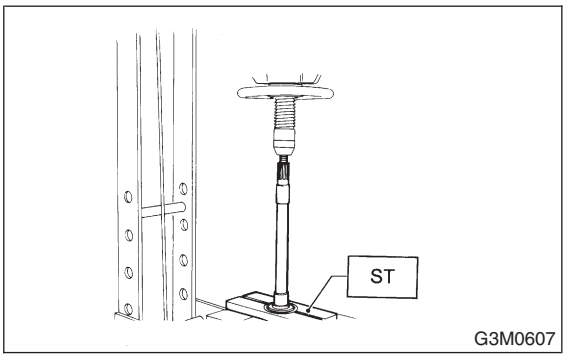


(A) Differential bevel gear sleeve
(B) Washer No. 1 (25 × 37.5 × t)
(C) Thrust bearing (25 × 37.5 × 3)
(D) Washer No. 2 (25 × 37.5 × 4)
(E) Needle bearing (25 × 30 × 20)
(F) Drive pinion collar
(G) Needle bearing (30 × 37 × 23)
(H) Thrust bearing (33 × 50 × 3)

3) Remove roller bearing and washer (33 × 50 × 5) using ST and press.

CAUTION:
Do not reuse roller bearing.

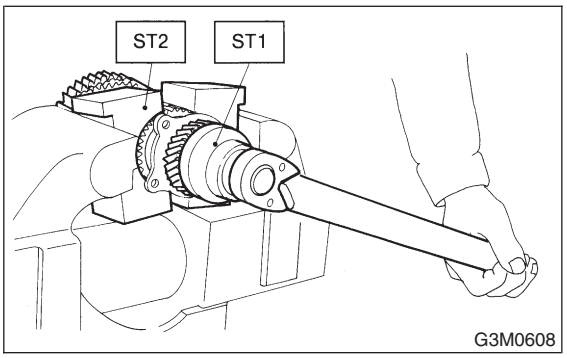
ST 498077000 REMOVER



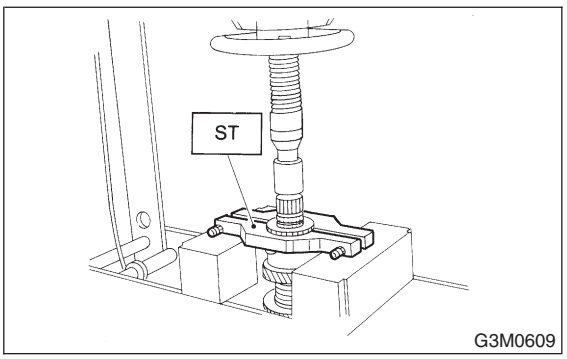
2. DRIVEN GEAR ASSEMBLY

CAUTION:
Attach a cloth to the end of driven shaft (on the frictional side of thrust needle bearing) during disassembly or reassembly to prevent damage.

1) Straighten lock nut at staked portion. Remove the lock nut using ST1 and ST2.
ST1 499987300 SOCKET WRENCH (50)
ST2 899884100 HOLDER

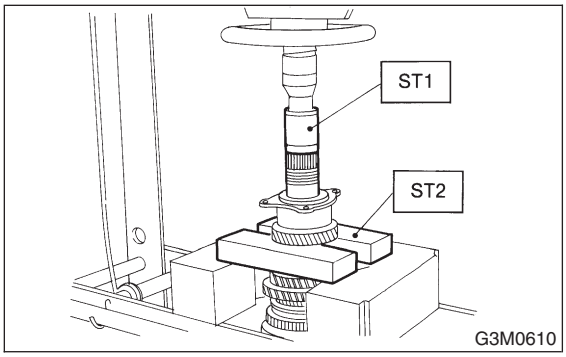


2) Remove 5th driven gear using ST.
ST 499857000 5TH DRIVEN GEAR REMOVER

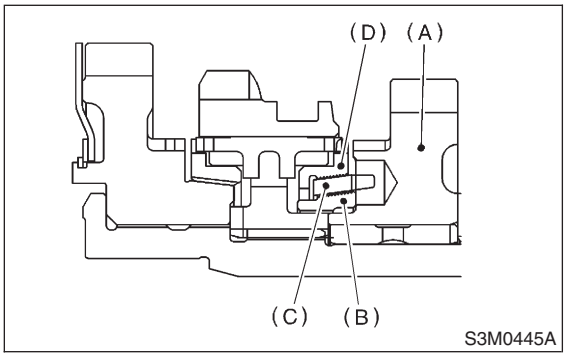


3) Remove woodruff key.

4) Remove roller bearing (42 × 74 × 40), 3rd-4th driven gear using ST1 and ST2.
ST1 499757002 SNAP RING PRESS
ST2 899714110 REMOVER



5) Remove the key.
6) Remove 2nd driven gear, inner baulk ring, synchro cone and outer baulk ring.

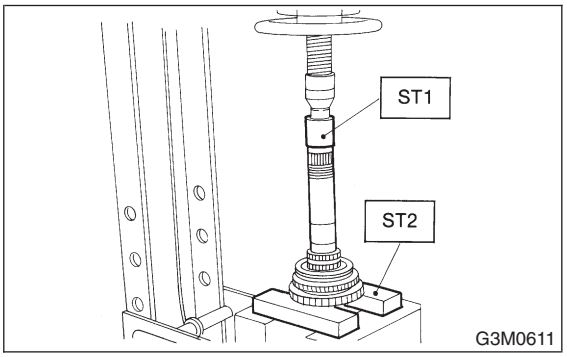


(A) 2nd driven gear
(B) Inner baulk ring
(C) Synchro cone
(D) Outer baulk ring

7) Remove 1st driven gear, 2nd gear bushing, gear and hub using ST1 and ST2.

NOTE:
Replace gear and hub if necessary. Do not attempt to disassemble if at all possible because they must engage at a specified point. If they have to be disassembled, mark the engaging point beforehand.

ST1 499757002 SNAP RING PRESS
ST2 899714110 REMOVER



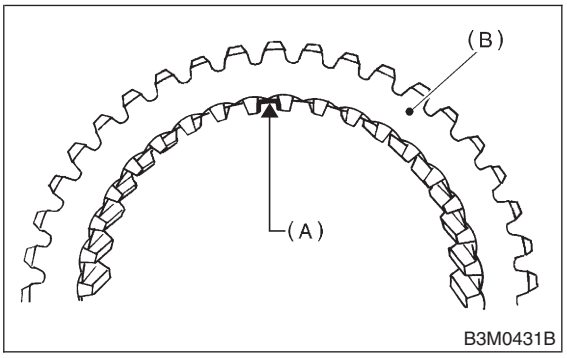
8) Remove sub gear for 1st driven gear.

B: ASSEMBLY

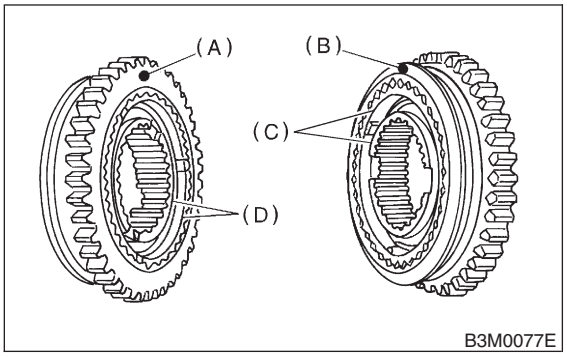
1. GEAR AND HUB ASSEMBLY

Assemble gear and hub assembly.

NOTE:
- Use new gear and hub assembly, if gear or hub have been replaced.
- Be sure the insert keys are correctly located in the insert key grooves inside the reverse driven gear.



(A) Key grooves
(B) Reverse driven gear



(A) 1st gear side
(B) 2nd gear side
(C) Flush surface
(D) Stepped surface

2. DRIVEN GEAR ASSEMBLY

1) Install sub gear to 1st driven gear.
2) Install 1st driven gear, 1st baulk ring, gear and hub assembly onto driven shaft.

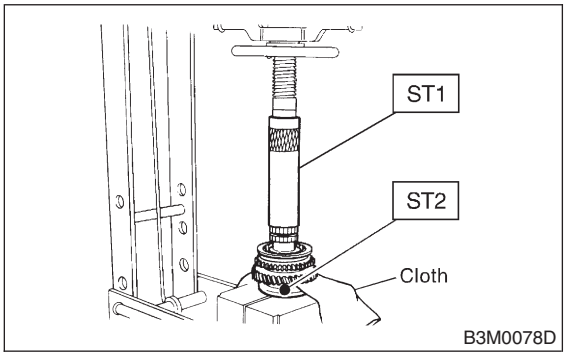
NOTE:
- Take care to install gear and hub assembly in proper direction.
- Align baulk ring and gear & hub assembly with key groove.

3) Install 2nd driven gear bushing onto driven shaft using ST1, ST2 and press.

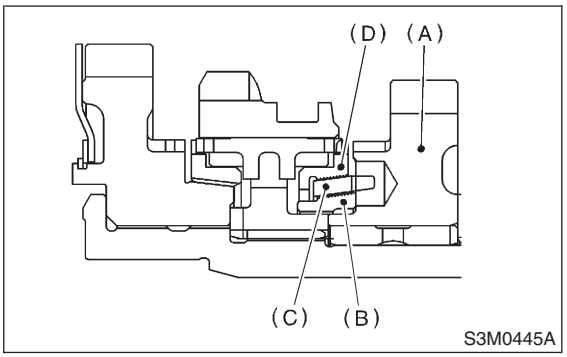
CAUTION:
- **Attach a cloth to the end of driven shaft to prevent damage.**
- **Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

NOTE:
When press fitting, align oil holes of shaft and bush.

ST1 499277200 INSTALLER
ST2 499587000 INSTALLER



4) Install 2nd driven gear, inner baulk ring, synchro cone, outer baulk ring and insert onto driven shaft.



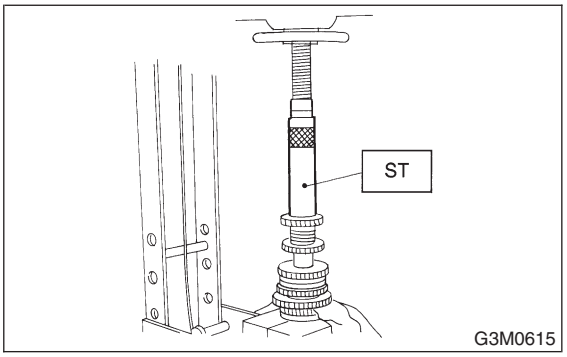
(A) 2nd driven gear
(B) Inner baulk ring
(C) Synchro cone
(D) Outer baulk ring

5) After installing key on driven shaft, install 3rd-4th driven gear using ST and press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

NOTE:
Align groove in baulk ring with insert.

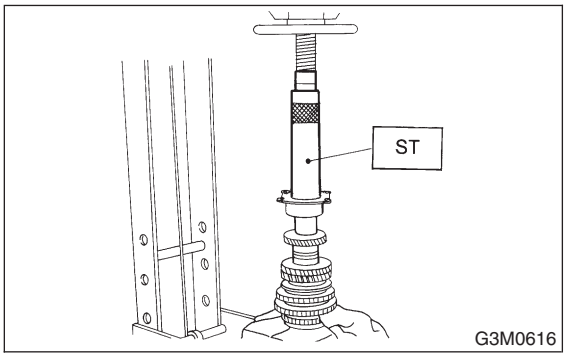
ST 499277200 INSTALLER



6) Install a set of roller bearings (42 × 74 × 40) onto the driven shaft using ST and press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

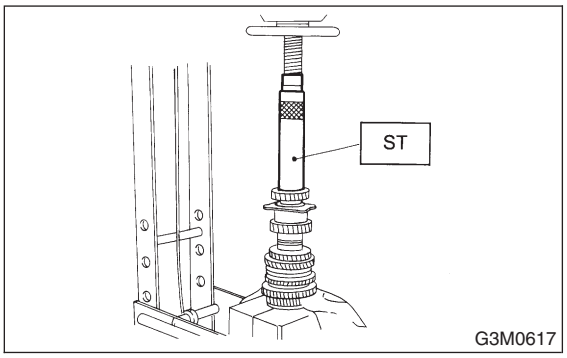
ST 499277200 INSTALLER



7) Position woodruff key in groove on the rear of driven shaft. Install 5th driven gear onto drive shaft using ST and press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

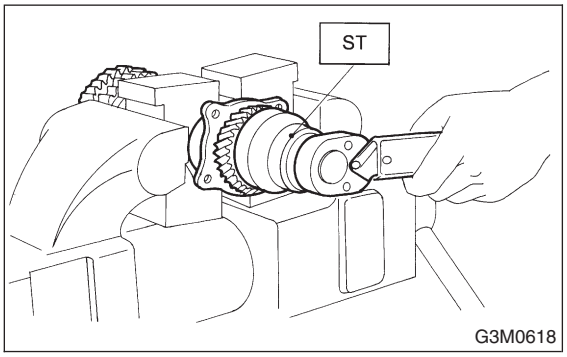
ST 499277200 INSTALLER



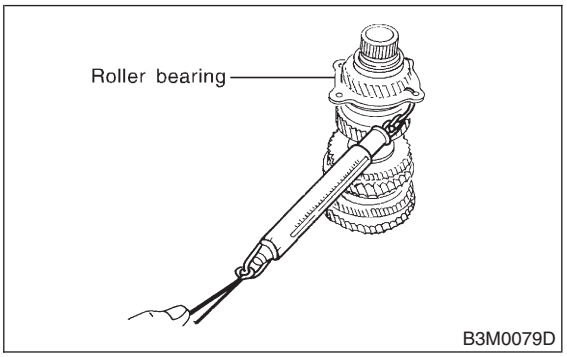
8) Install lock washer (42 × 53 × 2). Install lock nut (42 × 13) and tighten to the specified torque using ST.

ST 499987300 SOCKET WRENCH (50)

Tightening torque:
265±10 N·m (27±1 kg-m, 195±7 ft-lb)



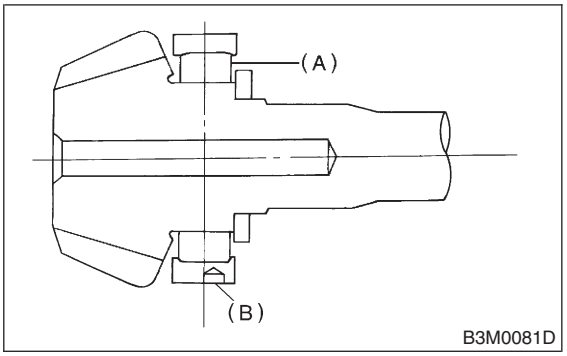
NOTE:
- Stake lock nut at two points.
- Using spring balancer, check that starting torque of roller bearing is 0.1 to 1.5 N·m (0.01 to 0.15 kg-m, 0.07 to 1.1 ft-lb).



3. DRIVE PINION SHAFT

1) Install roller bearing onto drive pinion.

NOTE:
When installing roller bearing, note its directions (front and rear) because knock pin hole in outer race is offset.

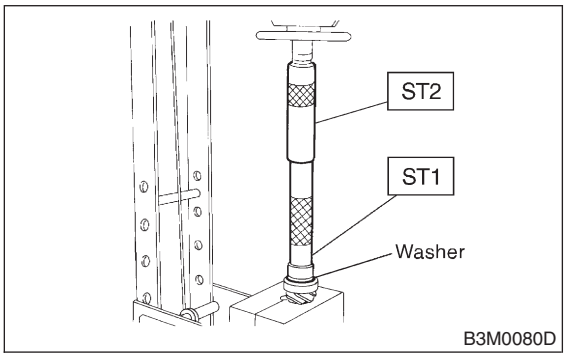


(A) Roller bearing
(B) Knock pin hole

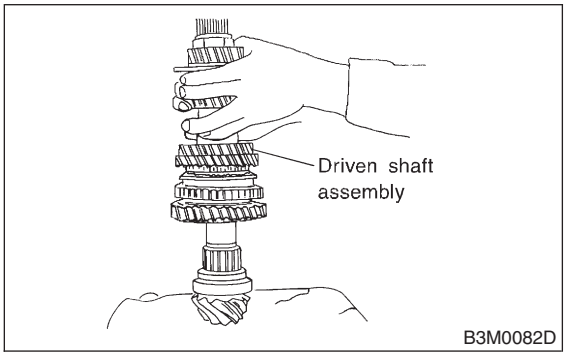
2) Install washer (33 × 50 × 5) using ST1, ST2 and press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

ST1 499277100 BUSH 1-2 INSTALLER
ST2 499277200 INSTALLER

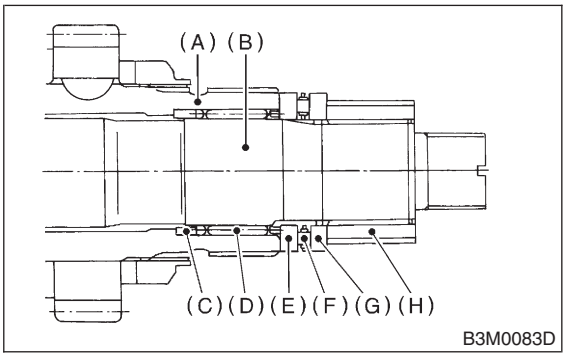


3) Install thrust bearing (33 × 50 × 3) and needle bearing (30 × 37 × 23). Install driven shaft assembly.



4) Install drive pinion collar, needle bearing, adjusting washer No. 2, thrust bearing, adjusting washer No. 1 and differential bevel gear sleeve in that order.

NOTE:
Be careful because spacer must be installed in proper direction.

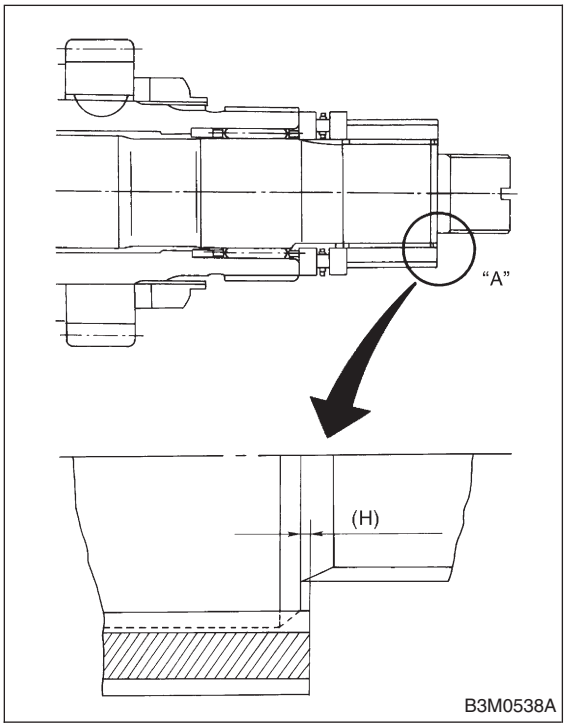


(A) Driven shaft
(B) Drive shaft
(C) Drive pinion collar
(D) Needle bearing (25 × 30 × 20)
(E) Washer No. 2 (25 × 36 × 4)
(F) Thrust bearing (25 × 37.5 × 3)
(G) Washer No. 1 (25 × 36 × t)
(H) Differential bevel gear sleeve

C: ADJUSTMENT

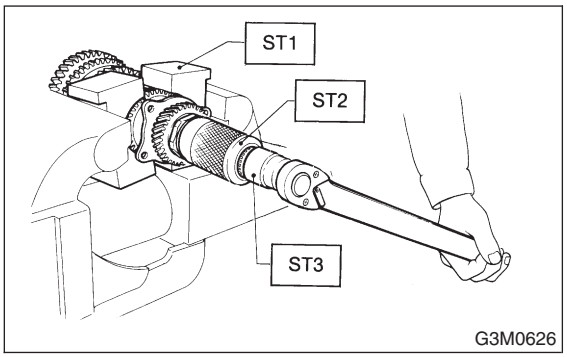
1. THRUST BEARING PRELOAD

1) After completing the preceding steps 1) through 3), select adjusting washer No. 1 so that dimension (H) is zero through visual check. Position washer (18.3 × 30 × 4) and lock washer (18 × 30 × 2) and install lock nut (18 × 13.5).



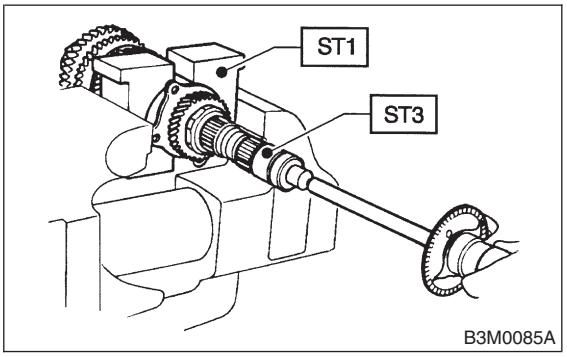
2) Using ST1, ST2 and ST3, tighten lock nut to the specified torque.
ST1 899884100 HOLDER
ST2 498427100 STOPPER
ST3 899988608 SOCKET WRENCH (27)

Tightening torque:
118±8 N·m (12±0.8 kg-m, 86.8±5.8 ft-lb)

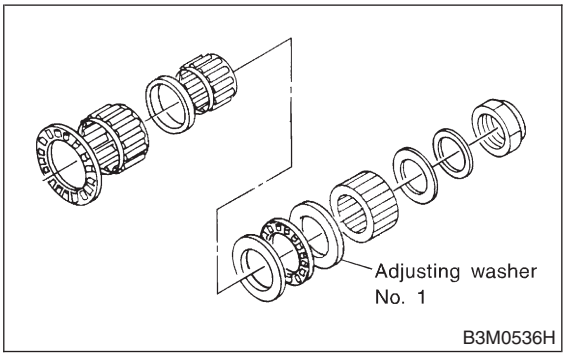


3) After removing ST2, measure starting torque using torque driver.
ST1 899884100 HOLDER
ST3 899988608 SOCKET WRENCH (27)

Starting torque:
54±25 N·m (5.5±2.5 kg-m, 40±18 ft-lb)

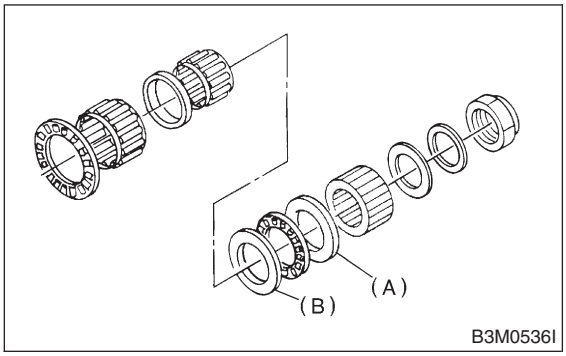


4) If starting torque is not within specified limit, select new adjusting washer No. 1 and recheck starting torque.



Adjusting washer No. 1	
Part No.	Thickness mm (in)
803025051	3.925 (0.1545)
803025052	3.950 (0.1555)
803025053	3.975 (0.1565)
803025054	4.000 (0.1575)
803025055	4.025 (0.1585)
803025056	4.050 (0.1594)
803025057	4.075 (0.1604)

5) If specified starting torque range cannot be obtained when a No. 1 adjusting washer is used, then select a suitable No. 2 adjusting washer from those listed in the following table. Repeat steps 1) through 4) to adjust starting torque.



(A) Adjusting washer No. 1
(B) Adjusting washer No. 2

Starting torque	Dimension H	Washer No. 2
Low	Small	Select thicker one.
High	Large	Select thinner one.

Adjusting washer No. 2	
Part No.	Thickness mm (in)
803025059	3.850 (0.1516)
803025054	4.000 (0.1575)
803025058	4.150 (0.1634)

6) Recheck that starting torque is within specified range, then clinch lock nut at four positions.

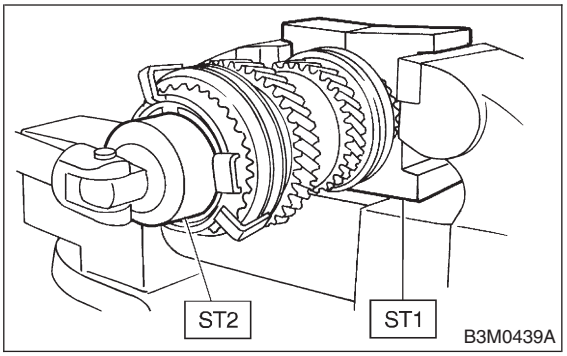
4. Main Shaft Assembly

A: DISASSEMBLY

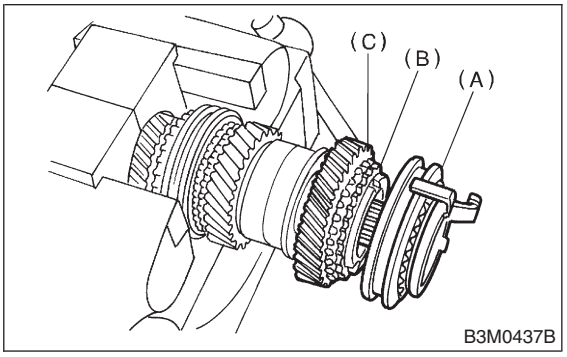
1) Put vinyl tape around main shaft splines to protect oil seal from damage. Then pull out oil seal and needle bearing by hand.
2) Remove lock nut from transmission main shaft assembly.

NOTE:
Remove caulking before taking off lock nut.

ST1 498937000 TRANSMISSION HOLDER
ST2 499987003 SOCKET WRENCH (35)

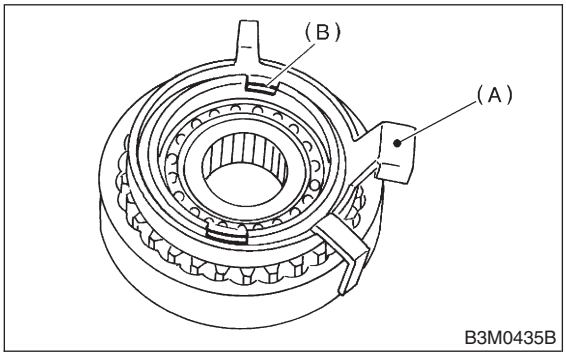


3) Remove 5th-Rev sleeve and hub assembly, baulk ring, 5th drive gear and needle bearing (32 × 36 × 25.7).



(A) 5th-Rev sleeve and hub ASSY
(B) Baulk ring
(C) 5th drive gear

4) Remove snap ring and synchro cone stopper from 5th-Rev sleeve and hub assembly.

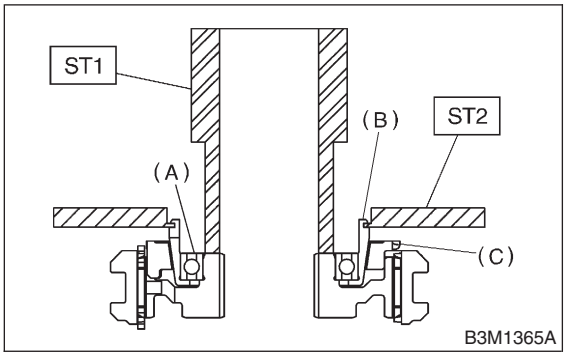


(A) Synchro cone stopper
(B) Snap ring

5) Using ST1, ST2 and a press, remove ball bearing, synchro cone and baulk ring (Rev).

NOTE:
● Replace sleeve and hub with new ones. Do not attempt to disassemble because they must engage at a specified point. If they should be disassembled, mark engagement point on splines beforehand.
● Do not reuse ball bearing.

ST1 499757002 SNAP RING PRESS
ST2 498077400 SYNCHRO CONE REMOVER

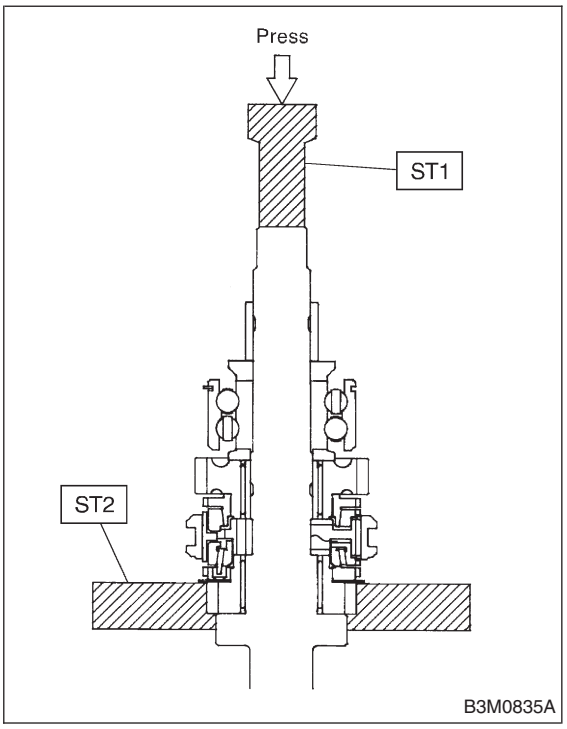


(A) Ball bearing
(B) Synchro cone
(C) Baulk ring

6) Using ST1 and ST2, remove the rest of parts.

NOTE:
Replace sleeve and hub with new ones. Do not attempt to disassemble because they must engage at a specified point. If they should be disassembled, marking engagement point on splines beforehand.

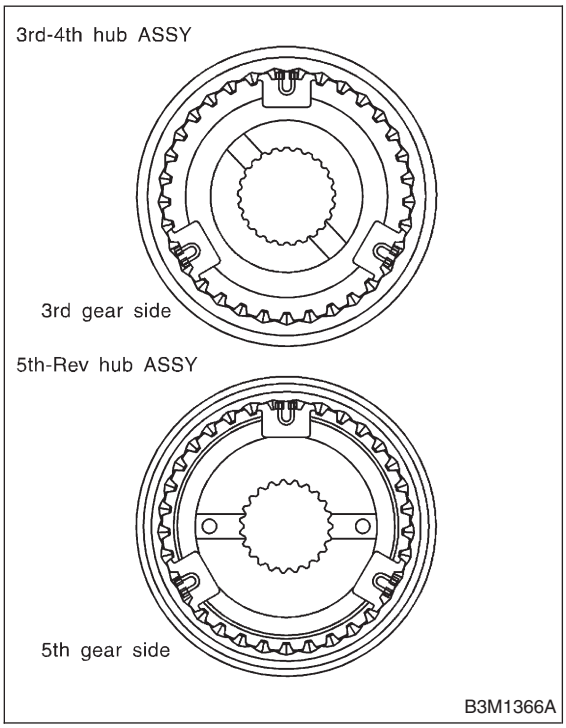
ST1 899864100 REMOVER
ST2 899714110 REMOVER



B: ASSEMBLY

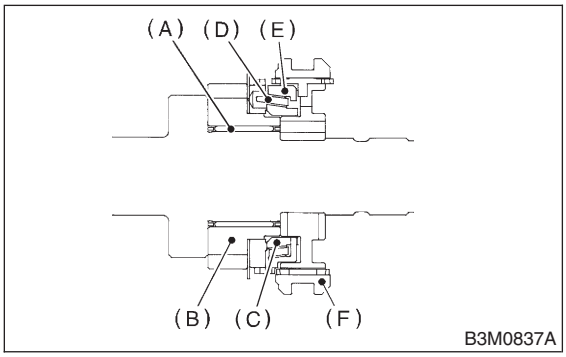
1) Assemble sleeve and hub assembly for 3rd-4th and, 5th synchronizing.

NOTE:
Position open ends of spring 120° apart.



2) Install 3rd drive gear, outer baulk ring, synchro cone, inner baulk ring, sleeve and hub assembly for 3rd needle bearing on transmission main shaft.

NOTE:
Align groove in baulk ring with shifting insert.

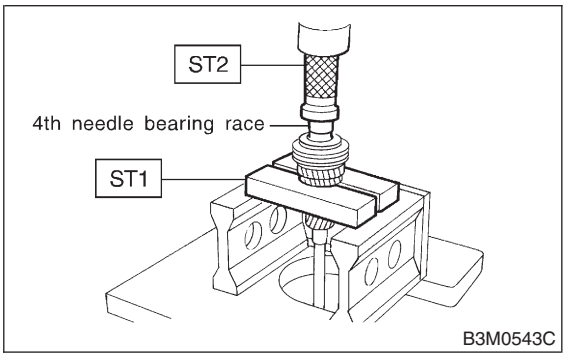


(A) 3rd needle bearing (32 × 36 × 25.7)
(B) 3rd drive gear
(C) Inner baulk ring
(D) Synchro cone
(E) Outer baulk ring
(F) Sleeve and hub ASSY

3) Install 4th needle bearing race onto transmission main shaft using ST1, ST2 and a press.

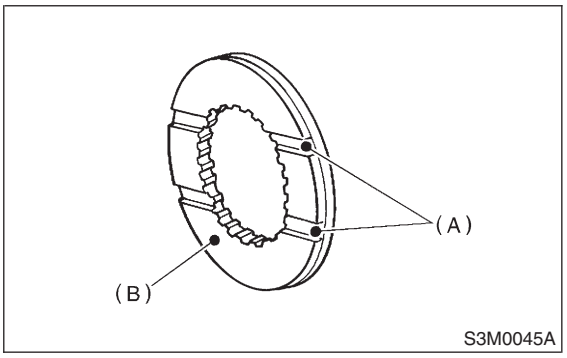
CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

ST1 899714110 REMOVER
ST2 499877000 RACE 4-5 INSTALLER



4) Install baulk ring, needle bearing (32 × 30 × 25.7), 4th drive gear and 4th gear thrust washer to transmission main shaft.

NOTE:
Align baulk ring and gear & hub assembly with key groove.

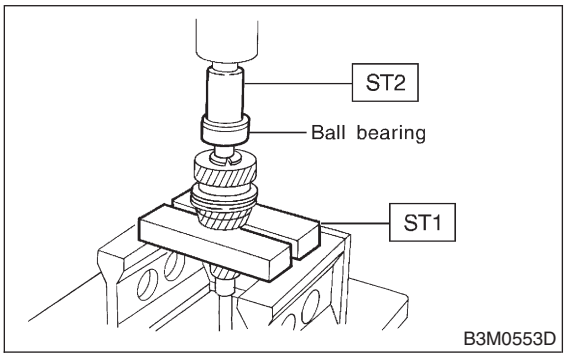


(A) Groove
(B) 4th gear side

5) Drive ball bearing onto the rear section of transmission main shaft using ST1, ST2 and a press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

ST1 899714110 REMOVER
ST2 499877000 RACE 4-5 INSTALLER

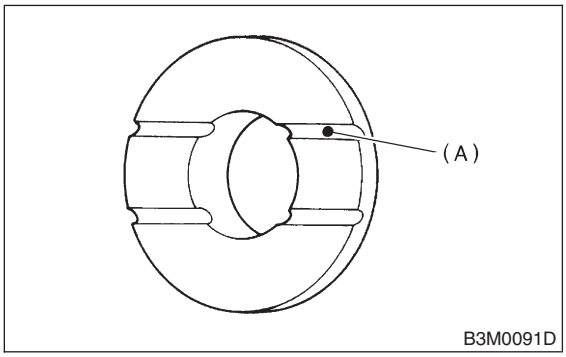


6) Using ST1 and ST2, install the 5th gear thrust washer and 5th needle bearing race onto the rear section of transmission main shaft.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

NOTE:
Face thrust washer in the correct direction.

ST1 899714110 REMOVER
ST2 499877000 RACE 4-5 INSTALLER



(A) Face this surface to 5th gear side.

7) Install bearing onto synchro cone.

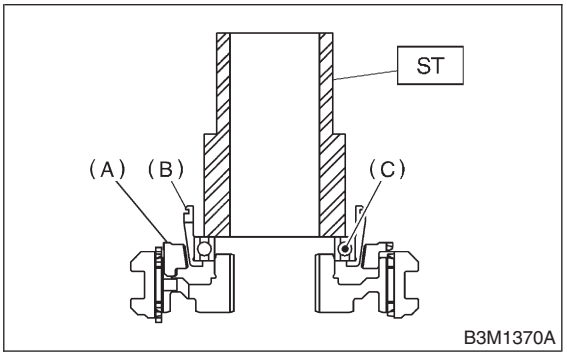
NOTE:
Align baulk ring and gear & hub assembly with key groove.

8) Install baulk ring and synchro cone onto 5th-Rev sleeve and hub assembly using ST and a press.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

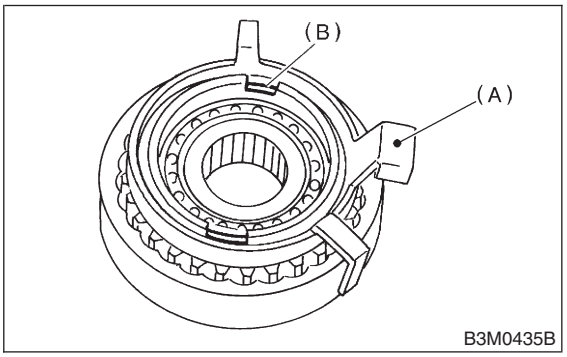
NOTE:
- Use new ball bearing.
- After press fitting, make sure synchro cone rotates freely.

ST 499757002 SNAP RING PRESS



(A) Baulk ring
(B) Synchro cone
(C) Ball bearing

9) Install synchro cone stopper and snap ring to 5th-Rev sleeve and hub assembly.

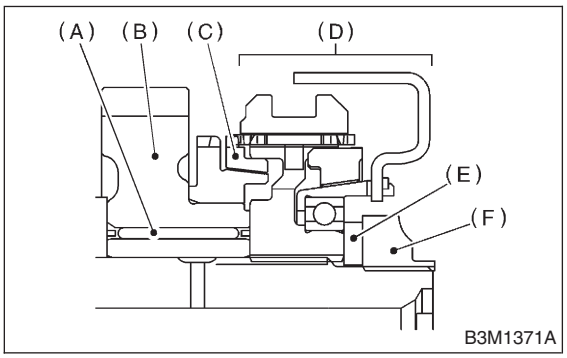


(A) Synchro cone stopper
(B) Snap ring

10) Install the rest parts to the rear section of transmission main shaft.

NOTE:
Align groove in baulk ring with shifting insert.

ST1 499987003 SOCKET WRENCH
ST2 498937000 TRANSMISSION HOLDER



(A) Needle bearing (32 × 36 × 25.7)
(B) 5th drive gear
(C) Baulk ring
(D) 5th-Rev sleeve and hub ASSY
(E) Lock washer (22 × 38 × 2)
(F) Lock nuts (22 × 13)

11) Tighten lock nuts to the specified torque using ST1 and ST2.

NOTE:
Secure lock nuts in two places after tightening.

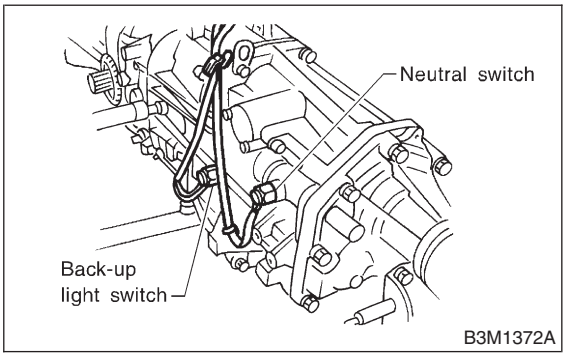
ST1 499987000 SOCKET WRENCH
ST2 498937000 TRANSMISSION HOLDER

Tightening torque:
118±6 N·m (12.0±0.6 kg-m, 86.8±4.3 ft-lb)

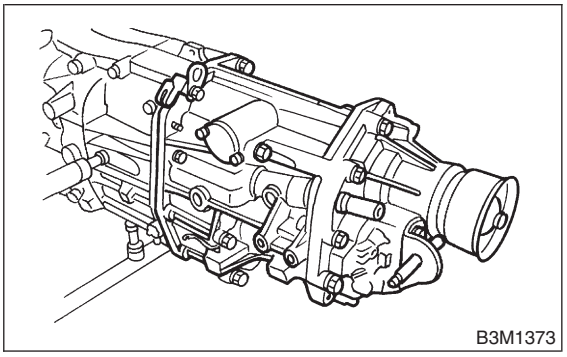
5. Transfer Case and Extension

A: REMOVAL

1) Remove back-up light switch and neutral switch.



2) Remove transfer case with extension assembly.

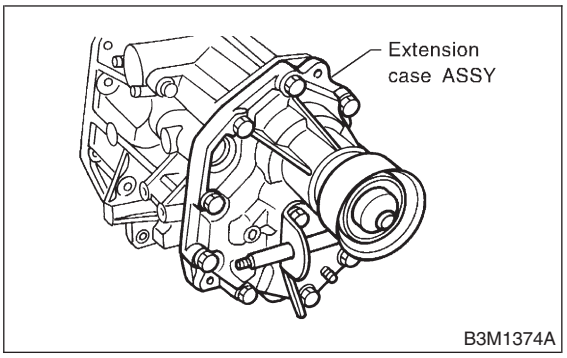


3) Remove shifter arm.

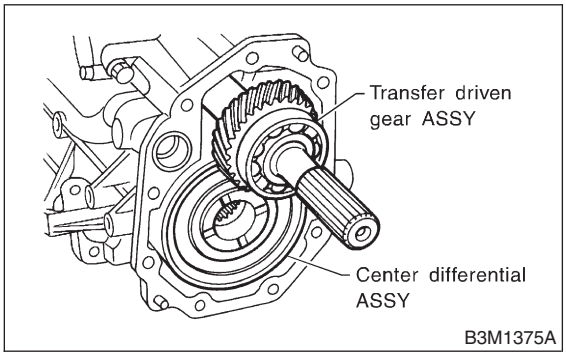
B: DISASSEMBLY

1. SEPARATION OF TRANSFER CASE AND EXTENSION ASSEMBLY

1) Separate transfer case and extension assembly.



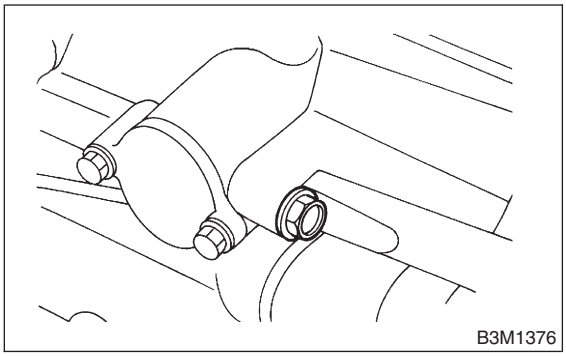
2) Remove transfer driven gear and center differential as a set.



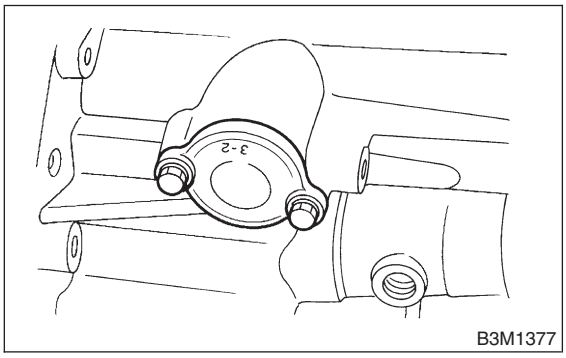
3) Remove thrust washer.

2. TRANSFER CASE

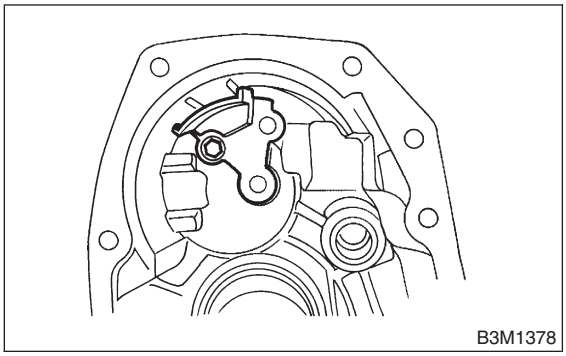
1) Remove plug, spring and reverse check ball.



2) Remove reverse check assembly.

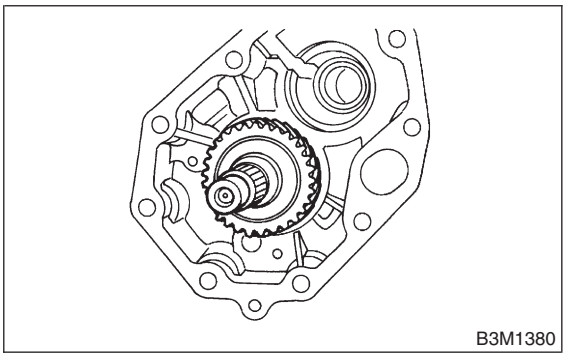


3) Remove oil guide.

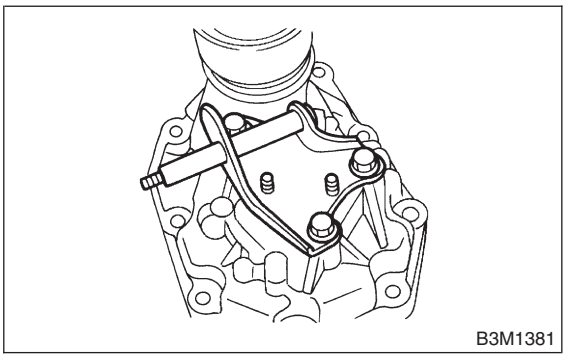


3. EXTENSION

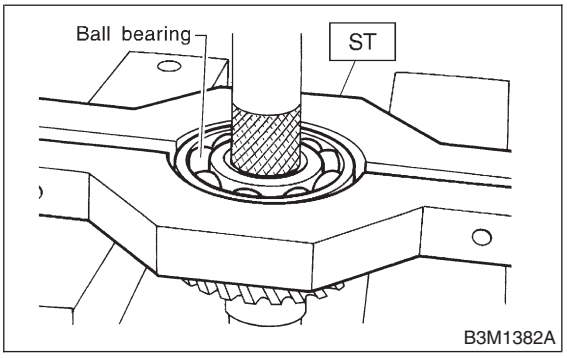
1) Remove transfer drive gear assembly.



2) Remove shift bracket.



3) Using ST, remove ball bearing from transfer drive gear.
ST 498077100 REMOVER

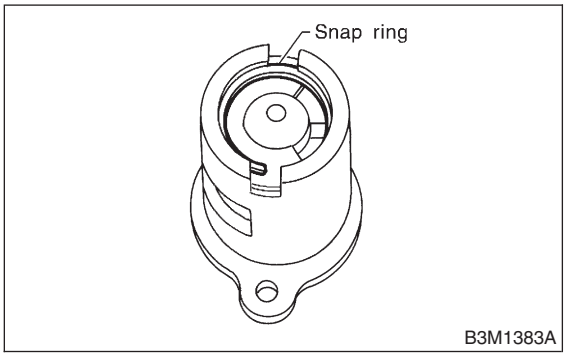


4) Remove oil seal from extension case.

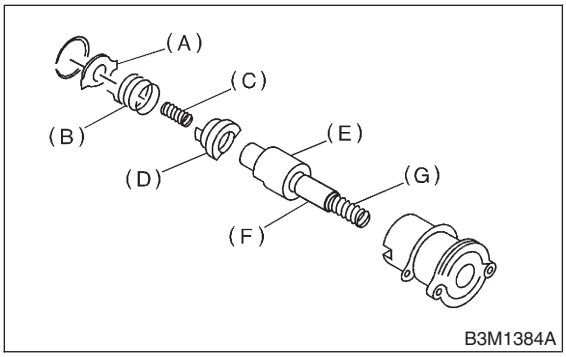
4. REVERSE CHECK SLEEVE

1) Using a standard screwdriver, remove snap ring.

NOTE:
Replace snap ring with a new one if deformed or weakened.



2) Remove reverse check plate, reverse check spring, reverse check cam, return spring (5th-Rev), reverse accent shaft, return spring cap and return spring (1st-2nd).



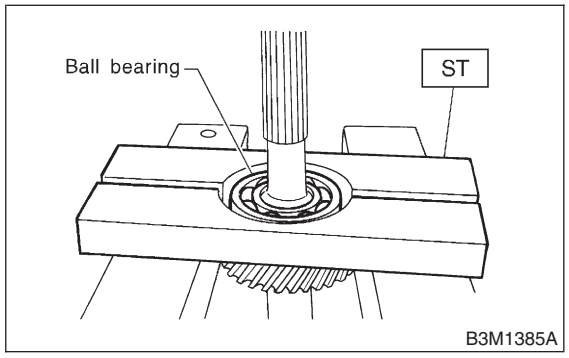
(A) Reverse check plate
(B) Reverse check spring
(C) Return spring (5th-Rev)
(D) Reverse check cam
(E) Reverse accent shaft
(F) Return spring cap
(G) Return spring (1st-2nd)

3) Remove O-ring.

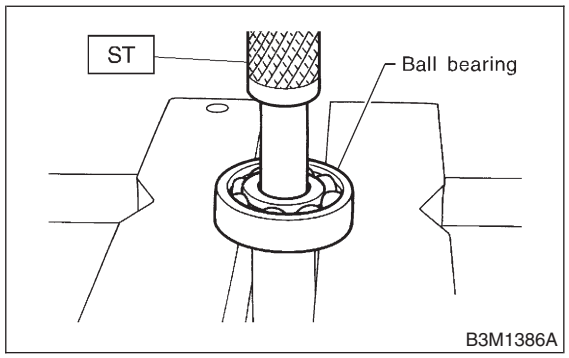
NOTE:
- Reverse check sleeve assembly uses an O-ring which should not be scratched.
- Be careful not to break adjustment shim placed between reverse check sleeve assembly and case.

5. TRANSFER DRIVEN GEAR

1) Using ST, remove ball bearing from transfer driven gear.
ST 498077000 REMOVER



2) Using ST, remove ball bearing from transfer driven gear.
ST 899864100 REMOVER

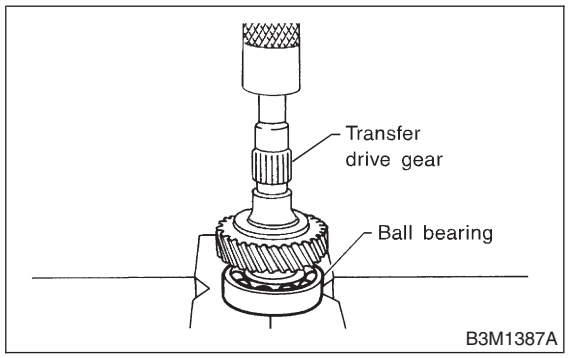


C: ASSEMBLY

1. EXTENSION

1) Install ball bearing to transfer drive gear.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).



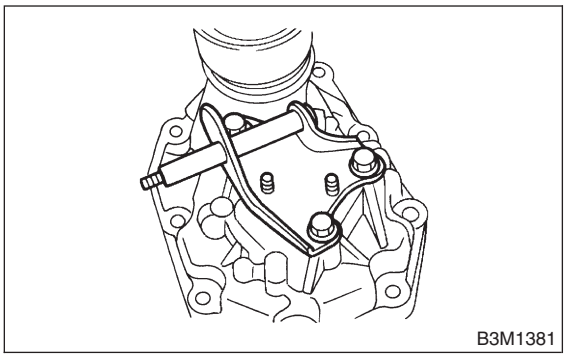
2) Using ST, install oil seal to extension case.

CAUTION:
Use new oil seal.

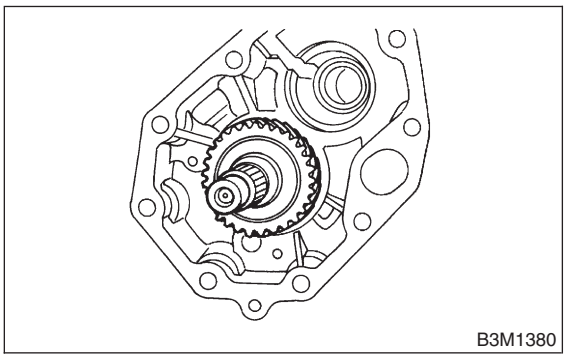
ST 498057300 INSTALLER

3) Install shift bracket to extension case.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)


B3M1381

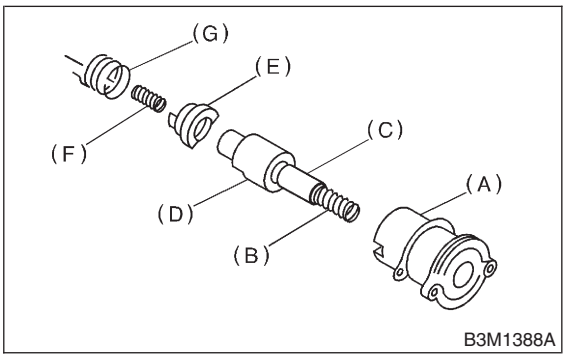
4) Install transfer drive gear to extension case.


B3M1380

2. REVERSE CHECK SLEEVE

1) Install return spring (1st-2nd), return spring cap, reverse accent shaft, check cam, return spring and check spring onto reverse check sleeve.

NOTE:
Be sure the bent section of reverse check spring is positioned in the groove in check cam.

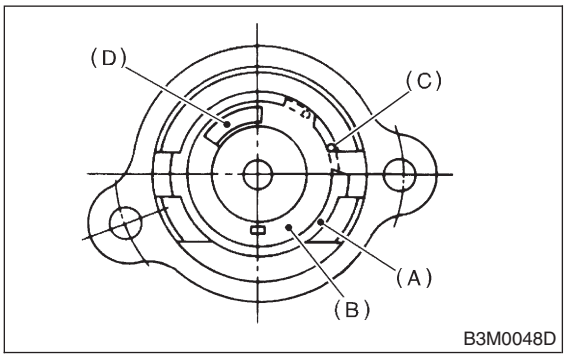


B3M1388A

(A) Reverse check sleeve
(B) Return spring (1st-2nd)
(C) Return spring cap
(D) Reverse accent shaft
(E) Reverse check cam
(F) Return spring (5th-Rev)
(G) Reverse check spring

2) Hook the bent section of reverse check spring over reverse check plate.
3) Rotate cam so that the protrusion of reverse check cam is at the opening in plate.
4) With cam held in that position, install plate onto reverse check sleeve and hold with snap ring.
5) Position O-ring in groove in sleeve.

CAUTION:
• Make sure the cutout section of reverse accent shaft is aligned with the opening in reverse check sleeve.
• Spin cam by hand for smooth rotation.
• Move cam and shaft all the way toward plate and release.
If cam does not return properly, replace reverse check spring; if shaft does not, check for scratches on the inner surface of sleeve. If sleeve is in good order, replace spring.



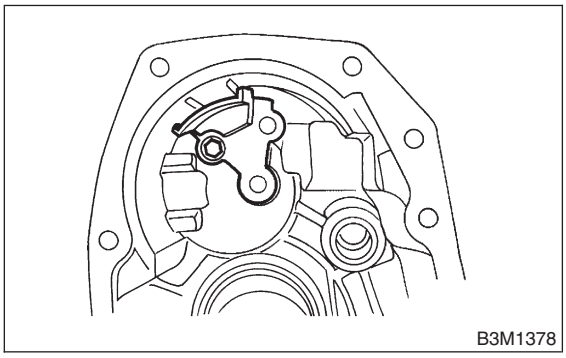
(A) Snap ring
(B) Reverse check plate
(C) Check spring
(D) Check cam

• Select a suitable reverse accent shaft and reverse check plate. <Ref. to 3-1 [W5E0].>

3. TRANSFER CASE

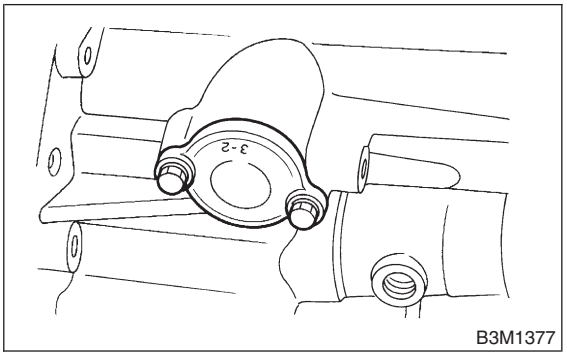
1) Install oil guide to transfer case.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



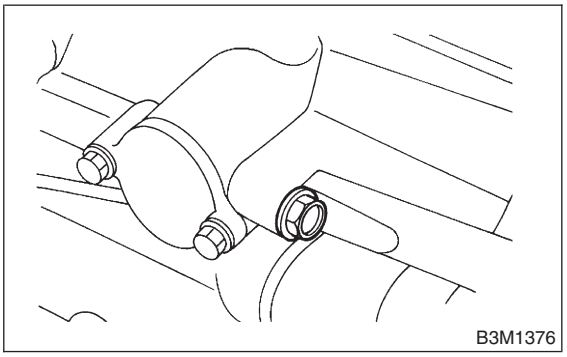
2) Install reverse check sleeve assembly to transfer case.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



3) Install ball, reverse accent spring, washer and plug to transfer case.

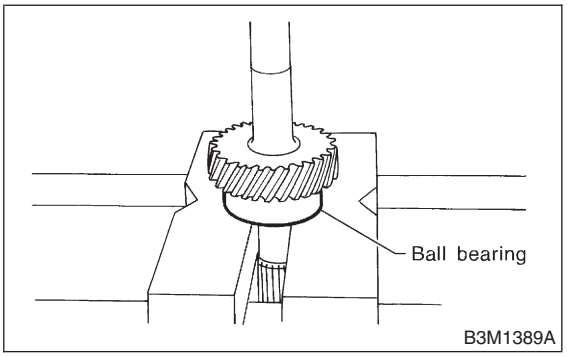
Tightening torque:
10±1 N·m (1.0±0.1 kg-m, 7.2±0.7 ft-lb)



4. TRANSFER DRIVEN GEAR

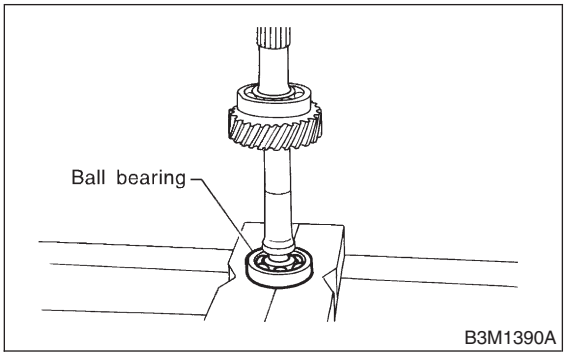
1) Install ball bearing to transfer driven gear.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).



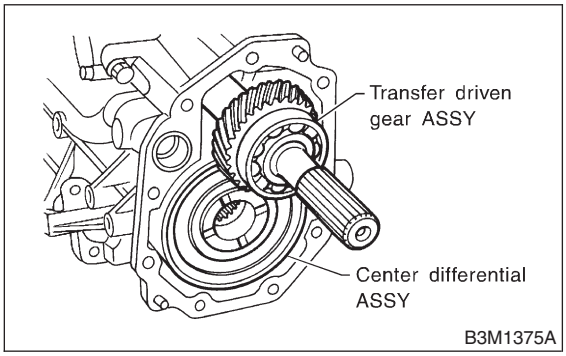
2) Install ball bearing to transfer driven gear.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

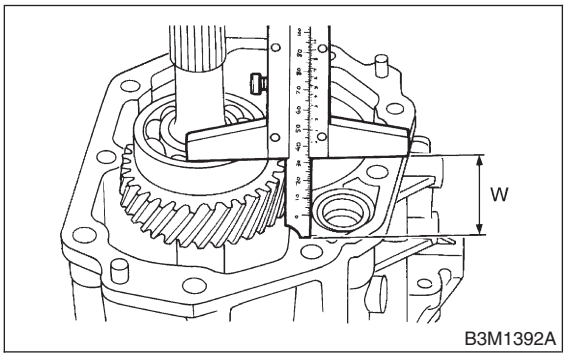


5. COMBINATION OF TRANSFER CASE AND EXTENSION ASSEMBLY

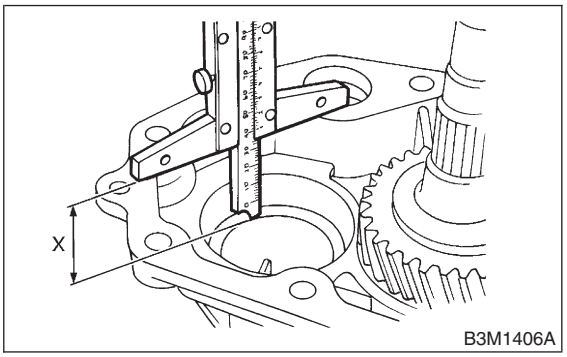
1) Install center differential and transfer driven gear into transfer case.



2) Measure height “W” between transfer case and ball bearing on the transfer driven gear.



3) Measure depth “X”.

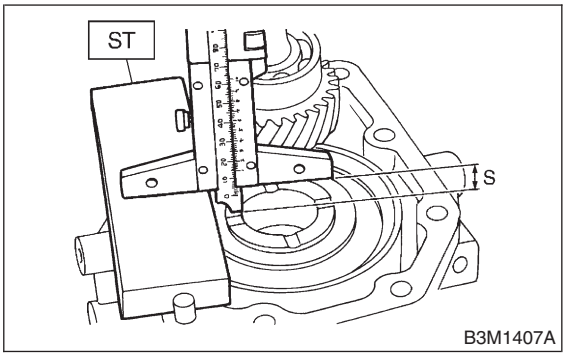


4) Calculate space “Y” using the following equation: Y = X – W + 0.24 mm (0.0094 in) [Thickness of gasket]
5) Select suitable washer in the following table:

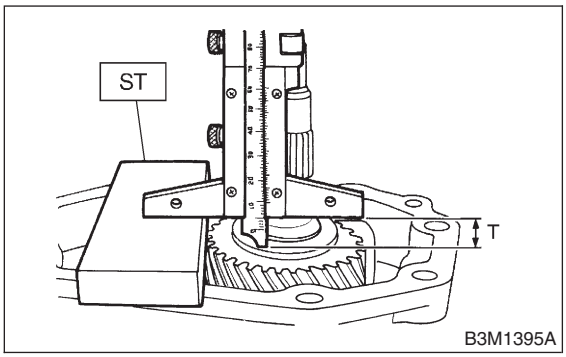
Standard clearance between thrust washer and ball bearing:
0.05 — 0.30 mm (0.0020 — 0.0118 in)

Space “Y” mm (in)	Thrust washer	
	Part No.	Thickness mm (in)
0.55 — 0.79 (0.0217 — 0.0311)	803052021	0.50 (0.0197)
0.80 — 1.04 (0.0315 — 0.0409)	803052022	0.75 (0.0295)
1.05 — 1.30 (0.0413 — 0.0512)	803052023	1.00 (0.0394)

6) Fit thrust washers on transfer drive shaft.
7) Measure depth “S” between transfer case and center differential.
ST 398643600 GAUGE



8) Measure depth “T” between extension case and transfer drive gear.
ST 398643600 GAUGE



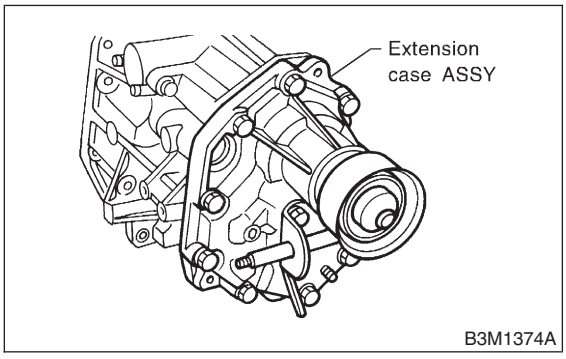
9) Calculate space “U” using the following equation: U = S + T – 0.24 mm (0.0094 in) [Thickness of gasket]
10) Select suitable washer in the following table:

Standard clearance:
0.15 — 0.35 mm (0.0059 — 0.0138 in)

Thrust washer	
Part No.	Thickness mm (in)
803036050	0.9 (0.035)
803036054	1.0 (0.039)
803036051	1.1 (0.043)
803036055	1.2 (0.047)
803036052	1.3 (0.051)
803036056	1.4 (0.055)
803036053	1.5 (0.059)
803036057	1.6 (0.063)
803036058	1.7 (0.067)

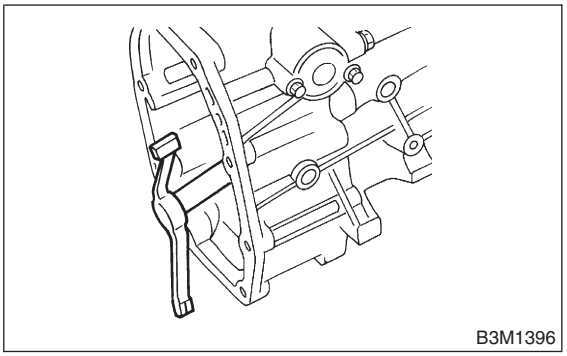
11) Fit thrust washer on center differential.
12) Install extension assembly into transfer case.

Tightening torque:
37±3 N·m (3.8±0.3 kg-m, 27.5±2.2 ft-lb)

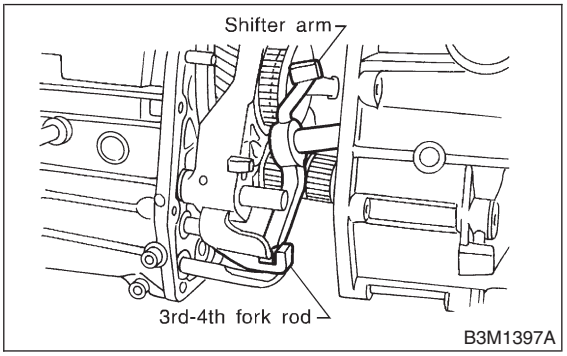


D: INSTALLATION

1) Install shifter arm to transfer case.

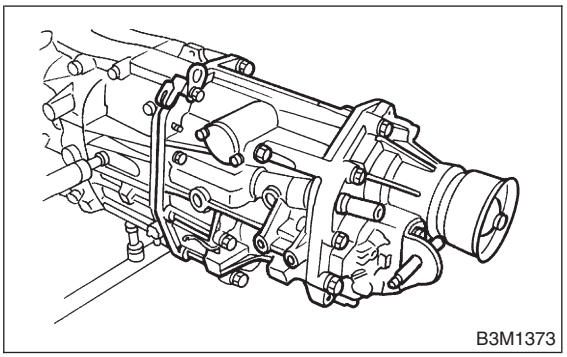


2) Hang the shifter arm on the 3rd-4th fork rod.



3) Install transfer case with extension assembly to transmission case.

Tightening torque:
25±2.0 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



E: ADJUSTMENT

1. NEUTRAL POSITION ADJUSTMENT

1) Shift gear into 3rd gear position.
2) Shifter arm turns lightly toward the 1st and 2nd gear side but heavily toward the reverse gear side because of the function of the return spring, until arm contacts the stopper.
3) Make adjustment so that the heavy stroke (reverse side) is a little more than the light stroke (1st/2nd side).
4) To adjust, remove bolts holding reverse check sleeve assembly to the case, move sleeve assembly outward, and place adjustment shim (0 to 1 ea.) between sleeve assembly and case to adjust the clearance.

CAUTION:
Be careful not to break O-ring when placing shim(s).

NOTE:
- When shim is removed, the neutral position will move closer to reverse; when shim is added, the neutral position will move closer to 1st gear.
- If shims alone cannot adjust the clearance, replace reverse accent shaft and re-adjust.

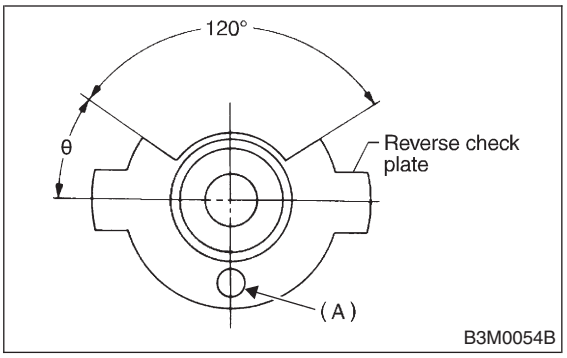
Adjustment shim	
Part No.	Thickness mm (in)
32190AA000	0.15 (0.0059)
32190AA010	0.30 (0.0118)

Reverse accent shaft		
Part No.	Mark	Remarks
32188AA090	X	Neutral position is closer to 1st gear.
32188AA100	Y	Standard
32188AA110	Z	Neutral position is closer to reverse gear.

2. REVERSE CHECK PLATE ADJUSTMENT

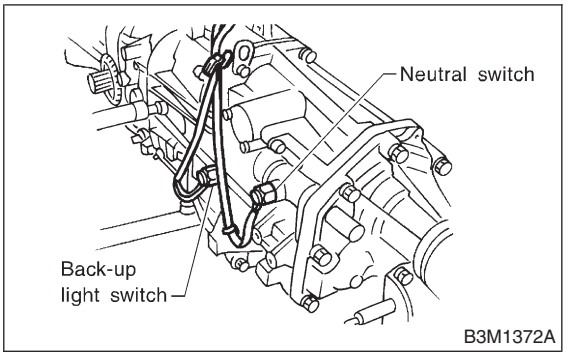
1) Shift shifter arm to “5th” and then to reverse to see if reverse check mechanism operates properly.
2) Also check to see if arm returns to neutral when released from the reverse position. If arm does not return properly, replace reverse check plate.

Reverse check plate			
Part No.	(A): No.	Angle θ	Remarks
32189AA000	0	28°	Arm stops closer to 5th gear.
32189AA010	1	31°	Arm stops closer to 5th gear.
32189AA020	2	34°	Arm stops in the center.
32189AA030	3	37°	Arm stops closer to reverse gear.
32189AA040	4	40°	Arm stops closer to reverse gear.



3) Install neutral position switch and back-up light switch to transfer case.

Tightening torque:
25±2.0 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



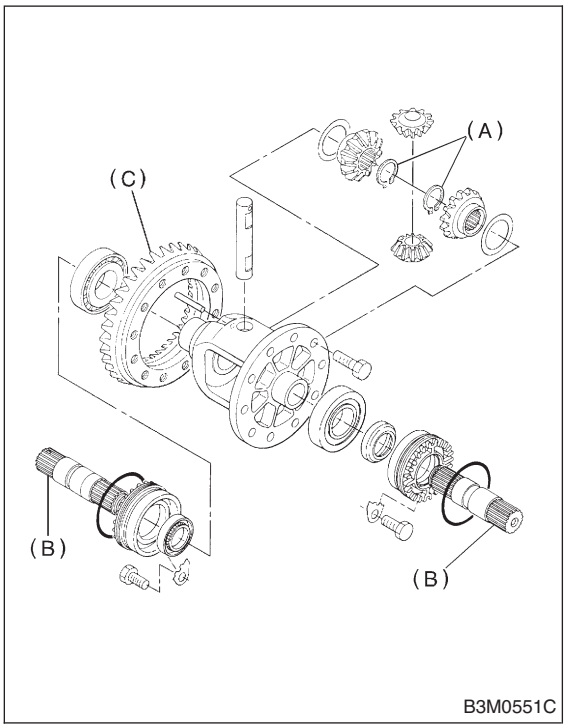
6. Front Differential

A: DISASSEMBLY

1) Remove right and left snap rings from differential, and then remove two axle drive shafts.

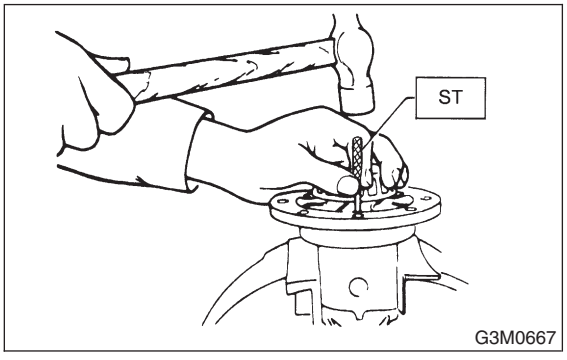
NOTE:
During reassembly, reinstall each axle drive shaft in the same place from which it was removed.

2) Loosen twelve bolts and remove hypoid driven gear.

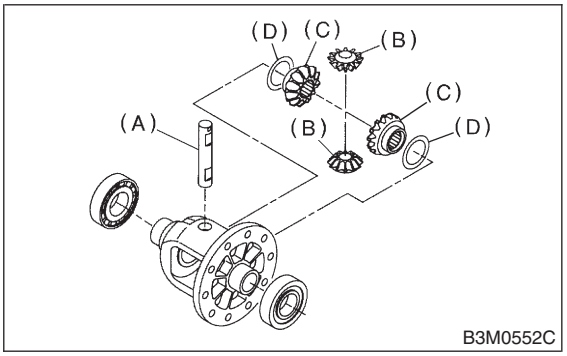


(A) Snap ring
(B) Axle drive shaft
(C) Hypoid driven gear

3) Drive out straight pin from differential assembly toward hypoid driven gear.
ST 899904100 REMOVER

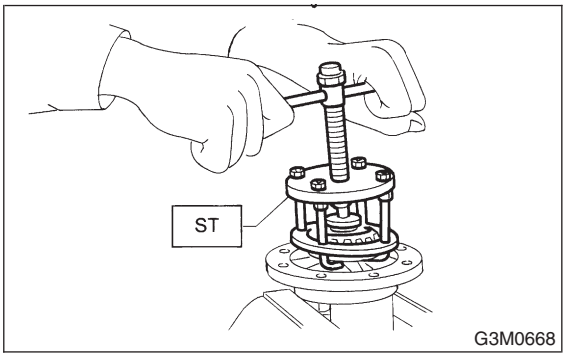


4) Pull out pinion shaft, and remove differential bevel pinion and gear and washer.



(A) Pinion shaft
(B) Bevel pinion
(C) Bevel gear
(D) Washer

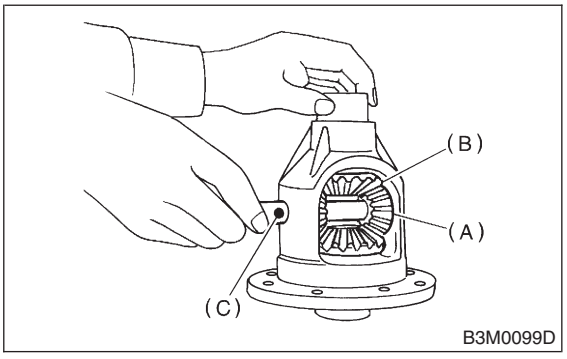
5) Remove roller bearing using ST.
ST 399527700 PULLER SET



B: ASSEMBLY

1) Install bevel gear and bevel pinion together with washers, and insert pinion shaft.

NOTE:
Face the chamfered side of washer toward gear.



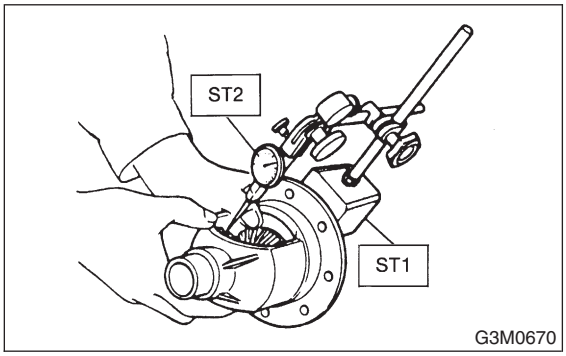
(A) Differential bevel pinion
(B) Differential bevel gear
(C) Pinion shaft

2) Measure backlash between bevel gear and pinion. If it is not within specifications, install a suitable washer to adjust it.

NOTE:
Be sure the pinion gear tooth contacts adjacent gear teeth during measurement.

ST1 498247001 MAGNET BASE
ST2 498247100 DIAL GAUGE

Standard backlash:
0.13 — 0.18 mm (0.0051 — 0.0071 in)

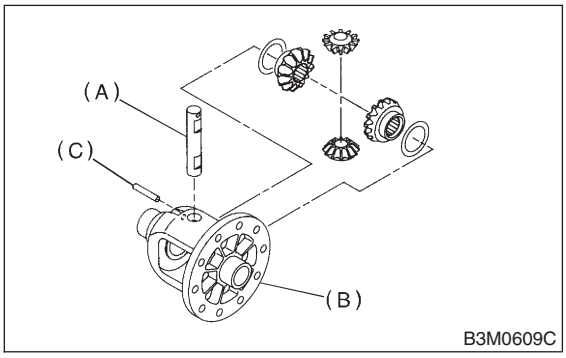


Washer (38.1 × 50 × t)	
Part No.	Thickness mm (in)
803038021	0.925 — 0.950 (0.0364 — 0.0374)
803038022	0.975 — 1.000 (0.0384 — 0.0394)
803038023	1.025 — 1.050 (0.0404 — 0.0413)

3) Align pinion shaft and differential case at their holes, and drive straight pin into holes from the hypoid driven gear side, using ST.

NOTE:
Lock straight pin after installing.

ST 899904100 REMOVER



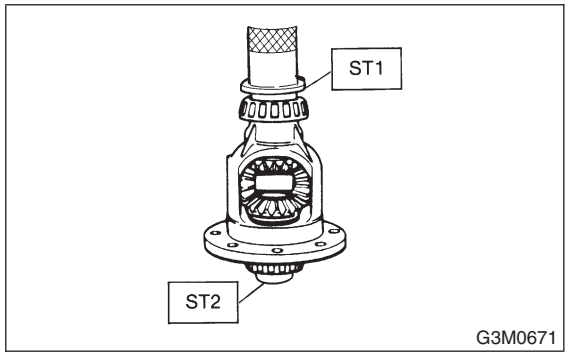
(A) Pinion shaft
(B) Differential case
(C) Straight pin

4) Install roller bearing (40 × 80 × 19.75) to differential case.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

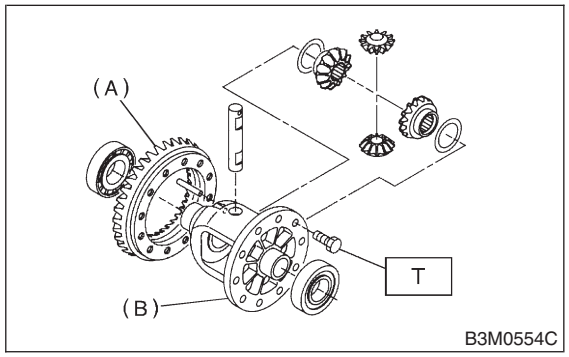
NOTE:
Be careful because roller bearing outer races are used as a set.

ST1 499277100 BUSH 1-2 INSTALLER
ST2 398497701 ADAPTER



5) Install hypoid driven gear to differential case using twelve bolts.

Tightening torque:
T: 62±5 N·m (6.3±0.5 kg-m, 45.6±3.6 ft-lb)

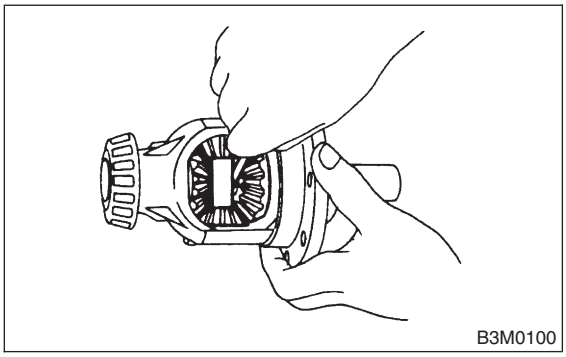


(A) Hypoid driven gear
(B) Differential case

6) Position drive axle shaft in differential case and hold it with outer snap ring (28). Using a thickness gauge, measure clearance between the shaft and case is within specifications.

NOTE:
If it is not within specifications, replace snap ring with a suitable one.

Clearance:
0 — 0.25 mm (0 — 0.0098 in)



Snap ring (Outer-28)	
Part No.	Thickness mm (in)
805028011	1.05 (0.0413)
805028012	1.20 (0.0472)

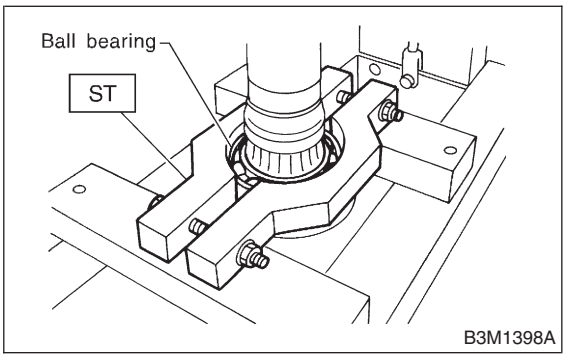
7. Center Differential

A: DISASSEMBLY AND ASSEMBLY

1) Remove ball bearing using ST.

CAUTION:
Do not reuse ball bearing.

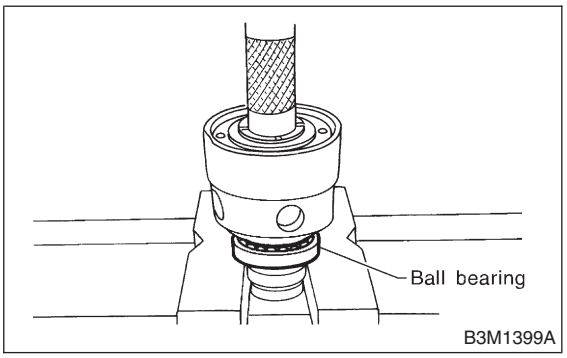
ST 498077300 CENTER DIFFERENTIAL BEARING REMOVER



2) Install ball bearing to center differential assembly.

CAUTION:
Do not apply pressure in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).

NOTE:
Do not disassemble center differential because it is a non-disassemble part.



1. Manual Transmission

Symptom	Possible cause	Remedy
1. Gears are difficult to intermesh. NOTE: The cause for difficulty in shifting gears can be classified into two kinds: one is malfunction of the gear shift system and the other is malfunction of the transmission. However, if the operation is heavy and engagement of the gears is difficult, defective clutch disengagement may also be responsible. Check whether the clutch is correctly functioning, before checking the gear shift system and transmission.	(a) Worn, damaged or burred chamfer of internal spline of sleeve and reverse driven gear	Replace.
	(b) Worn, damaged or burred chamfer of spline of gears	Replace.
	(c) Worn or scratched bushings	Replace.
	(d) Incorrect contact between synchronizer ring and gear cone or wear	Correct or replace.
2. Gear slips out. ● Gear slips out when coasting on rough road. ● Gear slips out during acceleration.	(a) Defective pitching stopper adjustment	Adjust
	(b) Loose engine mounting bolts	Tighten or replace.
	(c) Worn fork shifter, broken shifter fork rail spring	Replace.
	(d) Worn or damaged ball bearing	Replace.
	(e) Excessive clearance between splines of synchronizer hub and synchronizer sleeve	Replace.
	(f) Worn tooth step of synchronizer hub (responsible for slip-out of 3rd gear)	Replace.
	(g) Worn 1st driven gear, needle bearing and race	Replace.
	(h) Worn 2nd driven gear, needle bearing and race	Replace.
	(i) Worn 3rd drive gear and bushing	Replace.
	(j) Worn 4th drive gear and bushing	Replace.
	(k) Worn reverse idler gear and bushing	Replace.
3. Unusual noise comes from transmission. NOTE: If an unusual noise is heard when the vehicle is parked with its engine idling and if the noise ceases when the clutch is disengaged, it may be considered that the noise comes from the transmission.	(a) Insufficient or improper lubrication	Lubricate or replace with specified oil.
	(b) Worn or damaged gears and bearings NOTE: If the trouble is only wear of the tooth surfaces, merely a high roaring noise will occur at high speeds, but if any part is broken, rhythmical knocking sound will be heard even at low speeds.	Replace.

2. Differential

Symptom	Possible cause	Remedy
1. Broken differential (case, gear, bearing, etc.) NOTE: Abnormal noise will develop and finally it will become impossible to continue to run due to broken pieces obstructing the gear revolution.	(a) Insufficient or improper oil	Disassemble differential and replace broken components and at the same time check other components for any trouble, and replace if necessary.
	(b) Use of vehicle under severe conditions such as excessive load and improper use of clutch	Readjust bearing preload and backlash and face contact of gears.
	(c) Improper adjustment of taper roller bearing	Adjust.
	(d) Improper adjustment of drive pinion and hypoid driven gear	Adjust.
	(e) Excessive backlash due to worn differential side gear, washer or differential pinion vehicle under severe operating conditions.	Add recommended oil to specified level. Do not use vehicle under severe operating conditions.
	(f) Loose hypoid driven gear clamping bolts	Tighten.
2. Differential and hypoid gear noises Troubles of the differential and hypoid gear always appear as noise problems. Therefore noise is the first indication of the trouble. However noises from the engine, muffler, tire, exhaust gas, bearing, body, etc. are easily mistaken for the differential noise. Pay special attention to the hypoid gear noise because it is easily confused with other gear noises. There are the following four kinds of noises. ● Gear noise when driving: If noise increases as vehicle speed increases it may be due to insufficient gear oil, incorrect gear engagement, damaged gears, etc. ● Gear noise when coasting: Damaged gears due to maladjusted bearings and incorrect shim adjustment ● Bearing noise when driving or when coasting: Cracked, broken or damaged bearings ● Noise which mainly occurs when turning: Unusual noise from differential side gear, differential pinion, differential pinion shaft, etc.	(a) Insufficient oil	Lubricate.
	(b) Improper adjustment of hypoid driven gear and drive pinion	Check tooth contact.
	(c) Worn teeth of hypoid driven gear and drive pinion	Replace as a set. Readjust bearing preload.
	(d) Loose roller bearing	Readjust hypoid driven gear to drive pinion backlash and check tooth contact.
	(e) Distorted hypoid driven gear or differential case	Replace.
	(f) Worn washer and differential pinion shaft	Replace.

AUTOMATIC TRANSMISSION AND DIFFERENTIAL 3-2

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1. Torque Converter Clutch

Type	Symmetric, 3 element, single stage, 2 phase torque converter
Stall torque ratio	1.9 — 2.1
Nominal diameter	246 mm (9.69 in)
Stall speed (at sea level)	2,100 — 2,600 rpm
One-way clutch	Sprague type one-way clutch

2. Oil Pump

Type	Trochoid constant-displacement pump	
Driving method	Driven by engine	
Number of teeth	Inner rotor	9
	Outer rotor	10

3. Transmission Control Element

Type	4-forward, 1-reverse, double-row planetary gears
Multi-plate clutch	3 sets
Multi-plate brake	2 sets
One-way clutch (sprague type)	1 sets

4. Transmission Gear Ratio

	Gear ratio
1st	3.027
2nd	1.619
3rd	1.000
4th	0.694
Rev	2.272

5. Planetary Gear and Plate

Tooth number of front sun gear	33
Tooth number of front pinion	21
Tooth number of front internal gear	75
Tooth number of rear sun gear	42
Tooth number of rear pinion	17
Tooth number of rear internal gear	75
Drive & driven plate number of high clutch	4
Drive & driven plate number of low clutch	6
Drive & driven plate number of reverse clutch	2
Drive & driven plate number of 2-4 brake	3
Drive & driven plate number of low & reverse brake	6

6. Selector Position

P (Park)	Transmission in neutral, output member immovable, and engine start possible
R (Reverse)	Transmission in reverse for backing
N (Neutral)	Transmission in neutral and engine start possible
D (Drive)	Automatic gear change 1st $\overset{\leftarrow}{\underset{\rightarrow}{}}$ 2nd $\overset{\leftarrow}{\underset{\rightarrow}{}}$ 3rd $\overset{\leftarrow}{\underset{\rightarrow}{}}$ 4th
3 (3rd)	Automatic gear change 1st $\overset{\leftarrow}{\underset{\rightarrow}{}}$ 2nd $\overset{\leftarrow}{\underset{\rightarrow}{}}$ 3rd ← 4th
2 (2nd)	2nd gear locked (Deceleration possible 2nd ← 3rd ← 4th)
1 (1st)	1st gear locked (Deceleration possible 1st ← 2nd ← 3rd ← 4th)
Control method	Hydraulic remote control

7. Hydraulic Control and Lubrication

Type	Electronic/hydraulic control [Four forward speed changes by electrical signals of vehicle speed and accelerator (throttle) opening]
Fluid	Dexron IIE or Dexron III type Automatic transmission fluid
Fluid capacity	9.3 — 9.6 ℓ (9.8 — 10.1 US qt, 8.2 — 8.4 Imp qt)
Lubrication system	Forced feed lubrication with oil pump
Oil	Automatic transmission fluid (above mentioned)

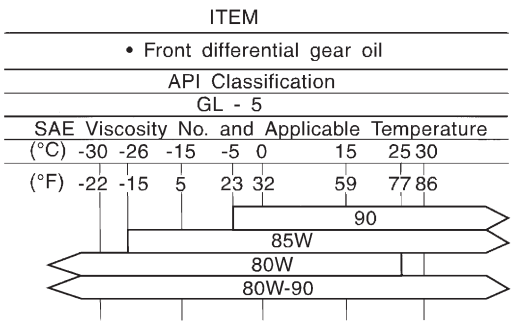
8. Cooling and Harness

Cooling system	Liquid-cooled cooler incorporated in radiator
ATF cooling system (Radiation capacity)	4.630 kW (3,981 kcal/h, 15,797 BTU/h)
Inhibitor switch	12 poles
Transmission harness	20 poles

9. Transfer

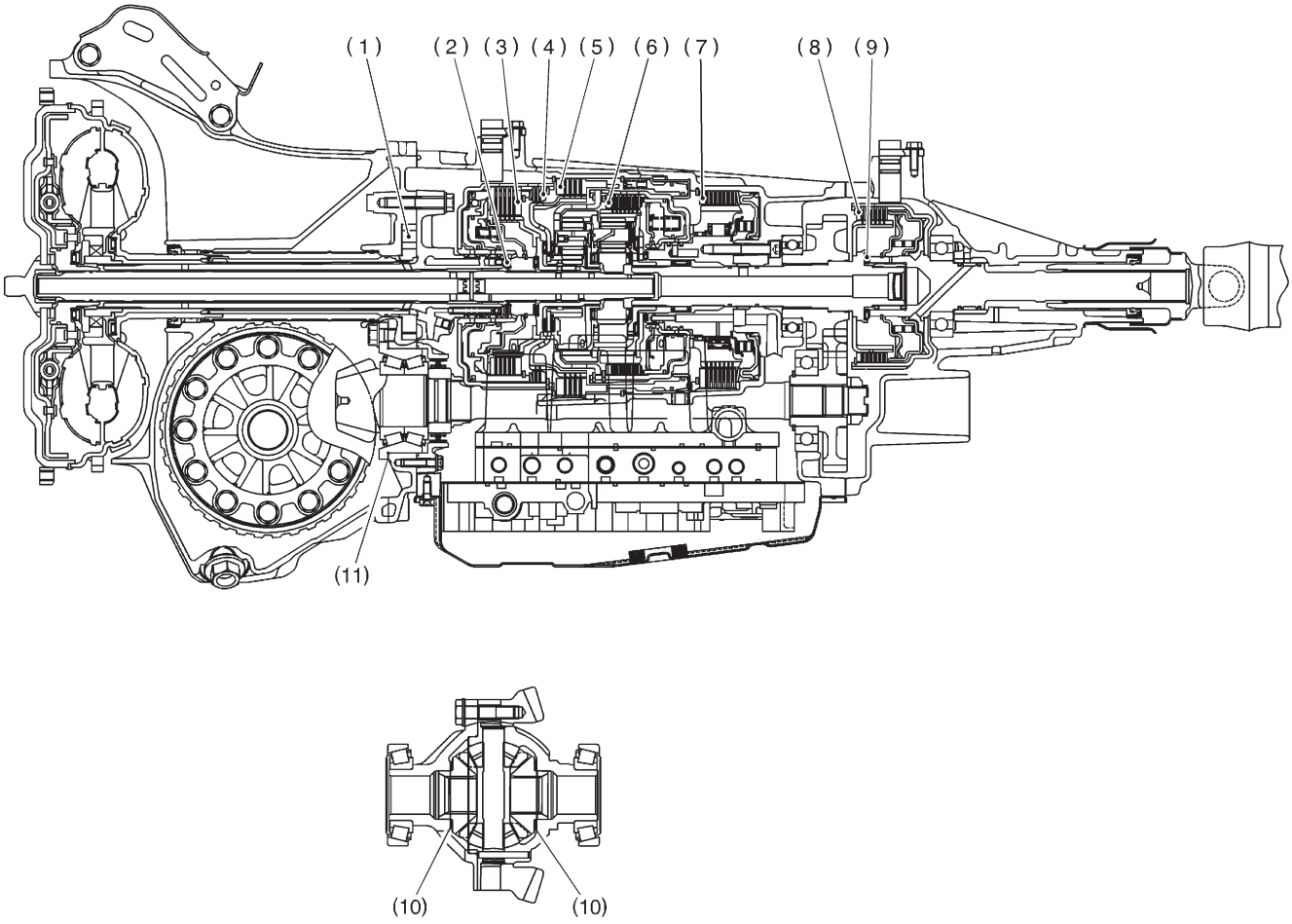
Transfer clutch	Hydraulic multi-plate clutch
Drive & driven plate number of transfer clutch	5
Control method	Electronic, hydraulic type
Lubricant	The same Automatic transmission fluid used in automatic transmission
1st reduction gear ratio	1.000 (53/53)

10. Final Reduction

Front final gear ratio	4.444 (40/9)
Lubrication oil	 H3M1235A
Front differential oil capacity	1.2 ℓ (1.3 US qt, 1.1 Imp qt)

MEMO:

11. Adjusting Parts



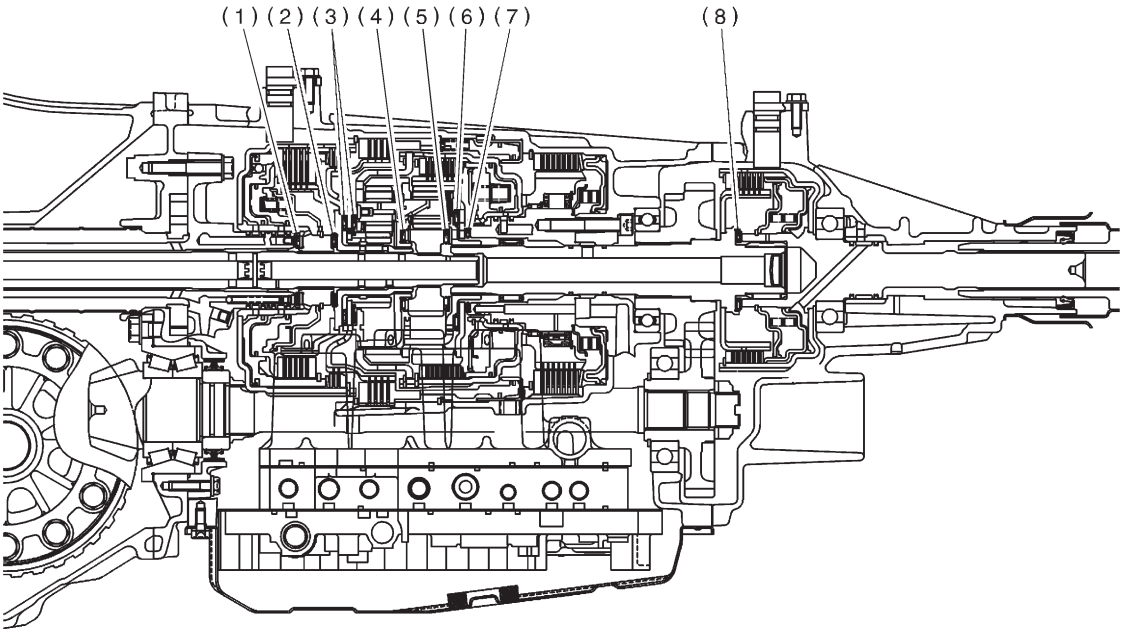
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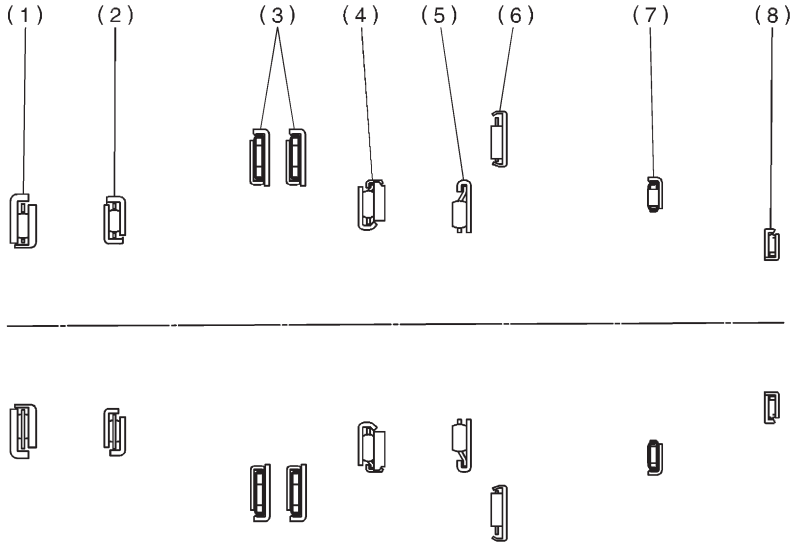
No.	Part Name	Part Number	Dimension mm (in)	Application
1	Rotor (Oil pump)	15008AA060 15008AA070 15008AA080	11.37 — 11.38 (0.4476 — 0.4480) 11.38 — 11.39 (0.4480 — 0.4484) 11.39 — 11.40 (0.4484 — 0.4488)	Adjusting side clearance of oil pump
2	Thrust bearing	806528050 806528060 806528070 806528080 806528090 806528100	4.11 (0.1618) 4.3 (0.169) 4.5 (0.177) 4.7 (0.185) 4.9 (0.193) 5.1 (0.201)	Adjusting total end play
3	Retaining plate (High clutch)	31567AA710 31567AA720 31567AA730 31567AA740 31567AA670 31567AA680 31567AA690 31567AA700	4.7 (0.185) 4.8 (0.189) 4.9 (0.193) 5.0 (0.197) 5.1 (0.201) 5.2 (0.205) 5.3 (0.209) 5.4 (0.213)	Adjusting clearance of high clutch
4	Retaining plate (Reverse clutch)	31567AA760 31567AA770 31567AA780 31567AA790 31567AA800	4.0 (0.157) 4.2 (0.165) 4.4 (0.173) 4.6 (0.181) 4.8 (0.189)	Adjusting clearance of reverse clutch
5	Retaining plate (2-4 brake)	31567AA612 31567AA622 31567AA632 31567AA642 31567AA652 31567AA662	5.6 (0.220) 5.8 (0.228) 6.0 (0.236) 6.2 (0.244) 6.4 (0.252) 6.6 (0.260)	Adjusting clearance of 2-4 brake
6	Retaining plate (Low clutch)	31567AA830 31567AA840 31567AA850 31567AA860 31567AA870	3.8 (0.150) 4.0 (0.157) 4.2 (0.165) 4.4 (0.173) 4.6 (0.181)	Adjusting clearance of low clutch
7	Retaining plate (Low and reverse brake)	31667AA320 31667AA330 31667AA340 31667AA350 31667AA360 31667AA370 31667AA380	4.2 (0.165) 4.5 (0.177) 4.8 (0.189) 5.1 (0.201) 5.4 (0.213) 5.7 (0.224) 6.0 (0.236)	Adjusting clearance of low and reverse brake
8	Pressure plate (Transfer clutch)	31593AA151 31593AA161 31593AA171 31593AA181	3.3 (0.130) 3.7 (0.146) 4.1 (0.161) 4.5 (0.177)	Adjusting clearance of transfer clutch
9	Thrust bearing (Transfer clutch)	806536020 806535030 806535040 806535050 806535060 806535070 806535090	3.8 (0.150) 4.0 (0.157) 4.2 (0.165) 4.4 (0.173) 4.6 (0.181) 4.8 (0.189) 5.0 (0.197)	Adjusting end play of transfer clutch
10	Washer (Front differential)	803038021 803038022 803038023	0.95 (0.0374) 1.00 (0.0394) 1.05 (0.0413)	Adjusting backlash of differential bevel gear

No.	Part Name	Part Number	Dimension mm (in)	Application
11	Drive pinion shim	31451AA050	0.150 (0.0059)	Adjusting drive pinion shim
		31451AA060	0.175 (0.0069)	
		31451AA070	0.200 (0.0079)	
		31451AA080	0.225 (0.0089)	
		31451AA090	0.250 (0.0098)	
		31451AA100	0.275 (0.0108)	

MEMO:

12. Location and Installing Direction of Thrust Needle Bearing





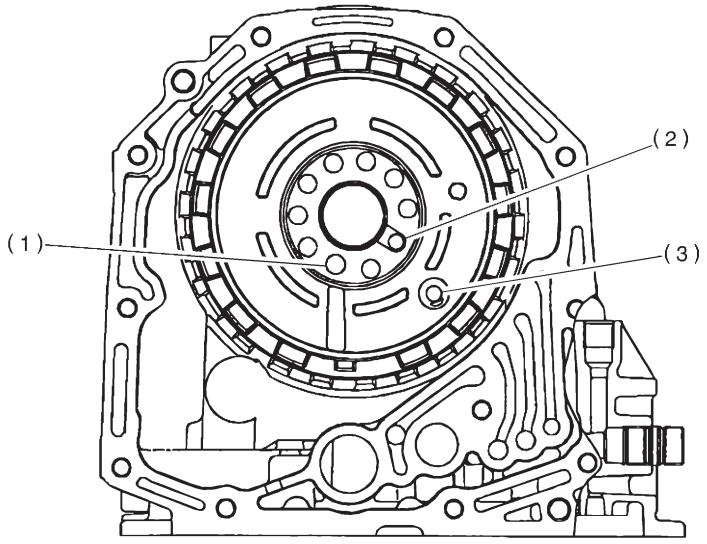
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12. Location and Installing Direction of Thrust Needle Bearing

No.	Part Name	Part Number	Inside diameter mm (in)	Outside diameter mm (in)	Dimension mm (in)	Application
(1)	Thrust needle bearing	806528050 806528060 806528070 806528080 806528090 806528100	28.5 (1.122)	48 (1.89)	4.1 (0.161) 4.3 (0.169) 4.5 (0.177) 4.7 (0.185) 4.9 (0.193) 5.1 (0.201)	Adjusting total end play
(2)	Thrust needle bearing	806530040	30 (1.18)	47 (1.85)	3.8 (0.150)	Place of high clutch
(3)	Thrust needle bearing	806551020	51 (2.01)	71 (2.80)	3.3 (0.130)	Place of front sun gear
(4)	Thrust needle bearing	806535120	35 (1.38)	53 (2.09)	4.8 (0.189)	Place of rear sun gear
(5)	Thrust needle bearing	806534060	35 (1.38)	53 (2.09)	3.3 (0.130)	Place of rear sun gear
(6)	Thrust needle bearing	806558030	58 (2.28)	78 (3.07)	2.8 (0.110)	Place of rear internal gear
(7)	Thrust needle bearing	806541020	39.7 (1.563)	54 (2.13)	3.6 (0.142)	Place of one-way clutch
(8)	Thrust needle bearing	806536020 806535030 806535040 806535050 806535060 806535070 806535090	36 (1.42)	53 (2.09)	3.8 (0.150) 4.0 (0.157) 4.2 (0.165) 4.4 (0.173) 4.6 (0.181) 4.8 (0.189) 5.0 (0.197)	Adjusting end play of transfer clutch

13. Fluid Passages

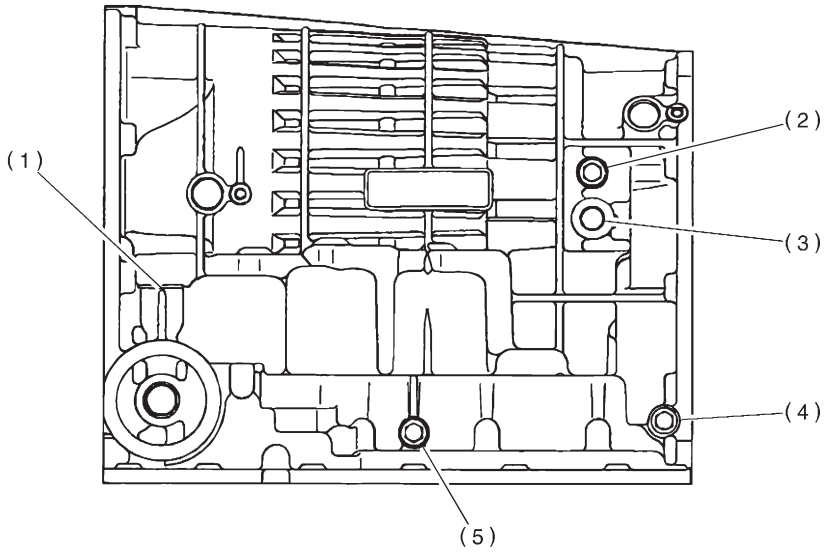
A: TRANSMISSION CASE (FRONT SIDE)



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(1) Low clutch pressure
(2) Oil cooler inlet pressure
(3) Low & reverse brake pressure

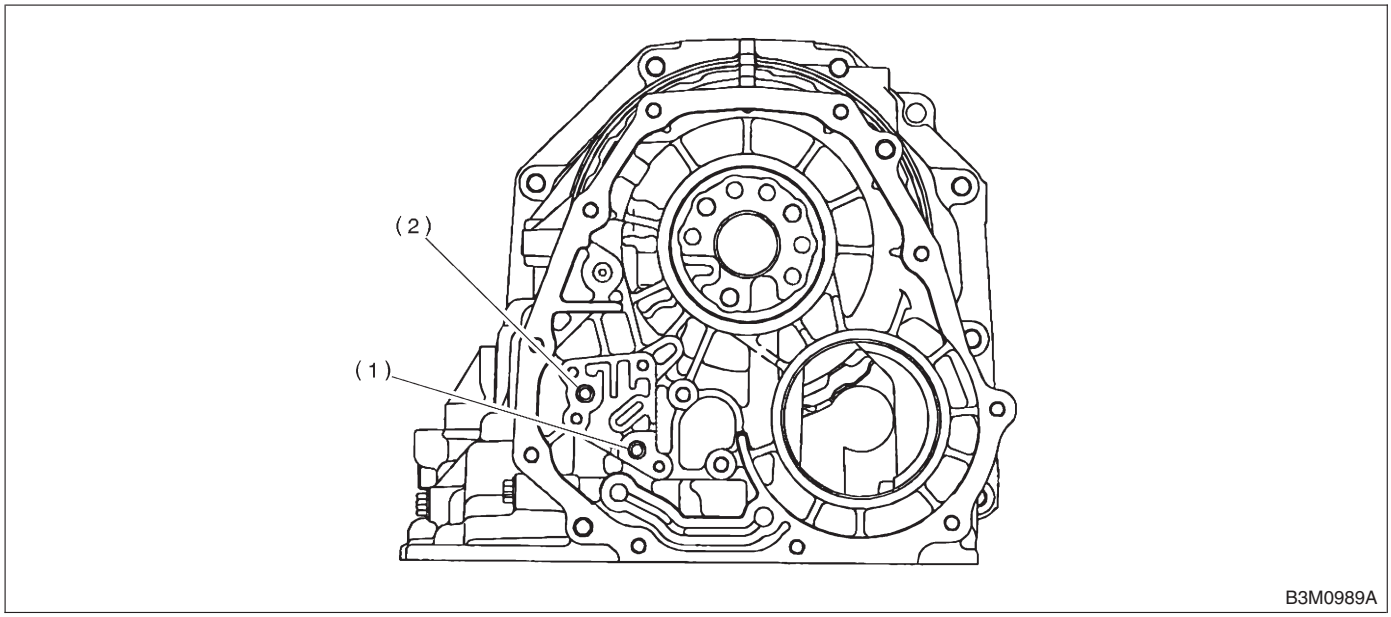
B: TRANSMISSION CASE (LH SIDE)



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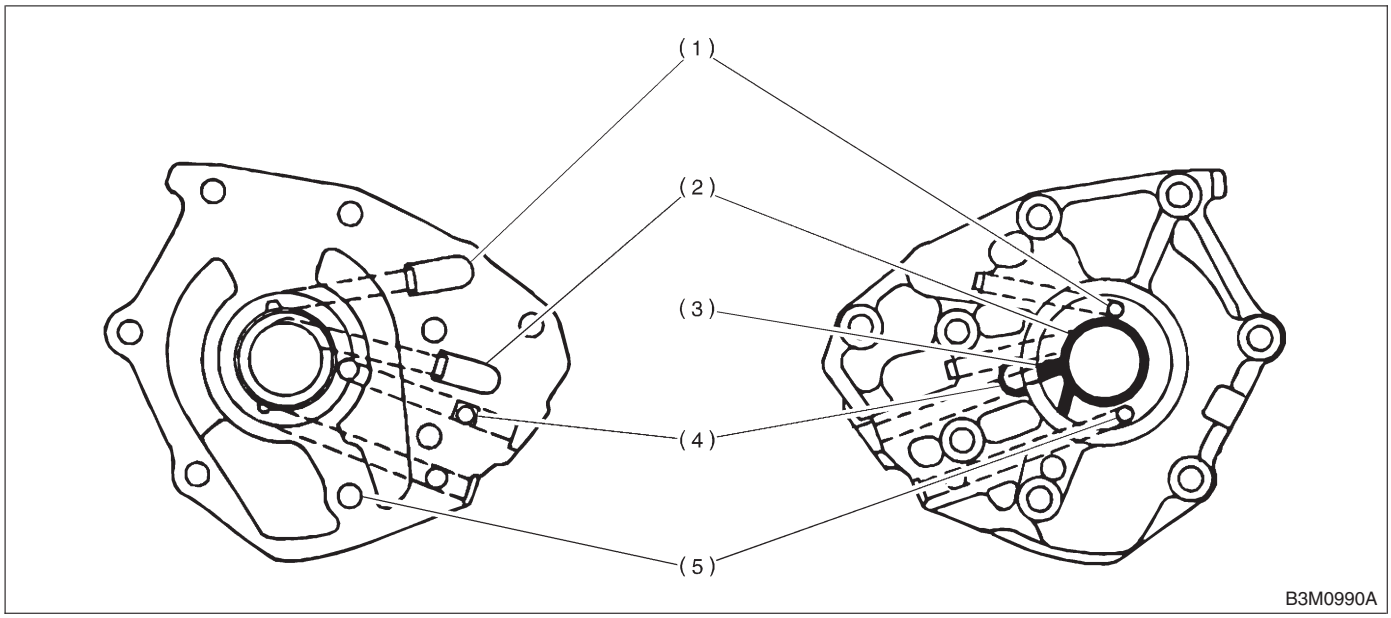
(1) Oil cooler outlet pressure
(2) Low & reverse brake pressure
(3) Oil cooler inlet pressure
(4) Low clutch pressure
(5) 2-4 brake pressure

C: TRANSMISSION CASE (REAR SIDE)



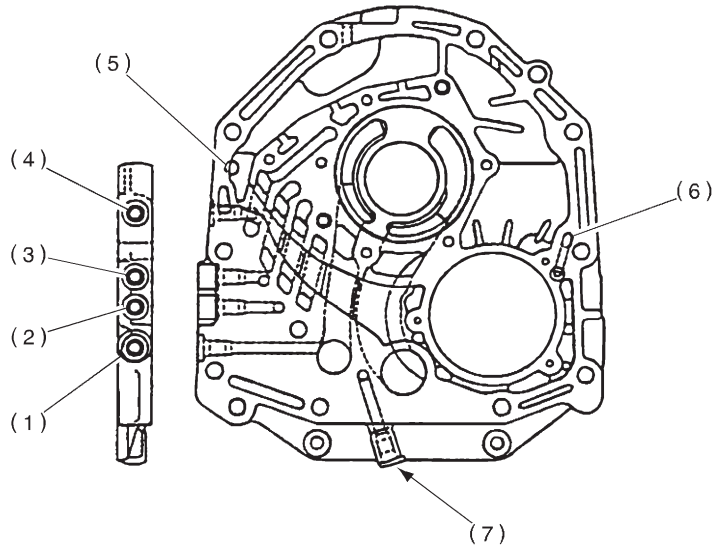
(1) Pilot pressure
(2) Line pressure

D: OIL PUMP COVER



(1) High clutch pressure
(2) Lock-up release pressure
(3) Front lubricating hole
(4) Lock-up apply pressure
(5) Reverse clutch pressure

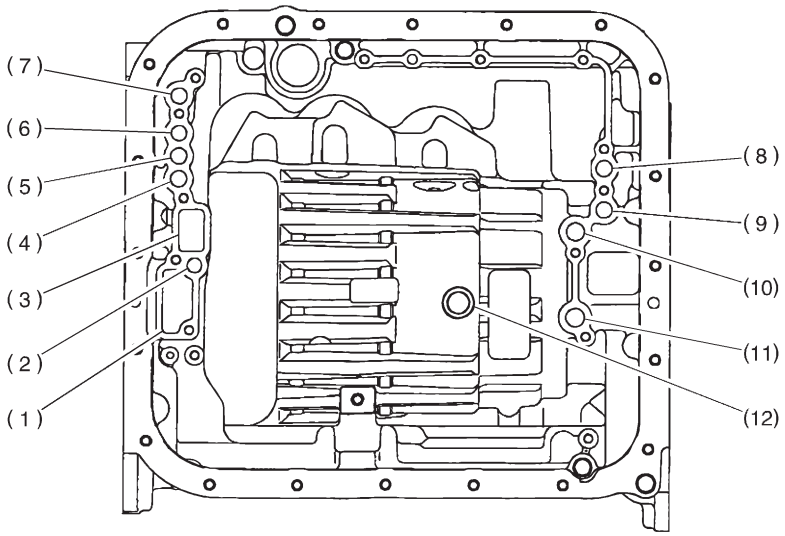
E: OIL PUMP HOUSING



B3M0991A

(1) Oil pump outlet pressure
(2) Lock-up apply pressure
(3) Lock-up release pressure
(4) High clutch pressure
(5) Drain
(6) Air breather
(7) Reverse clutch pressure

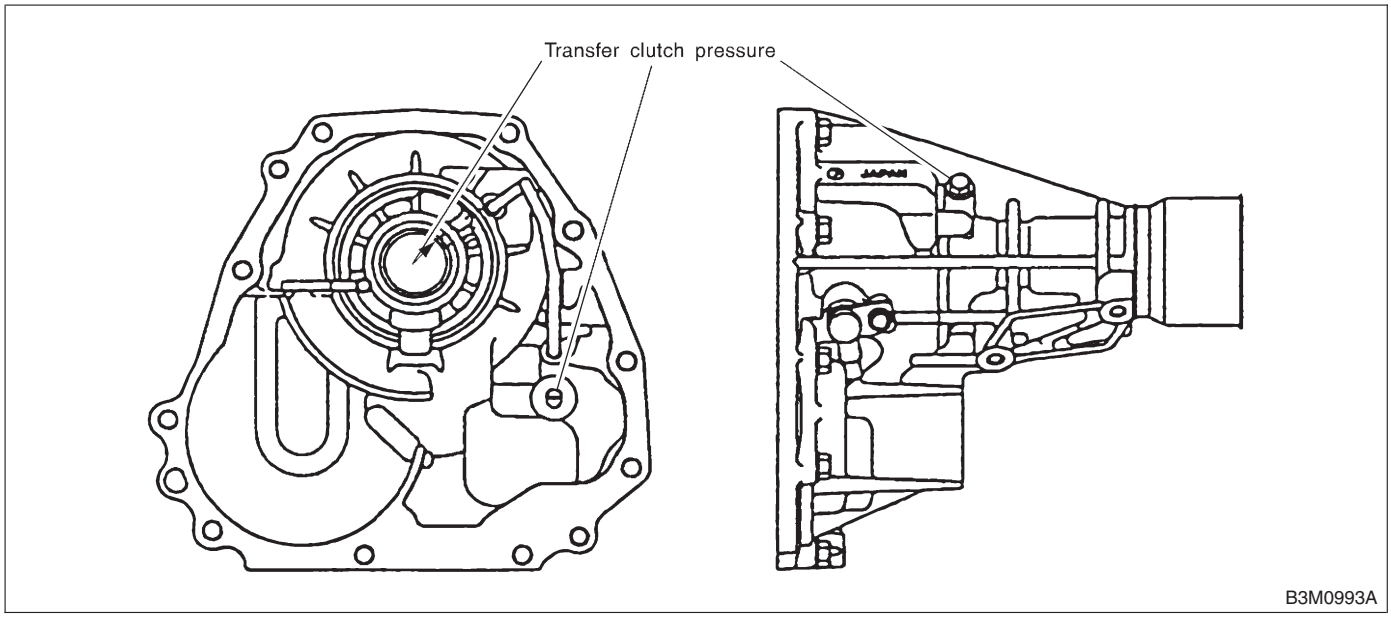
F: TRANSMISSION CASE



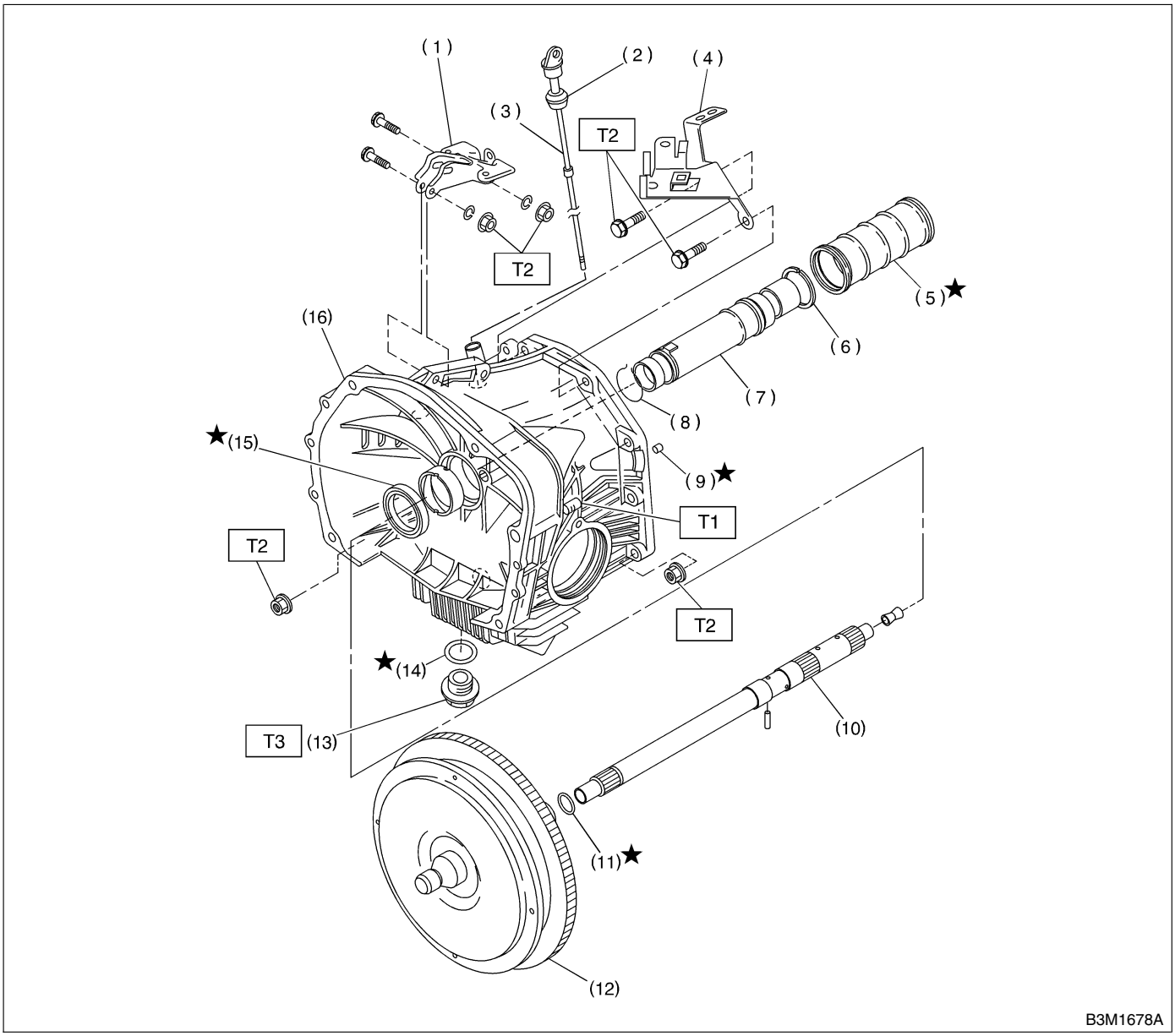
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(1) Oil pump inlet port
(2) Reverse clutch pressure
(3) Oil pump outlet port
(4) Lock-up apply pressure
(5) Lock-up release pressure
(6) High clutch pressure
(7) Oil cooler outlet pressure
(8) Line pressure
(9) Pilot pressure
(10) Low & reverse brake pressure
(11) Low clutch pressure
(12) 2-4 brake pressure

G: EXTENSION CASE



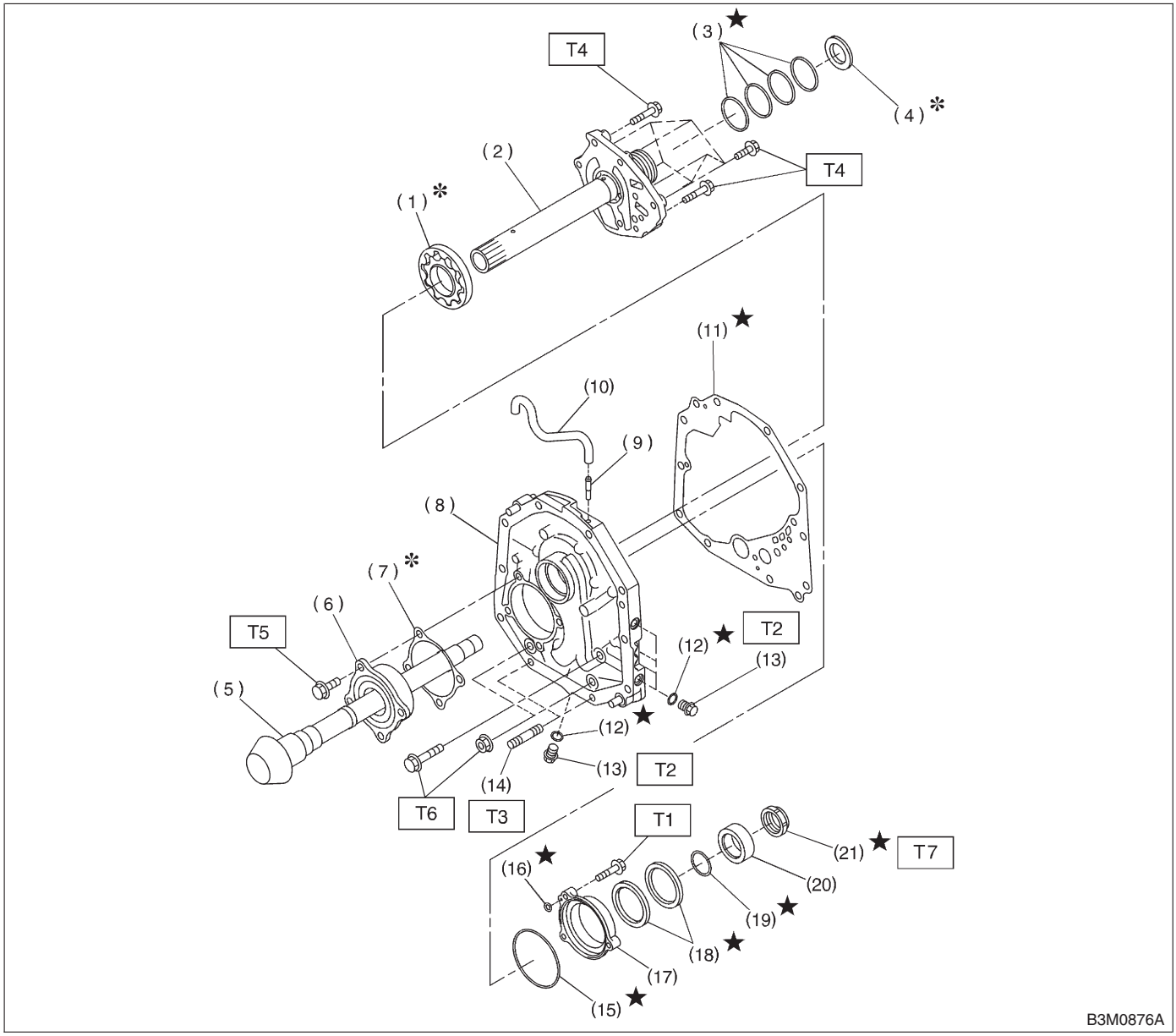
1. Torque Converter Clutch and Case



(1) Pitching stopper bracket
(2) O-ring
(3) Differential oil level gauge
(4) Stay
(5) Seal pipe
(6) Seal ring
(7) Oil pump shaft
(8) Clip
(9) Oil drain pipe
(10) Input shaft
(11) O-ring
(12) Torque converter clutch ASSY
(13) Drain plug
(14) Gasket
(15) Oil seal
(16) Torque converter clutch case

Tightening torque: N·m (kg-m, ft-lb)
T1: 18±5 (1.8±0.5, 13.0±3.6)
T2: 41±3 (4.2±0.3, 30.4±2.2)
T3: 44±3 (4.5±0.3, 32.5±2.2)

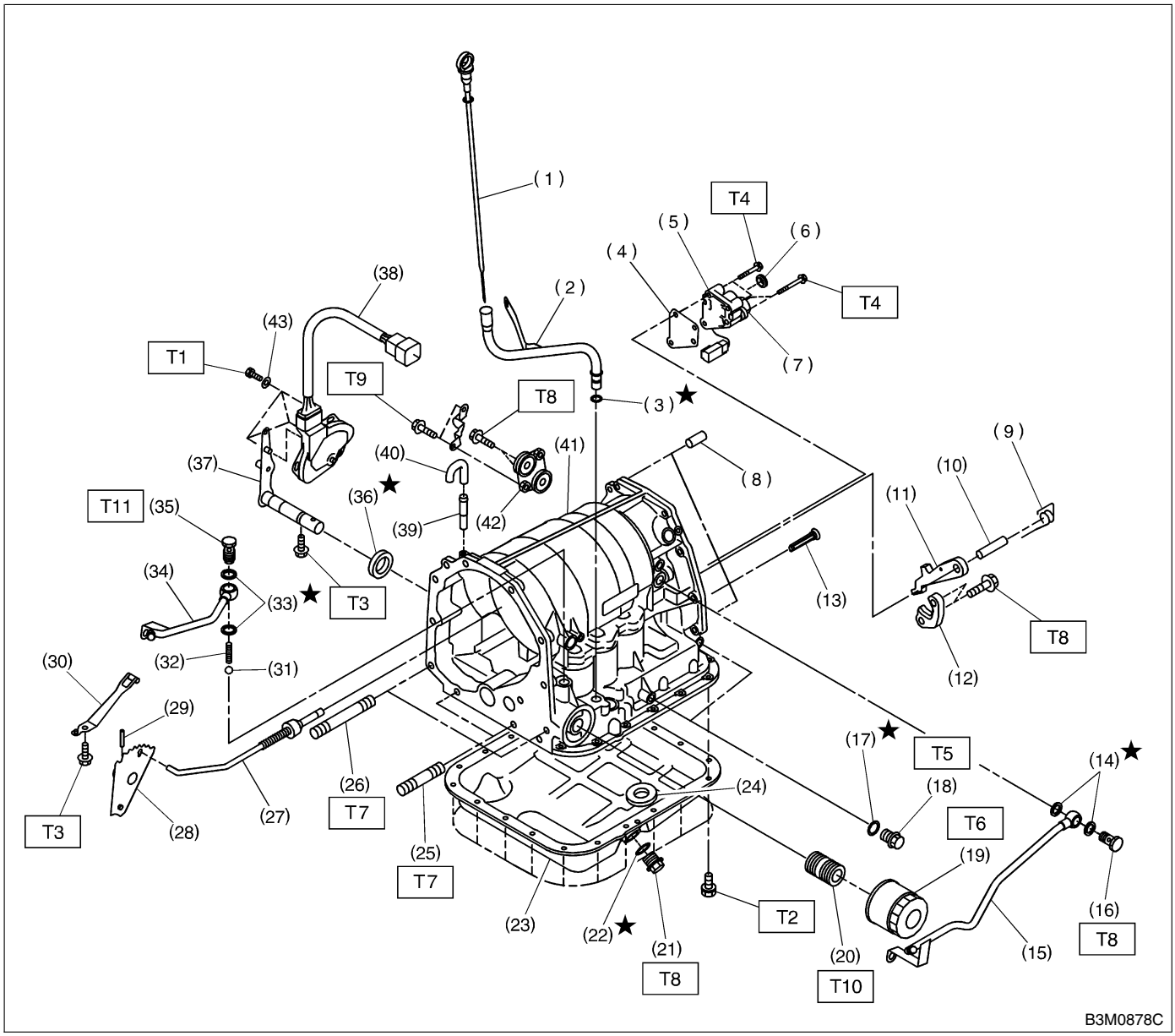
2. Oil Pump



(1) Oil pump rotor
(2) Oil pump cover
(3) Seal ring
(4) Thrust needle bearing
(5) Drive pinion shaft
(6) Roller bearing
(7) Shim
(8) Oil pump housing
(9) Nipple
(10) Air breather hose
(11) Gasket
(12) O-ring
(13) Test plug
(14) Stud bolt
(15) O-ring
(16) O-ring
(17) Oil seal retainer
(18) Oil seal
(19) O-ring
(20) Drive pinion collar
(21) Lock nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 7±1 (0.7±0.1, 5.1±0.7)
T2: 13±1 (1.3±0.1, 9.4±0.7)
T3: 18±5 (1.8±0.5, 13.0±3.6)
T4: 25±2 (2.5±0.2, 18.1±1.4)
T5: 39±3 (4.0±0.3, 28.9±2.2)
T6: 41±3 (4.2±0.3, 30.4±2.2)
T7: 121±5 (12.3±0.5, 89.0±3.6)

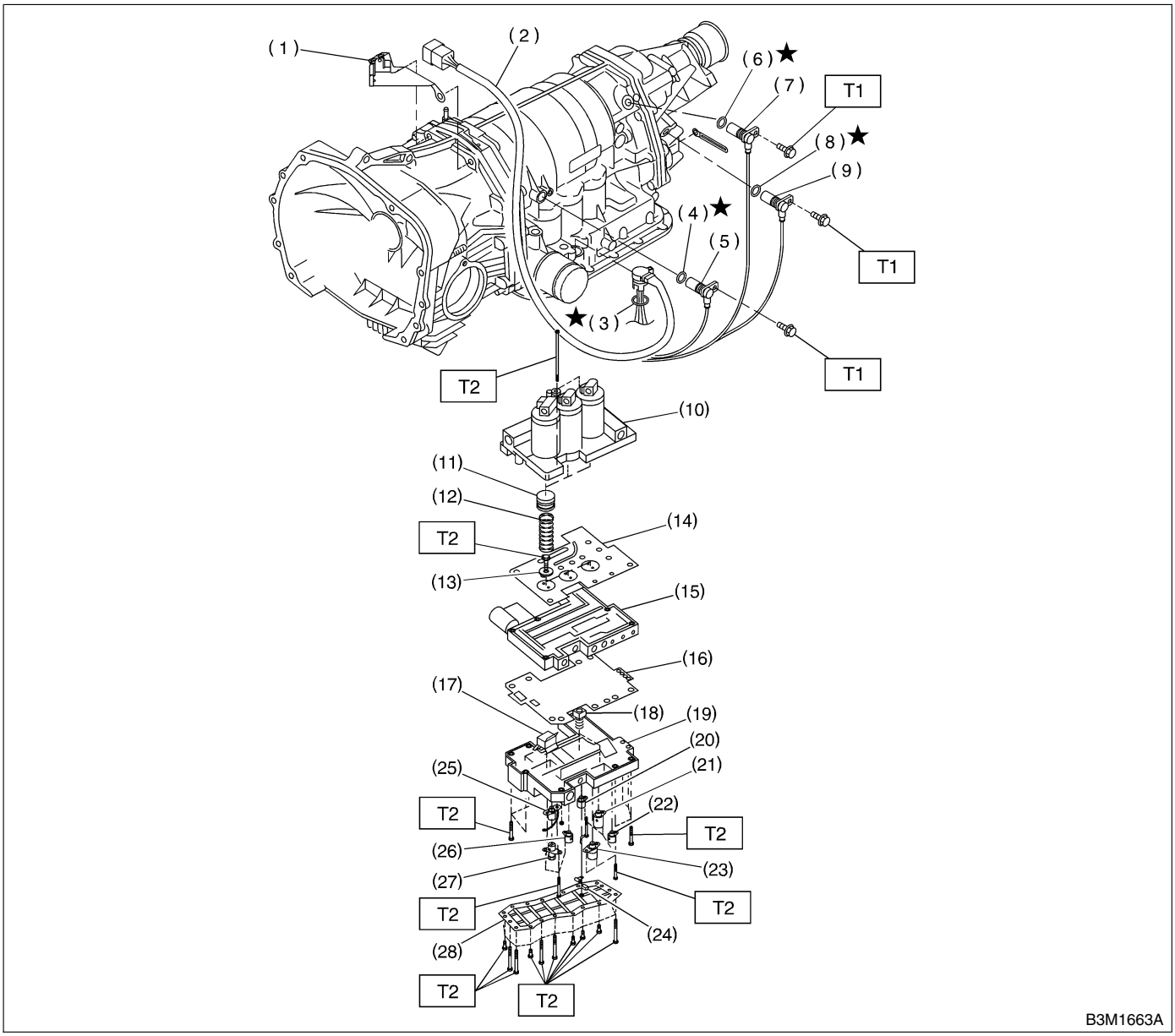
3. Transmission Case and Control Device



(1) Oil level gauge
(2) Oil charger pipe
(3) O-ring
(4) Transfer valve plate
(5) Transfer valve ASSY
(6) Transfer clutch seal
(7) Transfer duty solenoid
(8) Straight pin
(9) Return spring
(10) Shaft
(11) Parking pawl
(12) Parking support
(13) Inlet filter
(14) Gasket
(15) Inlet pipe
(16) Union screw
(17) O-ring
(18) Test plug
(19) Oil filter
(20) Oil filter stud bolt
(21) Drain plug
(22) Gasket
(23) Oil pan
(24) Magnet
(25) Stud bolt (Short)
(26) Stud bolt (Long)
(27) Parking rod
(28) Manual plate
(29) Spring pin
(30) Detention spring
(31) Ball
(32) Spring
(33) Gasket
(34) Outlet pipe
(35) Union screw
(36) Oil seal
(37) Select lever
(38) Inhibitor switch ASSY
(39) Nipple
(40) Air breather hose
(41) Transmission case
(42) Plate ASSY
(43) Washer

Tightening torque: N·m (kg-m, ft-lb)
T1: 3.4±0.5 (0.35±0.05, 2.5±0.4)
T2: 4.9±0.5 (0.50±0.05, 3.6±0.4)
T3: 6±1 (0.6±0.1, 4.3±0.7)
T4: 8±1 (0.8±0.1, 5.8±0.7)
T5: 13±1 (1.3±0.1, 9.4±0.7)
T6: 13.7±2.0 (1.4±0.2, 10.1±1.4)
T7: 18±3 (1.8±0.3, 13.0±2.2)
T8: 25±2 (2.5±0.2, 18.1±1.4)
T9: 33±10 (3.3±1.0, 24±7)
T10: 24.5±2.9 (2.5±0.3, 18.1±2.2)
T11: 44±4 (4.5±0.4, 32.5±2.9)

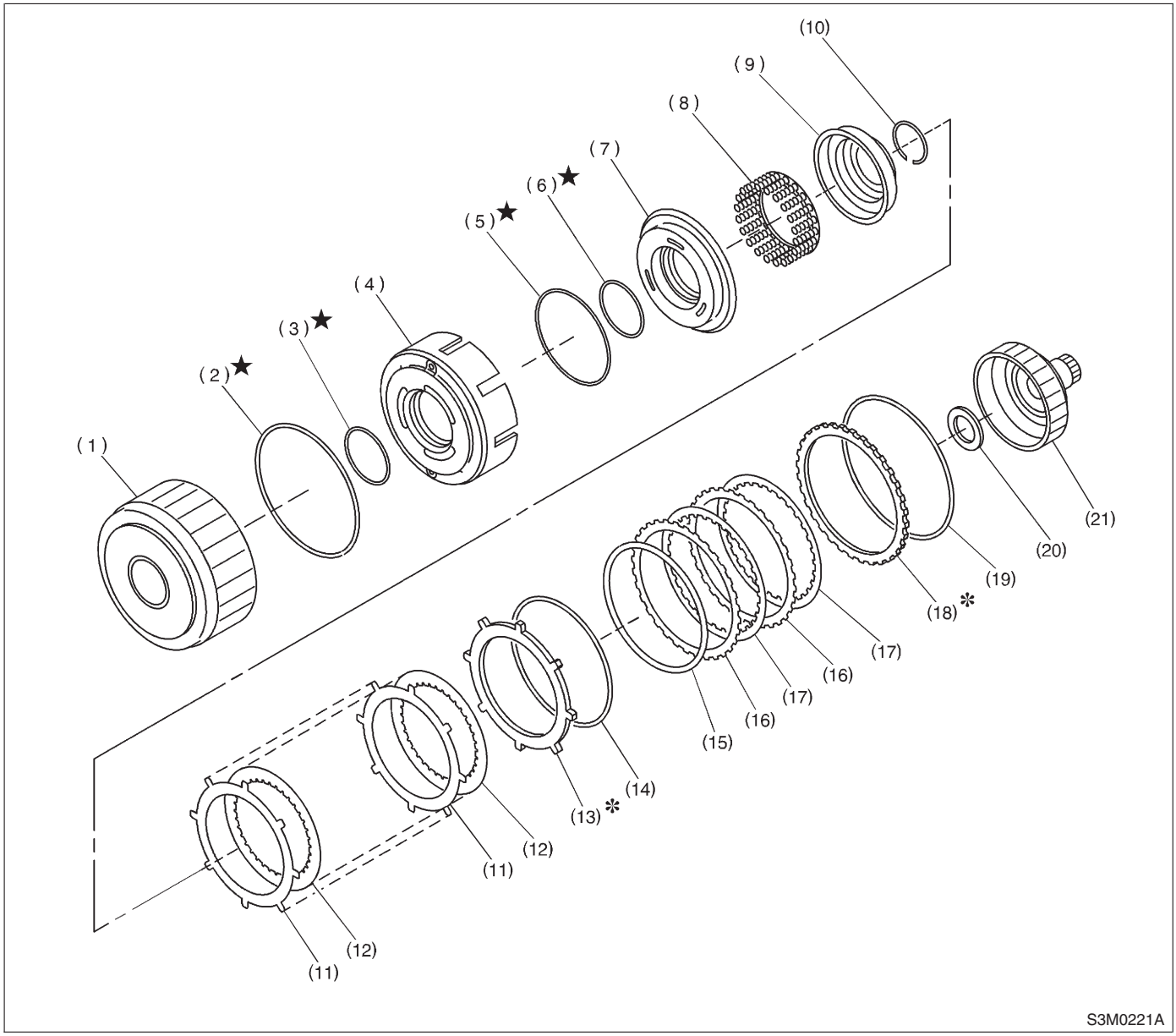
4. Control Valve and Harness Routing



(1) Stay
(2) Transmission harness
(3) O-ring
(4) O-ring
(5) Torque converter turbine speed sensor
(6) O-ring
(7) Vehicle speed sensor 2 (Front)
(8) O-ring
(9) Vehicle speed sensor 1 (Rear)
(10) Upper valve body
(11) Accumulator piston
(12) Accumulator spring
(13) Side plate
(14) Separate plate
(15) Middle valve body
(16) Separate plate
(17) Fluid filter
(18) Fluid filter
(19) Lower valve body
(20) Shift solenoid 2
(21) Shift solenoid 1
(22) 2-4 brake timing solenoid
(23) 2-4 brake duty solenoid
(24) ATF temperature sensor
(25) Line pressure duty solenoid
(26) Low clutch timing solenoid
(27) Lock-up duty solenoid
(28) Oil strainer

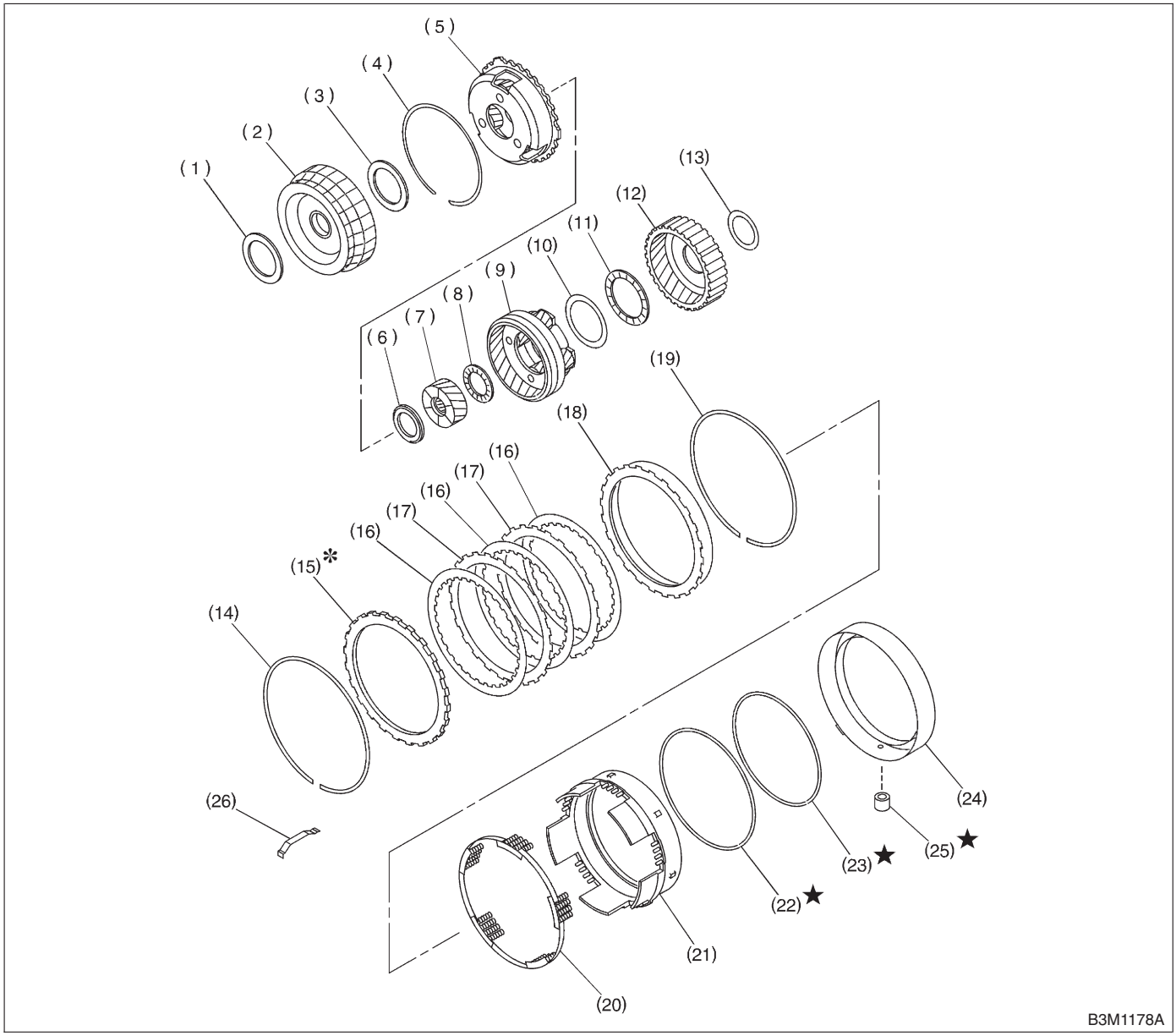
Tightening torque: N·m (kg-m, ft-lb)
T1: 7±1 (0.7±0.1, 5.1±0.7)
T2: 8±1 (0.8±0.1, 5.8±0.7)

5. High Clutch and Reverse Clutch



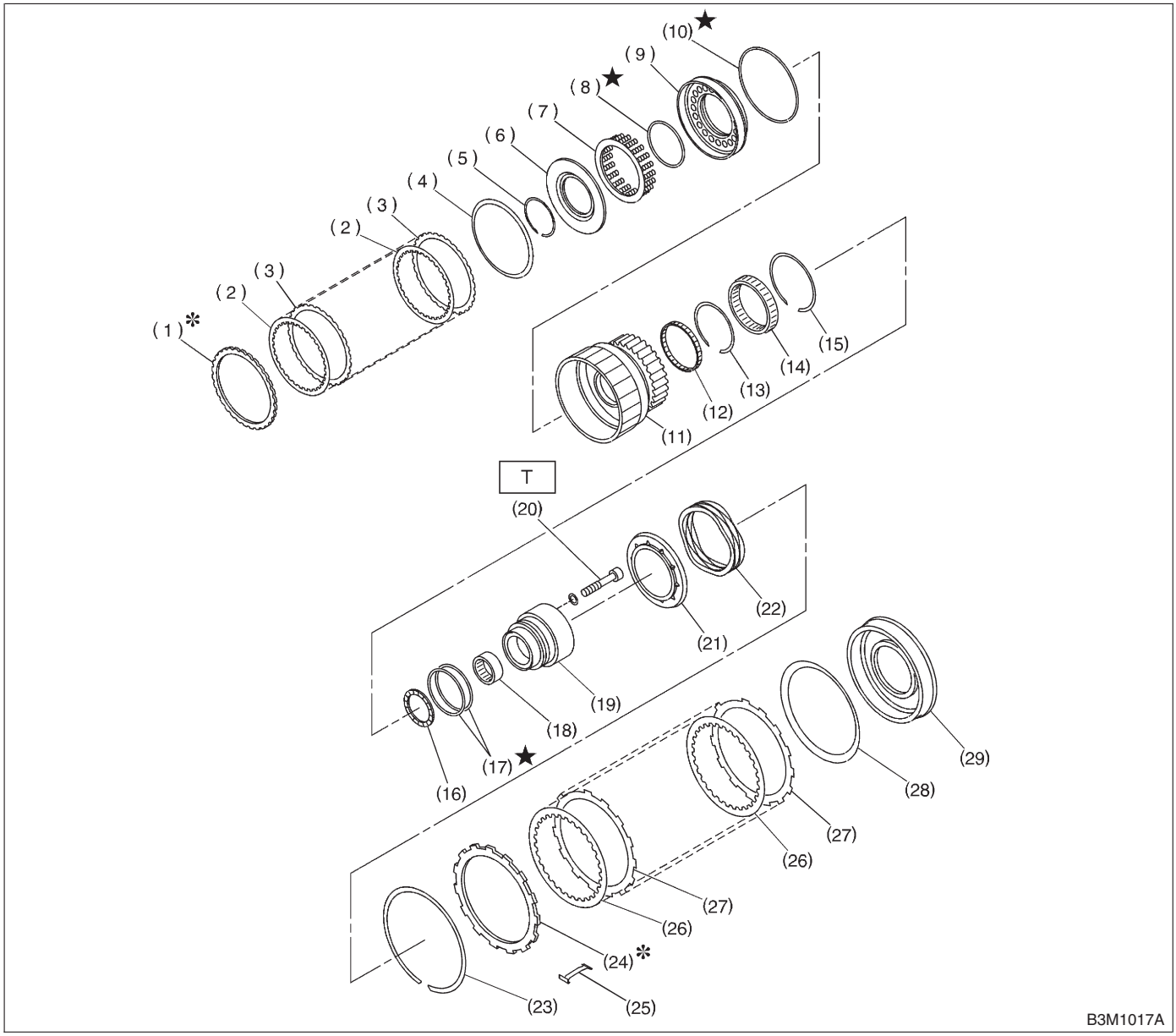
(1) High clutch drum
(2) Lip seal
(3) Lathe cut seal ring
(4) Reverse clutch piston
(5) Lathe cut seal ring
(6) Lathe cut seal ring
(7) High clutch piston
(8) Spring retainer
(9) Cover
(10) Snap ring
(11) Driven plate
(12) Drive plate
(13) Retaining plate
(14) Snap ring
(15) Dish plate
(16) Driven plate
(17) Drive plate
(18) Retaining plate
(19) Snap ring
(20) Thrust needle bearing
(21) High clutch hub

6. Planetary Gear and 2-4 Brake



(1) Thrust needle bearing
(2) Front sun gear
(3) Thrust needle bearing
(4) Snap ring
(5) Front planetary carrier
(6) Thrust needle bearing
(7) Rear sun gear
(8) Thrust needle bearing
(9) Rear planetary carrier
(10) Washer
(11) Thrust needle bearing
(12) Rear internal gear
(13) Washer
(14) Snap ring
(15) Retaining plate
(16) Drive plate
(17) Driven plate
(18) Pressure rear plate
(19) Snap ring
(20) Spring retainer
(21) 2-4 brake piston
(22) Lathe cut seal ring
(23) Lathe cut seal ring
(24) 2-4 brake piston retainer
(25) 2-4 brake seal
(26) Leaf spring

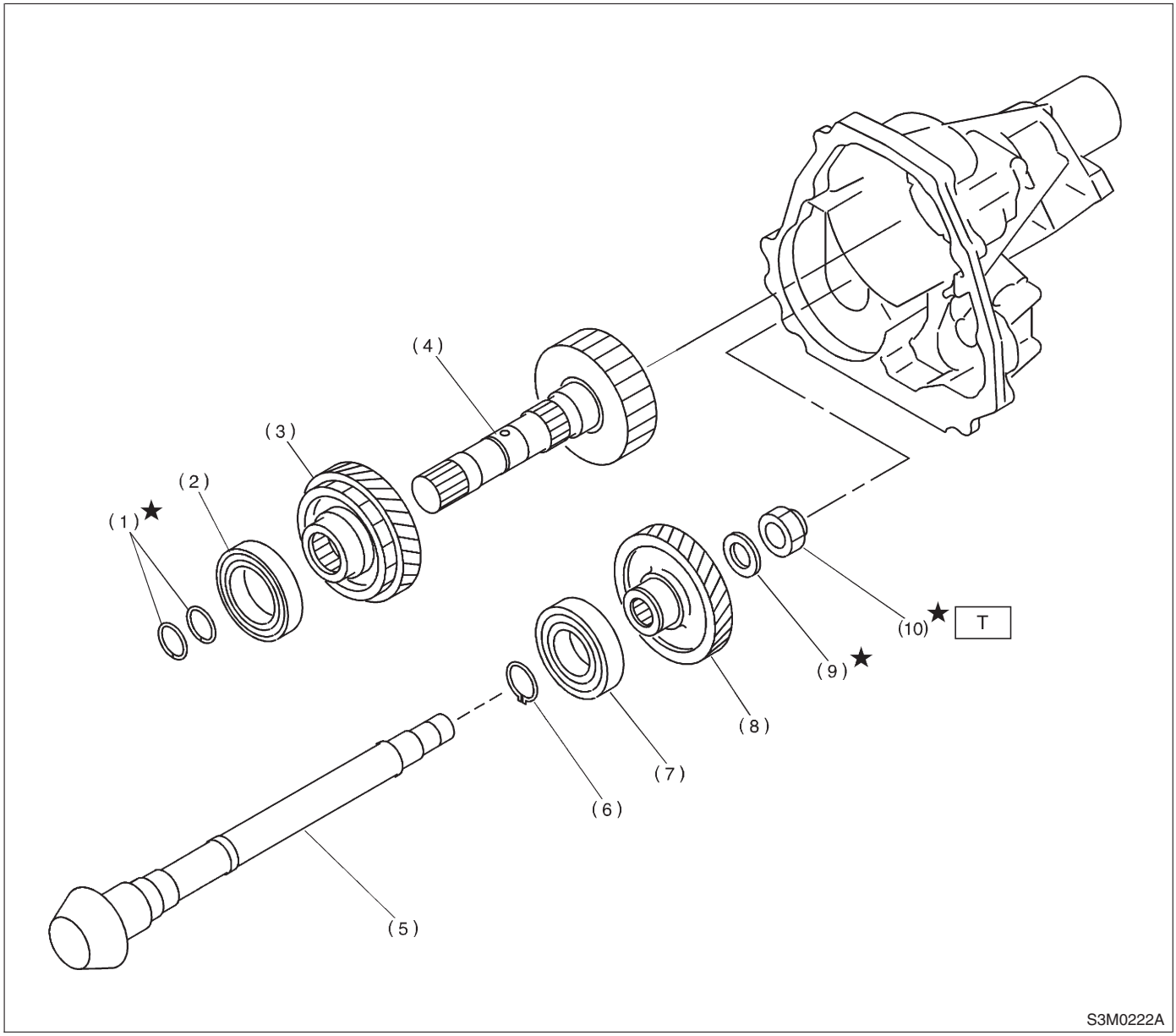
7. Low Clutch and Low & Reverse Brake



(1) Retaining plate
(2) Drive plate
(3) Driven plate
(4) Dish plate
(5) Snap ring
(6) Cover
(7) Spring retainer
(8) Lathe cut seal ring
(9) Low clutch piston
(10) Lathe cut seal ring
(11) Low clutch drum
(12) Needle bearing
(13) Snap ring (Inner)
(14) One-way clutch
(15) Snap ring (Outer)
(16) Thrust needle bearing
(17) Seal ring
(18) Needle bearing
(19) One-way clutch inner race
(20) Socket bolt
(21) Retainer
(22) Return spring
(23) Snap ring
(24) Retaining plate
(25) Leaf spring
(26) Drive plate
(27) Driven plate
(28) Dish plate
(29) Low and reverse brake piston

Tightening torque: N·m (kg-m, ft-lb)
T: 25±2 (2.5±0.2, 18.1±1.4)

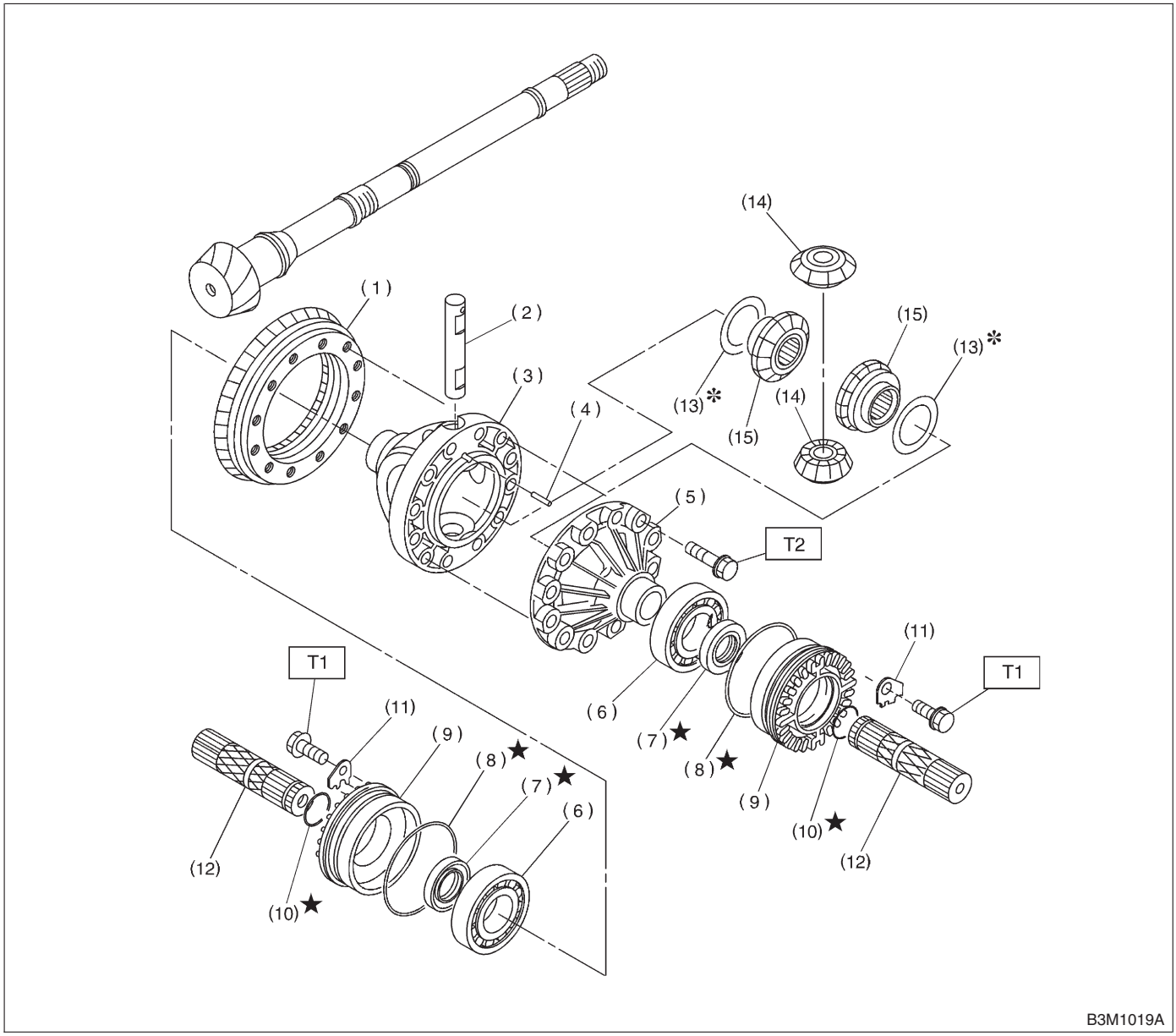
8. Reduction Gear



(1) Seal ring
(2) Ball bearing
(3) Reduction drive gear
(4) Reduction drive shaft
(5) Drive pinion shaft
(6) Snap ring
(7) Ball bearing
(8) Reduction driven gear
(9) Washer
(10) Lock nut

Tightening torque: N·m (kg-m, ft-lb)
T: 100±5 (10.2±0.5, 73.8±3.6)

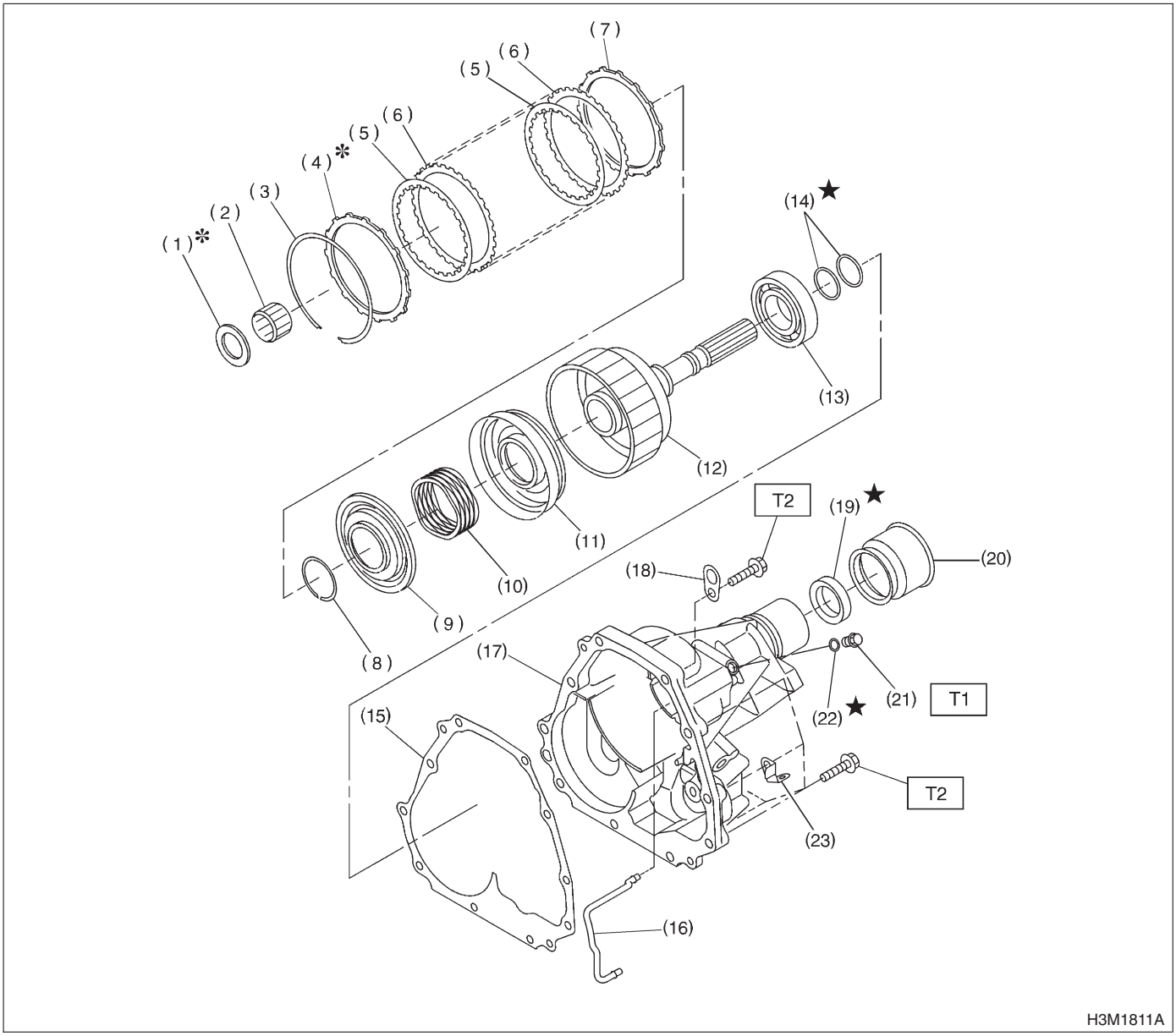
9. Differential Case



(1) Crown gear
(2) Pinion shaft
(3) Differential case (RH)
(4) Straight pin
(5) Differential case (LH)
(6) Taper roller bearing
(7) Oil seal
(8) O-ring
(9) Differential side retainer
(10) Circlip
(11) Lock plate
(12) Axle shaft
(13) Washer
(14) Differential bevel pinion
(15) Differential bevel gear

Tightening torque: N·m (kg-m, ft-lb)
T1: 25±2 (2.5±0.2, 18.1±1.4)
T2: 62±5 (6.3±0.5, 45.6±3.6)

10. Transfer and Extension



(1) Thrust needle bearing
(2) Needle bearing
(3) Snap ring
(4) Pressure plate
(5) Drive plate
(6) Driven plate
(7) Pressure plate
(8) Snap ring
(9) Transfer piston seal
(10) Return spring
(11) Transfer clutch piston
(12) Rear drive shaft
(13) Ball bearing
(14) Seal ring
(15) Gasket
(16) Transfer clutch pipe
(17) Extension case
(18) Transmission hanger
(19) Oil seal
(20) Dust cover
(21) Test plug
(22) O-ring
(23) Clip

Tightening torque: N·m (kg-m, ft-lb)
T1: 13±1 (1.3±0.1, 9.4±0.7)
T2: 25±2 (2.5±0.2, 18.1±1.4)

1. General

A: PRECAUTION

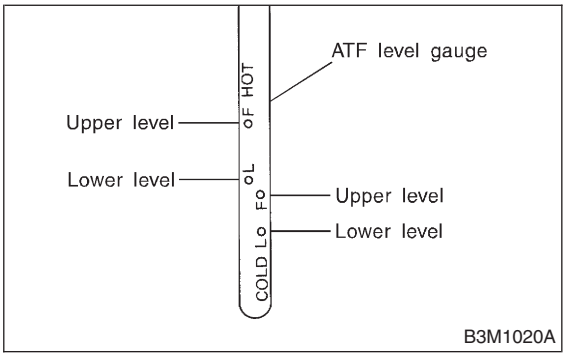
When disassembling or assembling the automatic transmission, observe the following instructions.
1) Workshop
Provide a place that is clean and free from dust. Principally the conventional workshop is suitable except for a dusty place. In a workshop where grinding work, etc. which produces fine particles is done, make independent place divided by the vinyl curtain or the equivalent.
2) Work table
The size of 1 x 1.5 m (40 x 60 in) is large enough to work, and it is more desirable that its surface be covered with flat plate like iron plate which is not rusted too much.
3) Cleaning of exterior
(1) Clean the exterior surface of transmission with steam and/or kerosene prior to disassembly, however it should be noted that vinyl tape be placed on the air breather or oil level gauge to prevent infiltration of the steam into the transmission and also the cleaning job be done away from the place of disassembly and assembly.
(2) Partial cleaning will do, depending on the extent of disassembly (such as when disassembly is limited to some certain parts).
4) Disassembly, assembly and cleaning
(1) Disassemble and assemble the transmission while inspecting the parts in accordance with the Diagnostics.
(2) During job, do not use gloves. Do not clean the parts with rags: Use chamois or nylon cloth.
(3) Pay special attention to the air to be used for cleaning. Get the moisture and the dust rid of the air as much as possible. Be careful not to scratch or dent any part while checking for proper operation with an air gun.
(4) Complete the job from cleaning to completion of assembly as continuously and speedily as possible in order to avoid occurrence of secondary troubles caused by dust. When stopping the job unavoidably cover the parts with clean chamois or nylon cloth to keep them away from any dust.
(5) Use kerosene, white gasoline or the equivalent as washing fluid. Use always new fluid for cleaning the automatic transmission parts and never reuse. The used fluid is usable in disassemble and assemble work of engine and manual transmission.
(6) Although the cleaning should be done by dipping into the washing fluid or blowing of the pressurized washing fluid, the dipping is more desirable. (Do not rub with a brush.) Assemble the parts immediately after the cleaning without exposure to the air for a while. Besides in case of washing rubber parts, perform the job quickly not to dip them into the washing fluid for long time.
(7) Apply the automatic transmission fluid (ATF) onto the parts immediately prior to assembly, and the specified tightening torque should be observed carefully.
(8) Use vaseline if it is necessary to hold parts in the position when assembling.
(9) Drain ATF and differential gear oil into a saucer so that the conditions of fluid and oil can be inspected.
(10) Do not support axle drive shaft, stator shaft, input shaft or various pipes when moving transmission from one place to another.
(11) Always discard old oil seals and O-ring, and install new ones.
(12) Be sure to replace parts which are damaged, worn, scratched, discolored, etc.

B: INSPECTION

1. ATF LEVEL

1) Raise ATF temperature to 60 to 80°C (140 to 176°F) from 40 to 60°C (104 to 140°F) (when cold) by driving a distance of 5 to 10 km (3 to 6 miles).

NOTE:
The level of ATF varies with fluid temperature. Pay attention to the fluid temperature when checking oil level.



2) Make sure the vehicle is level. After selecting all positions (P, R, N, D, 3, 2, 1), set the selector leveler in “P” range. Measure fluid level with the engine idling.

NOTE:
After running, idle the engine for one or two minutes before measurement.

3) If the fluid level is below the center between upper and lower marks, add the recommended ATF until the fluid level is found within the specified range (above the center between upper and lower marks). When the transmission is hot, the level

should be above the center of upper and lower marks, and when it is cold, the level should be found below the center of these two marks.

CAUTION:
● Use care not to exceed the upper limit level.
● ATF level varies with temperature. Remember that the addition of fluid to the upper limit mark when the transmission is cold will result in the overfilling of fluid.

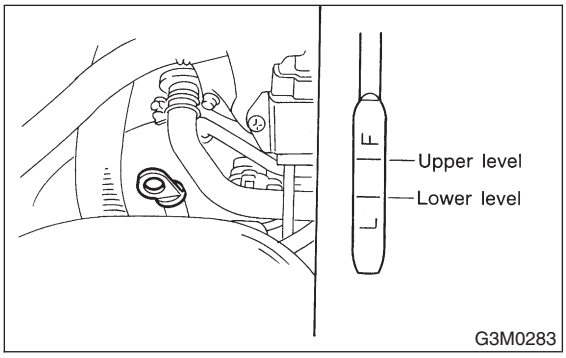
4) Fluid temperature rising speed
● By idling the engine
Time for temperature rise to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 25 minutes
<Reference>
Time for temperature rise to 30°C (86°F) with atmospheric temperature of 0°C (32°F): Approx. 8 minutes
● By running the vehicle
Time for temperature rise to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 10 minutes
5) Method for checking fluid level upon delivery or at periodic inspection
Check fluid level after a warm-up run of approx. 10 minutes. During the warm-up period, the automatic transmission functions can also be checked.

2. DIFFERENTIAL GEAR OIL LEVEL

1) Ensure the vehicle is in safe condition.

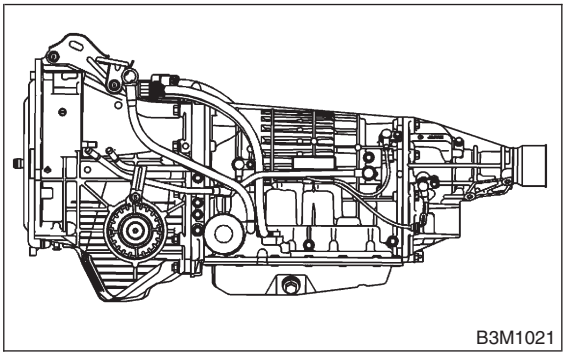
NOTE:
Do not check the oil level nor add oil to the case with the front end of the vehicle jacked-up; this will result in an incorrect reading of the oil level.

2) Check whether the oil level is between the upper (F) and lower (L) marks. If it is below the lower limit mark, add oil until the level reaches the upper mark.

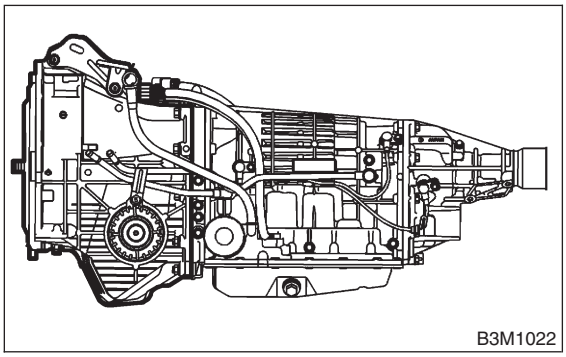


3. OIL LEAKAGE

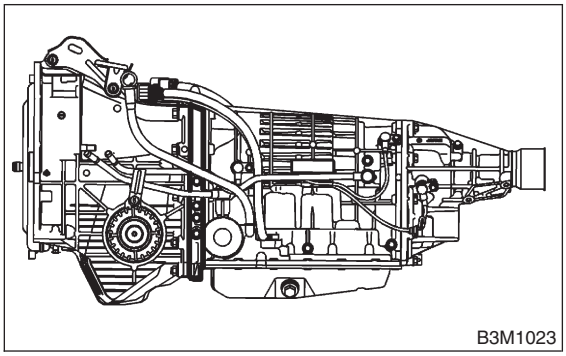
It is difficult to accurately determine the precise position of a oil leak, since the surrounding area also becomes wet with oil.
The points listed below should be checked for fluid leakage.
Checking method is as follows:
(1) Place the vehicle in the pit, and check whether the leaking oil is ATF or not. The ATF is wine red in color, and can be discriminated easily from engine oil and gear oil.
(2) Wipe clean the leaking oil and dust from a suspectable area, using a noninflammable organic solvent such as carbon tetrachloride.
(3) Run the engine to raise the fluid temperature, and set the selector lever to “D” in order to increase the fluid pressure and quickly detect a leaking point. Also check for fluid leaks while shifting select lever to “R”, “2”, and “1”.
The places where oil seals and gaskets are applied are:
1) Jointing portion of the case
● Transmission case and oil pump housing jointing portion
● Torque converter clutch case and oil pump housing jointing portion
● Transmission case and extension case jointing portion



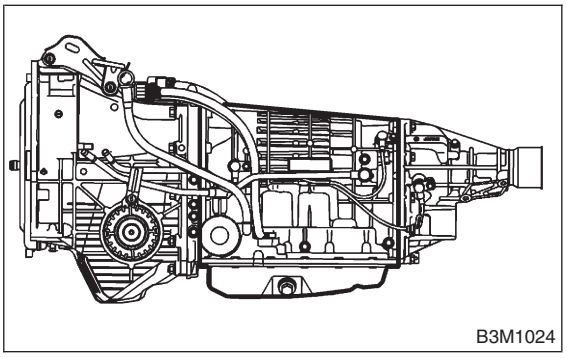
2) Torque converter clutch case
- Engine crankshaft oil seal
- Torque converter clutch impeller sleeve oil seal
- ATF cooler pipe connector
- Torque converter clutch
- Torque converter clutch case
- Axle shaft oil seal
- O-ring on the outside diameter of axle shaft oil seal holder
- O-ring on the differential oil gauge
- Differential oil drain plug
- Location of steel balls


B3M1022

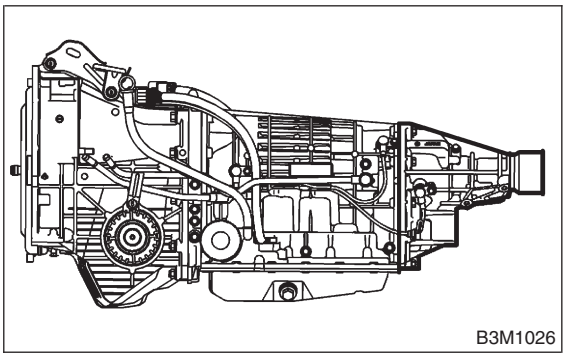
3) Oil pump housing
- Oil pump housing (Defective casting)
- O-ring on the test plugs
- Differential gear breather


B3M1023

4) Automatic transmission case
- Transmission case (Defective casting)
- Mating surface of oil pan
- O-ring on the test plugs
- Oil supply pipe connector
- ATF cooler pipe connector and gasket
- Oil pan drain plug
- O-ring on the transmission harness holder
- Oil pump plugs
- ATF breather
- Shift lever oil seal
- O-ring on the vehicle speed sensor 2 (Front)
- O-ring on the turbine revolution sensor
- ATF filter oil seal


B3M1024

5) Extension case
- Extension case (Defective casting)
- O-ring on the vehicle speed sensor 1 (Rear)
- Rear drive shaft oil seal
- O-ring on the test plugs


B3M1026

2. Inhibitor Switch

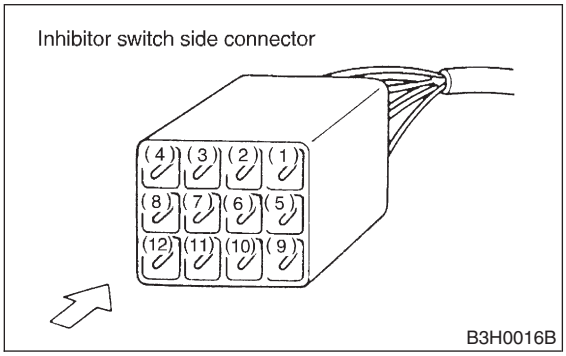
A: INSPECTION

When driving condition or starter motor operation is erroneous, first check the shift linkage for improper operation. If the shift linkage is functioning properly, check the inhibitor switch.
1) Disconnect inhibitor switch connector.
2) Check continuity in inhibitor switch circuits with select lever moved to each position.

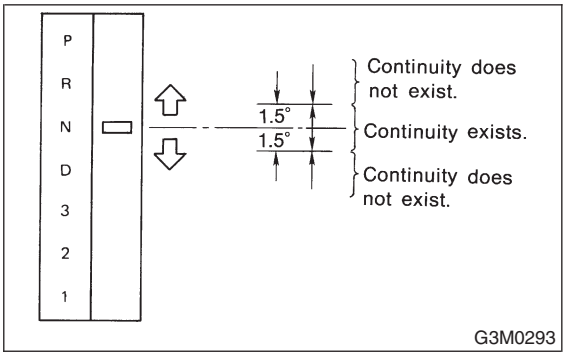
CAUTION:
Also check that continuity in ignition circuit does not exist when select lever is in R, D, 3, 2 and 1 ranges.

NOTE:
If inhibitor switch is inoperative, check for poor contact of connector on transmission side.

	Position	Pin No.
Signal sent to TCM	P	4 — 3
	R	4 — 2
	N	4 — 1
	D	4 — 8
	3	4 — 7
	2	4 — 6
	1	4 — 5
Ignition circuit	P/N	12 — 11
Back-up light circuit	R	10 — 9

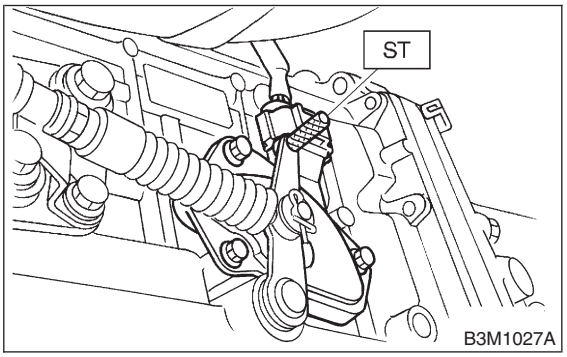


3) Check if there is continuity at equal points when the select lever is turned 1.5° in both directions from the N range.
If there is continuity in one direction and the continuity in the other or if there is continuity at unequal points, adjust the inhibitor switch.



B: ADJUSTMENT

1) Loosen the three inhibitor switch securing bolts.
2) Shift the select lever to the N range.
3) Insert ST as vertical as possible into the holes in the inhibitor switch lever and switch body.
ST 499267300 STOPPER PIN



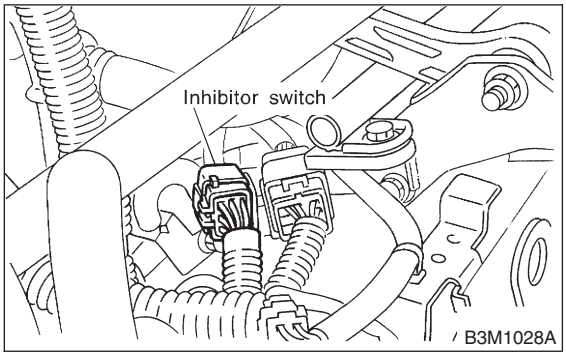
4) Tighten the three inhibitor switch bolts.

Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)

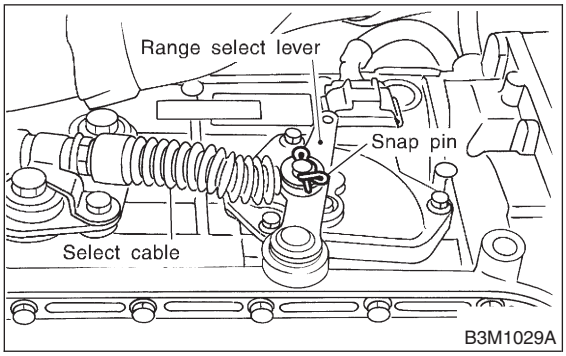
5) Repeat the above checks. If the inhibitor switch is determined to be “faulty”, replace it.

C: REMOVAL

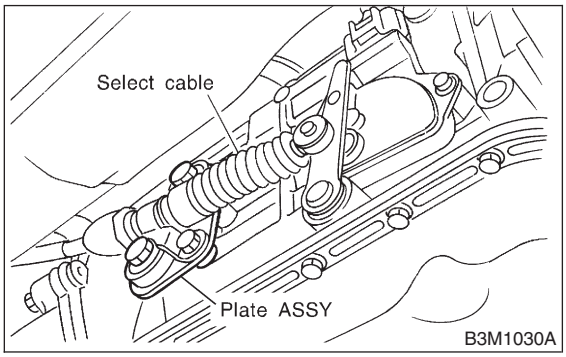
1) Move select lever to neutral position.
2) Remove air cleaner case and duct. <Ref. to 2-7 [W1A0].>
3) Disconnect inhibitor switch connector.



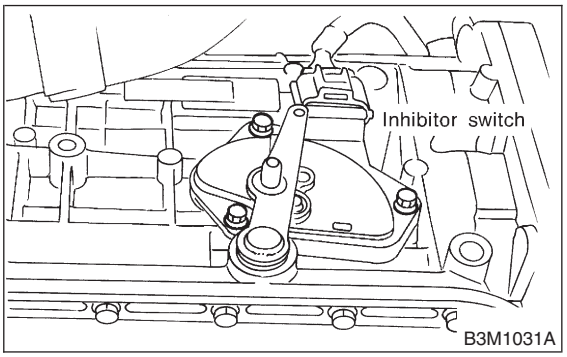
4) Remove front exhaust pipe. <Ref. to 2-9 [W1A0].>
5) Remove snap pin from range select lever.



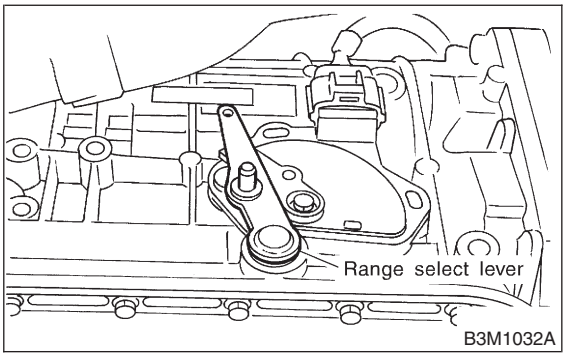
6) Remove plate assembly from transmission case.



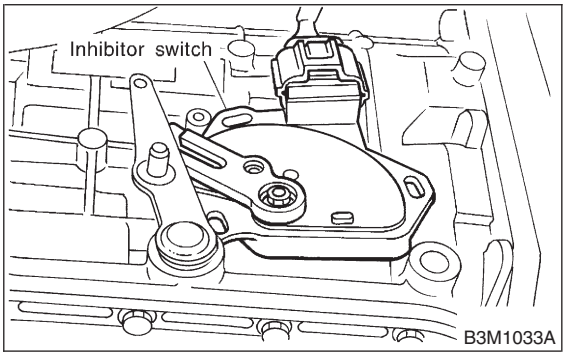
7) Remove bolts.



8) Move range select lever to parking position (left side).

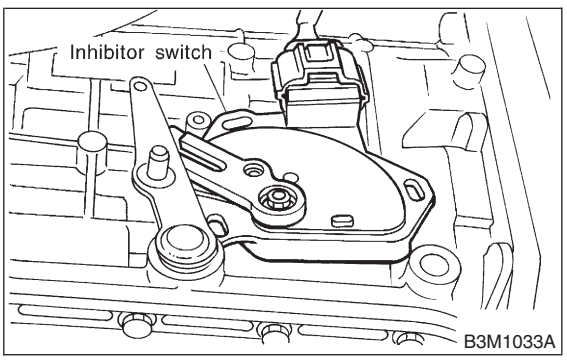


9) Remove inhibitor switch from transmission.

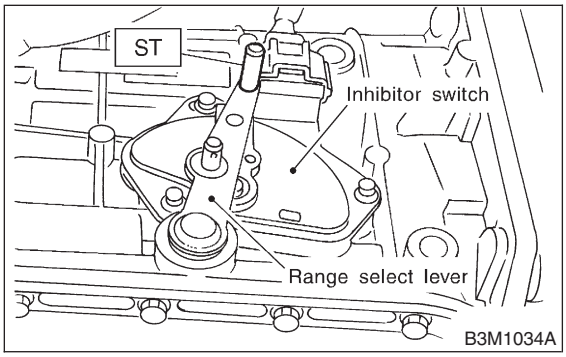


D: INSTALLATION

1) Install inhibitor switch to transmission case.

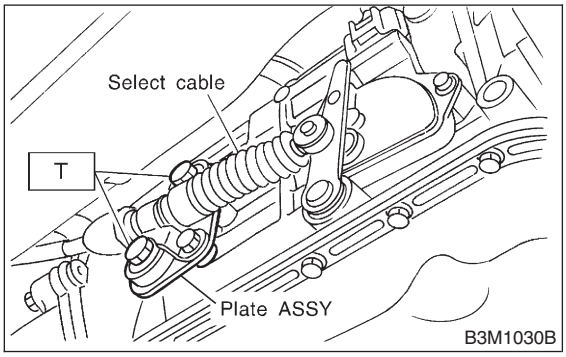


2) Move range select lever to neutral position.
3) Using ST, tighten bolts of inhibitor switch. <Ref. to 3-2 [W2B0].>
ST 499267300 STOPPER PIN

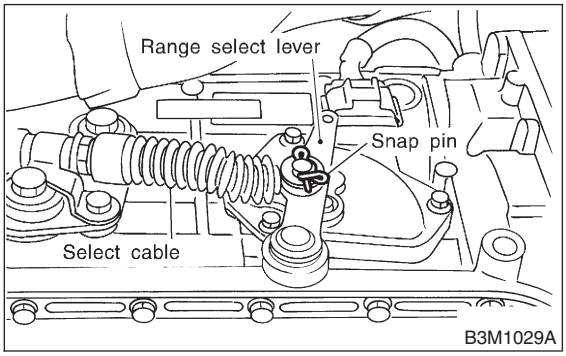


4) Install select cable to range select lever.
5) Install plate assembly to transmission.

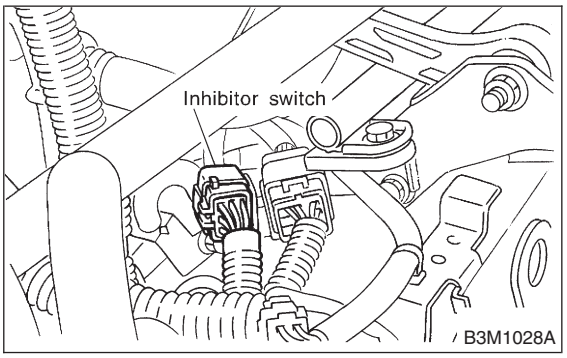
Tightening torque:
T: 24.5±2.0 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



6) Install snap pin to range select lever.



7) Install front exhaust pipe. <Ref. to 2-9 [W1B0].>
8) Connect inhibitor switch connector.

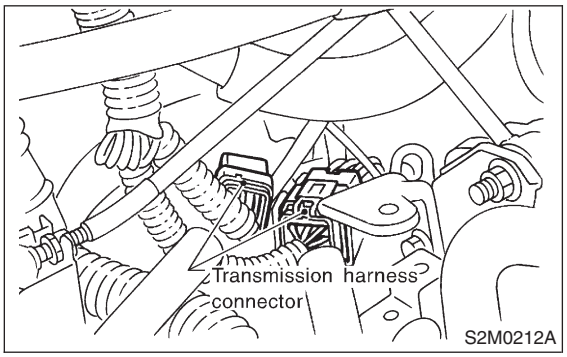


9) Install air cleaner case and duct. <Ref. to 2-7 [W1A0].>

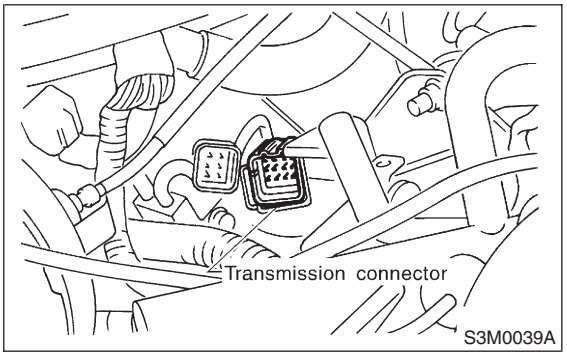
3. Sensor (in transmission)

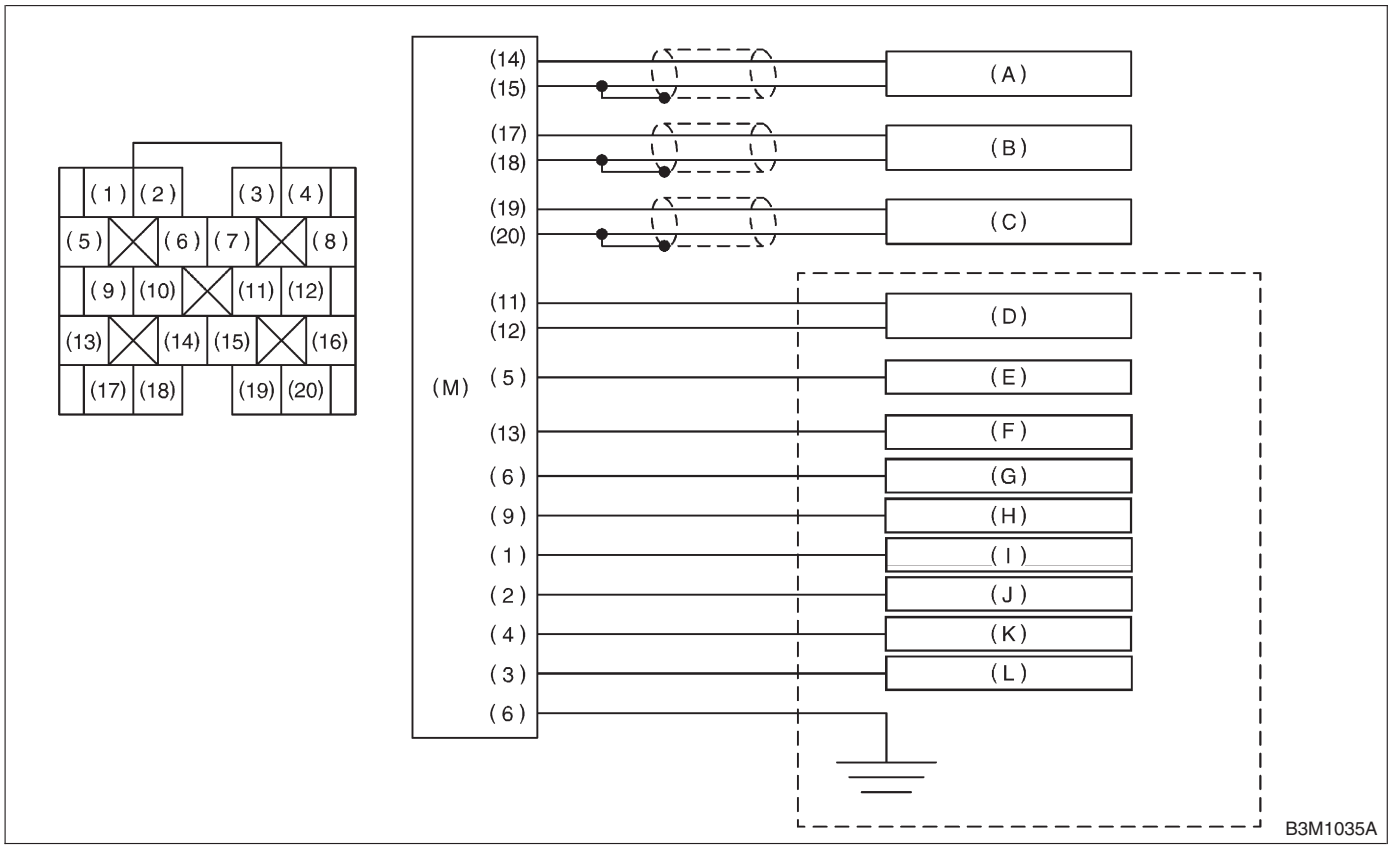
A: INSPECTION

1) Remove air cleaner case and duct. <Ref. to 2-7 [W1A0].>
2) Disconnect transmission connector.



3) Check each sensor, solenoid and ground system for short circuits.





(A) Torque converter turbine speed sensor
(B) Vehicle speed sensor 2 (Front)
(C) Vehicle speed sensor 1 (Rear)
(D) ATF temperature sensor
(E) Line pressure duty solenoid
(F) Lock-up duty solenoid
(G) Transfer duty solenoid
(H) 2-4 brake duty solenoid
(I) Shift solenoid 1
(J) Shift solenoid 2
(K) 2-4 brake timing solenoid
(L) Low clutch timing solenoid
(M) Transmission connector

1. EVALUATION

NOTE:
If part is faulty, its resistance value will be different from the standard value indicated above.

Part name	Terminal	Resistance (Ω)
Vehicle speed sensor 1	17 — 18	450 — 650
Vehicle speed sensor 2	19 — 20	450 — 650
ATF temperature sensor	11 — 12	2,100 — 2,900/ 20°C (68°F) 275 — 375/ 80°C (176°F)
Torque converter turbine speed sensor	14 — 15	450 — 650
Shift solenoid 1	1 — 16	10 — 16
Shift solenoid 2	2 — 16	10 — 16
Line pressure duty solenoid	5 — 16	2.0 — 4.5
Lock-up duty solenoid	13 — 16	10 — 17
2-4 brake duty solenoid	9 — 16	2.0 — 4.5
Low clutch timing solenoid	3 — 16	10 — 16
2-4 brake timing solenoid	4 — 16	10 — 16
Transfer duty solenoid	6 — 16	10 — 17

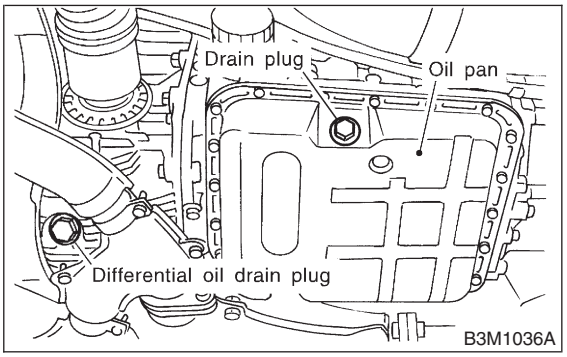
4. Shift Solenoid, Duty Solenoid and Valve

A: REMOVAL

1) Clean transmission exterior.
2) Drain ATF completely.

NOTE:
Tighten ATF drain plug after draining ATF.

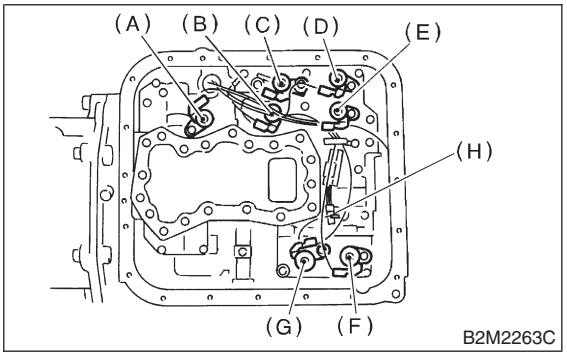
Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



3) Remove oil pan.

NOTE:
Drain oil into a container.

4) Disconnect solenoid and sensor connectors.
Remove connectors from clip and disconnect connectors at 8 places.

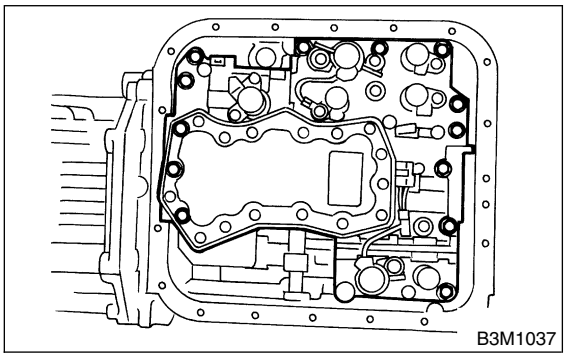


(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

5) Remove control valve body.

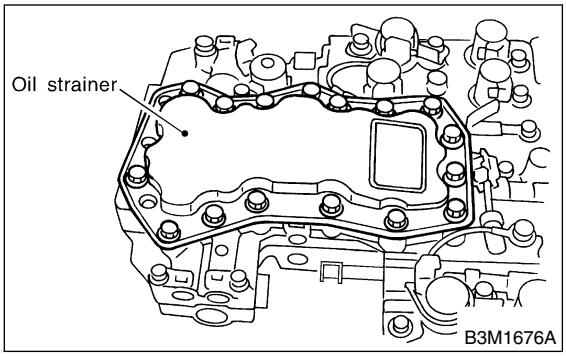
CAUTION:
When removing control valve body, be careful not to interfere with transfer transfer duty solenoid wiring.

NOTE:
Be careful because oil flows from valve body.

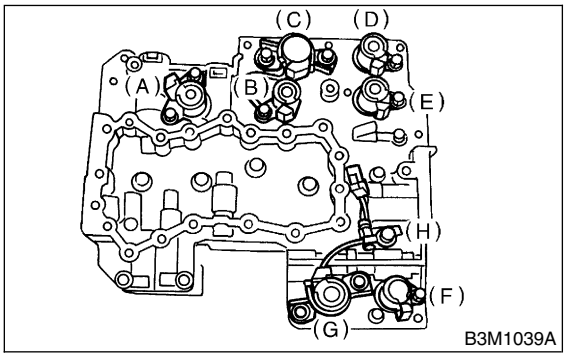


6) Remove oil strainer.

NOTE:
Be careful because oil flows from oil strainer.



7) Remove solenoids and duty solenoids.

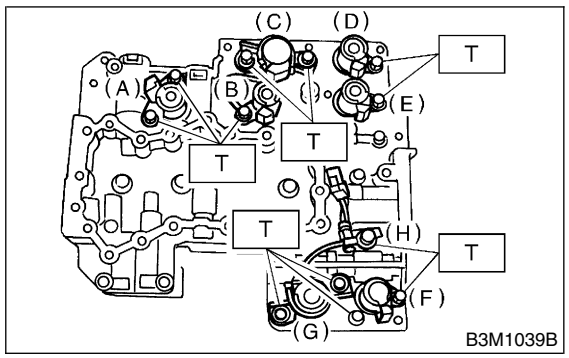


(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

B: INSTALLATION

1) Install 7 solenoids and ATF temperature sensor.

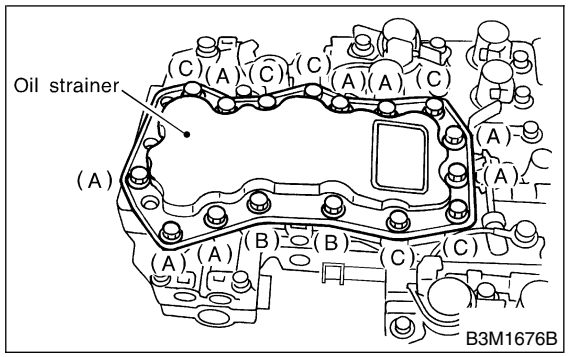
Tightening torque:
T: 8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)



(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

2) Install oil strainer.

Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

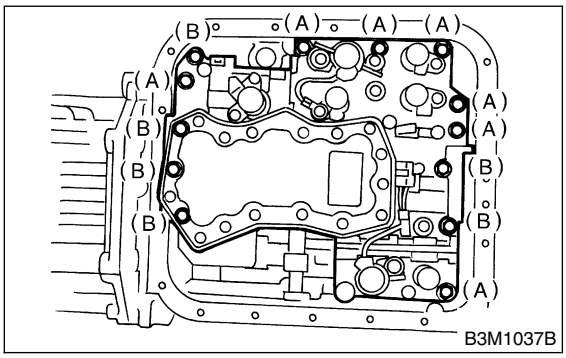


(A) Short bolt
(B) Middle bolt
(C) Long bolt

3) Install valve body to transmission case.
(1) Temporarily tighten the valve body on the transmission case.

CAUTION:
When installing control valve body, be careful not to interfere with transfer duty solenoid wiring (brown).

NOTE:
Align manual valve connections.

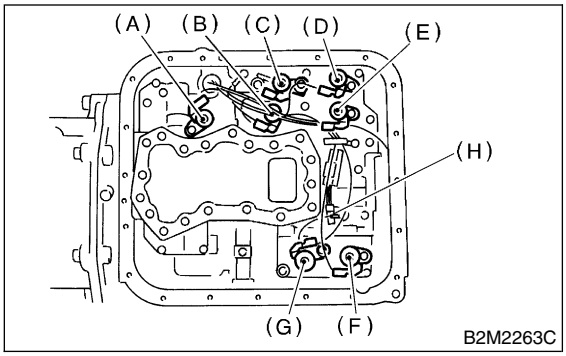


(A) Short bolts
(B) Long bolts

(2) Tighten the valve body to the specified torque.

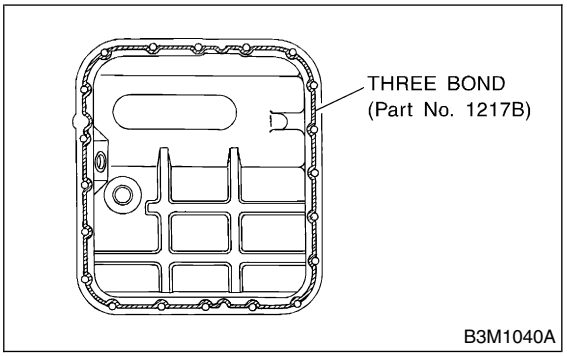
Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

4) Connect harness connectors at 8 places.
Connect connectors of same color, and secure connectors to valve body using clips.



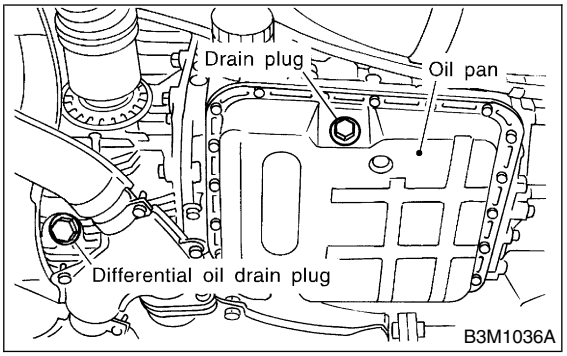
(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

5) Apply proper amount of liquid gasket (THREE BOND Part No. 1217B) to the entire oil pan mating surface.



6) Install oil pan.

Tightening torque:
4.9±0.5 N·m (0.50±0.05 kg-m, 3.6±0.4 ft-lb)

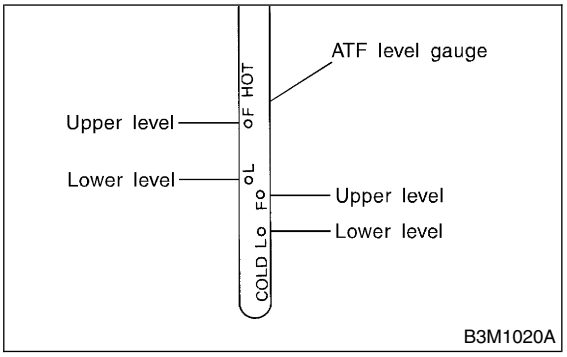


7) Fill ATF up to the middle of the “COLD” side level gauge by using level gauge hole.

Recommended fluid:
Dexron II E or Dexron III type automatic transmission fluid

Fluid capacity:
9.3 — 9.6 ℓ (9.8 — 10.1 US qt, 8.2 — 8.4 Imp qt)

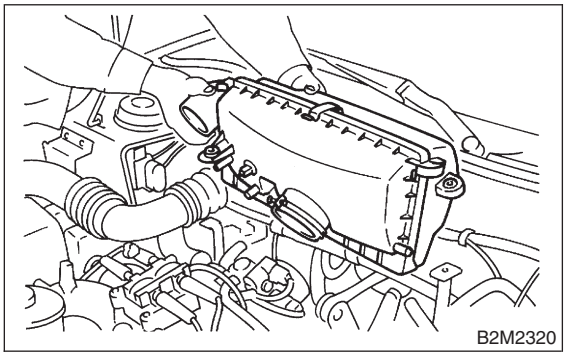
8) Run the vehicle until the ATF temperature rises from 60 to 80°C (140 to 176°F) and check the ATF level of the “HOT” side on level gauge.



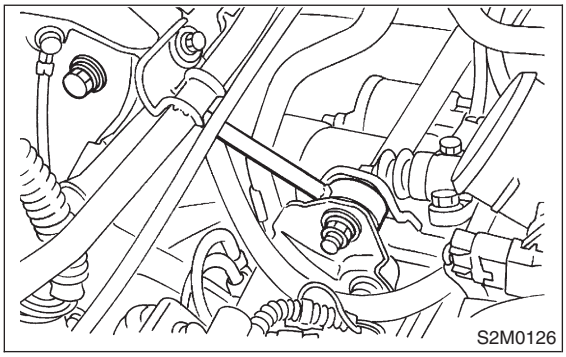
5. Transfer Duty Solenoid and Transfer Valve Body

A: REMOVAL

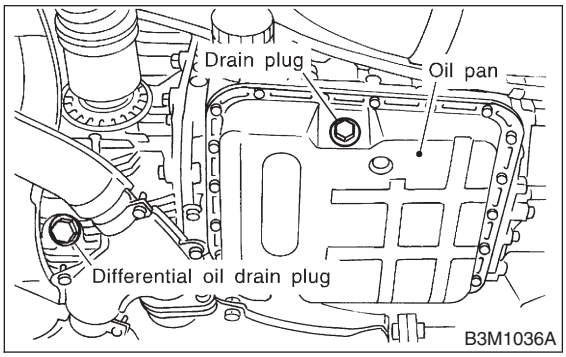
1) Remove air cleaner case and chamber.
<Ref. to 2-7 [W1A0].>


B2M2320

2) Remove pitching stopper.

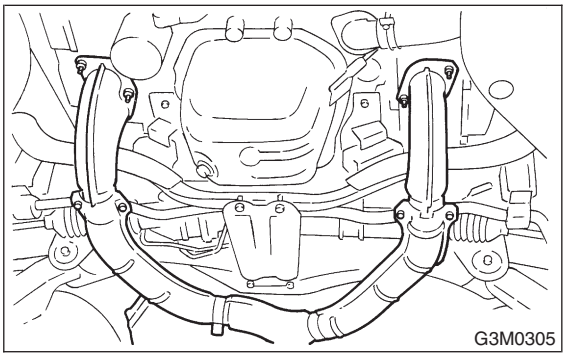

S2M0126

3) Raise vehicle and drain ATF.



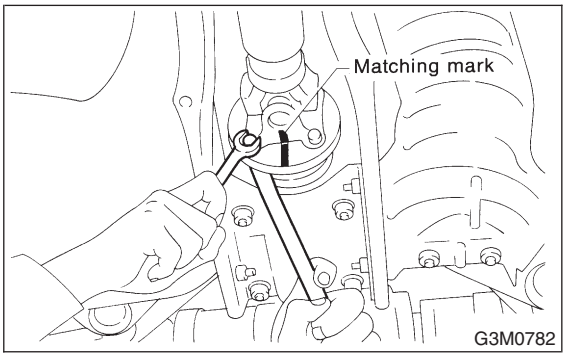
B3M1036A

4) Remove front exhaust pipe.
Disconnect oxygen sensor connector, and remove front and center exhaust pipe.
<Ref. to 2-9 [W1A0].>


G3M0305

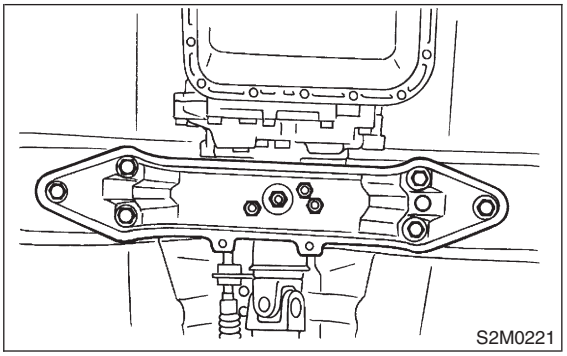
5) Remove propeller shaft.
<Ref. to 3-4 [W1B0].>

NOTE:
Before removing propeller shaft, scribe matching marks on propeller shaft and rear differential coupling.

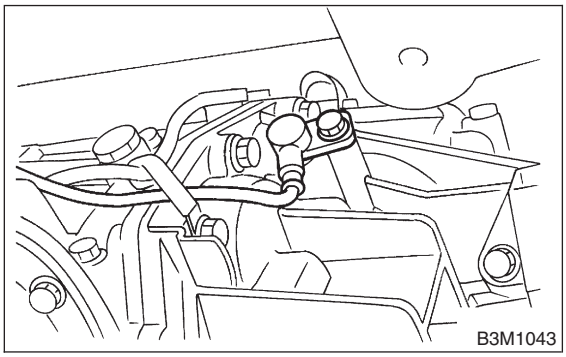


G3M0782

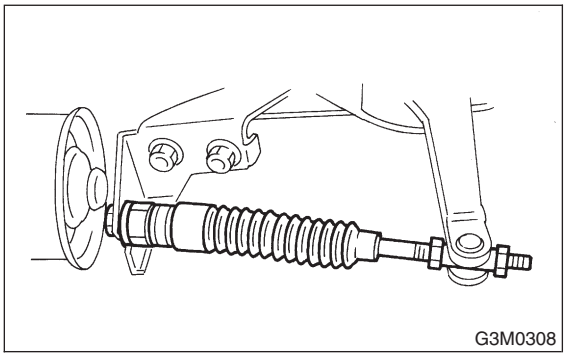
6) Remove rear crossmember.
(1) Support transmission using a transmission jack and raise slightly.
(2) Remove bolts and nuts as shown in Figure.


S2M0221

7) Remove vehicle speed sensor 1 (rear).

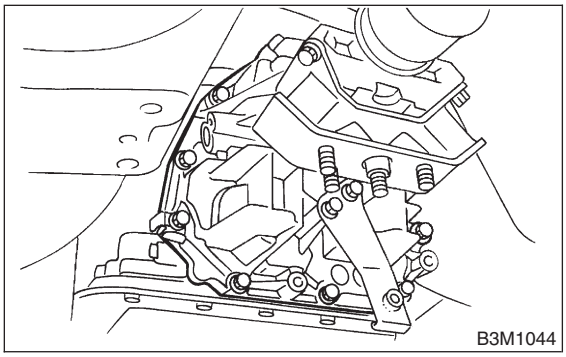


8) Remove extension and gasket.
(1) Remove select cable nut.

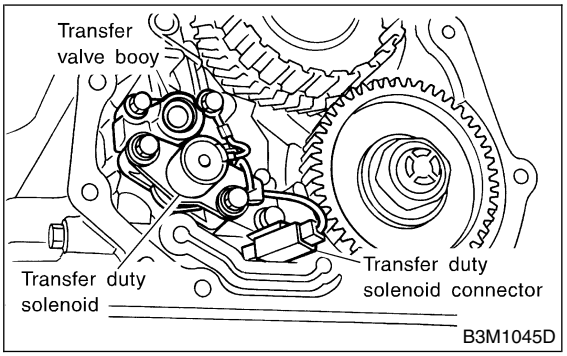


(2) Move gear select cable so that extension bolts can be removed.
(3) Remove bolts.
(4) Remove extension case.

NOTE:
Use a container to catch oil flowing from extension.



9) Disconnect transfer duty solenoid connector.
10) Remove transfer duty solenoid and transfer valve body.

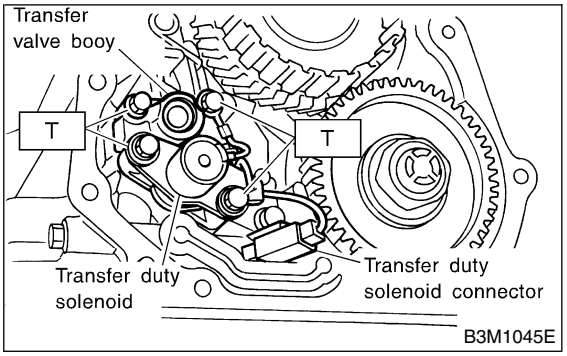


B: INSTALLATION

1) Install transfer duty solenoid and transfer valve body.
(1) Install transfer duty solenoid and transfer valve body.

Tightening torque:
T: 8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

(2) Connect transfer duty solenoid connector.

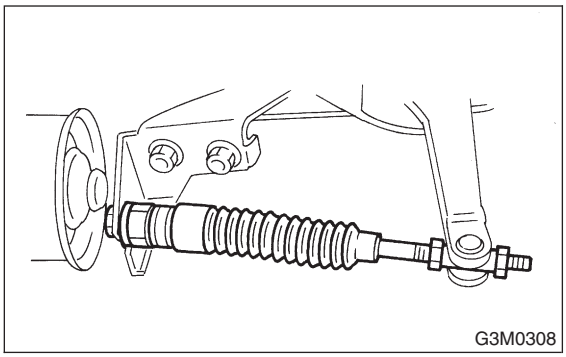


2) Install extension case to transmission case.
(1) Tighten 11 bolts.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)

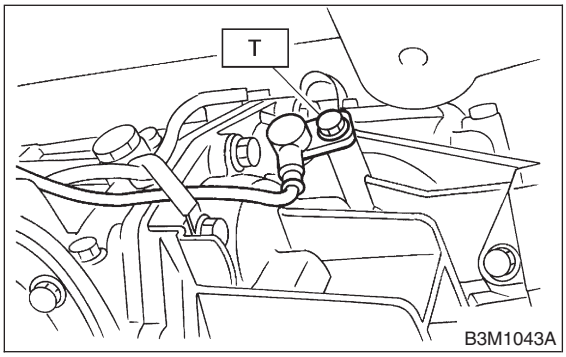
(2) Install select cable.

Tightening torque:
14±4 N·m (1.4±0.4 kg-m, 10.1±2.9 ft-lb)


G3M0308

3) Install vehicle speed sensor 1 (rear).

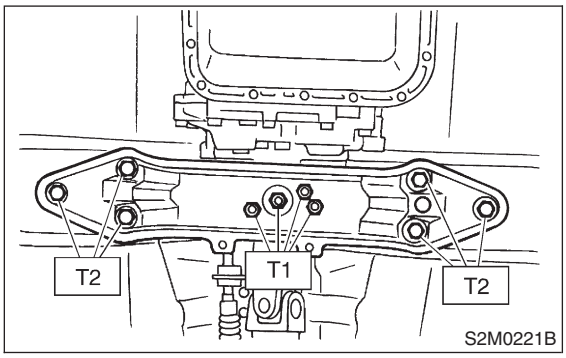
Tightening torque:
T: 7±1 N·m (0.7±0.1 kg-m, 5.1±0.7 ft-lb)



B3M1043A

4) Install rear crossmember.
(1) Tighten bolts.

Tightening torque:
T1: 34±5 N·m (3.5±0.5 kg-m, 25.3±3.6 ft-lb)
T2: 69±15 N·m (7.0±1.5 kg-m, 51±11 ft-lb)

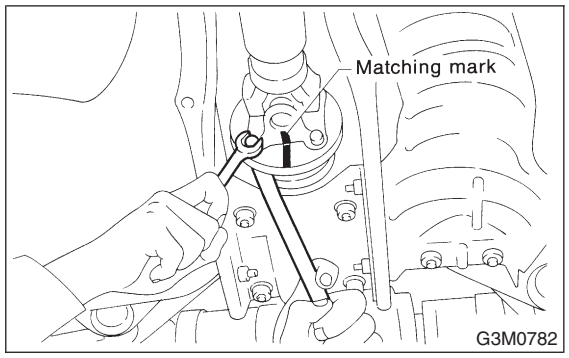


S2M0221B

(2) Lower and remove transmission jack.

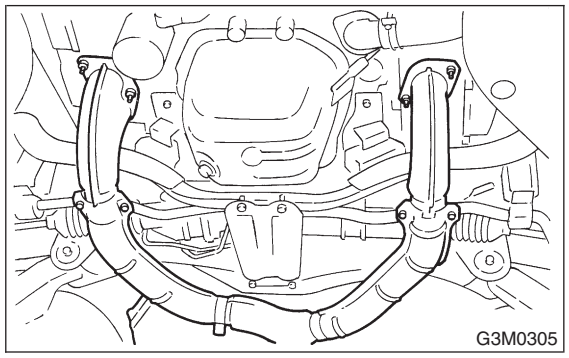
5) Install propeller shaft.
<Ref. to 3-4 [W1E0].>

NOTE:
Align matching marks on propeller shaft and rear differential coupling.

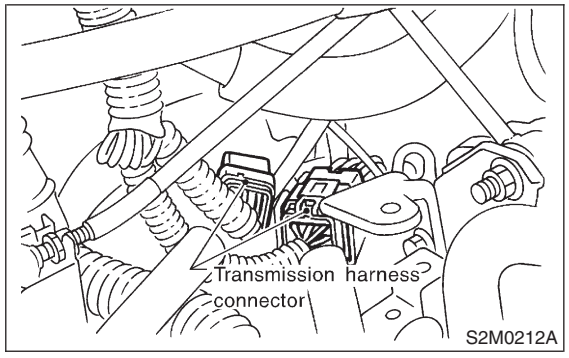


G3M0782

6) Install front exhaust pipe.
<Ref. to 2-9 [W1A0].>


G3M0305

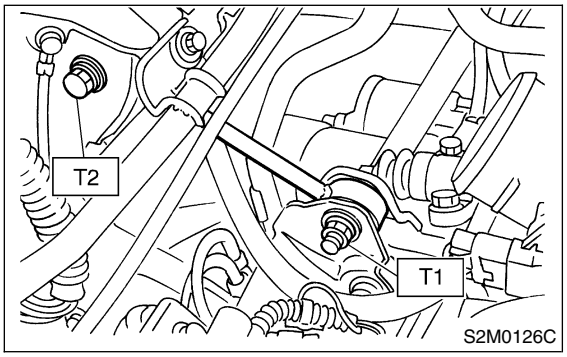
7) Lower and remove jack.
8) Connect the following parts:
(1) Oxygen sensor connector
(2) Transmission harness connector



S2M0212A

9) Install pitching stopper.

Tightening torque:
T1: 49±5 N·m (5.0±0.5 kg-m, 36.2±3.6 ft-lb)
T2: 57±10 N·m (5.8±1.0 kg-m, 42±7 ft-lb)

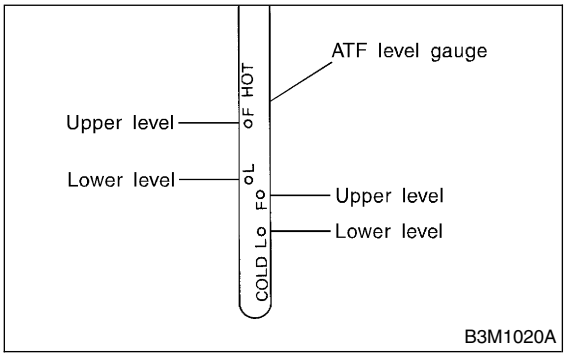


10) Install air cleaner duct and case.
11) Fill ATF up to the middle of the "COLD" side on level gauge by using gauge hole.

Recommended fluid:
Dexron II E or Dexron III type automatic transmission fluid

Fluid capacity:
9.3 — 9.6 ℓ (9.8 — 10.1 US qt, 8.2 — 8.4 Imp qt)

12) Run the vehicle until the ATF temperature rises from 60 to 80°C (140 to 176°F) and check the ATF level of the "HOT" side on level gauge.



6. ATF Filter

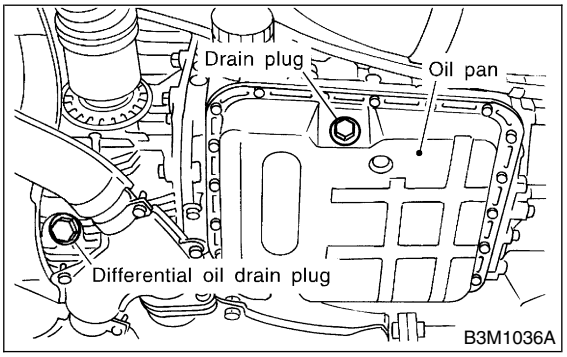
A: REMOVAL AND INSTALLATION

NOTE:
The ATF filter is maintenance free. Replace only when there are obvious dents or damage to the filter or if there is oil leakage from the joining area to the transmission.

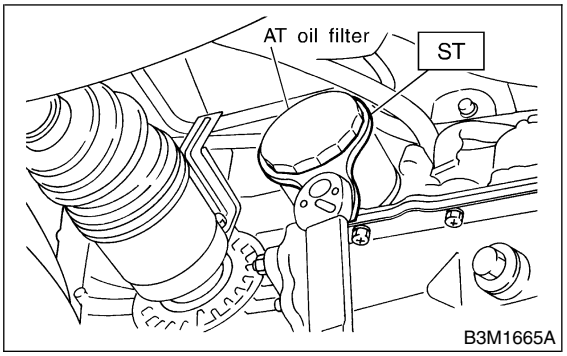
1) Drain ATF completely.

NOTE:
Tighten ATF drain plug after draining ATF.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



2) Using ST, remove ATF filter.
ST 498545400 OIL FILTER WRENCH



3) Get new ATF filter and apply a thin coat of ATF to the oil seal.
4) Install ATF filter. Turn it by hand, being careful not to damage oil seal.
5) Using ST, tighten ATF filter to transmission case.
Calculate ATF filter torque specifications using the following formula.
T2 = L2/(L1 + L2) × T1
T1: 14±2 N·m (1.4±0.2 kg-m, 10.1±1.4 ft-lb)
[Required torque setting]
T2: Tightening torque
L1: ST length 0.078 m (3.07 in)
L2: Torque wrench length

CAUTION:
Align ST with torque wrench while tightening ATF filter.

ST 498545400 OIL FILTER WRENCH

6) Add ATF.

7. Road Test

A: INSPECTION

1. GENERAL PRECAUTION

Road tests should be conducted to properly diagnose the condition of the automatic transmission.

CAUTION:
When performing test, do not exceed posted speed limit.

2. SHIFT PATTERNS

Check “kick-down”.

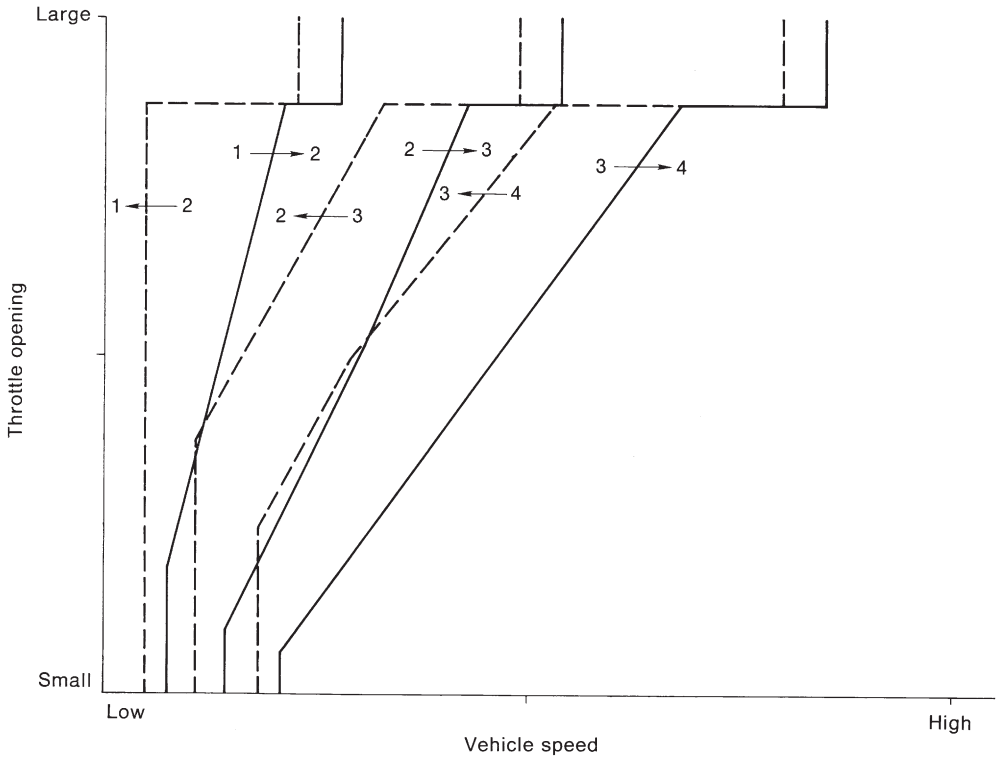
D range: 1st ←→ 2nd ←→ 3rd ←→ 4th

3 range: 1st ←→2nd ←→ 3rd ← 4th

2 range: 2nd ← 3rd ← 4th

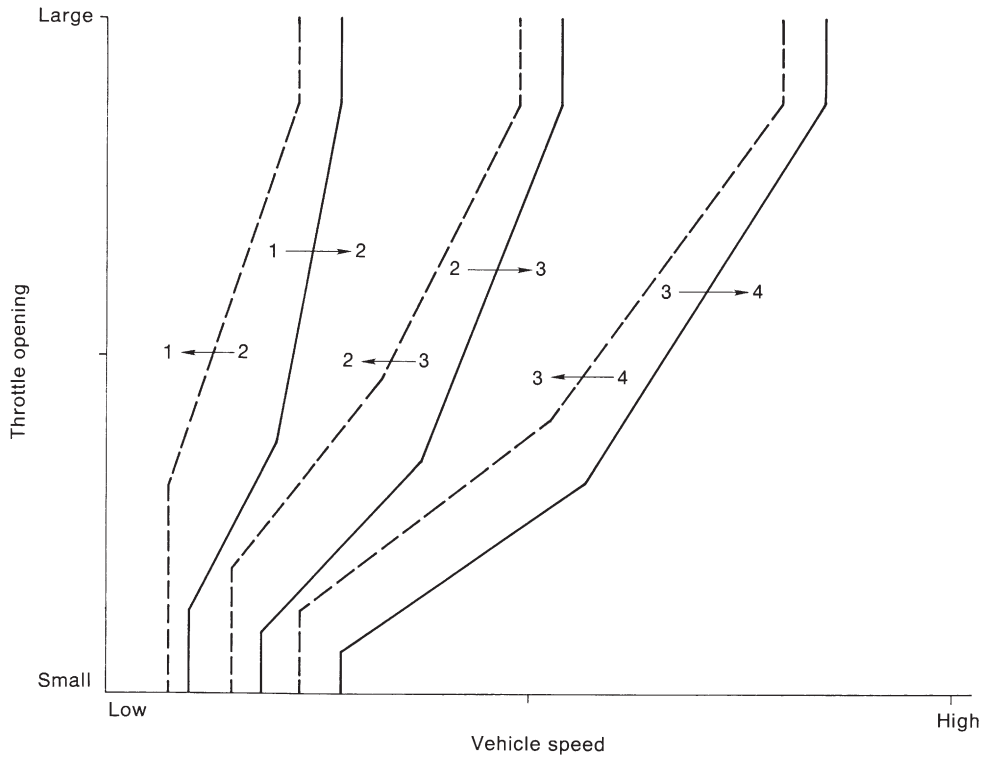
1 range: 1st ← 2nd ← 3rd ← 4th

AWD model “D” range (Normal pattern)



G3M0321

AWD model "D" range (Power pattern)



3. ENGINE BRAKE OPERATION

Engine brake operation:
D range → 4th gear
3 range → 3rd gear
2 range → 2nd gear
1 range → 1st gear

4. AWD FUNCTION

If "tight-corner braking" occurs when the steering wheel is fully turned at low speed:
1) Determine the applicable trouble code and check the corresponding transfer duty solenoid for improper operation.
2) If the solenoid is operating properly, check transfer clutch pressure.
3) If oil pressure is normal but "tight-corner braking" occurs:
Check the transfer control valve for sticking, and the transfer clutch facing for wear. <Ref. to 3-2 [W21B0].> and <Ref. to 3-2 [W22B0].>

8. Stall Test

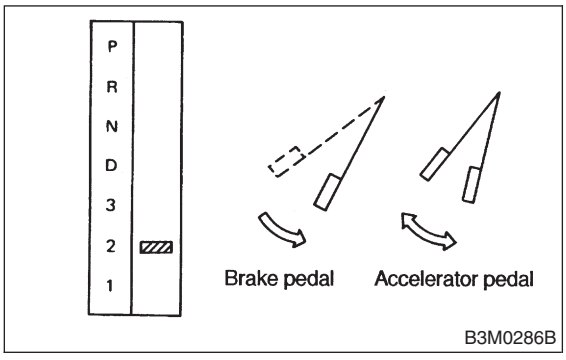
A: MEASUREMENT

1. GENERAL INFORMATION

The stall test is of extreme importance in diagnosing the condition of the automatic transmission and the engine. It should be conducted to measure the engine stall speeds in R and 2 ranges.
Purposes of the stall test:
1) To check the operation of the automatic transmission clutch.
2) To check the operation of the torque converter clutch.
3) To check engine performance.

2. TEST METHODS

1) Preparations before test:
   (1) Check that throttle valve opens fully.
   (2) Check that engine oil level is correct.
   (3) Check that coolant level is correct.
   (4) Check that ATF level is correct.
   (5) Check that differential gear oil level is correct.
   (6) Increase ATF temperature to 50 to 80°C (122 to 176°F) by idling the engine for approximately 30 minutes (with select lever set to “N” or “P”).
2) Install an engine tachometer at a location visible from the driver’s compartment and mark the stall speed range on the tachometer scale.
3) Place the wheel chocks at the front and rear of all wheels and engage the parking brake.
4) Move the manual linkage to ensure it operates properly, and shift the select lever to the 2 range.
5) While forcibly depressing the foot brake pedal, gradually depress the accelerator pedal until the engine operates at full throttle.



6) When the engine speed is stabilized, read that speed quickly and release the accelerator pedal.
7) Shift the select lever to Neutral, and cool down the engine by idling it for more than one minute.
8) Record the stall speed.
9) If stall speed in 2 range is higher than specifications, low clutch slipping and 2-4 brake slipping may occur. To identify it, conduct the same test as above in D range.
10) Perform the stall tests with the select lever in the R range.

NOTE:
● Do not continue the stall test for MORE THAN FIVE SECONDS at a time (from closed throttle, fully open throttle to stall speed reading). Failure to follow this instruction causes the engine oil and ATF to deteriorate and the clutch and brake to be adversely affected.
Be sure to cool down the engine for at least one minute after each stall test with the select lever set in the P or N range and with the idle speed lower than 1,200 rpm.
● If the stall speed is higher than the specified range, attempt to finish the stall test in as short a time as possible, in order to prevent the automatic transmission from sustaining damage.

Stall speed (at sea level):
2,100 — 2,600 rpm

3. EVALUATION

Stall speed (at sea level)	Position	Cause
Less than specifications	2 R	• Throttle valve not fully open • Erroneous engine operation • Torque converter clutch's one-way clutch slipping
Greater than specifications	D	• Low clutch slipping • One-way clutch malfunctioning
	R	• Line pressure too low • Reverse clutch slipping • Low & reverse brake slipping
	2	• Line pressure too low • Low clutch slipping • 2-4 brake slipping

9. Time Lag Test

A: INSPECTION

1. GENERAL INFORMATION

If the shift lever is shifted while the engine is idling, there will be a certain time elapse or lag before the shock can be felt. This is used for checking the condition of the low clutch, reverse clutch, low & reverse brake and one-way clutch.

CAUTION:
● Perform the test at normal operation fluid temperature 60 to 80°C (140 to 176°F).
● Be sure to allow a one minute interval between tests.
● Make three measurements and take the average value.

2. TEST METHODS

1) Fully apply the parking brake.
2) Start the engine.
Check engine speed is in idling speed (A/C OFF).
3) Shift the shift lever from "N" to "D" range.
Using a stop watch, measure the time it takes from shifting the lever until the shock is felt.
Time lag: Less than 1.2 seconds
4) In same manner, measure the time lag for "N" → "R".
Time lag: Less than 1.5 seconds

3. EVALUATION

1) If "N" → "D" time lag is longer than specified:
- Line pressure too low
- Low clutch worn
- One-way clutch not operating properly

2) If "N" → "R" time lag is longer than specified:
- Line pressure too low
- Reverse clutch worn
- Low & reverse brake worn

10. Line Pressure Test

A: MEASUREMENT

1. GENERAL INFORMATION

If the clutch or the brake shows a sign of slippage or shifting sensation is not correct, the line pressure should be checked.
● Excessive shocks during upshifting or shifting takes place at a higher point than under normal circumstances, may be due to the line pressure being too high.
● Slippage or inability to operate the vehicle may, in most cases, be due to loss of oil pressure for the operation of the clutch, brake or control valve.
1) Line pressure measurement (under no load)

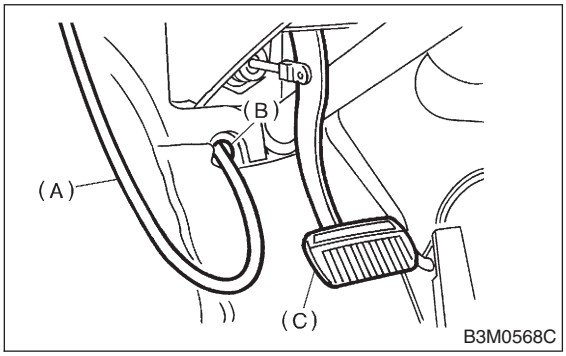
CAUTION:
● Before measuring line pressure, jack-up all wheels.
● Maintain temperature of ATF at approximately 50°C (122°F) during measurement. (ATF will reach the above temperature after idling the engine for approximately 30 minutes with select lever in "N" or "P".)

2) Line pressure measurement (under heavy load)

CAUTION:
● Before measuring line pressure, apply both foot and parking brakes with all wheels chocked (Same as for "stall" test conditions).
● Measure line pressure when select lever is in "R", "2" with engine under stall conditions.
● Measure line pressure within 5 seconds after shifting the select lever to each position. (If line pressure needs to be measured again, allow the engine to idle and then stop. Wait for at least one minute before measurement.)
● Maintain the temperature of ATF at approximately 50°C (122°F) during measurement. (ATF will reach the above temperature after idling the engine for approximately 30 minutes with the select lever in "N" or "P".)

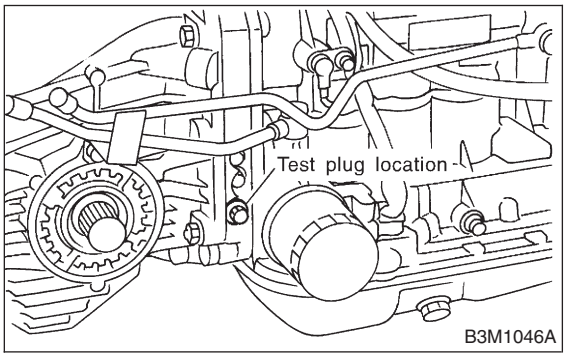
2. TEST METHODS

1) Temporarily attach the ST to a suitable place in the driver's compartment, remove the blind plug located in front of the toe board and pass the hose of the ST to the engine compartment.
ST 498575400 OIL PRESSURE GAUGE ASSY



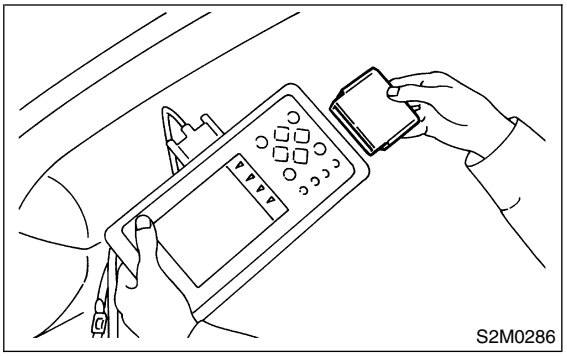
(A) Pressure gauge hose
(B) Hole in toe board (blank cap hole)
(C) Brake pedal

2) Remove the test plug and install ST instead.
ST 498897200 OIL PRESSURE GAUGE ADAPTER



3) Connect ST1 with ST2.
ST1 498897200 OIL PRESSURE GAUGE ADAPTER
ST2 498575400 OIL PRESSURE GAUGE ASSY

4) Check for duty ratio changes by opening and closing throttle valve using Subaru Select Monitor.
(1) Insert the cartridge to Subaru Select Monitor. <Ref. to 1-6 [G1100].>



(2) Connect Subaru Select Monitor to data link connector.
5) Check line pressure in accordance with the following chart.

3. EVALUATION

Standard line pressure			
Range position	Line pressure duty ratio (%)	Throttle position	Line pressure kPa (kg/cm^2, psi)
2	5	Full open	1,128 — 1,304 (11.5 — 13.3, 164 — 189)
R	5	Full open	1,520 — 1,716 (15.5 — 17.5, 220 — 249)
D	95	Full closed	304 — 412 (3.1 — 4.2, 44 — 60)

11. Transfer Clutch Pressure Test

A: MEASUREMENT

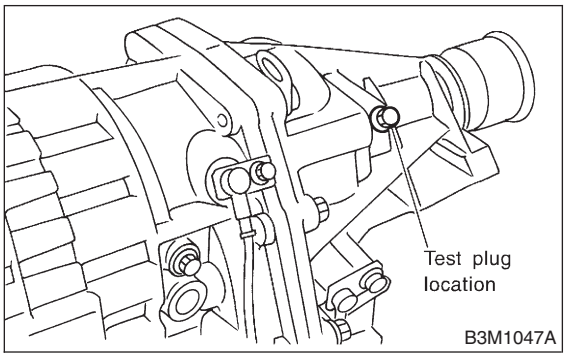
1. TEST METHODS

Check transfer clutch pressure in accordance with the following chart in the same manner as with line pressure.

ST 498897700 OIL PRESSURE ADAPTER SET
ST 498575400 OIL PRESSURE GAUGE ASSY

AWD mode: “D” range
FWD mode: “P” range, engine speed 2,000 rpm

CAUTION:
Before setting in FWD mode, install spare fuse on FWD mode switch.



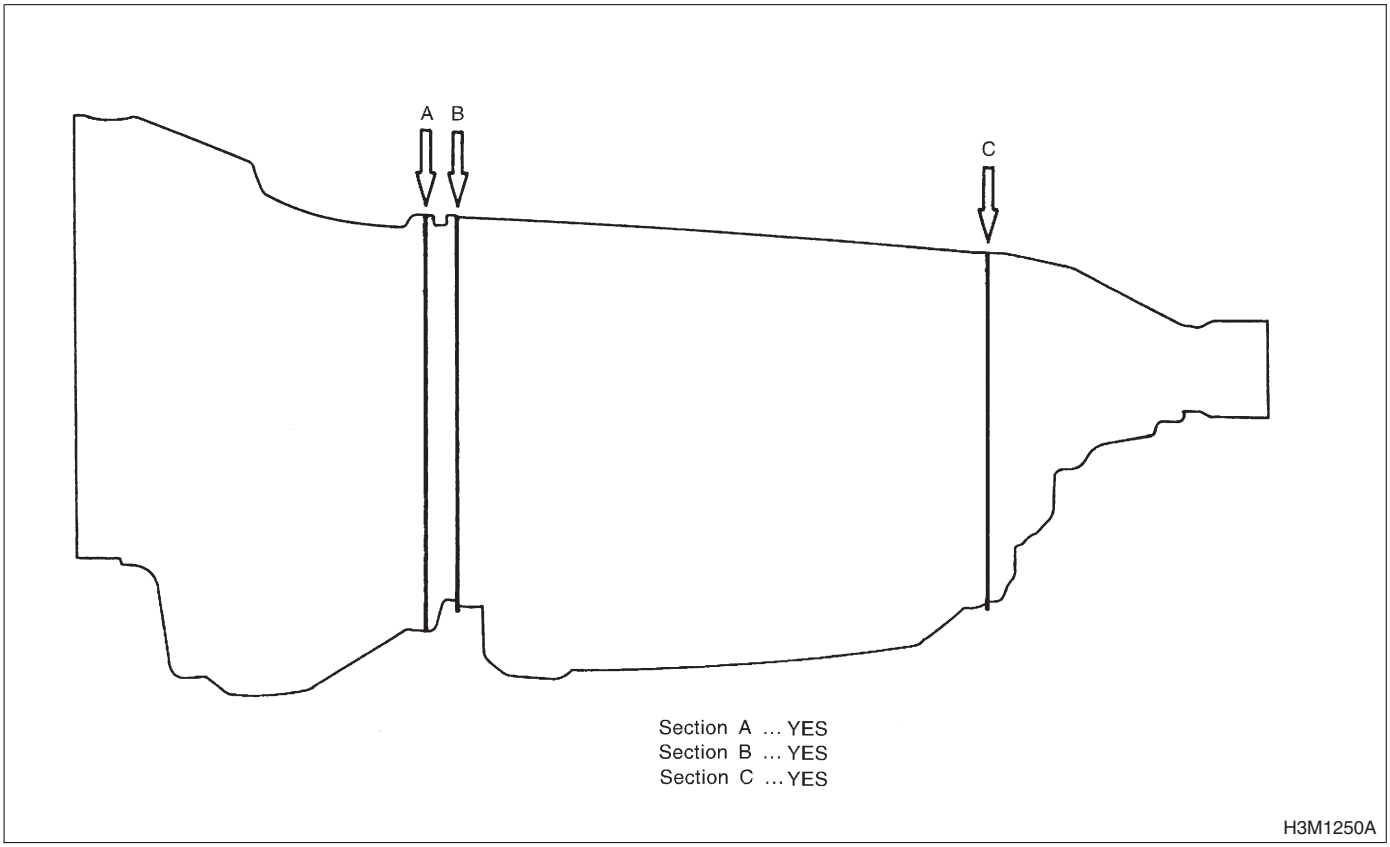
2. EVALUATION

NOTE:
If oil pressure is not produced or if it does not change in the AWD mode, the transfer duty solenoid or transfer valve assembly may be malfunctioning. If oil pressure is produced in the FWD mode, the problem is similar to that in the AWD mode.

Standard transfer clutch pressure kPa (kg/cm^2, psi)			
Duty ratio (%)	Throttle position	AWD mode	FWD mode
5	Full closed	932 — 1,089 (9.5 — 11.1, 135 — 158)	—
60	2/3 throttle	216 — 294 (2.2 — 3.0, 31 — 43)	—
95	Full open	—	0 (0, 0)

12. Overall Transmission

A: SECTIONS THAT CAN BE DETACHED/ASSEMBLED

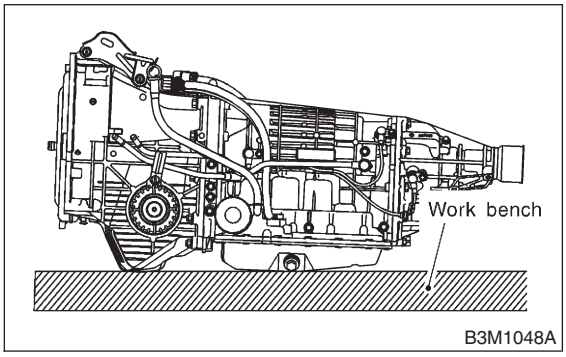


B: DISASSEMBLY

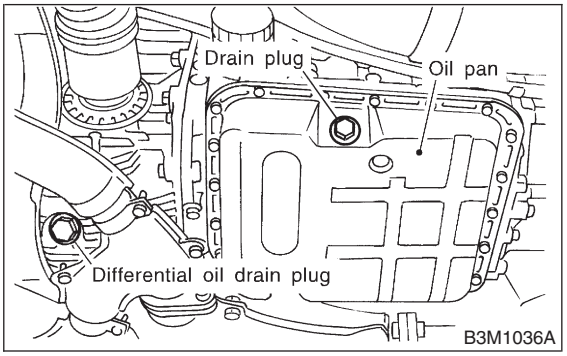
1. EXTERNAL PARTS

1) Place the transmission unit on a work bench, with the oil pan facing down.

CAUTION:
Be careful not to bend or damage external parts.

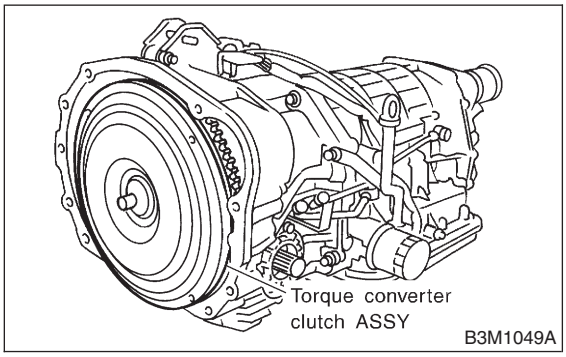


2) Remove the drain plug, and drain differential oil. Tighten the plug temporarily after draining.
3) Remove the drain plug, and drain automatic transmission fluid (ATF). Tighten the plug temporarily after draining.

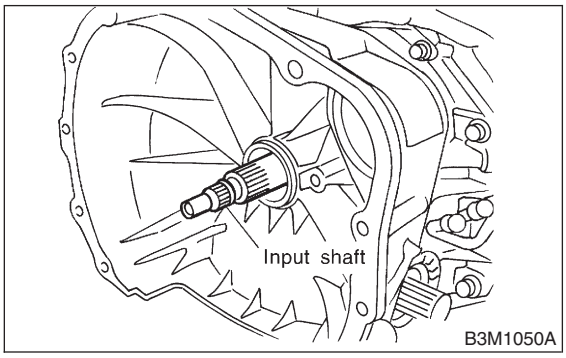


4) Extract the torque converter clutch assembly.

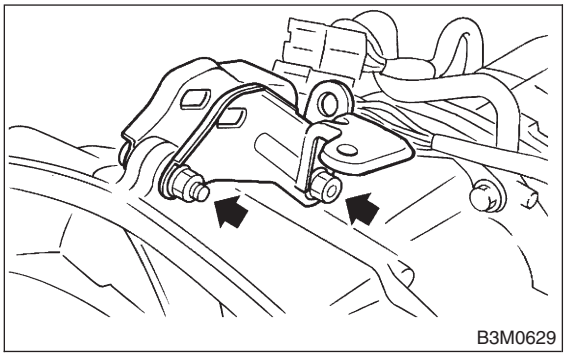
NOTE:
● Extract the torque converter clutch horizontally. Be careful not to scratch the bushing inside the oil pump shaft.
● Note that oil pump shaft also comes out.



5) Remove the input shaft.

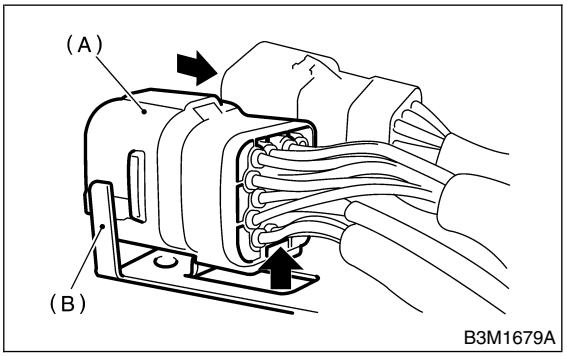


6) Remove the pitching stopper bracket.



7) Remove harnesses from stay.
(1) Disconnect transmission harness connector from stay.

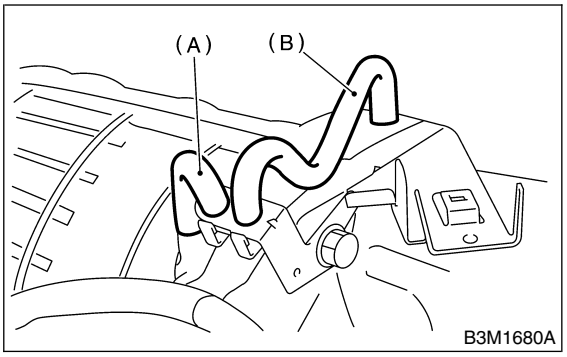
NOTE:
Lift-up lever behind connector and disconnect it from stay.



(A) Transmission harness
(B) Stay

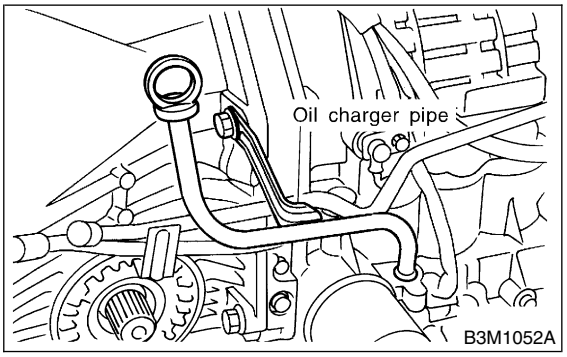
(2) Disconnect inhibitor switch connector stay.

8) Disconnect the air breather hose.



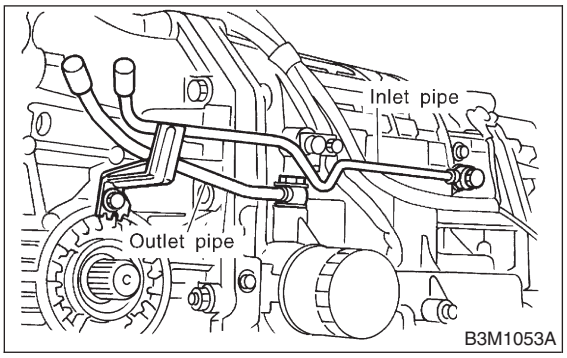
(A) Air breather hose (Transmission case)
(B) Air breather hose (Oil pump housing)

9) Remove the oil charger pipe, and remove the O-ring from the flange face. Attach the O-ring to the pipe.



10) Remove the oil cooler inlet and outlet pipes.

CAUTION:
When removing outlet pipes, be careful not to lose balls and springs used with retaining screws.

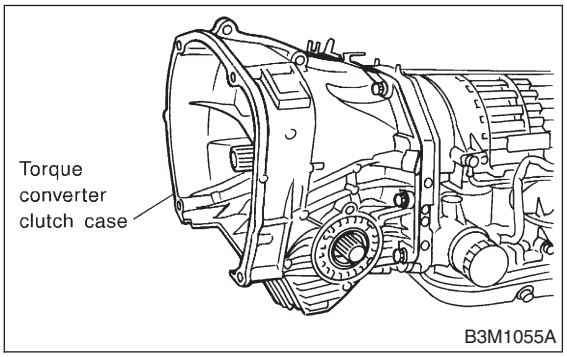


2. SEPARATION OF EACH SECTION

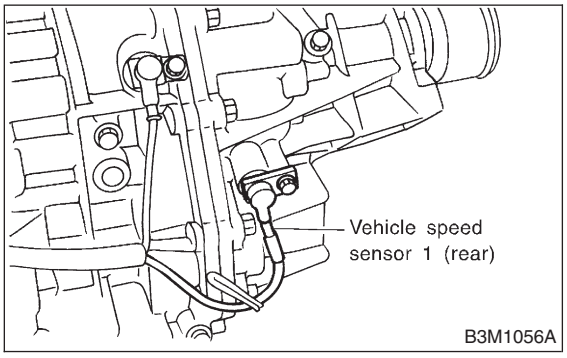
1) Separation of torque converter clutch case and transmission case sections

CAUTION:
- **Be careful not to damage the oil seal and bushing inside the torque converter clutch case by the oil pump cover.**
- **Be careful not to lose the rubber seal.**

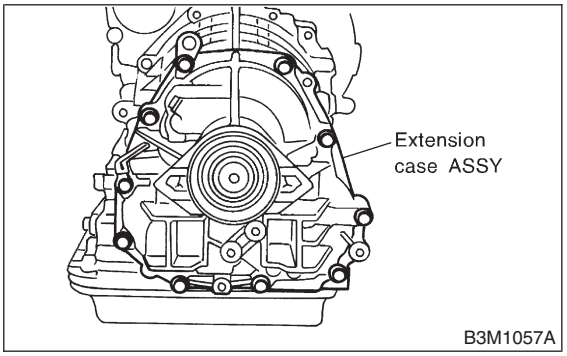
NOTE:
Separate these cases while tapping lightly on the housing.



2) Separation of transmission case and extension sections
(1) Remove vehicle speed sensor 1 (rear).



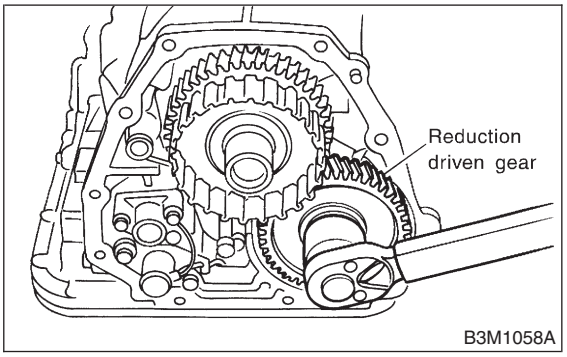
(2) Separation of transmission case and extension case sections



3. TRANSMISSION CASE SECTION

1) Remove the reduction driven gear.
(1) Straighten the staked portion, and remove the lock nut.

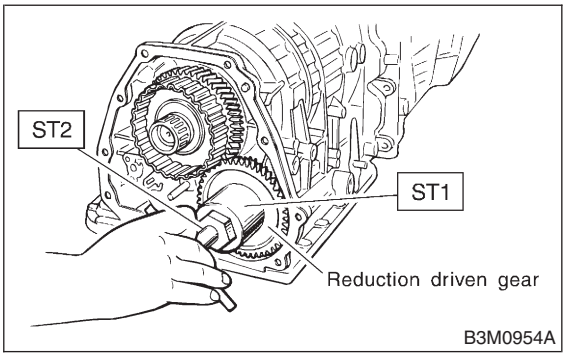
NOTE:
Set the range selector lever to “P”.



(2) Using the ST1 and ST2, extract the reduction driven gear.

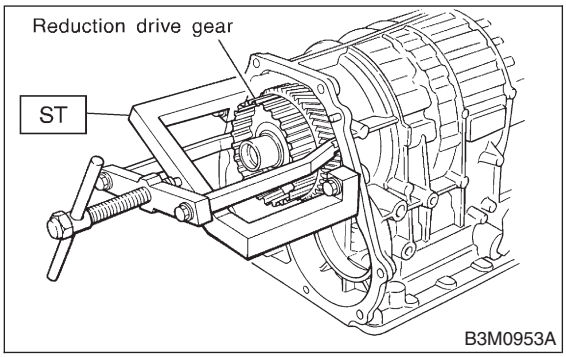
NOTE:

ST1 499737000 PULLER
ST2 899524100 PULLER SET



(3) Using the ST, extract the reduction drive gear.

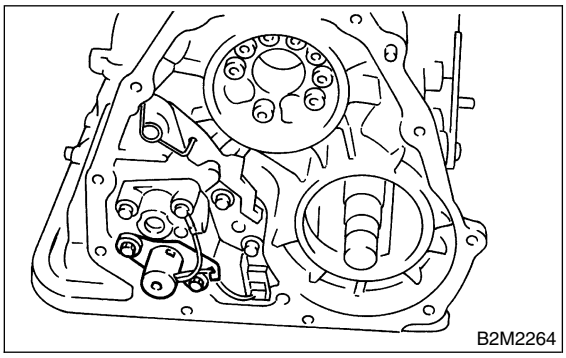
ST 499737100 PULLER SET



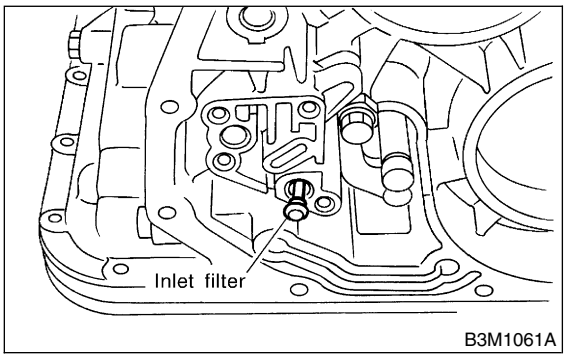
2) Remove transfer valve body and transfer duty solenoid.

(1) Disconnect connector from transfer duty solenoid.

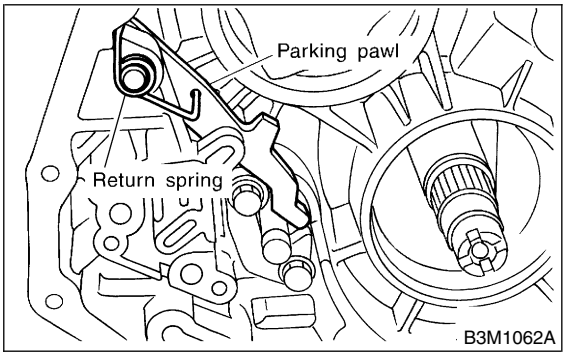
(2) Remove transfer valve body and transfer duty solenoid.



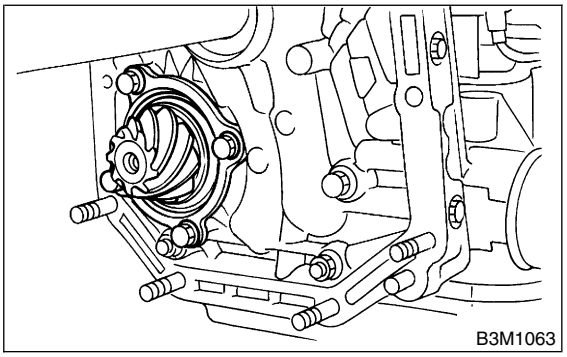
(3) Pull out inlet filter.



3) Remove the parking pawl, return spring and shaft.



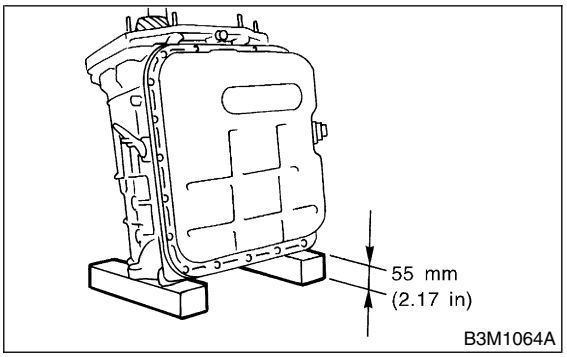
4) Loosen the taper roller bearing mounting bolts.



5) Place two wooden blocks on the workbench, and stand the transmission case with its rear end facing down.

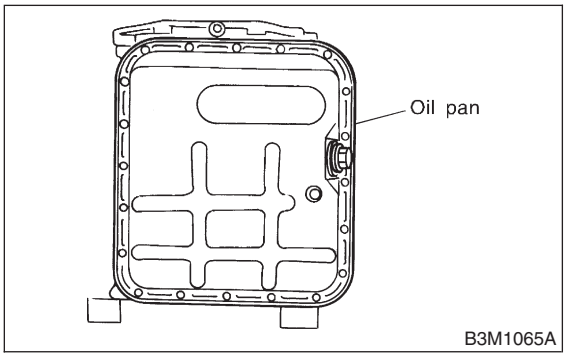
CAUTION:

- **Be careful not to scratch the rear mating surface of the transmission case.**
- **Note that the parking rod and drive pinion protrude from the mating surface.**

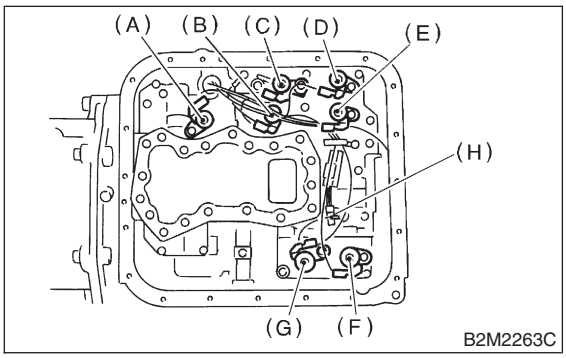


6) Remove the oil pan.

NOTE:
Use a scraper to remove oil pan.



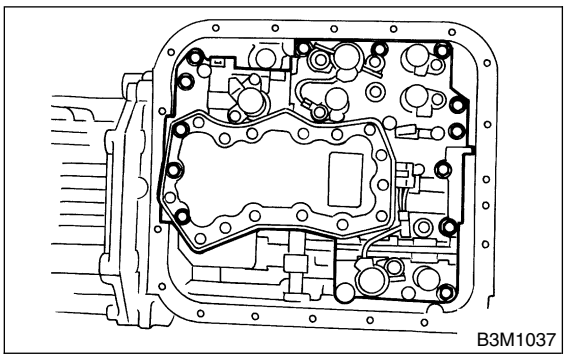
7) Disconnect the harness connectors for the solenoids, duty solenoids, ATF temperature sensor and the ground cord.



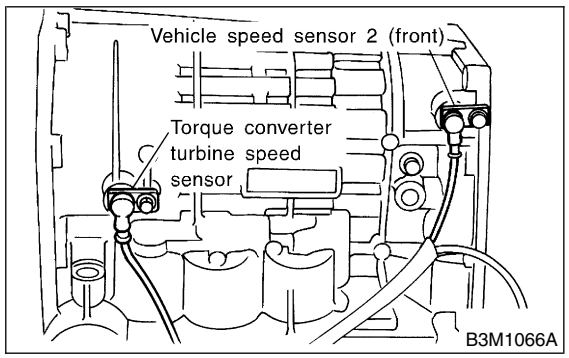
(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

8) Remove the control valve body.

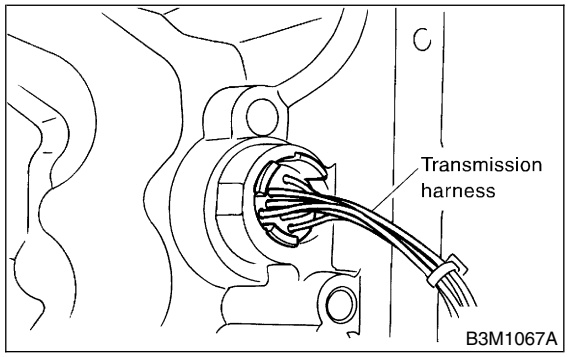
CAUTION:
When removing control valve body, be careful not to interfere with transfer transfer duty solenoid wiring.



9) Remove vehicle speed sensor 2 (front) and torque converter turbine speed sensor.

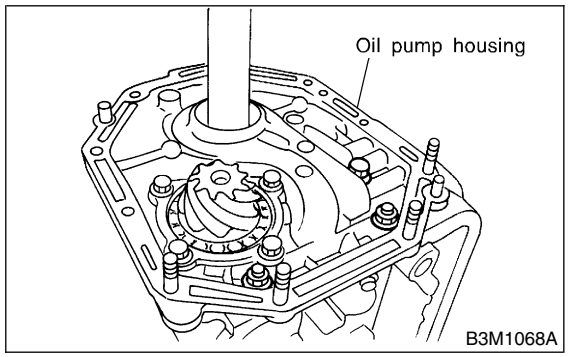


10) Remove transmission harness.

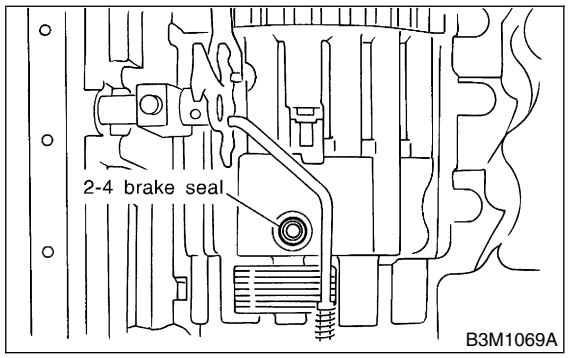


11) Remove the oil pump housing.

CAUTION:
Be careful not to lose the total end play adjusting thrust washer.

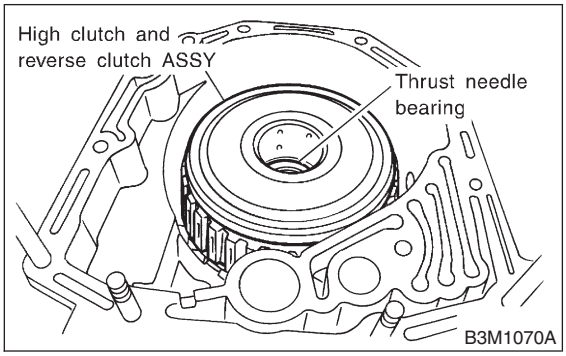


12) Remove 2-4 brake seal.

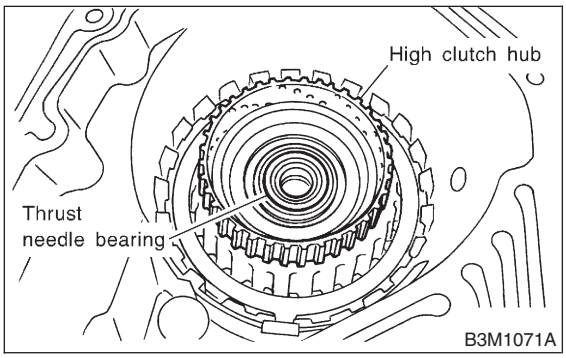


13) Take out the high clutch and reverse clutch assembly.

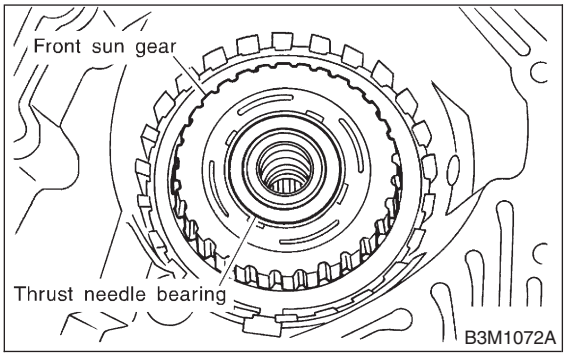
CAUTION:
Be careful not to lose thrust needle bearing.



14) Take out the high clutch hub and the thrust bearing.



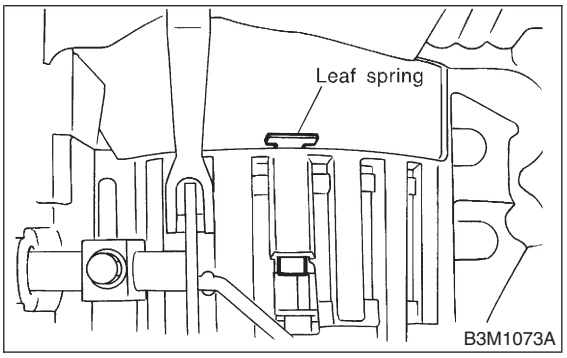
15) Take out the front sun gear and the thrust bearing.



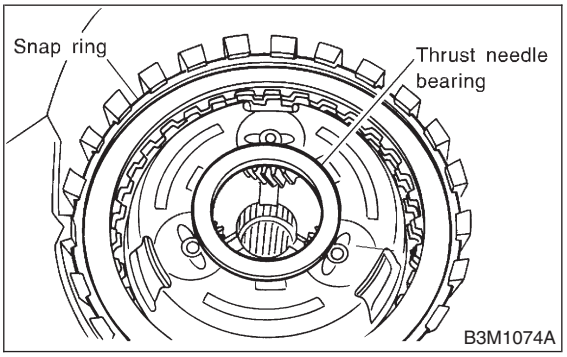
16) Pull out leaf spring.

CAUTION:
Be careful not to bend leaf spring during removal.

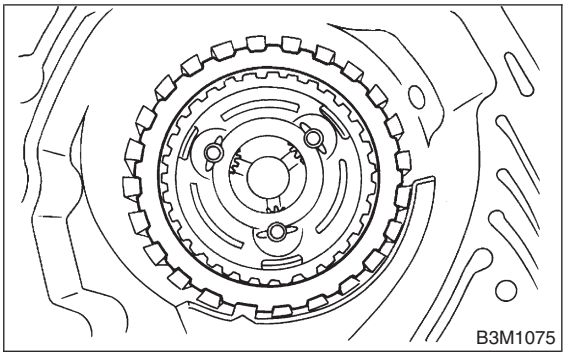
NOTE:
Remove it while pressing down on lower leaf spring.



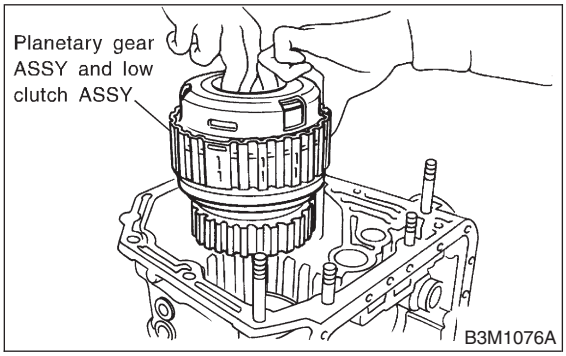
17) Remove snap ring and thrust needle bearing.



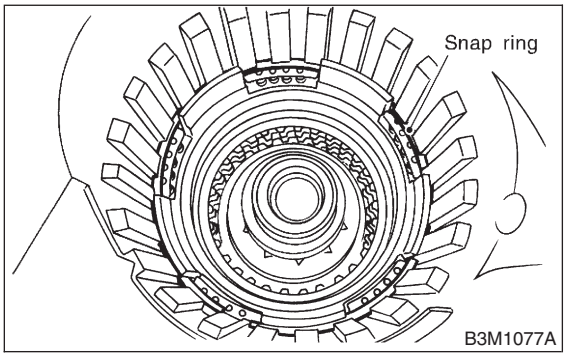
18) Take out retaining plate, drive plate and driven plate of 2-4 brake.



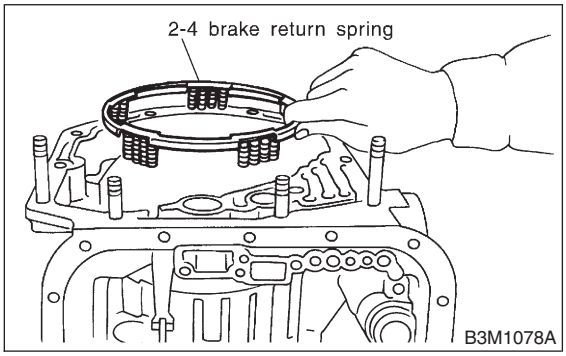
19) Take out the thrust needle bearing, planetary gear assembly and the low clutch assembly.



20) Remove snap ring.

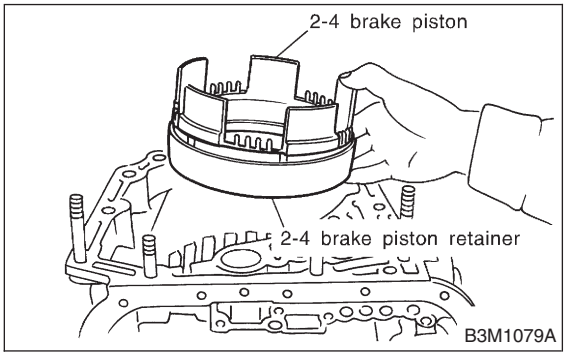


21) Take out 2-4 brake return spring.

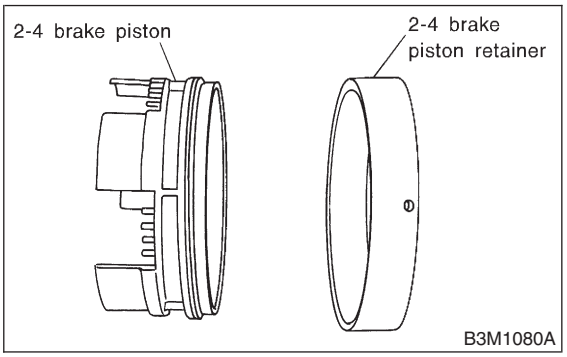


22) Take out 2-4 brake piston and piston retainer.

CAUTION:
When removing the brake piston 2-4 and piston retainer, be careful not to rub or bump them against the transmission case.

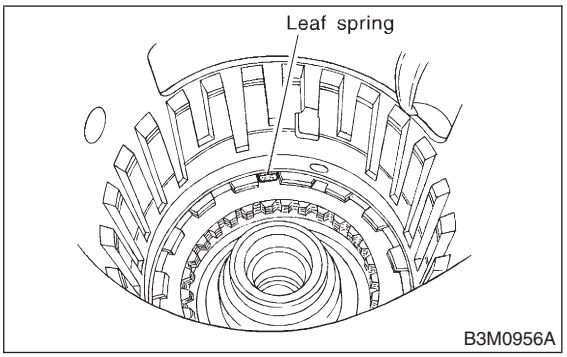


23) Separate 2-4 brake piston and piston retainer.

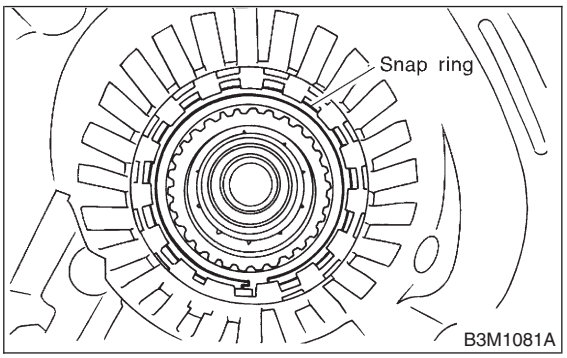


24) Pull out leaf spring.

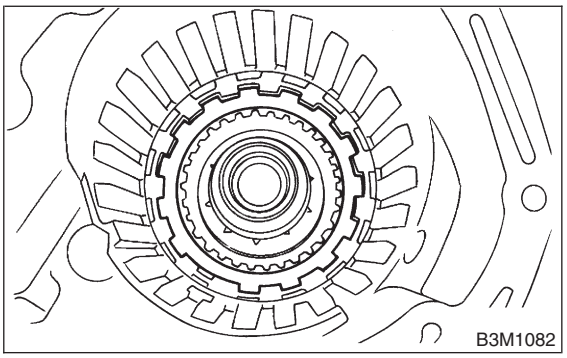
CAUTION:
Be careful not to bend leaf spring during removal.



25) Remove snap ring.

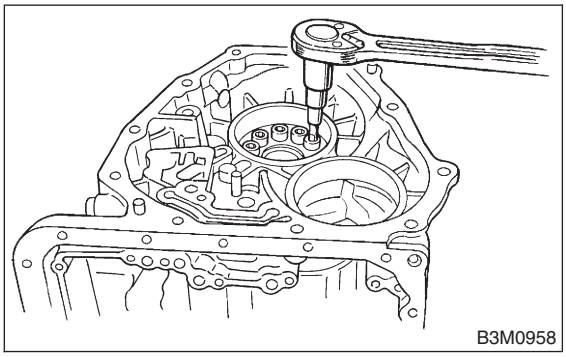


26) Take out retaining plate, drive plate, driven plate and dish plate.

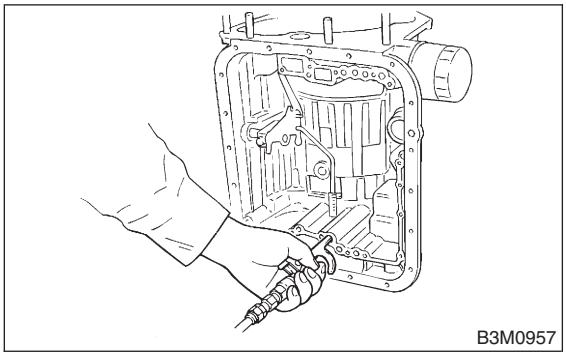


27) Turning the case upside down, take out the one-way clutch inner race, retainer and wave spring.

NOTE:
After loosening all socket bolts, place the side of the transmission case on the floor.


B3M0958

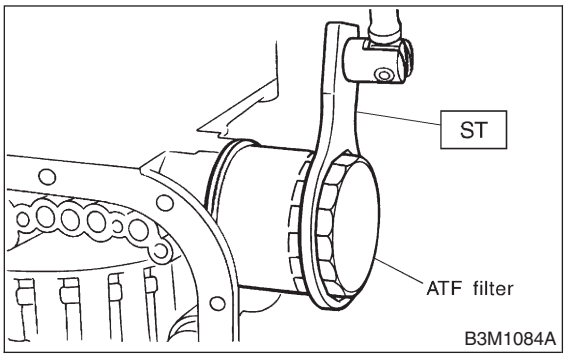
28) Take out the low & reverse piston by applying compressed air.


B3M0957

29) Using ST, remove ATF filter.

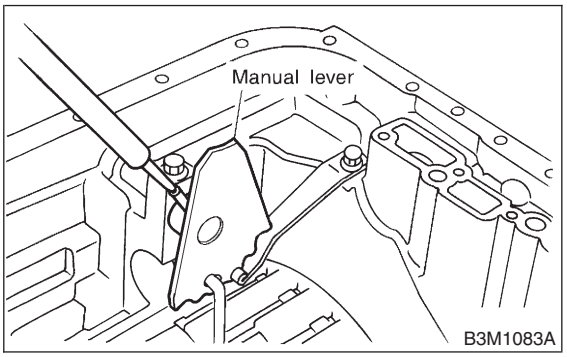
NOTE:
If any of the clutches or brakes are abnormally worn, replace ATF filter and oil seal with new ones.

ST 498545400 OIL FILTER WRENCH



B3M1084A

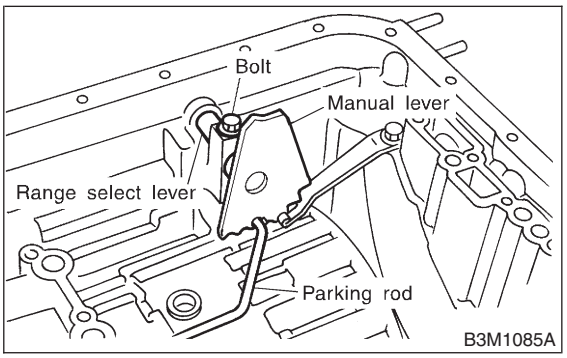
30) Pull off the straight pin of manual lever.



B3M1083A

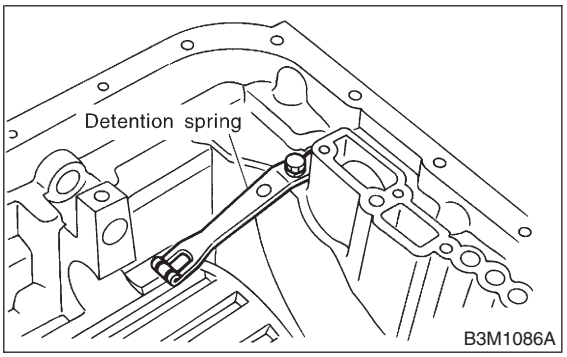
31) Remove bolts securing select lever, then remove select lever, manual lever and parking rod.

CAUTION:
Be careful not to damage the lips of the press-fitted oil seal in the case.



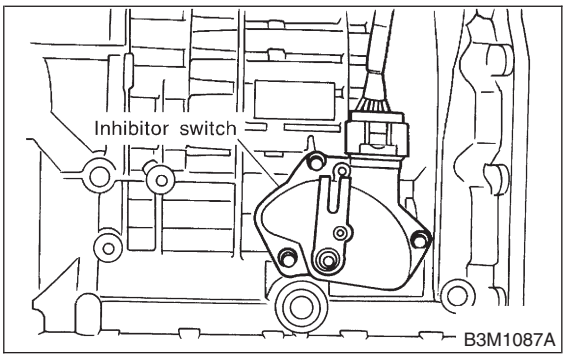
B3M1085A

32) Remove the detention spring.



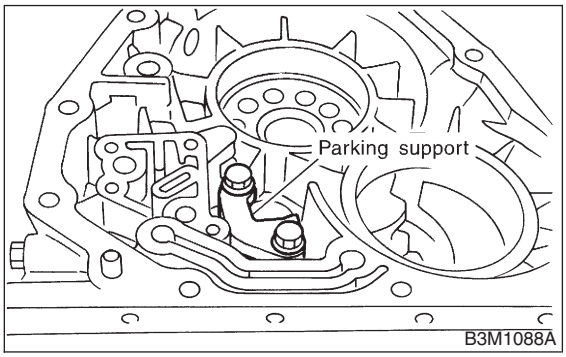
B3M1086A

33) Remove the inhibitor switch.



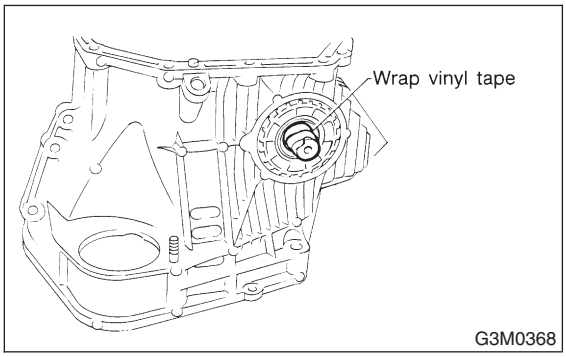
B3M1087A

34) Remove parking support.



4. TORQUE CONVERTER CLUTCH CASE SECTION

1) Wrap the axle shaft serration with vinyl tape.



2) Remove the differential side retainer with ST.

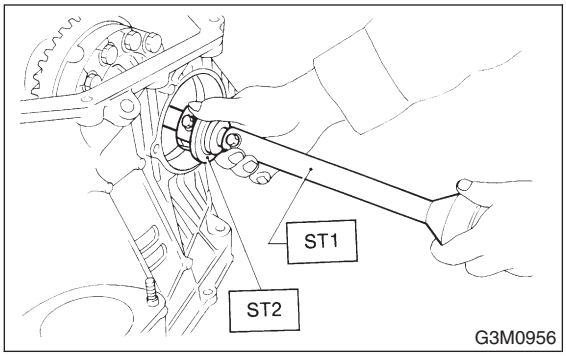
CAUTION:
Hold the differential case assembly by hand to avoid damaging retainer mounting hole of the torque converter clutch case and speedometer gears.

ST 499787000 WRENCH ASSY

3) Extract the axle shaft with ST1 and ST2.

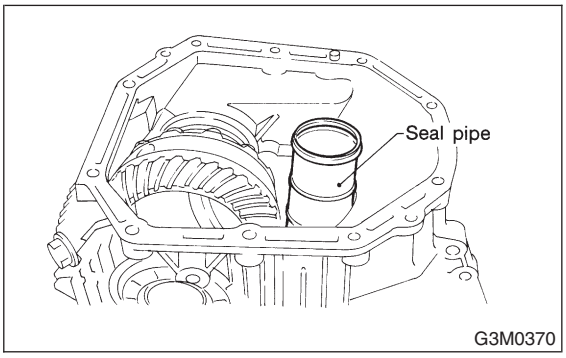
CAUTION:
Do not reuse the circlip.

ST1 499095500 REMOVER
ST2 499247300 INSTALLER



4) Remove the differential case assembly.

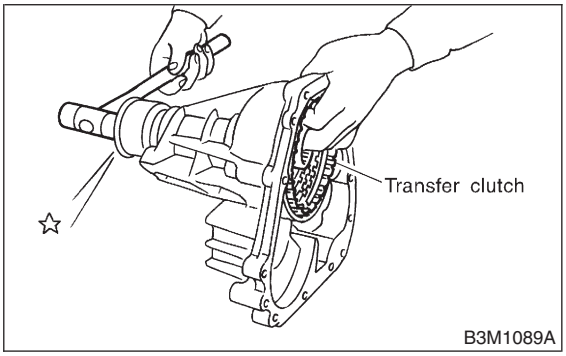
CAUTION:
● Remove the seal pipe if it is attached. (Reusing is not allowed.)
● Be careful not to damage the retainer mounting hole of the torque converter clutch case and the speedometer gears.



5. EXTENSION SECTION

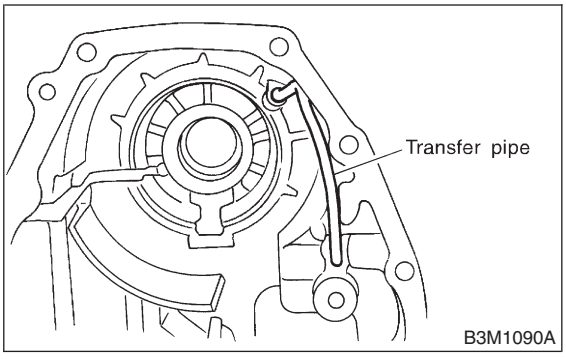
1) Take out the transfer clutch by lightly tapping the end of the rear drive shaft.

CAUTION:
Be careful not to damage the oil seal in the extension.



2) Remove the transfer pipe.

CAUTION:
Be careful not to bend the pipe.



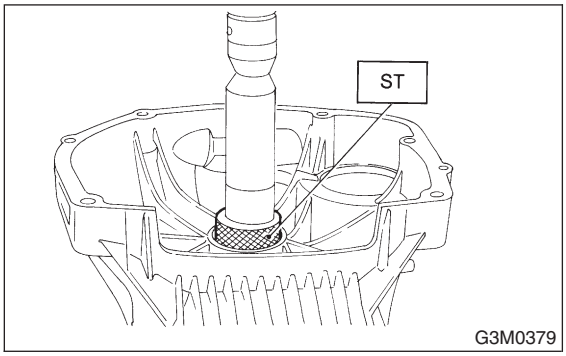
C: ASSEMBLY OF OVERALL TRANSMISSION

1. TORQUE CONVERTER CLUTCH CASE SECTION

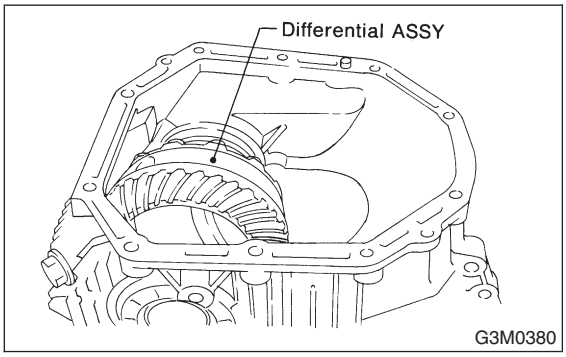
1) Check the appearance of each component and clean.

CAUTION:
Make sure each part is free of harmful cuts, damage and other faults.

2) Force-fit the oil seal to the torque converter clutch case with ST.
ST 398437700 DRIFT



3) Install the differential assembly to the case, paying special attention not to damage the inside of the case (particularly, the differential side retainer contact surface).

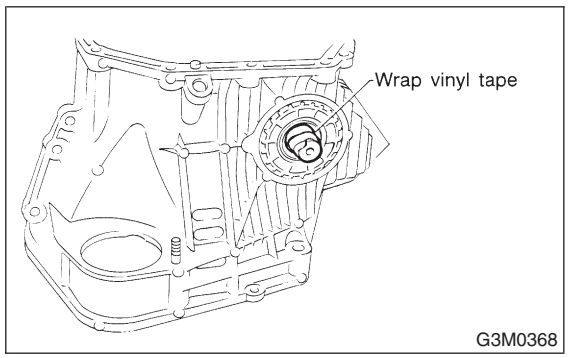


4) Install the circlip to the axle shaft, insert the shaft into the differential assembly, and tap it into position with a plastic hammer.

CAUTION:
- **If no play is felt, check whether the shaft is fully inserted. If shaft insertion is correct, replace the axle shaft.**
- **Be sure to use a new circlip.**

Thrust play:
0.3 — 0.5 mm (0.012 — 0.020 in)

5) Wrap vinyl tape around the splined portion of the axle shaft.



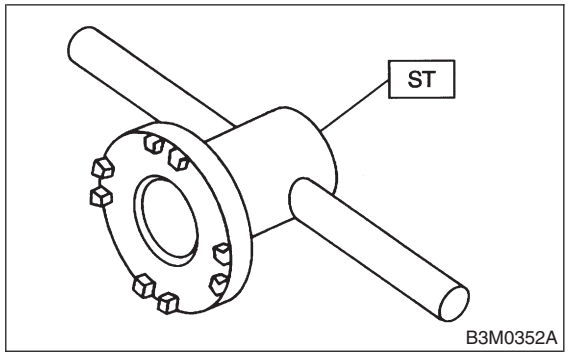
6) Install the oil seal and outer race (taper roller bearing) to the differential side retainer. Then screw in the retainer and the O-ring after coating the threads with oil.

CAUTION:
- **Pay attention not to damage the oil seal lips.**
- **Do not confuse the RH and LH oil seals.**
- **Keep the O-ring removed from the retainer.**

7) Using the ST, screw in the retainer until light contact is felt.

NOTE:
Screw in the RH side slightly deeper than the LH side.

ST 499787000 WRENCH ASSY

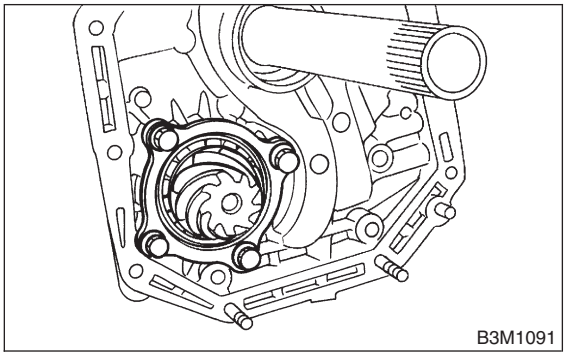


8) Hypoid gear backlash adjustment and tooth contact check
(1) Assemble the drive pinion assembly to the oil pump housing.

CAUTION:
- **Be careful not to bend the shims.**
- **Be careful not to force the pinion against the housing bore.**

(2) Tighten four bolts to secure the roller bearing.

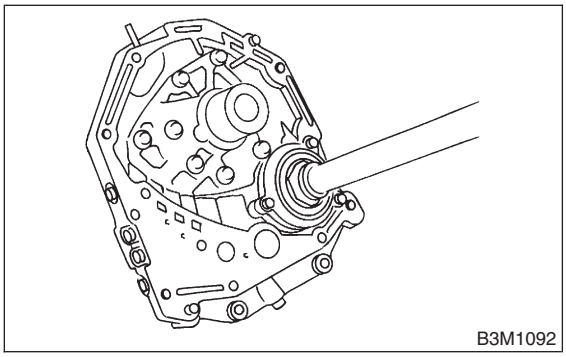
Tightening torque:
41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



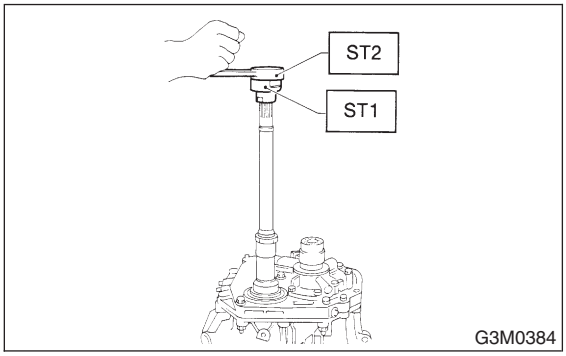
(3) Install the oil pump housing assembly to the torque converter clutch case, and secure evenly by tightening four bolts.

CAUTION:
● Thoroughly remove the liquid gasket from the case mating surface beforehand.
● Use an old gasket or an aluminum washer so as not to damage the mating surface of the housing.

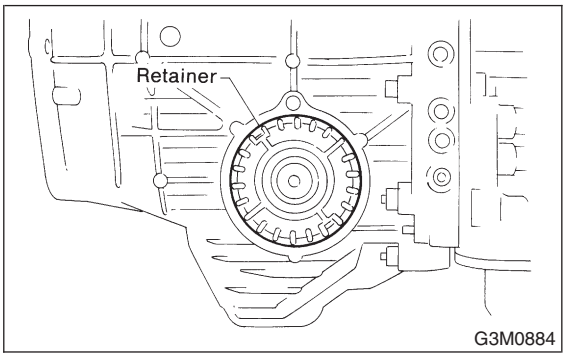
Tightening torque:
41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



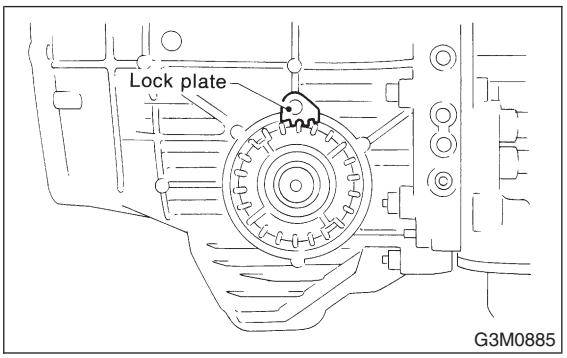
(4) Rotate the drive pinion several times with ST1 and ST2.
ST1 498937100 HOLDER
ST2 499787700 WRENCH



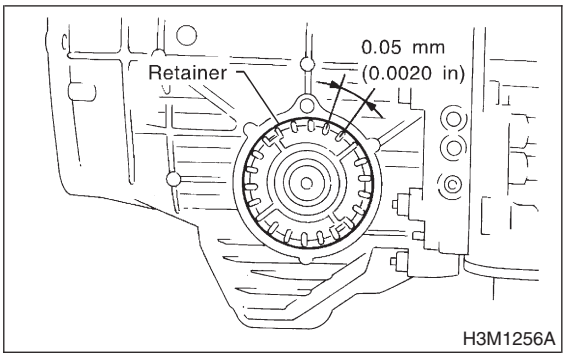
(5) Tighten the LH retainer until contact is felt while rotating the shaft. Then loosen the RH retainer. Keep tightening the LH retainer and loosening the RH retainer until the pinion shaft can no longer be turned. This is the “zero” state.



(6) After the “zero” state is established, back off the LH retainer 3 notches and secure it with the lock plate. Then back off the RH retainer and retighten until it stops. Repeat this procedure several times. Tighten the RH retainer 1-3/4 notches further. This sets the preload. Finally, secure the retainer with its lock plate.



NOTE:
Turning the retainer by one tooth changes the backlash about 0.05 mm (0.0020 in).

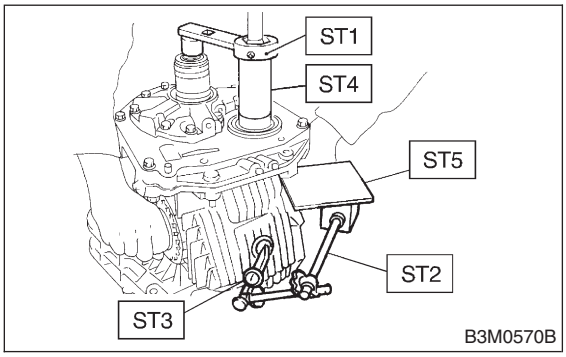


(7) Turn the drive pinion several rotations with ST1 and check to see if the backlash is within the standard value with ST2, ST3, ST4 and ST5.

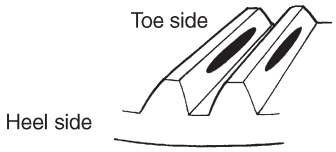
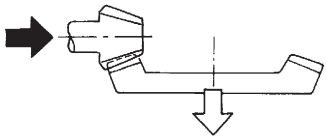
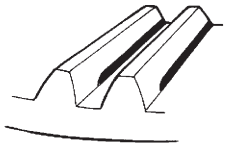
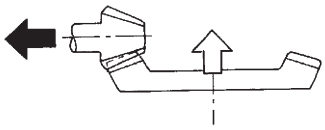
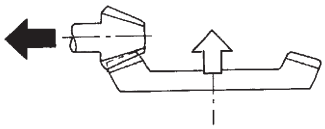
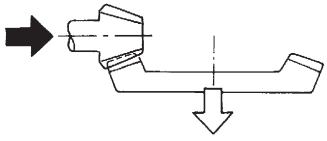
NOTE:
After confirming that the backlash is correct, check the tooth contact.

ST1	499787700	WRENCH
ST2	498247001	MAGNET BASE
ST3	498247100	DIAL GAUGE
ST4	499787500	ADAPTER WRENCH
ST5	498255400	PLATE

Backlash:
0.13 — 0.18 mm (0.0051 — 0.0071 in)



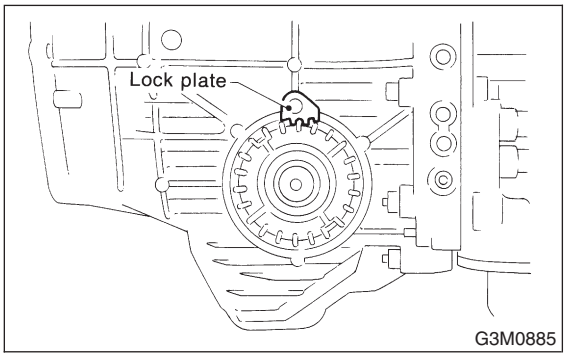
(8) Apply red lead evenly to the surfaces of three or four teeth of the crown gear. Rotate the drive pinion in the forward and reverse directions several times. Then remove the oil pump housing, and check the tooth contact pattern.
If tooth contact is improper, readjust the backlash or shim thickness.

Checking item	Contact pattern	Corrective action
Tooth contact Tooth contact pattern is slightly shifted toward to under no-load rotation. [When loaded, contact pattern moves toward heel.]	 B3M0317A	—
Face contact Backlash is too large.	This may cause noise and chipping at tooth ends.  B3M0319	Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.  B3M0323
Flank contact Backlash is too small.	This may cause noise and stepped wear on surfaces.  B3M0320	Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.  B3M0324
Toe contact (Inside end contact) Contact areas is small.	This may cause chipping at toe.  B3M0321	Adjust as for flank contact.  B3M0324
Heel contact (Outside end contact) Contact area is small.	This may cause chipping at heel ends.  B3M0322	Adjust as for face contact.  B3M0323

➡ : Adjusting direction of drive pinion
⇨ : Adjusting direction of crown gear

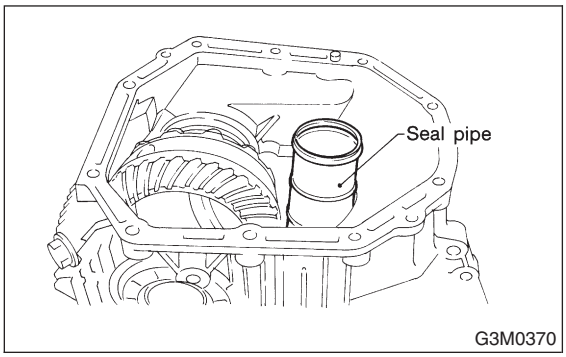
(9) If tooth contact is correct, mark the retainer position and loosen it. After fitting the O-ring, screw in the retainer to the marked position. Then tighten the lock plate to the specified torque.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



9) Install the seal pipe to the torque converter clutch case.

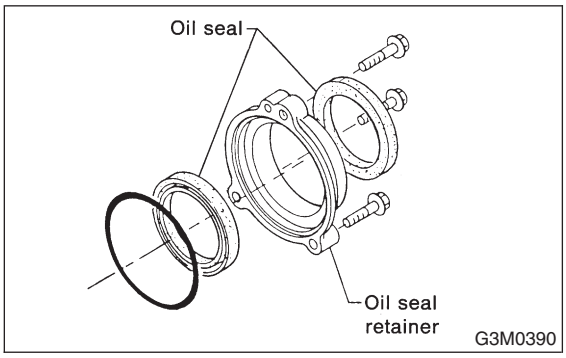
CAUTION:
Be sure to use a new seal pipe.



10) Install two oil seals to the oil seal retainer with ST.

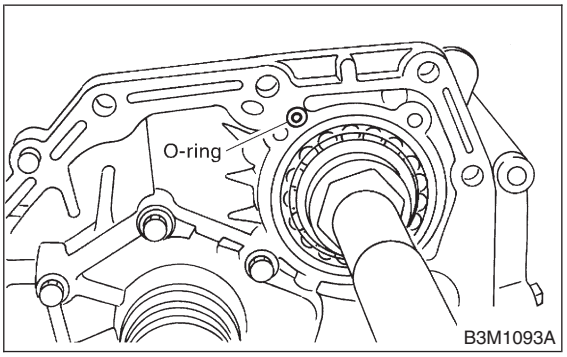
CAUTION:
• Always discard old oil seals, and install new ones.
• Pay attention to the orientation of the oil seals.

ST 499247300 INSTALLER



11) Attach the O-ring to the oil seal retainer with vaseline. Install the seal to the oil pump housing bore.

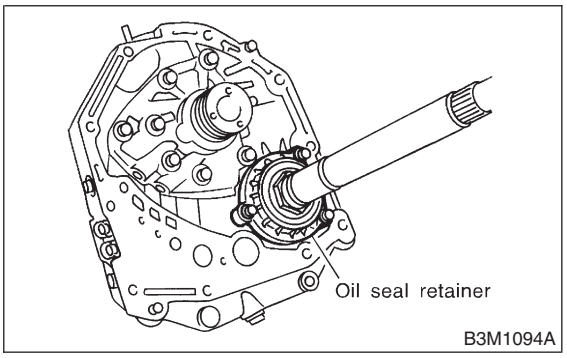
CAUTION:
Always discard old O-rings and install new ones.



12) Install the oil seal retainer taking care not to damage the oil seal lips. Then secure with three bolts.

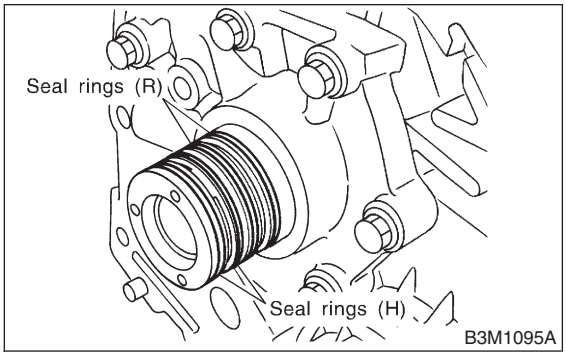
NOTE:
Make sure the O-ring is fitted correctly in position.

Tightening torque:
7±1 N·m (0.7±0.1 kg-m, 5.1±0.7 ft-lb)



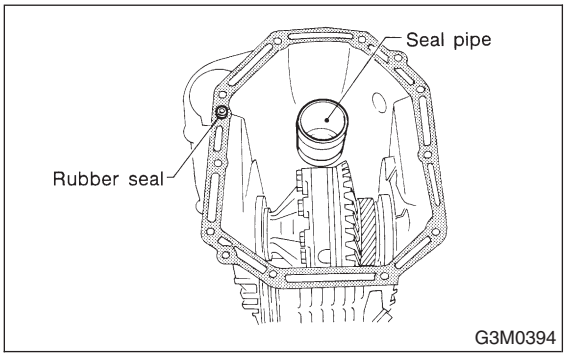
13) Apply vaseline to the groove on the oil pump cover, and install two (R) seal rings and two (H) seal rings.

NOTE:
● Fit the seal ring after compressing, and rub vaseline into the seal ring to avoid expansion.
● The “R” seal ring has a large diameter, while “H” has small diameter.



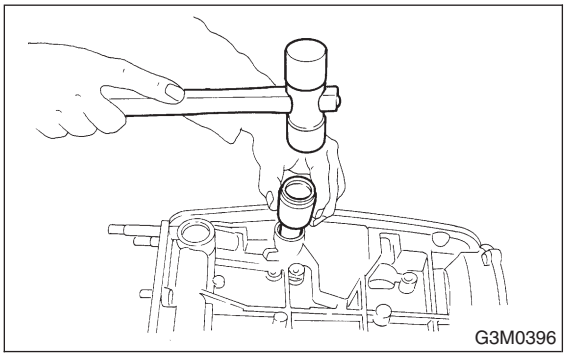
14) Install the rubber seal to the torque converter clutch case.

CAUTION:
Be careful not to lose the rubber seal.



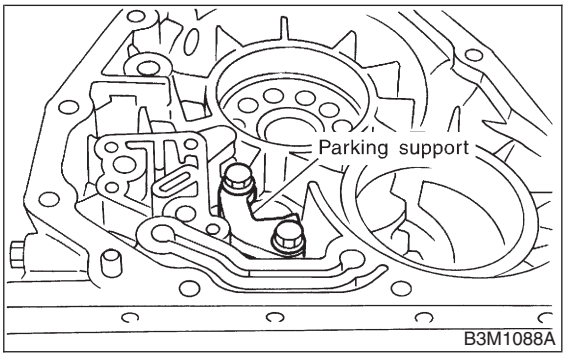
2. TRANSMISSION CASE SECTION

1) Using a plastic hammer, force-fit the oil seal.



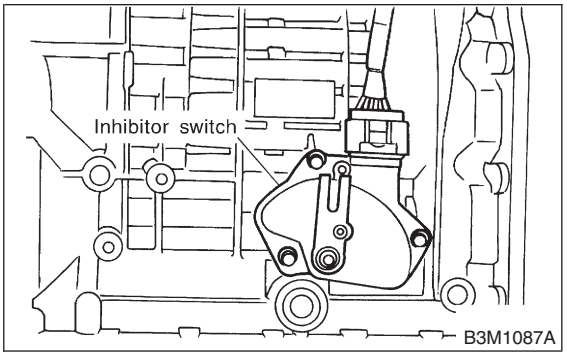
2) Install parking support to transmission case.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



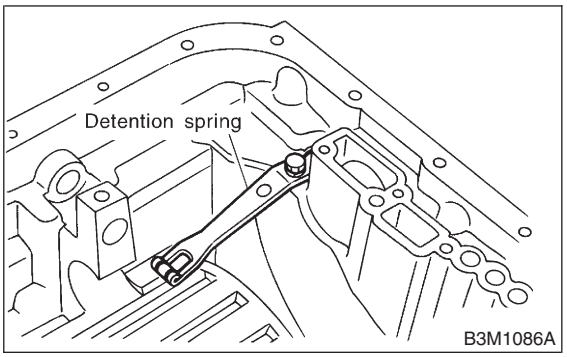
3) Install inhibitor switch to transmission case.

NOTE:
Temporary tighten inhibitor switch.



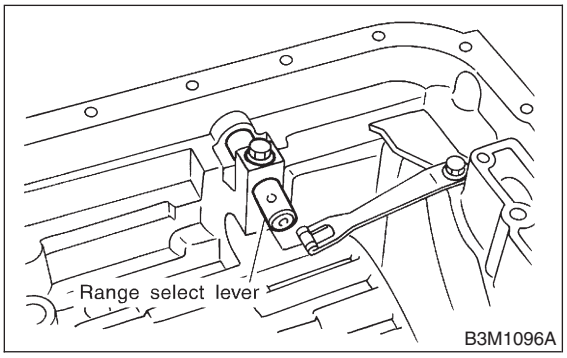
4) Install detention spring to transmission case.

Tightening torque:
6±1 N·m (0.6±0.1 kg-m, 4.3±0.7 ft-lb)

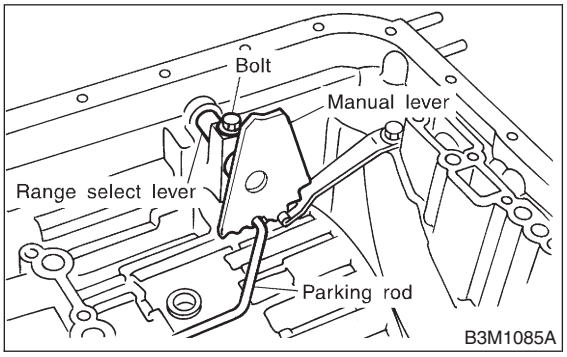


5) Insert range select lever, and tighten bolt.

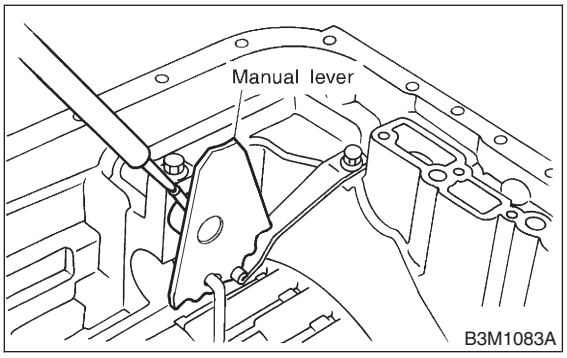
Tightening torque:
6±1 N·m (0.6±0.1 kg-m, 4.3±0.7 ft-lb)



6) Insert manual lever and parking rod.

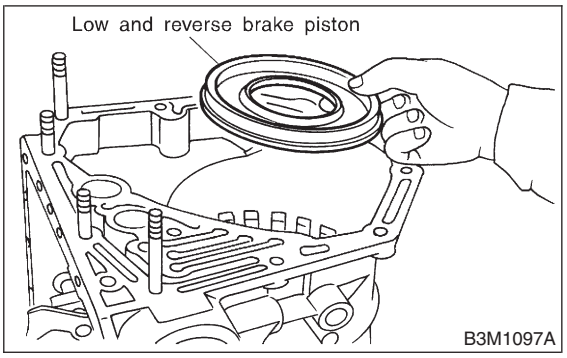


7) Insert spring pin to manual lever.

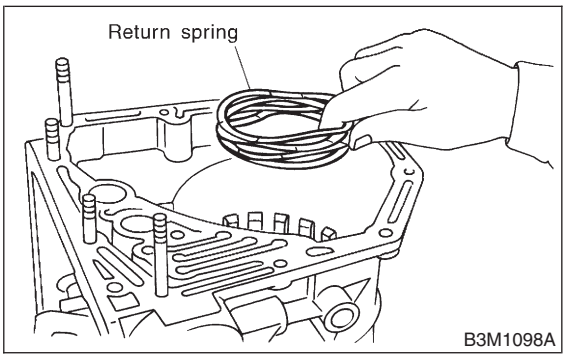


8) Install the low and reverse piston.

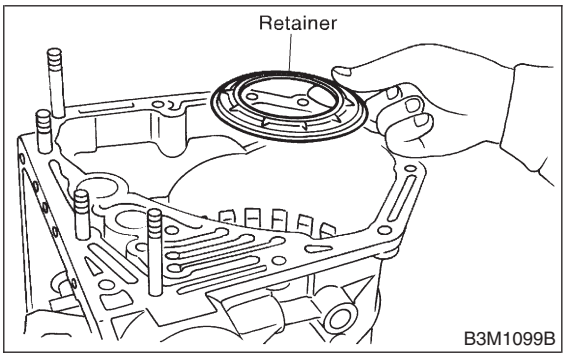
CAUTION:
● Be careful not to tilt the piston when installing.
● Be careful not to damage the lip seal.



9) Install return spring.



10) Install retainer.

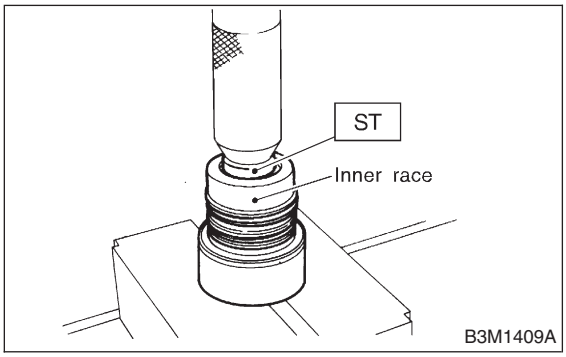


11) Install the one-way clutch inner race.
(1) Using a press and ST1, install the needle bearing to the inner race.

ST1 398497701 INSTALLER

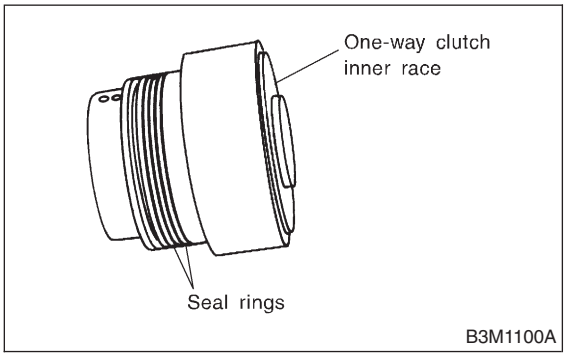
NOTE:
Use the following ST when removing.

ST 398527700 PULLER ASSY



(2) Install two seal rings to one-way clutch inner race.

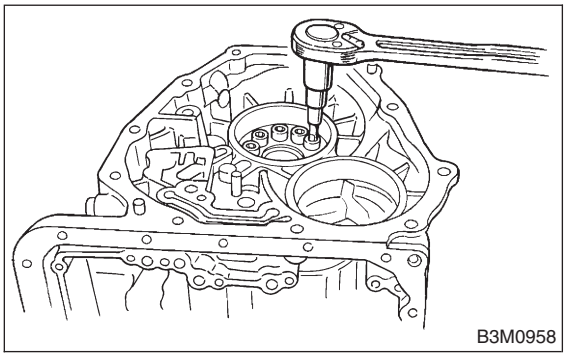
NOTE:
Apply vaseline to the groove of the inner race and to the seal ring after installation, so that the seal ring will not expand.



(3) Tighten eight socket head bolts from the rear side of the transmission case.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)

CAUTION:
Be sure to tighten evenly.

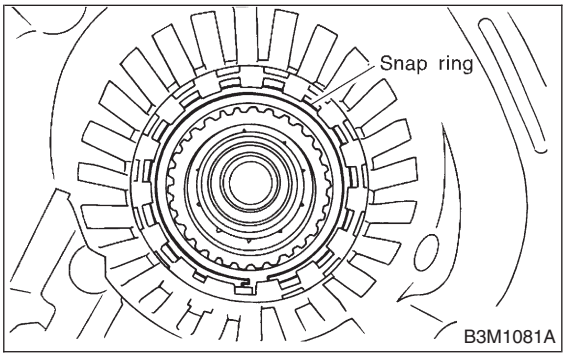


(4) Install thrust needle bearing.

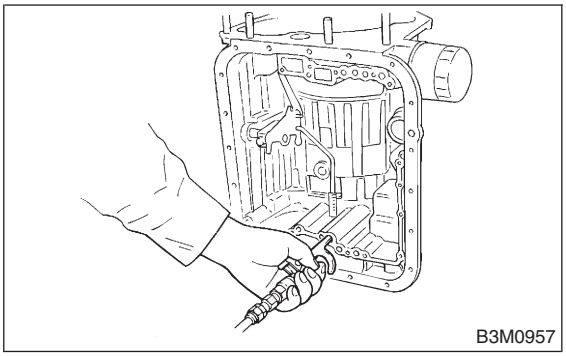
NOTE:
Place transmission case with the front facing up.

12) Installation of the low & reverse brake:
(1) Install dish plate, driven plates, drive plates, and a retaining plate, and secure with a snap ring.

NOTE:
Pay attention to the orientation of the dish plate.



(2) Apply compressed air intermittently to check for operation.

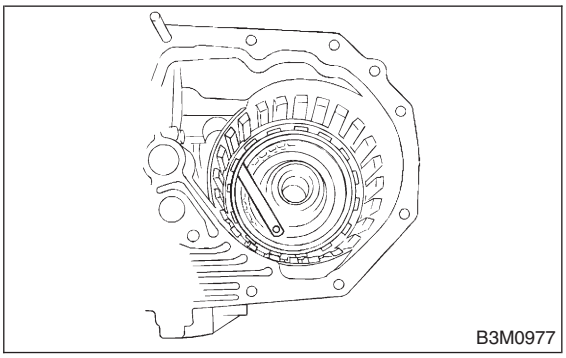


(3) Check the clearance. (Selection of retaining plate)

NOTE:
Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.

Standard value:
0.7 — 1.2 mm (0.028 — 0.047 in)

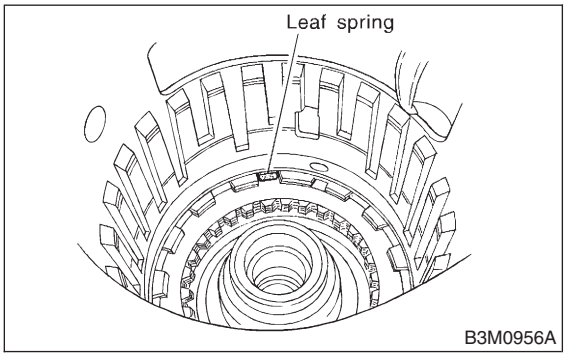
Allowable limit:
2.2 mm (0.087 in)



Available retaining plates	
Part No.	Thickness mm (in)
31667AA320	4.2 (0.165)
31667AA330	4.5 (0.177)
31667AA340	4.8 (0.189)
31667AA350	5.1 (0.201)
31667AA360	5.4 (0.213)
31667AA370	5.7 (0.224)
31667AA380	6.0 (0.236)

13) Install leaf spring of low and reverse brake.

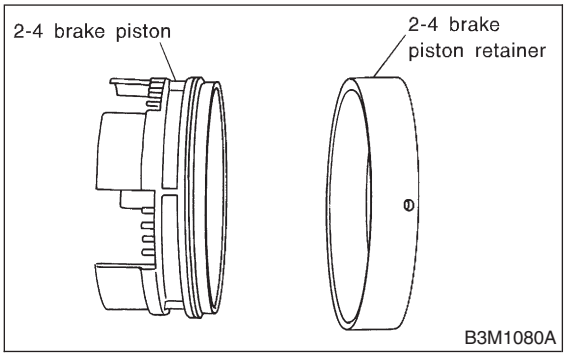
CAUTION:
Pay attention to the direction and position of leaf spring during installation.



14) Install O-ring to 2-4 brake piston.

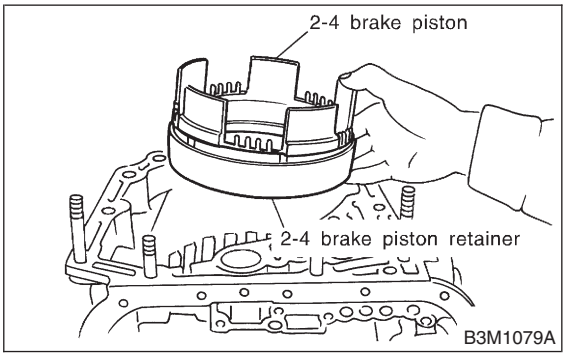
CAUTION:
- **If O-ring breaks or damage is noted, replace with new O-ring.**
- **Apply a coat of vaseline to inner side of O-ring before installation.**

15) Install 2-4 brake piston to 2-4 brake piston retainer.

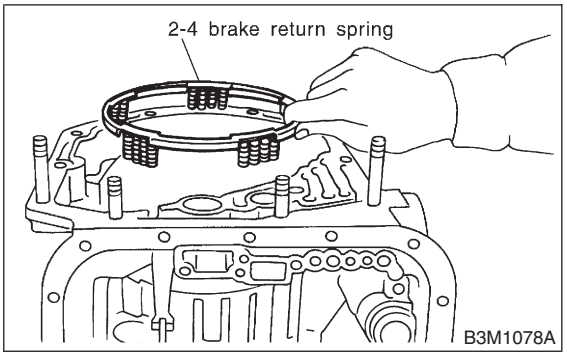


16) Install 2-4 brake piston and retainer to transmission case.

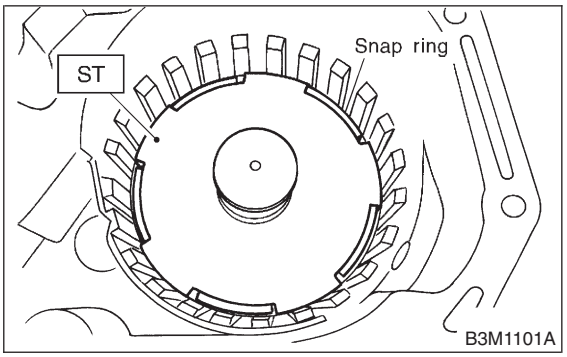
CAUTION:
Align the hole in the 2-4 brake seal of transmission case with the hole in 2-4 brake piston retainer during installation.



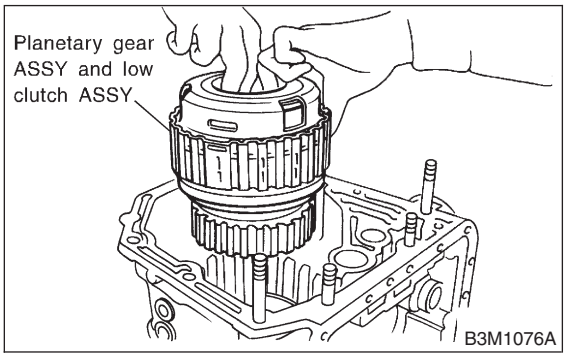
17) Install 2-4 brake piston return spring to transmission case.



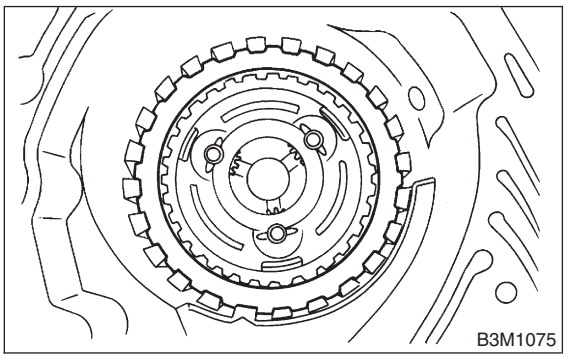
18) Position snap ring in transmission. Using ST, press the snap ring into place.
ST 498677100 COMPRESSOR



19) Install planetary gear and low clutch assembly to transmission case.
Install carefully while rotating the low clutch and planetary gear assembly slowly paying special attention not to damage the seal ring.

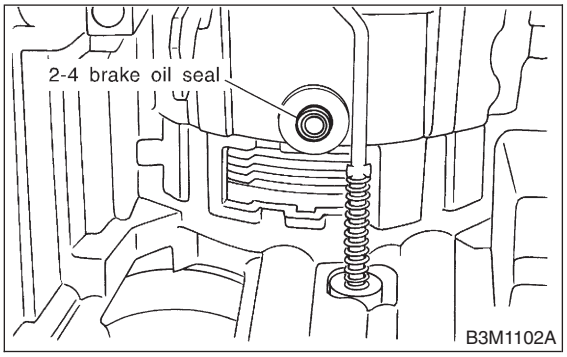


20) Installation of the 2-4 brake:
(1) Install pressure plate, drive plate, driven plate, retaining plate and snap ring.

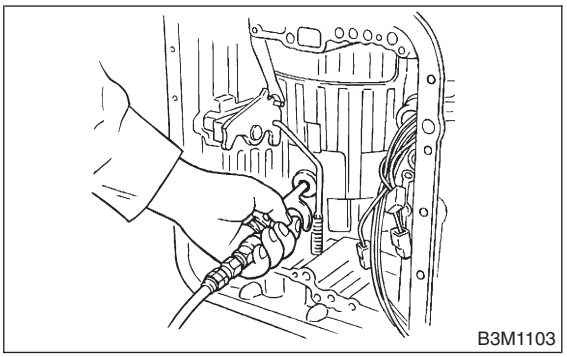


(2) Install 2-4 brake oil seal to transmission case.

NOTE:
Be sure to use a new one.



(3) After all 2-4 brake component parts have been installed, blow in air intermittently and confirm the operation of the brake.

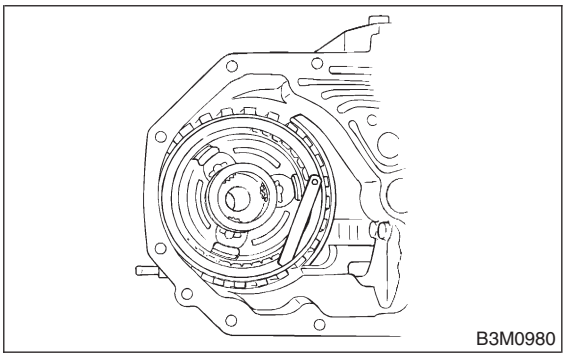


(4) Measure the clearance between the retaining plate and the snap ring.

NOTE:
Select a retaining plate with a suitable value from the following table, so that the clearance becomes the standard value.

Standard value:
0.8 — 1.2 mm (0.031 — 0.047 in)

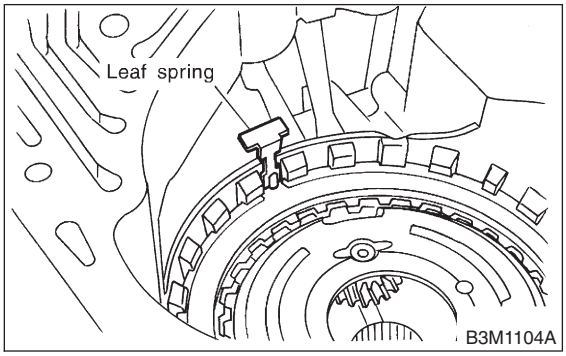
Allowable limit:
1.5 mm (0.059 in)



Available retaining plates	
Part No.	Thickness mm (in)
31567AA610	5.6 (0.220)
31567AA620	5.8 (0.228)
31567AA630	6.0 (0.236)
31567AA640	6.2 (0.244)
31567AA650	6.4 (0.252)
31567AA660	6.6 (0.260)

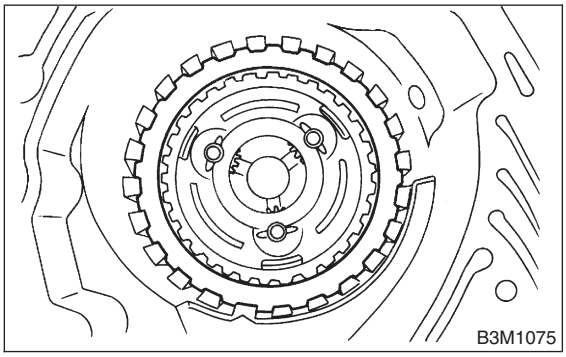
21) Install leaf spring of 2-4 brake.

NOTE:
Be careful not to mistake the location of the leaf spring to be inserted.



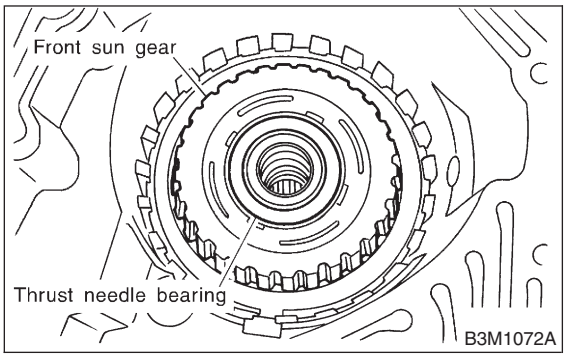
22) Install thrust needle bearing.

CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>



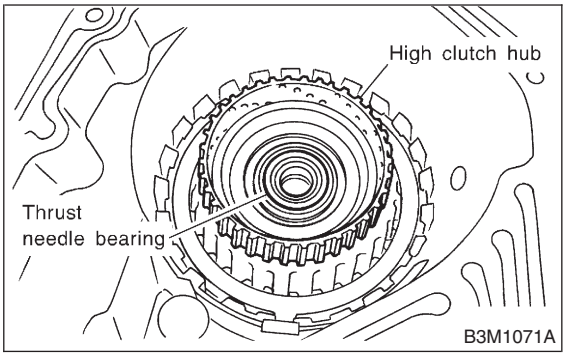
23) Install front sun gear and thrust needle bearing.

CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>



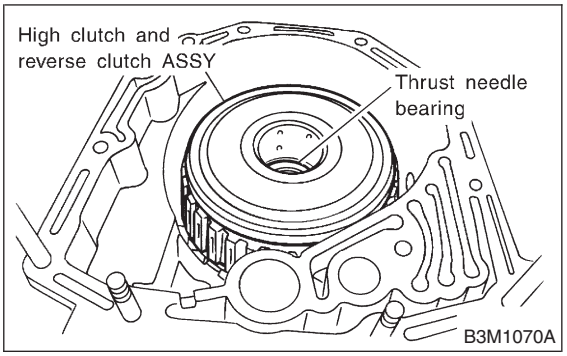
24) Install the high clutch hub and thrust needle bearing.
Attach the thrust needle bearing to the hub with vaseline and install the hub by correctly engaging the splines of the front planetary carrier.

CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>



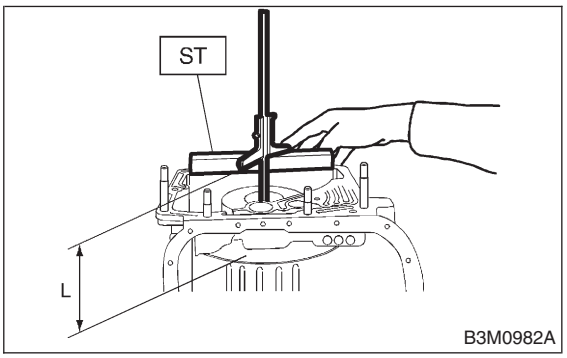
25) Install the high clutch assembly.

NOTE:
Correctly engage the high clutch hub and clutch splines.

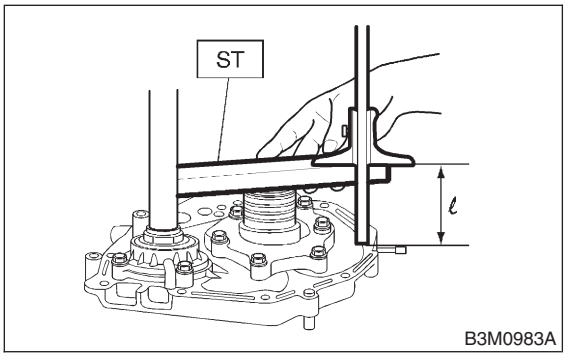


26) Adjustment of total end play:
(1) Using ST, measure the distance from the transmission case mating surface to the recessed portion of the high clutch drum “L”.

ST 398643600 GAUGE

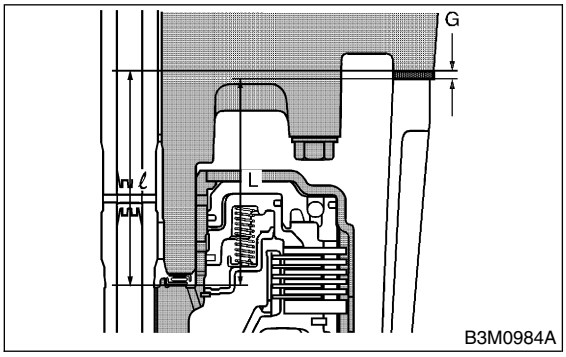


(2) Using ST, measure the distance from the oil pump housing mating surface to the top surface of the oil pump cover with thrust needle bearing.
ST 398643600 GAUGE



(3) Calculation of total end play
Select suitable bearing race from among those listed in this table so that clearance C is in the 0.25 — 0.55 mm (0.0098 — 0.0217 in) range.
C = (L + G) – ℓ

C	Clearance between concave portion of high clutch and end of clutch drum support
L	Length from case mating surface to concave portion of high clutch
G	Gasket thickness (0.28 mm, 0.0110 in)
ℓ	Height from housing mating surface to upper surface of clutch drum support



Thrust needle bearing	
Part No.	Thickness mm (in)
806528050	4.1 (0.161)
806528060	4.3 (0.169)
806528070	4.5 (0.177)
806528080	4.7 (0.185)
806528090	4.9 (0.193)
806528100	5.1 (0.201)

27) Install the oil pump housing assembly.
(1) After completing end play adjustment, insert the bearing race in the recess of the high clutch. Attach the thrust needle bearing to the oil pump cover with vaseline.

(2) After correctly installing the gasket to the case mating surface, carefully install the oil pump housing assembly. Be careful to avoid hitting the drive pinion against the inside of the case.

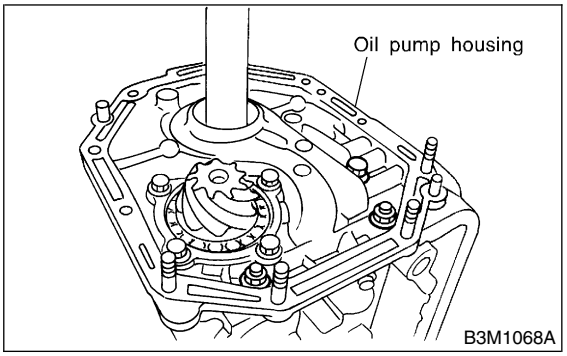
CAUTION:
- **Be careful not to damage the seal ring.**
- **Be sure to use a new gasket.**

(3) Install both parts with dowel pins aligned. Make sure no clearance exists at the mating surface.

NOTE:
Any clearance suggests a damaged seal ring.

(4) Secure the housing with two nuts.

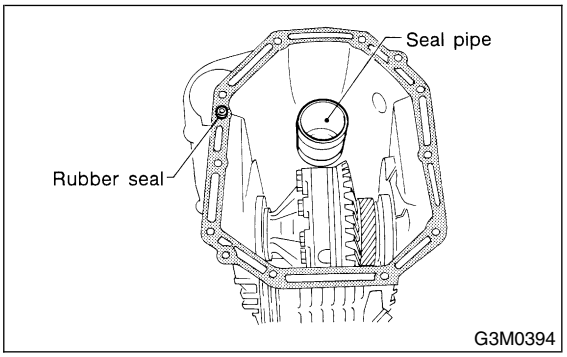
Tightening torque:
T: 41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



3. TORQUE CONVERTER CLUTCH CASE AND TRANSMISSION CASE

1) Apply proper amount of liquid gasket (THREE BOND Part No. 1215) to the entire torque converter clutch case mating surface.

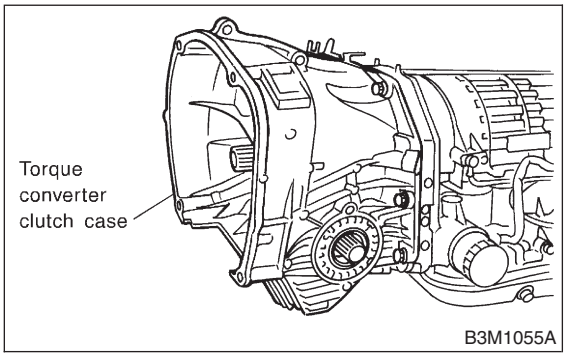
NOTE:
Make sure that the rubber seal and seal pipe are fitted in position.



2) Install the torque converter clutch case assembly to the transmission case assembly, and secure with six bolts and four nuts.

CAUTION:
When installing, be careful not to damage the torque converter clutch case bushing and oil seal.

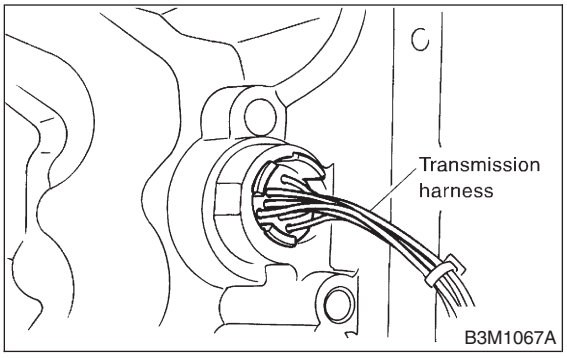
Tightening torque:
41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



4. CONTROL VALVE AND OIL PAN

1) Install and route the transmission harness.

CAUTION:
Be careful not to damage the harness.

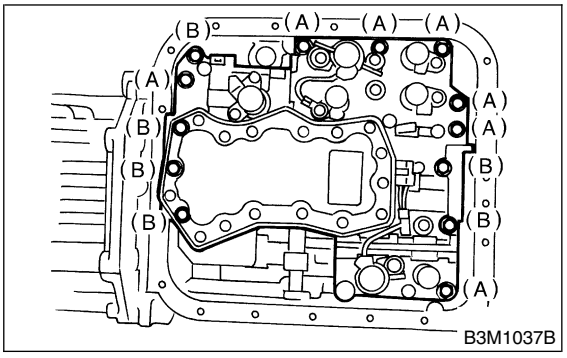


2) Install the control valve assembly.
(1) Set the select lever in range “N”.

(2) Install the control valve by engaging the manual valve and manual level, then tighten the 17 bolts.

CAUTION:
Tighten the control valve mounting bolts evenly.

Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

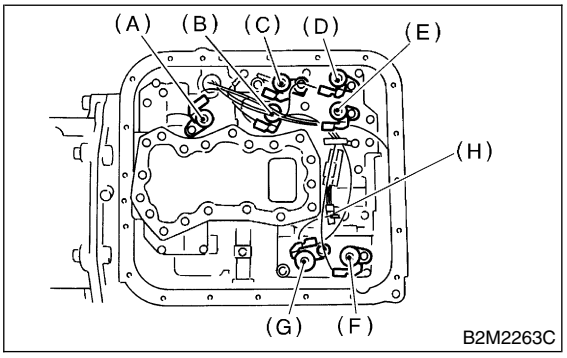


(A) Short bolts
(B) Long bolts

(3) Tighten the valve body to the specified torque.

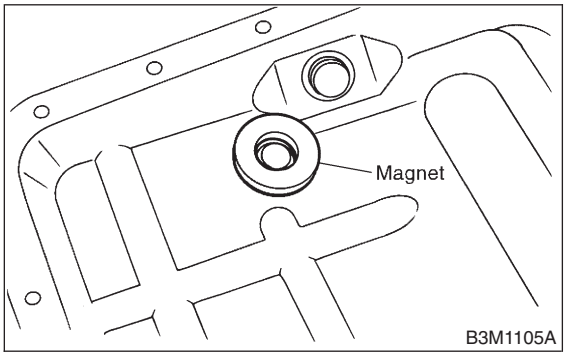
Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

3) Connect all connectors.

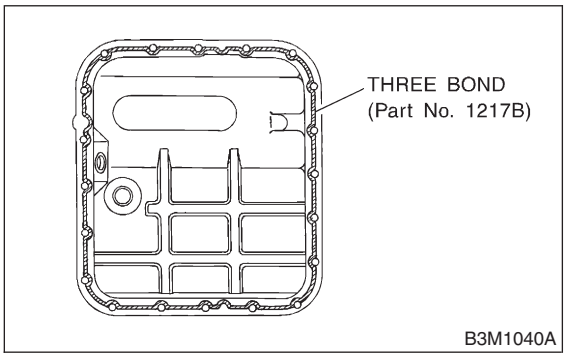


(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 2 (Yellow)
(E) Shift solenoid 1 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

4) Install the oil pan.
(1) Attach the magnet at the specified position.



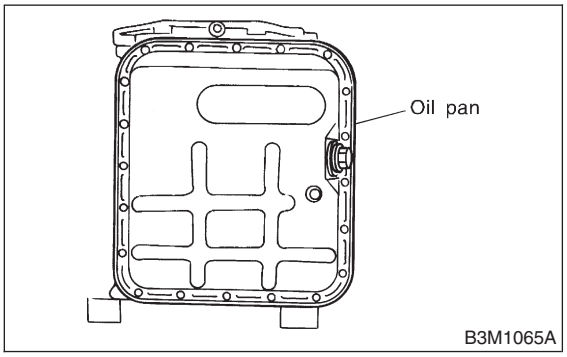
(2) Apply proper amount of liquid gasket (THREE BOND Part No. 1217B) to the entire oil pan mating surace.



(3) Install the oil pan to the transmission case assembly, and secure with 20 bolts.

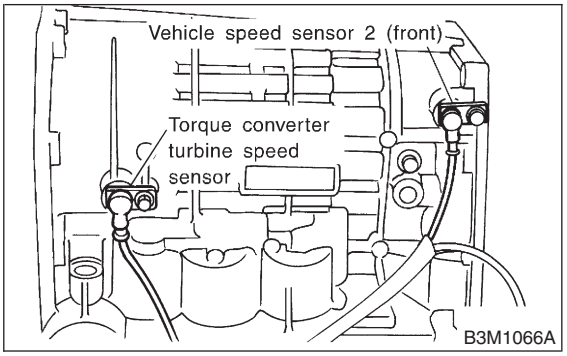
NOTE:
Tighten the bolts evenly.

Tightening torque:
4.9±0.5 N·m (0.50±0.05 kg-m, 3.6±0.4 ft-lb)



5) Install torque converter turbine speed sensor and vehicle speed sensor 2 (front).

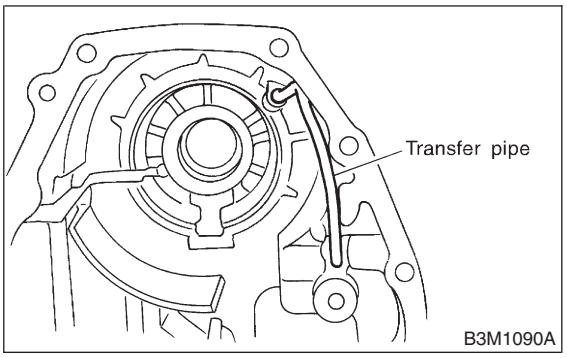
Tightening torque:
7±1 N·m (0.7±0.1 kg-m, 5.1±0.7 ft-lb)



5. EXTENSION SECTION

NOTE:
When installing new oil seal into extension case, press it with ST.

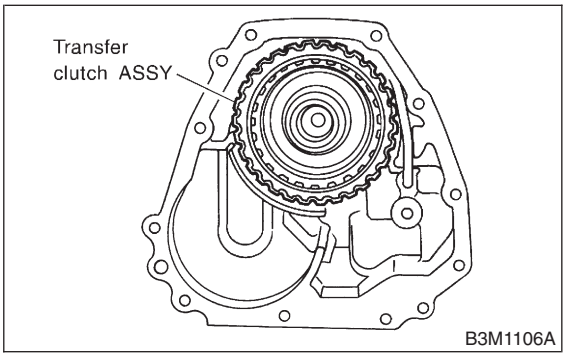
ST 498057300 INSTALLER
1) Install the transfer pipe to extension case.



2) Install the transfer clutch assembly to the case.

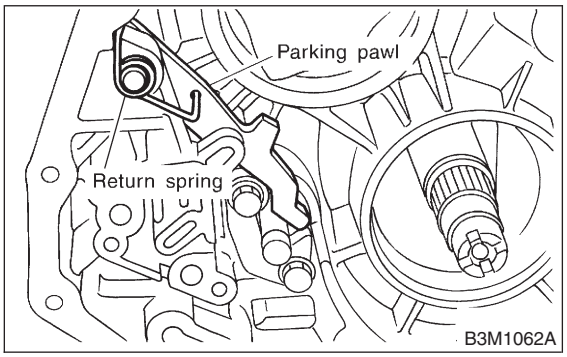
CAUTION:
Be careful not to damage the seal rings.

NOTE:
Insert the clutch assembly fully into position until the bearing shoulder bottoms.

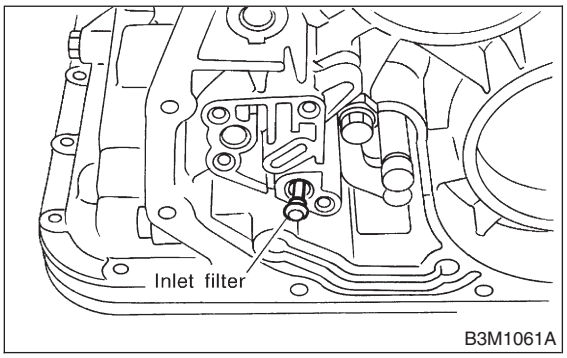


6. CONNECTION OF EACH SECTION

1) Install the parking pawl, shaft and return spring.



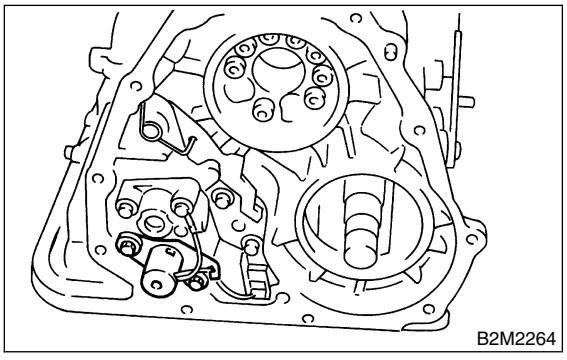
2) Install inlet filter to transmission case.



3) Install transfer valve plate, valve body and transfer duty solenoid to transmission case.

CAUTION:
● Be sure to install transfer seal lip to transfer control valve body.
● If transfer seal lip is damaged, replace seal with new one.

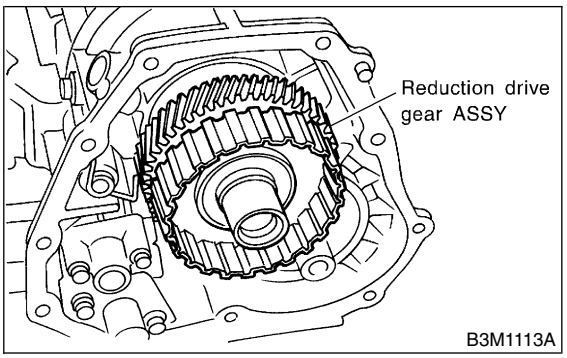
Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)



4) Connect connector to transfer duty solenoid.

5) Install the reduction drive gear assembly.

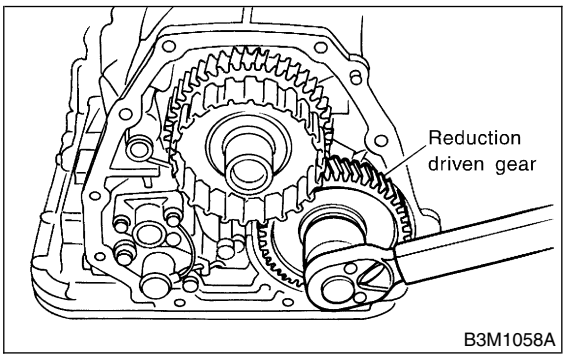
NOTE:
Insert it fully into position until the bearing shoulder bottoms.



6) Using a plastic hammer, install reduction driven gear assembly, and tighten drive pinion lock nut.

NOTE:
- Be sure to use a new lock nut and a washer.
- Set the select lever in the “P” range.
- After tightening, stake the lock nut securely.

Tightening torque:
98±5 N·m (10.0±0.5 kg-m, 72.3±3.6 ft-lb)

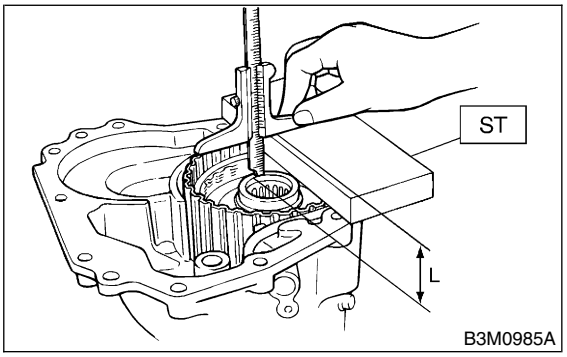


7) Measurement and adjustment of extension end play

(1) Measure distance L from end of extension case and rear drive shaft with ST.

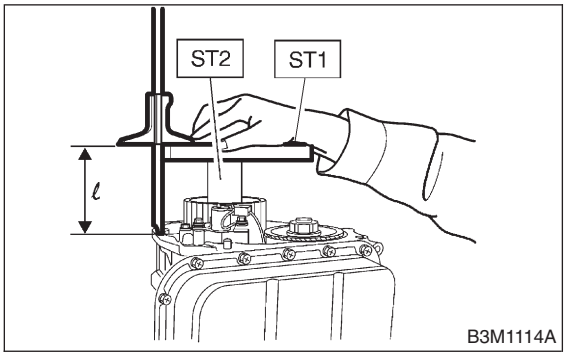
ST 398643600 GAUGE

L = Measured value – 15 mm



(2) Measure the distance "ℓ" from the transmission case mating surface to the reduction drive gear end surface with ST1 and ST2.
ℓ = Measured value – 50 mm

ST1 398643600 GAUGE
ST2 499577000 GAUGE



(3) Calculation equation:

NOTE:
Add 0.05 mm (0.0020 in) and 0.20 mm (0.0079 in) thick shims to area "T". Calculate formula 2 to determine "H". The calculated "H" refers to the shim thickness range. Select shims of suitable thicknesses within the calculated "H" range.

T = (L + G) – ℓ – H
T : Shim clearance
L : Distance from end of extension case to end of rear drive shaft
G: Gasket thickness (0.45 mm, 0.0177 in)
ℓ : Height from end of transmission case to end of reduction drive gear
H : Thrust needle bearing thickness
0.05 — 0.25 mm (0.0020 — 0.0098 in)

Thrust needle bearing	
Part No.	Thickness mm (in)
806536020	3.8 (0.150)
806535030	4.0 (0.157)
806535040	4.2 (0.165)
806535050	4.4 (0.173)
806535060	4.6 (0.181)
806535070	4.8 (0.189)
806535090	5.0 (0.197)

8) Installation of extension case and transmission case

(1) Attach the selected thrust needle bearing to the end surface of reduction drive gear with vaseline.

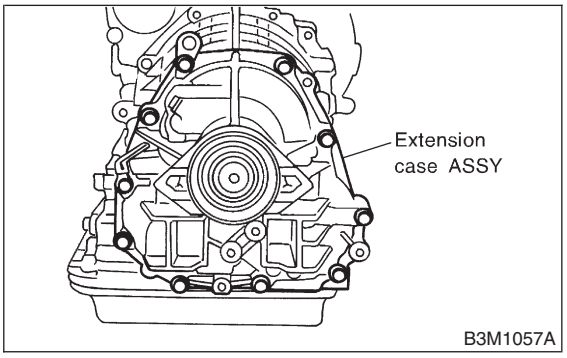
CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>

(2) Install the extension case to the transmission case.

CAUTION:
Be sure to use a new gasket.

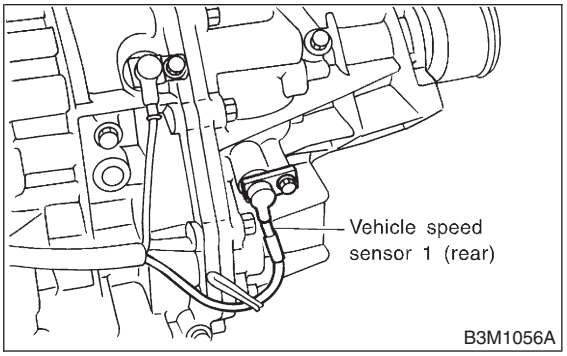
(3) Tighten bolts to secure the case.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



9) Install the vehicle speed sensor 1 (rear).

Tightening torque:
7±1 N·m (0.7±0.1 kg-m, 5.1±0.7 ft-lb)

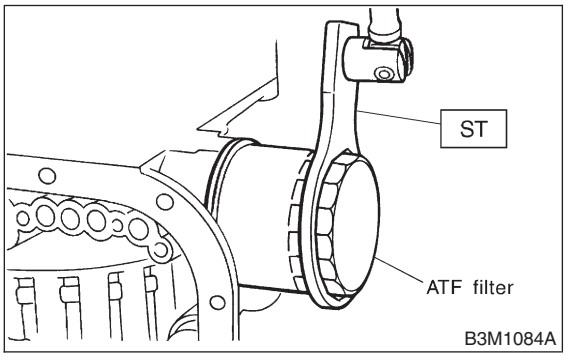


7. EXTERNAL PARTS

1) Using ST, install ATF filter to transmission case. Calculate ATF filter torque specifications using the following formula.
$T_2 = L_2/(L_1 + L_2) \times T_1$
T_1: 14±2 N·m (1.4±0.2 kg-m, 10.1±1.4 ft-lb) [Required torque setting]
T_2: Tightening torque
L_1: ST length 0.078 m (3.07 in)
L_2: Torque wrench length

CAUTION:
Align ST with torque wrench while tightening ATF filter.

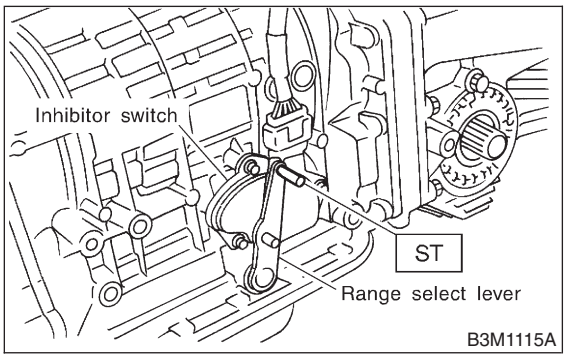
ST 498545400 OIL FILTER WRENCH



2) Adjustment of inhibitor switch
(1) With the select lever set to "N" adjust the inhibitor switch so that the hole of range select lever is aligned with the inhibitor switch hole with ST.

NOTE:
Ensure that gauge moves properly.

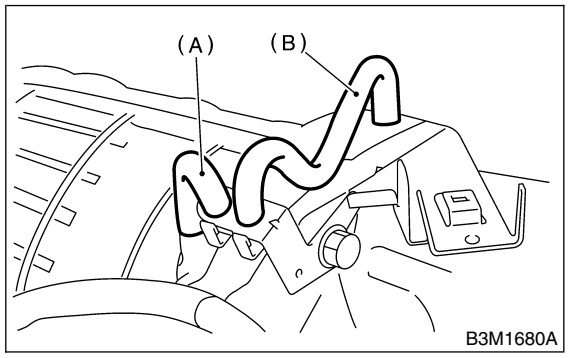
ST 499267300 STOPPER PIN



(2) With hole aligned, tighten three bolts to secure the inhibitor switch.

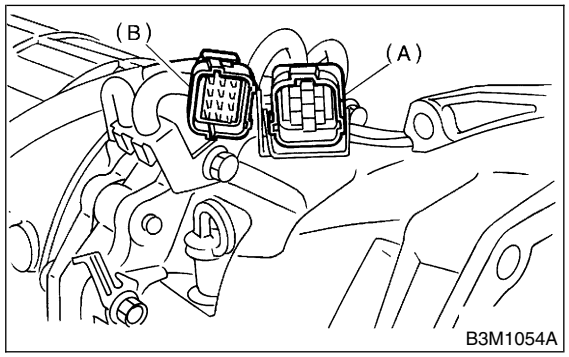
Tightening torque:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)

3) Install air breather hose.



(A) Air breather hose (Transmission case)
(B) Air breather hose (Oil pump housing)

4) Insert inhibitor switch harness and transmission harness connector into stay.



(A) Transmission harness
(B) Inhibitor switch harness

5) Install the oil cooler outlet pipe.

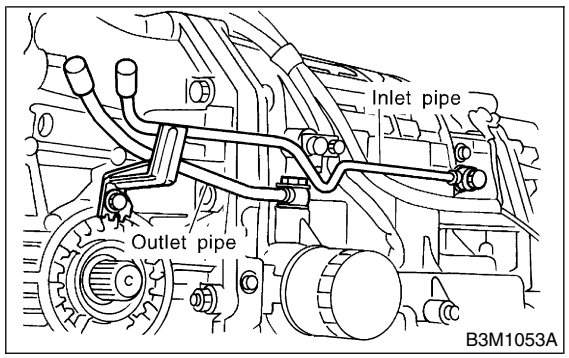
CAUTION:
Be sure to use a new aluminum washer.

Tightening torque:
34±3 N·m (3.5±0.3 kg-m, 25.3±2.2 ft-lb)

6) Install the oil cooler inlet pipe.

CAUTION:
Be sure to use a new aluminum washer.

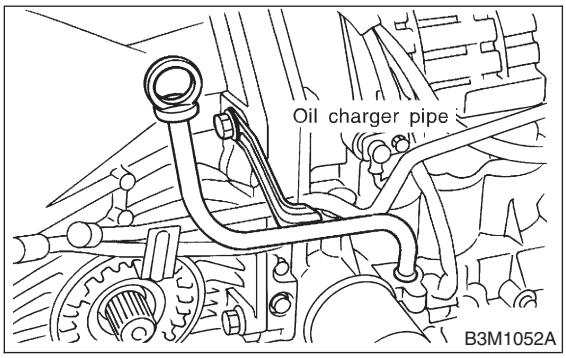
Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



7) Install the oil charge pipe.

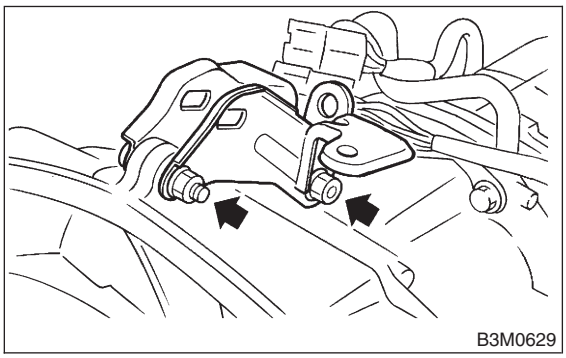
CAUTION:
Be careful not to damage the O-ring.

Tightening torque:
41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



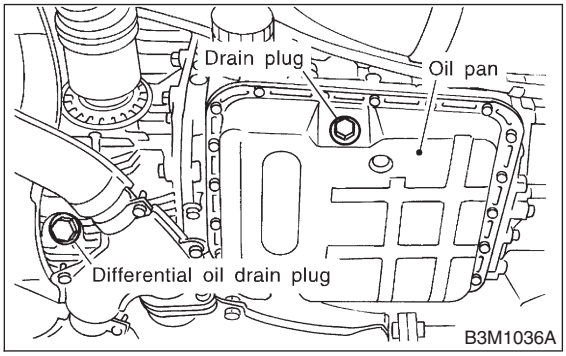
8) Install the pitching stopper bracket.

Tightening torque:
41±3 N·m (4.2±0.3 kg-m, 30.4±2.2 ft-lb)



9) Tighten the drain plugs.

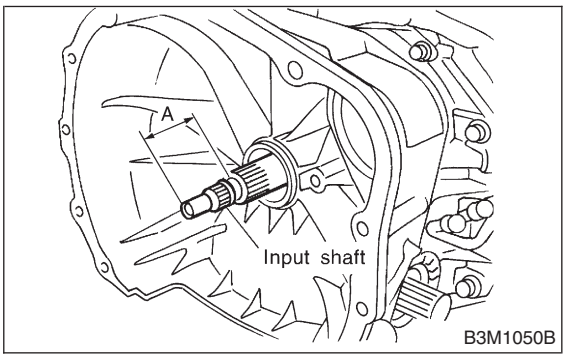
Tightening torque:
Diff.
44±3 N·m (4.5±0.3 kg-m, 32.5±2.2 ft-lb)
ATF
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)



10) Insert the input shaft while turning lightly by hand.

CAUTION:
Be careful not to damage the bushing.

Normal protrusion A:
50 — 55 mm (1.97 — 2.17 in)

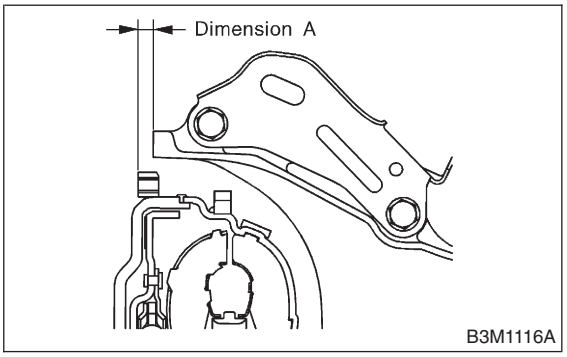


11) Install the torque converter clutch assembly.
(1) Install the oil pump shaft to the torque converter clutch.

NOTE:
Make sure the clip fits securely in its groove.

(2) Holding the torque converter clutch assembly by hand, carefully install it to the torque converter clutch case. Be careful not to damage the bushing. Also avoid undue contact between the oil pump shaft bushing and stator shaft portion of the oil pump cover.
(3) Rotate the shaft lightly by hand to engage the splines securely.

Dimension A:
2.7 — 2.9 mm (0.106 — 0.114 in)

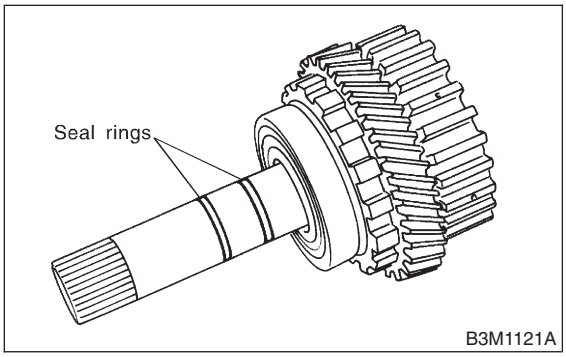


13. Reduction Drive Gear Assembly

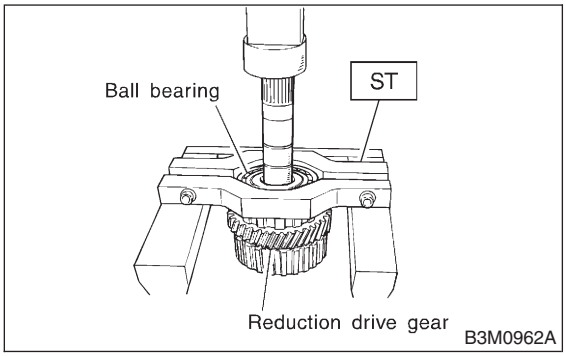
A: DISASSEMBLY

1) Take out the seal rings.

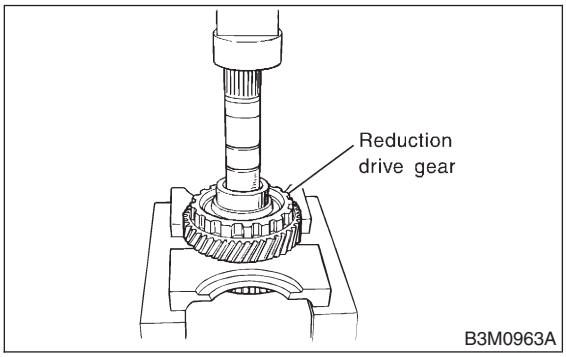
CAUTION:
Be careful not to damage the seal rings.



2) Using ST, remove the ball bearing.
ST 498077600 REMOVER



3) Using a press, remove the reduction drive gear.



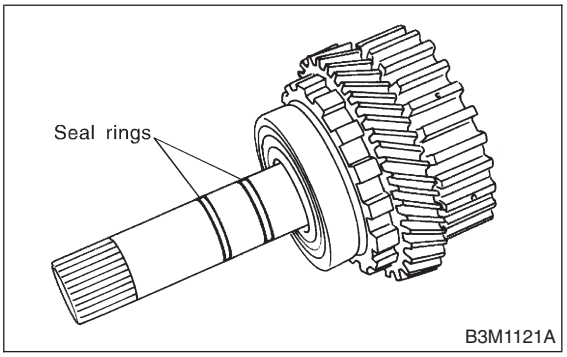
B: INSPECTION

Make sure that each component is free of harmful gouges, cuts, or dust.

C: ASSEMBLY

1) Press-fit the reduction drive gear to the shaft.
2) Press-fit the ball bearing to the reduction drive gear.
3) Attach two seal rings.

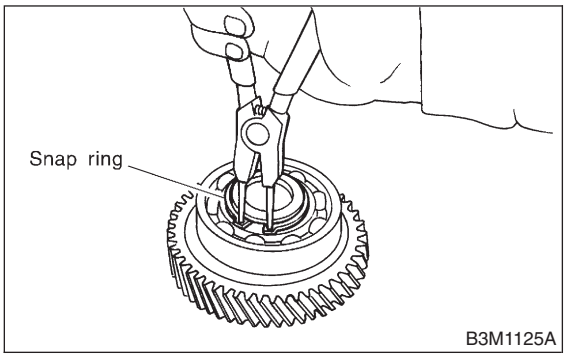
NOTE:
To make subsequent assembly easier, apply vaseline to the grooves of the shaft and to the exterior of the seal ring.



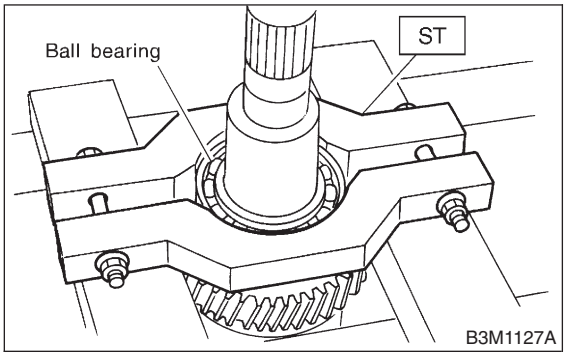
14. Reduction Driven Gear

A: DISASSEMBLY

1) Remove snap ring from reduction driven gear.



2) Using ST, remove ball bearing from reduction driven gear.
ST 498077600 REMOVER

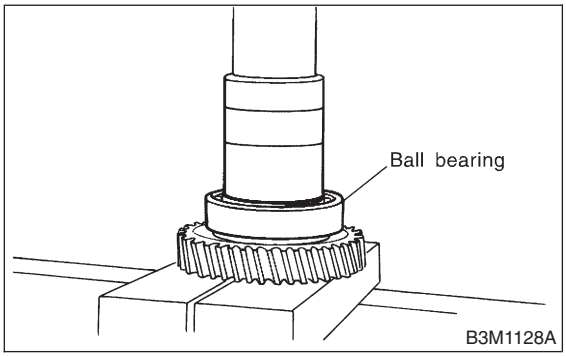


B: INSPECTION

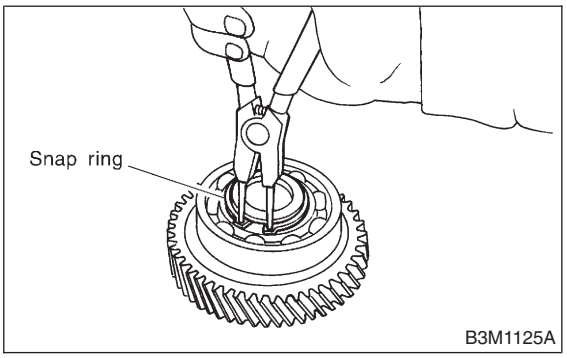
Check ball bearing and gear for dents or damage.

C: ASSEMBLY

1) Using a press, install ball bearing to reduction driven gear.



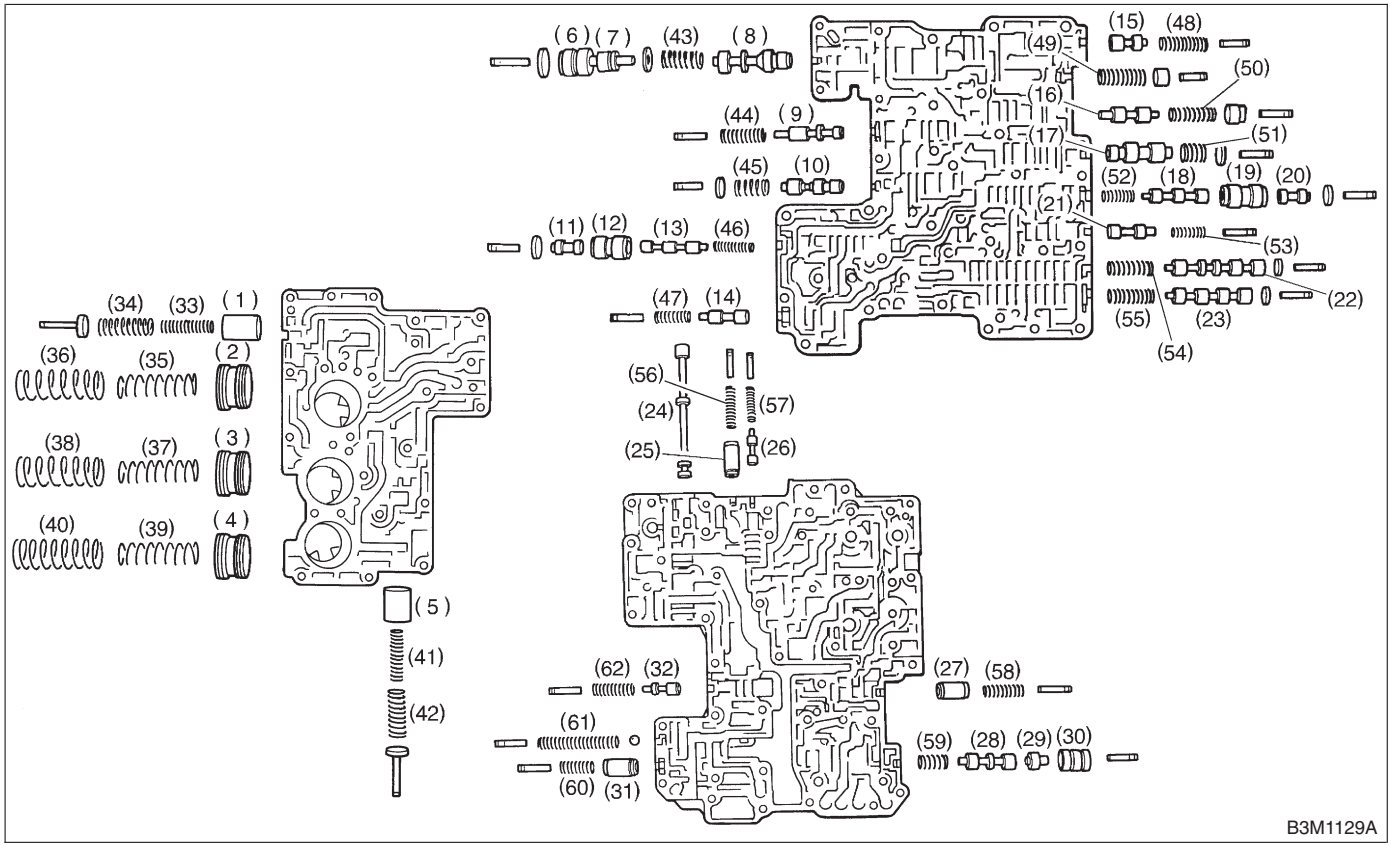
2) Install snap ring to reduction driven gear.



15. Control Valve Body

A: PRECAUTION

The control valve is composed of parts which are accurately machined to a high degree and should be handled carefully during disassembly and assembly. As these parts are similar in shape, they should be arranged in neat order on a table after disassembly so that they can be easily installed to their original positions. Spring loaded parts should be also handled carefully, as springs may jump out of place when the parts are disassembled or removed. Extreme care should be taken so as not to drop valves on the floor. Before assembling, the parts and valves should be dipped in a container filled with the ATF. Make sure that the valves are clean and free from any foreign material before assembly. Torque specifications should also be observed.

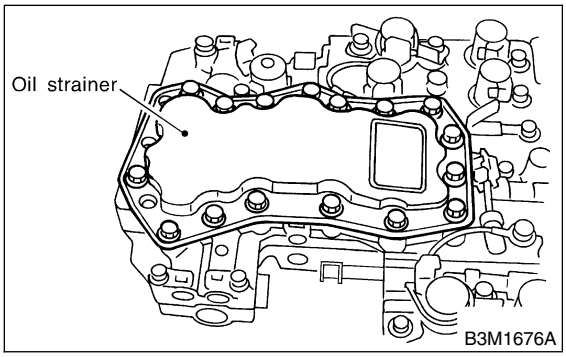


(1) 2-4 brake clutch accumulator piston B
(2) 2-4 brake clutch accumulator piston A
(3) Low clutch accumulator piston
(4) High clutch accumulator piston A
(5) High clutch accumulator piston B
(6) Pressure regulator sleeve
(7) Pressure regulator plug
(8) Pressure regulator valve
(9) Reverse inhibit valve
(10) Accumulator control valve B
(11) 2-4 brake timing plug
(12) 2-4 brake timing sleeve
(13) 2-4 brake timing valve A
(14) 2-4 brake timing valve B
(15) Torque convertor regulator valve
(16) Pressure modifier valve
(17) Accumulator control valve A
(18) Low clutch timing valve A
(19) Low clutch timing sleeve
(20) Low clutch timing plug
(21) Low clutch timing valve B
(22) Shift valve B
(23) Shift valve A
(24) Manual valve
(25) Throttle accumulator piston B
(26) 1st reducing valve
(27) Throttle accumulator piston A
(28) Lock-up control valve
(29) Lock-up control plug
(30) Lock-up control sleeve
(31) Modifier accumulator piston
(32) Pilot valve

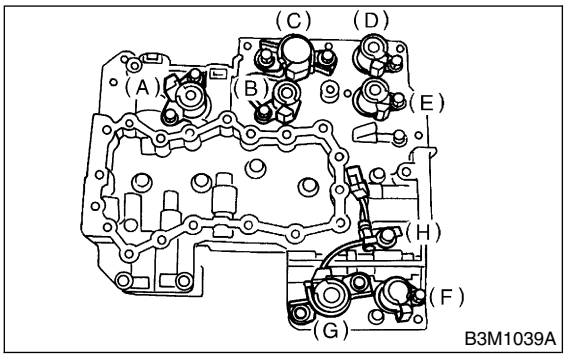
No.	Part name	Wire dia. mm (in)	Average dia. mm (in)	Effective turn	Free length mm (in)
33	2-4 brake accumulator B spring (Inlet)	1.6 (0.063)	9.3 (0.366)	14.6	47.0 (1.850)
34	2-4 brake accumulator B spring (Outlet)	2.3 (0.091)	13.7 (0.539)	8.79	45.0 (1.772)
35	2-4 brake accumulator A spring (Inlet)	1.8 (0.071)	21.3 (0.839)	8.0	69.1 (2.720)
36	2-4 brake accumulator A spring (Outlet)	1.7 (0.067)	25.3 (0.996)	6.3	69.1 (2.720)
37	Low clutch accumulator spring (Inlet)	1.8 (0.071)	21.3 (0.839)	8.0	69.1 (2.720)
38	Low clutch accumulator spring (Outlet)	1.7 (0.067)	25.3 (0.996)	6.3	69.1 (2.720)
39	High clutch accumulator A spring (Inlet)	1.8 (0.071)	21.3 (0.839)	8.0	69.1 (2.720)
40	High clutch accumulator A spring (Outlet)	1.7 (0.067)	25.3 (0.996)	6.3	69.1 (2.720)
41	High clutch accumulator B spring (Inlet)	1.6 (0.063)	9.3 (0.366)	14.6	47.0 (1.850)
42	High clutch accumulator B spring (Outlet)	2.3 (0.091)	13.7 (0.539)	8.79	45.0 (1.772)
43	Pressure regulator valve spring	1.0 (0.039)	13.5 (0.531)	6.5	35.0 (1.378)
44	Reverse inhibit valve spring	0.65 (0.0256)	8.4 (0.331)	7.7	26.5 (1.043)
45	Accumulator control valve B spring	0.5 (0.020)	10.5 (0.413)	4.5	21.5 (0.846)
46	2-4 brake timing valve A spring	0.5 (0.020)	6.5 (0.256)	7.78	19.3 (0.760)
47	2-4 brake timing valve B spring	0.60 (0.0236)	5.8 (0.228)	7.7	20.0 (0.787)
48	Torque converter regulator valve spring	1.40 (0.0551)	7.6 (0.299)	12.1	34.7 (1.366)
49	Plug hold spring	0.8 (0.031)	9.7 (0.382)	11.5	40.0 (1.575)
50	Pressure modifier valve spring	0.7 (0.028)	8.3 (0.327)	8.2	26.9 (1.059)
51	Accumulator control valve A	0.7 (0.028)	10.3 (0.406)	3.6	15.1 (0.594)
52	Low clutch timing valve A spring	0.5 (0.020)	6.5 (0.256)	7.78	19.3 (0.760)
53	Low clutch timing valve B spring	0.60 (0.0236)	5.8 (0.228)	7.7	20.0 (0.787)
54	Shift valve B spring	0.80 (0.0315)	8.2 (0.323)	7.9	25.2 (0.992)
55	Shift valve A spring	0.80 (0.0315)	8.2 (0.323)	7.9	25.2 (0.992)
56	Throttle accumulator B spring	1.6 (0.063)	8.4 (0.331)	9.77	36.0 (1.417)
57	1st reducing valve spring	0.75 (0.0295)	6.0 (0.236)	12.5	25.4 (1.000)
58	Throttle accumulator A spring	1.7 (0.067)	8.0 (0.315)	9.61	36.0 (1.417)
59	Lock-up control valve spring	0.9 (0.035)	11.2 (0.441)	4.0	19.7 (0.776)
60	Modifier accumulator spring	1.7 (0.067)	8.0 (0.315)	9.61	36.0 (1.417)
61	Line pressure relief valve spring	1.6 (0.063)	8.0 (0.315)	22.5	69.3 (2.728)
62	Pilot valve spring	1.1 (0.043)	7.9 (0.311)	10.76	30.6 (1.205)

B: DISASSEMBLY

1) Remove oil strainer from lower control valve body.

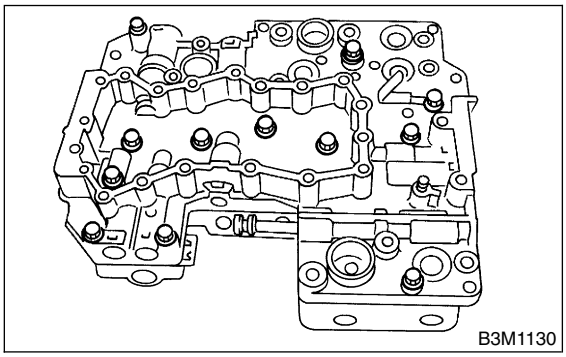


2) Remove the duty solenoids, solenoids and sensor from the lower valve body.



(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 1 (Yellow)
(E) Shift solenoid 2 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

3) Remove the upper-lower valve body tightening bolts.

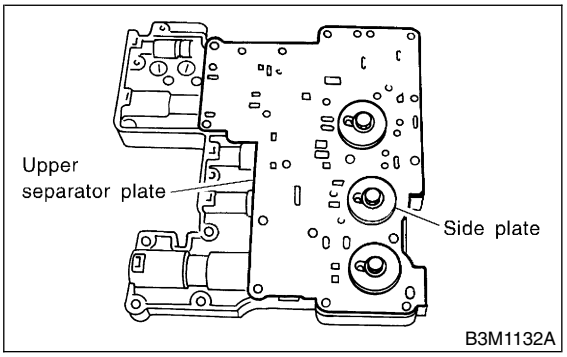


4) Separate the control valve body.

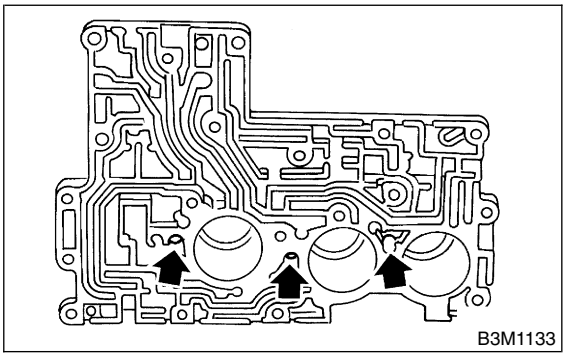
CAUTION:
• Do not lose the ten (10) steel balls contained in the upper valve body and middle valve body.
• Do not lose strainers contained in the lower valve body.

NOTE:
During ordinary servicing, clean the control valve bodies in this condition, without further disassembly. In the event of a seized clutch or other problem, disassemble the control valve bodies further, and clean the component parts.

5) Remove upper separator plate from middle valve body.



6) Remove valve springs from upper valve body.
7) Using air compressor, remove accumulator piston from upper valve body.



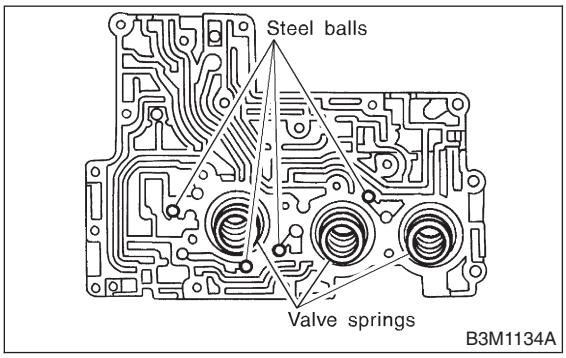
C: INSPECTION

Make sure that each component is free of harmful gouges, cuts, or dust.

D: ASSEMBLY

1) Install accumulator pistons, valve springs and steel balls to upper valve body.

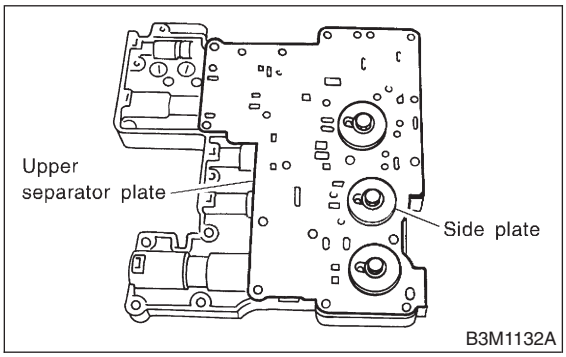
CAUTION:
Insert steel balls in their proper positions.



2) Install support plate and upper separate plate to middle valve body.

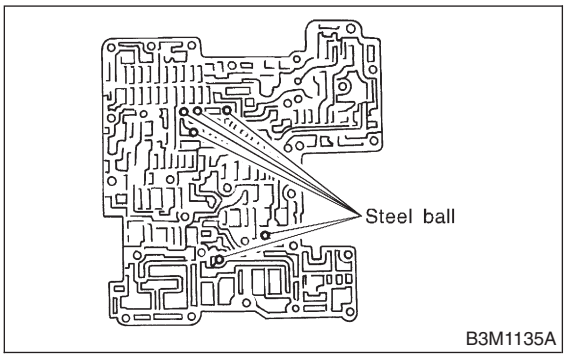
CAUTION:
Align the hole in support plate with the hole in separate plate.

Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)



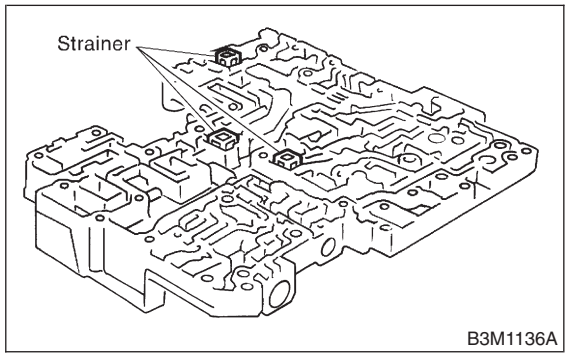
3) Install steel balls to middle valve body.

CAUTION:
Insert steel balls in their proper positions.

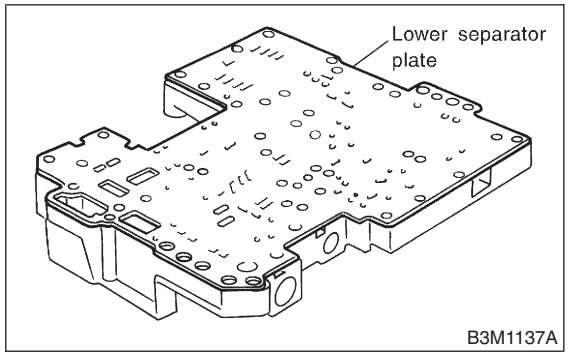


4) Install three filters to lower valve body.

CAUTION:
Pay attention to the location of filters.

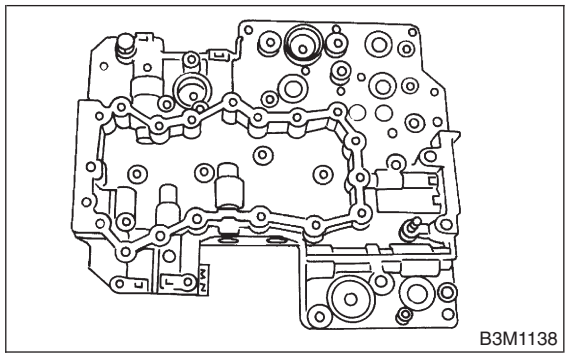


5) Install lower separate plate to lower valve body.



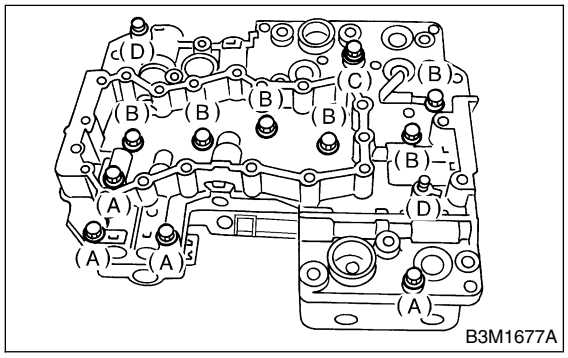
6) Temporarily assemble valve body.

CAUTION:
Be careful not to drop the middle valve body and upper body interior steel ball, or the lower body filter.



7) Tighten bolts.

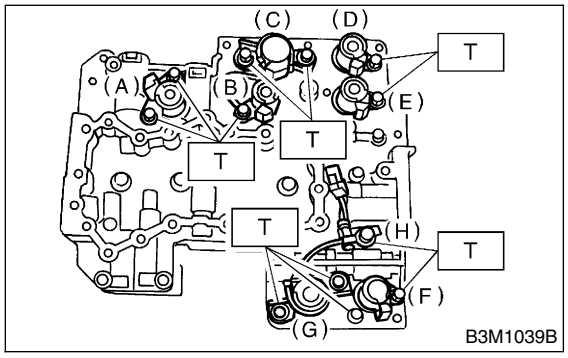
Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)



(A) Short bolts
(B) Middle bolts
(C) Long bolt
(D) Reamer bolts

8) Install the sensor, solenoids and duty solenoids.

Tightening torque:
T: 8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)



(A) Lock-up duty solenoid (Blue)
(B) Low clutch timing solenoid (Gray)
(C) Line pressure duty solenoid (Red)
(D) Shift solenoid 1 (Yellow)
(E) Shift solenoid 2 (Green)
(F) 2-4 brake timing solenoid (Black)
(G) 2-4 brake duty solenoid (Red)
(H) ATF temperature sensor

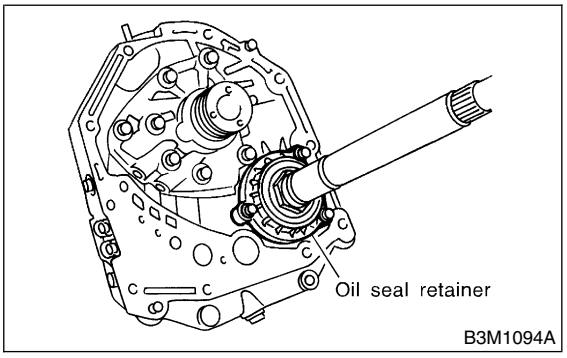
9) Install oil strainer to lower valve body.

Tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

16. Oil Pump Assembly

A: DISASSEMBLY

1) Remove the oil seal retainer.
Also remove the O-ring and oil seal (air breather).

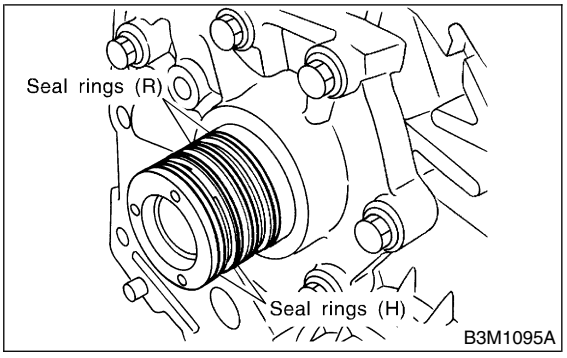


2) Remove O-rings from oil pump housing.

CAUTION:
Be careful not to damage O-ring.

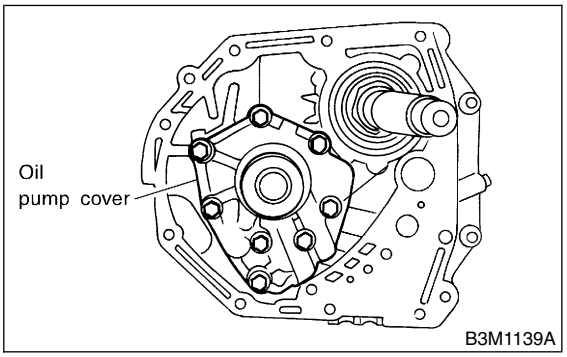
3) Remove four seal rings.

CAUTION:
Be careful not to damage O-ring.

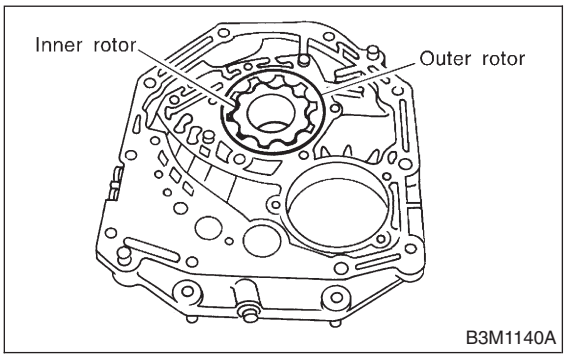


4) Remove the oil pump cover.

NOTE:
Lightly tap the end of the stator shaft to remove the cover.



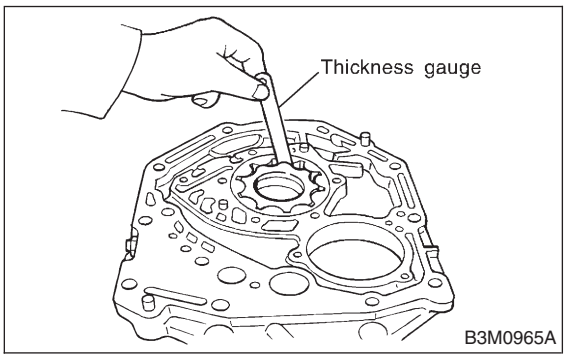
5) Remove the inner and outer rotor.



B: INSPECTION

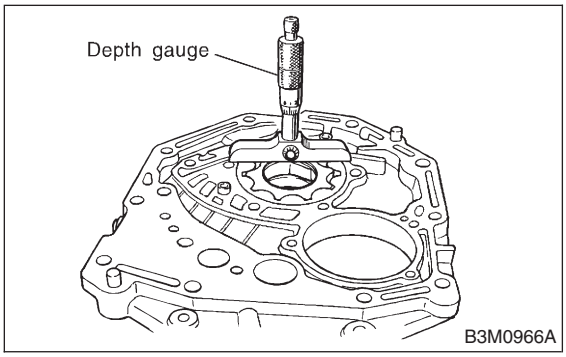
1) Check seal ring and O-ring oil seal for breaks or damage.
2) Check other parts for dents or abnormalities.
3) Selection of oil pump rotor assembly
(1) Tip clearance
Install inner rotor and outer rotor to oil pump. With rotor gears facing each other, measure crest-to-crest clearance.

Tip clearance:
0.02 — 0.15 mm (0.0008 — 0.0059 in)



(2) Side clearance
Set a depth gauge to oil pump housing, then measure oil pump housing-to-rotor clearances.

Side clearance:
0.02 — 0.04 mm (0.0008 — 0.0016 in)

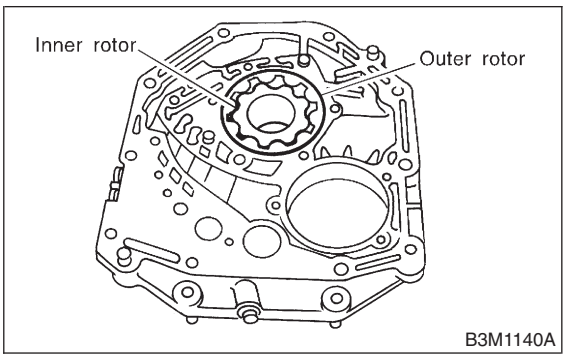


(3) If depth and/or side clearances are outside specifications, replace rotor assembly.

Oil pump rotor assembly	
Part No.	Thickness mm (in)
15008AA060	11.37 — 11.38 (0.4476 — 0.4480)
15008AA070	11.38 — 11.39 (0.4480 — 0.4484)
15008AA080	11.39 — 11.40 (0.4484 — 0.4488)

C: ASSEMBLY

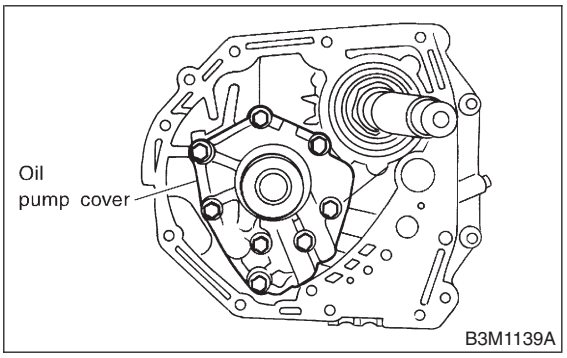
1) Install oil pump rotor assembly to oil pump housing.



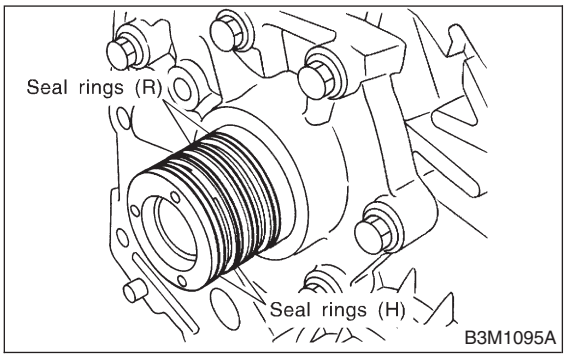
2) Install the oil pump cover.

Tightening torque:
25±2 N·m (2.5±0.2 kg-m, 18.1±1.4 ft-lb)

NOTE:
● Align both pivots with the pivot holes of the cover, and install the cover being careful not to apply undue force to the pivots.
● After assembling, turn the oil pump shaft to check for smooth rotation of the rotor.



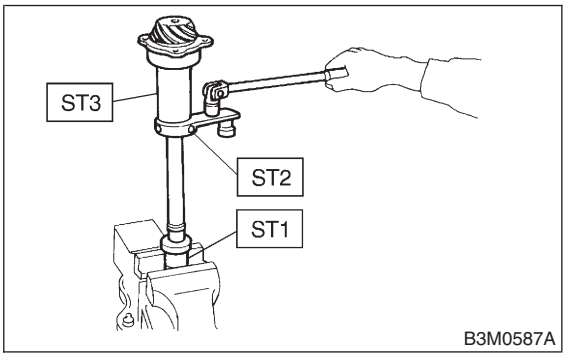
• Install the oil seal retainer and seal rings. After adjusting the drive pinion backlash and tooth contact.



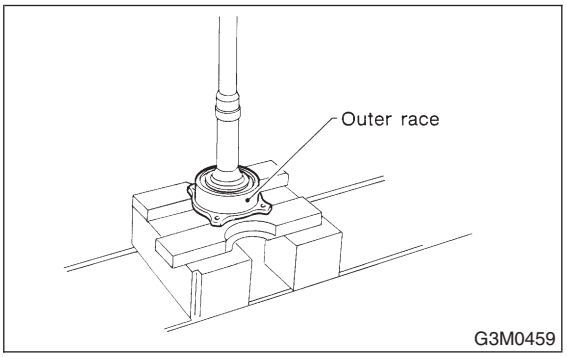
17. Drive Pinion Shaft

A: DISASSEMBLY

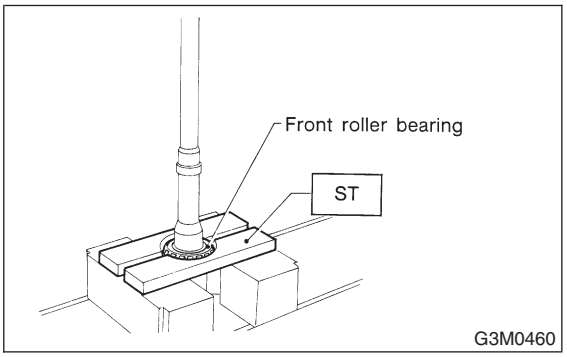
1) Straighten the staked portion of the lock nut, and remove the lock nut while locking the rear spline portion of the shaft with ST1 and ST2. Then pull off the drive pinion collar.
ST1 498937100 HOLDER
ST2 499787700 WRENCH
ST3 499787500 ADAPTER



2) Remove the O-ring.
3) Using a press, separate the rear roller bearing and outer race from the shaft.



4) Using a press and ST, separate the front roller bearing from the shaft.
ST 498517000 REPLACER

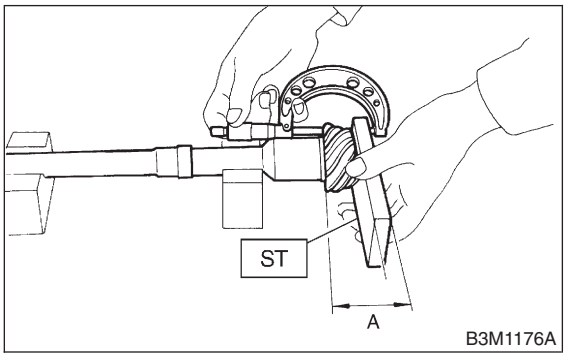


B: INSPECTION

Make sure that all component parts are free of harmful cuts, gouges, and other faults.

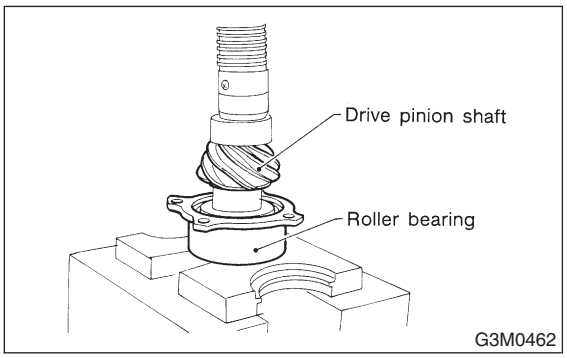
C: ASSEMBLY

1) Measure dimension “A” of the drive pinion shaft.
ST 398643600 GAUGE



2) Using a press, force-fit the roller bearing in position.

CAUTION:
Do not change the relative positions of the outer race and bearing cone.



3) After fitting the O-ring to the shaft, attach the drive pinion collar to the shaft.

CAUTION:
Be careful not to damage the O-ring.

4) Tighten the lock washer and lock nut with ST1, ST2 and ST3.
ST1 498937110 HOLDER
ST2 499787700 WRENCH
ST3 499787500 ADAPTER

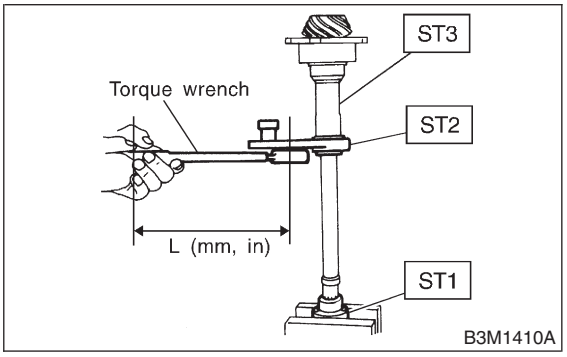
Actual tightening torque:
116±5 N·m (11.8±0.5 kg-m, 85.3±3.6 ft-lb)

NOTE:
- Pay attention to the orientation of lock washer.
- Tightening torque using torque wrench is determined by the following equation.

$T_1 = L/_{L + 72.2} \times T$

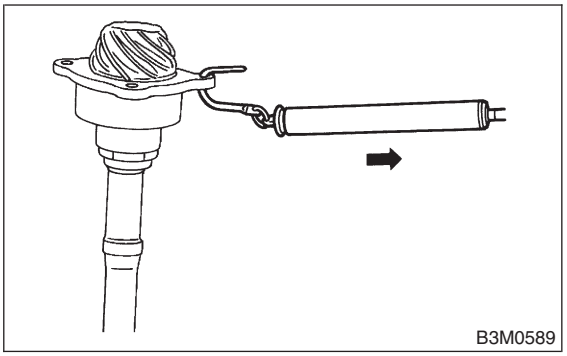
T: Actual tightening torque

- Install ST2 to torque wrench as straight as possible.



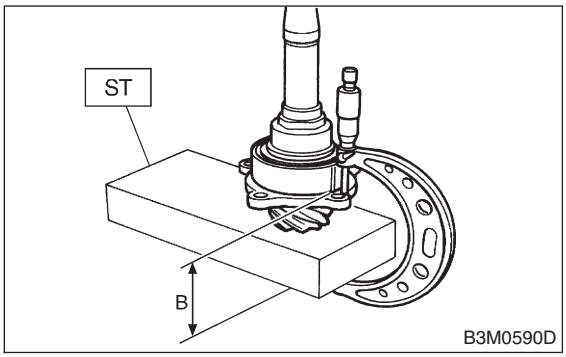
5) Measure the starting torque of the bearing. Make sure the starting torque is within the specified range. If out of the allowable range, replace the roller bearing.

Starting torque:
0.3 — 2.0 N·m (0.03 — 0.2 kg-m, 0.2 — 1.4 ft-lb)



6) Stake the lock nut securely at two places.

7) Measure dimension “B” of the drive pinion shaft.
ST 398643600 GAUGE



8) Determine the thickness “t” (mm) of the drive pinion shim.

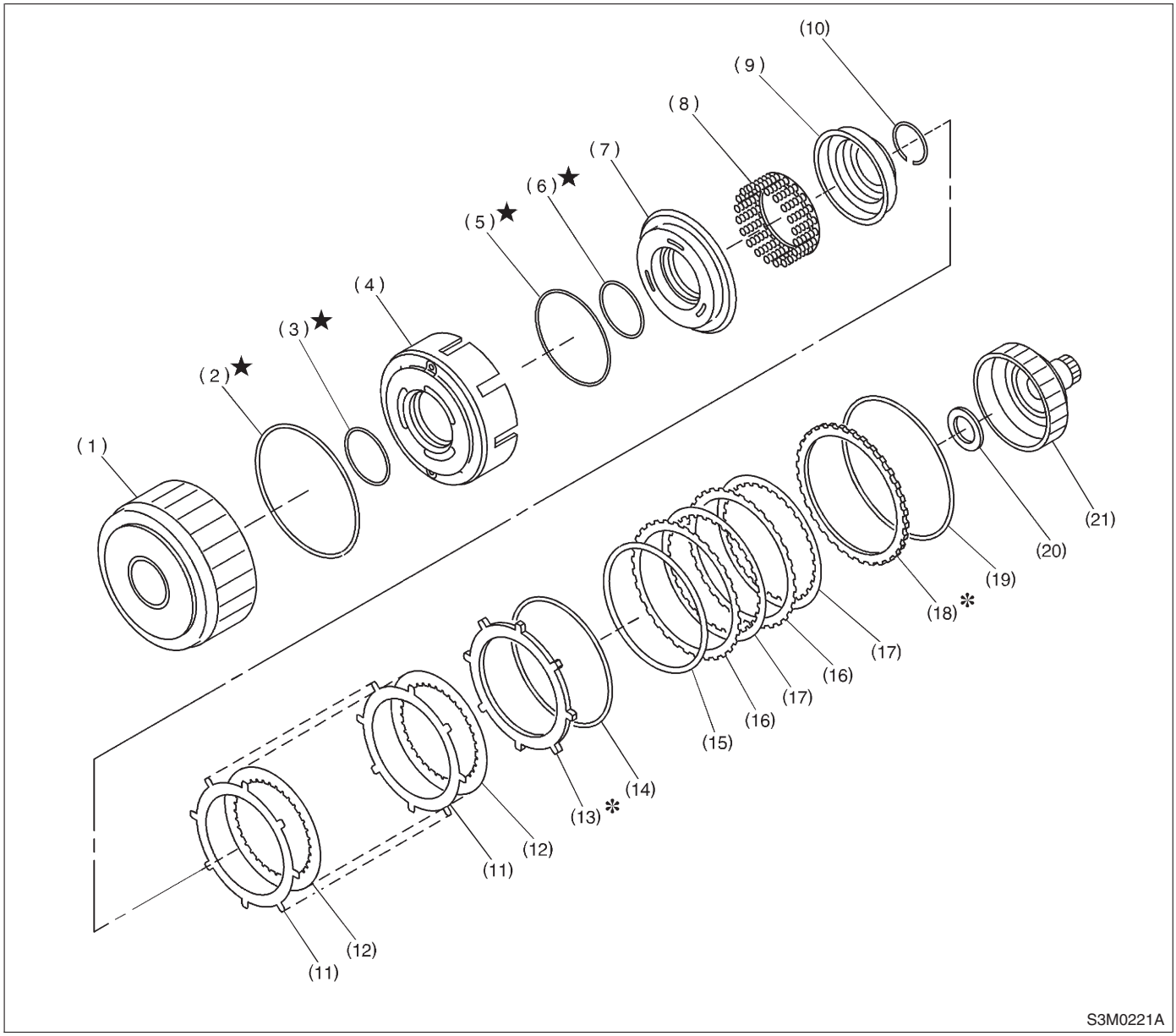
NOTE:
The number of shims must be three or less.

t = 6.5±0.0625 – (B – A)

Available drive pinion shims	
Part No.	Thickness mm (in)
31451AA050	0.150 (0.0059)
31451AA060	0.175 (0.0069)
31451AA070	0.200 (0.0079)
31451AA080	0.225 (0.0089)
31451AA090	0.250 (0.0098)
31451AA100	0.275 (0.0108)

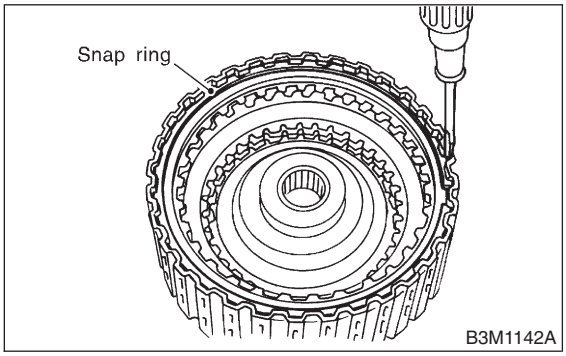
18. High Clutch and Reverse Clutch

A: DISASSEMBLY

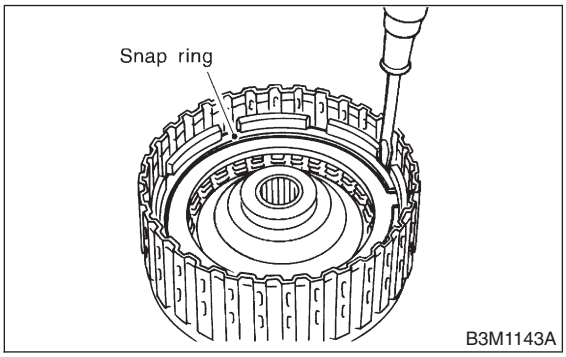


(1) Reverse clutch drum
(2) Lip seal
(3) Lathe cut seal ring
(4) Reverse clutch piston
(5) Lathe cut seal ring
(6) Lathe cut seal ring
(7) High clutch piston
(8) Spring retainer
(9) Cover
(10) Snap ring
(11) Driven plate
(12) Drive plate
(13) Retaining plate
(14) Snap ring
(15) Dish plate
(16) Driven plate
(17) Drive plate
(18) Retaining plate
(19) Snap ring
(20) Thrust needle bearing
(21) High clutch hub

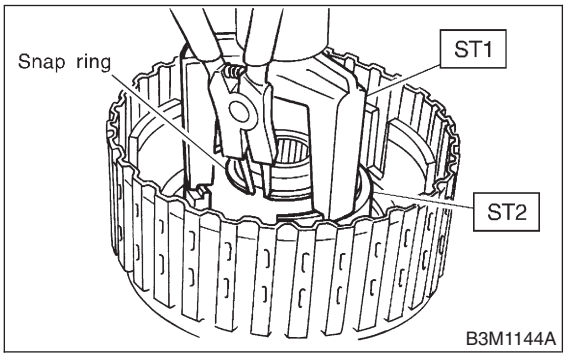
1) Remove the snap ring, and take out the retaining plate, drive plates, driven plates.



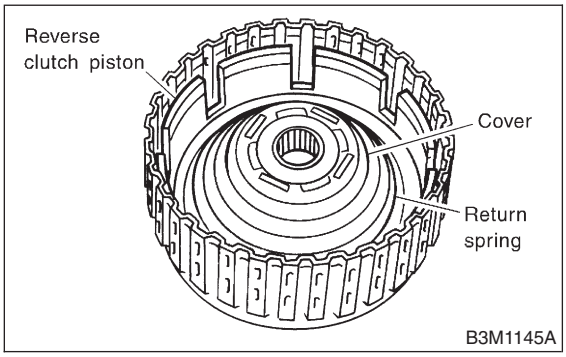
2) Remove snap ring, and take out the retaining plate, drive plates and driven plates.



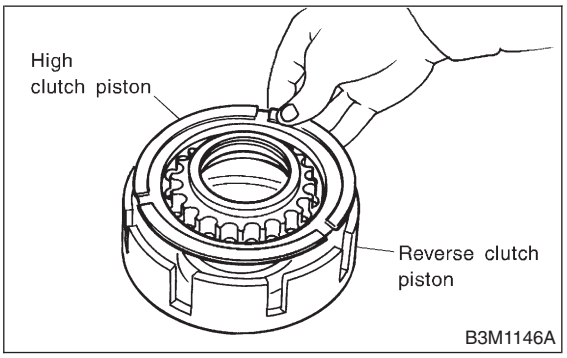
3) Using ST1 and ST2, remove snap ring.
ST1 398673600 COMPRESSOR
ST2 498627100 SEAT



4) Take out clutch cover, spring retainer, high clutch piston and reverse clutch piston.



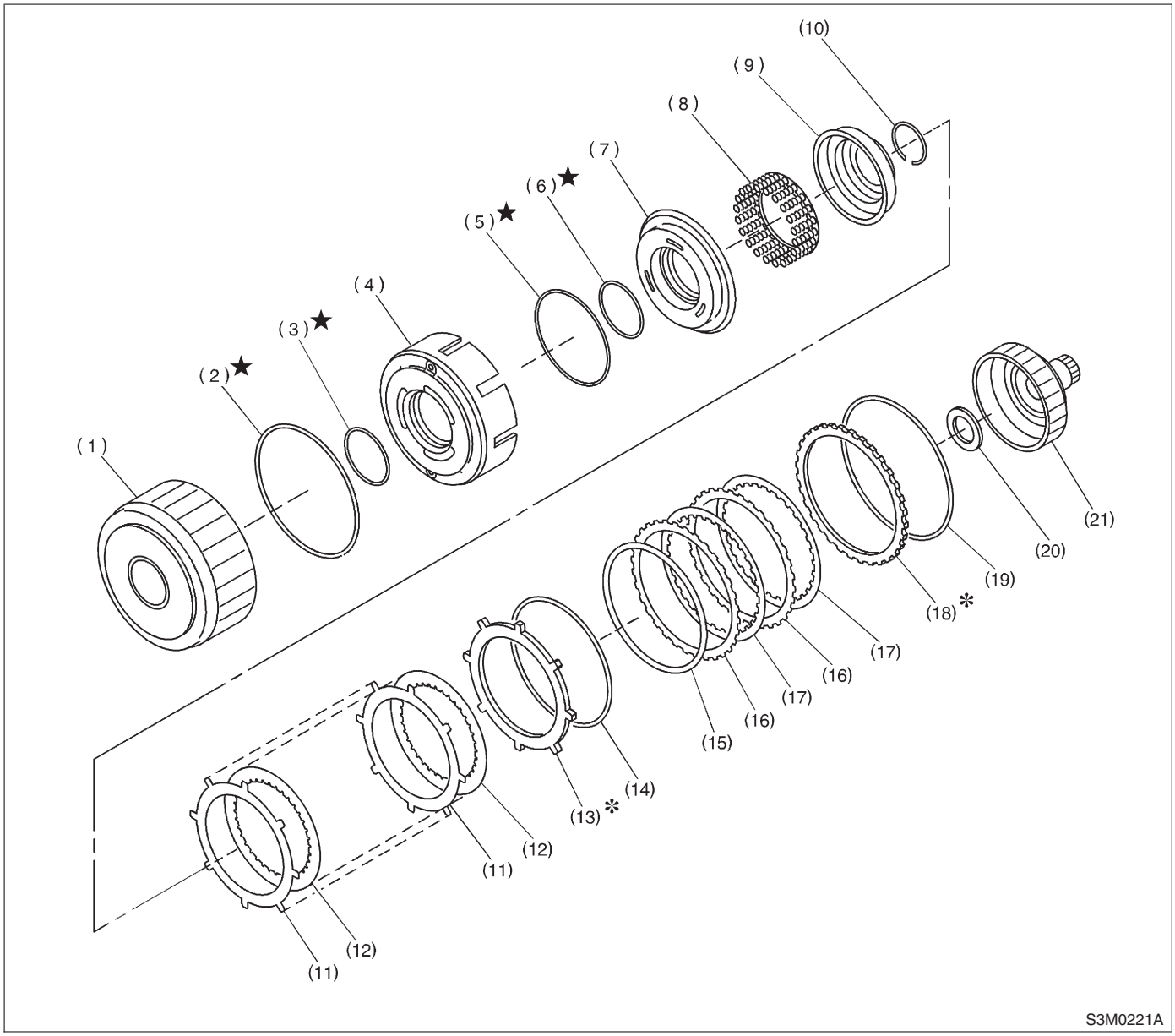
5) Remove seal rings and lip seal from high clutch piston and reverse clutch piston.



B: INSPECTION

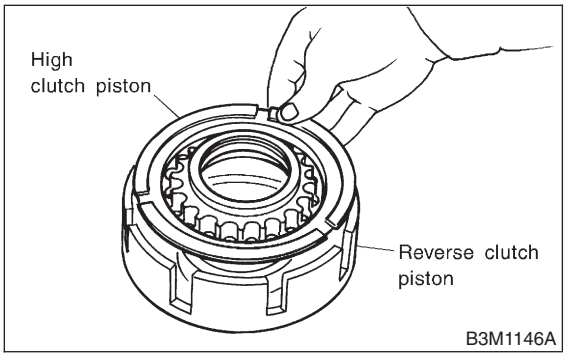
1) Drive plate facing for wear and damage
2) Snap ring for wear, return spring for breakage or setting, and spring retainer for deformation
3) Lip seal and lathe cut seal ring for damage
4) Piston check ball for operation

C: ASSEMBLY



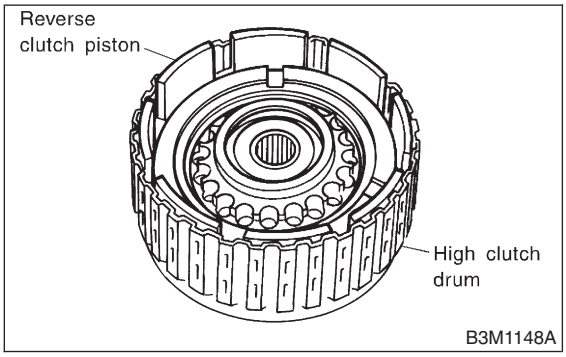
(1) Reverse clutch drum
(2) Lip seal
(3) Lathe cut seal ring
(4) Reverse clutch piston
(5) Lathe cut seal ring
(6) Lathe cut seal ring
(7) High clutch piston
(8) Spring retainer
(9) Cover
(10) Snap ring
(11) Driven plate
(12) Drive plate
(13) Retaining plate
(14) Snap ring
(15) Dish plate
(16) Driven plate
(17) Drive plate
(18) Retaining plate
(19) Snap ring
(20) Thrust needle bearing
(21) High clutch hub

1) Install seal rings and lip seal to high clutch piston and reverse clutch piston.
2) Install high clutch piston to reverse clutch piston.

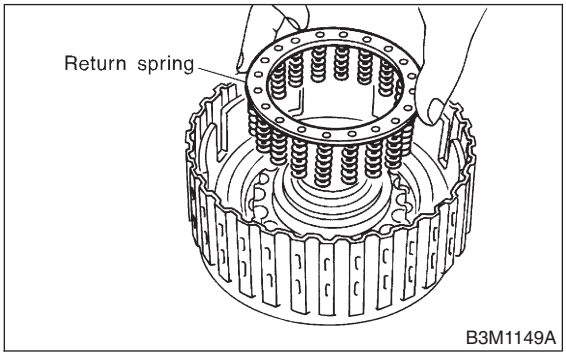


3) Install reverse clutch to high clutch drum.

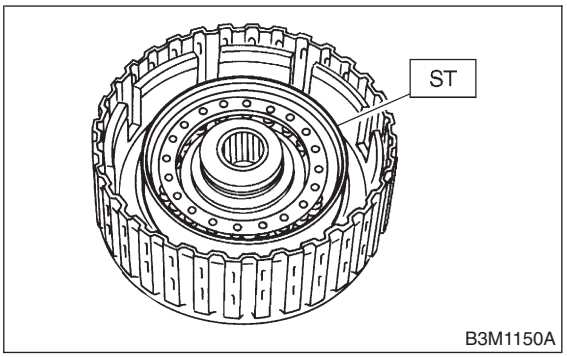
NOTE:
Align the groove on the reverse clutch piston with the groove on the high clutch drum during installation.



4) Install spring retainer to high clutch piston.



5) Install ST to high clutch piston.
ST 498437000 HIGH CLUTCH PISTON GAUGE



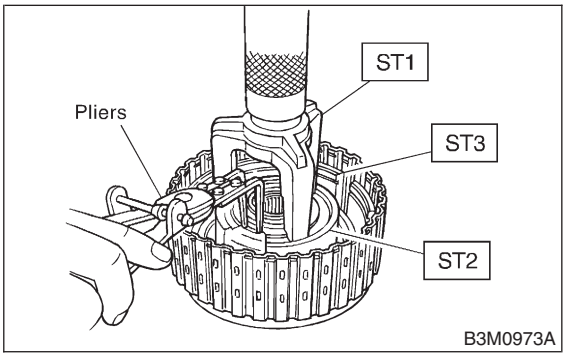
6) Install cover to high clutch piston.

CAUTION:
Be careful not to fold over the high clutch piston seal during installation.

7) Using ST1 and ST2, install snap ring.

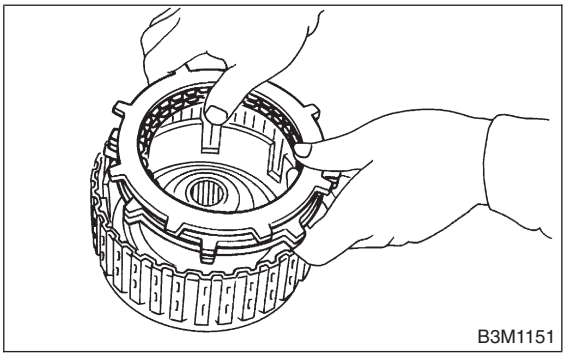
NOTE:
After installing snap ring, remove STs.

ST1 398673600 COMPRESSOR
ST2 498627100 SEAT
ST3 498437000 HIGH CLUTCH PISTON GAUGE



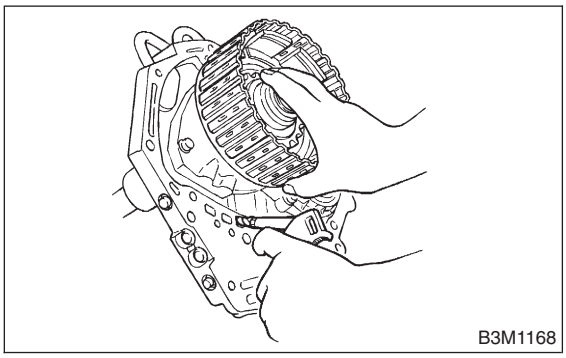
8) Install driven plate, drive plate and retaining plate to high clutch drum.

NOTE:
Install thicker driven plate on the piston side.



9) Install snap ring to high clutch drum.

10) Apply compressed air intermittently to check for operation.

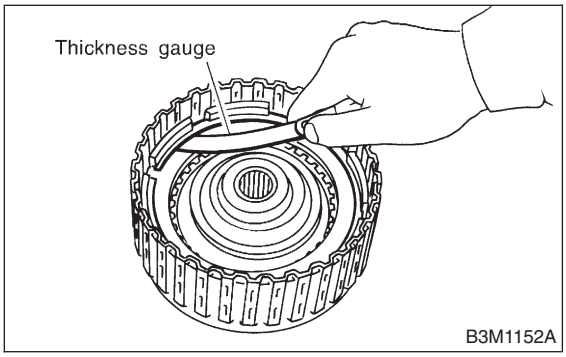


11) Measure the clearance between the retaining plate and snap ring.

CAUTION:
Do not press down retaining plate during clearance measurements.

Standard value:
0.8 — 1.1 mm (0.031 — 0.043 in)

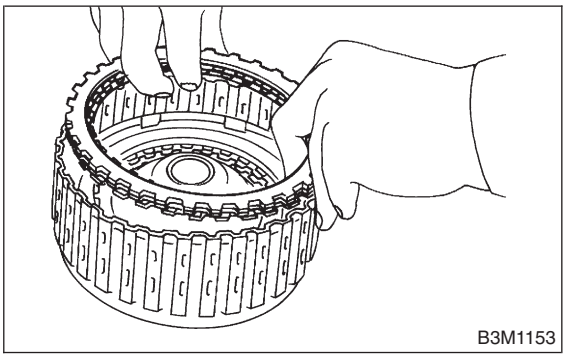
Allowable limit:
1.5 mm (0.059 in)



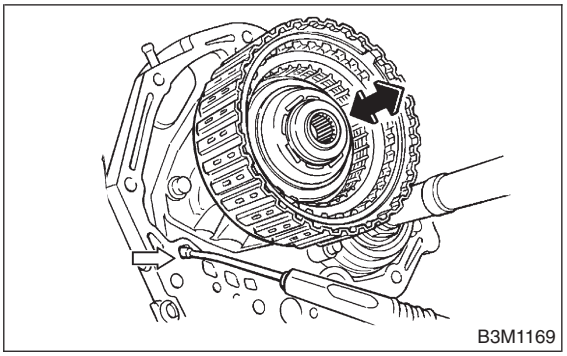
12) If specified tolerance limits are exceeded, select a suitable high clutch retaining plate.

High clutch retaining plate	
Part No.	Thickness mm (in)
31567AA710	4.7 (0.185)
31567AA720	4.8 (0.189)
31567AA730	4.9 (0.193)
31567AA740	5.0 (0.197)
31567AA670	5.1 (0.201)
31567AA680	5.2 (0.205)
31567AA690	5.3 (0.209)
31567AA700	5.4 (0.213)

13) Install driven plate, drive plate, retaining plate and snap ring.



14) Apply compressed air intermittently to check for operation.

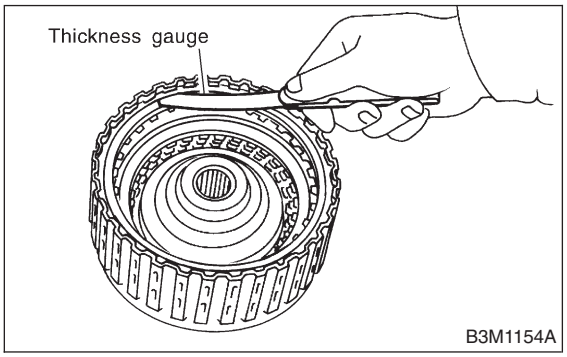


15) Measure the clearance between the retaining plate and snap ring.

CAUTION:
Do not press down retaining plate during clearance measurements.

Standard value:
0.5 — 0.8 mm (0.020 — 0.031 in)

Allowable limit:
1.2 mm (0.047 in)

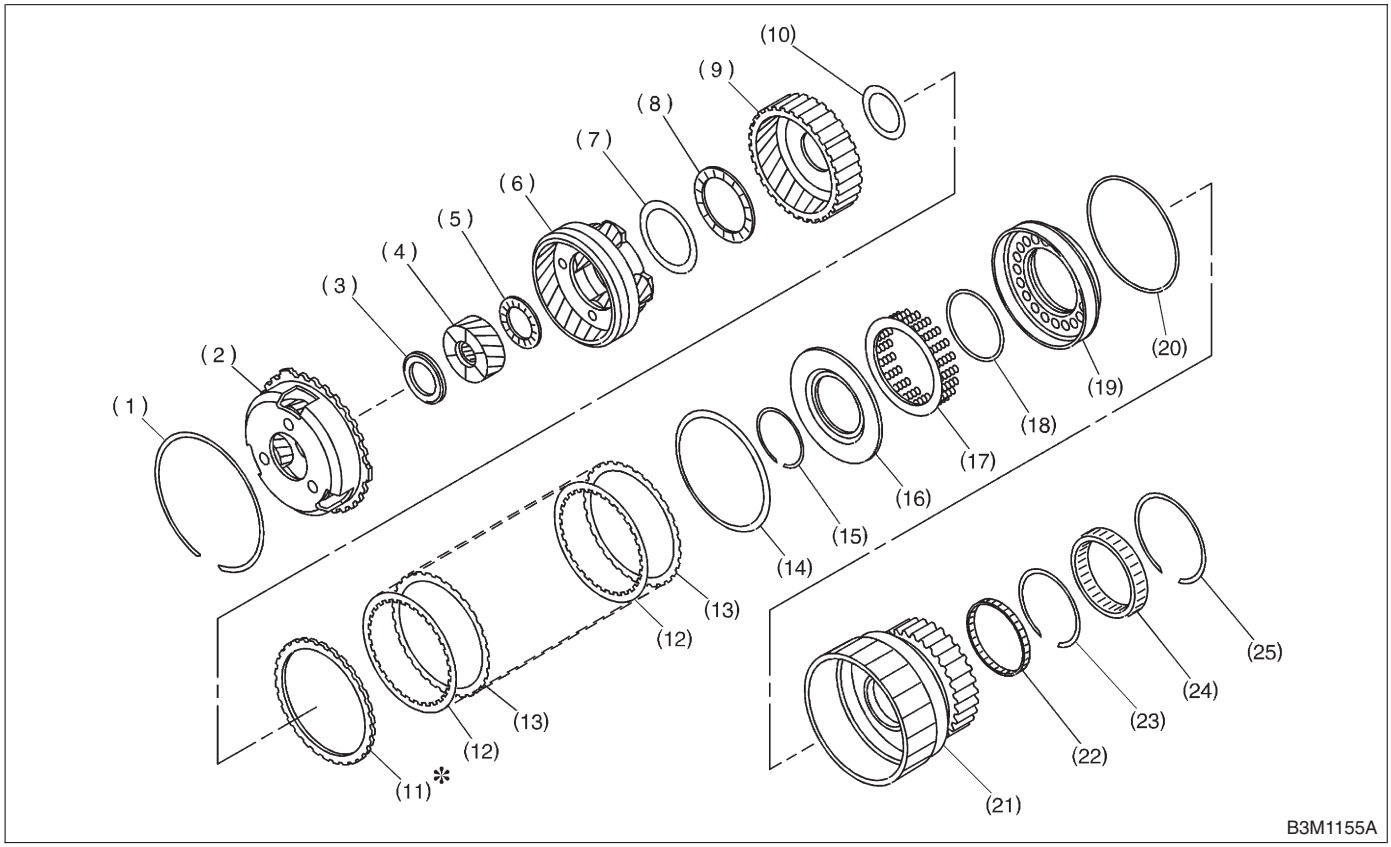


16) If specified tolerance limits are exceeded, select a suitable high clutch retaining plate.

Reverse clutch retaining plates	
Part No.	Thickness mm (in)
31567AA760	4.0 (0.157)
31567AA770	4.2 (0.165)
31567AA780	4.4 (0.173)
31567AA790	4.6 (0.181)
31567AA800	4.8 (0.189)

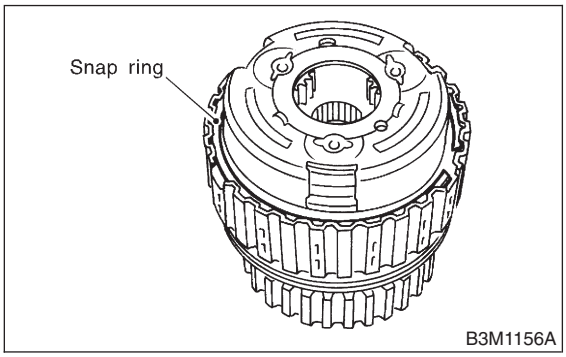
19. Low Clutch Drum and Planetary Gear

A: DISASSEMBLY

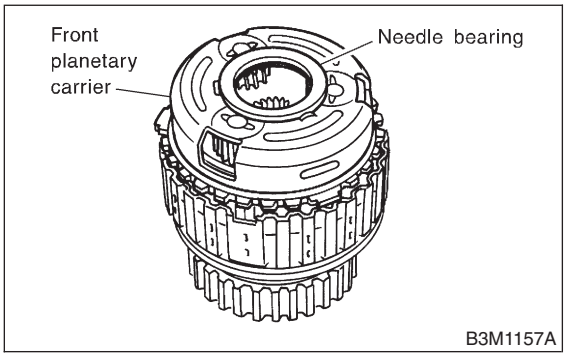


(1) Snap ring
(2) Front planetary carrier
(3) Thrust needle bearing
(4) Rear sun gear
(5) Thrust needle bearing
(6) Rear planetary carrier
(7) Washer
(8) Thrust needle bearing
(9) Rear internal gear
(10) Washer
(11) Retaining plate
(12) Drive plate
(13) Driven plate
(14) Dish plate
(15) Snap ring
(16) Cover
(17) Spring retainer
(18) Lathe cut seal ring
(19) Low clutch piston
(20) Lathe cut seal ring
(21) Low clutch drum
(22) Needle bearing
(23) Inner snap ring
(24) One-way clutch
(25) Outer snap ring

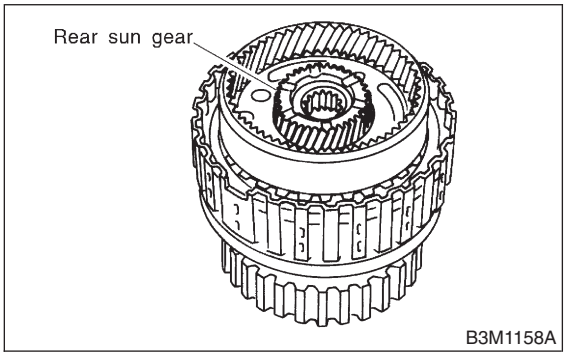
1) Remove snap ring from the low clutch drum.



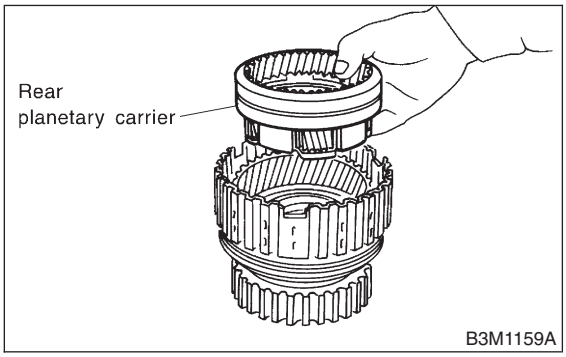
2) Take out front planetary carrier and thrust needle bearing from low clutch drum.



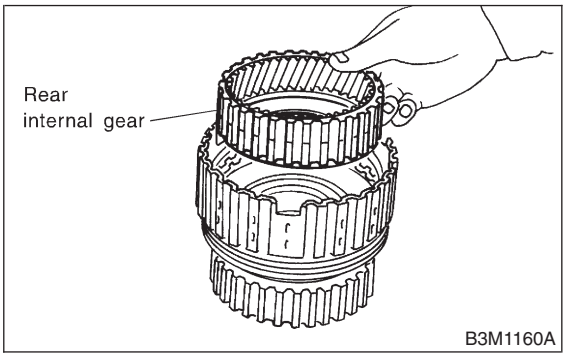
3) Take out rear sun gear.



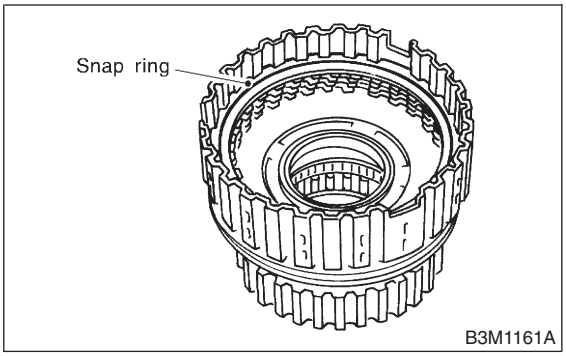
4) Take out rear planetary carrier, washer and thrust needle bearing.



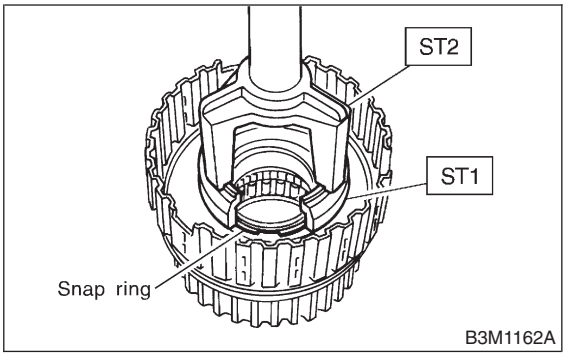
5) Take out rear internal gear.



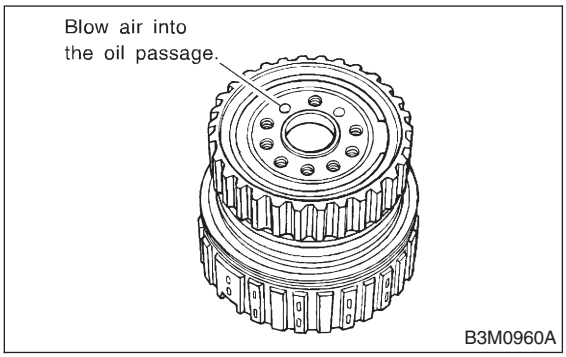
6) Remove the snap ring from the low clutch drum.



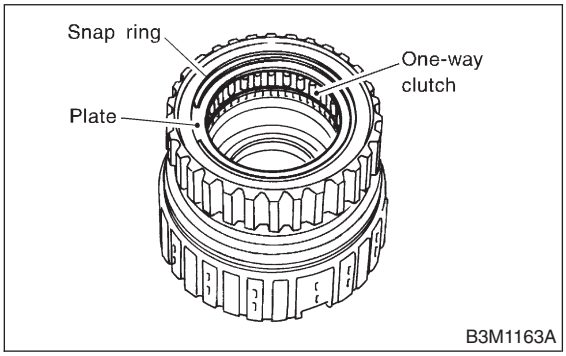
7) Remove the retaining plate, drive plates, driven plates and dish plate.
8) Compress the spring retainer, and remove the snap ring from the low clutch drum, by using ST1 and ST2.
ST1 498627100 SEAT
ST2 398673600 COMPRESSOR



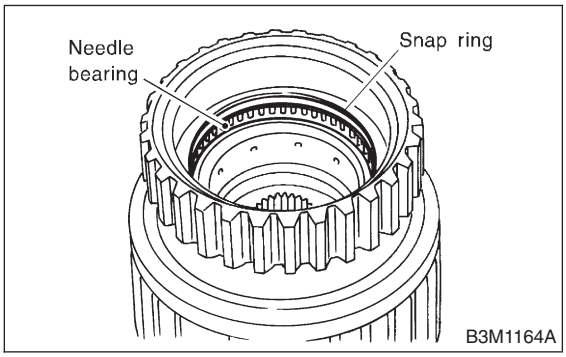
9) Install the one-way clutch inner race to the low clutch drum, and apply compressed air to remove the low clutch piston.



10) Remove the one-way clutch inner race.
11) Remove the one-way clutch after taking out the snap ring.



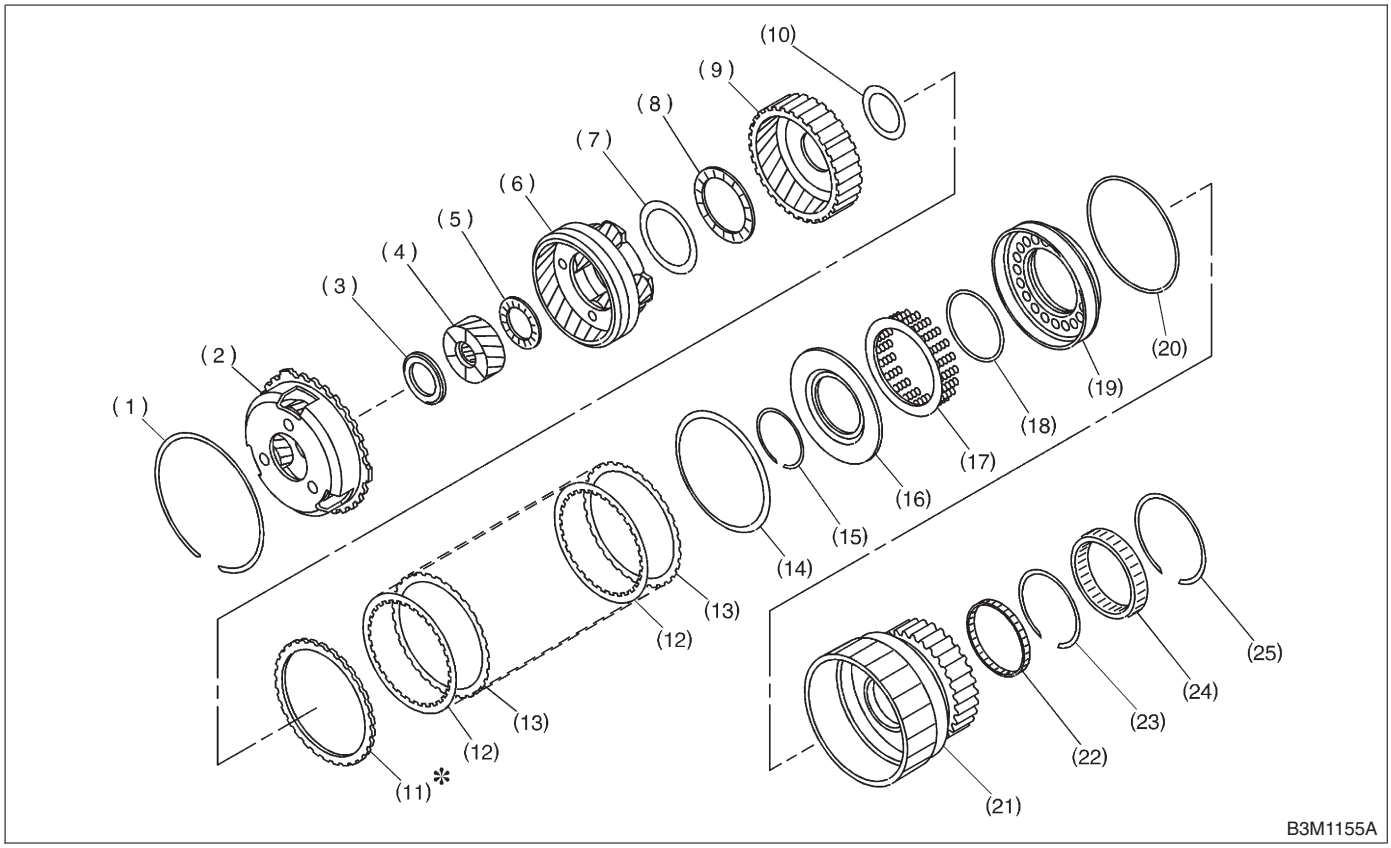
12) Remove the needle bearing after taking out the snap ring.



B: INSPECTION

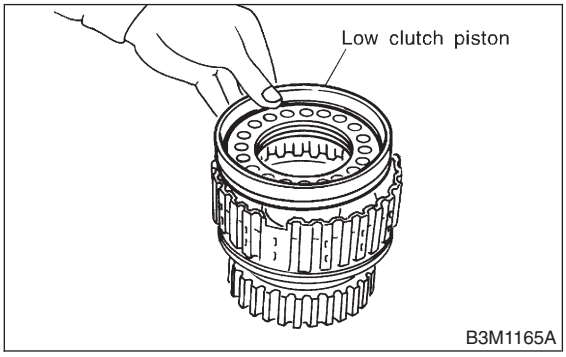
1) Drive plate facing for wear and damage
2) Snap ring for wear, return spring for setting and breakage, and snap ring retainer for deformation
3) Lip seal and lathe cut ring for damage
4) Piston and drum check ball for operation

C: ASSEMBLY

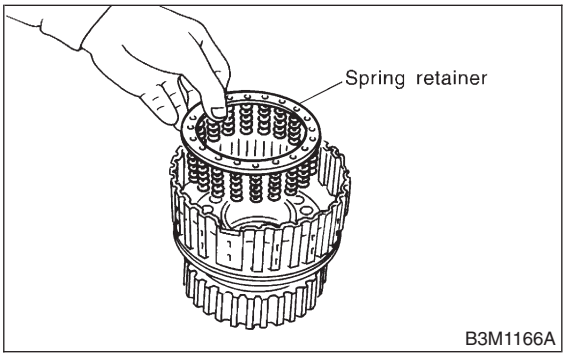


(1) Snap ring
(2) Front planetary carrier
(3) Thrust needle bearing
(4) Rear sun gear
(5) Thrust needle bearing
(6) Rear planetary carrier
(7) Washer
(8) Thrust needle bearing
(9) Rear internal gear
(10) Washer
(11) Retaining plate
(12) Drive plate
(13) Driven plate
(14) Dish plate
(15) Snap ring
(16) Cover
(17) Spring retainer
(18) Lathe cut seal ring
(19) Low clutch piston
(20) Lathe cut seal ring
(21) Low clutch drum
(22) Needle bearing
(23) Inner snap ring
(24) One-way clutch
(25) Outer snap ring

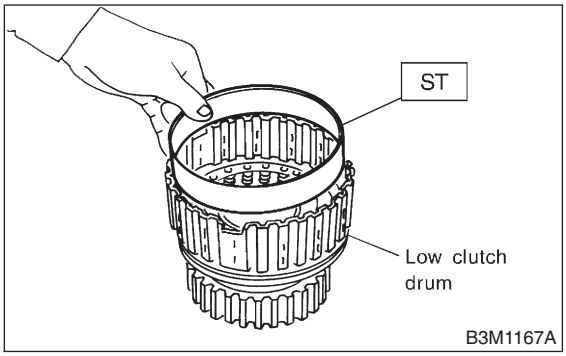
1) Install lathe cut seal ring to low clutch piston.
2) Fit the low clutch piston to the low clutch drum.



3) Install spring retainer to low clutch piston.



4) Install ST to low clutch drum.
ST 498437100 LOW CLUTCH PISTON GUIDE

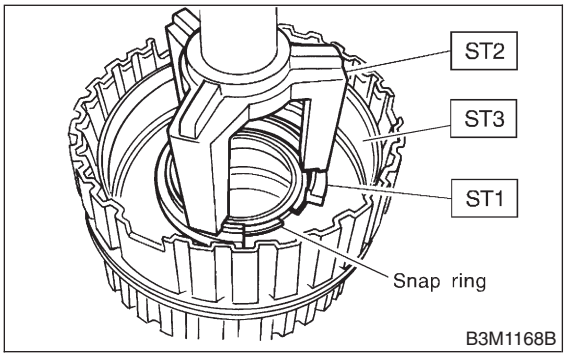


5) Set the cover on the piston with a press using ST1 and ST2, and attach the snap ring.

CAUTION:
Be careful not to fold cover seal during installation.

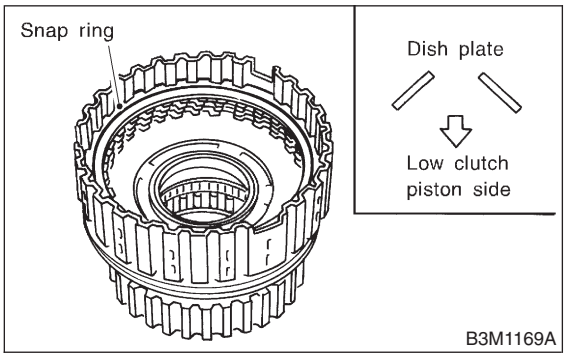
NOTE:
After installing snap ring, remove ST1, ST2 and ST3.

ST1 498627100 SEAT
ST2 398673600 COMPRESSOR
ST3 498437100 LOW CLUTCH PISTON GUIDE

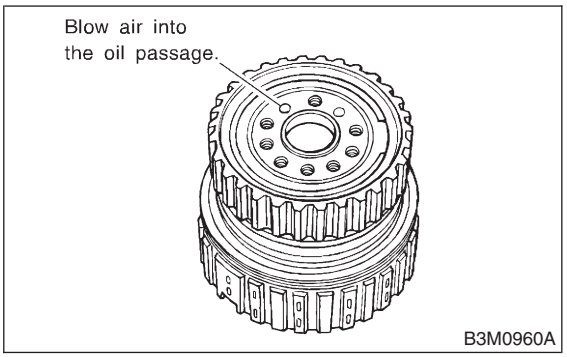


6) Install the dish plate, driven plates, drive plates, and retaining plate, and secure with the snap ring.

NOTE:
Pay attention to the orientation of the dish plate.



7) Check the low clutch for operation.
Set the one-way clutch inner race, and apply compressed air for checking.

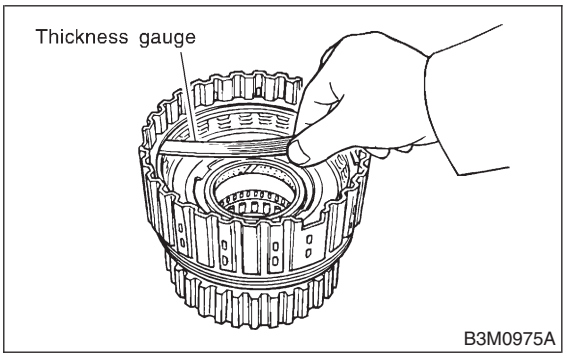


8) Checking low clutch clearance
Measure the gap between the retaining plate and the operation of the low clutch.

NOTE:
Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.
If the clearance is out of the specified range, select a proper retaining plate so that the standard clearance can be obtained.

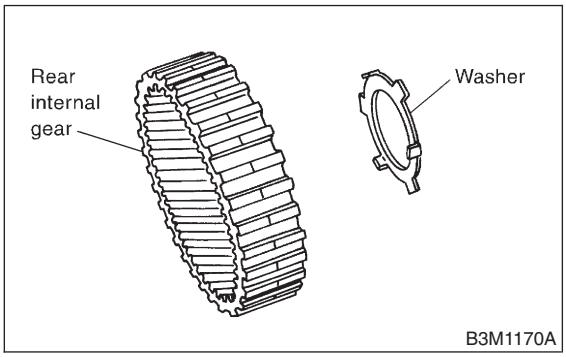
Standard value:
0.7 — 1.1 mm (0.028 — 0.043 in)

Allowable limit:
1.6 mm (0.063 in)

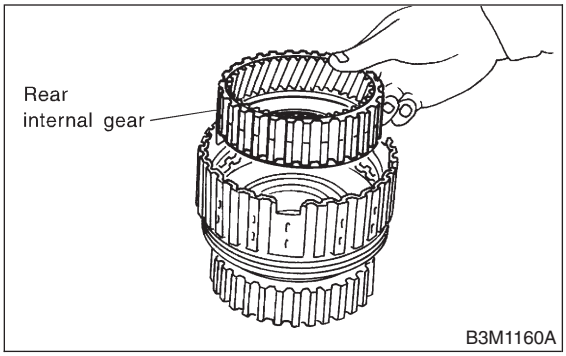


Available retaining plates	
Part No.	Thickness mm (in)
31567AA830	3.8 (0.150)
31567AA840	4.0 (0.157)
31567AA850	4.2 (0.165)
31567AA860	4.4 (0.173)
31567AA870	4.6 (0.181)

9) Install washer to rear internal gear.

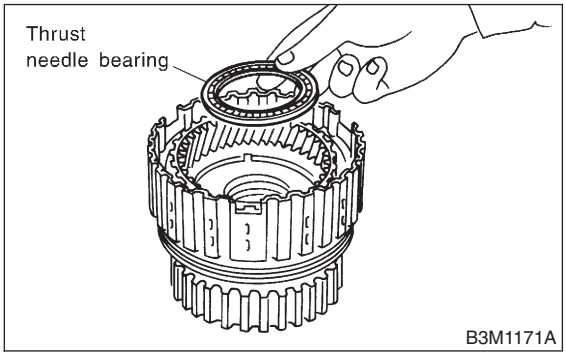


10) Install rear internal gear.



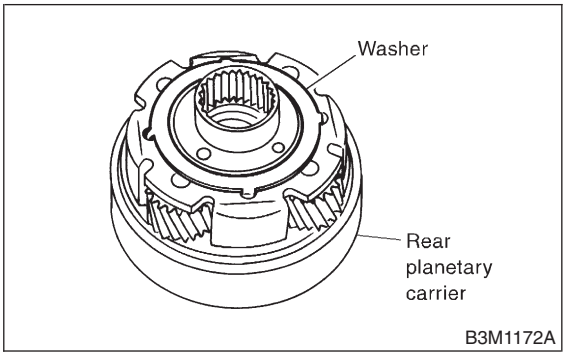
11) Install thrust needle bearing.

CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>

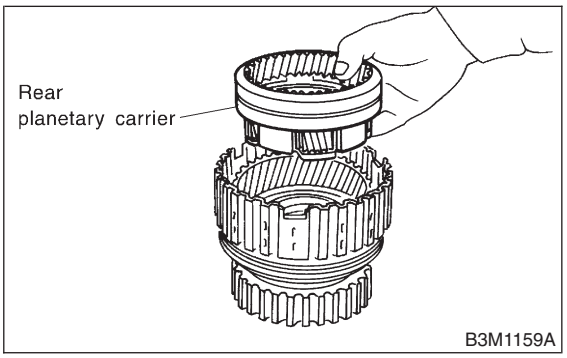


12) Install washer to rear planetary carrier.

NOTE:
Make sure washer tooth is inserted into hole on planetary carrier.

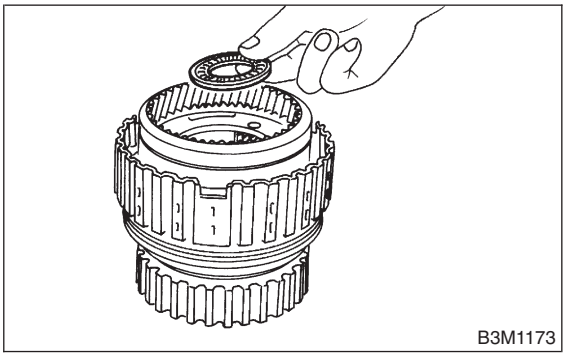


13) Install rear planetary carrier to low clutch drum.



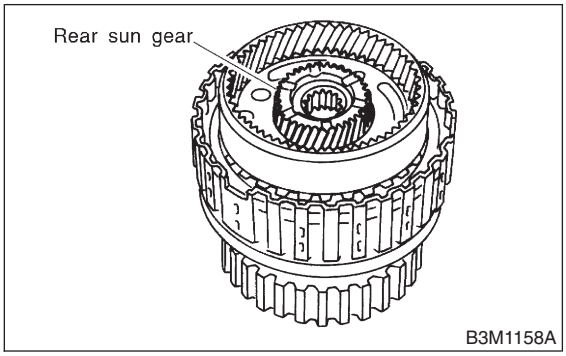
14) Install thrust needle bearing to rear planetary carrier.

CAUTION:
Install thrust needle bearing in the correct direction. <Ref. to 3-2 [S1200].>



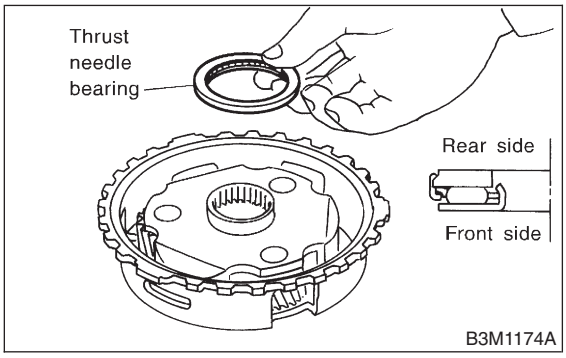
15) Install rear sun gear.

NOTE:
Pay attention to the orientation of the rear sun gear.

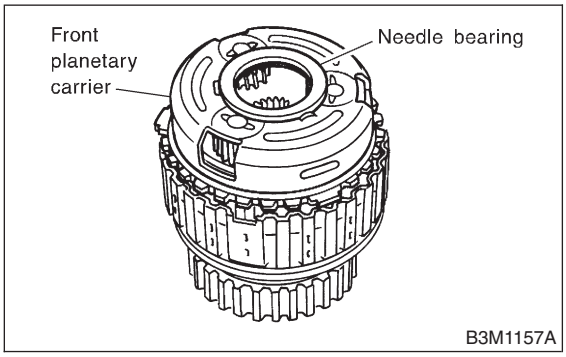


16) Install thrust needle bearing to front planetary carrier.

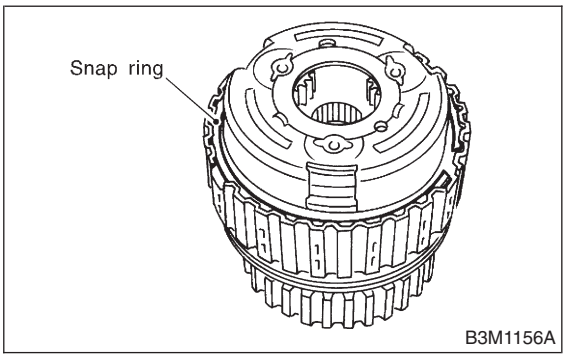
NOTE:
Pay attention to the orientation of the thrust needle bearing.



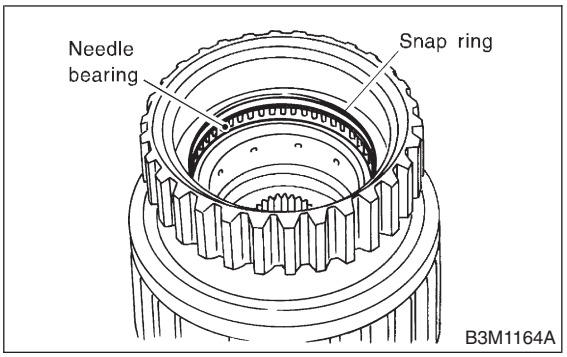
17) Install front planetary carrier to low clutch drum.



18) Install snap ring to low clutch drum.

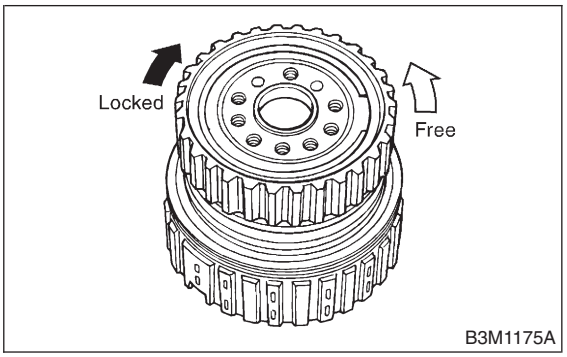


19) Install the needle bearing, and secure with the snap ring.



20) Install the one-way clutch, one-way clutch inner race and plate, and secure with the snap ring.

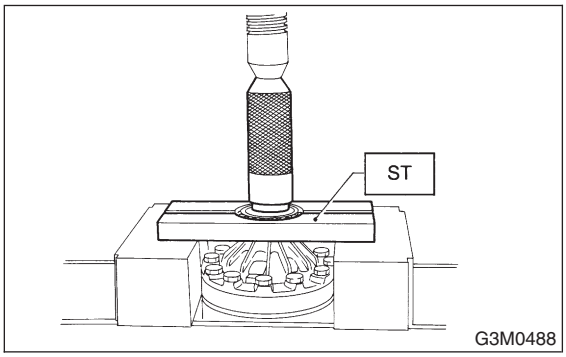
NOTE:
Set the inner race. Make sure that the forward clutch is free in the clockwise direction and locked in the counterclockwise direction, as viewed from the front of the vehicle.



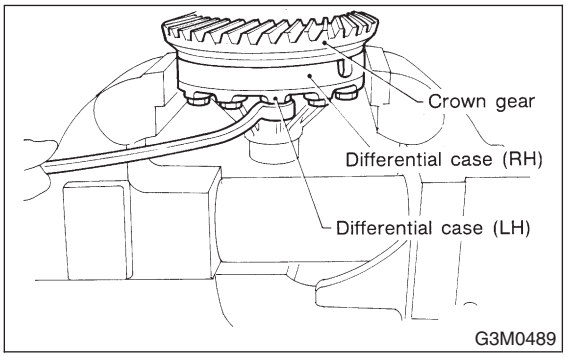
20. Differential Case Assembly

A: DISASSEMBLY

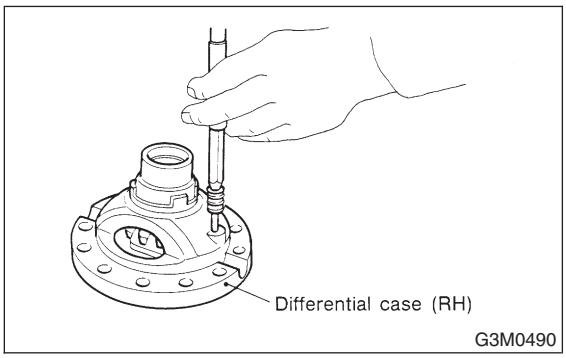
1) Using a press and ST, remove the taper roller bearing.
ST 498077000 REMOVER



2) Secure the case in a vise and remove the crown gear tightening bolts, then separate the crown gear, case (RH) and case (LH).



3) Pull out the straight pin and shaft, and remove the differential bevel gear, washer, and differential bevel pinion.



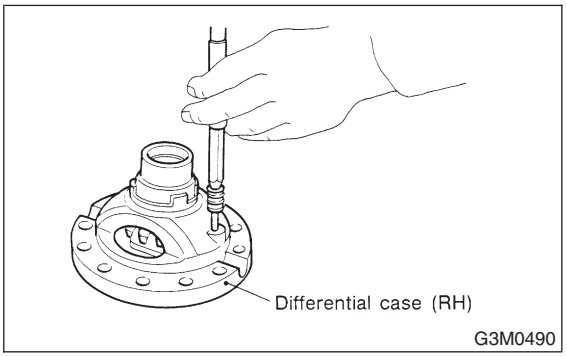
B: INSPECTION

Check each component for harmful cuts, damage and other faults.

C: ASSEMBLY

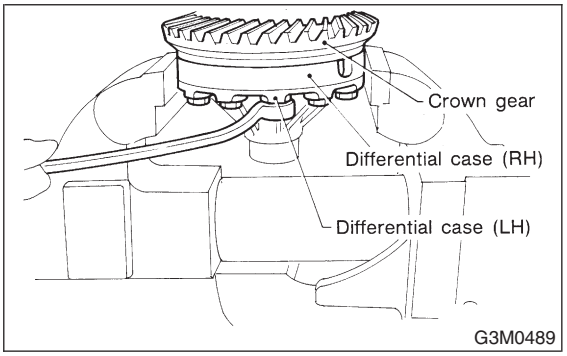
1) Install the washer, differential bevel gear and differential bevel pinion in the differential case (RH). Insert the pinion shaft, and fit the straight pin.

NOTE:
Install straight pin from reverse direction.



2) Install the washer and differential bevel gear to the differential case (LH). Then put the case over the differential case (RH), and connect both cases.
3) Install the crown gear and secure by tightening the bolt.

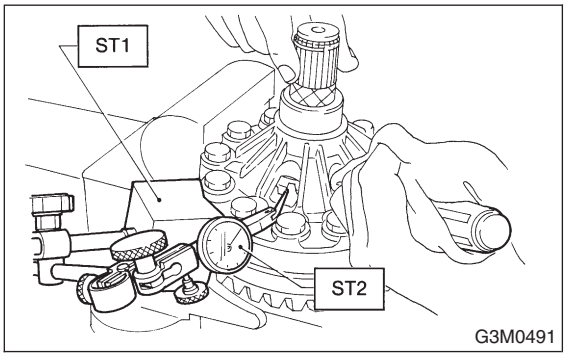
Standard tightening torque:
62±5 N·m (6.3±0.5 kg-m, 45.6±3.6 ft-lb)



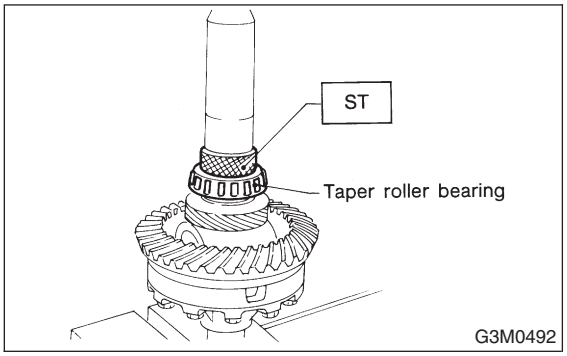
4) Measurement of backlash (Selection of washer)
Measure the gear backlash with ST1 and ST2, and insert ST2 through the access window of the case.
ST1 498247001 MAGNET BASE
ST2 498247100 DIAL GAUGE

NOTE:
Measure the backlash by applying a pinion tooth between two bevel gear teeth.

Standard value:
0.13 — 0.18 mm (0.0051 — 0.0071 in)



5) Using ST, install taper roller bearing.
ST 398487700 DRIFT

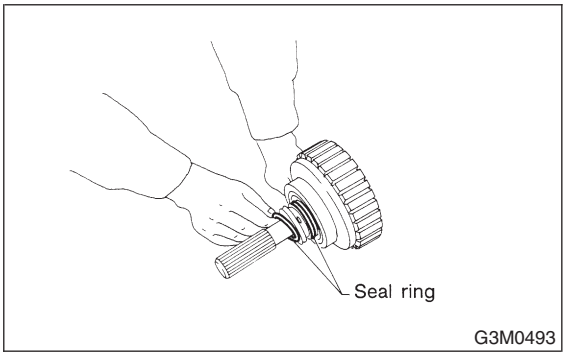


21. Transfer Clutch

A: DISASSEMBLY

1) Remove the seal ring.

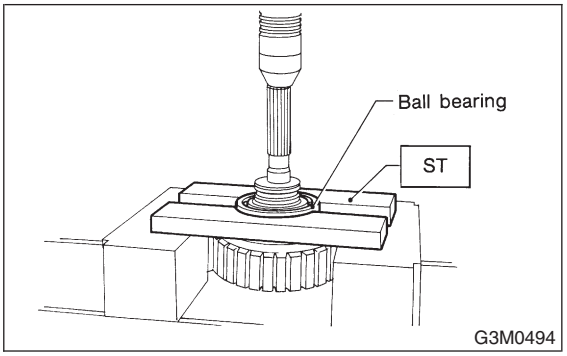
CAUTION:
Be careful not to damage the seal ring.



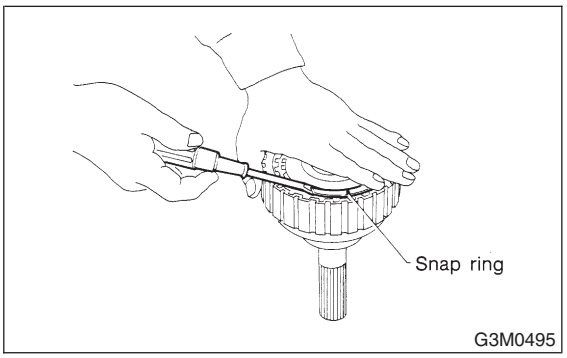
2) Using a press and ST, remove the ball bearing.

CAUTION:
Do not reuse the bearing.

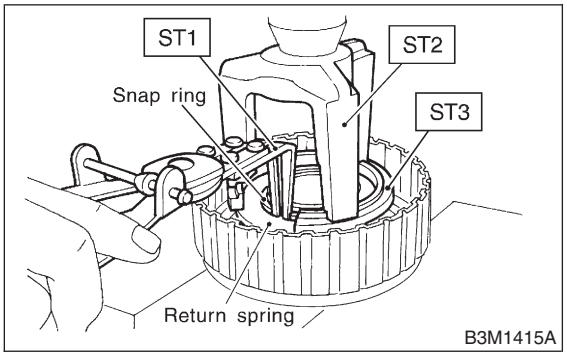
ST 498077600 REMOVER



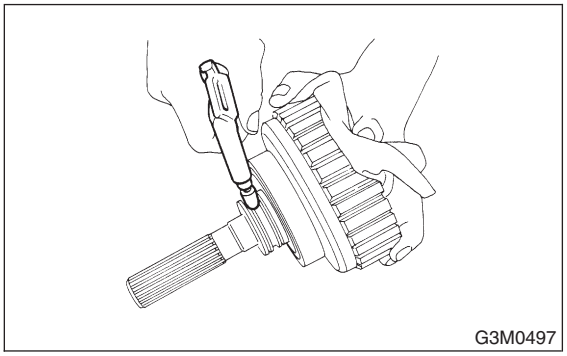
3) Remove the snap ring, and take out the pressure plate, drive plates, and driven plates.



4) Remove the snap ring with ST1, ST2 and ST3, and take out the return spring and transfer clutch piston seal.
ST1 399893600 PLIERS
ST2 398673600 COMPRESSOR
ST3 398623600 SEAT



5) Apply compressed air to the rear drive shaft to remove the piston.

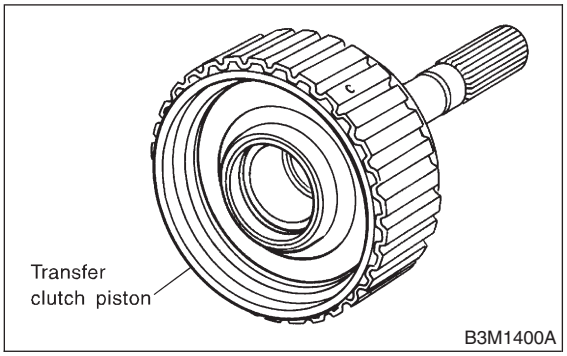


B: INSPECTION

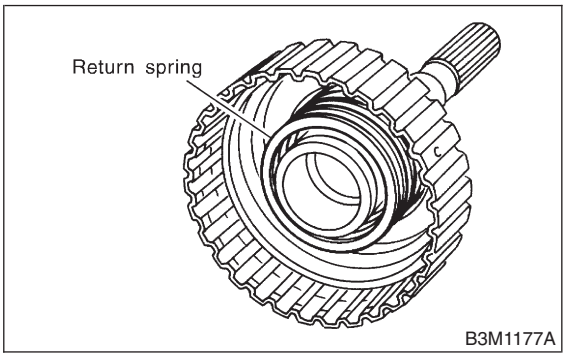
1) Check the drive plate facing for wear and damage.
2) Check the snap ring for wear, return spring for permanent set and breakage, and return spring for deformation.
3) Check the lathe cut ring for damage.

C: ASSEMBLY

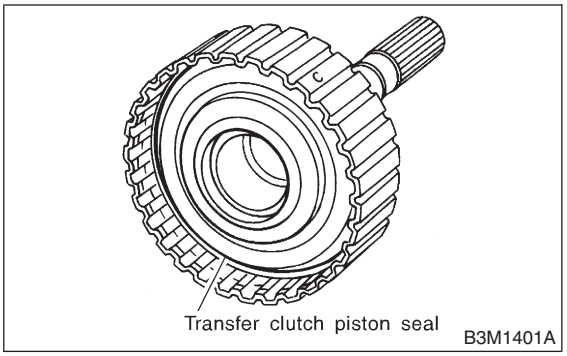
1) Install the transfer clutch piston.



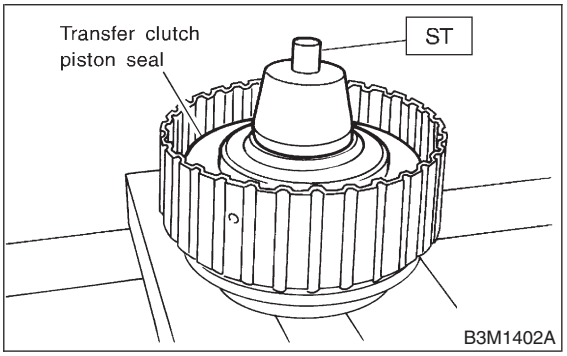
2) Install return spring to transfer piston.



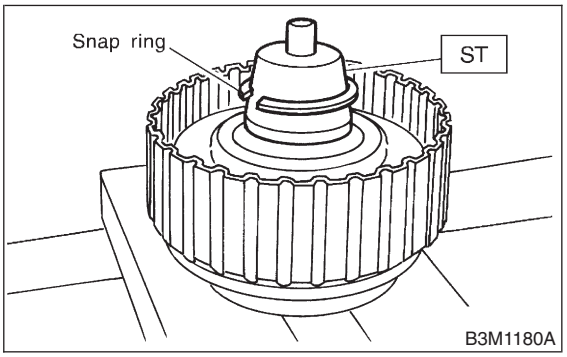
3) Install transfer clutch piston seal.



4) Install ST to rear drive shaft.
ST 499257300 SNAP RING OUTER GUIDE



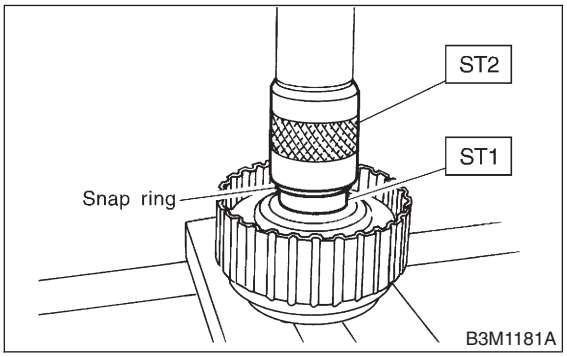
5) Install snap ring to ST.
ST 499257300 SNAP RING OUTER GUIDE



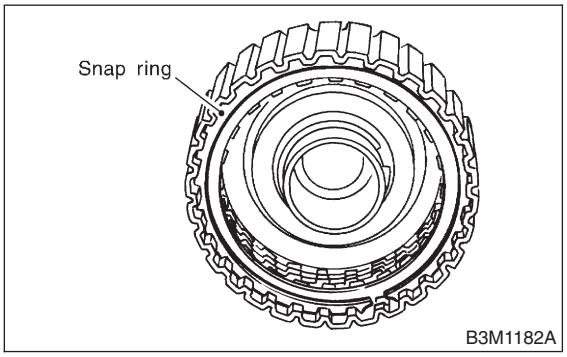
6) Using ST1 and ST2, install snap ring to rear drive shaft.

NOTE:
After installing snap ring, remove ST1 and ST2.

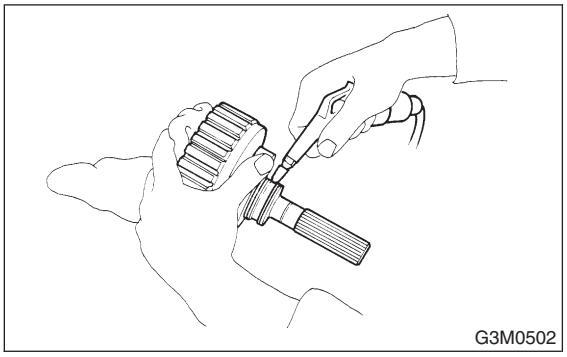
ST1 499257300 SNAP RING OUTER GUIDE
ST2 499247400 INSTALLER



7) Install the driven plates, drive plates, pressure plate and snap ring.



8) Apply compressed air to see if the assembled parts move smoothly.



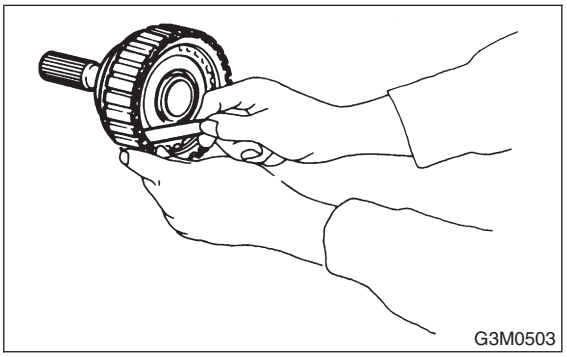
9) Check the clearance.

NOTE:
Before measuring clearance, place the same thickness of shim on both sides to prevent pressure plate from tilting.

If the clearance is not within the specified range, select a proper pressure plate.

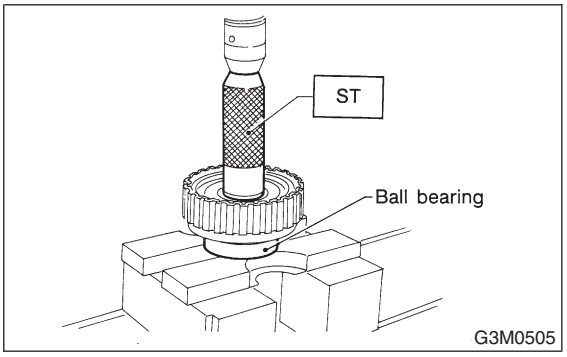
Standard value:
0.7 — 1.1 mm (0.028 — 0.043 in)

Allowable limit:
1.6 mm (0.063 in)



Available pressure plates	
Part No.	Thickness mm (in)
31593AA151	3.3 (0.130)
31593AA161	3.7 (0.146)
31593AA171	4.1 (0.161)
31593AA181	4.5 (0.177)

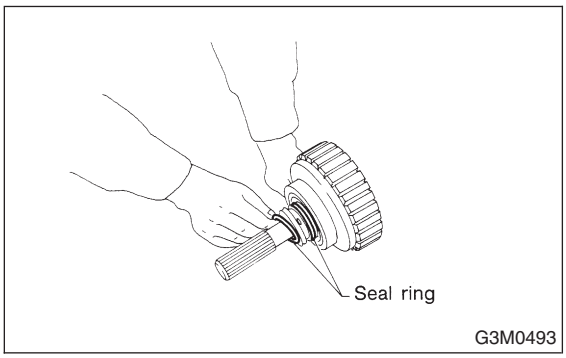
10) Press-fit the ball bearing with ST.
ST 899580100 INSTALLER



11) Coat the seal ring with vaseline, and install it in the seal ring groove of the shaft.

CAUTION:
Do not expand the seal ring excessively when installing.

ST 899580100 INSTALLER

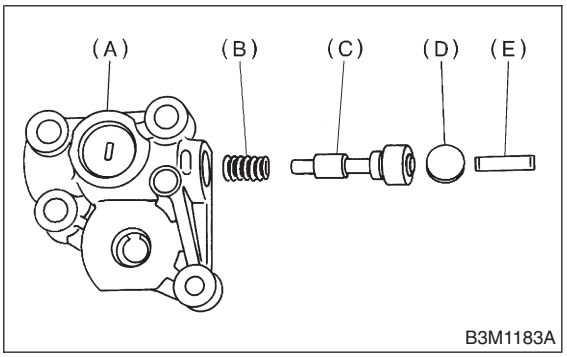


22. Transfer Valve Body

A: DISASSEMBLY

1) Separate transfer duty solenoid and transfer valve body.
2) Remove the stopper plate and pry out the plug with a screwdriver. Then extract the spring and transfer control valve together.

CAUTION:
Be careful not to damage the valve and valve body.



(A) Transfer valve body
(B) Return spring
(C) Transfer control valve
(D) Plug
(E) Stopper plate

B: INSPECTION

Check each component for harmful cuts, damage, or other faults.

C: ASSEMBLY

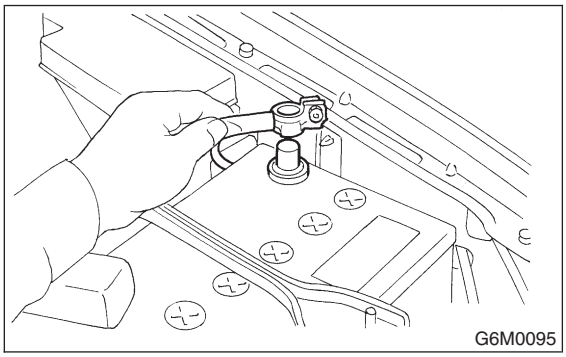
To assemble, reverse the removal sequence.

NOTE:
Make sure the valve slides smoothly after assembling.

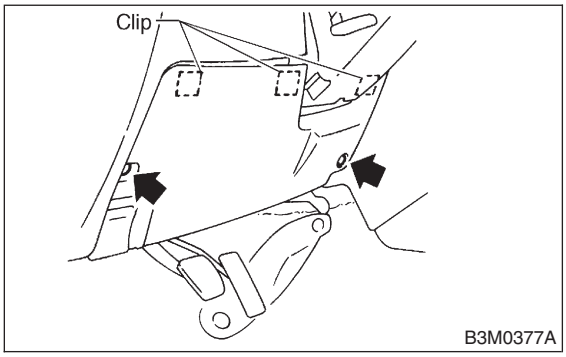
23. Transmission Control Module (TCM)

A: REMOVAL

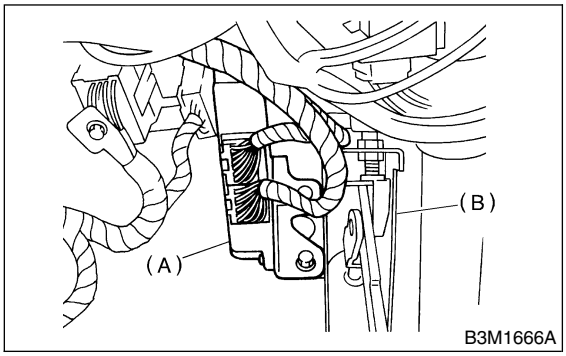
1) Disconnect battery ground terminal.



2) Remove lower cover and then disconnect connector.



3) Disconnect connectors form TCM.
4) Remove transmission control module.

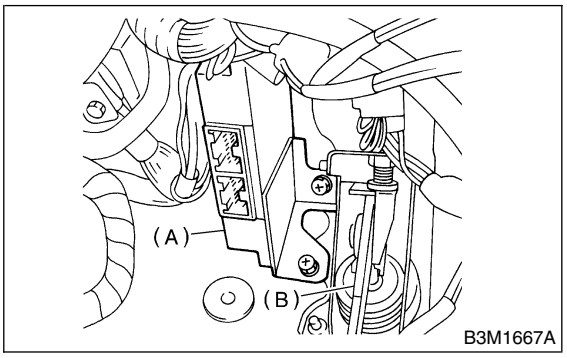


(A) Transmission control module
(B) Brake pedal bracket

B: INSTALLATION

1) Install TCM to brake pedal bracket.

Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)



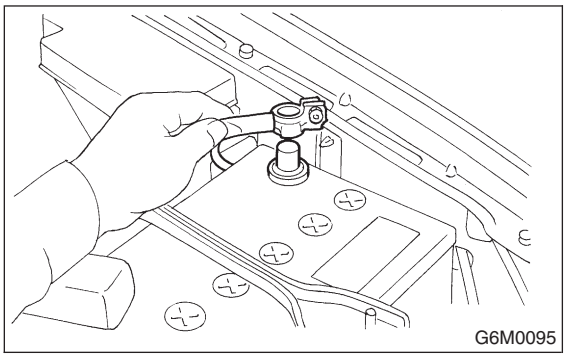
(A) Transmission control module
(B) Brake pedal bracket

2) Connect connectors to TCM.
3) Install lower cover and then connect connector.
4) Connect battery terminal.

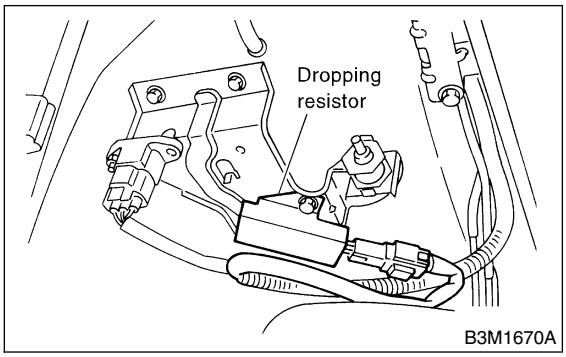
24. Dropping Resistor

A: REMOVAL AND INSTALLATION

1) Disconnect battery ground terminal.

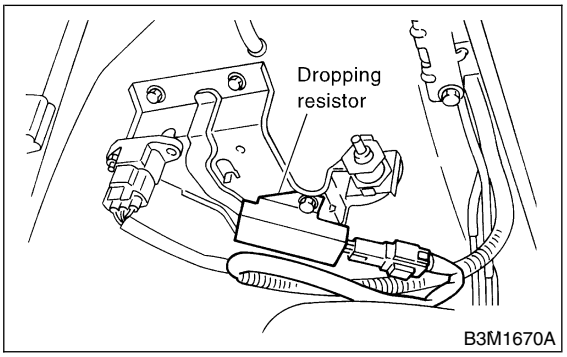


2) Remove air intake duct. <Ref. to 2-7 [W1A0].>
3) Disconnect connector from dropping resistor.
4) Remove dropping resistor from bracket.



5) Install dropping resistor.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



6) Installation is in the reverse order of removal.

MEMO:

AUTOMATIC TRANSMISSION AND DIFFERENTIAL 3-2

Page

T DIAGNOSTICS 2
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2. Pre-inspection 2
3. Electrical Components Location 4
4. Schematic 9
5. Transmission Control Module (TCM) I/O Signal 10
6. Diagnostic Chart for On-board Diagnostics System 13
7. Diagnostics for On-board Diagnostics Failed 16
8. Diagnostic Chart with Trouble Code 23
9. Diagnostic Chart with Select Monitor 100
10. General Diagnostic Table 126

1. Precaution

A: SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

Airbag system wiring harness is routed near the transmission control module (TCM).

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
• Be careful not to damage Airbag system wiring harness when performing diagnostics and servicing the TCM.

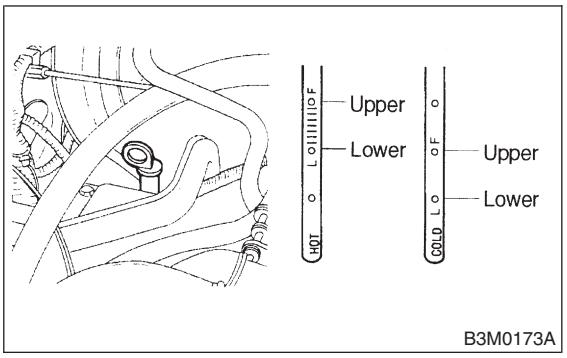
B: MEASUREMENT

When measuring voltage and resistance of the ECM, TCM or each sensor, use a tapered pin with a diameter of less than 0.64 mm (0.025 in) in order to avoid poor contact. Do not insert the pin more than 5 mm (0.20 in).

2. Pre-inspection

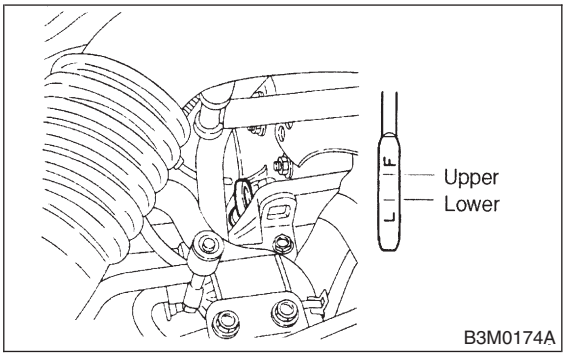
A: ATF LEVEL

Make sure that ATF level is in the specification.



B: FRONT DIFFERENTIAL OIL LEVEL

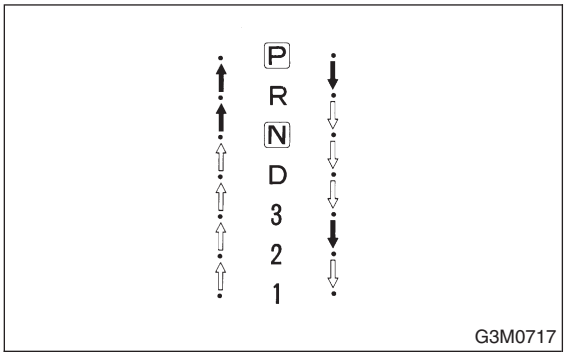
Make sure that front differential oil level is in the specification.



C: OPERATION OF SHIFT SELECTOR LEVER

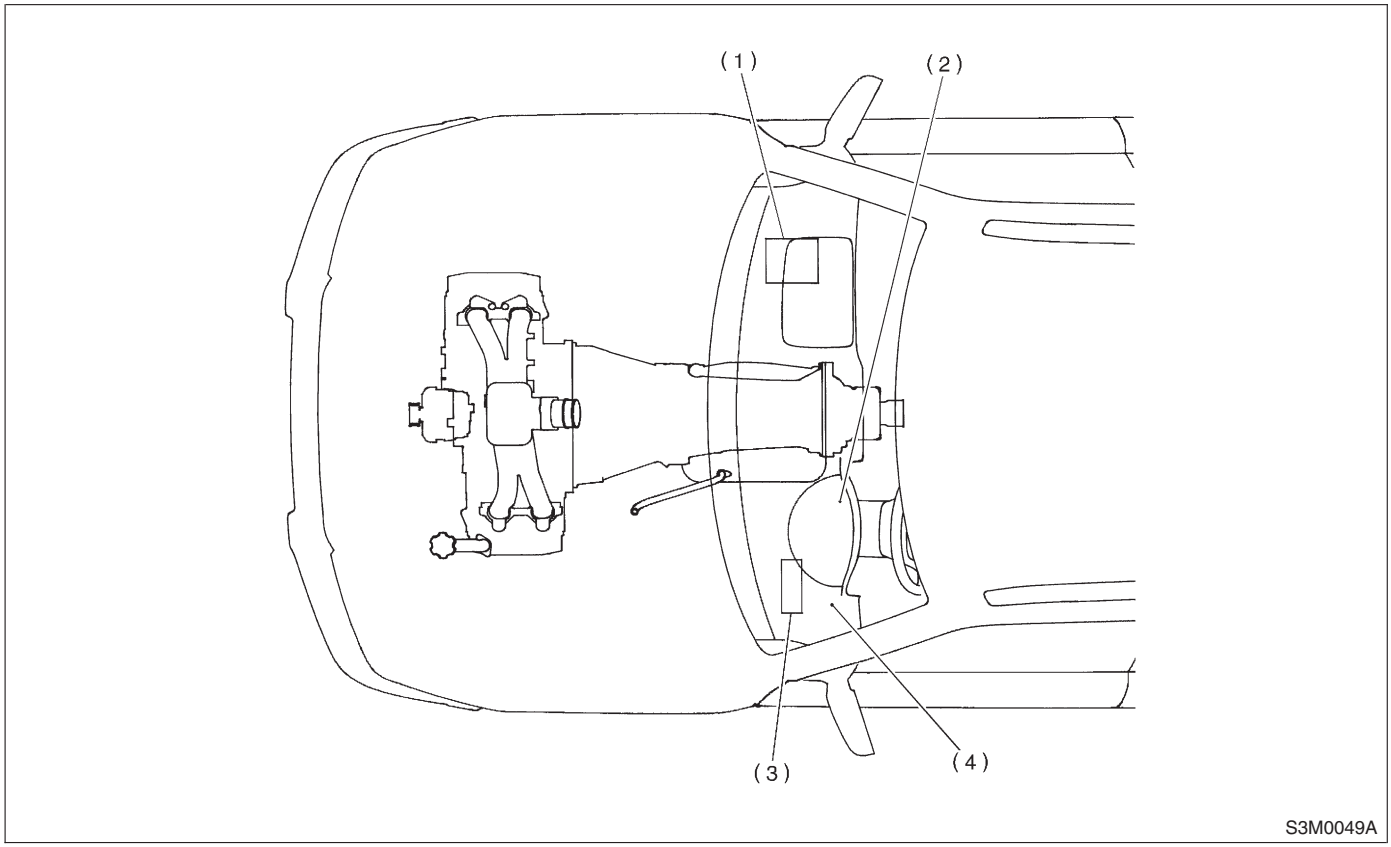
WARNING:
Stop the engine while checking operation of selector lever.

1) Check that selector lever does not move from “N” to “R” without pushing the button.
2) Check that selector lever does not move from “R” to “P” without pushing the button.
3) Check that selector lever does not move from “P” to “R” without pushing the button.
4) Check that selector lever does not move from “3” to “2” without pushing the button.

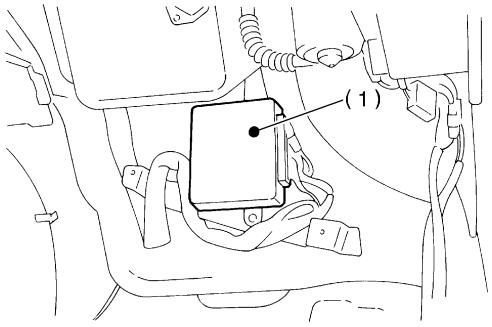


3. Electrical Components Location

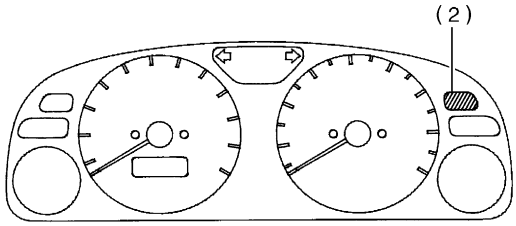
A: MODULE



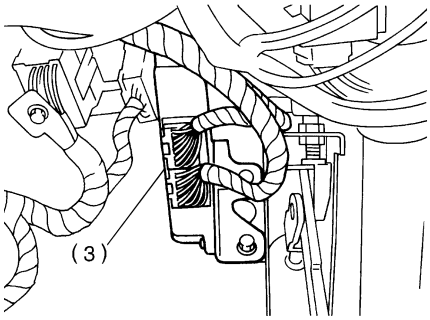
(1) ECM
(2) AT OIL TEMP indicator light (AT diagnostic indicator light)
(3) TCM
(4) Data link connector (for Subaru select monitor and OBD-II general scan tool)



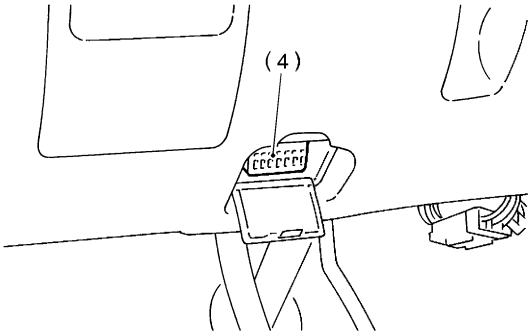
B3M0183E



S3M0057A

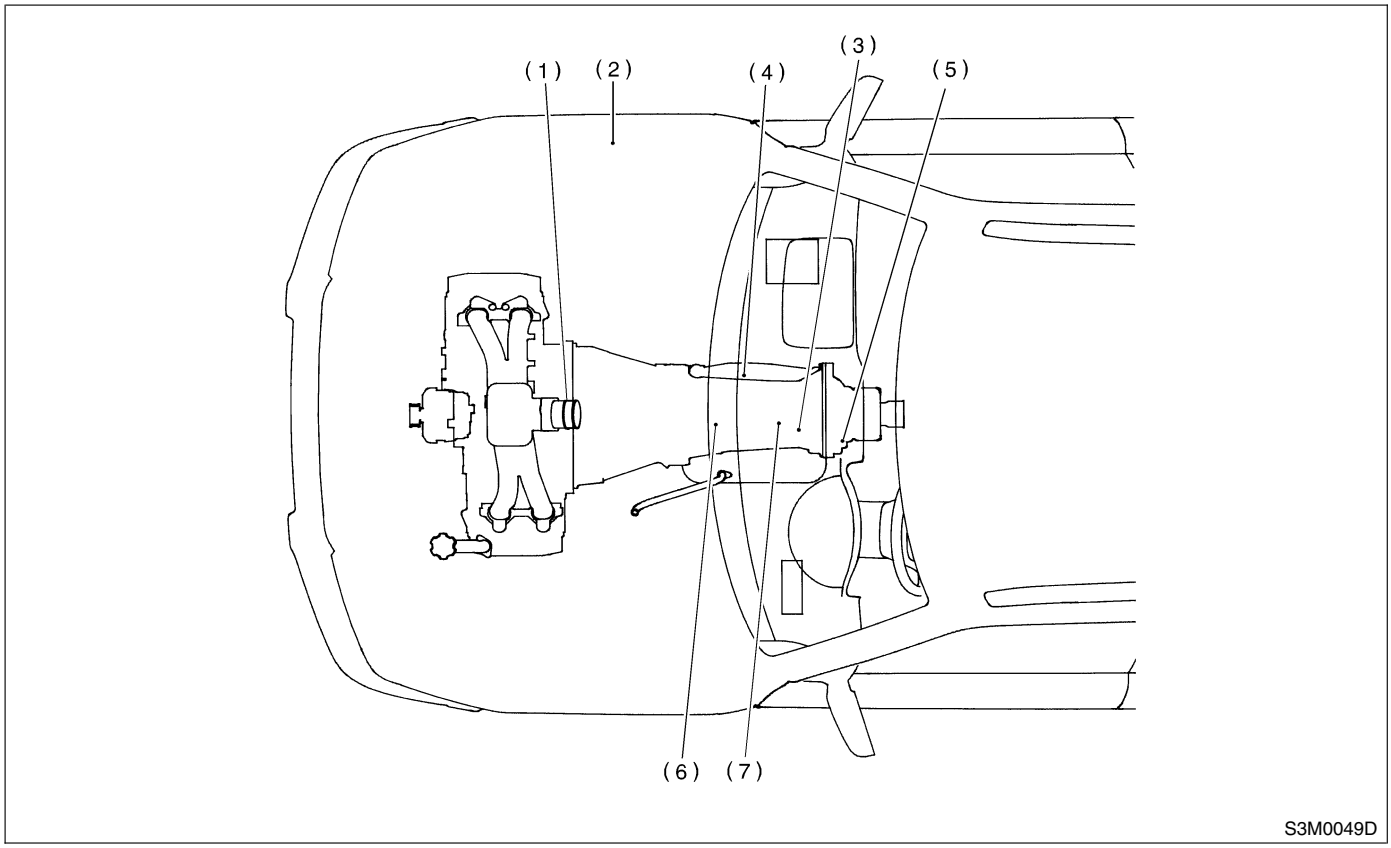


B3M1666C

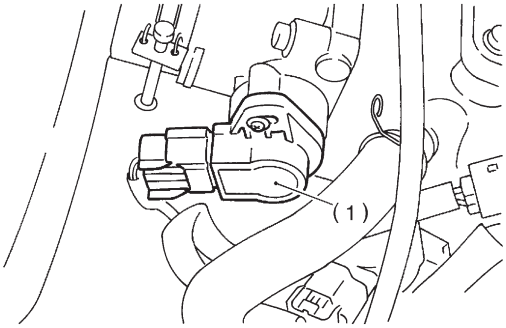


S2M0258C

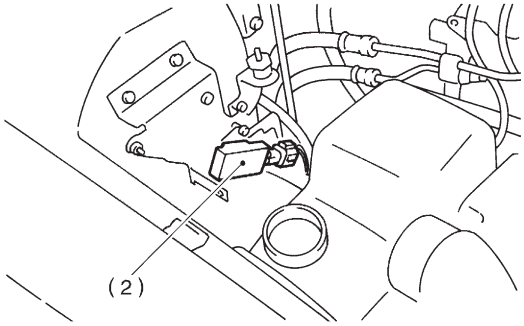
B: SENSOR



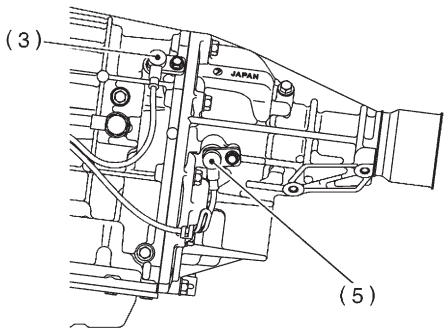
(1) Throttle position sensor
(2) Dropping resistor
(3) Vehicle speed sensor 2 (front)
(4) Inhibitor switch
(5) Vehicle speed sensor 1 (rear)
(6) Torque converter turbine speed sensor
(7) ATF temperature sensor



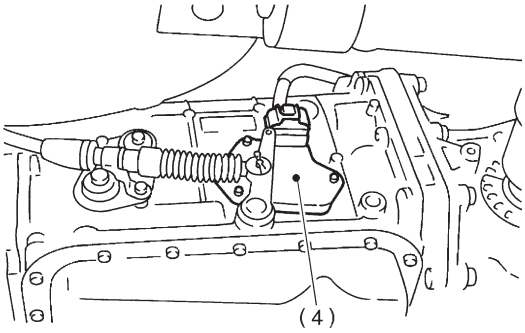
S2M0262B



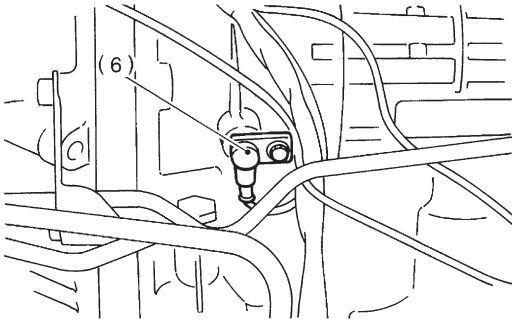
B2M2262C



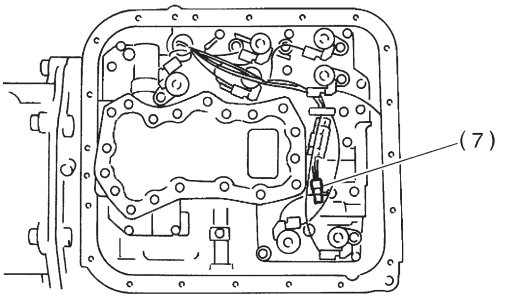
B2M2258C



B2M2246D

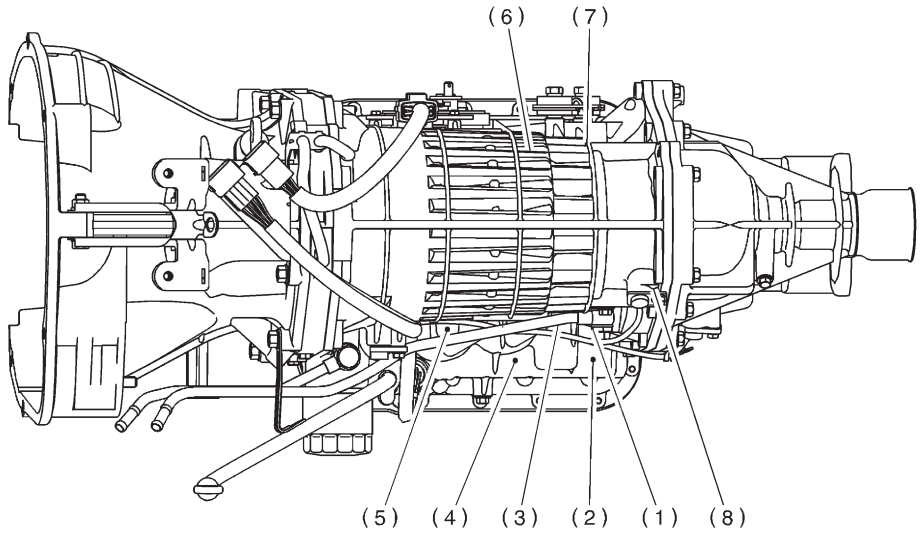


B2M2260C



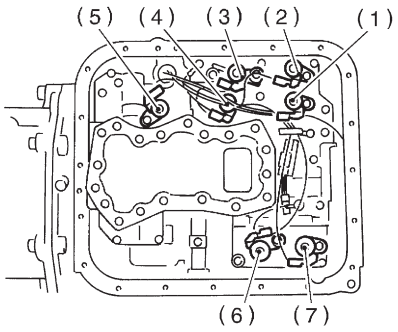
B2M2261C

C: SOLENOID

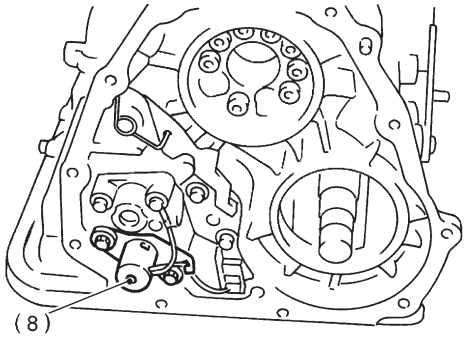


B3M1186A

(1) Shift solenoid 1
(2) Shift solenoid 2
(3) Line pressure duty solenoid
(4) Low clutch timing solenoid
(5) Lock-up duty solenoid
(6) 2-4 brake duty solenoid
(7) 2-4 brake timing solenoid
(8) Transfer duty solenoid

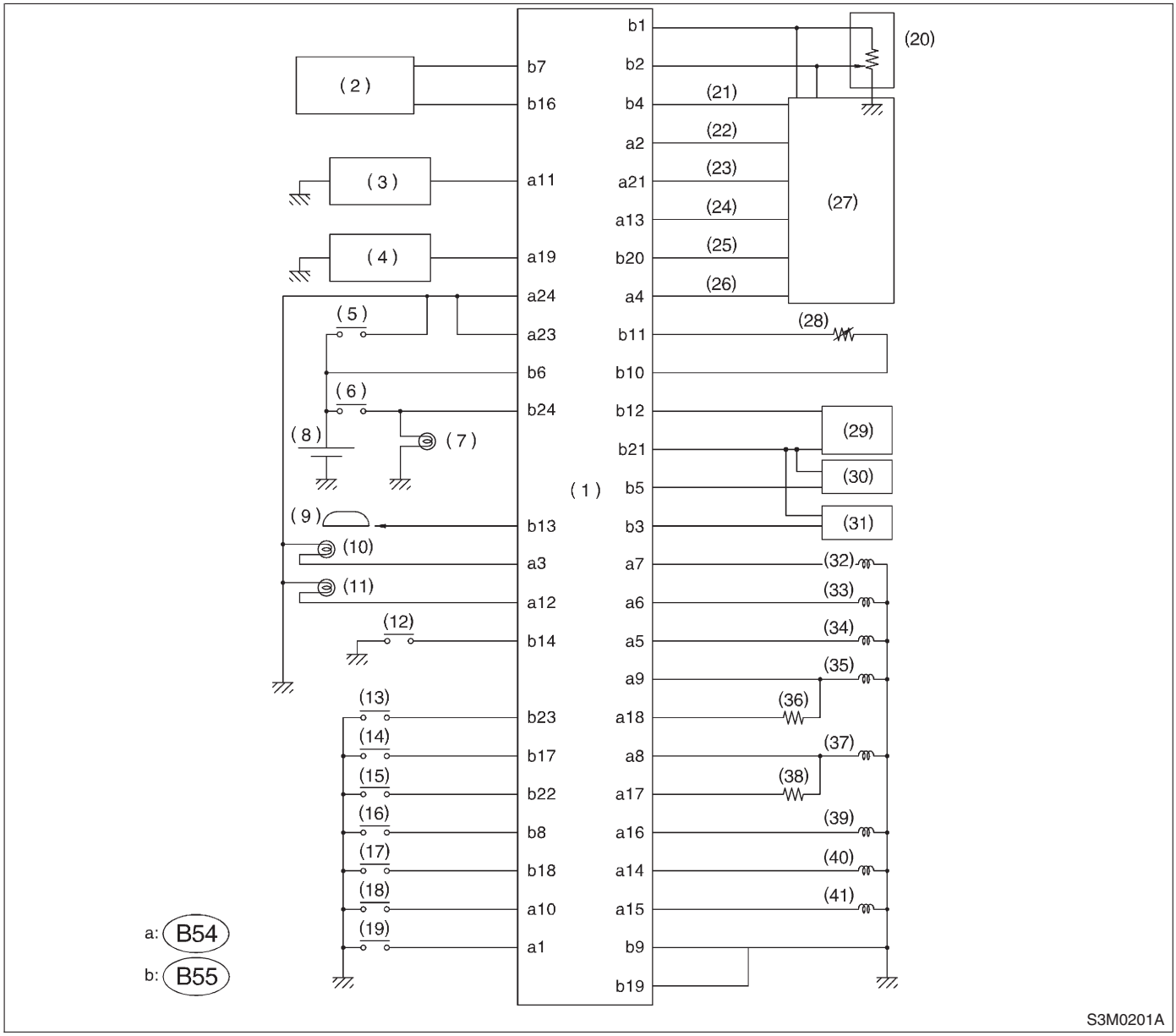


B2M2263D



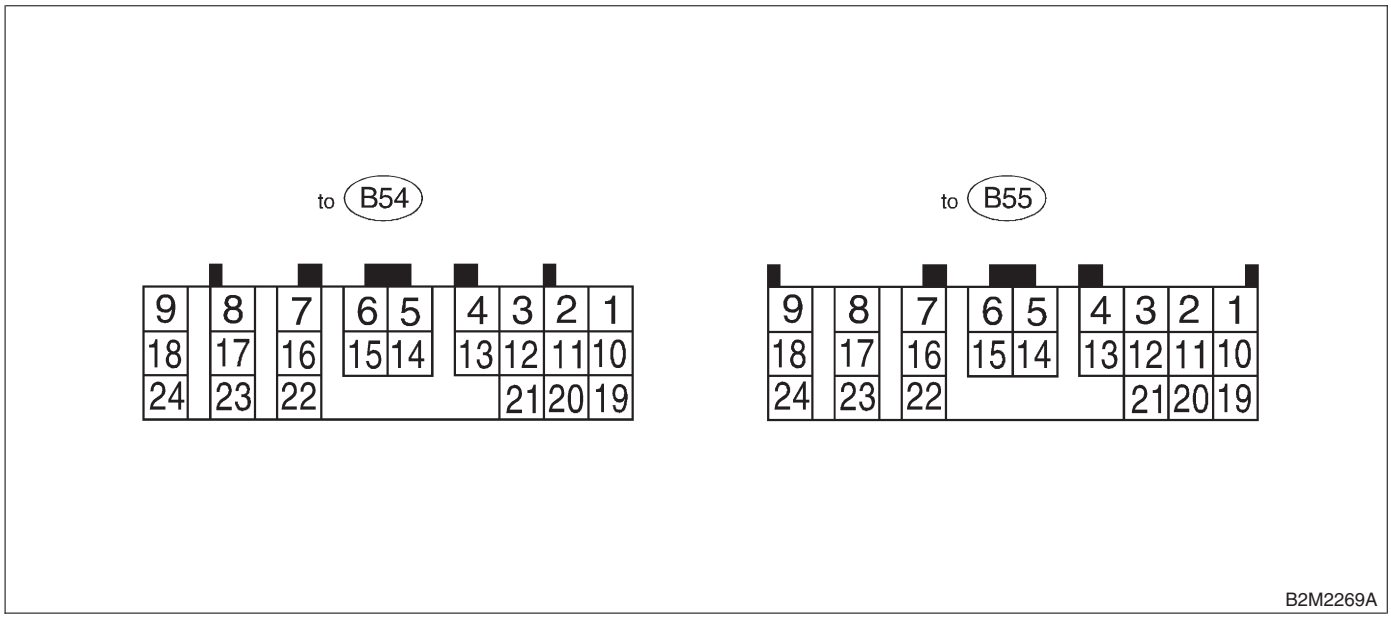
B2M2264E

4. Schematic



(1) Transmission control module
(2) Data link connector
(3) Cruise control module
(4) ABS control module
(5) Ignition switch
(6) Brake switch
(7) Brake light
(8) Battery
(9) Combination meter (Speedometer circuit)
(10) AT OIL TEMP indicator light
(11) FWD indicator light
(12) FWD switch
(13) “P” range switch
(14) “R” range switch
(15) “N” range switch
(16) “D” range switch
(17) “3” range switch
(18) “2” range switch
(19) “1” range switch
(20) Throttle position sensor
(21) Engine speed signal
(22) Torque control cut signal
(23) Torque control signal 2
(24) Torque control signal 1
(25) AT load signal
(26) AT diagnostics signal
(27) Engine control module
(28) ATF temperature sensor
(29) Torque converter turbine speed sensor
(30) Vehicle speed sensor 2 (Front)
(31) Vehicle speed sensor 1 (Rear)
(32) Shift solenoid 1
(33) Shift solenoid 2
(34) 2-4 brake timing solenoid
(35) Line pressure duty solenoid
(36) Line pressure dropping resistor
(37) 2-4 brake duty solenoid
(38) 2-4 brake dropping resistor
(39) Lock-up duty solenoid
(40) Low clutch timing solenoid
(41) Transfer duty solenoid

5. Transmission Control Module (TCM) I/O Signal



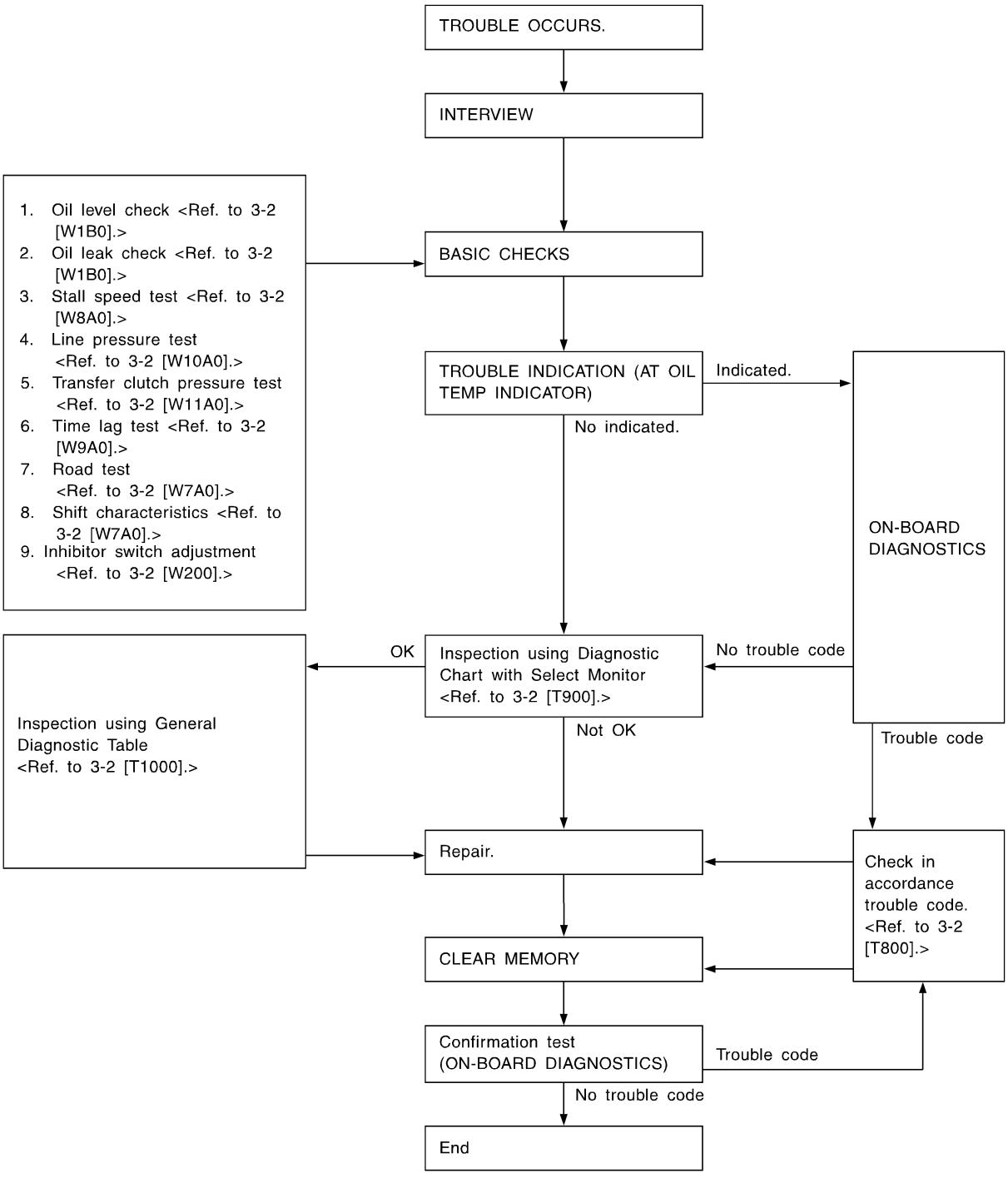
Check with ignition switch ON.						
Content		Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
Back-up power supply		B55	6	Ignition switch OFF	10 — 16	—
Ignition power supply		B54	23	Ignition switch ON (with engine OFF)	10 — 16	—
		B54	24			
Inhibitor switch	"P" range switch	B55	23	Select lever in "P" range	Less than 1	—
				Select lever in any other than "P" range (except "N" range)	More than 8	
	"N" range switch	B55	22	Select lever in "N" range	Less than 1	—
				Select lever in any other than "N" range (except "P" range)	More than 8	
	"R" range switch	B55	17	Select lever in "R" range	Less than 1	—
				Select lever in any other than "R" range	More than 9.5	
	"D" range switch	B55	8	Select lever in "D" range	Less than 1	—
				Select lever in any other than "D" range	More than 9.5	
	"3" range switch	B55	18	Select lever in "3" range	Less than 1	—
				Select lever in any other than "3" range	More than 9.5	
	"2" range switch	B54	10	Select lever in "2" range	Less than 1	—
				Select lever in any other than "2" range	More than 9.5	
	"1" range switch	B54	1	Select lever in "1" range	Less than 1	—
				Select lever in any other than "1" range	More than 9.5	
Brake switch		B55	24	Brake pedal depressed.	More than 10.5	—
				Brake pedal released.	Less than 1	
ABS signal		B54	19	ABS switch ON	Less than 1	—
				ABS switch OFF	6.5 — 15	

Check with ignition switch ON.					
Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
AT OIL TEMP indicator light	B54	3	Light ON	Less than 1	—
			Light OFF	More than 9	
Throttle position sensor	B55	2	Throttle fully closed.	0.3 — 0.7	—
			Throttle fully open.	4.3 — 4.9	
Throttle position sensor power supply	B55	1	Ignition switch ON (With engine OFF)	4.8 — 5.3	—
ATF temperature sensor	B55	11	ATF temperature 20°C (68°F)	2.9 — 4.0	2.1 — 2.9 k
			ATF temperature 80°C (176°F)	0.5 — 0.8	275 — 375
Vehicle speed sensor 1 (Rear)	B55	3	Vehicle stopped.	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Vehicle speed sensor 2 (Front)	B55	5	Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range) 4	450 — 650
Torque converter turbine speed sensor	B55	12	Vehicle stopped	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Vehicle speed output signal	B55	13	Vehicle speed at most 10 km/h (6 MPH)	Less than 1← →More than 4	—
Engine speed signal	B55	4	Ignition switch ON (with engine OFF)	More than 10.5	—
			Ignition switch ON (with engine ON)	8 — 11	
Cruise set signal	B54	11	When cruise control is set (SET lamp ON)	Less than 1	—
			When cruise control is not set (SET lamp OFF)	More than 6.5	
Torque control signal 1	B54	13	Ignition switch ON (with engine ON)	4 — 6	—
Torque control signal 2	B54	21	Ignition switch ON (with engine ON)	More than 9	—
Torque control cut signal	B54	2	Ignition switch ON	8	—
Intake manifold pressure signal	B55	20	Engine idling after warm-up.	1.2 — 1.8	—
Shift solenoid 1	B54	7	1st or 4th gear	More than 9	10 — 16
			2nd or 3rd gear	Less than 1	
Shift solenoid 2	B54	6	1st or 2nd gear	More than 9	10 — 16
			3rd or 4th gear	Less than 1	
Line pressure duty solenoid	B54	9	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Dropping resistor	B54	18	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Lock-up duty solenoid	B54	16	When lock up occurs.	More than 8.5	10 — 17
			When lock up is released.	Less than 0.5	

Check with ignition switch ON.					
Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
Transfer duty solenoid	B54	15	Fuse on FWD switch	More than 8.5	10 — 17
			Fuse removed from FWD switch (with throttle fully open and with select lever in 1st gear).	Less than 0.5	
2-4 brake duty solenoid	B54	8	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake dropping resistor	B54	17	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake timing solenoid	B54	5	1st gear	Less than 1	10 — 16
			3rd gear	More than 9	
Low clutch timing solenoid	B54	14	2nd gear	Less than 1	10 — 16
			4th gear	More than 9	
Sensor ground line 1	B55	10	—	0	Less than 1
Sensor ground line 2	B55	21	—	0	Less than 1
System ground line	B55	9	—	0	Less than 1
		19			
FWD switch	B55	14	Fuse removed.	6 — 9.1	—
			Fuse installed.	Less than 1	
FWD indicator light	B54	12	Fuse ON FWD switch	Less than 1	—
			Fuse removed from FWD switch	More than 9	
AT diagnosis signal	B54	4	Ignition switch ON	Less than 1← →More than 4	—
Data link signal (Subaru Select Monitor)	B55	7	—	—	—
		16	—	—	

6. Diagnostic Chart for On-board Diagnostics System

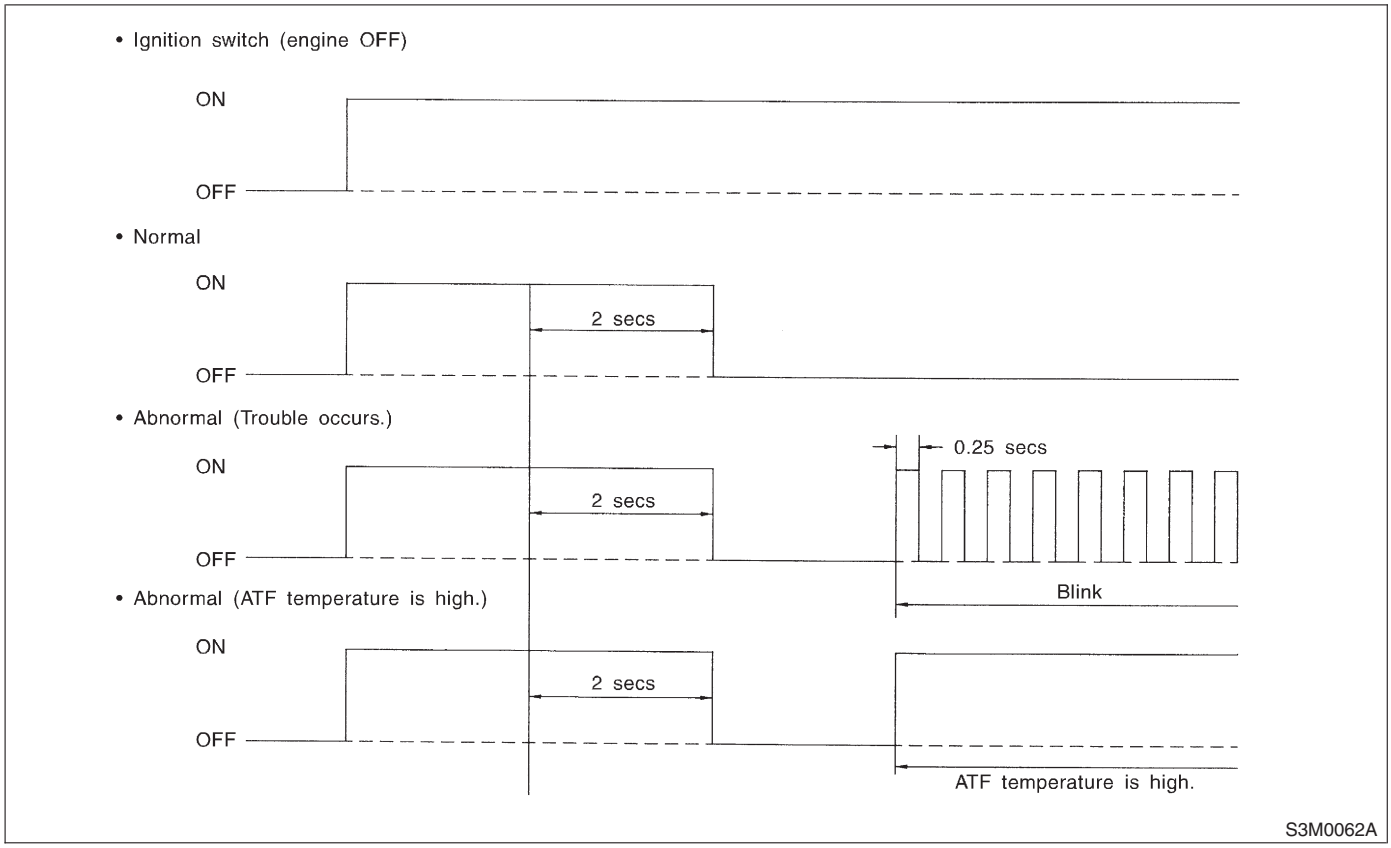
A: BASIC DIAGNOSTICS PROCEDURE



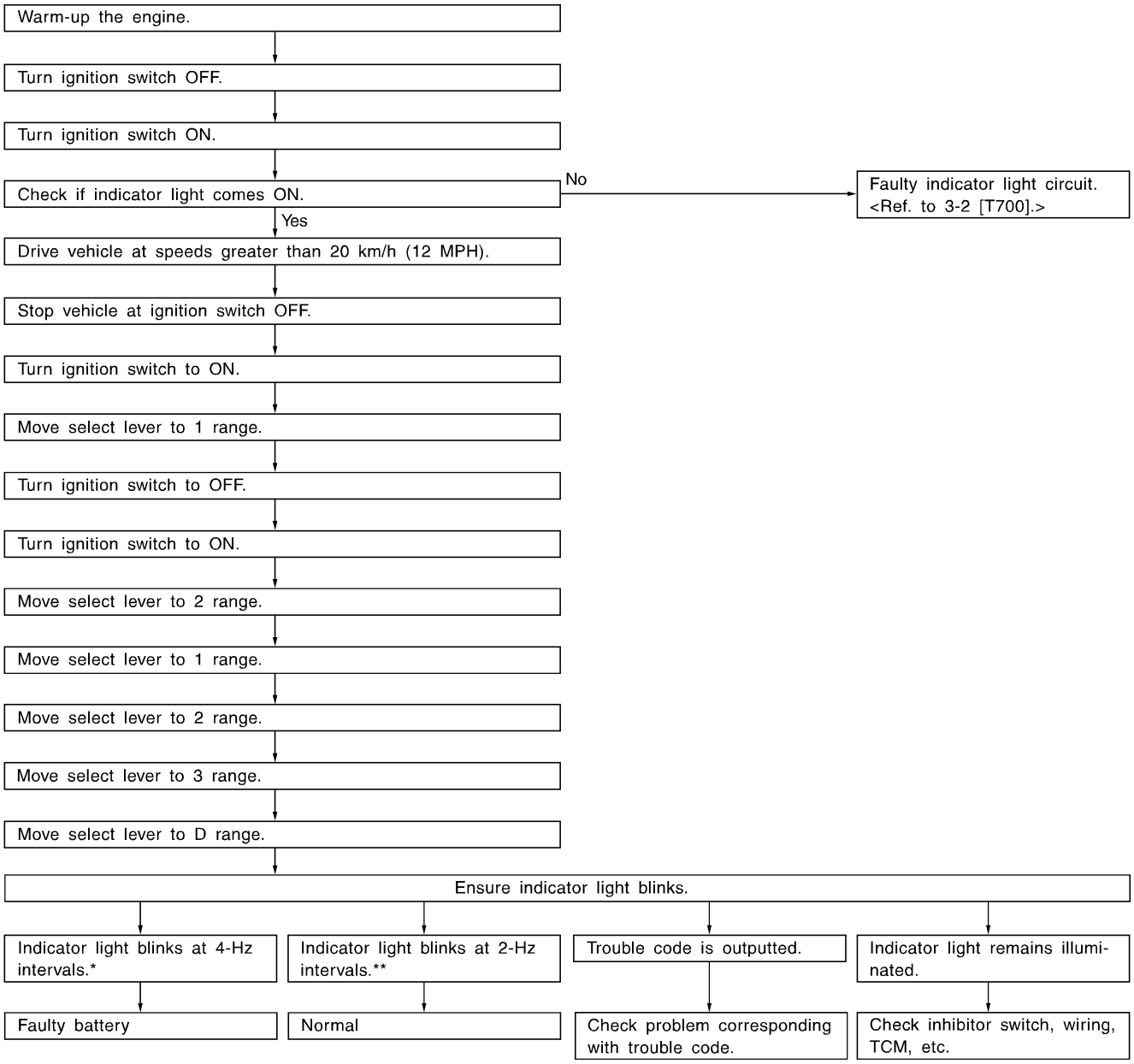
H3M1672H

B: ABNORMAL DISPLAY ON AT OIL TEMP INDICATOR

When any on-board diagnostics item is malfunctioning, the display on the AT OIL TEMP indicator light blinks from the time the malfunction is detected after starting the engine until the ignition switch is turned OFF. The malfunctioning part or unit can be determined by a trouble code during on-board diagnostics operation. Problems which occurred previously can also be identified through the memory function. If the AT OIL TEMP indicator does not show a problem (although a problem is occurring), the problem can be determined by checking the performance characteristics of each sensor using the select monitor. Indicator signal is as shown in the figure.



C: ON-BOARD DIAGNOSTICS



* : Blinks every 0.125 (1/8) seconds (until ignition switch is turned OFF).
** : Blinks every 0.25 (1/4) seconds (until ignition switch is turned OFF).

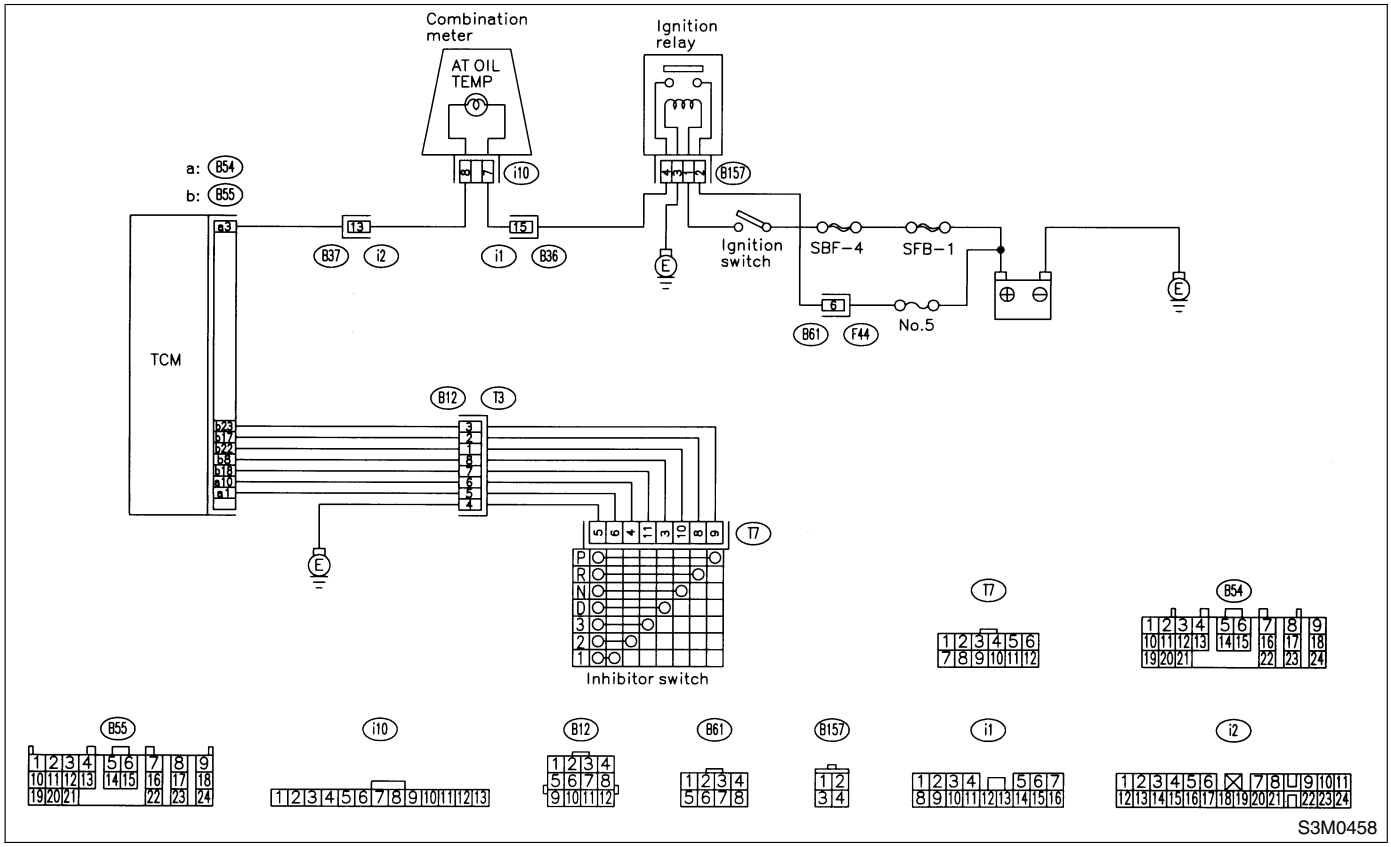
S3M0063B

7. Diagnostics for On-board Diagnostics Failed

A: AT OIL TEMP INDICATOR LIGHT

DIAGNOSIS:
The AT OIL TEMP indicator light circuit is open or shorted.
TROUBLE SYMPTOM:
- When ignition switch is turned to ON (engine OFF), AT OIL TEMP indicator light does not illuminate.
- When on-board diagnostics is performed, AT OIL TEMP indicator light remains illuminated.

WIRING DIAGRAM:



7A1 : CHECK AT OIL TEMP INDICATOR LIGHT.

Turn ignition switch to ON (engine OFF).

CHECK : ***Does AT OIL TEMP indicator light illuminate?***
YES : Go to step **7A4**.
NO : Go to step **7A2**.

7A2 : CHECK FUSE (NO. 5).

Remove fuse (No. 5).

CHECK : ***Is the fuse (No. 5) blown out?***
YES : Replace fuse (No. 5). If replaced fuse (No. 5) is blown out easily, repair short circuit in harness between fuse (No. 5) and combination meter.
NO : Go to step **7A3**.

7A3 : CHECK AT OIL TEMP INDICATOR LIGHT.

1) Turn ignition switch to OFF.
2) Remove combination meter.
3) Remove ATF OIL TEMP indicator light bulb from combination meter.

CHECK : ***Is ATF OIL TEMP indicator light bulb OK?***
YES : Go to step **7A5**.
NO : Replace AT OIL TEMP indicator light bulb.

7A4 : CHECK AT OIL TEMP INDICATOR LIGHT.

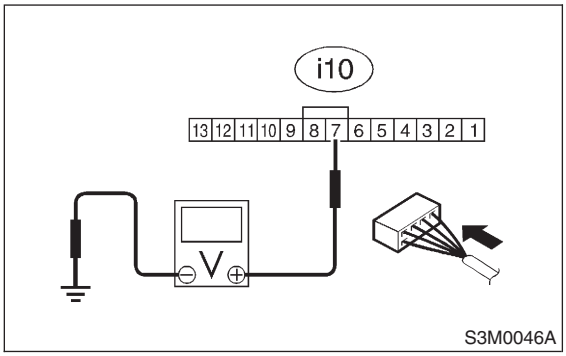
Perform on-board diagnostics. <Ref. to 3-2 [T6C0].>

CHECK : ***Does AT OIL TEMP indicator light blink?***
YES : A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM, inhibitor switch and combination meter.
NO : Go to step **7A8**.

7A5 : CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND IGNITION SWITCH.

1) Turn ignition switch to ON (engine OFF).
2) Measure voltage between combination meter connector and chassis ground.

Connector & terminal
(i10) No. 7 (+) — Chassis ground (–):

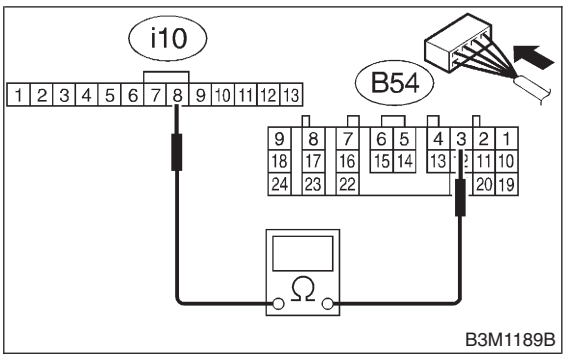


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7A6**.
NO : Repair open circuit in harness between combination meter and battery.

7A6 : CHECK OPEN CIRCUIT OF HARNESS.

1) Disconnect connector from combination meter connector.
2) Measure resistance of harness between combination meter.

Connector & terminal
(B54) No. 3 — (i10) No. 8:

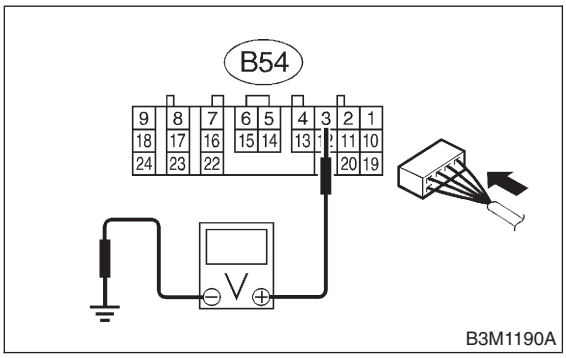


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **7A7**.
NO : Repair open circuit in harness between TCM and combination meter, and poor contact in coupling connector.

7A7 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connector to TCM and combination meter.
2) Turn ignition switch to ON (engine OFF).
3) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 3 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V?***
YES : Even if AT OIL TEMP indicator lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

7A8 : CHECK INHIBITOR SWITCH.

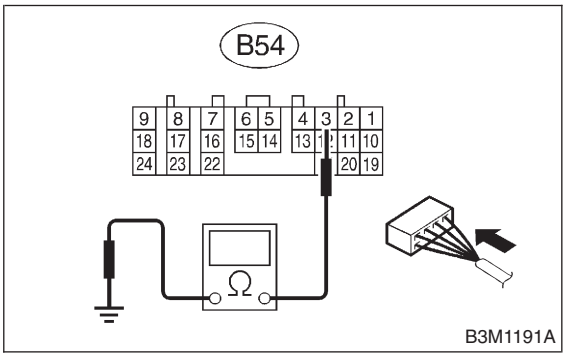
1) Connect Subaru Select Monitor to data link connector.
2) Turn ignition switch to ON.
3) Subaru Select Monitor to ON.
4) Read data of range switch using Subaru Select Monitor.
- Range switch is indicated in ON ⇔ OFF.

CHECK : ***When each range is selected, does LED of Subaru Select Monitor light up?***
YES : Go to step **7A9**.
NO : Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

7A9 : CHECK SHORT CIRCUIT OF HARNESS.

1) Disconnect connector from TCM.
2) Remove combination meter.
3) Disconnect connector from combination meter.
4) Measure resistance of harness connector between TCM and combination meter.

Connector & terminal/specified resistance
(B54) No. 3 — Chassis ground:

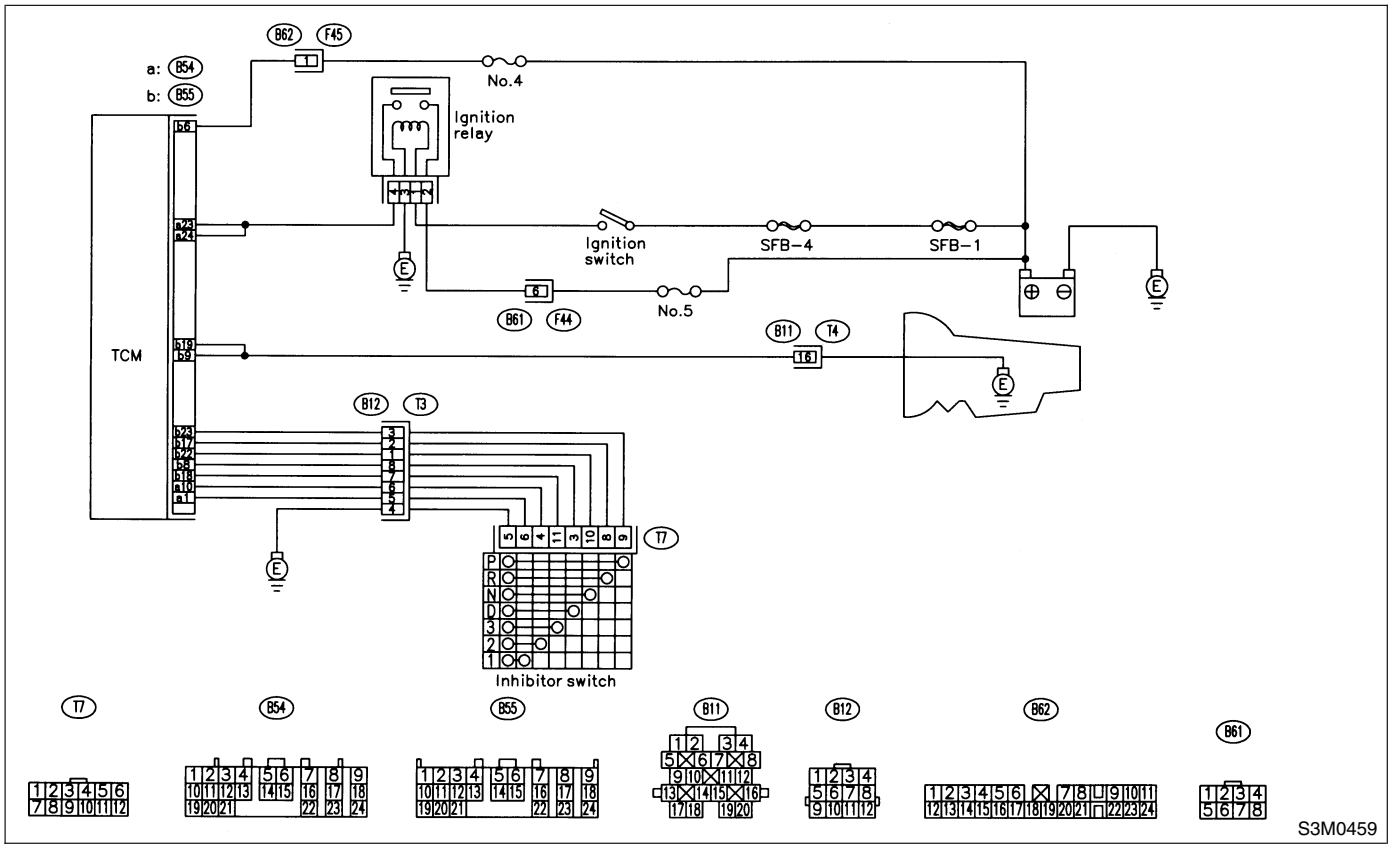


CHECK : ***Is the resistance less than 1 MΩ?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Repair short circuit in harness between combination meter connector and TCM connector.

MEMO:

B: CONTROL MODULE POWER SUPPLY AND GROUND LINE

WIRING DIAGRAM:



7B1 : CHECK FUSE (NO. 4).

Remove fuse (No. 4).

CHECK : ***Is the fuse (No. 4) blown out?***

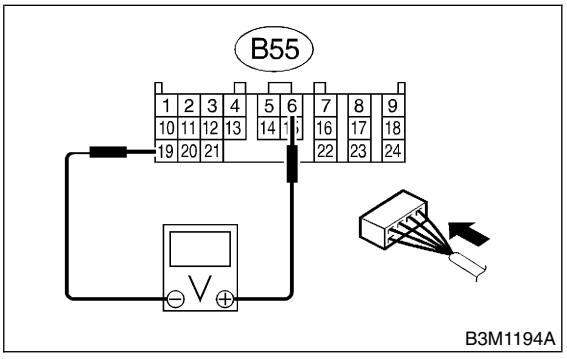
YES : Replace fuse (No. 4). If replaced fuse (No. 4) has blown out easily, repair short circuit in harness between fuse (No. 4) and TCM.

NO : Go to step **7B2**.

7B2 : CHECK BACK-UP POWER SUPPLY CIRCUIT.

1) Turn ignition switch to ON.
2) Measure back-up power supply voltage between TCM connector terminal.

Connector & terminal
(B55) No. 6 (+) — No. 19 (–):



CHECK : ***Is the voltage more than 10 V?***

YES : Go to step **7B3**.

NO : Repair open circuit in harness between fuse (No. 4) and TCM, and poor contact in coupling connector.

7B3 : CHECK FUSE (NO. 5).

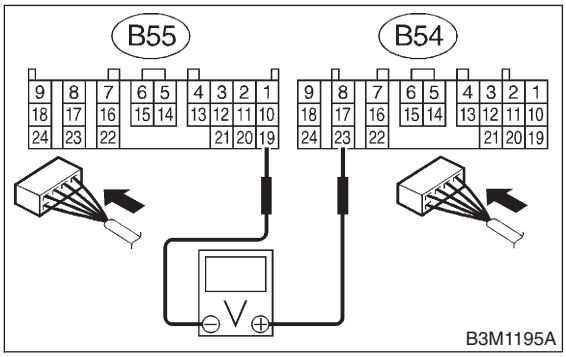
Remove fuse (No. 5).

CHECK : ***Is the fuse (No. 5) blown out?***
YES : Replace fuse (No. 5). If replaced fuse (No. 5) has blown out easily, repair short circuit in harness between fuse (No. 5) and TCM.
NO : Go to step **7B4**.

7B4 : CHECK IGNITION POWER SUPPLY CIRCUIT.

1) Turn ignition switch to ON (engine OFF).
2) Measure ignition power supply voltage between TCM connector terminal.

Connector & terminal
(B54) No. 23 (+) — (B55) No. 19 (–):

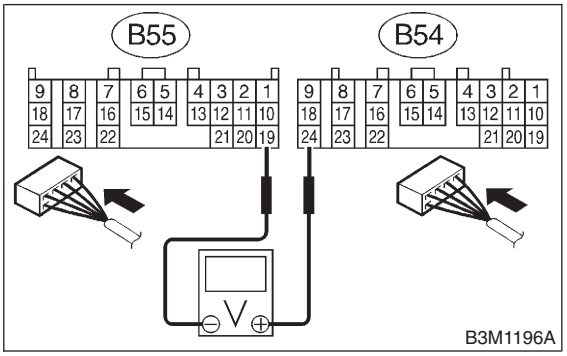


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **7B5**.
NO : Go to step **7B6**.

7B5 : CHECK IGNITION POWER SUPPLY CIRCUIT.

1) Turn ignition switch to ON (engine OFF).
2) Measure ignition power supply voltage between TCM connector terminal.

Connector & terminal
(B54) No. 24 (+) — (B55) No. 19:

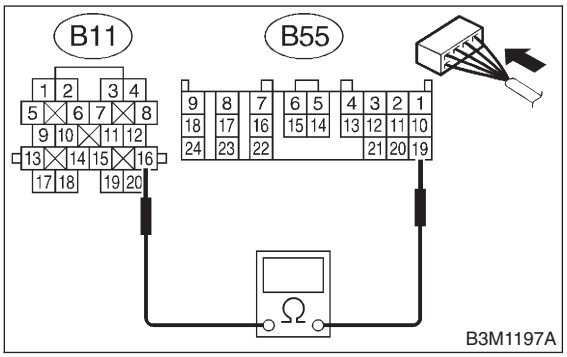


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **7B6**.
NO : Repair open circuit in harness between TCM and battery, and poor contact in coupling connector.

7B6 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Turn ignition switch to OFF.
2) Disconnect connector from TCM and transmission.
3) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 19 — (B11) No. 16:

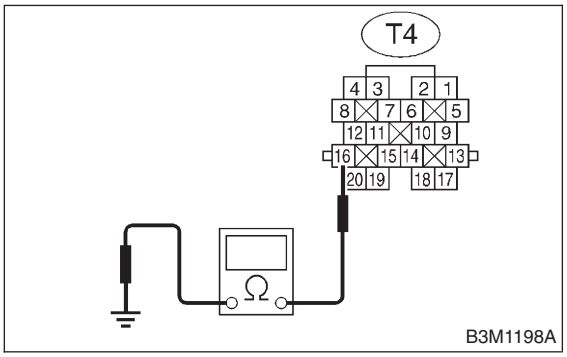


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **7B7**.
NO : Repair open circuit in harness between TCM and transmission harness connector.

7B7 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND TRANSMISSION GROUND.

Measure resistance of harness between transmission and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

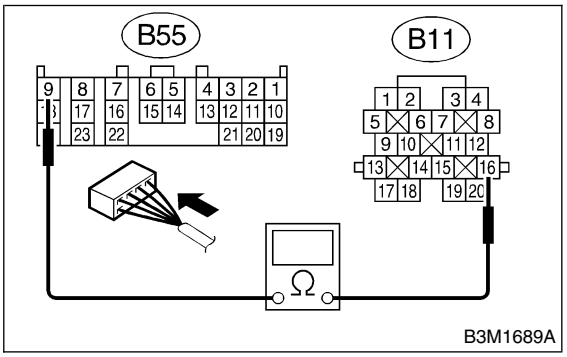


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **7B8**.
NO : Repair open circuit in harness between transmission and transmission ground.

7B8 : CHECK HARNESS CONNECTOR BETWEEN INHIBITOR SWITCH AND TCM.

1) Turn ignition switch to OFF.
2) Disconnect connector from inhibitor switch.
3) Measure resistance of harness between inhibitor switch side connector and TCM.

Connector & terminal
(B11) No. 16 — (B55) No. 9:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **7B9**.
NO : Repair open circuit in harness between TCM and inhibitor side connector, and poor contact in coupling connector.

7B9 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in control module power supply and ground line?***
YES : Repair poor contact and ground terminal.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

8. Diagnostic Chart with Trouble Code

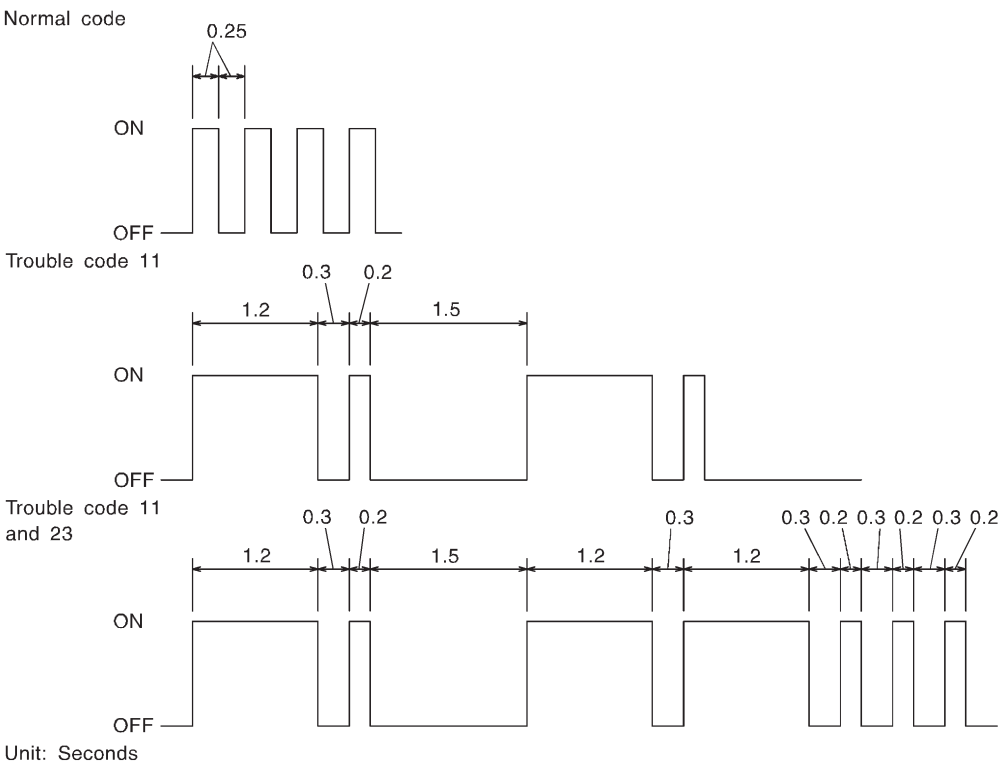
A: LIST OF TROUBLE CODE

1. TROUBLE CODE

Trouble code	Item	Content of diagnosis	Title index No.
11	Engine speed signal	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8C0].>
27	ATF temperature sensor	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8D0].>
31	Throttle position sensor	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8E0].>
33	Vehicle speed sensor 2 (Front)	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8F0].>
36	Torque converter turbine speed sensor	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8G0].>
38	Torque control signal	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8H0].>
45	Intake manifold pressure signal	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8I0].>
71	Shift solenoid 1	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8J0].>
72	Shift solenoid 2	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8K0].>
73	Low clutch timing solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8L0].>
74	2-4 brake timing solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8M0].>
75	Line pressure duty solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8N0].>
76	2-4 brake duty solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8O0].>
77	Lock-up duty solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8P0].>
79	Transfer duty solenoid	Detects open or shorted output signal circuit.	<Ref. to 3-2 [T8Q0].>
93	Vehicle speed sensor 1 (Rear)	Detects open or shorted input signal circuit.	<Ref. to 3-2 [T8R0].>

2. HOW TO READ TROUBLE CODE OF INDICATOR LIGHT

The AT OIL TEMP indicator light flashes the code corresponding to the faulty part.
The long segment (1.2 sec on) indicates a “ten”, and the short segment (0.2 sec on) signifies a “one”.



B: CLEAR MEMORY

Current trouble codes shown on the display are cleared by turning the ignition switch OFF after conducting on-board diagnostics operation. Previous trouble codes, however, cannot be cleared since they are stored in the TCM memory which is operating on the back-up power supply. These trouble codes can be cleared by removing the specified fuse (located under the light or left lower position of the instrument panel).

CLEAR MEMORY:

Removal of No. 4 fuse (for at least one minute)

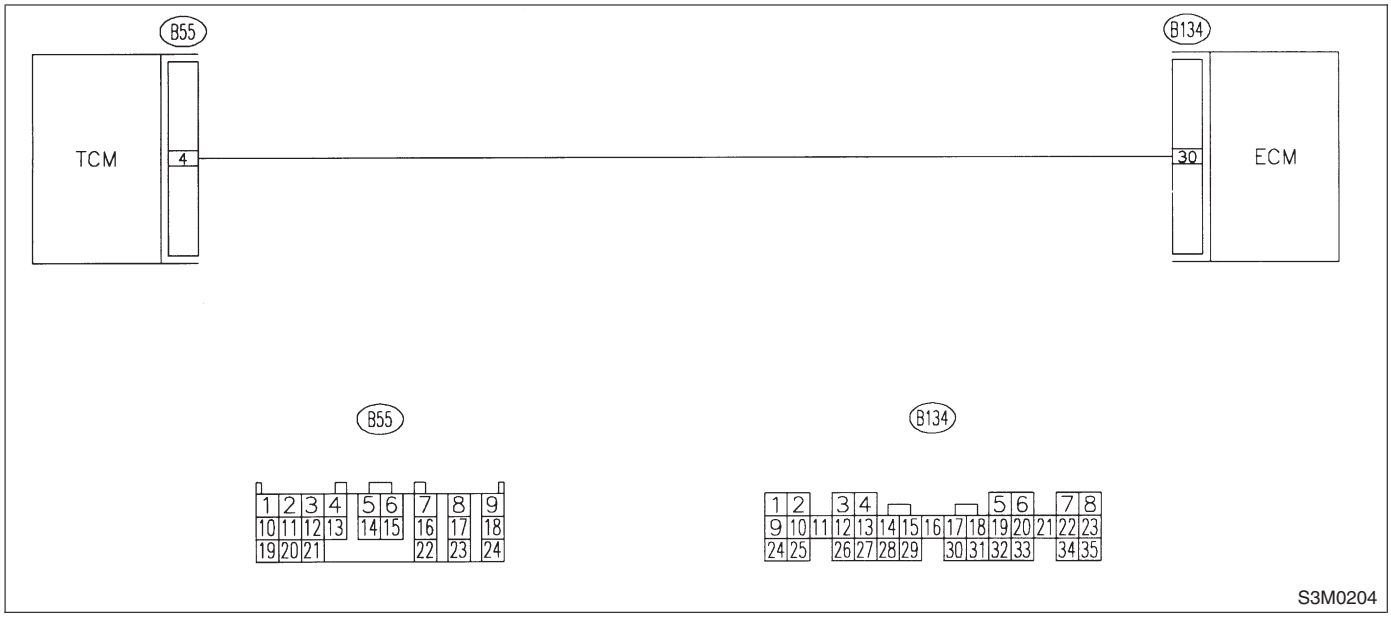
- The No. 4 fuse is located in the line to the memory back-up power supply of the TCM. Removal of this fuse clears the previous trouble codes stored in the TCM memory.
- Be sure to remove the No. 4 fuse for at least the specified length of time. Otherwise, trouble codes may not be cleared.

MEMO:

C: TROUBLE CODE 11 — ENGINE SPEED SIGNAL —

DIAGNOSIS:
Engine speed input signal circuit is open or shorted.
TROUBLE SYMPTOM:
- No lock-up (after engine warm-up).
- AT OIL TEMP indicator remains on when vehicle speed is “0”.

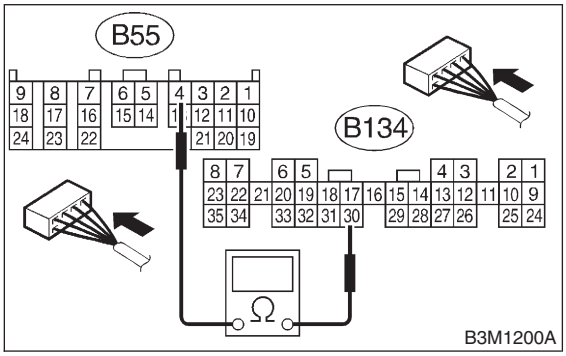
WIRING DIAGRAM:



8C1 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and ECM.
3) Measure resistance of harness between TCM and ECM connector.

Connector & terminal
(B55) No. 4 — (B134) No. 30:

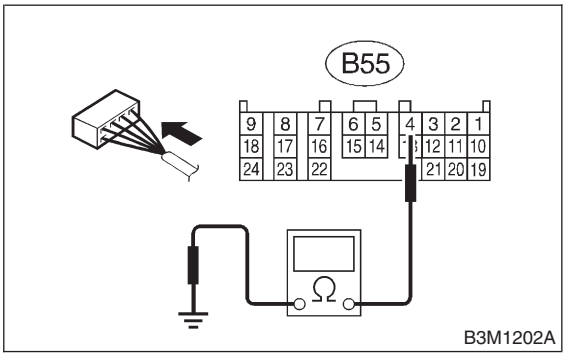


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8C2**.
NO : Repair open circuit in harness between TCM and ECM connector.

8C2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 4 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8C3**.
NO : Repair short circuit in harness between TCM and ECM connector.

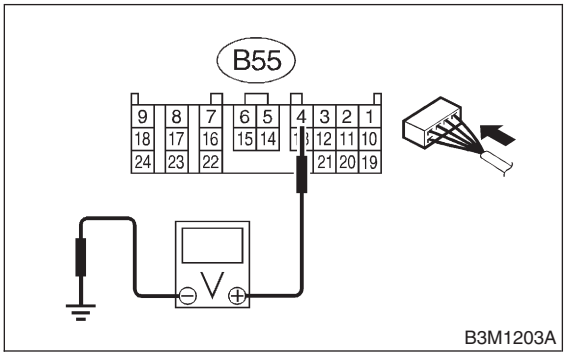
8C3 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8C5**.
NO : Go to step **8C4**.

8C4 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM and ECM.
2) Turn ignition switch to ON (engine OFF).
3) Measure voltage between TCM connector and chassis ground.

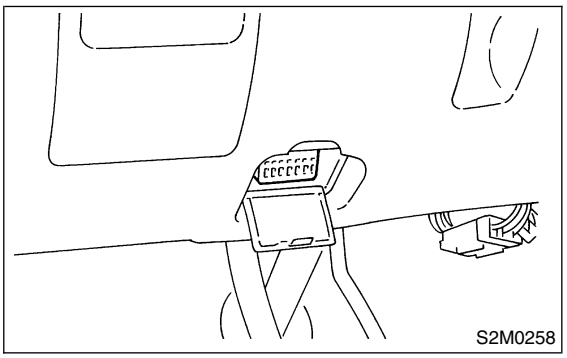
Connector & terminal
(B55) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10.5 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8C6**.

8C5 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and ECM.
2) Connect Subaru Select Monitor to data link connector.



3) Start the engine, and turn Subaru Select Monitor switch to ON.
4) Warm-up the engine until engine coolant temperature is above 80°C (176°F).
5) Engine idling.
6) Read data of engine speed using Subaru Select Monitor.
● Display shows engine speed signal value sent from ECM.

CHECK : ***Is the revolution value the same as the tachometer reading shown on the combination meter?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8C6**.

8C6 : CHECK POOR CONTACT.

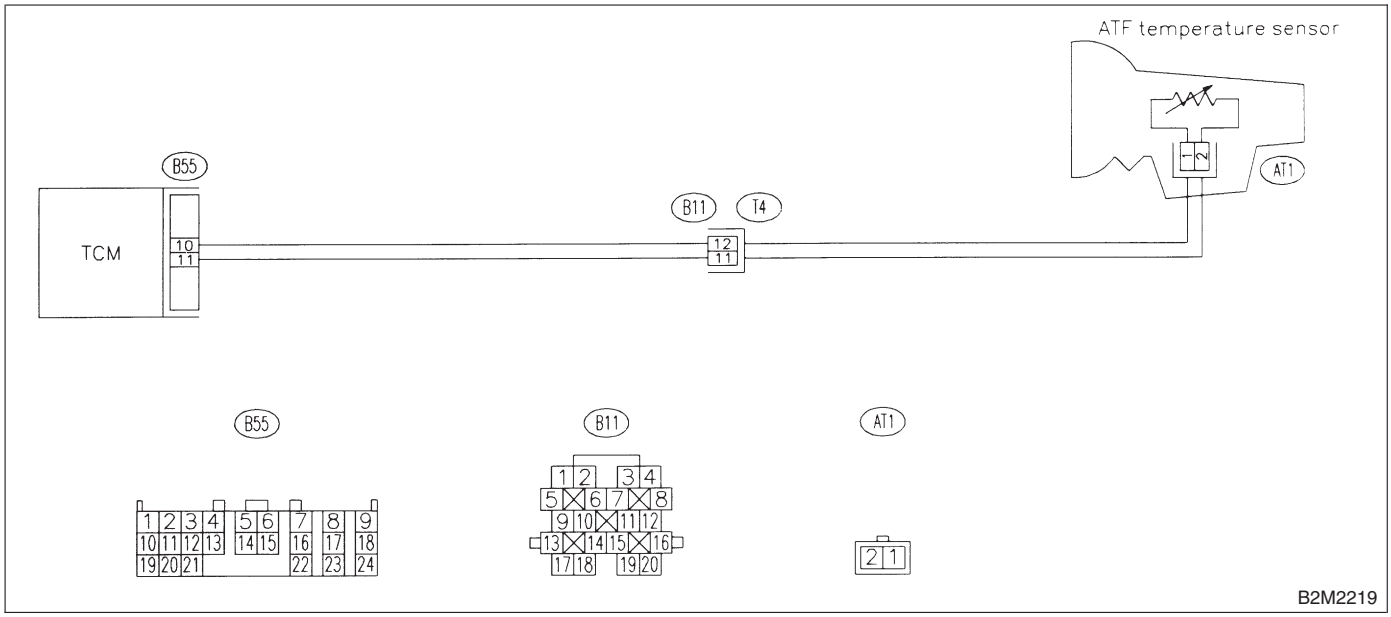
CHECK : ***Is there poor contact in engine speed signal circuit?***
YES : Repair poor contact.
NO : Go to step **8C7**.

8C7 : CONFIRM TROUBLE CODE 11.

CHECK : ***Replace ECM with a new one. Does the trouble code appear again, after the memory has been cleared?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

D: TROUBLE CODE 27 — ATF TEMPERATURE SENSOR —

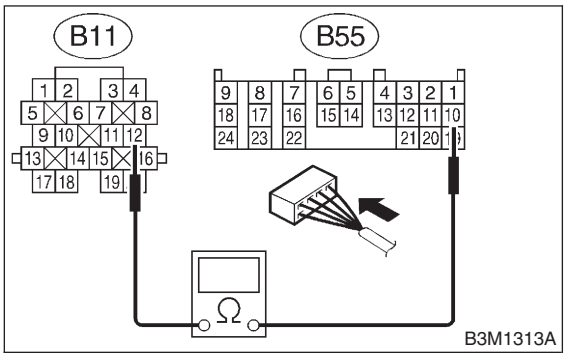
DIAGNOSIS:
Input signal circuit of TCM to ATF temperature sensor is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8D1 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission and TCM.
3) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 10 — (B11) No. 12:

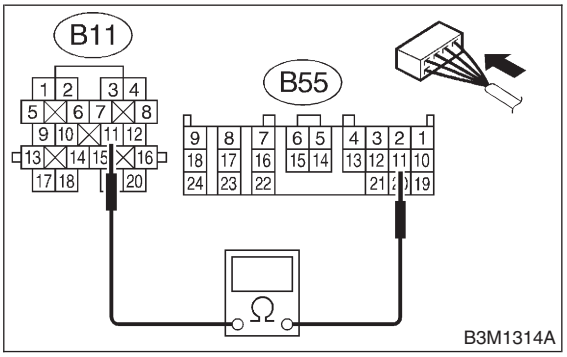


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D2**.
NO : Repair open circuit in harness between TCM and transmission connector.

8D2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 11 — (B11) No. 11:

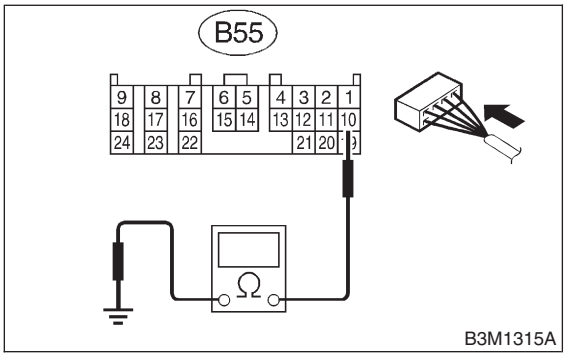


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D3**.
NO : Repair open circuit in harness between TCM and transmission connector.

8D3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 10 — Chassis ground:

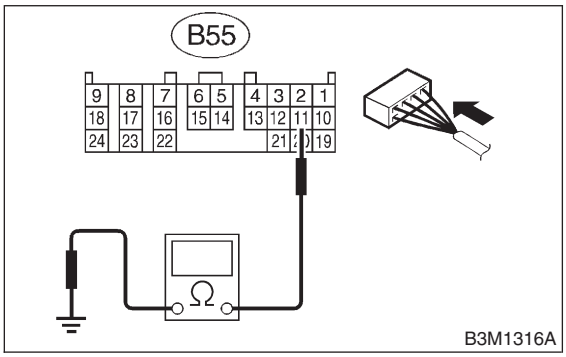


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8D4**.
NO : Repair short circuit in harness between TCM and transmission connector.

8D4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 11 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8D5**.
NO : Repair short circuit in harness between TCM and transmission connector.

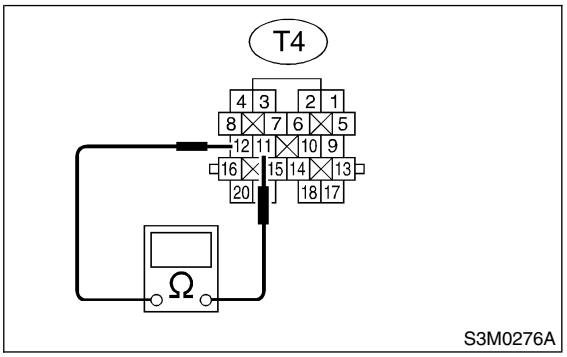
8D5 : CHECK ATF TEMPERATURE SENSOR.

1) Turn ignition switch to OFF.
2) Connect connectors to transmission and TCM.
3) Turn ignition switch to ON and start engine.
4) Warm-up the transmission until ATF temperature reaches to 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

5) Measure resistance between transmission connector terminals.
6) Disconnect connector from transmission.

Connector & terminal
(T4) No. 11 — No. 12:

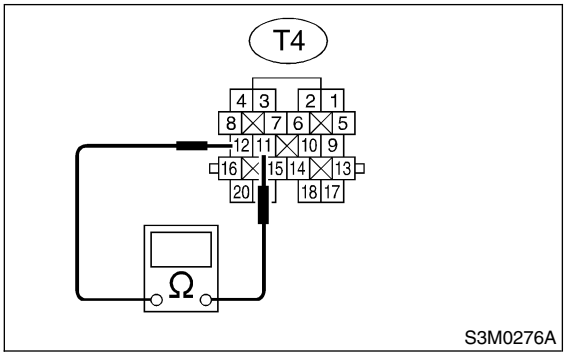


CHECK : ***Is the resistance between 275 and 375 Ω?***
YES : Go to step **8D6**.
NO : Go to step **8D12**.

8D6 : CHECK ATF TEMPERATURE SENSOR.

1) Turn ignition switch to ON (engine OFF).
2) Measure resistance between transmission connector terminals.

Connector & terminal
(T4) No. 11 — No. 12:



CHECK : ***Does the resistance value increase while the ATF temperature decreases?***
YES : Go to step **8D7**.
NO : Go to step **8D12**.

8D7 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8D9**.
NO : Go to step **8D8**.

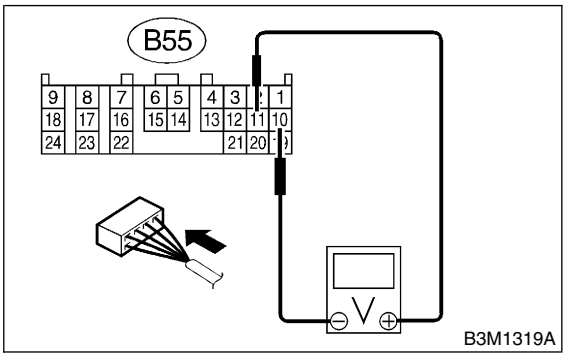
8D8 : CHECK INPUT SIGNAL FOR TCM.

1) Warm-up the transmission until ATF temperature is about 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

2) Measure voltage between TCM connector terminal.

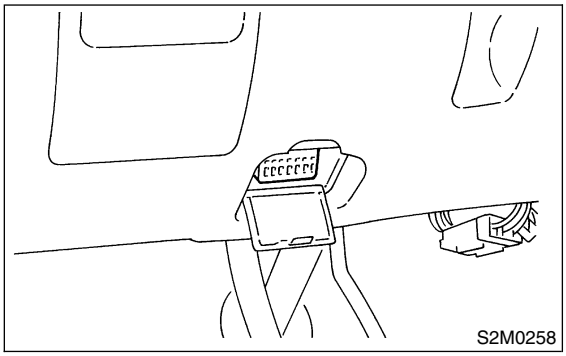
Connector & terminal
(B55) No. 11 (+) — No. 10 (–):



CHECK : ***Is the voltage between 0.5 and 0.8 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or contact in the TCM.
NO : Go to step **8D11**.

8D9 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Turn ignition switch to OFF.
2) Connect connectors to TCM and transmission.
3) Connect Subaru Select Monitor to data link connector.



4) Start the engine, and turn Subaru Select Monitor switch to ON.
5) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

6) Read data of ATF temperature using Subaru Select Monitor.
- ATF temperature is indicated in "°F" or "°C".

CHECK : ***Is the ATF temperature between 70 and 110°C (158 and 230°F).***
YES : Go to step **8D10**.
NO : Go to step **8D11**.

8D10 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

Turn ignition switch to ON (engine OFF).

CHECK : ***Does the ATF temperature gradually decrease?***
YES : Even if "AT OIL TEMP" light up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the case. Repair harness or contact in the ATF temperature sensor and transmission connector.
NO : Go to step **8D11**.

8D11 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in ATF temperature sensor circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

8D12 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Remove transmission connector from bracket.
4) Lift-up the vehicle and place safety stand.

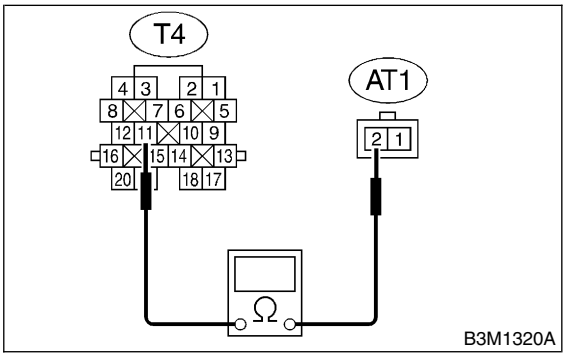
CAUTION:
On AWD models, raise all wheels off ground.

5) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

6) Remove oil pan, and disconnect connector from ATF temperature sensor connector.
7) Measure resistance of harness between ATF temperature sensor and transmission connector.

Connector & terminal
(T4) No. 11 — (AT1) No. 2:

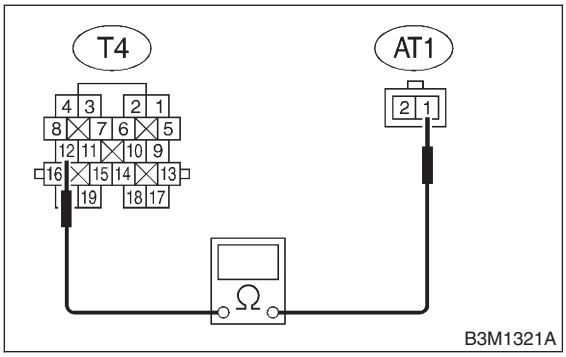


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D13**.
NO : Repair open circuit in harness between ATF temperature sensor and transmission connector.

8D13 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between ATF temperature sensor and transmission connector.

Connector & terminal
(T4) No. 12 — (AT1) No. 1:

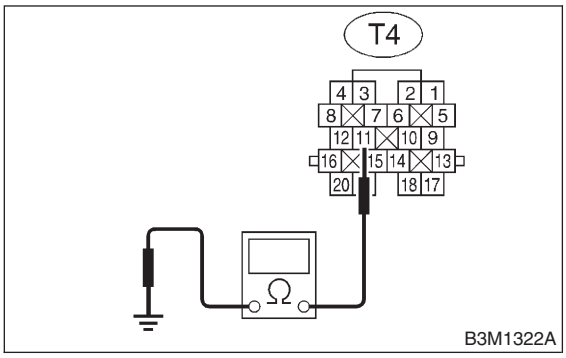


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8D14**.
NO : Repair open circuit in harness between ATF temperature sensor and transmission connector.

8D14 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between transmission connector and transmission ground.

Connector & terminal
(T4) No. 11 — Transmission ground:

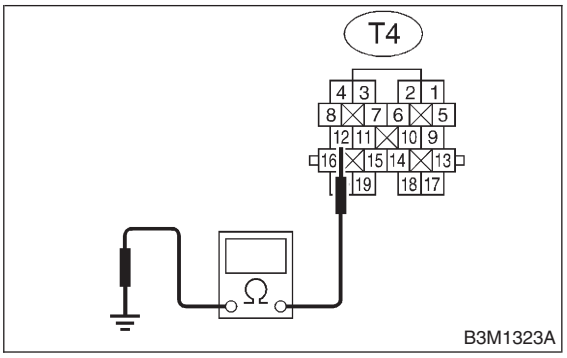


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8D15**.
NO : Repair short circuit in harness between ATF temperature sensor and transmission connector.

8D15 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.

Measure resistance of harness between transmission connector and transmission ground.

Connector & terminal
(T4) No. 12 — Transmission ground:

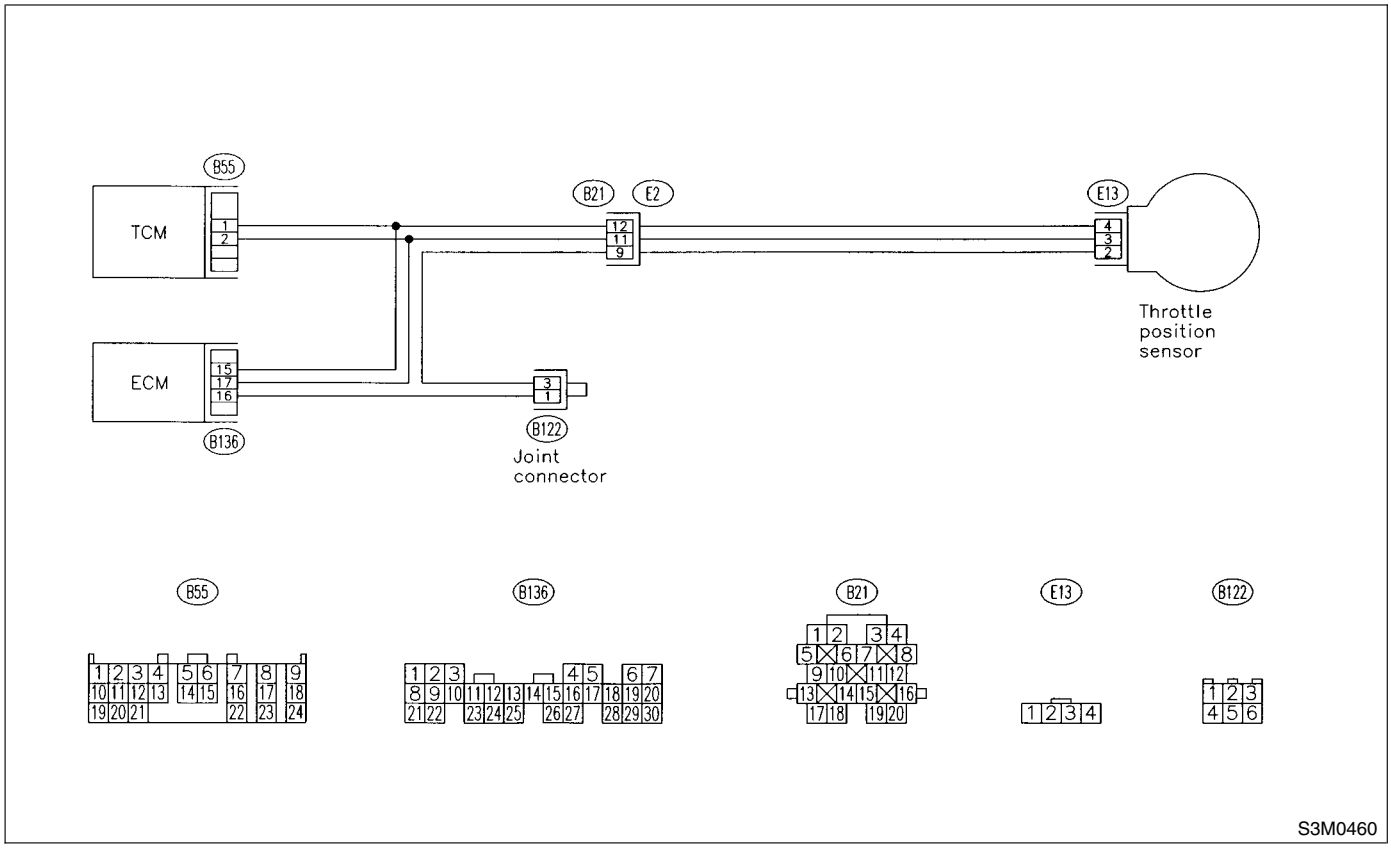


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Replace ATF temperature sensor. <Ref. to 3-2 [W4A0].>
NO : Repair short circuit in harness between ATF temperature sensor and transmission connector.

MEMO:

E: TROUBLE CODE 31 — THROTTLE POSITION SENSOR —

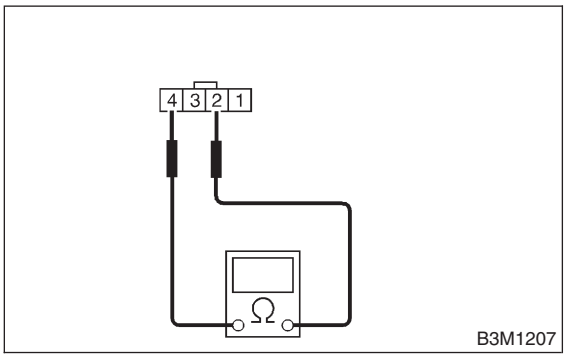
DIAGNOSIS:
Input signal circuit of throttle position sensor is open or shorted.
TROUBLE SYMPTOM:
Shift point too high or too low; engine brake not effected in “3” range: excessive shift shock; excessive tight corner “braking”.
WIRING DIAGRAM:



8E1 : CHECK THROTTLE POSITION SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from throttle position sensor.
3) Measure resistance between throttle position sensor connector receptacle's terminals.

Terminals
No. 4 — No. 2:

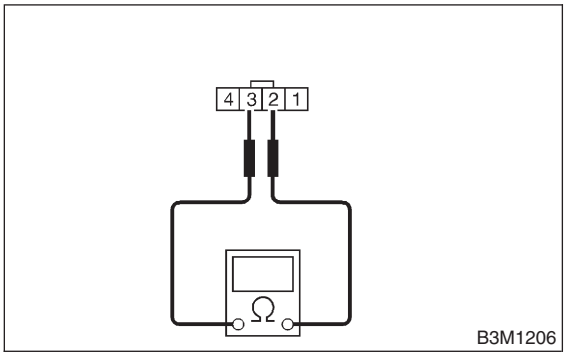


CHECK : ***Is the resistance between 0.3 and 0.7 kΩ?***
YES : Go to step **8E2**.
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

8E2 : CHECK THROTTLE POSITION SENSOR.

Measure resistance between throttle position sensor connector receptacle's terminals.

Terminals
No. 2 — No. 3:

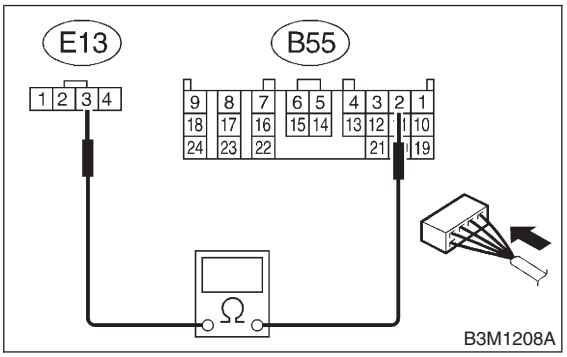


CHECK : ***Is the resistance between 3.5 and 6.5 kΩ?***
YES : Go to step **8E3**.
NO : Replace throttle position sensor. <Ref. to 2-7 [W10A0].>

8E3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND THROTTLE POSITION SENSOR.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and throttle position sensor connector.

Connector & terminal
(B55) No. 2 — (E13) No. 3:

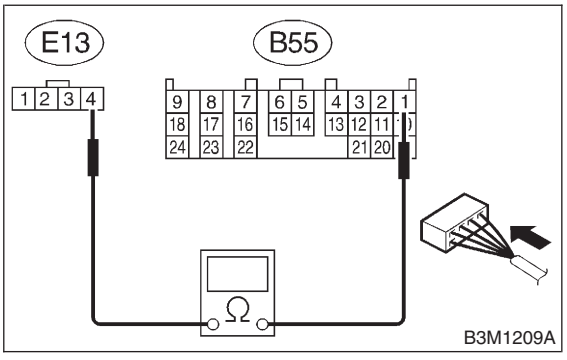


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8E4**.
NO : Repair open circuit in harness between TCM and throttle position sensor connector.

8E4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND THROTTLE POSITION SENSOR.

Measure resistance of harness between TCM and throttle position sensor connector.

Connector & terminal
(B55) No. 1 — (E13) No. 4:

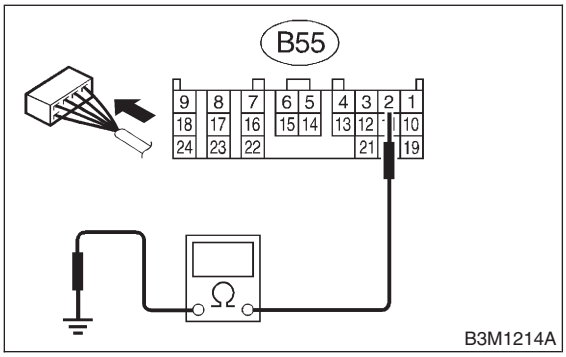


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8E5**.
NO : Repair open circuit in harness between TCM and throttle position sensor connector.

8E5 : CHECK HARNESS CONNECTOR BETWEEN TCM AND THROTTLE POSITION SENSOR.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 2 — Chassis ground:

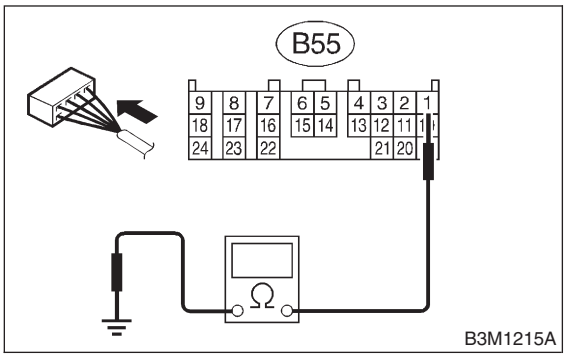


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8E6**.
NO : Repair short circuit in harness between TCM and throttle position sensor connector.

8E6 : CHECK HARNESS CONNECTOR BETWEEN TCM AND THROTTLE POSITION SENSOR.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 1 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8E7**.
NO : Repair short circuit in harness between TCM and throttle position sensor connector.

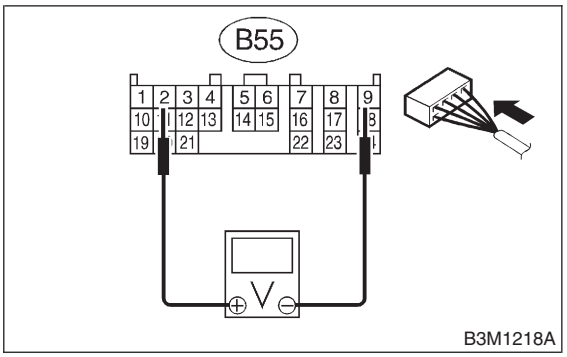
8E7 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8E10**.
NO : Go to step **8E8**.

8E8 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM, throttle position sensor and ECM.
2) Turn ignition switch to ON (engine OFF).
3) Measure voltage between TCM connector terminals.

Connector & terminal
(B55) No. 2 (+) — No. 9 (–):

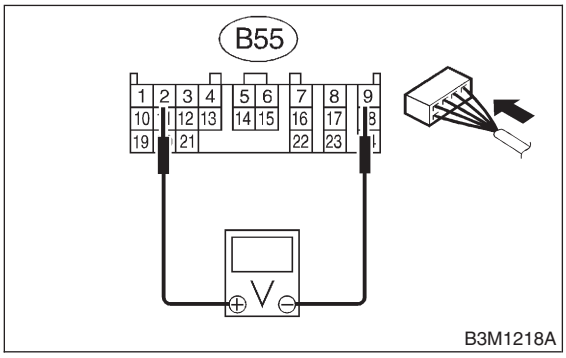


CHECK : ***Is the voltage between 0.3 and 0.7 V in throttle fully closed?***
YES : Go to step **8E9**.
NO : Go to step **8E14**.

8E9 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM connector terminals.

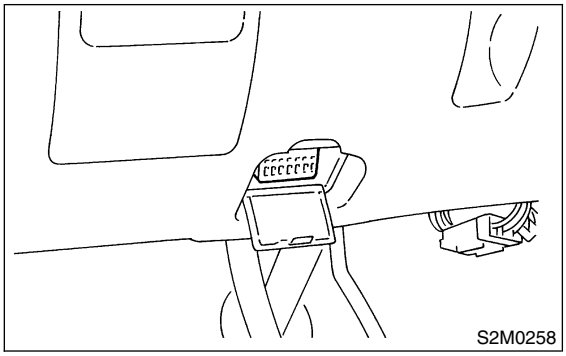
Connector & terminal
(B55) No. 2 (+) — No. 9 (–):



CHECK : ***Is the voltage between 4.3 and 4.9 V with throttle fully open?***
YES : Go to step **8E12**.
NO : Go to step **8E14**.

8E10 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM, throttle position sensor and ECM.
2) Connect Subaru Select Monitor to data link connector.



3) Turn ignition switch to ON (engine OFF).
4) Turn Subaru Select Monitor switch to ON.
5) Throttle fully closed.
6) Read data of throttle position sensor using Subaru Select Monitor.
- Throttle position sensor input signal is indicated.

CHECK : ***Is the value voltage between 0.3 and 0.7 V?***
YES : Go to step **8E11**.
NO : Go to step **8E14**.

8E11 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

Throttle fully open.

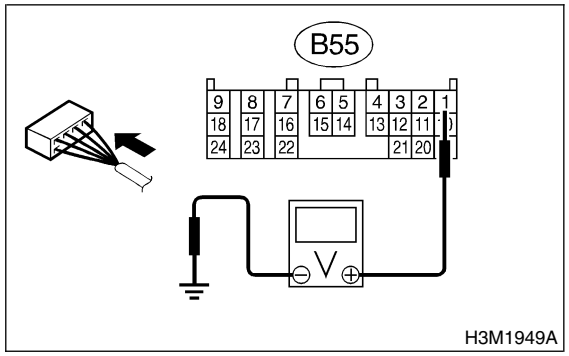
NOTE:
Must be changed correspondingly with accelerator pedal operation (from “released” to “depressed” position).

CHECK : ***Is the value voltage between 4.3 and 4.9 V?***
YES : Go to step **8E13**.
NO : Go to step **8E14**.

8E12 : CHECK INPUT SIGNAL FOR TCM (THROTTLE POSITION SENSOR POWER SUPPLY).

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B55) No. 1 (+) — Chassis ground:



CHECK : ***Is the voltage between 4.8 and 5.3 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in throttle position sensor circuit.
NO : Go to step **8E14**.

8E13 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR (THROTTLE POSITION SENSOR POWER SUPPLY).

Read data of throttle position sensor power supply using Subaru Select Monitor.
● Throttle position sensor power supply voltage is indicated.

CHECK : ***Is the value voltage between 4.8 and 5.3 V?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in throttle position sensor circuit.

NO : Go to step **8E14**.

8E14 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in throttle position sensor circuit?***

YES : Repair poor contact.

NO : Replace TCM. <Ref. to 3-2 [W23A0].>

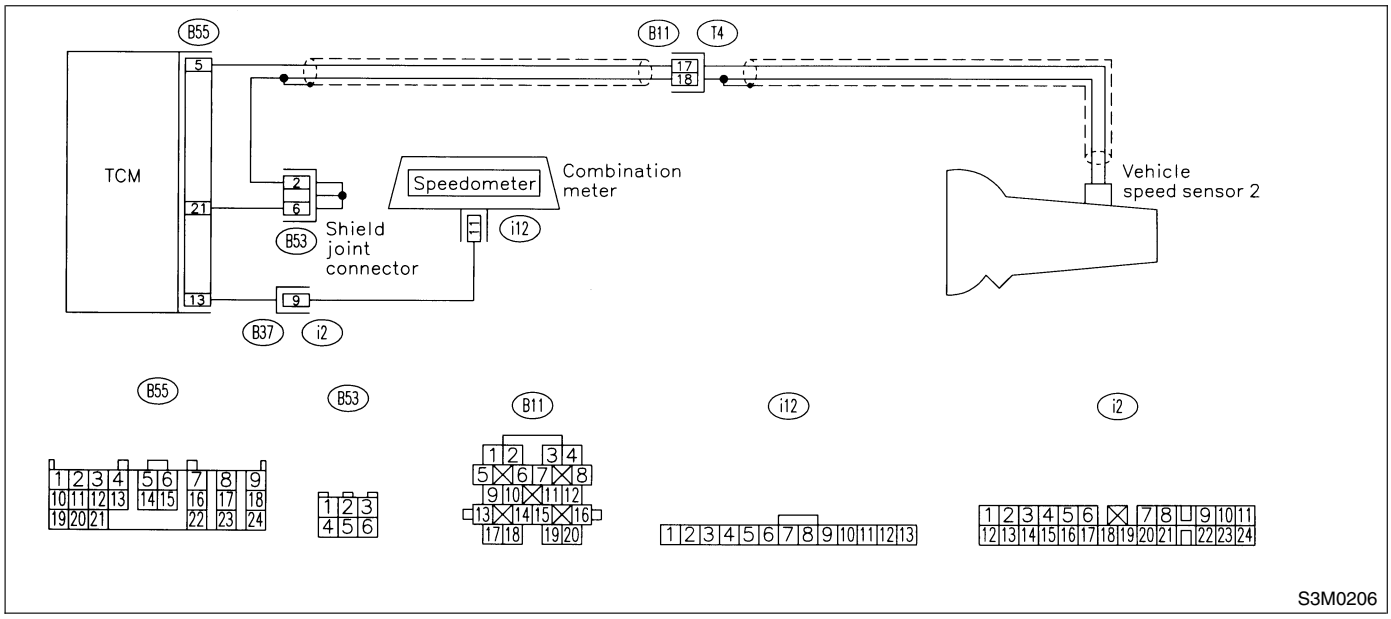
MEMO:

F: TROUBLE CODE 33 — VEHICLE SPEED SENSOR 2 (FRONT) —

DIAGNOSIS:
- The vehicle speed signal is abnormal.
- The circuit in combination meter is faulty.
- The harness connector between TCM and vehicle speed sensor is in short or open.

TROUBLE SYMPTOM:
- Erroneous idling.
- Engine stalls.
- Poor driving performance.

WIRING DIAGRAM:



8F1 : CHECK OPERATION OF SPEEDOMETER.

CHECK : ***Does speedometer operate normally?***

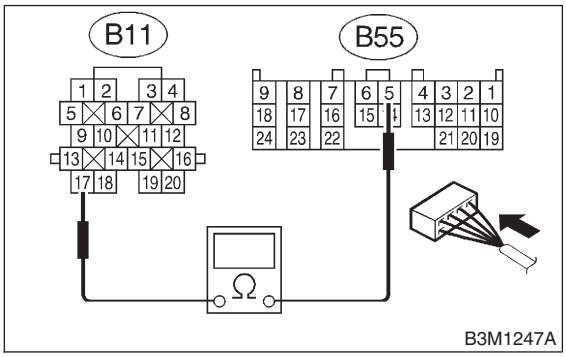
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.

NO : Go to step **8F2**.

8F2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 5 — (B11) No. 17:

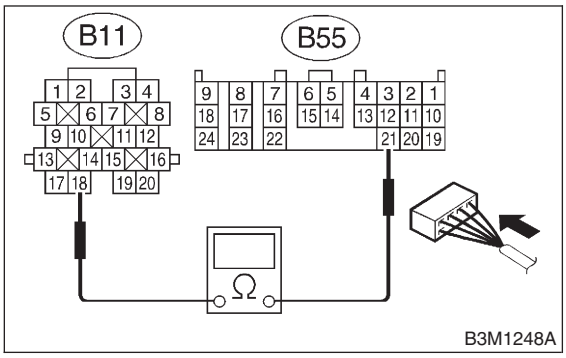


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8F3**.
NO : Repair open circuit in harness between TCM and transmission connector.

8F3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 21 — (B11) No. 18:

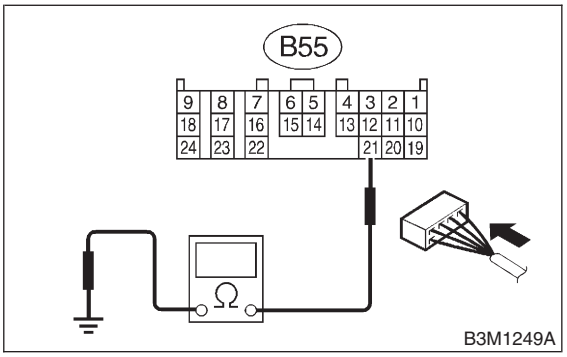


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8F4**.
NO : Repair open circuit in harness between TCM and transmission connector, and poor contact in coupling connector.

8F4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 21 — Chassis ground:

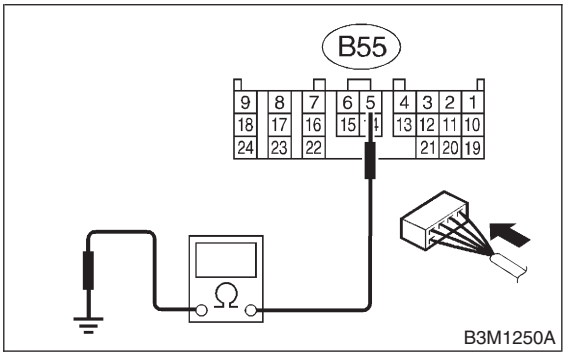


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8F5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8F5 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 5 — Chassis ground:

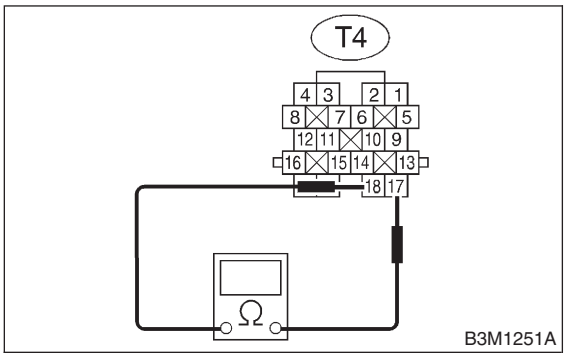


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8F6**.
NO : Repair short circuit in harness between TCM and transmission connector.

8F6 : CHECK VEHICLE SPEED SENSOR 2.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector receptacle's terminals.

Connector & terminal
(T4) No. 17 — No. 18:



CHECK : ***Is the resistance between 450 and 650 Ω?***
YES : Go to step **8F7**.
NO : Replace vehicle speed sensor 2. <Ref. to 3-2 [W12B0].>

8F7 : PREPARE OSCILLOSCOPE.

CHECK : ***Do you have oscilloscope?***
YES : Go to step **8F10**.
NO : Go to step **8F8**.

8F8 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8F11**.
NO : Go to step **8F9**.

8F9 : CHECK INPUT SIGNAL FOR TCM.

1) Connect all connectors.
2) Lift-up or raise the vehicle and place safety stands.

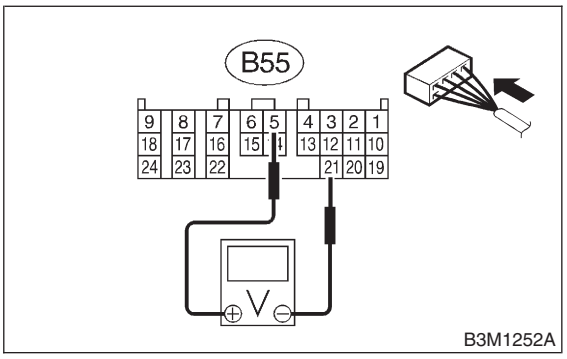
CAUTION:
On AWD models, raise all wheels off floor.

3) Start the engine and set vehicle in 20 km/h (12 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

4) Measure voltage between TCM connector terminals.

Connector & terminal
(B55) No. 5 (+) — No. 21 (–):



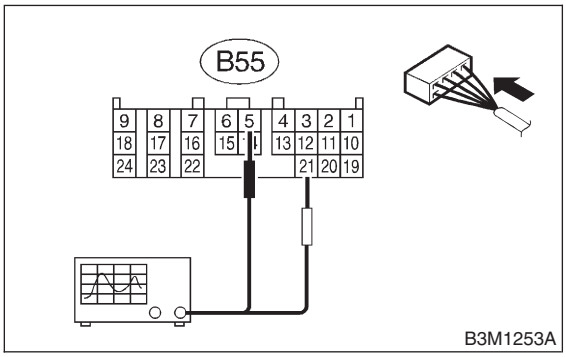
CHECK : ***Is the voltage more than AC 1 V?***
YES : Go to step **8F12**.
NO : Go to step **8F19**.

8F10 : CHECK VEHICLE SPEED SENSOR 2 USING OSCILLOSCOPE.

1) Connect all connectors.
2) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

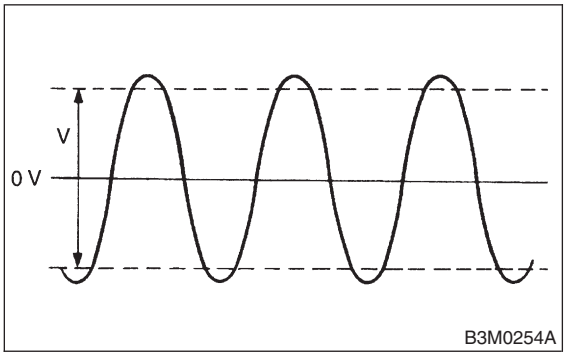
3) Set oscilloscope to TCM connector terminals.
Positive prove; (B55) No. 5
Earth lead; (B55) No. 21



4) Start the engine, and drive the wheels slowly.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunctions. When AT control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system. <Ref. to 4-4 [T6D2].>

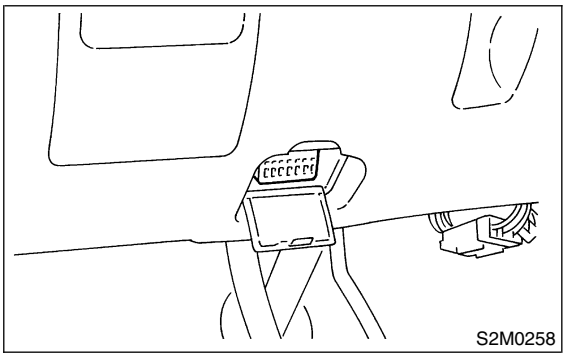
5) Measure signal voltage indicated on oscilloscope.



CHECK : ***Is the voltage more than AC 4 V?***
YES : Go to step **8F12**.
NO : Go to step **8F19**.

8F11 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect all connectors.
2) Connect Subaru Select Monitor to data link connector.



3) Lift-up or raise the vehicle and place safety stands.

CAUTION:
On AWD models, raise all wheels off floor.

4) Turn ignition switch to ON and turn Subaru Select Monitor switch to ON.
5) Start the engine.
6) Read data of vehicle speed using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in “km/h” or “MPH”.
7) Slowly increase vehicle speed to 60 km/h or 37 MPH.

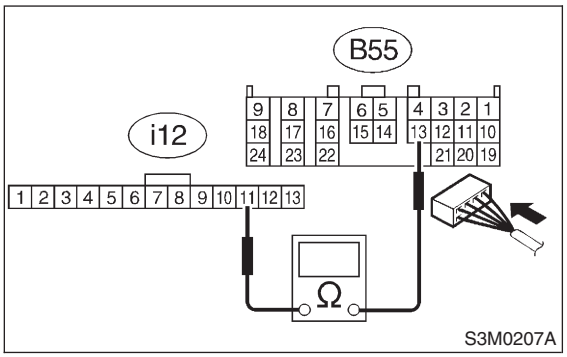
NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Go to step **8F12**.
NO : Go to step **8F19**.

8F12 : CHECK HARNESS CONNECTOR BETWEEN TCM AND COMBINATION METER.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and combination meter.
3) Measure resistance of harness between TCM and combination meter connector.

Connector & terminal
(B55) No. 13 — (i12) No. 11:

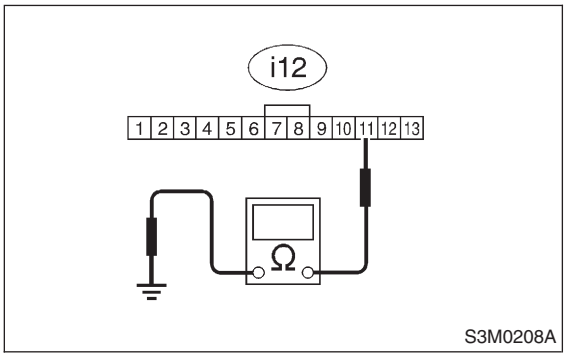


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8F13**.
NO : Repair open circuit in harness between TCM and combination meter connector, and poor contact in coupling connector.

8F13 : CHECK HARNESS CONNECTOR BETWEEN TCM AND COMBINATION METER.

Measure resistance of harness between combination meter and chassis ground.

Connector & terminal
(i12) No. 11 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8F14**.
NO : Repair short circuit in harness between TCM and combination meter connector.

8F14 : PREPARE OSCILLOSCOPE.

CHECK : ***Do you have oscilloscope?***
YES : Go to step **8F17**.
NO : Go to step **8F15**.

8F15 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8F18**.
NO : Go to step **8F16**.

8F16 : CHECK OUTPUT SIGNAL FOR TCM.

1) Connect all connectors.
2) Lift-up the vehicle and place safety stand.

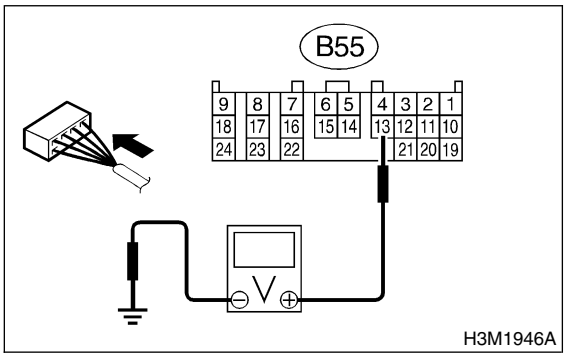
CAUTION:
On AWD models, raise all wheels off ground.

3) Set vehicle in 10 km/h (6 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure on on-board diagnostics system. <Ref. to 4-4 [T6D2].>

4) Measure voltage between TCM connector terminals.

Connector & terminal
(B55) No. 13 — Chassis ground:



CHECK : ***Is the voltage less than 1 V ←→ more than 4 V?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM.

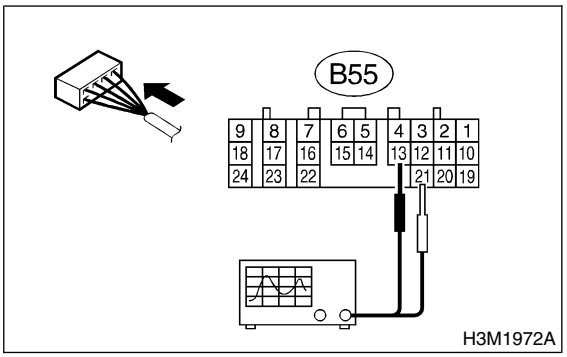
NO : Go to step **8F19**.

8F17 : CHECK INPUT SIGNAL FOR TCM USING OSCILLOSCOPE.

1) Connect connectors to TCM and combination meter.
2) Lift-up or raise the vehicle and place safety stands.

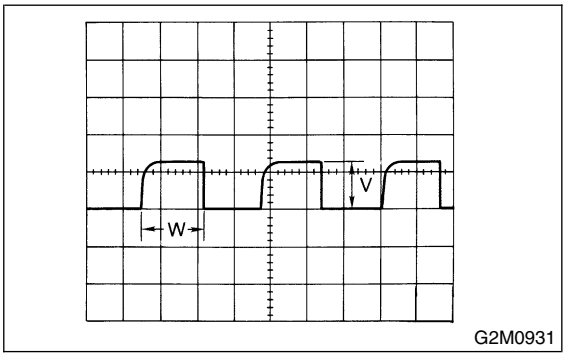
CAUTION:
On AWD models, raise all wheels off floor.

3) Set oscilloscope to TCM connector terminals.
Positive prove; (B55) No. 13
Earth lead; (B55) No. 21



4) Start the engine.
5) Shift on the gear position, and keep the vehicle speed at constant.
6) Measure signal voltage indicated on oscilloscope.

NOTE:
● If vehicle speed increases, the width of amplitude (W) decreases.
● The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>



CHECK : ***Is the voltage more than AC 2 V?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM.

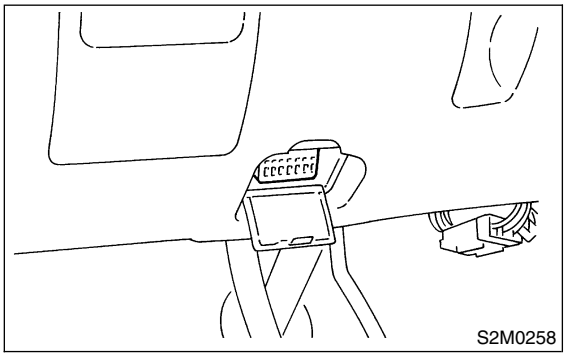
NO : Go to step **8F19**.

8F18 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect all connectors.
2) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Connect Subaru Select Monitor to data link connector.



4) Turn ignition switch to ON and Subaru Select Monitor switch to ON.
5) Start the engine, and drive all wheels.
6) Read data of vehicle speed using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in “km/h” or “MPH”.
7) Slowly increase vehicle speed to 60 km/h or 37 MPH.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM.
NO : Go to step **8F19**.

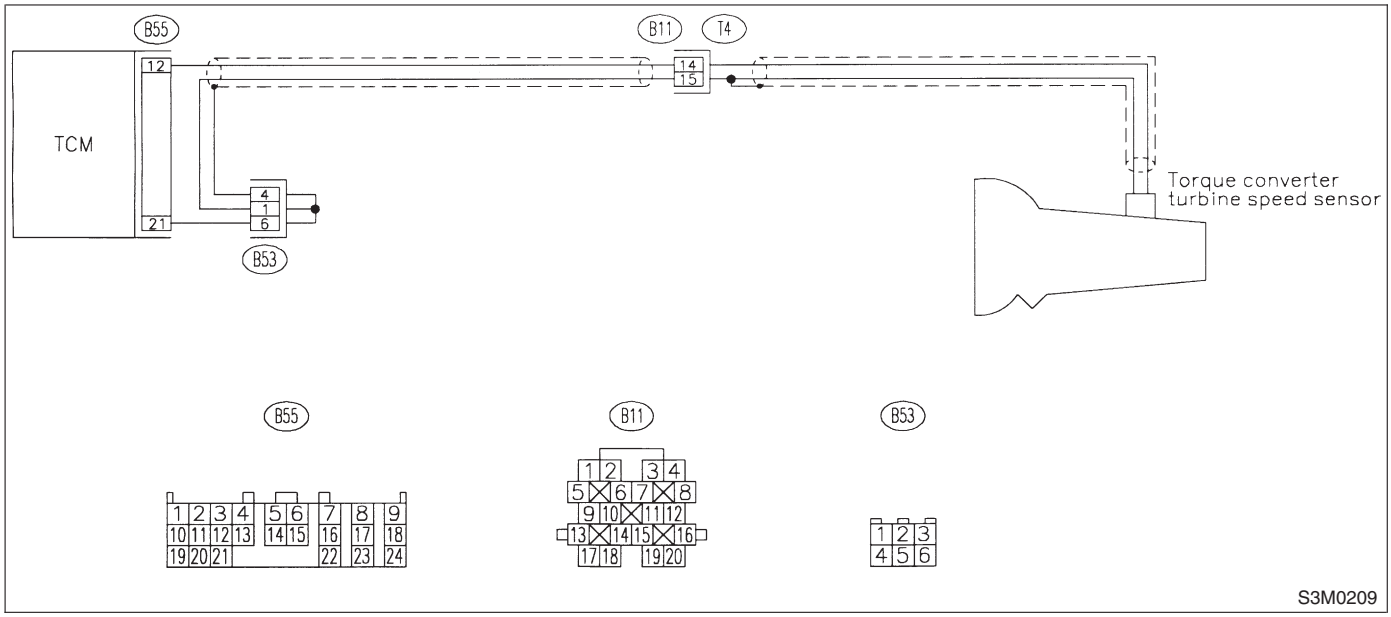
8F19 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in vehicle speed sensor 2 circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

MEMO:

G: TROUBLE CODE 36 — TORQUE CONVERTER TURBINE SPEED SENSOR —

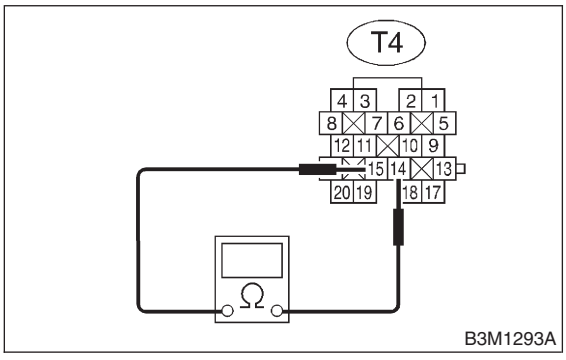
DIAGNOSIS:
Input signal circuit of TCM is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8G1 : CHECK VEHICLE SPEED SENSOR 1.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector receptacle's terminals.

Connector & terminal
(T4) No. 14 — No. 15:

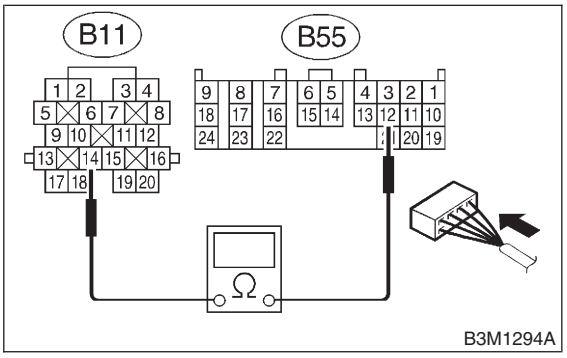


CHECK : ***Is the resistance between 450 and 650 Ω?***
YES : Go to step **8G2**.
NO : Replace torque converter turbine speed sensor. <Ref. to 3-2 [W12A0].>

8G2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 12 — (B11) No. 14:

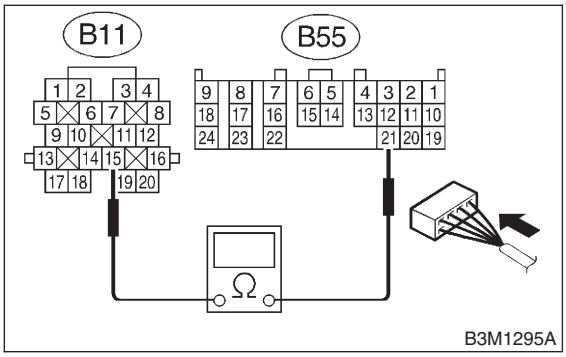


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8G3**.
NO : Repair open circuit in harness between TCM and transmission connector.

8G3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 21 — (B11) No. 15:

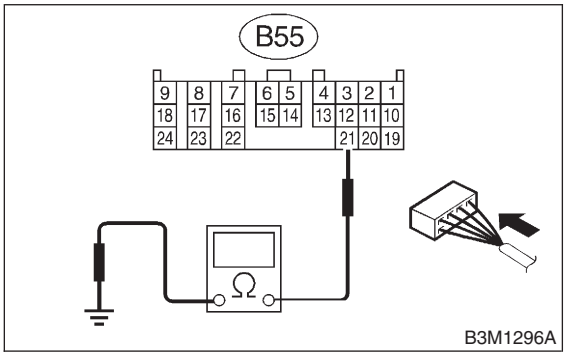


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8G4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8G4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 21 — Chassis ground:

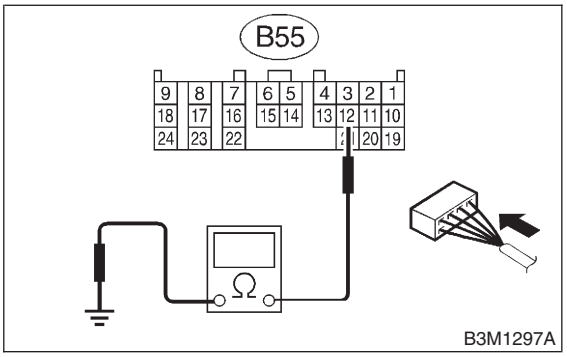


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8G5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8G5 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 12 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8G6**.
NO : Repair short circuit in harness between TCM and transmission connector.

8G6 : PREPARE OSCILLOSCOPE.

CHECK : ***Do you have oscilloscope?***
YES : Go to step **8G10**.
NO : Go to step **8G7**.

8G7 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8G9**.
NO : Go to step **8G8**.

8G8 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and place safety stands.

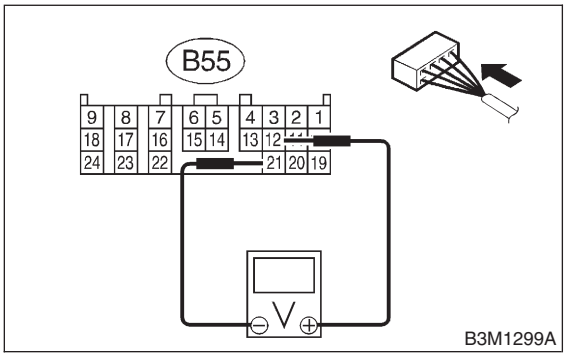
CAUTION:
Raise all wheels off floor.

3) Start the engine and set vehicle in 20 km/h (12 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

4) Measure voltage between TCM connector terminals.

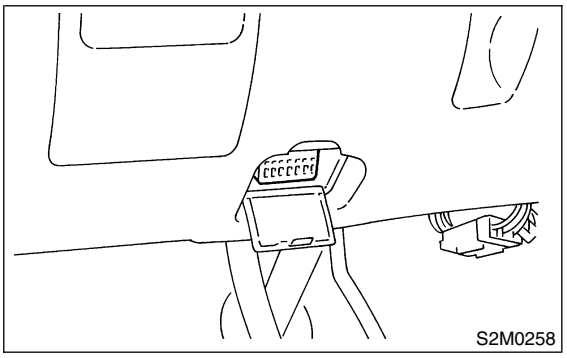
Connector & terminal
(B55) No. 12 (+) — No. 21 (–):



CHECK : ***Is the voltage more than AC 1 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.
NO : Go to step **8G11**.

8G9 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and transmission.
2) Connect Subaru Select Monitor to data link connector.



3) Lift-up or raise the vehicle and place safety stands.

CAUTION:
Raise all wheels off floor.

4) Turn ignition switch to ON and turn Subaru Select Monitor switch to ON.
5) Start the engine.
6) Read data of vehicle speed using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in “km/h” or “MPH”.
7) Slowly increase vehicle speed to 20 km/h or 12 MPH.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

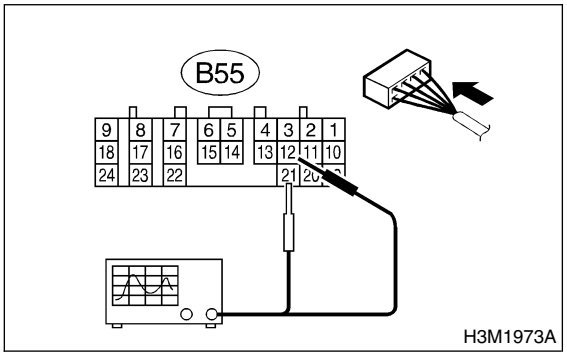
CHECK : ***Is the revolution value same as the tachometer reading shown on the combination meter?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.
NO : Go to step **8G11**.

8G10 : CHECK INPUT SIGNAL FOR TCM USING OSCILLOSCOPE.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and place safety stands.

CAUTION:
Raise all wheels off floor.

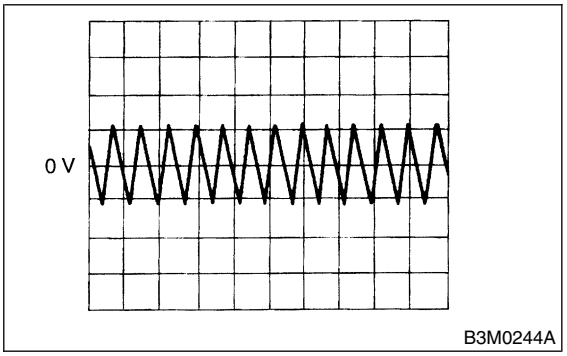
3) Set oscilloscope to TCM connector terminals.
Position prove; (B55) No. 12
Earth lead; (B55) No. 21



4) Start the engine and set vehicle in 20 km/h (12 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure signal voltage indicated on oscilloscope.



CHECK : ***Is the signal voltage more than AC 1 V?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.

NO : Go to step **8G11**.

8G11 : CHECK POOR CONTACT.

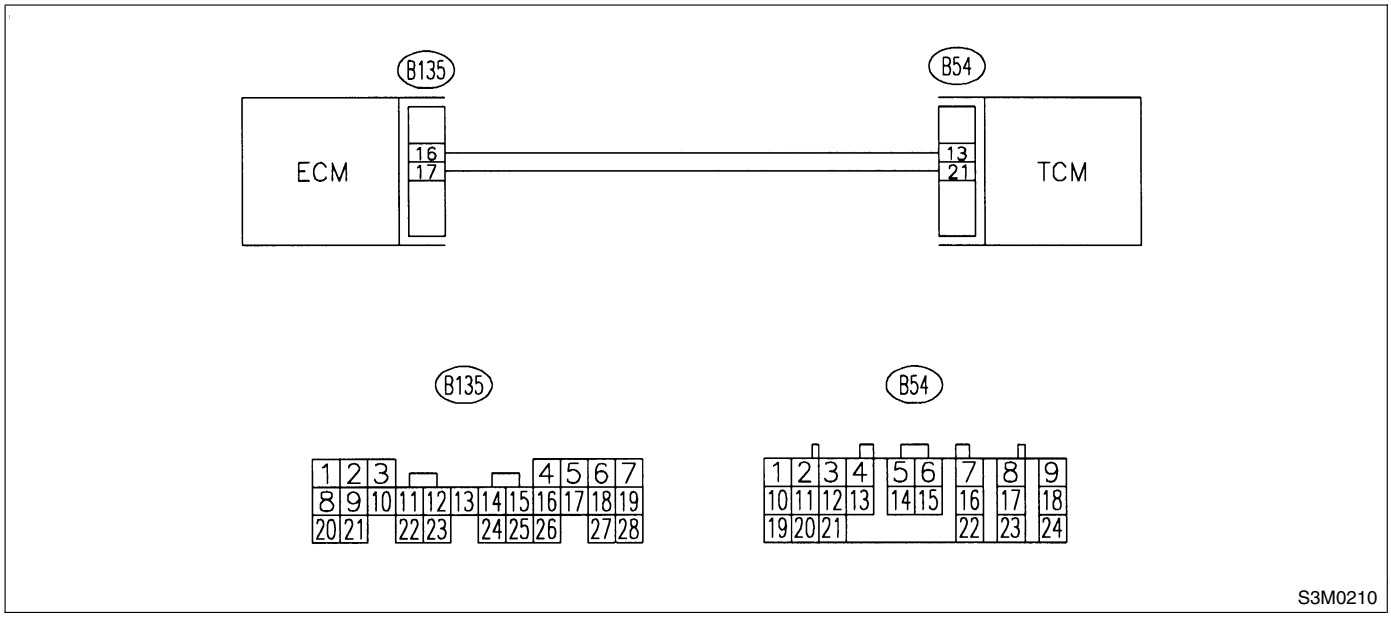
CHECK : ***Is there poor contact in vehicle speed sensor 1 circuit?***

YES : Repair poor contact.

NO : Replace TCM. <Ref. to 3-2 [W23A0].>

H: TROUBLE CODE 38 — TORQUE CONTROL SIGNAL —

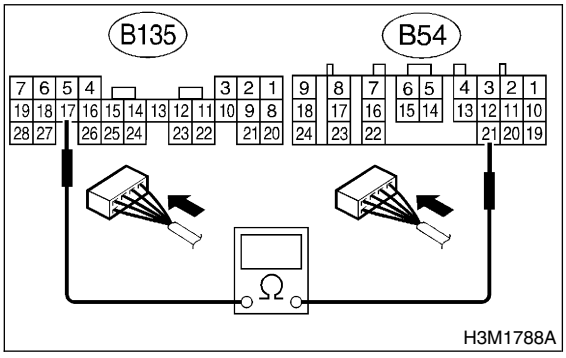
DIAGNOSIS:
● The signal circuit is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8H1 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and ECM.
3) Measure resistance of harness between TCM and ECM connector.

Connector & terminal
(B54) No. 21 — (B135) No. 17:

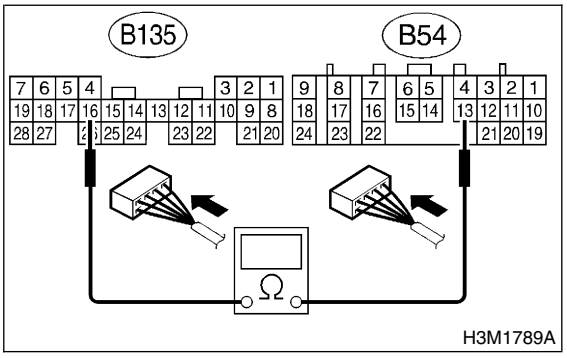


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8H2**.
NO : Repair open circuit in harness between TCM and ECM connector.

8H2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

Measure resistance of harness between TCM and ECM connector.

Connector & terminal
(B54) No. 13 — (B135) No. 16:

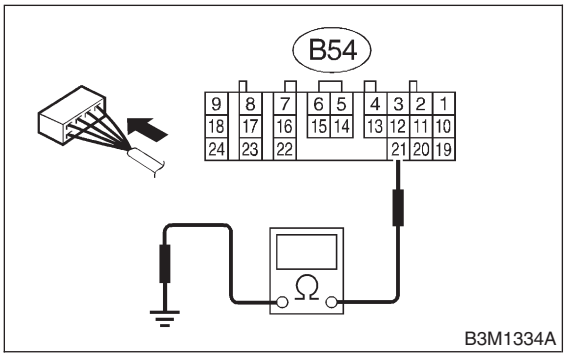


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8H3**.
NO : Repair open circuit in harness between TCM and ECM connector.

8H3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 21 — Chassis ground:

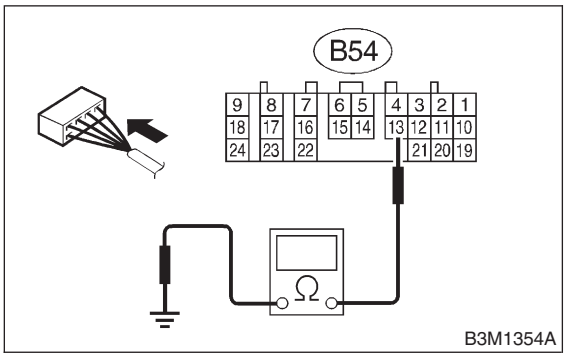


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8H4**.
NO : Repair short circuit in harness between TCM and ECM connector.

8H4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 13 — Chassis ground:

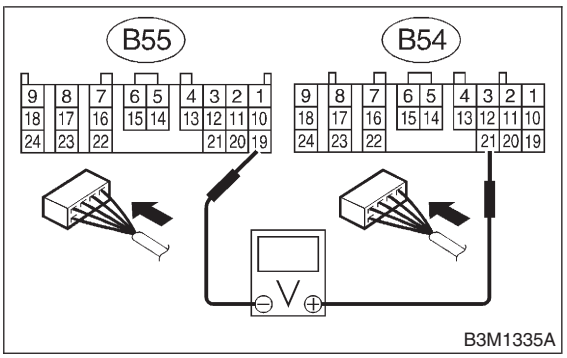


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8H5**.
NO : Repair short circuit in harness between TCM and ECM connector.

8H5 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and ECM.
2) Turn ignition switch to ON (engine OFF).
3) Measure voltage between TCM connector terminals.

Connector & terminal
(B54) No. 21 (+) — (B55) No. 19:

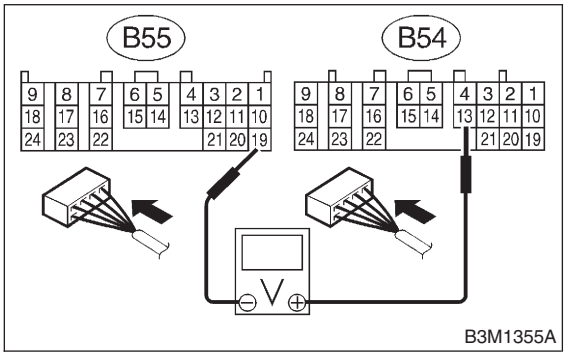


CHECK : ***Is the voltage more than 9 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8H6**.

8H6 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector terminals.

Connector & terminal
(B54) No. 13 (+) — (B55) No. 19 (–):



CHECK : ***Is the voltage between 4 and 6 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8H7**.

8H7 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in torque control signal circuit?***
YES : Repair poor contact.
NO : Go to step **8H8**.

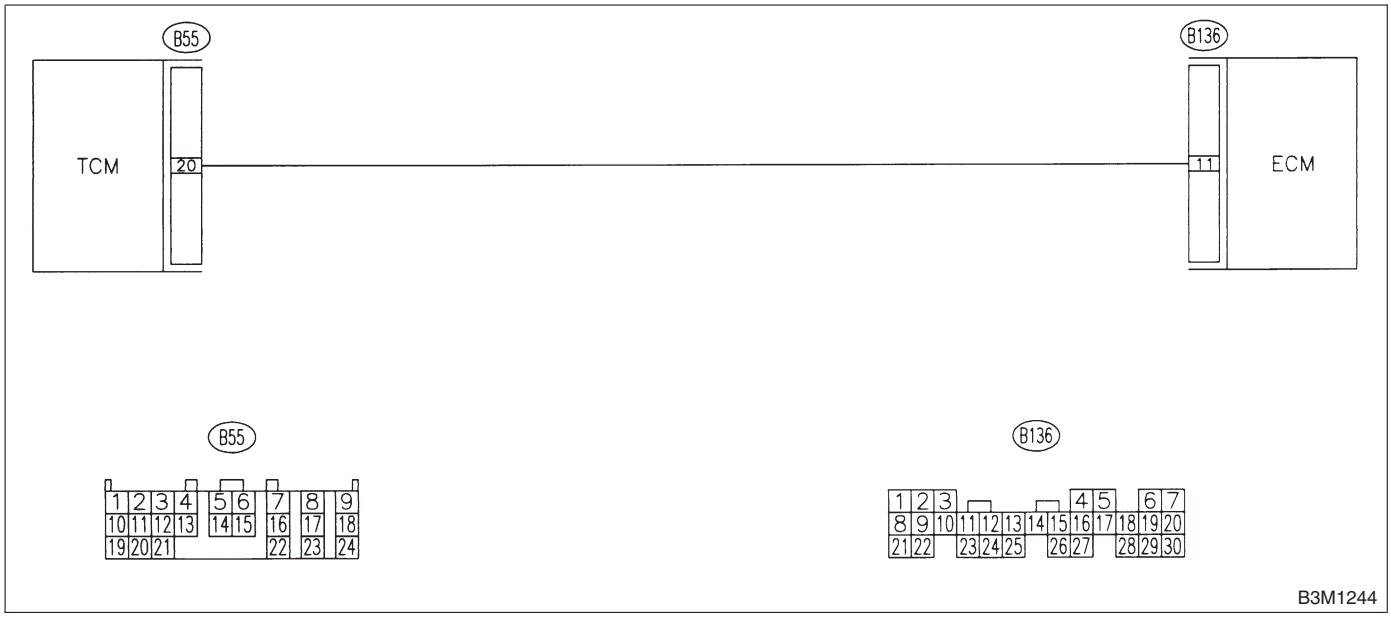
8H8 : CONFIRM TROUBLE CODE 38.

CHECK : ***Replace ECM with a new one. Does the trouble code appear again, after the memory has been cleared?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Replace ECM. <Ref. to 2-7 [W17A0].>

MEMO:

I: TROUBLE CODE 45 — INTAKE MANIFOLD PRESSURE SIGNAL —

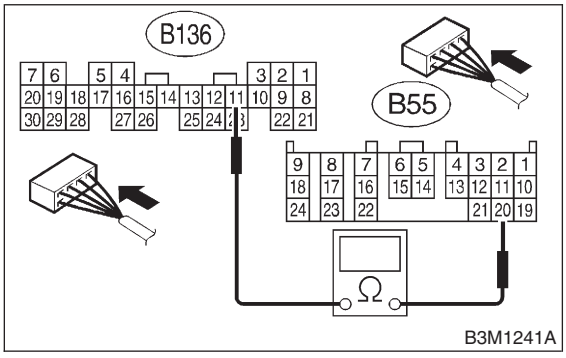
DIAGNOSIS:
Input signal circuit of TCM from ECM is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8I1 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and ECM.
3) Measure resistance of harness between TCM and ECM connector.

Connector & terminal
(B55) No. 20 — (B136) No. 11:

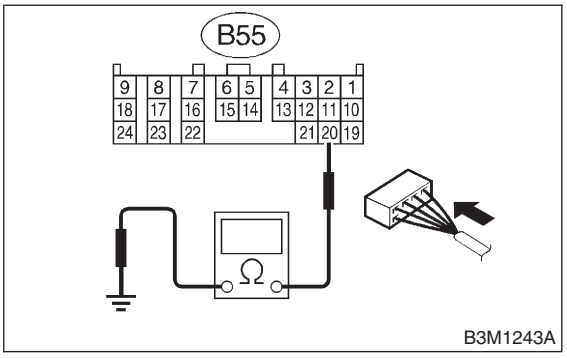


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8I2**.
NO : Repair open circuit in harness between TCM and ECM connector.

8I2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B55) No. 20 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8I3**.
NO : Repair short circuit in harness between TCM and ECM connector.

8I3 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8I5**.
NO : Go to step **8I4**.

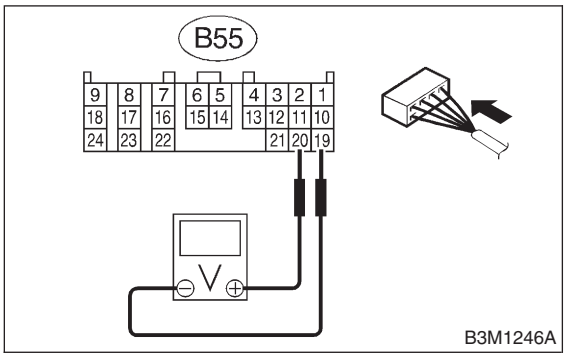
8I4 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM and ECM.
2) Start the engine, and warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Engine idling.
4) Measure voltage between TCM connectors.

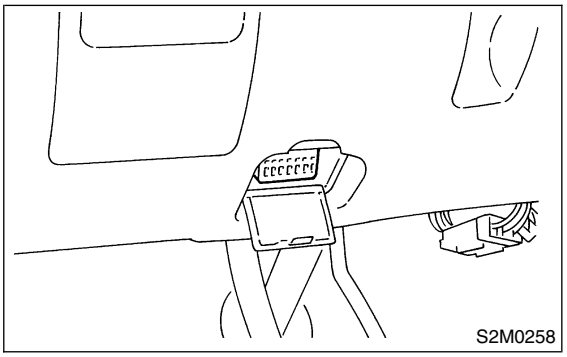
Connector & terminal
(B55) No. 20 (+) — No. 19 (–):



CHECK : ***Is the voltage between 1.2 and 1.8 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8I6**.

8I5 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and ECM.
2) Turn ignition switch to OFF.
3) Connect Subaru Select Monitor to data link connector.



4) Start the engine, and turn Subaru Select monitor switch to ON.
5) Warm-up the engine until engine coolant temperature is above 80°C (176°F).
6) Engine idling.
7) Read data of intake manifold pressure signal using Subaru Select Monitor.
● Display shows intake manifold pressure signal value sent from ECM.

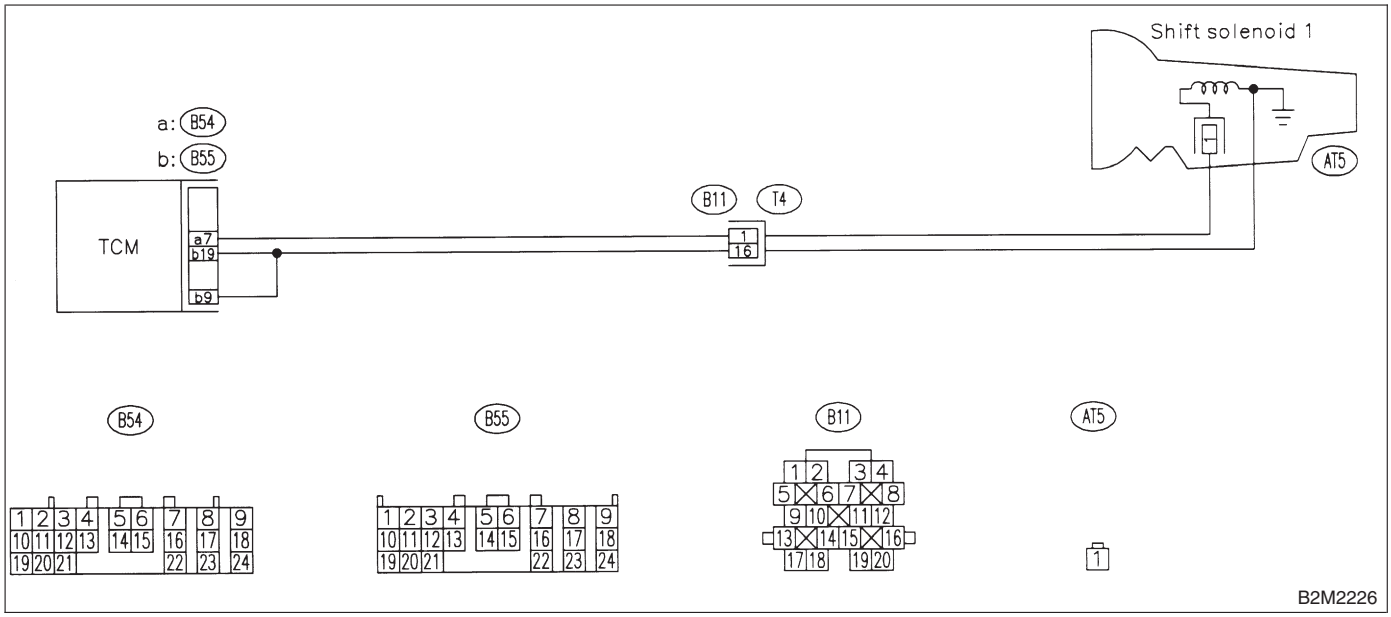
CHECK : ***Is the value between 1.2 and 1.8 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and ECM.
NO : Go to step **8I6**.

8I6 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in intake manifold pressure signal circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

J: TROUBLE CODE 71 — SHIFT SOLENOID 1 —

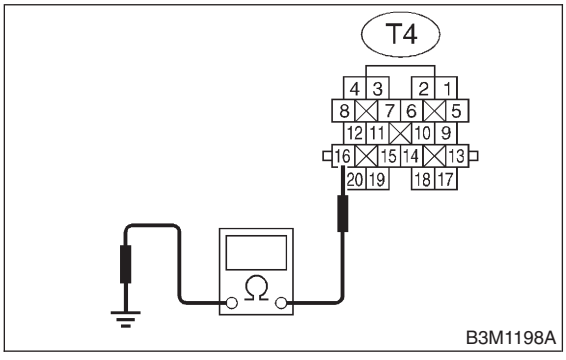
DIAGNOSIS:
Output signal circuit of shift solenoid 1 is open or shorted.
TROUBLE SYMPTOM:
Does not shift.
WIRING DIAGRAM:



8J1 : CHECK SHIFT SOLENOID 1 GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

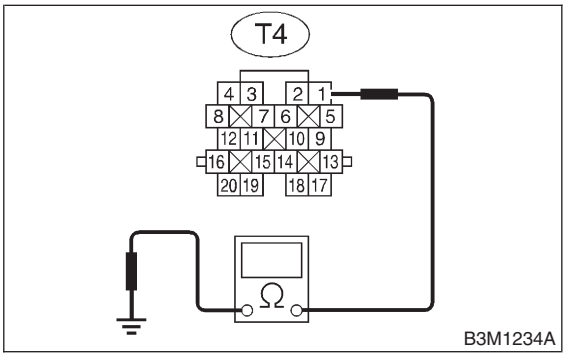


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8J2**.
NO : Repair open circuit in transmission harness.

8J2 : CHECK SHIFT SOLENOID 1.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 1 — Transmission ground:

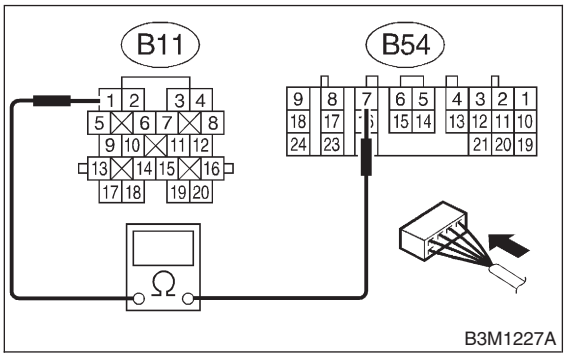


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8J3**.
NO : Go to step **8J6**.

8J3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and shift solenoid 1 connector.

Connector & terminal
(B54) No. 7 — (B11) No. 1:

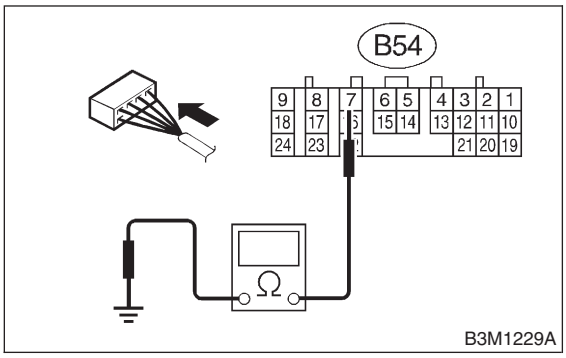


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8J4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8J4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 7 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8J5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8J5 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and support with safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

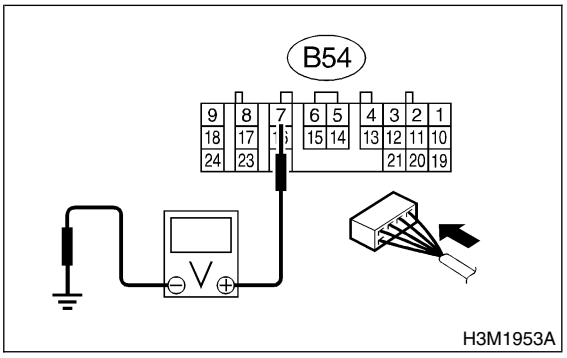
NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

4) Move selector lever to “D”, and slowly increase vehicle speed to 50 km/h (31 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 7 (+) — Chassis ground:



CHECK : ***Is the voltage 1 V → 9 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM.
NO : Go to step **8J8**.

8J6 : CHECK SHIFT SOLENOID 1 (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Lift-up or raise the vehicle and support with safety stand.

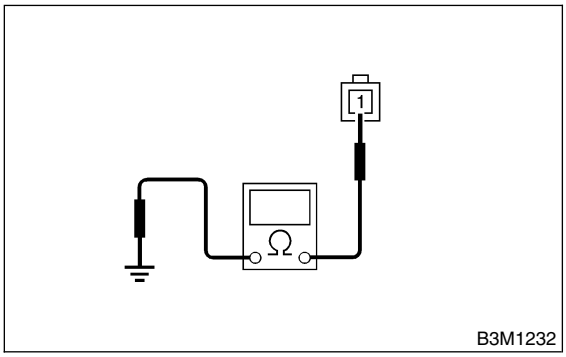
CAUTION:
On AWD models, raise all wheels off ground.

3) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

4) Remove oil pan, and disconnect connector from shift solenoid 1.
5) Measure resistance between shift solenoid 1 connector and transmission ground.

Terminal
No. 1 — Transmission ground:

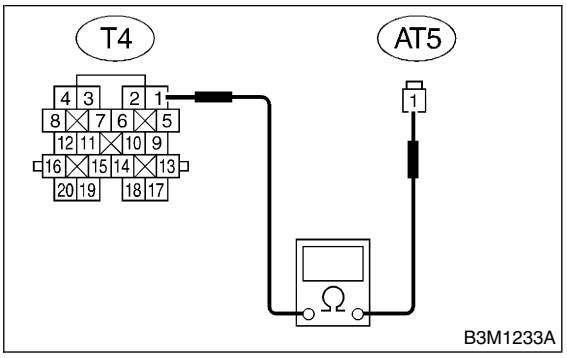


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8J7**.
NO : Replace shift solenoid 1. <Ref. to 3-2 [W4A0].>

8J7 : CHECK HARNESS CONNECTOR BETWEEN SHIFT SOLENOID 1 AND TRANSMISSION.

Measure resistance of harness between shift solenoid 1 and transmission connector.

Connector & terminal
(AT5) No. 1 — (T4) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8J8**.
NO : Repair open circuit in harness between shift solenoid 1 and transmission connector.

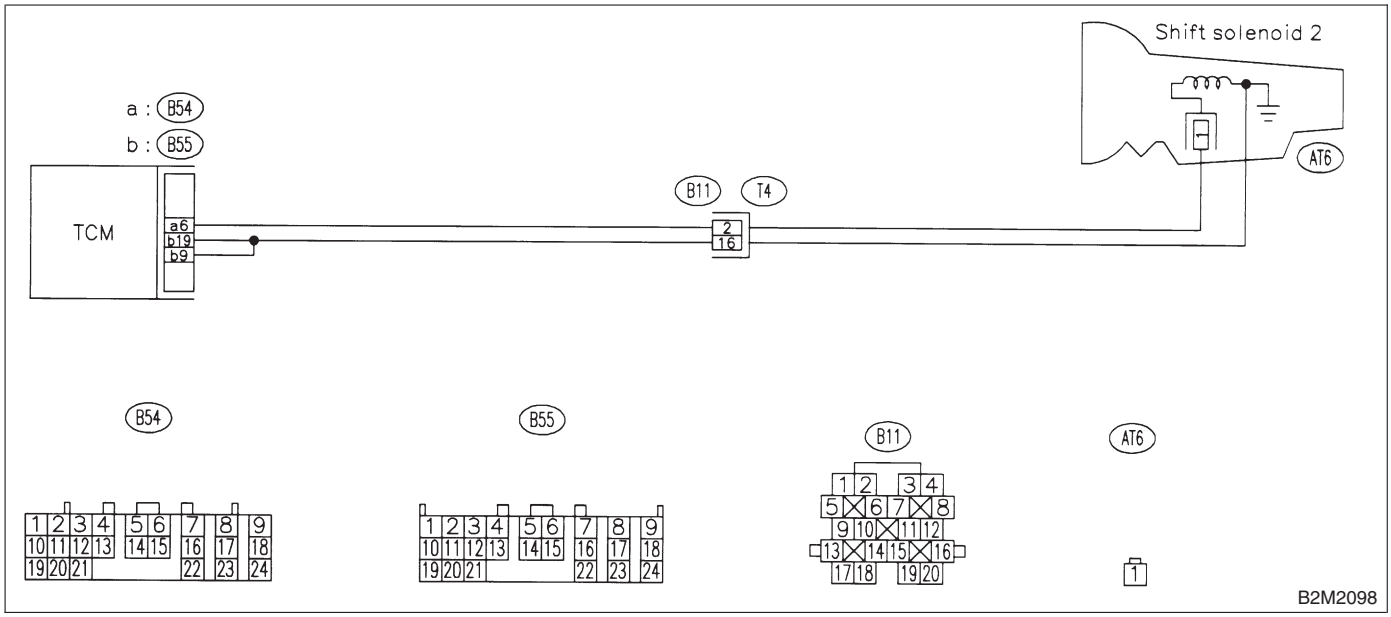
8J8 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in shift solenoid 1 circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

MEMO:

K: TROUBLE CODE 72 — SHIFT SOLENOID 2 —

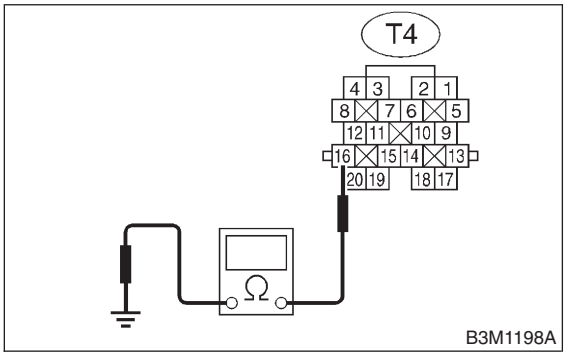
DIAGNOSIS:
Output signal circuit of shift solenoid 2 is open or shorted.
TROUBLE SYMPTOM:
Does not shift.
WIRING DIAGRAM:



8K1 : CHECK SHIFT SOLENOID 2 GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

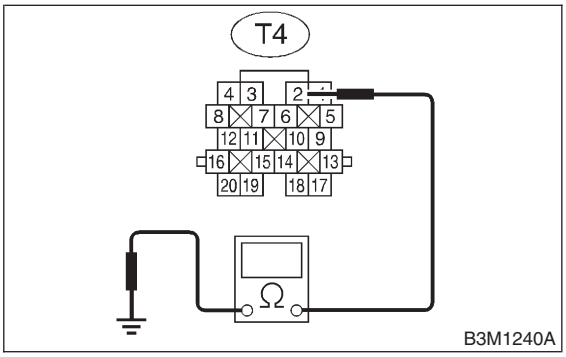


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8K2**.
NO : Repair open circuit in transmission harness.

8K2 : CHECK SHIFT SOLENOID 2.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 2 — Transmission ground:

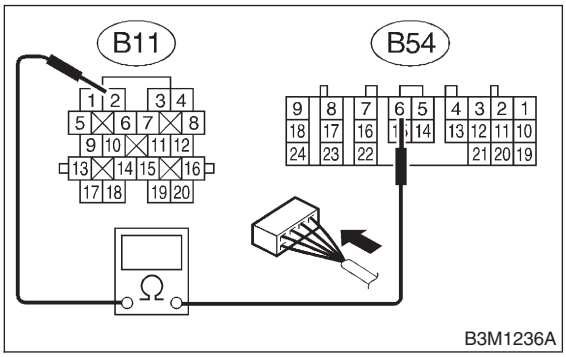


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8K3**.
NO : Go to step **8K6**.

8K3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 6 — (B11) No. 2:

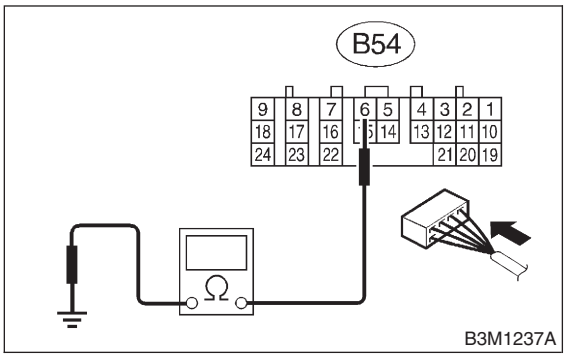


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8K4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8K4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 6 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8K5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8K5 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and support with safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine, and warm-up the transmission until ATF temperature is above 80°C (176°F).

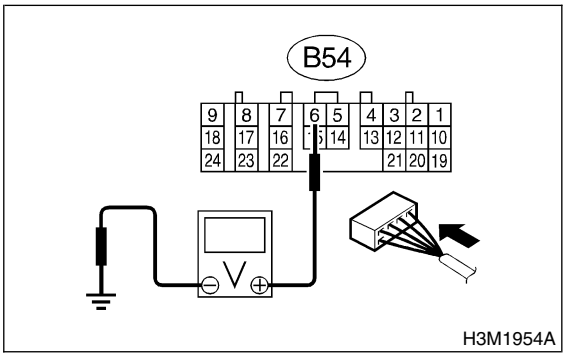
NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

4) Move selector lever to “D”, and slowly increase vehicle speed to 50 km/h (31 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 6 (+) — Chassis ground:



CHECK : ***Is the voltage 9 V → 1 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or contact in the TCM.
NO : Go to step **8K8**.

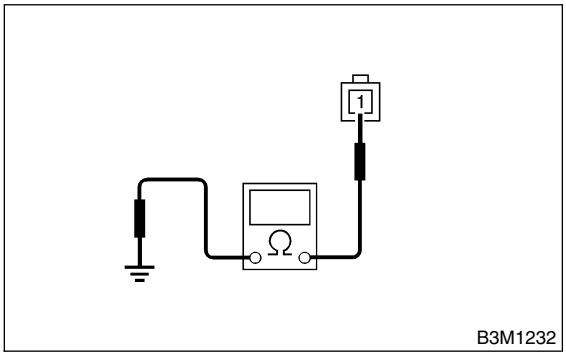
8K6 : CHECK SHIFT SOLENOID 2 (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

3) Remove oil pan, and disconnect connector from shift solenoid 2.
4) Measure resistance between shift solenoid 2 connector and transmission ground.

Connector & terminal
No. 1 — Transmission ground:

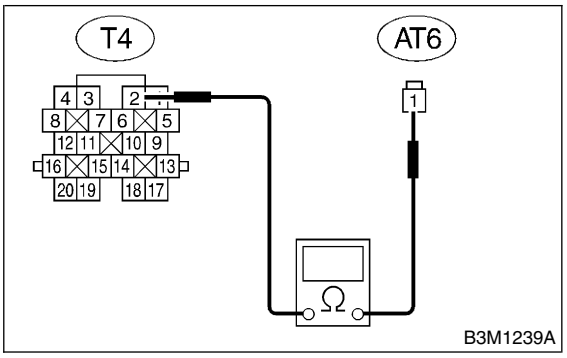


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8K7**.
NO : Replace shift solenoid assembly. <Ref. to 3-2 [W4A0].>

8K7 : CHECK HARNESS CONNECTOR BETWEEN SHIFT SOLENOID 2 AND TRANSMISSION.

Measure resistance of harness between shift solenoid 2 and transmission connector.

Connector & terminal
(AT6) No. 1 — (T4) No. 2:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8K8**.
NO : Repair open circuit in harness between shift solenoid 2 and transmission connector.

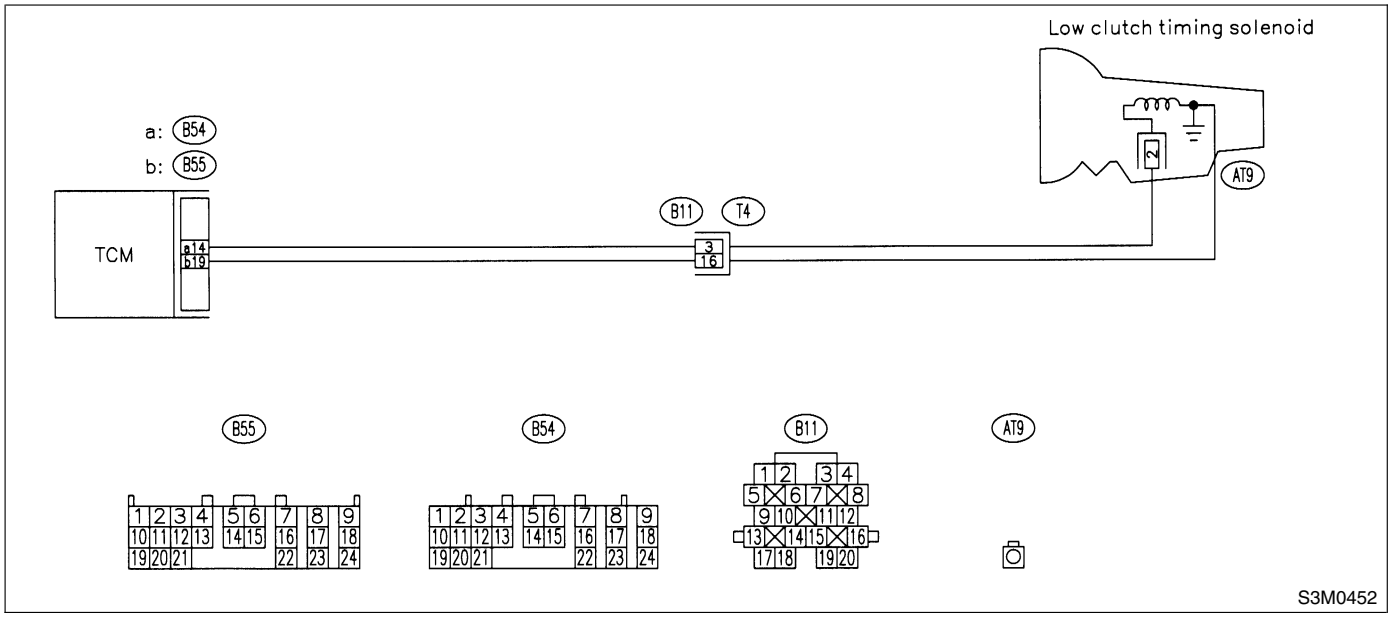
8K8 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in shift solenoid 2 circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

MEMO:

L: TROUBLE CODE 73 — LOW CLUTCH TIMING SOLENOID —

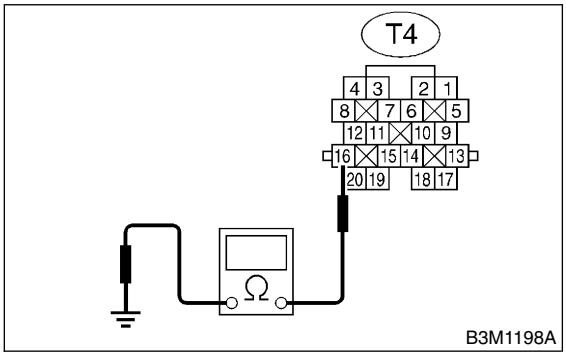
DIAGNOSIS:
Output signal circuit of low clutch timing solenoid is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8L1 : CHECK LOW CLUTCH TIMING SOLENOID GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

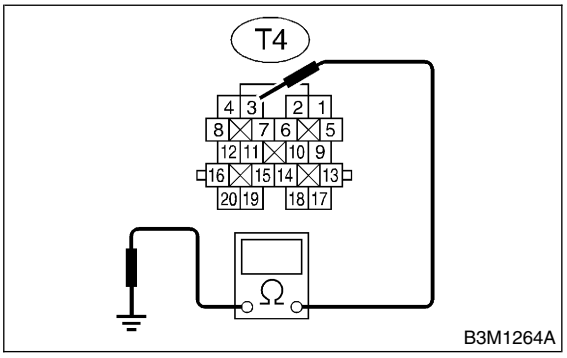


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8L2**.
NO : Repair open circuit in transmission harness.

8L2 : CHECK LOW CLUTCH TIMING SOLENOID.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 3 — Transmission ground:

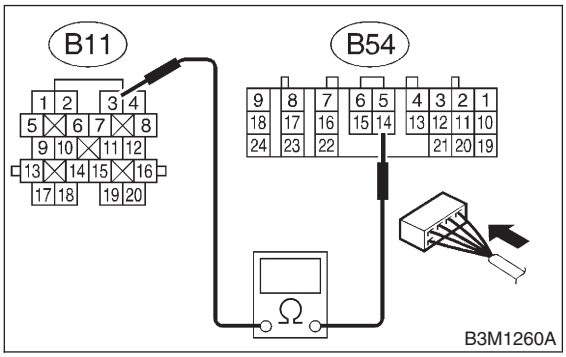


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8L3**.
NO : Go to step **8L7**.

8L3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 14 — (B11) No. 3:

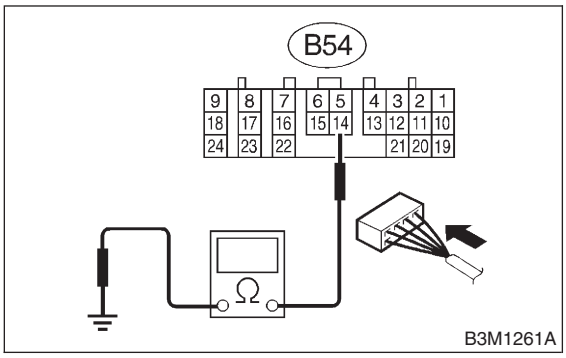


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8L4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8L4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 14 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8L5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8L5 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and support with safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

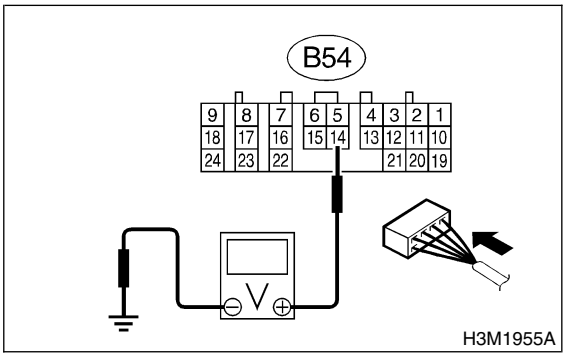
NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

4) Move selector lever to “2”, and slowly increase vehicle speed to 35 km/h (22 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 14 (+) — Chassis ground:



CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8L6**.
NO : Go to step **8L9**.

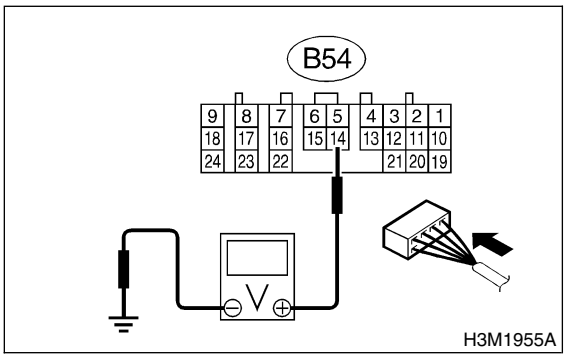
8L6 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Move selector lever to "D", and slowly increase vehicle speed to 65 km/h (40 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

2) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 14 (+) — Chassis ground:



CHECK : ***Is the voltage more than 9 V?***
YES : Even if "AT OIL TEMP" lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or contact in the TCM.
NO : Go to step **8L9**.

8L7 : CHECK LOW CLUTCH TIMING SOLENOID (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Lift-up or raise the vehicle and support with safety stand.

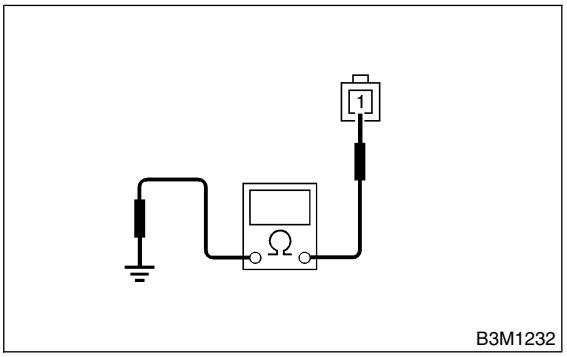
CAUTION:
On AWD models, raise all wheels off ground.

3) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

4) Remove oil pan, and disconnect connector from low clutch timing solenoid.
5) Measure resistance between low clutch timing solenoid connector and transmission ground.

Terminal
No. 1 — Transmission ground:

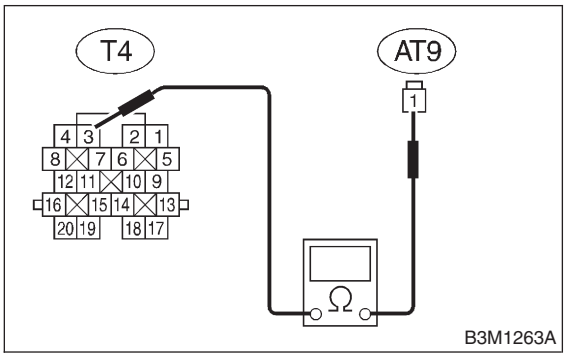


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8L8**.
NO : Replace low clutch timing solenoid. <Ref. to 3-2 [W4A0].>

8L8 : CHECK HARNESS CONNECTOR BETWEEN LOW CLUTCH TIMING SOLENOID AND TRANSMISSION.

Measure resistance of harness between low clutch timing solenoid and transmission connector.

Connector & terminal
(AT9) No. 1 — (T4) No. 3:



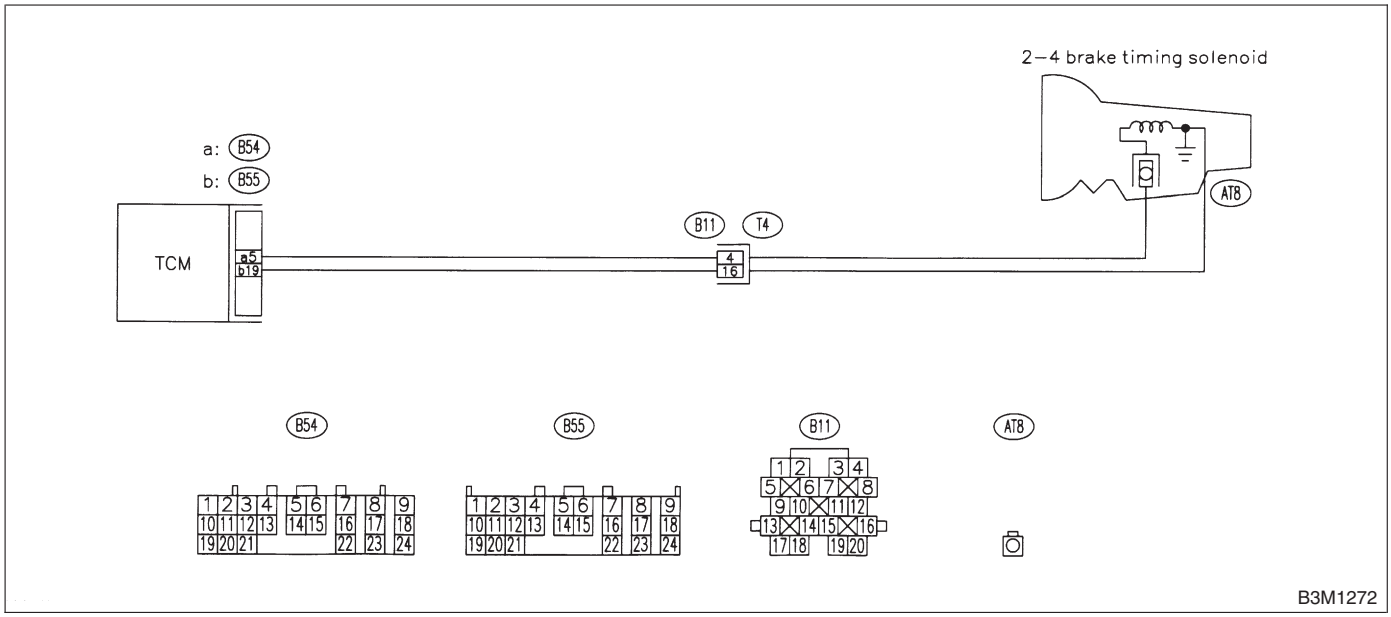
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8L9**.
NO : Repair open circuit in harness between low clutch timing solenoid and transmission connector.

8L9 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in low clutch timing solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

M: TROUBLE CODE 74 — 2-4 BRAKE TIMING SOLENOID —

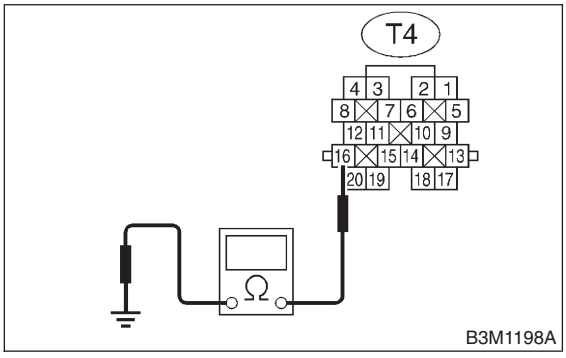
DIAGNOSIS:
Output signal circuit of 2-4 brake timing solenoid is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8M1 : CHECK 2-4 BRAKE TIMING SOLENOID GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

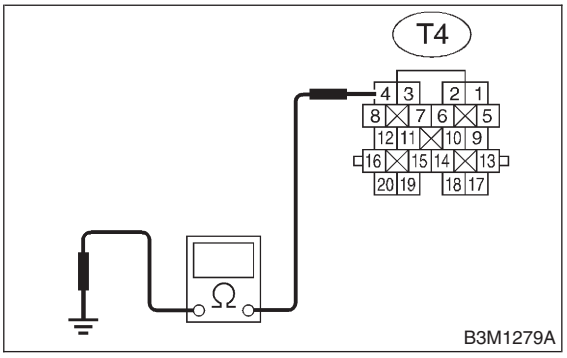


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8M2**.
NO : Repair open circuit in transmission harness.

8M2 : CHECK 2-4 BRAKE TIMING SOLENOID.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 4 — Transmission ground:

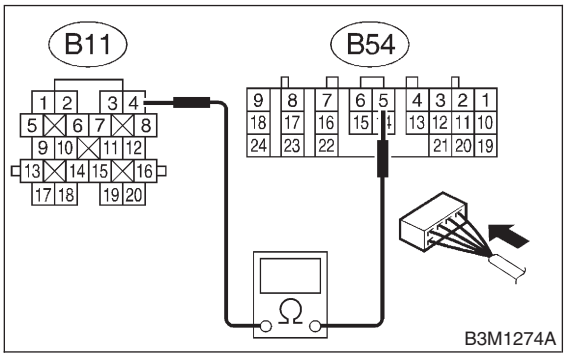


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8M3**.
NO : Go to step **8M7**.

8M3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 5 — (B11) No. 4:

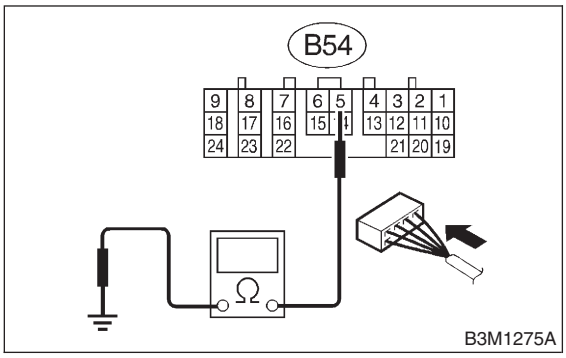


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8M4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8M4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM connector and chassis ground.

Connector & terminal
(B54) No. 5 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8M5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8M5 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and support with safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

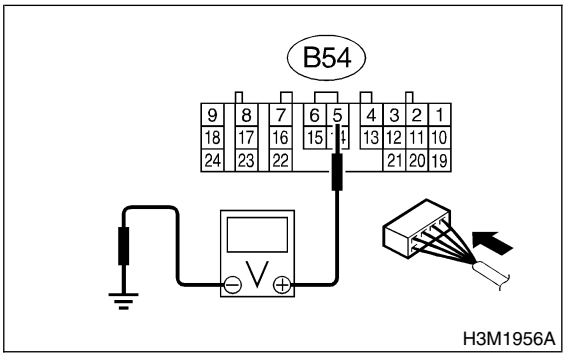
NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

4) Move selector lever to "1", and slowly increase vehicle speed to 10 km/h (6 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 5 (+) — Chassis ground:



CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8M6**.
NO : Go to step **8M9**.

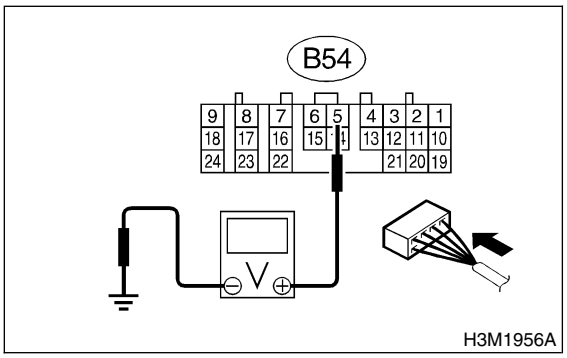
8M6 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Move selector lever to “D”, and slowly increase vehicle speed to 65 km/h (40 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

2) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 5 (+) — Chassis ground:



CHECK : ***Is the voltage more than 9 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or contact in the TCM.
NO : Go to step **8M9**.

8M7 : CHECK 2-4 BRAKE TIMING SOLENOID (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Lift-up or raise the vehicle and support with safety stand.

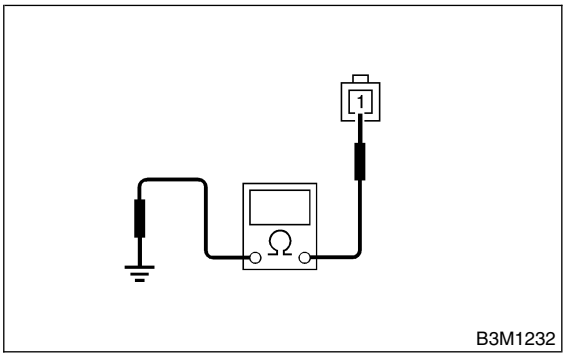
CAUTION:
On AWD models, raise all wheels off ground.

3) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

4) Remove oil pan, and disconnect connector from 2-4 brake timing solenoid.
5) Measure resistance between 2-4 brake timing solenoid connector and transmission ground.

Terminal
No. 1 — Transmission ground:

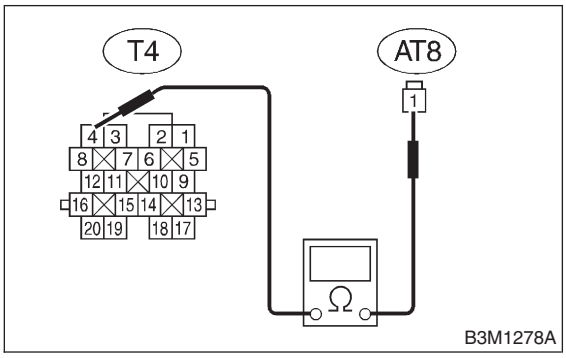


CHECK : ***Is the resistance between 10 and 16 Ω?***
YES : Go to step **8M8**.
NO : Replace 2-4 brake timing solenoid. <Ref. to 3-2 [W4A0].>

8M8 : CHECK HARNESS CONNECTOR BETWEEN 2-4 BRAKE TIMING SOLENOID AND TRANSMISSION.

Measure resistance of harness between 2-4 brake timing solenoid and transmission connector.

Connector & terminal
(AT8) No. 1 — (T4) No. 4:



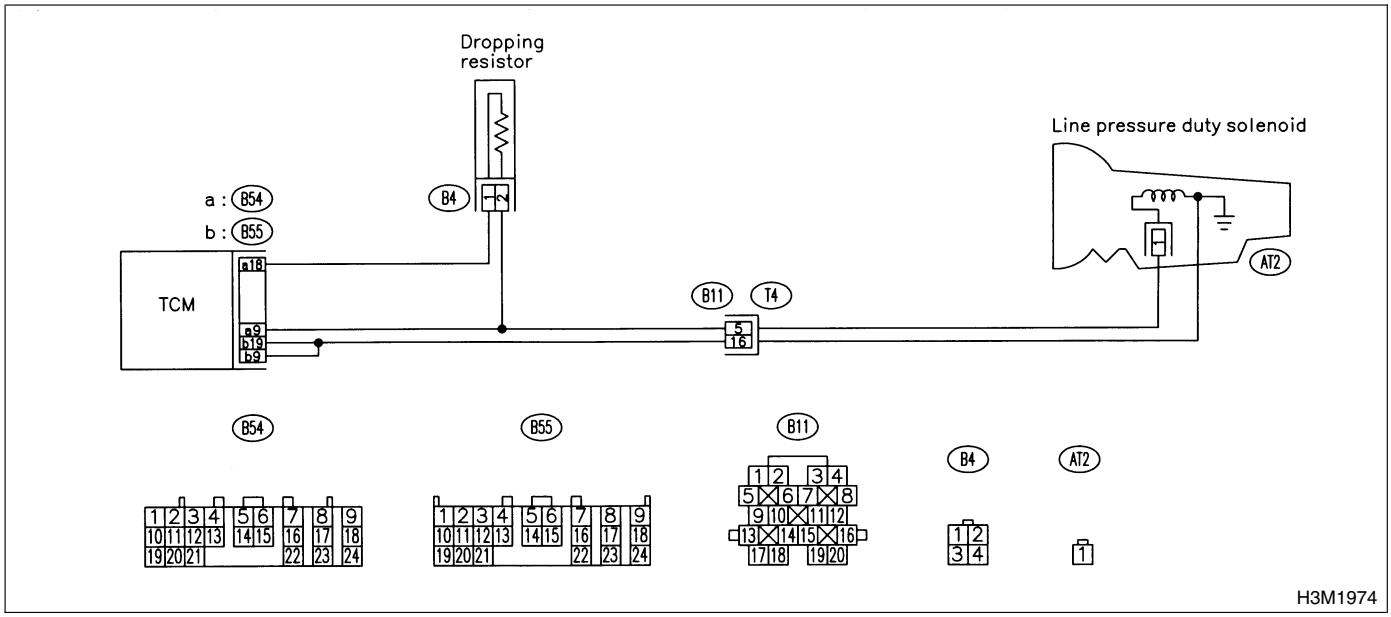
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8M9**.
NO : Repair open circuit in harness between 2-4 brake timing solenoid and transmission connector.

8M9 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in 2-4 brake timing solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

N: TROUBLE CODE 75 — LINE PRESSURE DUTY SOLENOID —

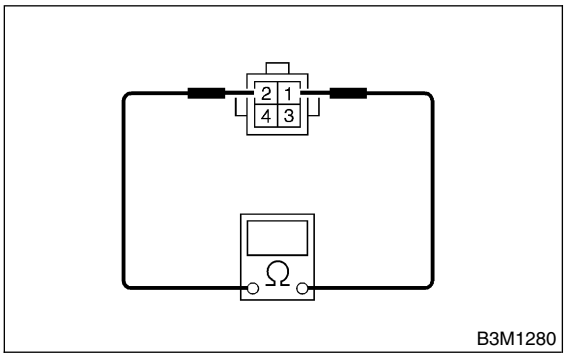
DIAGNOSIS:
Output signal circuit of line pressure duty solenoid or resistor is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8N1 : CHECK RESISTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from dropping resistor.
3) Measure resistance between dropping resistor terminal.

Terminals
No. 1 — No. 2:

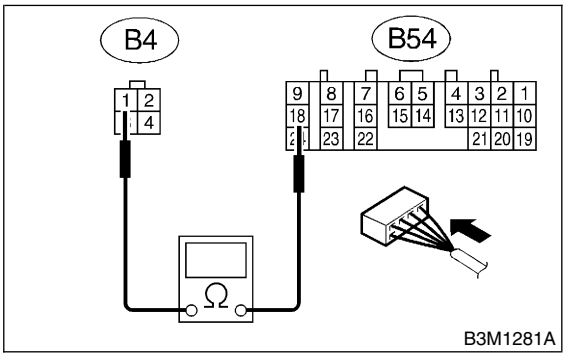


CHECK : ***Is the resistance between 9 and 15 Ω?***
YES : Go to step **8N2**.
NO : Replace dropping resistor. <Ref. to 3-2 [W24A0].>

8N2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND DROPPING RESISTOR.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM connector and dropping resistor connector.

Connector & terminal
(B54) No. 18 — (B4) No. 1:

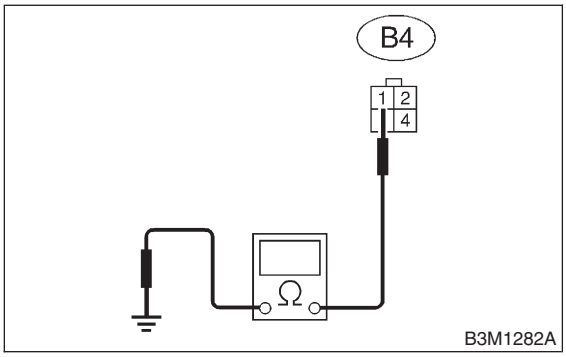


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8N3**.
NO : Repair open circuit in harness between TCM and dropping resistor connector.

8N3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND DROPPING RESISTOR.

Measure resistance of harness between dropping resistor connector and chassis ground.

Connector & terminal
(B4) No. 1 — Chassis ground:

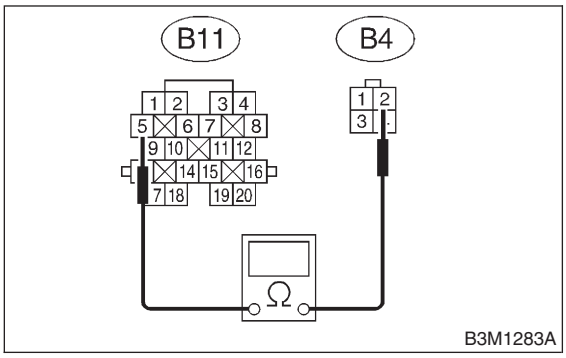


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8N4**.
NO : Repair short circuit in harness between TCM and dropping resistor connector.

8N4 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND DROPPING RESISTOR.

1) Disconnect connector from transmission.
2) Measure resistance of harness between transmission and dropping resistor connector.

Connector & terminal
(B4) No. 2 — (B11) No. 5:

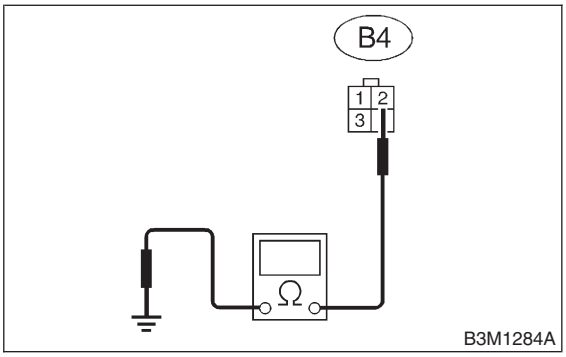


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8N5**.
NO : Repair open circuit in harness between dropping resistor and transmission connector.

8N5 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND DROPPING RESISTOR.

Measure resistance of harness between dropping resistor connector and chassis ground.

Connector & terminal
(B4) No. 2 — Chassis ground:

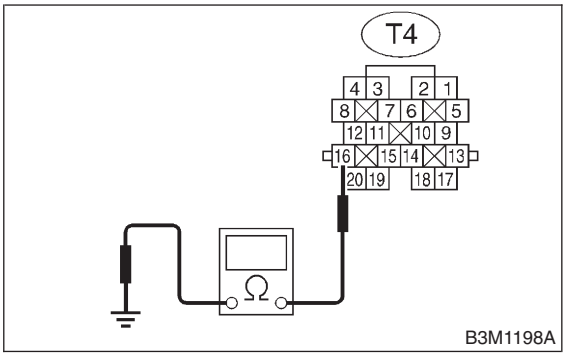


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8N6**.
NO : Repair short circuit in harness between dropping resistor and transmission connector.

8N6 : CHECK LINE PRESSURE DUTY SOLENOID GROUND LINE.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

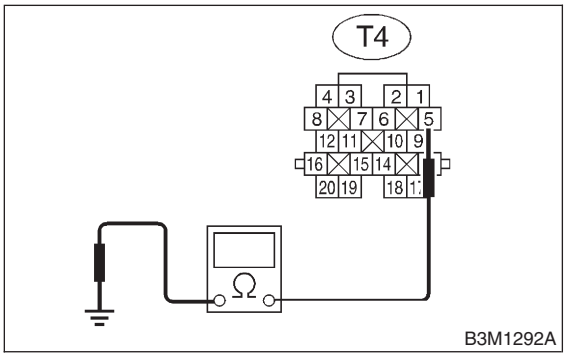


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8N7**.
NO : Repair open circuit in transmission harness.

8N7 : CHECK LINE PRESSURE DUTY SOLENOID.

Measure resistance between transmission connector and transmission ground.

Terminal
(T4) No. 5 — Transmission ground:

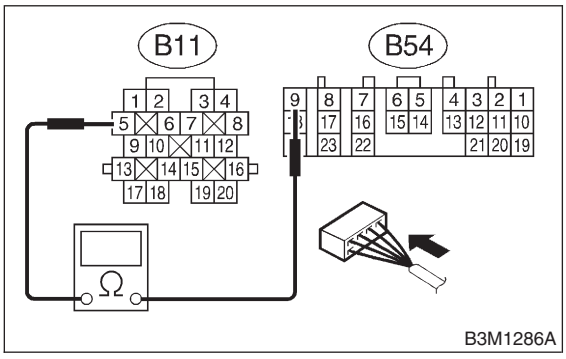


CHECK : ***Is the resistance between 2.0 and 4.5 Ω?***
YES : Go to step **8N8**.
NO : Go to step **8N17**.

8N8 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 9 — (B11) No. 5:

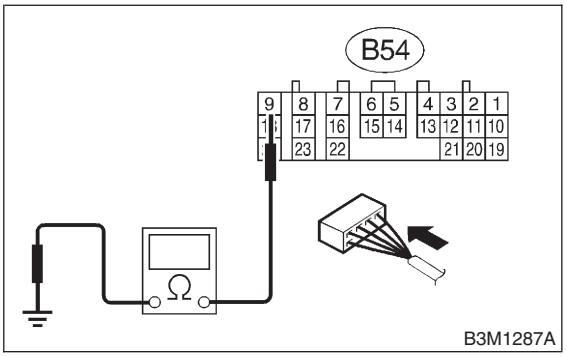


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8N9**.
NO : Repair open circuit in harness between TCM and transmission connector.

8N9 : CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B54) No. 9 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8N10**.
NO : Repair short circuit in harness between TCM and transmission connector.

8N10 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8N15**.
NO : Go to step **8N11**.

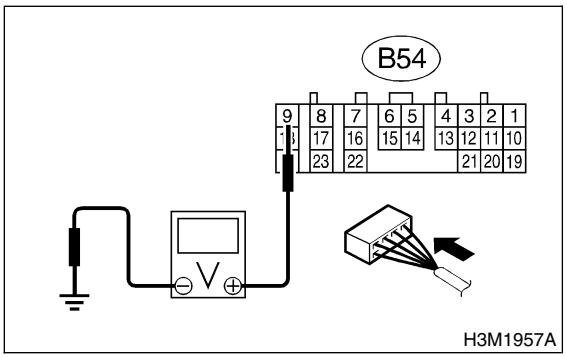
8N11 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect all connectors.
2) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Turn ignition switch to ON (engine OFF).
4) Move selector lever to "N".
5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 9 (+) — Chassis ground:

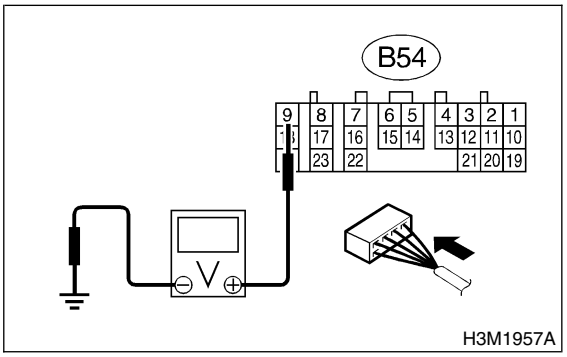


CHECK : ***Is the voltage between 1.5 and 4.0 V with throttle fully closed?***
YES : Go to step **8N12**.
NO : Go to step **8N19**.

8N12 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 9 (+) — Chassis ground:

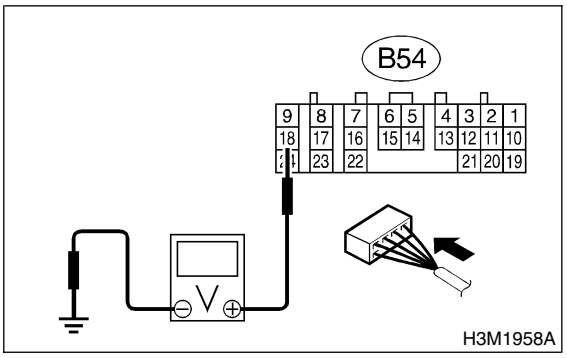


CHECK : ***Is the voltage less than 1 V with throttle fully open?***
YES : Go to step **8N13**.
NO : Go to step **8N19**.

8N13 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 18 (+) — Chassis ground:

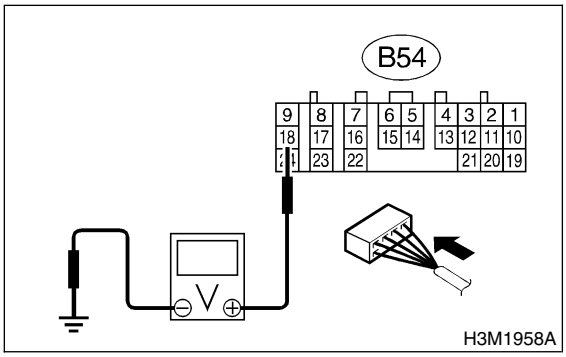


CHECK : ***Is the voltage more than 8.5 V with throttle fully closed?***
YES : Go to step **8N14**.
NO : Go to step **8N19**.

8N14 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 18 (+) — Chassis ground:



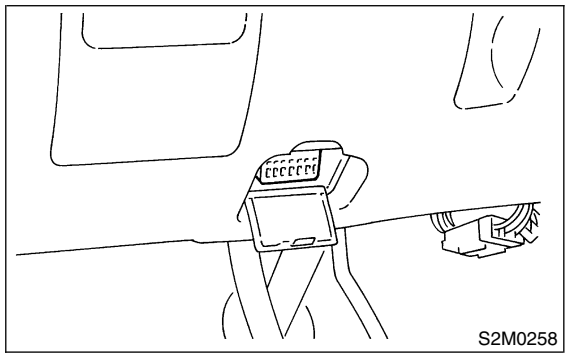
CHECK : ***Is the voltage less than 1 V with throttle fully open?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.

NO : Go to step **8N19**.

8N15 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and transmission.
2) Connect Subaru Select Monitor to data link connector.



3) Start the engine, and turn Subaru Select Monitor switch to ON.
4) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

5) Stop the engine and turn ignition switch to ON (engine OFF).
6) Move selector lever to “N”.
7) Read data of line pressure duty solenoid using Subaru Select Monitor.
● Line pressure duty solenoid is indicated in “%”.
8) Throttle is fully closed.

CHECK : ***Is the value 100%?***

YES : Go to step **8N16**.

NO : Go to step **8N19**.

8N16 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Turn ignition switch to ON (Engine OFF).
2) Throttle is fully open.

CHECK : ***Is the value between 10 and 20%?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.

NO : Go to step **8N19**.

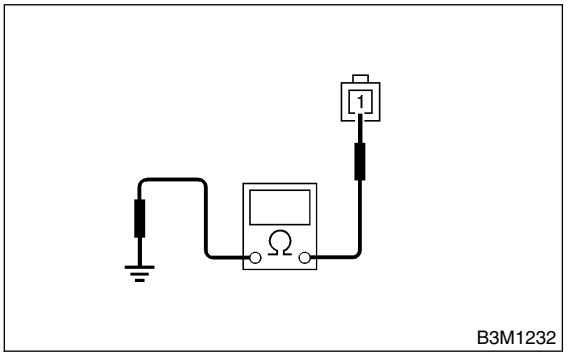
8N17 : CHECK LINE PRESSURE DUTY SOLENOID (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

3) Remove oil pan, and disconnect connector from line pressure duty solenoid.
4) Measure resistance between line pressure duty solenoid connector and transmission ground.

Terminal
No. 1 — Transmission ground:

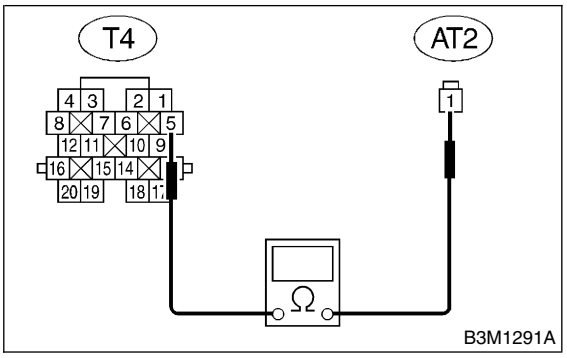


CHECK : ***Is the resistance between 2.0 and 4.5 Ω?***
YES : Go to step **8N18**.
NO : Replace line pressure duty solenoid. <Ref. to 3-2 [W4A0].>

8N18 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LINE PRESSURE DUTY SOLENOID.

Measure resistance of harness between line pressure duty solenoid and transmission connector.

Connector & terminal
(T4) No. 5 — (AT2) No. 1:



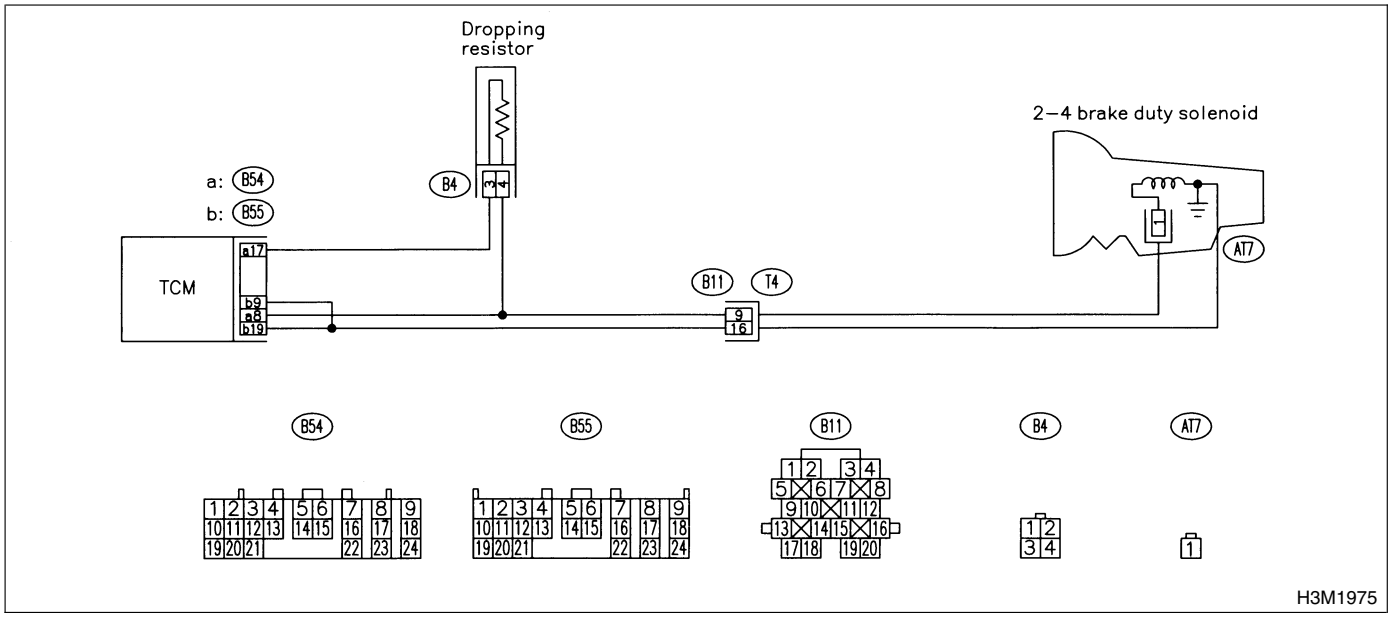
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8N19**.
NO : Repair open circuit in harness between line pressure duty solenoid and transmission connector.

8N19 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in line pressure duty solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

O: TROUBLE CODE 76 — 2-4 BRAKE DUTY SOLENOID —

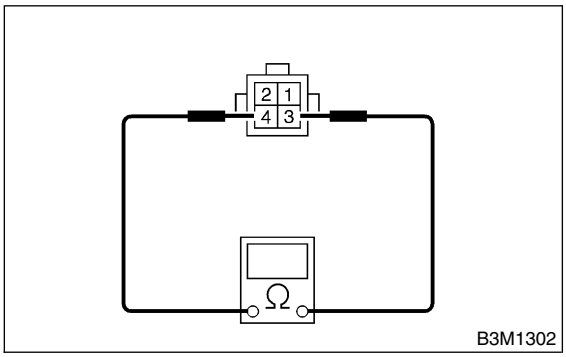
DIAGNOSIS:
Output signal circuit of 2-4 brake duty solenoid is open or shorted.
TROUBLE SYMPTOM:
Excessive shift shock.
WIRING DIAGRAM:



8O1 : CHECK RESISTOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from dropping resistor.
3) Measure resistance between dropping resistor terminal.

Terminals
No. 3 — No. 4:

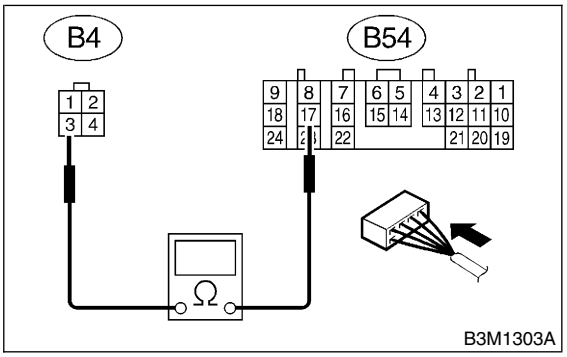


CHECK : ***Is the resistance between 9 and 15 Ω?***
YES : Go to step **8O2**.
NO : Replace dropping resistor. <Ref. to 3-2 [W24A0].>

8O2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND DROPPING RESISTOR.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM connector and dropping resistor connector.

Connector & terminal
(B54) No. 17 — (B4) No. 3:

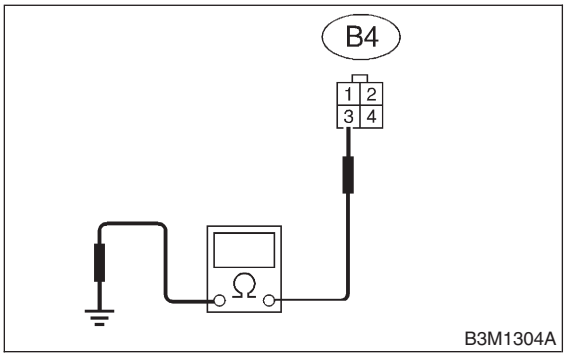


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8O3**.
NO : Repair open circuit in harness between TCM and dropping resistor connector.

8O3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND DROPPING RESISTOR.

Measure resistance of harness between dropping resistor connector and chassis ground.

Connector & terminal
(B4) No. 3 — Chassis ground:

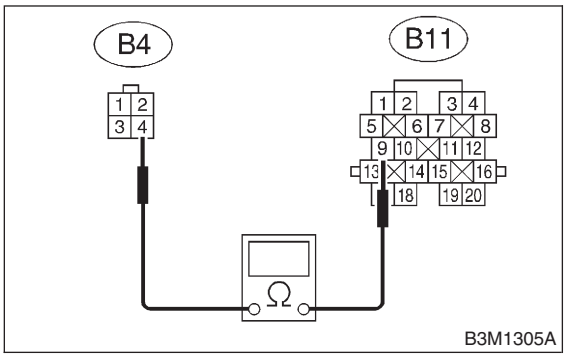


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8O4**.
NO : Repair short circuit in harness between TCM and dropping resistor connector.

8O4 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND DROPPING RESISTOR.

1) Disconnect connector from transmission.
2) Measure resistance of harness between transmission and dropping resistor connector.

Connector & terminal
(B4) No. 4 — (B11) No. 9:

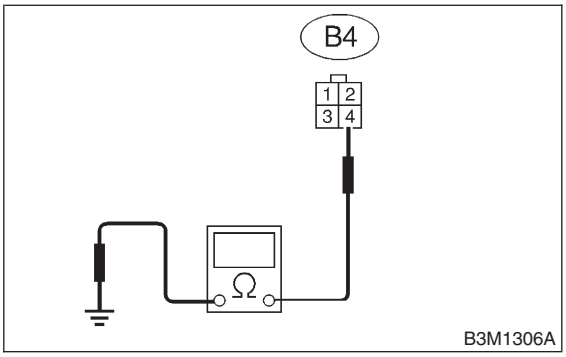


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8O5**.
NO : Repair open circuit in harness between dropping resistor and transmission connector.

8O5 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND DROPPING RESISTOR.

Measure resistance of harness between dropping resistor connector and chassis ground.

Connector & terminal
(B4) No. 4 — Chassis ground:

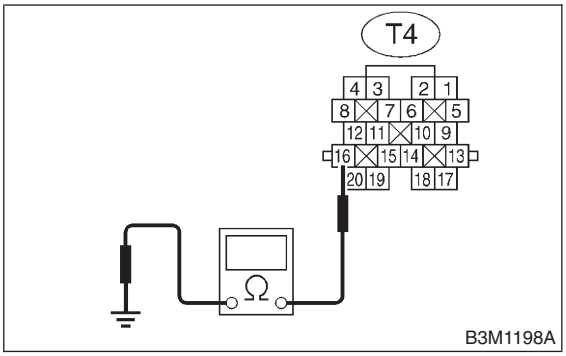


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8O6**.
NO : Repair short circuit in harness between dropping resistor and transmission connector.

8O6 : CHECK 2-4 BRAKE DUTY SOLENOID GROUND LINE.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

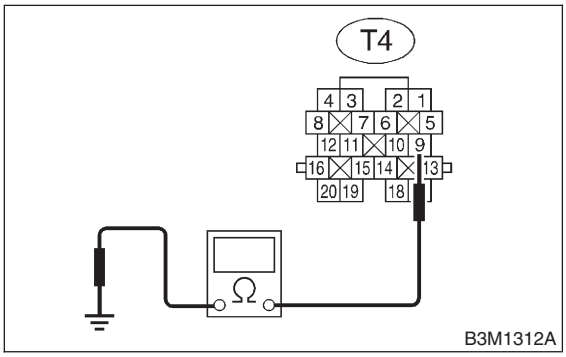


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8O7**.
NO : Repair open circuit in transmission harness.

8O7 : CHECK 2-4 BRAKE DUTY SOLENOID.

Measure resistance between transmission connector and transmission ground.

Terminal
(T4) No. 16 — Transmission ground:

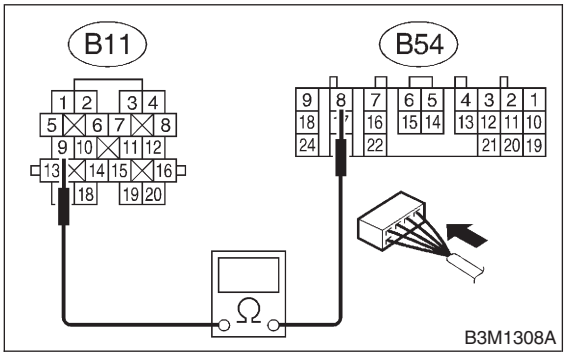


CHECK : ***Is the resistance between 2.0 and 4.5 Ω?***
YES : Go to step **8O8**.
NO : Go to step **8O17**.

8O8 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 8 — (B11) No. 9:

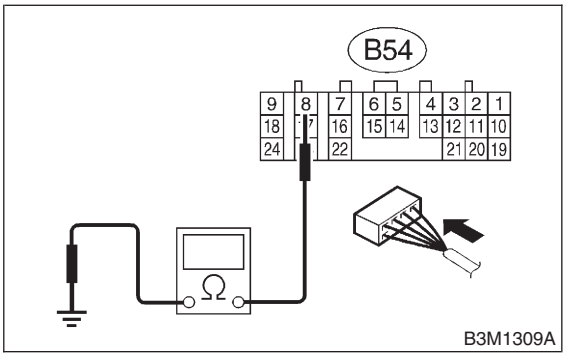


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8O9**.
NO : Repair open circuit in harness between TCM and transmission connector.

8O9 : CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B54) No. 8 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8O10**.
NO : Repair short circuit in harness between TCM and transmission connector.

8O10 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8O15**.
NO : Go to step **8O11**.

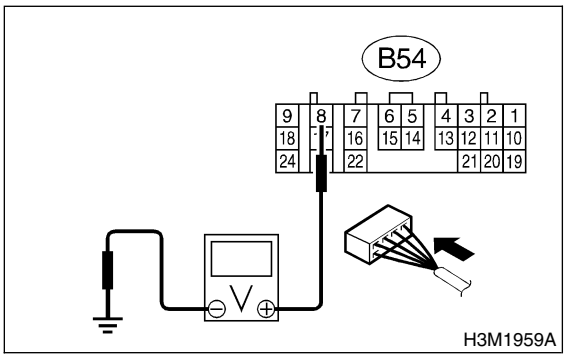
8O11 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect all connectors.
2) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Turn ignition switch to ON (engine OFF).
4) Move selector lever to "N".
5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 8 (+) — Chassis ground:

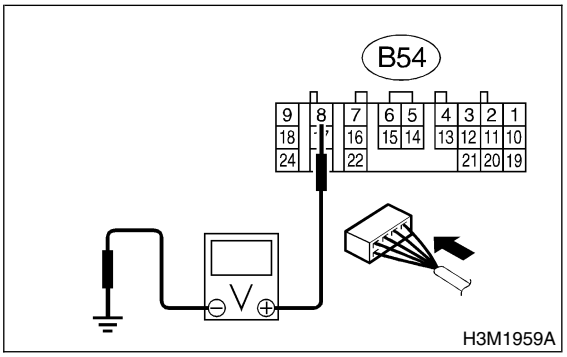


CHECK : ***Is the voltage between 1.5 and 4.0 V with throttle fully closed?***
YES : Go to step **8O12**.
NO : Go to step **8O19**.

8O12 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 8 (+) — Chassis ground:

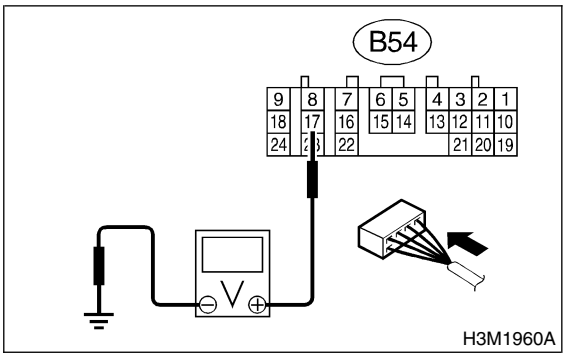


CHECK : ***Is the voltage less than 1 V with throttle fully open?***
YES : Go to step **8O13**.
NO : Go to step **8O19**.

8O13 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 17 (+) — Chassis ground:

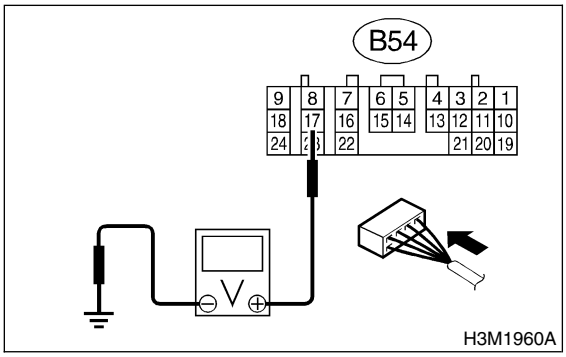


CHECK : ***Is the voltage more than 8.5 V with throttle fully closed?***
YES : Go to step **8O14**.
NO : Go to step **8O19**.

8O14 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector terminal and chassis ground.

Connector & terminal
(B54) No. 17 (+) — Chassis ground:



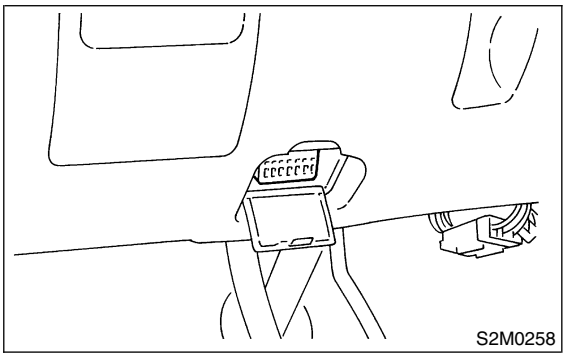
CHECK : ***Is the voltage less than 1 V with throttle fully open?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.

NO : Go to step **8O19**.

8O15 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Connect all connectors.
2) Connect Subaru Select Monitor to data link connector.



3) Start the engine, and turn Subaru Select Monitor switch to ON.
4) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

5) Stop the engine and turn ignition switch to ON (engine OFF).
6) Move selector lever to “N”.
7) Read data of 2-4 brake duty solenoid using Subaru Select Monitor.
- Line pressure duty is indicated in “%”.

8) Throttle is fully closed.

CHECK : ***Is the value 100%?***

YES : Go to step **8O16**.

NO : Go to step **8O19**.

8O16 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Turn ignition switch to ON (Engine OFF).
2) Throttle is fully open.

CHECK : ***Is the value between 10 and 20%?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.

NO : Go to step **8O19**.

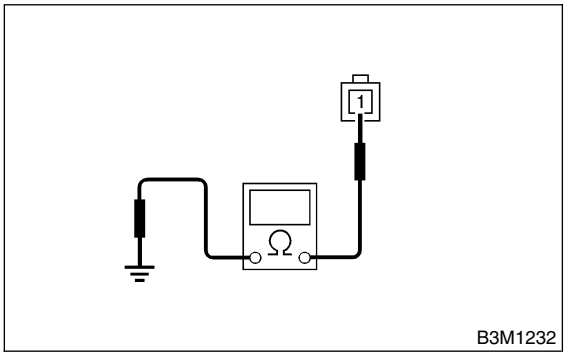
8O17 : CHECK 2-4 BRAKE DUTY SOLENOID (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

3) Remove oil pan, and disconnect connector from 2-4 brake duty solenoid.
4) Measure resistance between 2-4 brake duty solenoid connector and transmission ground.

Terminal
No. 1 — Transmission ground:

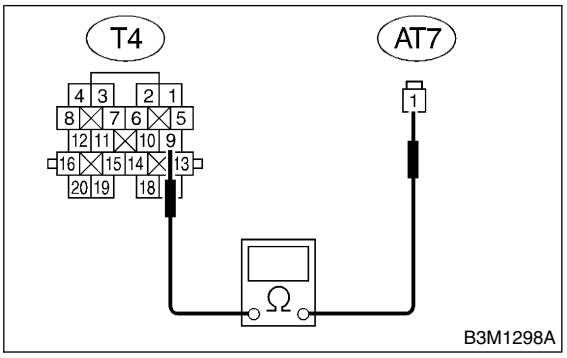


CHECK : ***Is the resistance between 2.0 and 4.5 Ω?***
YES : Go to step **8O18**.
NO : Replace 2-4 brake duty solenoid. <Ref. to 3-2 [W4A0].>

8O18 : CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND 2-4 BRAKE DUTY SOLENOID.

Measure resistance of harness between 2-4 brake duty solenoid and transmission connector.

Connector & terminal
(T4) No. 9 — (AT7) No. 1:



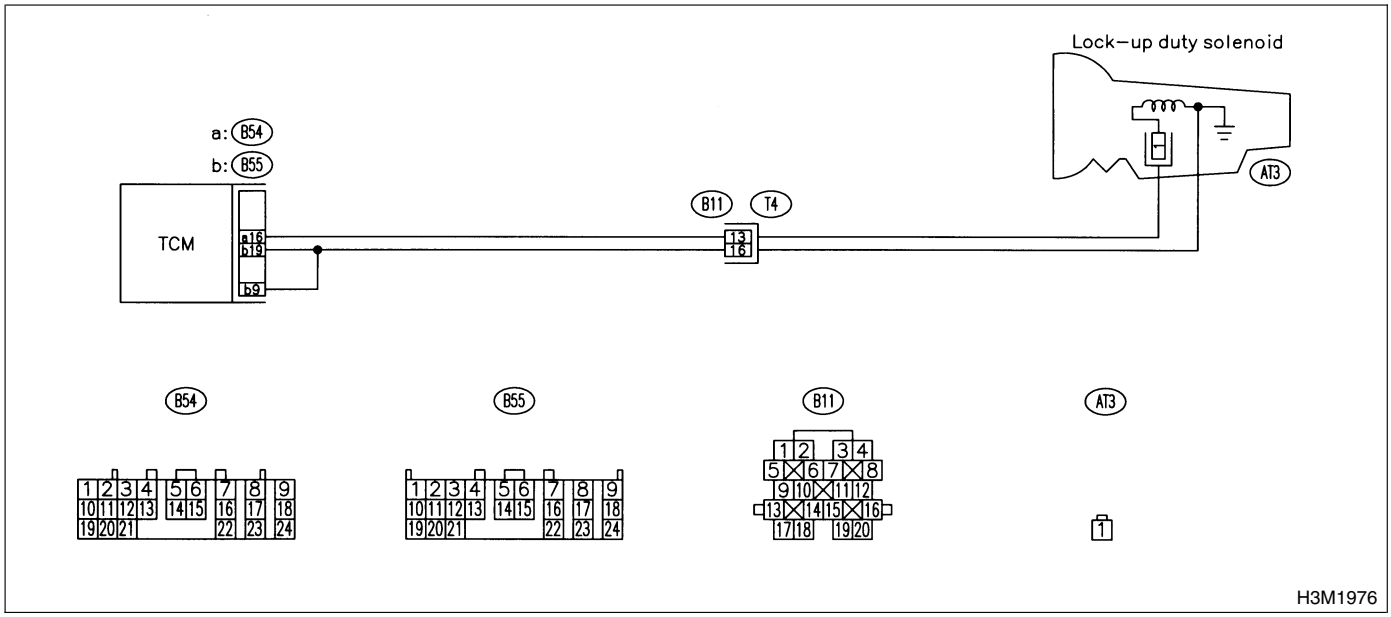
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8O19**.
NO : Repair open circuit in harness between 2-4 brake duty solenoid and transmission connector.

8O19 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in line pressure duty solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

P: TROUBLE CODE 77 — LOCK-UP DUTY SOLENOID —

DIAGNOSIS:
Output signal circuit of lock-up duty solenoid is open or shorted.
TROUBLE SYMPTOM:
No “lock-up” (after engine warm-up).
WIRING DIAGRAM:



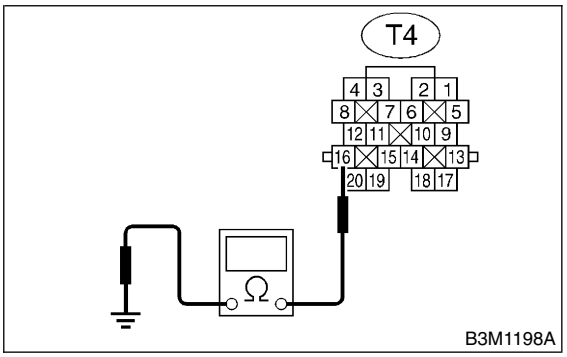
8P1 : CHECK TROUBLE CODE.

CHECK : ***Do multiple trouble codes appear in the on-board diagnostics test mode?***
YES : Go to another trouble code.
NO : Go to step **8P2**.

8P2 : CHECK LOCK-UP DUTY SOLENOID GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

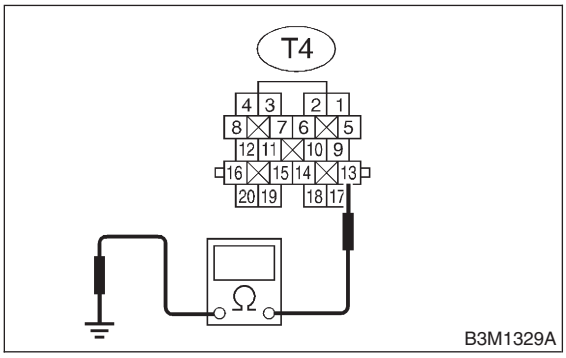


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8P3**.
NO : Repair open circuit in transmission harness.

8P3 : CHECK LOCK-UP DUTY SOLENOID.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 13 — Transmission ground:

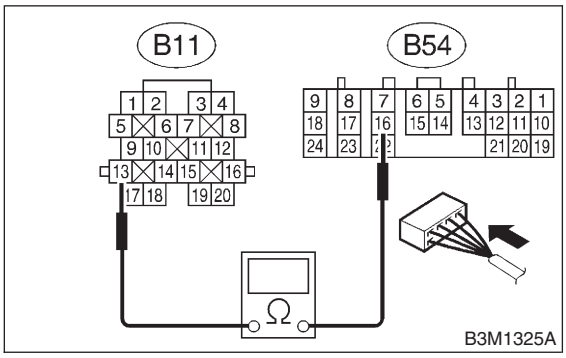


CHECK : ***Is the resistance between 9 and 15 Ω?***
YES : Go to step **8P4**.
NO : Go to step **8P11**.

8P4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness connector between TCM and transmission.

Connector & terminal
(B54) No. 16 — (B11) No. 13:

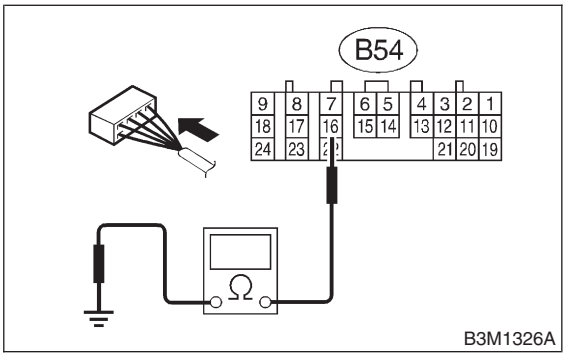


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8P5**.
NO : Repair open circuit in harness between TCM and transmission connector.

8P5 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness connector between TCM and chassis ground.

Connector & terminal
(B54) No. 16 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8P6**.
NO : Repair short circuit in harness between TCM and transmission connector.

8P6 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8P9**.
NO : Go to step **8P7**.

8P7 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

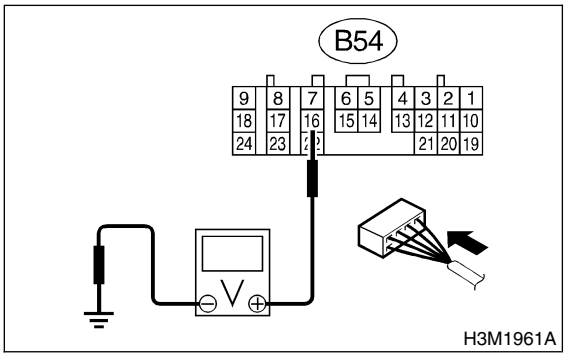
NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

4) Move selector lever to “D” and slowly increase vehicle speed to 75 km/h (47 MPH). Wheels will lock-up.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 16 (+) — Chassis ground:

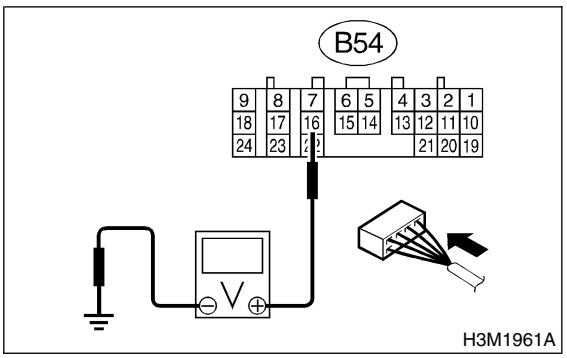


CHECK : ***Is the voltage more than 8.5 V?***
YES : Go to step **8P8**.
NO : Go to step **8P13**.

8P8 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Return the engine to idling speed and move selector lever to “N”.
2) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 16 (+) — Chassis ground:



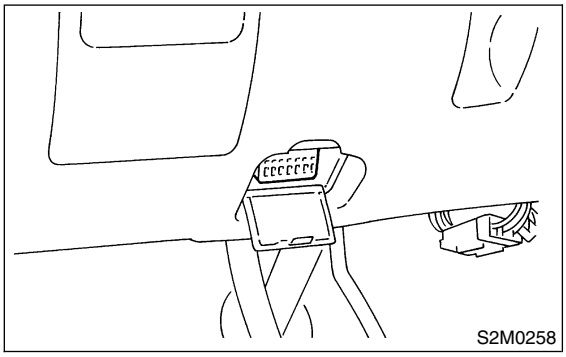
CHECK : ***Is the voltage less than 0.5 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.
NO : Go to step **8P13**.

8P9 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and transmission.
2) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

3) Connect Subaru Select Monitor to data link connector.



4) Start the engine, and turn Subaru Select Monitor switch to ON.
5) Start the engine and warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

6) Read data of lock-up duty solenoid using Subaru Select Monitor.
● Lock-up duty is indicated in "%".
7) Move selector lever to "D" and slowly increase vehicle speed to 75 km/h (47 MPH). Wheels will lock-up.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Is the value 95%?***
YES : Go to step **8P10**.
NO : Go to step **8P13**.

8P10 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

Return the engine to idling speed and move selector lever to "N".

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Is the value 5%?***
YES : Even if "AT OIL TEMP" lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in TCM.
NO : Go to step **8P13**.

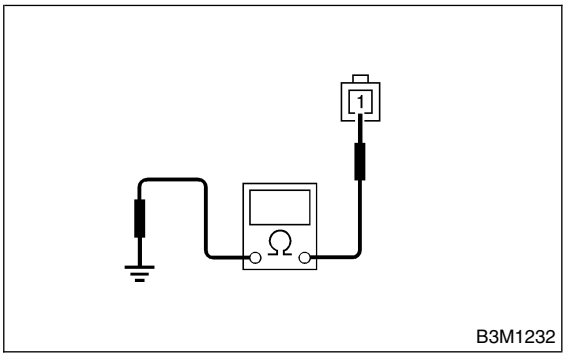
8P11 : CHECK LOCK-UP DUTY SOLENOID (IN TRANSMISSION).

1) Remove transmission connector from bracket.
2) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

3) Remove oil pan, and disconnect connector from lock-up duty solenoid.
4) Measure resistance between lock-up duty solenoid connector and transmission ground.

Terminal
No. 1 — Transmission ground:

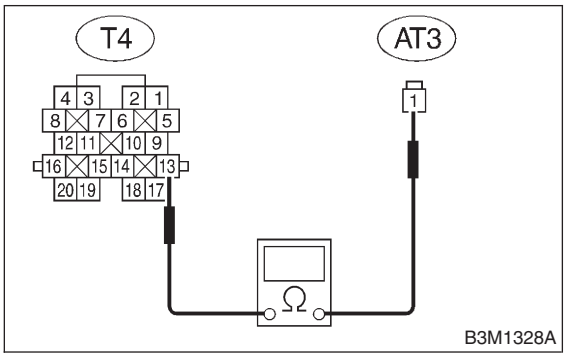


CHECK : ***Is the resistance between 10 and 17 Ω?***
YES : Go to step **8P12**.
NO : Replace lock-up duty solenoid. <Ref. to 3-2 [W4A0].>

8P12 : CHECK HARNESS CONNECTOR BETWEEN LOCK-UP DUTY SOLENOID AND TRANSMISSION.

Measure resistance of harness between lock-up duty solenoid and transmission connector.

Connector & terminal
(T4) No. 13 — (AT3) No. 1:



CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8P13**.
NO : Repair open circuit in harness between lock-up duty solenoid and transmission connector.

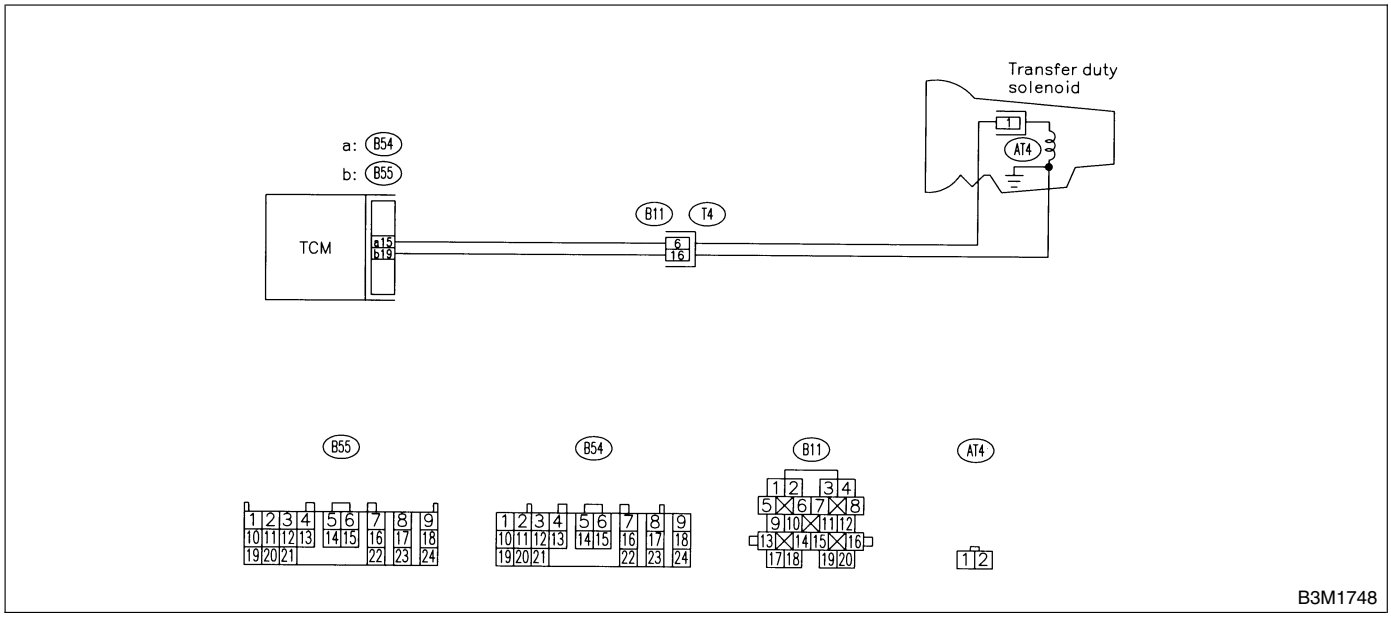
8P13 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in lock-up duty solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

MEMO:

Q: TROUBLE CODE 79 — TRANSFER DUTY SOLENOID —

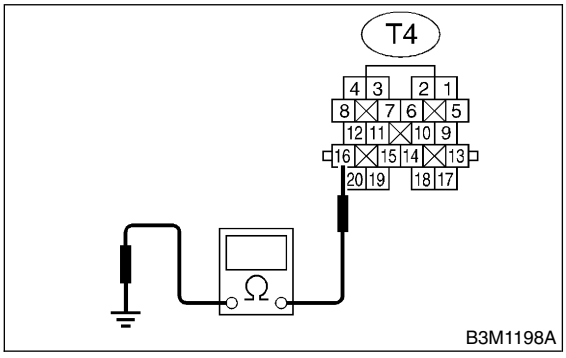
DIAGNOSIS:
Output signal circuit of transfer duty solenoid is open or shorted.
TROUBLE SYMPTOM:
Excessive “braking” in tight corners.
WIRING DIAGRAM:



8Q1 : CHECK TRANSFER DUTY SOLENOID GROUND LINE.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 16 — Transmission ground:

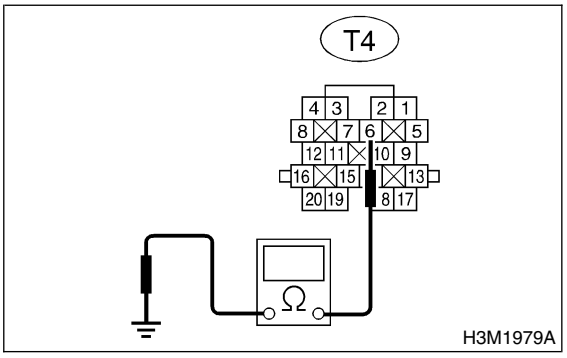


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8Q2**.
NO : Repair open circuit in transmission harness.

8Q2 : CHECK TRANSFER DUTY SOLENOID.

Measure resistance between transmission connector and transmission ground.

Connector & terminal
(T4) No. 6 — Transmission ground:

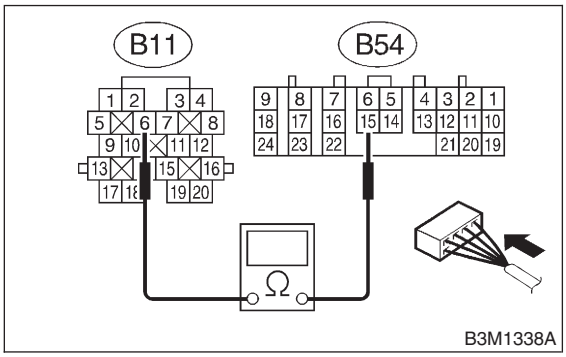


CHECK : ***Is the resistance between 10 and 17 Ω?***
YES : Go to step **8Q3**.
NO : Go to step **8Q10**.

8Q3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B54) No. 15 — (B11) No. 6:

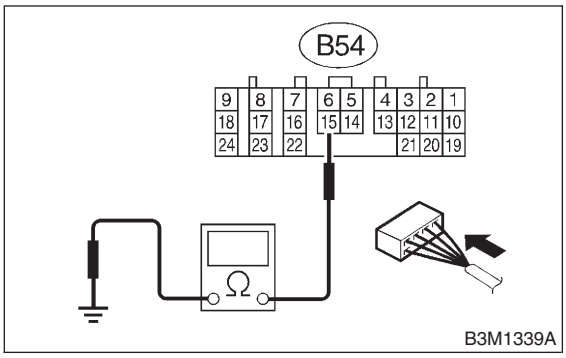


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8Q4**.
NO : Repair open circuit in harness between TCM and transmission connector.

8Q4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance harness connector between TCM and chassis ground.

Connector & terminal
(B54) No. 15 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8Q5**.
NO : Repair short circuit in harness between TCM and transmission connector.

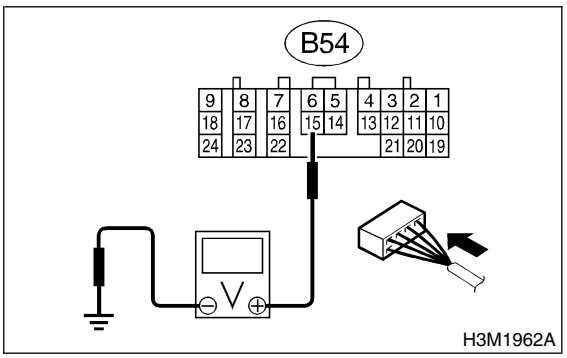
8Q5 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8Q8**.
NO : Go to step **8Q6**.

8Q6 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Connect connectors to TCM and transmission.
2) Turn ignition switch to ON (engine OFF).
3) Throttle is fully closed.
4) Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 15 (+) — Chassis ground:

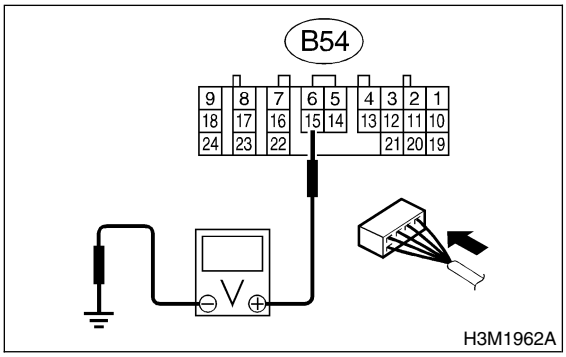


CHECK : ***Is the voltage less than 1 V in "P" range?***
YES : Go to step **8Q7**.
NO : Go to step **8Q12**.

8Q7 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure voltage between TCM connector and chassis ground.

Connector & terminal
(B54) No. 15 (+) — Chassis ground:



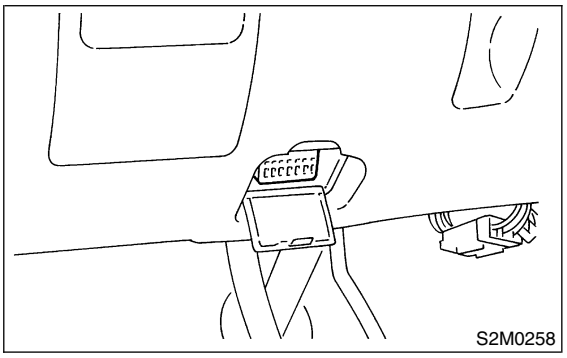
CHECK : ***Is the voltage between 5 and 7 V in "D" range?***

YES : Even if "AT OIL TEMP" lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the transfer duty solenoid and TCM connector.

NO : Go to step **8Q12**.

8Q8 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and transmission.
2) Connect Subaru Select Monitor to data link connector.



3) Turn ignition switch to ON (engine OFF) and turn Subaru Select Monitor switch to ON.
4) Move selector lever to "D" with throttle fully open (vehicle speed 0 km/h or 0 MPH).
5) Read data of transfer duty solenoid using Subaru Select Monitor.
- Transfer duty solenoid is indicated in "%".

CHECK : ***Is the value between 5 and 10%?***
YES : Go to step **8Q9**.
NO : Go to step **8Q12**.

8Q9 : CHECK OUTPUT SIGNAL EMITTED FROM TCM USING SUBARU SELECT MONITOR.

1) Set FWD mode.
2) Throttle fully closed.

CHECK : ***Is the value 95%?***

YES : Even if "AT OIL TEMP" lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the transfer duty solenoid and TCM connector.

NO : Go to step **8Q12**.

8Q10 : CHECK TRANSFER DUTY SOLENOID (IN TRANSMISSION).

1) Lift-up the vehicle and place safety stand.

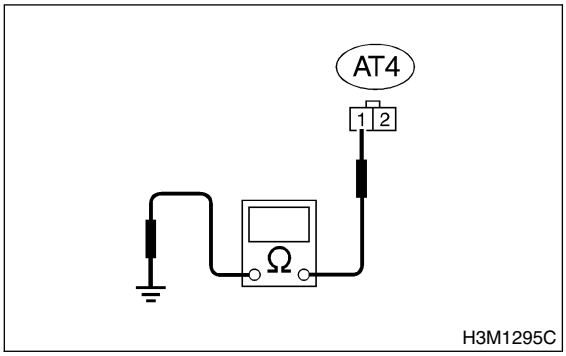
CAUTION:
On AWD models, raise all wheels off ground.

2) Drain automatic transmission fluid.

CAUTION:
Do not drain the automatic transmission fluid until it cools down.

3) Remove extension case, and disconnect connector from transfer duty solenoid.
4) Measure resistance between transfer duty solenoid connector and transmission ground.

Connector & terminal
(AT4) No. 1 — Transmission ground:

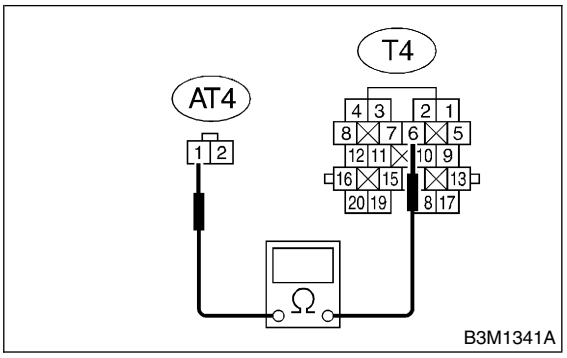


CHECK : ***Is the resistance between 10 and 17 Ω?***
YES : Go to step **8Q11**.
NO : Replace transfer duty solenoid. <Ref. to 3-2 [W5A0].>

8Q11 : CHECK HARNESS CONNECTOR BETWEEN TRANSFER DUTY SOLENOID AND TRANSMISSION.

Measure resistance of harness between transfer duty solenoid and transmission connector.

Connector & terminal
(T4) No. 6 — (AT4) No. 1:



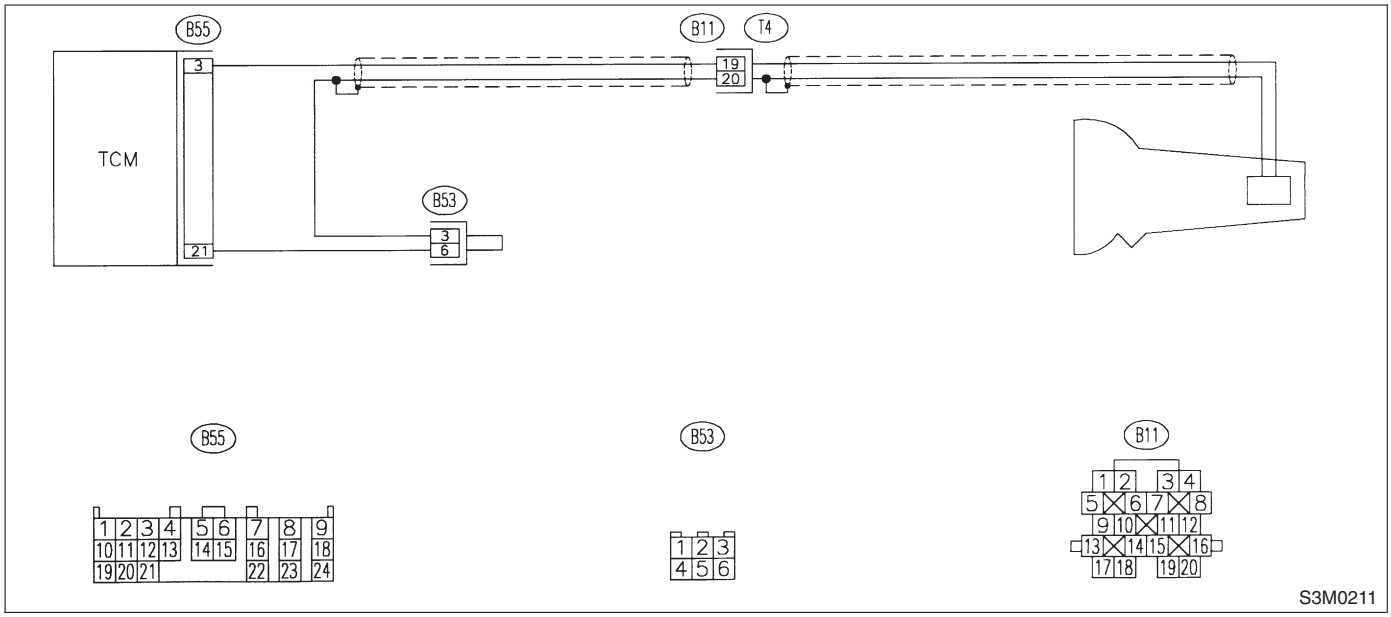
CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8Q12**.
NO : Repair open circuit in harness between transfer duty solenoid and transmission connector.

8Q12 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in transfer duty solenoid circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

R: TROUBLE CODE 93 — VEHICLE SPEED SENSOR 1 (REAR) —

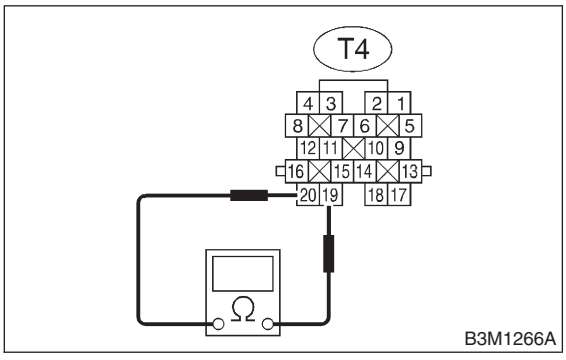
DIAGNOSIS:
Input signal circuit of TCM is open or shorted.
TROUBLE SYMPTOM:
No lock-up or excessive tight corner “braking”.
WIRING DIAGRAM:



8R1 : CHECK VEHICLE SPEED SENSOR 1.

1) Turn ignition switch to OFF.
2) Disconnect connector from transmission.
3) Measure resistance between transmission connector receptacle’s terminals.

Connector & terminal
(T4) No. 19 — No. 20:

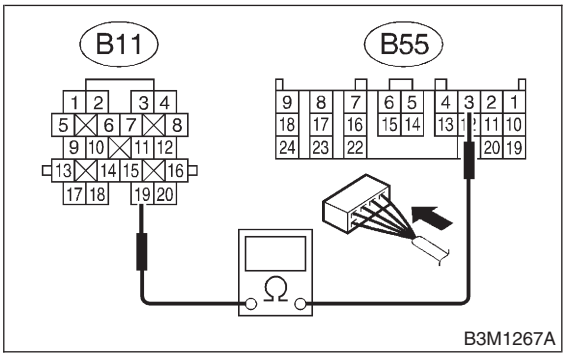


CHECK : ***Is the resistance between 450 and 650 Ω?***
YES : Go to step **8R2**.
NO : Replace transmission harness connector. <Ref. to 3-2 [W12A0].>

8R2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

1) Disconnect connector from TCM.
2) Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 3 — (B11) No. 19:

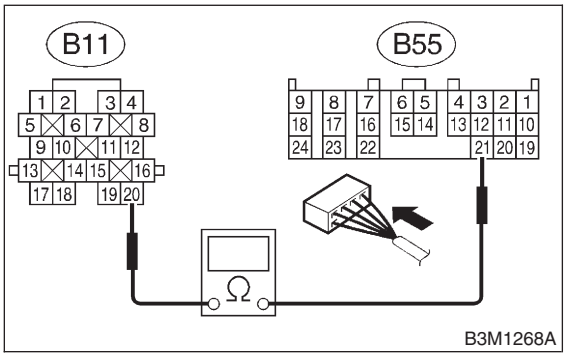


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8R3**.
NO : Repair open circuit in harness between TCM and transmission connector.

8R3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and transmission connector.

Connector & terminal
(B55) No. 21 — (B11) No. 20:

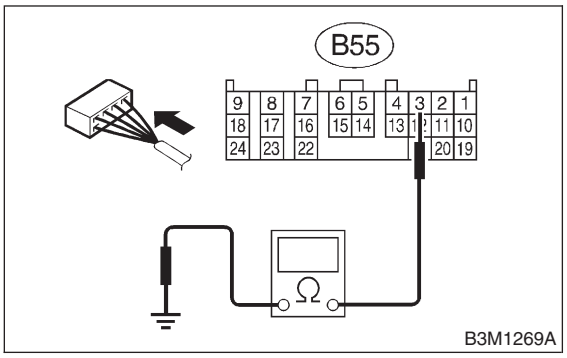


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **8R4**.
NO : Repair open circuit in harness between TCM and transmission, and poor contact in coupling connector.

8R4 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 3 — Chassis ground:

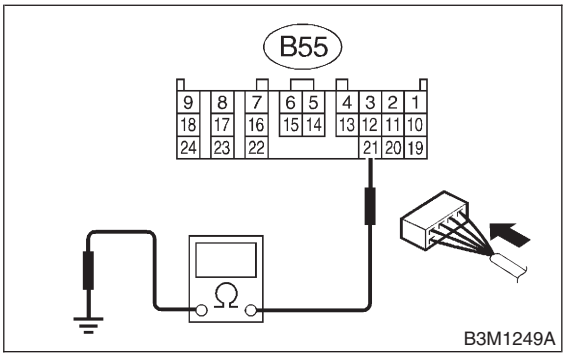


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8R5**.
NO : Repair short circuit in harness between TCM and transmission connector.

8R5 : CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.

Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 21 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8R6**.
NO : Repair short circuit in harness between TCM and transmission connector.

8R6 : PREPARE OSCILLOSCOPE.

CHECK : ***Do you have oscilloscope?***
YES : Go to step **8R10**.
NO : Go to step **8R7**.

8R7 : PREPARE SUBARU SELECT MONITOR.

CHECK : ***Do you have a Subaru Select Monitor?***
YES : Go to step **8R9**.
NO : Go to step **8R8**.

8R8 : CHECK INPUT SIGNAL FOR TCM.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and place safety stands.

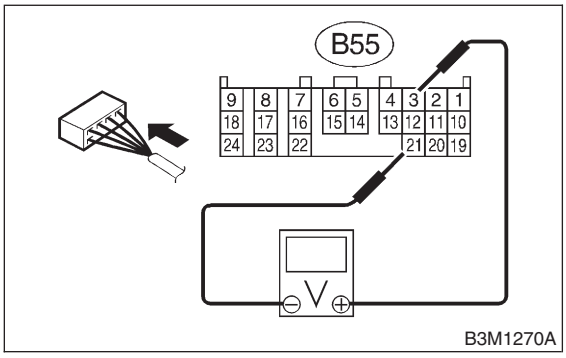
CAUTION:
On AWD models, raise all wheels off floor.

3) Start the engine and set vehicle in 20 km/h (12 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

4) Measure voltage between TCM connector terminals.

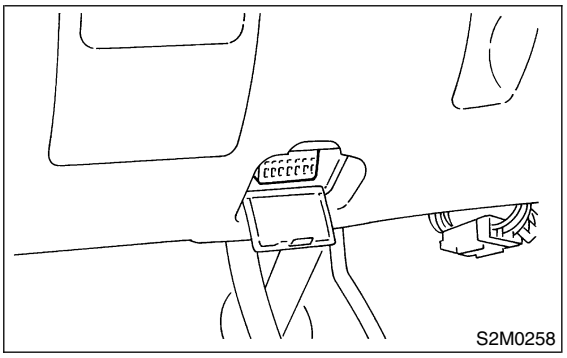
Connector & terminal
(B55) No. 3 (+) — No. 21 (–):



CHECK : ***Is the voltage more than AC 1 V?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.
NO : Go to step **8R11**.

8R9 : CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.

1) Connect connectors to TCM and transmission.
2) Connect Subaru Select Monitor to data link connector.



3) Lift-up or raise the vehicle and place safety stands.

CAUTION:
On AWD models, raise all wheels off floor.

4) Turn ignition switch to ON and turn Subaru Select Monitor switch to ON.
5) Start the engine.
6) Read data of vehicle speed using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in “km/h” or “MPH”.
7) Slowly increase vehicle speed to 60 km/h or 37 MPH.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

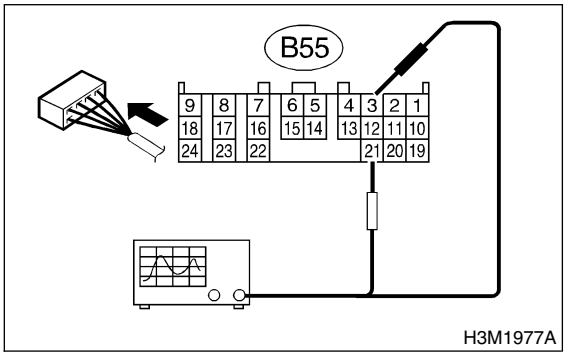
CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.
NO : Go to step **8R11**.

8R10 : CHECK INPUT SIGNAL FOR TCM USING OSCILLOSCOPE.

1) Connect connectors to TCM and transmission.
2) Lift-up or raise the vehicle and place safety stands.

CAUTION:
On AWD models, raise all wheels off floor.

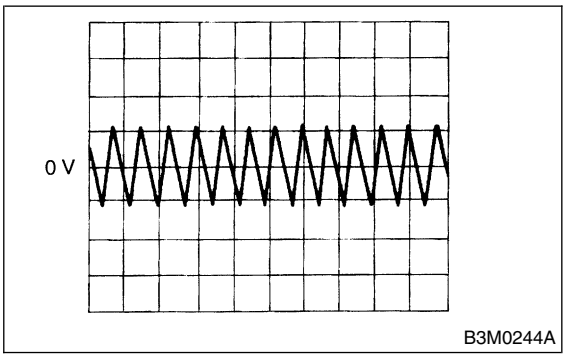
3) Set oscilloscope to TCM connector terminals.
Position prove; (B55) No. 3
Earth lead; (B55) No. 21



4) Start the engine and set vehicle in 20 km/h (12 MPH) condition.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

5) Measure signal voltage indicated on oscilloscope.



CHECK : ***Is the signal voltage more than AC 1 V?***

YES : Even if “AT OIL TEMP” lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the TCM and transmission.

NO : Go to step **8R11**.

8R11 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in vehicle speed sensor 1 circuit?***

YES : Repair poor contact.

NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9. Diagnostic Chart with Select Monitor

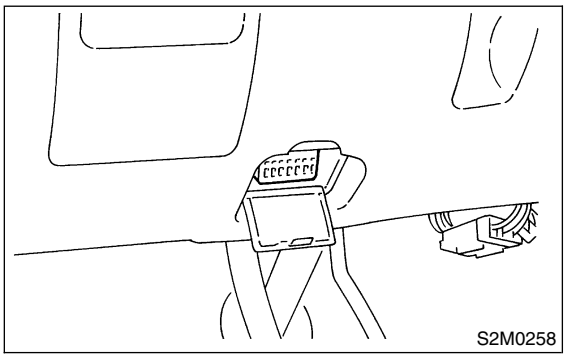
A: BASIC DIAGNOSTIC CHART

If no trouble codes appear in the on-board diagnostics operation (although problems have occurred or are occurring), measure performance characteristics of sensors, actuators, etc., in the Subaru Select Monitor and compare with the "basic data" to determine the cause of problems.
1) Trouble occurs.
2) No trouble codes appear in on-board diagnostics operation.
3) Measure each item using Subaru Select Monitor.
4) Compare measured values with basic data.
5) Determine item which is outside basic data specifications.
6) Check sensor and actuator affected.

B: BATTERY VOLTAGE

9B1 : CHECK BATTERY VOLTAGE.

1) Turn ignition switch to OFF.
2) Connect Subaru Select Monitor to data link connector.



3) Start the engine, and engine idling after warm-up.
4) Turn Subaru Select Monitor switch to ON.
5) Read data of battery voltage using Subaru Select Monitor.
● Battery voltage applied to TCM.

CHECK : ***Is voltage between 10 and 16 V?***
YES : Go to step VEHICLE SPEED SENSOR 1. <Ref. to 3-2 [T9C0].>
NO : Check battery voltage and specification of electrolyte, regulating voltage under no loads and generator (as a single unit).

C: CHECK VEHICLE SPEED SENSOR 1.

9C1 : CHECK VEHICLE SPEED SENSOR 1.

1) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

2) Read data of vehicle speed #1 using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in "MPH" or "km/h".

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Go to step VEHICLE SPEED SENSOR 2. <Ref. to 3-2 [T9D0].>
NO : Check vehicle speed sensor 1 circuit. <Ref. to 3-2 [T8R0].>

D: CHECK VEHICLE SPEED SENSOR 2.

9D1 : CHECK VEHICLE SPEED SENSOR 2.

Read data of vehicle speed #2 using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in "MPH" or "km/h".

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Go to step ENGINE SPEED SIGNAL. <Ref. to 3-2 [T9E0].>
NO : Check vehicle speed sensor 2 circuit. <Ref. to 3-2 [T8F0].>

E: CHECK ENGINE SPEED SIGNAL.

9E1 : CHECK ENGINE SPEED SIGNAL.

1) Turn A/C switch to OFF (with A/C models).
2) Warm-up the engine until engine coolant temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Read data of engine speed using Subaru Select Monitor.
- Engine speed is indicated in “rpm”.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the tachometer revolution increase as the Subaru Select Monitor revolution data increases?***
YES : Go to step ATF TEMPERATURE SENSOR. <Ref. to 3-2 [T9F0].>
NO : Check engine speed signal circuit. <Ref. to 3-2 [T8C0].>

F: CHECK ATF TEMPERATURE SENSOR.

9F1 : CHECK AT OIL TEMP WARNING LIGHT.

CHECK : ***Does the AT OIL TEMP warning light remain on 2 seconds after the engine has been started?***
YES : Go to step **9F2**.
NO : Check ATF temperature sensor and combination meter circuit. <Ref. to 3-2 [T8D0].>

9F2 : CHECK ATF TEMPERATURE SENSOR.

1) Read data of ATF temperature using Subaru Select Monitor.
- ATF temperature is indicated in “°F” or “°C”.

2) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Turn ignition switch to ON (engine OFF).

CHECK : ***Does the ATF temperature change from 176°F (80°C)?***
YES : Go to step THROTTLE POSITION SENSOR. <Ref. to 3-2 [T9G0].>
NO : Check ATF temperature sensor circuit. <Ref. to 3-2 [T8D0].>

G: CHECK THROTTLE POSITION SENSOR.

9G1 : CHECK INPUT SIGNAL FOR TCM.

Read data of throttle position sensor using Subaru Select Monitor.
- Throttle position sensor input signal is indicated.

CHECK : ***Is voltage between 0.3 and 0.7 V when the accelerator pedal is completely released?***
YES : Go to step **9G2**.
NO : Check throttle position sensor circuit. <Ref. to 3-2 [T8E0].>

9G2 : CHECK INPUT SIGNAL FOR TCM.

CHECK : ***Is voltage between 4.4 and 4.8 V when the accelerator pedal is completely depressed?***
YES : Go to step **9G3**.
NO : Check throttle position sensor circuit. <Ref. to 3-2 [T8E0].>

9G3 : CHECK INPUT SIGNAL FOR TCM.

CHECK : ***Does voltage decrease smoothly when the accelerator pedal is fully depressed and then fully released?***

YES : Go to step GEAR POSITION. <Ref. to 3-2 [T9H0].>

NO : Check throttle position sensor circuit. <Ref. to 3-2 [T8E0].>

H: CHECK GEAR POSITION.

9H1 : CHECK GEAR POSITION.

1) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

2) Start the engine.
3) Move select lever to “D”, and drive vehicle.
4) Read data of gear position using Subaru Select Monitor.
- Gear position is indicated.

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the transmission gear correspond to the gear which is shown on display?***

YES : Go to step LINE PRESSURE DUTY SOLENOID. <Ref. to 3-2 [T9I0].>

NO : Check shift solenoid 1 and shift solenoid 2 signal circuit. <Ref. to 3-2 [T8J0].> and <Ref. to 3-2 [T8K0].>

I: CHECK LINE PRESSURE DUTY SOLENOID.

9I1 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

2) Stop the engine and turn ignition switch to ON (engine OFF).
3) Move selector lever to “N”.
4) Read data of line pressure duty solenoid using Subaru Select Monitor.
- Line pressure duty solenoid is indicated in “%”.

CHECK : ***Does the Subaru Select Monitor indicate 100% when the accelerator pedal is completely released?***

YES : Go to step **9I2**.

NO : Go to step **9I4**.

9I2 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

CHECK : ***Does the Subaru Select Monitor indicate between 10 and 20% when the accelerator pedal is completely depressed?***

YES : Go to step **9I3**.

NO : Go to step **9I4**.

9I3 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

CHECK : ***Does the Subaru Select Monitor change smoothly when the accelerator pedal is fully depressed and then fully released?***

YES : Go to step LOCK-UP DUTY SOLENOID. <Ref. to 3-2 [T9J0].>

NO : Go to step **9I4**.

9I4 : CHECK THROTTLE POSITION SENSOR.

NOTE:
For the diagnostics procedure on throttle position sensor circuit, <Ref. to 3-2 [T9G0].>.

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit, <Ref. to 3-2 [T8E0].>.
NO : Go to step **9I5**.

9I5 : CHECK ENGINE SPEED SIGNAL.

NOTE:
For the diagnostics procedure on engine speed signal circuit, <Ref. to 3-2 [T9E0].>.

CHECK : ***Is there any trouble in engine speed signal circuit?***
YES : Repair or replace engine speed signal circuit, <Ref. to 3-2 [T8C0].>.
NO : Go to step **9I6**.

9I6 : CHECK ATF TEMPERATURE SENSOR.

NOTE:
For the diagnostics procedure on ATF temperature sensor circuit, <Ref. to 3-2 [T9F1].>.

CHECK : ***Is there any trouble in ATF temperature sensor circuit?***
YES : Repair or replace ATF temperature sensor circuit, <Ref. to 3-2 [T8D0].>.
NO : Go to step **9I7**.

9I7 : CHECK INHIBITOR SWITCH.

1) Turn ignition switch and Subaru Select Monitor to ON.
2) Read data of range switch using Subaru Select Monitor.
- Range switch is indicated in ON ⇔ OFF.

CHECK : ***When each range is selected, does LED of the range switch on Subaru Select Monitor light up?***
YES : Go to step LOCK-UP DUTY SOLENOID. <Ref. to 3-2 [T9J0].>
NO : Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

J: CHECK LOCK-UP DUTY SOLENOID.

9J1 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Read data of lock-up duty solenoid using Subaru Select Monitor.
- Lock-up duty solenoid is indicated in "%".

CHECK : ***Does the Subaru Select Monitor indicate 5%?***
YES : Go to step **9J2**.
NO : Go to step **9J3**.

9J2 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Move selector lever to "D" and slowly increase vehicle speed to 75 km/h (47 MPH).

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the Subaru Select Monitor indicate 95%?***
YES : Go to step TRANSFER DUTY SOLENOID. <Ref. to 3-2 [T9K0].>
NO : Go to step **9J3**.

9J3 : CHECK THROTTLE POSITION SENSOR.

NOTE:
For the diagnostics procedure on throttle position sensor circuit, <Ref. to 3-2 [T9G0].>.

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit, <Ref. to 3-2 [T8E0].>.
NO : Go to step **9J4**.

9J4 : CHECK VEHICLE SPEED SENSOR 1.

NOTE:
For the diagnostics procedure on vehicle speed sensor 1 circuit, <Ref. to 3-2 [T9C0].>.

CHECK : ***Is there any trouble in vehicle speed sensor 1 circuit?***
YES : Repair or replace vehicle speed sensor 1 circuit, <Ref. to 3-2 [T8R0].>.
NO : Go to step **9J5**.

9J5 : CHECK VEHICLE SPEED SENSOR 2.

NOTE:
For the diagnostics procedure on vehicle speed sensor 2 circuit, <Ref. to 3-2 [T9D0].>.

CHECK : ***Is there any trouble in vehicle speed sensor 2 circuit?***
YES : Repair or replace vehicle speed sensor 2 circuit, <Ref. to 3-2 [T8F0].>.
NO : Go to step **9J6**.

9J6 : CHECK ENGINE SPEED SIGNAL.

NOTE:
For the diagnostics procedure on engine speed signal circuit, <Ref. to 3-2 [T9E0].>.

CHECK : ***Is there any trouble in engine speed signal circuit?***
YES : Repair or replace engine speed signal circuit, <Ref. to 3-2 [T8C0].>.
NO : Go to step **9J7**.

9J7 : CHECK INHIBITOR SWITCH.

Read data of range switch using Subaru Select Monitor.
- Range switch is indicated in ON ⇔ OFF.

CHECK : ***When each range is selected, does LED of the range switch on Subaru Select Monitor light up?***
YES : Go to step TRANSFER DUTY SOLENOID. <Ref. to 3-2 [T9K0].>
NO : Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

K: CHECK TRANSFER DUTY SOLENOID.

9K1 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Turn ignition switch to ON (engine OFF).
2) Move selector lever to “D”.
3) Read data of transfer duty solenoid using Subaru Select Monitor.
- Transfer duty solenoid is indicated in “%”.

CHECK : ***Does the duty solenoid change in response to the depress-release motion of the accelerator pedal?***
YES : Go to step **9K2**.
NO : Go to step **9K3**.

9K2 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Turn ignition switch to OFF.
2) Set FWD mode.
3) Turn ignition switch to ON (engine OFF).

CHECK : ***Does the Subaru Select Monitor indicate 95%?***
YES : Go to step THROTTLE POSITION SENSOR POWER SUPPLY. <Ref. to 3-2 [T9L0].>
NO : Go to step **9K3**.

9K3 : CHECK THROTTLE POSITION SENSOR.

NOTE:
For the diagnostics procedure on throttle position sensor circuit, <Ref. to 3-2 [T9G0].>.

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit, <Ref. to 3-2 [T8E0].>.
NO : Go to step **9K4**.

9K4 : CHECK VEHICLE SPEED SENSOR 1.

NOTE:
For the diagnostics procedure on vehicle speed sensor 1 circuit, <Ref. to 3-2 [T9C0].>.

CHECK : ***Is there any trouble in vehicle speed sensor 1 circuit?***
YES : Repair or replace vehicle speed sensor 1 circuit, <Ref. to 3-2 [T8R0].>.
NO : Go to step **9K5**.

9K5 : CHECK VEHICLE SPEED SENSOR 2.

NOTE:
For the diagnostics procedure on vehicle speed sensor 2 circuit, <Ref. to 3-2 [T9D0].>.

CHECK : ***Is there any trouble in vehicle speed sensor 2 circuit?***
YES : Repair or replace vehicle speed sensor 2 circuit, <Ref. to 3-2 [T8F0].>.
NO : Go to step **9K6**.

9K6 : CHECK ATF TEMPERATURE SENSOR.

NOTE:
For the diagnostics procedure on ATF temperature sensor circuit, <Ref. to 3-2 [T9F0].>.

CHECK : ***Is there any trouble in ATF temperature sensor circuit?***
YES : Repair or replace ATF temperature sensor circuit, <Ref. to 3-2 [T8D0].>.
NO : Go to step **9K7**.

9K7 : CHECK INHIBITOR SWITCH.

Read data of range switch using Subaru Select Monitor.
- Range switch is indicated in ON ⇔ OFF.

CHECK : ***When each range is selected, does LED of range switch on Subaru Select Monitor light up?***
YES : Go to step **9K8**.
NO : Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

9K8 : CHECK ABS SIGNAL.

1) Start the engine, and turn Subaru Select Monitor switch to ON.
2) Read data of ABS signal using Subaru Select Monitor.
- ABS switch is indicated in ON ⇔ OFF.

CHECK : ***Does the LED of ABS switch light up?***
YES : Check ABS signal circuit. <Ref. to 4-4 [T10Y0].> and <Ref. to 4-4 [T10Z0].>
NO : Go to step THROTTLE POSITION SENSOR POWER SUPPLY. <Ref. to 3-2 [T9L0].>

L: CHECK THROTTLE POSITION SENSOR POWER SUPPLY.

9L1 : CHECK THROTTLE POSITION SENSOR POWER SUPPLY.

Read data of throttle position sensor power supply using Subaru Select Monitor.
- Throttle position sensor power supply voltage is indicated.

CHECK : ***Is the value fixed between 4.8 and 5.3 V?***
YES : Go to step INTAKE MANIFOLD PRESSURE SIGNAL. <Ref. to 3-2 [T9M0].>
NO : Check throttle position sensor power supply circuit. <Ref. to 3-2 [T8E0].>

M: CHECK INTAKE MANIFOLD PRESSURE SIGNAL.

9M1 : CHECK INPUT SIGNAL FOR TCM.

1) Start the engine.
2) Warm-up the engine until engine coolant temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

3) Engine idling after warm-up.
4) Move selector lever to "N".
5) Read data of intake manifold pressure signal using Subaru Select Monitor.
● Display shows intake manifold pressure signal value sent from ECM.

CHECK : ***Does voltage change in response to the depress-release motion of the accelerator pedal?***
YES : Go to step **9M2**.
NO : Check intake manifold pressure signal circuit. <Ref. to 3-2 [T8I0].>

9M2 : CHECK ECM.

CHECK : ***Has trouble been eliminated after ECM replacement?***
YES : Replace ECM. <Ref. to 2-7 [W17A0].>
NO : Go to step **9M3**.

9M3 : CHECK TCM.

NOTE:
Install former ECM.

CHECK : ***Has trouble been eliminated after TCM replacement?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Go to step TORQUE CONVERTER TURBINE SPEED SENSOR. <Ref. to 3-2 [T9N0].>

N: CHECK TORQUE CONVERTER TURBINE SPEED SENSOR.

9N1 : CHECK TORQUE CONVERTER TURBINE SPEED SENSOR.

1) Lift-up the vehicle and place safety stand.

CAUTION:
On AWD models, raise all wheels off ground.

2) Read data of torque converter turbine speed sensor using Subaru Select Monitor.
● Compare speedometer with Subaru Select Monitor indications.
● Vehicle speed is indicated in "MPH" or "km/h".

NOTE:
The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to 4-4 [T6D2].>

CHECK : ***Does the speedometer indication increase as the Subaru Select Monitor data increases?***
YES : Go to step 2-4 BRAKE DUTY SOLENOID. <Ref. to 3-2 [T9O0].>
NO : Check torque converter turbine speed sensor circuit. <Ref. to 3-2 [T8G0].>

O: CHECK 2-4 BRAKE DUTY SOLENOID.

9O1 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Warm-up the transmission until ATF temperature is above 80°C (176°F).

NOTE:
If ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.

2) Stop the engine and turn ignition switch to ON (engine OFF).
3) Move selector lever to "N".
4) Read data of 2-4 brake duty solenoid using Subaru Select Monitor.
● 2-4 brake duty solenoid is indicated in "%".

CHECK : ***Does the Subaru Select Monitor indicate 100% when the accelerator pedal is completely released?***
YES : Go to step **9O2**.
NO : Go to step **9O4**.

9O2 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

CHECK : ***Does the Subaru Select Monitor indicate between 10 and 20% when the accelerator pedal is completely depressed?***
YES : Go to step **9O3**.
NO : Go to step **9O4**.

9O3 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

CHECK : ***Does the Subaru Select Monitor change smoothly when the accelerator pedal is fully depressed and then fully released?***
YES : Go to step FWD SWITCH. <Ref. to 3-2 [T9P0].>
NO : Go to step **9O4**.

9O4 : CHECK THROTTLE POSITION SENSOR.

NOTE:
For the diagnostics procedure on throttle position sensor circuit, <Ref. to 3-2 [T9G0].>.

CHECK : ***Is there any trouble in throttle position sensor circuit?***
YES : Repair or replace throttle position sensor circuit, <Ref. to 3-2 [T8E0].>.
NO : Go to step **9O5**.

9O5 : CHECK ENGINE SPEED SIGNAL.

NOTE:
For the diagnostics procedure on engine speed signal circuit, <Ref. to 3-2 [T9E0].>.

CHECK : ***Is there any trouble in engine speed signal circuit?***
YES : Repair or replace engine speed signal circuit, <Ref. to 3-2 [T8C0].>.
NO : Go to step **9O6**.

9O6 : CHECK ATF TEMPERATURE SENSOR.

NOTE:
For the diagnostics procedure on ATF temperature sensor circuit, <Ref. to 3-2 [T9F0].>.

CHECK : ***Is there any trouble in ATF temperature sensor circuit?***
YES : Repair or replace ATF temperature sensor circuit, <Ref. to 3-2 [T8D0].>.
NO : Go to step **9O7**.

9O7 : CHECK INHIBITOR SWITCH.

1) Turn ignition switch and Subaru Select Monitor to ON.
2) Read data of range switch using Subaru Select Monitor.
● Range switch is indicated in ON ⇔ OFF.

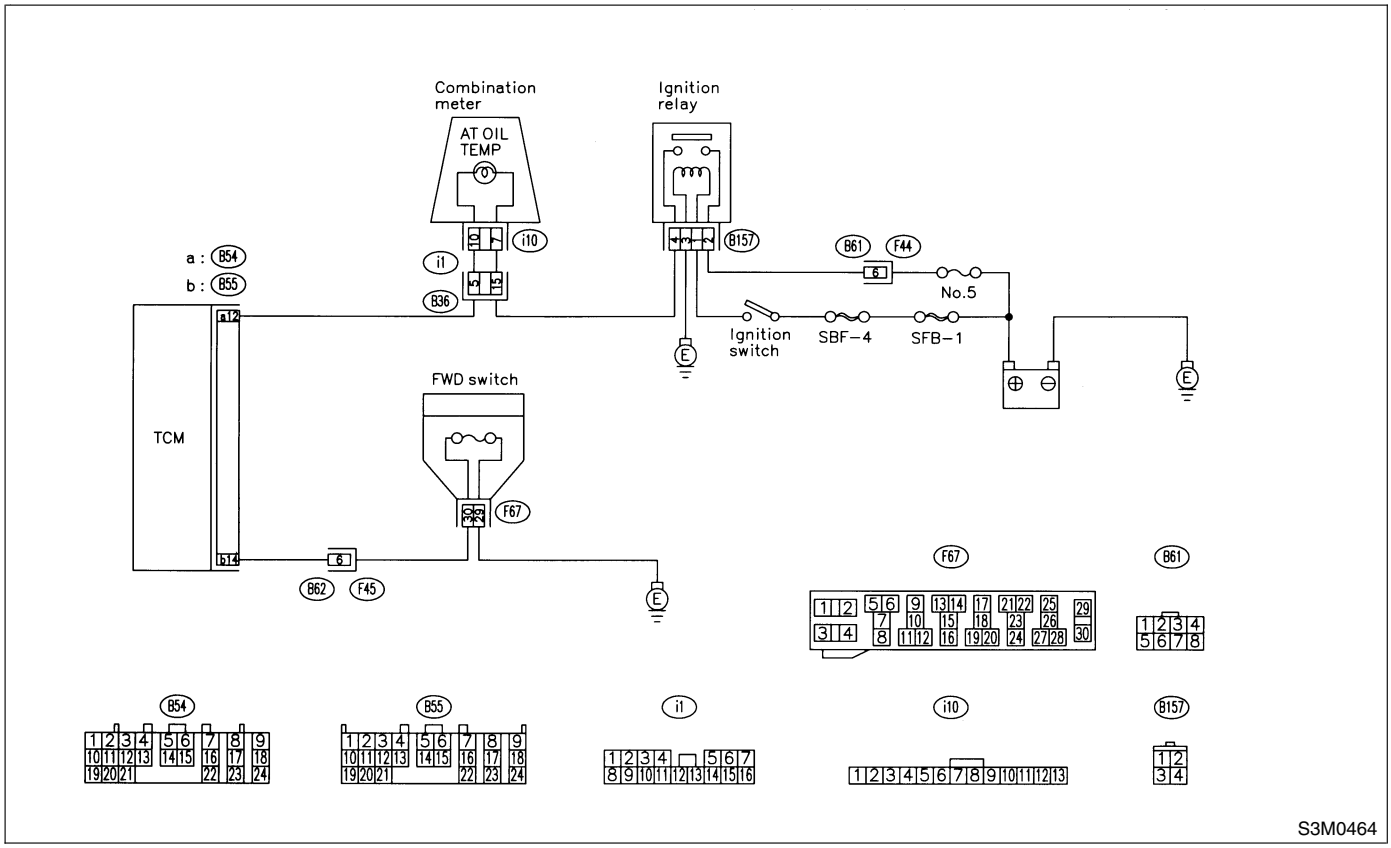
CHECK : ***When each range is selected, does LED of the range switch on Subaru Select Monitor light up?***
YES : Go to step FWD SWITCH. <Ref. to 3-2 [T9P0].>
NO : Check inhibitor switch circuit. <Ref. to 3-2 [T9T0].>

P: CHECK FWD SWITCH.

DIAGNOSIS:

- LED does not come on even if FWD switch is ON.
- FWD switch circuit is open or short.

WIRING DIAGRAM:



9P1 : CHECK FWD SWITCH.

CHECK : ***When fuse is inserted to FWD switch, does LED light up?***

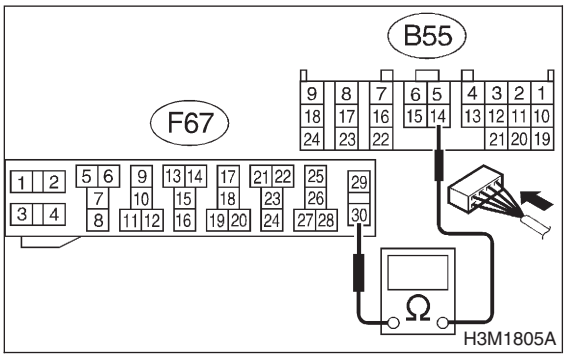
YES : Go to step BRAKE SWITCH. <Ref. to 3-2 [T9Q0].>

NO : Go to step **9P2**.

9P2 : CHECK HARNESS CONNECTOR BETWEEN TCM AND FWD SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from TCM and FWD switch.
3) Measure resistance of harness between TCM and FWD switch connector.

Connector & terminal
(B55) No. 14 — (F67) No. 30:

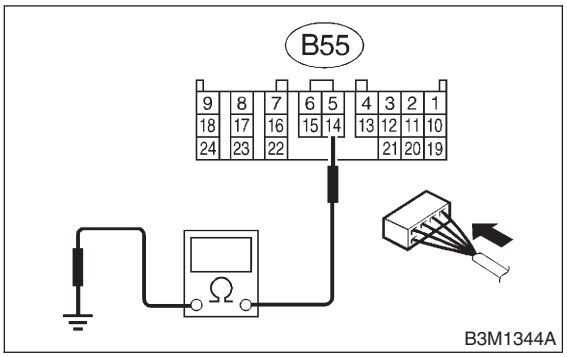


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9P3**.
NO : Repair open circuit in harness between TCM and FWD switch connector.

9P3 : CHECK HARNESS CONNECTOR BETWEEN TCM AND FWD SWITCH.

Measure resistance of harness connector between TCM and body to make sure that circuit does not short.

Connector & terminal
(B55) No. 14 — Chassis ground:

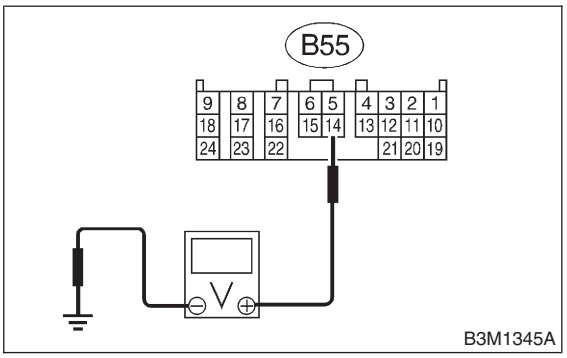


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9P4**.
NO : Repair short circuit in harness connector between TCM and chassis ground.

9P4 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and FWD switch.
3) Turn ignition switch to ON.
4) Measure signal voltage for TCM while installing the fuse to FWD switch connector.

Connector & terminal
(B55) No. 14 (+) — Chassis ground (–):

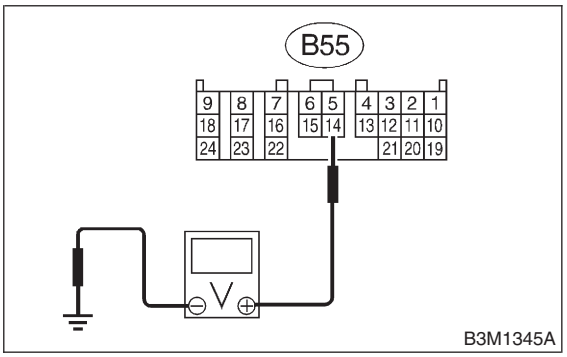


CHECK : ***Is the voltage less than 1 V in FWD switch while installing?***
YES : Go to step **9P5**.
NO : Go to step **9P11**.

9P5 : CHECK INPUT SIGNAL FOR TCM.

Measure signal voltage for TCM while removing the fuse from FWD switch connector.

Connector & terminal
(B55) No. 14 (+) — Chassis ground (–):



CHECK : ***Is the voltage more than 10 V in FWD switch while removing?***
YES : Go to step **9P6**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9P6 : CHECK FWD INDICATOR LIGHT.

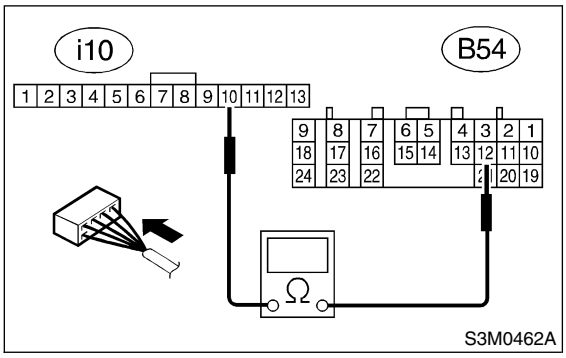
1) Turn ignition switch to OFF.
2) Remove combination meter.
3) Remove FWD indicator light bulb from combination meter.

CHECK : ***Is FWD indicator light bulb OK?***
YES : Go to step **9P7**.
NO : Replace FWD indicator light bulb.

9P7 : CHECK HARNESS CONNECTOR BETWEEN TCM AND COMBINATION METER.

1) Turn ignition switch to OFF.
2) Disconnect connector from TCM and combination meter.
3) Measure resistance of harness between TCM and diagnosis connector.

Connector & terminal
(B54) No. 12 — (i10) No. 10:

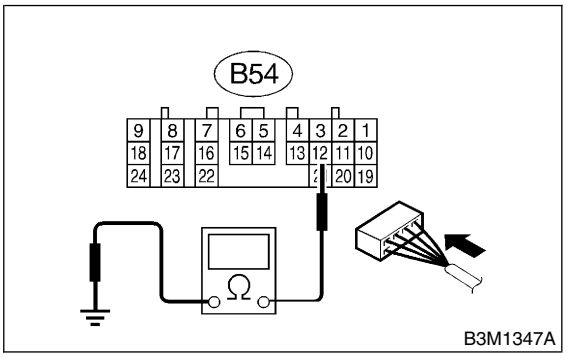


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9P8**.
NO : Repair open circuit in harness between TCM and combination meter and poor contact in coupling connector.

9P8 : CHECK HARNESS CONNECTOR BETWEEN TCM AND COMBINATION METER.

Measure resistance of harness connector between TCM and chassis ground to make sure that circuit does not short.

Connector & terminal
(B54) No. 12 — Chassis ground:

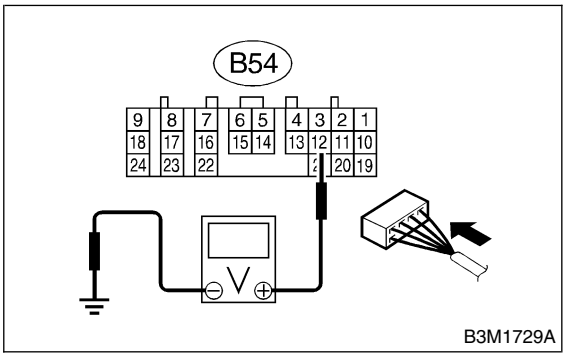


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9P9**.
NO : Repair short circuit in harness between TCM and combination meter connector.

9P9 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and combination meter.
3) Turn ignition switch to ON.
4) Measure signal voltage for TCM while installing and removing the fuse to FWD switch connector.

Connector & terminal
(B54) No. 12 — Chassis ground:

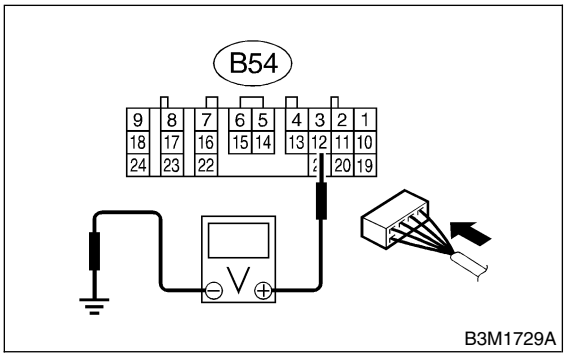


CHECK : ***Is the voltage less than 1 V in FWD switch while installing?***
YES : Go to step **9P10**.
NO : Go to step **9P11**.

9P10 : CHECK OUTPUT SIGNAL EMITTED FROM TCM.

Measure signal voltage for TCM while removing the fuse from FWD switch connector.

Connector & terminal
(B54) No. 12 — Chassis ground:



CHECK : ***Is the voltage more than 10 V in FWD switch while removing?***
YES : Go to step **9P11**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9P11 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in FWD switch circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

Q: CHECK BRAKE SWITCH.

9Q1 : CHECK BRAKE SWITCH.

CHECK : ***When the brake pedal is depressed, does LED light up?***
YES : Go to step ABS SWITCH. <Ref. to 3-2 [T9R0].>
NO : Check brake switch circuit. <Ref. to 2-7 [T10AW0].>

R: CHECK ABS SWITCH.

9R1 : CHECK ABS SWITCH.

CHECK : ***Does the LED of ABS switch light up?***
YES : Check ABS switch circuit. <Ref. to 4-4 [T10Y0].> and <Ref. to 4-4 [T10Z0].>
NO : Go to step CRUISE CONTROL SWITCH. <Ref. to 3-2 [T9S0].>

S: CHECK CRUISE CONTROL SWITCH.

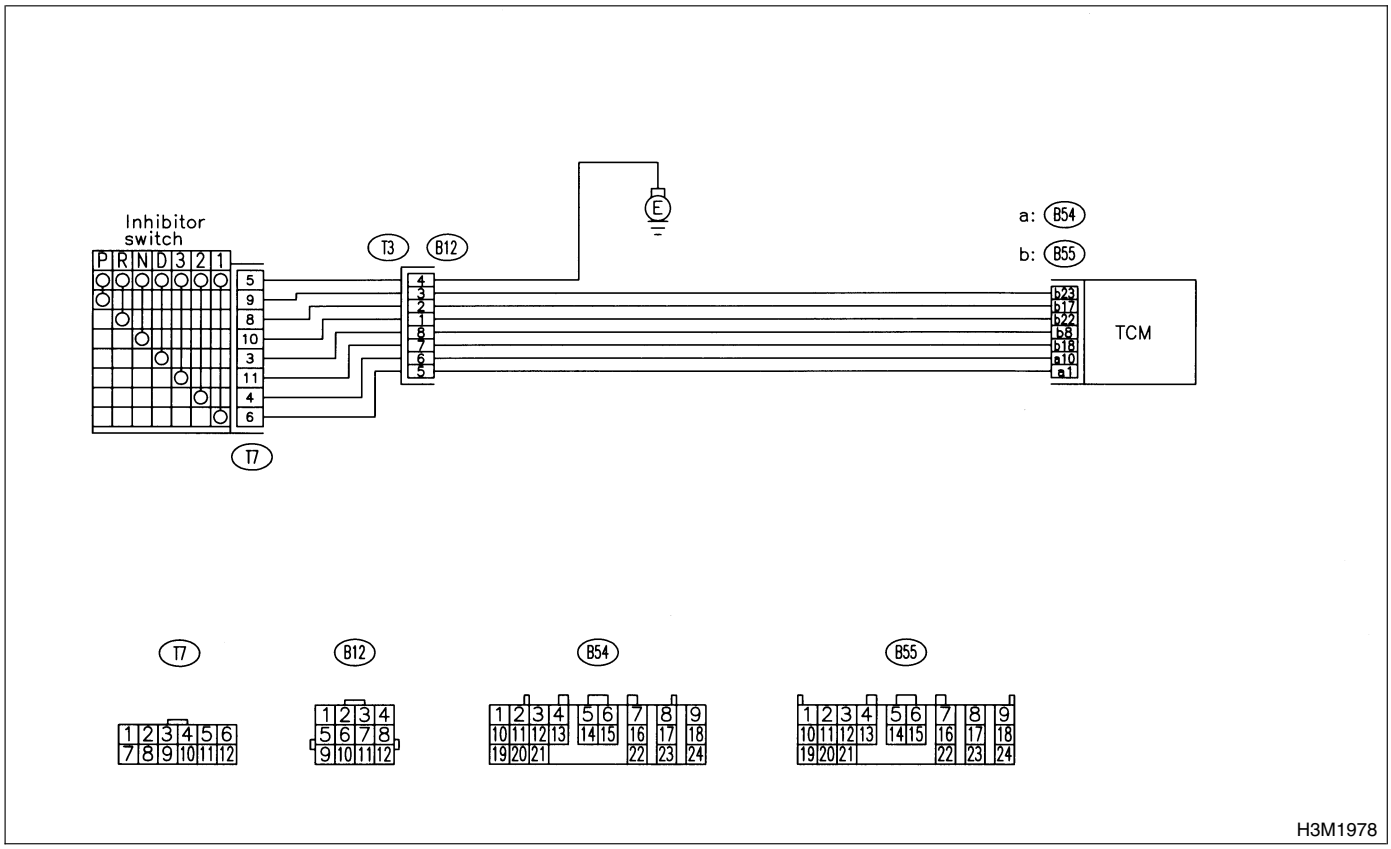
9S1 : CHECK CRUISE CONTROL SWITCH.

CHECK : ***When cruise control is set, does LED light up?***
YES : Go to step INHIBITOR SWITCH. <Ref. to 3-2 [T9T0].>
NO : Check cruise control. <Ref. to 6-2 [T2A0].>

T: CHECK INHIBITOR SWITCH.

DIAGNOSIS:
Input signal circuit of inhibitor switch is open or shorted.
TROUBLE SYMPTOM:
- Shift characteristics are erroneous.
- Engine brake is not effected when selector lever is in “3” range.
- Engine brake is not effected when selector lever is in “2” range.
- Engine brake is not effected when selector lever is in “1” range.

WIRING DIAGRAM:



9T1 : CHECK “P” RANGE SWITCH.

CHECK : ***When “P” range is selected, does LED light up?***
YES : Go to step **9T2**.
NO : Go to step **9T15**.

9T2 : CHECK “P” RANGE SWITCH.

CHECK : ***When the “R” range is selected, does “P” range LED light up?***
YES : Go to step **9T20**.
NO : Go to step **9T3**.

9T3 : CHECK “R” RANGE SWITCH.

CHECK : ***When the “R” range is selected, does LED light up?***
YES : Go to step **9T4**.
NO : Go to step **9T22**.

9T4 : CHECK “R” RANGE SWITCH.

CHECK : ***When the “N” range is selected, does “R” range LED light up?***
YES : Go to step **9T26**.
NO : Go to step **9T5**.

9T5 : CHECK "N" RANGE SWITCH.

CHECK : ***When the "N" range is selected, does LED light up?***
YES : Go to step **9T6**.
NO : Go to step **9T28**.

9T6 : CHECK "N" RANGE SWITCH.

CHECK : ***When the "D" range is selected, does "N" range LED light up?***
YES : Go to step **9T32**.
NO : Go to step **9T7**.

9T7 : CHECK "D" RANGE SWITCH.

CHECK : ***When the "D" range is selected, does LED light up?***
YES : Go to step **9T8**.
NO : Go to step **9T34**.

9T8 : CHECK "D" RANGE SWITCH.

CHECK : ***When the "3" range is selected, does "D" range LED light up?***
YES : Go to step **9T38**.
NO : Go to step **9T9**.

9T9 : CHECK "3" RANGE SWITCH.

CHECK : ***When the "3" range is selected, does LED light up?***
YES : Go to step **9T10**.
NO : Go to step **9T40**.

9T10 : CHECK "3" RANGE SWITCH.

CHECK : ***When the "2" range is selected, does "3" range LED light up?***
YES : Go to step **9T11**.
NO : Go to step **9T44**.

9T11 : CHECK "2" RANGE SWITCH.

CHECK : ***When the "2" range is selected, does LED light up?***
YES : Go to step **9T12**.
NO : Go to step **9T46**.

9T12 : CHECK "2" RANGE SWITCH.

CHECK : ***When the "1" range is selected, does "2" range LED light up?***
YES : Go to step **9T13**.
NO : Go to step **9T50**.

9T13 : CHECK "1" RANGE SWITCH.

CHECK : ***When the "1" range is selected, does LED light up?***
YES : Go to step **9T14**.
NO : Go to step **9T52**.

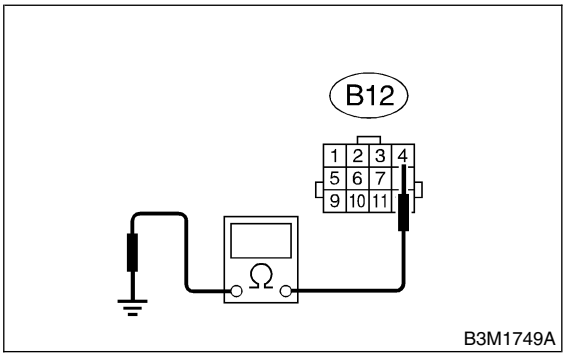
9T14 : CHECK "1" RANGE SWITCH.

CHECK : ***When the "P" range is selected, does "1" range LED light UP?***
YES : Go to step **9T56**.
NO : Go to step SHIFT SOLENOID 1. <Ref. to 3-2 [T9U0].>

9T15 : CHECK HARNESS CONNECTOR BETWEEN INHIBITOR SWITCH AND CHASSIS GROUND.

1) Turn ignition switch to OFF.
2) Disconnect connector from inhibitor switch.
3) Measure resistance of harness between inhibitor switch and chassis ground.

Connector & terminal
(B12) No. 4 — Chassis ground:

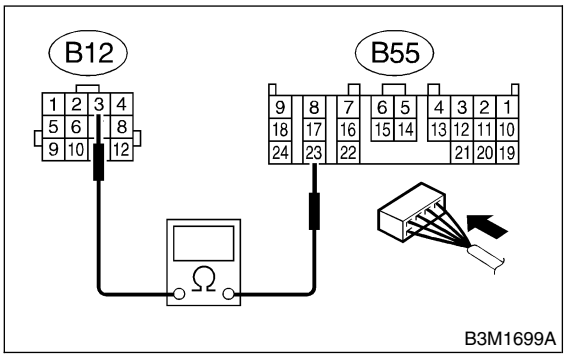


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T16**.
NO : Repair open circuit in harness between inhibitor switch connector and combination meter.

9T16 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B55) No. 23 — (B12) No. 3:

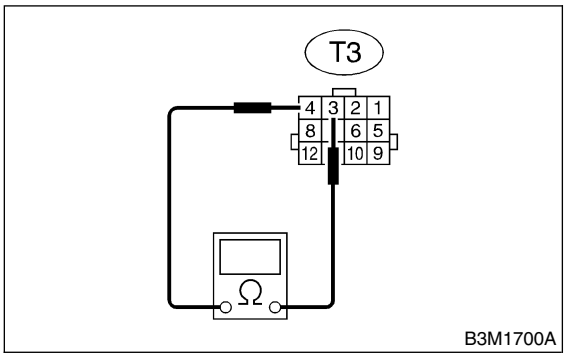


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T17**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T17 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 3:

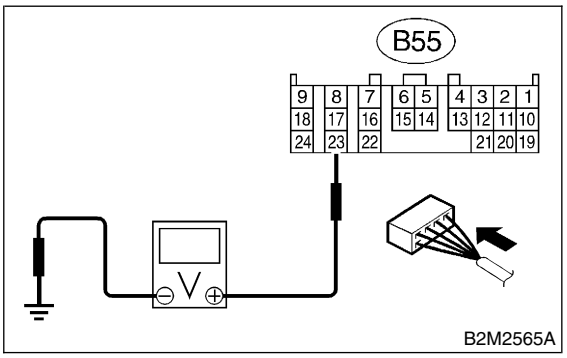


CHECK : ***Is the resistance less than 1 Ω in "P" range?***
YES : Go to step **9T18**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T18 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 23 (+) — Chassis ground (–):

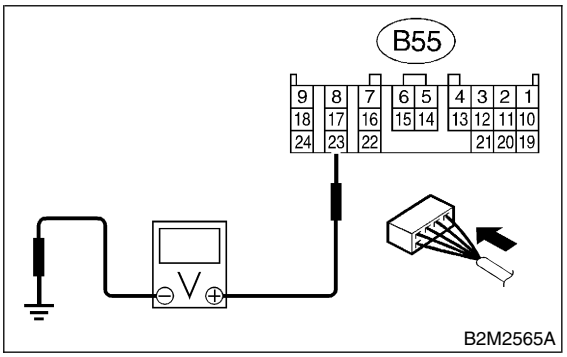


CHECK : ***Is the voltage less than 1 V in "P" range?***
YES : Go to step **9T19**.
NO : Go to step **9T58**.

9T19 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 23 (+) — Chassis ground (–):

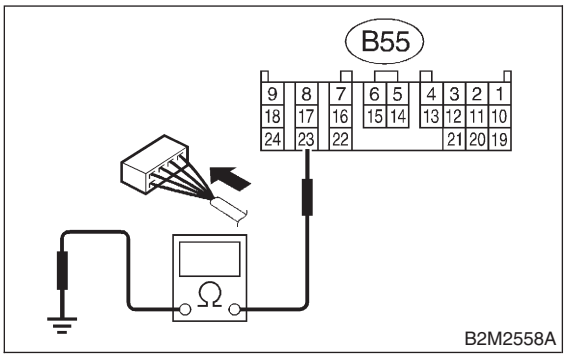


CHECK : ***Is the voltage more than 8 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T20 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 23 — Chassis ground:

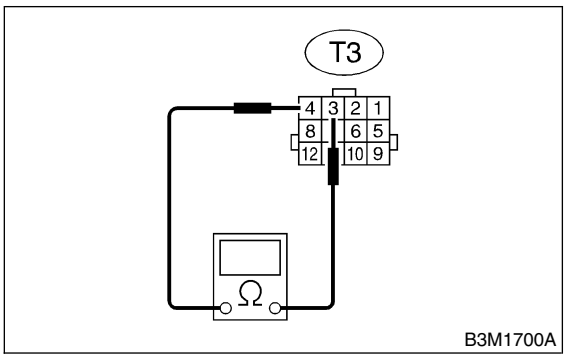


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T21**.
NO : Repair ground short circuit in "P" range circuit.

9T21 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 3:

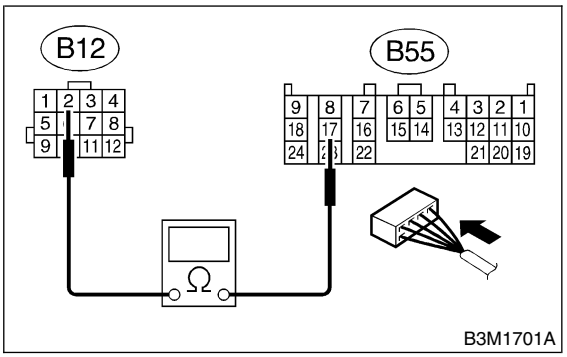


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T22 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B55) No. 17 — (B12) No. 2:

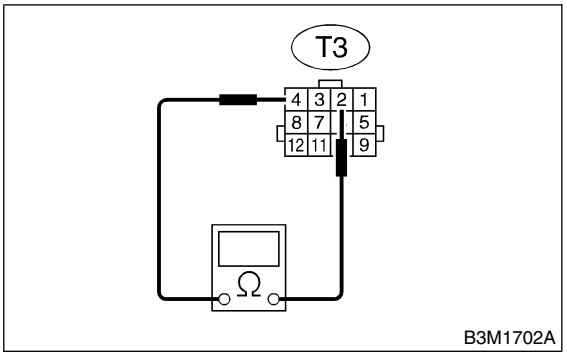


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T23**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T23 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 2 — No. 4:

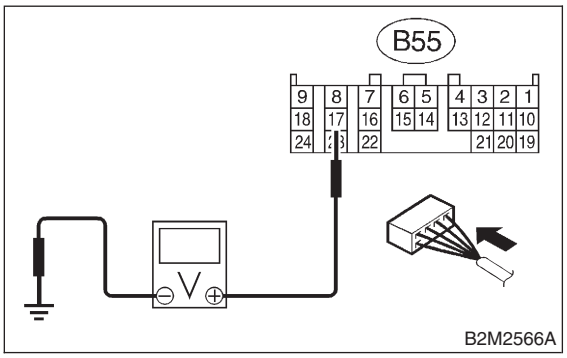


CHECK : ***Is the resistance less than 1 Ω in "R" range?***
YES : Go to step **9T24**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T24 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 17 (+) — Chassis ground (–):

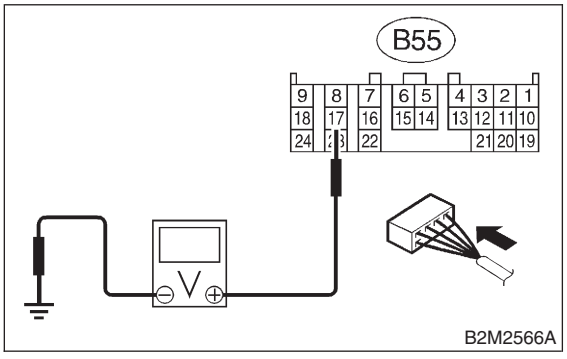


CHECK : ***Is the voltage less than 1 V in "R" range?***
YES : Go to step **9T25**.
NO : Go to step **9T58**.

9T25 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 17 (+) — Chassis ground (–):

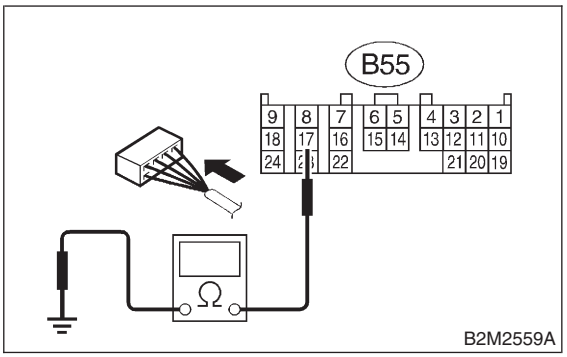


CHECK : ***Is the voltage more than 9.5 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T26 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 17 — Chassis ground:

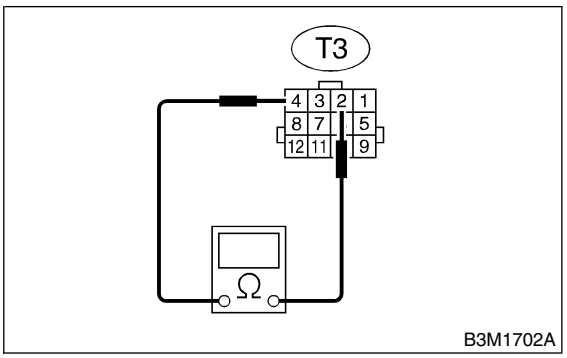


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T27**.
NO : Repair ground short circuit in "R" range circuit.

9T27 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 2 — No. 4:

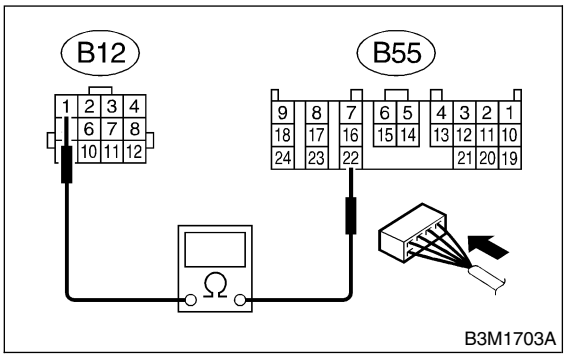


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T28 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B55) No. 22 — (B12) No. 1:

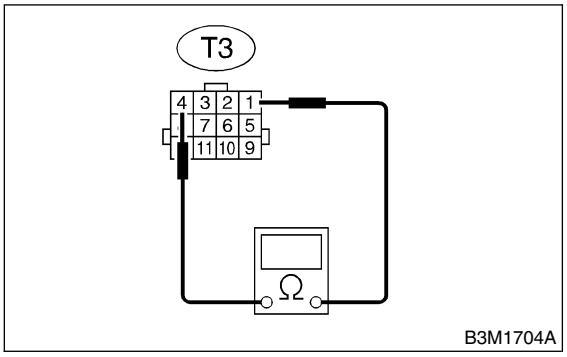


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T29**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T29 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 1:

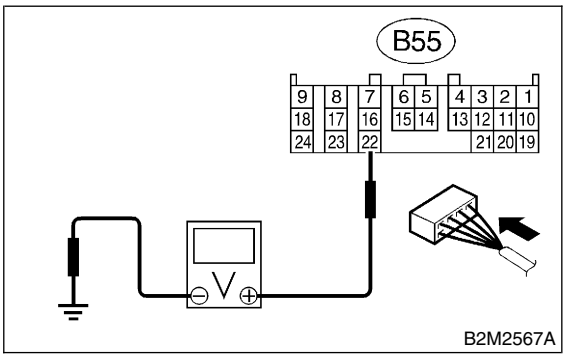


CHECK : ***Is the resistance less than 1 Ω in "N" range?***
YES : Go to step **9T30**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T30 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 22 (+) — Chassis ground (–):

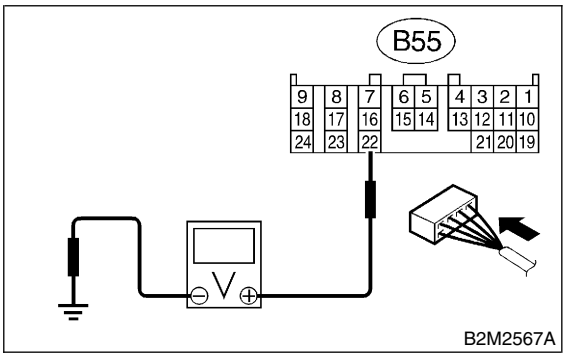


CHECK : ***Is the voltage less than 1 V in "N" range?***
YES : Go to step **9T31**.
NO : Go to step **9T58**.

9T31 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 22 (+) — Chassis ground (–):

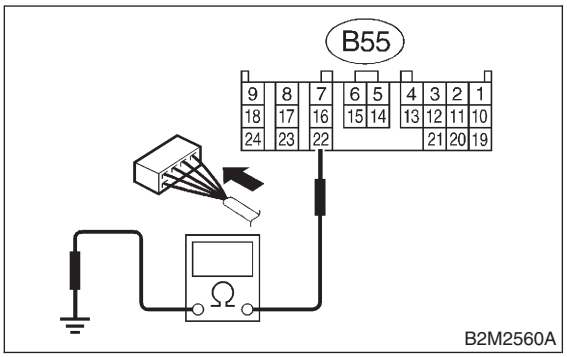


CHECK : ***Is the voltage more than 8 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T32 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 22 — Chassis ground:

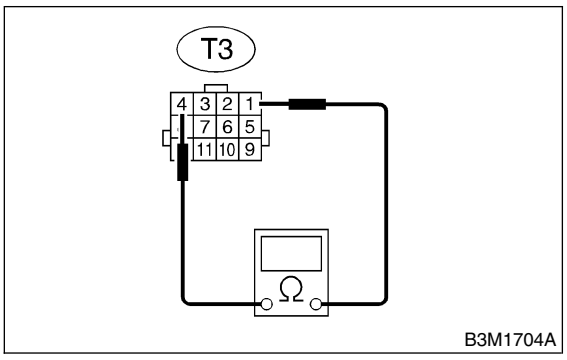


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T33**.
NO : Repair ground short circuit in "N" range circuit.

9T33 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 1 — No. 4:

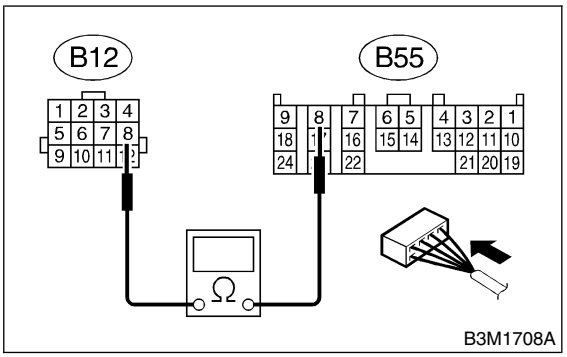


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T34 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B55) No. 8 — (B12) No. 8:

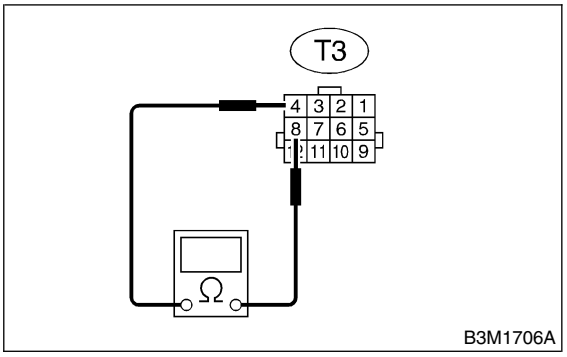


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T35**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T35 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 8:

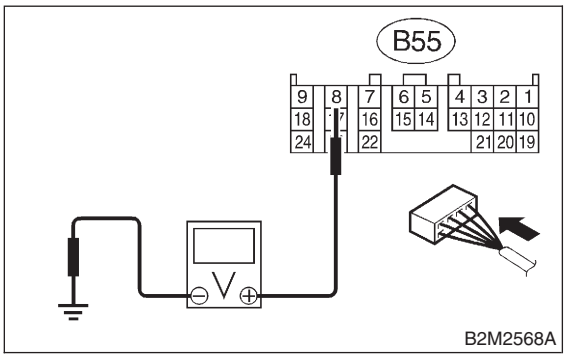


CHECK : ***Is the resistance less than 1 Ω in "D" range?***
YES : Go to step **9T36**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T36 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 8 (+) — Chassis ground (–):

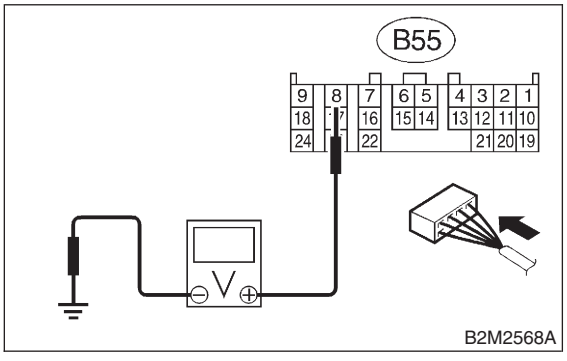


CHECK : ***Is the voltage less than 1 V in "D" range?***
YES : Go to step **9T37**.
NO : Go to step **9T58**.

9T37 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 8 (+) — Chassis ground (–):

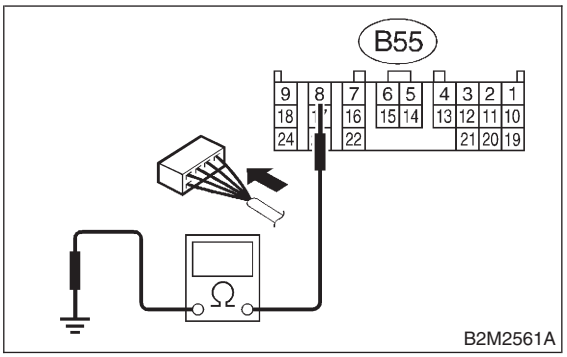


CHECK : ***Is the voltage more than 9.5 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T38 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 8 — Chassis ground:

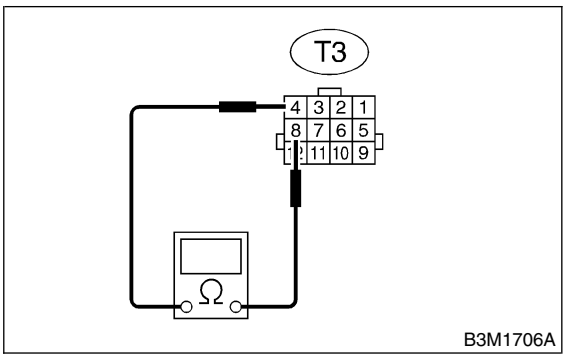


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T39**.
NO : Repair ground short circuit in "D" range circuit.

9T39 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 8:

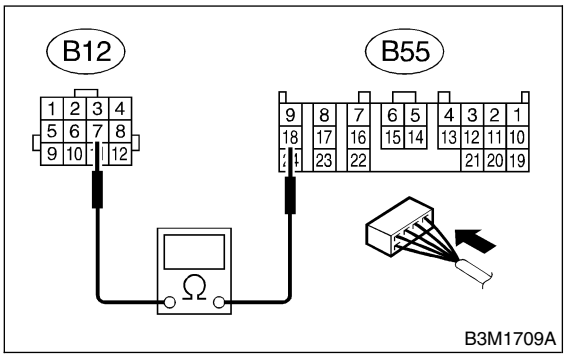


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T40 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B55) No. 18 — (B12) No. 7:

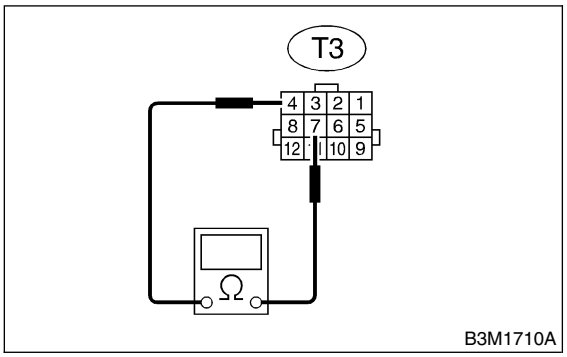


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T41**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T41 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 7:

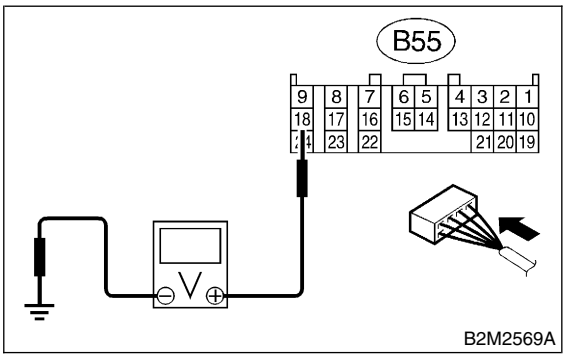


CHECK : ***Is the resistance less than 1 Ω in "3" range?***
YES : Go to step **9T42**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T42 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 18 (+) — Chassis ground (–):

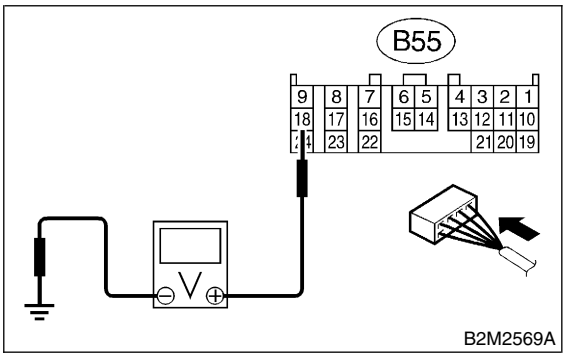


CHECK : ***Is the voltage less than 1 V in "3" range?***
YES : Go to step **9T43**.
NO : Go to step **9T58**.

9T43 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B55) No. 18 (+) — Chassis ground (–):

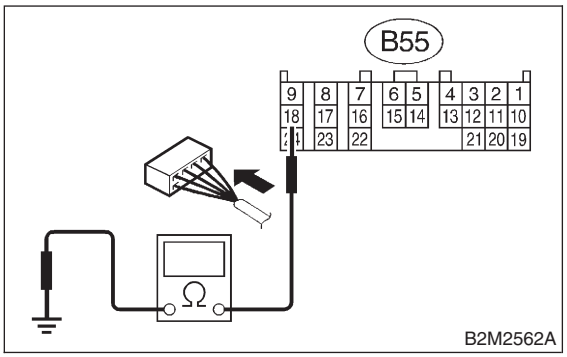


CHECK : ***Is the voltage more than 9.5 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T44 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B55) No. 18 — Chassis ground:

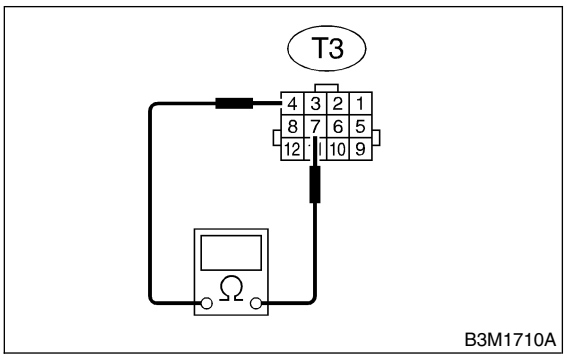


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T45**.
NO : Repair ground short circuit in "3" range circuit.

9T45 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 4 — No. 7:

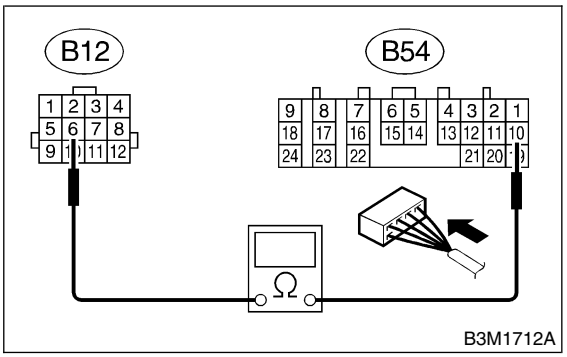


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T46 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B54) No. 10 — (B12) No. 6:

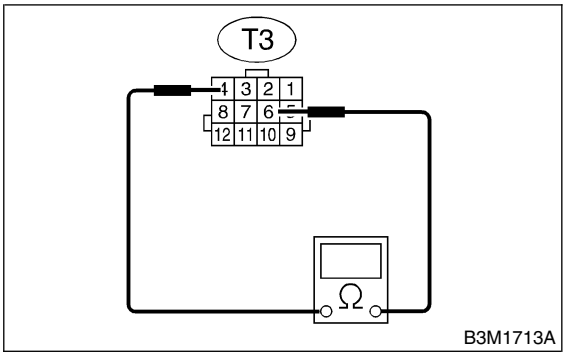


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T47**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T47 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 6 — No. 4:

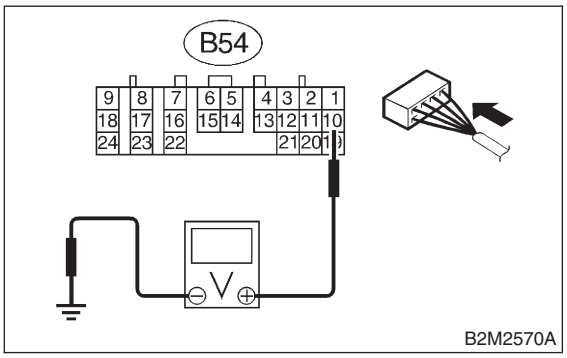


CHECK : ***Is the resistance less than 1 Ω in "2" range?***
YES : Go to step **9T48**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T48 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 10 (+) — Chassis ground (–):

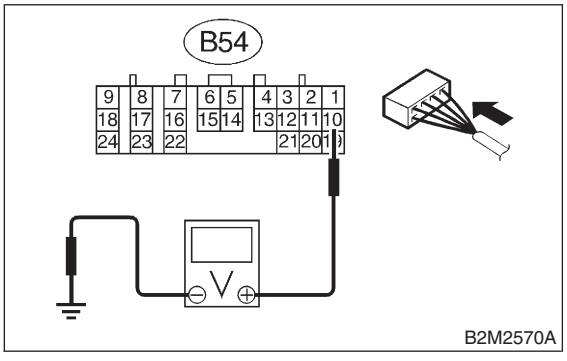


CHECK : ***Is the voltage less than 1 V in "2" range?***
YES : Go to step **9T49**.
NO : Go to step **9T58**.

9T49 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 10 (+) — Chassis ground (–):

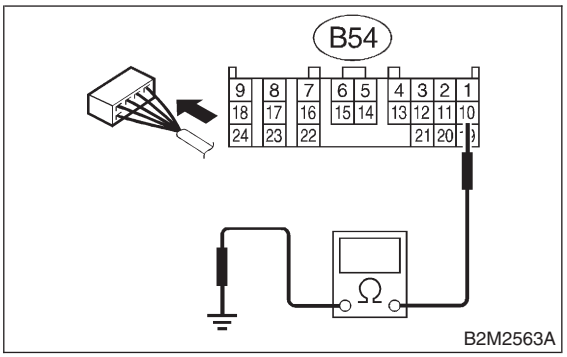


CHECK : ***Is the voltage more than 9.5 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T50 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B54) No. 10 — Chassis ground:

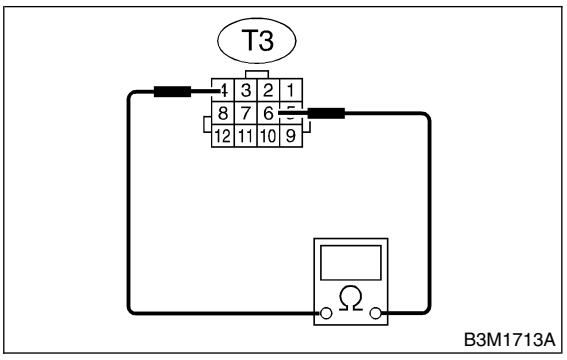


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T51**.
NO : Repair ground short circuit in "2" range circuit.

9T51 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 6 — No. 4:

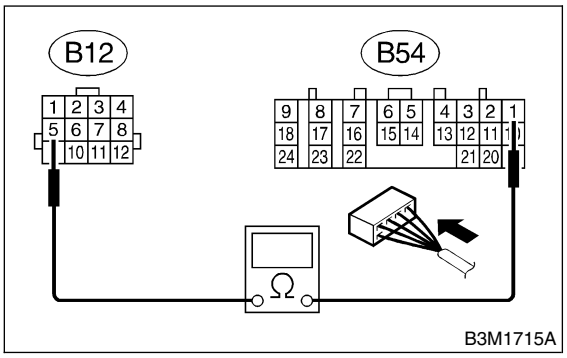


CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T52 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM and inhibitor switch.
3) Measure resistance of harness between TCM and inhibitor switch connector.

Connector & terminal
(B54) No. 1 — (B12) No. 5:

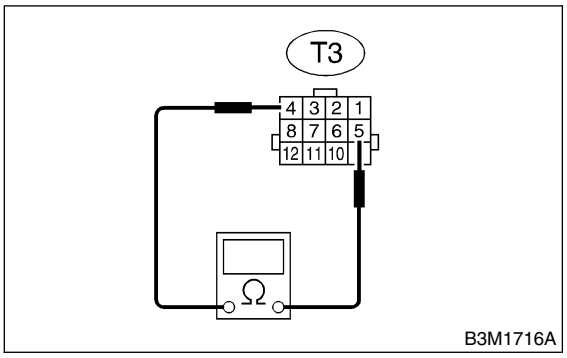


CHECK : ***Is the resistance less than 1 Ω?***
YES : Go to step **9T53**.
NO : Repair open circuit in harness between TCM and inhibitor switch connector, and poor contact in coupling connector.

9T53 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 5 — No. 4:

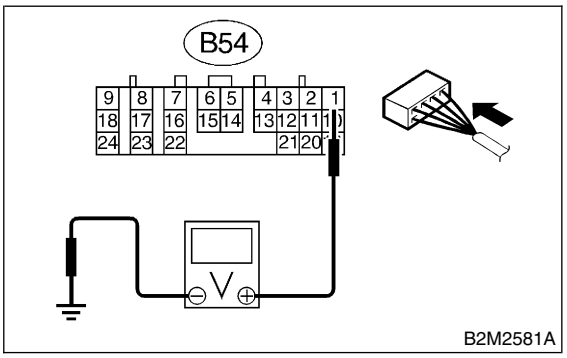


CHECK : ***Is the resistance less than 1 Ω in "1" range?***
YES : Go to step **9T54**.
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T54 : CHECK INPUT SIGNAL FOR TCM.

1) Turn ignition switch to OFF.
2) Connect connector to TCM and inhibitor switch.
3) Turn ignition switch to ON.
4) Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 1 (+) — Chassis ground (–):

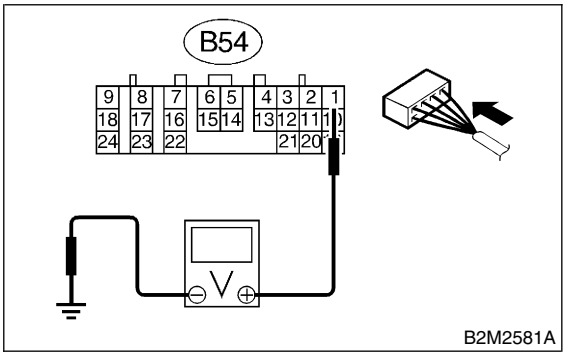


CHECK : ***Is the voltage less than 1 V in "1" range?***
YES : Go to step **9T55**.
NO : Go to step **9T58**.

9T55 : CHECK INPUT SIGNAL FOR TCM.

Measure voltage between TCM and chassis ground.

Connector & terminal
(B54) No. 1 (+) — Chassis ground (–):

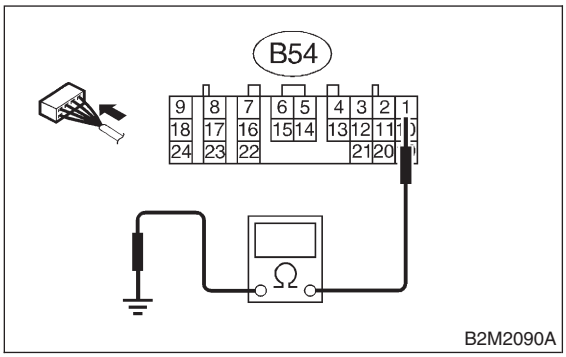


CHECK : ***Is the voltage more than 9.5 V in other ranges?***
YES : Go to step **9T58**.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

9T56 : CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connectors from TCM, inhibitor switch and combination meter.
3) Measure resistance of harness between TCM and chassis ground.

Connector & terminal
(B54) No. 1 — Chassis ground:

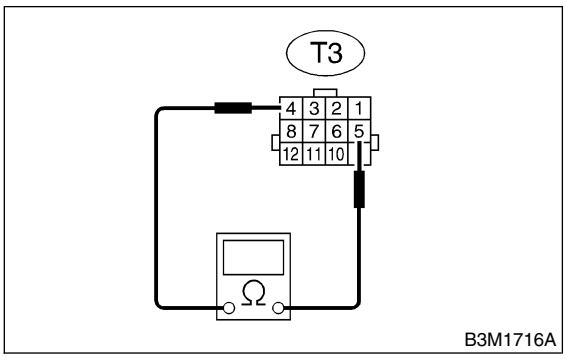


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **9T57**.
NO : Repair ground short circuit in "1" range circuit.

9T57 : CHECK INHIBITOR SWITCH.

Measure resistance between inhibitor switch connector receptacle's terminals.

Terminals
(T3) No. 5 — No. 4:



CHECK : ***Is the resistance more than 1 MΩ in other ranges?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Adjust inhibitor switch. <Ref. to 3-2 [W200].>

9T58 : CHECK POOR CONTACT.

CHECK : ***Is there poor contact in inhibitor switch circuit?***
YES : Repair poor contact.
NO : Replace TCM. <Ref. to 3-2 [W23A0].>

U: CHECK SHIFT SOLENOID 1.

9U1 : CHECK SHIFT SOLENOID 1.

CHECK : ***Does the LED of shift solenoid 1 light up?***
YES : Go to step SHIFT SOLENOID 2. <Ref. to 3-2 [T9V0].>
NO : Check shift solenoid 1 circuit. <Ref. to 3-2 [T8J0].>

V: CHECK SHIFT SOLENOID 2.

9V1 : CHECK SHIFT SOLENOID 2.

CHECK : ***Does the LED of shift solenoid 2 light up?***
YES : Go to step TORQUE CONTROL 1 SIGNAL. <Ref. to 3-2 [T9W0].>
NO : Check shift solenoid 2 circuit. <Ref. to 3-2 [T8K0].>

W: CHECK TORQUE CONTROL 1 SIGNAL.

9W1 : CHECK TORQUE CONTROL 1 SIGNAL.

Turn ignition switch to ON (engine ON).

CHECK : ***Does the LED of torque control 1 signal light up?***
YES : Go to step TORQUE CONTROL 2 SIGNAL. <Ref. to 3-2 [T9X0].>
NO : Check torque control 1 signal circuit. <Ref. to 3-2 [T8H0].>

X: CHECK TORQUE CONTROL 2 SIGNAL.

9X1 :	CHECK TORQUE CONTROL 2 SIGNAL.

Turn ignition switch to ON (engine ON).

CHECK : ***Does the LED of torque control 2 signal illuminate?***

YES : Go to step 2-4 BRAKE TIMING SOLENOID. <Ref. to 3-2 [T9Y0].>

NO : Check torque control 2 signal circuit. <Ref. to 3-2 [T8H0].>

Y: CHECK 2-4 BRAKE TIMING SOLENOID.

9Y1 :	CHECK 2-4 BRAKE TIMING SOLENOID.

Turn ignition switch to ON, and select 1 range.

CHECK : ***Does the LED of 2-4 brake timing solenoid illuminate?***

YES : Go to step LOW CLUTCH TIMING SOLENOID. <Ref. to 3-2 [T9Z0].>

NO : Check 2-4 brake timing solenoid circuit. <Ref. to 3-2 [T8M0].>

Z: CHECK LOW CLUTCH TIMING SOLENOID.

9Z1 :	CHECK LOW CLUTCH TIMING SOLENOID.

Turn ignition switch to ON, and select 2 range.

CHECK : ***Does the LED of low clutch timing solenoid illuminate?***

YES : Go to step DIAGNOSIS LIGHT. <Ref. to 3-2 [T9AA0].>

NO : Check low clutch timing solenoid circuit. <Ref. to 3-2 [T8L0].>

AA: CHECK DIAGNOSIS LIGHT.

9AA1 :	CHECK DIAGNOSIS LIGHT.

Turn ignition switch to ON (engine OFF).

CHECK : ***Does diagnosis light illuminate?***

YES : Go to step FWD LIGHT. <Ref. to 3-2 [T9AB0].>

NO : Check diagnosis light circuit.

AB: CHECK FWD LIGHT.

9AB1 :	CHECK FWD LIGHT.

CHECK : ***Does the LED of FWD light illuminate?***

YES : Check FWD switch circuit. <Ref. to 3-2 [T9P0].>

NO : Go to step General Diagnostic Table. <Ref. to 3-2 [T1000].>

10. General Diagnostic Table

Symptom	Problem parts
Starter does not rotate when select lever is in “P” or “N”; starter rotates when select lever is in “R”, “D”, “3” or “2”.	1) Inhibitor switch 2) Select cable 3) Select lever 4) Starter motor and harness
Abnormal noise when select lever is in “P” or “N”.	1) Strainer 2) Transfer duty solenoid 3) Oil pump 4) Drive plate 5) ATF level too high or too low
Hissing noise occurs during standing start.	1) Strainer 2) ATF level too high or too low
Noise occurs while driving in “D1”.	1) Final gear 2) Planetary gear 3) Reduction gear 4) Differential gear oil level too high or too low
Noise occurs while driving in “D2”.	
Noise occurs while driving in “D3”.	1) Final gear 2) Low & reverse brake 3) Reduction gear 4) Differential gear oil level too high or too low
Noise occurs while driving in “D4”.	1) Final gear 2) Low & reverse brake 3) Planetary gear 4) Reduction gear 5) Differential gear oil level too high or too low
Engine stalls while shifting from one range to another.	1) Control valve 2) Lock-up damper 3) Engine performance 4) Input shaft
Vehicle moves when select lever is in “N”.	1) Control module 2) Low clutch
Shock occurs when select lever is moved from “N” to “D”.	1) Control module 2) Harness 3) Control valve 4) ATF deterioration 5) Dropping resistor
Excessive time lag occurs when select lever is moved from “N” to “D”.	1) Control valve 2) Low clutch 3) Line pressure duty solenoid 4) Seal ring 5) Front gasket transmission case
Shock occurs when select lever is moved from “N” to “R”.	1) Control module 2) Harness 3) Control valve 4) ATF deterioration 5) Dropping resistor
Excessive time lag occurs when select lever is moved from “N” to “R”.	1) Control valve 2) Low & reverse clutch 3) Reverse clutch 4) Line pressure duty solenoid 5) Seal ring 6) Front gasket transmission case
Vehicle does not start in any shift range (engine stalls).	1) Parking brake mechanism 2) Planetary gear

Symptom	Problem parts
Vehicle does not start in any shift range (engine revving up).	1) Strainer 2) Line pressure duty solenoid 3) Control valve 4) Drive pinion 5) Hypoid gear 6) Axle shaft 7) Differential gear 8) Oil pump 9) Input shaft 10) Output shaft 11) Planetary gear 12) Drive plate 13) ATF level too low 14) Front gasket transmission case
Vehicle does not start in “R” range only (engine revving up).	1) Select cable 2) Select lever 3) Control valve 4) Low & reverse clutch 5) Reverse clutch
Vehicle does not start in “R” range only (engine stalls).	1) Low clutch 2) 2-4 brake 3) Planetary gear 4) Parking brake mechanism
Vehicle does not start in “D”, “3” range only (engine revving up).	1) Low clutch 2) One-way clutch
Vehicle does not start in “D”, “3” or “2” range only (engine revving up).	1) Low clutch
Vehicle does not start in “D”, “3” or “2” range only (engine stalls).	1) Reverse clutch
Vehicle starts in “R” range only (engine revving up).	1) Control valve
Acceleration during standing starts is poor (high stall rpm).	1) Control valve 2) Low clutch 3) Reverse clutch 4) ATF level too low 5) Front gasket transmission case 6) Differential gear oil level too high or too low
Acceleration during standing starts is poor (low stall rpm).	1) Oil pump 2) Torque converter one-way clutch 3) Engine performance
Acceleration is poor when select lever is in “D”, “3” or “2” range (normal stall rpm).	1) Control module 2) Control valve 3) High clutch 4) 2-4 brake 5) Planetary gear
Acceleration is poor when select lever is in “R” (normal stall rpm).	1) Control valve 2) High clutch 3) 2-4 brake 4) Planetary gear
No shift occurs from 1st to 2nd gear.	1) Control module 2) Vehicle speed sensor 1 (Rear) 3) Vehicle speed sensor 2 (Front) 4) Throttle position sensor 5) Shift solenoid 1 6) Control valve 7) 2-4 brake
No shift occurs from 2nd to 3rd gear.	1) Control module 2) Control valve 3) High clutch 4) Shift solenoid 2

Symptom	Problem parts
No shift occurs from 3rd to 4th gear.	1) Control module 2) Shift solenoid 1 3) ATF temperature sensor 4) Control valve 5) 2-4 brake
Engine brake is not effected when select lever is in “3” range.	1) Inhibitor switch 2) Control module 3) Throttle position sensor 4) Control valve
Engine brake is not effected when select lever is in “3” or “2” range.	1) Control valve
Engine brake is not effected when select lever is in “1” range.	1) Control valve 2) Low & reverse brake
Shift characteristics are erroneous.	1) Inhibitor switch 2) Control module 3) Vehicle speed sensor 1 (Front) 4) Vehicle speed sensor 2 (Rear) 5) Throttle position sensor 6) Control valve 7) Ground earth
No lock-up occurs.	1) Control module 2) Throttle position sensor 3) ATF temperature sensor 4) Control valve 5) Lock-up facing 6) Engine speed signal
Parking brake is not effected.	1) Select cable 2) Select lever 3) Parking mechanism
Shift lever cannot be moved or is hard to move from “P” range.	
ATF spurts out.	1) ATF level too high
Differential oil spurts out.	1) Differential gear oil too high
Differential oil level changes excessively.	1) Seal pipe 2) Double oil seal
Odor is produced from ATF supply pipe.	1) High clutch 2) 2-4 brake 3) Low & reverse clutch 4) Reverse clutch 5) Lock-up facing 6) ATF deterioration
Shock occurs from 1st to 2nd gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) 2-4 brake 8) ATF deterioration 9) Engine performance 10) Dropping resistor 11) 2-4 brake timing solenoid
Slippage occurs from 1st to 2nd gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) 2-4 brake 8) 2-4 brake timing solenoid 9) High clutch

Symptom	Problem parts
Shock occurs from 2nd to 3rd gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) High clutch 8) 2-4 brake 9) ATF deterioration 10) Engine performance 11) 2-4 brake timing solenoid
Slippage occurs from 2nd to 3rd gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) High clutch 8) 2-4 brake 9) 2-4 brake timing solenoid
Shock occurs from 3rd to 4th gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) 2-4 brake timing solenoid 8) 2-4 brake 9) ATF deterioration 10) Engine performance 11) Low clutch timing solenoid 12) Low clutch
Slippage occurs from 3rd to 4th gear.	1) Control module 2) Throttle position sensor 3) 2-4 brake duty solenoid 4) ATF temperature sensor 5) Line pressure duty solenoid 6) Control valve 7) 2-4 brake 8) 2-4 brake timing solenoid
Shock occurs when select lever is moved from “3” to “2” range.	1) Control module 2) Throttle position sensor 3) ATF temperature sensor 4) Line pressure duty solenoid 5) Control valve 6) 2-4 brake duty solenoid 7) 2-4 brake 8) ATF deterioration 9) 2-4 brake timing solenoid
Shock occurs when select lever is moved from “D” to “1” range.	1) Control module 2) Throttle position sensor 3) ATF temperature sensor 4) Line pressure duty solenoid 5) Control valve 6) ATF deterioration 7) 2-4 brake duty solenoid 8) 2-4 brake timing solenoid 9) Low clutch timing solenoid

Symptom	Problem parts
Shock occurs when select lever is moved from “2” to “1” range.	1) Control module 2) Throttle position sensor 3) ATF temperature sensor 4) Line pressure duty solenoid 5) Control valve 6) Low & reverse clutch 7) ATF deterioration 8) 2-4 brake duty solenoid 9) 2-4 brake timing solenoid 10) Low clutch timing solenoid
Shock occurs when accelerator pedal is released at medium speeds.	1) Control module 2) Throttle position sensor 3) ATF temperature sensor 4) Line pressure duty solenoid 5) Control valve 6) Lock-up damper 7) Engine performance 8) 2-4 brake duty solenoid 9) 2-4 brake timing solenoid 10) Low clutch timing solenoid
Vibration occurs during straight-forward operation.	1) Control module 2) Lock-up duty solenoid 3) Lock-up facing 4) Lock-up damper
Vibration occurs during turns (tight corner “braking” phenomenon).	1) Control module 2) Vehicle speed sensor 1 (Front) 3) Vehicle speed sensor 2 (Rear) 4) Throttle position sensor 5) ATF temperature sensor 6) Transfer clutch 7) Transfer valve 8) Transfer duty solenoid 9) ATF deterioration 10) Harness
Front wheel slippage occurs during standing starts.	1) Control module 2) Vehicle speed sensor 2 (Front) 3) FWD switch 4) Throttle position sensor 5) ATF temperature sensor 6) Control valve 7) Transfer clutch 8) Transfer valve 9) Transfer pipe 10) Transfer duty solenoid
Vehicle is not set in FWD mode.	1) Control module 2) FWD switch 3) Transfer clutch 4) Transfer valve 5) Transfer duty solenoid
Select lever is hard to move.	1) Select cable 2) Select lever 3) Detent spring 4) Manual plate
Select lever is too high to move (unreasonable resistance).	1) Detent spring 2) Manual plate
Select lever slips out of operation during acceleration or while driving on rough terrain.	1) Select cable 2) Select lever 3) Detent spring 4) Manual plate

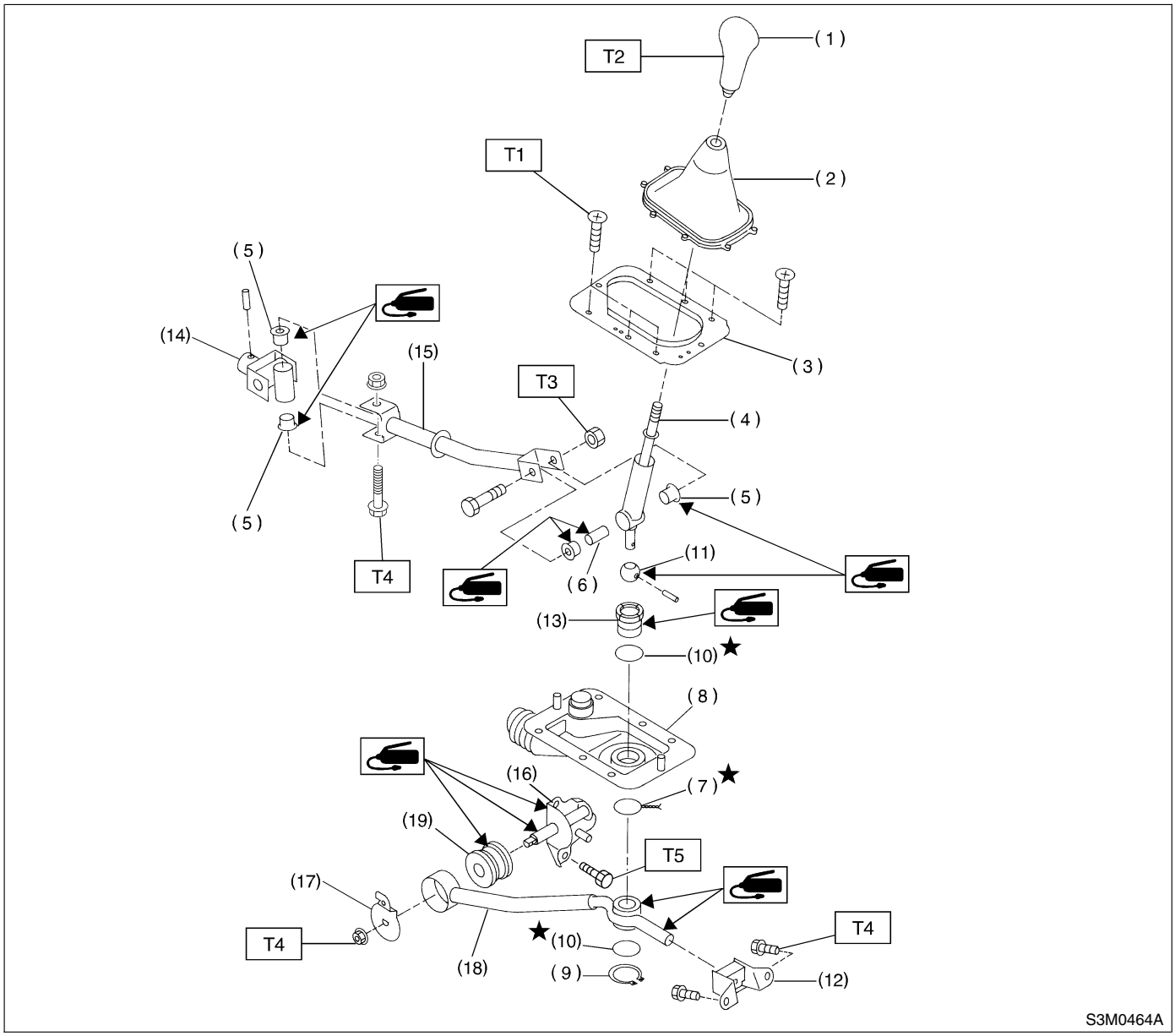
MEMO:

TRANSMISSION CONTROL SYSTEM 3-3

Page

C COMPONENT PARTS 2
1. Gear Shift Lever 2
2. Select Lever 3
W SERVICE PROCEDURE 4
1. Gear Shift Lever 4
2. Select Lever 7

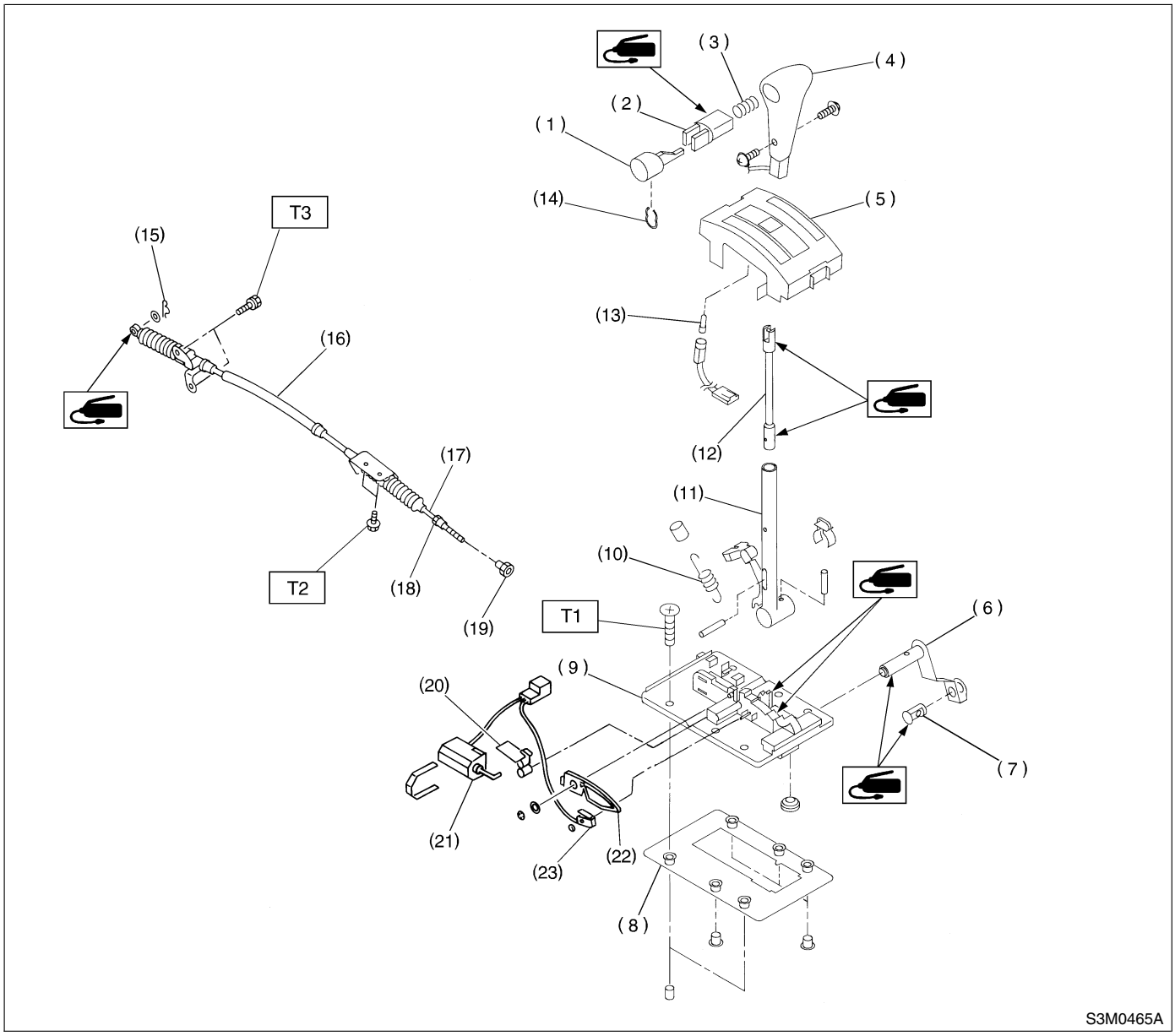
1. Gear Shift Lever



(1) Gear shift knob
(2) Console boot
(3) Boot plate
(4) Lever
(5) Bush
(6) Spacer
(7) Locking wire
(8) Boot
(9) Snap ring
(10) O-ring
(11) Bush (Shift lever)
(12) Cushion rubber
(13) Bush (Stay rear)
(14) Joint
(15) Rod
(16) Bracket
(17) Washer
(18) Stay
(19) Bush (Stay front)

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.5±1.5 (0.46±0.15, 3.3±1.1)
T2: 5 (0.51, 3.7)
T3: 12±3 (1.2±0.3, 8.7±2.2)
T4: 18±5 (1.8±0.5, 13.0±3.6)
T5: 24.5±2
(2.50±0.20, 18.07±1.48)

2. Select Lever



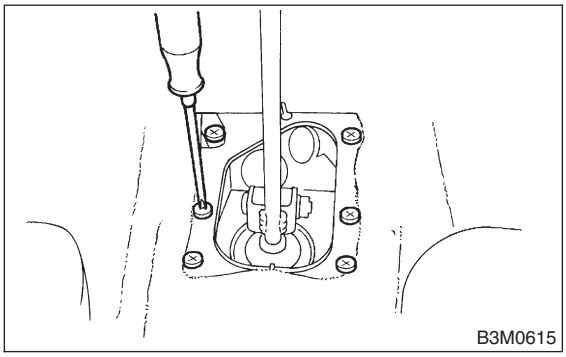
(1) Button A
(2) Button B
(3) Spring (button)
(4) Grip
(5) Indicator cover
(6) Selector lever lower
(7) Pin
(8) Packing
(9) Plate
(10) Detent spring
(11) Selector lever upper
(12) Rod
(13) Indicator light bulb
(14) Retainer spring
(15) Snap pin
(16) Outer cable
(17) Inner cable
(18) Nut (front)
(19) Nut (rear)
(20) Lock plate
(21) Shift-lock solenoid
(22) Lock arm
(23) “P” position switch

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.5±1.5 (0.46±0.15, 3.3±1.1)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 33±10 (3.4±1.0, 25±7)

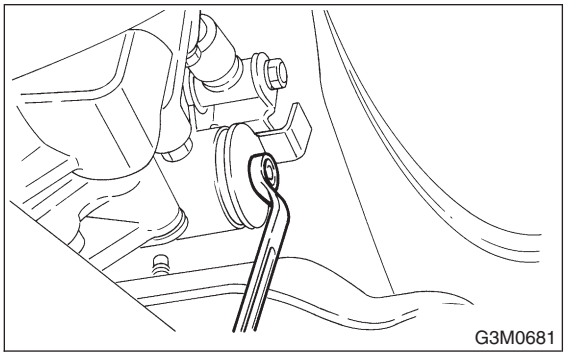
1. Gear Shift Lever

A: REMOVAL

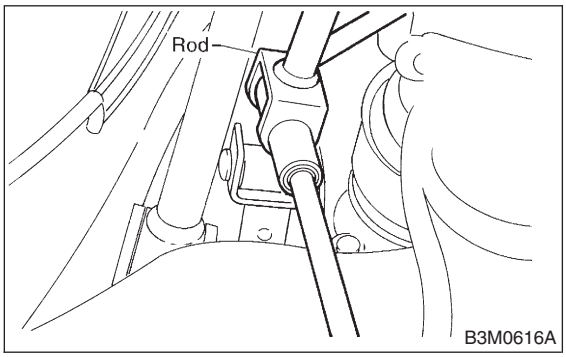
1) Remove console box. <Ref. to 5-4 [W1A0].>
2) Remove plate from the body.


B3M0615

3) Remove stay from bracket.

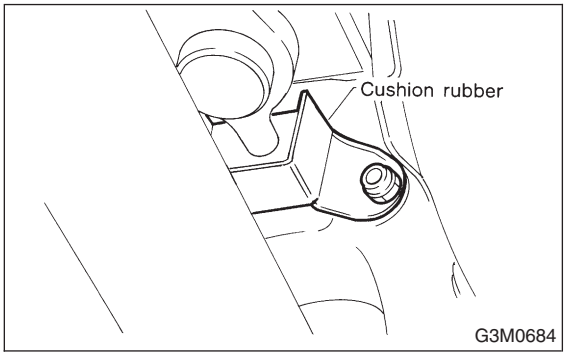

G3M0681

4) Remove rod from joint.



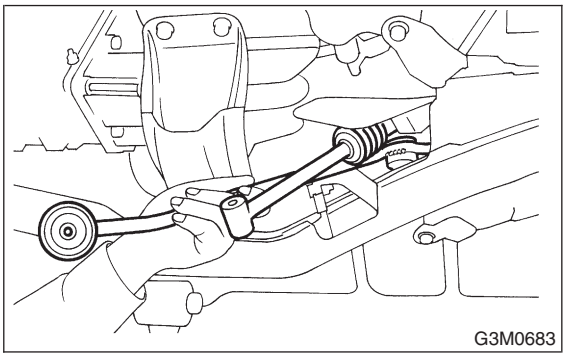
B3M0616A

5) Remove the exhaust cover and remove cushion rubber from the body.



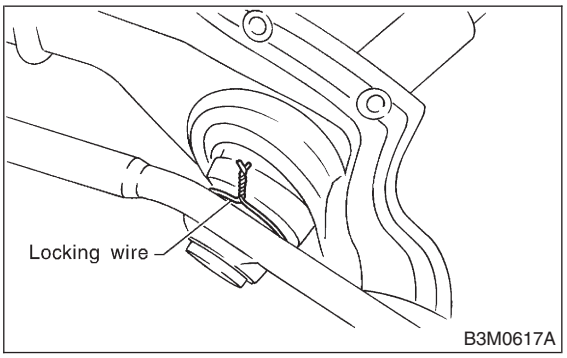
G3M0684

6) Remove gearshift lever.


G3M0683

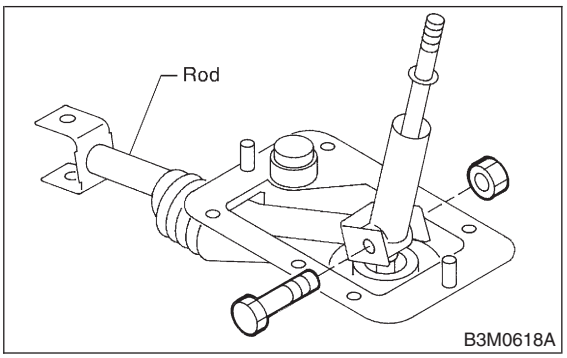
B: DISASSEMBLY

1) Disconnect locking wire.



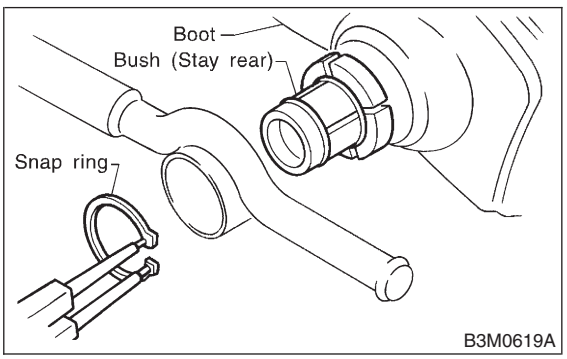
B3M0617A

2) Remove rod from lever.



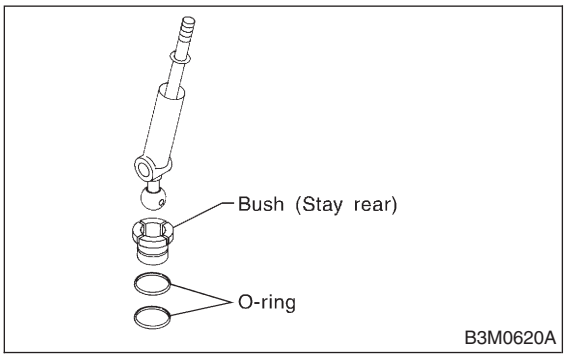
B3M0618A

3) Remove snap ring, then disconnect lever from stay.
4) Remove boot from gearshift lever.

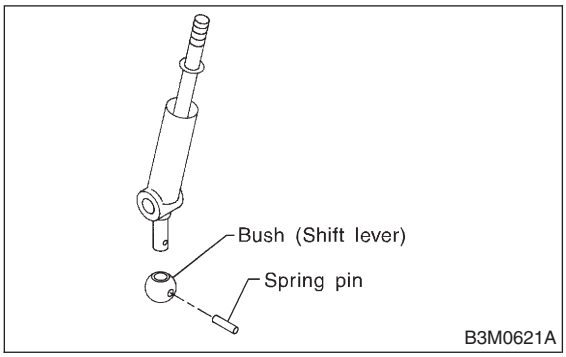


B3M0619A

5) Remove O-ring, then disconnect bush (Stay rear).

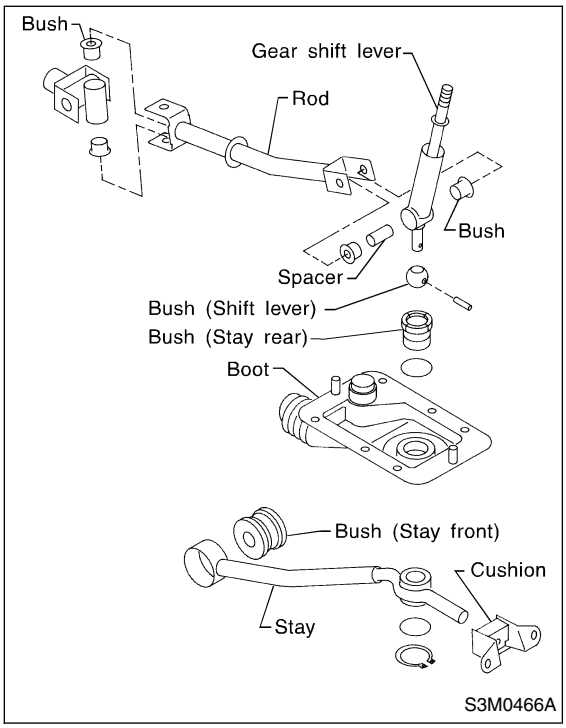


6) Draw out spring pin, then remove bush (Shift lever) from lever.



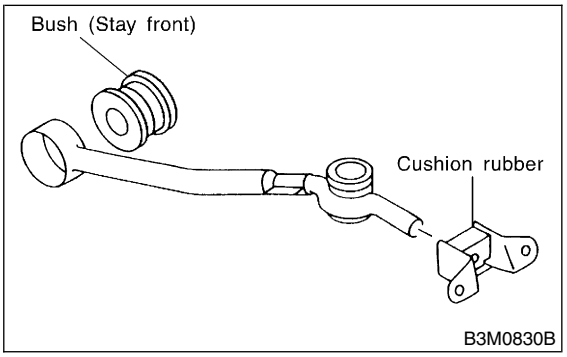
C: INSPECTION

Check each parts (Bush, cushion, spacer, boot, stay and rod etc.) for deformation, damage and wear. Repair or replace any defective parts. Determine defective parts by comparing with new parts.



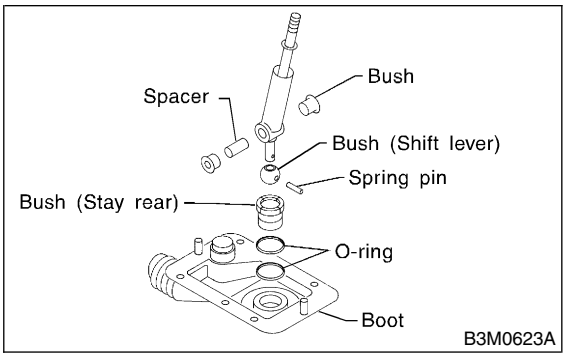
D: ASSEMBLY

1) Clean all parts before assembly.
2) Mount the following parts on the stay.

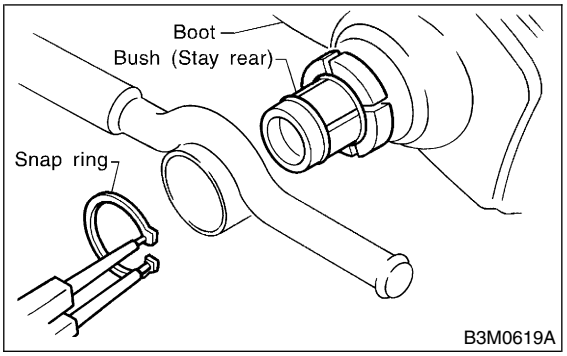


3) Mount each parts (Boot, O-ring, bush and spacer) on the gearshift lever.

CAUTION:
- **Always use new O-rings.**
- **Apply grease [NIGTIGHT LYW No. 2 or equivalent] to the inner and side surfaces of the bush when installing spacer.**

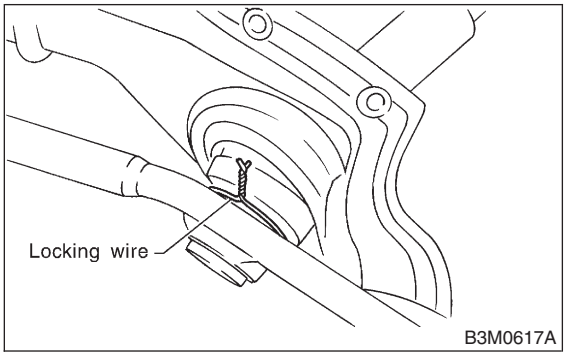


4) Insert the lever into the boot hole.
5) Mount lever on the stay.
6) Install snap ring to the bottom of the bush (Stay rear).



7) Tighten with locking wire to the extent that the boot will not come off.

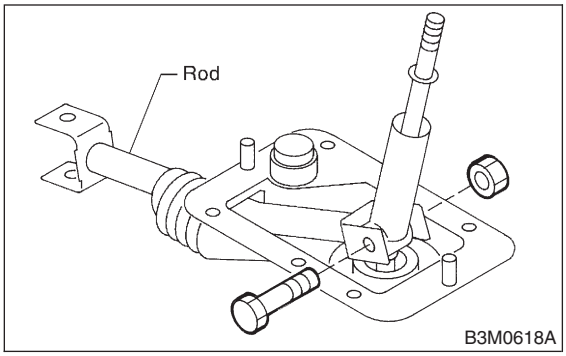
CAUTION:
Always use new locking wire.



8) Insert the rod into the boot hole.
9) Connect rod to gearshift lever.

Tightening torque:
12±3 N·m (1.2±0.3 kg-m, 8.7±2.2 ft-lb)

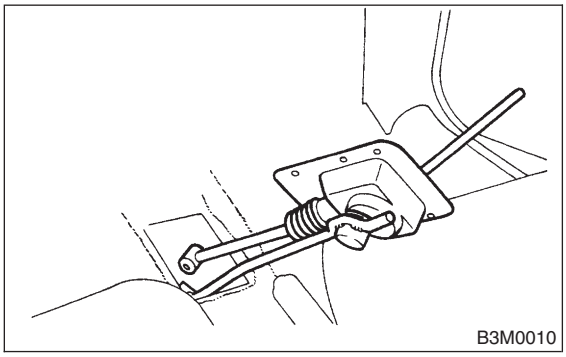
Rocking torque:
0.7 N·m (0.07 kg-m, 0.5 ft-lb) or less



10) Check that there is no excessive play and that parts move smoothly.

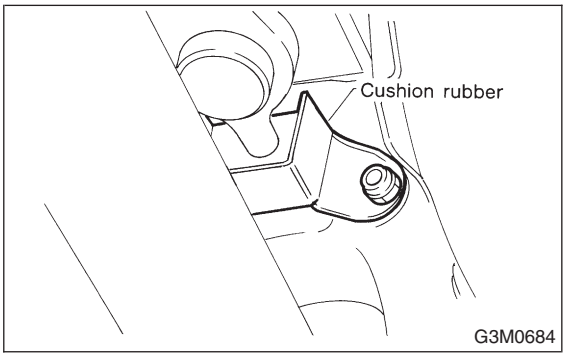
E: INSTALLATION

1) Put into gearshift lever from passenger compartment.
2) Mount boot plate on the body.
3) Install console box and gearshift knob. <Ref. to 5-4 [W1B0].>



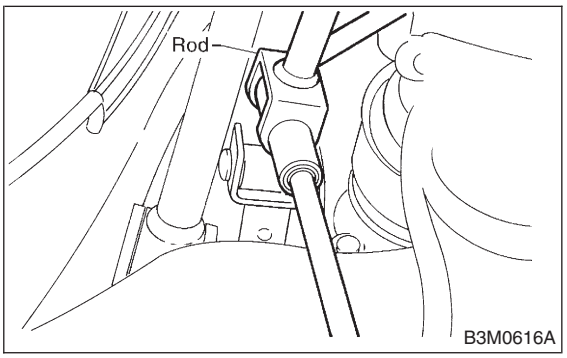
4) Mount cushion rubber on the body.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)



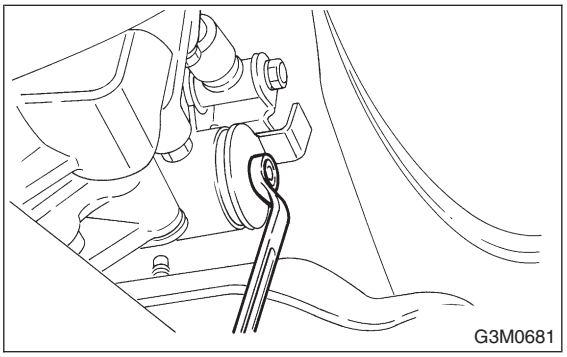
5) Connect rod to the joint.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)



6) Connect stay to the bracket.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

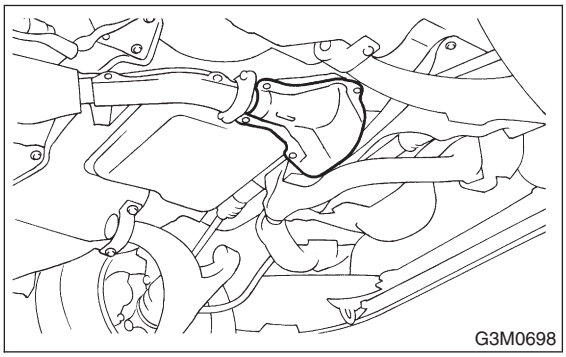


7) Install the exhaust cover.

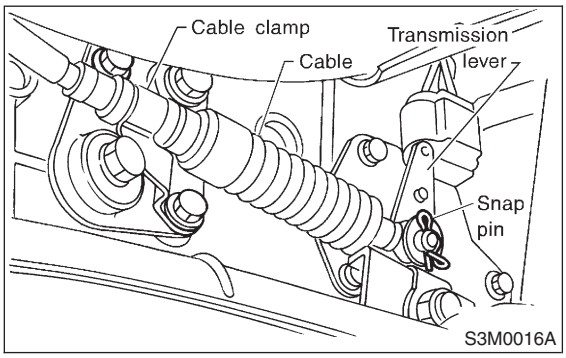
2. Select Lever

A: REMOVAL

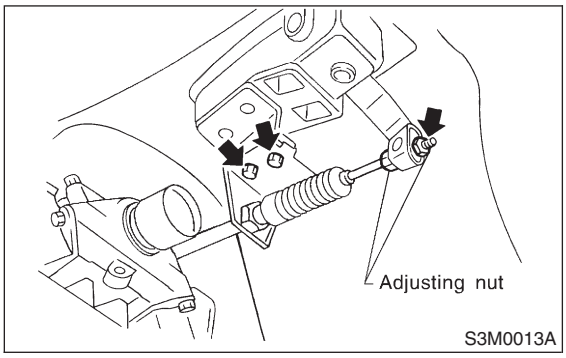
1) Remove the cable.
(1) Prior to removal, set lever to “N” position.
(2) Remove front exhaust pipe.



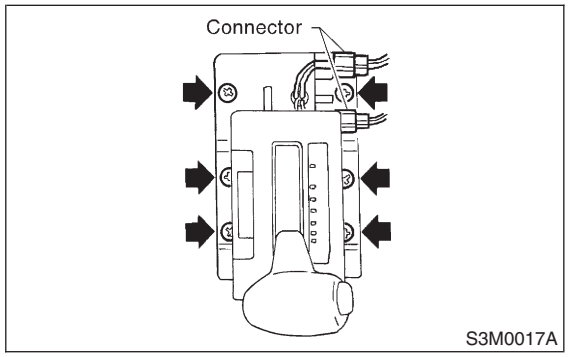
(3) Separate cable from transmission lever.
(4) Remove clamp from transmission case.



(5) Disconnect cable from selector lever and then remove cable bracket.

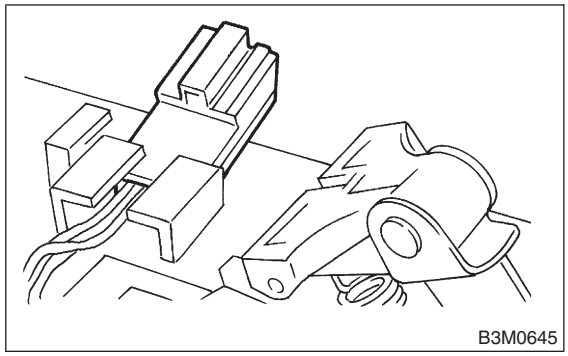


2) Remove console box. <Ref. to 5-4 [W1A0].>
3) Disconnect the connectors, then remove the six screws to take out the selector lever assembly from the body.



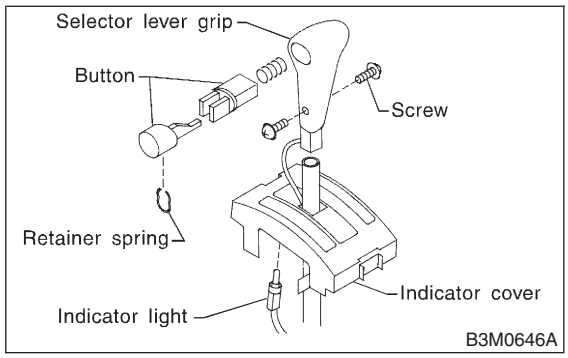
B: DISASSEMBLY

1) Remove connector from plate.

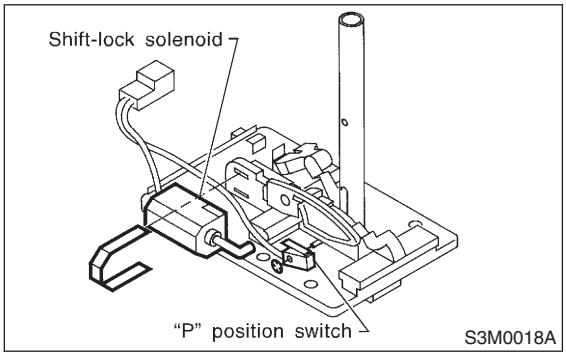


2) Remove indicator light and two screws.
3) Remove retainer spring, then pull up selector lever grip with indicator cover for holding selector lever button.

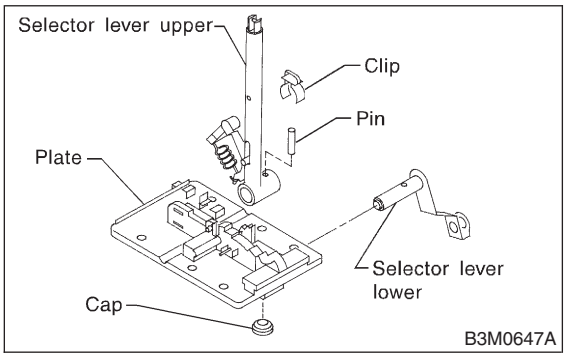
CAUTION:
Pull the selector lever grip carefully so that the selector lever button may not jump out.



4) Remove shift-lock solenoid and “P” position switch.



5) Remove cap and clip, then extract pin.
6) Remove selector lever lower then take away selector lever upper from plate.



C: INSPECTION

1) Inspect removed parts by comparing with new ones for deformation, damage and wear. Correct or replace if defective.
2) Confirm the following parts for operating condition before assembly.
(1) Sliding condition of the button in the grip ... it should move smoothly.
(2) Insertion of the grip on the selector lever ... when pushing the grip on the selector lever by hand, screw holes should be aligned.
(3) Operation of selector lever and rod ... they should move smoothly.

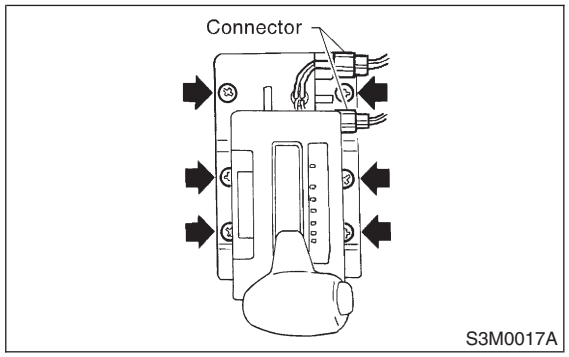
D: ASSEMBLY

1) Clean all parts before assembly.
2) Apply grease [NIGTIGHT LYW No. 2 or equivalent] to each parts. <Ref. to 3-3 [C200].>
3) Assembly is in the reverse order of disassembly.
4) After completion of fitting, transfer selector lever to range “P” — “1”, pressing the button of the grip; then check whether the indicator and selector lever agree, whether the pointer and position mark agree and what the operating force is.

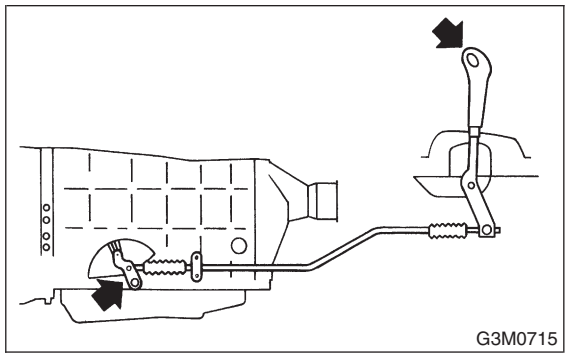
E: INSTALLATION

1) Mount the selector lever onto the vehicle body.
2) Tighten the six bolts to install the selector lever to the vehicle body, then connect connectors.

Tightening torque:
4.5±1.5 N·m (0.46±0.15 kg-m, 3.3±1.1 ft-lb)

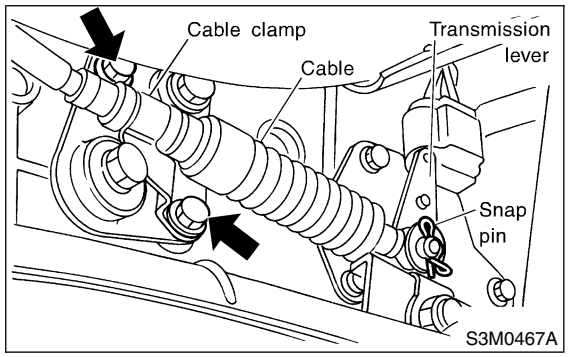


3) Install console box.
4) Set location of selector lever at “N” position.
5) Set location of selector arm installed on the transmission body at “N” position.



6) Pass inner cable through selector arm pin and then connect it using a washer and snap pin.
7) Attach outer cable to plate on transmission case with the bolts.

Tightening torque:
33±10 N·m (3.4±1.0 kg-m, 25±7 ft-lb)

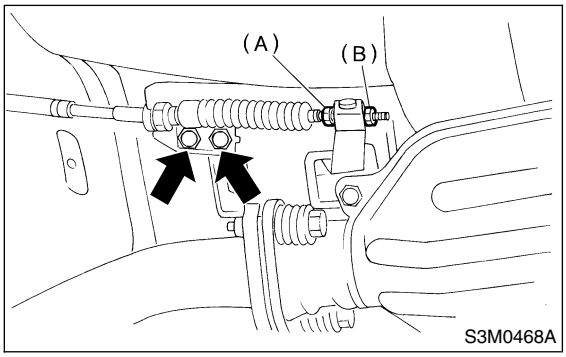


8) Insert the thread portion of the other inner cable and into the connector hole of the selector lever, and fix the other outer cable end to the bracket.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

9) Adjust the inner cable length.
(1) Put connector into contact with nut (A).
(2) Tighten nut (B).

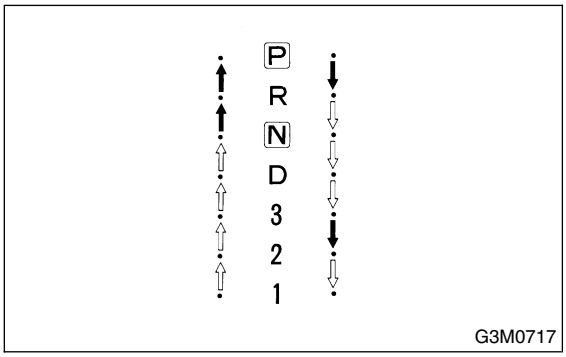
Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)



10) After completion of fitting, make sure that the selector lever operates smoothly all across the operating range.
11) Connect the harnesses and check the following items.
(1) The engine starts operating when selector lever is in position “P”, but not in other positions.
(2) The back-up light is lit when the selector lever is in position “R”, but not in other positions.
12) Check selector lever operation.

WARNING:
Stop the engine while checking operation of selector lever.

(1) Check that selector lever does not move from “N” to “R” without pushing the button.
(2) Check that selector lever does not move from “R” to “P” without pushing the button.
(3) Check that selector lever does not move from “P” to “R” without pushing the button.
(4) Check that selector lever does not move from “3” to “2” without pushing the button.



13) Check shift-lock system.
(1) Ensure ignition switch rotates from “ACC” to “LOCK” when the selector lever is set at “P”. Also check that ignition key can be removed only from the “LOCK” position.
(2) Ensure selector lever moves from “P” to any other position when the brake pedal is depressed with ignition key set at “ON” or “START”.

MEMO:

AWD SYSTEM 3-4

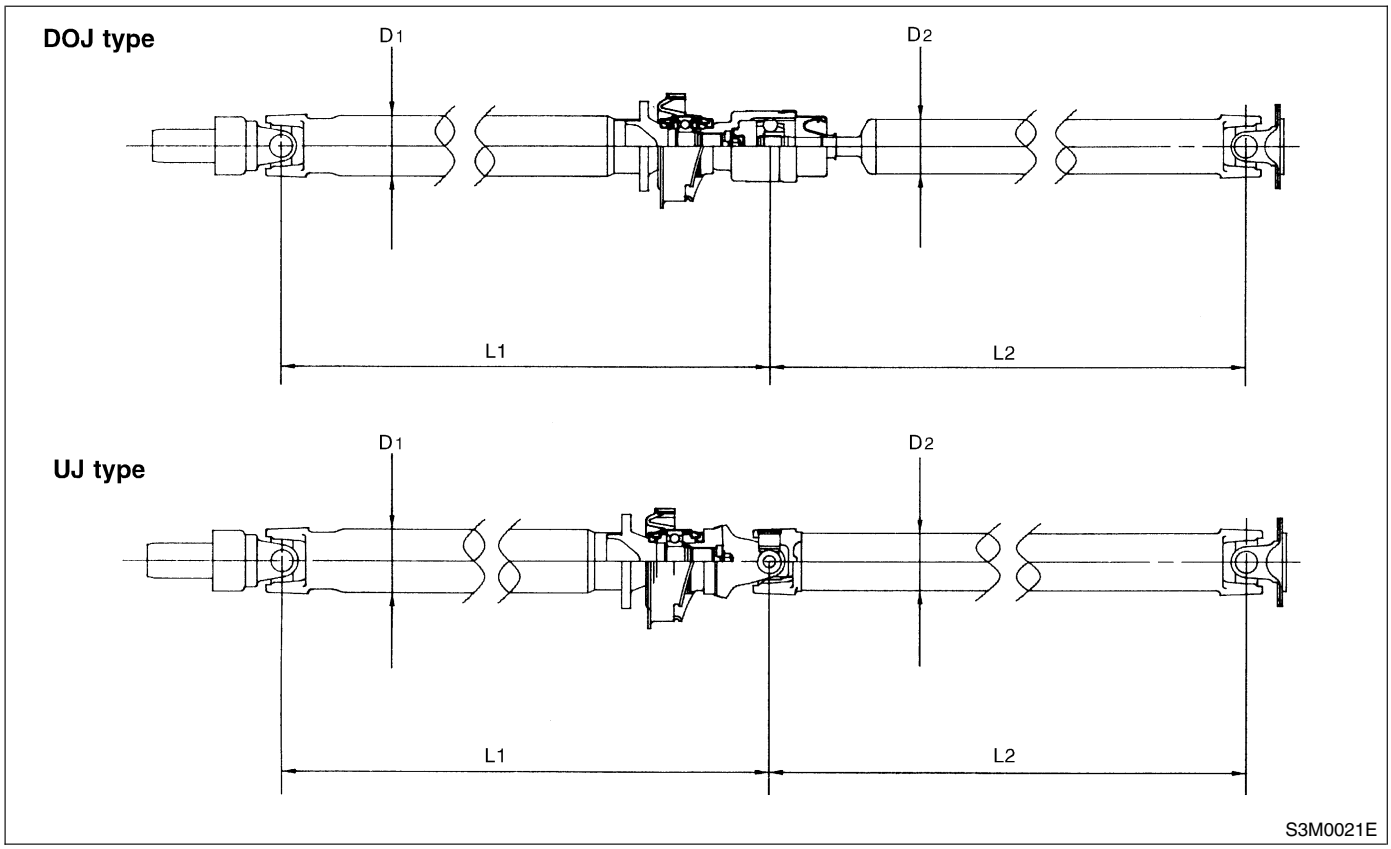
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1. Propeller Shaft

A: SPECIFICATIONS

Model		MT	AT
Propeller shaft type		UJ type	DOJ type
Front propeller shaft Joint-to-Joint length: L_1		644 mm (25.35 in)	580 mm (22.83 in)
Rear propeller shaft Joint-to-Joint length: L_2		707 mm (27.83 in)	712 mm (28.03 in)
Outside dia. of tube:	D_1	63.5 mm (2.500 in)	
	D_2	57.0 mm (2.244 in)	



2. Rear Differential

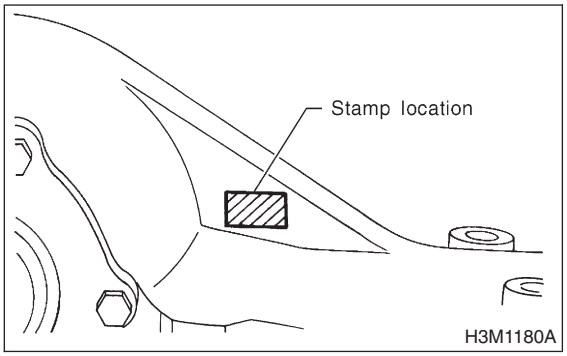
A: SPECIFICATIONS

Model	MT	AT	MT	AT
Rear differential type	T type T2	T type TP	T type BK	T type CF
	Without LSD		With LSD	
Type of gear	Hipoide gear			
Gear ratio (Number of gear teeth)	4.111 (37/9)	4.444 (40/9)	4.111 (37/9)	4.444 (40/9)
Oil capacity	0.8 ℓ (0.8 US qt, 0.7 Imp qt)			
Rear differential gear oil	GL-5			

B: IDENTIFICATION

When replacing a rear differential assembly, select the correct one according to the following table.

CAUTION:
Using the different rear differential assembly causes the drive line and tires to "drag" or emit abnormal noise when AWD is selected.



C: ADJUSTING PARTS

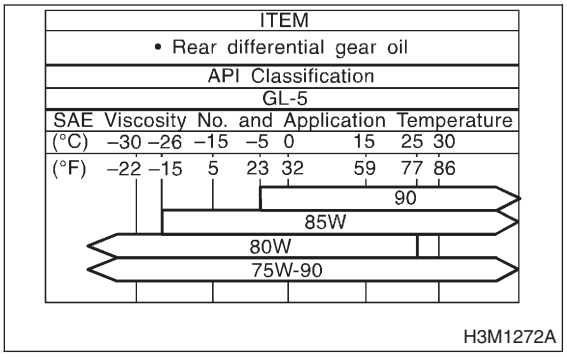
Front and rear bearing preload at companion flange bolt hole	New bearing	19.6 — 28.4 N (2.0 — 2.9 kg, 4.4 — 6.4 lb)
	Used bearing	8.34 — 16.67 N (0.85 — 1.70 kg, 1.87 — 3.75 lb)
Preload adjusting spacer	Part No.	Length
	383695201	56.2 mm (2.213 in)
	383695202	56.4 mm (2.220 in)
	383695203	56.6 mm (2.228 in)
	383695204	56.8 mm (2.236 in)
	383695205	57.0 mm (2.244 in)
	383695206	57.2 mm (2.252 in)
Preload adjusting washer	Part No.	Thickness
	383705200	2.59 mm (0.1020 in)
	383715200	2.57 mm (0.1012 in)
	383725200	2.55 mm (0.1004 in)
	383735200	2.53 mm (0.0996 in)
	383745200	2.51 mm (0.0988 in)
	383755200	2.49 mm (0.0980 in)
	383765200	2.47 mm (0.0972 in)
	383775200	2.45 mm (0.0965 in)
	383785200	2.43 mm (0.0957 in)
	383795200	2.41 mm (0.0949 in)
	383805200	2.39 mm (0.0941 in)
	383815200	2.37 mm (0.0933 in)
	383825200	2.35 mm (0.0925 in)
	383835200	2.33 mm (0.0917 in)
	383845200	2.31 mm (0.0909 in)
Pinion height adjusting shim	Part No.	Thickness
	383495200	3.09 mm (0.1217 in)
	383505200	3.12 mm (0.1228 in)
	383515200	3.15 mm (0.1240 in)
	383525200	3.18 mm (0.1252 in)
	383535200	3.21 mm (0.1264 in)
	383545200	3.24 mm (0.1276 in)
	383555200	3.27 mm (0.1287 in)
	383565200	3.30 mm (0.1299 in)
	383575200	3.33 mm (0.1311 in)
	383585200	3.36 mm (0.1323 in)
	383595200	3.39 mm (0.1335 in)
	383605200	3.42 mm (0.1346 in)
	383615200	3.45 mm (0.1358 in)
	383625200	3.48 mm (0.1370 in)
	383635200	3.51 mm (0.1382 in)
	383645200	3.54 mm (0.1394 in)
	383655200	3.57 mm (0.1406 in)
	383665200	3.60 mm (0.1417 in)
	383675200	3.63 mm (0.1429 in)
	383685200	3.66 mm (0.1441 in)
Side gear backlash	—	0.10 — 0.20 mm (0.0039 — 0.0079 in)

Side gear thrust washer	Part No.	Thickness
	383445201	0.75 — 0.80 mm (0.0295 — 0.0315 in)
	383445202	0.80 — 0.85 mm (0.0315 — 0.0335 in)
	383445203	0.85 — 0.90 mm (0.0335 — 0.0354 in)
Side bearing standard width	—	20.00 mm (0.7874 in)
Side bearing retainer shim	Part No.	Thickness
	383475201	0.20 mm (0.0079 in)
	383475202	0.25 mm (0.0098 in)
	383475203	0.30 mm (0.0118 in)
	383475204	0.40 mm (0.0157 in)
	383475205	0.50 mm (0.0197 in)
Crown gear to drive pinion backlash	Limit	0.10 — 0.20 mm (0.0039 — 0.0079 in)
Crown gear runout on its back surface		0.05 mm (0.0020 in)

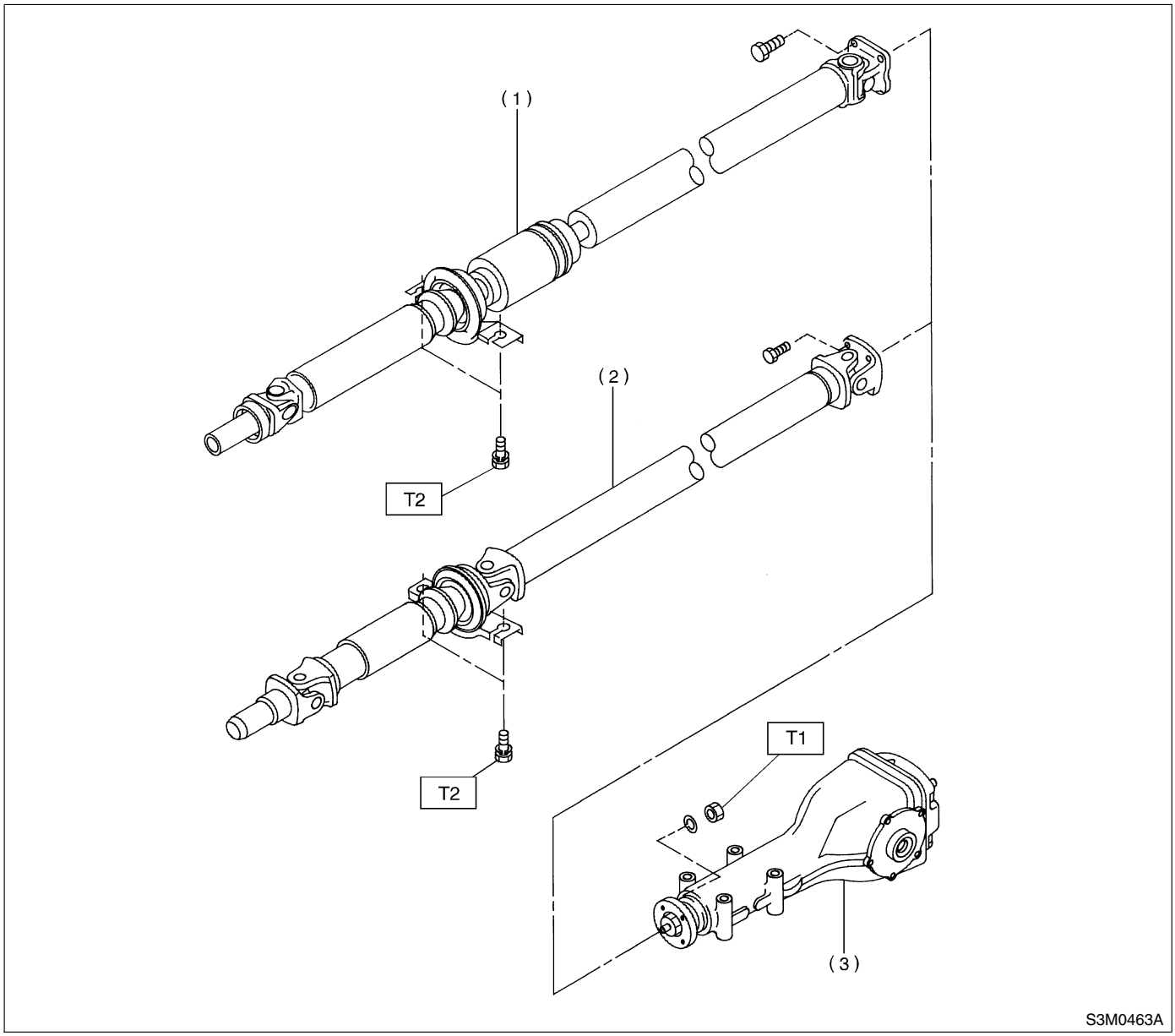
D: REAR DIFFERENTIAL GEAR OIL

- Recommended oil

CAUTION:
Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.



1. Propeller Shaft

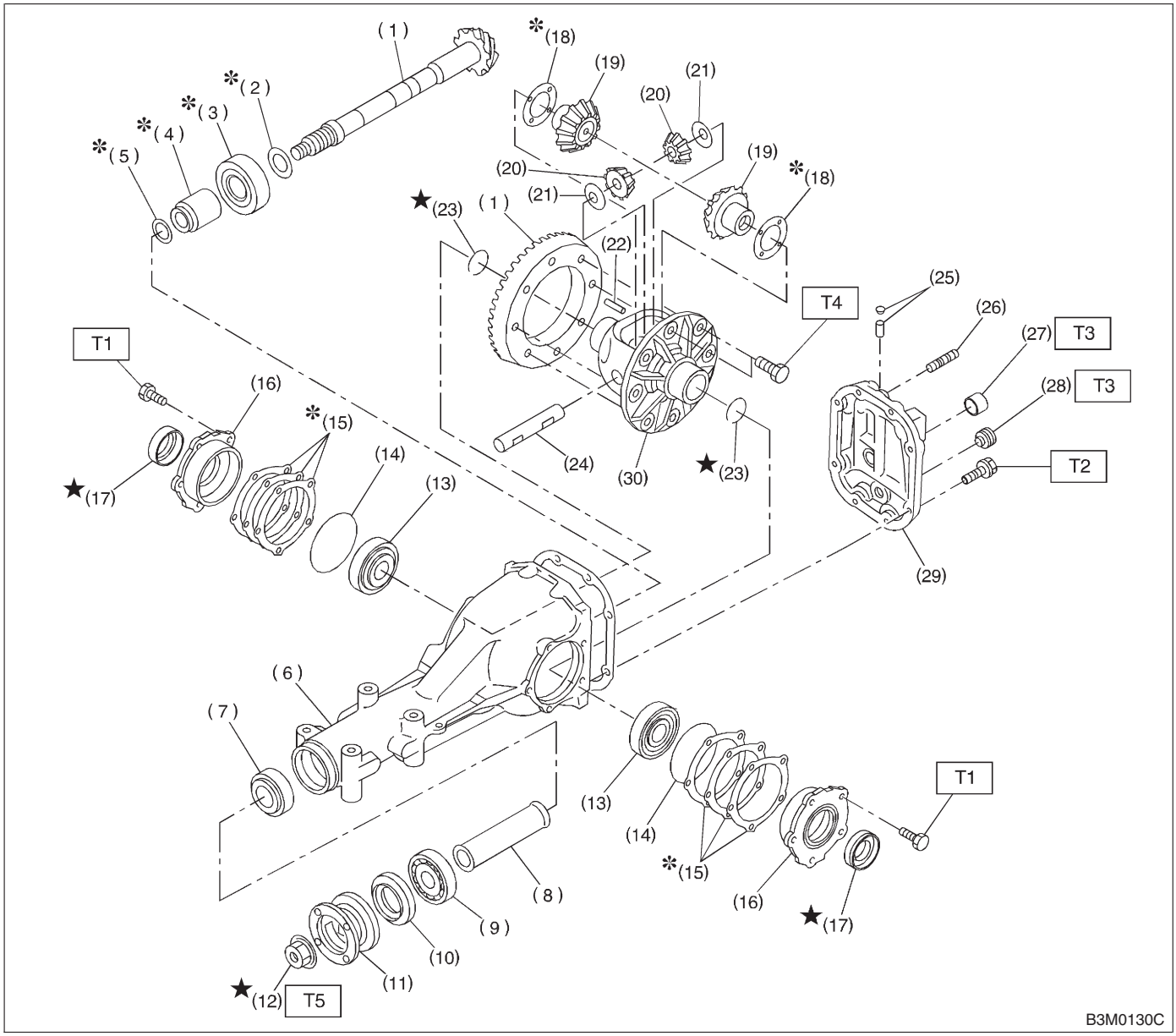


(1) Propeller shaft (DOJ type)
(2) Propeller shaft (UJ type)
(3) Rear differential

Tightening torque: N·m (kg-m, ft-lb)
T1: 31±8 (3.2±0.8, 23.1±5.8)
T2: 52±5 (5.3±0.5, 38.3±3.6)

2. Rear Differential Assembly

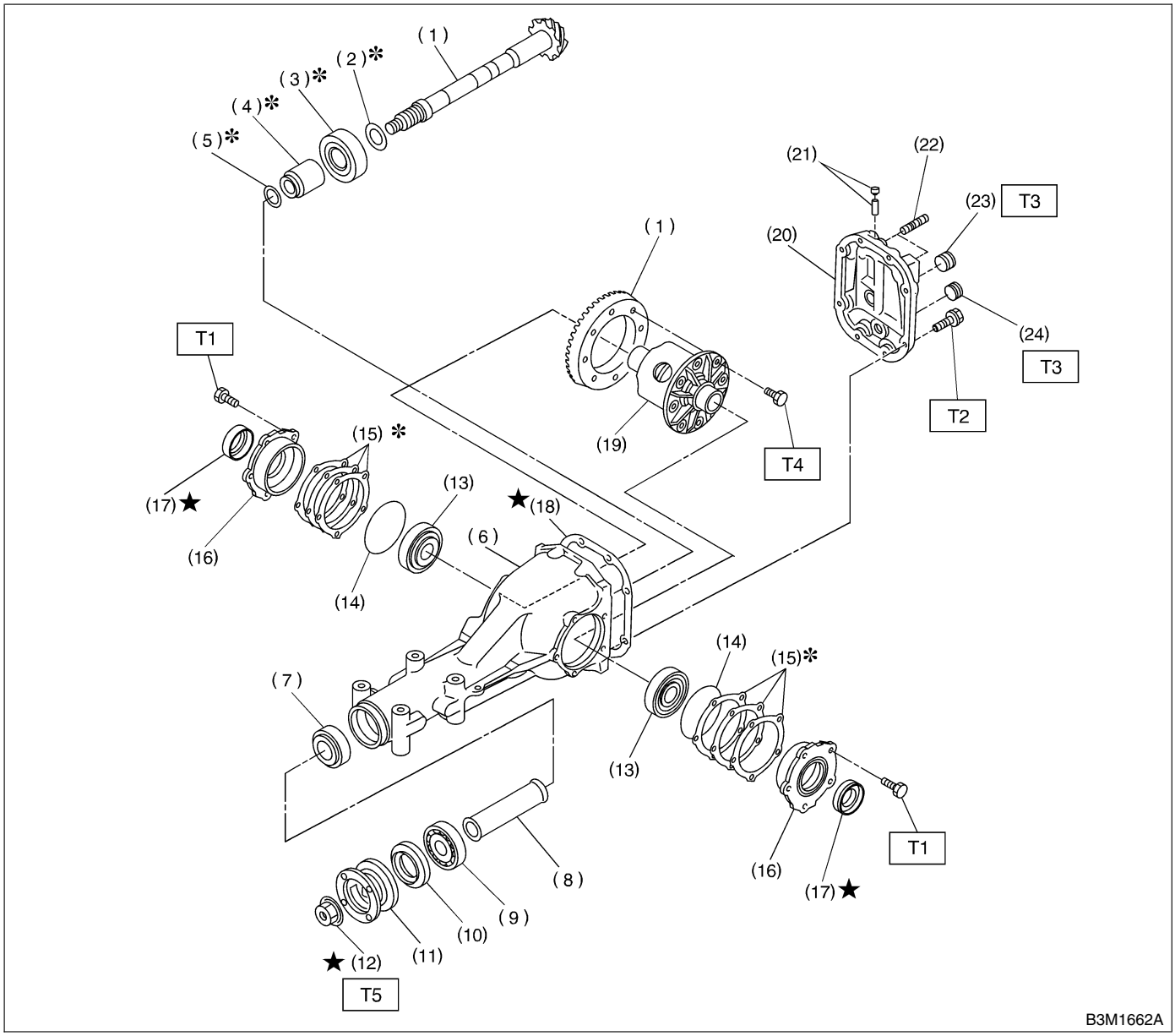
A: WITHOUT LSD



(1) Pinion crown gear set
(2) Pinion height adjusting washer
(3) Rear bearing
(4) Bearing preload adjusting spacer
(5) Bearing preload adjusting washer
(6) Differential carrier
(7) Front bearing
(8) Collar
(9) Pilot bearing
(10) Front oil seal
(11) Companion flange
(12) Self-locking nut
(13) Side bearing
(14) O-ring
(15) Side bearing retainer shim
(16) Side bearing retainer
(17) Side oil seal
(18) Side gear thrust washer
(19) Side gear
(20) Pinion mate gear
(21) Pinion mate gear washer
(22) Pinion shaft lock pin
(23) Circlip
(24) Pinion mate shaft
(25) Air breather cap
(26) Stud bolt
(27) Oil filler plug
(28) Oil drain plug
(29) Rear cover
(30) Differential case

Tightening torque: N·m (kg-m, ft-lb)
T1: 10.3±1.5 (1.05±0.15, 7.6±1.1)
T2: 29±4.9 (3.0±0.5, 21.7±3.6)
T3: 49.0±9.8 (5.0±1.0, 36.2±7.2)
T4: 103±10 (10.5±1.0, 76±7)
T5: 181±14 (18.5±1.5, 134±11)

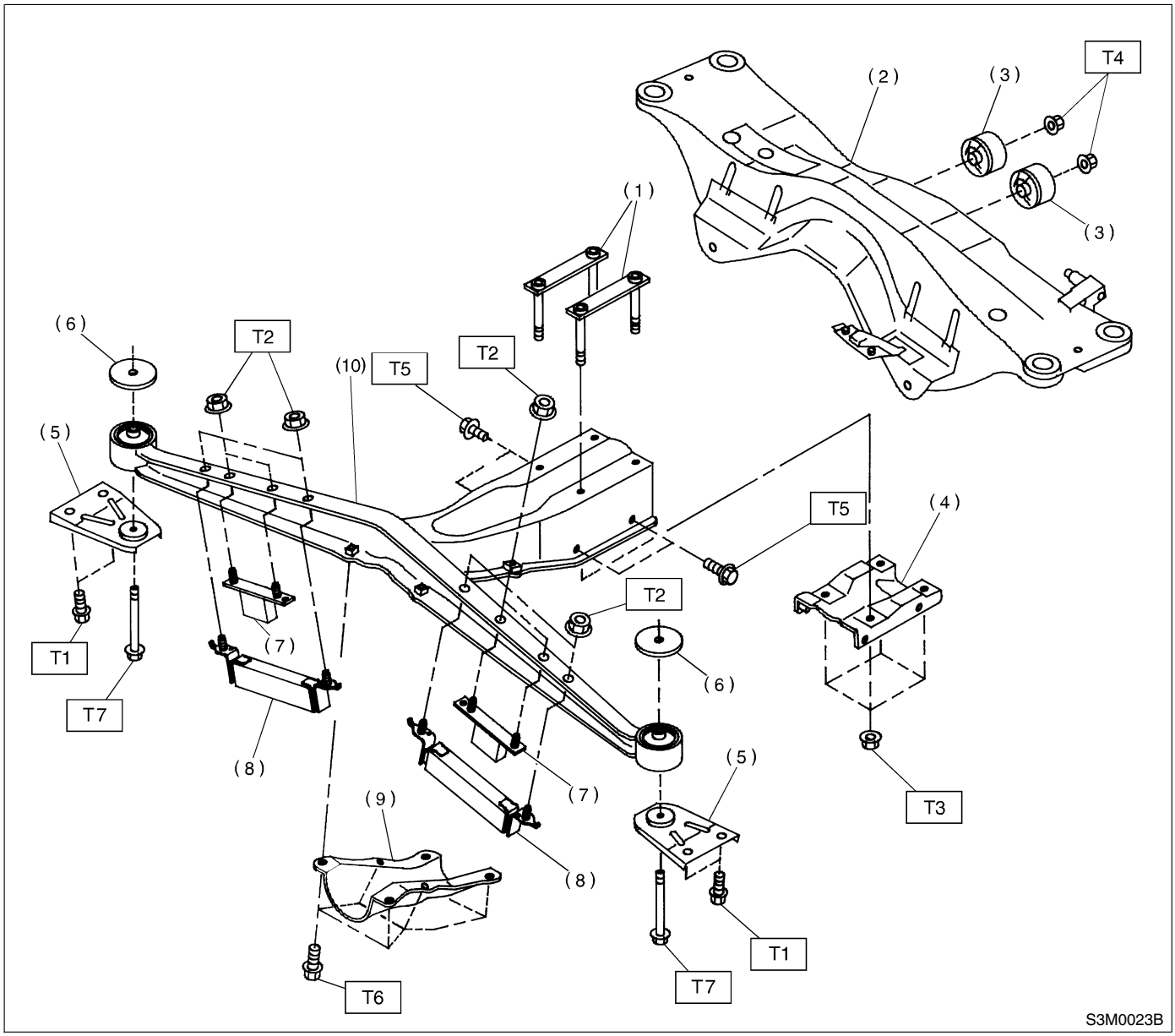
B: WITH LSD



(1) Pinion crown gear set
(2) Pinion height adjusting shim
(3) Rear bearing
(4) Bearing preload adjusting spacer
(5) Bearing preload adjusting washer
(6) Differential carrier
(7) Front bearing
(8) Collar
(9) Pilot bearing
(10) Front oil seal
(11) Companion flange
(12) Self-locking nut
(13) Side bearing
(14) O-ring
(15) Side bearing retainer shim
(16) Side bearing retainer
(17) Side oil seal
(18) Gasket
(19) Differential case
(20) Rear cover
(21) Air breather cap
(22) Stud bolt
(23) Oil filler plug
(24) Oil drain plug

Tightening torque: N·m (kg-m, ft-lb)
T1: 10.3±1.5 (1.05±0.15, 7.6±1.1)
T2: 29±5 (3.0±0.5, 21.7±3.6)
T3: 49.0±9.8 (5.0±1.0, 36.2±7.2)
T4: 103.0±9.8 (10.50±1.00, 75.9±7.2)
T5: 181±15 (18.5±1.5, 134±11)

3. Rear Differential Mounting System



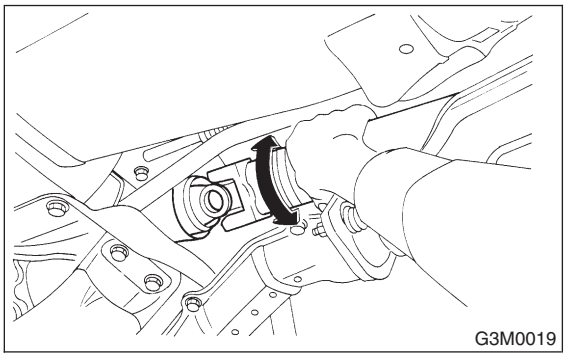
(1) Plate
(2) Crossmember
(3) Rear bushing
(4) Differential mount lower bracket
(5) Differential mount bracket
(6) Stopper
(7) Mass damper (AT vehicles)
(8) Dynamic damper (MT vehicles)
(9) Differential mount front cover
(10) Differential front member

Tightening torque: N·m (kg-m, ft-lb)
T1: 32±8 (3.3±0.8, 23.9±5.8)
T2: 40±10 (4.1±1.0, 29.7±7.2)
T3: 64±8 (6.5±0.8, 47.0±5.8)
T4: 69±8 (7.0±0.8, 50.6±5.8)
T5: 69±10 (7.0±1.0, 51.0±7.2)
T6: 88±10 (9.0±1.0, 65.0±7.2)
T7: 98±10 (10.0±1.0, 72.0±7.2)

1. Propeller Shaft

A: ON-CAR SERVICE

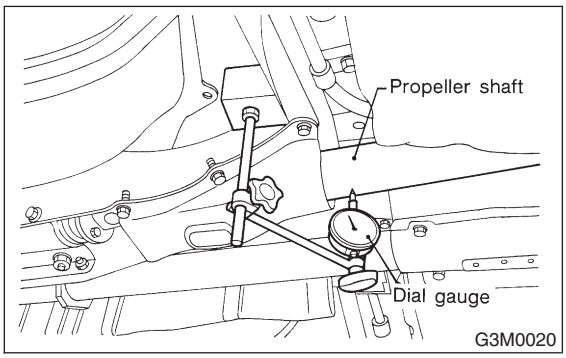
1) Joints and connections
Check for any looseness of yoke flange connecting bolts and center bearing retaining bolts.
2) Splines and bearing locations
Turn propeller shaft by hand to see if abnormal free play exists at splines. Also move yokes to see if abnormal free play exists at spiders and bearings.


G3M0019

3) Runout of propeller shaft
Turn rear wheels by hand to check for “runout” of propeller shaft.

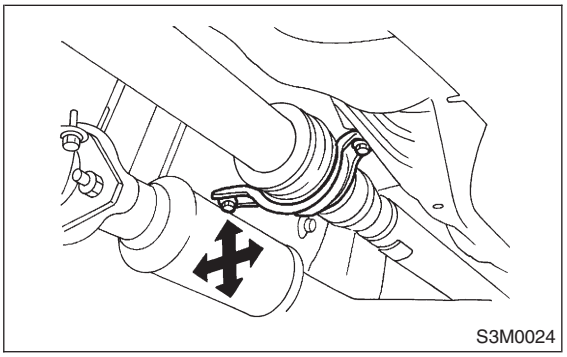
NOTE:
Measure runout with a dial gauge at the center of front and rear propeller shaft tubes.

Runout:
Limit 0.6 mm (0.024 in)



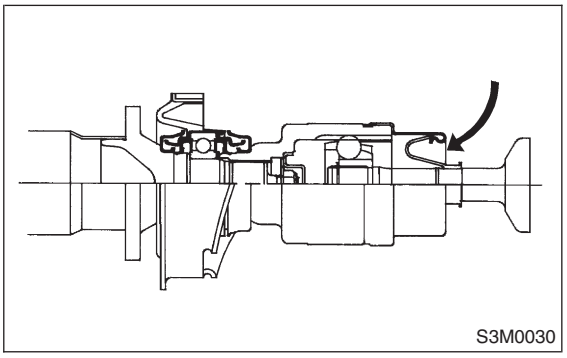
G3M0020

4) Center bearing free play
While holding propeller shaft near center bearing with your hand, move it up and down, and left and right to check for any abnormal bearing free play.

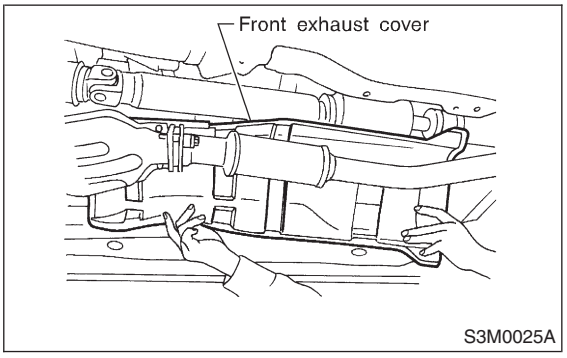

S3M0024

B: REMOVAL

NOTE:
● Before removing propeller shaft, wrap metal parts with a cloth or rubber material.
● In case of DOJ type, before removing propeller shaft, wrap metal parts (installed at the rubber boot of center DOJ) with a cloth or rubber material, as shown in the figure. Rubber boot may be damaged due to interference with adjacent metal parts while bending the DOJ during removal.

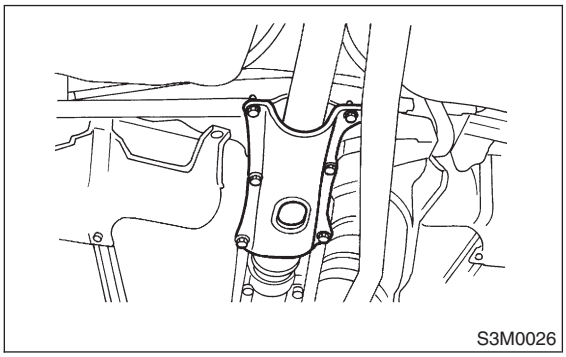

S3M0030

1) Disconnect ground terminal from battery.
2) Move selector lever or gear shift lever to “N”.
3) Release the parking brake.
4) Jack-up vehicle and support it with sturdy racks.
5) Remove front exhaust cover.



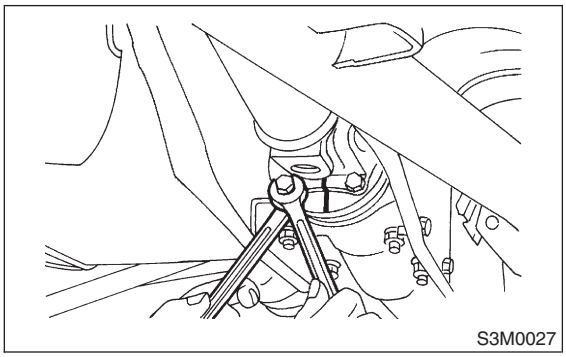
S3M0025A

6) Remove differential mount front cover.

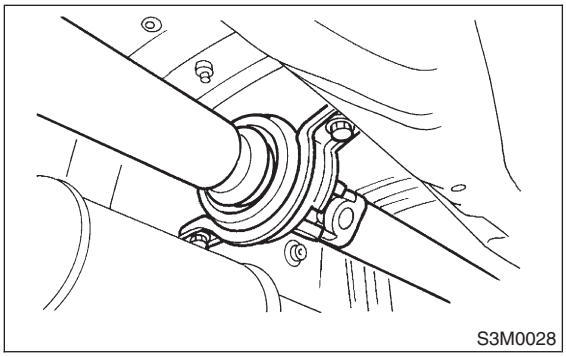

S3M0026

7) Remove the four bolts which hold propeller shaft to rear differential.

NOTE:
● Put matching mark on affected parts before removal.
● Remove all but one bolt.


S3M0027

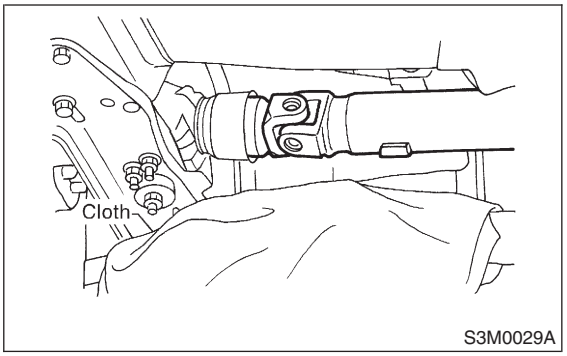
8) Remove the two bolts which hold center bearing to vehicle body.


S3M0028

9) Remove propeller shaft from transmission.

CAUTION:
● Be sure not to damage oil seals and the frictional surface of sleeve yoke.
● Cover the center exhaust pipe with a cloth because ATF or oil may be spilled from transmission, when removing propeller shaft.

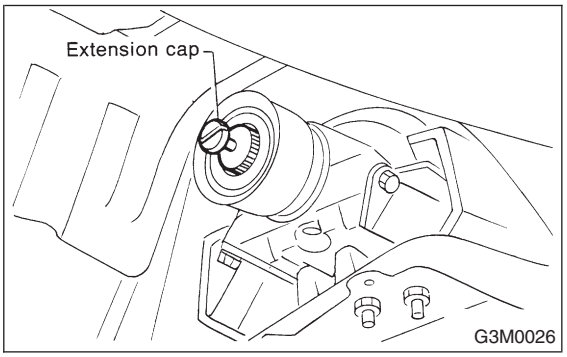
NOTE:
● Be sure to use an empty oil can to catch oil flowing out when removing propeller shaft.
● Be sure to plug the opening in transmission after removal of propeller shaft.



S3M0029A

10) Install the extension cap to transmission.

NOTE:
If extension cap is not available, cover the opening with a vinyl bag in order to prevent gear oil or ATF leakage.



G3M0026

C: DISASSEMBLY AND ASSEMBLY

NOTE:
Do not disassemble propeller shaft. It is a single unit.

D: INSPECTION

NOTE:
Do not disassemble propeller shaft. Check the following and replace if necessary.

1) Tube surfaces for dents or cracks
2) Splines for deformation or abnormal wear
3) Joints for non-smooth operation or abnormal noise

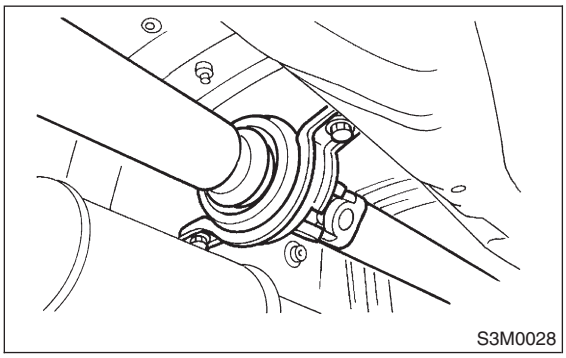
4) Center bearing for free play, noise or non-smooth operation
5) Oil seals for abnormal wear or damage
6) Center bearing for breakage or damage to rubber boot

E: INSTALLATION

NOTE:
Be careful not to damage rubber boot (installed at DOJ) while installing propeller shaft.

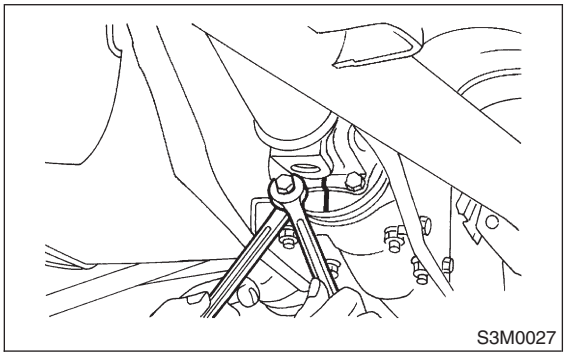
1) Insert sleeve yoke into transmission and attach center bearing to vehicle body.

Tightening torque:
52±5 N·m (5.3±0.5 kg-m, 38.3±3.6 ft-lb)


S3M0028

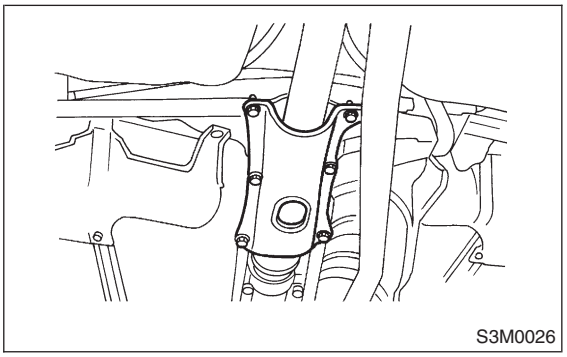
2) Align matching marks and connect flange yoke and rear differential.

Tightening torque:
31±8 N·m (3.2±0.8 kg-m, 23.1±5.8 ft-lb)

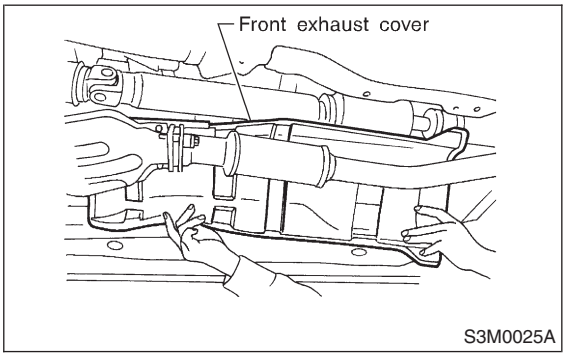

S3M0027

3) Install differential mount front cover.

Tightening torque:
88±10 N·m (9.0±1.0 kg-m, 65±7 ft-lb)


S3M0026

4) Install front exhaust cover.



S3M0025A

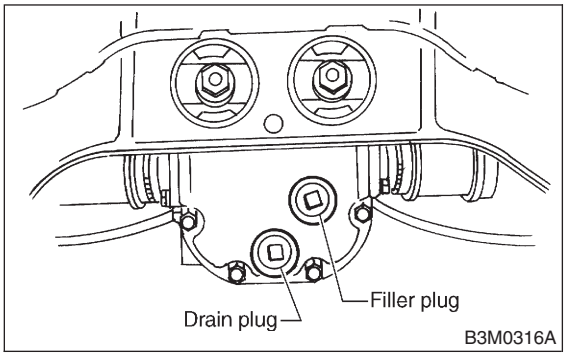
5) Install rear exhaust pipe and muffler.

2. Rear Differential

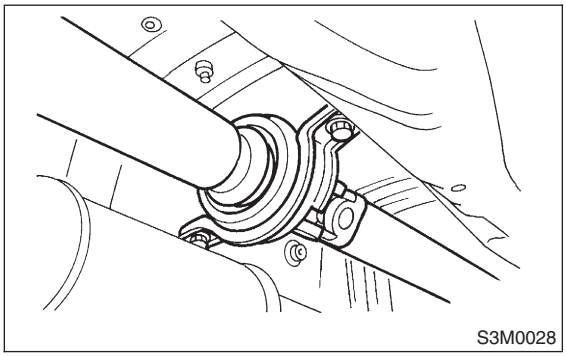
A: ON-CAR SERVICE

1. FRONT OIL SEAL

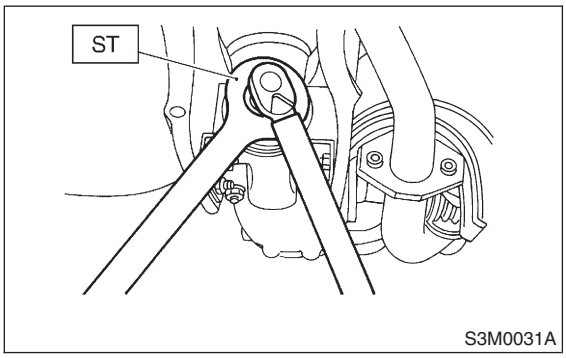
1) Disconnect ground terminal from battery.
2) Move selector lever or gear shift lever to “N”.
3) Release the parking brake.
4) Remove oil drain plug, and drain gear oil.



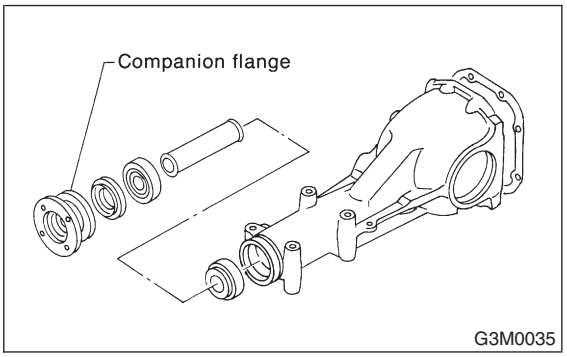
5) Jack-up rear wheels and support the vehicle body with sturdy racks.
6) Remove propeller shaft from body. <Ref. to 3-4 [W1B0].>



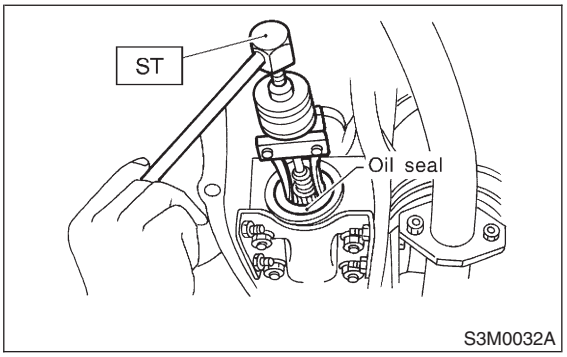
7) Remove self-locking nut while holding companion flange with ST.
ST 498427200 FLANGE WRENCH



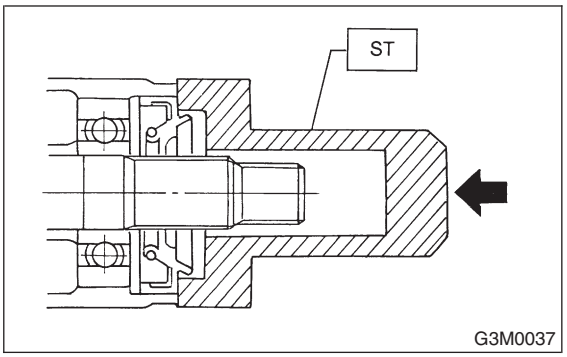
8) Extract companion flange with a puller.



9) Remove oil seal using ST.
ST 398527700 PULLER ASSY



10) Fit a new oil seal using ST.
ST 498447120 OIL SEAL INSTALLER



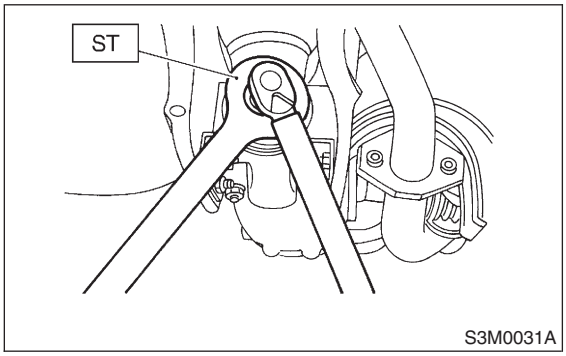
11) Install companion flange.

12) Tighten self-locking nut within the specified torque range so that the turning resistance of companion flange becomes the same as that before replacing oil seal.

CAUTION:
Use a new self-locking nut.

ST 498427200 FLANGE WRENCH

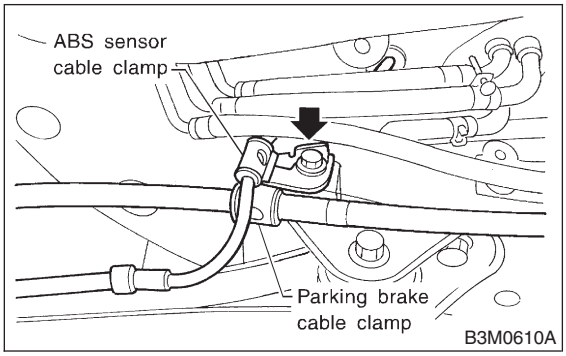
Tightening torque:
181.4±14.7 N·m (18.50±1.50 kg-m, 133.8±10.8 ft-lb)



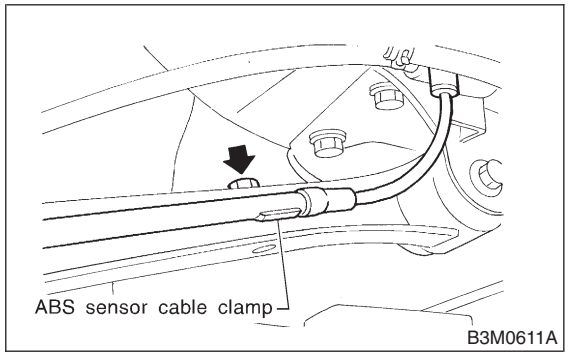
13) Reassembling procedure hereafter is the reverse of the disassembling.

2. SIDE OIL SEAL

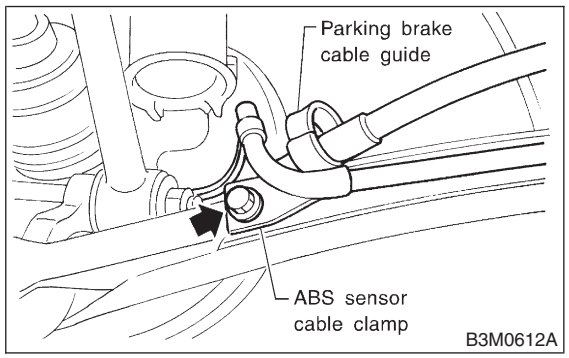
1) Disconnect ground terminal from battery.
2) Move selector lever or gear shift lever to “N”.
3) Release the parking brake.
4) Loosen both wheel nuts.
5) Jack-up the vehicle and support it with rigid racks.
6) Remove wheels.
7) Remove muffler. <Ref. to 2-9 [W3A0].>
8) Remove the ABS sensor cable clamp and parking brake cable clamp from bracket.



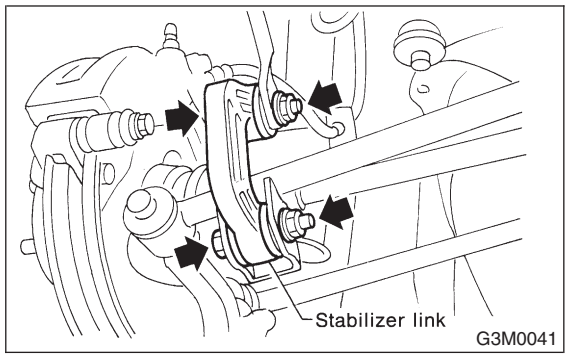
9) Remove the ABS sensor cable clamp from the trailing link.



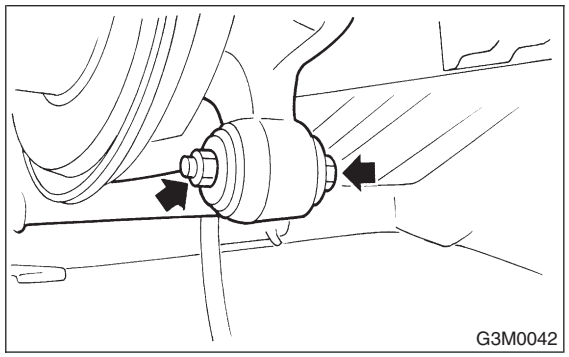
10) Remove the ABS sensor cable clamp and parking brake cable guide from the trailing link.



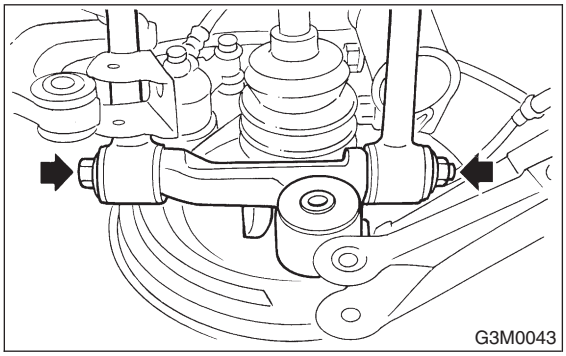
11) Remove the rear stabilizer link.



12) Remove the bolts which secure the trailing link to the rear housing.



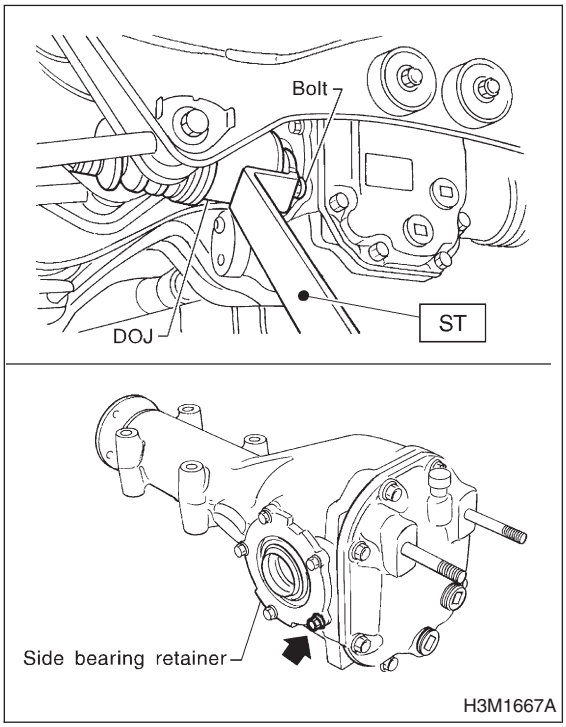
13) Remove the bolts which secure the front and rear lateral link to the rear housing.



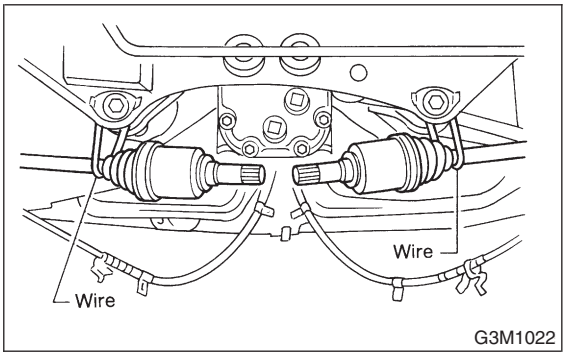
14) Remove the DOJ from the rear differential by using ST.

CAUTION:
When removing the DOJ from the rear differential, fit ST to the bolt as shown in figure so as not to damage the side bearing retainer.

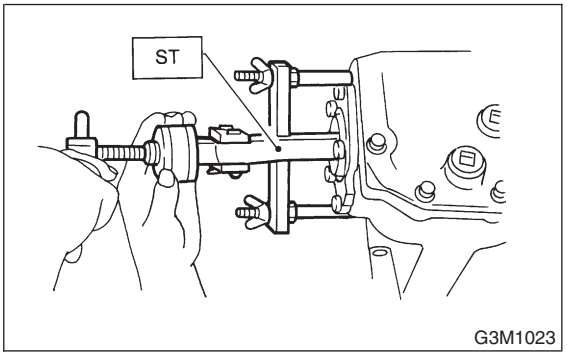
ST 208099PA100 DRIVE SHAFT REMOVER



15) Secure rear drive shaft to rear crossmember using wire.



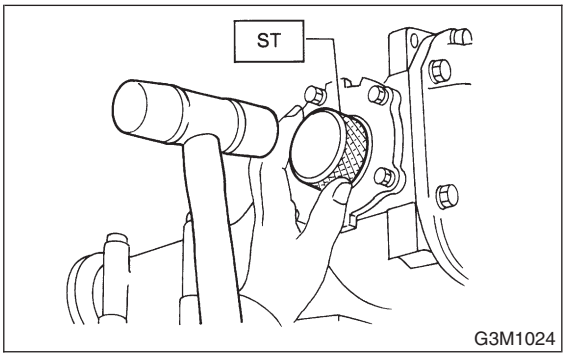
16) Remove side oil seal with ST.
ST 398527700 PULLER ASSY



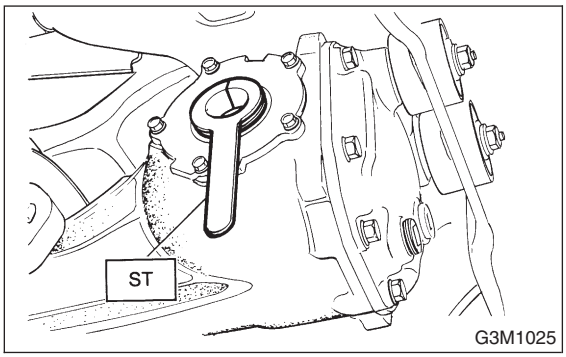
17) Drive in a new side oil seal with ST.

CAUTION:
Apply chassis grease between the oil seal lips.

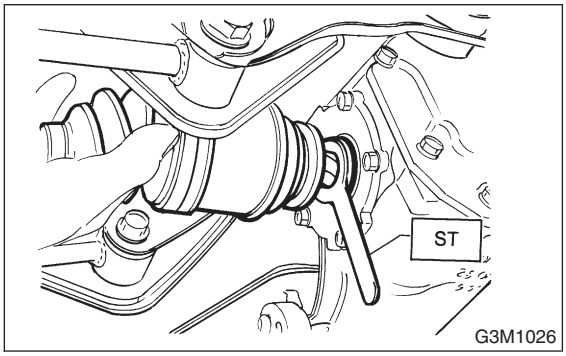
ST 398437700 DRIFT



18) Install ST to rear differential.
ST 28099PA090 SIDE OIL SEAL PROTECTOR



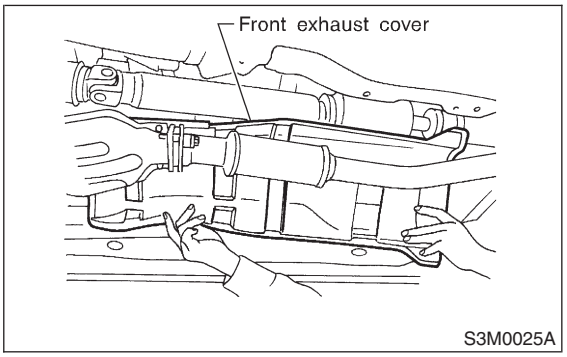
19) Insert the spline shaft until the spline portion is inside the side oil seal.
ST 28099PA090 SIDE OIL SEAL PROTECTOR



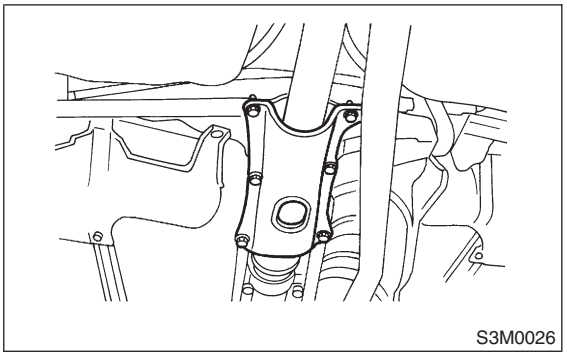
20) Remove ST.
ST 28099PA090 SIDE OIL SEAL PROTECTOR
21) Hereafter, re-assemble in reverse order of disassembly.

B: REMOVAL

1) Disconnect ground terminal from battery.
2) Move selector lever or gear shift lever to “N”.
3) Release the parking brake.
4) Loosen wheel nuts.
5) Jack-up vehicle and support it with sturdy racks.
6) Remove wheels.
7) Remove rear exhaust pipe and muffler.
<Ref. to 2-9 [W2A0].> and <Ref. to 2-9 [W3A0].>
8) Remove front exhaust cover.



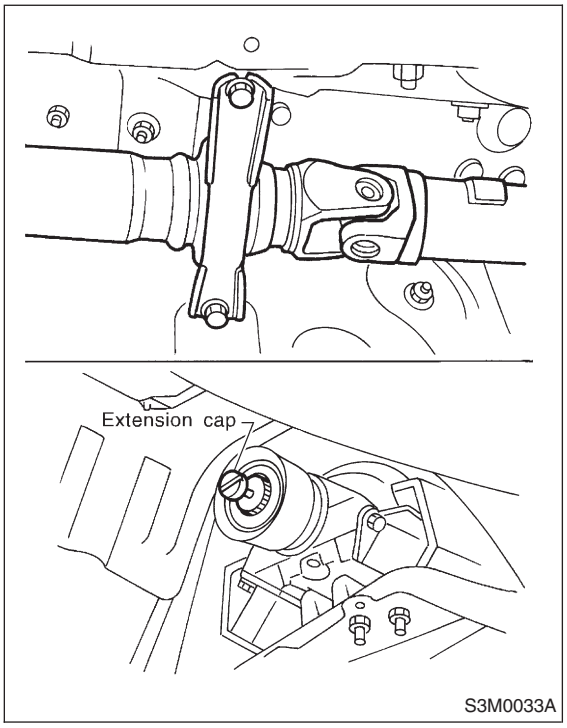
9) Remove front cover of rear differential mount.



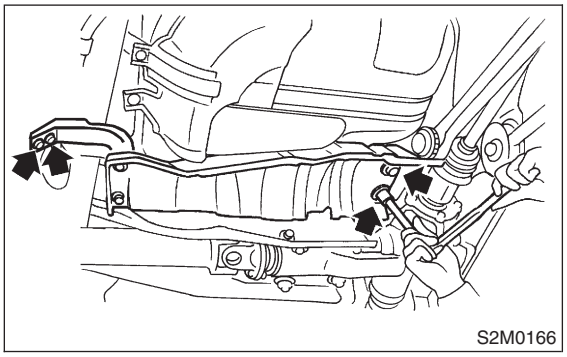
10) Remove propeller shaft.

CAUTION:
When removing propeller shaft, pay attention not to damage the sliding surfaces of rear drive shaft (extension) spline, oil seal and sleeve yoke.

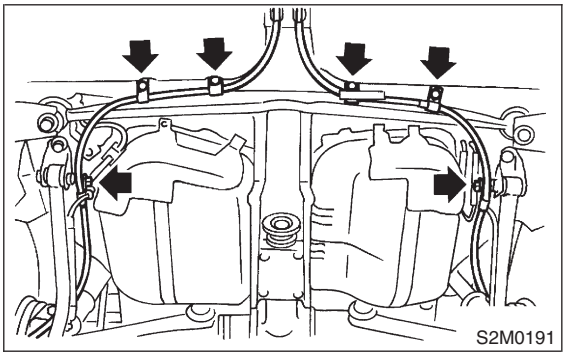
NOTE:
● Prepare an oil can and cap since the transmission oil flows out from the extension at removing propeller shaft.
● Insert the cap into the extension to prevent transmission oil from flowing out immediately after removing the propeller shaft.



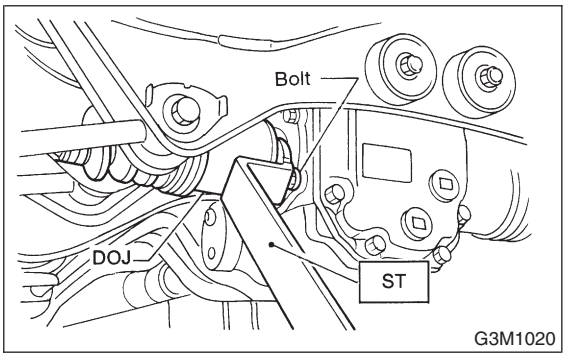
11) Remove heat sealed cover.



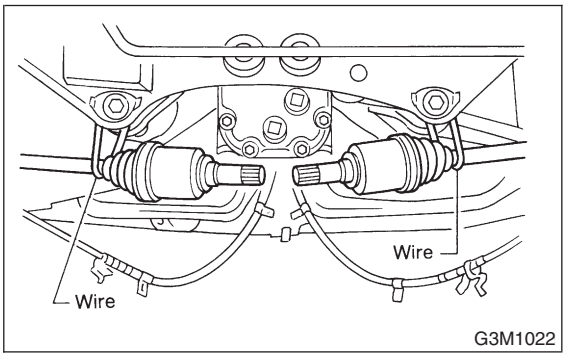
12) Remove clamps and bracket of parking brake cable.



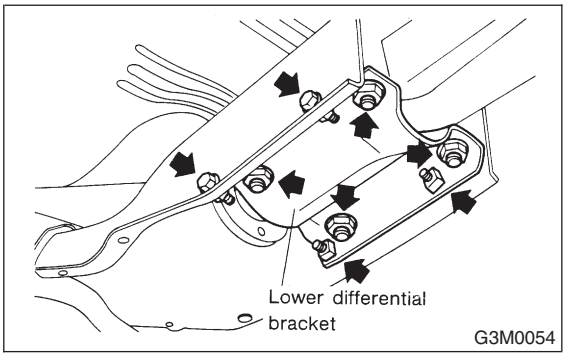
13) Remove DOJ of rear drive shaft from rear differential using ST. <Ref. to 3-4 [W2A2].>
ST 28099PA100 DRIVE SHAFT REMOVER



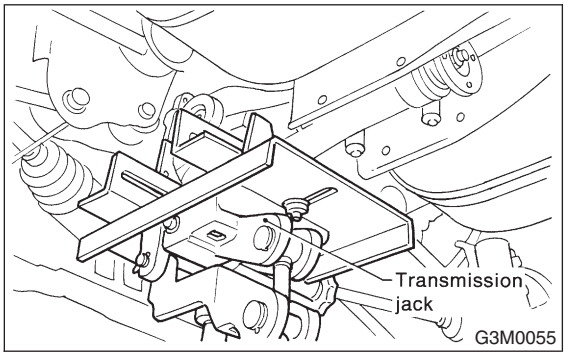
14) Secure rear drive shaft to rear crossmember using wire.



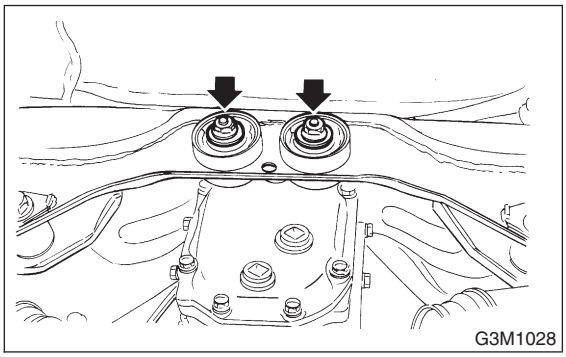
15) Remove lower differential bracket. (If rear differential protector is not equipped.)



16) Support rear differential with transmission jack.



17) Remove self-locking nuts connecting rear differential to rear crossmember.

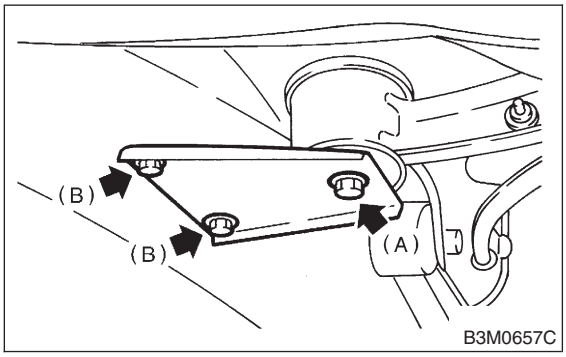


18) Remove bolts which secure rear differential front member to body.

(1) Loosen bolt A first, then remove bolts B.

NOTE:
Support front member with the use of a helper to prevent it from dropping.

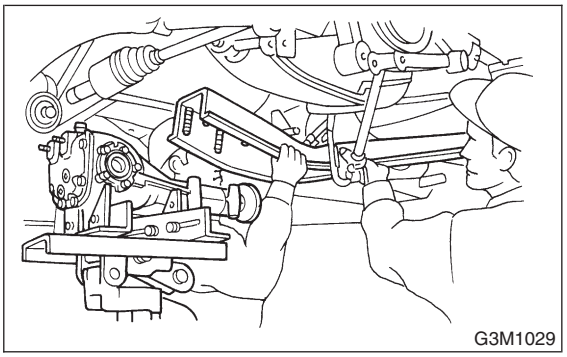
(2) Remove bolt A.



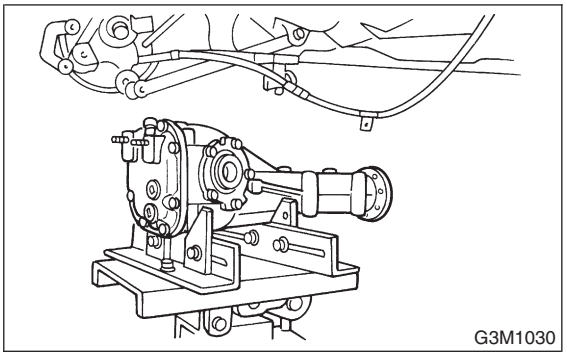
(A) Bolt A
(B) Bolt B

19) While slowly lowering transmission jack, move rear differential forward and remove front member and rear differential from body.

NOTE:
If rear differential protector is equipped, remove front member, rear differential and rear differential protector as a unit from body.



20) Remove rear differential protector. (If rear differential protector is equipped.)
21) Remove lower differential bracket. (If rear differential protector is equipped.)
22) Remove rear differential from front member.

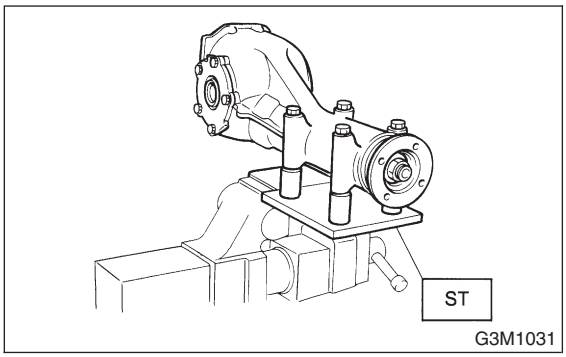


C: DISASSEMBLY

NOTE:
To detect real cause of trouble, inspect the following items before disassembling. <Ref. to 3-4 [W2E0].>

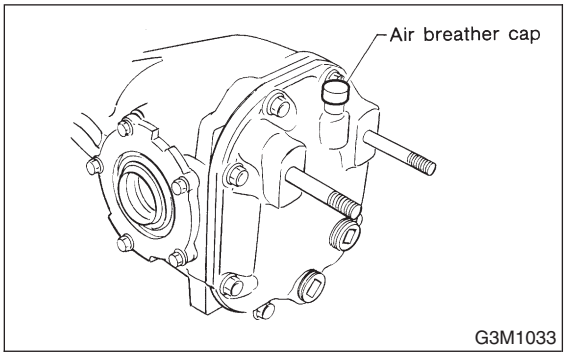
- Tooth contact of crown gear and pinion, and backlash
- Runout of crown gear at its back surface
- Turning resistance of drive pinion

1) Set ST on vise and install the differential assembly to ST.
ST 398217700 ATTACHMENT

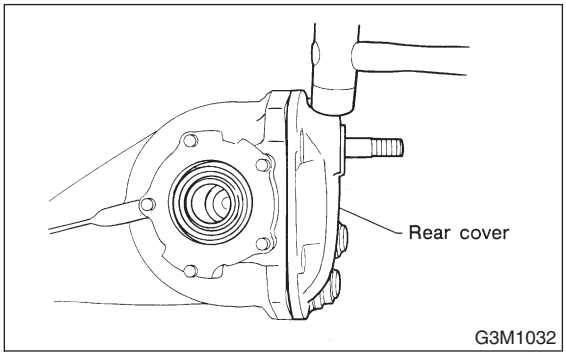


2) Drain gear oil by removing plug.
3) Remove the air breather cap.

NOTE:
Do not attempt to replace the air breather cap unless necessary.



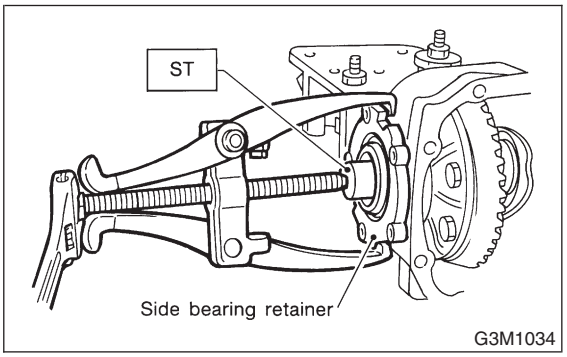
4) Remove rear cover by loosening retaining bolts.



5) Make right and left side bearing retainers in order to identify them at reassembly. Remove side bearing retainer attaching bolts, set ST to differential case, and extract right and left side bearing retainers with a puller.

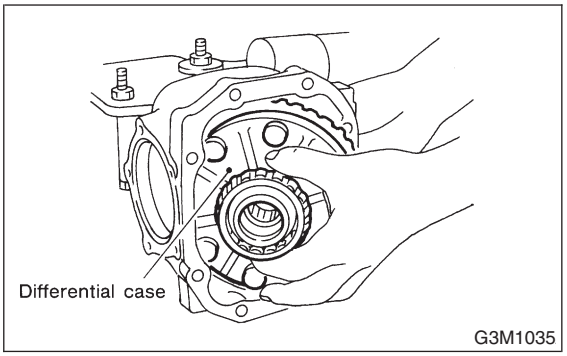
CAUTION:
Each shim, which is installed to adjust the side bearing preload, should be kept together with its mating retainer.

ST 398457700 ATTACHMENT

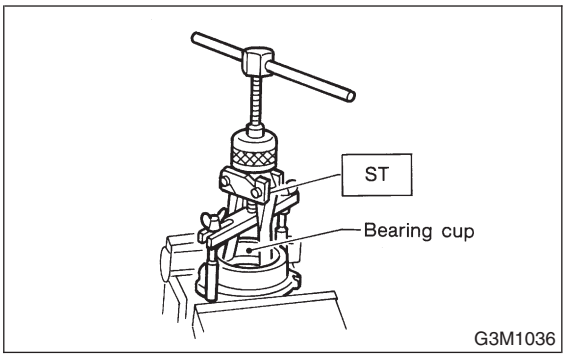


6) Pull out differential assembly from differential carrier.

CAUTION:
Be careful not to hit the teeth against the case.



7) When replacing side bearing, pull bearing cup from side bearing retainer using ST.
ST 398527700 PULLER ASSY

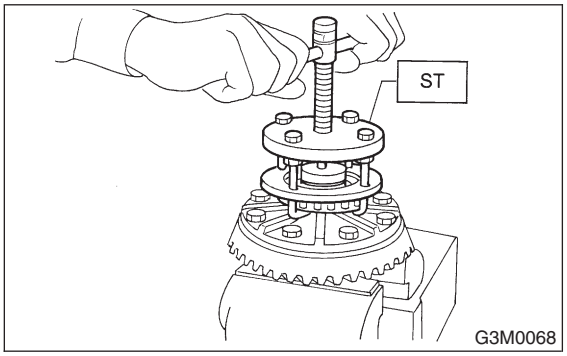


8) Extract bearing cone with ST.

CAUTION:
Do not attempt to disassemble the parts unless necessary.

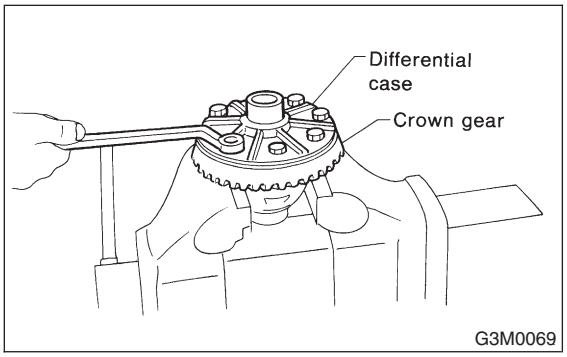
NOTE:
● Set puller so that its claw catch the edge of the bearing cone.
● Never mix up the right and left hand bearing cups and cones.

ST 399527700 PULLER SET



9) Remove crown gear by loosening crown gear bolts.

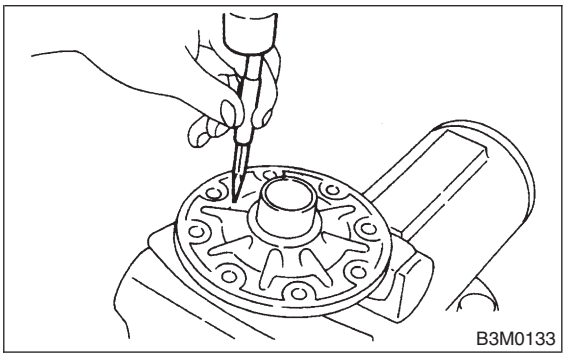
CAUTION:
Further disassembling is not allowed.



10) Drive out pinion shaft lock pin from crown gear side. (Without LSD)

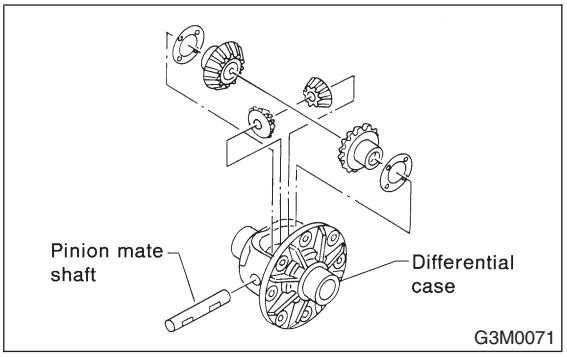
NOTE:
The lock pin is staked at the pin hole end on the differential carrier; do not drive it out forcibly before unstaking it.

ST 899904100 STRAIGHT PIN REMOVER

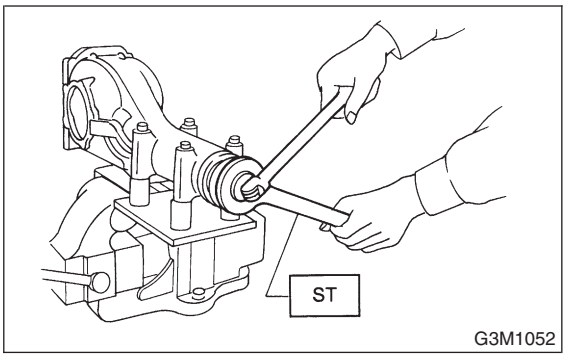


11) Draw out pinion mate shaft and remove pinion mate gears, side gears and thrust washers. (Without LSD)

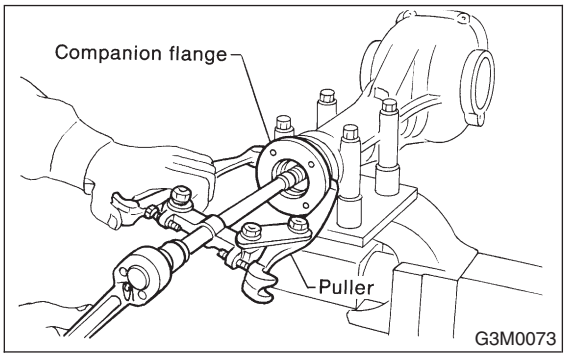
NOTE:
The gears as well as thrust washers should be marked or kept separated left and right, and front and rear.



12) Hold companion flange with ST and remove drive pinion nut.
ST 498427200 FLANGE WRENCH



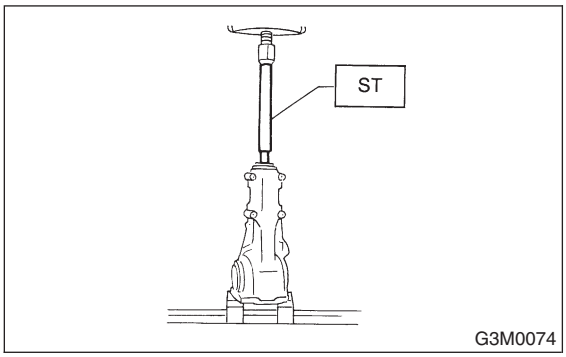
13) Extract the companion flange with a puller.



14) Press the end of drive pinion shaft and extract it together with rear bearing cone, preload adjusting spacer and washer.

NOTE:
Hold the drive pinion so as not to drop it.

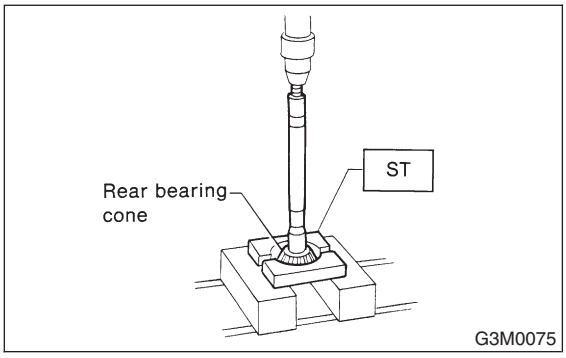
ST 398467700 DRIFT



15) Remove rear bearing cone from drive pinion by supporting cone with ST.

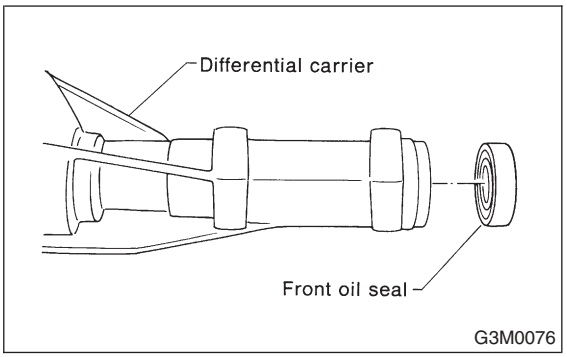
NOTE:
Place the replacer so that its center-recessed side faces the pinion gear.

ST 498515500 REPLACER



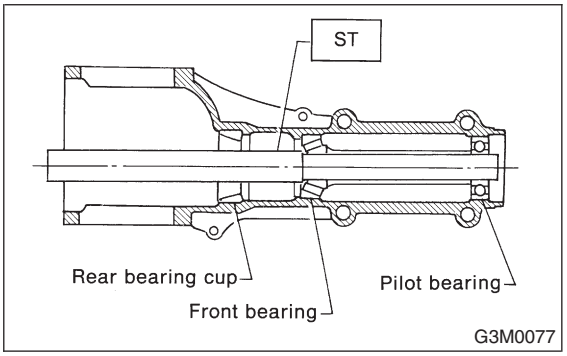
16) Remove front oil seal from differential carrier using ST.

ST 398527700 PULLER ASSY

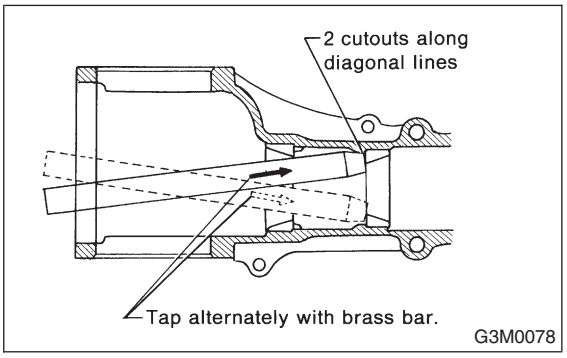


17) Remove pilot bearing together with front bearing cone using ST.

ST 398467700 DRIFT



18) When replacing bearings, tap front bearing cup and rear bearing cup in this order out of case by using a brass bar.

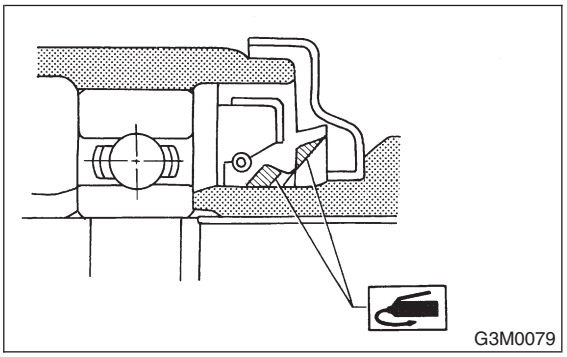


D: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage, or other defects. Repair or replace defective parts as necessary.
1) Crown gear and drive pinion
● If abnormal tooth contact is evident, find out the cause and adjust to give correct tooth contact at assembly. Replace the gear if excessively worn or incapable of adjustment.
● If crack, score, or seizure is evident, replace as a set. Slight damage of tooth can be corrected by oil stone or the like.
2) Side gear and pinion mate gear
● Replace if crack, score, or other defects are evident on tooth surface.
● Replace if thrust washer contacting surface is worn or seized. Slight damage of the surface can be corrected by oil stone or the like.
3) Bearing
Replace if seizure, peeling, wear, rust, dragging during rotation, abnormal noise or other defect is evident.
4) Thrust washers of side gear and pinion mate gear Replace if seizure, flaw, abnormal wear or other defect is evident.
5) Oil seal
Replace if deformed or damaged, and at every disassembling.
6) Differential carrier
Replace if the bearing bores are worn or damaged.
7) Differential case
Replace if its sliding surfaces are worn or cracked.
8) Companion flange
Replace if the oil seal lip contacting surfaces have flaws.

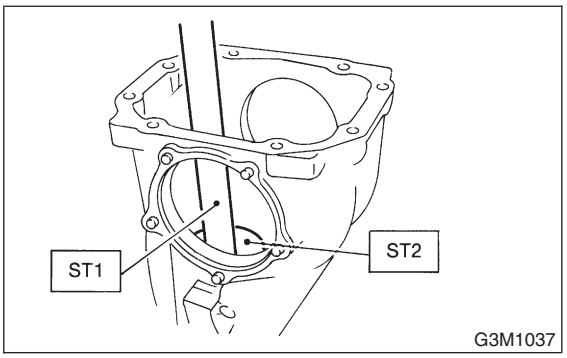
E: ASSEMBLY

1) Precautions for assembling
● Assemble in the reverse order of disassembling.
● Check and adjust each part during assembly.
● Keep the shims and washers in order, so that they are not misinstalled.
● Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
● Apply gear oil when installing the bearings and thrust washers.
● Be careful not to mix up the right and left hand cups of the bearings.
● Replace the oil seal with new one at every disassembly. Apply chassis grease between the lips when installing the oil seal.


G3M0079

2) Adjusting preload for front and rear bearings
Adjust the bearing preload with spacer and washer between front and rear bearings. Pinion height adjusting washers are not affected by this adjustment. The adjustment must be carried out without the oil seal inserted.
(1) Press rear bearing race into differential carrier with ST1 and ST2.

ST1 398477701 HANDLE
ST2 398477703 DRIFT 2



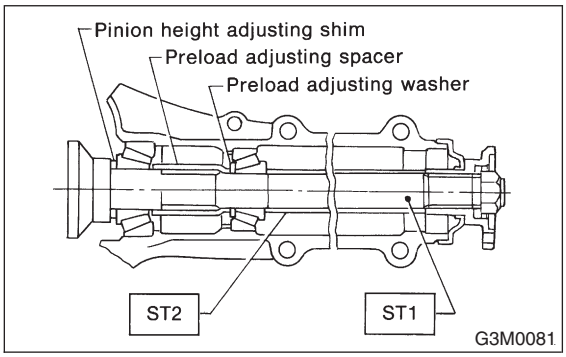
G3M1037

(2) Insert ST1 into case with pinion height adjusting washer and rear bearing cone fitted onto it.

CAUTION:
- **Re-use the used washer if not deformed.**
- **Use a new rear bearing cone.**

(3) Then install preload adjusting spacer and washer, front bearing cone, ST2, companion flange, and washer and drive pinion nut.

ST1 398507702 DUMMY SHAFT
ST2 398507703 DUMMY COLLAR



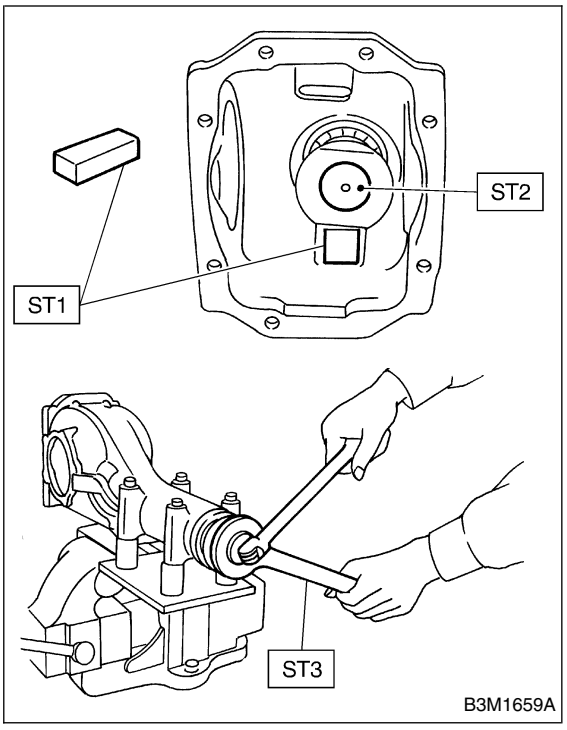
(4) Turn ST1 with hand to make it seated, and tighten drive pinion nut while measuring the preload with spring balance. Select preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque with ST3.

ST1 398507704 BLOCK
ST2 398507702 DUMMY SHAFT
ST3 498427200 FLANGE WRENCH

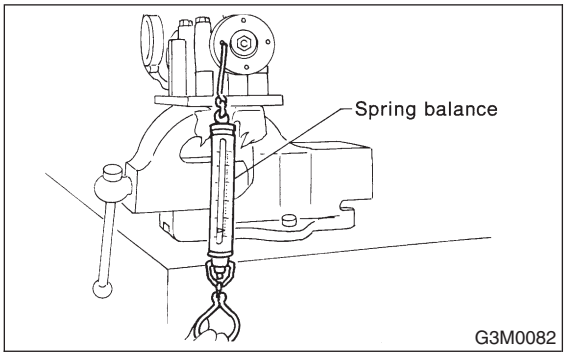
CAUTION:
Use a new lock nut.

NOTE:
- Be careful not to give excessive preload.
- When tightening the drive pinion nut, lock ST1 with ST2 as shown in the figure.

Tightening torque:
181±15 N·m (18.5±1.5 kg-m, 134±11 ft-lb)



Front and rear bearing preload
For new bearing: 17.7 — 25.5 N (1.8 — 2.6 kg, 4.0 — 5.7 lb) at companion flange bolt hole



	Part No.	Thickness mm (in)
• Preload adjusting washer	383705200	2.59 (0.1020)
	383715200	2.57 (0.1012)
	383725200	2.55 (0.1004)
	383735200	2.53 (0.0996)
	383745200	2.51 (0.0988)
	383755200	2.49 (0.0980)
	383765200	2.47 (0.0972)
	383775200	2.45 (0.0965)
	383785200	2.43 (0.0957)
	383795200	2.41 (0.0949)
	383805200	2.39 (0.0941)
	383815200	2.37 (0.0933)
	383825200	2.35 (0.0925)
	383835200	2.33 (0.0917)
	383845200	2.31 (0.0909)
	Part No.	Length mm (in)
• Preload adjusting spacer	383695201	56.2 (2.213)
	383695202	56.4 (2.220)
	383695203	56.6 (2.228)
	383695204	56.8 (2.236)
	383695205	57.0 (2.244)
	383695206	57.2 (2.252)

3) Adjusting drive pinion height

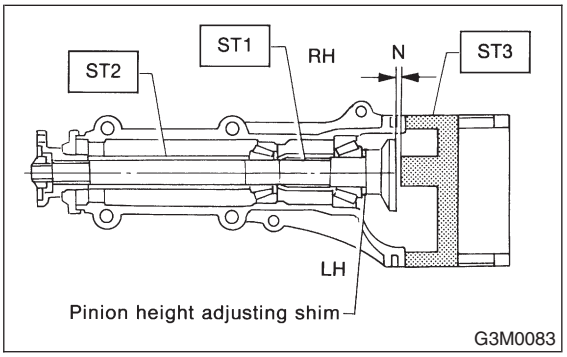
Adjust drive pinion height with shim installed between rear bearing cone and the back of pinion gear.

(1) Install ST1, ST2 and ST3, as shown in the figure, and apply the specified preload on the bearings.

Front and rear bearing preload
For new bearing: 17.7 — 25.5 N (1.8 — 2.6 kg, 4.0 — 5.7 lb) at companion flange bolt hole

Adjust preload for front and rear bearings.

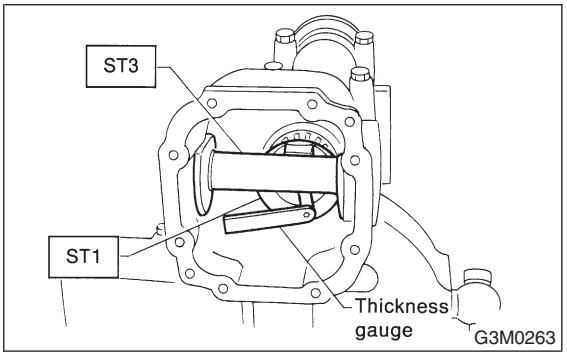
NOTE:
At this time, install a pinion height adjusting shim which is temporarily selected or the same as that used before.



(2) Measure the clearance N between the end of ST3 and the end surface of ST1 by using a thickness gauge.

NOTE:
Make sure there is no clearance between the case and ST3.

ST1 398507702 DUMMY SHAFT
ST2 398507703 DUMMY COLLAR
ST3 398507701 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting shim to be inserted from the following formula, and replace the temporarily installed shim with this one.

$T = To + N - (H \times 0.01) - 0.20$ (mm)

Where:

T = Thickness of pinion height adjusting shim (mm)

To = Thickness of shim temporarily inserted (mm)

N = Reading of thickness gauge (mm)

H = Figure marked on drive pinion head

(Example of calculation)

To = 2.20 + 1.20 = 3.40 mm

N = 0.23 mm H = + 1,

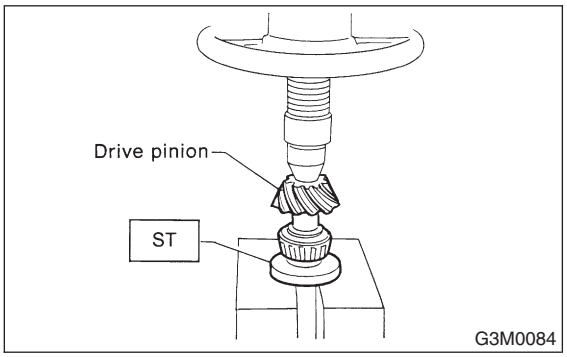
T = 3.40 + 0.23 – 0.01 – 0.20 = 3.42

Result: Thickness = 3.42 mm

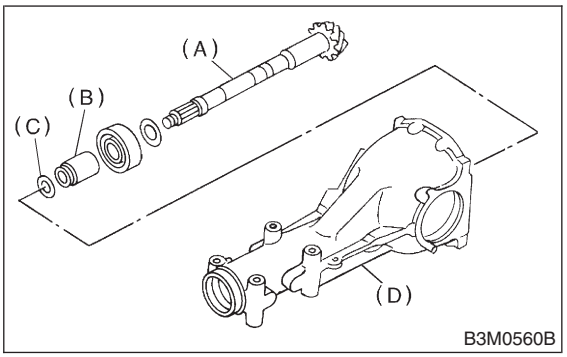
Therefore use the shim 383605200.

Pinion height adjusting shim	
Part No.	Thickness mm (in)
383495200	3.09 (0.1217)
383505200	3.12 (0.1228)
383515200	3.15 (0.1240)
383525200	3.18 (0.1252)
383535200	3.21 (0.1264)
383545200	3.24 (0.1276)
383555200	3.27 (0.1287)
383565200	3.30 (0.1299)
383575200	3.33 (0.1311)
383585200	3.36 (0.1323)
383595200	3.39 (0.1335)
383605200	3.42 (0.1346)
383615200	3.45 (0.1358)
383625200	3.48 (0.1370)
383635200	3.51 (0.1382)
383645200	3.54 (0.1394)
383655200	3.57 (0.1406)
383665200	3.60 (0.1417)
383675200	3.63 (0.1429)
383685200	3.66 (0.1441)

4) Install the selected pinion height adjusting shim on drive pinion, and press the rear bearing cone into position with ST.
ST 398177700 INSTALLER

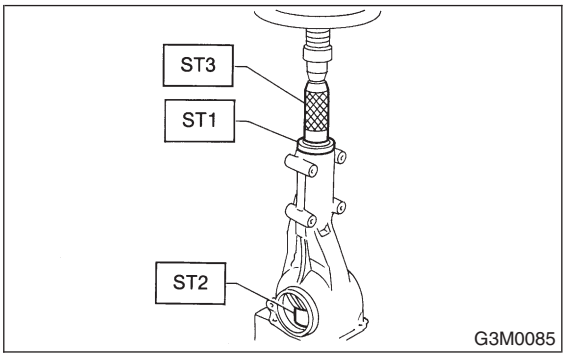


5) Insert drive pinion into differential carrier, install the previously selected bearing preload adjusting spacer and washer.

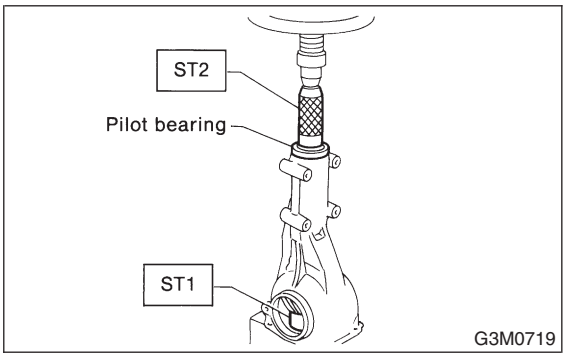


(A) Drive pinion
(B) Bearing preload adjusting spacer
(C) Bearing preload adjusting washer
(D) Differential carrier

6) Press-fit front bearing cone into case with ST1, ST2 and ST3.
ST1 398507703 DUMMY COLLAR
ST2 399780104 WEIGHT
ST3 899580100 INSTALLER



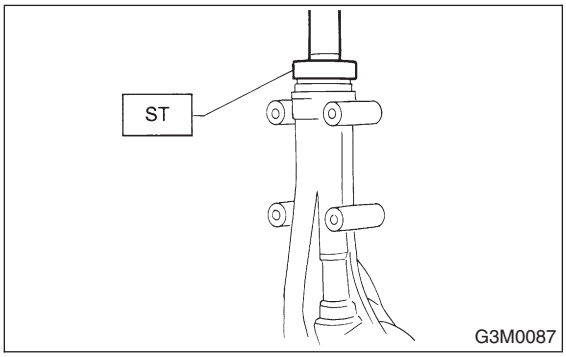
7) Insert spacer, then press-fit pilot bearing with ST1 and ST2.
ST1 399780104 WEIGHT
ST2 899580100 INSTALLER



8) Fit a new oil seal with ST.

NOTE:
● Press-fit until end of oil seal is 1 mm (0.04 in) inward from end of carrier.
● Apply grease between the oil seal lips. <Ref. to 3-4 [W2E0].>

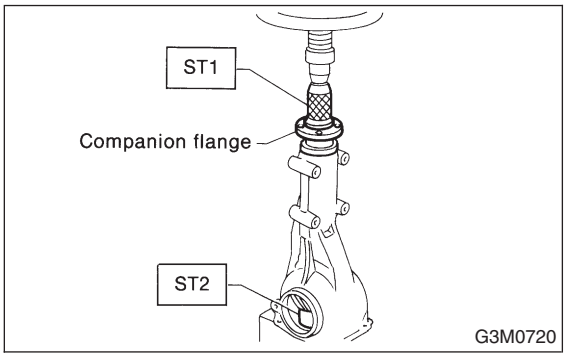
ST 498447120 OIL SEAL INSTALLER



9) Press-fit companion flange with ST1 and ST2.

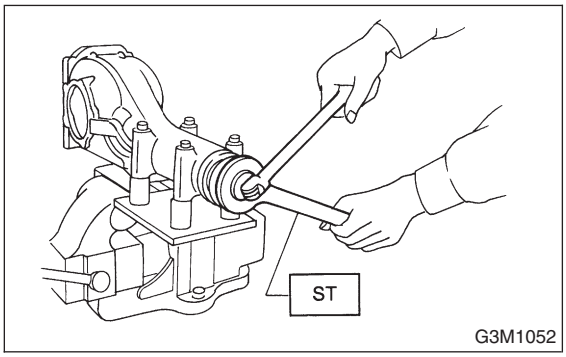
CAUTION:
Be careful not to damage bearing.

ST1 899874100 INSTALLER
ST2 399780104 WEIGHT



10) Install self-locking nut. Then tighten it with ST.
ST 498427200 FLANGE WRENCH

Tightening torque:
181±15 N·m (18.5±1.5 kg-m, 134±11 ft-lb)



11) Assembly of differential case
12) Install side gears and pinion mate gears, with their thrust washers and pinion mate shaft, into differential case.

CAUTION:
● Apply gear oil on both sides of the washer and on the side gear shaft before installing.
● Insert the pinion mate shaft into the differential case by aligning the lock pin holes.

(1) Measure the clearance between differential case and the back of side gear.
(2) Adjust the clearance as specified by selecting side gear thrust washer.

Side gear backlash:
0.1 — 0.2 mm (0.004 — 0.008 in)

Part No.	Thickness mm (in)
383445201	0.75 — 0.80 (0.0295 — 0.0315)
383445202	0.80 — 0.85 (0.0315 — 0.0335)
383445203	0.85 — 0.90 (0.0335 — 0.0354)
383445204	0.90 — 0.95 (0.0354 — 0.0374)
383445205	0.95 — 1.0 (0.0374 — 0.0394)

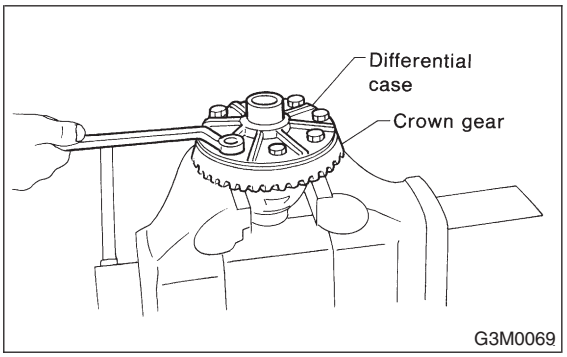
(3) Check the condition of rotation after applying oil to the gear tooth surfaces and thrust surfaces.
(4) After inserting pinion shaft lock pin into differential case, stake the both sides of the hole to prevent pin from falling off.
(5) Install crown gear on differential case.

CAUTION:
Before installing bolts, apply Lock Tite to bolt threads.

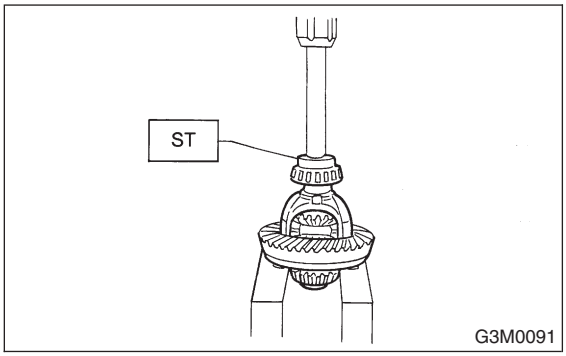
Lock Tite:
THREE BOND 1324 or equivalent

NOTE:
Tighten diagonally while tapping the bolt heads.

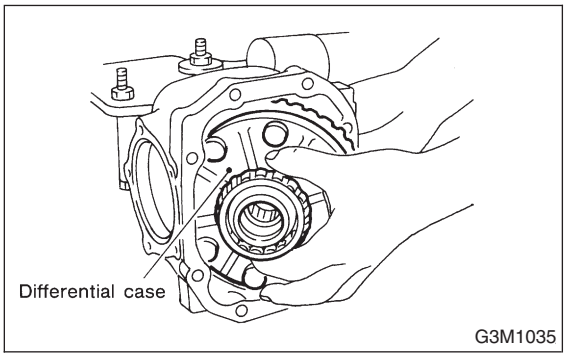
Tightening torque:
103±10 N·m (10.5±1.0 kg-m, 76±7 ft-lb)



13) Press side bearing cone onto differential case with ST.
ST 398487700 DRIFT



14) Adjusting side bearing retainer shims
(1) The driven gear backlash and side bearing preload can be determined by the side bearing retainer shim thickness.
(2) Install the differential case assembly into differential carrier in the reverse order of disassembly.



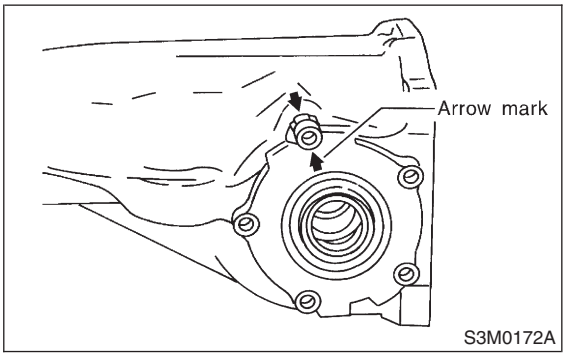
(3) Install side retainer shims and O-rings to the left and right retainers from which they were removed.

NOTE:
- Replace broken or cracked O-ring with new one.
- Replace broken or corroded side retainer shim with new one of same thickness.

Side bearing retainer shim	
Part No.	Thickness mm (in)
383475201	0.20 (0.0079)
383475202	0.25 (0.0098)
383475203	0.30 (0.0118)
383475204	0.40 (0.0157)
383475205	0.50 (0.0197)

(4) Align arrow marked on differential carrier with that marked on side retainer during installation.

CAUTION:
Be careful that side bearing outer race is not damaged by bearing roller.

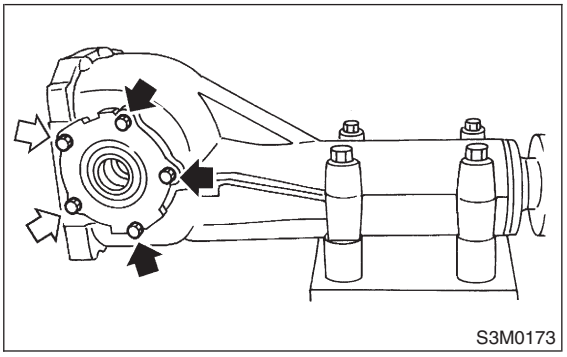


(5) Tighten side bearing retainer bolts.

CAUTION:
Before tightening the two side bearing retainer bolts, apply Lock Tite to bolt threads.

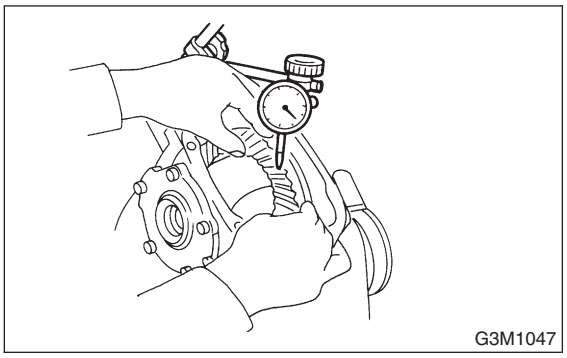
⇨ ***Lock Tite:***
THREE BOND 1105 or equivalent

Tightening torque:
10.3±1.5 N·m (1.05±0.15 kg-m, 7.6±1.1 ft-lb)



(6) Measure the crown gear-to-drive pinion backlash.
Set magnet base on differential carrier. Align contact point of dial gauge with tooth face of crown gear, and move crown gear while holding drive pinion still. Read value indicated on dial gauge.

Backlash:
0.10 — 0.20 mm (0.0039 — 0.0079 in)



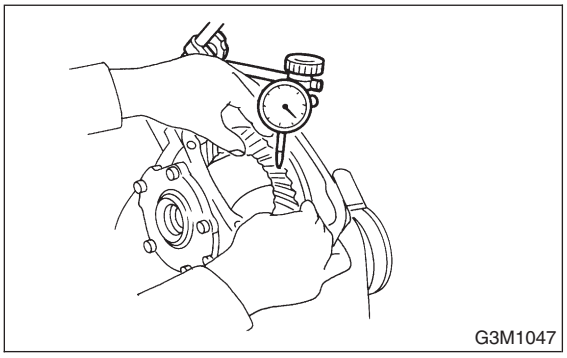
(7) At the same time, measure the turning resistance of drive pinion. Compared with the resistance when differential case is not installed, if the increase of the resistance is not within the specified range, readjust side bearing retainer shims.

NOTE:
If measured backlash is not within specified range, repeat procedure for adjustment of side bearing retainer shims.

Turning resistance increase:
2.9 — 10.8 N (0.3 — 1.1 kg, 0.7 — 2.4 lb)

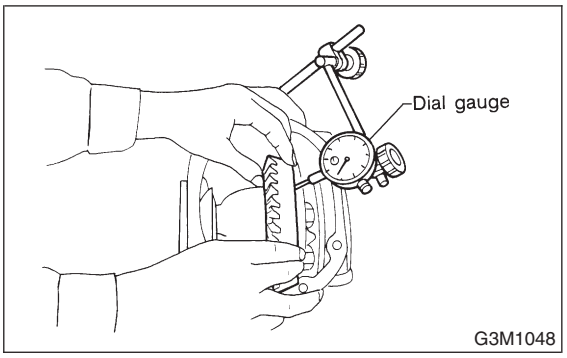
15) Re-check crown gear-to-pinion backlash.

Backlash:
0.10 — 0.20 mm (0.0039 — 0.0079 in)



16) Check the crown gear runout on its back surface, and make sure pinion and crown gear rotate smoothly.

Limit of runout:
Less than 0.05 mm (0.0020 in)



17) Checking and adjusting tooth contact of crown gear
(1) Apply an even coat of red lead on both sides of three or four teeth on the crown gear. Check the contact pattern after rotating crown gear several revolutions back and forth until a definite contact pattern appears on the crown gear.
(2) When the contact pattern is incorrect, readjust according to the instructions given in “TOOTH CONTACT PATTERN”.

NOTE:
Be sure to wipe off red lead completely after adjustment is completed.

18) If proper tooth contact is not obtained, once again adjust the drive pinion height, changing RH and LH side bearing retainer shims and the hypoid gear backlash.

(1) Drive pinion height

ST1 398507702 DUMMY SHAFT
ST2 398507701 DIFFERENTIAL CARRIER GAUGE

T = To + N – (H x 0.01) – 0.20 (mm)

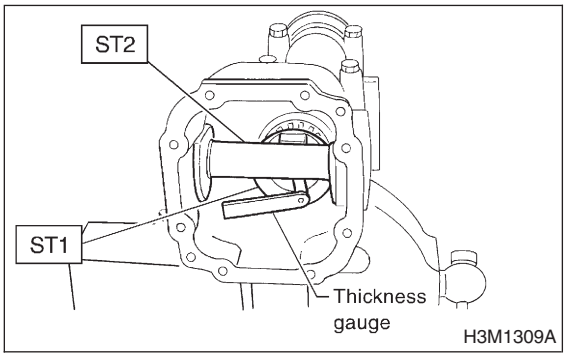
Where:

T = Thickness of pinion height adjusting shim (mm)

To = Thickness of shim temporarily inserted (mm)

N = Reading of thickness gauge (mm)

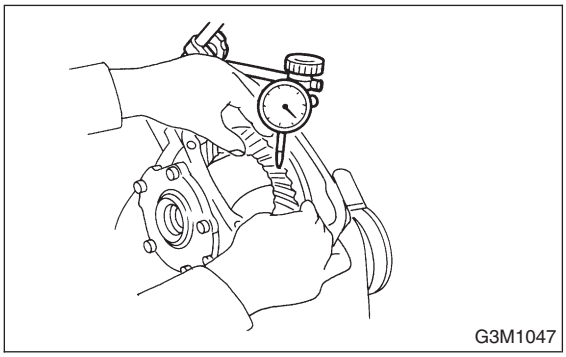
H = Figure marked on drive pinion head



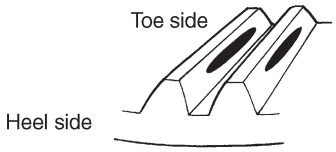
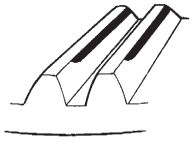
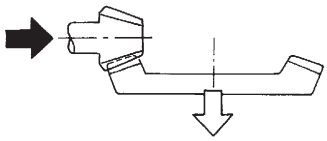
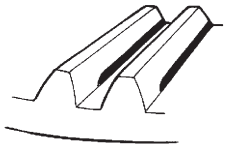
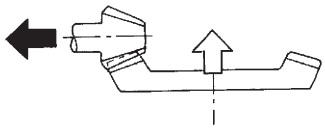
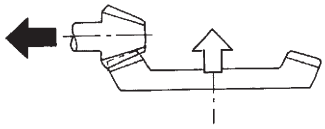
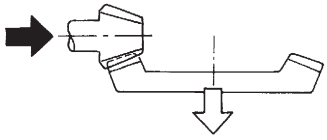
(2) Hypoid gear backlash

Backlash:

0.10 — 0.20 mm (0.0039 — 0.0079 in)

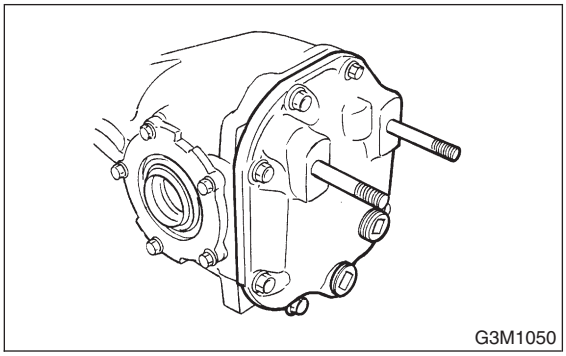


➡ : Adjusting direction of drive pinion
⇨ : Adjusting direction of crown gear

TOOTH CONTACT PATTERN		
Condition	Contact pattern	Adjustment
Correct tooth contact Tooth contact pattern slightly shifted towards toe under no load rotation. (When loaded, contact pattern moves toward heel.)	 B3M0317A	—
Face contact Backlash is too large.	This may cause noise and chipping at tooth ends.  B3M0319	Increase thickness of drive pinion height adjusting shim in order to bring drive pinion closer to crown gear center.  B3M0323
Flank contact Backlash is too small.	This may cause noise and stepped wear on surfaces.  B3M0320	Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.  B3M0324
Toe contact Contact area is small.	This may cause chipping at toe ends.  B3M0321	Adjust as for flank contact.  B3M0324
Heel contact Contact area is small.	This may cause chipping at heel ends.  B3M0322	Adjust as for face contact.  B3M0323

19) Install rear cover and tighten bolts to specified torque.

Tightening torque:
29±5 N·m (3.0±0.5 kg-m, 21.7±3.6 ft-lb)


G3M1050

F: INSTALLATION

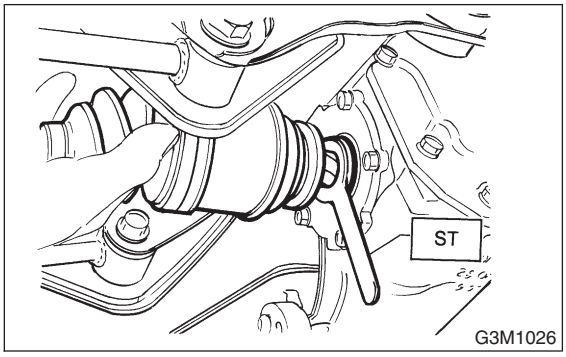
To install, reverse the removal sequence.
1) Install the air breather cap tapping with a plastic hammer.

CAUTION:
Be sure to install new air breather cap.

2) Position front member on body by passing it under parking brake cable and securing to rear differential.

NOTE:
When installing rear differential front member, do not confuse the installation sequence of the upper and lower stoppers.

3) Install DOJ of rear drive shaft into rear differential.
<Ref. to 3-4 [W2A2].>
ST 28099PA090 SIDE OIL SEAL PROTECTOR



G3M1026

4) Installing procedure hereafter is in the reverse order of removal.

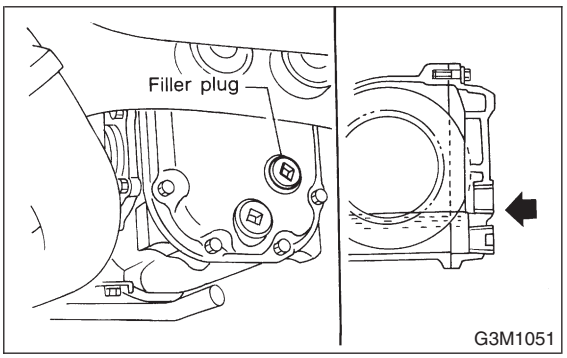
5) After installation, fill differential carrier with gear oil to the upper plug level.

CAUTION:
Apply fluid packing to plug.

Fluid packing:
THREE BOND 1205 or equivalent

Oil capacity:
0.8 ℓ (0.8 US qt, 0.7 Imp qt)

Tightening torque:
49.0±9.8 N·m (5.0±1.0 kg-m, 36.2±3.6 ft-lb)



G3M1051

3. Rear Differential Front Member

A: REMOVAL

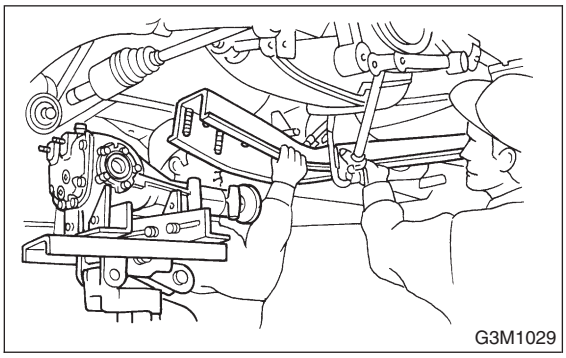
1) Disconnect ground terminal from battery.
2) Move selector lever or gear shift lever to “N”.
3) Release the parking brake.
4) Loosen wheel nuts.
5) Jack-up vehicle and support it with sturdy racks.
6) Remove wheels.
7) Remove rear exhaust pipe and muffler.
<Ref. to 2-9 [W2A0].> and <Ref. to 2-9 [W3A0].>
8) Remove rear differential front member.

NOTE:
When removing rear differential front member, work the removal procedure as rear differential.
<Ref. to 3-4 [W2B0].>

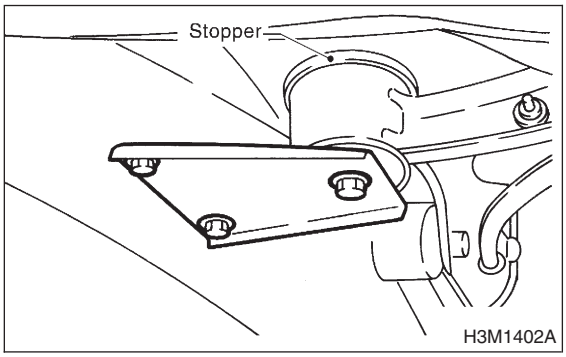
B: INSTALLATION

To install, reverse the removal sequence.
1) Position front member on body by passing it under parking brake cable and securing to rear differential.

NOTE:
● If rear differential protector has been or will be equipped, install front member, rear differential and rear differential protector as a unit.


G3M1029

● When installing rear differential front member, do not confuse the installation sequence of the stopper.

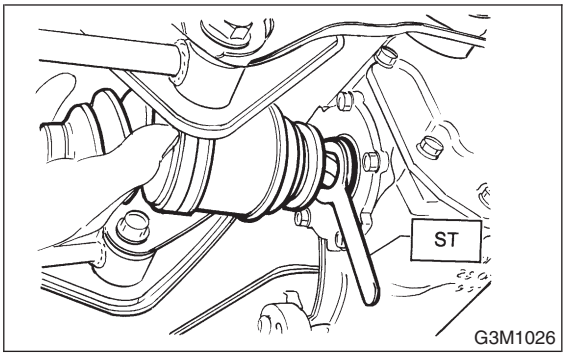


H3M1402A

2) Insert DOJ of rear drive shaft into rear differential.

CAUTION:
Before inserting, replace the differential side oil seal and the circlip at the end of the spline shaft with a new one.

ST 28099PA090 SIDE OIL SEAL PROTECTOR



G3M1026

3) Installing procedure hereafter is in the reverse order of removal.

1. Propeller Shaft

NOTE:
Vibration while cruising may be caused by an unbalanced tire, improper tire inflation pressure, improper wheel alignment, etc.

Symptom	Possible cause	Remedy
1. Vibration of propeller shaft NOTE: Vibration is caused by propeller shaft during operation and is transferred to vehicle body. Generally vibration increase in proportion to vehicle speed.	(1) Worn or damaged universal joint/ DOJ.	Replace.
	(2) Unbalanced propeller shaft due to bend or dent.	Replace.
	(3) Loose installation of propeller shaft.	Retighten.
	(4) Worn or damaged center bearing and damaged center mounting rubber.	Replace.
2. Tapping when starting and noise while cruising, caused by propeller shaft.	(1) Worn or damaged universal joint/ DOJ.	Replace.
	(2) Worn spline of sleeve yoke.	Replace.
	(3) Loose installation of propeller shaft.	Retighten.
	(4) Loose installation of joint.	Replace.
	(5) Worn or damaged center bearing and damaged center mounting rubber.	Replace.

2. Rear Differential

Symptom	Possible cause	Remedy
1. Oil leakage	(1) Worn, scratched, or incorrectly seated front or side oil seal. Scored, battered, or excessively worn sliding surface of companion flange.	Repair or replace.
	(2) Clogged or damaged air breather.	Clean, repair or replace.
	(3) Loose bolts on differential spindle or side retainer, or incorrectly fitted O-ring.	Tighten bolts to specified torque. Replace O-ring.
	(4) Loose rear cover attaching bolts or damaged gasket.	Tighten bolts to specified torque. Replace gasket and apply liquid packing.
	(5) Loose oil filler or drain plug.	Retighten and apply liquid packing.
	(6) Wear, damage or incorrectly fitting for spindle, side retainer and oil seal.	Repair or replace.
2. Seizure NOTE: Seized or damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	(1) Insufficient backlash for hypoid gear.	Readjust or replace.
	(2) Excessive preload for side, rear, or front bearing.	Readjust or replace.
	(3) Insufficient or improper oil used.	Replace seized part and fill with specified oil to specified level.
3. Damage NOTE: Damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	(1) Improper backlash for hypoid gear.	Replace.
	(2) Insufficient or excessive preload for side, rear, or front bearing.	Readjust or replace.
	(3) Excessive backlash for differential gear.	Replace gear or thrust washer.
	(4) Loose bolts and nuts such as crown gear bolt.	Retighten.
	(5) Damage due to overloading.	Replace.
4. Noises when starting or shifting gears NOTE: Noises may be caused by differential assembly, universal joint, wheel bearing, etc. Find out what is actually making noise before disassembly.	(1) Excessive backlash for hypoid gear.	Readjust.
	(2) Excessive backlash for differential gear.	Replace gear or thrust washer.
	(3) Insufficient preload for front or rear bearing.	Readjust.
	(4) Loose drive pinion nut.	Tighten to specified torque.
	(5) Loose bolts and nuts such as side bearing retainer attaching bolt.	Tighten to specified torque.
5. Noises when cornering	(1) Damaged differential gear.	Replace.
	(2) Excessive wear or damage of thrust washer.	Replace.
	(3) Broken pinion mate shaft.	Replace.
	(4) Seized or damaged side bearing.	Replace.
6. Gear noises NOTE: Since noises from engine, muffler, transmission, propeller shaft, wheel bearings, tires, and body are sometimes mistaken for noises from differential assembly, be careful in checking them. Inspection methods to locate noises include coasting, accelerating, cruising, and jacking-up all four wheels. Perform these inspections according to condition of trouble. When listening to noises, shift gears into four wheel drive and fourth speed position, trying to pick up only differential noise.	(1) Improper tooth contact of hypoid gear.	Readjust or replace hypoid gear set.
	(2) Improper backlash for hypoid gear.	Readjust.
	(3) Scored or chipped teeth of hypoid gear.	Replace hypoid gear set.
	(4) Seized hypoid gear.	Replace hypoid gear set.
	(5) Improper preload for front or rear bearings.	Readjust.
	(6) Seized, scored, or chipped front or rear bearing.	Replace.
	(7) Seized, scored, or chipped side bearing.	Replace.
	(8) Vibrating differential carrier.	Replace.

MEMO:

MECHANICAL COMPONENTS SECTION

FOREWORD

This portion of the service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of both the fully qualified and the less-experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

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1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into six volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- ENGINE SECTION
- TRANSMISSION AND DIFFERENTIAL SECTION
- MECHANICAL COMPONENTS SECTION
- BODY AND ELECTRICAL SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following six types of areas.

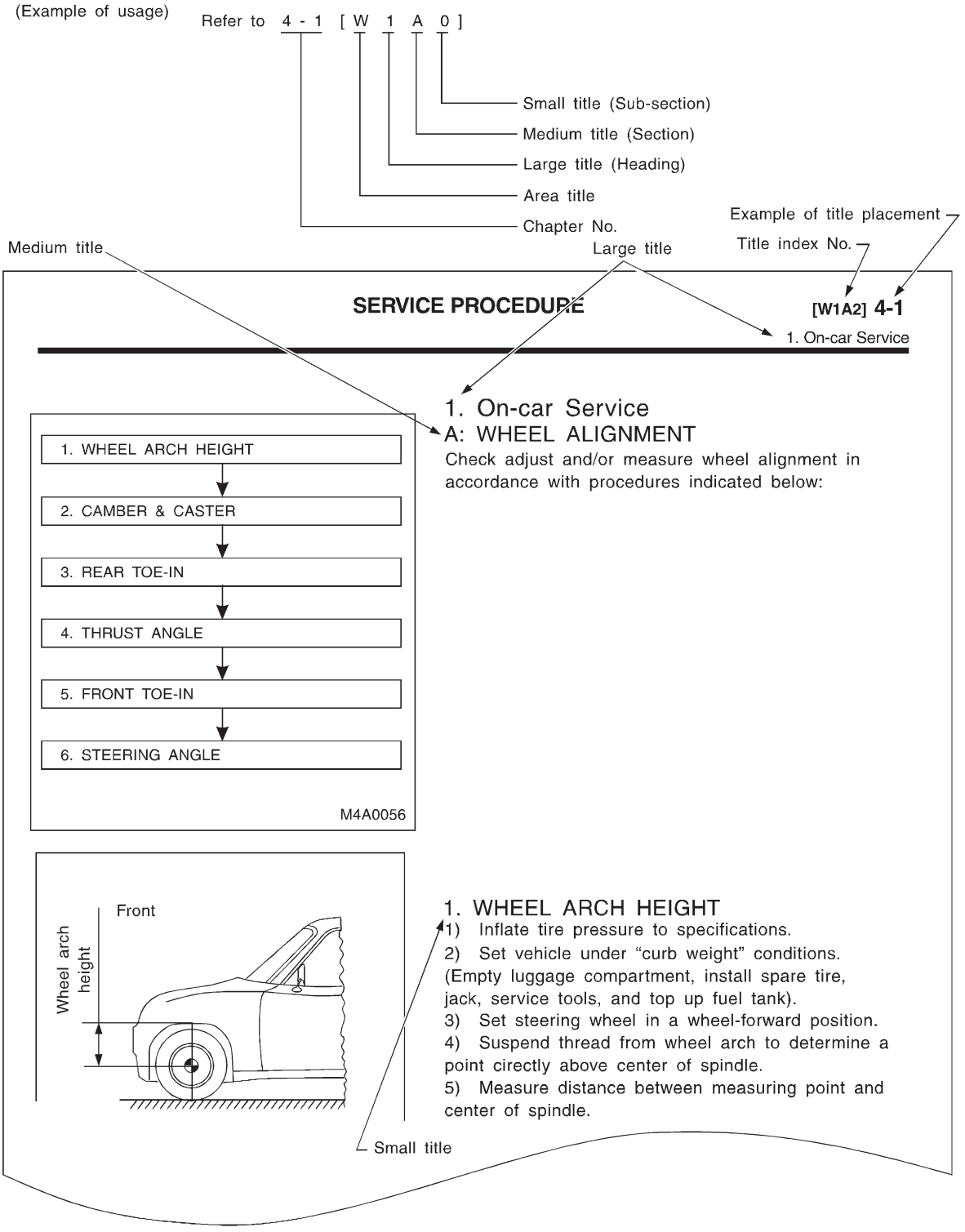
S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS (MECHANICAL)
T	DIAGNOSTICS (ELECTRICAL)
D	WIRING DIAGRAM

● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the six types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

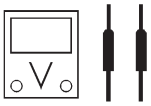
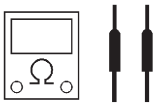
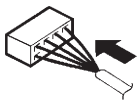
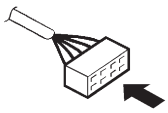
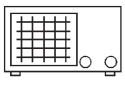
● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.



H0M0010

- In this manual, the following symbols are used.

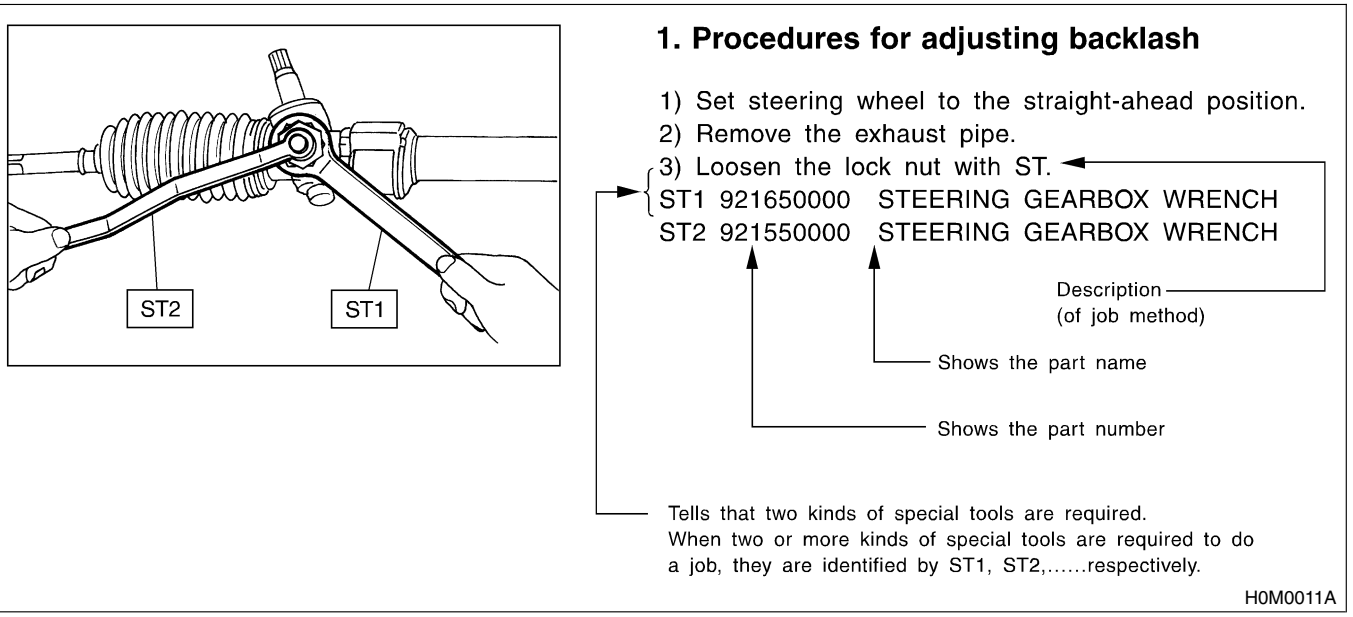
Symbol	Description
*	Selective part
★	Replacement part
 S0M0001	Should be lubricated with oil.
 S0M0002	Should be lubricated with grease.
 S0M0003	Sealing point
T S0M0004	Tightening torque

Character	Description
 B0M0002	Circuit tester ● Voltage measurement
 B0M0003	Circuit tester ● Resistance measurement
 B0M0004	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0005	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0006	Oscilloscope
B0M0007	Oscilloscope positive probe
B0M0008	Oscilloscope earth head

● **WARNING, CAUTION,** NOTE

WARNING:	Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
CAUTION:	Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
NOTE:	Indicates the hints, knacks, etc. which make the maintenance job easier.

● SPECIAL TOOLS
When any special tool is required to perform the job, it is identified by “ST” in the applicable illustration and its part number is shown in the manual.

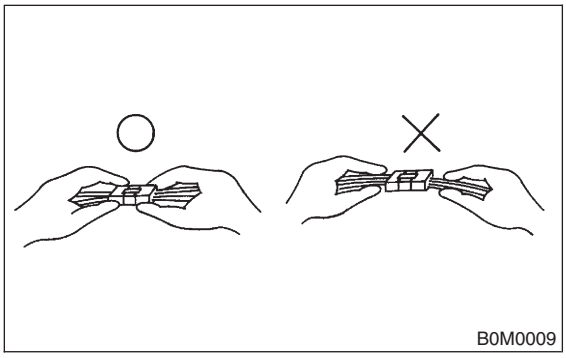


3. Basic Checks for Diagnostics

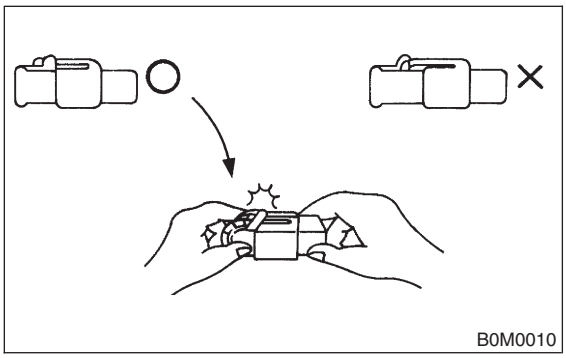
A: DISCONNECTING CONNECTORS

- Always hold the connector itself.

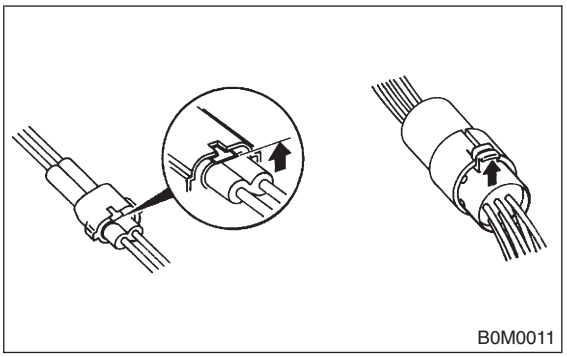
CAUTION:
Don't pull the harness.



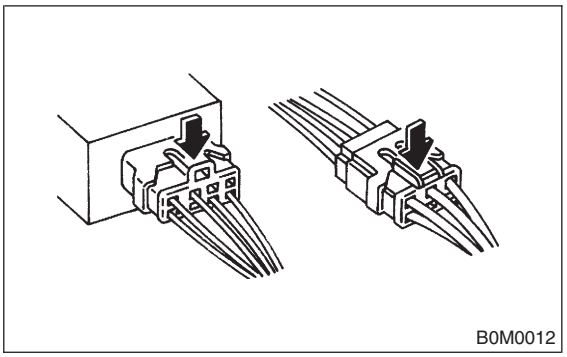
- Inspect a connector by pushing it all the way in. If the connector is equipped with a locking device, push it in until a clicking sound is heard.



- To disconnect a locking connector, first release the lock, then pull the connector off.
<Unlock by pulling the locking tab.>



<Unlock by pushing the locking tab.>

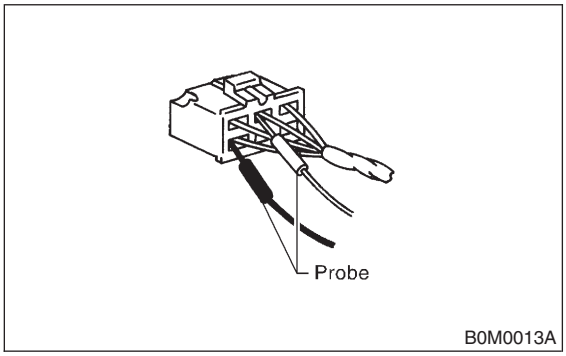


NOTE:
- After disconnecting connectors, visually check for contamination, distortion, or damage of connectors before reconnecting them. Also, check for loose or missing terminals.
- If there are any contamination, or water droplets on the contact points of the terminals, wipe them off using an air gun or a waste cloth. Never polish the contact points using sandpaper. If polished with sandpaper, the surface plating may peel off.
- Avoid excessive impact and twisting force to connectors when connecting. Otherwise, connector housings or terminals may be damaged.
- When disconnecting waterproof connectors, be sure to prevent the inner waterproof seal from collapsing.

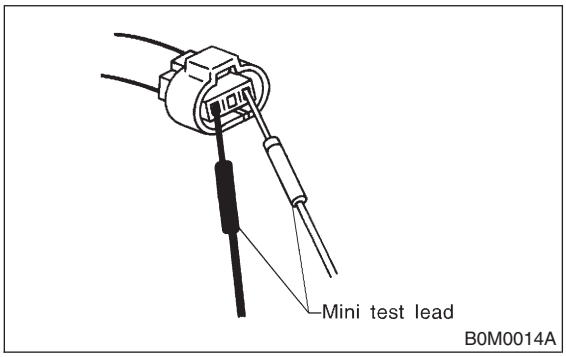
B: INSERTING A PROBE

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

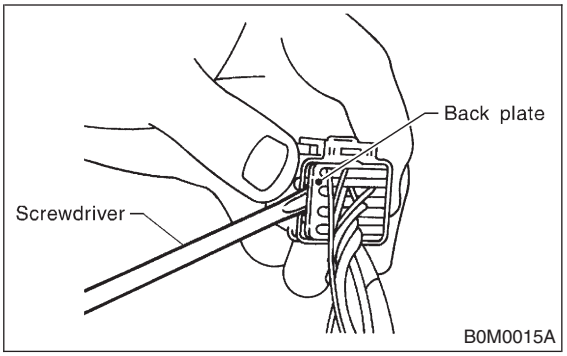
- Generally, probes are inserted into connectors from the rear side (wire side).
- When removing the shock protector take care not to deform it; this also applies to waterproof connectors, which cannot be tested from the wire side.



- Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.



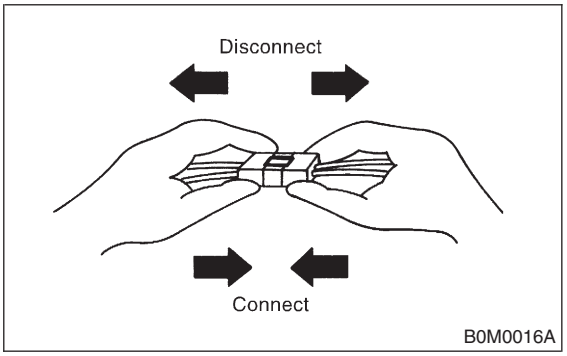
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, since the terminals might brake off.)



C: CHECKING FOR POOR CONTACT ON PLUG-IN CONNECTORS

1. POOR CONTACT

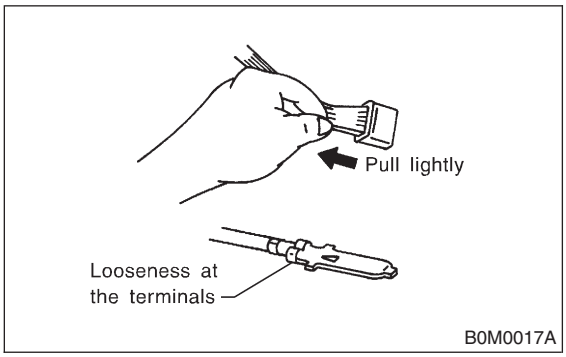
Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. Quite often a plug with poor contact will work perfectly again after it has been pulled off and reconnected. If harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of trouble.



2. VISUAL INSPECTION

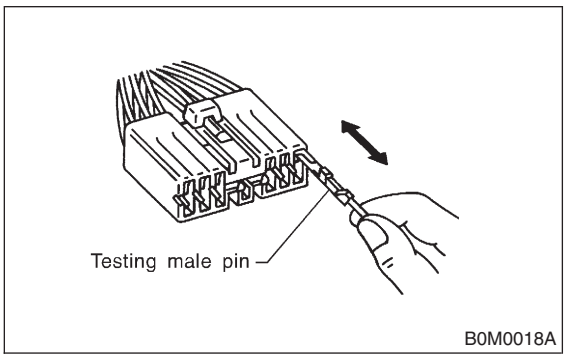
1) Disconnect the two connector halves.
2) Check the connector pins for signs of corrosion or foreign material.
3) Check the connector for loose and damaged terminals, and make sure they are set correctly in the connector.

NOTE:
When the harness is pulled lightly, the terminals should not come out.

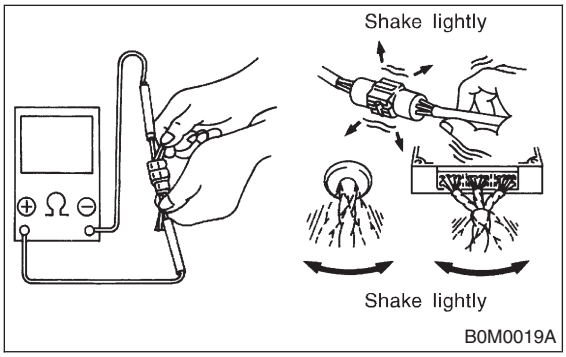


4) Insert the male pin of the connector into the female pin, then pull it out.

NOTE:
If one of the pins allows to pull out easily, it is a likely source of a malfunction.



5) Shake lightly the connector and the harness, and check for sudden changes in voltage or resistance.



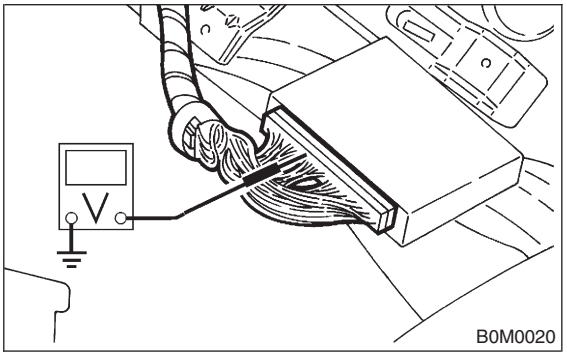
4. Diagnosis and Checking Procedure Using Instruments

A: USING A CIRCUIT TESTER

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

1. VOLTAGE CHECK (range set to DC V)

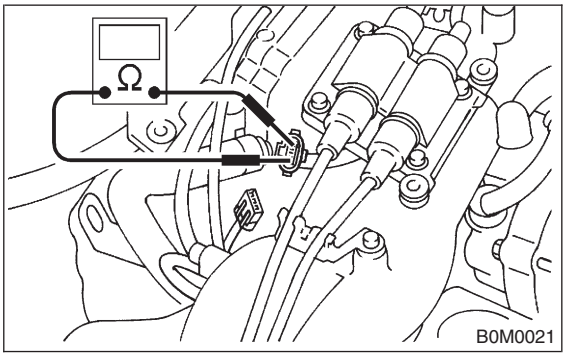
Connect the positive probe to the terminal to be tested, and the negative probe to body ground. (or the ground terminal of the ECM)



2. CHECKING THE CONNECTION (range set to Ω)

Measure the resistance and check for open or shorted wire in the harness or the connector.

NOTE:
This check must be carried out with both connectors disconnected.
(This avoids by-passing the connection through other circuits.)



1) Check for open circuit. (range: Ω × 1K)
Measure the resistance between the respective pins in both connectors.

Specified resistance:
More than 1 MΩ (No continuity) Open circuit
Less than 10 Ω (Continuity) O.K.

2) Check for correct insulation value. (range: Ω × 1K)
Measure the resistance between the pins in both connectors, as well as between the suspected pin and the body. (body short)

Specified resistance:
More than 1 MΩ (No continuity) O.K.
Less than 10 Ω (Continuity) Short circuit

3) Resistance measurement (range set to Ω)
Measuring the internal resistance of sensors, solenoid valves etc. to check the operating condition of components.

NOTE:
● Select the appropriate range for measuring the internal resistance, or the measurement will result in an incorrect reading.
● Before changing the measurement range the gauge must be reset to zero.

B: USING A SUBARU SELECT MONITOR

With this testing procedure the defective component can be determined by directly monitoring input/output signals of the ECM or the trouble codes.

1. FEATURES

● A variety of data can be checked without movements from the drivers seat, passenger's seat or from outside the vehicle.
● This unit allows the identification of the type of malfunction, for example whether the cause is an open or shorted wire in the input/output signal line, or whether the breakdown of a component is caused by a lack of maintenance.

2. DIAGNOSIS

● Refer to the reference values for input/output and control data to determine whether the malfunction is caused by a worn out component, an open wire, a short etc.
● Perform the diagnostics procedure as described in chapter "Check based on trouble codes" by monitoring the trouble codes.

NOTE:
It will be easier to determine a malfunction if the vehicle data for normal conditions are available for comparison.

C: USING AN OSCILLOSCOPE

A malfunction can be determined by displaying the waveforms of input/output signals on the oscilloscope.

1. DIAGNOSIS

A simple comparison of the waveforms may lead to an incorrect diagnosis. To exactly determine the sources of the malfunction it will be necessary to determine them under consideration about information other than waveforms.

2. APPLYING INPUT/OUTPUT SIGNALS

Connect the probe directly with the terminal of the signal.

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MECHANICAL COMPONENTS SECTION	4-1 Suspension 4-2 Wheels and Axles 4-3 Steering System 4-4 Brakes 4-5 Pedal System and Control Cables 4-6 Heater and Ventilator 4-7 Air Conditioning System
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SUSPENSION 4-1

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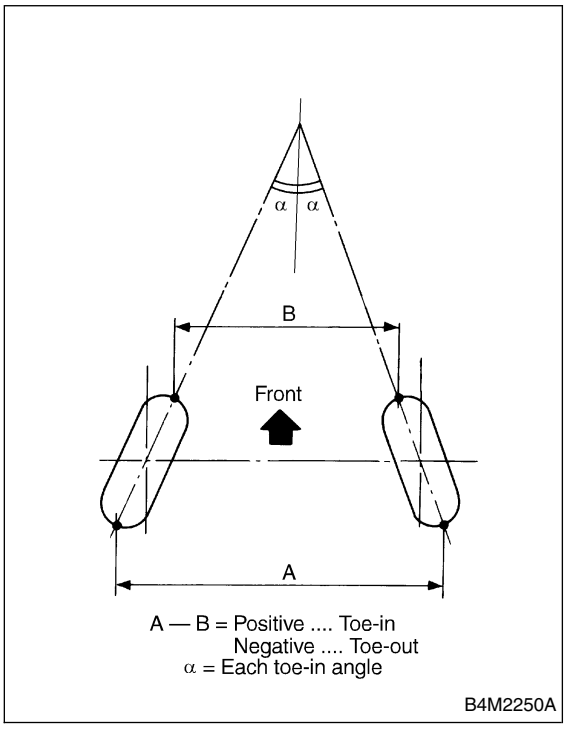
1. Stabilizer

Model	Bar dia.	
	Front	Rear
2500 cc	19 mm (0.75 in)	13 mm (0.51 in)

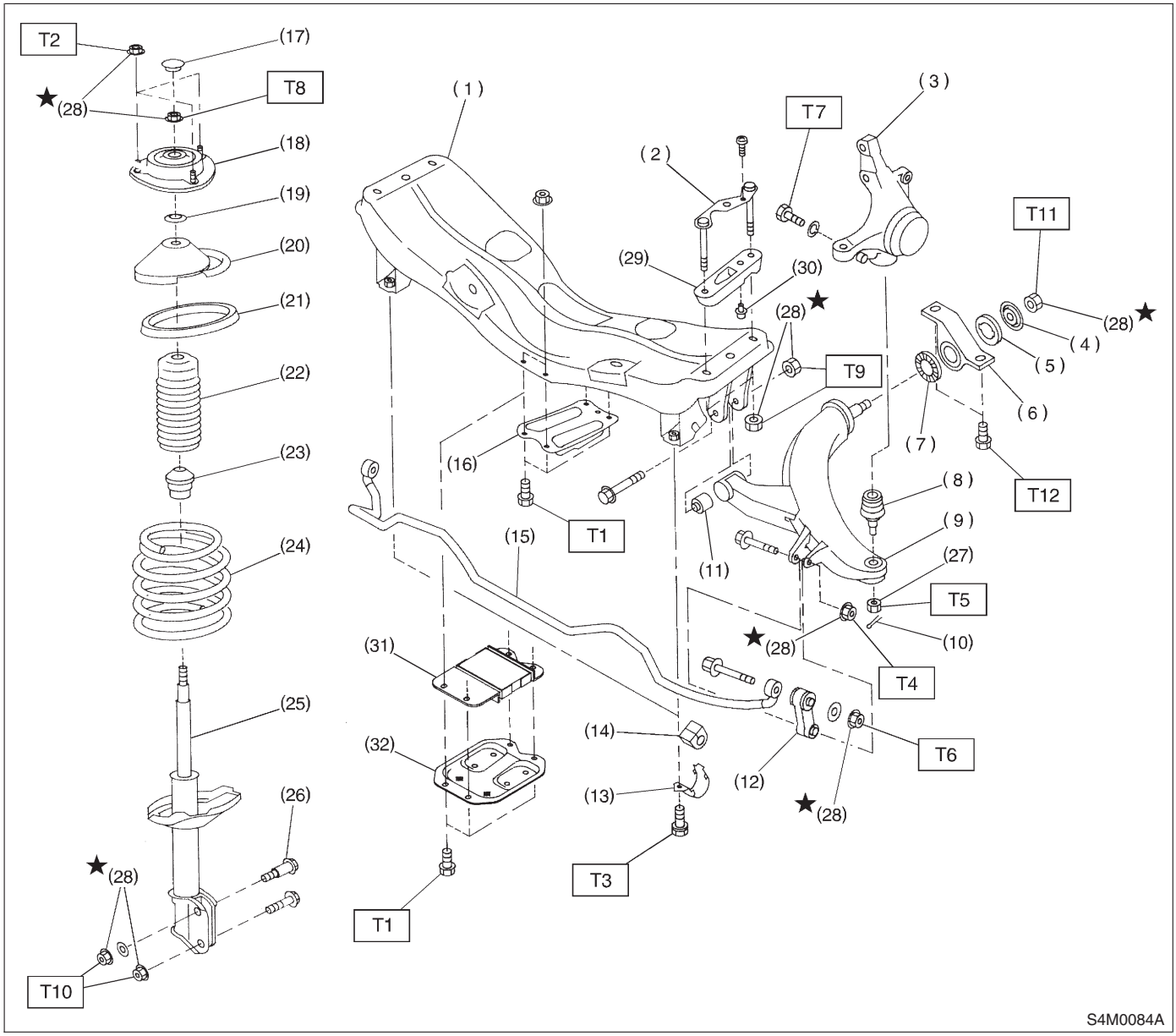
2. Wheel Alignment

Front	Camber (tolerance: ±0°30′)	–0°15′
	Caster (tolerance: ±0°45′)	2°50′
	Toe-in	0±3 mm (0±0.12 in) Each toe-in angle: 0°±09′
	Kingpin angle (tolerance: ±1°)	13°25′
	Wheel arch height [tolerance: $^{+12}/_{-24}$ mm ($^{+0.47}/_{-0.94}$ in)]	432 mm (17.01 in)
Rear	Camber (tolerance: ±0°45′)	–0°15′
	Toe-in	1 — 4 mm (0.04 — 0.16 in) Each toe-in angle: 0°03′ — 0°12′
	Wheel arch height [tolerance: $^{+12}/_{-24}$ mm ($^{+0.47}/_{-0.94}$ in)]	435 mm (17.13 in)
	Thrust angle	0°±20′

NOTE:
- Front and rear toe-ins and front camber can be adjusted. If toe-in or front camber tolerance exceeds specifications, adjust toe-in and camber to the specification.
- The other items indicated in the specification table cannot be adjusted. If the other items exceeds specifications, check suspension parts and joint portions of body suspension parts for deformities; and replace with new ones as required.



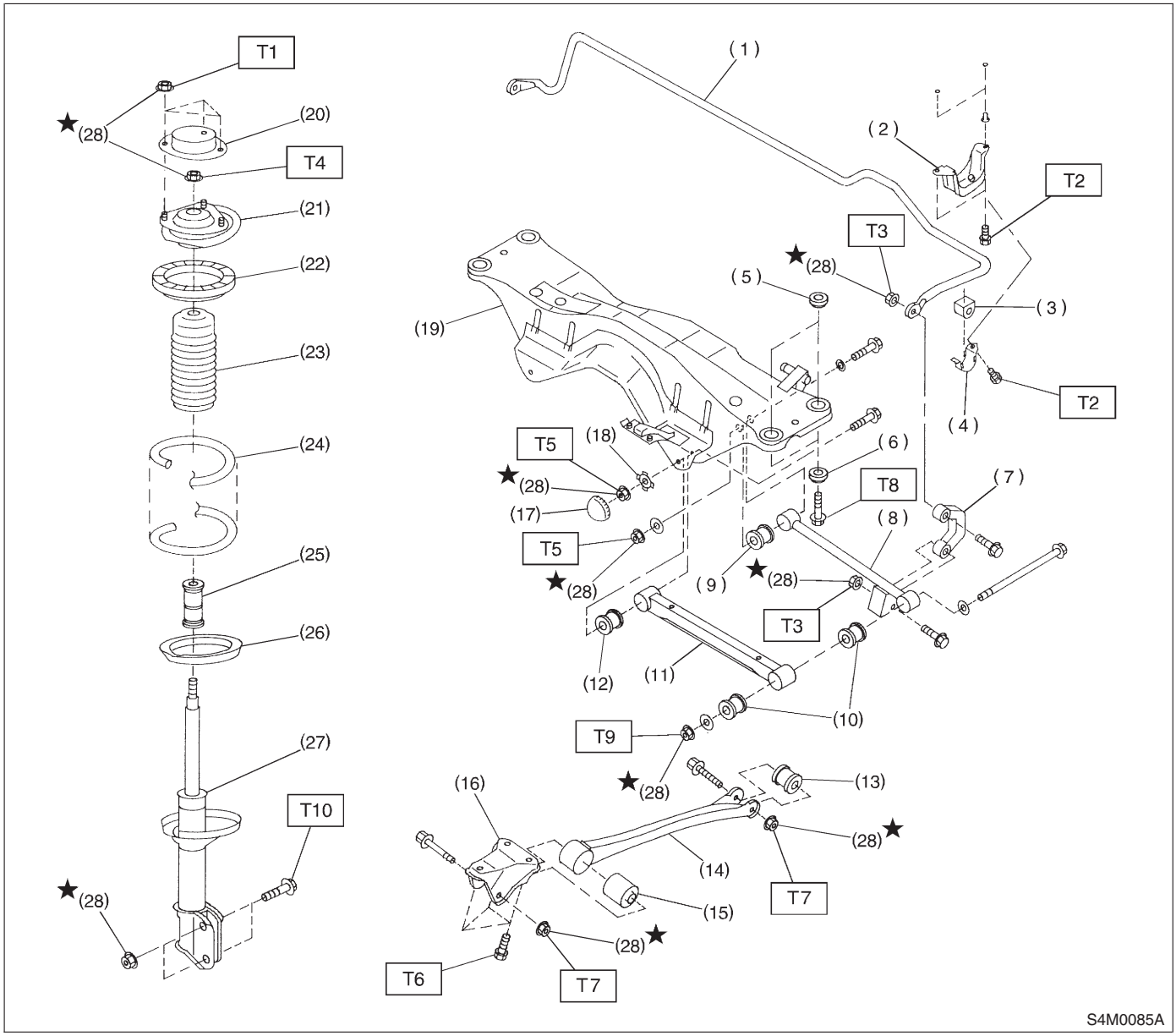
1. Front Suspension



(1) Front crossmember
(2) Bolt ASSY
(3) Housing
(4) Washer
(5) Stopper rubber (Rear)
(6) Rear bushing
(7) Stopper rubber (Front)
(8) Ball joint
(9) Transverse link
(10) Cotter pin
(11) Front bushing
(12) Stabilizer link
(13) Clamp
(14) Bushing
(15) Stabilizer
(16) Jack-up plate (Except MT model)
(17) Dust seal
(18) Strut mount
(19) Spacer
(20) Upper spring seat
(21) Rubber seat
(22) Dust cover
(23) Helper
(24) Coil spring
(25) Damper strut
(26) Adjusting bolt
(27) Castle nut
(28) Self-locking nut
(29) Adapter front crossmember
(30) Clip
(31) Dynamic damper (MT model)
(32) Jack-up plate (MT model)

Tightening torque: N·m (kg-m, ft-lb)
T1: 18±5 (1.8±0.5, 13.0±3.6)
T2: 20±6 (2.0±0.6, 14.5±4.3)
T3: 25±4 (2.5±0.4, 18.1±2.9)
T4: 29±5 (3.0±0.5, 21.7±3.6)
T5: 39 (4, 29)
T6: 44±6 (4.5±0.6, 32.5±4.3)
T7: 49±10 (5.0±1.0, 36±7)
T8: 54±5 (5.5±0.5, 39.8±3.6)
T9: 98±15 (10.0±1.5, 72±11)
T10: 152±20 (15.5±2.0, 112±14)
T11: 186±10 (19.0±1.0, 137±7)
T12: 245±49 (25.0±5.0, 181±36)

2. Rear Suspension



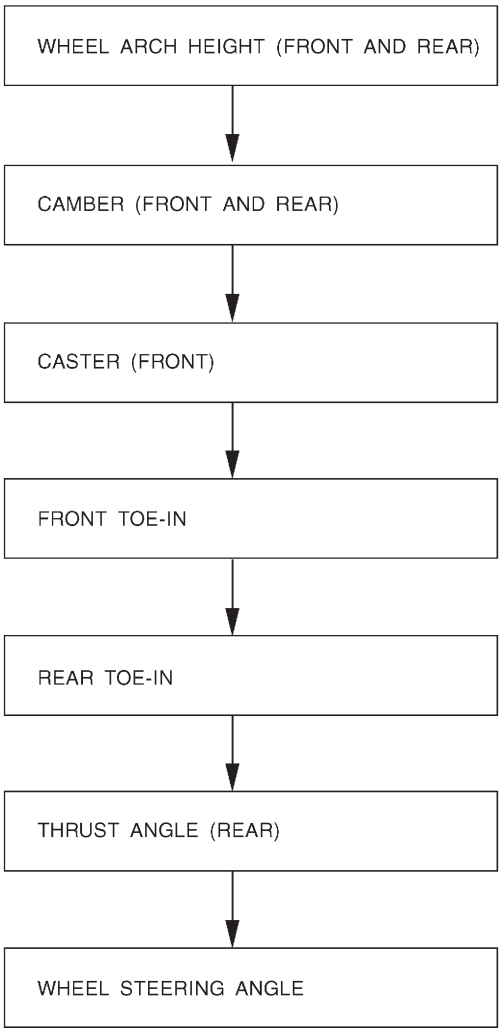
(1) Stabilizer
(2) Stabilizer bracket
(3) Stabilizer bushing
(4) Clamp
(5) Floating bushing
(6) Stopper
(7) Stabilizer link
(8) Rear lateral link
(9) Bushing (C)
(10) Bushing (A)
(11) Front lateral link
(12) Bushing (B)
(13) Trailing link rear bushing
(14) Trailing link
(15) Trailing link front bushing
(16) Trailing link bracket
(17) Cap (Protection)
(18) Washer
(19) Rear crossmember
(20) Strut mount cap
(21) Strut mount
(22) Rubber seat upper
(23) Dust cover
(24) Coil spring
(25) Helper
(26) Rubber seat lower
(27) Damper strut
(28) Self-locking nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 20±6 (2.0±0.6, 14.5±4.3)
T2: 25±7 (2.5±0.7, 18.1±5.1)
T3: 44±6 (4.5±0.6, 32.5±4.3)
T4: 59±10 (6.0±1.0, 43±7)
T5: 98±15 (10.0±1.5, 72±11)
T6: 98±20 (10.0±2.0, 72±14)
T7: 113±15 (11.5±1.5, 83±11)
T8: 127±20 (13.0±2.0, 94±14)
T9: 137±20 (14.0±2.0, 101±14)
T10: 196^{+39}_{-10} ($20.0^{+4.0}_{-1.0}$, 145^{+29}_{-7})

1. On-car Service

A: WHEEL ALIGNMENT PROCEDURES

Check, adjust and/or measure wheel alignment in accordance with procedures indicated in figure:

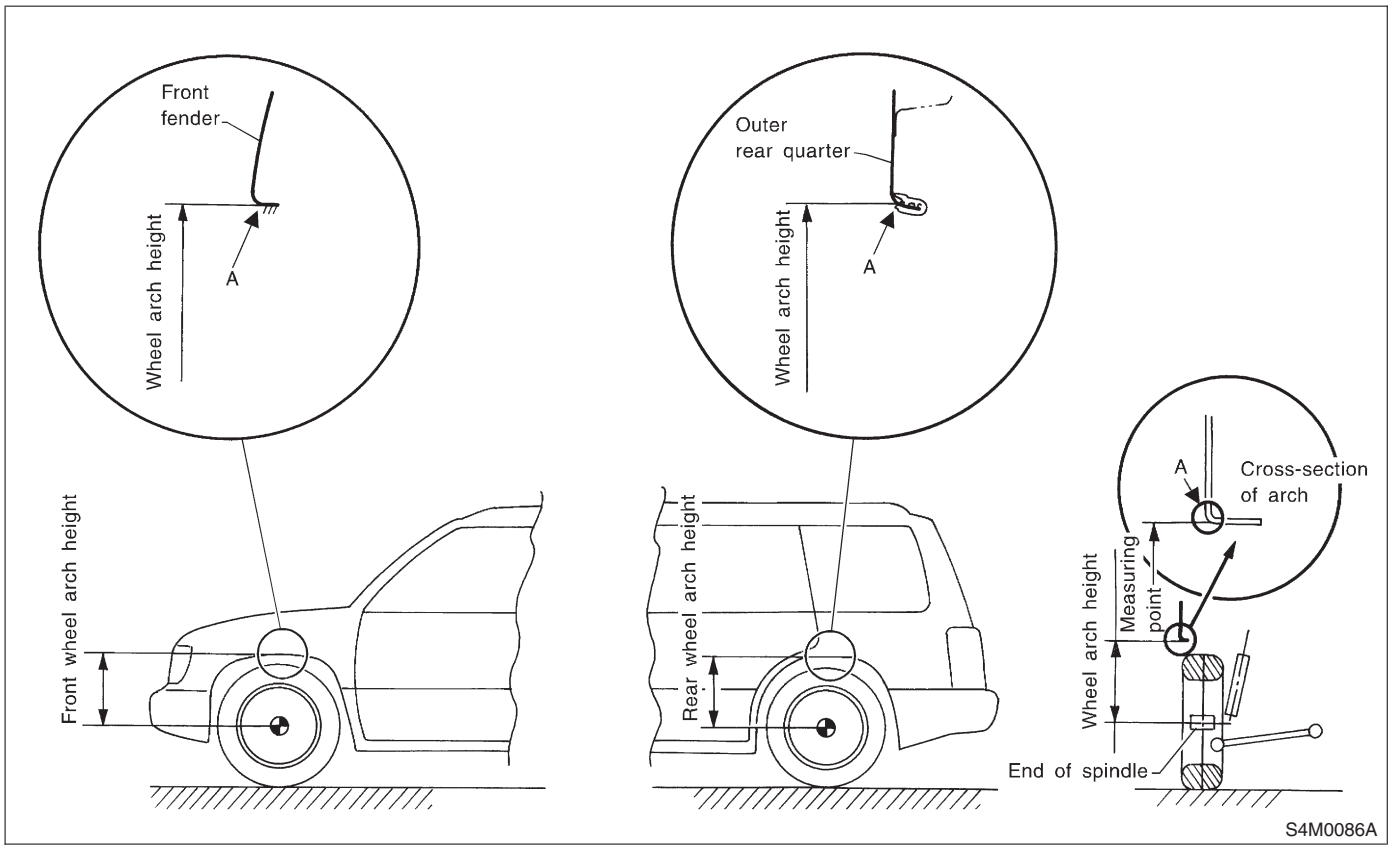


B4M1088A

B: INSPECTION AND ADJUSTMENT

1. WHEEL ARCH HEIGHT (FRONT AND REAR)

1) Adjust tire pressure to specifications.
2) Set vehicle under “curb weight” conditions. (Empty luggage compartment, install spare tire, jack, service tools, and top up fuel tank.)
3) Set steering wheel in a wheel-forward position.
4) Suspend thread from wheel arch (point “A” in figure) to determine a point directly above center of spindle.
5) Measure distance between measuring point and center of spindle.

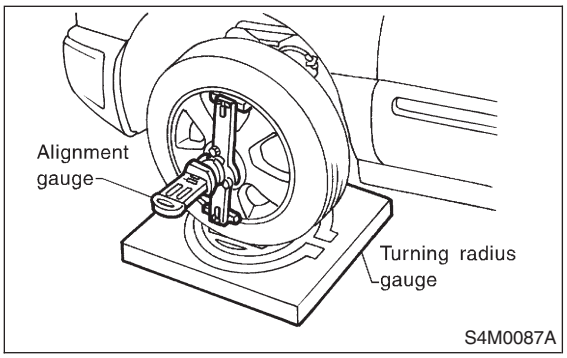


Specified wheel arch height	
Front	Rear
$432^{+12}/_{-24}$ mm ($17.01^{+0.47}/_{-0.94}$ in)	$435^{+12}/_{-24}$ mm ($17.13^{+0.47}/_{-0.94}$ in)

2. CAMBER (FRONT AND REAR)

● Inspection

1) Place front wheel on turning radius gauge. Make sure ground contacting surfaces of front and rear wheels are set at the same height.
2) Set ST into the center of the wheel, and then install the wheel alignment gauge.
ST 927380000 ADAPTER



NOTE:
Refer to the "SPECIFICATIONS AND SERVICE DATA" for the camber values. <Ref. to 4-1 [S200].>

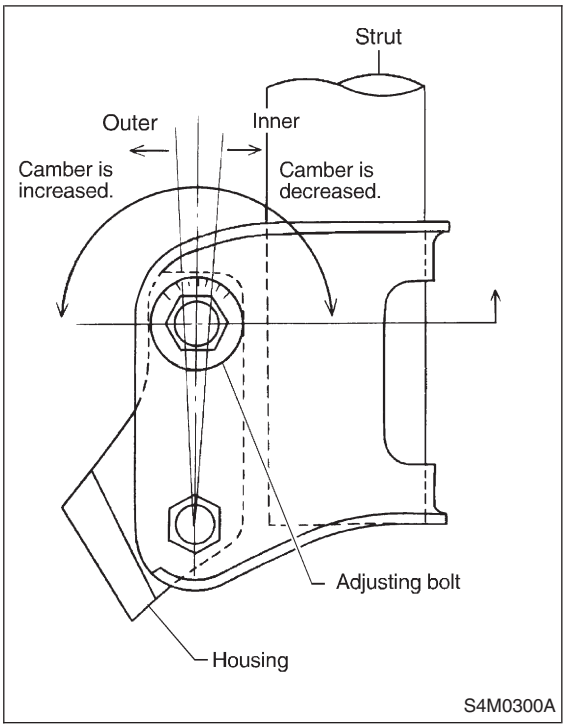
● Front Camber Adjustment

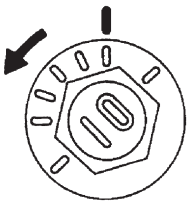
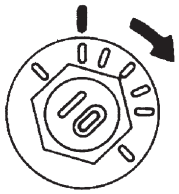
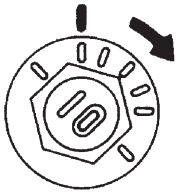
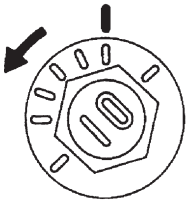
1) Loosen two self-locking nuts located at lower front portion of strut.

CAUTION:
● When adjusting bolt needs to be loosened or tightened, hold its head with a wrench and turn self-locking nut.
● Discard loosened self-locking nut and replace with a new one.

2) Turn camber adjusting bolt so that camber is set at the specification.

NOTE:
Moving the adjusting bolt by one scale graduation changes camber by approximately 0°10′.



	Left side	Right side
Camber is increased.	 Rotate counterclockwise. B4M0190	 Rotate clockwise. B4M0350
Camber is decreased.	 Rotate clockwise. B4M0350	 Rotate counterclockwise. B4M0190

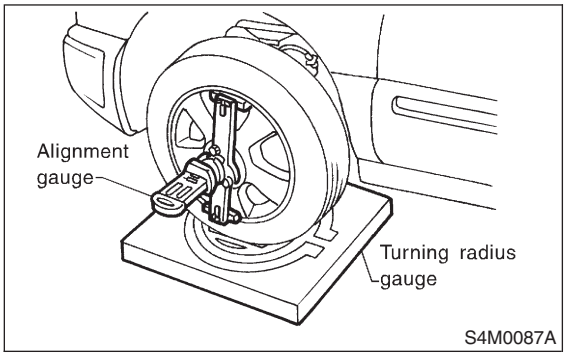
3) Tighten the two self-locking nuts.

Tightening torque:
152±20 N·m (15.5±2.0 kg-m, 112±14 ft-lb)

3. CASTER (FRONT)

• Inspection

1) Place front wheel on turning radius gauge. Make sure ground contacting surfaces of front and rear wheels are set at the same height.
2) Set ST into the center of the wheel, and then install the wheel alignment gauge.
ST 927380000 ADAPTER



NOTE:
Refer to the “SPECIFICATIONS AND SERVICE DATA” for the caster value. <Ref. to 4-1 [S200].>

4. FRONT WHEEL TOE-IN

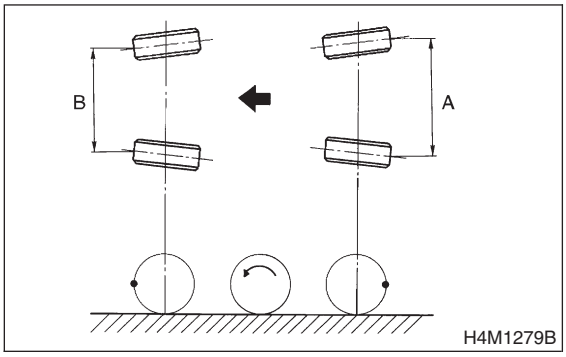
• Inspection

1) Using a toe gauge, measure front wheel toe-in.

Toe-in:
0±3 mm (±0.12 in)

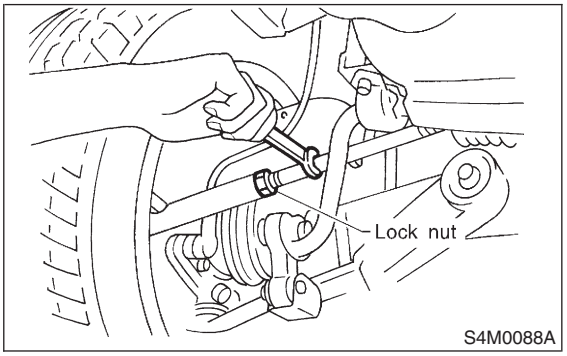
2) Mark rear sides of left and right tires at height corresponding to center of spindles and measure distance “B” between marks.
3) Move vehicle forward so that marks line up with front sides at height corresponding to center of spindles.
4) Measure distance “A” between left and right marks. Toe-in can then be obtained by the following equation:

A – B = Toe-in



• Adjustment

1) Loosen the left and right side steering tie-rods lock nuts.
2) Turn the left and right tie rods equal amounts until the toe-in is at the specification.
Both the left and right tie-rods are right-hand threaded. To increase toe-in, turn both tie-rods clockwise equal amounts (as viewed from the inside of the vehicle).



3) Tighten tie-rod lock nut.

Tightening torque:
83±5 N·m (8.5±0.5 kg-m, 61.5±3.6 ft-lb)

CAUTION:
Correct tie-rod boot, if it is twisted.

NOTE:
Check the left and right wheel steering angle is within specifications.

5. REAR WHEEL TOE-IN

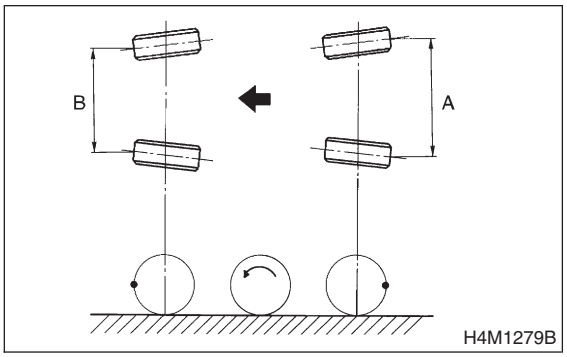
• Inspection

1) Using a toe-in gauge, measure rear wheel toe-in.

Toe-in:
1 — 4 mm (0.04 — 0.16 in)

2) Mark rear sides of left and right tires at height corresponding to center of spindles and measure distance “B” between marks.
3) Move vehicle forward so that marks line up with front sides at height corresponding to center of spindles.
4) Measure distance “A” between left and right marks. Toe-in can then be obtained by the following equation:

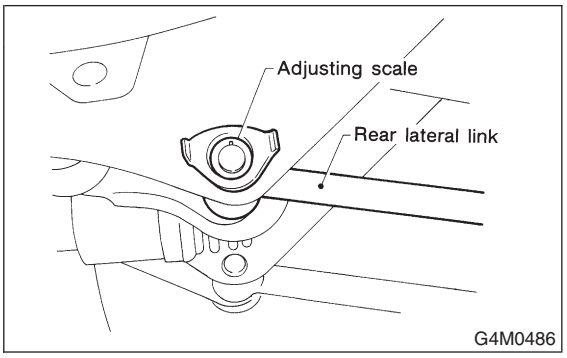
A – B = Toe-in



• Adjustment

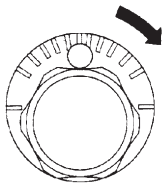
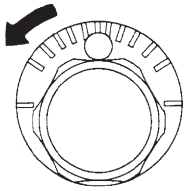
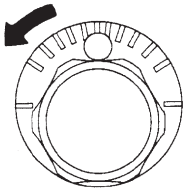
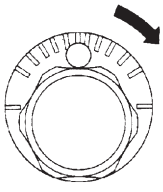
1) Loosen self-locking nut on inner side of rear lateral link.

CAUTION:
• When loosening or tightening adjusting bolt, hold bolt head and turn self-locking nut.
• Discard loosened self-locking nut and replace with a new one.



2) Turn adjusting bolt head until toe-in is at the specification.

NOTE:
When left and right wheels are adjusted for toe-in at the same time, the movement of one scale graduation changes toe-in by approximately 3 mm (0.12 in).

	Left side	Right side
Toe-in is increased.	 B4M0192 Rotate clockwise.	 B4M0352 Rotate counterclockwise.
Toe-in is decreased.	 B4M0352 Rotate counterclockwise.	 B4M0192 Rotate clockwise.

3) Tighten self-locking nut.

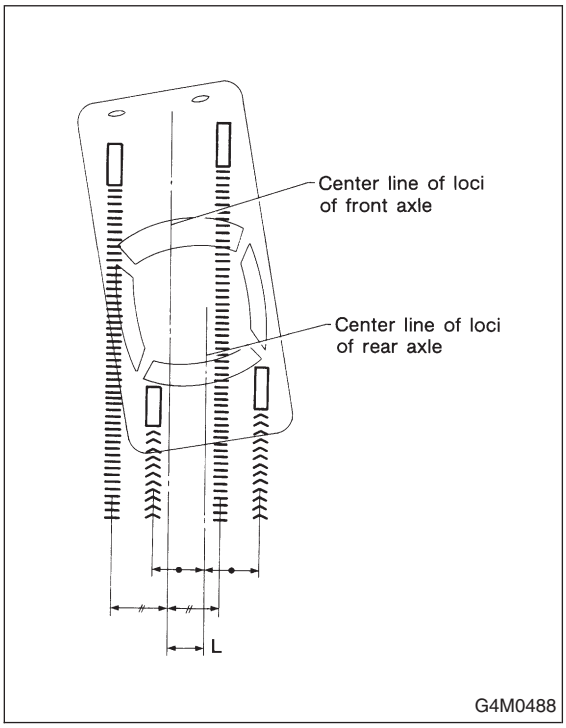
Tightening torque:
98±15 N·m (10±1.5 kg-m, 72±11 ft-lb)

6. THRUST ANGLE

● Inspection

1) Position vehicle on a level surface.
2) Move vehicle 3 to 4 meters directly forward.
3) Determine locus of both front and rear axles.
4) Measure distance “L” between center line of loci of the axles.

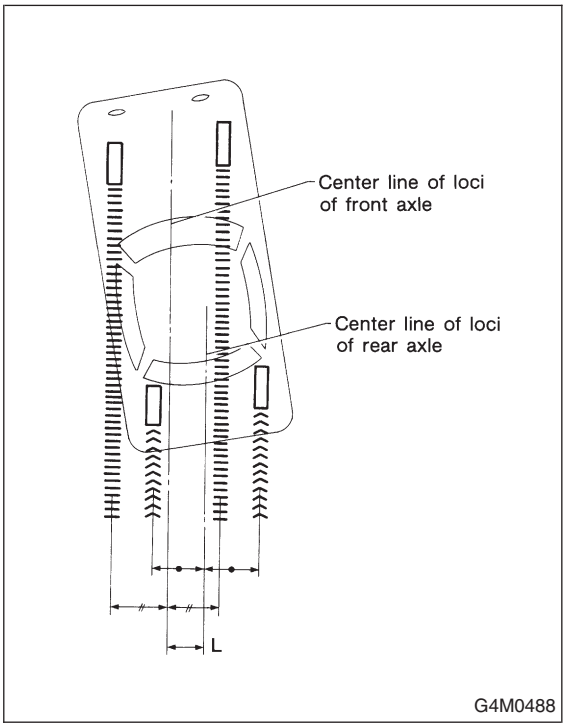
Thrust angle:
Less than 20′ when “L” is equal to or less than 15 mm (0.59 in).



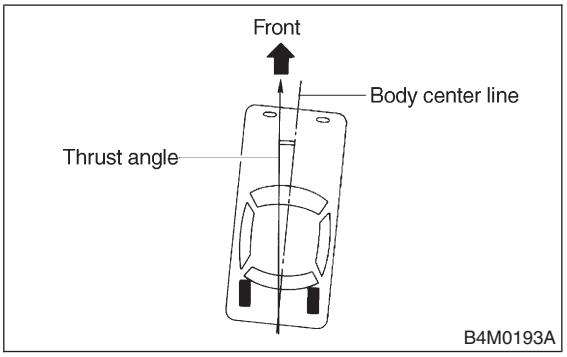
● Adjustment

1) Make thrust angle adjustments by turning toe-in adjusting bolts of rear suspension equally in the same direction.
2) When one rear wheel is adjusted in a toe-in direction, adjust the other rear wheel equally in toe-out direction, in order to make thrust angle adjustment.
3) When left and right adjusting bolts are turned incrementally by one graduation in the same direction, the thrust angle will change approximately 10′ [“L” is almost equal to 7.5 mm (0.295 in)].

Thrust angle:
0°±20′

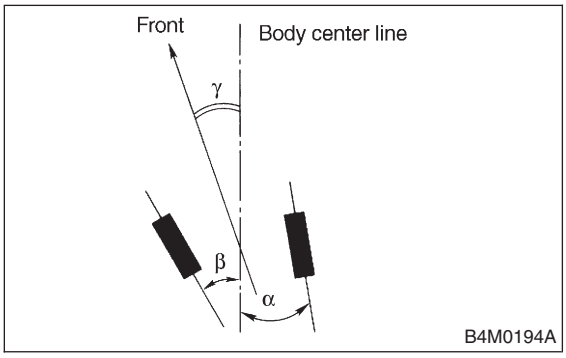


NOTE:
Thrust angle refers to a mean value of left and right rear wheel toe angles in relation to vehicle body center line. Vehicle is driven straight in the thrust angle direction while swinging in the oblique direction depending on the degree of the mean thrust angle.



Thrust angle: r = (α – β)/2

α: Right rear wheel toe angle
β: Left rear wheel toe angle



NOTE:
Here, use only positive toe-in values from each wheel to substitute for α and β in the equation.

7. STEERING ANGLE

● Inspection

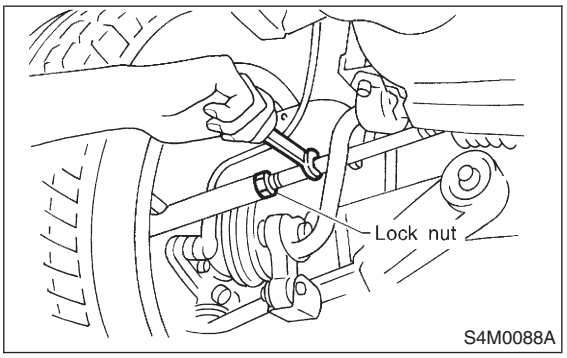
1) Place vehicle on a turning radius gauge.
2) While depressing brake pedal, turn steering wheel fully to the left and right. With steering wheel held at each fully turned position, measure both the inner and outer wheel steering angle.

Steering angle:
Inner wheel
34.4°±1.5°
Outer wheel
30.2°±1.5°

● Adjustment

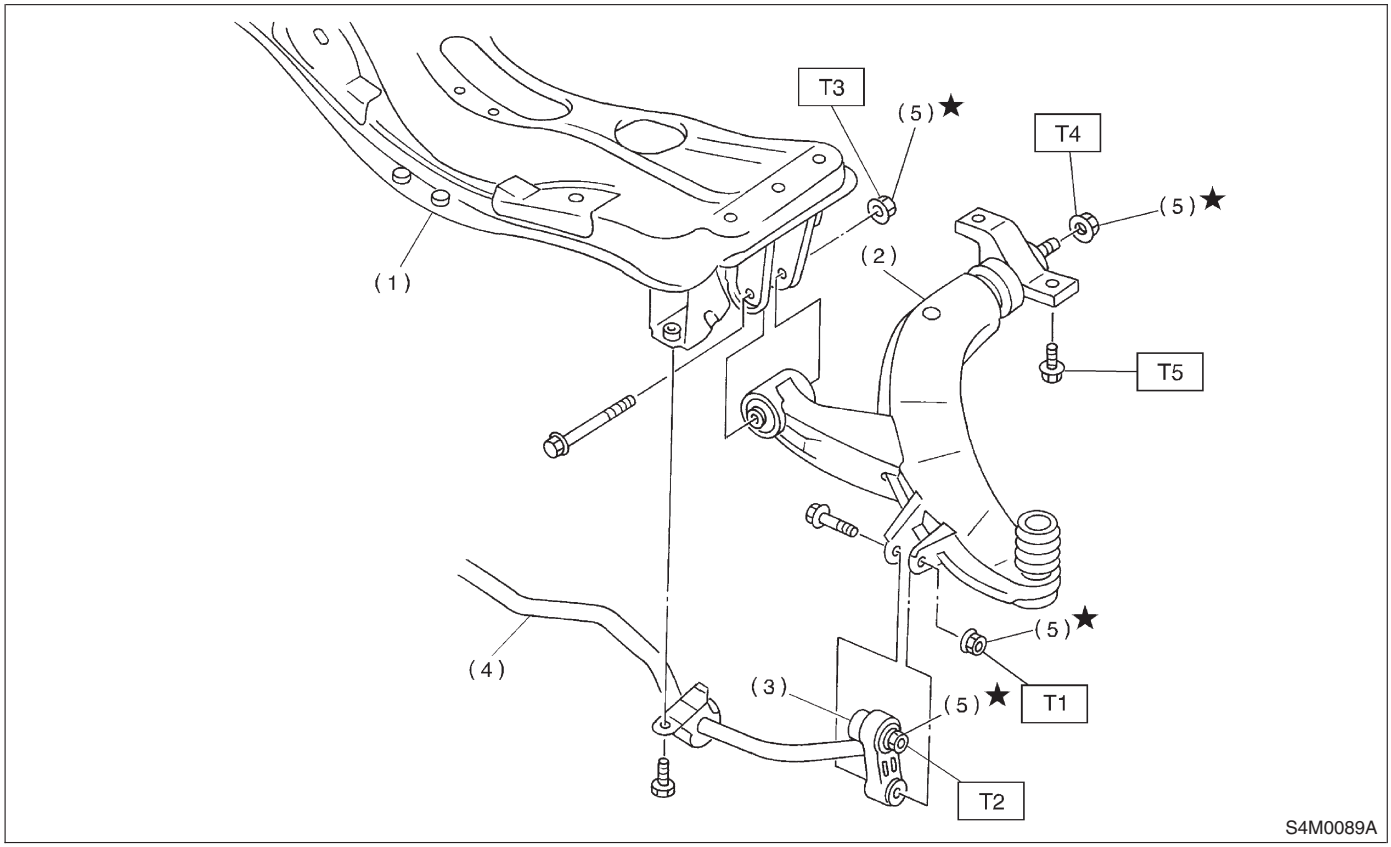
Turn tie-rod to adjust steering angle of both inner and outer wheels.

CAUTION:
- **Check toe-in.**
- **Correct boot if it is twisted.**



2. Front Transverse Link

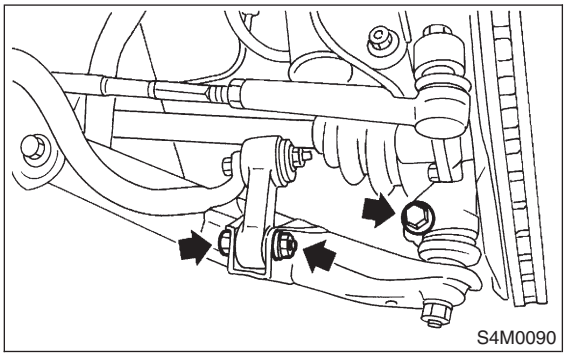
A: REMOVAL



(1) Front crossmember
(2) Transverse link
(3) Stabilizer link
(4) Front stabilizer
(5) Self-locking nut

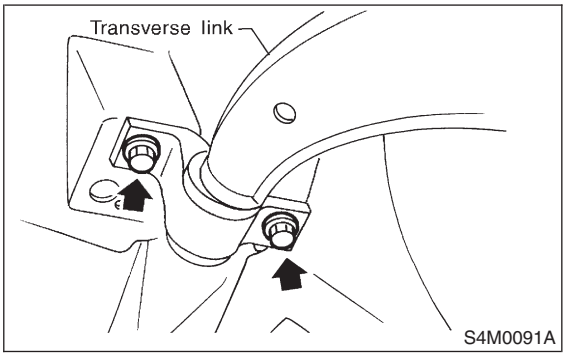
Tightening torque: N·m (kg-m, ft-lb)
T1: 29±5 (3.0±0.5, 21.7±3.6)
T2: 44±6 (4.5±0.6, 32.5±4.3)
T3: 98±15 (10.0±1.5, 72±11)
T4: 186±10 (19.0±1.0, 137±7)
T5: 245±49 (25.0±5.0, 181±36)

1) Disconnect stabilizer link from transverse link.
2) Remove bolt securing ball joint of transverse link to housing.



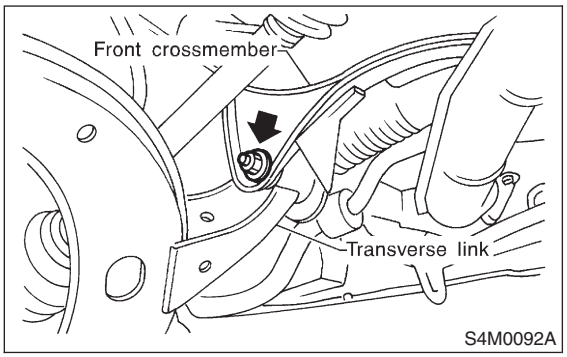
3) Remove nut (do not remove bolt.) securing transverse link to crossmember.

4) Remove two bolts securing bushing bracket of transverse link to vehicle body at rear bushing location.



5) Extract ball joint from housing.

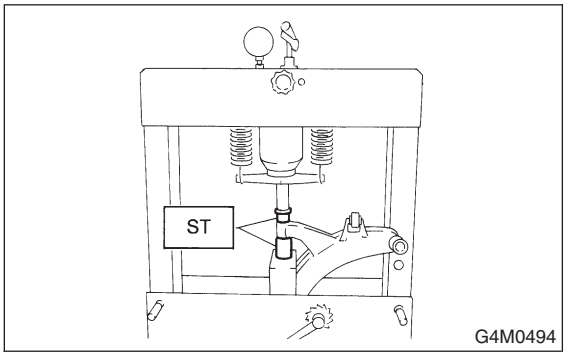
6) Remove bolt securing transverse link to crossmember and extract transverse link from crossmember.



B: DISASSEMBLY

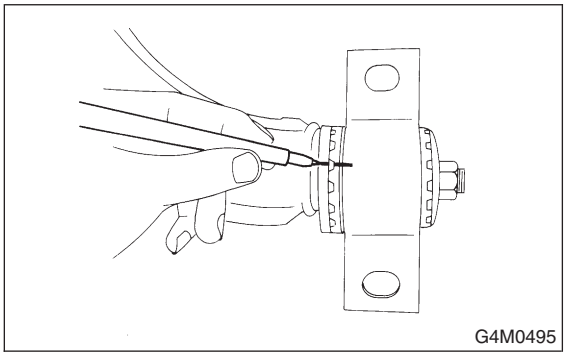
1. FRONT BUSHING

Using ST, press front bushing out of place.
ST 927680000 INSTALLER & REMOVER SET



2. REAR BUSHING

1) Scribe an aligning mark on transverse link and rear bushing.



2) Loosen nut and remove rear bushing.

C: INSPECTION

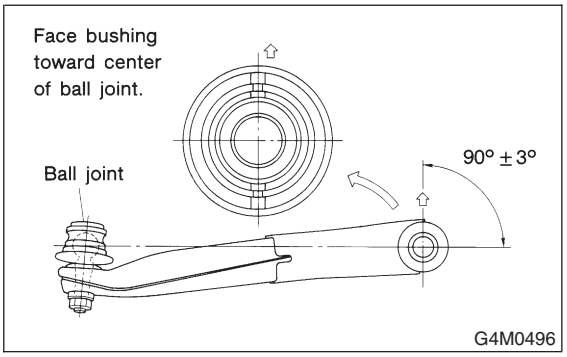
1) Check transverse link for wear, damage and cracks, and correct or replace if defective.
2) Check bushings for cracks, wear, damage and creeping.
3) Check rear bushing for oil leaks.
4) If defective, replace with new one.

D: ASSEMBLY

1. FRONT BUSHING

To reassemble, reverse disassembly procedures.

CAUTION:
Install front bushing in correct direction, as shown in figure.



2. REAR BUSHING

1) Install rear bushing to transverse link and align aligning marks scribed on the two.
2) Tighten self-locking nut.

CAUTION:
• Discard loosened self-locking nut and replace with a new one.
• While holding rear bushing so as not to change position of aligning marks, tighten self-locking nut.

Tightening torque:
186±10 N·m (19.0±1.0 kg-m, 137±7 ft-lb)

E: INSTALLATION

1) Temporarily tighten the two bolts used to secure rear bushing of the transverse link to body.

NOTE:
These bolts should be tightened to such an extent that they can still move back and forth in the oblong shaped hole in the bracket (which holds the bushing).

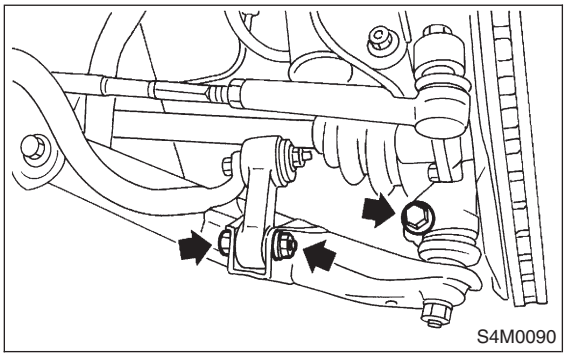
2) Install bolts used to connect transverse link to crossmember and temporarily tighten with nut.

CAUTION:
Discard loosened self-locking nut and replace with a new one.

3) Insert ball joint into housing.

4) Connect stabilizer link to transverse link, and temporarily tighten bolts.

CAUTION:
Discard loosened self-locking nut and replace with a new one.


S4M0090

5) Tighten the following points in the order shown below when wheels are in full contact with the ground and vehicle is at curb weight condition.
(1) Transverse link and stabilizer link

Tightening torque:
29±5 N·m (3.0±0.5 kg-m, 21.7±3.6 ft-lb)

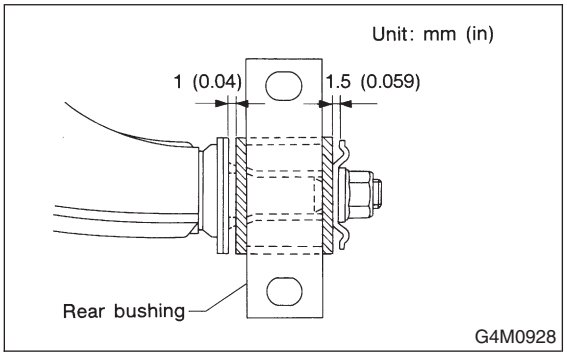
(2) Transverse link and crossmember

Tightening torque:
98±15 N·m (10.0±1.5 kg-m, 72±11 ft-lb)

(3) Transverse link rear bushing and body

Tightening torque:
245±49 N·m (25±5 kg-m, 181±36 ft-lb)

NOTE:
- Move rear bushing back and forth until transverse link-to-rear bushing clearance is established (as indicated in figure.) before tightening.
- Check wheel alignment and adjust if necessary.

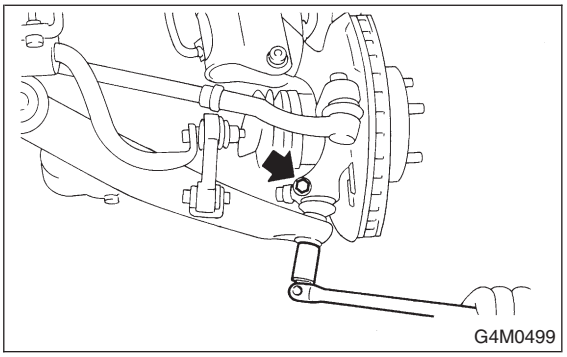


G4M0928

3. Front Ball Joint

A: REMOVAL

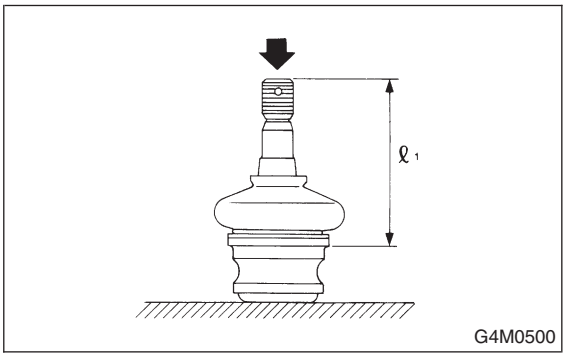
1) Remove the wheel.
2) Pull out the cotter pin from the ball stud, remove the castle nut, and extract the ball stud from the transverse link.
3) Remove the bolt securing the ball joint to the housing.


G4M0499

4) Extract the ball joint from the housing.

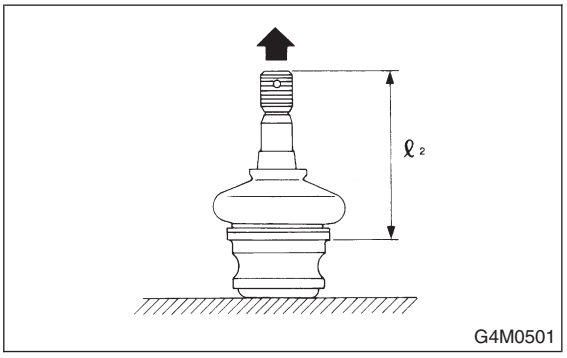
B: INSPECTION

1) Measure play of ball joint by the following procedures. Replace with a new one when the play exceeds the specified value.
(1) With 686 N (70 kg, 154 lb) loaded in the direction shown in the figure, measure dimension ℓ_1.



G4M0500

(2) With 686 N (70 kg, 154 lb) loaded in the opposite direction shown in the figure, measure dimension ℓ_2.



G4M0501

(3) Calculate plays from the following formula.
$S = \ell_2 - \ell_1$
(4) When plays are larger than the following value, replace with a new one.

FRONT BALL JOINT
Specified play for replacement:
Less than 0.3 mm (0.012 in)

2) When play is smaller than the specified value, visually inspect the dust cover.
3) If the dust cover is damaged, replace with the new ball joint.
4) Check ball joint for damage and cracks. If defective, replace with new one.

C: INSTALLATION

1) Install ball joint onto housing.

Tightening torque (Bolt):
49±10 N·m (5.0±1.0 kg-m, 36±7 ft-lb)

CAUTION:
Do not apply grease to tapered portion of ball stud.

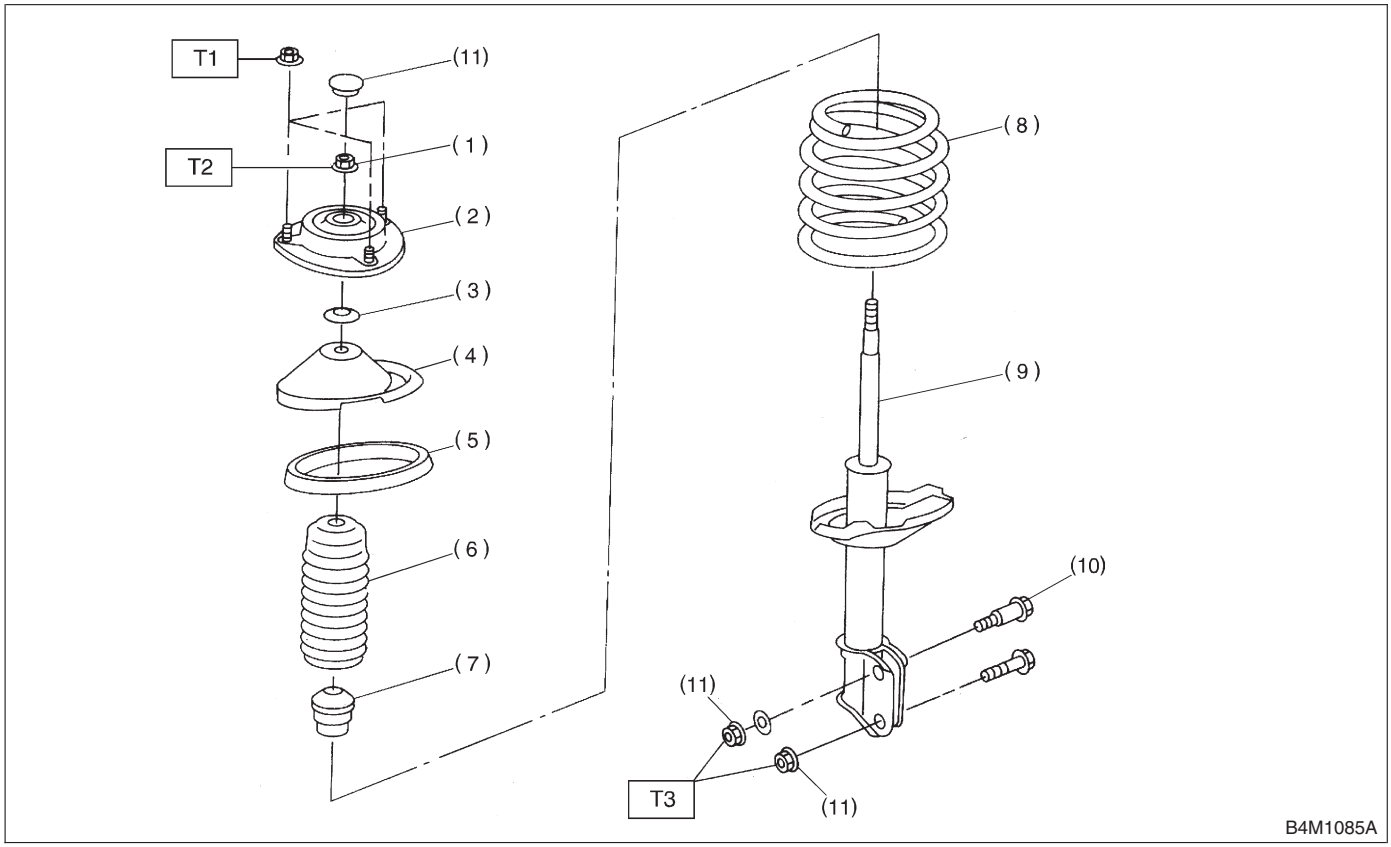
2) Connect ball joint to transverse link.

Tightening torque (Castle nut):
39 N·m (4.0 kg-m, 29 ft-lb)

3) Retighten castle nut further within 60° until a slot in castle nut is aligned with the hole of ball stud end, then insert new cotter pin and bend it around castle nut.
4) Install front wheel.

4. Front Strut

A: REMOVAL

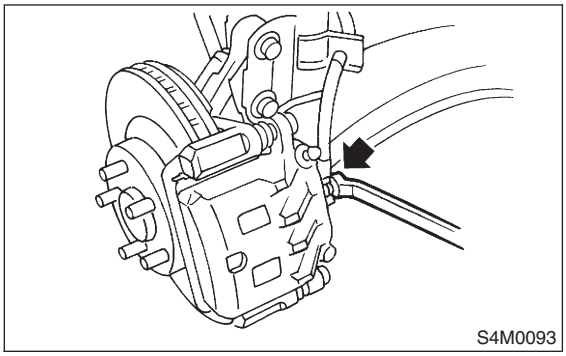


(1) Dust seal
(2) Strut mount
(3) Spacer
(4) Upper spring seat
(5) Rubber seat
(6) Dust cover
(7) Helper
(8) Coil spring
(9) Damper strut
(10) Adjusting bolt
(11) Self-locking nut

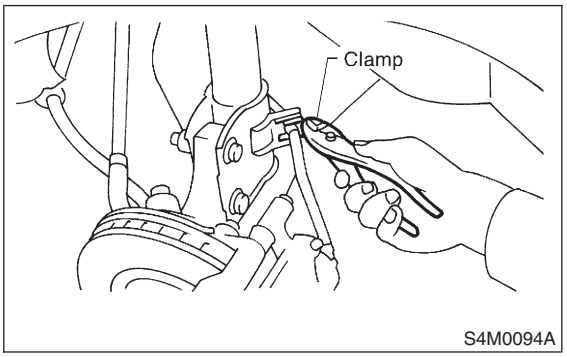
Tightening torque: N·m (kg-m, ft-lb)
T1: 20±6 (2.0±0.6, 14.5±4.3)
T2: 54±5 (5.5±0.5, 39.8±3.6)
T3: 152±20 (15.5±2.0, 112±14)

1) Remove wheel.
2) Depress brake pedal and hold it down using a wooden block etc.
3) Remove union bolts from caliper.

CAUTION:
Use brake hose cap to prevent brake fluid from escaping.



4) Remove brake hose clamp and disconnect brake hose from strut. Attach brake hose to body using gum tape.

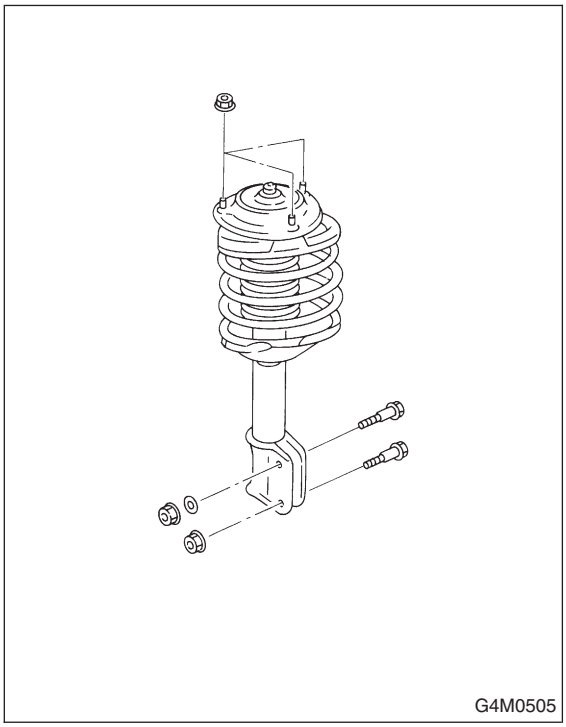


5) Scribe an alignment mark on the camber adjusting bolt which secures strut to housing.
6) Remove bolt securing the ABS sensor harness. (ABS equipped models)

7) Remove two bolts securing housing to strut.

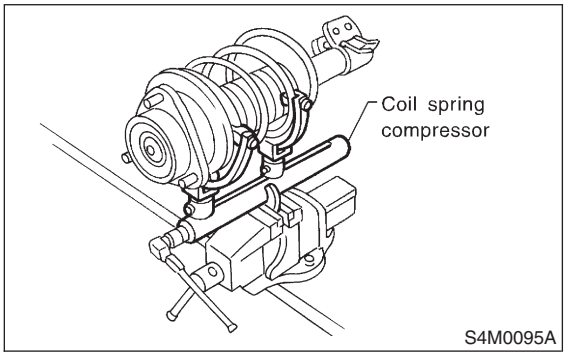
CAUTION:
While holding head of adjusting bolt, loosen self-locking nut.

8) Remove the three nuts securing strut mount to body.

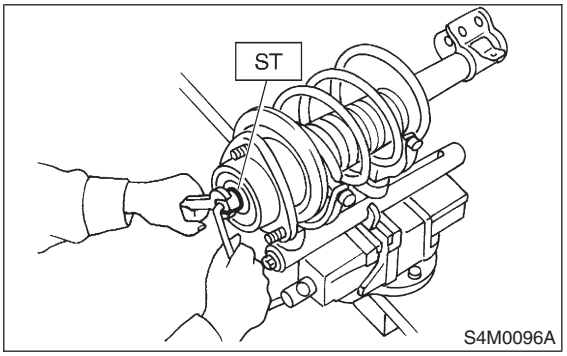


B: DISASSEMBLY

1) Using a coil spring compressor, compress coil spring.



2) Using ST, remove self-locking nut.
ST 927760000 STRUT MOUNT SOCKET



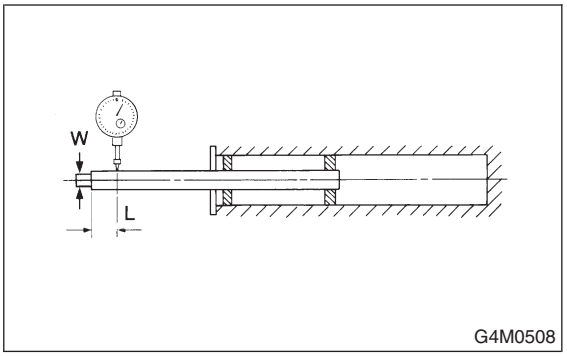
3) Remove strut mount, upper spring seat and rubber seat from strut.
4) Gradually decreasing compression force of spring compressor, and remove coil spring.
5) Remove dust cover and helper.

C: INSPECTION

Check the disassembled parts for cracks, damage and wear, and replace with new parts if defective.

1. DAMPER STRUT

1) Check for oil leakage.
2) Move the piston rod up and down to check its operates smoothly without any binding.
3) Play of piston rod
● Measure the play as follows:
Fix outer shell and fully extend the rod. Set a dial gauge at the end of the rod: L [10 mm (0.39 in)], then apply a force of W [20 N (2 kg, 4 lb)] to threaded portion. With the force of 20 N (2 kg, 4 lb) applied, read dial gauge indication: P_1. Apply a force of 20 N (2 kg, 4 lb) in the opposite direction of “W”, then read dial gauge indication: P_2.



The free play is determined by the following equation:

Play = P_1, P_2

Limit of play:
Less than 0.8 mm (0.031 in)

If the play is greater, replace the strut with new one.

2. STRUT MOUNT

Check rubber part for wear, cracks and deterioration, and replace it with new one if defective.

3. DUST COVER

If any cracks or damage are found, replace it with new one.

4. COIL SPRING

When vehicle posture is uneven, although there are no considerable reasons like tire puncture, uneven loading, etc., check coil spring and spring seats for cracks, deformation, etc., and replace it with a new one if defective.

5. HELPER

Replace it with new one if cracked or damaged.

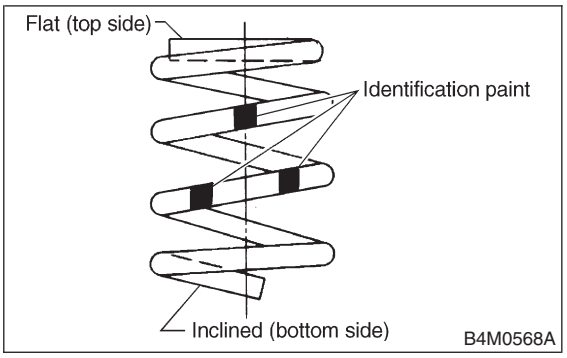
D: ASSEMBLY

1) Before installing coil spring, strut mount, etc., on the strut, check for the presence of air in the dampening force generating mechanism of the strut since air prevents proper dampening force from being produced.
2) Checking for the presence of air
   (1) Place the strut vertically with the piston rod facing upward.
   (2) Move the piston rod to the center of its entire stroke.
   (3) While holding the piston rod end with fingertips, move the rod up and down.
   (4) If the piston rod moves at least 10 mm (0.39 in) in former step, purge air from the strut.
3) Air purging procedure
   (1) Place the strut vertically with the piston rod facing upward.
   (2) Fully extend the piston rod.
   (3) With the piston rod fully extended, place the piston rod side down. The strut must stand vertically.
   (4) Fully contract the piston rod.
   (5) Repeat 3 or 4 times from first step.

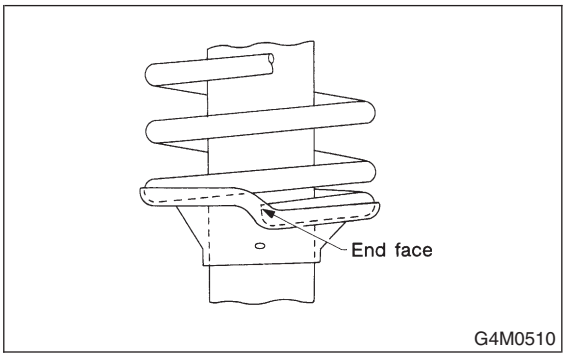
NOTE:
After completely purging air from the strut, be sure to place the strut with the piston rod facing upward. If it is laid down, check for entry of air in the strut as outlined under “Checking for the presence of air”.

4) Using a coil spring compressor, compress the coil spring.

NOTE:
Make sure that the vertical installing direction of coil spring is as shown in figure.

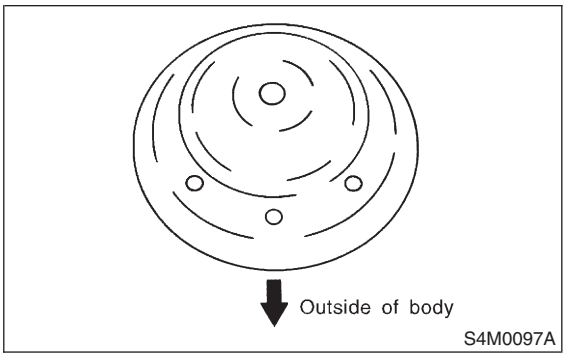


5) Set the coil spring correctly so that its end face fits well into the spring seat as shown.



6) Install helper and dust cover to the piston rod.
7) Pull the piston rod fully upward, and install rubber seat and spring seat.

NOTE:
Ensure that upper spring seat is positioned as show in figure.

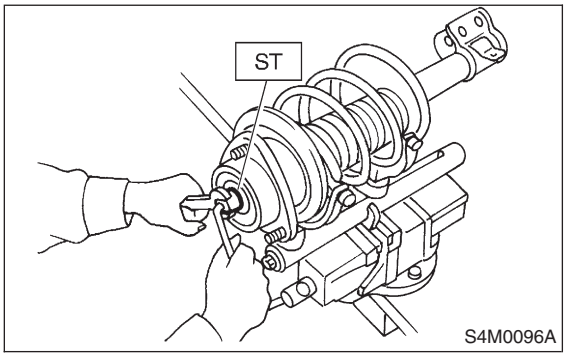


8) Install strut mount to the piston rod, and tighten the self-locking nut temporarily.

CAUTION:
Be sure to use a new self-locking nut.

9) Using hexagon wrench to prevent strut rod from turning, tighten self-locking nut with ST.
ST 927760000 STRUT MOUNT SOCKET

Tightening torque:
54±5 N·m (5.5±0.5 kg-m, 39.8±3.6 ft-lb)



10) Loosen the coil spring carefully.

E: INSTALLATION

1) Install strut mount at upper side of strut to body and tighten with nuts.

Tightening torque:
20±6 N·m (2.0±0.6 kg-m, 14.5±4.3 ft-lb)

2) Connect housing to lower side of strut.
3) Position aligning mark on camber adjusting bolt with aligning mark on lower side bracket of strut.

CAUTION:
- **While holding head of adjusting bolt, tighten self-locking nut.**
- **Be sure to use new self-locking nut.**

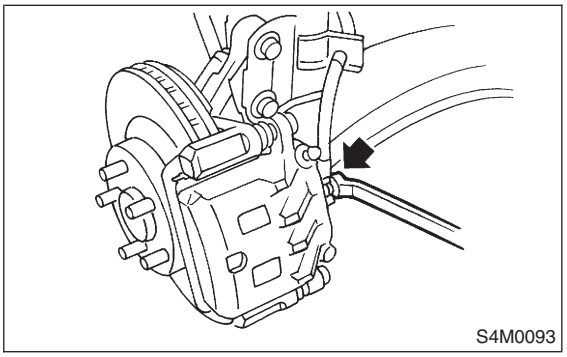
Tightening torque:
152±20 N·m (15.5±2.0 kg-m, 112±14 ft-lb)

4) Install ABS sensor harness to strut. (ABS equipped models)

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

5) Install brake hose at lower side of strut with clamp.
6) Install union bolts which secure brake caliper to brake hose.

Tightening torque:
18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)



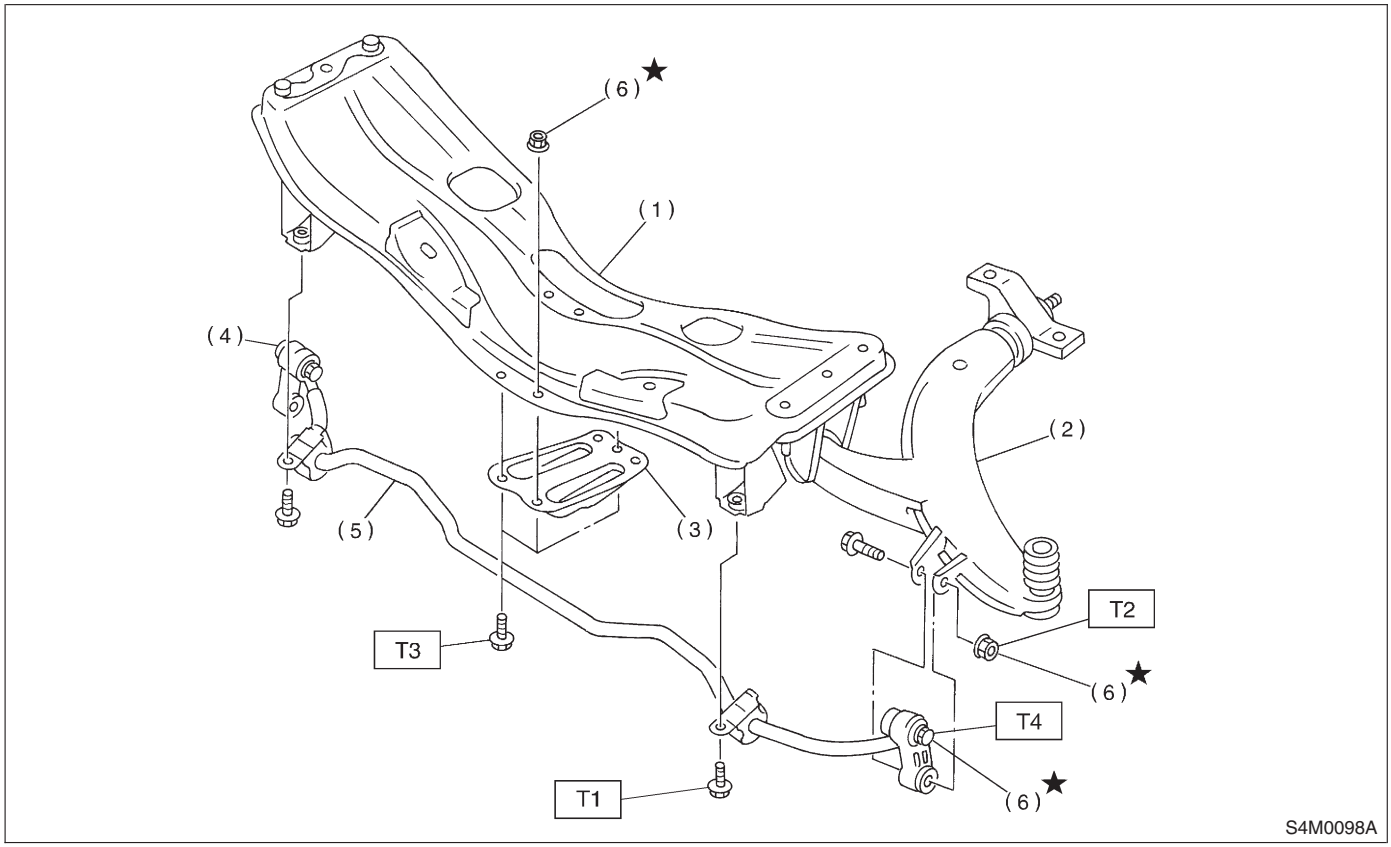
CAUTION:
Be sure to bleed air from brake system.

7) Install wheels.

NOTE:
Check wheel alignment and adjust if necessary.

5. Front Stabilizer

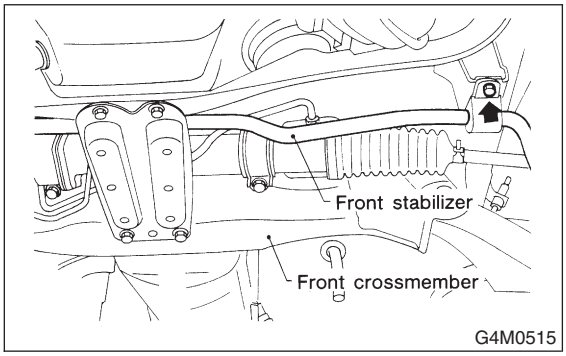
A: REMOVAL



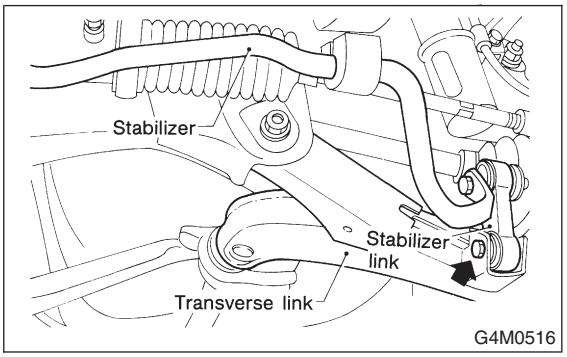
(1) Front crossmember
(2) Transverse link
(3) Jack-up plate
(4) Stabilizer link
(5) Front stabilizer
(6) Self-locking nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 25±4 (2.5±0.4, 18.1±2.9)
T2: 29±5 (3.0±0.5, 21.7±3.6)
T3: 18±5 (1.8±0.5, 13.0±3.6)
T4: 44±6 (4.5±0.6, 32.5±4.3)

1) Jack-up the front part of the vehicle, support it with safety stand (rigid racks).
2) Remove bolts which secure stabilizer to crossmember.



3) Remove bolts which secure stabilizer link to front transverse link.



4) Remove jack-up plate from lower part of crossmember.

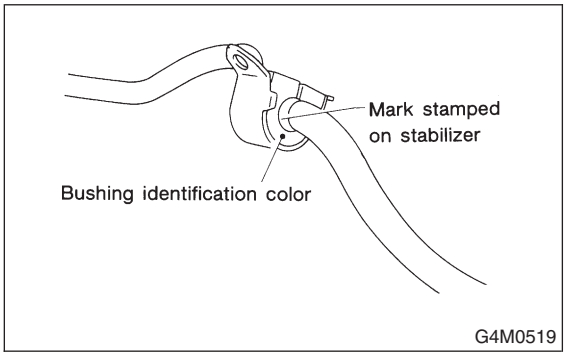
B: INSPECTION

1) Check bushing for cracks, fatigue or damage.
2) Check stabilizer link for deformities, cracks, or damage, and bushing for protrusions from the hole of stabilizer link and its play.

C: INSTALLATION

1) To install, reverse the removal procedure.

NOTE:
● Be sure that the protruding of the bushing is inserted inside the clamp hole.
● Install bushing (on front crossmember side) while aligning it with paint mark on stabilizer.
● Ensure that bushing and stabilizer have the same identification colors when installing.



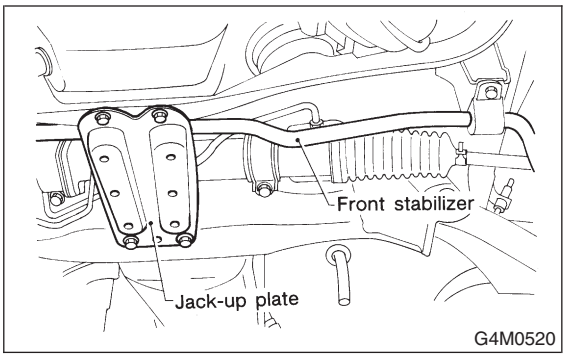
2) Always tighten rubber bushing location when wheels are in full contact with the ground and vehicle is at curb weight condition.

Tightening torque:
Jack-up plate to crossmember:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)
Stabilizer link to front transverse link:
29±5 N·m (3.0±0.5 kg-m, 21.7±3.6 ft-lb)
Stabilizer to crossmember:
25±4 N·m (2.5±0.4 kg-m, 18.1±2.9 ft-lb)

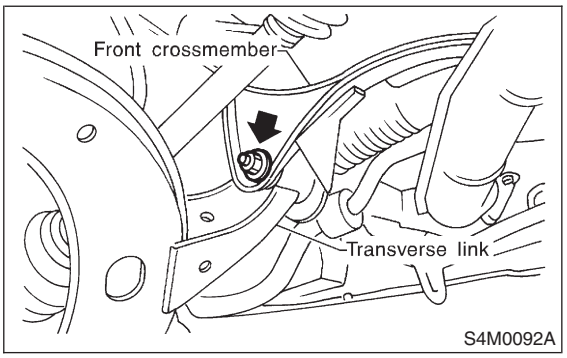
6. Front Crossmember

A: REMOVAL

1) Disconnect ground cable from battery.
2) Loosen front wheel nuts.
3) Lift-up vehicle, and remove front tires and wheels.
4) Remove both stabilizer and jack-up plate.



5) Disconnect tie-rod end from housing.
6) Remove front exhaust pipe.
7) Remove front transverse link from front crossmember and body.



8) Remove nuts attaching engine mount cushion rubber to crossmember.
9) Remove self-locking nuts connecting steering U/J and pinion shaft.
10) Lift engine by approx. 10 mm (0.39 in) by using chain block.
11) Support crossmember with a jack, remove nuts securing crossmember to body and lower crossmember gradually along with steering gearbox.

CAUTION:
When removing crossmember downward, be careful that tie-rod end does not interfere with DOJ boot.

B: INSTALLATION

1) Installation is in the reverse order of removal procedures.

CAUTION:
Always tighten rubber bushing when wheels are in full contact with the ground and vehicle is at curb weight condition.

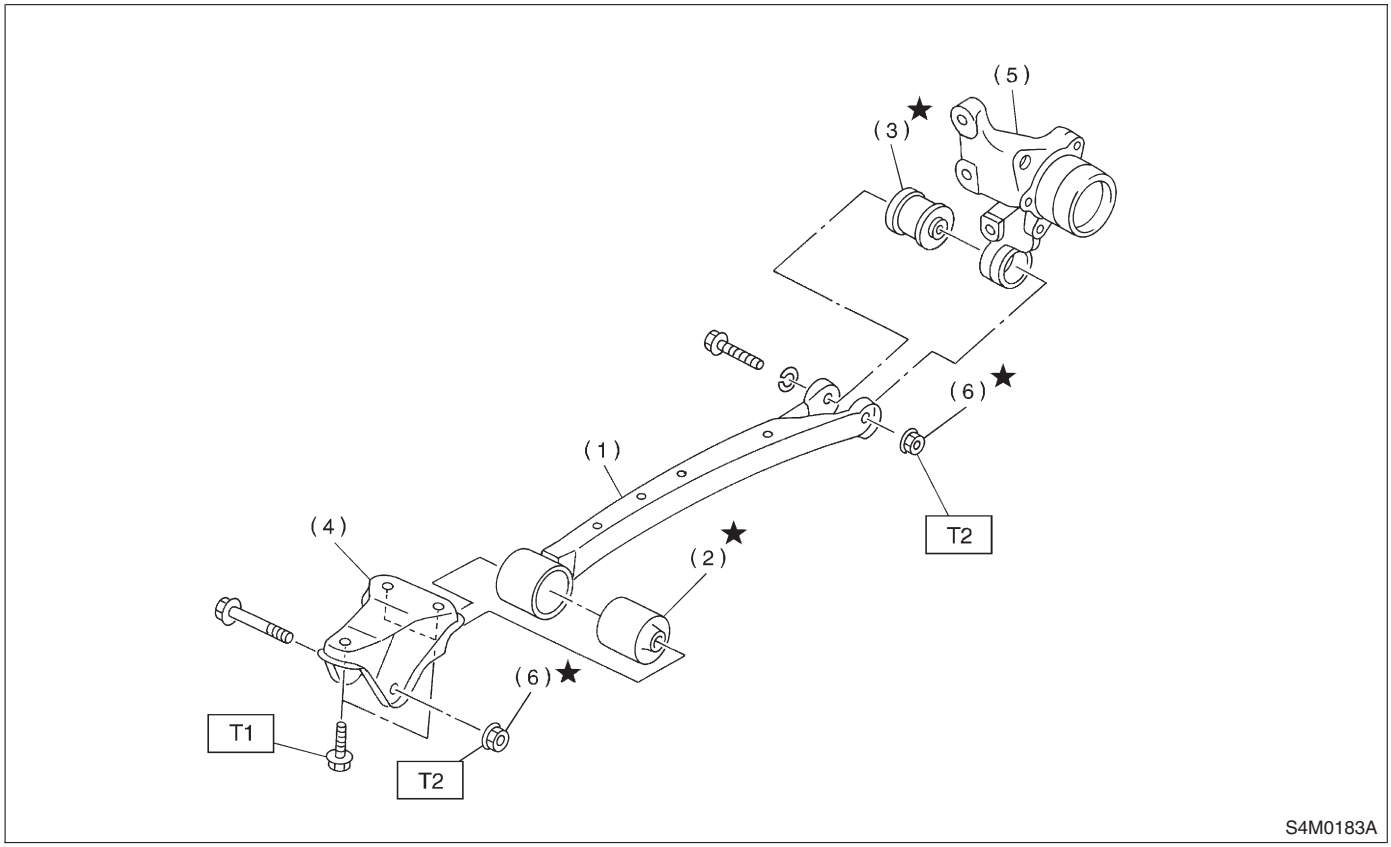
Tightening torque:
- ***Transverse link bushing to crossmember:***
  98±15 N·m (10.0±1.5 kg-m, 72±11 ft-lb)
- ***Stabilizer to bushing:***
  25±4 N·m (2.5±0.4 kg-m, 18.1±2.9 ft-lb)
- ***Tie-rod end to housing:***
  27.0±2.5 N·m (2.75±0.25 kg-m, 19.9±1.8 ft-lb)
- ***Front cushion rubber to crossmember:***
  83±15 N·m (8.5±1.5 kg-m, 61±11 ft-lb)
- ***Universal joint to pinion shaft:***
  24±3 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)
- ***Crossmember to body:***
  98±15 N·m (10.0±1.5 kg-m, 72±11 ft-lb)

2) Purge air from power steering system.

NOTE:
Check wheel alignment and adjust if necessary.

7. Rear Trailing Link

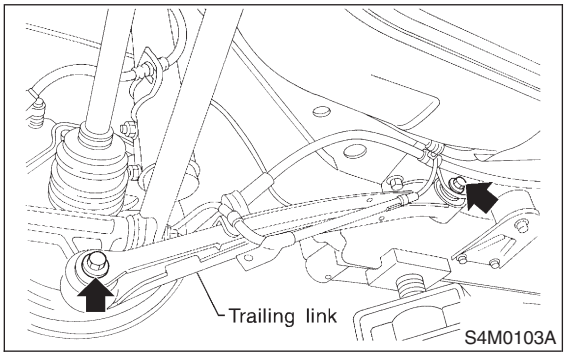
A: REMOVAL



(1) Trailing link
(2) Front bushing
(3) Rear bushing
(4) Bracket
(5) Housing
(6) Self-locking nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 98±20 (10.0±2.0, 72±14)
T2: 113±15 (11.5±1.5, 83±11)

1) Loosen rear wheel nuts.
2) Lift-up vehicle, support it with safety stands (rigid racks) and remove rear wheels.
3) Remove both rear parking brake clamp and ABS sensor harness. (ABS equipped models)
4) Remove bolt which secure trailing link to trailing link bracket.

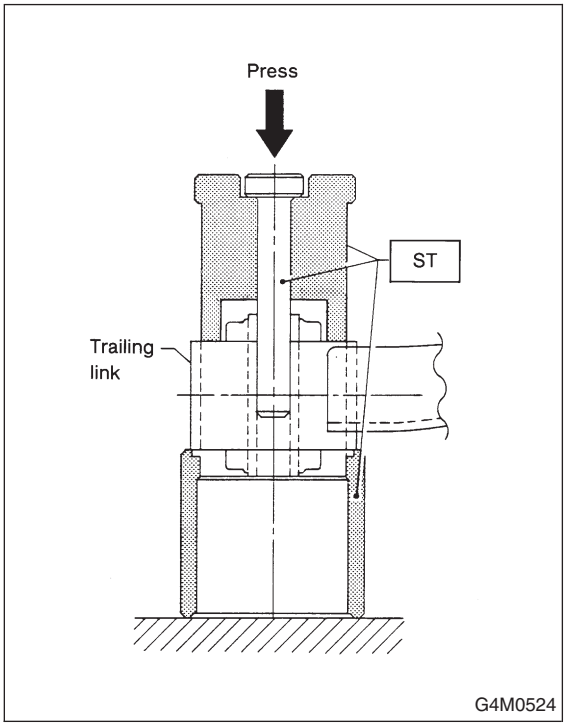


5) Remove bolt which secure trailing link to rear housing.

B: DISASSEMBLY

1. FRONT BUSHING

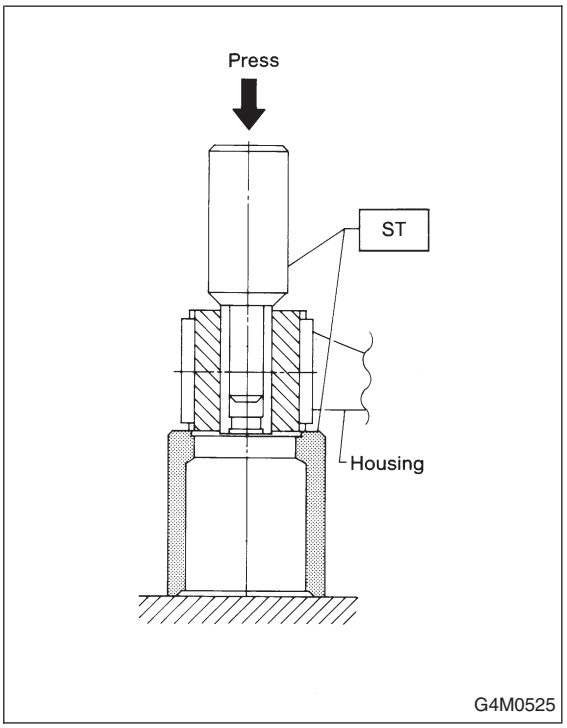
Using ST, press front bushing out of place.
ST 927720000 INSTALLER & REMOVER SET



2. REAR BUSHING

1) Remove housing.
<Ref. to 4-2 [W2A0].>

2) Using ST, press rear bushing out of place.
ST 927730000 INSTALLER & REMOVER SET



C: INSPECTION

Check trailing links for bends, corrosion or damage.

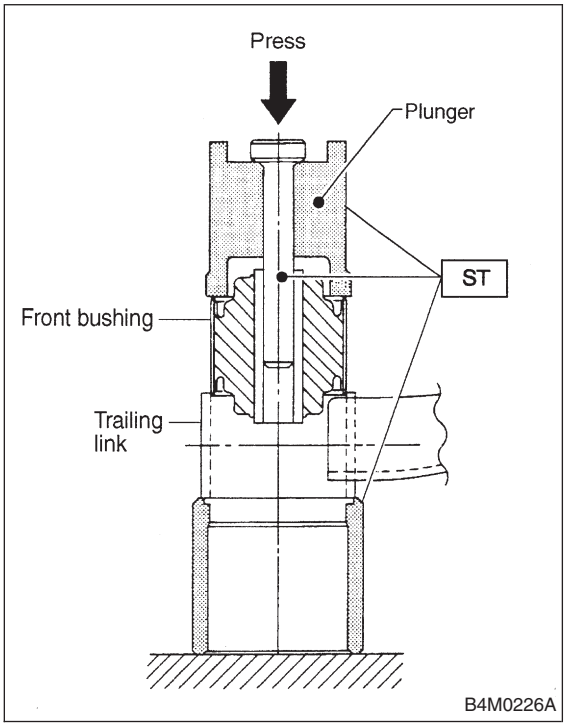
D: ASSEMBLY

To assemble, reverse above disassembly procedures.

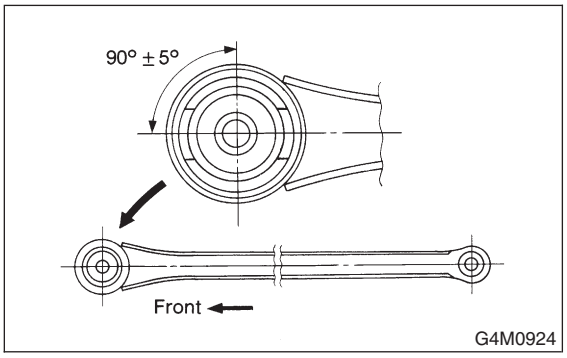
1. FRONT BUSHING

Using ST, press bushing into trailing link.
ST 927720000 INSTALLER & REMOVER SET

CAUTION:
When installing bushing, turn ST plunger upside down and press it until plunger end surface contacts trailing link end surface.



CAUTION:
Install front bushing in the proper direction, as shown in figure.

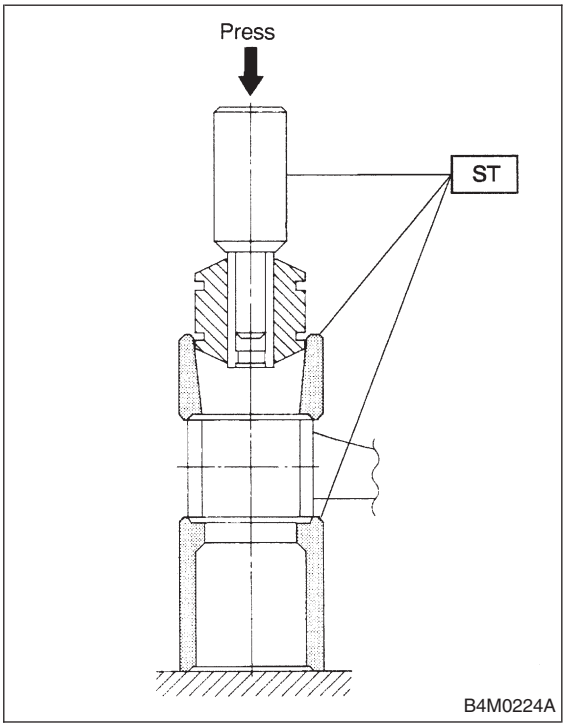


2. REAR BUSHING

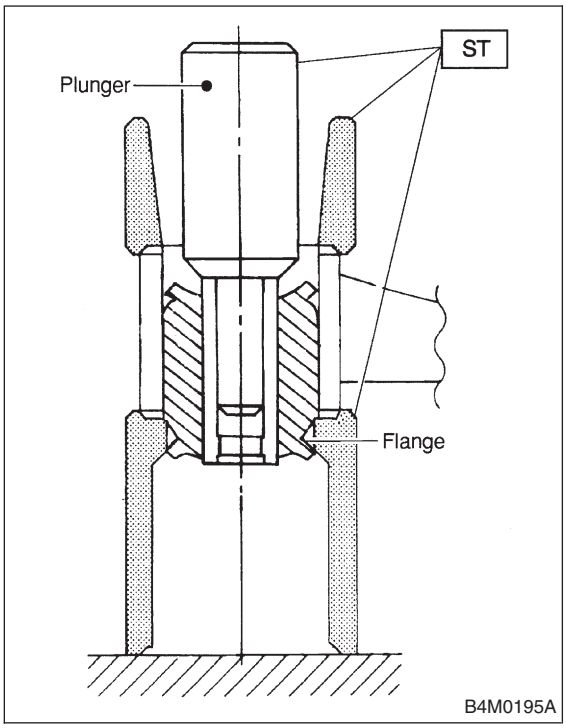
1) Using ST, press bushing into trailing link.
ST 927730000 INSTALLER & REMOVER SET

NOTE:
If it is difficult to press bushing into trailing link, apply water-diluted TIRE LUBE to the inner surface of ST as a lubricant.

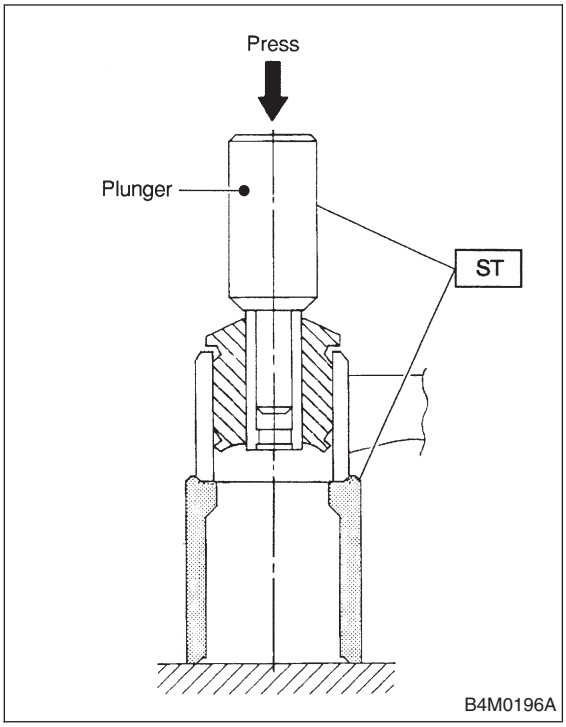
Specified lubricant:
TIRE LUBE : water = 1 : 3



2) Press ST plunger until bushing flange protrudes beyond trailing link.
ST 927730000 INSTALLER & REMOVER SET



3) Turn trailing link upside down. Press ST plunger in the direction opposite that outlined in the former procedure until bushing is correctly positioned in trailing link.
ST 927730000 INSTALLER & REMOVER SET



E: INSTALLATION

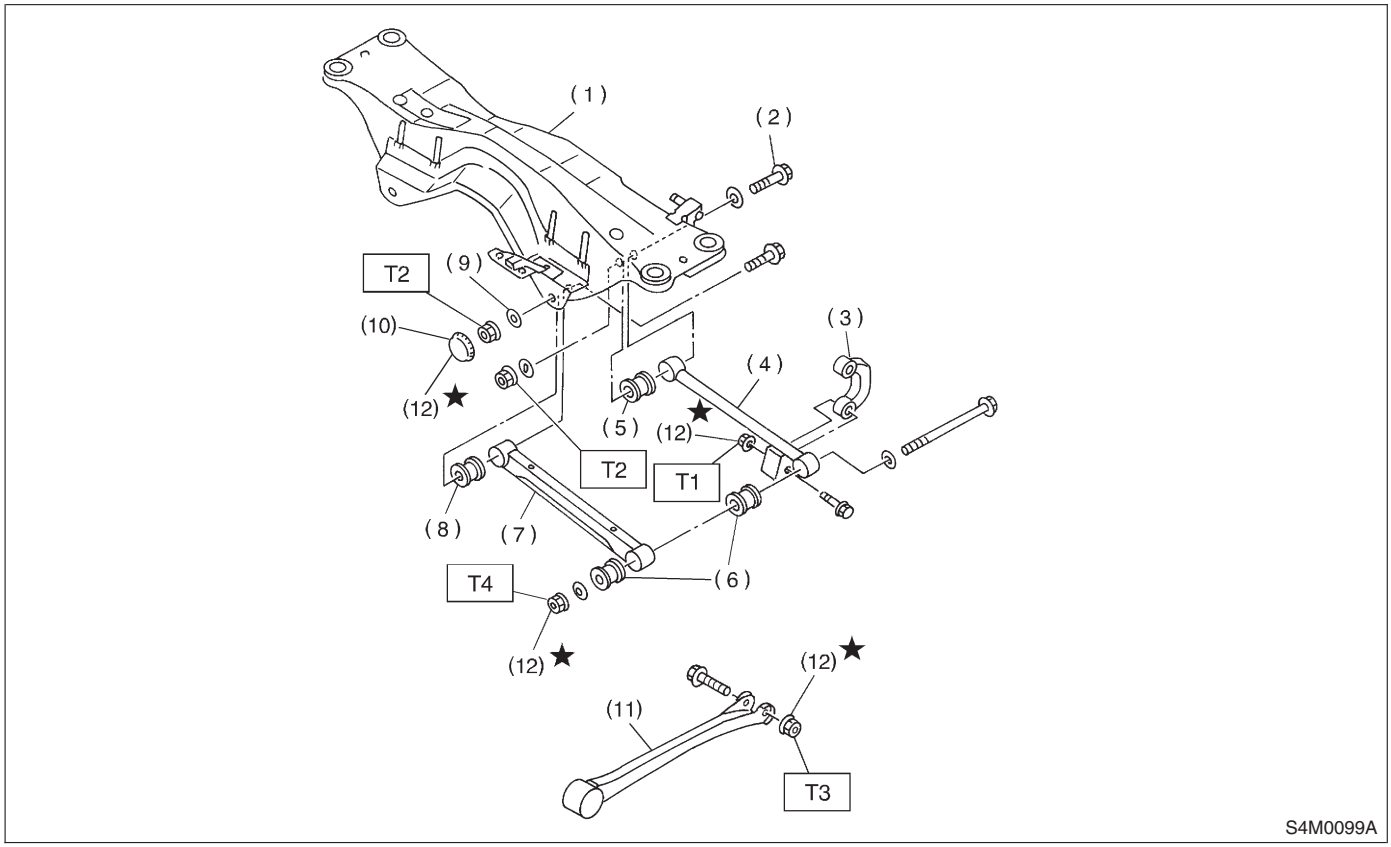
Installation is in the reverse order of removal.

CAUTION:
Always tighten rubber bushing location when wheels are in full contact with the ground and vehicle is at curb weight condition.

NOTE:
Check wheel alignment and adjust if necessary.

8. Lateral Link

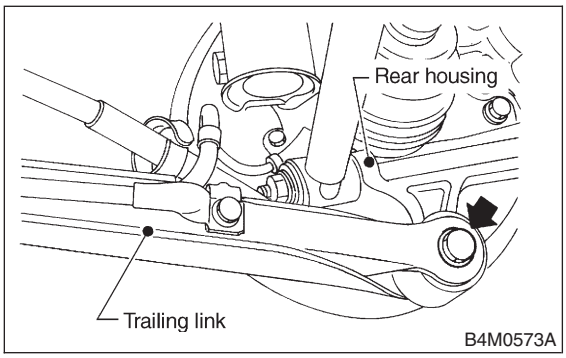
A: REMOVAL



(1) Crossmember
(2) Adjusting bolt
(3) Stabilizer link
(4) Rear lateral link
(5) Bushing (C)
(6) Bushing (A)
(7) Front lateral link
(8) Bushing (B)
(9) Washer
(10) Cap (Protection)
(11) Trailing link
(12) Self-locking nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 44±6 (4.5±0.6, 32.5±4.3)
T2: 98±15 (10.0±1.5, 72±11)
T3: 113±15 (11.5±1.5, 83±11)
T4: 137±20 (14.0±2.0, 101±14)

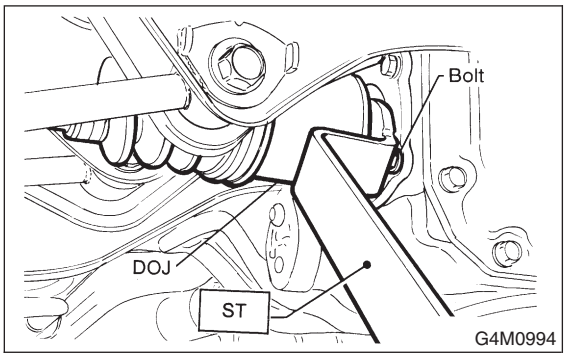
1) Loosen wheel nuts. Lift-up vehicle and remove wheel.
2) Remove stabilizers link from lateral link.
3) Remove ABS sensor harness from trailing link. (ABS equipped models)
4) Remove bolt securing trailing link to housing.



5) Remove bolts which secure lateral link assembly to rear housing.

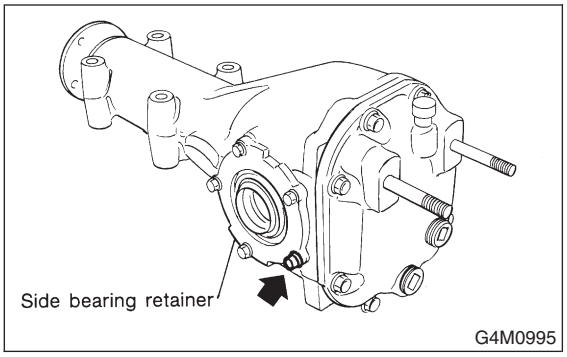
6) Remove DOJ from rear differential using ST.
ST 28099PA100 DRIVE SHAFT REMOVER

NOTE:
The side spline shaft circlip comes out together with the shaft.



CAUTION:
Be careful not to damage side bearing retainer. Always use bolt as shown in figure, as supporting point for ST during removal.

ST 28099PA100 DRIVE SHAFT REMOVER



7) Scribe an alignment mark on rear lateral link adjusting bolt and crossmember.
8) Remove bolts securing front and rear lateral links to crossmember, detach lateral links.

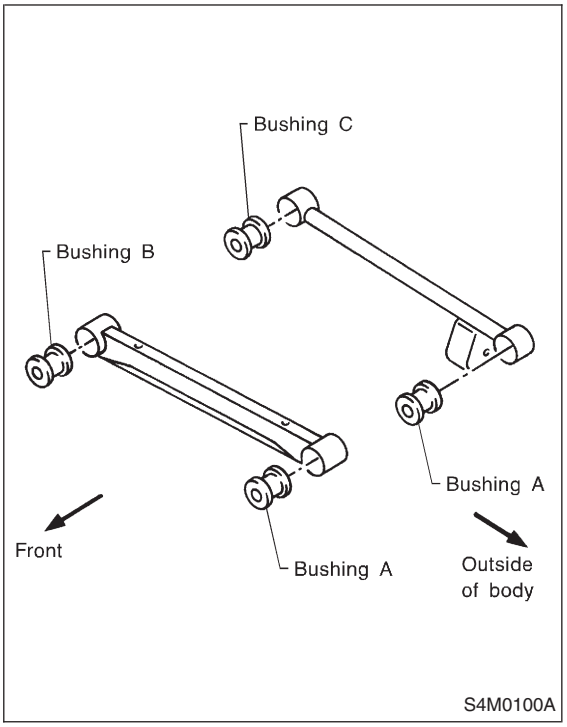
CAUTION:
To loosen adjusting bolt, always loosen nut while holding the head of adjusting bolt.

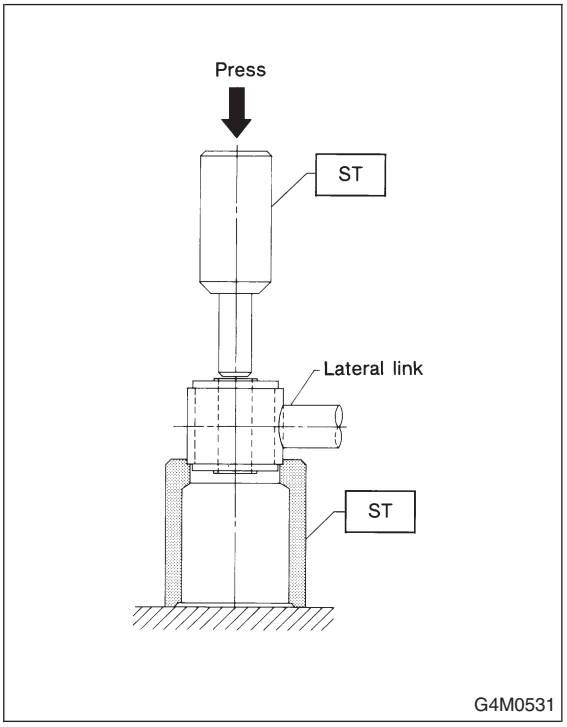
B: DISASSEMBLY

Using ST, press bushing out of place.

NOTE:
● Using the following table as a guide, verify the type of bushings.
● Select ST according to the type of bushings used.

Bushing	ST: INSTALLER & REMOVER SET
Bushing A	927700000
Bushing B	927690000
Bushing C	927700000





C: INSPECTION

Visually check lateral links for damage or bends.

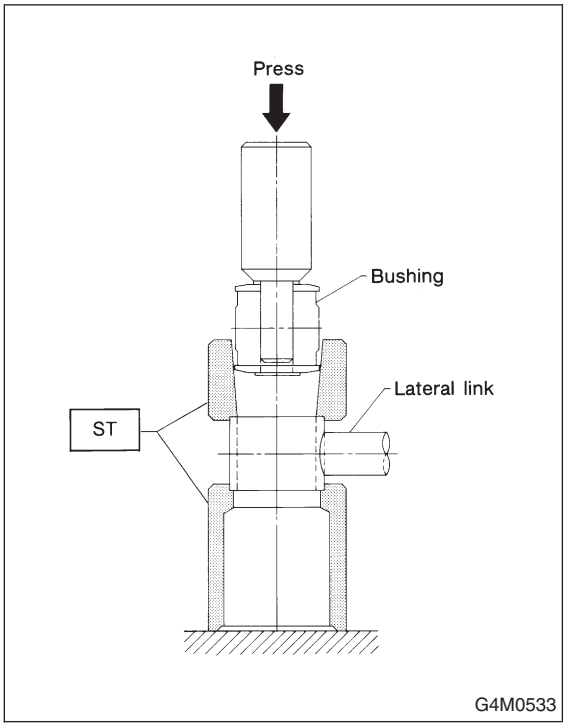
D: ASSEMBLY

1) Using ST, press bushing into place.

CAUTION:
Select ST according to the type of bushings used.

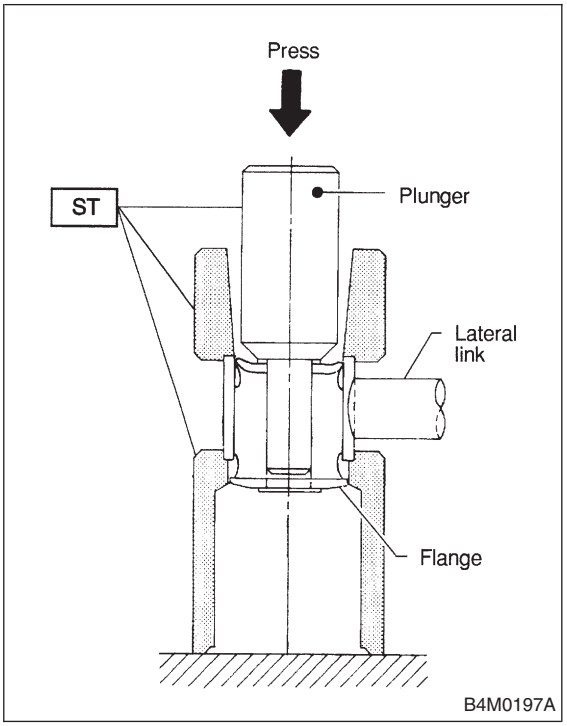
NOTE:
● Use the same ST as that used during disassembly.
● If it is difficult to press bushing into trailing link, apply water-diluted TIRE LUBE to the inner surface of ST as a lubricant.

Specified lubricant:
TIRE LUBE : water = 1 : 3



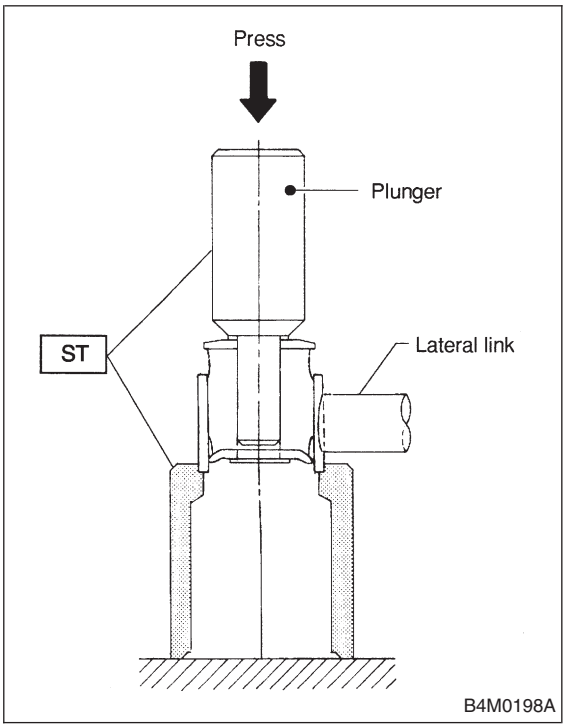
2) Press ST plunger until bushing flange protrudes beyond lateral link.

NOTE:
Use the same ST as that used during disassembly.



3) Turn lateral link upside down. Press ST plunger in the opposite direction that outlined in step 2) until bushing is correctly positioned in trailing link.

NOTE:
Use the same ST as that used during disassembly.



E: INSTALLATION

To install, reverse removal procedures, reading the following instructions.

- Installation of DOJ to differential <Ref. to 4-2 [W3E2].>

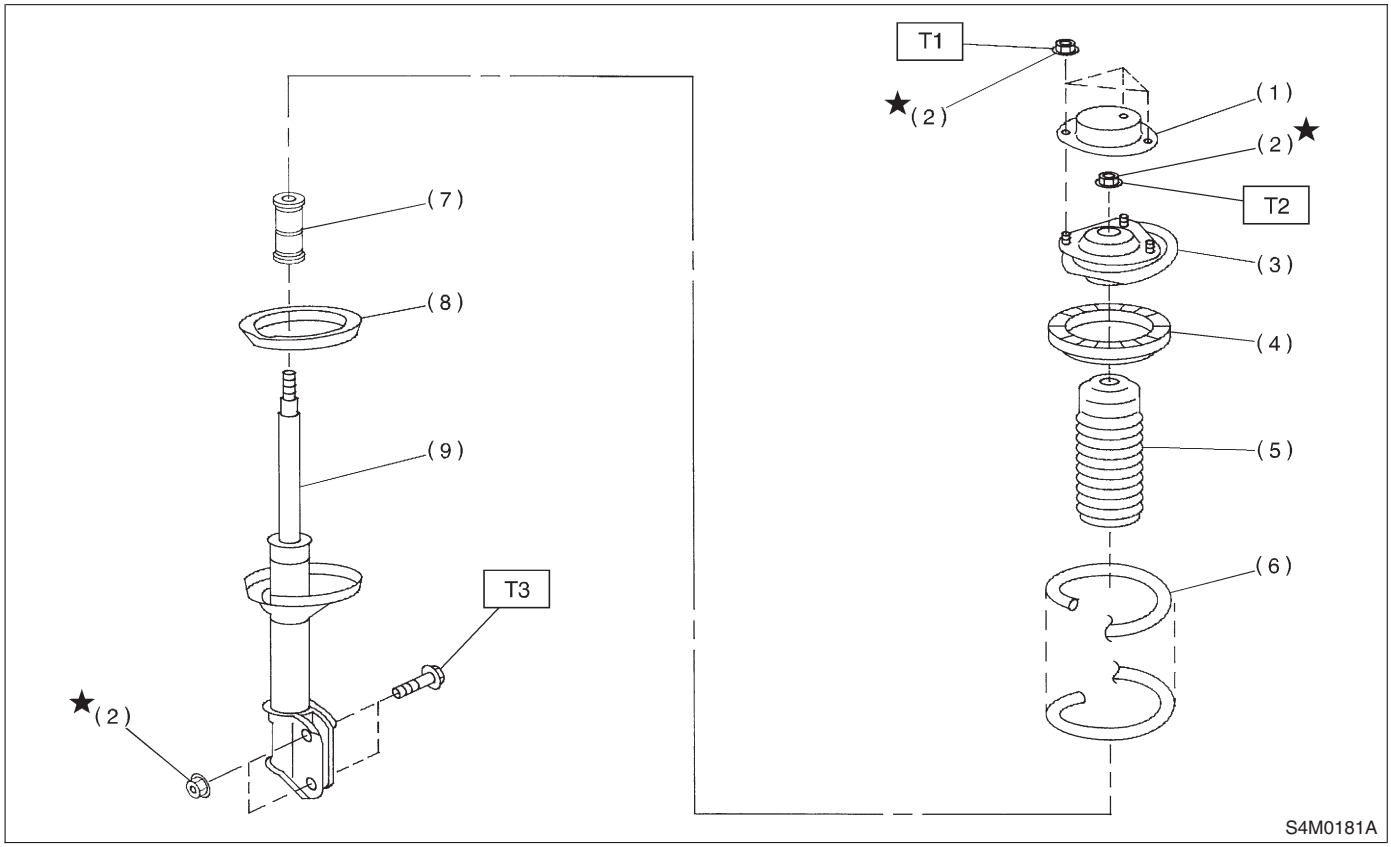
CAUTION:

- **Do not allow DOJ splines to damage side oil seal.**
- **Always tighten rubber bushing when wheels are in full contact with the ground and vehicle is at curb weight condition.**
- **Tighten nut when installing adjusting bolt.**
- **Replace self-locking nut with new one.**

NOTE:
Check wheel alignment and adjust if necessary.

9. Rear Strut

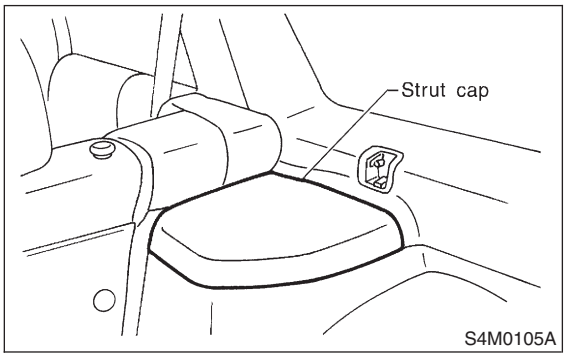
A: REMOVAL



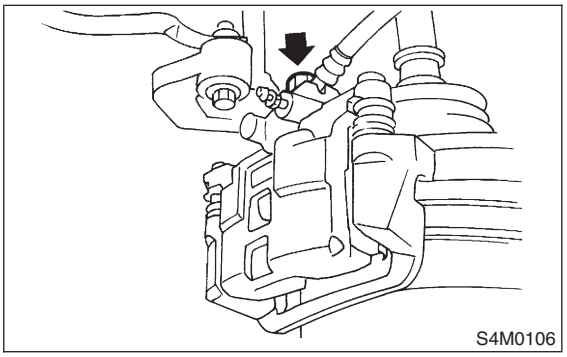
(1) Strut mount cap
(2) Self-locking nut
(3) Strut mount
(4) Rubber seat upper
(5) Dust cover
(6) Coil spring
(7) Helper
(8) Rubber seat lower
(9) Damper strut

Tightening torque: N·m (kg-m, ft-lb)
T1: 20±6 (2.0±0.6, 14.5±4.3)
T2: 59±10 (6.0±1.0, 43±7)
T3: 196^{+39}_{-10} ($20.0^{+4.0}_{-1.0}$, 145^{+29}_{-7})

1) Depress brake pedal and secure it in that position using a wooden block, etc.
2) Remove strut cap of rear quarter trim.

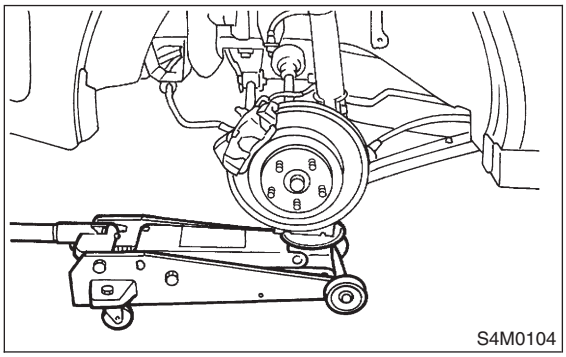


3) Loosen rear wheel nuts.
4) Jack-up vehicle, support it with safety stands (rigid racks) and remove rear wheels.
5) Remove brake hose clip.
6) Models equipped with rear disc brakes: Remove union bolt from brake caliper.

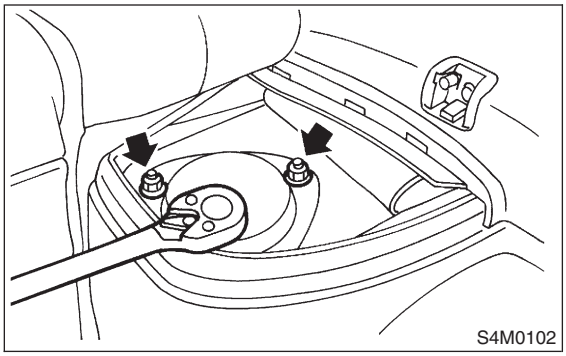


7) Models equipped with rear drum brakes: Disconnect brake hose from brake pipe from strut, and disconnect brake pipe from drum brake.

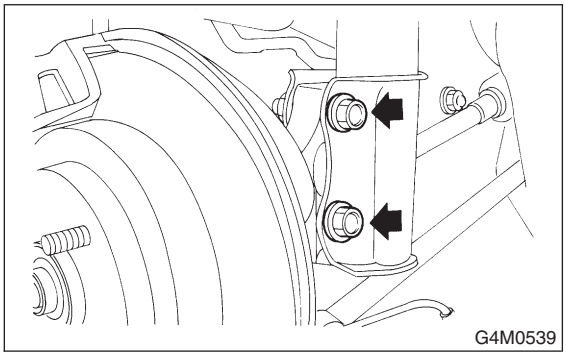
8) Use a garage jack to support the rear housing.


S4M0104

9) Remove nuts securing strut mount to body.


S4M0102

10) Remove bolts which secure rear strut to housing.


G4M0539

11) Remove strut mount.

B: DISASSEMBLY

For disassembly of rear strut, refer to procedures outlined under front strut as a guide.
<Ref. to 4-1 [W4B0].>

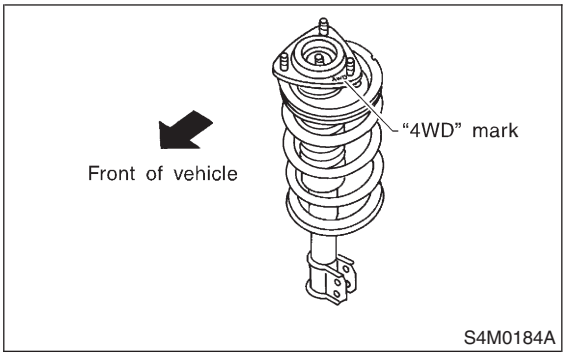
C: INSPECTION

Refer to Front Strut as a guide for inspection procedures. <Ref. to 4-1 [W4C0].>

D: ASSEMBLY

Refer to Front Strut as a guide for assembly procedures. <Ref. to 4-1 [W4D0].>

CAUTION:
• Install rear strut with "4WD" mark on strut mount facing outside of vehicle body.
• Insert the protrusion of lower rubber seat into the strut spring seat hole.



S4M0184A

E: INSTALLATION

1) Install strut mount cap.
2) Tighten self-locking nut used to secure strut mount to vehicle body.

CAUTION:
Use a new self-locking nut.

NOTE:
Tighten strut mount and cap as a unit.

Tightening torque:
20±6 N·m (2.0±0.6 kg-m, 14.5±4.3 ft-lb)

3) Tighten bolts securing rear strut to housing.

Tightening torque:
196^{+39}_{-10} N·m ($20.0^{+4.0}_{-1.0}$ kg-m, 145^{+29}_{-7} ft-lb)

CAUTION:
Use a new self-locking nut.

4) Models with rear disc brakes:
Tighten brake hose union bolt on brake caliper.

Tightening torque:
18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)

Models with rear drum brakes:
Connect brake hose to brake pipe.

Tightening torque:
15^{+3}_{-2} N·m ($1.5^{+0.3}_{-0.2}$ kg-m, $10.8^{+2.2}_{-1.4}$ ft-lb)

5) Insert brake hose clip between brake hose and lower side of strut.

CAUTION:
• Check that hose clip is positioned properly.
• Check brake hose for twisting, or excessive tension.
• Models equipped with ABS:
Do not subject ABS sensor harness to excessive tension.

6) Be sure to bleed air from brake system.

7) Lower vehicle and tighten wheel nut.

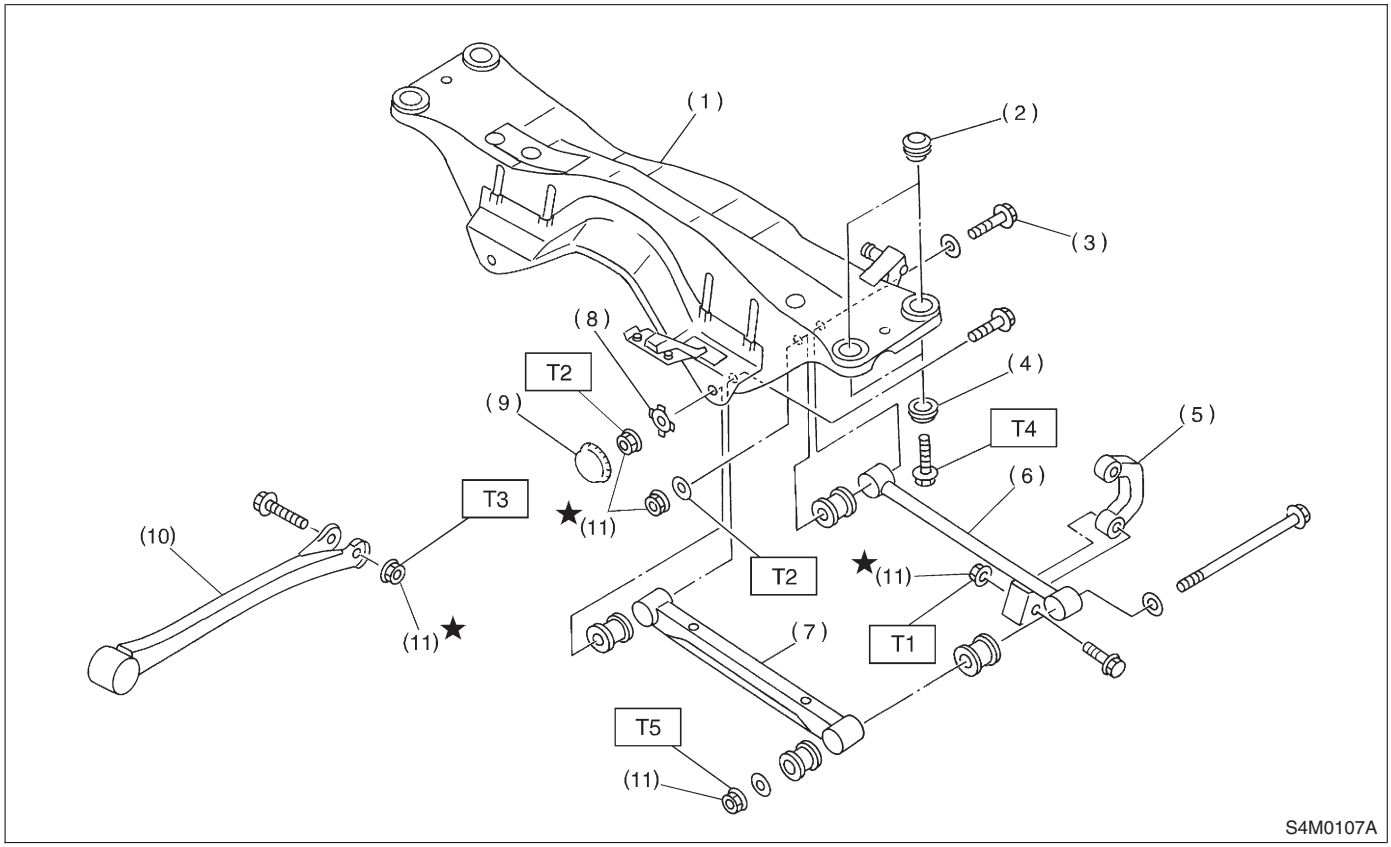
Tightening torque:
88±10 N·m (9±1 kg-m, 65±7 ft-lb)

8) Install strut cap of rear quarter trim.

NOTE:
Check wheel alignment and adjust if necessary.

10. Rear Crossmember

A: REMOVAL

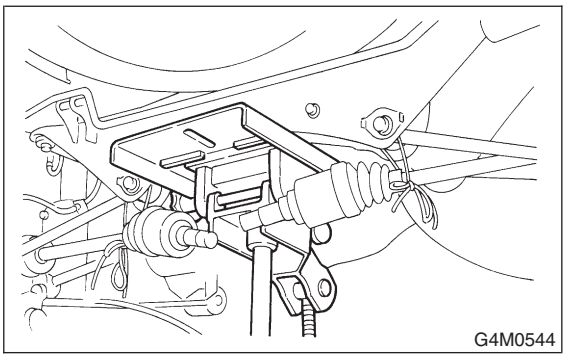


(1) Crossmember
(2) Floating bushing
(3) Adjusting bolt
(4) Stopper
(5) Stabilizer link
(6) Rear lateral link
(7) Front lateral link
(8) Washer
(9) Cap (Protection)
(10) Trailing link
(11) Self-locking nut

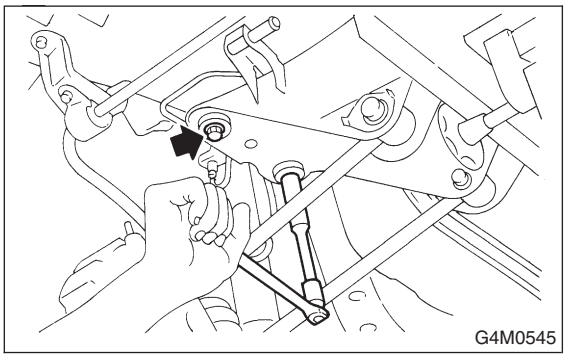
Tightening torque: N·m (kg-m, ft-lb)
T1: 44±6 (4.5±0.6, 32.5±4.3)
T2: 98±15 (10.0±1.5, 72±11)
T3: 113±15 (11.5±1.5, 83±11)
T4: 127±20 (13.0±2.0, 94±14)
T5: 137±20 (14.0±2.0, 101±14)

CAUTION:
Do not subject ABS sensor harness to excessive tension. (ABS equipped models)

1) Separate front exhaust pipe and rear exhaust pipe.
2) Remove rear exhaust pipe and muffler.
3) Remove rear differential. <Ref. to 3-4 [W2B0].>
4) Place transmission jack under rear crossmember.



5) Remove bolts securing crossmember to vehicle body, and remove crossmember.



6) Scribe an alignment mark on rear lateral link cam bolt and crossmember.
7) Remove four bolts securing front and rear lateral links to crossmember by loosening nuts.

B: INSPECTION

Check removed parts for damage and cracks, and correct or replace if defective.

C: INSTALLATION

1) Install in reverse order of removal.

NOTE:
One of the four crossmember installing bolts has a larger diameter than the others. Install it first.

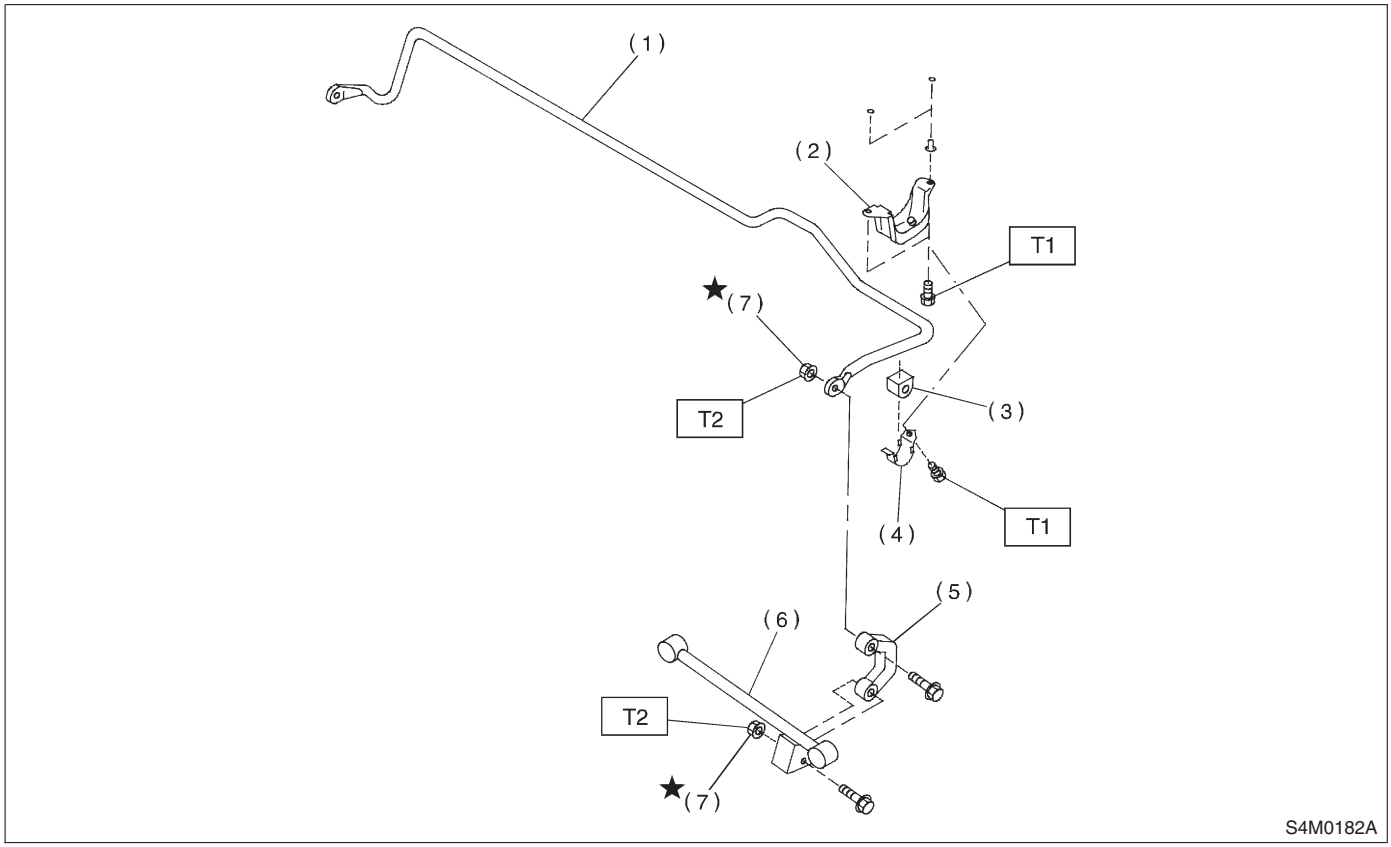
2) Install rear differential. <Ref. to 3-4 [W2F0].>

CAUTION:
Always tighten rubber bushing when wheels are in full contact with the ground and vehicle is at curb weight condition.

NOTE:
Check wheel alignment and adjust if necessary.

11. Rear Stabilizer

A: REMOVAL



(1) Rear stabilizer
(2) Stabilizer bracket
(3) Stabilizer bushing
(4) Clamp
(5) Stabilizer link
(6) Rear lateral link
(7) Self-locking nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 25±7 (2.5±0.7, 18.1±5.1)
T2: 44±6 (4.5±0.6, 32.5±4.3)

1) Jack-up the rear part of the vehicle, support it with safety stands (rigid racks).
2) Remove bolts which secure stabilizer link to rear lateral link.
3) Remove bolts which secure stabilizer to stabilizer bracket.

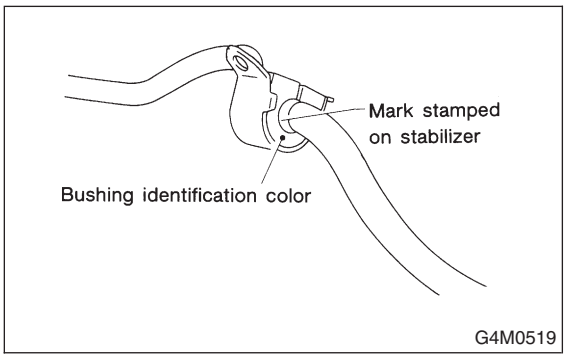
B: INSPECTION

1) Check bushing for cracks, fatigue or damage.
2) Check stabilizer links for deformities, cracks, or damage, and bushing for protrusions from the hole of stabilizer link.

C: INSTALLATION

1) To install, reverse the removal procedure.

NOTE:
● Install bushing while aligning it with paint mark on stabilizer.
● Ensure that bushing and stabilizer have the same identification colors when installing.



2) Always tighten rubber bushing location when wheels are in full contact with the ground and vehicle is curb weight.

Tightening torque:
Stabilizer link to rear lateral link:
44±6 N·m (4.5±0.6 kg-m, 32.5±4.3 ft-lb)
Stabilizer to stabilizer bracket:
25±7 N·m (2.5±0.7 kg-m, 18.1±5.1 ft-lb)

1. Suspension

A: IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible causes	Countermeasures
(1) Permanent distortion or breakage of coil spring	Replace.
(2) Unsmooth operation of damper strut	Replace.
(3) Installation of wrong strut	Replace with proper parts.
(4) Installation of wrong coil spring	Replace with proper parts.

B: POOR RIDE COMFORT

1) Large rebound shock
2) Rocking of vehicle continues too long after running over bump and/or hump.
3) Large shock in bumping

Possible causes	Countermeasures
(1) Breakage of coil spring	Replace.
(2) Over-inflation pressure of tire	Adjust.
(3) Improper wheel arch height	Adjust or replace coil springs with new ones.
(4) Fault in operation of damper strut	Replace.
(5) Damage or deformation of strut mount	Replace.
(6) Unsuitability of maximum and/or minimum length of damper strut	Replace with proper parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly	Replace.
(9) Oil leakage of damper strut	Replace.

C: NOISE

Possible causes	Countermeasures
(1) Wear or damage of damper strut component parts	Replace.
(2) Loosening of suspension link installing bolt and/or nut	Retighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitability of maximum and/or minimum length of damper strut	Replace with proper parts.
(5) Breakage of coil spring	Replace.
(6) Wear or damage of ball joint	Replace.
(7) Deformation of stabilizer clamp	Replace.

WHEELS AND AXLES 4-2

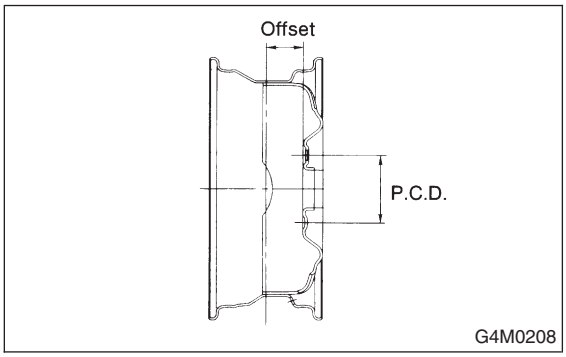
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1. Tire and Wheel Size



		Tire size	Rim size	Rim offset	P.C.D.
Front and Rear	BASE, L	P205/70R15 95S	15 × 6JJ	48 mm (1.89 in)	100 mm (3.94 in) dia.
	S	P215/60R16 94H	16 × 6 1/2JJ	48 mm (1.89 in)	

NOTE:
Spare tires are the same for both front and rear.

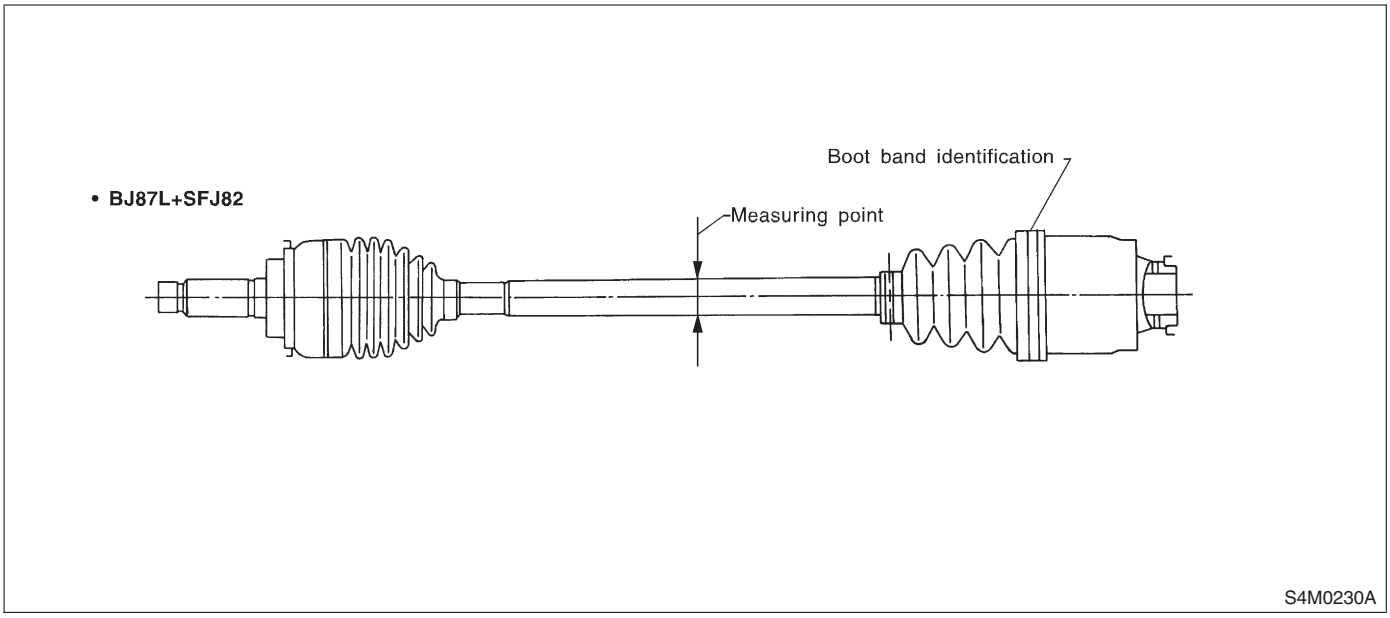
2. Tire Inflation Pressure

Model	Tire size	Tire inflation pressure	
		Light load	Full load
BASE L	P205/70R15 95S	Ft: 200 kPa (2.0 kg/cm^2, 29 psi) Rr: 180 kPa (1.8 kg/cm^2, 26 psi)	Ft: 200 kPa (2.0 kg/cm^2, 29 psi) Rr: 250 kPa (2.5 kg/cm^2, 36 psi)
S	P215/60R16 94H		

NOTE:
At trailer towing, rear inflation pressure is 280 kPa (2.8 kg/cm^2, 41 psi).

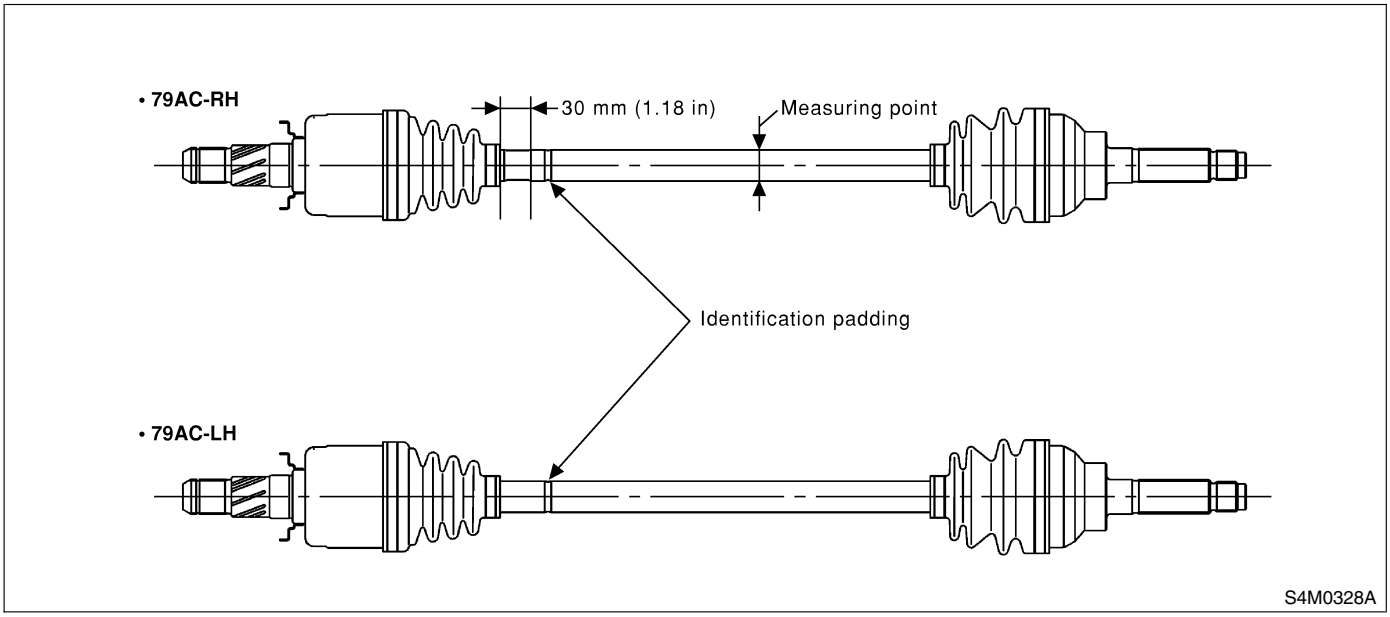
3. Front Drive Shaft Assembly

Type of drive shaft assembly	SHAFT	Boot band identification color
	Shaft diameter	
BJ87L+SFJ82	26 mm (1.02 in)	White



4. Rear Drive Shaft Assembly

Type of drive shaft assembly	SHAFT	
	No. of identification paddings on shaft	Shaft diameter
79AC-RH	2 (Two)	23 mm (0.91 in)
79AC-LH	1 (One)	23 mm (0.91 in)



5. Application Table

Power unit	Front drive shaft	Rear drive shaft
2500 cc	BJ87L+SFJ82	79AC-RH, 79AC-LH

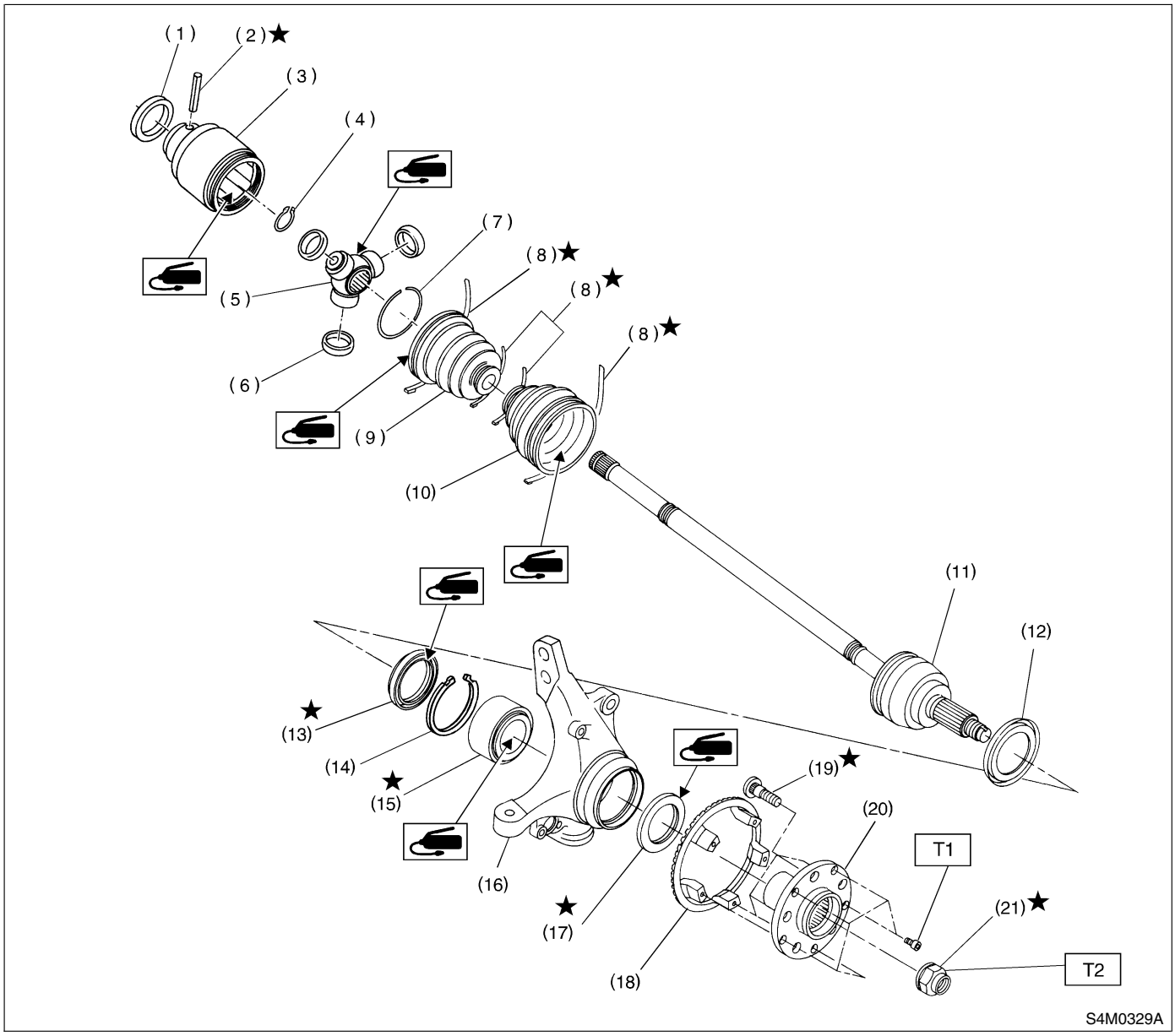
6. Wheel Balance

Wheel balancing	Standard	Service limit
Dynamic unbalance	Less than 5 g (0.18 oz)	

Balance weight part number (For steel wheel)	Weight
28101FC000	5 g (0.18 oz)
28101FC010	10 g (0.35 oz)
28101FC020	15 g (0.53 oz)
723141320	20 g (0.71 oz)
723141330	25 g (0.88 oz)
723141340	30 g (1.06 oz)
723141350	35 g (1.23 oz)
723141360	40 g (1.41 oz)
723141370	45 g (1.59 oz)
723141380	50 g (1.76 oz)
723141580	55 g (1.94 oz)
723141590	60 g (2.12 oz)

Balance weight part number (For aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
—	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

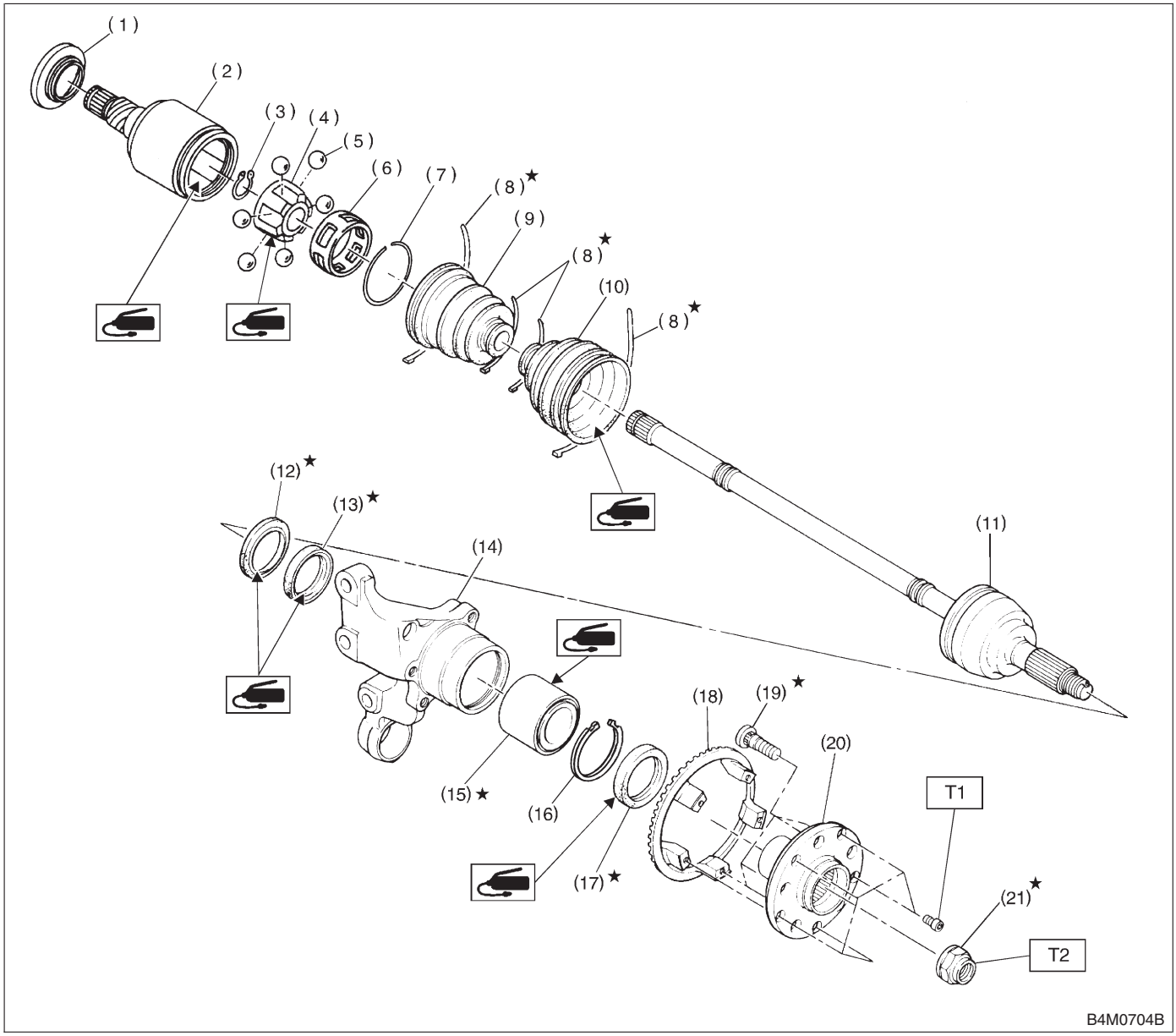
1. Front Axle



(1) Baffle plate (SFJ)
(2) Spring pin
(3) Outer race (SFJ)
(4) Snap ring
(5) Trunnion
(6) Free ring
(7) Circlip
(8) Boot band
(9) Boot
(10) Boot (BJ)
(11) BJ ASSY
(12) Baffle plate
(13) Oil seal (IN)
(14) Snap ring
(15) Bearing
(16) Housing
(17) Oil seal (OUT)
(18) Tone wheel
(19) Hub bolt
(20) Hub
(21) Axle nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 13±3 (1.3±0.3, 9.4±2.2)
T2: 186±20 (19±2, 137±14)

2. Rear Axle



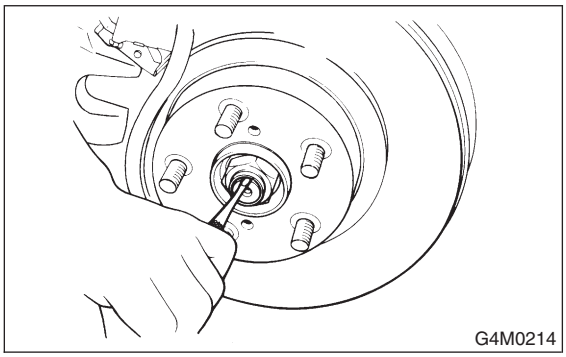
(1) Baffle plate (DOJ)
(2) Outer race (DOJ)
(3) Snap ring
(4) Inner race
(5) Ball
(6) Cage
(7) Circlip
(8) Boot band
(9) Boot (DOJ)
(10) Boot (BJ)
(11) BJ ASSY
(12) Oil seal (IN. No. 2)
(13) Oil seal (IN. No. 3)
(14) Housing
(15) Bearing
(16) Snap ring
(17) Oil seal (OUT)
(18) Tone wheel
(19) Hub bolt
(20) Hub
(21) Axle nut

Tightening torque: N·m (kg-m, ft-lb)
T1: 13±3 (1.3±0.3, 9.4±2.2)
T2: 186±20 (19±2, 137±14)

1. Front Axle

A: REMOVAL

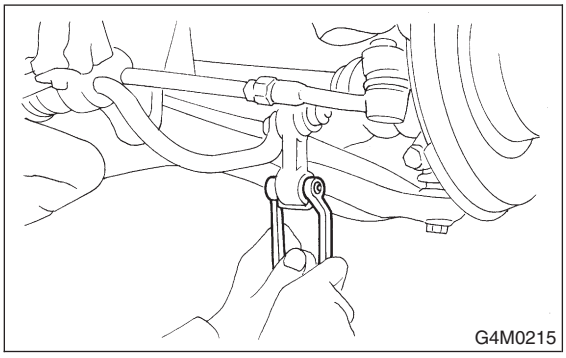
1) Disconnect ground cable from battery.
2) Jack-up vehicle, support it with safety stands, and remove front wheels.
3) Unlock axle nut.



4) Remove axle nut using a socket wrench.

CAUTION:
Be sure to loose and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

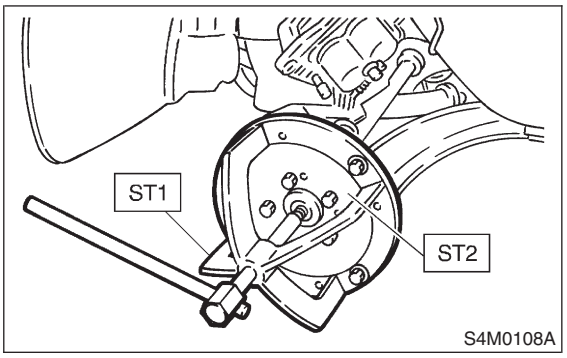
5) Remove stabilizer link.



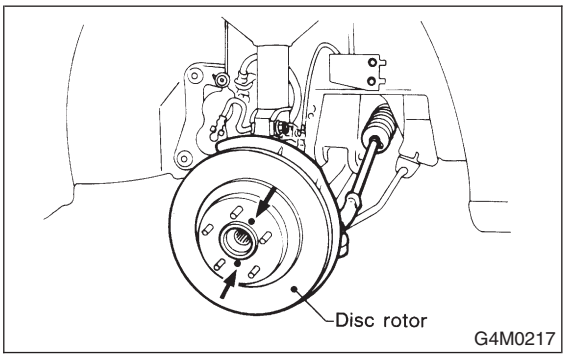
6) Remove disc brake caliper from housing, and suspend it from strut using a wire.

7) Remove front drive shaft assembly from hub. If it is hard to remove, use STs.
ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

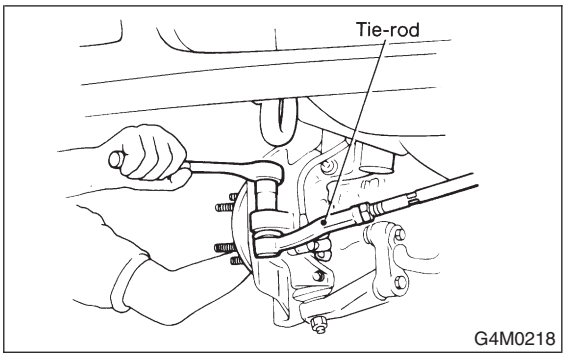
CAUTION:
• Be careful not to damage oil seal lip when removing front drive shaft.
• When replacing front drive shaft, also replace inner oil seal.



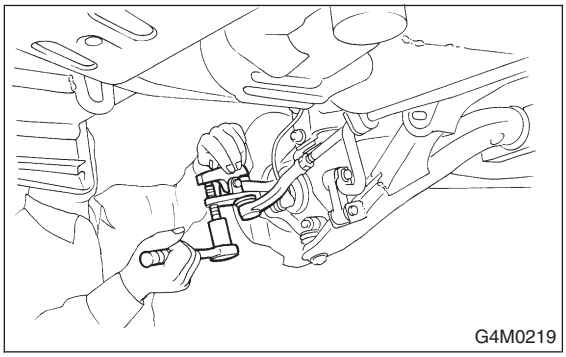
8) Remove disc rotor from hub.
If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in screw hole on the rotor.



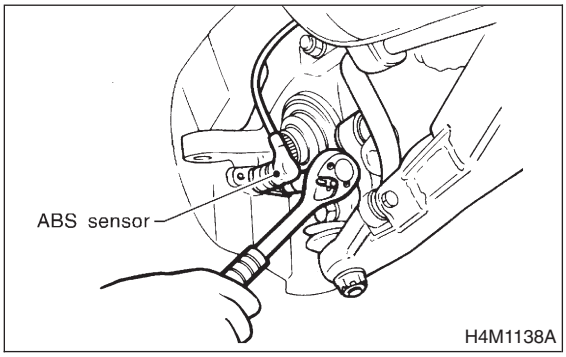
9) Remove cotter pin and castle nut which secure tie-rod end to housing knuckle arm.



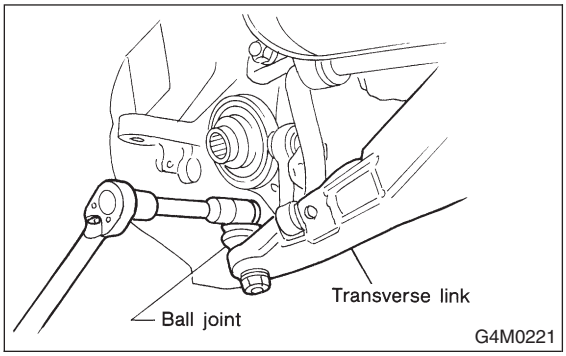
10) Using a puller, remove tie-rod ball joint from knuckle arm.



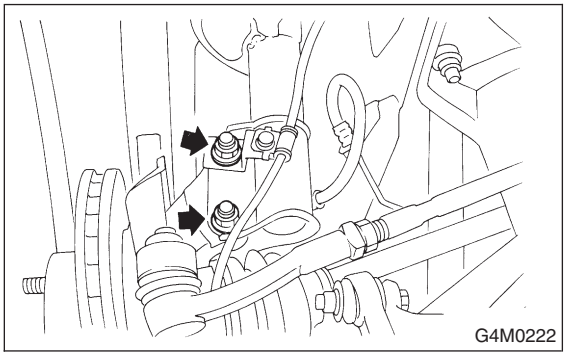
11) On ABS equipped models, remove ABS sensor assembly and harness in advance.



12) Remove transverse link ball joint from housing.



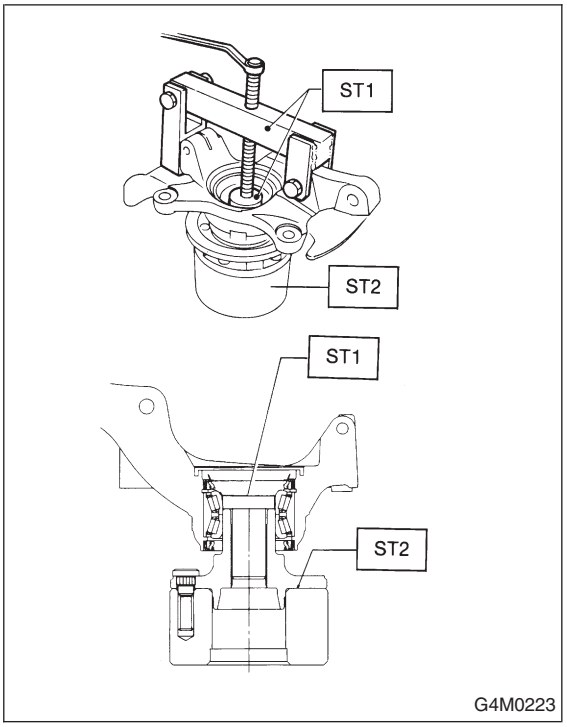
13) After scribing an alignment mark on camber adjusting bolt head, remove bolts which connect housing and strut, and disconnect housing from strut.



B: DISASSEMBLY

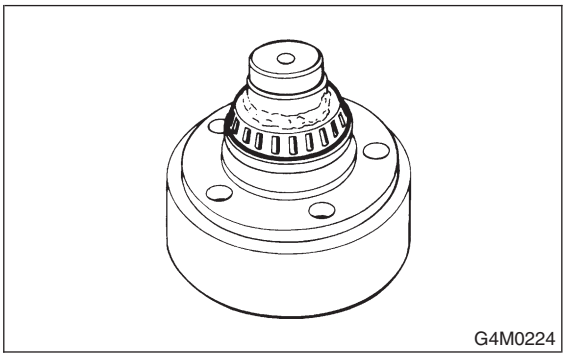
1) Using ST1, support housing and hub securely.
2) Attach ST2 to housing and drive hub out.

ST1 927060000 HUB REMOVER
ST2 927080000 HUB STAND

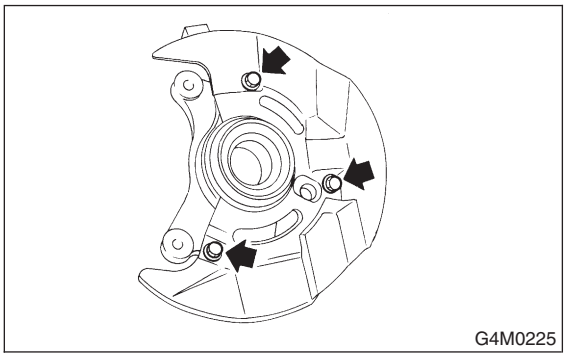


If inner bearing race remains in the hub, remove it with a suitable tool (commercially available).

CAUTION:
• Be careful not to scratch polished area of hub.
• Be sure to install inner race on the side of outer race from which it was removed.



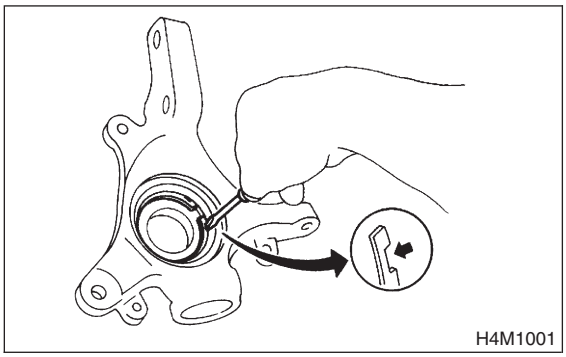
3) Remove disc cover from housing.



4) Using a standard screwdriver, remove outer and inner oil seals.

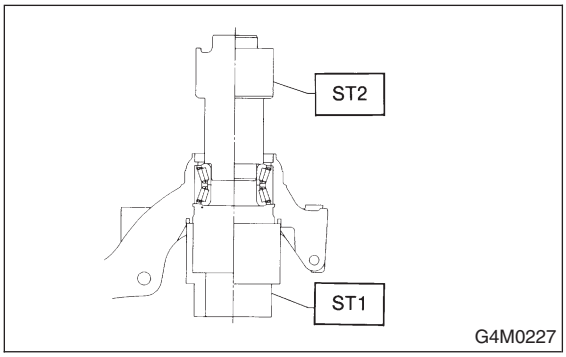
CAUTION:
Do not use old oil seals.

5) Using flat bladed screwdriver, remove snap ring.



6) Using ST1, support housing securely.
7) Using ST2, press inner race to drive out outer bearing.
ST1 927400000 HOUSING STAND
ST2 927100000 BEARING REMOVER

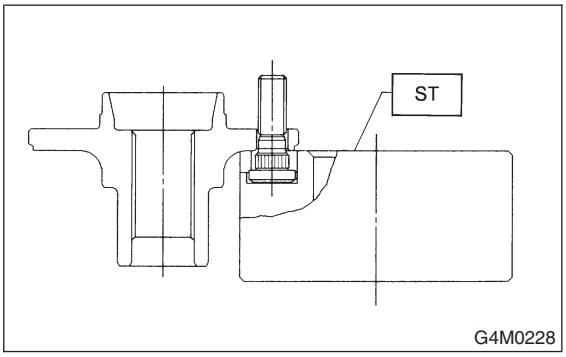
CAUTION:
- **Do not remove outer race unless it is faulty.**
- **Discard outer race after removal.**
- **Do not replace inner or outer race separately; always replace as a unit.**



8) Loosen bolts which secure tone wheel to hub. Remove tone wheel (only vehicle equipped with ABS).

9) Using ST and a hydraulic press, drive hub bolts out.
ST 927080000 HUB STAND

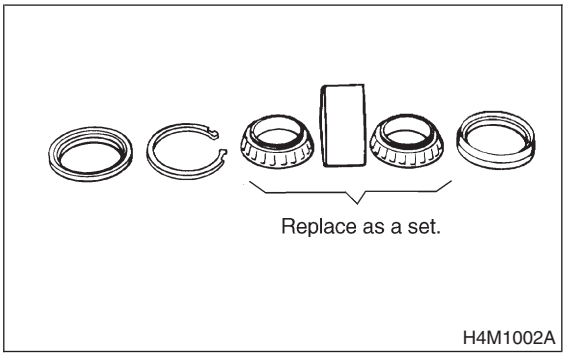
CAUTION:
Be careful not to hammer hub bolts. This may deform hub.



C: INSPECTION

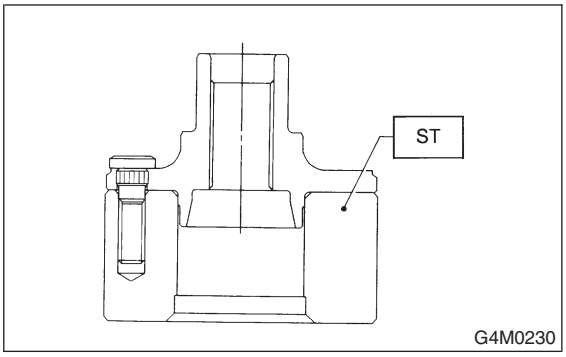
Check the removed parts for wear and damage. If defective, replace with new ones.

CAUTION:
- **If bearing is faulty, replace it as a bearing set.**
- **Be sure to replace oil seal at every overhaul.**



D: ASSEMBLY

1) Attach hub to ST securely.
ST 927080000 HUB STAND



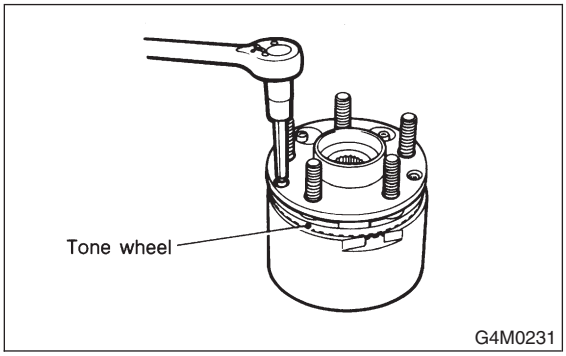
2) Using a hydraulic press, press new hub bolts into place.

CAUTION:
Be sure to press hub bolts until their seating surfaces contact the hub.

NOTE:
Use 12 mm (0.47 in) dia. holes in HUB STAND to prevent bolts from tilting.

3) Remove foreign particles (dust, rust, etc.) from mating surfaces of hub and tone wheel, and install tone wheel to hub (only vehicle equipped with ABS).

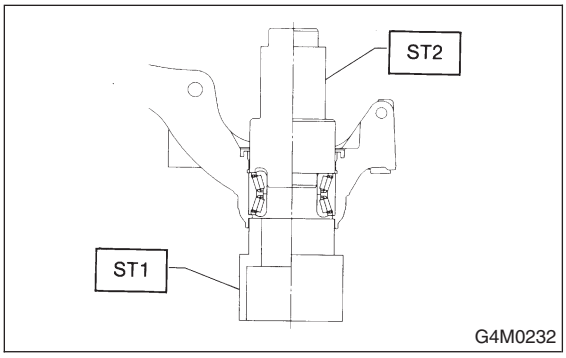
CAUTION:
- **Be careful not to damage tone wheel teeth.**
- **Ensure tone wheel closely contacts hub.**



4) Clean dust or foreign particles from inside the housing.
5) Using ST1 and ST2, press a new bearing into place.
ST1 927400000 HOUSING STAND
ST2 927100000 BEARING REMOVER

CAUTION:
- **Always press outer race when installing bearing.**
- **Be careful not to remove plastic lock from inner race when installing bearing.**
- **Charge bearing with new grease when outer race is not removed.**

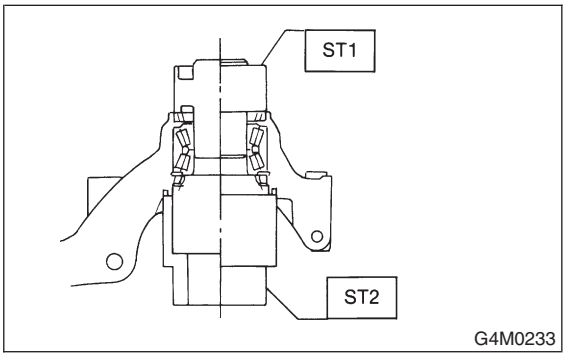
Specified grease:
SHELL 6459N



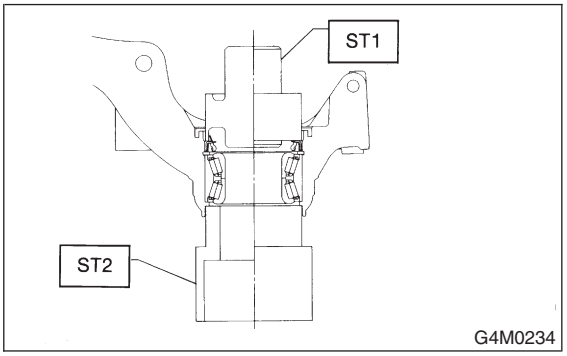
6) Install snap ring in its groove.

NOTE:
Make sure to install it firmly to groove.

7) Using ST1 and ST2, press outer oil seal until it contacts the bottom of housing.
ST1 927410000 OIL SEAL INSTALLER
ST2 927400000 HOUSING STAND



8) Using ST1 and ST2, press inner oil seal until it contacts circlip.
ST1 927410000 OIL SEAL INSTALLER
ST2 927400000 HOUSING STAND



9) Invert ST and housing.
ST 927400000 HOUSING STAND
10) Apply sufficient grease to oil seal lip.

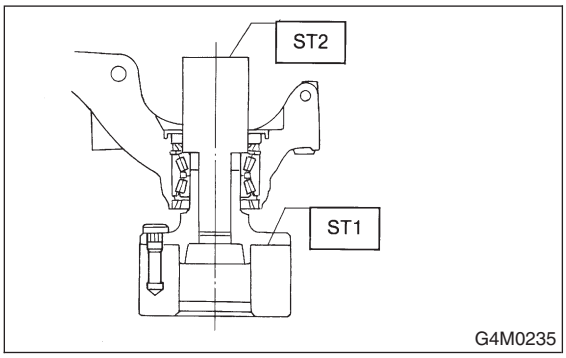
Specified grease:
SHELL 6459N

CAUTION:
- **If specified grease is not available, remove bearing grease and apply Auto Rex A instead.**
- **Do not mix different types of grease.**

11) Install disc cover to housing the three bolts.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

12) Attach hub to ST1 securely.
13) Clean dust or foreign particles from the polished surface of hub.
14) Using ST2, press bearing into hub by driving inner race.
ST1 927080000 HUB STAND
ST2 927120000 HUB INSTALLER



E: INSTALLATION

1) Install transverse link ball joint to housing.

Tightening torque:
49±10 N·m (5±1 kg-m, 36±7 ft-lb)

2) While aligning alignment mark on camber adjusting bolt head, connect housing and strut.

CAUTION:
Use a new self-locking nut.

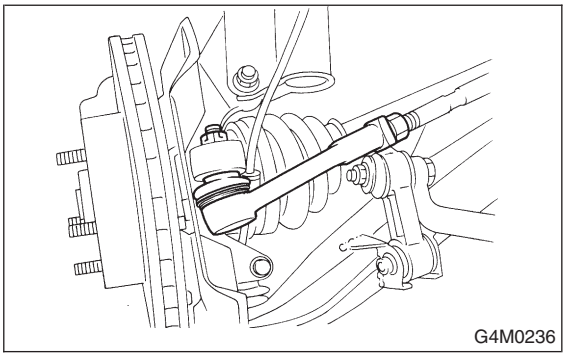
Tightening torque:
152^{+44}_{-20} N·m ($15.5^{+4.5}_{-2.0}$ kg-m, 112^{+33}_{-14} ft-lb)

3) Install speed sensor and harness on housing (only vehicle equipped with ABS).
4) Install disc rotor on hub.
5) Install disc brake caliper on housing.

Tightening torque:
78±10 N·m (8±1 kg-m, 58±7 ft-lb)

6) Install front drive shaft. <Ref. to 4-2 [W3E1].>
7) Connect stabilizer link.
8) Install tie-rod end ball joint on housing knuckle arm.

Tightening torque:
27.0±2.5 N·m (2.75±0.25 kg-m, 19.9±1.8 ft-lb)

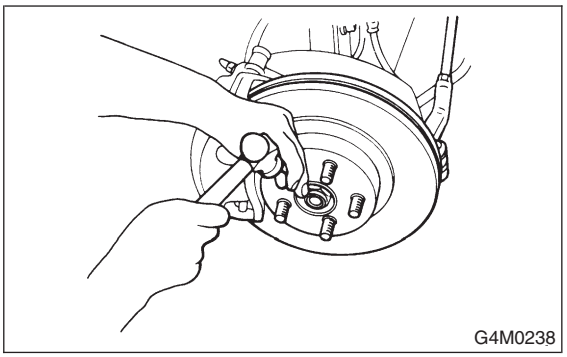


9) While depressing brake pedal, tighten axle nut and lock it securely.

CAUTION:
• Use a new axle nut.
• Always tighten axle nut before installing wheel on vehicle. If wheel is installed and comes in contact with ground when axle nut is loose, wheel bearings may be damaged.
• Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

Tightening torque:
186±20 N·m (19±2 kg-m, 137±14 ft-lb)

10) After tightening axle nut, lock it securely.



11) Install wheel and tighten wheel nuts to specified torque.

Tightening torque:
88±10 N·m (9±1 kg-m, 65±7 ft-lb)

2. Rear Axle

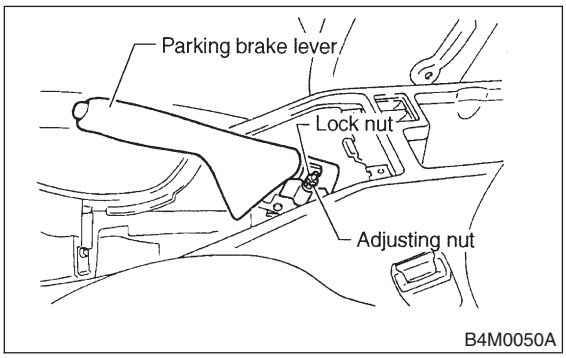
A: REMOVAL

1. DISC BRAKE

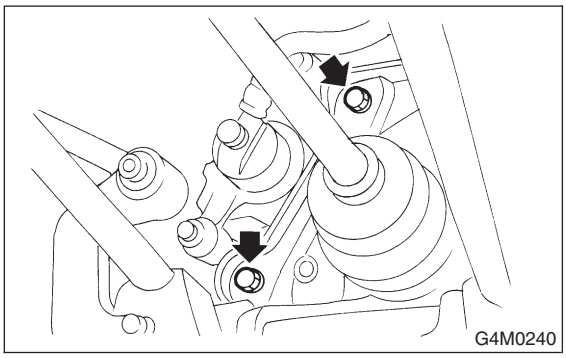
1) Disconnect ground cable from battery.
2) Jack-up vehicle, and remove rear wheel cap and wheels.

CAUTION:
Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

3) Unlock axle nut.
4) Remove axle nut using a socket wrench.
5) Return parking brake lever and loosen adjusting nut.



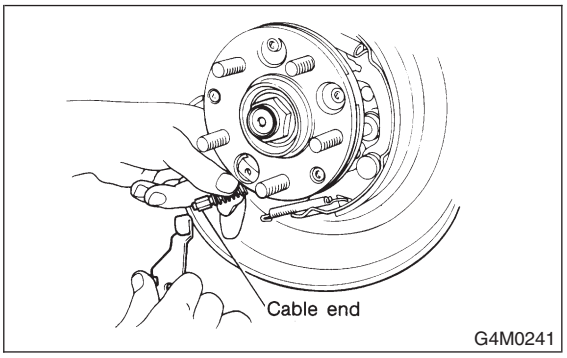
6) Remove disc brake caliper from back plate, and suspend it from strut using a piece of wire.



7) Remove disc rotor from hub.

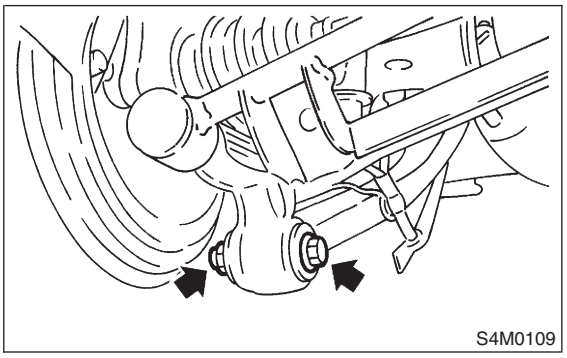
NOTE:
If disc rotor seizes up within hub, drive it out by installing an 8-mm bolt into bolt hole in disc rotor.

8) Disconnect parking brake cable end.



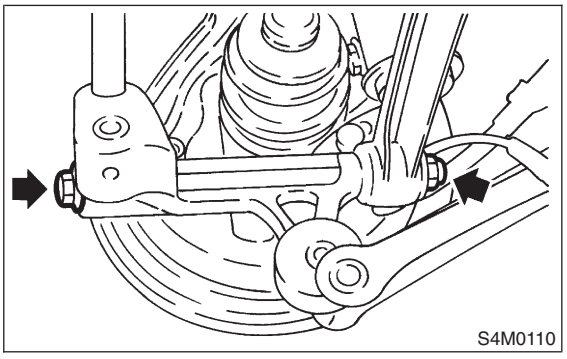
9) Disconnect rear stabilizer from rear lateral link.
10) Remove bolts which secure trailing link assembly to rear housing.

CAUTION:
Discard old self-locking nut. Replace with a new one.



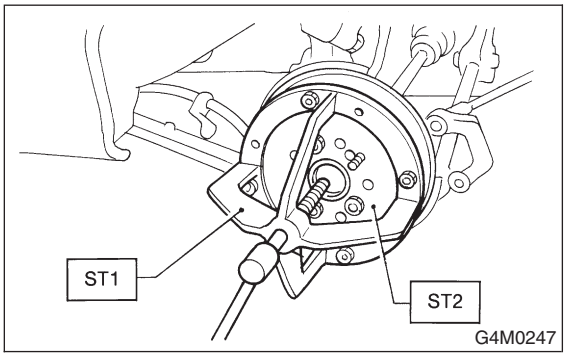
11) Remove bolts which secure lateral link assembly to rear housing.

CAUTION:
Discard old self-locking nut. Replace with a new one.

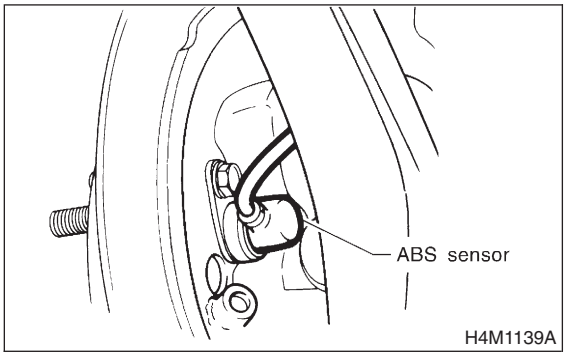


12) Disengage BJ from housing splines, and remove rear drive shaft assembly. If it is hard to remove, use STs.
ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

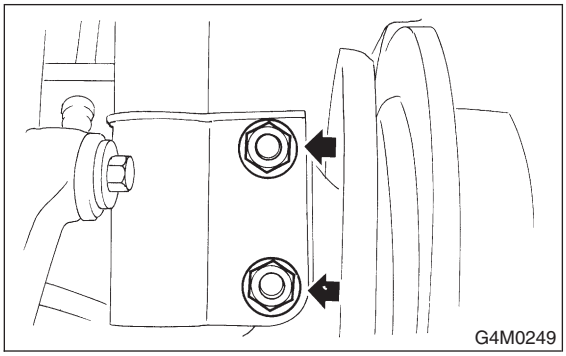
CAUTION:
• Be careful not to damage oil seal lip when removing rear drive shaft.
• When rear drive shaft is to be replaced, also replace inner oil seal with a new one.



13) Remove rear ABS sensor from back plate (only vehicle equipped with ABS).



14) Remove bolts which secure rear housing to strut, and separate the two.

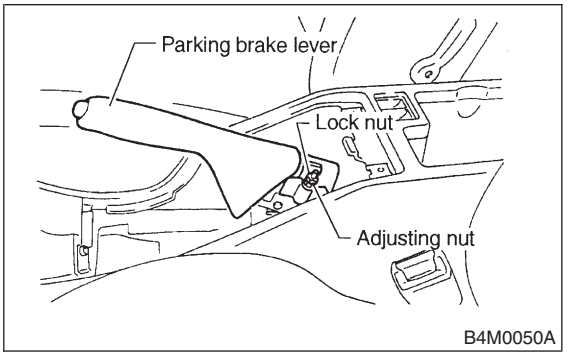


2. DRUM BRAKE

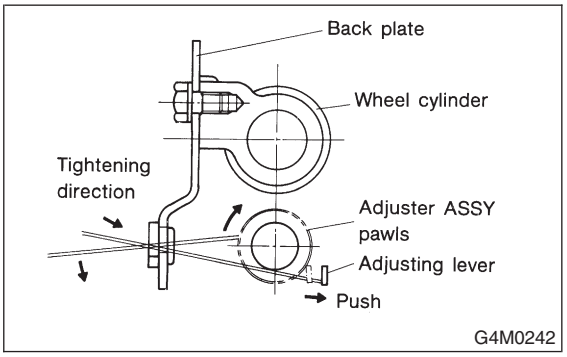
1) Disconnect ground cable from battery.
2) Jack-up vehicle, and remove rear wheel cap and wheels.

CAUTION:
Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

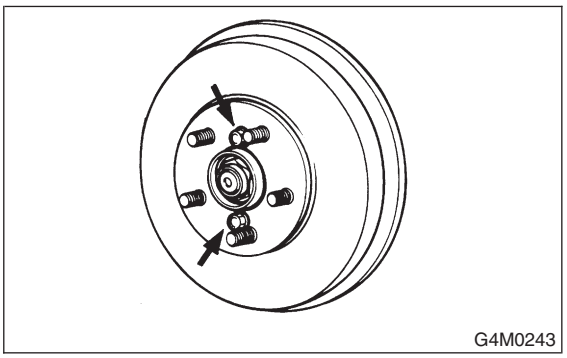
3) Unlock axle nut.
4) Remove axle nut using a socket wrench.
5) Return parking brake lever and loosen adjusting nut.



6) Remove brake drum from hub.
7) If it is difficult to remove brake drum, remove adjusting hole cover from back plate, and then turn adjusting screw using a slot-type screwdriver until brake shoe separates from the drum.

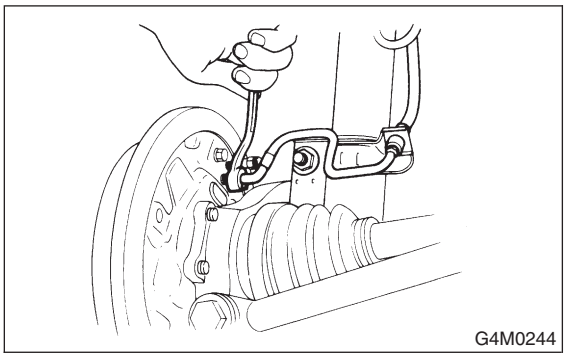


NOTE:
If brake drum is difficult to remove, drive it out by installing an 8-mm bolt into bolt hole in brake drum.

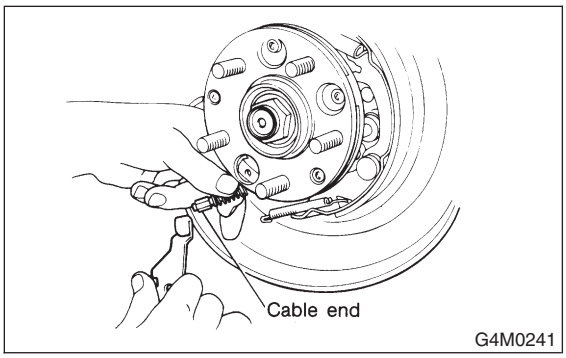


8) Using a flare-nut wrench, disconnect brake pipe from wheel cylinder.

CAUTION:
Cover open end of wheel cylinder to prevent entry of foreign particles.

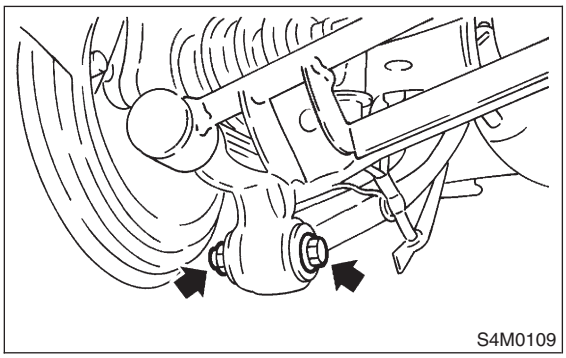


9) Disconnect parking brake cable end.



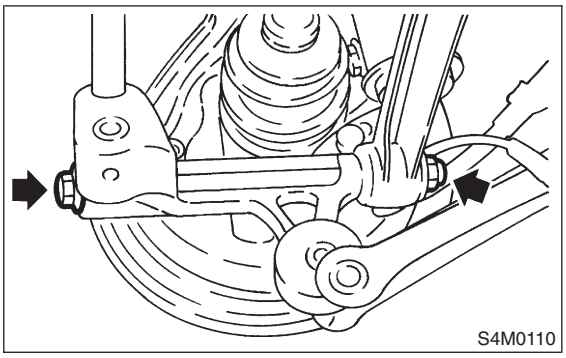
10) Disconnect rear stabilizer from rear lateral link.
11) Remove bolts which secure trailing link assembly to rear housing.

CAUTION:
Discard old self-locking nut. Replace with a new one.



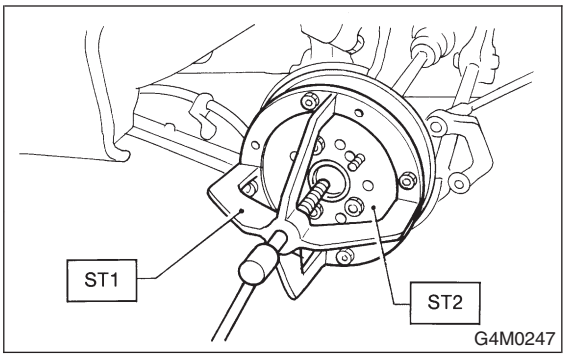
12) Remove bolts which secure lateral link assembly to rear housing.

CAUTION:
Discard old self-locking nut. Replace with a new one.

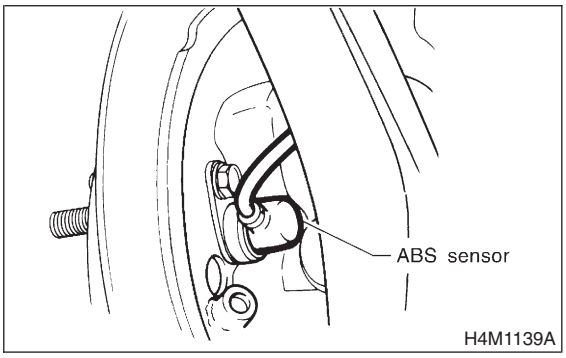


13) Disengage BJ from housing splines, and remove rear drive shaft assembly. If it is hard to remove, use STs.
ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

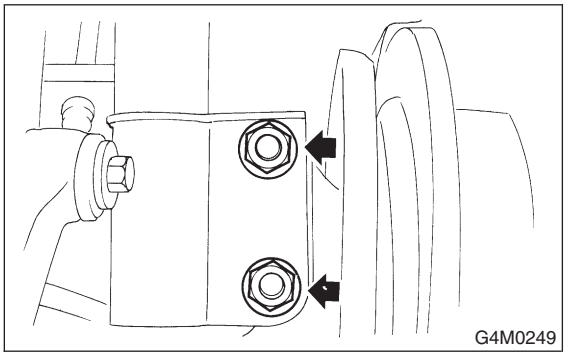
CAUTION:
- **Be careful not to damage oil seal lip when removing rear drive shaft.**
- **When rear drive shaft is to be replaced, also replace inner oil seal with a new one.**



14) Remove rear ABS sensor from back plate (only vehicle equipped with ABS).

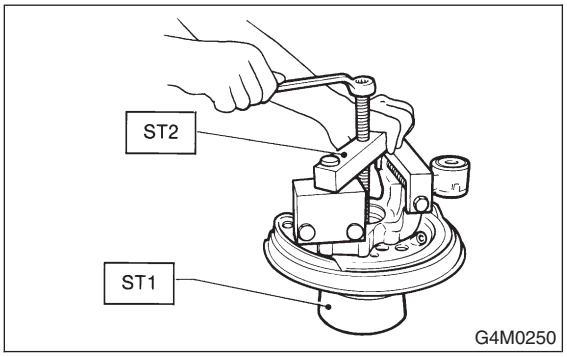


15) Remove bolts which secure rear housing to strut, and separate the two.



B: DISASSEMBLY

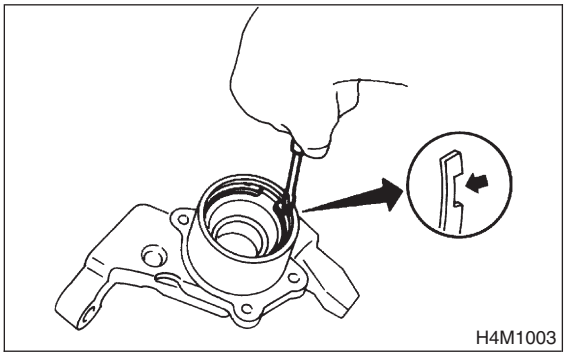
1) Using ST1 and ST2, remove hub from rear housing.
ST1 927080000 HUB STAND
ST2 927420000 HUB REMOVER



2) Remove back plate from rear housing.
3) Using a standard screwdriver, remove outer and inner oil seals.

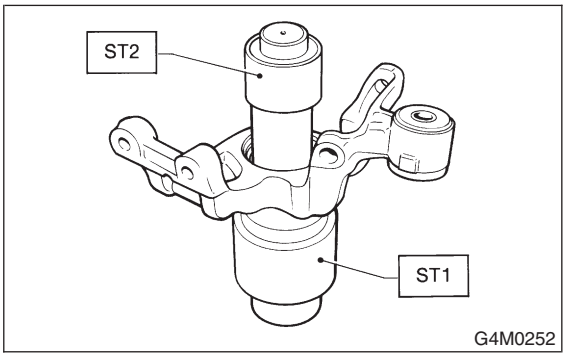
CAUTION:
Use new oil seals.

4) Using flat bladed screwdriver, remove snap ring.



5) Using ST1 and ST2, remove bearing by pressing inner race.
ST1 927430000 HOUSING STAND
ST2 927440000 BEARING REMOVER

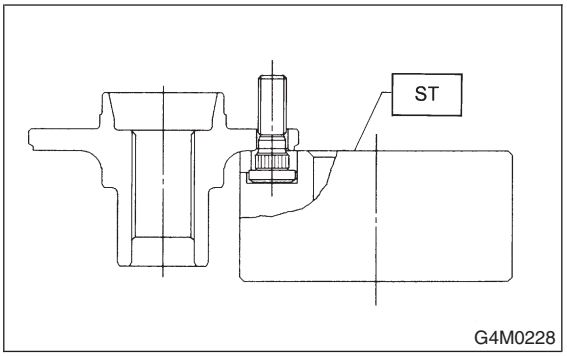
CAUTION:
- **Do not remove bearing unless damaged.**
- **Do not re-use bearing after removal.**



6) Remove tone wheel bolts and remove tone wheel from hub (only vehicle equipped with ABS).
7) Using ST, press hub bolts out.

CAUTION:
Be careful not to hammer hub bolts. This may deform hub.

ST 927080000 HUB STAND



C: INSPECTION

Check the removed parts for wear and damage. If defective, replace with new ones.

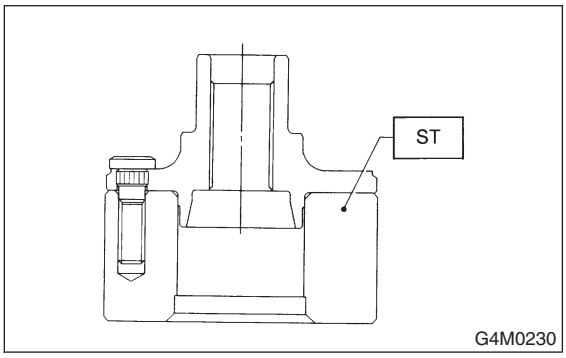
CAUTION:
● If a bearing is faulty, replace it as a bearing set.
● Be sure to replace oil seal at every overhaul.

D: ASSEMBLY

1) Using ST, press new hub bolt into place.

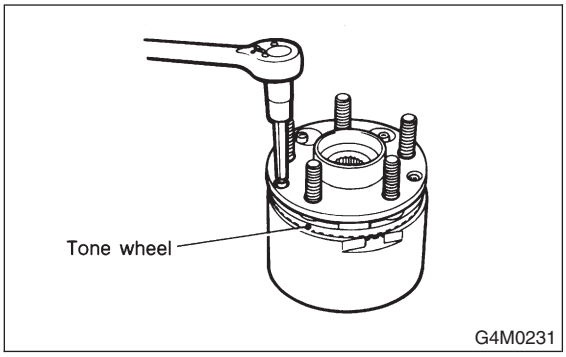
CAUTION:
● Ensure hub bolt closely contacts hub.
● Use a 12 mm (0.47 in) hole in the ST to prevent hub bolt from tilting during installation.

ST 927080000 HUB STAND



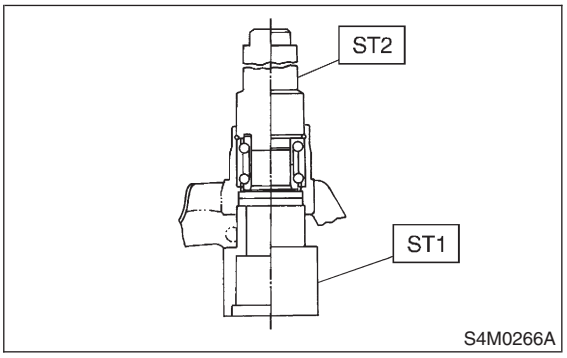
2) Remove foreign particles (dust, rust, etc.) from mating surfaces of hub and tone wheel, and install tone wheel to hub (only vehicle equipped with ABS).

CAUTION:
● Ensure tone wheel closely contacts hub.
● Be careful not to damage tone wheel teeth.



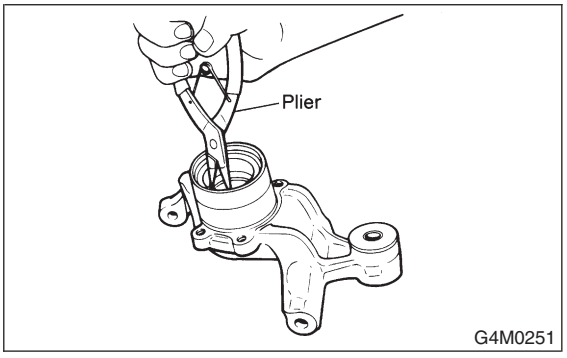
3) Clean housing interior completely. Using ST1 and ST2, press bearing into housing.
ST1 927430000 HOUSING STAND
ST2 927440000 BEARING REMOVER

CAUTION:
● Always press outer race when installing bearing.
● Be careful not to remove plastic lock from inner race when installing bearing.
● Charge bearing with new grease when outer race is not removed.

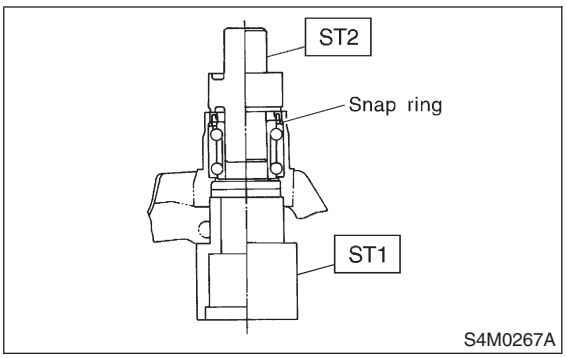


4) Install snap ring.

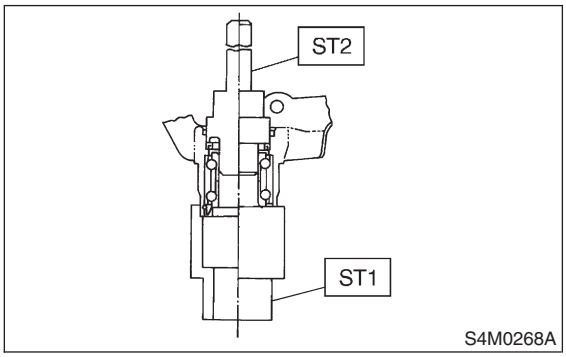
CAUTION:
Ensure snap ring fits in groove properly.



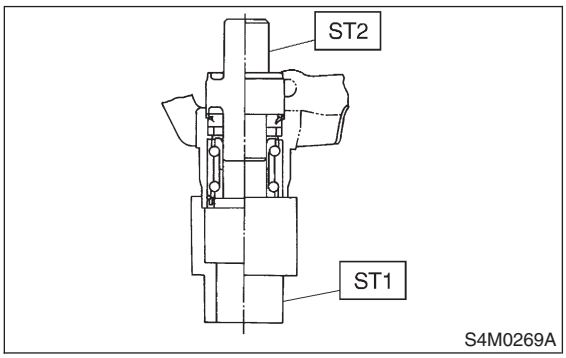
5) Using ST1 and ST2, press outer oil seal until it comes in contact with snap ring.
ST1 927430000 HOUSING STAND
ST2 927460000 OIL SEAL INSTALLER



6) Invert both ST1 and housing.
7) Using ST2, press inner oil seal into housing until it touches bottom.
ST1 927430000 HOUSING STAND
ST2 927460000 OIL SEAL INSTALLER



8) Using ST1 and ST2, press sub seal into place.
ST1 927430000 HOUSING STAND
ST2 927460000 OIL SEAL INSTALLER



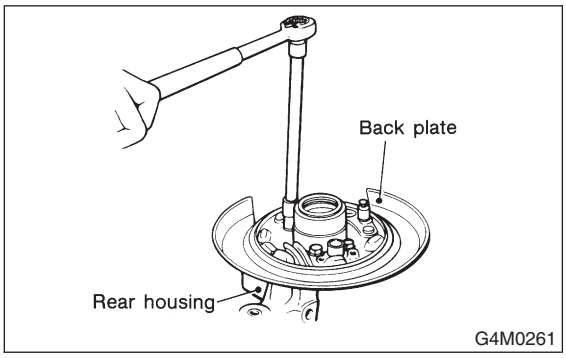
9) Apply sufficient grease to oil seal lip.

Specified grease:
SHELL 6459N

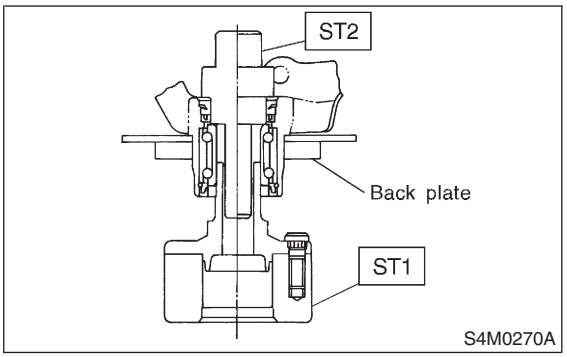
CAUTION:
• If specified grease is not available, remove bearing grease and apply Auto Rex A instead.
• Do not mix different types of grease.

10) Install back plate to rear housing.

Tightening torque:
$52^{+10}/_{-6}$ N·m ($5.3^{+1.0}/_{-0.6}$ kg-m, $38.3^{+7.2}/_{-4.3}$ ft-lb)



11) Using ST1 and ST2, press bearing into hub.
ST1 927080000 HUB STAND
ST2 927450000 HUB INSTALLER



E: INSTALLATION

1. DISC BRAKE

1) Connect rear housing assembly and strut assembly.

CAUTION:
Use a new self-locking nut.

Tightening torque:
$196^{+39}/_{-10}$ N·m ($20^{+4}/_{-1}$ kg-m, $145^{+29}/_{-7}$ ft-lb)

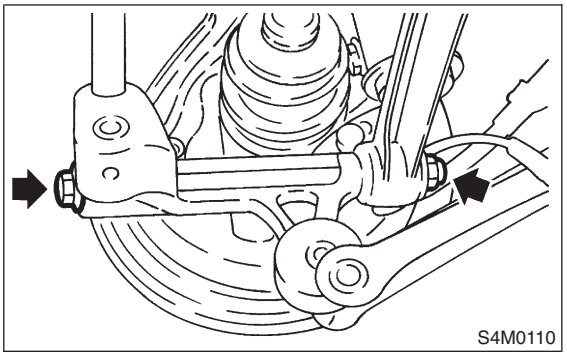
2) Fit BJ (bell joint) to rear housing splines.

CAUTION:
Be careful not to damage inner oil seal lip.

3) Connect rear housing assembly to lateral link assembly.

CAUTION:
Use a new self-locking nut.

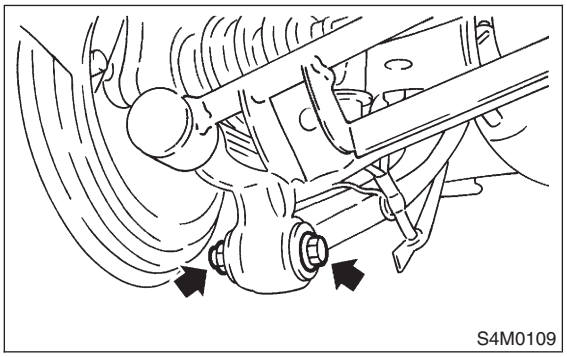
Tightening torque:
137±20 N·m (14±2 kg-m, 101±14 ft-lb)



4) Connect rear housing assembly to trailing link assembly.

CAUTION:
Use a new self-locking nut.

Tightening torque:
113±15 N·m (11.5±1.5 kg-m, 83±11 ft-lb)


S4M0109

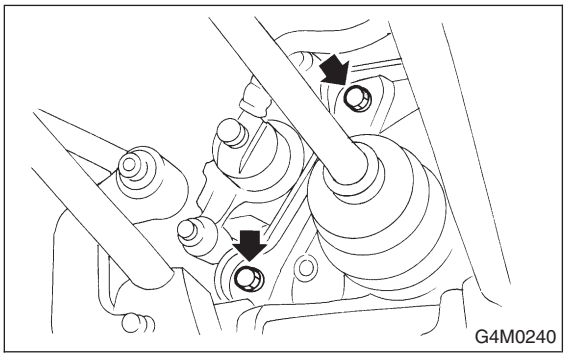
5) Connect rear stabilizer to rear lateral link.

CAUTION:
Use a new self-locking nut.

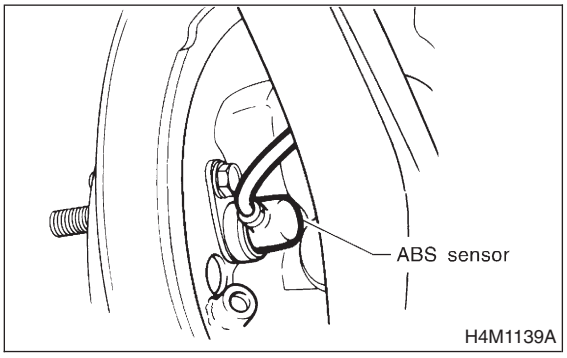
Tightening torque:
44±6 N·m (4.5±0.6 kg-m, 32.5±4.3 ft-lb)

6) Connect parking brake cable to parking brake.
7) Install disc rotor on rear housing assembly.
8) Install disc brake caliper on back plate.

Tightening torque:
52^{+10}_{-6} N·m ($5.3^{+1.0}_{-0.6}$ kg-m, $38.3^{+7.2}_{-4.3}$ ft-lb)


G4M0240

9) Install rear ABS sensor to back plate (only vehicle equipped with ABS).



H4M1139A

10) Bleed air from brake system. <Ref. to 4-4 [W10B0].>
11) Adjust parking brake lever stroke by turning adjuster.
12) Move brake lever back to apply brakes. While depressing brake pedal, tighten axle nut using a socket wrench. Lock axle nut after tightening.

Tightening torque:
186±20 N·m (19±2 kg-m, 137±14 ft-lb)

CAUTION:
- **Use a new axle nut.**
- **Always tighten axle nut before installing wheel on vehicle. If wheel is installed and comes in contact with ground when axle nut is loose, wheel bearings may be damaged.**
- **Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.**

13) Install wheel and tighten wheel nuts to specified torque.

Tightening torque:
88±10 N·m (9±1 kg-m, 65±7 ft-lb)

2. DRUM BRAKE

1) Connect rear housing assembly and strut assembly.

CAUTION:
Use a new self-locking nut.

Tightening torque:
196^{+39}_{-10} N·m (20^{+4}_{-1} kg-m, 145^{+29}_{-7} ft-lb)

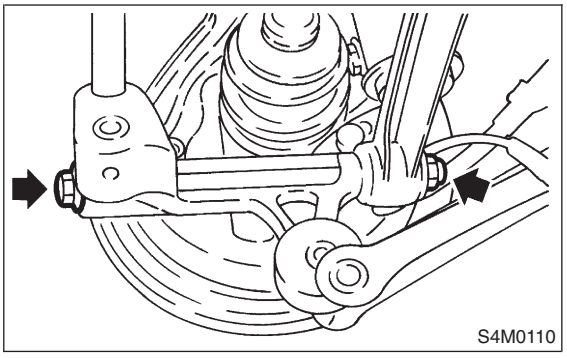
2) Fit BJ (bell joint) to rear housing splines.

CAUTION:
Be careful not to damage inner oil seal lip.

3) Connect rear housing assembly to lateral link assembly.

CAUTION:
Use a new self-locking nut.

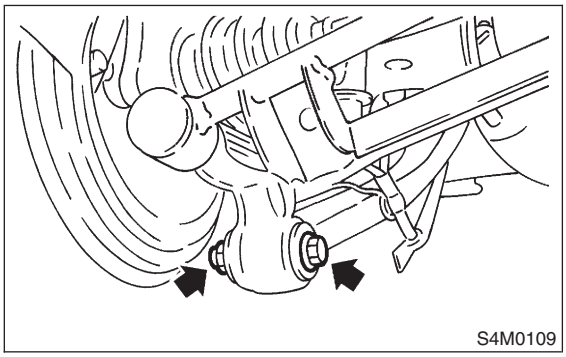
Tightening torque:
137±20 N·m (14±2 kg-m, 101±14 ft-lb)


S4M0110

4) Connect rear housing assembly to trailing link assembly.

CAUTION:
Use a new self-locking nut.

Tightening torque:
113±15 N·m (11.5±1.5 kg-m, 83±11 ft-lb)

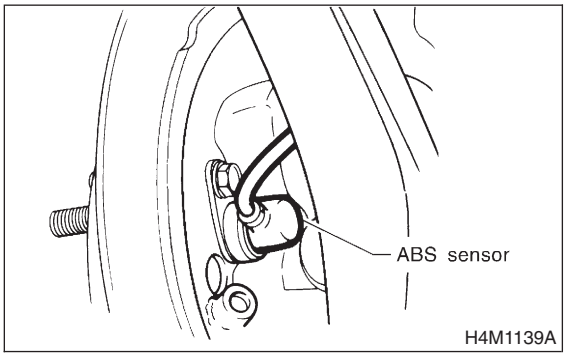

S4M0109

5) Connect rear stabilizer to rear lateral link.

CAUTION:
Use a new self-locking nut.

Tightening torque:
44±6 N·m (4.5±0.6 kg-m, 32.5±4.3 ft-lb)

6) Connect parking brake cable to parking brake.
7) Clean brake pipe connection. Using a flare-nut wrench, connect brake pipe to wheel cylinder.
8) Connect rear ABS sensor to back plate (only vehicle equipped with ABS).



H4M1139A

9) Connect parking brake cable to lever.
10) Install brake drum on rear housing assembly.
11) Bleed air from brake system. <Ref. to 4-4 [W10B0].>
12) Adjust parking brake lever stroke by turning adjuster.
13) Move brake lever back to apply brakes. While depressing brake pedal, tighten axle nut using a socket wrench. Lock axle nut after tightening.

Tightening torque:
186±20 N·m (19±2 kg-m, 137±14 ft-lb)

CAUTION:
• Use a new axle nut.
• Always tighten axle nut before installing wheel on vehicle. If wheel is installed and comes in contact with ground when axle nut is loose, wheel bearings may be damaged.
• Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

14) Install wheel and tighten wheel nuts to specified torque.

Tightening torque:
88±10 N·m (9±1 kg-m, 65±7 ft-lb)

3. Front and Rear Drive Shafts

A: REMOVAL

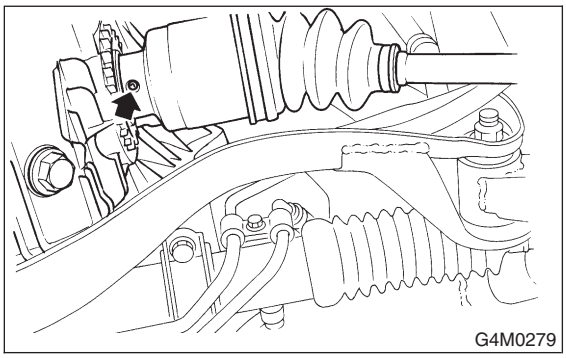
1. FRONT DRIVE SHAFT

1) Disconnect ground cable from battery.
2) Jack-up vehicle, support it with safety stands (rigid racks), and remove front wheel cap and wheels.
3) Unlock axle nut.
4) While depressing brake pedal, remove axle nut using a socket wrench.

CAUTION:
Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

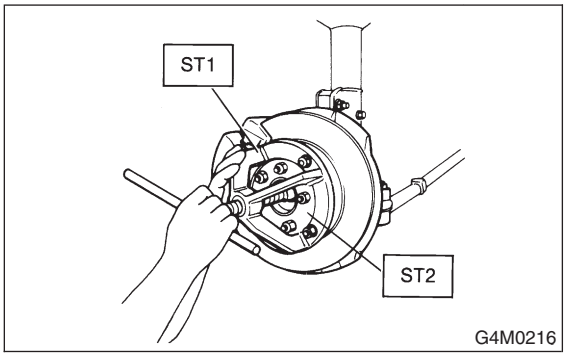
5) Disconnect stabilizer link from transverse link.
6) Disconnect transverse link from housing.
7) Remove spring pin which secures transmission spindle to SFJ.

CAUTION:
Use a new spring pin.


G4M0279

8) Remove front drive shaft assembly. If it is hard to remove, use ST1 and ST2.
ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

CAUTION:
• Be careful not to damage oil seal lip when removing front drive shaft.
• When front drive shaft is to be replaced, also replace inner oil seal.



G4M0216

2. REAR DRIVE SHAFT

1) Disconnect ground cable from battery.
2) Lift-up vehicle, and remove rear wheel cap and wheels.

CAUTION:
Be sure to loosen and retighten axle nut after removing wheel from vehicle. Failure to follow this rule may damage wheel bearings.

3) Unlock axle nut.
4) Loosen axle nut using a socket wrench.

CAUTION:
Do not remove axle nut.

5) Remove ABS sensor clamps and parking brake cable bracket.
6) Remove bolts which secure lateral link assembly to rear housing.

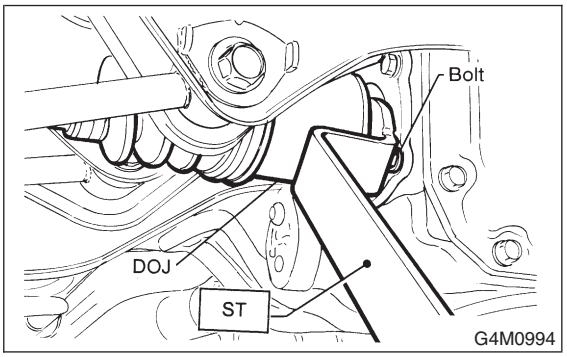
CAUTION:
Discard old self-locking nut. Replace with a new one.

7) Remove bolts which secure trailing link assembly to rear housing.

CAUTION:
Discard old self-locking nut. Replace with a new one.

8) Remove DOJ from rear differential using ST.
ST 28099PA100 DRIVE SHAFT REMOVER

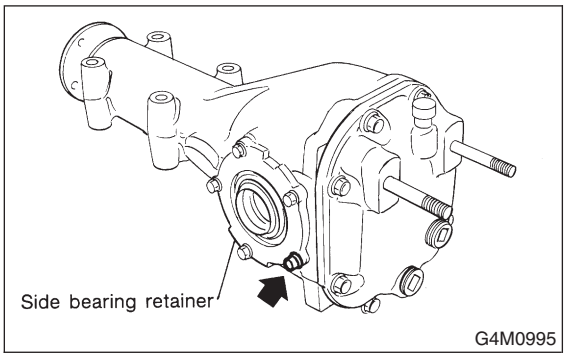
CAUTION:
Do not remove circlip attached to inside of differential.



G4M0994

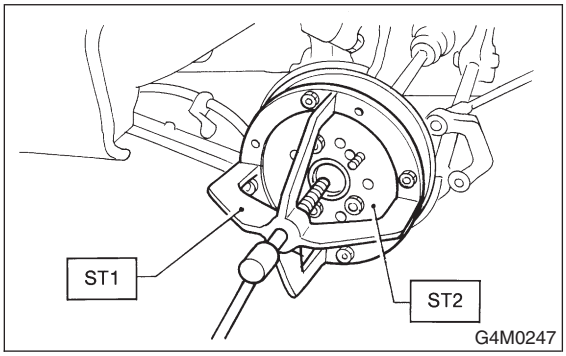
CAUTION:
Be careful not to damage side bearing retainer. Always use bolt as shown in figure, as supporting point for ST during removal.

ST 28099PA100 DRIVE SHAFT REMOVER



9) Remove axle nut and drive shaft. If it is hard to remove, use ST1 and ST2.
ST1 926470000 AXLE SHAFT PULLER
ST2 927140000 PLATE

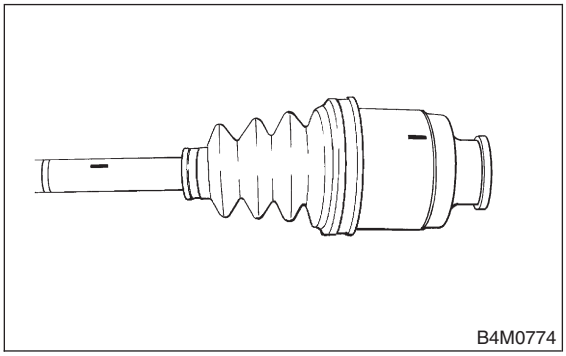
CAUTION:
• Be careful not to damage oil seal lip when removing rear drive shaft.
• When rear drive shaft is to be replaced, also replace inner oil seal with a new one.



B: DISASSEMBLY

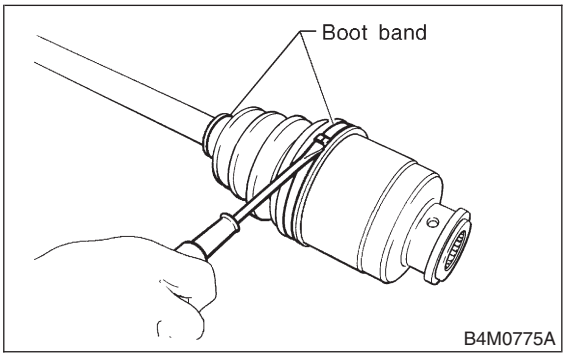
1. FRONT DRIVE SHAFT

1) Place alignment marks on shaft and outer race.

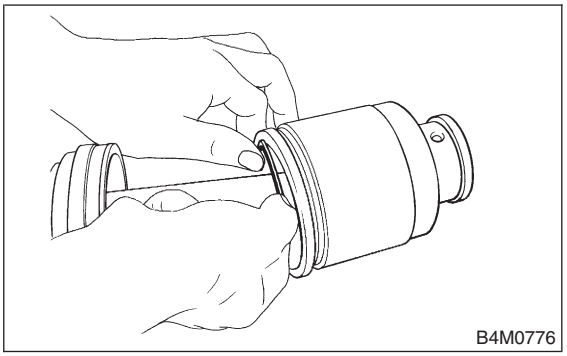


2) Remove SFJ boot band and boot.

CAUTION:
Be careful not to damage boot.



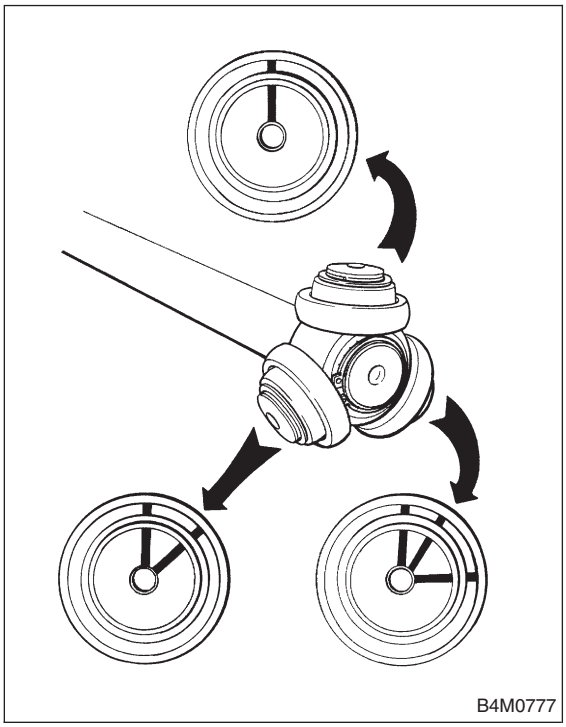
3) Remove circlip from SFJ outer race using screwdriver.



4) Remove SFJ outer race from shaft assembly.
5) Wipe off grease.

CAUTION:
The grease is a special grease. Do not confuse with other greases.

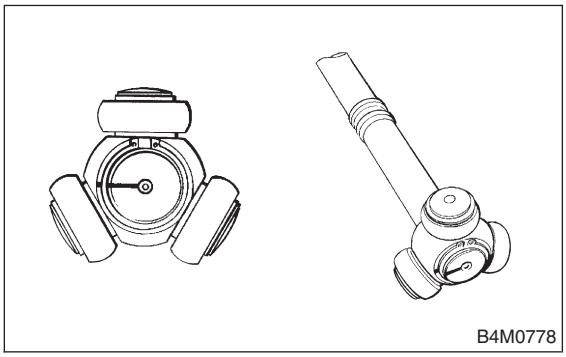
6) Place alignment mark on free ring and trunnion.


B4M0777

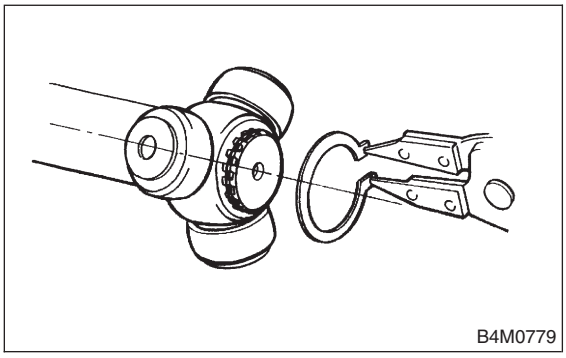
7) Remove free ring from trunnion.

CAUTION:
Be careful with the free ring position.

8) Place alignment mark on trunnion and shaft.


B4M0778

9) Remove snap ring and trunnion.

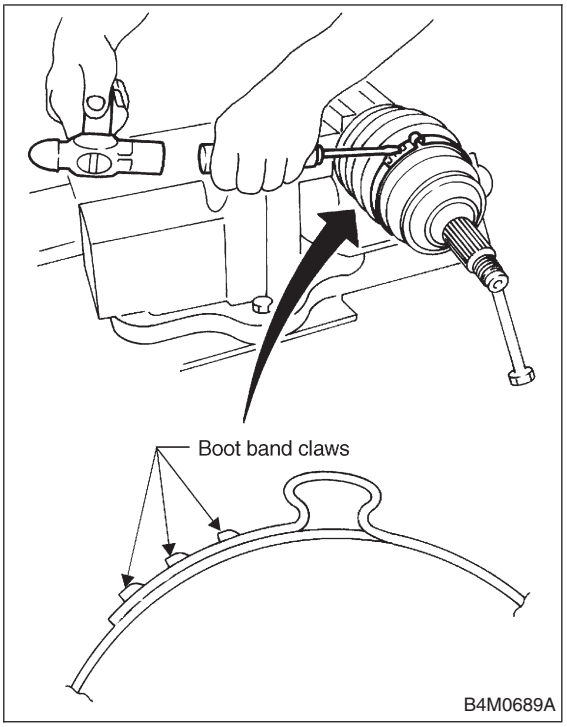

B4M0779

CAUTION:
Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

10) Remove SFJ boot.
11) Place drive shaft in a vise between wooden blocks.

CAUTION:
Do not place drive shaft directly in the vise; use wooden block.

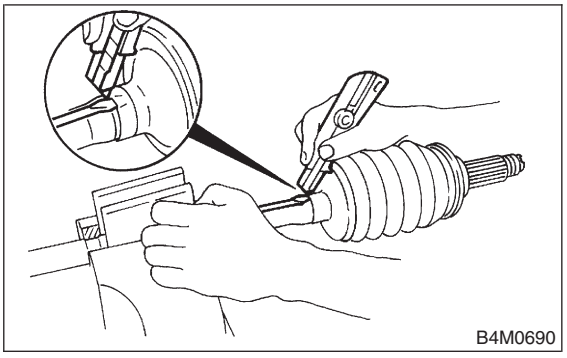
12) Raise boot band claws by means of screwdriver and hammer.



B4M0689A

13) Cut and remove the boot.

CAUTION:
The boot must be replaced with a new one whenever it is removed.

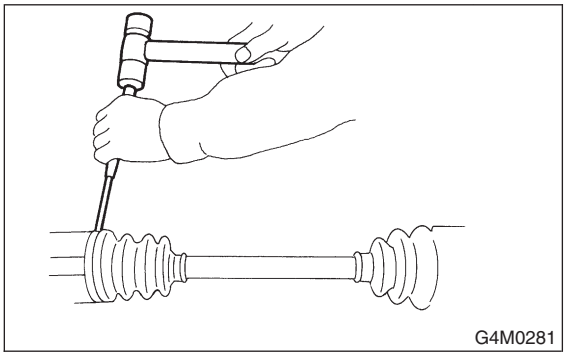

B4M0690

14) Thus, disassembly of axle is completed, but BJ cannot be disassembled.

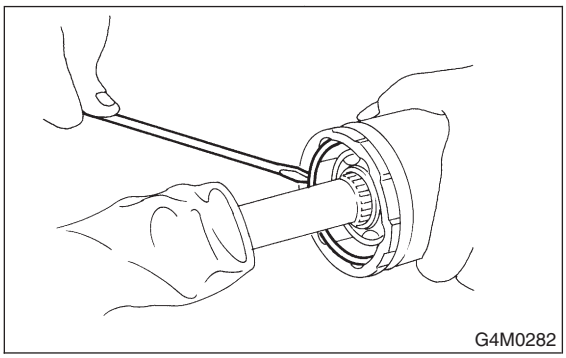
2. REAR DRIVE SHAFT

1) Straighten bent claw of larger end of DOJ boot.

2) Loosen band by means of screwdriver or pliers with care of not damaging boot.



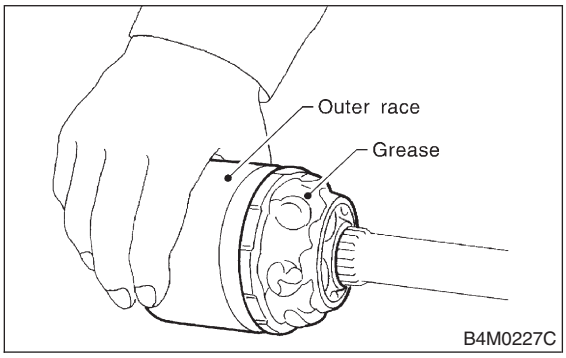
3) Remove boot band on the small end of DOJ boot in the same manner.
4) Remove the larger end of DOJ boot from DOJ outer race.
5) Pry and remove round circlip located at the neck of DOJ outer race with a screwdriver.



6) Take out DOJ outer race from shaft assembly.
7) Wipe off grease and take out balls.

CAUTION:
The grease is a special grease (grease for constant velocity joint). Do not confuse with other greases.

NOTE:
Disassemble exercising care not to lose balls (6 pcs).



8) To remove the cage from the inner race, turn the cage by a half pitch to the track groove of the inner race and shift the cage.
9) Remove snap ring, which fixes inner race to shaft, by using pliers.
10) Take out DOJ inner race.
11) Take off DOJ cage from shaft and remove DOJ boot.

CAUTION:
Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

12) Remove BJ boot in the same procedure as DOJ boot.
13) Thus, disassembly of axle is completed, but BJ is unable to be disassembled.

C: INSPECTION

Check the removed parts for damage, wear, corrosion etc. If faulty, repair or replace.
1) DOJ (Double Offset Joint)
Check seizure, corrosion, damage, wear and excessive play.
2) SFJ (Shudder-less Freering tripod Joint)
Check seizure, corrosion, damage and excessive play.
3) Shaft
Check excessive bending, twisting, damage and wear.
4) BJ (Bell Joint)
Check seizure, corrosion, damage and excessive play.
5) Boot
Check for wear, warping, breakage or scratches.
6) Grease
Check for discoloration or fluidity.

D: ASSEMBLY

1. FRONT DRIVE SHAFT

CAUTION:
Use specified grease.

BJ side:
NTG2218 (Part No. 28093AA000)

SFJ side:
SSG6003 (Part No. 28093TA000)

1) Place BJ boot and small boot band on BJ side of shaft.

CAUTION:
Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

2) Place drive shaft in a vise.

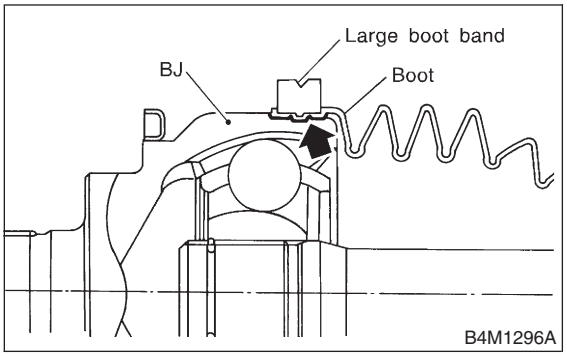
CAUTION:
Do not place drive shaft directly in the vise; use wooden blocks.

3) Apply a coat of specified grease [60 to 70 g (2.12 to 2.47 oz)] to BJ.

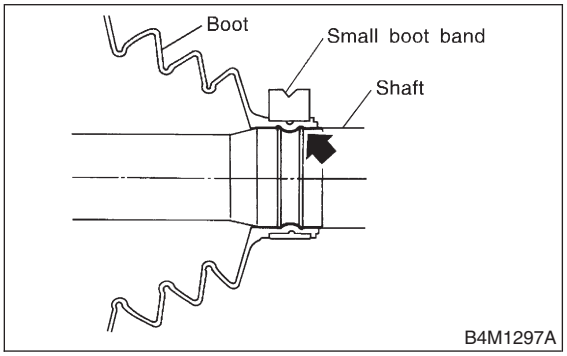
4) Apply an even coat of specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to shaft.

NOTE:
The inside of the larger end of BJ boot and the boot groove shall be cleaned so as to be free from grease and other substances.

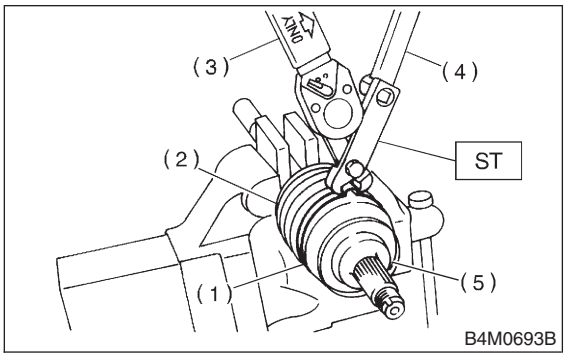
5) Install boot projecting portion to BJ groove.



6) Set large boot band in place.
7) Install boot projecting portion to shaft groove.



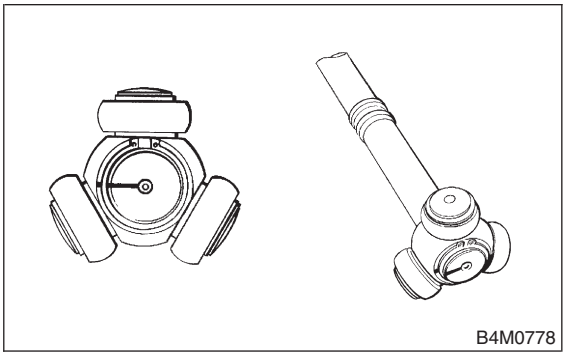
8) Tighten boot bands using ST, torque wrench and socket flex handle.
ST 28099AC000 BOOT BAND PLIER



(1) Large boot band
(2) Boot
(3) Torque wrench
(4) Socket flex handle
(5) BJ

Tightening torque:
Large boot band
157 N·m (16.0 kg-m, 116 ft-lb) or more
Small boot band
133 N·m (13.6 kg-m, 98 ft-lb) or more

9) Place SFJ boot at the center of shaft.
10) Align alignment marks and install trunnion on shaft.

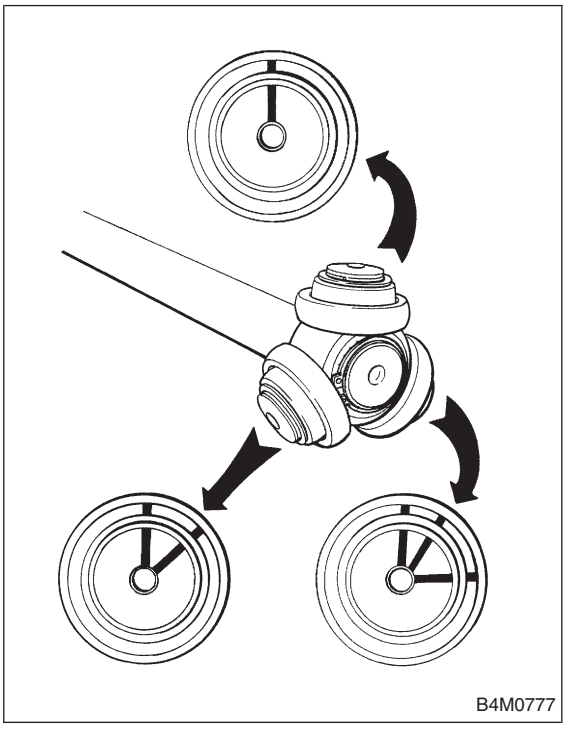


11) Install snap ring to shaft.

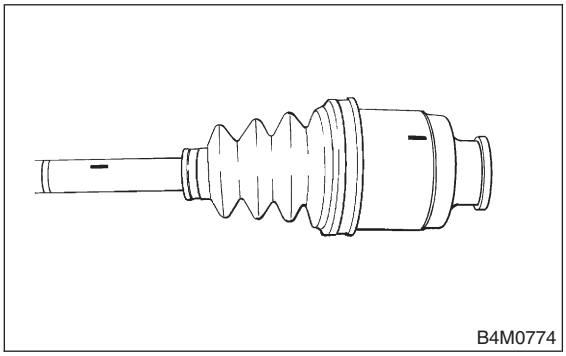
CAUTION:
Confirm that the snap ring is completely fitted in the shaft groove.

12) Fill 100 to 110 g (3.53 to 3.88 oz) of specified grease into the interior of SFJ outer race.
13) Apply a coat of specified grease to free ring and trunnion.
14) Align alignment marks on free ring and trunnion and install free ring.

CAUTION:
Be careful with the free ring position.



15) Align alignment marks on shaft and outer race, and install outer race.



16) Install circlip in the groove on SFJ outer race.

CAUTION:
Pull the shaft lightly and assure that the circlip is completely fitted in the groove.

17) Apply an even coat of the specified grease 30 to 40 g (1.06 to 1.41 oz) to the entire inner surface of boot.
18) Install SFJ boot taking care not to twist it.

CAUTION:
• The inside of the larger end of SFJ boot and the boot groove shall be cleaned so as to be free from grease and other substances.
• When installing SFJ boot, position outer race of SFJ at center of its travel.

19) Put a band through the clip and wind twice in alignment with band groove of boot.

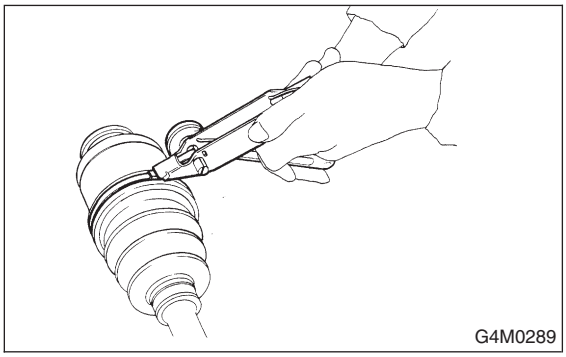
CAUTION:
Use a new band.

20) Pinch the end of band with pliers. Hold the clip and tighten securely.

NOTE:
When tightening boot, exercise care so that the air within the boot is appropriate.

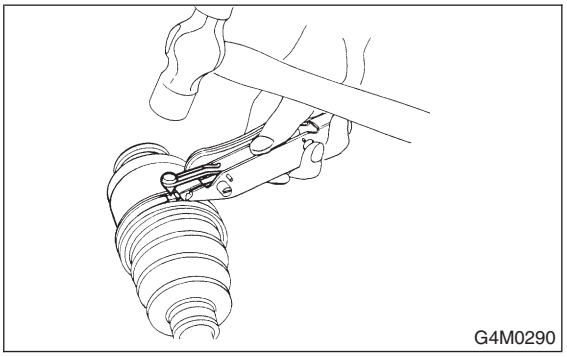
21) Tighten band by using ST.
ST 925091000 BAND TIGHTENING TOOL

NOTE:
Tighten band until it cannot be moved by hand.



22) Tap on the clip with the punch provided at the end of ST.
ST 925091000 BAND TIGHTENING TOOL

CAUTION:
Tap to an extent that the boot underneath is not damaged.



23) Cut off band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

CAUTION:
Be careful so that the end of the band is in close contact with clip.

24) Fix up boot on BJ in the same manner.

NOTE:
Extend and retract SFJ to provide equal grease coating.

2. REAR DRIVE SHAFT

CAUTION:
Use specified grease.

BJ side:
Molylex No. 2 (Part No. 723223010) or Sunlight TB2-A

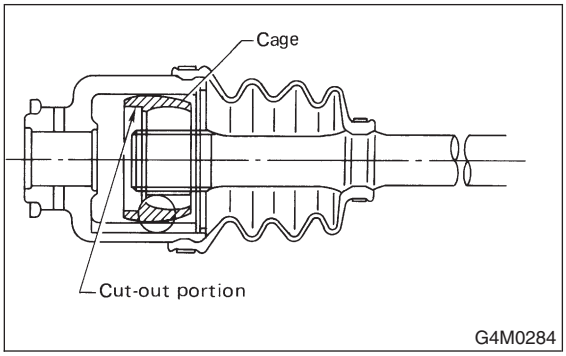
DOJ side:
VU-3A702 (Yellow) (Part No. 23223GA050)

1) Install BJ boot in specified position, and fill it with 60 to 70 g (2.12 to 2.47 oz) of specified grease.
2) Place DOJ boot at the center of shaft.

CAUTION:
Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.

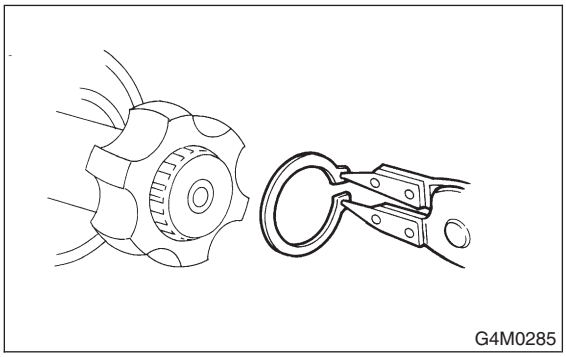
3) Insert DOJ cage onto shaft.

NOTE:
Insert the cage with the cut-out portion facing the shaft end, since the cage has an orientation.



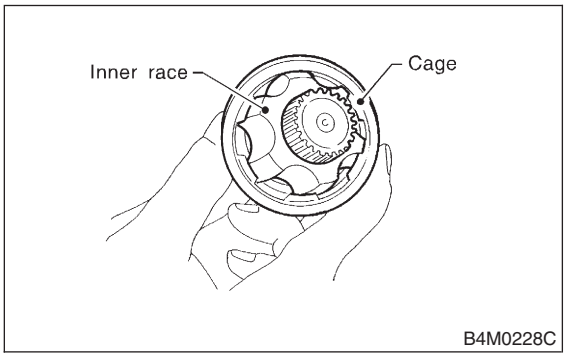
4) Install DOJ inner race on shaft and fit snap ring with pliers.

NOTE:
Confirm that the snap ring is completely fitted in the shaft groove.

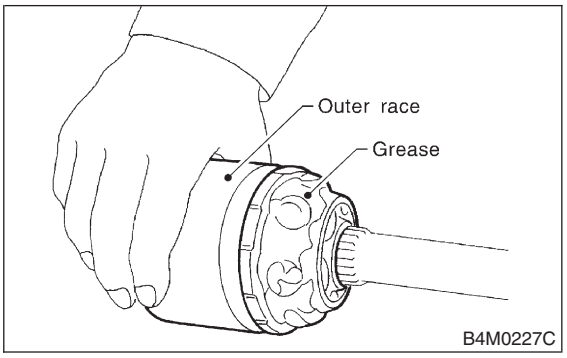


5) Install cage, which was previously fitted, to inner race fixed upon shaft.

NOTE:
Fit the cage with the protruded part aligned with the track on the inner race and then turn by a half pitch.

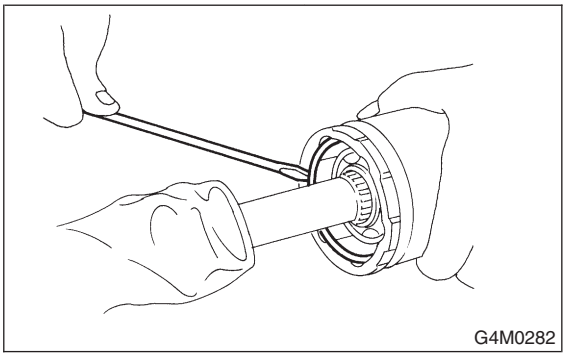


6) Fill 80 to 90 g (2.82 to 3.17 oz) of specified grease into the interior of DOJ outer race.
7) Apply a coat of specified grease to the cage pocket and six balls.
8) Insert six balls into the cage pocket.
9) Align the outer race track and ball positions and place in the part where shaft, inner race, cage and balls are previously installed, and then fit outer race.



10) Install circlip in the groove on DOJ outer race.

NOTE:
● Assure that the balls, cage and inner race are completely fitted in the outer race of DOJ.
● Exercise care not to place the matched position of circlip in the ball groove of outer race.
● Pull the shaft lightly and assure that the circlip is completely fitted in the groove.



11) Apply an even coat of the specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to shaft.
12) Install DOJ boot taking care not to twist it.

NOTE:
● The inside of the larger end of DOJ boot and the boot groove shall be cleaned so as to be free from grease and other substances.
● When installing DOJ boot, position outer race of DOJ at center of its travel.

13) Put a band through the clip and wind twice in alignment with band groove of boot.

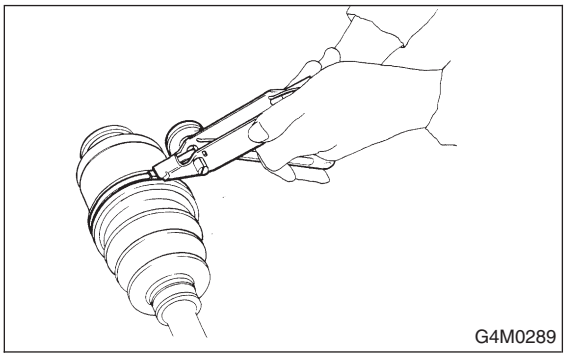
CAUTION:
Use a new band.

14) Pinch the end of band with pliers. Hold the clip and tighten securely.

NOTE:
When tightening boot, exercise care so that the air within the boot is appropriate.

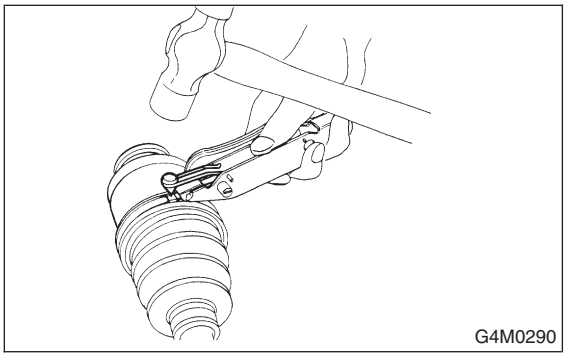
15) Tighten band by using ST.
ST 925091000 BAND TIGHTENING TOOL

NOTE:
Tighten band until it cannot be moved by hand.


G4M0289

16) Tap on the clip with the punch provided at the end of ST.
ST 925091000 BAND TIGHTENING TOOL

CAUTION:
Tap to an extent that the boot underneath is not damaged.


G4M0290

17) Cut off band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

CAUTION:
Be careful so that the end of the band is in close contact with clip.

18) Fix up boot on BJ in the same manner.

NOTE:
Extend and retract DOJ to provide equal grease coating.

E: INSTALLATION

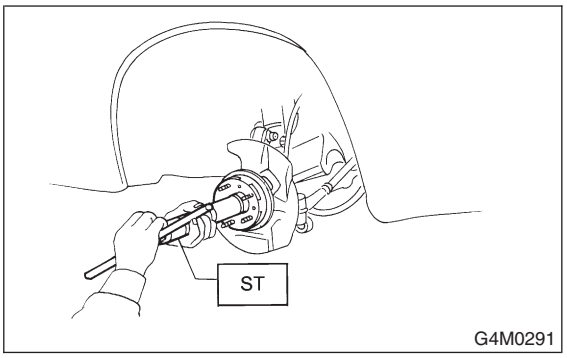
1. FRONT DRIVE SHAFT

1) Insert BJ into hub splines.

CAUTION:
Be careful not to damage inner oil seal lip.

2) Using ST1 and ST2, pull drive shaft into place.
ST1 922431000 AXLE SHAFT INSTALLER
ST2 927390000 ADAPTER

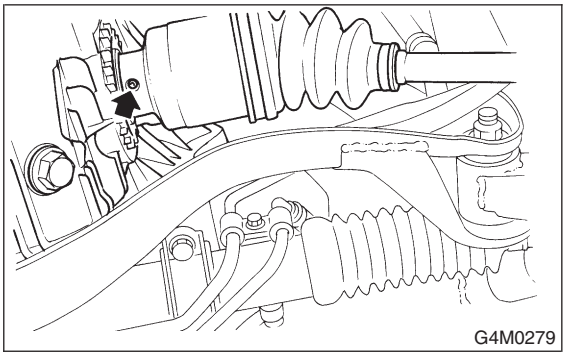
CAUTION:
Do not hammer drive shaft when installing it.



G4M0291

3) Tighten axle nut temporarily.
4) Install SFJ on transmission spindle and drive spring pin into place.

CAUTION:
Always use a new spring pin.


G4M0279

5) Connect transverse link to housing.

Tightening torque (self-locking nut):
49±10 N·m (5.0±1.0 kg-m, 36±7 ft-lb)

CAUTION:
Use a new self-locking nut.

6) Install stabilizer bracket.

7) While depressing brake pedal, tighten axle nut to the specified torque.

Tightening torque:
186±20 N·m (19±2 kg-m, 137±14 ft-lb)

CAUTION:
• Use a new axle nut.
• Always tighten axle nut before installing wheel on vehicle. If wheel is installed and comes in contact with ground when axle nut is loose, wheel bearings may be damaged.
• Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

8) After tightening axle nut, lock it securely.

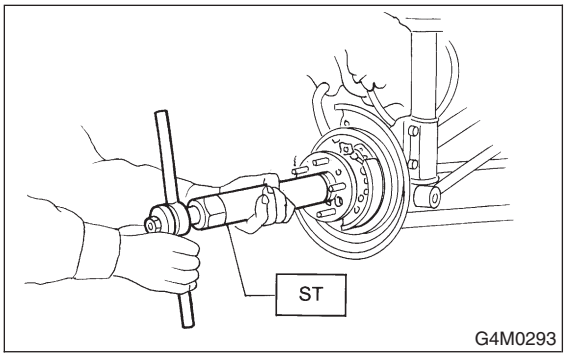
2. REAR DRIVE SHAFT

1) Insert BJ into rear housing splines.

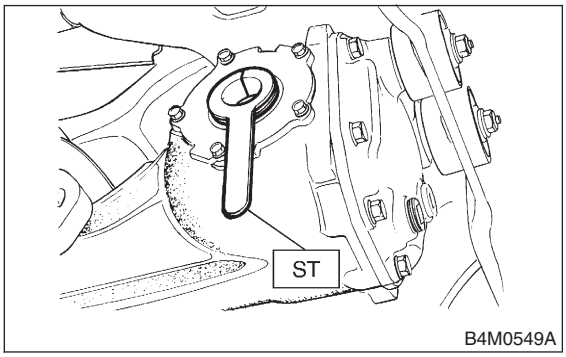
CAUTION:
Be careful not to damage inner oil seal lip.

2) Using ST1 and ST2, pull drive shaft into place.
ST1 922431000 AXLE SHAFT INSTALLER
ST2 927390000 ADAPTER

CAUTION:
Do not hammer drive shaft when installing it.



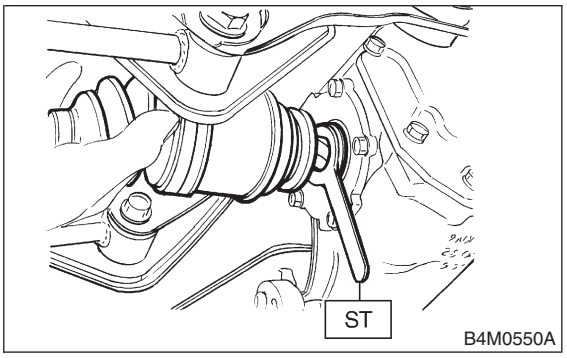
3) Tighten axle nut temporarily.
4) Using ST, install DOJ into differential.
ST 28099PA090 SIDE OIL SEAL PROTECTOR



5) Insert DOJ spline end into bore of side oil seal, and remove ST.

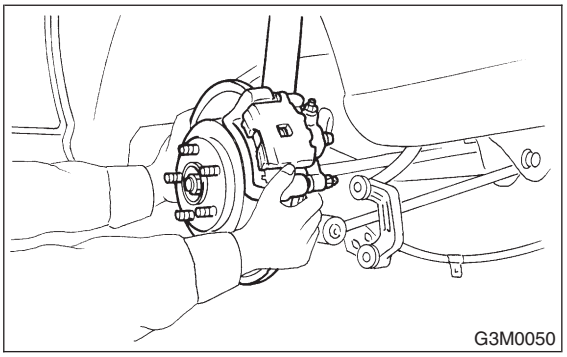
CAUTION:
Do not allow DOJ splines to damage side oil seal.

ST 28099PA090 SIDE OIL SEAL PROTECTOR



6) Align DOJ and differential splines.
7) Push housing to insert DOJ into differential.

NOTE:
Make sure DOJ is inserted properly.



8) Connect rear housing assembly to trailing link assembly, and tighten self-locking nut.

Tightening torque:
113±15 N·m (11.5±1.5 kg-m, 83±11 ft-lb)

9) Connect rear housing assembly to lateral link assembly, and tighten self-locking nut.

Tightening torque:
137±20 N·m (14±2 kg-m, 101±14 ft-lb)

10) Install stabilizer bracket.

11) While depressing brake pedal, tighten axle nut using a socket wrench.

Tightening torque:
186±20 N·m (19±2 kg-m, 137±14 ft-lb)

CAUTION:
• Use a new axle nut.
• Always tighten axle nut before installing wheel on vehicle. If wheel is installed and comes in contact with ground when axle nut is loose, wheel bearings may be damaged.
• Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage wheel bearing.

12) After tightening axle nut, lock it securely.

4. Replacement of Front BJ and SFJ Boots

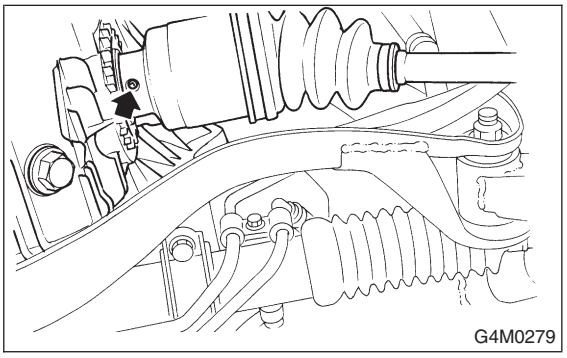
A: REMOVAL

1) Disconnect ground cable from battery.
2) Jack-up vehicle, support it with safety stands (rigid rocks), and remove front wheel cap and wheels.

NOTE:
Do not remove axle nut.

3) Remove stabilizer link.
4) Disconnect transverse link from housing.
5) Remove spring pin which secures transmission spindle to SFJ.

CAUTION:
Use a new spring pin.

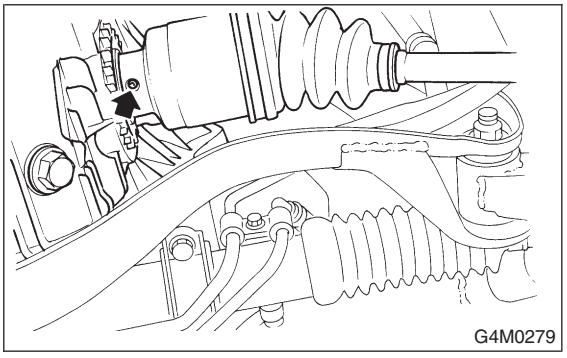


6) Remove BJ and SFJ boots from drive shaft. <Ref. to 4-2 [W3B1].>

B: INSTALLATION

1) Install BJ and SFJ boots to drive shaft. <Ref. to 4-2 [W3D1].>
2) Install SFJ on transmission spindle and drive spring pin into place.

CAUTION:
Always use a new spring pin.



3) Connect transverse link to housing.
4) Install stabilizer link.

5. Replacement of Rear DOJ and BJ Boots

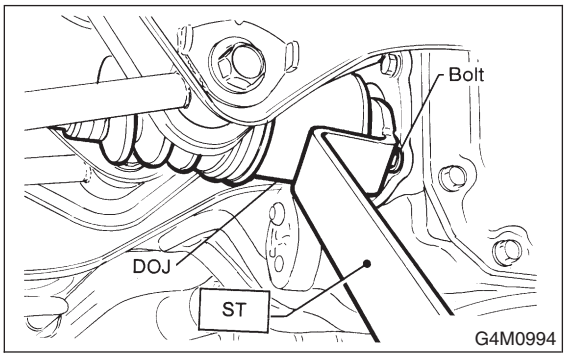
A: REMOVAL

1) Disconnect ground cable from battery.
2) Lift-up vehicle, and remove rear wheel cap and wheels.

NOTE:
Axle nut need not be removed.

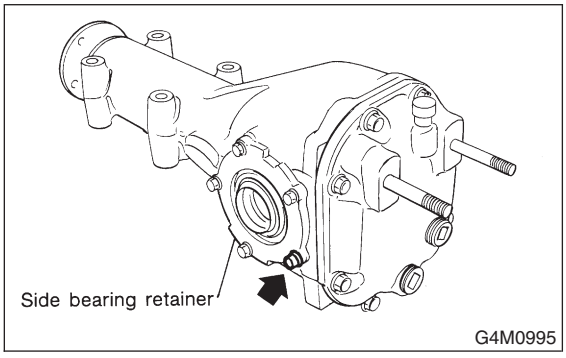
3) Remove ABS sensor clamps and parking brake cable bracket.
4) Disconnect stabilizer link from lateral link.
5) Remove bolts which secure lateral link assembly to rear housing.
6) Remove bolts which secure trailing link assembly to rear housing.
7) Remove DOJ from rear differential using ST.
ST 28099PA100 DRIVE SHAFT REMOVER

NOTE:
The side spline shaft circlip comes out together with the shaft.



CAUTION:
Be careful not to damage side bearing retainer. Always use bolt as shown in figure, as supporting point for ST during removal.

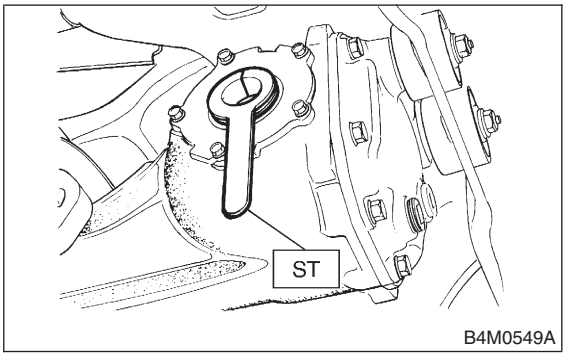
ST 28099PA100 DRIVE SHAFT REMOVER



8) Remove DOJ and BJ boots from drive shaft. <Ref. to 4-2 [W3B2].>

B: INSTALLATION

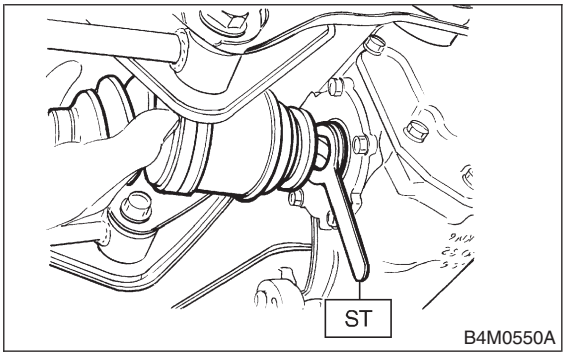
1) Install DOJ and BJ boots to drive shaft. <Ref. to 4-2 [W3D2].>
2) Using ST, install DOJ into differential.
ST 28099PA090 SIDE OIL SEAL PROTECTOR



3) Insert DOJ spline end into bore of side oil seal, and remove ST.

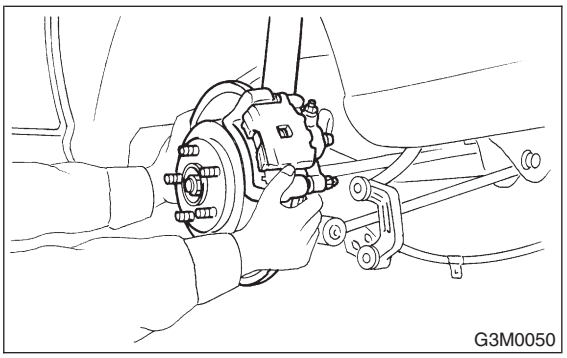
CAUTION:
Do not allow DOJ splines to damage side oil seal.

ST 28099PA090 SIDE OIL SEAL PROTECTOR



4) Align DOJ and differential splines.
5) Push housing to insert DOJ into differential.

NOTE:
Make sure DOJ is inserted properly.



CAUTION:
Discard old self-locking nut. Replace with a new one.

6) Connect rear housing assembly to trailing link assembly, and tighten self-locking nut.
7) Connect rear housing assembly to lateral link assembly, and tighten self-locking nut.
8) Connect stabilizer link to lateral link.
9) Install ABS sensor clamps and parking brake cable bracket.

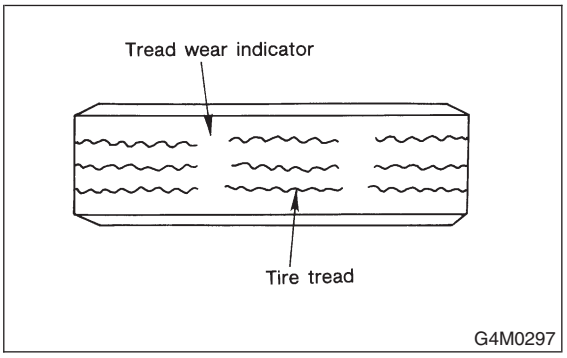
6. Steel Wheel and Tire

A: INSPECTION

1) Deformation or damage on the rim can cause air leakage. Check the rim flange for deformation, crack, or damage, and repair or replace as necessary.
2) Take stone, glass, nail etc. off the tread groove.
3) Replace tire:

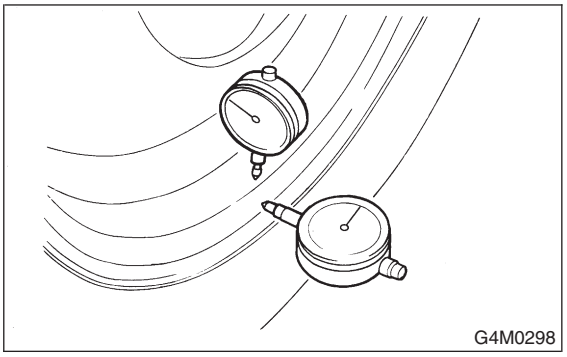
CAUTION:
● When replacing a tire, make sure to use only the same size, construction and load range as originally installed.
● Avoid mixing radial, belted bias or bias tires on the vehicle.

(1) when large crack on side wall, damage or crack on tread is found.
(2) when the “tread wear indicator” appears as a solid band across the tread.

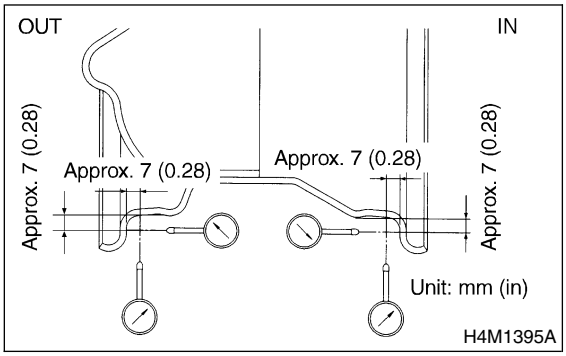


1. INSPECTION OF WHEEL RUNOUT

1) Jack-up vehicle until wheels clear the floor.
2) Slowly rotate wheel to check rim “runout” using a dial gauge.



	Axial runout limit	Radial runout limit
Steel wheel	1.5 mm (0.059 in)	
Aluminum wheel	1.0 mm (0.039 in)	



3) If rim runout exceeds specifications, remove tire from rim and check runout while attaching dial gauge to positions shown in figure.
4) If measured runout still exceeds specifications, replace the wheel.

7. Aluminum Wheel

A: INSPECTION

Inspection for aluminum wheels is basically the same as the one for steel wheels. However, check the rim flange for cracks or damage, and replace (not repair) aluminum wheel if air leakage is found.

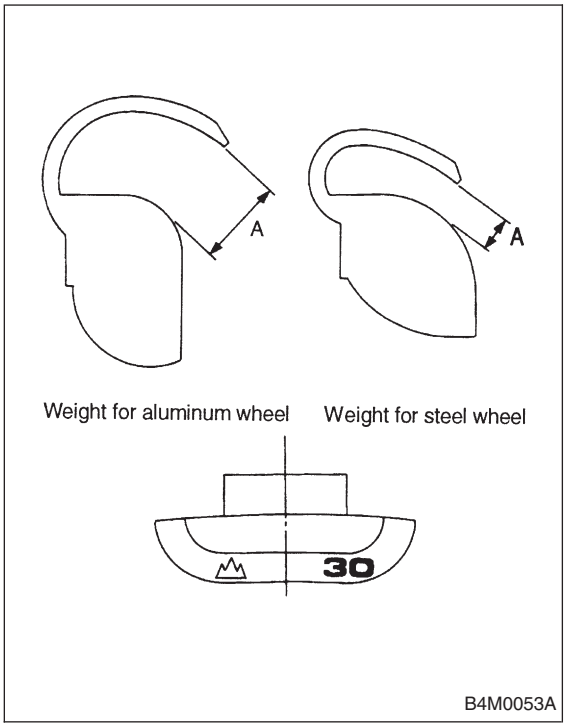
B: PRECAUTIONS

Aluminum wheels are easily scratched. To maintain their appearance and safety, do the following:
1) Do not damage aluminum wheels during removal, disassembly, installation, wheel balancing, etc. After removing aluminum wheels, place them on a rubber mat, etc.
2) While vehicle is being driven, be careful not to ride over sharp obstacles or allow aluminum wheels to contact the shoulder of the road.
3) When installing tire chain, be sure to install it properly not to have a slack; otherwise it may hit wheel while driving.
4) When washing aluminum wheel, use neutral synthetic detergent and water. Avoid using the cleanser including abrasive, hard brushes or an automatic car washer.

8. Wheel Balancing

1) Proper wheel balance may be lost if the tire is repaired or if it wears. Check the tire for dynamic balance, and repair as necessary.
2) To check for dynamic balance, use a dynamic balancer. Drive in the balance weight on both the top and rear sides of the rim.
3) Some types of balancer can cause damage to the wheel. Use an appropriate balancer when adjusting the wheel balance.
4) Use genuine balance weights.

CAUTION:
• 55 g (1.94 oz) weight used with aluminum wheel is not available.
• Balance weights are available for use with any of 14- to 16-inch wheels.



Service limit: A
Weight for steel wheel;
1.8 — 2.0 mm (0.071 — 0.079 in)
Weight for aluminum wheel;
4.6 — 5.4 mm (0.181 — 0.213 in)

9. Installation of Wheel Assembly to Vehicle

1) Attach the wheel to the hub by aligning the wheel bolt hole with the hub bolt.
2) Temporarily attach the wheel nuts to the hub bolts. (In the case of aluminum wheel, use SUBARU genuine wheel nut for aluminum wheel.)
3) Manually tighten the nuts making sure the wheel hub hole is aligned correctly to the guide portion of hub.
4) Tighten the wheel nuts in a diagonal selection to the specified torque. Use a wheel nut wrench.

Wheel nut tightening torque:
88±10 N·m (9±1 kg-m, 65±7 ft-lb)

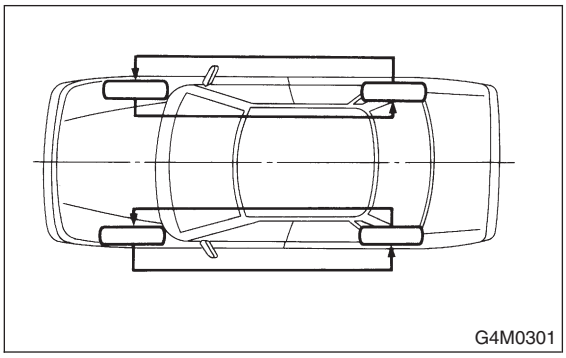
CAUTION:
• Tighten the wheel nuts in two or three steps by gradually increasing the torque and working diagonally, until the specified torque is reached. For drum brake models, excess tightening of wheel nuts may cause wheels to "judder".
• Do not depress the wrench with a foot; Always use both hands when tightening.
• Make sure the bolt, nut and the nut seating surface of the wheel are free from oils.

5) If a wheel is removed for replacement or for repair of a puncture, retighten the wheel nuts to the specified torque after running 1,000 km (600 miles).

10. Tire Rotation

If tires are maintained at the same positions for a long period of time, uneven wear results. Therefore, they should be periodically rotated. This lengthens service life of tires.

CAUTION:
When rotating tires, replace unevenly worn or damaged tires with new ones.



STEERING SYSTEM 4-3

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1. Steering System

A: SPECIFICATIONS

Whole system	Minimum turning radius		m (ft)	5.4 (17.7)
	Steering angle (Inside-Outside)			34.4°±1.5° — 30.2°±1.5°
	Steering wheel diameter		mm (in)	385 (15.16)
	Overall gear ratio (Turns, lock to lock)			19.0 (3.4)
Gearbox	Type			Rack and pinion, Integral
	Backlash			0 (Automatically adjustable)
	Valve (Power steering system)			Rotary valve
Pump (Power steering system)	Type			Vane pump
	Oil tank			Installed on pump
	Output		cm^3 (cu in)/rev.	7.2 — 0.6 (0.439 — 0.037)
	Relief pressure		kPa (kg/cm^2, psi)	7,355 (75, 1,067)
	Hydraulic fluid control			Drooping in response to increased engine revolutions
	Hydraulic fluid		ℓ (US qt, Imp qt)	1,000 rpm: 7 (7.4, 6.2) 3,000 rpm: 5 (5.3, 4.4)
	Range of revolution		rpm	500 — 7,500
	Revolving direction			Clockwise
Working fluid (Power steering system)	Name			ATF DEXRON IIE or III
	Capacity	Oil tank	ℓ (US qt, Imp qt)	0.3 (0.3, 0.3)
		Total	ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)

B: SERVICE DATA

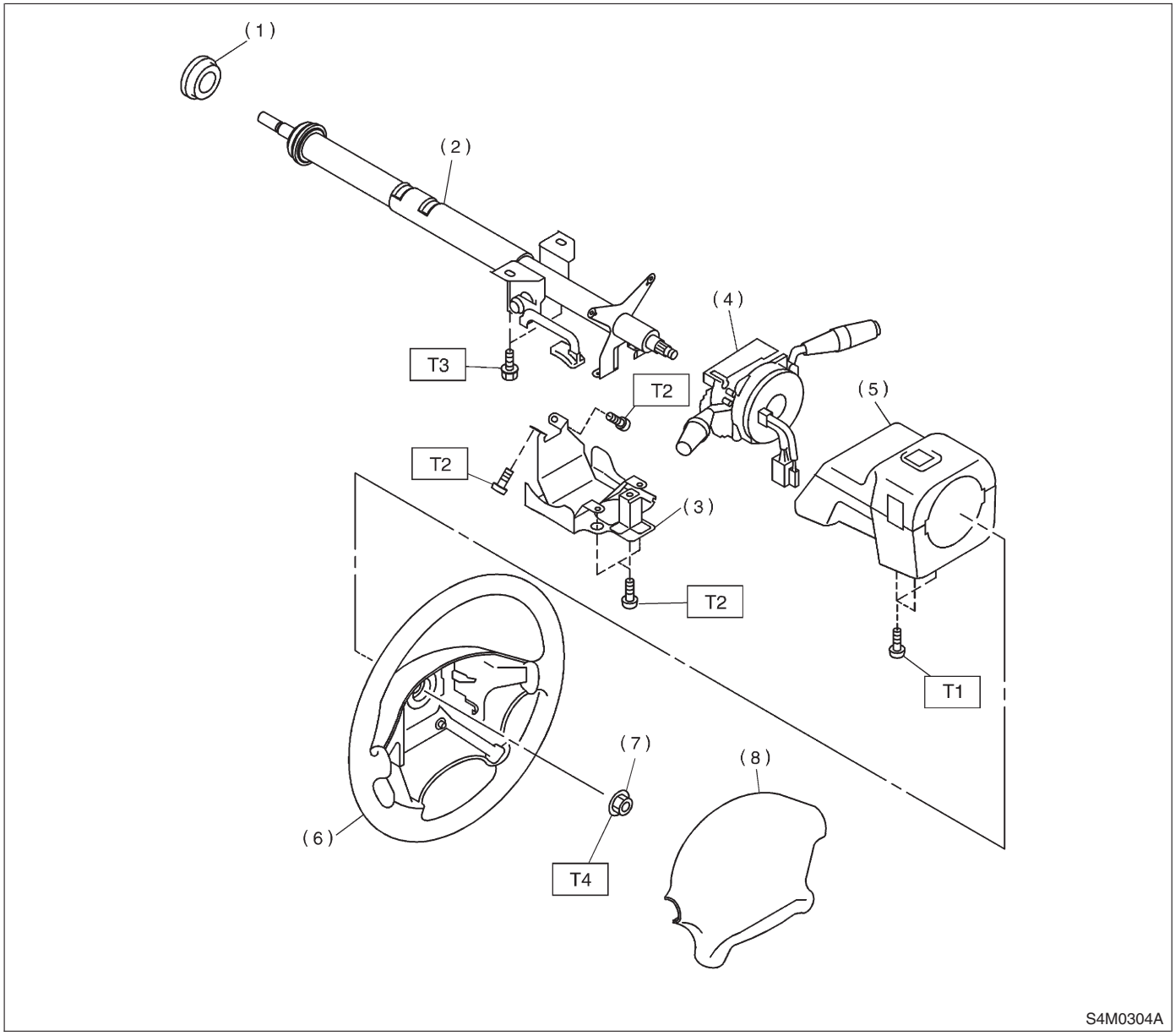
Steering wheel	Free play		mm (in)	17 (0.67)
Turning angle	Inner tire & wheel			34.4°±1.5°
	Outer tire & wheel			30.2°±1.5°
Steering shaft	Clearance between steering wheel and column cover		mm (in)	3.0 (0.118)
Steering gearbox (Power steering system)	Sliding resistance		N (kg, lb)	304.0 (31.0, 68.4) or less
	Rack shaft play in radial direction	Right-turn steering	mm (in)	0.15 (0.0059) or less
		Left-turn steering	mm (in)	Horizontal movement: 0.3 (0.012) or less Vertical movement: 0.15 (0.0059) or less
	Input shaft play	In radial direction	mm (in)	0.18 (0.0071) or less
		In axial direction	mm (in)	0.1 (0.004) or less
	Turning resistance		N (kg, lb)	Within 30 mm (1.18 in) from rack center in straight ahead position: Less than 11.18 (1.14, 2.51) Maximum allowable value: 12.7 (1.3, 2.9)
Oil pump (Power steering system)	Pulley shaft	Radial play	mm (in)	0.4 (0.016) or less
		Axial play	mm (in)	0.9 (0.035) or less
	Pulley	Ditch deflection	mm (in)	1.0 (0.039) or less
		Resistance to rotation	N (kg, lb)	9.22 (0.94, 2.07) or less
	Regular pressure		kPa (kg/cm^2, psi)	981 (10, 142) or less
	Relief pressure		kPa (kg/cm^2, psi)	7,355 (75, 1,067)
Steering wheel effort (Power steering system)	At standstill with engine idling on a concrete road		N (kg, lb)	29.4 (3.0, 6.6) or less
	At standstill with engine stalled on a concrete road		N (kg, lb)	294.2 (30, 66.2) or less

C: RECOMMENDED POWER STEERING FLUID

Recommended power steering fluid	Manufacturer
ATF DEXRON IIE or III	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

MEMO:

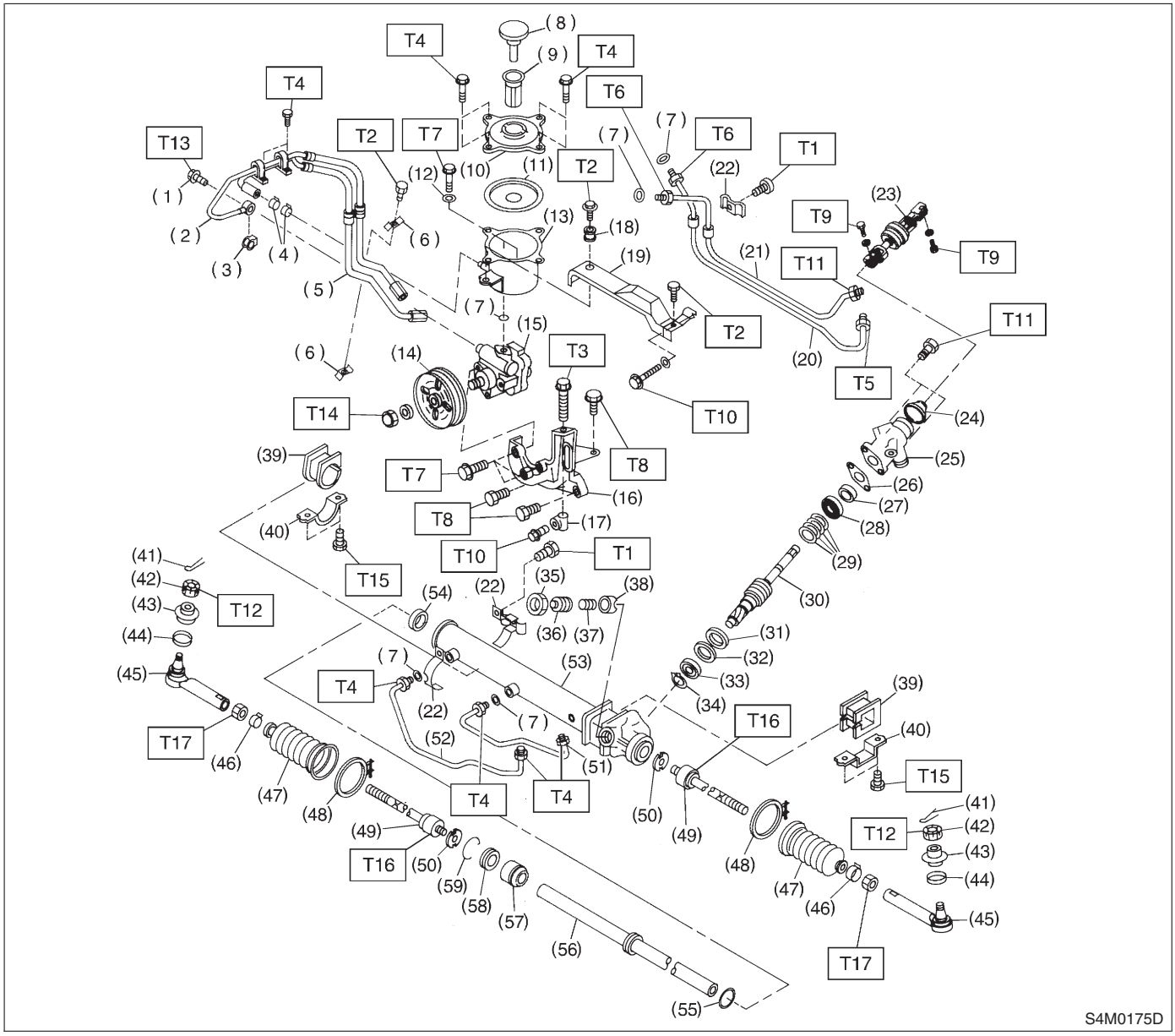
1. Steering Wheel and Column



(1) Bushing
(2) Steering shaft
(3) Knee protector
(4) Steering roll connector
(5) Column cover
(6) Steering wheel
(7) Flange nut
(8) Airbag module

Tightening torque: N·m (kg-m, ft-lb)
T1: 1.2±0.2 (0.12±0.02, 0.9±0.1)
T2: 3.4±1.0 (0.35±0.1, 2.5±0.7)
T3: 25±5 (2.5±0.5, 18.1±3.6)
T4: 44±5 (4.5±0.5, 32.5±3.6)

2. Power Steering System



(1) Eye bolt
(2) Pipe C
(3) Gasket
(4) Clip
(5) Pipe D
(6) Clamp E
(7) O-ring
(8) Cap
(9) Strainer
(10) Shell upper
(11) Buffle
(12) Seal washer
(13) Shell lower
(14) Pulley
(15) Oil pump
(16) Bracket
(17) Belt tension nut
(18) Bush
(19) Belt cover
(20) Pipe E
(21) Pipe F
(22) Clamp plate
(23) Universal joint
(24) Dust cover
(25) Valve housing
(26) Gasket
(27) Oil seal
(28) Special bearing
(29) Seal ring
(30) Pinion and valve ASSY
(31) Oil seal
(32) Back-up washer
(33) Ball bearing
(34) Snap ring
(35) Lock nut
(36) Adjusting screw
(37) Spring
(38) Sleeve
(39) Adapter
(40) Clamp
(41) Cotter pin
(42) Castle nut
(43) Dust seal
(44) Clip
(45) Tie-rod end
(46) Clip
(47) Boot
(48) Band
(49) Tie-rod
(50) Lock washer
(51) Pipe B
(52) Pipe A
(53) Housing ASSY
(54) Oil seal
(55) Piston ring
(56) Rack
(57) Rack bushing
(58) Rack stopper
(59) Circlip

Tightening torque: N·m (kg-m, ft-lb)

T1: 6±1 (0.6±0.1, 4.3±0.7)
T2: 7.4±2.0 (0.75±0.20, 5.4±1.4)
T3: 8±2 (0.8±0.2, 5.8±1.4)
T4: 13±3 (1.3±0.3, 9.4±2.2)
T5: 15±3 (1.5±0.3, 10.8±2.2)
T6: 15±5 (1.5±0.5, 10.8±3.6)
T7: 18^{+5}_{0} ($1.8^{+0.5}_{0}$, $13.0^{+3.6}_{0}$)
T8: 22±2 (2.2±0.2, 15.9±1.4)
T9: 24±3 (2.4±0.3, 17.4±2.2)
T10: 25±2 (2.5±0.2, 18.1±1.4)
T11: 25±5 (2.5±0.5, 18.1±3.6)
T12: 27.0±2.5 (2.75±0.25, 19.9±1.8)
T13: 39±5 (4.0±0.5, 28.9±3.6)
T14: 52±10 (5.3±1.0, 38±7)
T15: 59±12 (6.0±1.2, 43±9)
T16: 78±10 (8.0±1.0, 58±7)
T17: 83±5 (8.5±0.5, 61.5±3.6)

1. Supplemental Restraint System “Airbag” AIRBAG

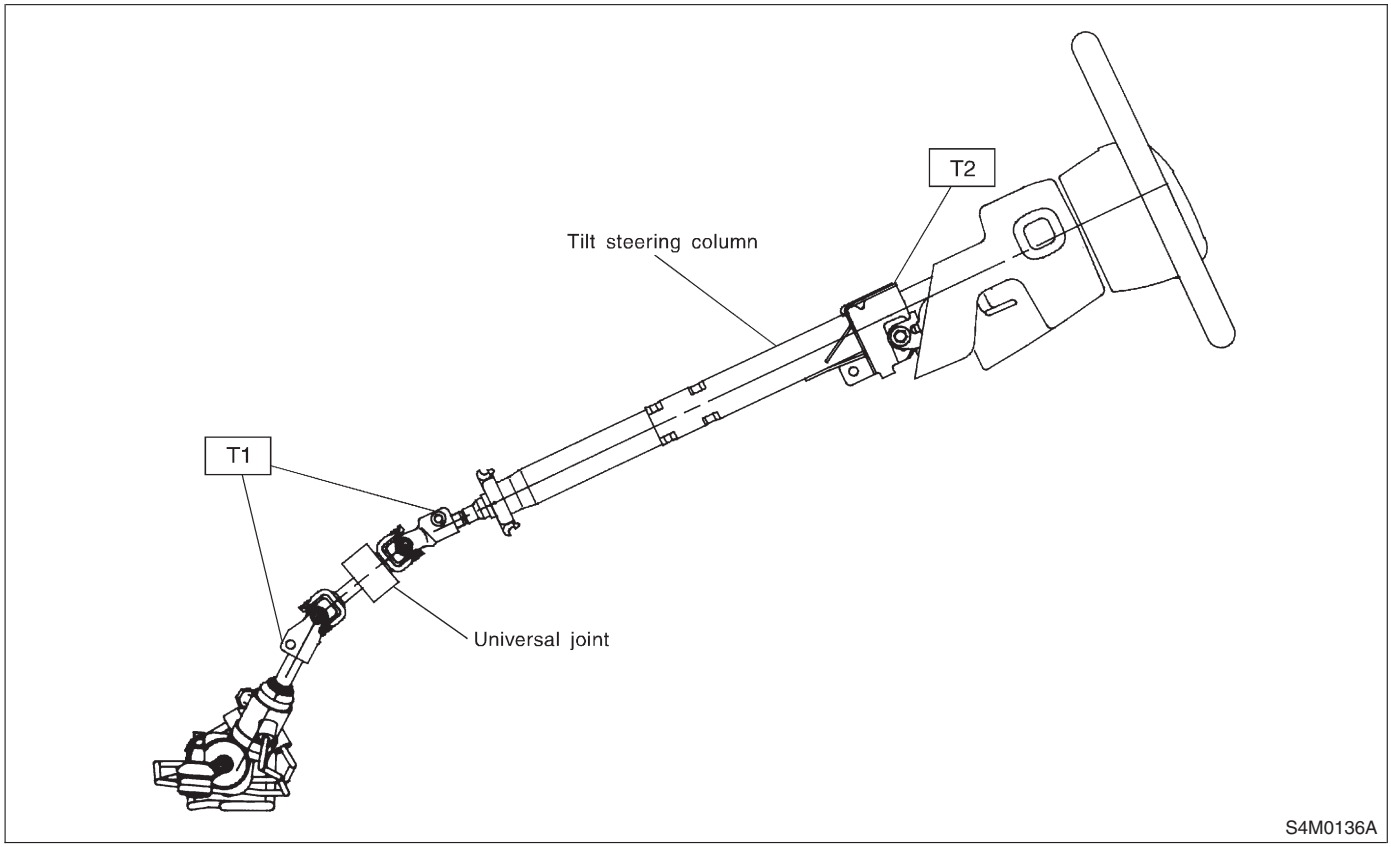
A: PRECAUTION

Airbag system wiring harness is routed near the steering wheel, steering shaft and column.

WARNING:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
• Be careful not to damage Airbag system wiring harness when servicing the steering wheel, steering shaft and column.

2. Tilt Steering Column

A: REMOVAL

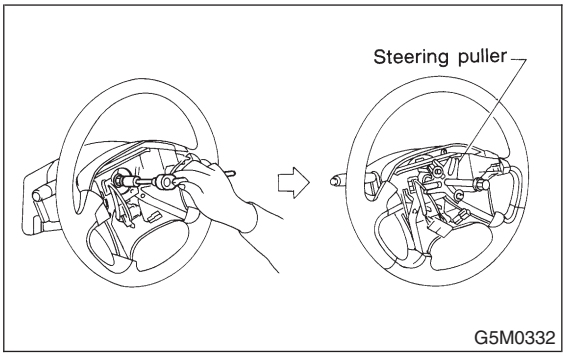


Tightening torque: N·m (kg-m, ft-lb)
T1: 24±3 (2.4±0.3, 17.4±2.2)
T2: 25±5 (2.5±0.5, 18.1±3.6)

1) Disconnect battery minus terminal.
2) Lift-up vehicle.
3) Remove airbag module. (with airbag model) <Ref. to 5-5 [W3A1].>

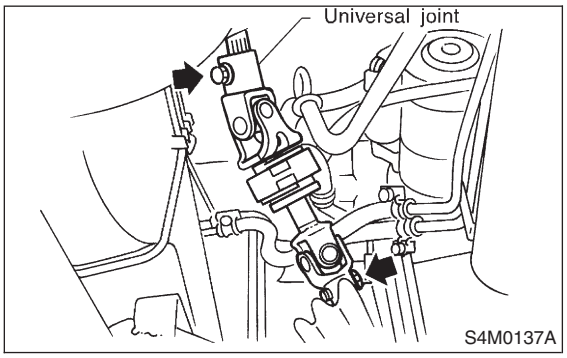
WARNING:
Always refer to "5-5 Supplemental Restraint System" before performing airbag module service (if so equipped). <Ref. to 5-5 [W1A0].>

4) Remove steering wheel nut, then draw out steering wheel from shaft using steering puller.

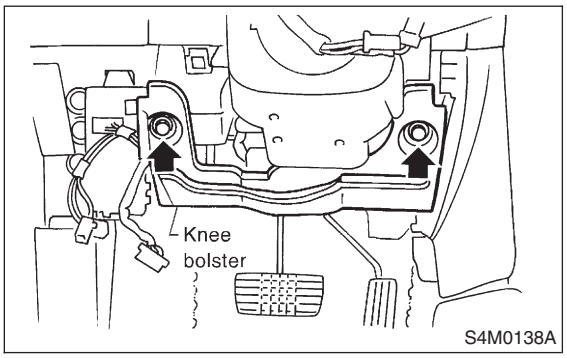


5) Remove universal joint bolts and then remove universal joint.

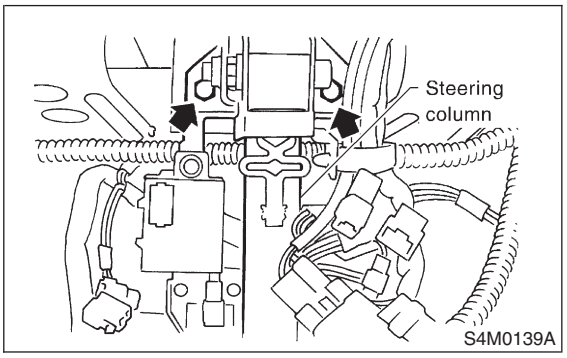
CAUTION:
Scribe alignment marks on universal joint so that it can be reassembled at the original serration.



6) Remove trim panel under instrument panel.
7) Remove knee bolster.



8) Disconnect connectors for ignition switch and combination switch wiring harness under instrument panel.
9) Remove the two bolts under instrument panel securing steering column.



10) Pull out steering shaft assembly from hole on toe board.

CAUTION:
Be sure to remove universal joint before removing steering shaft assembly installing bolts when removing steering shaft assembly or when lowering it for servicing of other parts.

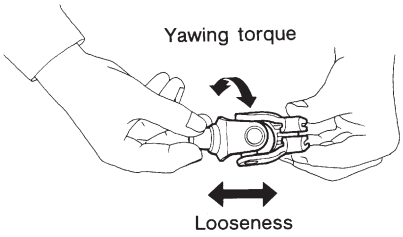
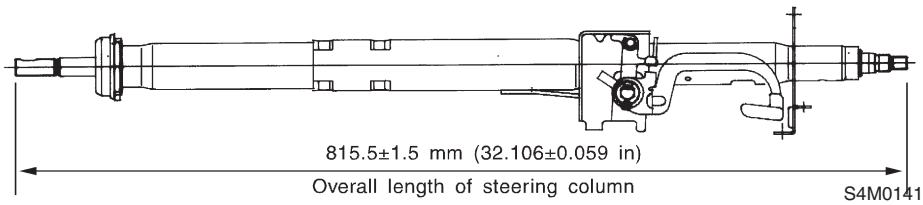
B: DISASSEMBLY

1) Remove the three screws securing upper and lower steering column covers, and the two screws securing combination switch, then remove related parts.

C: INSPECTION

1. BASIC INSPECTION

Clean the disassembled parts with a cloth, and check for wear, damage, or any other faults. If necessary, repair or replace faulty parts.

Part name	Inspection	Corrective action
Universal joint	• Free play • Swinging torque Yawing torque Looseness  G4M0089 **Standard value of universal joint free play: 0 mm (0 in)** **Max. value of universal joint swinging torque: 0.3 N·m (0.03 kg-m, 0.2 ft-lb)**	Replace if faulty.
Steering column	• Overall length of steering column Measure overall length of steering column. Standard overall length of steering column:  S4M0141A	Replace steering column assembly.

2. AIRBAG MODEL INSPECTION

WARNING:
For airbag model inspection procedures, refer to 5-5 Supplemental Restraint System. <Ref. to 5-5 [W2F0].> and <Ref. to 5-5 [W2G0].>

D: ASSEMBLY

1) Insert combination switch to upper column shaft, and install lower column cover with tilt lever held in the lowered position. Then route ignition key harness and combination switch harness between column cover mounting bosses.
2) Fit upper column cover to lower column cover, and tighten combination switch and column cover.

Tightening torque:
1.2±0.2 N·m (0.12±0.02 kg-m, 0.9±0.1 ft-lb)

CAUTION:
Don't overtorque screw.

E: INSTALLATION

1) Insert end of steering shaft into toeboard grommet.
2) Tighten steering shaft mounting bolts under instrument panel.

Tightening torque:
25±5 N·m (2.5±0.5 kg-m, 18.1±3.6 ft-lb)

3) Connect ignition and combination switch connectors under instrument panel.
4) Connect airbag system connector at harness spool.

NOTE:
Make sure to apply double lock.

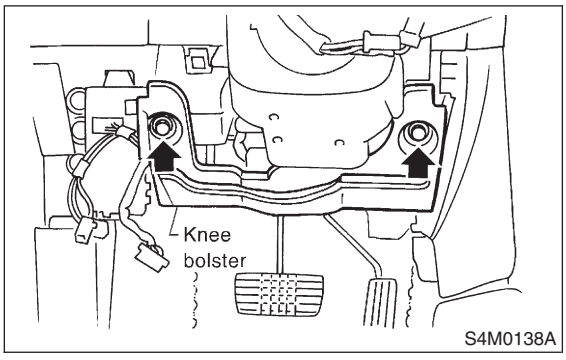
5) Install universal joint.
(1) Align bolt hole on the long yoke side of universal joint with the cutout at the serrated section of shaft end, and insert universal joint.
(2) Align bolt hole on the short yoke side of universal joint with the cutout at the serrated section of gearbox assembly. Lower universal joint completely.
(3) Temporarily tighten bolt on the short yoke side. Raise universal joint to make sure the bolt is properly passing through the cutout at the serrated section.
(4) Tighten bolt on the long yoke side, then that on the short yoke side.

Tightening torque:
24±3 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)

CAUTION:
• Make sure that universal joint bolts is tightened through notch in shaft serration.
• Excessively large tightening torque of universal joint bolts may lead to heavy steering wheel operation.

Standard clearance between gearbox to DOJ:
Over 15 mm (0.59 in)

6) Install knee bolster.



7) Align center of roll connector. (with airbag model) <Ref. to 5-5 [W8B1].>

CAUTION:
Ensure that front wheels are set in straight forward direction.

8) Set steering wheel to neutral and install it onto steering shaft.

Tightening torque:
44±5 N·m (4.5±0.5 kg-m, 32.5±3.6 ft-lb)

Column cover-to-steering wheel clearance:
2 — 4 mm (0.08 — 0.16 in)

CAUTION:
Insert roll connector guide pin into guide hole on lower end of surface of steering wheel to prevent damage. Draw out airbag system connector, horn connector and cruise control connectors from guide hole of steering wheel lower end. (with airbag model)

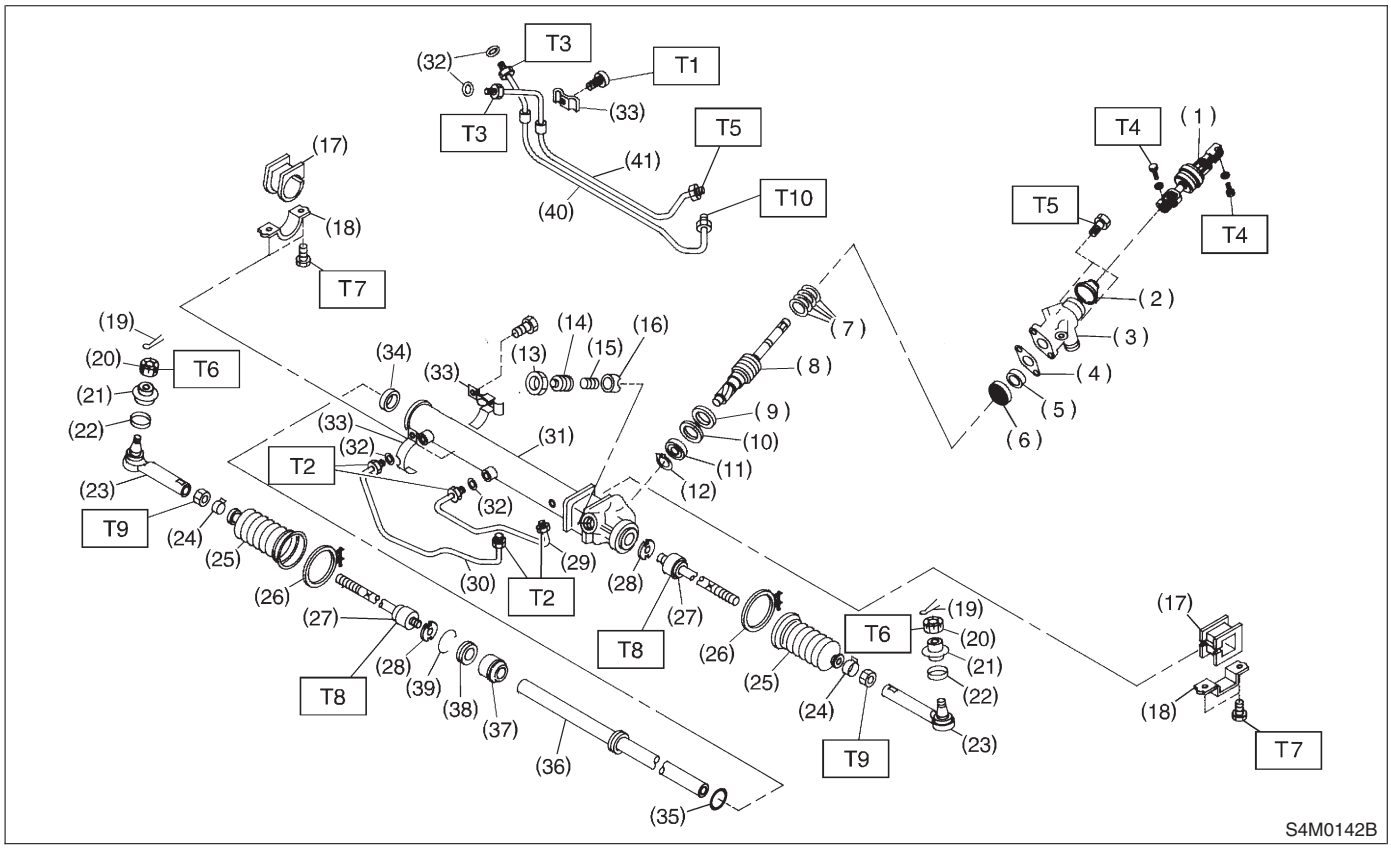
9) Install airbag module to steering wheel. (with airbag model)

WARNING:
Always refer to 5-5 Supplemental Restraint System before performing the service operation. <Ref. to 5-5 [W3A0].>

3. Steering Gearbox (Power Steering System)

A: REMOVAL

NOTE:
For disassembly and assembly of gearbox unit, refer to section Control Valve (Power Steering Gearbox). <Ref. to 4-3 [W4B0].> and <Ref. to 4-3 [W4D0].>



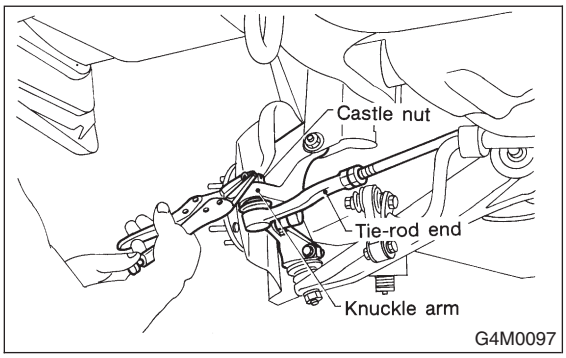
(1) Universal joint
(2) Dust cover
(3) Valve housing
(4) Gasket
(5) Oil seal
(6) Special bearing
(7) Seal ring
(8) Pinion and valve ASSY
(9) Oil seal
(10) Back-up washer
(11) Ball bearing
(12) Snap ring
(13) Lock nut
(14) Adjusting screw
(15) Spring
(16) Sleeve
(17) Adapter
(18) Clamp
(19) Cotter pin
(20) Castle nut
(21) Dust cover
(22) Clip
(23) Tie-rod end
(24) Clip
(25) Boot
(26) Band
(27) Tie-rod
(28) Lock washer
(29) Pipe B
(30) Pipe A
(31) Housing ASSY
(32) O-ring
(33) Clamp
(34) Oil seal
(35) Piston ring
(36) Rack
(37) Rack bushing
(38) Rack stopper
(39) Circlip
(40) Pipe E
(41) Pipe F

Tightening torque: N·m (kg-m, ft-lb)
T1: 6±1 (0.6±0.1, 4.3±0.7)
T2: 13±3 (1.3±0.3, 9.4±2.2)
T3: 15±5 (1.5±0.5, 10.8±3.6)
T4: 24±3 (2.4±0.3, 17.4±2.2)
T5: 25±5 (2.5±0.5, 18.1±3.6)
T6: 27.0±2.5 (2.75±0.25, 19.9±1.8)
T7: 59±12 (6.0±1.2, 43±9)
T8: 78±10 (8.0±1.0, 58±7)
T9: 83±5 (8.5±0.5, 61.5±3.6)
T10: 15±3 (1.5±0.3, 10.8±2.2)

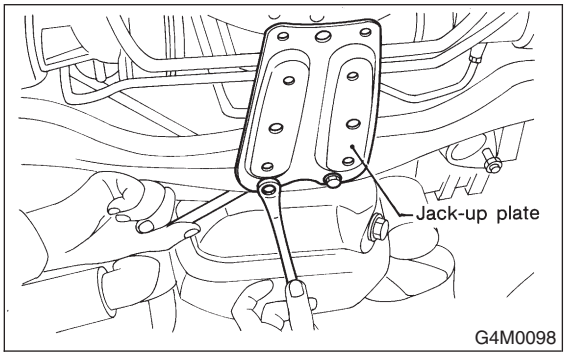
1) Disconnect battery minus terminal.
2) Loosen front wheel nut.
3) Lift vehicle and remove front wheels.
4) Remove front exhaust pipe assembly.

WARNING:
Be careful, exhaust pipe is hot.

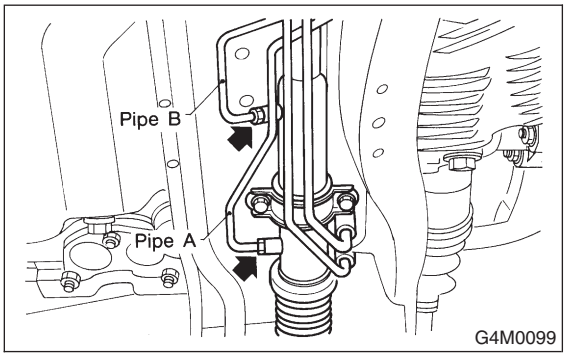
5) Using a puller, remove tie-rod end from knuckle arm after pulling off cotter pin and removing castle nut.



6) Remove jack-up plate and front stabilizer.

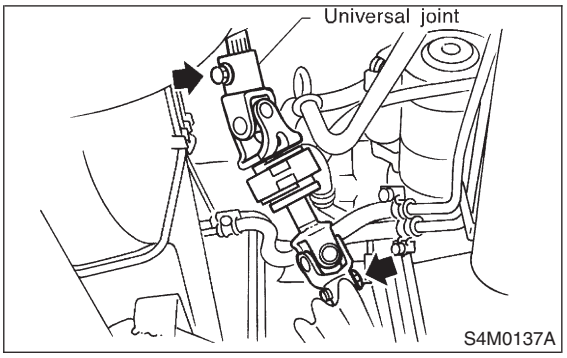


7) Remove one pipe joint at the center of gearbox, and connect vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.



8) Remove lower side bolt of universal joint, then remove upper side bolt and lift the joint upward.

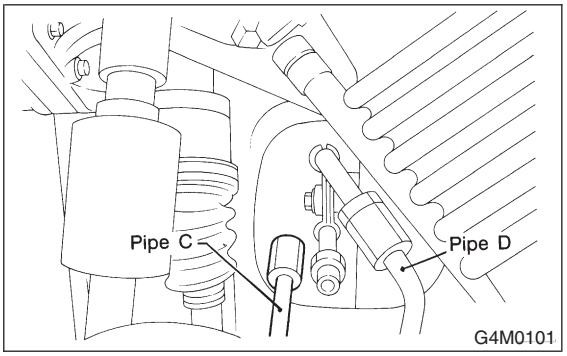
NOTE:
Place a mark on the joint and mating serration so that they can be re-installed at the original position.



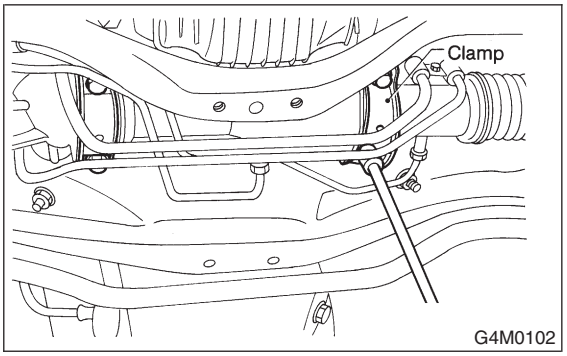
9) Disconnect pipes C and D from pipe of gearbox.

CAUTION:
Be careful not to damage these pipes.

NOTE:
Disconnect upper pipe D first, and lower pipe C second.



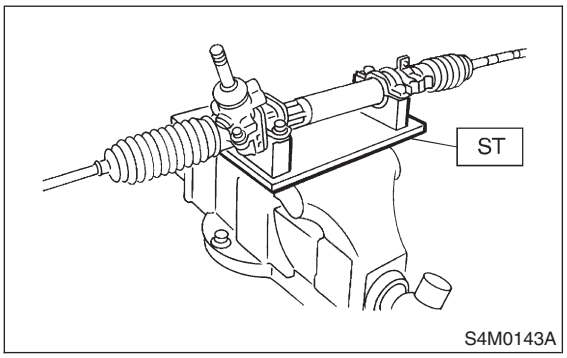
10) Remove clamp bolts securing gearbox to crossmember, and remove gearbox.



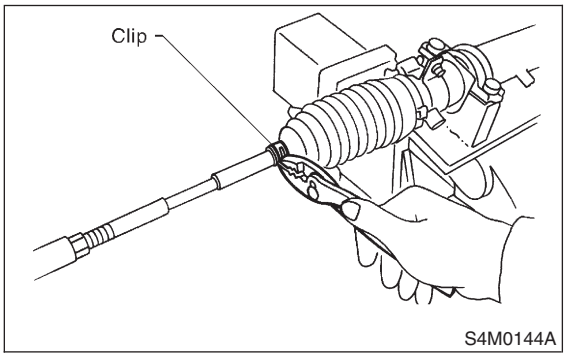
B: DISASSEMBLY

1) Disconnect four pipes from gearbox.
2) Secure gearbox removed from vehicle in vice using ST.
ST 926200000 STAND

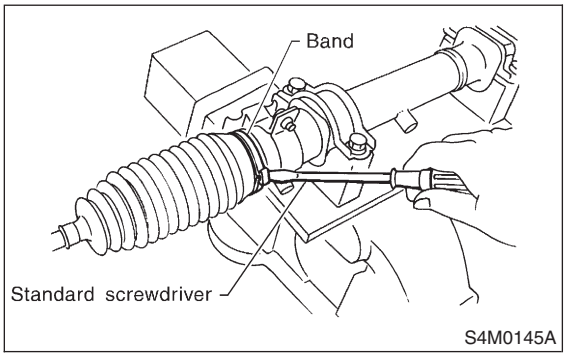
CAUTION:
Secure the gearbox in a vice using the ST as shown. Do not attempt to secure it without this ST.



3) Remove tie-rod end and lock nut from gearbox.
4) Remove small clip from boot using pliers, and move boot to tie-rod end side.

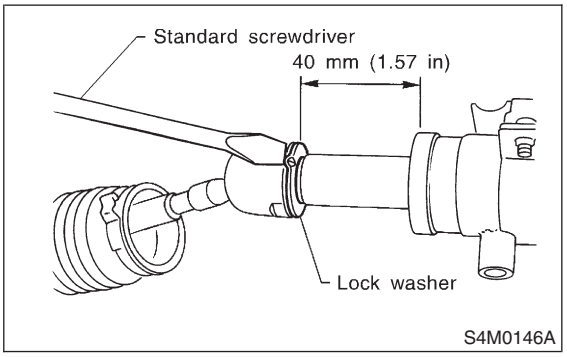


5) Using standard screwdriver, remove band from boot.

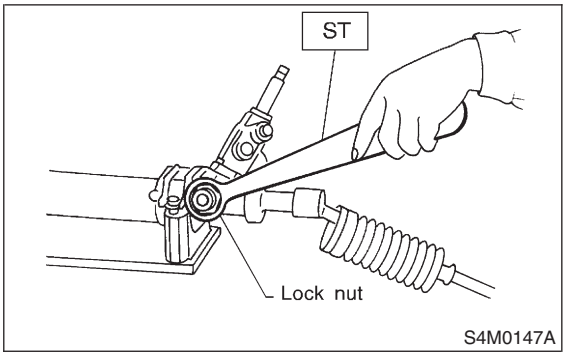


6) Extend rack approximately 40 mm (1.57 in) out. Unlock lock wire at lock washer on each side of tie-rod end using a standard screwdriver.

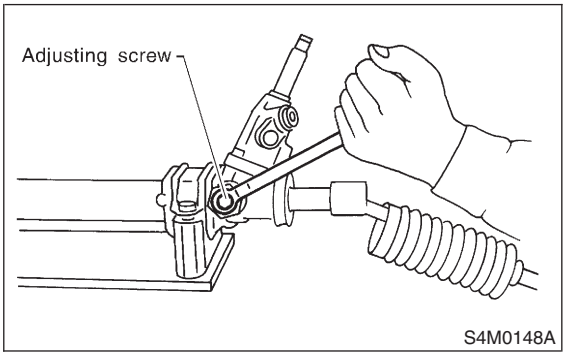
CAUTION:
Be careful not to scratch rack surface as oil leaks may result.



7) Using ST, loosen lock nut.
ST 926230000 SPANNER

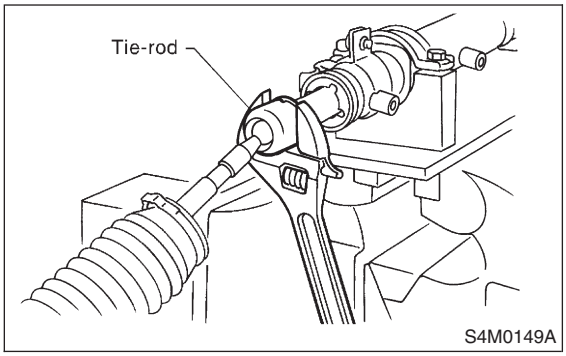


8) Tighten adjusting screw until it no longer tightens.



9) Using a wrench [32 mm (1.26 in) width across flats] or adjustable wrench, remove tie-rod.

CAUTION:
• Check ball joint for free play, and tie-rod for bends. Replace if necessary.
• Check dust seals used with tie-rod end ball joint for damage or deterioration. Replace if necessary.



10) Loosen adjusting screw and remove spring and sleeve.

CAUTION:
Replace spring and/or sleeve if damaged.

C: INSPECTION

1) Clean all disassembled parts, and check for wear, damage, or any other faults, then repair or replace as necessary.
2) When disassembling, check inside of gearbox for water. If any water is found, carefully check boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bend of input shaft (2) Damage on serration	If bend or damage is excessive, replace entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If outer wall slips, lip is worn out or damage is found, replace it with new one.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust backlash properly. By measuring turning torque of gearbox and sliding resistance of rack, check if rack and pinion engage uniformly and smoothly with each other. (Refer to “Service limit”.) (2) Keeping rack pulled out all the way so that all teeth emerge, check teeth for damage. Even if abnormality is found in either (1) or (2), replace entire gearbox.
4	Gearbox unit	(1) Bend of rack shaft (2) Bend of cylinder portion (3) Crack or damage on cast iron portion	Replace gearbox with new one.
		(4) Wear or damage on rack bush	If free play of rack shaft in radial direction is out of the specified range, replace gearbox with new one. (Refer to “Service limit”.)
		(5) Wear on input shaft bearing	If free plays of input shaft in radial and axial directions are out of the specified ranges, replace gearbox with new one. (Refer to “Service limit”.)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration on dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipes	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

1. SERVICE LIMIT

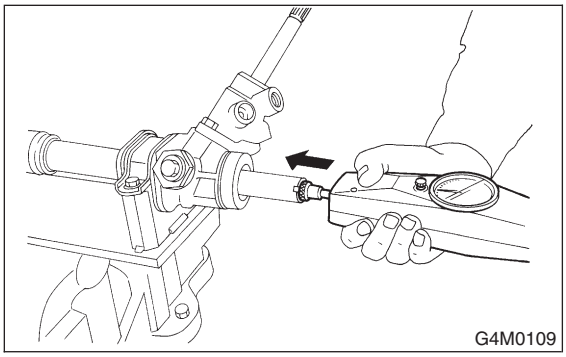
Make a measurement as follows. If it exceeds the specified service limit, adjust or replace.

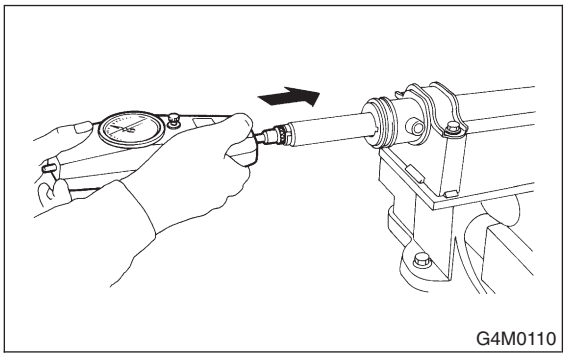
NOTE:
When making a measurement, vise gearbox by using ST. Never vise gearbox by inserting aluminum plates, etc. between vise and gearbox.

ST 926200000 STAND

Sliding resistance of rack shaft:

Service limit
304.0 N (31.0 kg, 68.4 lb) or less


G4M0109

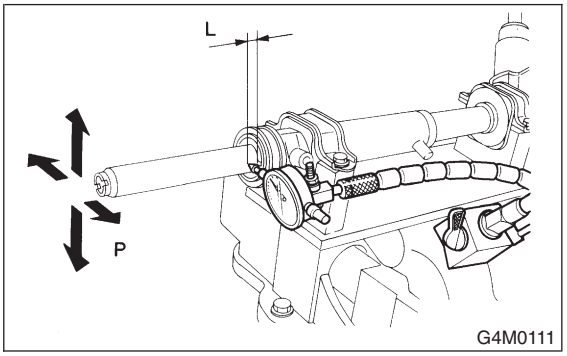

G4M0110

2. RACK SHAFT PLAY IN RADIAL DIRECTION

Right-turn steering:

Service limit
0.15 mm (0.0059 in) or less

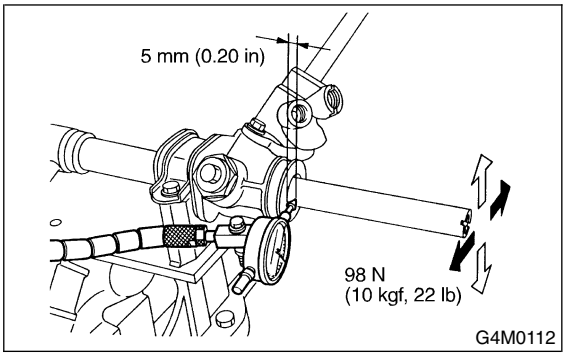
On condition
L: 5 mm (0.20 in)
P: 98 N (10 kg, 22 lb)



G4M0111

Left-turn steering:

Service limit
Direction ⇦ ⇨
0.3 mm (0.012 in) or less
Direction ⬅ ➡
0.15 mm (0.0059 in) or less



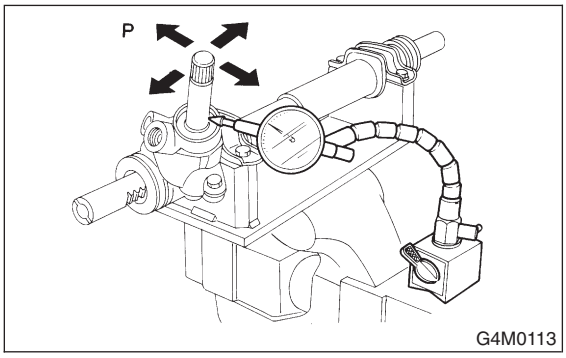
G4M0112

3. INPUT SHAFT PLAY

In radial direction:

Service limit
0.18 mm (0.0071 in) or less

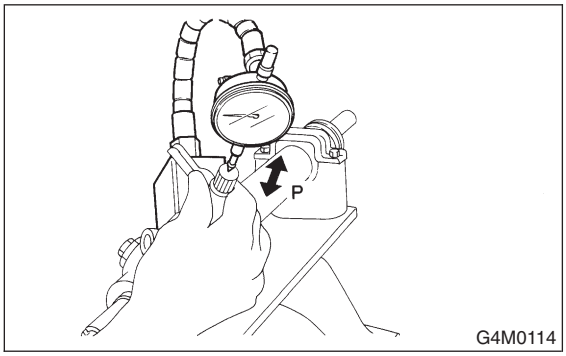
On condition
P: 98 N (10 kg, 22 lb)



In axial direction:

Service limit
0.1 mm (0.004 in) or less

On condition
P: 20 — 49 N (2 — 5 kg, 4 — 11 lb)

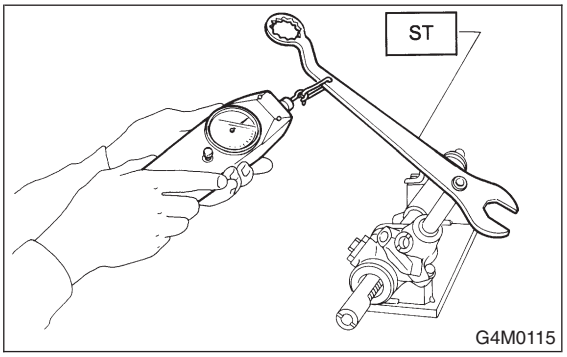


4. TURNING RESISTANCE OF GEARBOX

Using ST, measure gearbox turning resistance.

ST 926230000 SPANNER

Service limit:
Straight-ahead position within 30 mm (1.18 in) from rack center
Less than 11.18 N (1.14 kg, 2.51 lb)
Maximum allowable resistance
12.7 N (1.3 kg, 2.9 lb)



D: ASSEMBLY

CAUTION:
Use only SUBARU genuine grease for gearbox.

Grease:
VALIANT GREASE M2
[Part No. 003608001, net 0.5 kg (1.1 lb)]

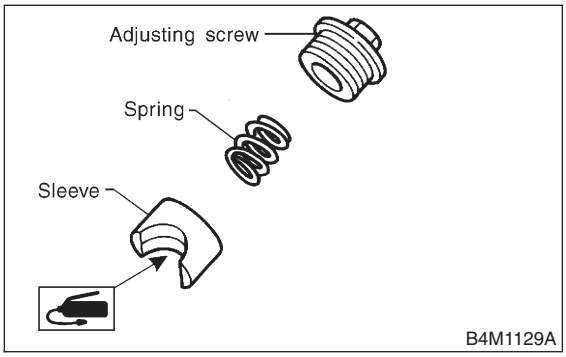
1) Clean all parts and tools before reassembling.
2) Apply grease to teeth of rack so that grease applied is about as high as teeth, and also apply a thin film of grease to sliding portion of rack shaft.

CAUTION:
• When moving rack to stroke end without tie-rod attached, prevent shocks from being applied at the end.
• Do not apply grease to threaded portion at end of rack shaft.
• Move rack shaft to stroke end two (2) or three (3) times to squeeze grease which accumulates on both ends. Remove grease to prevent it from choking air passage hole.

3) Apply grease to sleeve insertion hole.
4) Apply grease to dust seal insertion hole.

CAUTION:
Apply clean grease with clean hands. If material having a sharp edge is used for applying grease, oil seal at the inside might be damaged.

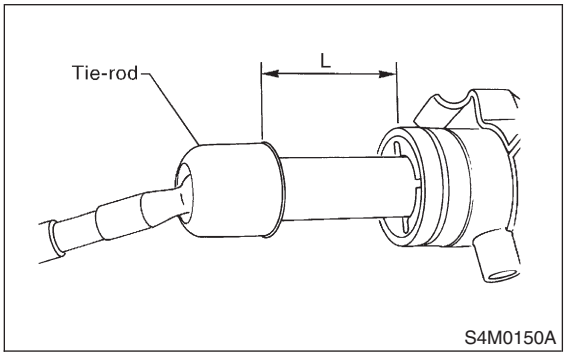
5) Apply grease to sliding surface of sleeve and spring seat, then insert sleeve into pinion housing. Fit spring into sleeve screw, pack grease inside of screw, then install the screw.



6) Install lock washers and tighten left and right tie-rods into rack ends.

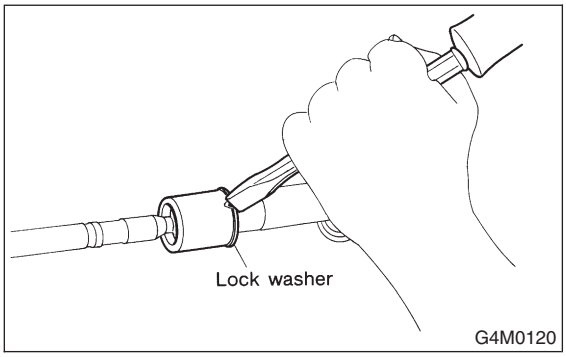
On condition
L: Approximately 40 mm (1.57 in)

Tightening torque:
78±10 N·m (8.0±1.0 kg-m, 58±7 ft-lb)

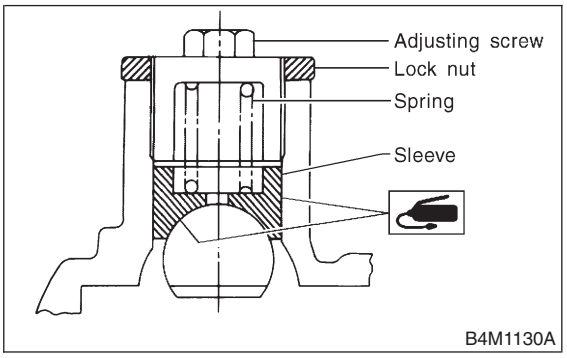


7) Bend lock washer using a chisel.

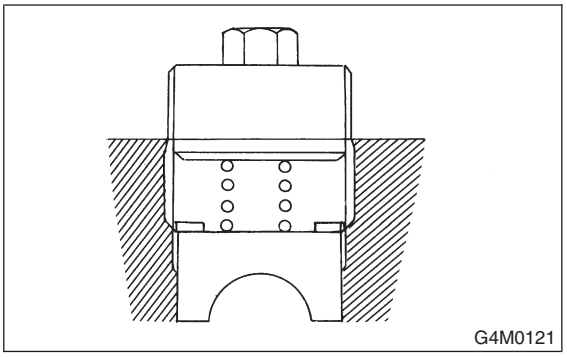
CAUTION:
Be careful not to scratch rack when bending lock washer.



8) Rack and pinion backlash adjustment
(1) Loosen adjusting screw.
(2) Rotate input shaft so that rack is in the straight ahead direction.
(3) Apply grease to sleeve.

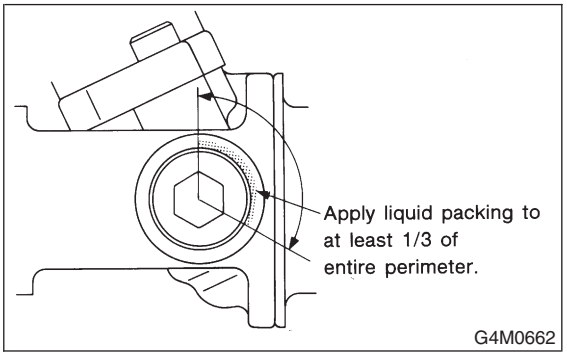


(4) Tighten adjusting screw by two threads.



(5) Apply liquid packing to at least 1/3 of entire perimeter of adjusting screw thread.

Liquid packing:
THREE BOND 1141



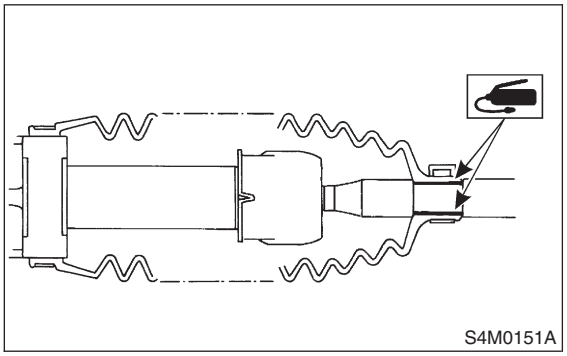
(6) Tighten adjusting screw to 7.4 N·m (0.75 kg-m, 5.4 ft-lb) and back off 25°.
(7) Install lock nut. While holding adjusting screw with a wrench, tighten lock nut using ST.
ST 926230000 SPANNER

Tightening torque (Lock nut):
39±10 N·m (4.0±1.0 kg-m, 29±7 ft-lb)

NOTE:
● Hold adjusting screw with a wrench to prevent it from turning while tightening lock nut.
● Make adjustment so that steering wheel can be rotated fully from lock to lock without binding.

9) Check for service limit as per article of “Service limit”. <Ref. to 4-3 [W3C1].> Make replacement and adjustment if necessary.
10) Install boot to housing.

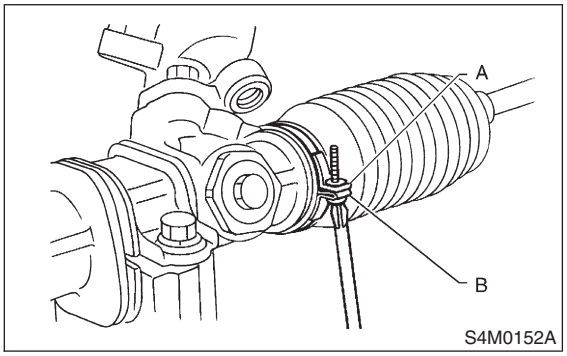
NOTE:
● Before installing boot, be sure to apply grease to the groove of tie-rod.
● Install fitting portions of boots to the following portions in both sides of assembled steering gear-box.
The groove on gearbox
The groove on the rod
● Make sure that boot is installed without unusual inflation or deflation.


S4M0151A

11) Using a screwdriver, tighten the screw until the ends “A” and “B” of the band come into contact with each other.

CAUTION:
Use a new band.

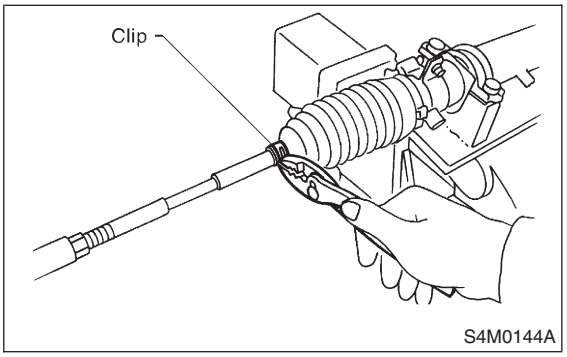
NOTE:
Always tighten the band from the underside of the gear box.



S4M0152A

12) Fix boot end with clip (small).

CAUTION:
After installing, check boot end is positioned into groove on tie-rod.

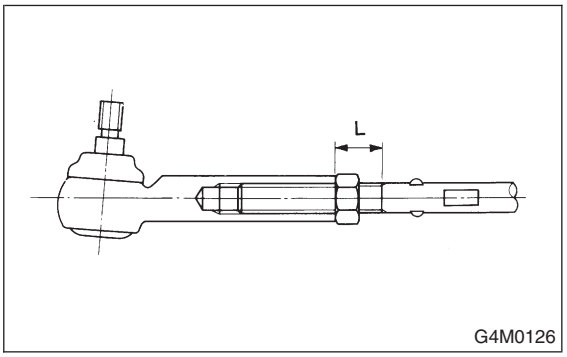


S4M0144A

13) If tie-rod end was removed, screw in lock nut and tie-rod end to screwed portion of tie-rod, and tighten lock nut temporarily in a position as shown in figure.

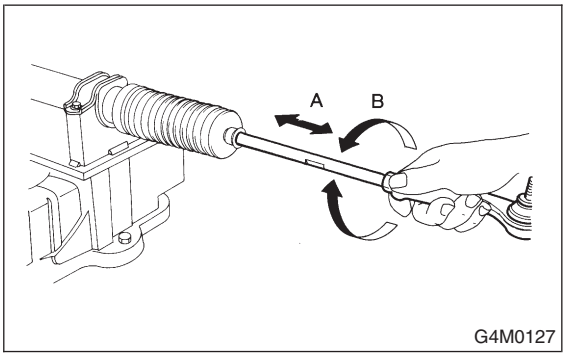
Installed tie-rod length: L
15 mm (0.59 in)

NOTE:
Pay attention to difference between right and left tie-rod ends.



G4M0126

14) Inspect gearbox as follows:
“A” Holding tie-rod end, repeat lock to lock two or three times as quickly as possible.
“B” Holding tie-rod end, turn it slowly at a radius one or two times as large as possible.
After all, make sure that boot is installed in the specified position without deflation.



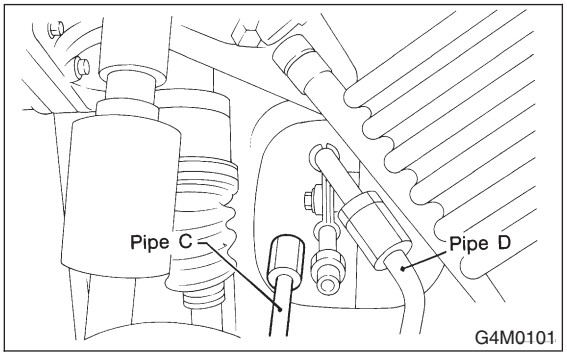
G4M0127

15) Remove gearbox from ST.
ST 926200000 STAND
16) Install four pipes on gearbox.
(1) Connect pipes A and B to four pipe joints of gearbox. Connect upper pipe B first, and lower pipe A.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

(2) Connect pipes C and D to gearbox.
Connect lower pipe C first, and upper pipe D second.

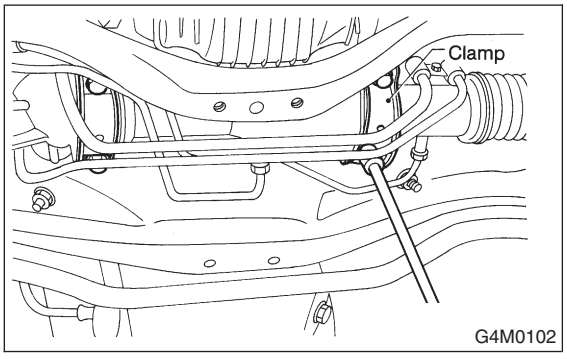
Tightening torque:
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)



E: INSTALLATION

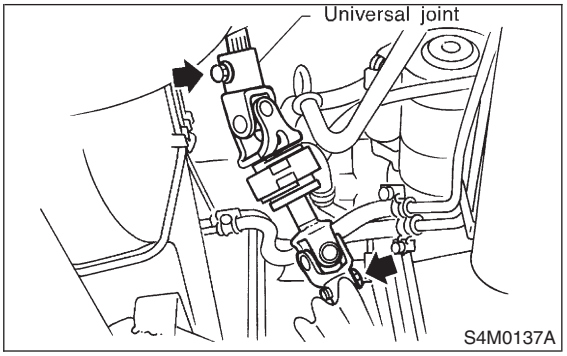
1) Insert gearbox into crossmember, being careful not to damage gearbox boot.
2) Tighten gearbox to crossmember bracket via clamp with bolt to the specified torque.

Tightening torque:
59±12 N·m (6.0±1.2 kg-m, 43±9 ft-lb)



3) How to install the joint.
(1) Push the long yoke of the joint, all the way into the serrated portion of the steering shaft, setting the bolt hole in the cutout.
(2) Then pull the short yoke all way out of the serrated portion of the gear box, setting the bolt hole in the cutout.
(3) Insert the bolt through the short yoke, pull the joint and confirm that the bolt is on cutout of the gearbox.
(4) Fasten the short yoke side with a spring washer and bolt, then fasten the long yoke side.

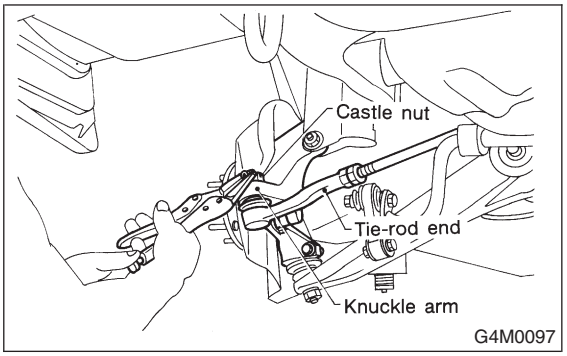
Tightening torque:
24±3 N·m (2.4±0.3 kg-m, 17.4±2.2 ft-lb)



4) Connect tie-rod end and knuckle arm, and tighten with castle nut. Fit cotter pin into the nut and bend the pin to lock.

Castle nut tightening torque:
Tighten to 27.0±2.5 N·m (2.75±0.25 kg-m, 19.9±1.8 ft-lb), and tighten further within 60° until cotter pin hole is aligned with a slot in the nut.

CAUTION:
When connecting, do not hit cap at the bottom of tie-rod end with hammer.



5) Install front stabilizer to vehicle.
6) Install front exhaust pipe assembly.
<Ref. to 2-9 [W1B0].>
7) Install tires.
8) Tighten wheel nuts to the specified torque.

Tightening torque:
88±10 N·m (9.0±1.0 kg-m, 65±7 ft-lb)

9) Connect ground cable to battery.
10) Pour fluid into oil tank, and bleed air.
<Ref. to 4-3 [W7A0].>
11) Check for fluid leaks.
12) Install jack-up plate.

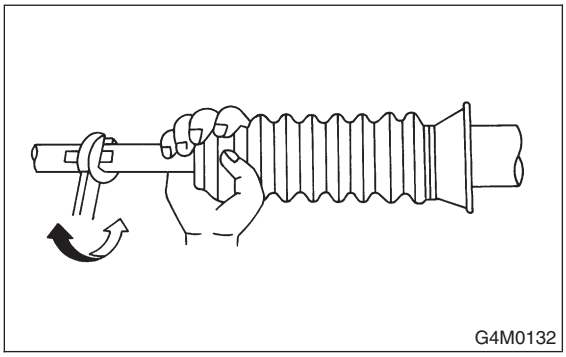
WARNING:
Be careful, exhaust manifold is hot.

13) Lower vehicle.

14) Check fluid level in oil tank.
15) After adjusting toe-in and steering angle, tighten lock nut on tie-rod end.

Tightening torque:
83±5 N·m (8.5±0.5 kg-m, 61.5±3.6 ft-lb)

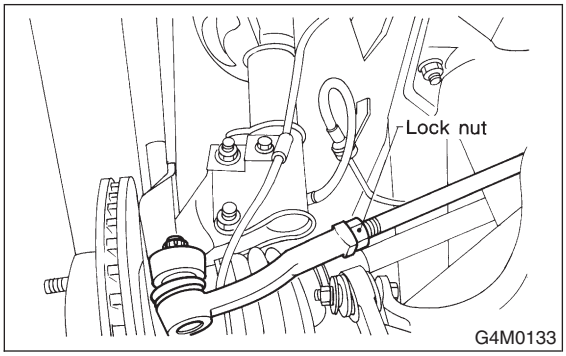
CAUTION:
When adjusting toe-in, hold boot as shown to prevent it from being rotated or twisted. If twisted, straighten it.


G4M0132

F: ADJUSTMENT

1) Adjust front toe.

Standard of front toe:
IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)



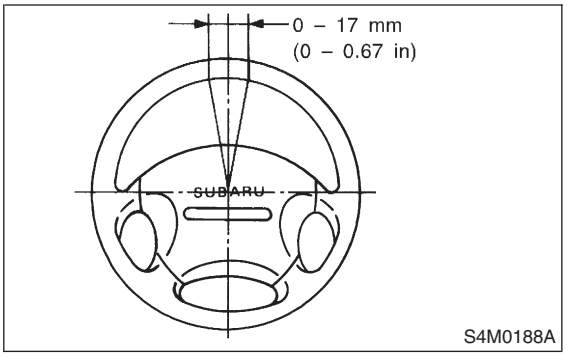
G4M0133

2) Adjust steering angle of wheels.

Inner wheel: 34.4°±1.5°

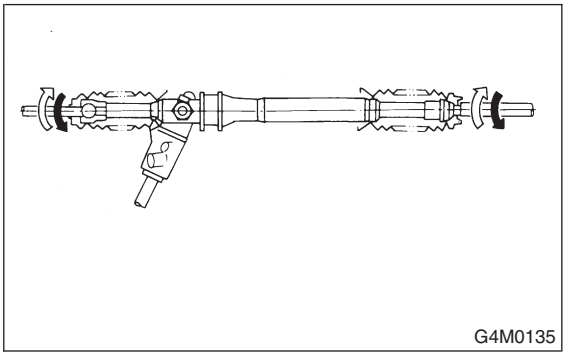
Outer wheel: 30.2°±1.5°

3) If steering wheel spokes are not horizontal when wheels are set in the straight ahead position, and error is more than 5° on the periphery of steering wheel, correctly re-install the steering wheel.



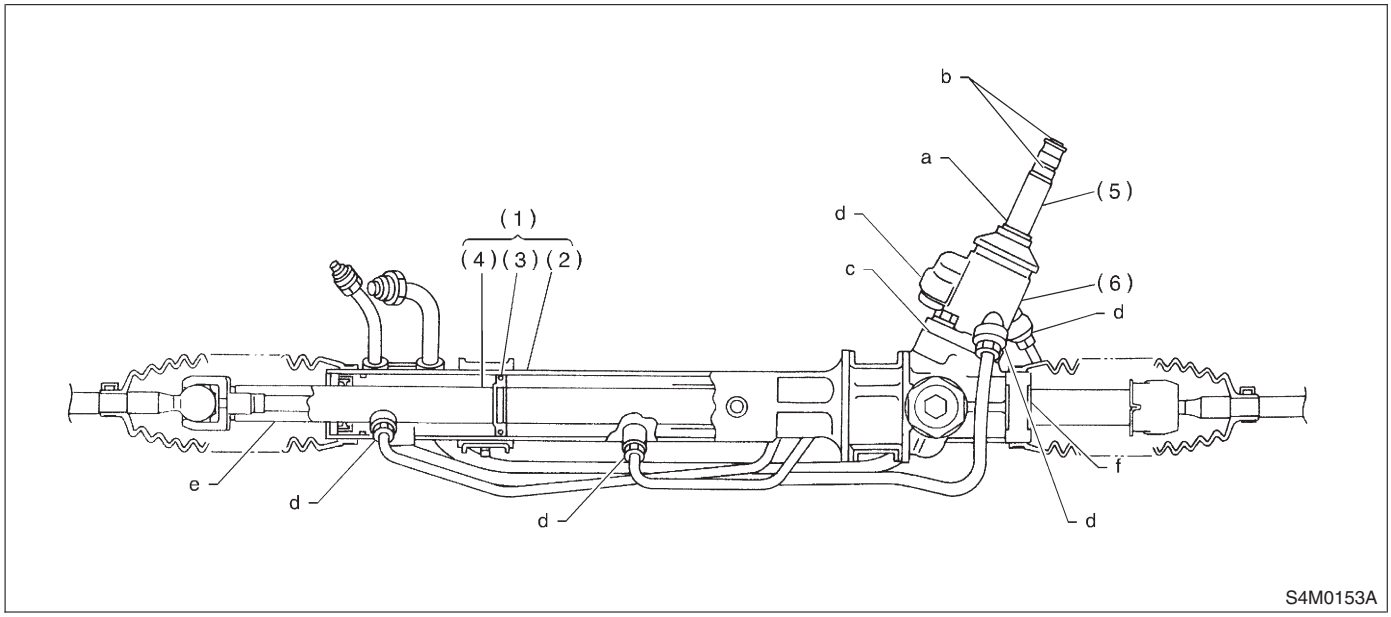
S4M0188A

4) If steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the same direction by the same turns.


G4M0135

4. Control Valve (Power Steering Gearbox)

A: CHECKING OIL LEAKING POINTS



(1) Power cylinder
(2) Cylinder
(3) Rack piston
(4) Rack axle
(5) Input shaft
(6) Valve housing

1. OIL LEAKING POINTS

1) If leak point is other than a, b, c, or d, perform the 5th step in “OIL LEAK CHECK PROCEDURE AND REPLACEMENT PARTS” before dismounting gearbox from vehicle. <Ref. to 4-3 [W4A2].> If gearbox is dismounted without confirming where the leak is, it must be mounted again to locate the leak point.
2) Even if the location of the leak can be easily found by observing the leaking condition, it is necessary to thoroughly remove the oil from the suspected portion and turn the steering wheel from lock to lock about 30 to 40 times with engine running, then make comparison of the suspected portion between immediately after and several hours after this operation.
3) Before starting oil leak repair work, be sure to clean the gearbox, hoses, pipes, and surrounding parts. After completing repair work, clean these areas again.

2. OIL LEAK CHECK PROCEDURE AND REPLACEMENT PARTS

NOTE:
Parts requiring replacement are described in the smallest unit of spare parts including damaged parts and spare parts damaged. In actual disassembly work, accidental damage as well as inevitable damage to some related parts must be taken into account, and spare parts for them must also be prepared. However, it is essential to pinpoint the cause of trouble, and limit the number of replacement parts as much as possible.

1) Leakage from “a”
The oil seal is damaged. Replace valve assembly with a new one.
2) Leakage from “b”
The torsion bar O-ring is damaged. Replace valve assembly with a new one.
3) Leakage from “c”
The oil seal is damaged. Replace valve assembly or oil seal with a new one.
4) Leakage from “d”
The pipe is damaged. Replace the faulty pipe or O-ring.
5) If leak is other than a, b, c, or d, and if oil is leaking from the gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove oil from the surrounding portions. Then, turn the steering wheel from lock to lock 30 to 40 times with the engine running, then make comparison of the leaked portion immediately after and several hours after this operation.
(1) Leakage from “e”
The cylinder seal is damaged. Replace rack bush with a new one.
(2) Leakage from “f”

There are two possible causes. Take following step first. Remove the pipe assembly B from the valve housing, and close the circuit with ST.

ST 926420000 PLUG

Turn the steering wheel from lock to lock 30 to 40 times with the engine running, then make comparison of the leaked portion between immediately after and several hours after this operation.

CAUTION:

- **If leakage from "f" is noted again:**

The oil seal of pinion and valve assembly is damaged. Replace pinion and valve assembly with a new one. Or replace the oil seal and the parts that are damaged during disassembly with new ones.

- **If oil stops leaking from "f":**

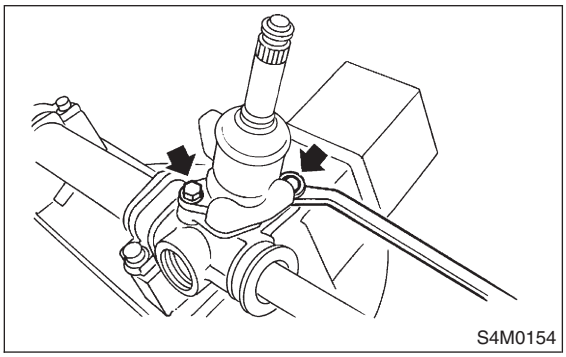
The oil seal of rack housing is damaged. Replace the oil seal and the parts that are damaged during disassembly with new ones.

B: DISASSEMBLY

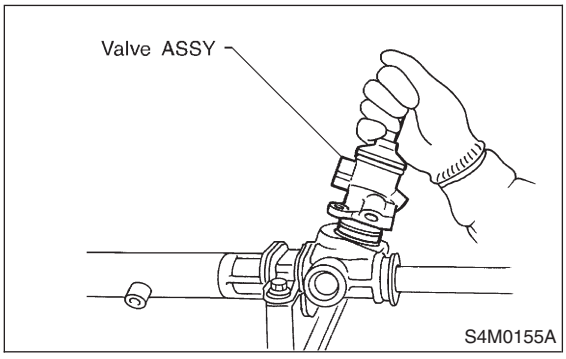
NOTE:
This section focuses on the disassembly and reassembly of control valve. For the inspection and adjustment and the service procedures for associated parts, refer to "Steering Gearbox". <Ref. to 4-3 [W3A0].>

1. VALVE ASSEMBLY

1) Remove two bolts securing valve assembly.

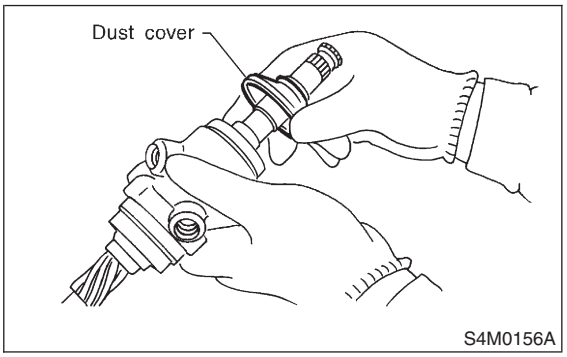

S4M0154

2) Carefully draw out input shaft and remove valve assembly.



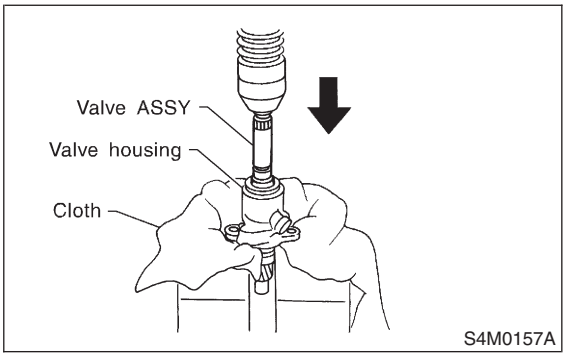
S4M0155A

3) Slide dust cover out.



S4M0156A

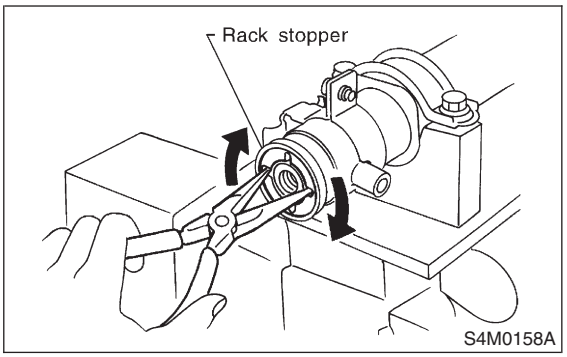
4) Using a press remove pinion and valve assembly from valve housing.



S4M0157A

2. RACK ASSEMBLY

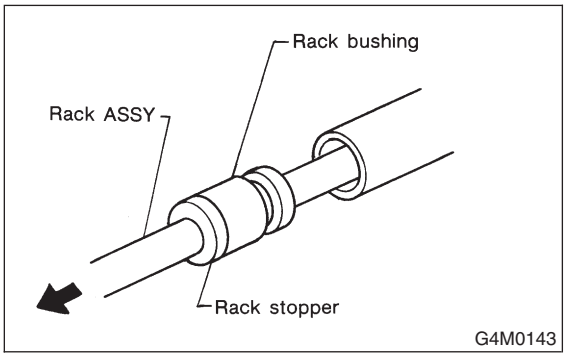
1) Using a sharp pointed pliers, rotate the rack stopper in the direction of the arrow until the end of the circlip comes out of the stopper. Rotate the circlip in the opposite direction and pull it out.



S4M0158A

2) Pull rack assembly from cylinder side, and draw out rack bushing and rack stopper together with rack assembly.

CAUTION:
Be careful not to contact rack to inner wall of cylinder when drawing out. Any scratch on cylinder inner wall will cause oil leakage.



3) Remove rack bushing and rack stopper from rack assembly.

CAUTION:
Do not reuse removed rack bushing and circlip.

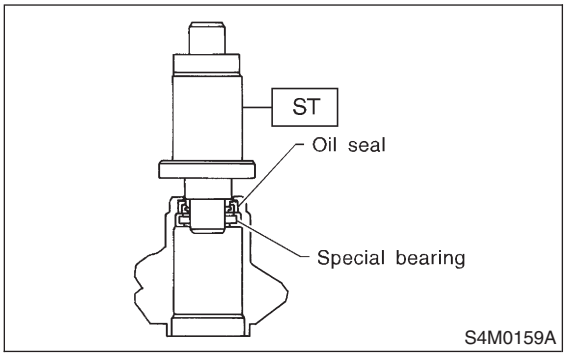
C: REPLACEMENT OF SEAL AND PACKING

1. VALVE HOUSING OIL SEAL

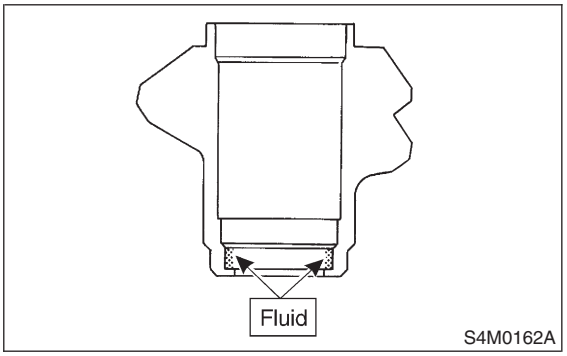
Specified steering grease:
VALIANT GREASE M2 (Part No. 003608001)

1) Using ST and press, remove dust seal, oil seal and special bearing from valve housing.
ST 34099FA120 INSTALLER & REMOVER SEAL

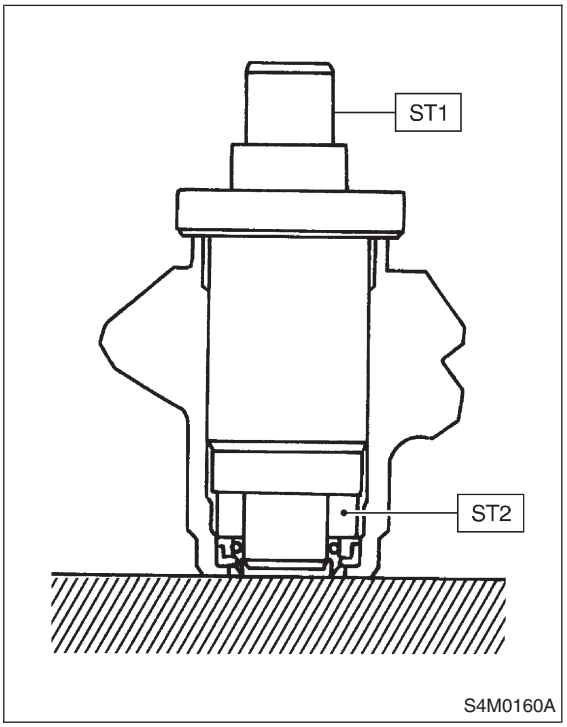
CAUTION:
- **Do not apply a force to end surface of valve housing.**
- **Do not reuse oil seal after removal.**



2) Apply a coat of specified power steering fluid to inner wall of valve housing.

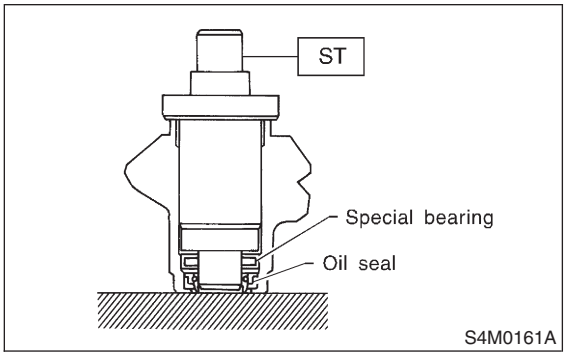


3) Attach ST2 to ST1, and press oil seal into place using a press.
ST1 34099FA120 INSTALLER & REMOVER SEAL
ST2 34099FA130 INSTALLER SEAL
(1) Face oil seal in the direction shown in figure when installing.
(2) To avoid scratching oil seal, apply a coat of grease to contact surface of installer and oil seal.
(3) To facilitate installation, attach oil seal to installer and position in valve housing before pressing into place.



4) Using ST and press, install special bearing in valve housing.
ST 34099FA120 INSTALLER & REMOVER SEAL

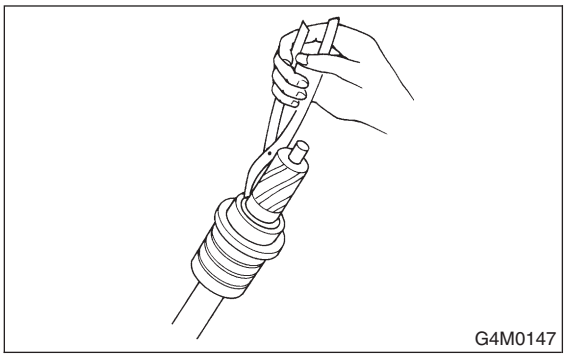
NOTE:
To facilitate installation, attach ball bearing to remover and position in valve housing before pressing it into place.



2. PINION AND VALVE ASSEMBLY

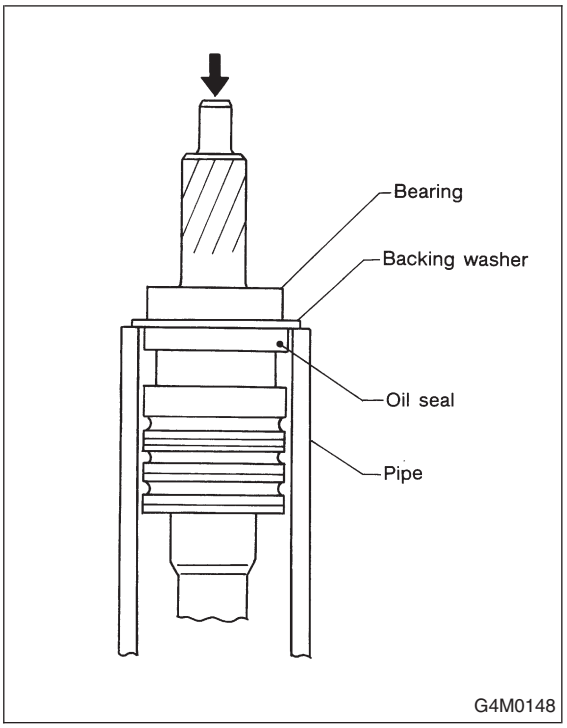
1) Remove snap ring using snap ring pliers.

CAUTION:
- **Do not reuse removed snap ring.**
- **Be careful not to scratch pinion and valve assembly.**



2) Press out bearing together with backing washer using pipe of I.D. 38.5 to 39.5 mm (1.516 to 1.555 in) and press.

CAUTION:
Do not reuse removed bearing.



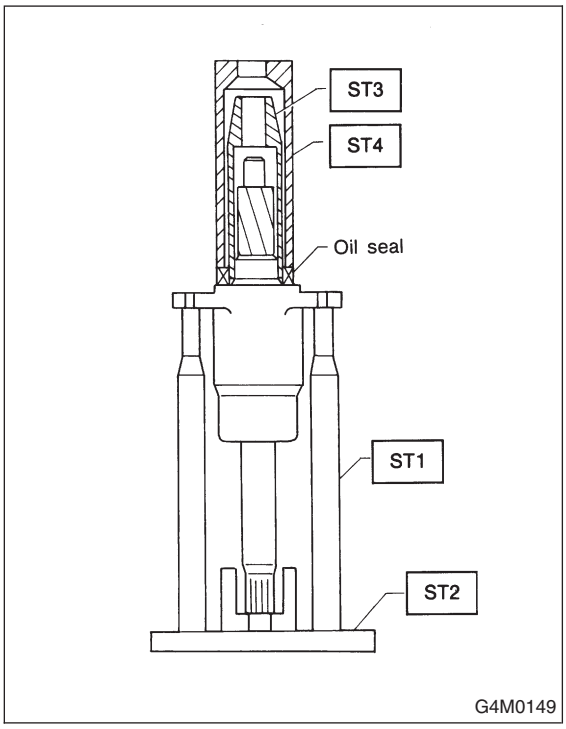
3) Remove oil seal.

CAUTION:
Do not reuse removed oil seal.

4) Put vinyl tape around pinion shaft splines to protect oil seal from damage.
5) Fit pinion and valve assembly into valve housing.

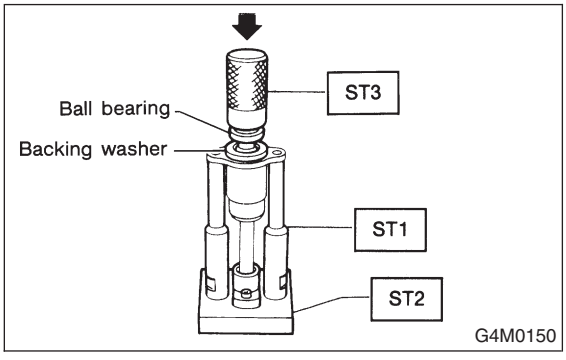
NOTE:
Apply specified power steering fluid to outer diameter surface of input shaft and outer surface of valve body seal ring, and pay special attention not to damage seal when inserting pinion and valve assembly.

6) Secure valve assembly to ST1 and ST2.
7) Put ST3 over pinion, and insert oil seal, then force-fit oil seal into housing using ST4.
ST1 926370000 INSTALLER A
ST2 34099FA100 STAND BASE
ST3 926360000 INSTALLER A
ST4 927620000 INSTALLER B



NOTE:
● Apply specified power steering fluid to oil seal and ST3, being careful not to damage oil seal lip.
● Push oil seal until ST3 contacts housing end face.

8) Remove ST3, and fit backing washer.
9) Force-fit ball bearing using ST3.
ST1 926370000 INSTALLER A
ST2 34099FA100 STAND BASE
ST3 927640000 INSTALLER B



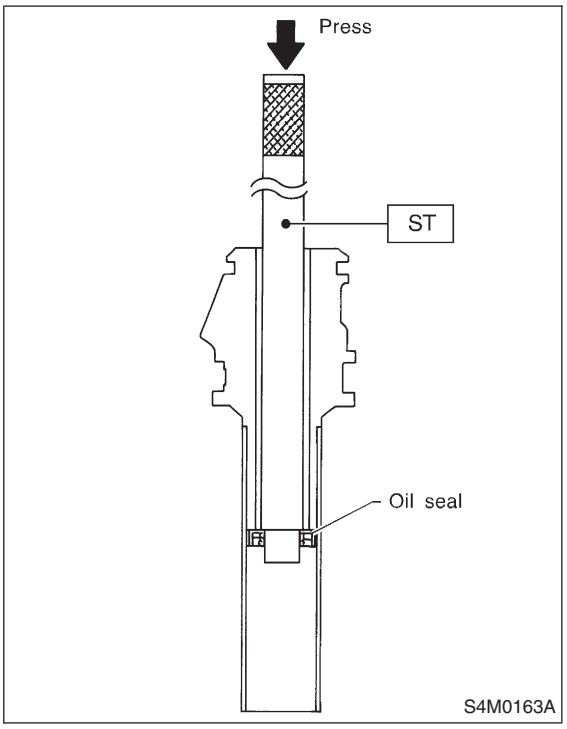
NOTE:
Be careful not to tilt ball bearing during installation.

10) Install snap ring using snap ring pliers.

NOTE:
Rotate snap ring to check for proper installation.

3. RACK HOUSING OIL SEAL

1) Insert ST from pinion housing side and remove oil seal using a press.
ST 34199AE050 REMOVER OIL SEAL

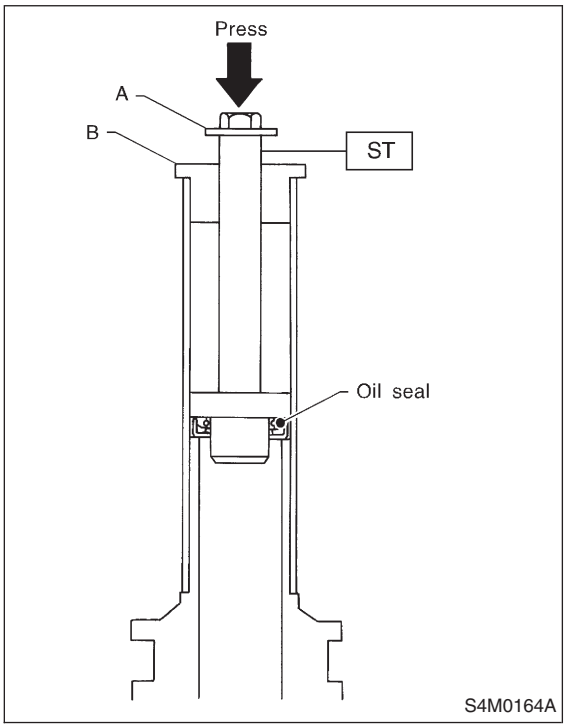


NOTE:
Discard removed oil seal.

2) Force-fit oil seal using ST.
ST 34099FA110 INSTALLER

CAUTION:
Be careful not to damage or scratch cylinder inner wall.

NOTE:
- Apply specified power steering fluid to oil seal.
- Pay special attention not to install oil seal in wrong direction.
- Push oil seal until the stepped portion of A contacts end face of B.



D: ASSEMBLY

1. RACK ASSEMBLY

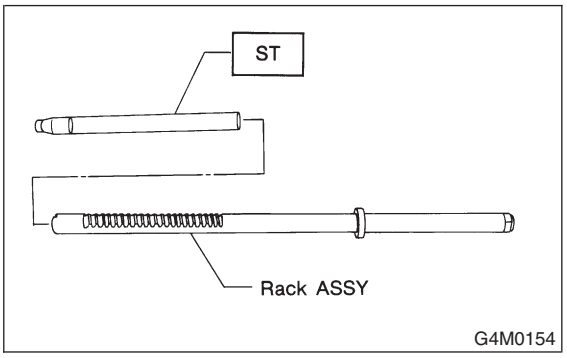
CAUTION:
Use only SUBARU genuine grease for gearbox.

Specified grease for gearbox:
VALIANT GREASE M2 (Part No. 003608001)

1) Fixing rack housing
Fix rack housing in vice using ST.
ST 926200000 STAND

CAUTION:
- **When fixing rack housing in vice, be sure to use this special tool. Do not fix rack housing in vice using pad such as aluminum plates, etc.**
- **When using old rack housing, be sure to clean and remove rust before assembling. Check pinion housing bushing carefully.**

2) Fit ST over toothed portion of rack assembly, and check for binding or unsmooth insertion. If any deformation is noted on flats at the end of rack, shape by using file, and wash with cleaning fluid.
ST 926390001 COVER and REMOVER



3) Apply genuine grease to teeth of thoroughly washed rack assembly, and fit ST over the toothed portion.

CAUTION:
- **Be careful not to block air passage with grease. Remove excessive grease.**
- **After fitting cover, check air passage hole for clogging. If clogged, open by removing grease from the hole.**
- **Check rack shaft for damage.**
- **Apply specified power steering fluid to this ST and surface of piston ring to prevent seal from being damaged.**

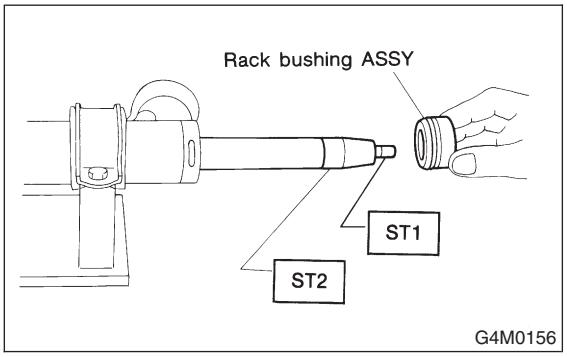
4) Insert rack assembly into rack housing from cylinder side, and remove ST after it has passed completely through oil seal.

NOTE:
Before inserting rack assembly, apply a coat of specified power steering fluid to surfaces of ST and rack piston.

ST 926390001 COVER AND REMOVER

5) Fit ST1 and ST2 over the end of rack, and install rack bushing.
ST1 926400000 GUIDE
ST2 927660000 GUIDE

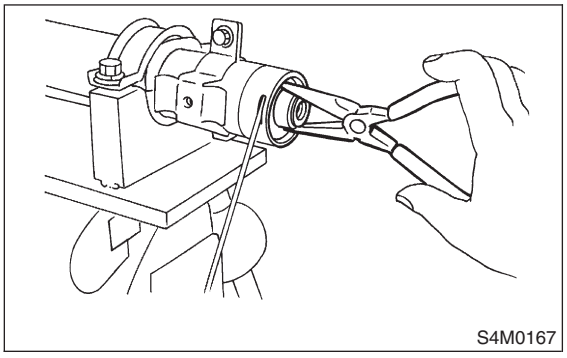
CAUTION:
• If burrs, or nicks are found on this guide and rack shaft portion, remove by filing.
• Dip rack bushing in specified power steering fluid before installing, and pay attention not to damage O-ring and oil seal.



6) Insert rack stopper into cylinder tube until internal groove (on cylinder side) is aligned with external groove (on rack stopper). Turn rack stopper with ST so that rack stopper hole is seen through cylinder slits.
7) Insert rack stopper into rack housing, and wrap circlip using a sharp pointed pliers to secure rack stopper in position.

CAUTION:
Be careful not to scratch rack while winding circlip.

NOTE:
Rotate wrench another 90 to 180° after the end of circlip has been wrapped in.



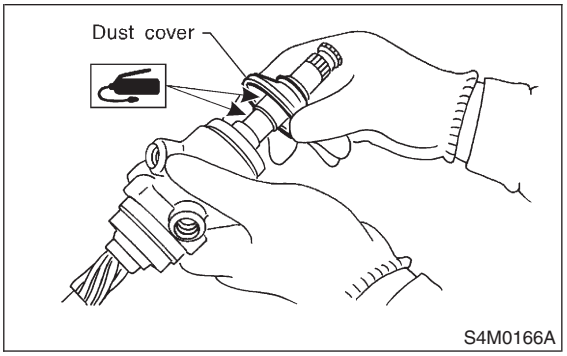
8) Fit mounting rubber onto rack housing.

2. VALVE ASSEMBLY

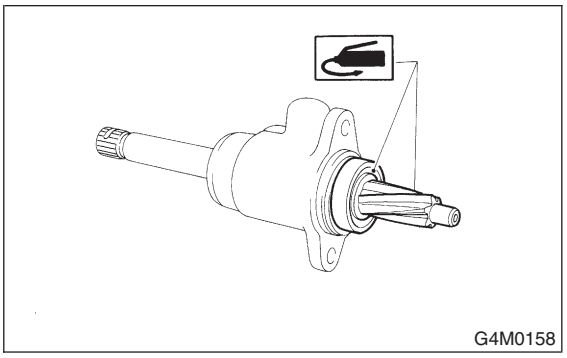
CAUTION:
Use only SUBARU genuine grease for gearbox.

Specified grease for gearbox:
VALIANT GREASE M2 (Part No. 003608001)

1) Apply specified grease to dust cover.



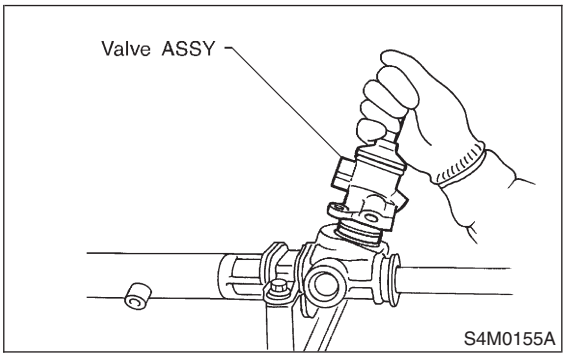
2) Install dust cover on valve assembly.
3) Apply genuine grease to pinion gear and bearing of valve assembly.



4) Install gasket on valve assembly. Insert valve assembly into place while facing rack teeth toward pinion.

CAUTION:
Be sure to use a new gasket.

NOTE:
Do not allow packing to be caught when installing valve assembly.



5) Tighten bolts alternately to secure valve assembly.

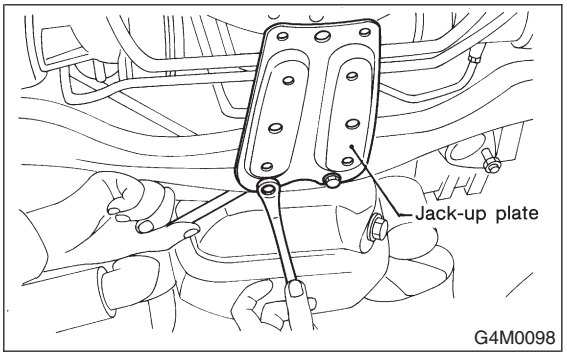
Tightening torque:
25±5 N·m (2.5±0.5 kg-m, 18.1±3.6 ft-lb)

CAUTION:
Be sure to alternately tighten bolts.

5. Pipe Assembly (Power Steering System)

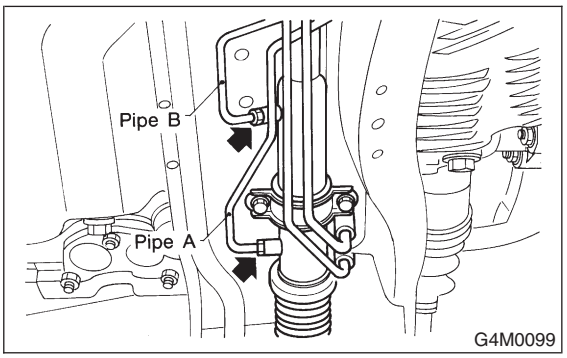
A: REMOVAL

1) Disconnect battery minus terminal.
2) Lift vehicle and remove jack-up plate.

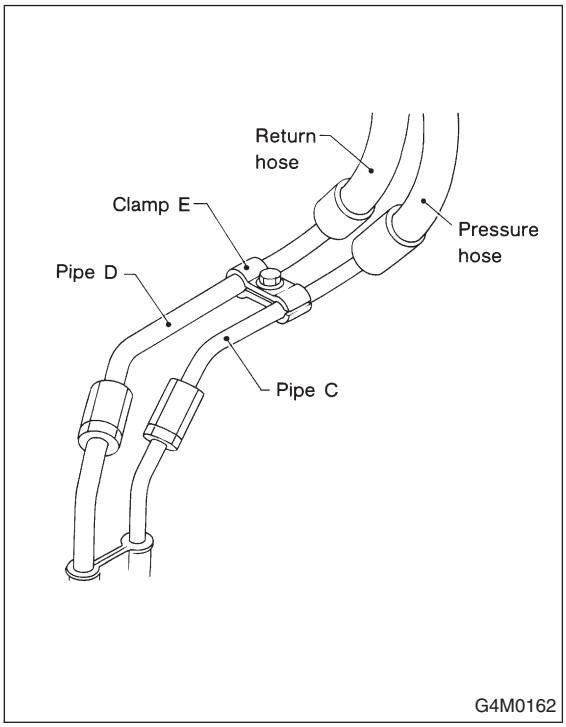


3) Remove one pipe joint at the center of gearbox, and connect vinyl hose to pipe and joint. Discharge fluid by turning steering wheel fully clockwise and counterclockwise. Discharge fluid similarly from the other pipe.

CAUTION:
Improper removal and installation of parts often causes fluid leak trouble. To prevent this, clean the surrounding portions before disassembly and reassembly, and pay special attention to keep dirt and other foreign matter from mating surfaces.

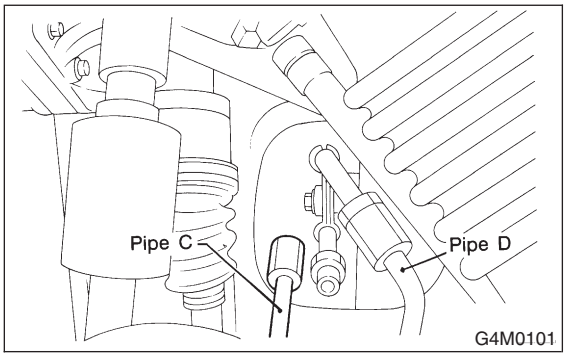


4) Remove clamp E from pipes C and D.



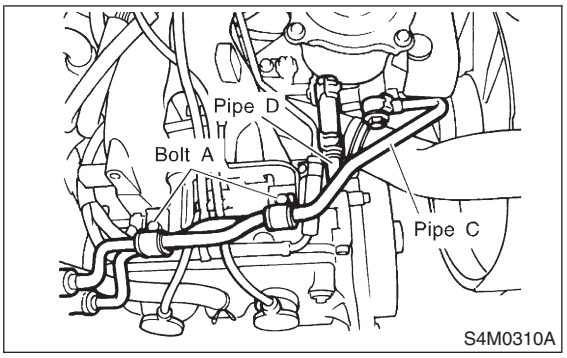
5) Disconnect pipe C from pipe (on the gearbox side).

CAUTION:
● When disconnecting pipe C, use two wrenches to prevent deformities.
● Be careful to keep pipe connections free from foreign matter.



6) Remove bolt A.
Disconnect pipe C from oil pump. Disconnect pipe D from oil tank.

CAUTION:
● Do not allow fluid from the hose end to come into contact with pulley belt.
● To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.



B: CHECK

Check all disassembled parts for wear, damage or other abnormalities. Repair or replace faulty parts as required.

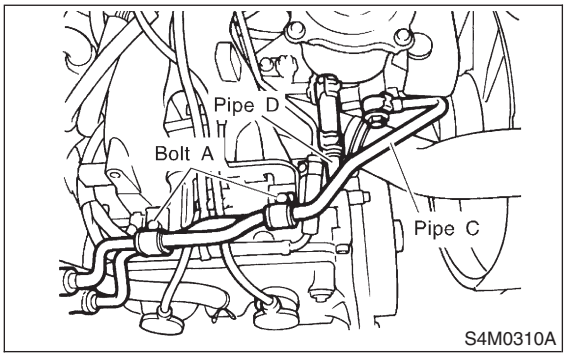
Part name	Inspection	Remedy
Pipe	● O-ring fitting surface for damage ● Nut for damage ● Pipe for damage	Replace with new one.
Clamp B	● Clamps for weak clamping force	Replace with new one.
Clamp C		
Clamp E		
Hose	● Flared surface for damage ● Flare nut for damage ● Outer surface for cracks ● Outer surface for wear ● Clip for damage ● End coupling or adapter for degradation	Replace with new one.

C: INSTALLATION

1) Connect pipes C and D to steering gearbox.

Tightening torque:
Joint nut
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)

CAUTION:
Visually check that hose between tank and pipe D is free from bending or twisting.



2) Connect pipe D to oil tank.
3) Connect pipe C to oil pump.

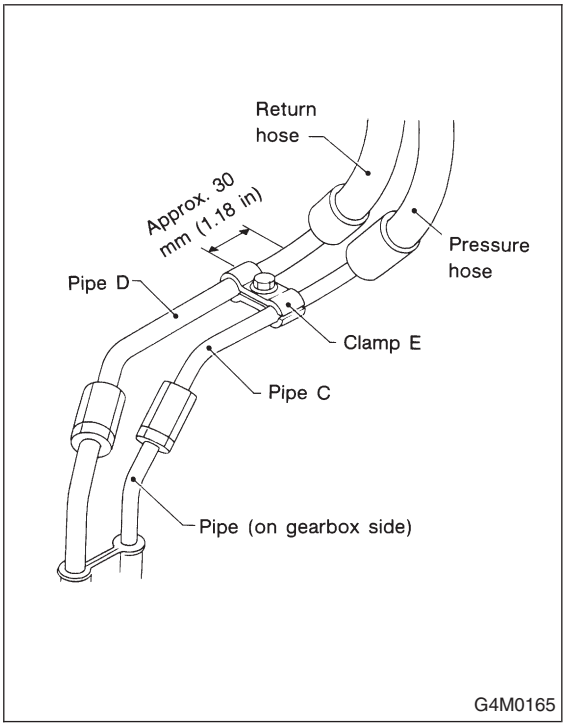
CAUTION:
Use a new gasket.

Tightening torque:
39±5 N·m (4.0±0.5 kg-m, 28.9±3.6 ft-lb)

4) Tighten bolt A.

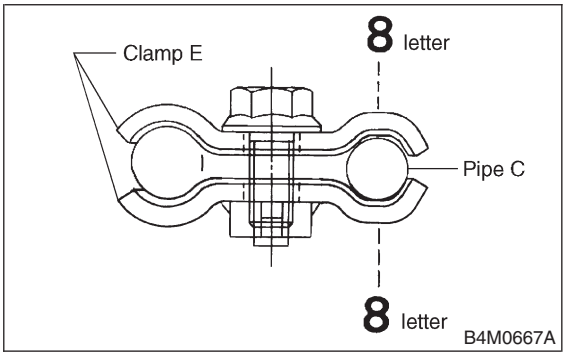
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

5) Temporarily connect pipes C and D to pipes (on the gearbox side).



6) Temporarily install clamp E on pipes C and D.

CAUTION:
Ensure that the letter "8" side of clamp E is on the pipe C side as shown in the figure.



7) Tighten clamp E firmly.

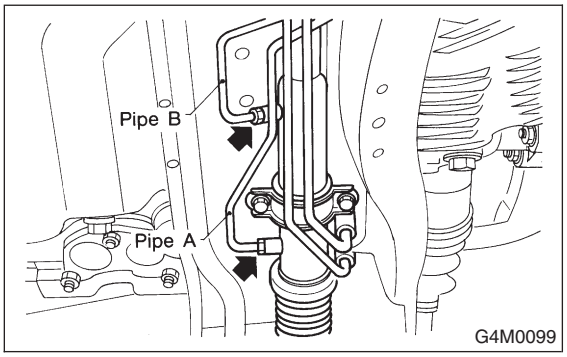
Tightening torque:
7.4±2.0 N·m (0.75±0.20 kg-m, 5.4±1.4 ft-lb)

8) Tighten joint nut.

Tightening torque:
15±5 N·m (1.5±0.5 kg-m, 10.8±3.6 ft-lb)

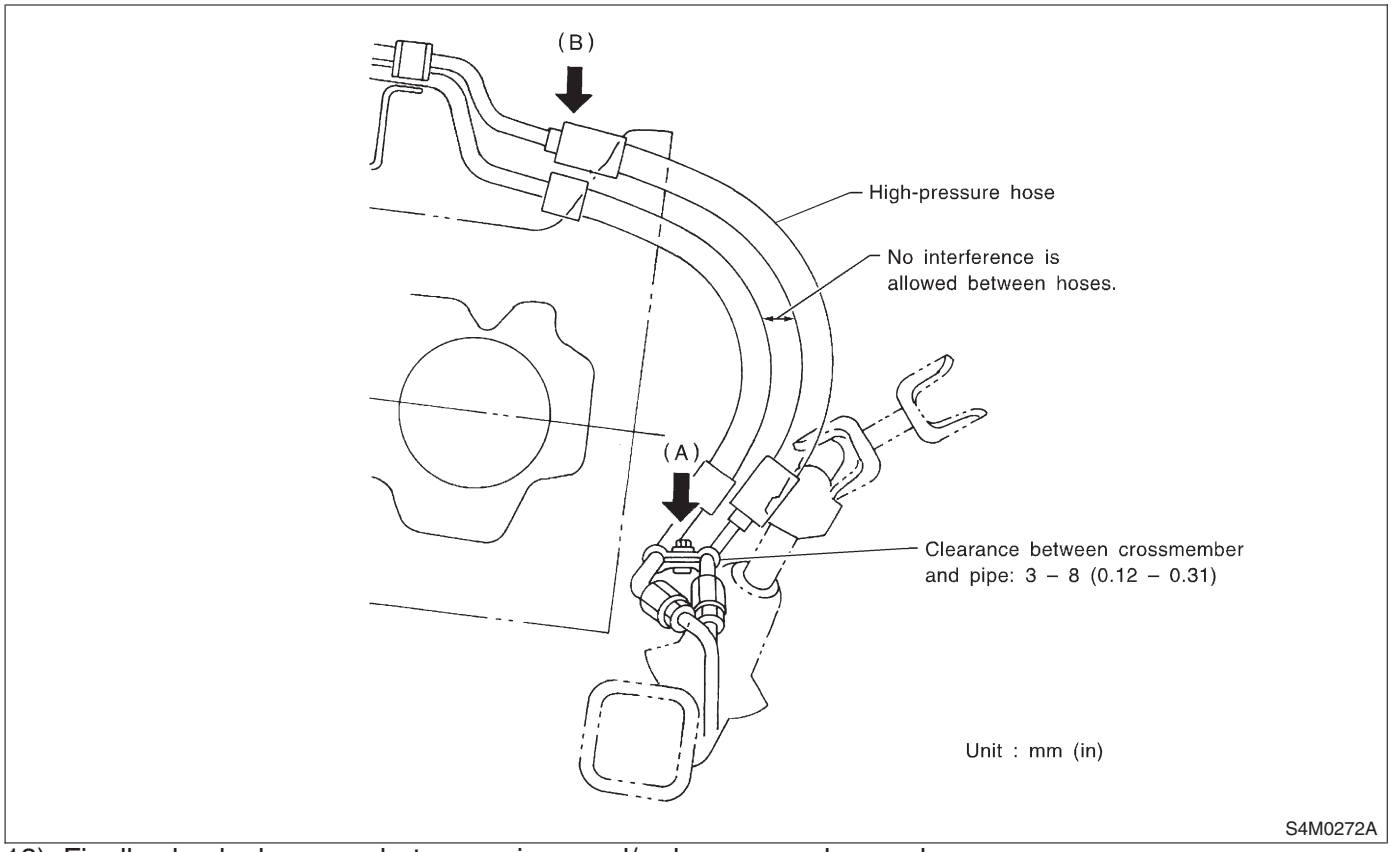
9) Connect pipes A and B to four pipe joints of gearbox. Connect upper pipe B first, and lower pipe A second.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



10) Install jack-up plate.
11) Connect battery minus terminal.
12) Feed the specified fluid and discharge air.

NOTE:
Never start the engine before feeding the fluid; otherwise vane pump might be seized up.



13) Finally check clearance between pipes and/or hoses, as shown above.
If clearance between cruise control pump and power steering hose is less than 10 mm (0.39 in), proceed as follows:

(1) Move clamped section (A) (refer to figure above.) down to a point where pipe is close to crossmember.

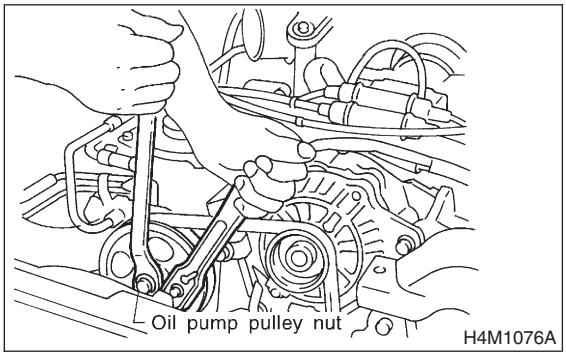
Pipe-to-crossmember clearance:
10 mm (0.39 in), min.

(2) Check that clearance between cruise control pump and power steering hose is at least 10 mm (0.39 in). If it is not, bend section (B) down until a clearance of at least 10 mm (0.39 in) is obtained.

6. Oil Pump (Power Steering System)

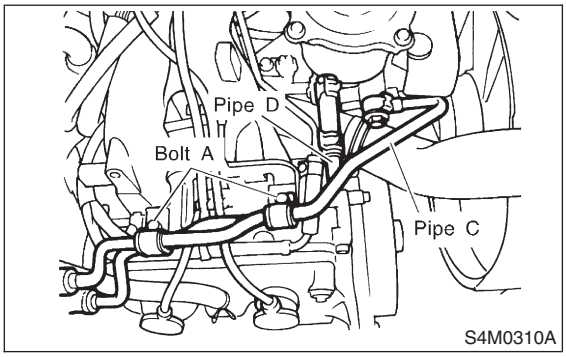
A: REMOVAL

1) Remove ground cable from battery.
2) Drain the working fluid about 0.3 ℓ (0.3 US qt, 0.3 Imp qt) from oil tank.
3) Remove pulley belt cover bracket.
4) Loosen oil pump pulley nut, then remove bolts which secure alternator.

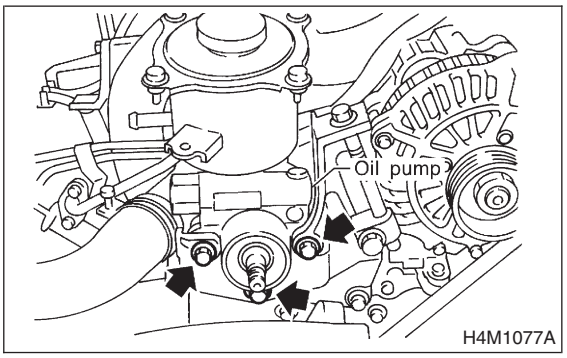


5) Loosen pulley belt(s).
6) Remove the nut and detach oil pump pulley.
7) Disconnect pipe C from oil pump. Disconnect pipe D from oil tank.

CAUTION:
• Do not allow fluid from the hose end to come into contact with pulley belt.
• To prevent foreign matter from entering the hose and pipe, cover the open ends of them with a clean cloth.
• Except when only oil tank needs to be inspected, detach oil tank and oil pump as a unit. Then separate one from the other on a work bench to prevent oil from spilling on any part of the engine.



8) Remove three bolts from the front side of oil pump and detach the pump.

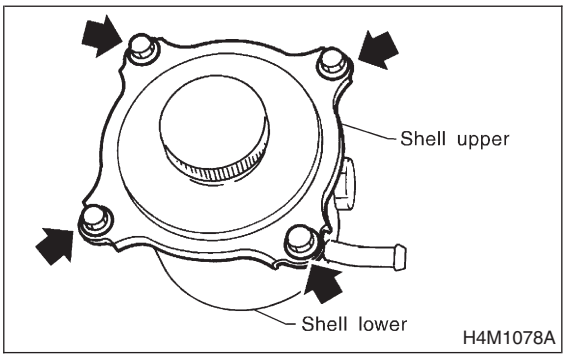


9) Remove three bolts from the lower side of bracket and detach the bracket.

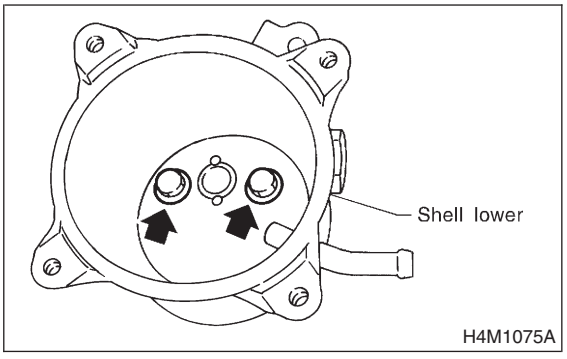
CAUTION:
The bracket does not need to be removed unless it is damaged.

10) Place oil pump in a vise, and remove shell upper and baffle from shell lower.

CAUTION:
Do not clamp oil pump too hard; otherwise oil pump may be dented.



11) Remove shell lower from oil pump.



B: CHECK

● In accordance with the following table, check all removed parts for wear and damage, and make repair or replacement if necessary.

No.	Parts	Inspection	Corrective action
1	Oil pump (Exterior)	(1) Crack, damage or oil leakage	Replace oil pump with a new one.
		(2) Play of pulley shaft	Measure radial play and axial play. If any of these exceeds the service limit, replace oil pump with a new one. <Ref. to 4-3 [W6B1].>
2	Pulley	(1) Damage	Replace it with a new one.
		(2) Bend	Measure V ditch deflection. If it exceeds the service limit, replace pulley with a new one. <Ref. to 4-3 [W6B1].>
3	Cap	Crack or damage	Replace it with a new one.
4	Strainer	(1) Clogging with dirt	Wash it.
		(2) Breakage	Replace it with a new one.
5	Oil pump (Interior)	(1) Defect or burning of vane pump	Check resistance to rotation of pulley. If it is past the service limit, replace oil pump with a new one. <Ref. to 4-3 [W6B1].>
		(2) Bend in the shaft or damage to bearing	Oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump when turning with a string put around its pulley, replace oil pump with a new one.
6	O-ring	Crack or deterioration	Replace it with a new one.
7	Oil tank	Crack, damage or oil leakage	Replace it with a new one.
8	Bracket	Crack	Replace it with a new one.

1. SERVICE LIMIT

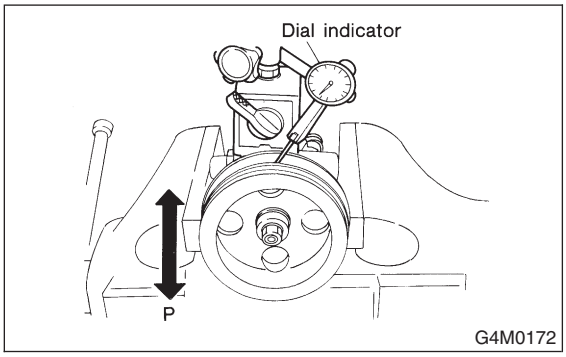
Make a measurement as follows. If it exceeds the specified service limit, replace the parts with new ones.

CAUTION:
● Fix oil pump on a vise to make a measurement. At this time, hold oil pump with the least possible force between two wood pieces.
● Do not set outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.

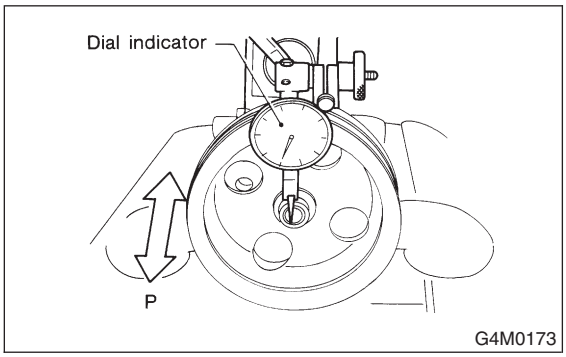
● **Play of pulley shaft**

On condition:
P: 9.8 N (1.0 kg, 2.2 lb)

Service limit:
Radial play (Direction ⟷)
0.4 mm (0.016 in) or less



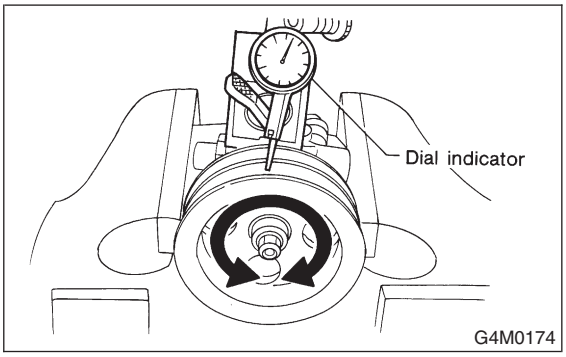
Axial play (Direction ⟺)
0.9 mm (0.035 in) or less



● **Ditch deflection of pulley**

Service limit:
1.0 mm (0.039 in) or less

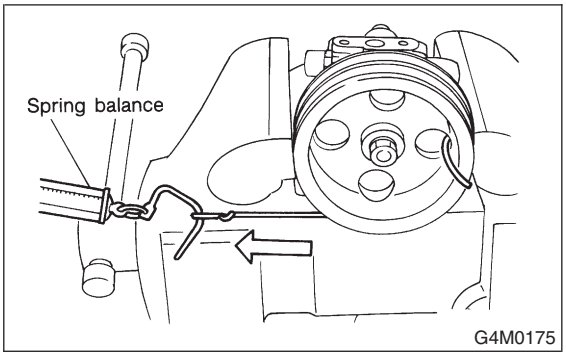
NOTE:
Read the value for one surface of V ditch, and then the value for another off the dial.



● **Resistance to rotation of pulley**

Service limit:
Maximum load; 9.22 N (0.94 kg, 2.07 lb) or less

NOTE:
● A rather higher value may be indicated when pulley starts turning.
● Measure the load during rotation and make a judgment.



C: INSTALLATION

1) Install bracket on engine.

Tightening torque:
22±2 N·m (2.2±0.2 kg-m, 15.9±1.4 ft-lb)

2) Install oil pump on oil tank as follows outside the vehicle:

NOTE:
Prior to installation, make sure that all oil is removed from oil pump, oil tank and pipe.

(1) Place oil pump in a vise and install stay to oil pump.

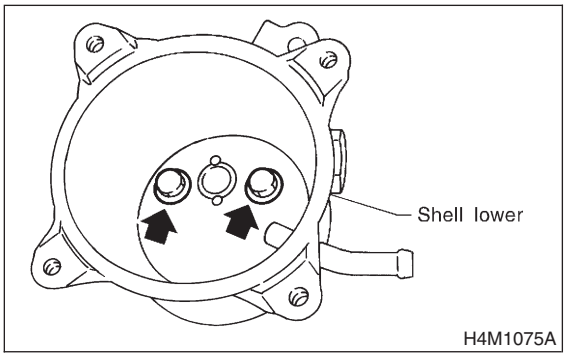
CAUTION:
Do not place oil pump directly in vise; use soft pads and hold oil pump lightly to protect it.

Tightening torque:
15.7±2.4 N·m (1.60±0.24 kg-m, 11.6±1.7 ft-lb)

(2) Install shell lower to oil pump.

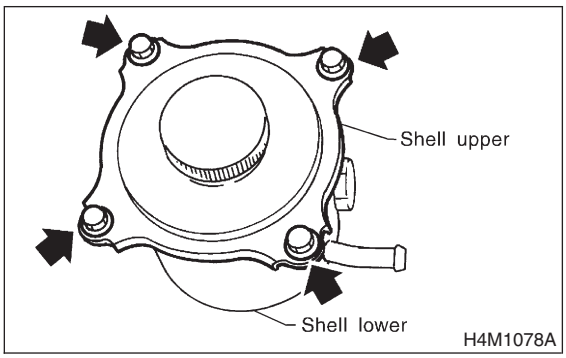
Tightening torque:
18$^{+5}_{0}$ N·m (1.8$^{+0.5}_{0}$ kg-m, 13.0$^{+3.6}_{0}$ ft-lb)

CAUTION:
Be sure to use a new seal washer.



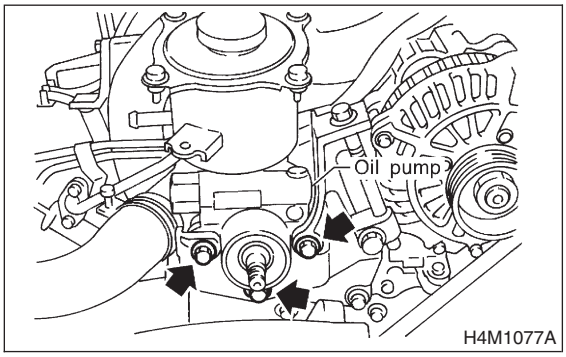
(3) Install shell upper and baffle to shell lower.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



3) Install oil pump, previously assembled to oil tank, on bracket.

Tightening torque:
18$^{+5}_{0}$ N·m (1.8$^{+0.5}_{0}$ kg-m, 13.0$^{+3.6}_{0}$ ft-lb)



4) Place oil pump pulley and tighten pulley nut temporarily.
5) Install pulley belt to oil pump.
6) Tighten oil pump pulley nut to the specified torque.

Tightening torque:
52±10 N·m (5.3±1.0 kg-m, 38±7 ft-lb)

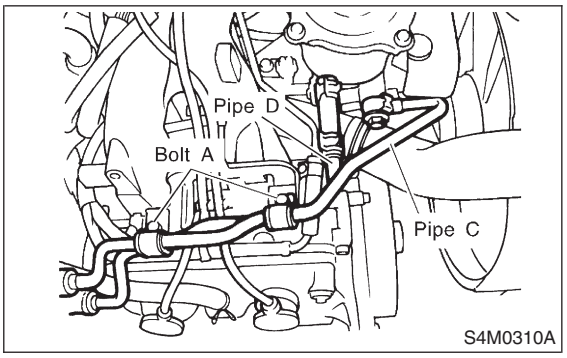
7) Check pulley belt tension. <Ref. to 1-5 [G2A0].>
8) Tighten bolt belt tension.

Tightening torque:
8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)

9) Interconnect pipes C and D.

Tightening torque:
Eye bolt
39±5 N·m (4.0±0.5 kg-m, 28.9±3.6 ft-lb)

CAUTION:
If a hose is twisted at this step, the hose may come into contact with some other parts.



10) Install pulley belt cover bracket.
11) Connect minus terminal of battery.
12) Feed the specified power steering fluid and discharge air. <Ref. to 4-3 [W7A0].>

CAUTION:
Never start the engine before feeding the fluid; otherwise vane pump might be seized up.

7. Power Steering Fluid

A: RECOMMENDED POWER STEERING FLUID AND AIR BLEEDING

Recommended power steering fluid	Manufacturer
ATF DEXRON II, IIE or III	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

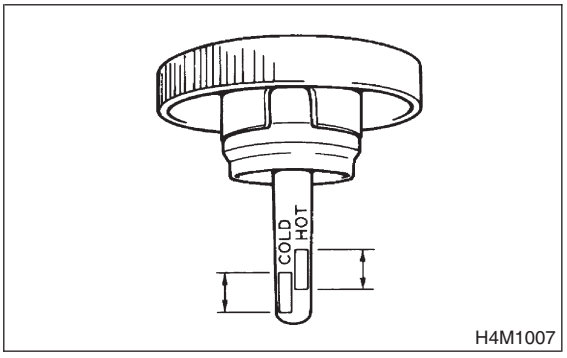
1) Feed the specified fluid with its level being about 4 cm (1.6 in) lower than the mouth of tank.
2) Continue to turn steering wheel slowly from lock to lock until bubbles stop appearing in the tank while keeping the fluid at that level.
3) In case air is absorbed to deliver bubbles into piping because the fluid level is lower, leave it about half an hour and then do the previous step all over again.
4) Start, and idle the engine.
5) Continue to turn steering wheel slowly from lock to lock again until bubbles stop appearing in the tank while keeping the fluid at that level. It is normal that bubbles stop appearing after three times turning of steering wheel.
6) In case bubbles do not stop appearing in the tank, leave it about half an hour and then do the step 5) all over again.
7) Stop the engine, and take out safety stands after jacking up vehicle again.
Then lower the vehicle, and idle the engine.
8) Continue to turn steering wheel from lock to lock until bubbles stop appearing and change of the fluid level is within 3 mm (0.12 in).
9) In case the following happens, leave it about half an hour and then do the previous step.
(1) The fluid level changes over 3 mm (0.12 in).
(2) Bubbles remain on the upper surface of the fluid.
(3) Grinding noise is generated from oil pump.
10) Check the fluid leakage at flare nuts after turning steering wheel from lock to lock with engine running.

CAUTION:
• Before checking, wipe off any fluid on flare nuts, eye bolt and piping.
• In case the fluid leaks from flare nut, it is caused by dust (or the like) and/or damage between flare and tapered seat in piping.
• So remove the flare nut, tighten again it to the specified torque after cleaning flare and tapered seat. If flare or tapered seat is damaged, replace it with a new one.

11) Inspect fluid level on flat and level surface with engine “OFF” by indicator of filler cap. If the level is at lower point or below, add fluid to keep the level in the specified range of the indicator. If at upper point or above, drain fluid by using a syringe or the like.

Fluid capacity:
0.7 ℓ (0.7 US qt, 0.6 Imp qt)

(1) Check at temperature 21°C (70°F) on reservoir surface of oil pump, read the fluid level on the “COLD” side.
(2) Check at temperature 60°C (140°F) on reservoir surface of oil pump, read the fluid level on the “HOT” side.



1. Power Steering

A: STEERING CONDITION

Trouble	Possible cause	Corrective action
• Heavy steering effort in all ranges • Heavy steering effort at stand still • Steering wheel surges when turning.	1. Pulley belt • Unequal length of pulley belts • Adhesion of oil and grease • Loose or damage of pulley belt • Poor uniformity of pulley belt cross section • Pulley belt touches to pulley bottom • Poor revolution of pulleys except oil pump pulley • Poor revolution of oil pump pulley	Adjust or replace.
	2. Tire and rim • Improper tires out of specification • Improper rims out of specification • Tires not properly inflated*1	Replace or reinflate.
	3. Fluid • Low fluid level • Aeration • Dust mix • Deterioration of fluid • Poor warming-up of fluid *2	Refill, bleed air, replace or instruct customer.
	4. Idling speed • Lower idling speed • Excessive drop of idling speed at start or at turning steering wheel *3	Adjust or instruct customer.
	5. Measure hydraulic pressure. <Ref. to 4-3 [K1B0].>	Replace problem parts.
	6. Measure steering effort. <Ref. to 4-3 [K1C0].>	Adjust or replace.
• Vehicle leads to one side or the other. • Poor return of steering wheel to center • Steering wheel surges when turning.	1. Fluid line • Folded hose • Flattened pipe	Reform or replace.
	2. Tire and rim • Flat tire • Mix use of different tires • Mix use of different rims • Abnormal wear of tire • Unbalance of remained grooves • Unbalance of tire pressure	Fix or replace.
	3. Front alignment • Improper or unbalance caster • Improper or unbalance toe-in • Loose connection of suspension	Adjust or retighten.
	4. Others • Damaged joint assembly • Unbalanced height • One-sided weight	Replace, adjust or instruct customer.
	5. Measure steering effort. <Ref. to 4-3 [K1C0].>	Adjust or replace.

*1 If tires and/or rims are wider, the load to power steering system is the more. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before maximum turning angle. In this case, steering effort may be heavy. When measured hydraulic pressure is normal, there is no abnormal thing.
*2 In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn steering wheel from stop to stop several times to warm-up fluid. Then if steering effort reduces normally, there is no abnormal thing.
*3 In cold weather or with insufficient warm-up of engine, steering effort may be heavy due to excessive drop of idling when turning steering wheel. In this case, it is recommended to start the vehicle with increasing engine speed than usual. Then if steering effort reduces normally, there is no abnormal thing.

B: MEASUREMENT OF HYDRAULIC PRESSURE

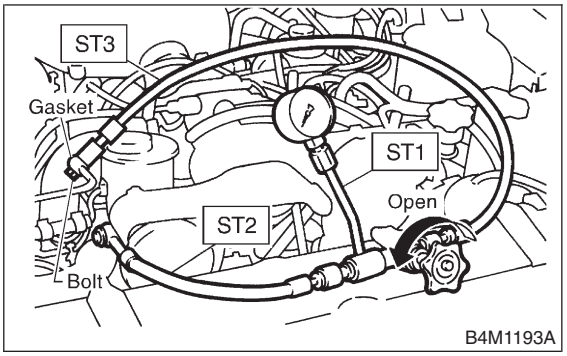
CAUTION:
● Be sure to complete all items aforementioned in "STEERING CONDITION", prior to measuring hydraulic pressure. Otherwise, pressure can not be measured correctly. <Ref. to 4-3 [K1A0].>
● Do not leave the valve of pressure gauge closed or hold the steering wheel at stop end for 5 seconds or more in any case, as the oil pump may be damaged due to long keep of these conditions.
● Put cotton cloth waste at a place where fluid drops before pressure gauge is installed. Wipe off split fluid thoroughly after the measurement.

NOTE:
Keep engine idling during the measurement.

1B1 : MEASURE REGULAR PRESSURE.

1) Install STs to power steering pump.
   (1) Drain the power steering fluid about 0.35 ℓ (0.4 US qt, 0.3 Imp qt) from oil tank.
   (2) Remove two bolts securing power steering pipes to engine.
   (3) Install ST1, 2 and 3 between power steering pump and pipes using gasket (Part No. 34621AC020) and bolt (Part No. 34620AC010).

ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A

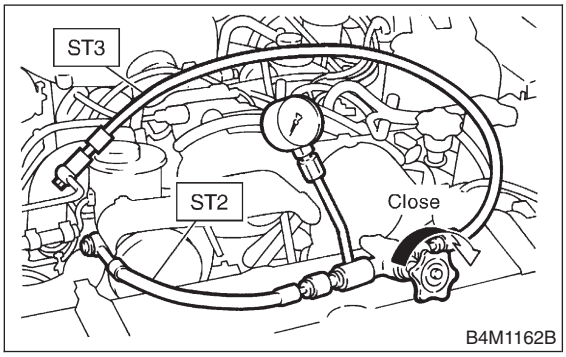


   (4) Replenish power steering fluid up to specified level.
2) Open valve, and start the engine.
3) Measure regular pressure.

CHECK : ***Is pressure 981 kPa (10 kg/cm^2, 142 psi) or less?***
YES : Go to step **1B2**.
NO : Trouble may be due to crushed pipe or hose, leakage from fluid line, foreign particles in fluid line, etc. Replace faulty parts with new ones.

1B2 : MEASURE RELIEF PRESSURE.

1) Using STs, measure relief pressure.
ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A



2) Close valve.

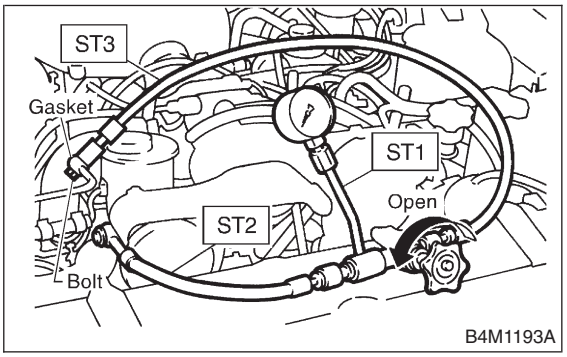
CHECK : ***Is pressure 7,159 — 7,748 kPa (73 — 79 kg/cm^2, 1,038 — 1,123 psi)?***

YES : Go to step **1B3**.

NO : Trouble may be due to malfunctioning relief valve, fluid leaking into oil pump interior, abnormal wear of pump vanes, etc. Replace with new oil pump.

1B3 : MEASURE WORKING PRESSURE.

1) Using STs, measure working pressure.
ST1 925711000 PRESSURE GAUGE
ST2 34099AC020 ADAPTER HOSE B
ST3 34099AC010 ADAPTER HOSE A



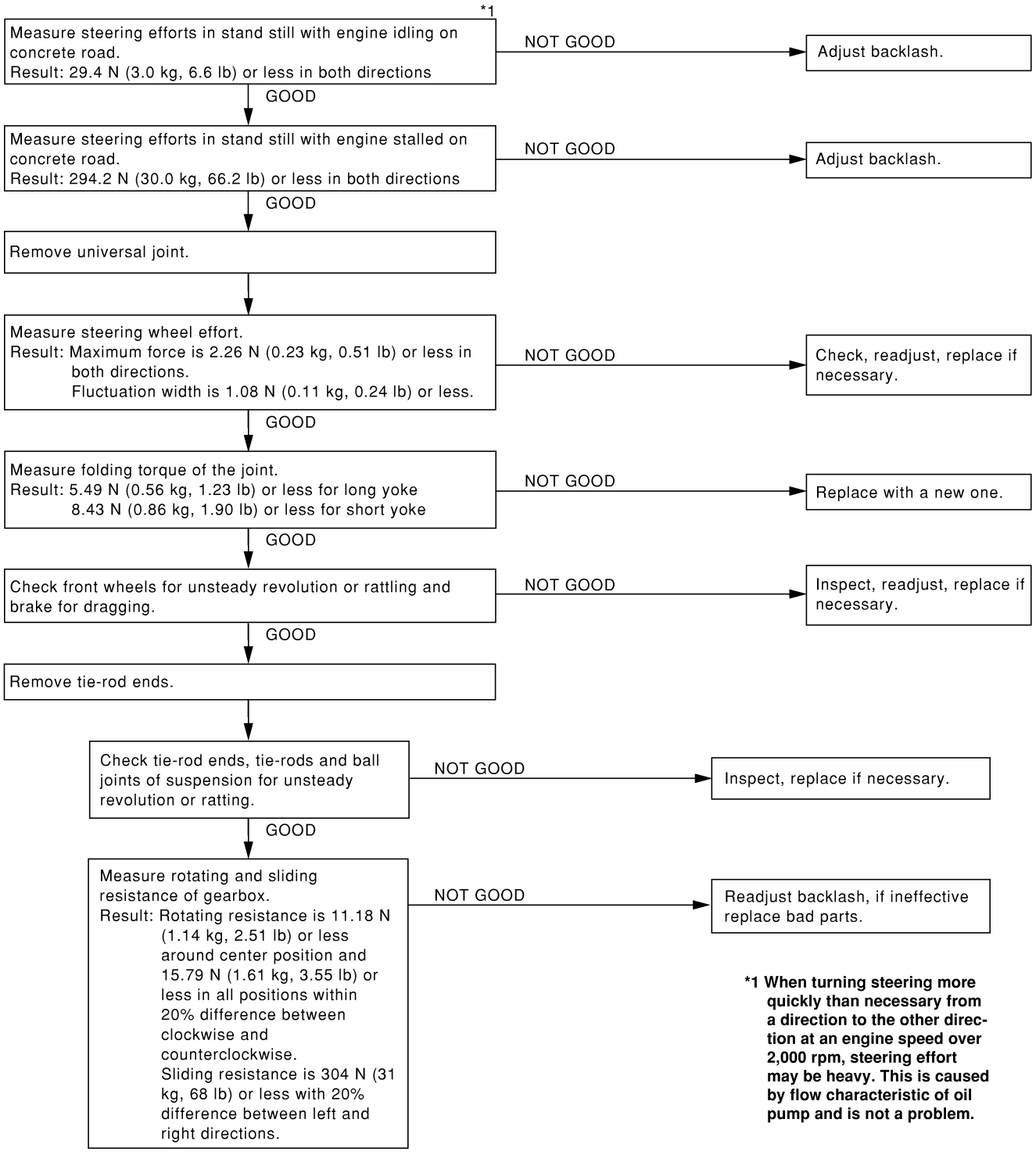
2) Open valve.
3) Measure working pressure of control valve by turning wheel from stop to stop.

CHECK : ***Is pressure 7,159 — 7,748 kPa (73 — 79 kg/cm^2, 1,038 — 1,123 psi)?***

YES : Measure steering force. <Ref. to 4-3 [K1C0].>

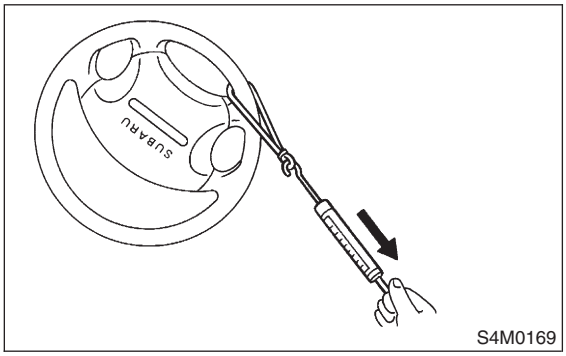
NO : Control valve is inoperative. Replace control valve itself or control valve and pinion as a single unit with new ones.

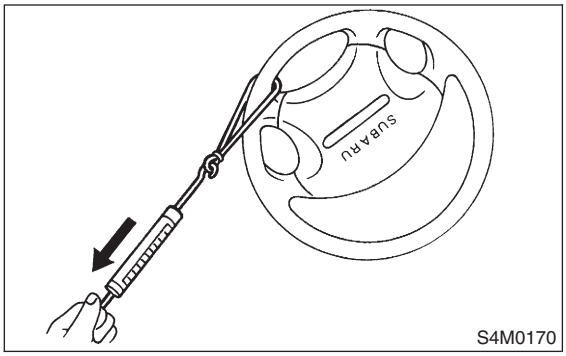
C: MEASUREMENT OF STEERING EFFORT



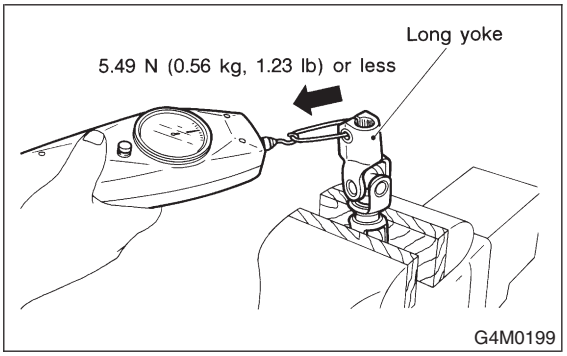
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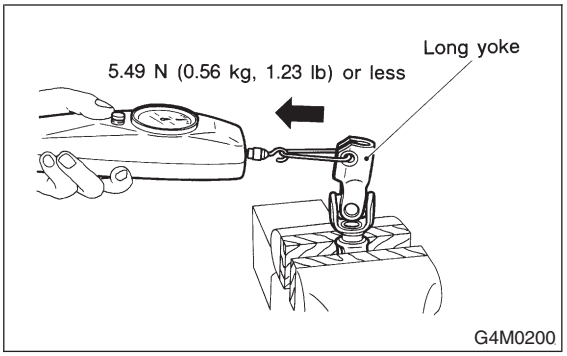
1) Measurement of steering effort is as shown in the figures.

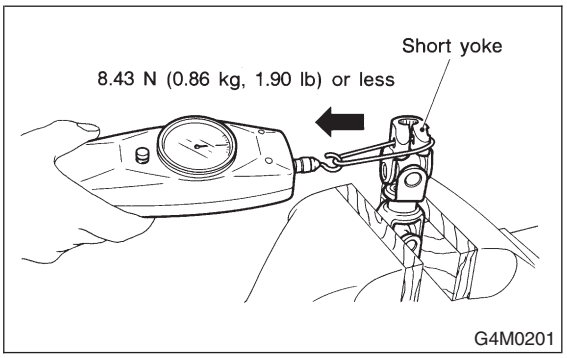


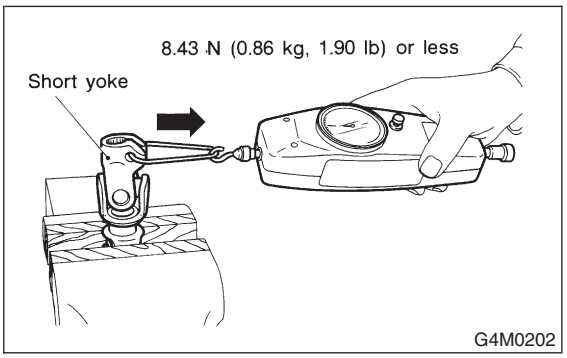


2) Measurement of folding torque of universal joint is as shown in the figures.



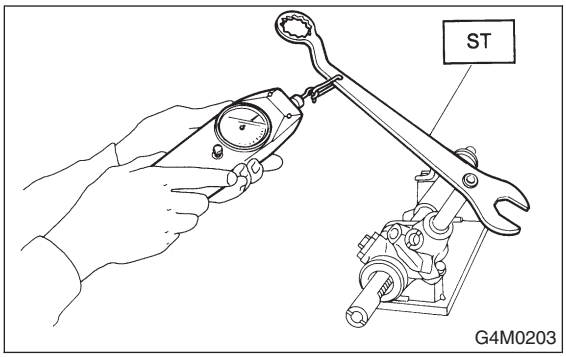




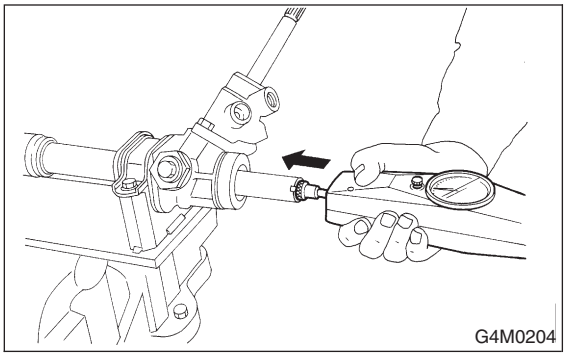


3) Using ST, measure resistances of gearbox.
ST 926230000 SPANNER

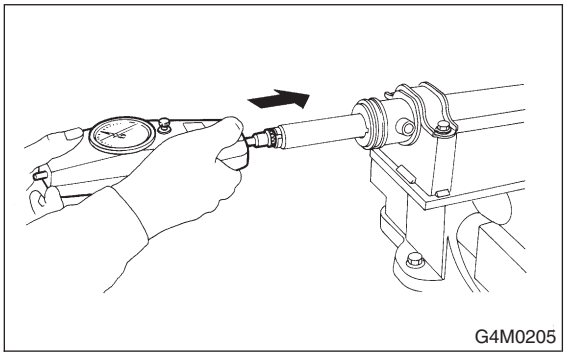
Rotating resistance:
Straight-ahead position within 30 mm (1.18 in) from rack center;
Less than 11.18 N (1.14 kg, 2.51 lb)
Maximum allowable torque;
15.7 N (1.6 kg, 3.5 lb)



Sliding resistance:
Right-turn steering;
304 N (31 kg, 68 lb) or less

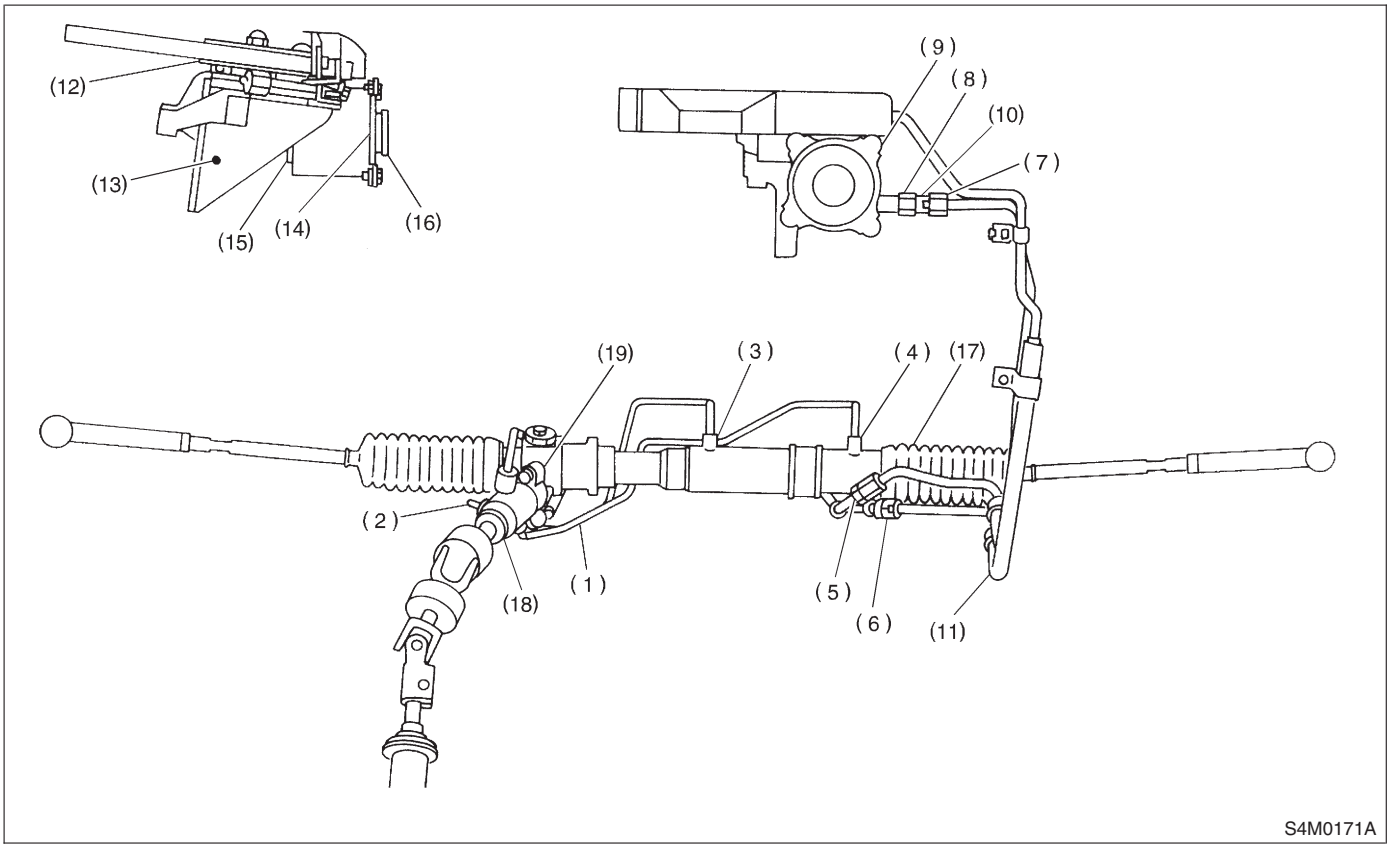


Left-turn steering;
304 N (31 kg, 68 lb) or less



D: FLUID LEAKAGE

CAUTION:
It is likely that although one judges fluid leakage, there is actually no leakage. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.



Fluid leaking area	Possible cause	Corrective action
Leakage from connecting portions of pipes and hoses, numbered with (1) through (9) in figure	Insufficient tightening of flare nut, catching dirt or the like, damage to flare or flare nut or eye bolt	Loosen and retighten, if ineffective, replace.
	Poor insertion of hose, poor clamping	Retighten or replace clamp.
	Damaged O-ring or gasket	Replace O-ring or gasket pipe or hose with new one, if ineffective, replace gear-box also.
Leakage from hose (10) and (11) in figure	Crack or damage in hose	Replace with a new one.
	Crack or damage in hose hardware	Replace with a new one.
Leakage from surrounding of cast iron portion of oil pump (12) and (13) in figure	Damaged O-ring	Replace oil pump.
	Damaged gasket	Replace oil pump.
Leakage from oil tank (14) and (15) in figure	Crack in oil tank, (14)	Replace oil tank.
	Damaged O-ring, (15)	Replace O-ring.
Leakage from filler neck (16)	Damaged cap packing	Replace cap.
	Crack in root of filler neck	Replace oil tank.
	High fluid level *1	Adjust fluid level.
Leakage from surrounding of power cylinder of gearbox (17) in figure	Damaged oil seal	Replace oil seal.
Leakage from control valve of gear-box (18) and (19) in figure	Damaged packing or oil seal	Replace problem parts.
	Damage in control valve	Replace control valve.

NOTE:
Fluid level is specified at optimum position (range) for ordinary use. Accordingly, if the vehicle is used often under hard conditions such as on very rough roads or in mountainous areas, fluid may bleed out from cap air vent hole. This is not a problem. If a customer complains strongly and is not likely to be satisfied with the leakage, lower the fluid level to the extent that fluid will not bleed out under the conditions described, and have the customer check the fluid level and its quality more frequency than usual.

E: NOISE AND VIBRATION

CAUTION:
Don't keep the relief valve operated over 5 seconds at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.

NOTE:
- Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.
- Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at stand still there is no abnormal function in the system provided that the noise eliminates when the vehicle is running.
- When stopping with service brake and/or parking brake applied, power steering can be operated easily due to its light steering effort. If doing so, the disk rotates slightly and makes creaking noise. The noise is generated by creaking between the disk and pads. If the noise goes off when the brake is released, there is no abnormal function in the system.
- There may be a little vibration around the steering devices when turning steering wheel at standstill, even though the component parts are properly adjusted and have no defects.

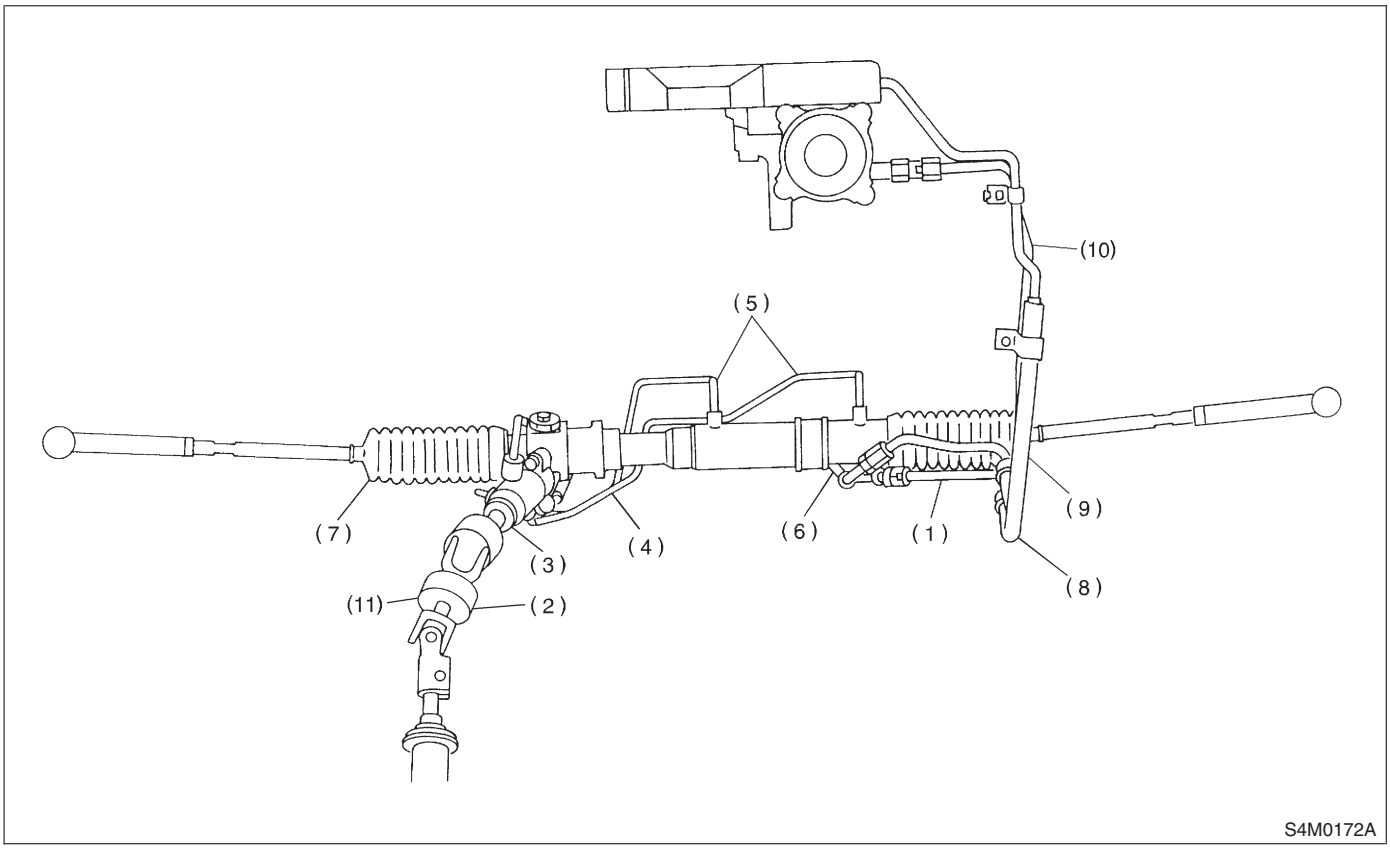
Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.
This phenomena does not indicate there is some abnormal function in the system.
The vibration can be known when steering wheel is turned repeatedly at various speeds from slow to rapid step by step with parking brake applied on concrete road and in "D" range for automatic transmission vehicle.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Don't keep this condition over 5 seconds.)	Normal
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is faulty.	Defective Replace oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check clearance. Correct if necessary. <Ref. to 4-3 [K1F0].>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loosened installation of oil pump pulley or other pulley(s)	Retighten.
	Loosened linkage or play of steering or suspension Loosened tightening of joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace bad parts of the gearbox or oil pump.
Knocking When turning steering wheel in both direction with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Loosened tightening or play of tie-rod, tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Vane pump aeration	Inspect and retighten fluid line connection. Refill fluid and vent air.
	Vane pump seizing	Replace oil pump.
	Pulley bearing seizing of oil pump	Replace oil pump.
	Folded hose, flat pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Maladjustment of pulley belt Damaged or charged pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Run out or soilage of V-groove surface of oil pump pulley	Clean or replace.
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix wrong part causing aeration. Replace fluid and vent air.
	Damaged pipe of gearbox	Replace pipe.
	Abnormal inside of hose or pipe Flat hose or pipe	Rectify or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install cap.
Whistle (continuous) While engine is running.	Abnormal pipe of gearbox or abnormal inside of hose	Replace bad parts of gearbox or hose.
Whine or growl (continuous or intermittent) While engine is running with/ without steering turned.	Loosened installation of oil pump, oil pump bracket	Retighten.
	Abnormal inside of oil pump, hose	Replace oil pump, hose, if the noise can be heard when running as well as stand still.
	Torque converter growl, air conditioner compression growl	Remove power steering pulley belt and confirm.
Creaking noise (intermittent) While engine is running with steering turned.	Abnormal inside of gearbox	Replace bad parts of gearbox.
	Abnormal bearing for steering shaft	Apply grease or replace.
	Generates when turning steering wheel with brake (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running with/ without steering turned.	Too low engine speed at start	Adjust and instruct customers.
	Vane pump aeration	Fix wrong part. Vent air.
	Damaged valve in oil pump, gearbox	Replace oil pump, bad parts of gearbox.
	Looseness of play of steering, suspension parts	Retighten.

F: CLEARANCE TABLE

CAUTION:
This table lists various clearances that must be correctly adjusted to ensure normal vehicle driving without interfering noise, or any other faults.

Location	Minimum allowance
(1) Crossmember — Pipe	5 mm (0.20 in)
(2) DOJ — Shaft or joint	14 mm (0.55 in)
(3) DOJ — Valve housing	11 mm (0.43 in)
(4) Pipe — Pipe	2 mm (0.08 in)
(5) Stabilizer — Pipe	5 mm (0.20 in)
(6) Exhaust pipe — Pipe	15 mm (0.59 in)
(7) Exhaust pipe — Gearbox bolt	15 mm (0.59 in)
(8) Side frame — Hose A and B	15 mm (0.59 in)
(9) Cruise control pump — Hose A and B	15 mm (0.59 in)
(10) Pipe portion of hose A — Pipe portion of hose B	1.5 mm (0.059 in)
(11) AT cooling hose — Joint	20 mm (0.79 in)



G: BREAKAGE OF HOSES

CAUTION:
Although surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. It is very important to keep the hoses free from before mentioned fluids and to wipe out immediately when the hoses are adhered with the fluids.
Since resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform careful inspection frequently when the vehicle is used in hot weather areas, cold weather area and/or a driving condition in which many steering operations are required in short time.
Particularly continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump, the fluid, etc. due to over heat.
So, avoid to keep this kind of condition when servicing as well as driving.

Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of relief valve	Replace oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Forced out return hose	Poor connection	Correct.
	Poor holding of clip	Retighten.
	Poor cold characteristic of fluid	Replace fluid.
Fluid bleeding out of hose slightly	Wrong layout, tensioned	Replace hose.
	Excessive play of engine due to deterioration of engine mounting rubber	Replace defective parts.
	Improper stop position of pitching stopper	Replace defective parts.
Crack on hose	Excessive holding time of relief status	Replace. Instruct customer.
	Excessive tightening torque for return hose clip	Replace.
	Power steering fluid, brake fluid, engine oil, electrolyte adhere on the hose surface	Replace. Pay attention on service work.
	Too many times use in extremely cold weather	Replace. Instruct customers.

MEMO:

BRAKES 4-4

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1. Brakes

A: SPECIFICATIONS

Engine (cc)			2500		
Driving system			AWD		
			BASE	L	S
Front disc brake	Type		Disc (Floating type, ventilated)		
	Effective disc diameter	mm (in)	228 (8.98)		
	Disc thickness × Outer diameter	mm (in)	24 × 277 (0.94 × 10.91)		
	Effective cylinder diameter	mm (in)	42.8 (1.685) × 2		
	Pad dimensions (length × width × thickness)	mm (in)	112.3 × 50.0 × 11.0 (4.42 × 1.969 × 0.433)		
	Clearance adjustment		Automatic adjustment		
Rear disc brake	Type		—		Disc (Floating type)
	Effective disc diameter	mm (in)	—		230 (9.06)
	Disc thickness × Outer diameter	mm (in)	—		10 × 266 (0.39 × 10.47)
	Effective cylinder diameter	mm (in)	—		38.1 (1.500)
	Pad dimensions (length × width × thickness)	mm (in)	—		82.4 × 33.7 × 9.0 (3.244 × 1.327 × 0.354)
	Clearance adjustment		—		Automatic adjustment
Rear drum brake	Type		Drum (Leading-Trailing type)		—
	Effective drum diameter	mm (in)	228.6 (9)		—
	Effective cylinder diameter	mm (in)	19.0 (0.748)		—
	Lining dimensions (length × width × thickness)	mm (in)	218.8 × 35.0 × 4.1 (8.61 × 1.378 × 0.161)		—
	Clearance adjustment		Automatic adjustment		—
Parking brake	Type		Mechanical on rear brakes, drum in disc		
	Effective drum diameter	mm (in)	228.6 (9)		170 (6.69)
	Lining dimensions (length × width × thickness)	mm (in)	218.8 × 35.0 × 4.1 (8.61 × 1.378 × 0.161)		162.6 × 30.0 × 3.2 (6.40 × 1.181 × 0.126)
	Clearance adjustment		Automatic adjustment		Manual adjustment
Master cylinder	Type		Tandem		
	Effective diameter	mm (in)	26.99 (1-1/16)		
	Reservoir type		Sealed type		
	Brake fluid reservoir capacity	cm^3 (cu in)	205 (12.51)		
Brake booster	Type		Vacuum suspended		
	Effective diameter	mm (in)	205 + 230 (8.07 + 9.06)		
Proportioning valve	Split point	kPa (kg/cm^2, psi)	3,678 (37.5, 533)		
	Reducing ratio		0.3		
Brake line			Dual circuit system		
ABS			—	STD	

B: SERVICE DATA

ITEM		STANDARD	SERVICE LIMIT
Front brake	Pad thickness (including back metal)	17 mm (0.67 in)	7.5 mm (0.295 in)
	Disc thickness	24 mm (0.94 in)	22 mm (0.87 in)
	Disc runout	—	0.075 mm (0.0030 in)
Rear brake (Disc type)	Pad thickness (including back metal)	14 mm (0.55 in)	6.5 mm (0.256 in)
	Disc thickness	10 mm (0.39 in)	8.5 mm (0.335 in)
	Disc runout	—	0.07 mm (0.0028 in)
Rear brake (Drum type)	Inside diameter	228.6 mm (9 in)	230.6 mm (9.08 in)
	Lining thickness	4.1 mm (0.161 in)	1.5 mm (0.059 in)
Rear brake (Disc type parking)	Inside diameter	170 mm (6.69 in)	171 mm (6.73 in)
	Lining thickness	3.2 mm (0.126 in)	1.5 mm (0.059 in)
Parking brake	Lever stroke	7 to 8 notches/196 N (20 kg, 44 lb)	

		Brake pedal force	Fluid pressure
Brake booster	Brake fluid pressure without engine running	147 N (15 kg, 33 lb)	588 kPa (6 kg/cm^2, 85 psi)
		294 N (30 kg, 66 lb)	1,765 kPa (18 kg/cm^2, 256 psi)
	Brake fluid pressure with engine running and vacuum at 66.7 kPa (500 mmHg, 19.69 inHg)	147 N (15 kg, 33 lb)	5,590 kPa (57 kg/cm^2, 811 psi)
		294 N (30 kg, 66 lb)	9,807 kPa (100 kg/cm^2, 1,422 psi)

C: RECOMMENDED BRAKE FLUID

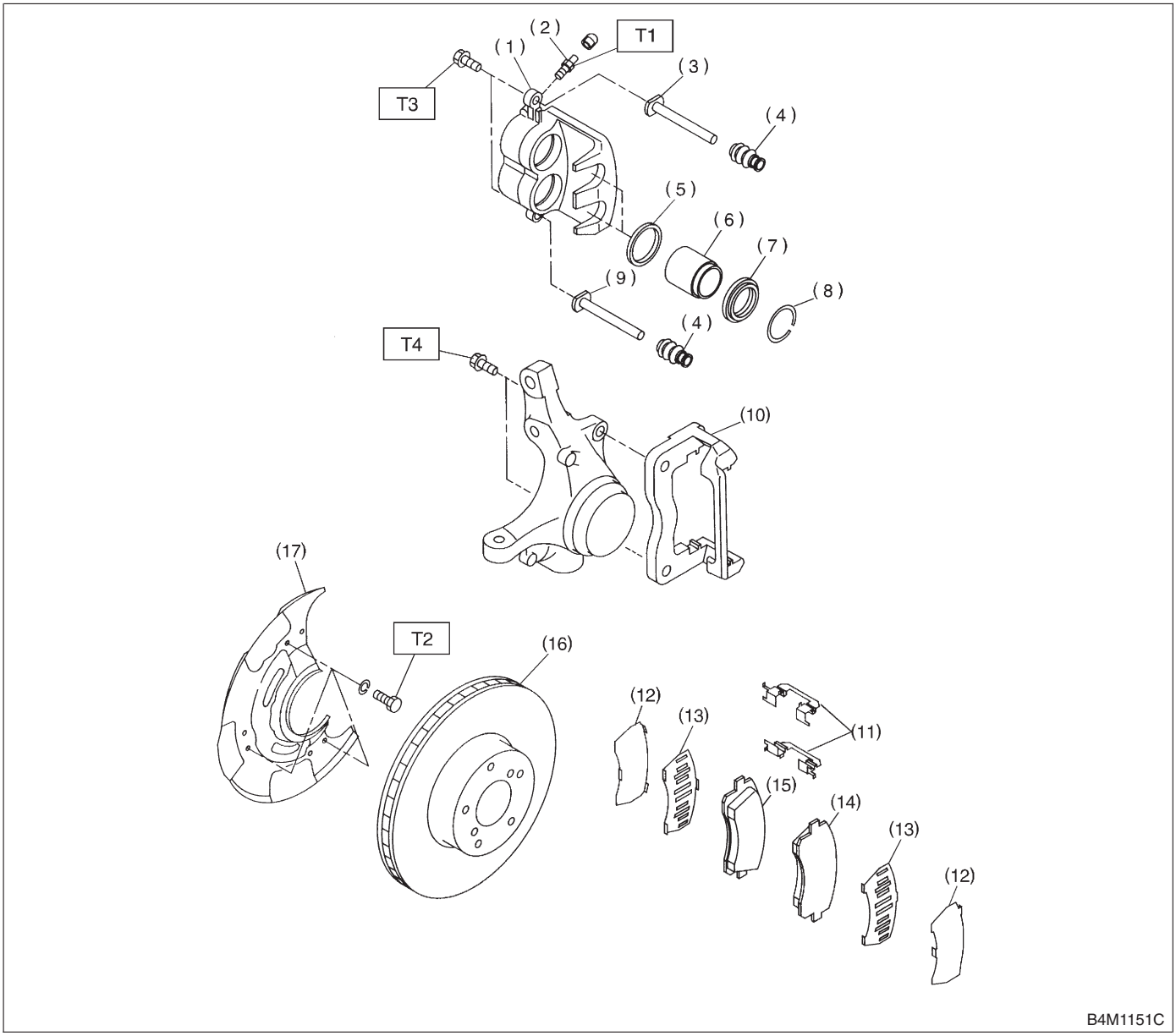
FMVSS No. 116, fresh DOT3 or 4 brake fluid

CAUTION:
- **Avoid mixing brake fluid of different brands to prevent the fluid performance from degrading.**
- **When brake fluid is supplemented, be careful not to allow any dust into the reservoir.**
- **Use fresh DOT3 or 4 brake fluid when replacing or refilling the fluid.**

D: BRAKE FLUID LEVEL INDICATOR

Reserve tank with level indicator:
Residual fluid quantity at light ON
Approx. 80 cm^3 (4.88 cu in)
Tank capacity
205 cm^3 (12.51 cu in)

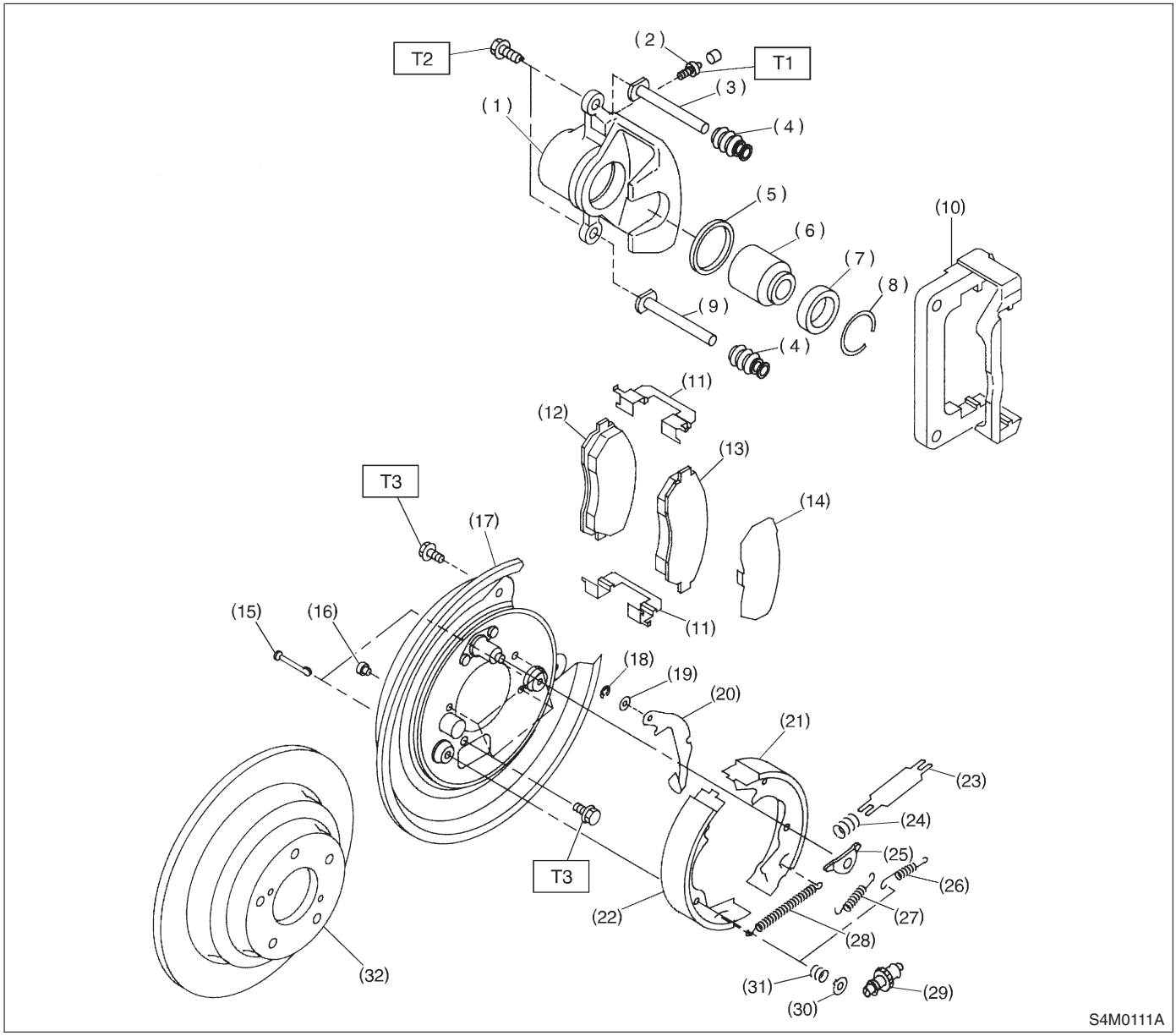
1. Front Disc Brake



(1) Caliper body
(2) Air bleeder screw
(3) Guide pin (Green)
(4) Pin boot
(5) Piston seal
(6) Piston
(7) Piston boot
(8) Boot ring
(9) Lock pin (Yellow)
(10) Support
(11) Pad clip
(12) Outer shim
(13) Inner shim
(14) Pad (Outside)
(15) Pad (Inside)
(16) Disc rotor
(17) Disc cover

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 37±5 (3.8±0.5, 27.5±3.6)
T4: 78±10 (8.0±1.0, 58±7)

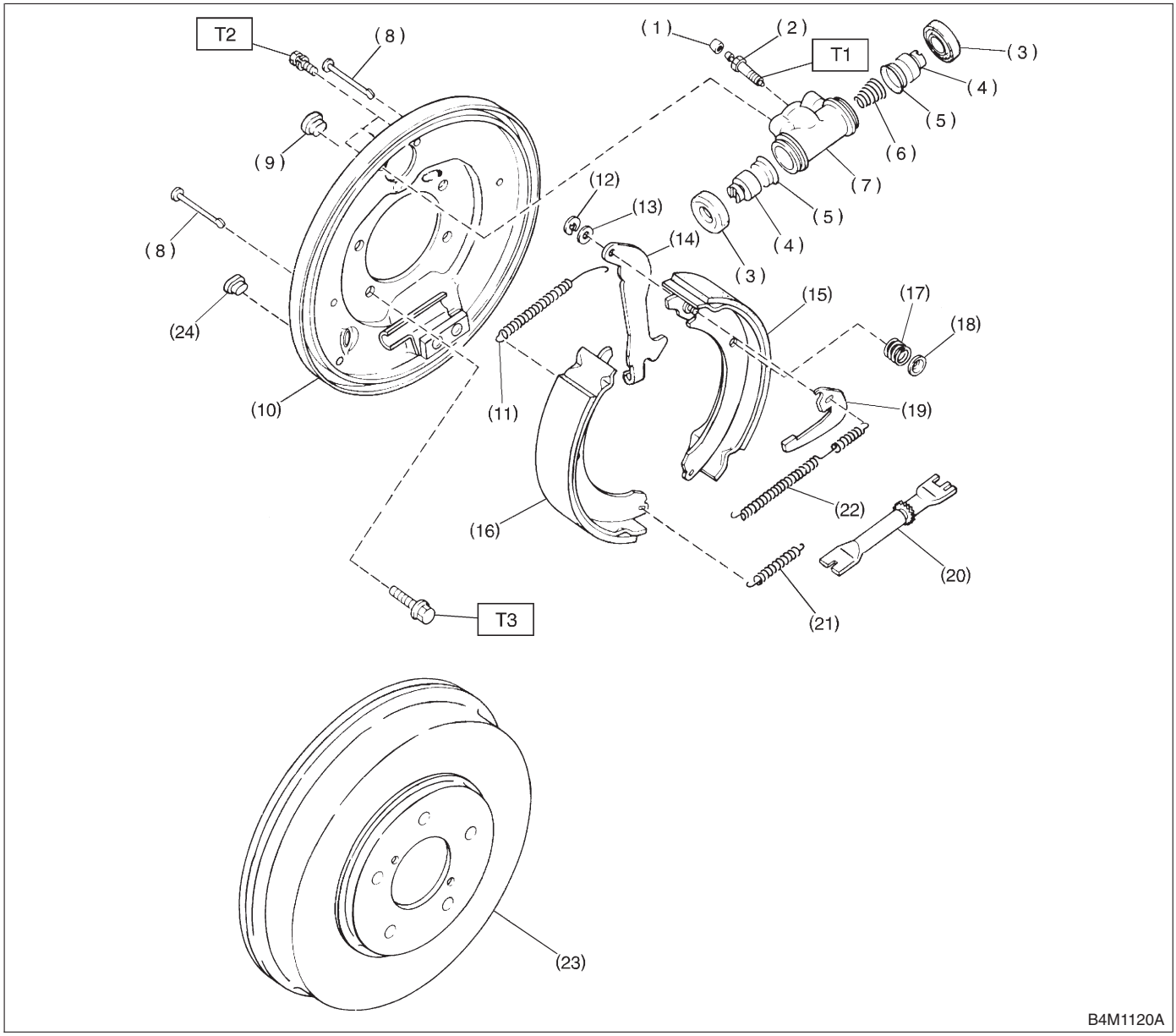
2. Rear Disc Brake



(1) Caliper body
(2) Air bleeder screw
(3) Guide pin (Green)
(4) Pin boot
(5) Piston seal
(6) Piston
(7) Piston boot
(8) Boot ring
(9) Lock pin (Yellow)
(10) Support
(11) Pad clip
(12) Inner pad
(13) Outer pad
(14) Shim
(15) Shoe hold-down pin
(16) Cover
(17) Back plate
(18) Retainer
(19) Spring washer
(20) Parking brake lever
(21) Parking brake shoe (Secondary)
(22) Parking brake shoe (Primary)
(23) Strut
(24) Strut shoe spring
(25) Shoe guide plate
(26) Secondary shoe return spring
(27) Primary shoe return spring
(28) Adjusting spring
(29) Adjuster
(30) Shoe hold-down cup
(31) Shoe hold-down spring
(32) Disc rotor

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 39±5 (4.0±0.5, 28.9±3.6)
T3: 52^{+10}_{-6} ($5.3^{+1.0}_{-0.6}$, $38.2^{+7.2}_{-4.3}$)

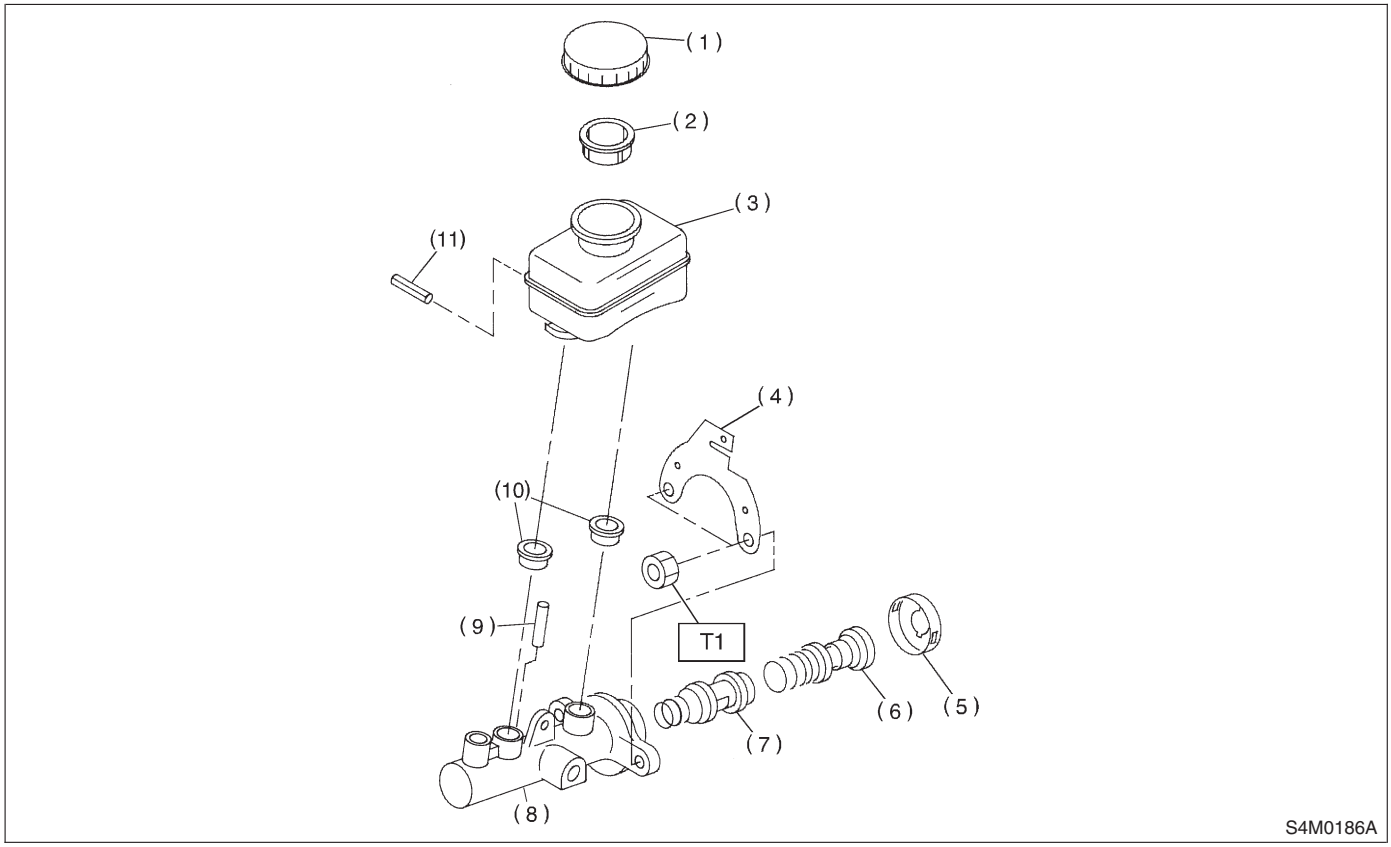
3. Rear Drum Brake



(1) Air bleeder cap
(2) Air bleeder screw
(3) Boot
(4) Piston
(5) Cup
(6) Spring
(7) Wheel cylinder body
(8) Pin
(9) Plug
(10) Back plate
(11) Upper shoe return spring
(12) Retainer
(13) Washer
(14) Parking brake lever
(15) Brake shoe (Trailing)
(16) Brake shoe (Leading)
(17) Shoe hold-down spring
(18) Cup
(19) Adjusting lever
(20) Adjuster
(21) Lower shoe return spring
(22) Adjusting spring
(23) Drum
(24) Plug

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 10±2 (1.0±0.2, 7.2±1.4)
T3: 52±6 (5.3±0.6, 38.3±4.3)

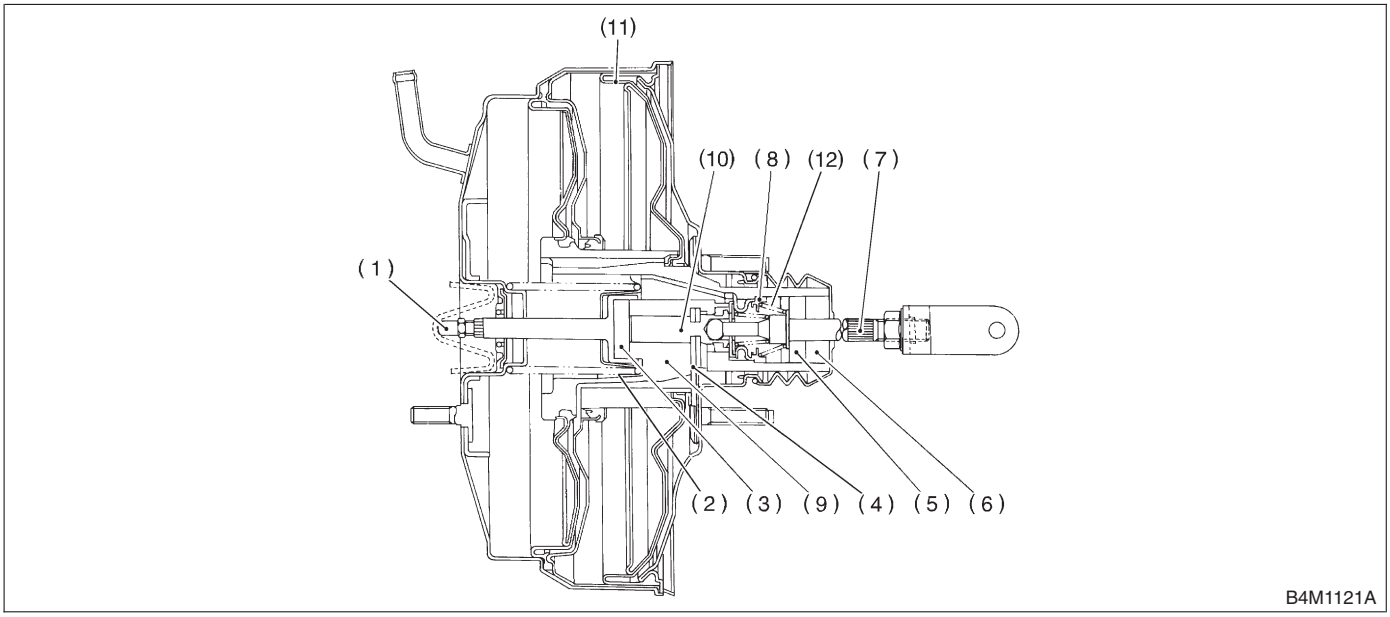
4. Master Cylinder



(1) Cap
(2) Filter
(3) Reservoir tank
(4) Bracket
(5) Piston retainer
(6) Primary piston
(7) Secondary piston
(8) Cylinder body
(9) Cylinder pin (With ABS)
(10) Seal
(11) Pin

Tightening torque: N·m (kg-m, ft-lb)
T1: 14±4 (1.4±0.4, 10.1±2.9)

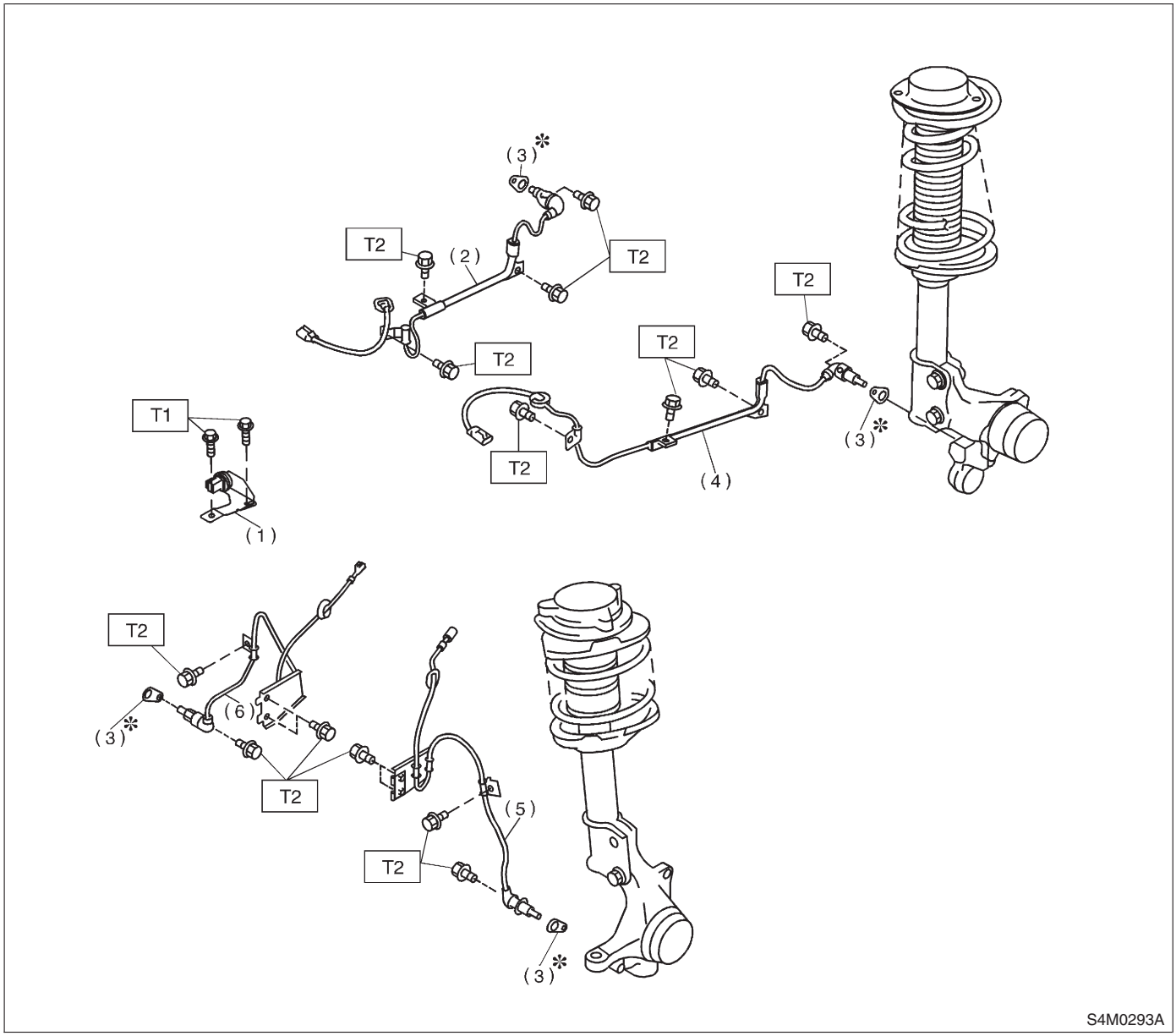
5. Brake Booster



(1) Push rod
(2) Return spring
(3) Reaction disc
(4) Key
(5) Filter
(6) Silencer
(7) Operating rod
(8) Poppet valve
(9) Valve body
(10) Plunger valve
(11) Diaphragm plate
(12) Valve return spring

6. ABS System

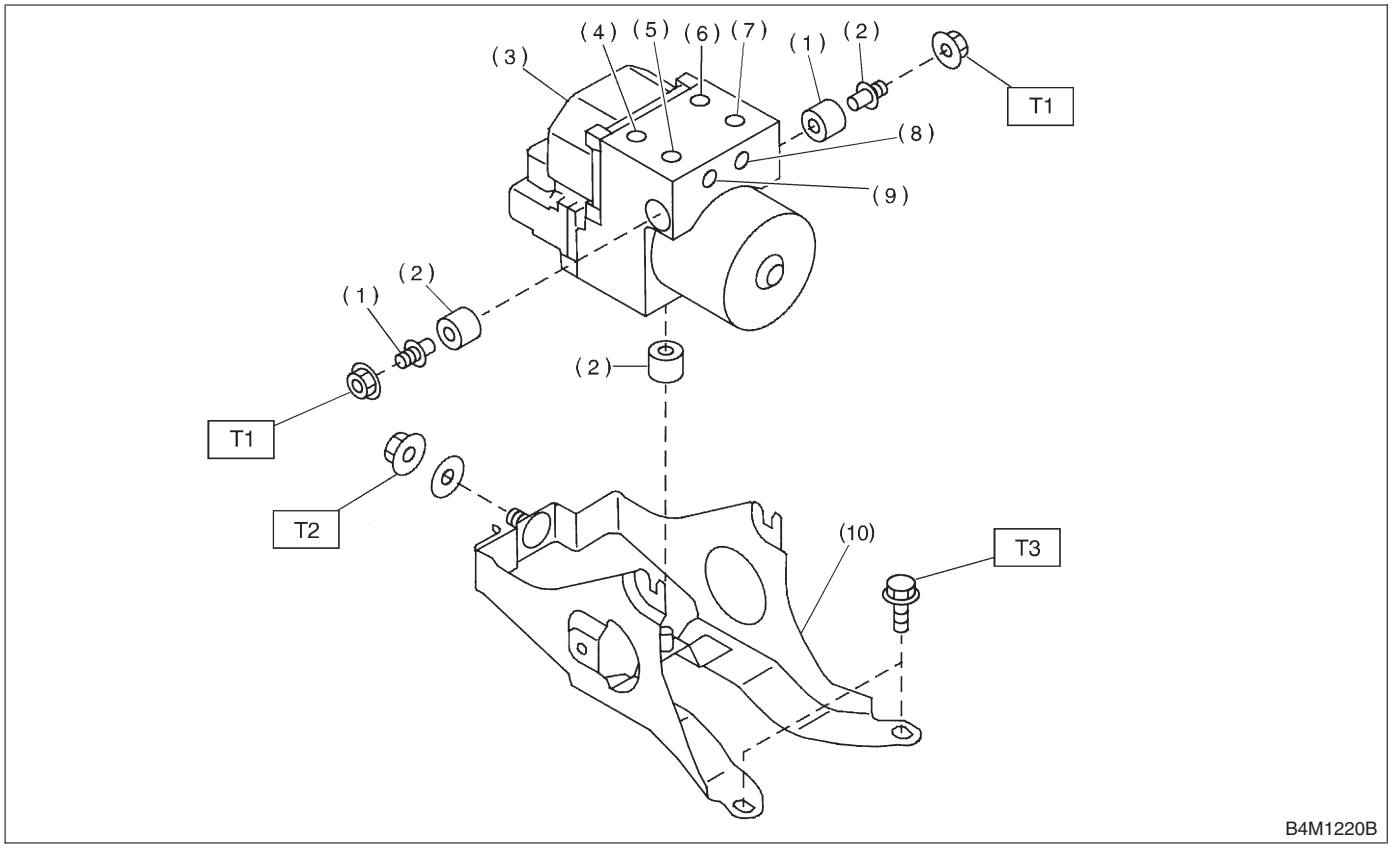
A: SENSOR



(1) G sensor
(2) Rear ABS sensor RH
(3) ABS spacer
(4) Rear ABS sensor LH
(5) Front ABS sensor LH
(6) Front ABS sensor RH

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 32±10 (3.3±1.0, 24±7)

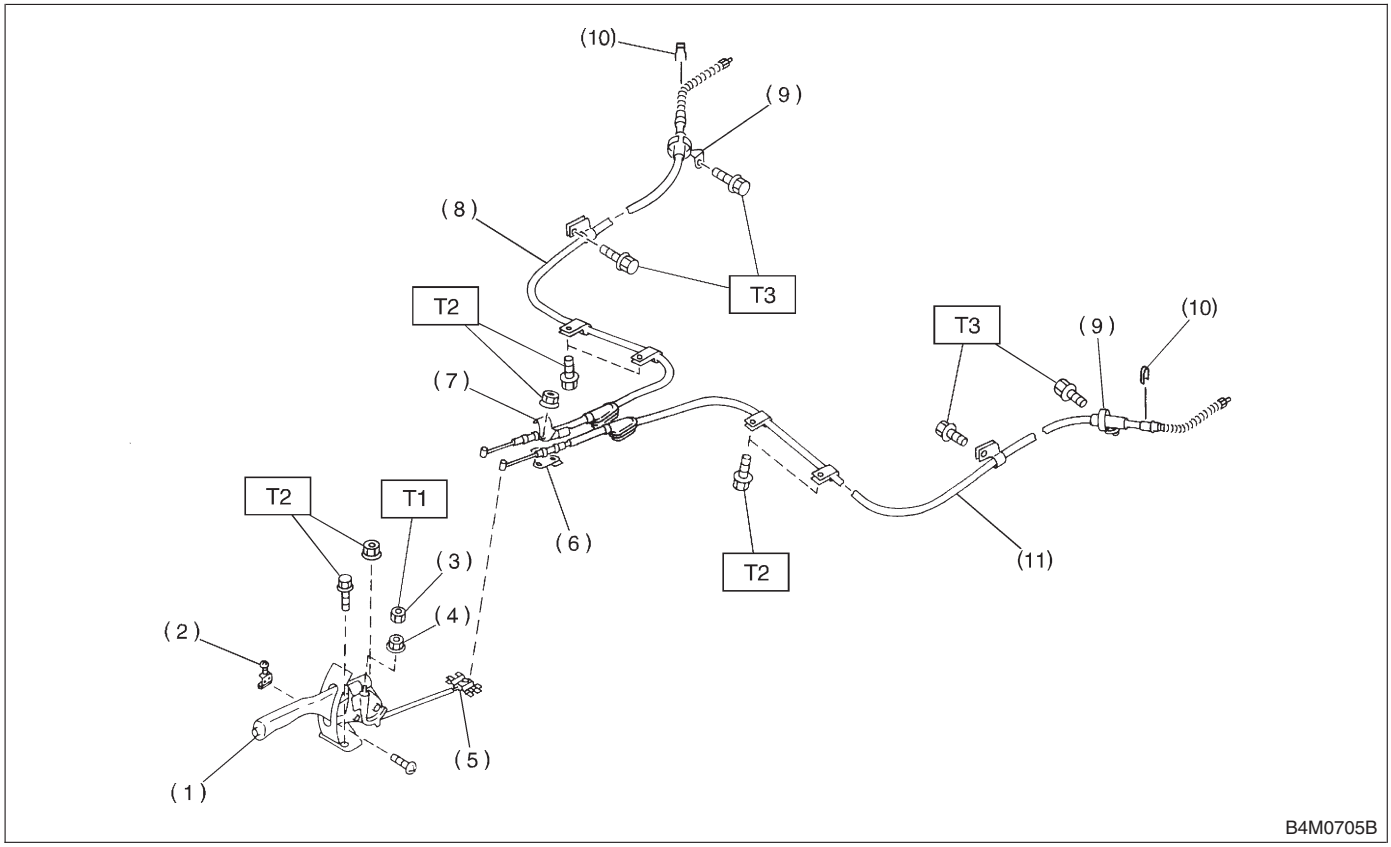
B: ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)



(1) Stud bolt
(2) Damper
(3) ABS control module and hydraulic control unit
(4) Front-LH outlet
(5) Secondary inlet
(6) Front-RH outlet
(7) Primary inlet
(8) Rear-LH outlet
(9) Rear-RH outlet
(10) Bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 18±5 (1.8±0.5, 13.0±3.6)
T2: 29±7 (3.0±0.7, 21.7±5.1)
T3: 32±10 (3.3±1.0, 24±7)

7. Parking Brake



(1) Parking brake lever
(2) Parking brake switch
(3) Lock nut
(4) Adjusting nut
(5) Equalizer
(6) Bracket
(7) Clamp
(8) Parking brake cable RH
(9) Cable guide
(10) Clamp (Rear disc brake model only)
(11) Parking brake cable LH

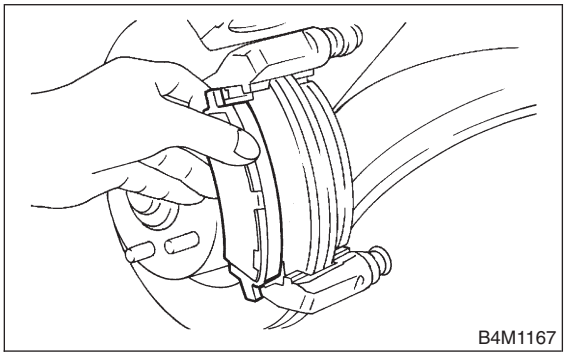
Tightening torque: N·m (kg-m, ft-lb)
T1: 5.9±1.5 (0.60±0.15, 4.3±1.1)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 32±10 (3.3±1.0, 24±7)

1. Front Disc Brake

A: ON-CAR SERVICE

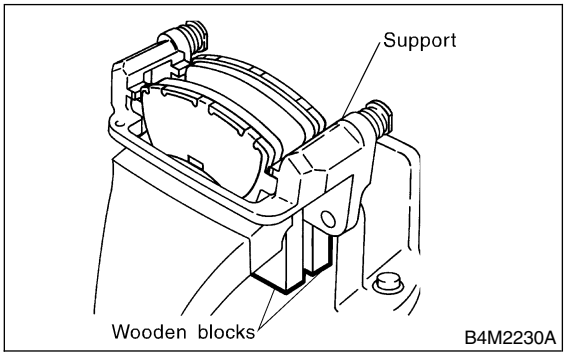
1. PAD

1) Remove lock pin.
2) Raise caliper body.
3) Remove pad.


B4M1167

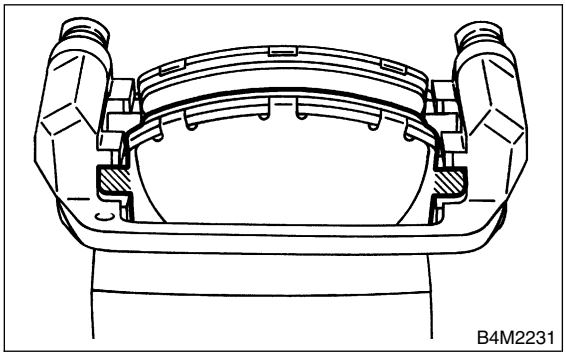
NOTE:
If brake pad is difficult to remove, proceed as follows:

(1) Remove caliper body and fasten it provisionally to coil spring.
(2) Remove support.
(3) Place a support in a vise between wooden blocks.

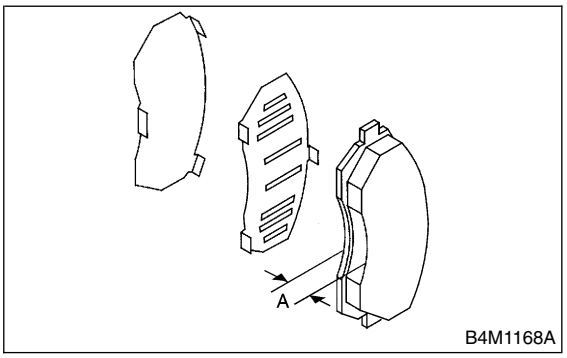


B4M2230A

(4) Attach a rod of less than 12 mm (0.47 in) dia. to the shaded area of brake pad, and strike the rod with a hammer to drive brake pad out of place.


B4M2231

4) Check pad thickness A.

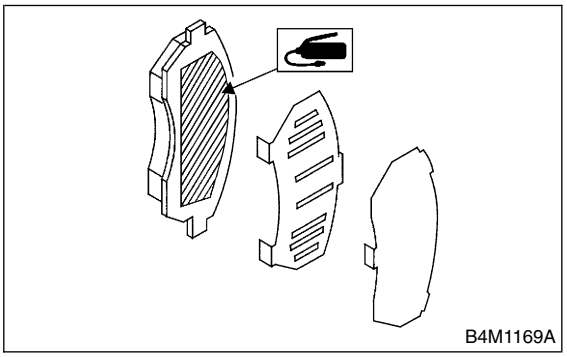


B4M1168A

Pad thickness (including back metal)	Standard value	17 mm (0.67 in)
	Wear limit	7.5 mm (0.295 in)

CAUTION:
• Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
• A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
• Replace pad if there is oil or grease on it.

5) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad clip.
6) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and inner shim.

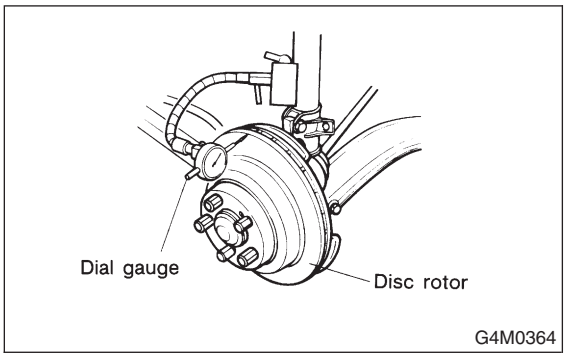

B4M1169A

7) Install pads on support.
8) Install caliper body on support.

NOTE:
If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

2. DISC ROTOR

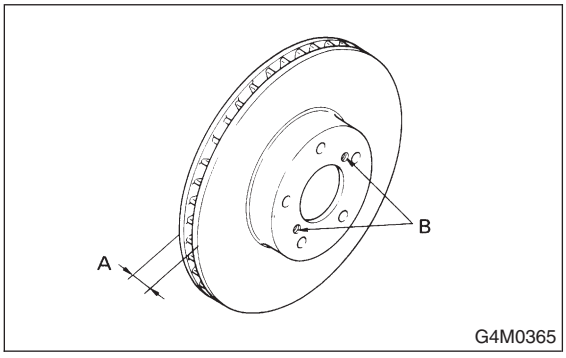
1) Install disc rotor by tightening the five wheel nuts.
2) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.



NOTE:
Make sure that dial gauge is set 10 mm (0.39 in) inward of rotor outer perimeter.
If the runout of disc rotor exceeds the limit, check for abnormal free play at hub bearing and runout in the thrust direction. If the hub bearing is okay, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 3.

Disc rotor runout limit:
0.075 mm (0.0030 in)

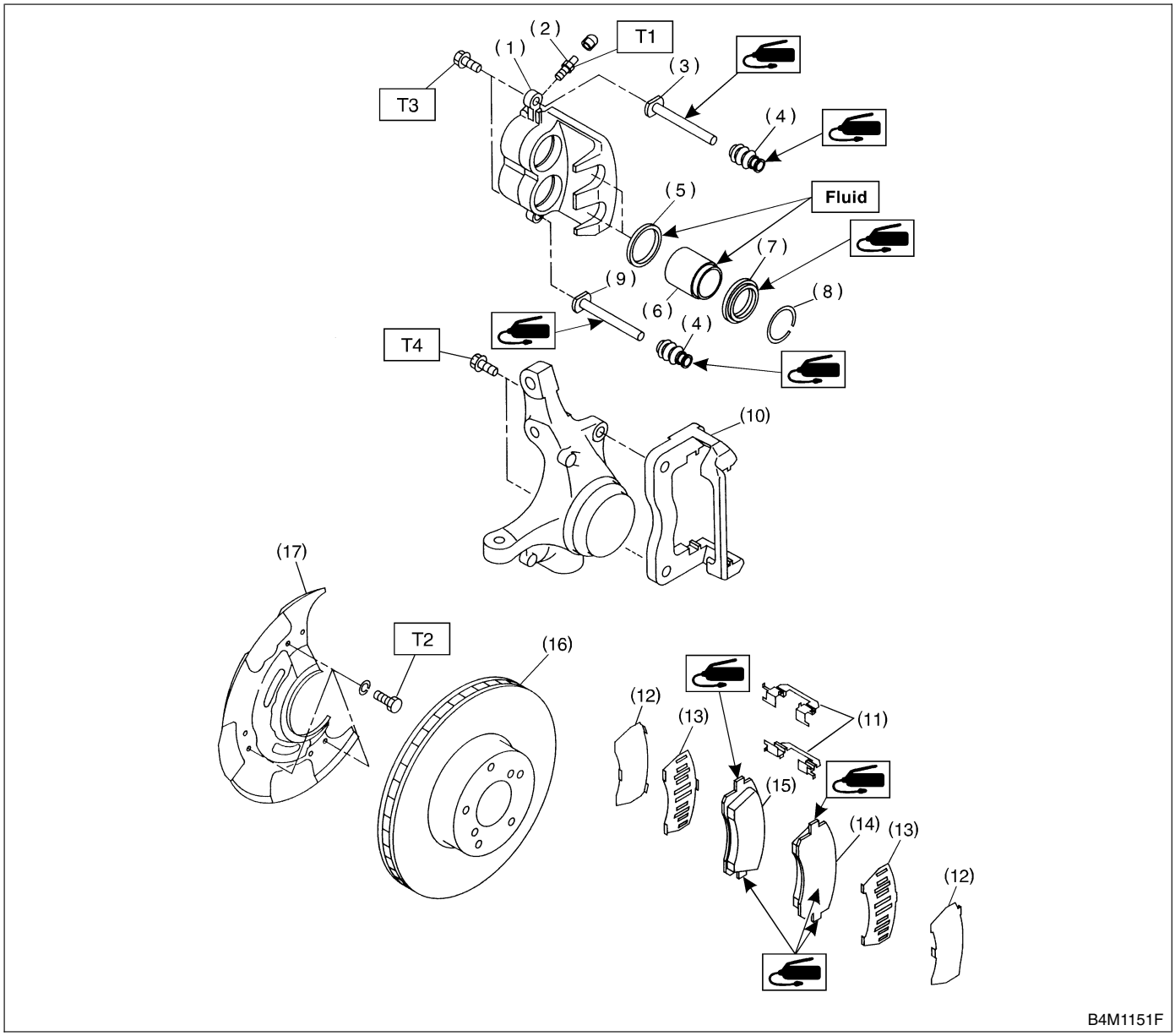
3) Measure disc rotor thickness. If the thickness of disc rotor is below service limit, replace the disc rotor.



NOTE:
Make sure that micrometer is set 10 mm (0.39 in) inward of rotor outer perimeter.

	Standard value	Service limit	Disc outer dia.
Disc rotor thickness A	24 mm (0.94 in)	22 mm (0.87 in)	260 mm (10.24 in)

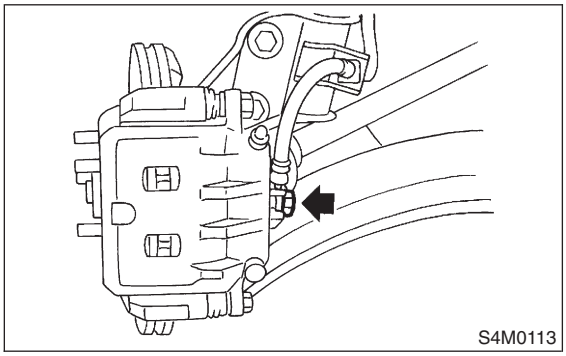
B: REMOVAL



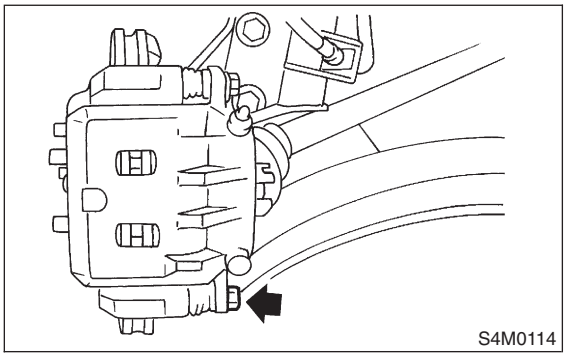
(1) Caliper body
(2) Air bleeder screw
(3) Guide pin (Green)
(4) Pin boot
(5) Piston seal
(6) Piston
(7) Piston boot
(8) Boot ring
(9) Lock pin (Yellow)
(10) Support
(11) Pad clip
(12) Outer shim
(13) Inner shim
(14) Pad (Outside)
(15) Pad (Inside)
(16) Disc rotor
(17) Disc cover

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 37±5 (3.8±0.5, 27.5±3.6)
T4: 78±10 (8.0±1.0, 58±7)

1) Remove union bolt and disconnect brake hose from caliper body assembly.

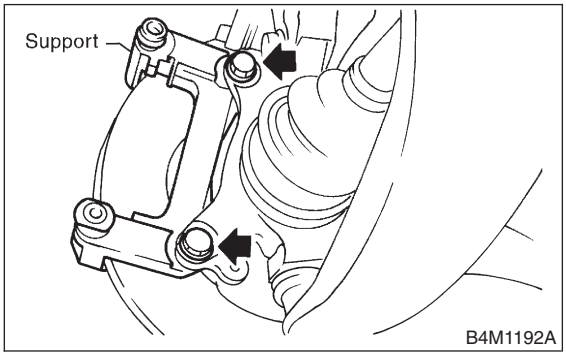


2) Remove bolt securing lock pin to caliper body.



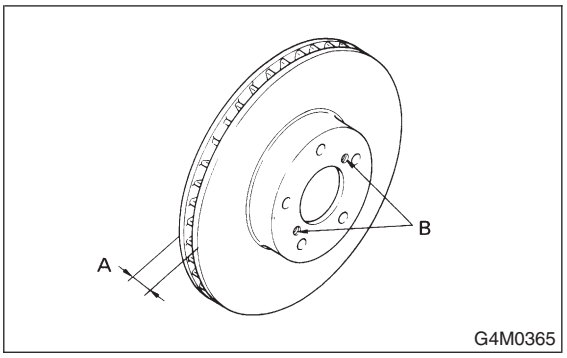
3) Raise caliper body and move it toward vehicle center to separate it from support.
4) Remove support from housing.

NOTE:
Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body assembly.



5) Remove disc rotor from hub.

NOTE:
If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.



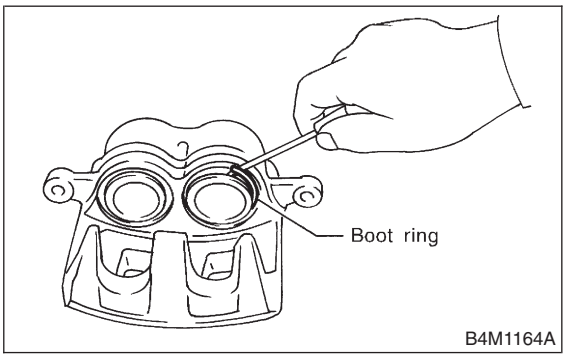
6) Clean mud and foreign particles from caliper body assembly and support.

C: DISASSEMBLY

1) Clean mud and foreign particles from caliper body assembly and support.

CAUTION:
Be careful not to allow foreign particles to enter inlet (at brake hose connector).

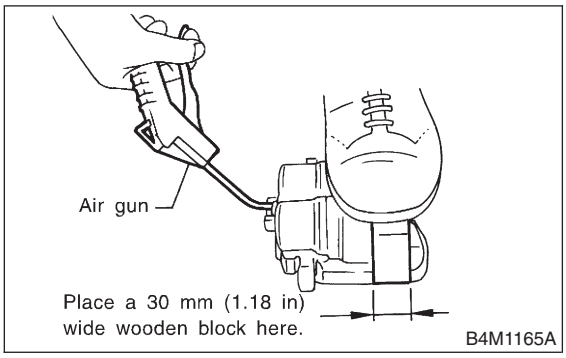
2) Using a standard screwdriver, remove boot ring from piston.



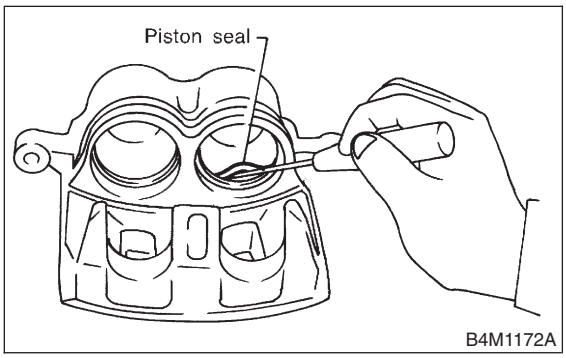
3) Remove boot from piston end.

4) Gradually supply compressed air via caliper body brake hose to force piston out.

CAUTION:
Place a wooden block as shown in Figure to prevent damage to piston.



5) Remove piston seal from caliper body cylinder.



6) Remove lock pin boot and guide pin boot.

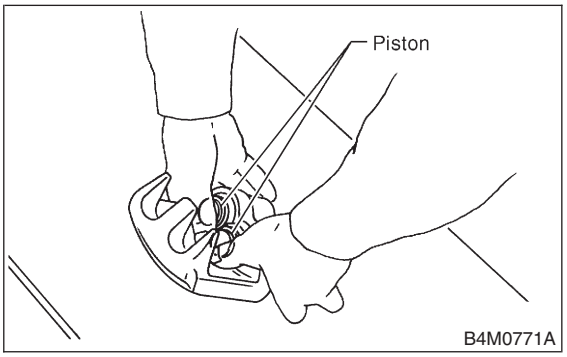
D: INSPECTION

1) Repair or replace faulty parts.
2) Check caliper body and piston for uneven wear, damage or rust.
3) Check rubber parts for damage or deterioration.

E: ASSEMBLY

1) Clean caliper body interior using brake fluid.
2) Apply a coat of brake fluid to piston seal and fit piston seal in groove on caliper body.
3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.
4) Insert piston into cylinder.

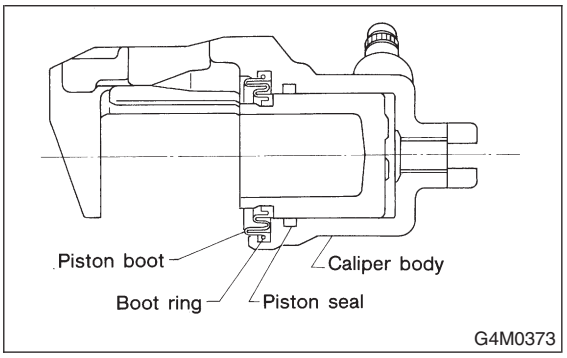
CAUTION:
Do not force piston into cylinder.



5) Apply a coat of specified grease to boot and fit in groove on ends of cylinder and piston.

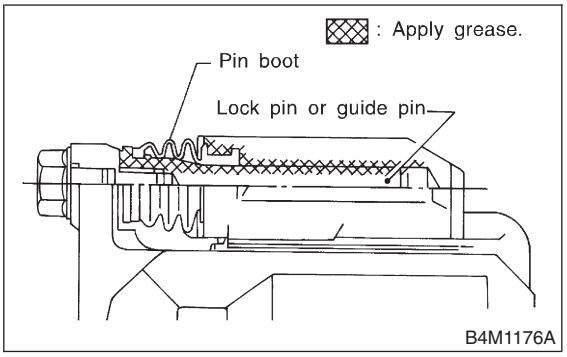
Grease:
NIGLUBE RX-2 (Part No. 003606000)

To facilitate installation, fit boot starting with piston end.



6) Position boot in grooves on cylinder and piston.
7) Install boot ring. Be careful not scratch boot.
8) Apply a coat of specified grease to lock pin and guide pin, outer surface, cylinder inner surface, and boot grooves.

Grease:
NIGLUBE RX-2 (Part No. 003606000)



9) Install lock pin boot and guide pin boot on support.

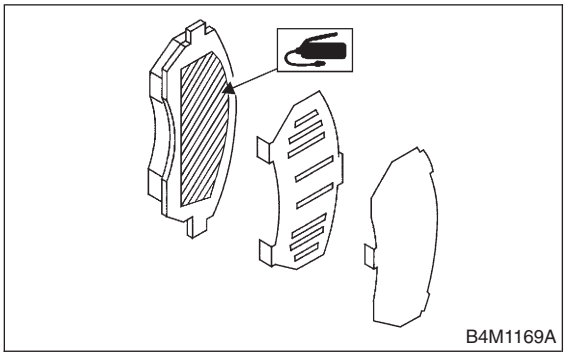
F: INSTALLATION

1) Install disc rotor on hub.
2) Install support on housing.

Tightening torque:
78±10 N·m (8±1 kg-m, 58±7 ft-lb)

CAUTION:
• Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
• A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
• When replacing the pad, replace pads of the right and left wheels at the same time.

3) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad clip.
4) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and inner shim.


B4M1169A

5) Install pads, rubber coated shim and stainless shim on support.
6) Install caliper body on support.

Tightening torque:
39±5 N·m (4±0.5 kg-m, 28.9±3.6 ft-lb)

7) Connect brake hose.

Tightening torque:
18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)

CAUTION:
Replace brake hose gaskets with new ones.

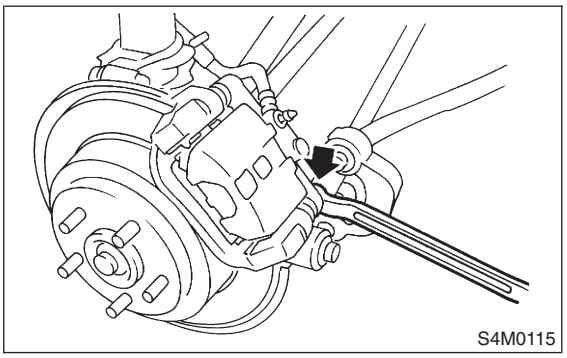
8) Bleed air from brake system.

2. Rear Disc Brake

A: ON-CAR SERVICE

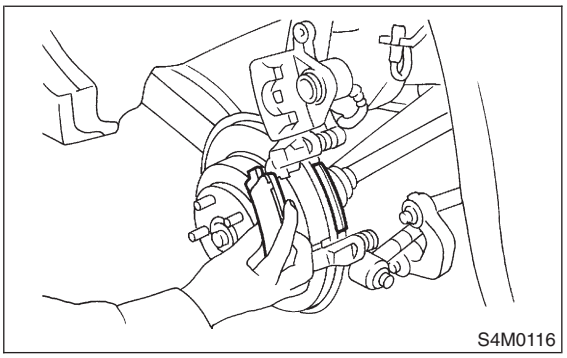
1. PAD

1) Remove lock pin.


S4M0115

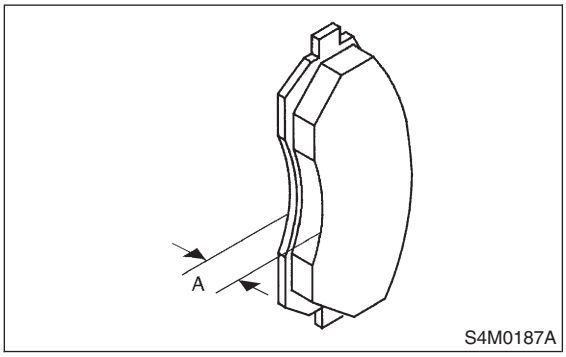
2) Raise caliper body.
3) Remove pad from support.

NOTE:
If brake pad is difficult to remove, use the same procedure as for front disc brake pad. <Ref. to 4-4 [W1A1].>


S4M0116

4) Check pad thickness (including back metal).

Pad thickness: A
Standard value
14 mm (0.55 in)
Wear limit
6.5 mm (0.256 in)



CAUTION:
• Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
• A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
• Replace pad if there is oil or grease on it.

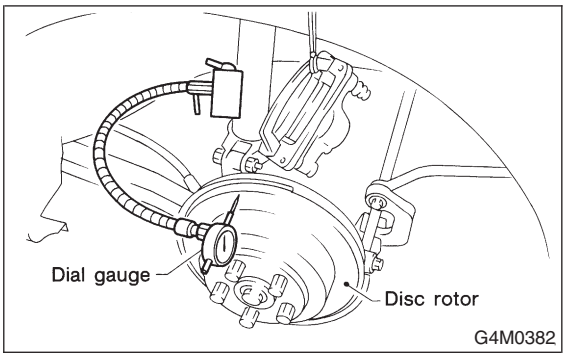
5) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad clip.
6) Install pad on support.
7) Install caliper body on support.

Tightening torque:
20±4 N·m (2.0±0.4 kg-m, 14.5±2.9 ft-lb)

NOTE:
If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

2. DISC ROTOR

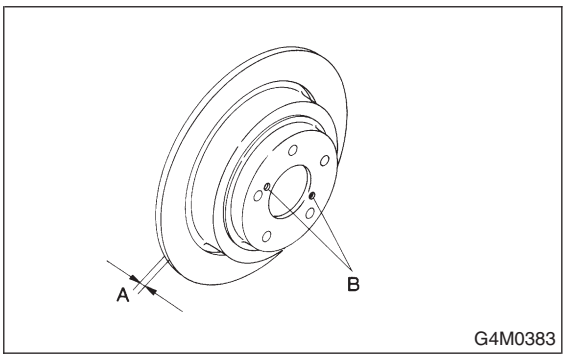
1) Install disc rotor by tightening the five wheel nuts.
2) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.



NOTE:
Make sure that dial gauge is set 10 mm (0.39 in) inward of rotor outer perimeter.
If the runout of disc rotor exceeds the limit, check for abnormal free play at hub bearing and runout in the thrust direction. If the hub bearing is okay, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 3.

Disc rotor runout limit:
0.07 mm (0.0028 in)

3) Measure disc rotor thickness. If the thickness of disc rotor is below service limit, replace the disc rotor.

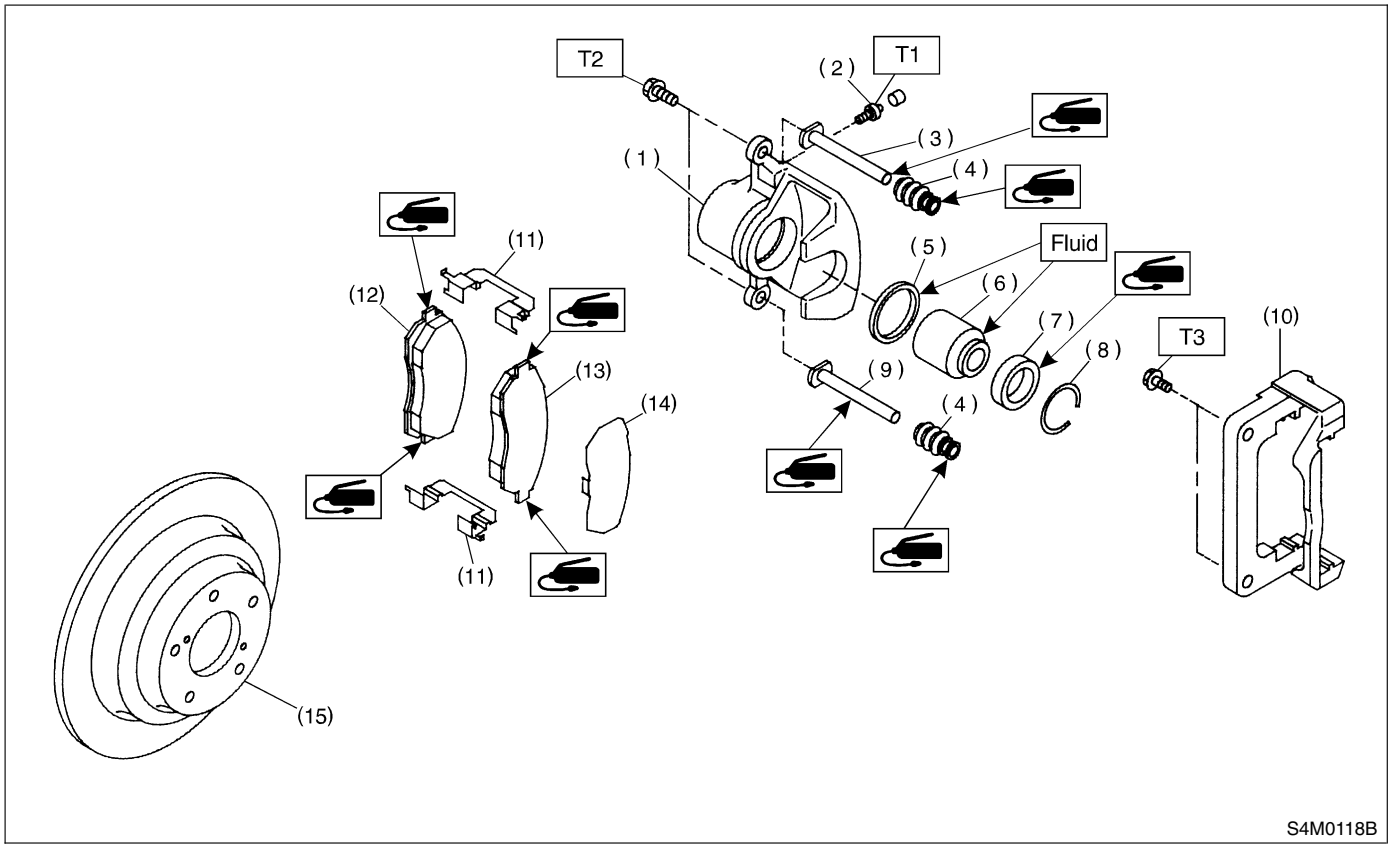


NOTE:
Make sure that micrometer is set 10 mm (0.39 in) inward of rotor outer perimeter.

Disc rotor thickness: A
Standard value
10 mm (0.39 in)
Service limit
8.5 mm (0.335 in)

NOTE:
When removing disc rotor, refer to instructions under Parking Brake. <Ref. to 4-4 [W4A0].>

B: REMOVAL

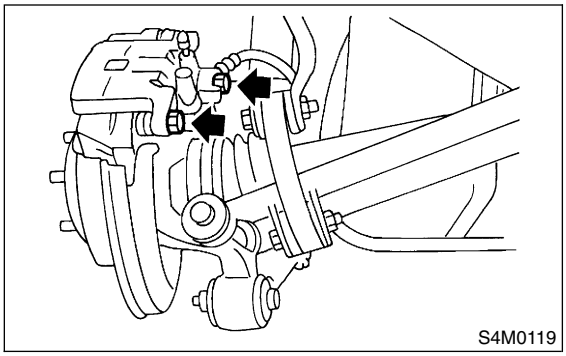


(1) Caliper body
(2) Air bleeder screw
(3) Guide pin (Green)
(4) Pin boot
(5) Piston seal
(6) Piston
(7) Piston boot
(8) Boot ring
(9) Lock pin (Yellow)
(10) Support
(11) Pad clip
(12) Inner pad
(13) Outer pad
(14) Shim
(15) Disc rotor

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 39±5 (4.0±0.5, 28.9±3.6)
T3: 52^{+10}_{-6} ($5.3^{+1.0}_{-0.6}$, $38.2^{+7.2}_{-4.3}$)

1) Lift-up vehicle and remove wheels.
2) Disconnect brake hose from caliper body assembly.

CAUTION:
Do not allow brake fluid to come in contact with vehicle body; wipe off completely if spilled.



3) Remove lock pin.
4) Raise caliper body and move it toward vehicle center to separate it from support.
5) Remove support from back plate.

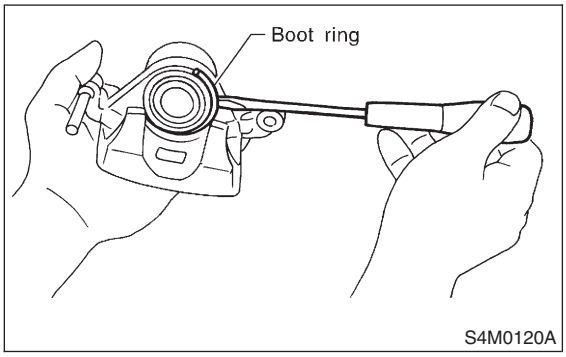
NOTE:
Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body assembly.

6) Clean mud and foreign particles from caliper body assembly and support.

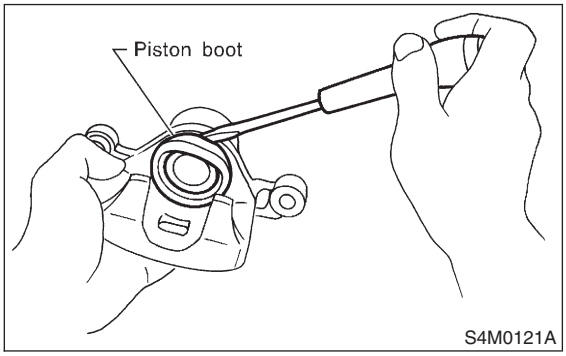
CAUTION:
Be careful not to allow foreign particles to enter inlet (at brake hose connector).

C: DISASSEMBLY

1) Remove the boot ring.

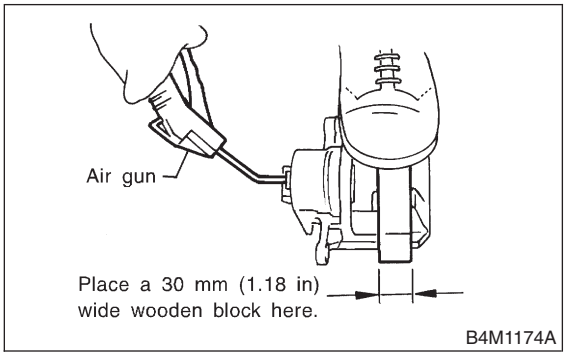


2) Remove the piston boot.

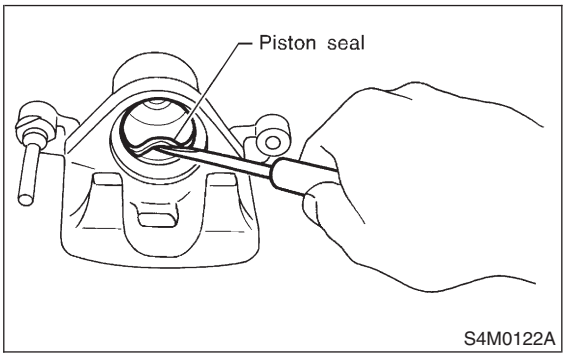


3) Gradually supply compressed air via inlet of caliper body to force piston out.

CAUTION:
- **Place a wooden block as shown in Figure to prevent damage to piston.**
- **Do not apply excessively high-pressure.**



4) Remove piston seal from caliper body cylinder.



5) Remove lock pin sleeve and boot from caliper body.
6) Remove guide pin boot.

D: INSPECTION

1) Repair or replace faulty parts.
2) Check caliper body and piston for uneven wear, damage or rust.
3) Check rubber parts for damage or deterioration.

E: ASSEMBLY

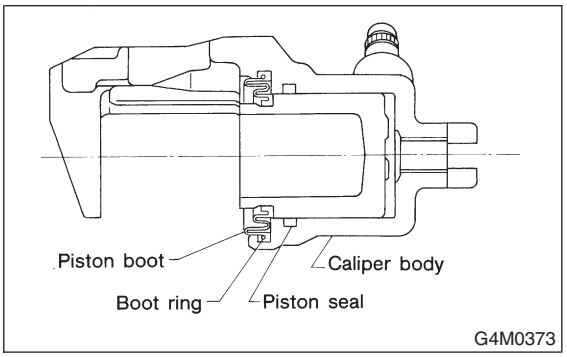
1) Clean caliper body interior using brake fluid.
2) Apply a coat of brake fluid to piston seal and fit piston seal in groove on caliper body.
3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.
4) Insert piston into cylinder.

CAUTION:
Do not force piston into cylinder.

5) Apply a coat of specified grease to boot and fit in groove on ends of cylinder and piston.

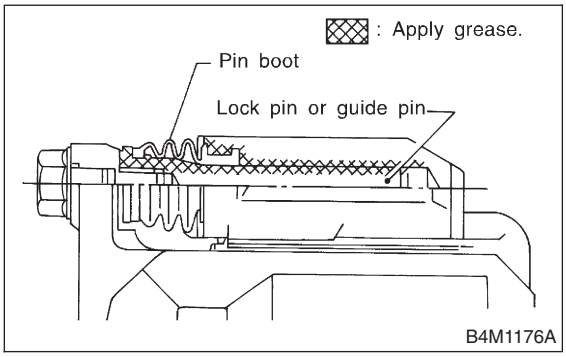
Grease
NIGLUBE RX-2 (Part No. 003606000)

6) Install the piston boot to the caliper body, and attach boot ring.



7) Apply a coat of specified grease to guide pin, outer surface, sleeve outer surface, cylinder inner surface, and boot grooves.

Grease
NIGLUBE RX-2 (Part No. 003606000)



8) Install guide pin boot on caliper body.
9) Install lock pin boot on caliper body and insert lock pin sleeve into place.

F: INSTALLATION

1) Install disc rotor on hub.
2) Install support on back plate.

Tightening torque:
52^{+10}_{-6} N·m ($5.3^{+1.0}_{-0.6}$ kg-m, $38.2^{+7.2}_{-4.3}$ ft-lb)

CAUTION:
● Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
● A wear indicator is provided on the inner disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.
● Replace pads if there is oil or grease on them.

3) Apply thin coat of Molykote AS880N (Part No. 26298AC000) to the frictional portion between pad and pad clip.
4) Install pads on support.
5) Install caliper body on support.

Tightening torque:
20±4 N·m (2.0±0.4 kg-m, 14.5±2.9 ft-lb)

6) Connect brake hose.

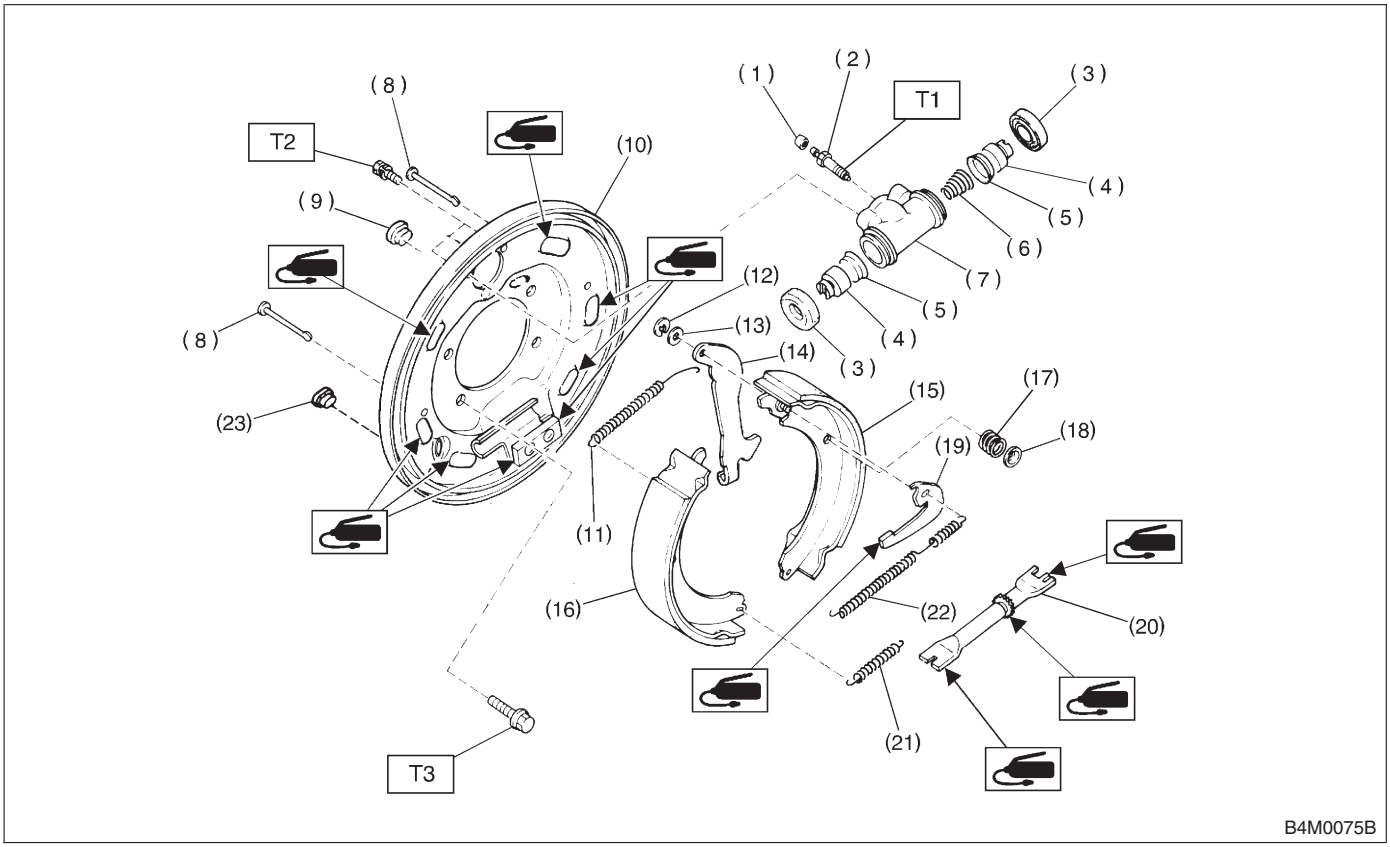
Tightening torque:
18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)

CAUTION:
● The brake hose must be connected without any twist.
● Replace brake hose gaskets with new ones.

7) Bleed air from brake system.

3. Rear Drum Brake

A: REMOVAL

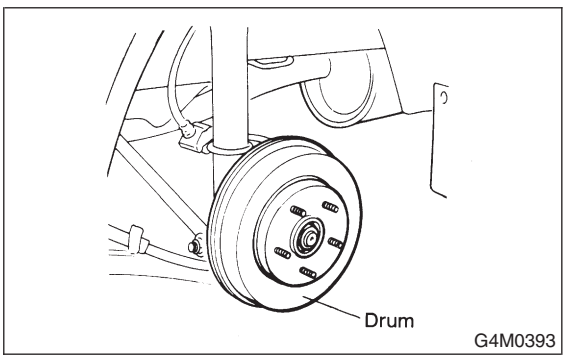


(1) Air bleeder cap
(2) Air bleeder screw
(3) Boot
(4) Piston
(5) Cup
(6) Spring
(7) Wheel cylinder body
(8) Pin
(9) Plug
(10) Back plate
(11) Upper shoe return spring
(12) Retainer
(13) Washer
(14) Parking brake lever
(15) Brake shoe (Trailing)
(16) Brake shoe (Leading)
(17) Shoe hold-down spring
(18) Cup
(19) Adjusting lever
(20) Adjuster
(21) Lower shoe return spring
(22) Adjusting spring
(23) Plug

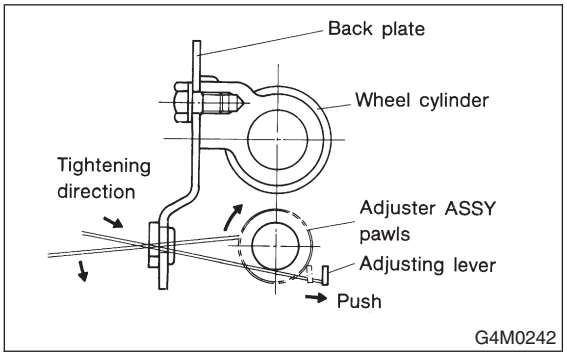
Tightening torque: N·m (kg-m, ft-lb)
T1: 8±1 (0.8±0.1, 5.8±0.7)
T2: 10±2 (1.0±0.2, 7.2±1.4)
T3: 52±6 (5.3±0.6, 38.3±4.3)

1. BRAKE DRUM AND SHOE

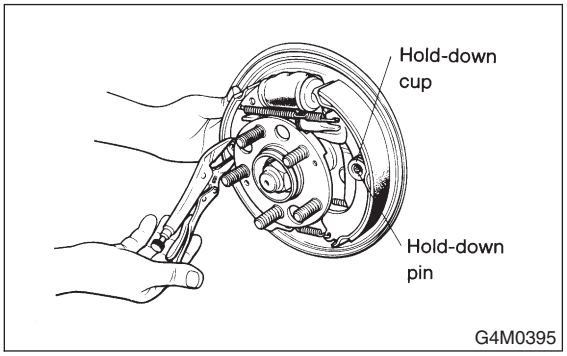
1) Loosen wheel nuts, jack-up vehicle, support it with rigid racks, and remove wheel.
2) Release parking brake.
3) Remove brake drum from brake assembly.



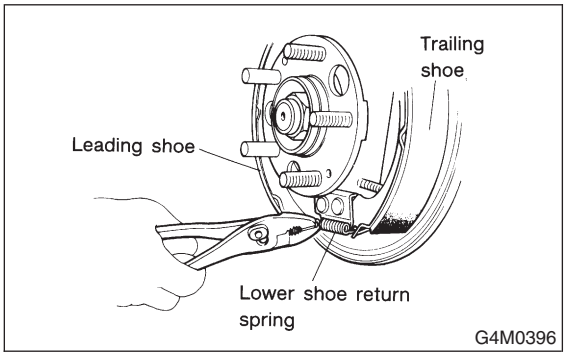
NOTE:
If it is difficult to remove brake drum, remove adjusting hole cover from back plate, and then, turn adjuster assembly pawls using a slot-type screwdriver until brake shoe separates from the drum.



4) Hold hold-down pin by securing rear of back plate with your hand.

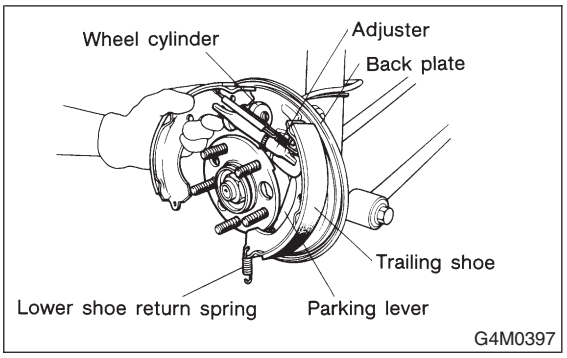


5) Disconnect hold-down cup from hold-down pin by rotating hold-down cup.
6) Disconnect lower shoe return spring from shoes.

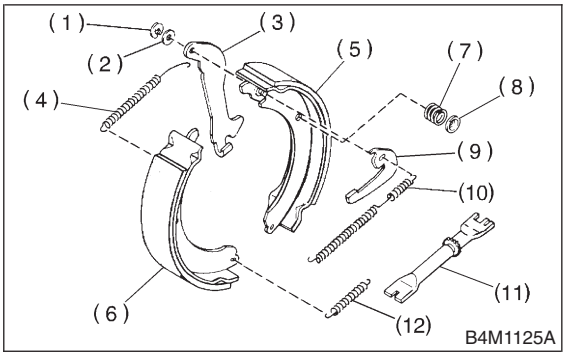


7) Remove shoes one by one from back plate with adjuster.

CAUTION:
Be careful not to bend parking brake cable excessively when removing brake shoes.



8) Disconnect parking brake cable from parking lever.
9) Remove the following:

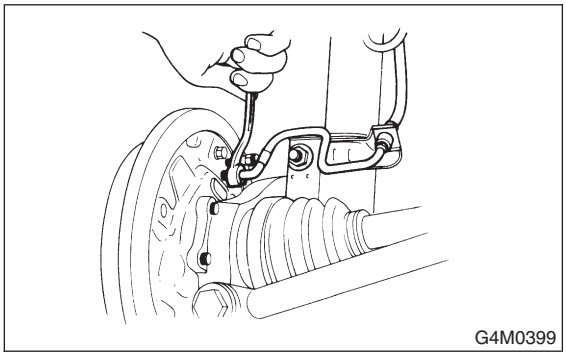


(1) Retainer
(2) Washer
(3) Parking lever
(4) Upper shoe return spring
(5) Trailing shoe
(6) Leading shoe
(7) Shoe hold-down spring
(8) Shoe hold-down cup
(9) Adjusting lever
(10) Adjusting spring
(11) Adjuster
(12) Lower shoe return spring

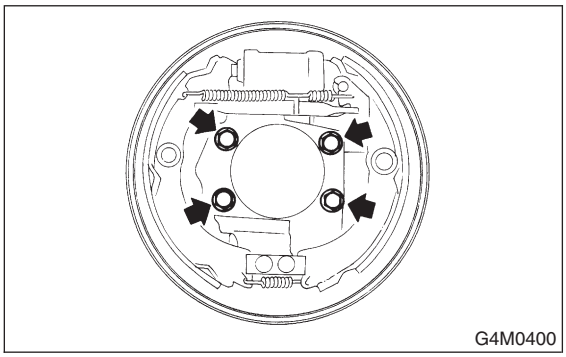
2. BRAKE ASSEMBLY

1) Remove wheel.
2) Remove axle nut.
3) Remove brake drum.

4) Unscrew the brake pipe flare nut and disconnect brake pipe.

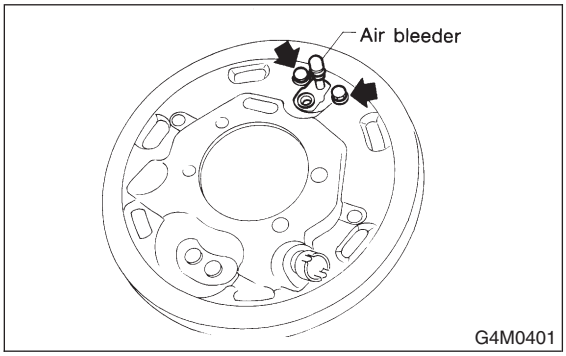

G4M0399

5) Remove hub. <Ref. to 4-2 [W2A0].>
6) Remove the bolts installing back plate, and then, remove brake assembly.


G4M0400

3. WHEEL CYLINDER

1) Remove brake drum and shoes.
2) Unscrew brake pipe flare nut; and disconnect brake pipe.
3) Remove the bolts installing wheel cylinder on back plate, and remove it.

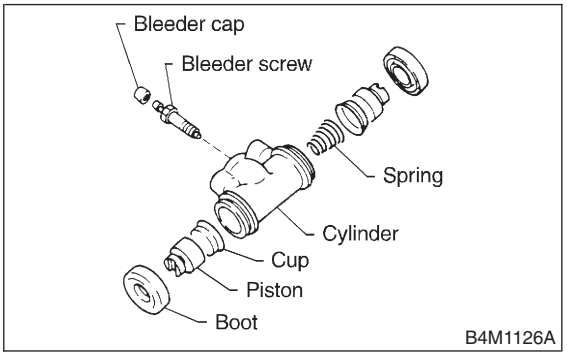


G4M0401

B: DISASSEMBLY

1. WHEEL CYLINDER

1) Remove right and left dust boots from wheel cylinder.



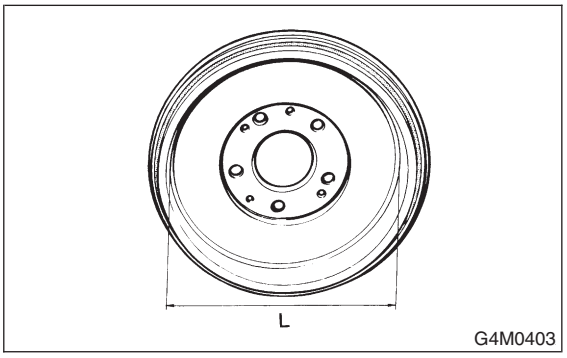
B4M1126A

2) Remove piston, cup, spring and air bleeder screw and cap.

C: INSPECTION

1) If the inside surface of brake drum is streaked, correct the surface. And, if it is unevenly worn, taperingly streaked, or the outside surface of brake drum is damaged, correct or replace it.
2) Measure the drum inner diameter.

Drum inner diameter: "L"
Standard
228.6 mm (9 in)
Service limit
230.6 mm (9.08 in)



G4M0403

3) Measure the lining thickness.

Lining thickness:
Standard
4.1 mm (0.161 in)
Service limit
1.5 mm (0.059 in)

4) If the deformation or wear of back plate, shoe, etc. are notable, replace them.
5) When the shoe return spring tension is excessively weakened, replace it, taking care to identify upper and lower springs.

D: ASSEMBLY

1. WHEEL CYLINDER

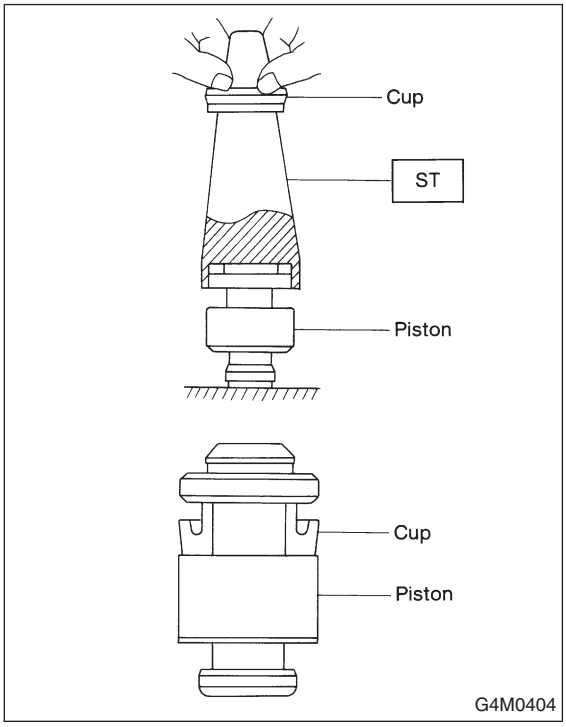
1) Clean all parts in brake fluid. Check and replace faulty parts.
- Cup and boot for damage or fatigue
- Cylinder, piston and spring or damage or rust formation

2) Assembly is the reverse order of disassembly.
(1) When installing the cup, use ST, apply brake fluid to the frictional surface for smooth installation and pay attention to cup direction.
(2) STs are available in different sizes.

CAUTION:
- **When replacing the repair kit, make sure that the sizes of cylinder and cup are the same as those which were replaced.**
- **Use only the tool of the correct size.**

ST: ADAPTER	
Applicable size	Part No.
19.05 mm (3/4 in)	926460000

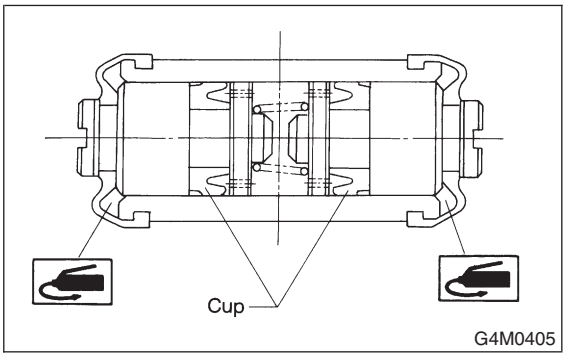
CAUTION:
While assembling, be careful to prevent any metal chip, dust or dirt from entering the wheel cylinder.



3) Apply rubber grease to the boot inside as shown in Figure.

Grease:
NIGLUBE RX-2 (Part No. 003606000)

CAUTION:
Never use brake grease.

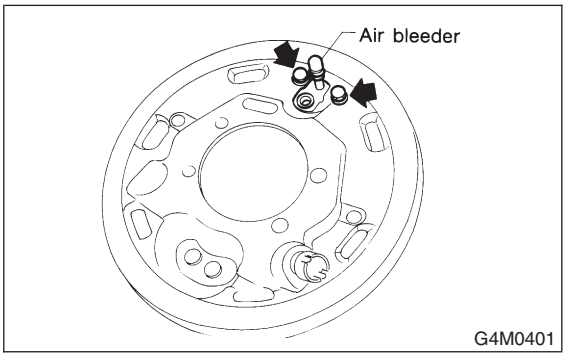


E: INSTALLATION

1. WHEEL CYLINDER

Install wheel cylinder on back plate, and tighten bolts.

Tightening torque:
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)

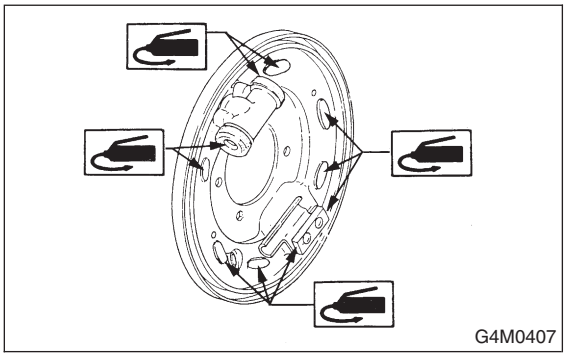


2. BRAKE DRUM AND SHOE

1) Clean back plate and wheel cylinder.

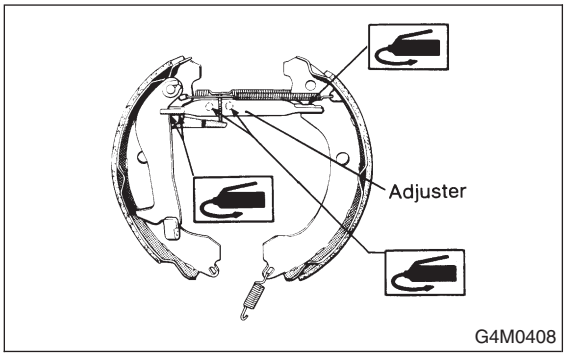
2) Apply grease to portions indicated by arrows in Figure.

Brake grease:
Dow Corning Molykote No. 7439 (Part No. 725191460)

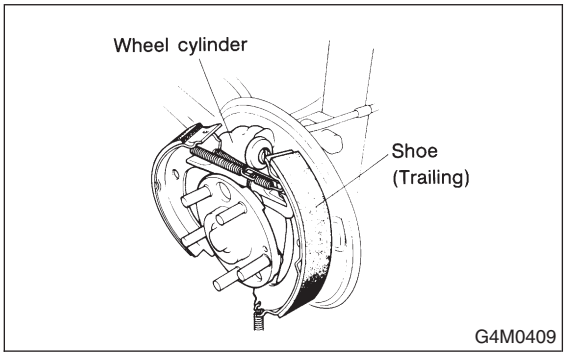


3) Apply grease to adjusting screw and both ends of adjuster.

Brake grease:
Dow Corning Molykote No. 7439 (Part No. 725191460)



4) Connect upper shoe return spring to shoes.
5) While positioning shoes (one at a time) in groove on wheel cylinder, secure shoes.

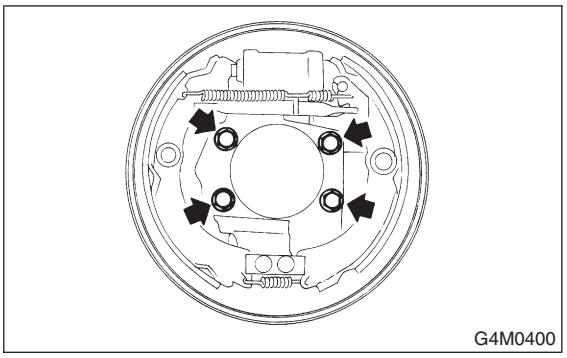


6) Connect lower shoe return spring.
7) Fix shoes by connecting hold-down cup to hold-down pin.

3. BRAKE ASSEMBLY

1) Install brake assembly on housing, and tighten bolts to install back plate.

Tightening torque:
52±6 N·m (5.3±0.6 kg-m, 38.3±4.3 ft-lb)



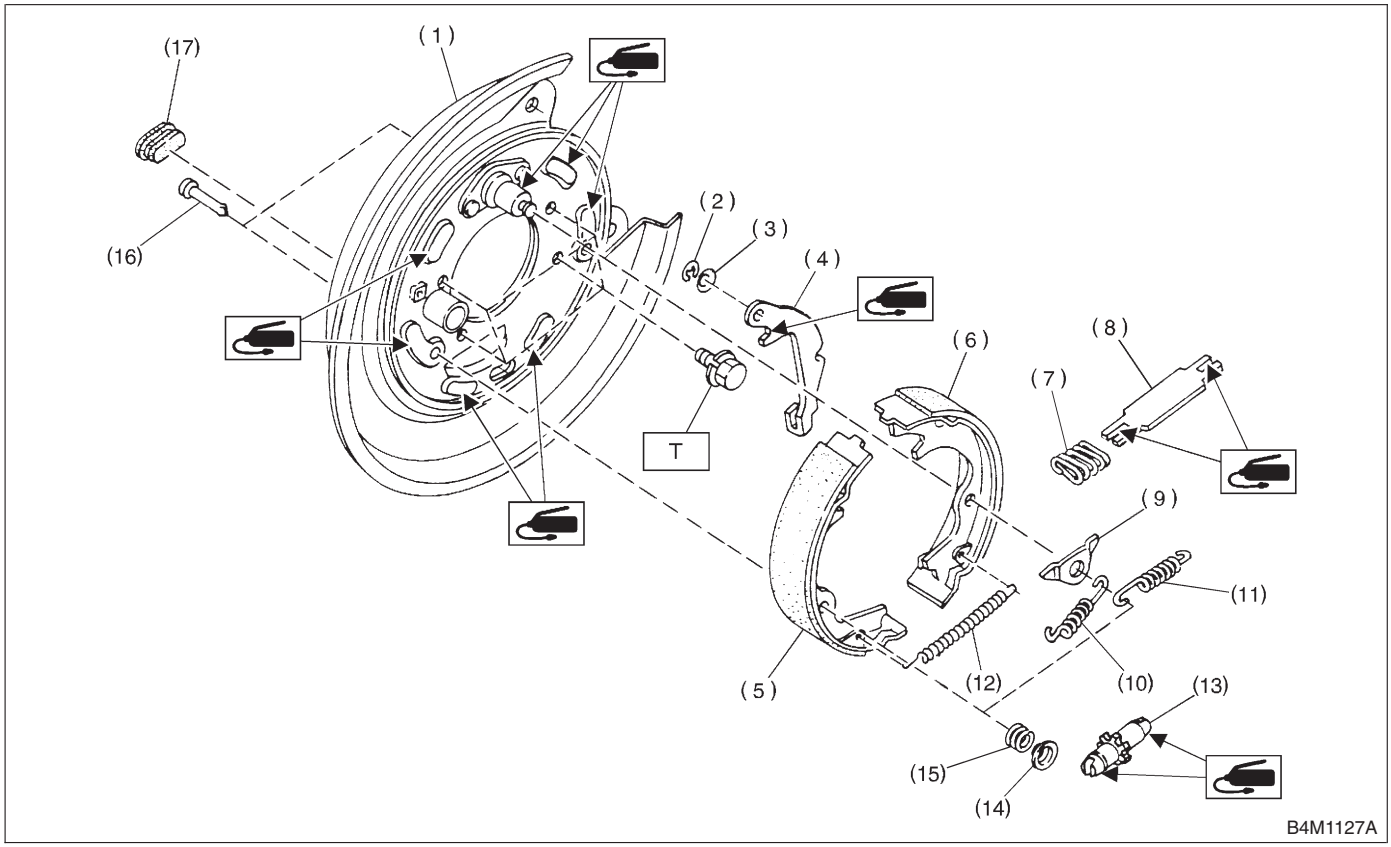
2) Install hub. <Ref. to 4-2 [W2D0].>
3) Connect brake pipe, and tighten brake pipe flange nut.

Tightening torque:
$15^{+3}/_{-2}$ N·m ($1.5^{+0.3}/_{-0.2}$ kg-m, $10.8^{+2.2}/_{-1.4}$ ft-lb)

4) Set the outside diameter of brake shoes less than 0.5 to 0.8 mm (0.020 to 0.031 in) in comparison with the inside diameter of brake drum.
5) Install brake drum.
6) After installing brake assembly, bleed air from brake line.

4. Parking Brake (Rear Disc Brake)

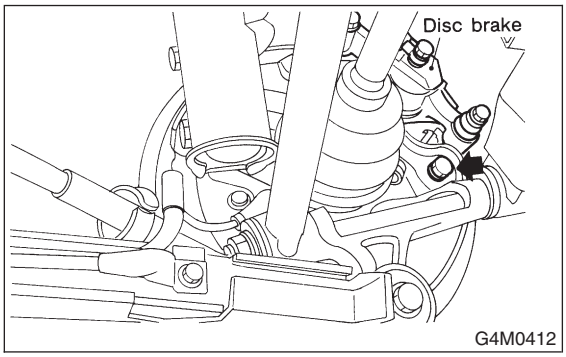
A: REMOVAL



(1) Back plate
(2) Retainer
(3) Spring washer
(4) Lever
(5) Parking brake shoe (Primary)
(6) Parking brake show (Secondary)
(7) Strut spring
(8) Strut
(9) Shoe guide plate
(10) Primary return spring
(11) Secondary return spring
(12) Adjusting spring
(13) Adjuster
(14) Shoe hold-down cup
(15) Shoe hold down spring
(16) Shoe hold down pin
(17) Adjusting hole cover

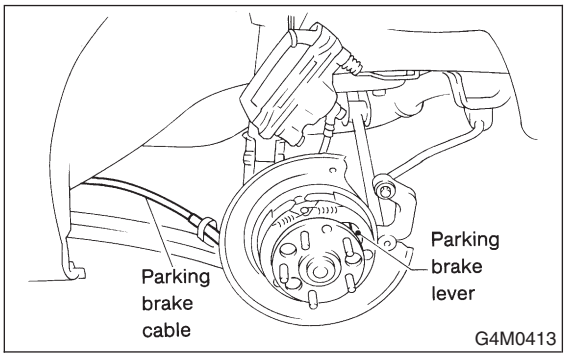
Tightening torque: N·m (kg-m, ft-lb)
T: 52±6 (5.3±0.6, 38.3±4.3)

1) Remove the two mounting bolts to the disc brake assembly and remove the disc brake assembly.



2) Suspend the disc brake assembly so that the hose is not stretched.
3) Remove the disc rotor.
4) Remove shoe return spring from parking brake assembly.
5) Remove front shoe hold down spring and pin with pliers.
6) Remove strut and strut spring.
7) Remove adjuster assembly from parking brake assembly.
8) Remove brake shoe.
9) Remove rear shoe hold-down spring and pin with pliers.

10) Remove parking cable from parking lever.



11) Using a standard screwdriver, raise retainer. Remove parking lever and washer from brake shoe.

B: INSPECTION

1) Measure brake disc inside diameter. If the disc is scored or worn, replace the brake disc.

Disc inside diameter:
Standard
170 mm (6.69 in)
Service limit
171 mm (6.73 in)

2) Measure the lining thickness. If it exceeds the limit, replace shoe assembly.

Lining thickness:
Standard
3.2 mm (0.126 in)
Service limit
1.5 mm (0.059 in)

CAUTION:
Replace the brake shoes on the right and left brake assembly at the same time.

C: INSTALLATION

CAUTION:
Be sure lining surface is free from oil contamination.

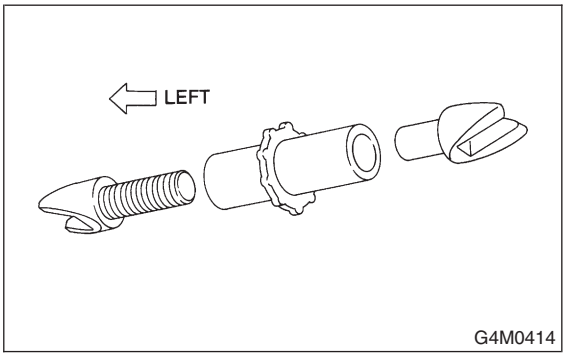
Brake grease:
Dow Corning Molykote No 7439 (Part No. 725191460)

1) Apply brake grease to the following places.
- Six contact surfaces of shoe rim and back plate packing
- Contact surface of shoe wave and anchor pin
- Contact surface of lever and strut
- Contact surface of shoe wave and adjuster assembly
- Contact surface of shoe wave and strut
- Contact surface of lever and shoe wave

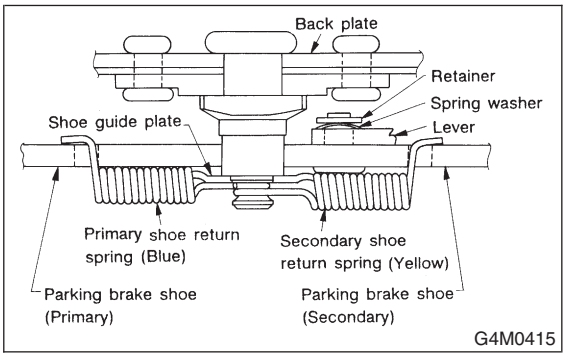
2) Installation is in reverse order of removal.

CAUTION:
- **Use new retainers and clinch them when installing brake shoes to levers.**
- **Ensure that parking lever moves smoothly.**
- **Do not confuse left parking lever with right one.**
- **Do not confuse left strut with right one.**

NOTE:
Ensure that adjuster assembly is securely installed with screw in the left side, facing vehicle front.



NOTE:
Ensure that shoe return spring is installed as shown in Figure.



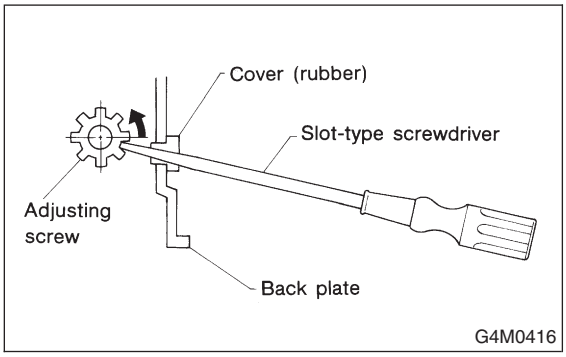
3) Adjust parking brakes. <Ref. to 4-4 [W4D1].>

CAUTION:
After replacing parking brake lining, be sure to drive vehicle for "break-in" purposes.
(1) Drive the vehicle about 35 km/h (22 MPH).
(2) With the parking brake release button pushed in, pull the parking brake lever gently, pulling with a force of approximately 147 N (15 kg, 33 lb).
(3) Drive the vehicle for about 200 m (0.12 mile) in this condition.
(4) Wait 5 to 10 minutes for the parking brake to cool down. Repeat this procedure once more.
(5) After breaking-in, re-adjust parking brakes.

D: ADJUSTMENT

1. SHOE CLEARANCE

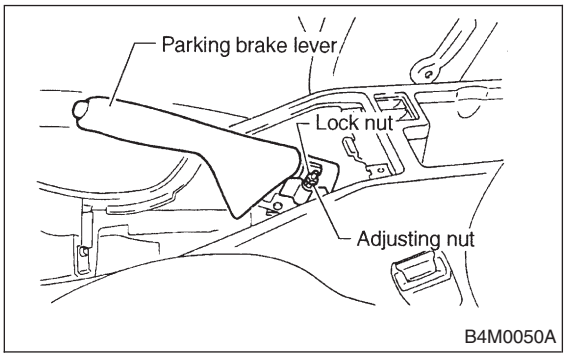
1) Remove adjusting hole cover from back plate.
2) Turn adjusting screw using a slot-type screwdriver until brake shoe is in close contact with disc rotor.



3) Turn back (downward) adjusting screw 3 or 4 notches.
4) Install adjusting hole cover to back plate.

2. LEVER STROKE

1) Remove console box lid.
2) Forcibly pull parking brake lever 3 to 5 times.
3) Adjust parking brake lever by turning adjusting nut until parking brake lever stroke is set at 7 to 8 notches with operating force of 196 N (20 kg, 44 lb).



4) Tighten lock nut.
5) Install console box lid.

Lever stroke:
7 to 8 notches when pulled with a force of 196 N (20 kg, 44 lb)

Tightening torque (Lock nut):
5.9±1.5 N·m (0.60±0.15 kg-m, 4.3±1.1 ft-lb)

5. Master Cylinder

A: REMOVAL

1) Thoroughly drain brake fluid from reservoir tank.
2) Disconnect fluid level indicator harness connector.
3) Remove brake pipes from master cylinder.
4) Remove master cylinder mounting nuts, and take out master cylinder from brake booster.

CAUTION:
Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wipe it off quickly if spilt.

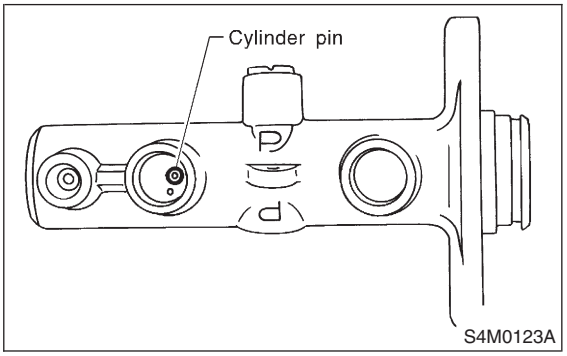
B: DISASSEMBLY

1. PRECAUTIONS FOR DISASSEMBLING

1) Remove mud and dirt from the surface of brake master cylinder.
2) Prepare tools necessary for disassembly operation, and arrange them neatly on work bench.
3) Clean work bench.

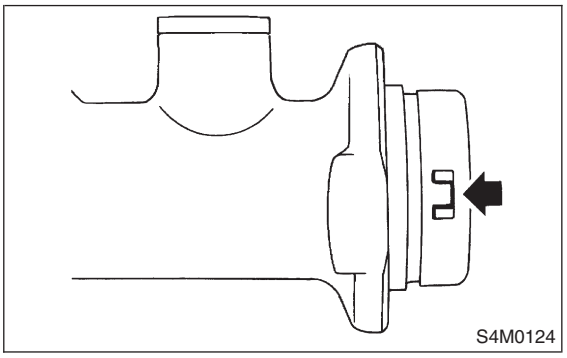
2. DISASSEMBLING PROCEDURE

1) Remove reserve tank.
2) Remove cylinder pin. (only vehicle equipped with ABS)



3) Pry up the pawl and remove the piston retainer.

NOTE:
Piston may jump out from master cylinder.



4) Extract primary piston assembly and secondary piston assembly.

CAUTION:
• Do not disassemble the piston assembly; otherwise, the spring set value may be changed.
• Use brake fluid or methanol to wash inside wall of cylinder, pistons and piston cups. Be careful not to damage parts when washing. If methanol is used for washing, do not dip rubber parts, such as piston cups, in it for more than 30 seconds; otherwise, they may become swelled.

C: INSPECTION

If any damage, deformation, wear, swelling, rust, and other faults are found on the primary piston assembly, secondary piston assembly, supply valve stopper, or gasket, replace the faulty part.

CAUTION:
• The primary and secondary pistons must be replaced as complete assemblies.
• The service limit of the clearance between each piston and the master cylinder inner dia. is 0.11 mm (0.0043 in).
• When handling parts, be extremely careful not to damage or scratch the parts, or let any foreign matter get on them.

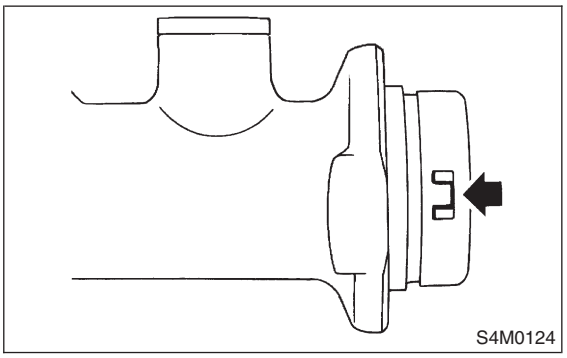
D: ASSEMBLY

1. PRECAUTIONS FOR ASSEMBLING

1) When assembling, be sure to use recommended brake fluid.
2) Ensure that the inside wall of cylinder, pistons, and piston cups are free from dirt when assembling.
3) Be extremely careful not to damage, scratch, or dent cylinder inside wall, pistons, and piston cups.
4) Do not drop parts. Never attempt to use any part that has been dropped accidentally.

2. ASSEMBLING OPERATION

1) Assembling piston assembly:
Apply recommended brake fluid to inside wall of cylinder, and to outer surface of piston assembly, and install piston assemblies carefully into cylinder.
2) Assembling cylinder pin:
3) Press the pawl and install the piston retainer into the master cylinder.



E: INSTALLATION

To install the master cylinder to the body, reverse the sequence of removal procedure.

Tightening torque:
Master cylinder mounting nut
14±4 N·m (1.4±0.4 kg-m, 10.1±2.9 ft-lb)
Piping flare nut
$15^{+3}/_{-2}$ N·m ($1.5^{+0.3}/_{-0.2}$ kg-m, $10.8^{+2.2}/_{-1.4}$ ft-lb)

CAUTION:
Be sure to use recommended brake fluid.

6. Brake Booster

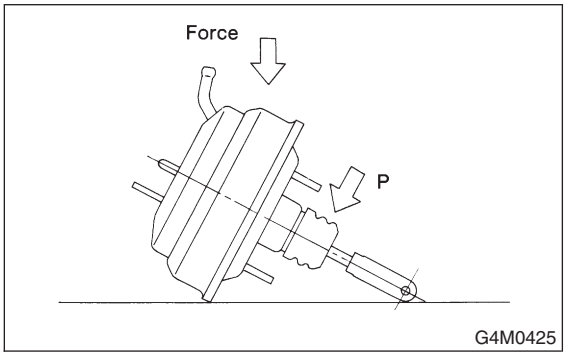
A: REMOVAL

1) Remove or disconnect the following parts at engine compartment.
   (1) Disconnect connector for brake fluid level indicator.
   (2) Remove brake pipes from master cylinder.
   (3) Remove master cylinder installing nuts.
   (4) Disconnect vacuum hose from brake booster.
2) Remove the following parts from the pedal bracket.
   (1) Snap pin and clevis pin
   (2) Four brake booster installing nuts
3) Remove brake booster while shunning brake pipes.

B: HANDLING PRECAUTIONS

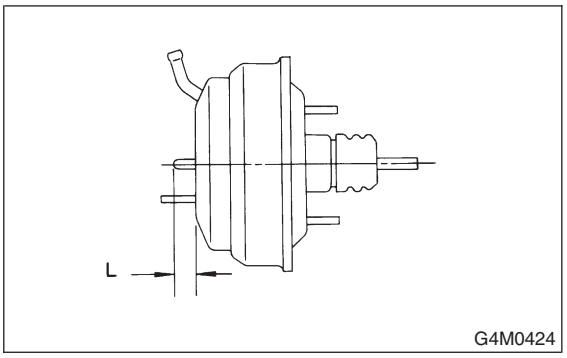
1) Be careful not to drop brake booster. Brake booster should be discarded if it has been dropped.
2) Use special care when handling operating rod. If excessive force is applied to operating rod, sufficient to cause a change in the angle in excess of ±3°, it may result in damage to the power piston cylinder.
3) Use care when placing brake booster on the floor.

CAUTION:
If external force is applied from above when brake booster is placed in this position, the resin portion as indicated by "P", may be damaged.



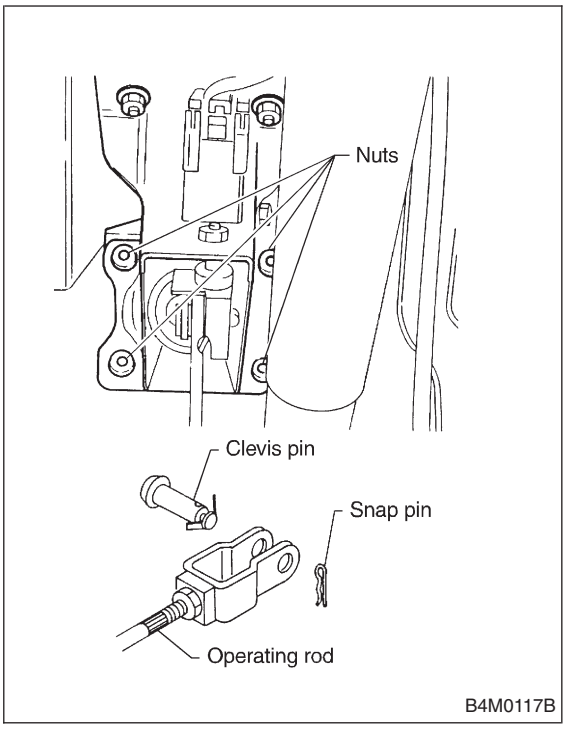
4) Do not change the push rod length. If it has been changed, reset the projected length "L" to the standard length.

Standard:
L = 10 mm (0.39 in)

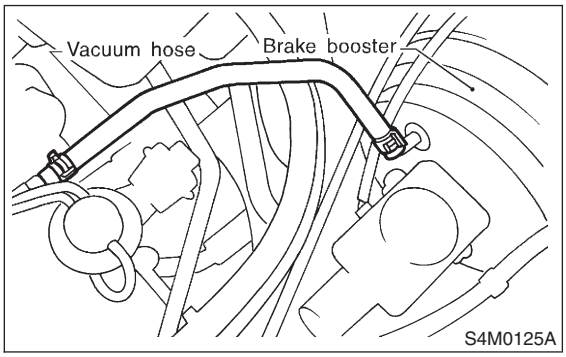


C: INSTALLATION

1) Mount brake booster in position.
2) Connect operating rod to brake pedal with clevis pin and snap pin.



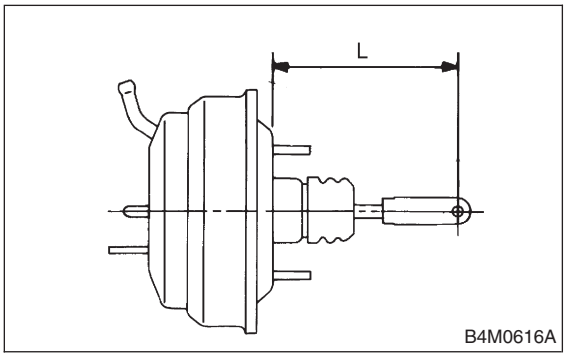
3) Connect vacuum hose to brake booster.



4) Mount master cylinder onto brake booster.
5) Connect brake pipes to master cylinder.
6) Connect electric connector for brake fluid level indicator.
7) Adjust operating rod of brake booster.

Standard: L
145.3 mm (5.72 in)

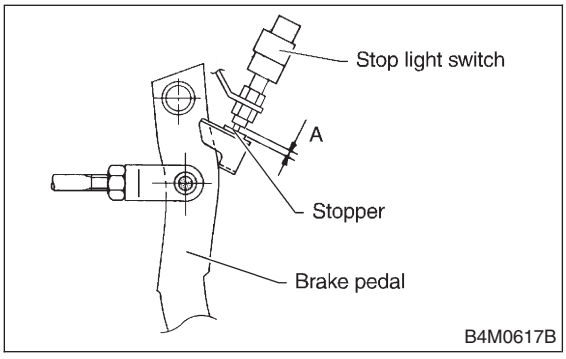
If it is not in specified value, adjust it by adjusting brake booster operating rod.



8) Measure the clearance between threaded end of stop light switch and stopper.
If it is not in specified value, adjust it by adjusting position of stop light switch.

CAUTION:
Be careful not to rotate stop light switch.

Stop light switch clearance: A
0.3 mm (0.012 in)



9) Apply grease to operating rod connecting pin to prevent it from wearing.

10) Bleed air from brake system.

Tightening torque (Air bleeder screw):
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

11) Conduct road tests to ensure brakes do not drag.

D: OPERATION CHECK (WITHOUT USING GAUGES)

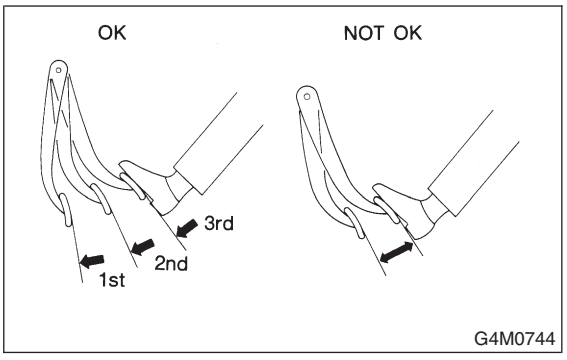
CAUTION:
When checking operation, be sure to securely apply the hand brake.

1. CHECKING WITHOUT USING GAUGES

This method cannot determine the exact portion which has failed, but it can provide a rough understanding of the nature of the failure if checking is conducted in accordance with the following procedures.

2. AIR TIGHTNESS CHECK

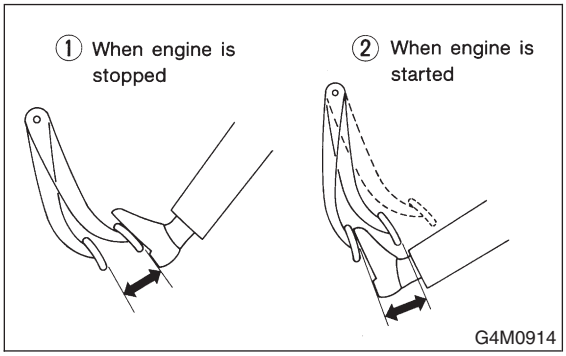
Start engine, and run it for 1 to 2 minutes, then turn it off.
Depress brake pedal several times applying the same pedal force as that used in ordinary braking operations. The pedal stroke should be greatest on the 1st depression, and it should become smaller with each successive depression. If no change occurs in the pedal height while in a depressed state, brake booster is faulty.



NOTE:
● In the event of defective operation, inspect the condition of the check valve and vacuum hose.
● Replace them if faulty and conduct the test again.
● If no improvement is observed, check precisely with gauges.

3. OPERATION CHECK

1) With engine off, depress brake pedal several times applying the same pedal force and make sure that the pedal height does not vary with each depression of the pedal.



2) With brake pedal depressed, start engine.
3) As engine starts, brake pedal should move slightly toward the floor. If no change occurs in the pedal height, brake booster is faulty.

NOTE:
If faulty, check precisely with gauges.

4. LOADED AIR TIGHTNESS CHECK

Depress brake pedal while engine is running, and turn off engine while the pedal is still depressed. Keep the pedal depressed for 30 seconds; if no change occurs in the pedal height, brake booster is functioning normally; if the pedal height increases, it is faulty.

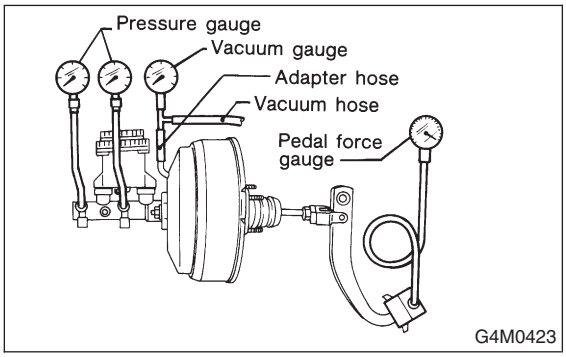
NOTE:
If faulty, check precisely with gauges.

E: OPERATION CHECK (WITH USING GAUGES)

CAUTION:
When checking operation, be sure to securely apply the hand brake.

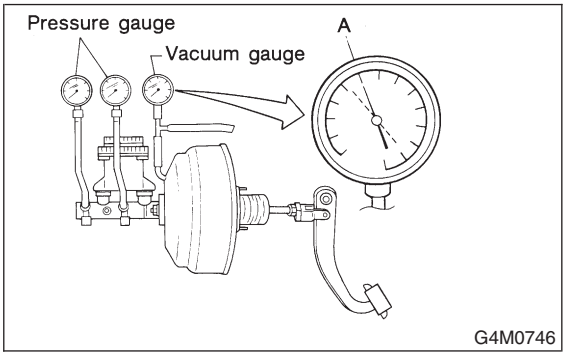
1. CHECKING WITH GAUGES

Connect gauges as shown in Figure. After bleeding air from pressure gauges, proceed to each check.



2. AIR TIGHTNESS CHECK

1) Start engine and keep it running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) = point A is indicated on vacuum gauge. Do not depress brake pedal.

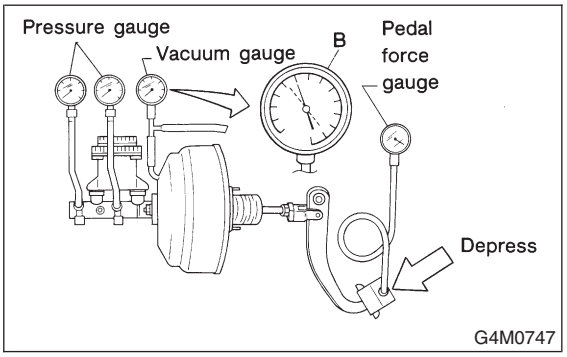


2) Stop engine and watch the gauge. If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly. If defective, the cause may be one of those listed below.

- Check valve malfunction
- Leak from vacuum hose
- Leak from the shell jointed portion or stud bolt welded portion
- Damaged diaphragm
- Leak from valve body seal and bearing portion
- Leak from plate and seal assembly portion
- Leak from poppet valve assembly portion

3. LOADED AIR TIGHTNESS CHECK

1) Start engine and depress brake pedal with pedal force of 196 N (20 kg, 44 lb). Keep engine running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) = point B is indicated on vacuum gauge while the pedal is still depressed.



2) Stop engine and watch vacuum gauge.
If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly. If defective, refer to “AIR TIGHTNESS CHECK”. <Ref. to 4-4 [W6E2].>

4. LACK OF BOOSTING ACTION CHECK

Turn off engine, and set the vacuum gauge reading at “0”. Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed below.

Brake pedal force	147 N (15 kg, 33 lb)	294 N (30 kg, 66 lb)
Fluid pressure	588 kPa (6 kg/cm^2, 85 psi)	1,765 kPa (18 kg/cm^2, 256 psi)

5. BOOSTING ACTION CHECK

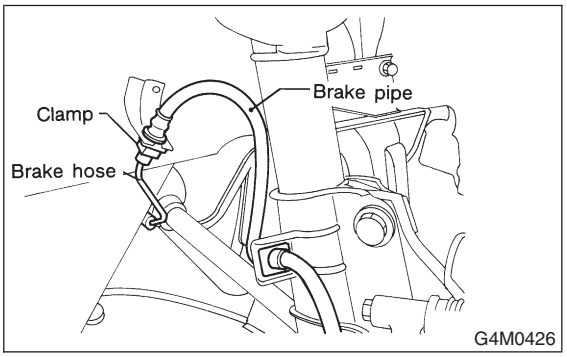
Set the vacuum gauge reading at 66.7 kPa (500 mmHg, 19.69 inHg) by running engine. Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed below.

Brake pedal force	147 N (15 kg, 33 lb)	294 N (30 kg, 66 lb)
Fluid pressure	5,590 kPa (57 kg/cm^2, 811 psi)	9,807 kPa (100 kg/cm^2, 1,422 psi)

7. Brake Hose

A: REMOVAL

1) Separate brake pipe from brake hose.
(Always use flare nut wrench and be careful not to deform flare nut.)



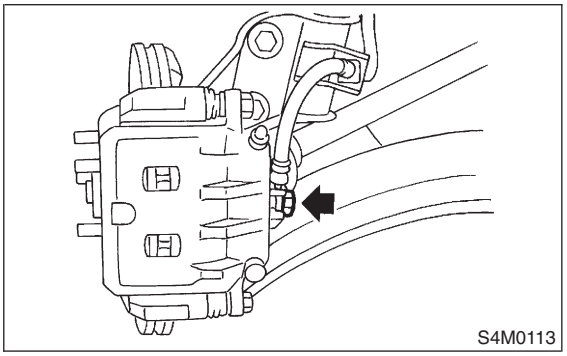
2) Pull out clamp to remove brake hose.
3) Remove clamp at strut and union bolt.

B: INSTALLATION

1. FRONT BRAKE HOSE

1) Route end of brake hose (on caliper side) through hole in brake hose bracket at strut location.
2) Tighten end of brake hose at caliper using a union bolt.

Tightening torque (Union bolt):
18±3 N·m (1.8±0.3 kg-m, 13.0±2.2 ft-lb)



3) Secure middle fitting of brake hose to bracket at strut location using a clamp.
4) Position disc in straight-forward direction and route brake hose through hole in bracket on wheel apron side.

CAUTION:
Be sure brake hose is not twisted.

5) Temporarily tighten flare nut to connect brake pipe and hose.
6) Fix brake hose with clamp at wheel apron bracket.

7) While holding hexagonal part of brake hose fitting with a wrench, tighten flare nut to the specified torque.

Tightening torque (Brake pipe flare nut):
15^{+3}_{-2} N·m ($1.5^{+0.3}_{-0.2}$ kg-m, $10.8^{+2.2}_{-1.4}$ ft-lb)

8) Bleed air from the brake system.

2. REAR BRAKE HOSE

1) Pass brake hose through the hole of bracket, and lightly tighten flare nut to connect brake pipe.
2) Insert clamp upward to fix brake hose.
3) While holding hexagonal part of brake hose fitting with a wrench, tighten flare nut to the specified torque.

Tightening torque (Brake pipe flare nut):
15^{+3}_{-2} N·m ($1.5^{+0.3}_{-0.2}$ kg-m, $10.8^{+2.2}_{-1.4}$ ft-lb)

4) Bleed air from the brake system.

8. Parking Brake Lever

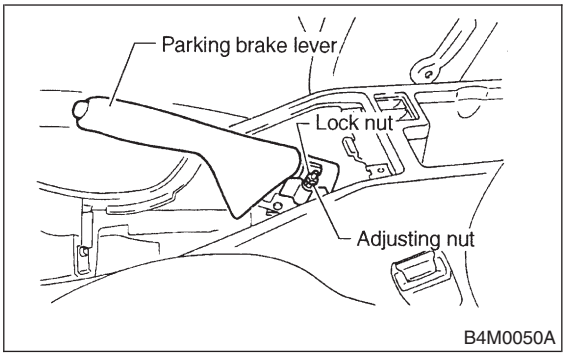
A: REPLACEMENT

1) Remove console box from front floor.
2) Disconnect electric connector for parking brake switch.
3) Loosen parking brake adjuster, and remove inner cable end from equalizer.
4) Remove parking brake lever.
5) Install parking brake lever in the reverse order of removal.

Torque (Lever installing bolt):
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

6) Adjust parking brake lever by turning adjuster until parking brake lever stroke is set at 7 to 8 notches with operating force of 196 N (20 kg, 44 lb).
7) Tighten lock nut.

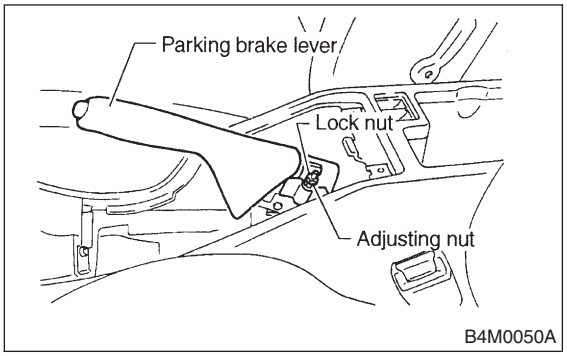
Torque (Adjuster lock nut):
5.9±1.5 N·m (0.60±0.15 kg-m, 4.3±1.1 ft-lb)



B: PARKING BRAKE ADJUSTMENT

1. LEVER STROKE ADJUSTMENT

1) Remove console cover.
2) Forcibly pull parking brake lever 3 to 5 times.
3) Adjust parking brake lever by turning adjuster until parking brake lever stroke is set at 7 to 8 notches with operating force of 196 N (20 kg, 44 lb).



4) Tighten lock nut.

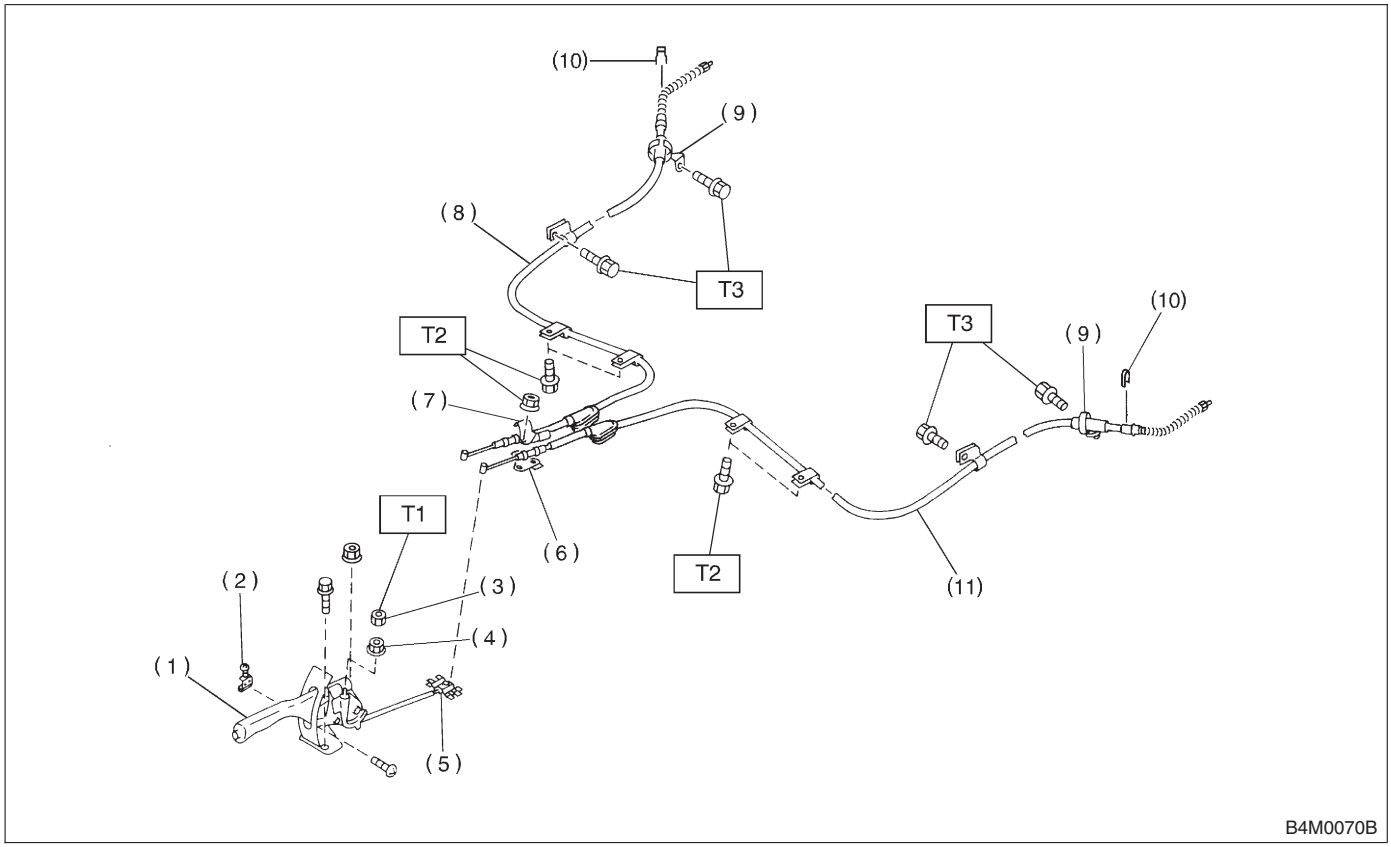
Lever stroke:
7 to 8 notches when pulled with a force of 196 N (20 kg, 44 lb)

Tightening torque (Lock nut):
5.9±1.5 N·m (0.60±0.15 kg-m, 4.3±1.1 ft-lb)

5) Install console cover.

9. Parking Brake Cable

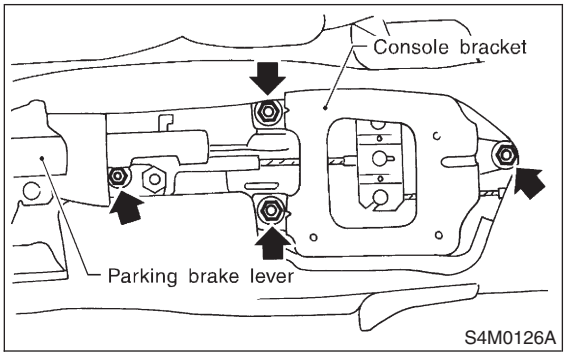
A: REPLACEMENT



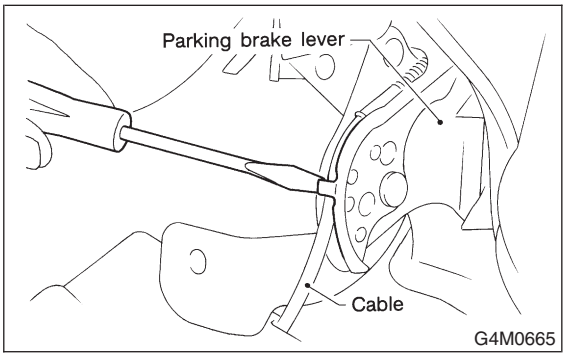
(1) Parking brake lever
(2) Parking brake switch
(3) Lock nut
(4) Adjusting nut
(5) Equalizer
(6) Bracket
(7) Clamp
(8) Parking brake cable RH
(9) Cable guide
(10) Clamp (Rear disc brake model only)
(11) Parking brake cable LH

Tightening torque: N·m (kg-m, ft-lb)
T1: 5.9±1.5 (0.60±0.15, 4.3±1.1)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 32±10 (3.3±1.0, 24±7)

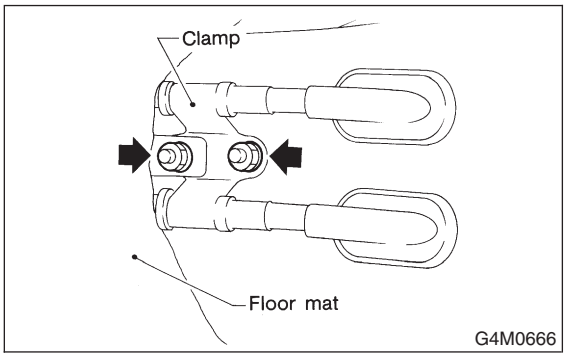
1) Lift-up vehicle.
2) Remove rear tires and wheels.
3) Remove rear cushion.
4) Remove console box from front floor.
5) Loosen parking cable adjusting nut and console bracket.
6) Remove parking brake lever.



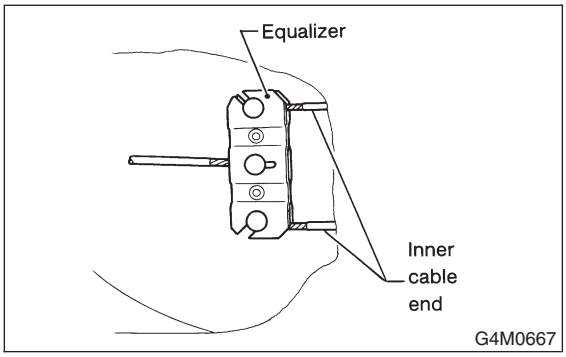
7) Unbend parking brake lever pawls and remove cable.



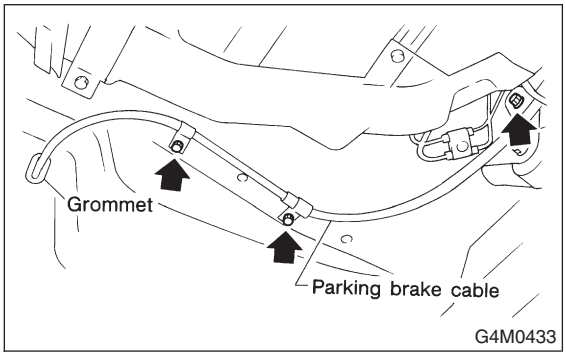
8) Roll up floor mat and remove clamps.



9) Remove equalizer cover.
10) Remove inner cable end from equalizer.



11) Pull out parking brake cable from rear brake. <Ref. to 4-4 [W2A0].>
12) Pull out clamp from rear brake.
13) Remove bolt and bracket from trailing link bracket.
14) Remove bolt and clamp from rear floor.



15) Detach grommet from rear floor.
16) Remove cable assembly from cabin by forcibly pulling it backward.
17) Detach parking brake cable from cable guide at rear trailing link.
18) Install (new) parking brake assembly in the reverse order of removal.

NOTE:
● Be sure to pass cable through cable guide inside the tunnel.
● Be sure to adjust the lever stroke. <Ref. to 4-4 [W8B1].>

10. Air Bleeding

A: GENERAL RULES FOR EFFECTIVE BLEEDING

1) Start with the brakes (wheels) connecting to the secondary chamber of the master cylinder.
2) The time interval between two brake pedal operations (from the time when the pedal is released to the time when it is depressed another time) shall be approximately 3 seconds.
3) The air bleeder on each brake shall be released for 1 to 2 seconds.

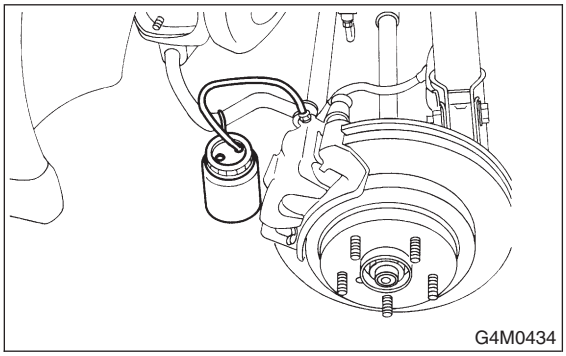
B: BLEEDING PROCEDURE

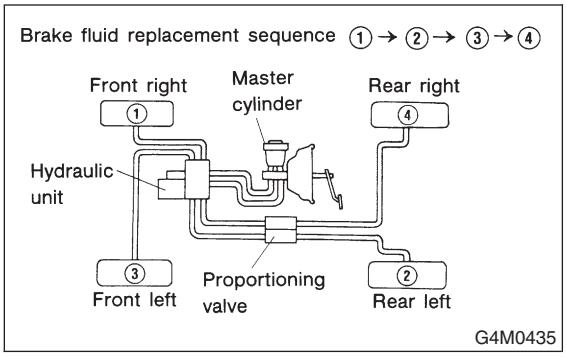
CAUTION:
● The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
● Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
● Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
● Be careful not to allow dirt or dust to get into the reservoir tank.

NOTE:
● During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
● Brake pedal operating must be very slow.
● For convenience and safety, it is advisable to have two men working.

1) Make sure that there is no leak from joints and connections of the brake system.

2) Fit one end of vinyl tube into the air bleeder and put the other end into a brake fluid container.





3) Slowly depress the brake pedal and keep it depressed. Then, open the air bleeder to discharge air together with the fluid.
Release air bleeder for 1 to 2 seconds.
Next, with the bleeder closed, slowly release the brake pedal.
Repeat these steps until there are no more air bubbles in the vinyl tube.
Allow 3 to 4 seconds between two brake pedal operations.

CAUTION:
Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.

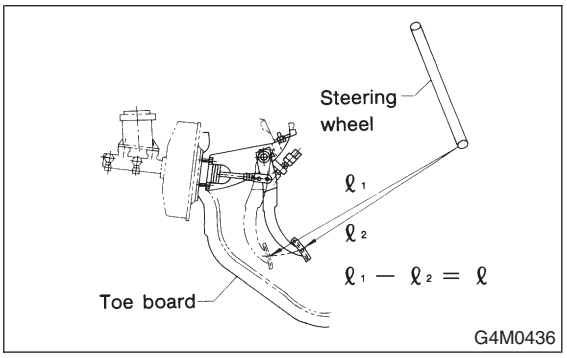
NOTE:
Brake pedal operating must be very slow.

4) Tighten air bleeder securely when no air bubbles are visible.

Air bleeder tightening torque:
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

5) Perform these steps for the brakes connecting to the secondary chamber of master cylinder, first, and then for the ones connecting to primary chamber. With all procedures completed, fully depress the brake pedal and keep it in that position for approximately 20 seconds to make sure that there is no leak evident in the entire system.
6) Perform sequence control. (With ABS model) <Ref. to 4-4 [W14C1].>

7) Check the pedal stroke.
While the engine is idling, depress the brake pedal with a 490 N (50 kg, 110 lb) load and measure the distance between the brake pedal and steering wheel. With the brake pedal released, measure the distance between the pedal and steering wheel again. The difference between the two measurements must be more than specified.



Specified pedal stroke:
Without ABS
90 mm (3.54 in)
With ABS
95 mm (3.74 in)
When depressing brake pedal with a 490 N (50 kg, 110 lb) load.

(1) Models without ABS
If the distance is more than specifications, there is a possibility that air is in the brake line.
Bleed air from the brake line.
(2) Models with ABS
If the distance is more than specifications, there is a possibility air is in the inside of the hydraulic unit. Therefore, air must be bled from the inside of the hydraulic unit to the brake pipes in accordance with the bleeding sequence control. <Ref. to 4-4 [W14C1].>
8) Add brake fluid to the required level (MAX. level) of reserve tank.
9) As a final step, test run the vehicle at low speed and apply brakes relatively hard 2 to 3 times to ensure that brakes provide normal braking action on all four wheels without dragging and uneven braking.

11. Brake Fluid

A: REPLACEMENT

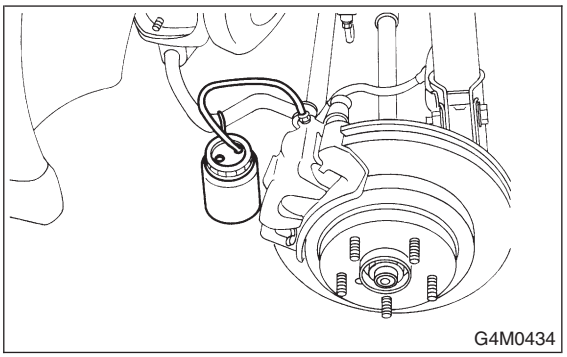
CAUTION:
● To always maintain the brake fluid characteristics, replace the brake fluid according to maintenance schedule or earlier than that when used in severe condition.
● The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
● Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
● Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
● Be careful not to allow dirt or dust to get into the reservoir tank.

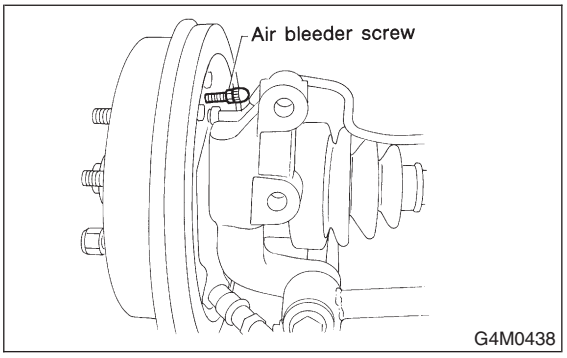
NOTE:
● During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
● Brake pedal operating must be very slow.
● For convenience and safety, it is advisable to have two men working.
● The amount of brake fluid required is approximately 500 mℓ (16.9 US fl oz, 17.6 Imp fl oz) for total brake system.

1) Either jack-up vehicle and place a safety stand under it, or lift-up vehicle.
2) Remove both front and rear wheels.
3) Draw out the brake fluid from reserve tank with syringe.
4) Refill reservoir tank with recommended brake fluid.

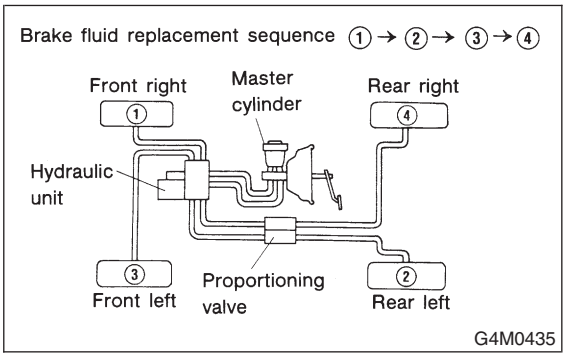
Recommended brake fluid:
FMVSS No. 116, fresh DOT3 or 4 brake fluid

5) Install one end of a vinyl tube onto the air bleeder of and insert the other end of the tube into a container to collect the brake fluid.


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G4M0435

6) Instruct your co-worker to depress the brake pedal slowly two or three times and then hold it depressed.
7) Loosen bleeder screw approximately 1/4 turn until a small amount of brake fluid drains into container, and then quickly tighten screw.
8) Repeat again from the twe former procedures until there are no air bubbles in drained brake fluid and new fluid flows through vinyl tube.

CAUTION:
Add brake fluid as necessary while performing the air bleed operation, in order to prevent the tank from running short of brake fluid.

9) After completing the bleeding operation, hold brake pedal depressed and tighten screw and install bleeder cap.

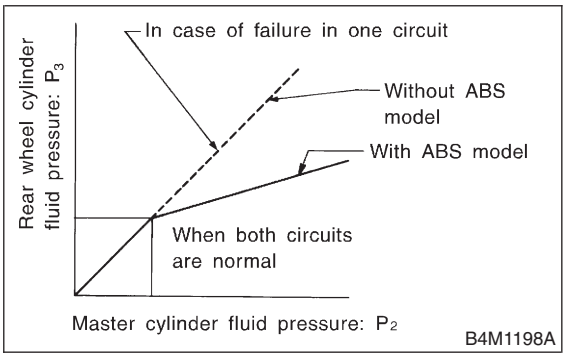
Tightening torque (Bleeder screw):
8±1 N·m (0.8±0.1 kg-m, 5.8±0.7 ft-lb)

10) Bleed air from each wheel cylinder using the same procedures as described in before.
11) Depress brake pedal with a force of approximately 294 N (30 kg, 66 lb) and hold it there for approximately 20 seconds. At this time check pedal to see if it shows any unusual movement.
Visually inspect bleeder screws and brake pipe joints to make sure that there is no fluid leakage.
12) Install wheels, and drive vehicle for a short distance between 2 to 3 km (1 to 2 miles) to make sure that brakes are operating properly.

12. Proportioning Valve

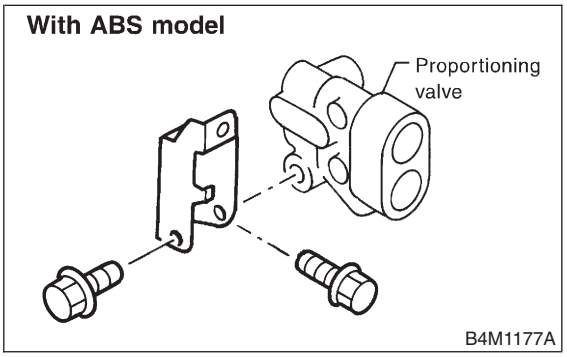
A: INSPECTION

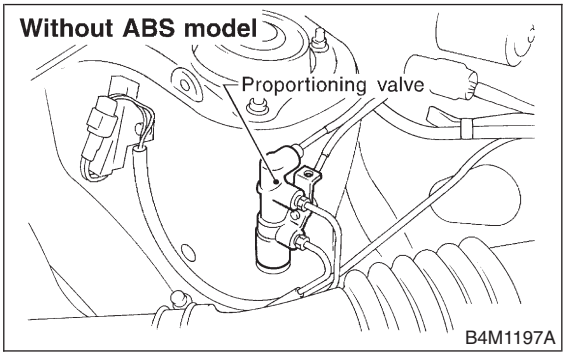
1) Install the oil pressure gauges to measure the master cylinder fluid pressure (front wheel brake fluid pressure) and rear wheel cylinder fluid pressure.
2) Bleed air from the oil pressure gauges.
3) Check the master cylinder fluid pressure and rear wheel cylinder fluid pressure.
The standard values are shown in Figure.



4) For the oil pressure in case of split point, refer to SPECIFICATIONS. <Ref. to 4-4 [S1A0].>

B: REMOVAL





1) Remove brake pipe from proportioning valve at four places.
2) Remove proportioning valve from its bracket.

CAUTION:
Do not disassemble or adjust the proportioning valve. (The proportioning valve must be replaced as an assembly.)

C: INSTALLATION

1) Install proportioning valve to bracket.
2) Connect brake pipes correctly to proportioning valve.
3) Bleed air, then check each joint of brake pipe for oil leaks.

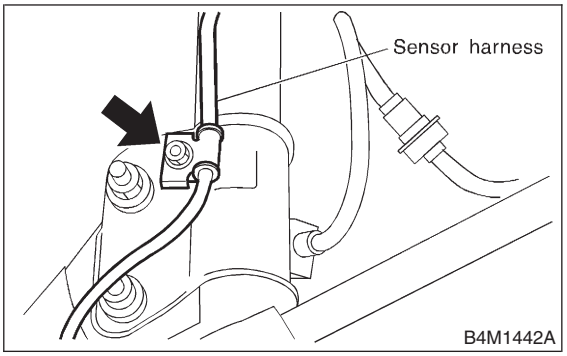
Tightening torque:
Proportioning valve to brake pipe flare nut:
15^{+3}_{-2} N·m ($1.5^{+0.3}_{-0.2}$ kg-m, $10.8^{+2.2}_{-1.4}$ ft-lb)
Proportioning valve to bracket:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

13. ABS Sensor

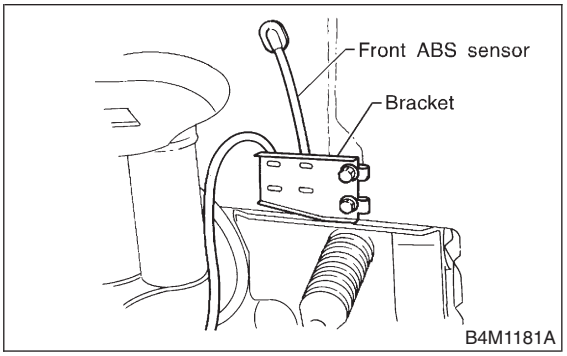
A: REMOVAL

1. FRONT ABS SENSOR

1) Disconnect front ABS sensor connector located in engine compartment.
2) Remove bolts which secure sensor harness to strut.

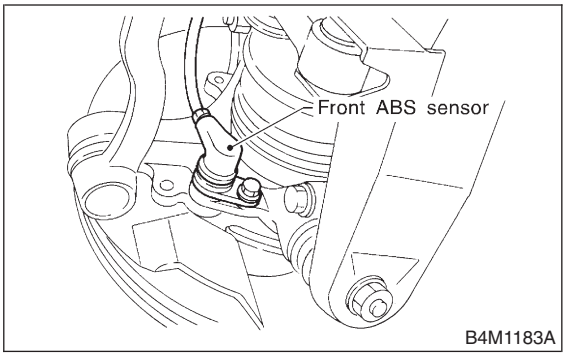


3) Remove bolts which secure sensor harness to body.



4) Remove bolts which secure front ABS sensor to housing, and remove front ABS sensor.

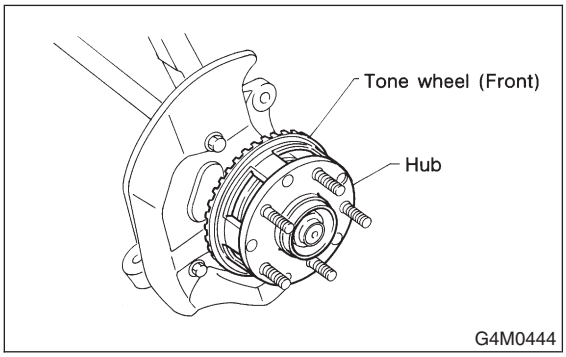
CAUTION:
• Be careful not to damage pole piece located at tip of the sensor and teeth faces during removal.
• Do not pull sensor harness during removal.



5) Remove front disc brake caliper and disc rotor from housing after removing front tire.

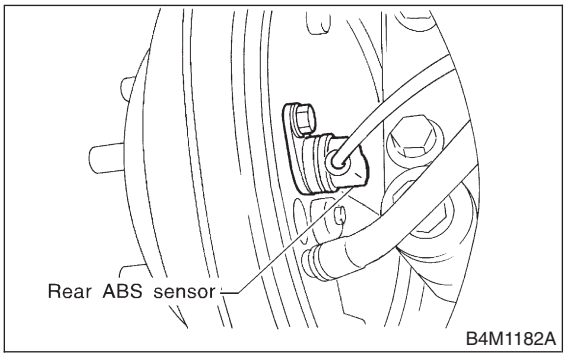
6) Remove front drive shaft and housing and hub assembly. <Ref. to 4-2 [W1A0].>
7) Remove tone wheel while removing hub from housing and hub assembly. <Ref. to 4-2 [W1B0].>

CAUTION:
Be careful not to damage teeth faces of tone wheel during removal.



2. REAR ABS SENSOR

1) Remove rear seat and disconnect rear ABS sensor connector.
2) Remove rear sensor harness bracket from rear trailing link and bracket.
3) Remove rear ABS sensor from rear back plate.



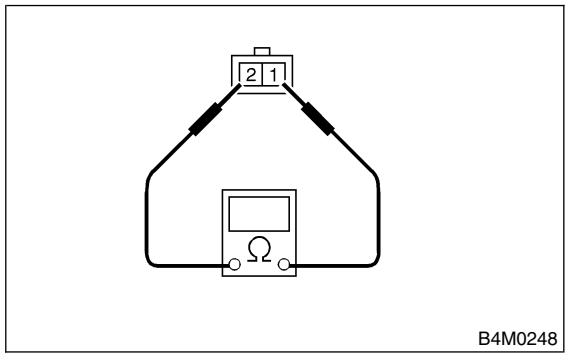
4) Remove rear tone wheel while removing hub from housing and hub assembly. <Ref. to 4-2 [W2A0].>

CAUTION:
- **Be careful not to damage pole piece located at tip of the sensor and teeth faces during removal.**
- **Do not pull sensor harness during removal.**

B: INSPECTION

1. ABS SENSOR

1) Check pole piece of ABS sensor for foreign particles or damage. If necessary, clean pole piece or replace ABS sensor.
2) Measure ABS sensor resistance.



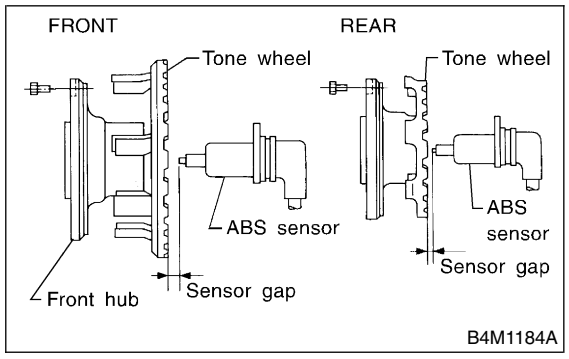
ABS sensor	Terminal No.	Standard
Front - LH	1 and 2	1.0±0.2 kΩ
Front - RH	1 and 2	
Rear - LH	1 and 2	
Rear - RH	1 and 2	

CAUTION:
If resistance is outside the standard value, replace ABS sensor with new one.

NOTE:
Check ABS sensor cable for discontinuity. If necessary, replace with a new one.

2. TONE WHEEL

1) Check tone wheel's teeth (44 pieces) for cracks or dents. If necessary, replace tone wheel with a new one.
2) Clearances (sensor gaps) should be measured one by one to ensure tone wheel and speed sensor are installed correctly.



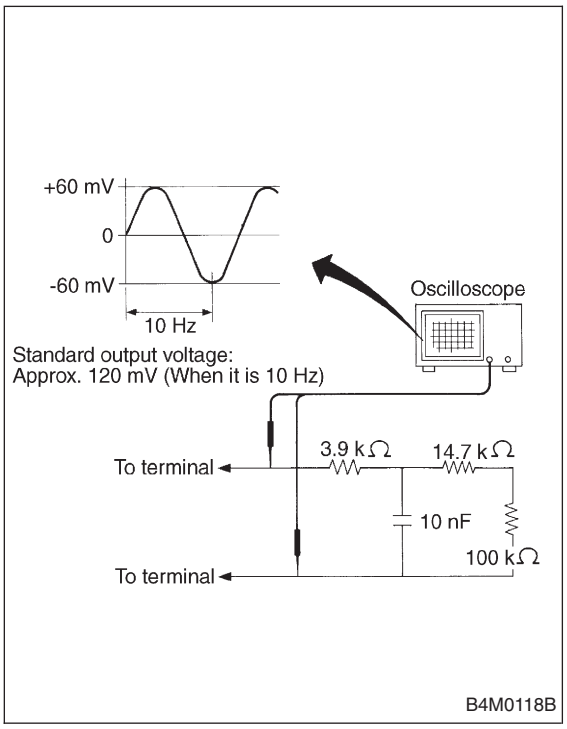
ABS sensor clearance:
Front
0.9 — 1.4 mm (0.035 — 0.055 in)
Rear
0.7 — 1.2 mm (0.028 — 0.047 in)

NOTE:
- If clearance is narrow, adjust by using spacer (Part No. 26755AA000).
- If clearance is wide, check the outputted voltage then replace ABS sensor or tone wheel if the outputted voltage is outside the specification.

3. OUTPUT VOLTAGE

Output voltage can be checked by the following method. Install resistor and condenser, then rotate wheel about 2.75 km/h (2 MPH) or equivalent.

NOTE:
Regarding terminal No., please refer to item 1. ABS SENSOR.

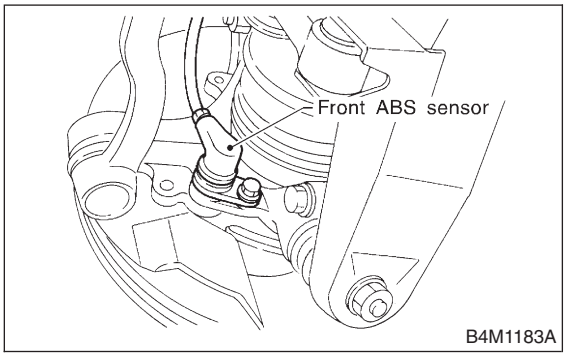


C: INSTALLATION

1. FRONT ABS SENSOR

1) Install tone wheel on hub, then install housing on hub assembly. <Ref. to 4-2 [W1D0].>
2) Temporarily install front ABS sensor on housing.

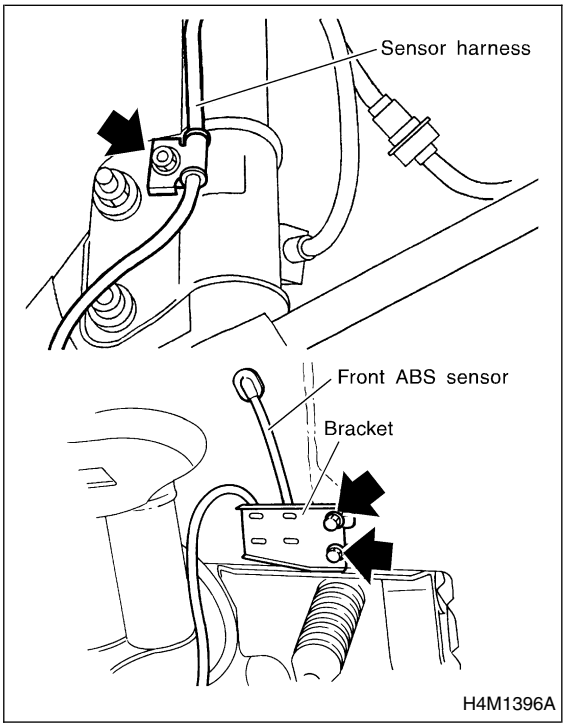
CAUTION:
Be careful not to strike ABS sensor's pole piece and tone wheel's teeth against adjacent metal parts during installation.



3) Install front drive shaft to hub spline. <Ref. to 4-2 [W1E0].>

4) Install front ABS sensor on strut and wheel apron bracket.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)



5) Place a thickness gauge between ABS sensor's pole piece and tone wheel's tooth face. After standard clearance is obtained over the entire perimeter, tighten ABS sensor on housing to specified torque.

ABS sensor standard clearance:
0.9 — 1.4 mm (0.035 — 0.055 in)

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

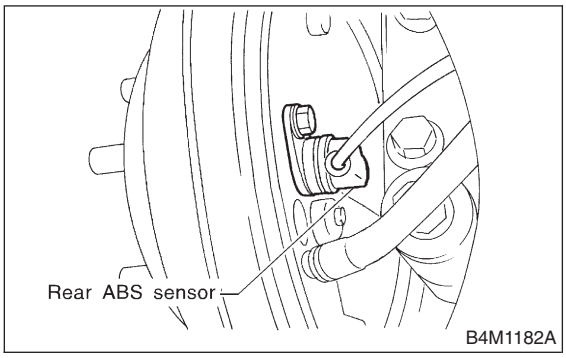
CAUTION:
Check the marks on the harness to make sure that no distortion exists. (RH: white, LH: yellow)

NOTE:
If the clearance is outside specifications, readjust.

2. REAR ABS SENSOR

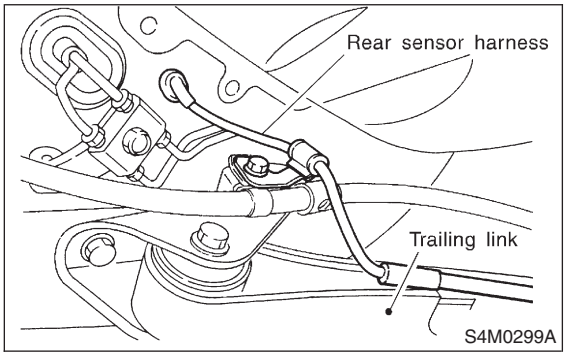
1) Install rear tone wheel on hub, then rear housing on hub. <Ref. to 4-2 [W2D0].>
2) Temporarily install rear ABS sensor on back plate.

CAUTION:
Be careful not to strike ABS sensor's pole piece and tone wheel's teeth against adjacent metal parts during installation.



3) Install rear drive shaft to rear housing and rear differential spindle. <Ref. to 4-2 [W2E0].>
4) Install rear sensor harness on rear trailing link.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)



5) Place a thickness gauge between ABS sensor's pole piece and tone wheel's tooth face. After standard clearance is obtained over the entire perimeter, tighten ABS sensor on back plate to specified torque.

ABS sensor standard clearance:
0.7 — 1.2 mm (0.028 — 0.047 in)

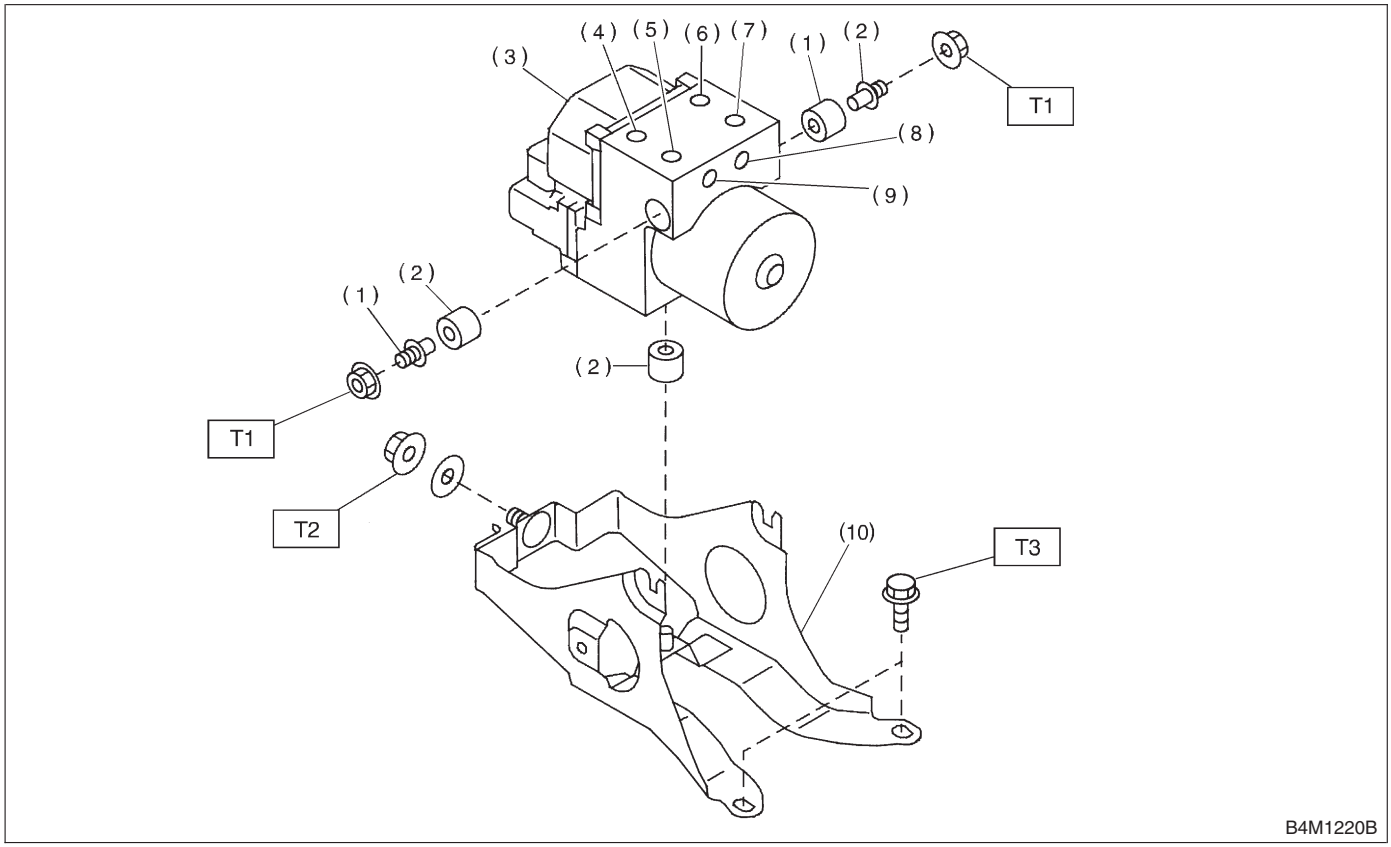
Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CAUTION:
Check the marks on the harness to make sure that no distortion exists. (RH: white, LH: yellow)

NOTE:
If the clearance is outside specifications, readjust.

14. ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)

A: REMOVAL



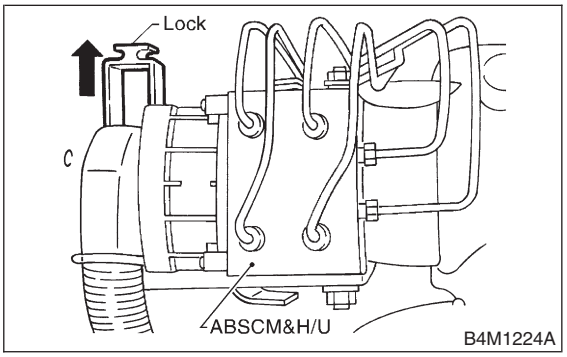
(1) Stud bolt
(2) Damper
(3) ABS control module and hydraulic control unit
(4) Front-LH outlet
(5) Secondary inlet
(6) Front-RH outlet
(7) Primary inlet
(8) Rear-LH outlet
(9) Rear-RH outlet
(10) Bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 18±5 (1.8±0.5, 13.0±3.6)
T2: 29±7 (3.0±0.7, 21.7±5.1)
T3: 32±10 (3.3±1.0, 24±7)

1) Disconnect ground cable from battery.
2) Remove air intake duct from engine compartment to facilitate removal of ABSCM&H/U.
3) Use an air-gun to get rid of water around the ABSCM&H/U.

CAUTION:
The contact will be insufficient if the terminal gets wet.

4) Pull on the lock of the ABSCM&H/U connector to remove it.



5) Disconnect connector from ABSCM&H/U.

CAUTION:
Be careful not to let water or other foreign matter contact the ABSCM&H/U terminal.

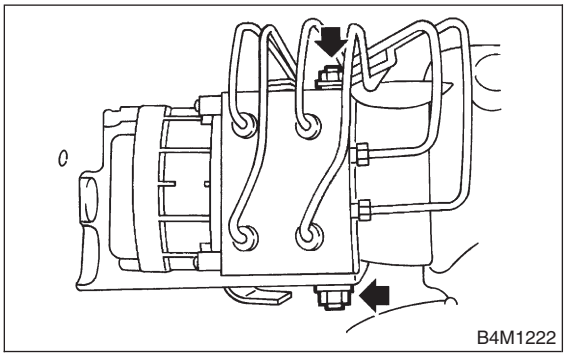
6) Unlock cable clip.

7) Disconnect brake pipes from ABSCM&H/U.

CAUTION:
Wrap brake pipes with vinyl bag to avoid spilling brake fluid on vehicle body.

8) Remove ABSCM&H/U from engine compartment.

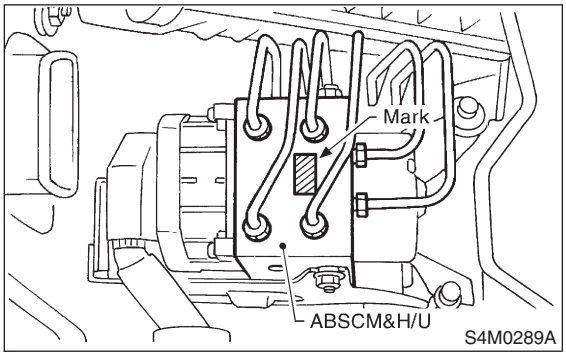
CAUTION:
• ABSCM&H/U cannot be disassembled. Do not attempt to loosen bolts and nuts.
• Do not drop or bump ABSCM&H/U.
• Do not turn the ABSCM&H/U upside down or place it on its side.
• Be careful to prevent foreign particles from getting into ABSCM&H/U.
• Apply a coat of rust-preventive wax (Nippeco LT or GB) to bracket attaching bolt after tightening.
• Do not pull harness disconnecting harness connector.



B: INSPECTION

1) Check connected and fixed condition of connector.
2) Check specifications of the mark with ABSCM&H/U.

Mark	Model
C7	AWD AT
C8	AWD MT



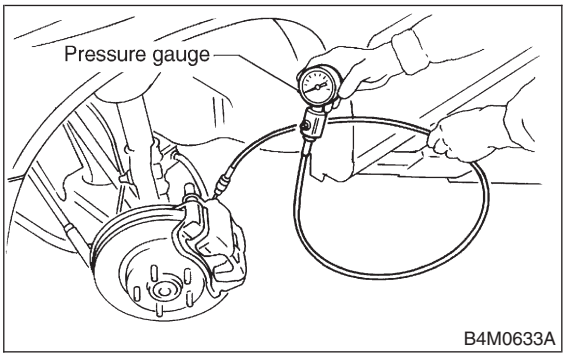
C: CHECKING THE HYDRAULIC UNIT ABS OPERATION

1. CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE

1) Lift-up vehicle and remove wheels.
2) Disconnect the air bleeder screws from the FL and FR caliper bodies.
3) Connect two pressure gauges to the FL and FR caliper bodies.

CAUTION:
• Pressure gauges used exclusively for brake fluid must be used.
• Do not employ pressure gauge previously used for transmission since the piston seal is expanded which may lead to malfunction of the brake.

NOTE:
Wrap sealing tape around the pressure gauge.



4) Bleed air from the pressure gauges.
5) Perform ABS sequence control.
<Ref. to 4-4 [W14D0].>
6) When the hydraulic unit begins to work, and first the FL side performs decompression, holding, and compression, and then the FR side performs decompression, holding, and compression.
7) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets the standard values. Also check if any irregular brake pedal tightness is felt.

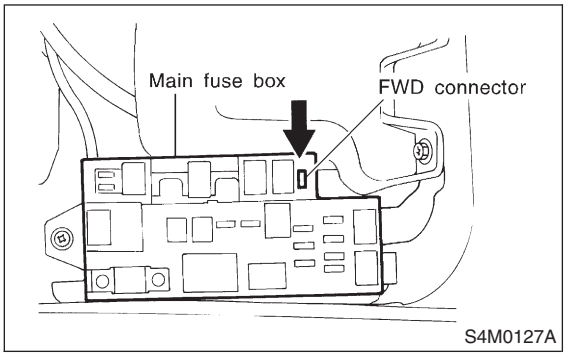
	Front wheel	Rear wheel
Initial value	3,432 kPa (35 kg/cm^2, 498 psi)	3,432 kPa (35 kg/cm^2, 498 psi)
When decompressed	490 kPa (5 kg/cm^2, 71 psi) or less	490 kPa (5 kg/cm^2, 71 psi) or less
When compressed	3,432 kPa (35 kg/cm^2, 498 psi) or more	3,432 kPa (35 kg/cm^2, 498 psi) or more

8) Remove pressure gauges from FL and FR caliper bodies.

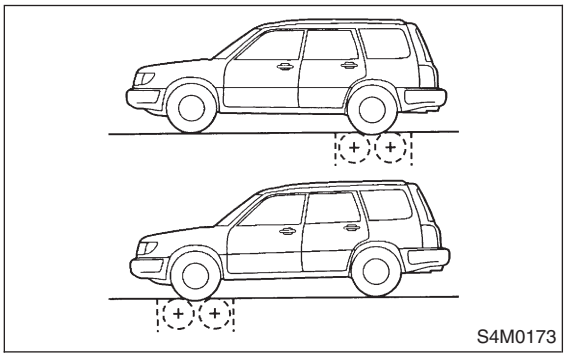
9) Remove air bleeder screws from the RL and RR caliper bodies.
10) Connect the air bleeder screws to the FL and FR caliper bodies.
11) Connect two pressure gauges to the RL and RR caliper bodies.
12) Bleed air from the pressure gauges and the FL and FR caliper bodies.
13) Perform ABS sequence control.
<Ref. to 4-4 [W14D0].>
14) When the hydraulic unit begins to work, at first the RR side performs decompression, holding, and compression, and then the RL side performs decompression, holding, and compression.
15) Read values indicated on the pressure gauges and check if they meet the standard value.
16) After checking, remove the pressure gauges from caliper bodies.
17) Connect the air bleeder screws to RL and RR caliper bodies.
18) Bleed air from brake line.

2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH BRAKE TESTER

1) In the case of AWD AT vehicles, install a spare fuse with the FWD connector in the main fuse box to simulate FWD vehicles.



2) Prepare for operating ABS sequence control. <Ref. to 4-4 [W14D1].> or <Ref. to 4-4 [W14D2].>
3) Set the front wheels or rear wheels on the brake tester and set the select lever's position at "neutral".



4) Operate the brake tester.
5) Perform ABS sequence control. <Ref. to 4-4 [W14D1].> or <Ref. to 4-4 [W14D2].>
6) Hydraulic unit begins to work; and check the following working sequence.
(1) The FL wheel performs decompression, holding, and compression in sequence, and subsequently the FR wheel repeats the cycle.
(2) The RR wheel performs decompression, holding, and compression in sequence, and subsequently the RL wheel repeats the cycle.
7) Read values indicated on the brake tester and check if the fluctuation of values, when decompressed and compressed, meet the standard values.

	Front wheel	Rear wheel
Initial value	981 N (100 kg, 221 lb)	981 N (100 kg, 221 lb)
When decompressed	490 N (50 kg, 110 lb) or less	490 N (50 kg, 110 lb) or less
When compressed	981 N (100 kg, 221 lb) or more	981 N (100 kg, 221 lb) or more

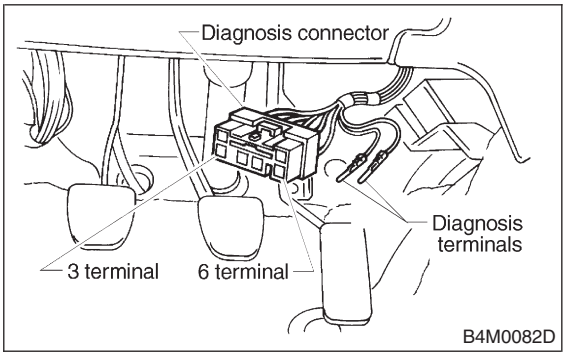
8) After checking, also check if any irregular brake pedal tightness is felt.

D: ABS SEQUENCE CONTROL

1) Under the ABS sequence control, after the hydraulic unit solenoid valve is driven, the operation of the hydraulic unit can be checked by means of the brake tester or pressure gauge.
2) ABS sequence control can be started by diagnosis connector or select monitor.

1. OPERATIONAL GUIDELINES OF THE ABS SEQUENCE CONTROL WITH DIAGNOSIS CONNECTOR

1) Connect diagnosis terminals to terminals No. 3 and No. 6 of the diagnosis connector beside driver's seat heater unit.



2) Set the speed of all wheels at 4 km/h (2 MPH) or less.
3) Turn ignition switch OFF.

4) Within 0.5 seconds after the ABS warning light goes out, depress the brake pedal and hold it immediately after ignition switch is turned to ON.

CAUTION:
Do not depress the clutch pedal.

NOTE:
● When the ignition switch is set to on, the brake pedal must not be depressed.
● Engine must not operate.

5) After completion of ABS sequence control, turn ignition switch OFF.

2. OPERATIONAL GUIDELINES OF THE ABS SEQUENCE CONTROL WITH SELECT MONITOR

NOTE:
● In the event of any trouble, the sequence control may not be operative. In such a case, activate the sequence control, referring to "OPERATIONAL GUIDELINES OF THE ABS SEQUENCE CONTROL WITH DIAGNOSIS CONNECTOR". <Ref. to 4-4 [W14D1].>
● When the diagnosis terminal is connected to the diagnosis connector, the sequence control will not operate.

1) Connect select monitor to data link connector beside driver's seat instrument panel lower cover.
2) Turn ignition switch ON.
3) Turn select monitor switch ON.
4) Put select monitor to {ABS/TCS} mode.
5) When {Function check sequence} is selected, 'ABS sequence control' will start.
6) The message 'Press Brake Pedal Firmly' is displayed as follows:
   (1) When using the brake tester, depress brake pedal with braking force of 981 N (100 kg, 221 lb).
   (2) When using the pressure gauge, depress brake pedal so as to make the pressure gauge indicate 3,432 kPa (35 kg/cm^2, 498 psi).

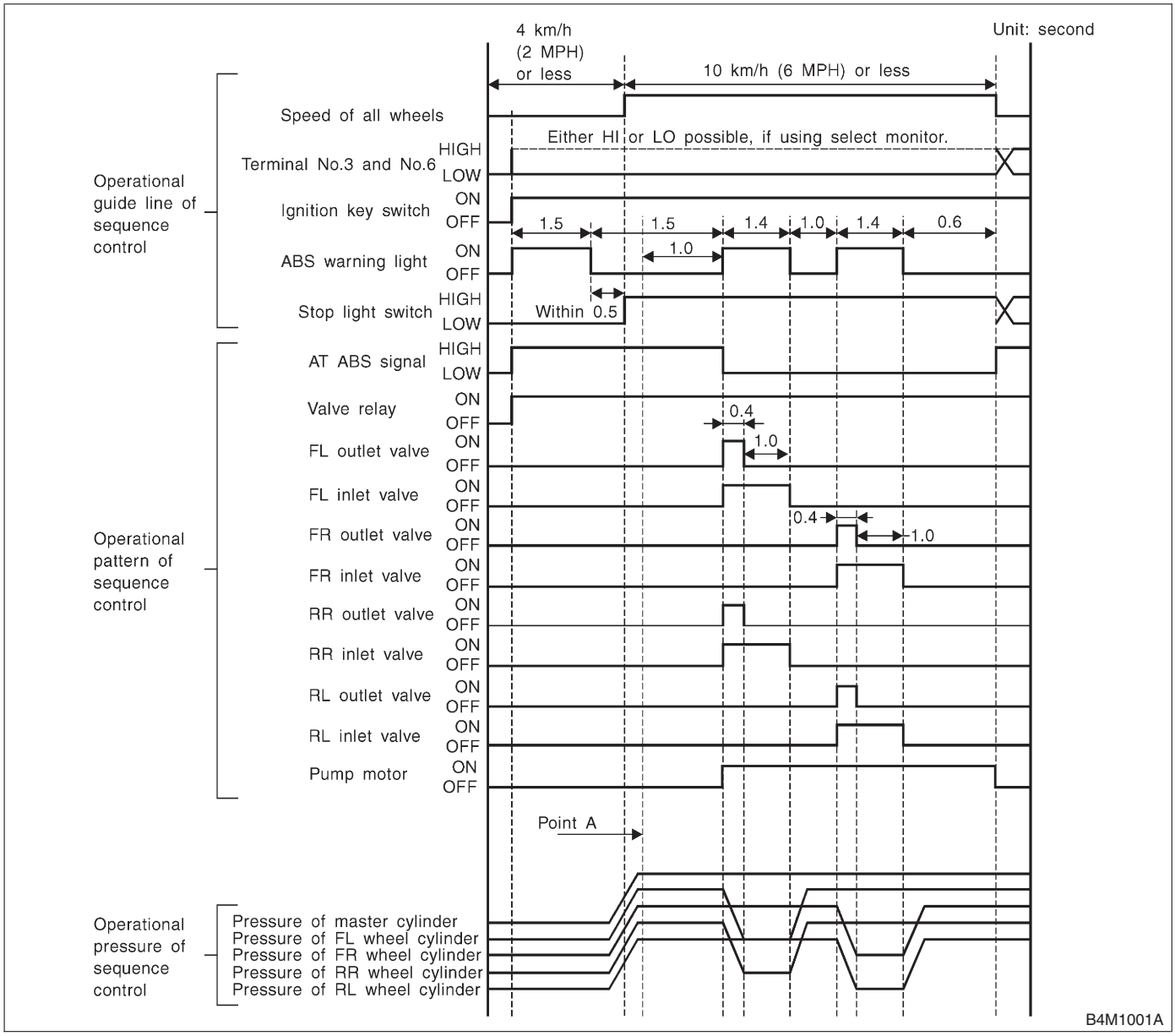
CAUTION:
Do not depress the clutch pedal.

7) When the message "Press YES" is displayed, press YES key.
8) Operation points will be displayed on select monitor.

3. CONDITIONS FOR COMPLETION OF ABS SEQUENCE CONTROL

When the following conditions develop, the ABS sequence control stops and ABS operation is returned to the normal control mode.
1) When the speed of at least one wheel reaches 10 km/h (6 MPH).
2) When terminal No. 3 or No. 6 are separated from diagnosis terminals. (When select monitor is not used.)
3) When the brake pedal is released during sequence control and the braking lamp switch is set to off.
4) When brake pedal is depressed after ignition key is turned to ON, and before ABS warning light goes out. (When select monitor is not used.)
5) When brake pedal is not depressed after ignition key is turned to ON, and within 0.5 seconds after ABS warning light goes out. (When select monitor is not used.)
6) After completion of the sequence control.
7) When malfunction is detected. (When select monitor is used.)

4. CONDITIONS FOR ABS SEQUENCE CONTROL



NOTE:
- When select monitor is used, control operation starts at point A. The patterns from IGN key ON to the point A show that operation is started by diagnosis connector.
- HIGH means high voltage.
- LOW means low voltage.

E: INSTALLATION

1) Install ABSCM&H/U.

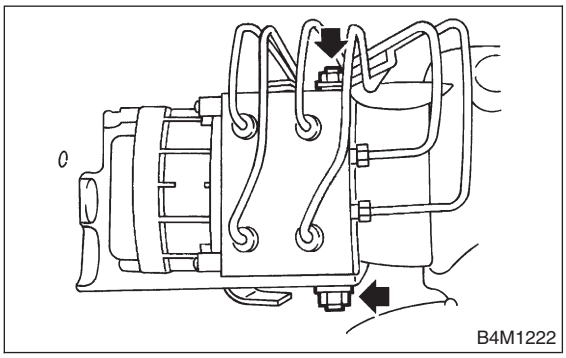
CAUTION:
Confirm that the specifications of the ABSCM&H/U conforms to the vehicle specifications.

Tightening torque:
18±5 N·m (1.8±0.5 kg-m, 13.0±3.6 ft-lb)

2) Install ABSCM&H/U ground terminal to bracket.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

3) Connect brake pipes to their correct ABSCM&H/U connections. <Ref. to 4-4 [W16B0].>


B4M1222

4) Using cable clip, secure ABSCM&H/U harness to bracket.
5) Connect connector to ABSCM&H/U.

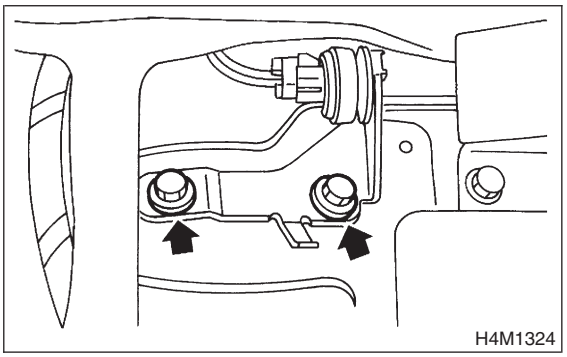
CAUTION:
• Be sure to remove all foreign matter from inside the connector before connecting.
• Ensure that the ABSCM&H/U connetor is securely locked.

6) Install air intake duct.
7) Connect ground cable to battery.
8) Bleed air from the brake system.

15. G Sensor

A: REMOVAL AND INSTALLATION

1) Turn ignition switch to OFF.
2) Remove console cover. <Ref. to 5-4 [W1A0].>
3) Disconnect connector from G sensor.
4) Remove G sensor from body.


H4M1324

5) To install, reverse the removal procedure.

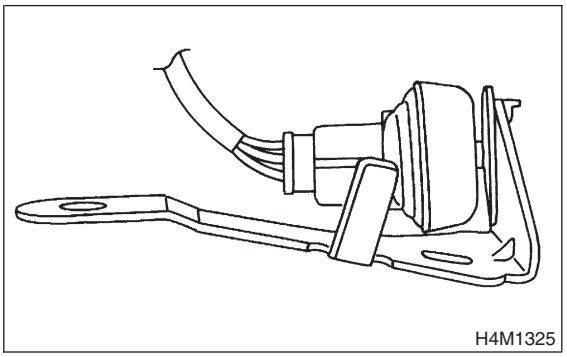
CAUTION:
Do not drop or bump G sensor.

B: INSPECTION WITH CIRCUIT TESTER

15B1 : CHECK G SENSOR.

1) Turn ignition switch to OFF.
2) Remove G sensor from vehicle.
3) Connect connector to G sensor.
4) Turn ignition switch to ON.
5) Measure voltage between G sensor connector terminals.

Connector & terminal
(P9) No. 2 (+) — No. 3 (–)

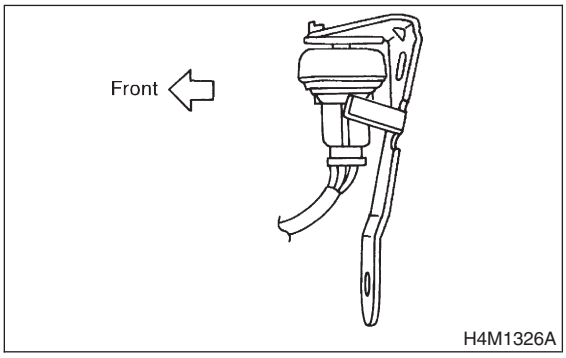

H4M1325

CHECK : ***Is the voltage 2.3±0.2 V when G sensor is horizontal?***
YES : Go to step **15B2**.
NO : Replace G sensor.

15B2 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(P9) No. 2 (+) — No. 3 (–)

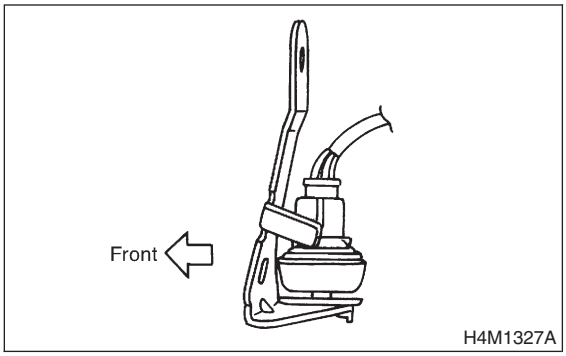


CHECK : ***Is the voltage 3.9±0.2 V when G sensor is inclined forwards to 90°?***
YES : Go to step **15B3**.
NO : Replace G sensor.

15B3 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(P9) No. 2 (+) — No. 3 (–)



CHECK : ***Is the voltage 0.7±0.2 V when G sensor is inclined backwards to 90°?***
YES : G sensor is normal.
NO : Replace G sensor.

C: INSPECTION WITH SELECT MONITOR

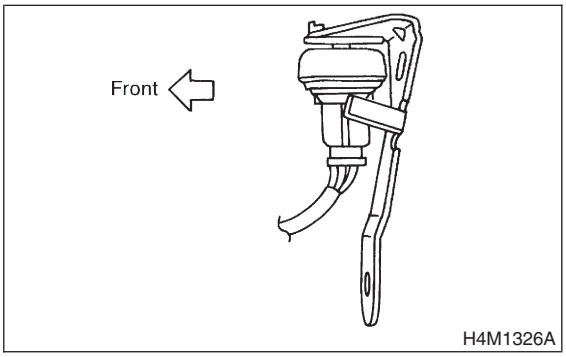
15C1 : CHECK G SENSOR.

1) Turn ignition switch to OFF.
2) Connect select monitor connector to data link connector.
3) Turn select monitor into {ABS/TCS} mode.
4) Set the display in the {Current Data Display & Save} mode.
5) Read the G sensor output voltage.

CHECK : ***Is the indicated reading 2.3±0.2 V when the vehicle is in horizontal position?***
YES : Go to step **15C2**.
NO : Replace G sensor.

15C2 : CHECK G SENSOR.

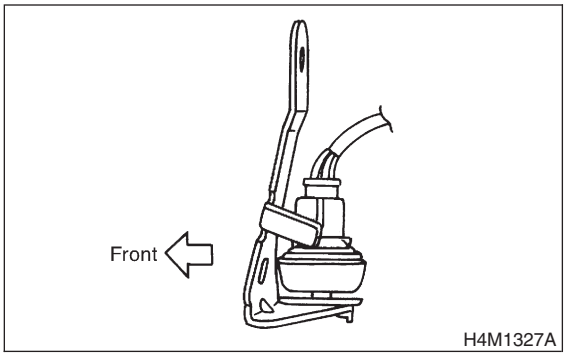
1) Remove console box.
2) Remove G sensor from vehicle. (Do not disconnect connector.)
3) Read the select monitor display.



CHECK : ***Is the indicated reading 3.9±0.2 V when G sensor is inclined forwards to 90°?***
YES : Go to step **15C3**.
NO : Replace G sensor.

15C3 : CHECK G SENSOR.

Read the select monitor display.



CHECK : ***Is the indicated reading 0.7±0.2 V when G sensor is inclined backwards to 90°?***

YES : G sensor is normal.

NO : Replace G sensor.

16. Brake Pipe AIRBAG

A: SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the center brake pipe.

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
• Be careful not to damage Airbag system wiring harness when servicing the center brake pipe.

B: REMOVAL AND INSTALLATION

CAUTION:
• When removing and installing the brake pipe, make sure that it is not bent.
• After installing the brake pipe and hose, bleed the air.
• After installing the brake hose, make sure that it does not touch the tire or suspension assembly, etc.

Brake pipe tightening torque:
$15^{+3}/_{-2}$ N·m ($1.5^{+0.3}/_{-0.2}$ kg-m, $10.8^{+2.2}/_{-1.4}$ ft-lb)

1. Entire Brake System

	Trouble and possible cause	Corrective action
1. Insufficient braking	(1) Fluid leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
	(2) Entry of air into the hydraulic mechanism	Bleed the air.
	(3) Excessively wide shoe clearance	Adjust the clearance.
	(4) Wear, deteriorated surface material, adhering water or fluid on the lining	Replace, grind or clean.
	(5) Improper operation of master cylinder, disc caliper, brake booster or check valve	Correct or replace.
2. Unstable or uneven braking	(1) Fluid on the lining, drum or rotor	Eliminate cause of fluid leakage, clean, or replace.
	(2) Drum or rotor eccentricity	Correct or replace the drum or rotor.
	(3) Worn brake drum, or damage to the drum caused by sand	Correct by grinding, or replace.
	(4) Improper lining contact, deteriorated surface material, improper inferior material, or wear	Correct by grinding, or replace.
	(5) Deformed back plate	Correct or replace.
	(6) Improper tire inflation	Inflate to correct pressure.
	(7) Disordered wheel alignment	Adjust alignment.
	(8) Loosened back plate or the support installing bolts	Retighten.
	(9) Loosened wheel bearing	Retighten to normal tightening torque or replace.
	(10) Trouble in the hydraulic system	Replace the cylinder, brake pipe or hose.
	(11) Uneven effect of the parking brake	Check, adjust, or replace the rear brake and cable system.
3. Excessive pedal stroke	(1) Entry of air into the hydraulic mechanism	Bleed the air.
	(2) Excessive play in the master cylinder push rod	Adjust.
	(3) Fluid leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
	(4) Improperly adjusted shoe clearance	Adjust.
	(5) Improper lining contact or worn lining	Correct or replace.
4. Brake dragging or improper brake return	(1) Insufficient pedal play	Adjust play.
	(2) Improper master cylinder return	Clean or replace the cylinder.
	(3) Clogged hydraulic system	Replace.
	(4) Improper return or adjustment of parking brake	Correct or adjust.
	(5) Weakened spring tension or breakage of shoe return spring	Replace the spring.
	(6) Excessively narrow shoe clearance	Adjust the clearance.
	(7) Improper disc caliper operation	Correct or replace.
	(8) Improper adjusted wheel bearing	Adjust or replace.
5. Brake noise (1) (creak sound)	(1) Hardened or deteriorated lining	Replace the shoe assembly or pad.
	(2) Worn lining	Replace the shoe assembly or pad.
	(3) Loosened back plate or the support installing bolts	Retighten.
	(4) Loose wheel bearing	Retighten to normal tightening torque.
	(5) Dirty drum or rotor	Clean the drum or rotor, or clean and replace the brake assembly.
6. Brake noise (2) (hissing sound)	(1) Worn lining	Replace the shoe assembly or pad.
	(2) Improper installed shoe or pad	Correct or replace the shoe assembly or pad.
	(3) Loose or bent drum or rotor	Retighten or replace.

	Trouble and possible cause	Corrective action
7. Brake noise (3) (click sound)	In the case of the disc brake:	
	(1) Excessively worn pad or the support	Replace the pad or the support.
	In the case of the drum brake:	
	(1) Excessively worn shoe ridge	Replace the back plate.
	(2) Lack of oil on the shoe ridge surface and anchor	Add more grease.

MEMO:

Page

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1. Precaution

A: SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the ABS sensor, ABS control module and hydraulic control unit.

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
• Be careful not to damage Airbag system wiring harness when servicing the ABS sensor, ABS control module and hydraulic control unit.

2. Pre-inspection

Before performing diagnostics, check the following items which might affect ABS problems:

A: MECHANICAL INSPECTION

1. POWER SUPPLY

1) Measure battery voltage and specific gravity of electrolyte.

Standard voltage: 12 V, or more

Specific gravity: Above 1.260

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

2. BRAKE FLUID

1) Check brake fluid level.
2) Check brake fluid leakage.

3. BRAKE DRAG

Check brake drag. <Ref. to 4-4 [K100].>

4. BRAKE PAD AND ROTOR

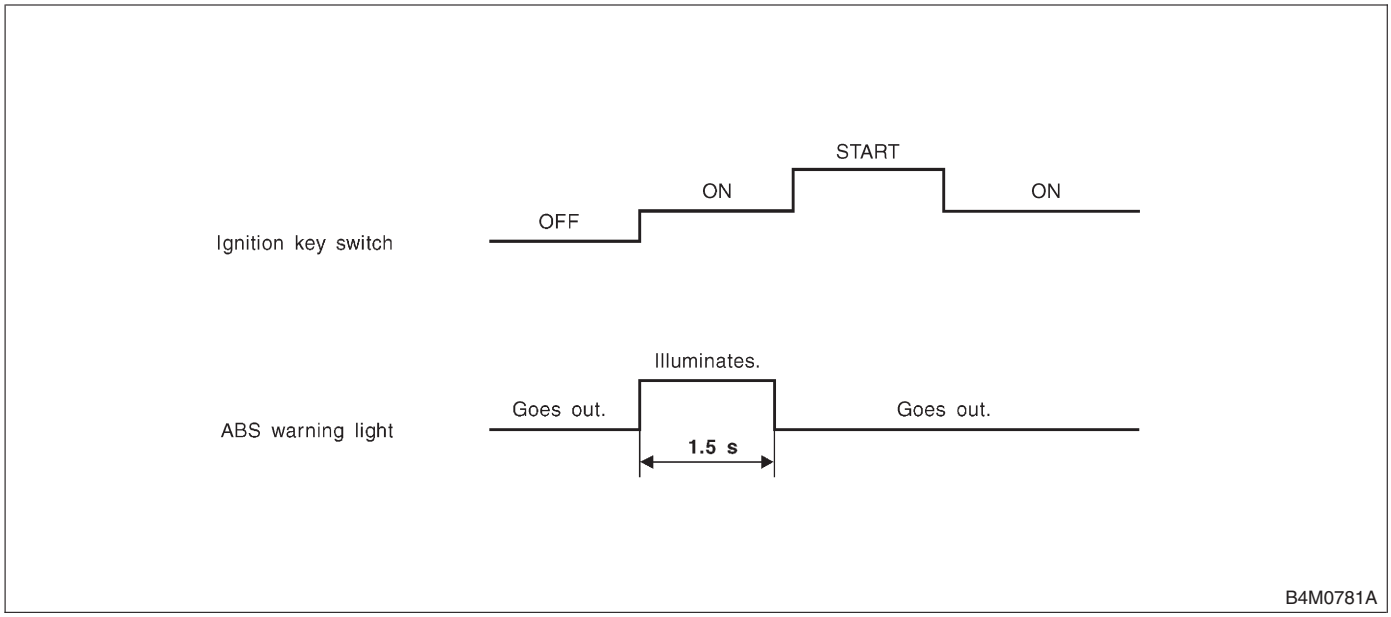
Check brake pad and rotor. <Ref. to 4-4 [K100].>

5. TIRE SPECIFICATIONS, TIRE WEAR AND AIR PRESSURE

Check tire specifications, tire wear and air pressure. <Ref. to 4-2 [S100].> and <Ref. to 4-2 [S200].>

B: ELECTRICAL INSPECTION

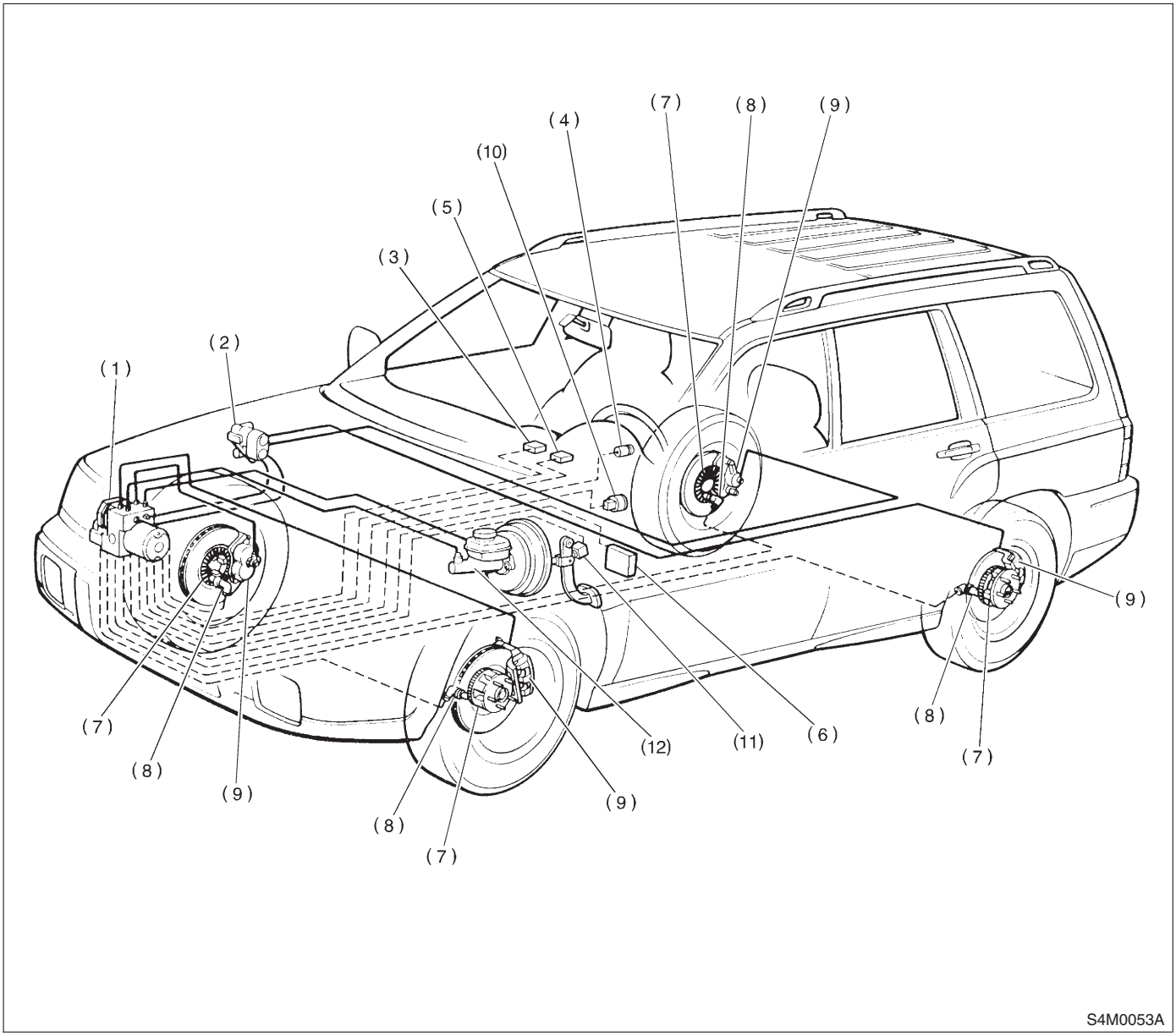
1. WARNING LIGHT ILLUMINATION PATTERN



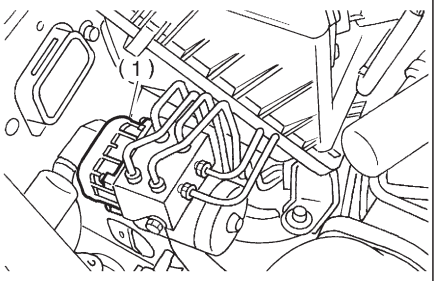
1) When the ABS warning light does not illuminate in accordance with this illumination pattern, there must be an electrical malfunction.
2) When the ABS warning light remains constantly OFF, repair the ABS warning light circuit or diagnosis circuit. <Ref. to 4-4 [T7A0].>

NOTE:
Even though the ABS warning light does not go out 1.5 seconds after it illuminates, the ABS system operates normally when the warning light goes out while driving at approximately 12 km/h (7 MPH). However, the Anti-lock brakes do not work while the ABS warning light is illuminated.

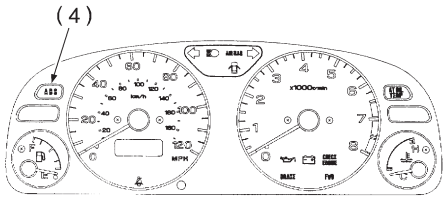
3. Electrical Components Location



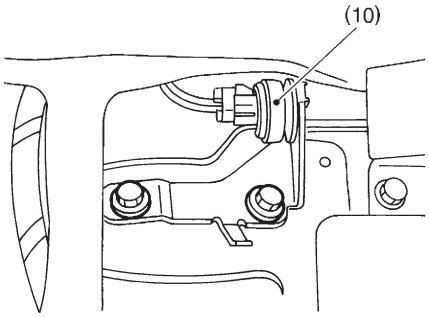
(1) ABS control module and hydraulic control unit (ABSCM&H/U)
(2) Proportioning valve
(3) Diagnosis connector
(4) ABS warning light
(5) Data link connector (for Subaru select monitor)
(6) Automatic transmission control module
(7) Tone wheel
(8) ABS sensor
(9) Wheel cylinder
(10) G sensor
(11) Brake switch
(12) Master cylinder



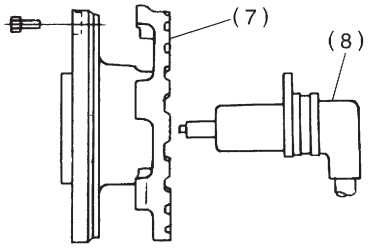
B4M1226B



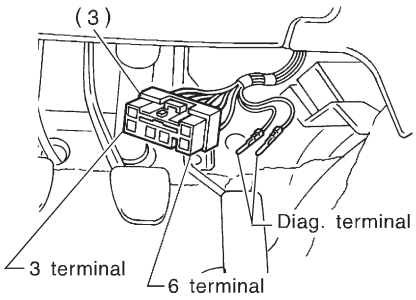
S4M0054A



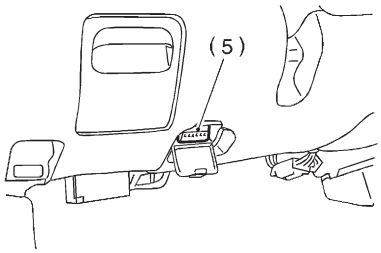
H4M1328A



B4M0646E

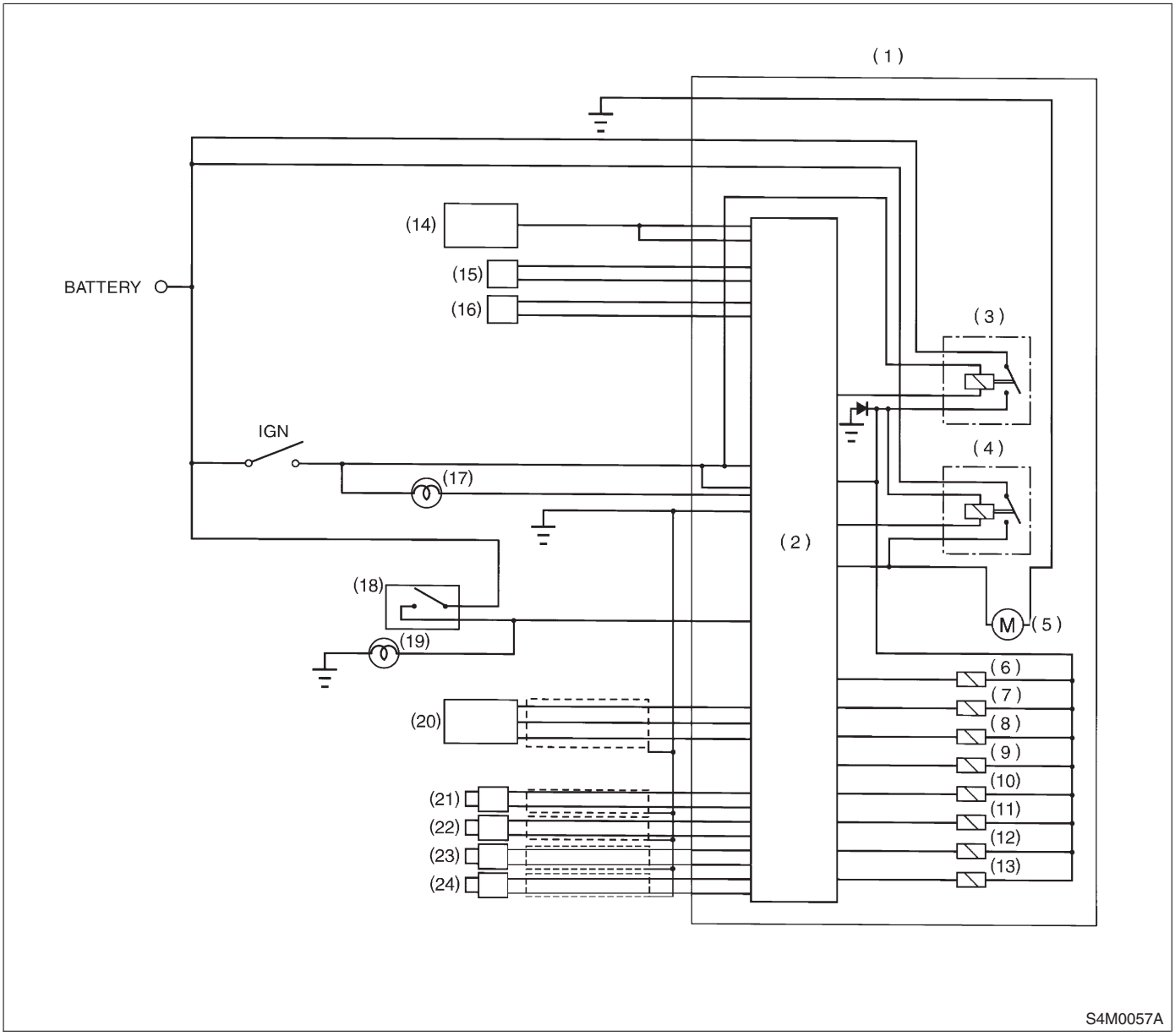


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S4M0056A

4. Schematic

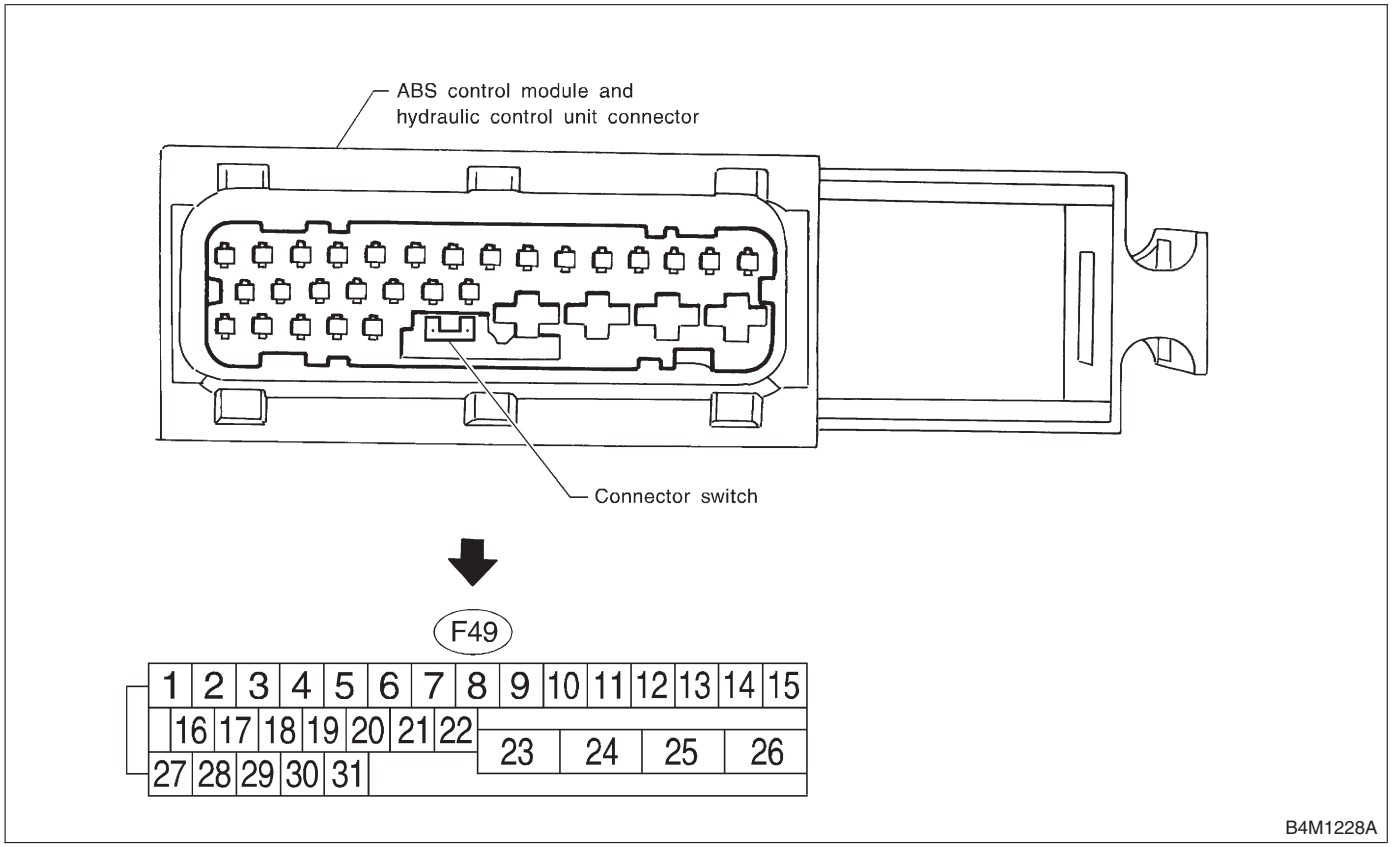


(1) ABS control module and hydraulic control unit (ABSCM&H/U)
(2) ABS control module area
(3) Valve relay
(4) Motor relay
(5) Motor
(6) Front left inlet solenoid valve
(7) Front left outlet solenoid valve
(8) Front right inlet solenoid valve
(9) Front right outlet solenoid valve
(10) Rear left inlet solenoid valve
(11) Rear left outlet solenoid valve
(12) Rear right inlet solenoid valve
(13) Rear right outlet solenoid valve
(14) Automatic transmission control module
(15) Diagnosis connector
(16) Data link connector
(17) ABS warning light
(18) Stop light switch
(19) Stop light
(20) G sensor
(21) Front left ABS sensor
(22) Front right ABS sensor
(23) Rear left ABS sensor
(24) Rear right ABS sensor

MEMO:

5. Control Module I/O Signal

A: I/O SIGNAL VOLTAGE

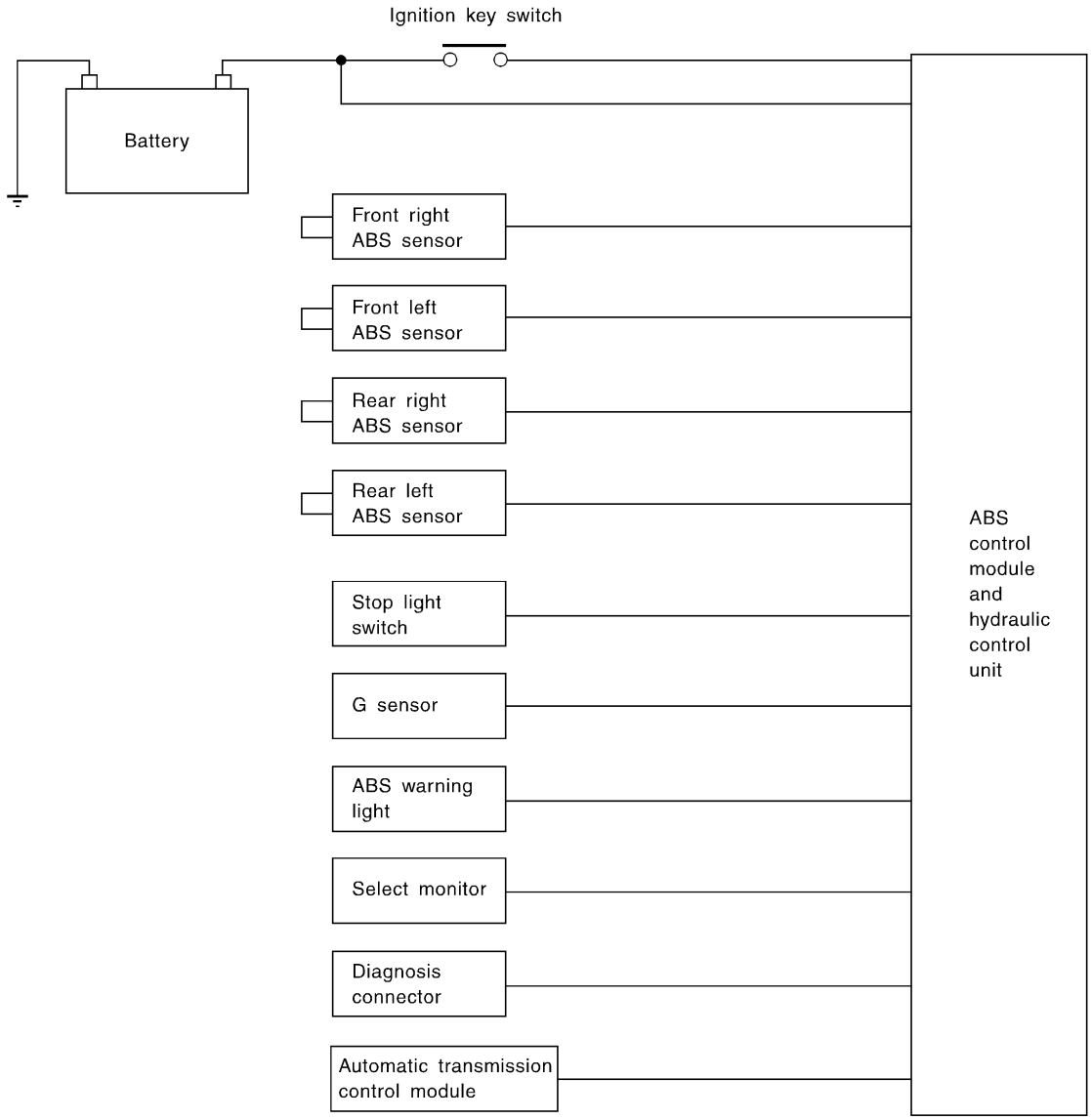


NOTE:
- The terminal numbers in the ABS control module and hydraulic control unit connector are as shown in the figure.
- When the connector is removed from the ABSCM&H/U, the connector switch closes the circuit between terminal No. 21 and No. 23. The ABS warning light illuminates.

Contents		Terminal No. (+)—(–)	Input/Output signal Measured value and measuring conditions
ABS sensor*2 (Wheel speed sensor)	Front left wheel	9—10	0.12 — 1 V (When it is 20 Hz.)
	Front right wheel	11—12	
	Rear left wheel	7—8	
	Rear right wheel	13—15	
Valve relay power supply		24—23	10 — 15 V when ignition switch is ON.
Motor relay power supply		25—23	10 — 15 V when ignition switch is ON.
G sensor*2 (AWD model only)	power supply	30—28	4.75 — 5.25 V
	ground	28	—
	output	6—28	2.3±0.2 V when vehicle is in horizontal position.
Stop light switch*1		2—23	Less than 1.5 V when the stop light is OFF and, 10 — 15 V when the stop light is ON.
ABS warning light*2		21—23	Less than 1.5 V during 1.5 seconds when ignition switch is ON, and 10 — 15 V after 1.5 seconds.
AT ABS signal*2 (AT model only)		3—23	Between 5.5 V and 15 V when the ABS control does not operate still and less than 1.5 V when ABS operates.
ABS operation signal monitor*2 (AT model only)		31—23	Between 5.5 V and 15 V when the ABS control does not operate still and less than 1.5 V when ABS operates.
Select monitor*2	Data is received.	20—23	Less than 1.5 V when no data is received.
	Data is sent.	5—23	4.75 — 5.25 V when no data is sent.
ABS diagnosis connector*2	Terminal No. 3	29—23	10 — 15 V when ignition switch is ON.
	Terminal No. 6	4—23	10 — 15 V when ignition switch is ON.
Power supply*1		1—23	10 — 15 V when ignition switch is ON.
Grounding line		23	—
Grounding line		26	—

*1: Measure the I/O signal voltage after removing the connector from the ABSCM&H/U terminal.
*2: Measure the I/O signal voltage at connector (F2) or (F55).

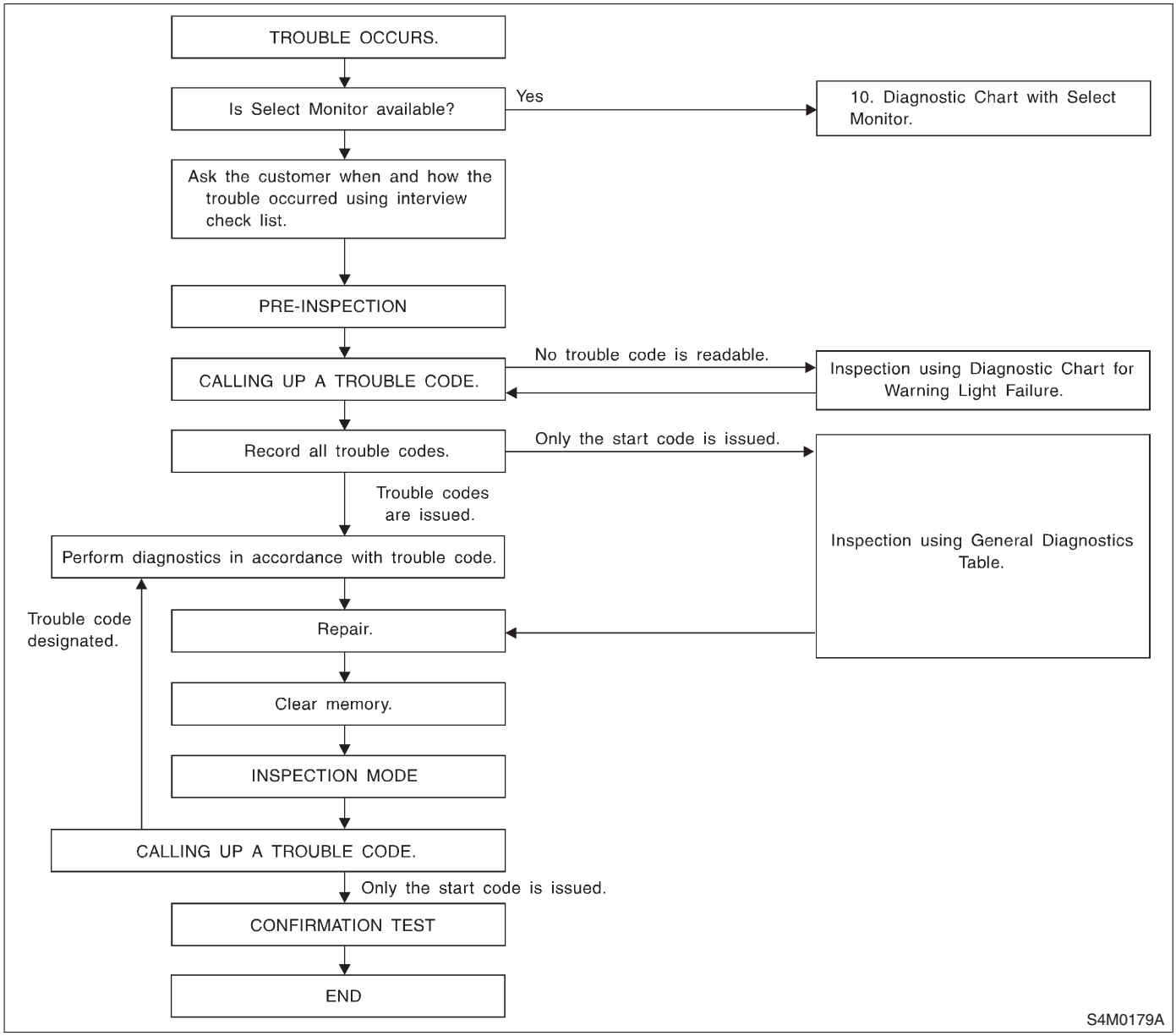
B: I/O SIGNAL DIAGRAM



B4M1229D

6. Diagnostics Chart for On-board Diagnosis System

A: BASIC DIAGNOSTICS PROCEDURE



CAUTION:
Remove foreign matter (dust, water, etc.) from the ABSCM&H/U connector during removal and installation.

NOTE:
- To check harness for broken wires or short circuits, shake it while holding it or the connector.
- When ABS warning light illuminates, read and record trouble code indicated by ABS warning light.

B: CHECK LIST FOR INTERVIEW

Check The Following Items About The Vehicle's State.

1. THE STATE OF THE ABS WARNING LIGHT

ABS warning light comes on.	☐ Always ☐ Sometimes ☐ Only once ☐ Does not come on ● When / how long does it come on? :		
Ignition key position	☐ LOCK ☐ ACC ☐ ON (before starting engine) ☐ START ☐ On after starting (Engine is running) ☐ On after starting (Engine is stop)		
Timing	☐ Immediately after ignition is ON. ☐ Immediately after ignition starts.		
	☐ When advancing		km/h to km/h MPH to MPH
	☐ While traveling at a constant speed	km/h	MPH
	☐ When decelerating		km/h to km/h MPH to MPH
	☐When turning to right	Steering angle :	deg
		Steering time :	sec
	☐ When turning to left	Steering angle :	deg
		Steering time :	sec
	☐ When moving other electrical parts		
	● Parts name : ● Operating condition :		

2. SYMPTOMS

ABS operating condition	☐ Performs no work.		
	☐ Operates only when abruptly applying brakes.	Vehicle speed :	km/h MPH
	● How to step on brake pedal :		
	a) Operating time :		sec
	b) Operating noise : ☐ Produce / ☐ Does not produce		
	● What kind of noise?	☐ Knock ☐ Gong gong ☐ Bong ☐ Buzz ☐ Gong gong buzz ☐ Others :	
	c) Reaction force of brake pedal		
		☐ Stick ☐ Press down once with a clunk ☐ Press and released ☐ Others :	

Behavior of vehicle	a) Directional stability cannot be obtained or steering arm refuses to work when applying brakes : ☐ Yes / ☐ No	
	● When :	☐ Vehicle turns to right ☐ Vehicle turns to left ☐ Spins ☐ Others :
	b) Directional stability cannot be obtained or steering arm refuses to work when accelerating : ☐ Yes / ☐ No	
	● When :	☐ Vehicle turns to right ☐ Vehicle turns to left ☐ Spins ☐ Others :
	c) Brakes are out of order : ☐ Yes / ☐ No	
	● What :	☐ Braking distance is long ☐ Brakes lock or drag ☐ Pedal stroke is long ☐ Pedal sticks ☐ Others :
	d) Poor acceleration : ☐ Yes / ☐ No	
	● What :	☐ Fails to accelerate ☐ Engine stalls ☐ Others :
	e) Occurrence of vibration : ☐ Yes / ☐ No	
	● Where ● What kind :	
	f) Occurrence of abnormal noise : ☐ Yes / ☐ No	
	● Where ● What kind :	
	g) Occurrence of other phenomena : ☐ Yes / ☐ No	
	● What kind :	

3. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others :
	b) Ambient temperature	°F (°C)
	c) Road	☐ Urban area ☐ Suburbs ☐ Highway ☐ General road ☐ Ascending slope ☐ Descending slope ☐ Paved road ☐ Gravel road ☐ Muddy road ☐ Sandy place ☐ Others :
	d) Road surface	☐ Dry ☐ Wet ☐ New-fallen snow ☐ Compressed snow ☐ Frozen slope ☐ Others :

Condition	a) Brakes	Deceleration :	g
		☐ Continuous / ☐ Intermittent	
	b) Accelerator	Acceleration :	g
		☐ Continuous / ☐ Intermittent	
	c) Vehicle speed	km/h	MPH
		☐ Advancing ☐ Accelerating ☐ Reducing speed ☐ Low speed ☐ Turning ☐ Others :	
	d) Tire inflation pressure	Front RH tire :	kPa
		Front LH tire :	kPa
		Rear RH tire :	kPa
		Rear LH tire :	kPa
	e) Degree of wear	Front RH tire :	
		Front LH tire :	
		Rear RH tire :	
		Rear LH tire :	
	f) Genuine parts are used. : ☐ Yes / ☐ No		
	g) Chain is passed around tires. : ☐ Yes / ☐ No		
	h) T tire is used. : ☐ Yes / ☐ No		
	i) Condition of suspension alignment :		
	j) Loading state :		
	k) Repair parts are used. : ☐ Yes / ☐ No		
	• What :		
	l) Others :		

C: INSPECTION MODE

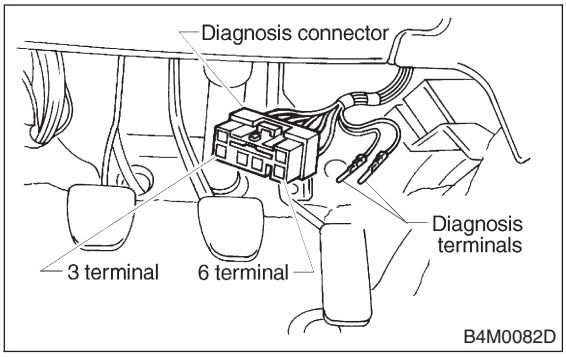
Reproduce the condition under which the problem has occurred as much as possible.
Drive the vehicle at a speed more than 40 km/h (25 MPH) for at least one minute.

D: TROUBLE CODES

When on-board diagnosis of the ABS control module detects a problem, the information (up to a maximum of three) will be stored in the EEP ROM as a trouble code. When there are more than three, the most recent three will be stored. (Stored codes will stay in memory until they are cleared.)

1. CALLING UP A TROUBLE CODE

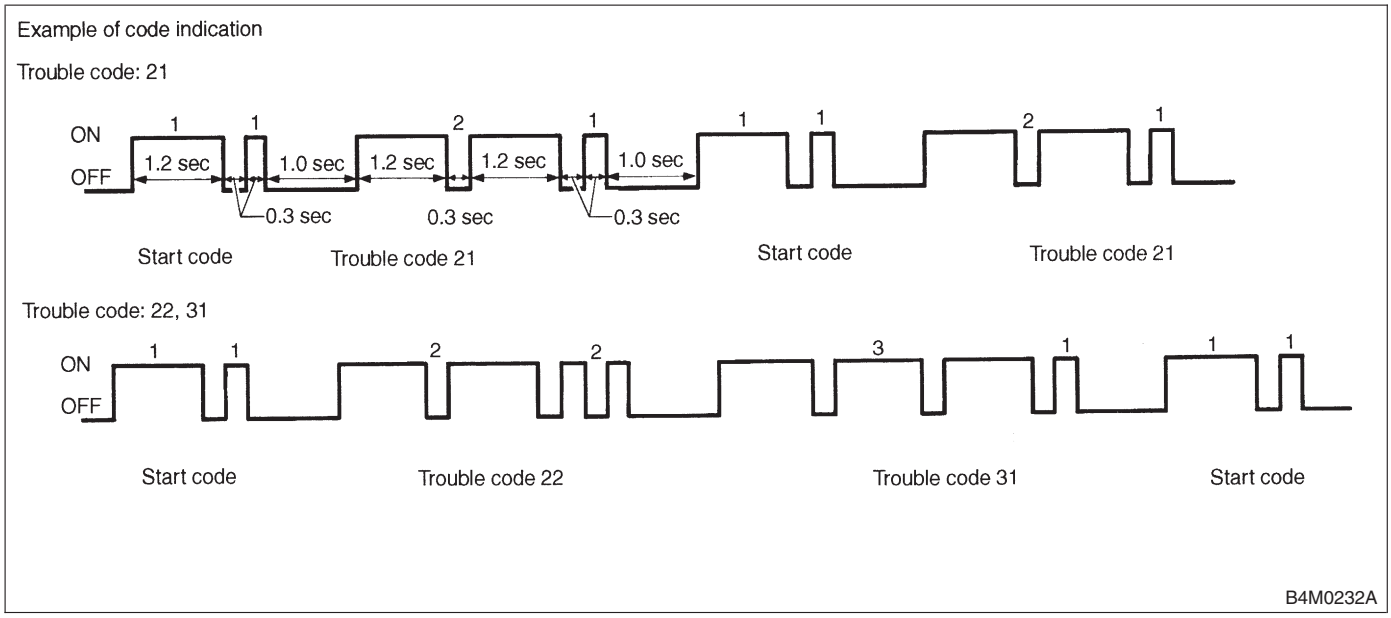
1) Take out diagnosis connector from side of driver's seat heater unit.



2) Turn ignition switch OFF.
3) Connect diagnosis connector terminal 6 to diagnosis terminal.
4) Turn ignition switch ON.
5) ABS warning light is set in the diagnostic mode and blinks to identify trouble code.

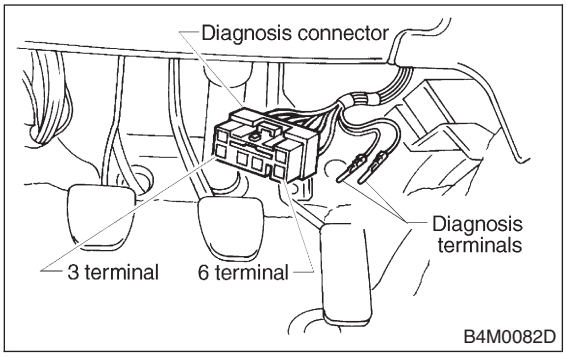
6) After the start code (11) is shown, the trouble codes will be shown in order of the last information first. These repeat for a maximum of 3 minutes.

NOTE:
When there are no trouble codes in memory, only the start code (11) is shown.

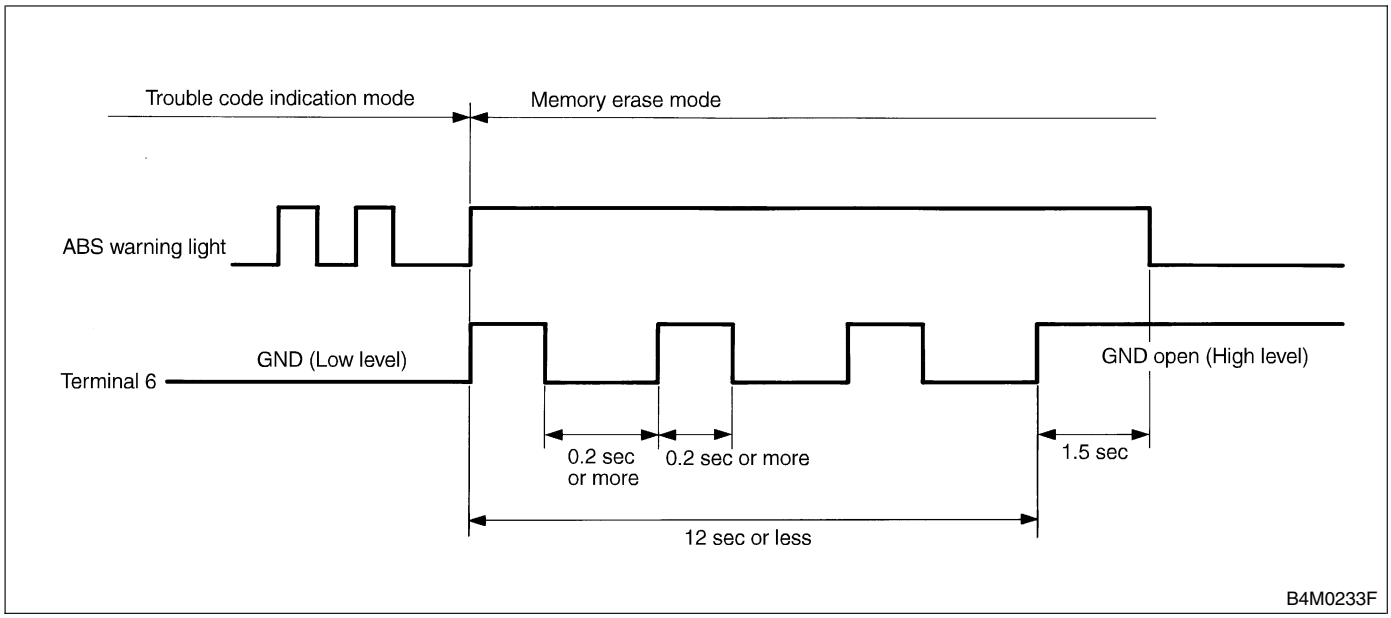


2. CLEARING MEMORY

1) After calling up a trouble code, disconnect diagnosis connector terminal 6 from diagnosis terminal.



2) Repeat 3 times within approx. 12 seconds; connecting and disconnecting terminal 6 and diagnosis terminal for at least 0.2 seconds each time.



NOTE:
After diagnostics is completed, make sure to clear memory. Make sure only start code (11) is shown after memory is cleared.

MEMO:

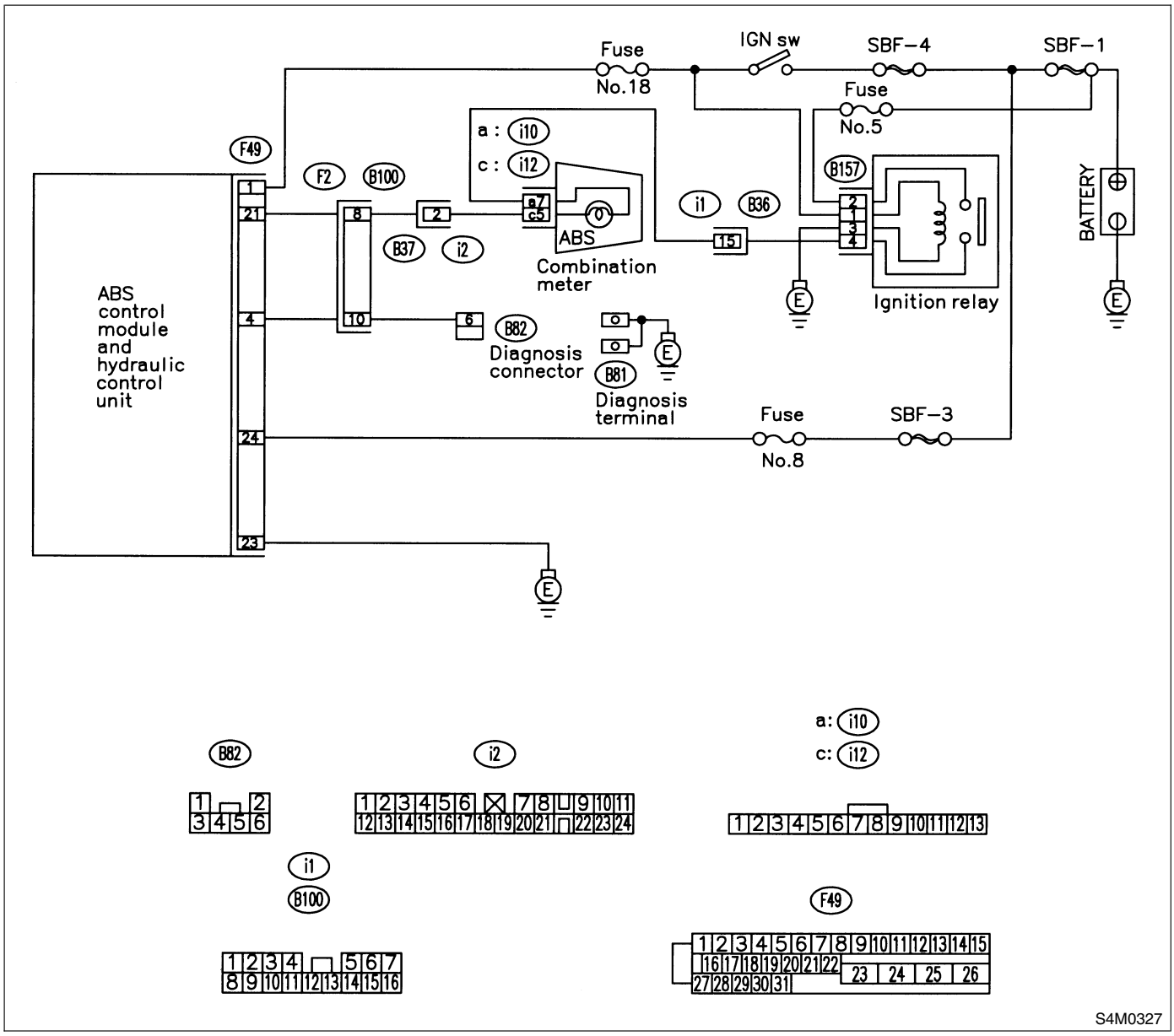
7. Diagnostics Chart for ABS Warning Light Circuit and Diagnosis Circuit Failure

A: ABS WARNING LIGHT DOES NOT COME ON.

DIAGNOSIS:
- ABS warning light circuit is open or shorted.

TROUBLE SYMPTOM:
- When ignition switch is turned ON (engine OFF), ABS warning light does not come on.

WIRING DIAGRAM:



7A1 : CHECK IF OTHER WARNING LIGHTS TURN ON.

Turn ignition switch to ON (engine OFF).

CHECK : ***Do other warning lights turn on?***
YES : Go to step **7A2**.
NO : Repair combination meter. <Ref. to 6-2 [W8A0].>

7A2 : CHECK ABS WARNING LIGHT BULB.

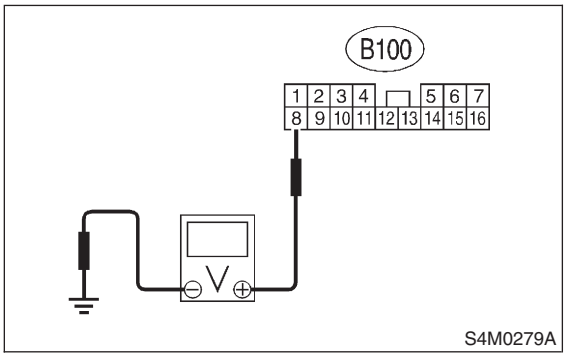
1) Turn ignition switch to OFF.
2) Remove combination meter. <Ref. to 6-2 [W8A0].>
3) Remove ABS warning light bulb from combination meter.

CHECK : ***Is ABS warning light bulb OK?***
YES : Go to step **7A3**.
NO : Replace ABS warning light bulb. <Ref. to 6-2 [W8B0].>

7A3 : CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS.

1) Disconnect connector (B100) from connector (F2).
2) Measure voltage between connector (B100) and chassis ground.

Connector & terminal
(B100) No. 8 (+) — Chassis ground (–):

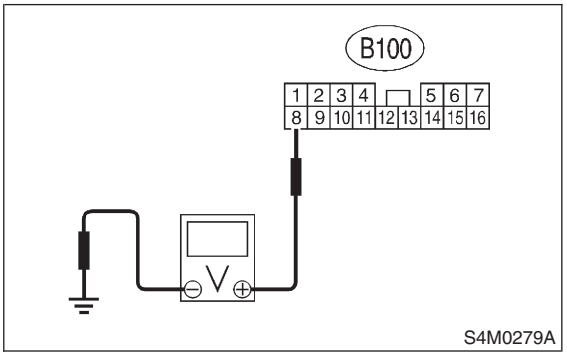


CHECK : ***Is the voltage less than 3 V?***
YES : Go to step **7A4**.
NO : Repair warning light harness.

7A4 : CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between connector (B100) and chassis ground.

Connector & terminal
(B100) No. 8 (+) — Chassis ground (–):

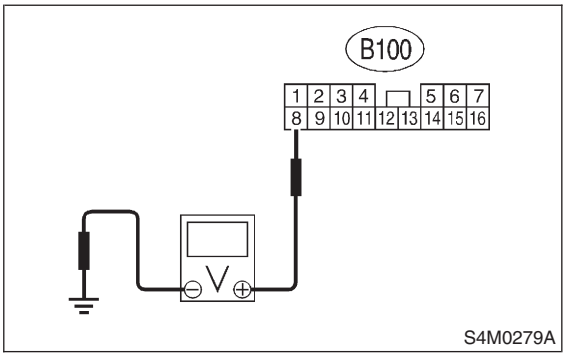


CHECK : ***Is voltage less than 3 V?***
YES : Go to step **7A5**.
NO : Repair warning light harness.

7A5 : CHECK WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Install ABS warning light bulb from combination meter.
3) Install combination meter.
4) Turn ignition switch to ON.
5) Measure voltage between connector (B100) and chassis ground.

Connector & terminal
(B100) No. 8 (+) — Chassis ground (–):

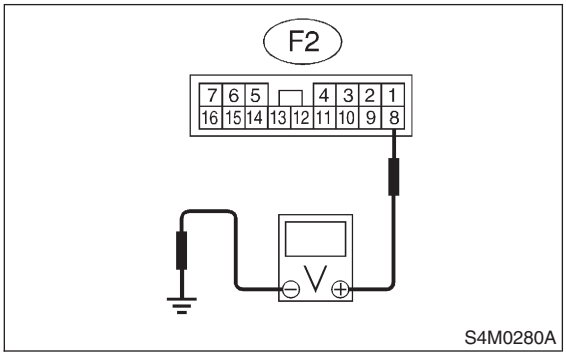


CHECK : ***Is voltage between 10 and 15 V?***
YES : Go to step **7A6**.
NO : Repair wiring harness.

7A6 : CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS.

1) Turn ignition switch to OFF.
2) Measure voltage between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 (+) — Chassis ground (–):

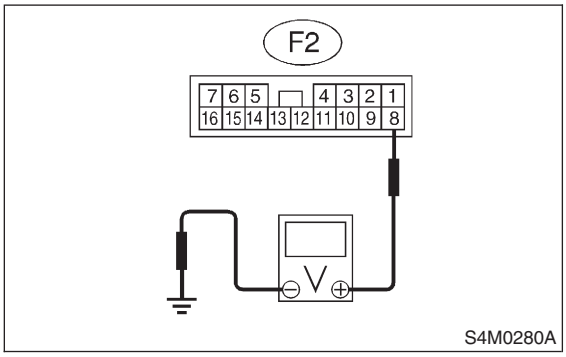


CHECK : ***Is the voltage less than 3 V?***
YES : Go to step **7A7**.
NO : Repair wiring harness.

7A7 : CHECK BATTERY SHORT OF ABS WARNING LIGHT HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 (+) — Chassis ground (–):

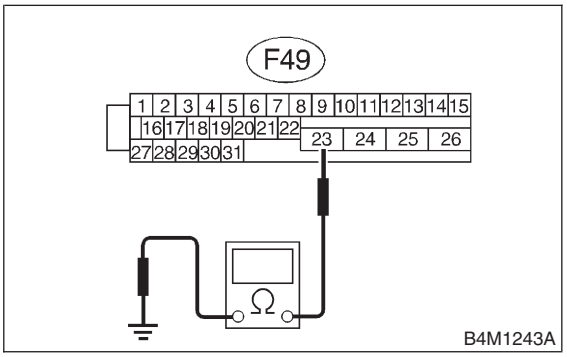


CHECK : ***Is voltage less than 3 V?***
YES : Go to step **7A8**.
NO : Repair wiring harness.

7A8 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

Measure resistance between ABSCM&H/U and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:

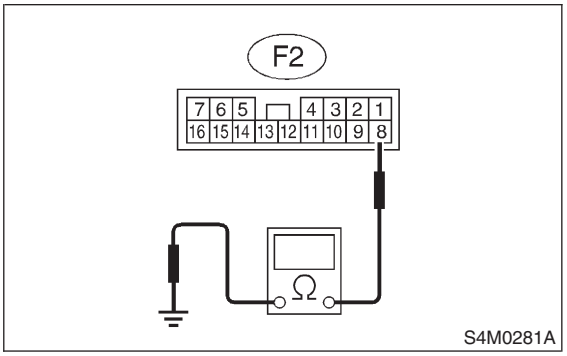


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **7A9**.
NO : Repair ABSCM&H/U ground harness.

7A9 : CHECK WIRING HARNESS.

Measure resistance between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **7A10**.
NO : Repair harness/connector.

7A10 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connectors between combination meter and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

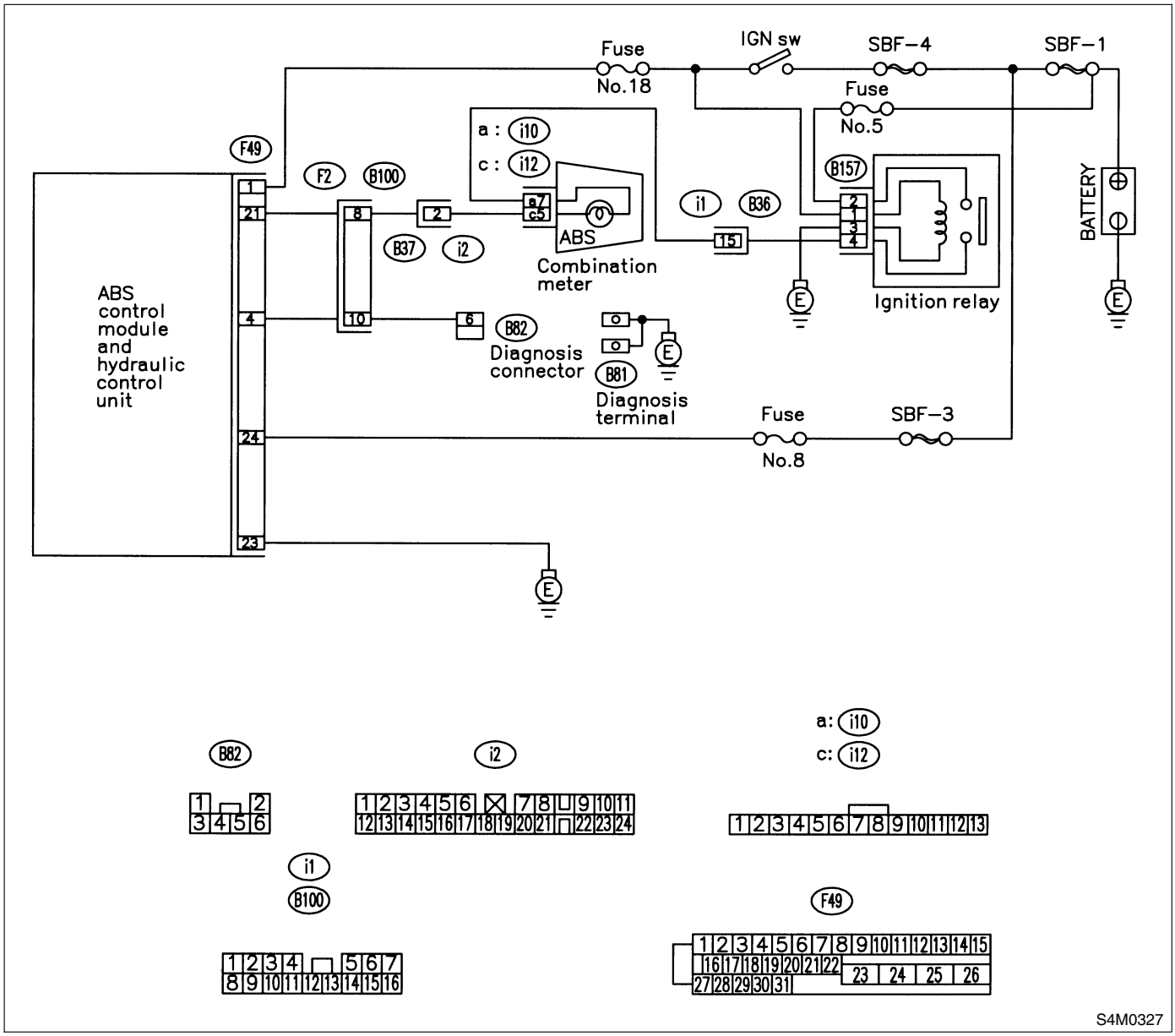
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

B: ABS WARNING LIGHT DOES NOT GO OFF.

DIAGNOSIS:
- ABS warning light circuit is open or shorted.

TROUBLE SYMPTOM:
- When starting the engine and while ABS warning light is kept ON.

WIRING DIAGRAM:



7B1 : CHECK INSTALLATION OF ABSCM&H/U CONNECTOR.

Turn ignition switch to OFF.

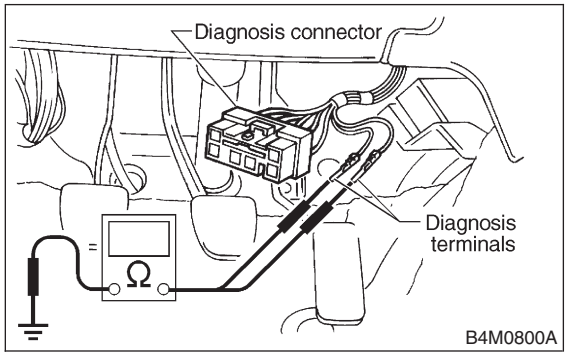
CHECK : ***Is ABSCM&H/U connector inserted into ABSCM until the clamp locks onto it?***

YES : Go to step **7B2**.

NO : Insert ABSCM&H/U connector into ABSCM&H/U until the clamp locks onto it.

7B2 : CHECK DIAGNOSIS TERMINAL.

Measure resistance between diagnosis terminals (B81) and chassis ground.



Terminals

Diagnosis terminal (A) — Chassis ground:

Diagnosis terminal (B) — Chassis ground:

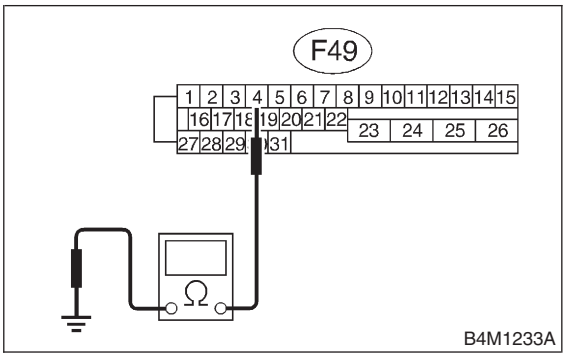
CHECK : ***Is the resistance less than 0.5 Ω?***

YES : Go to step **7B3**.

NO : Repair diagnosis terminal harness.

7B3 : CHECK DIAGNOSIS LINE.

1) Turn ignition switch to OFF.
2) Connect diagnosis terminal (B81) to diagnosis connector (B82) No. 6.
3) Disconnect connector from ABSCM&H/U.
4) Measure resistance between ABSCM&H/U connector and chassis ground.



Connector & terminal

(F49) No. 4 — Chassis ground:

CHECK : ***Is the resistance less than 0.5 Ω?***

YES : Go to step **7B4**.

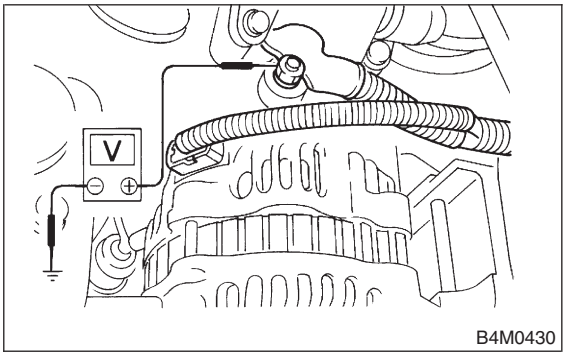
NO : Repair harness connector between ABSCM&H/U and diagnosis connector.

7B4 : CHECK GENERATOR.

1) Start the engine.
2) Idle the engine.
3) Measure voltage between generator and chassis ground.

Terminal

Generator B terminal (+) — Chassis ground (–):



CHECK : ***Is the voltage between 10 and 15 V?***

YES : Go to step **7B5**.

NO : Repair generator. <Ref. to 6-1 [W2A0].>

7B5 : CHECK BATTERY TERMINAL.

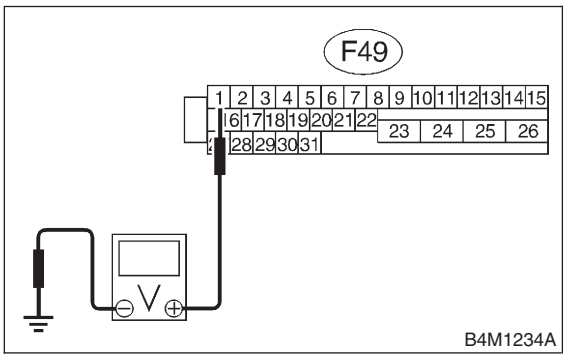
Turn ignition switch to OFF.

CHECK : ***Is there poor contact at battery terminal?***
YES : Repair battery terminal.
NO : Go to step **7B6**.

7B6 : CHECK POWER SUPPLY OF ABSCM.

1) Disconnect connector from ABSCM&H/U.
2) Start engine.
3) Idle the engine.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **7B7**.
NO : Repair ABSCM&H/U power supply circuit.

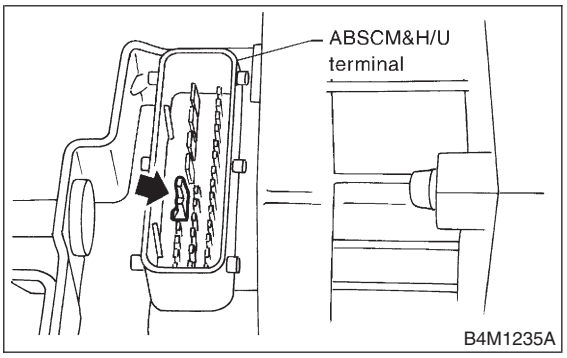
7B7 : CHECK WIRING HARNESS.

1) Disconnect connector (F2) from connector (B100).
2) Turn ignition switch to ON.

CHECK : ***Does the ABS warning light remain off?***
YES : Go to step **7B8**.
NO : Repair front wiring harness.

7B8 : CHECK PROJECTION AT ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Check for broken projection at the ABSCM&H/U terminal.

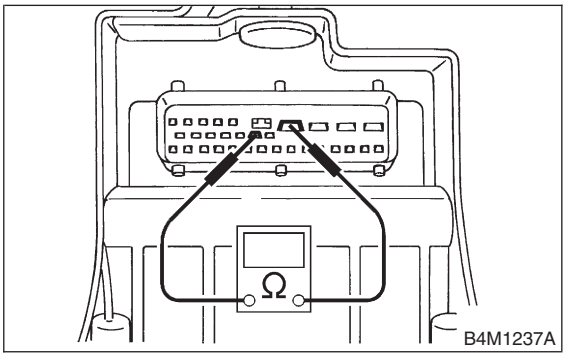


CHECK : ***Are the projection broken?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **7B9**.

7B9 : CHECK ABSCM&H/U.

Measure resistance between ABSCM&H/U terminals.

Terminal
No. 21 — No. 23:

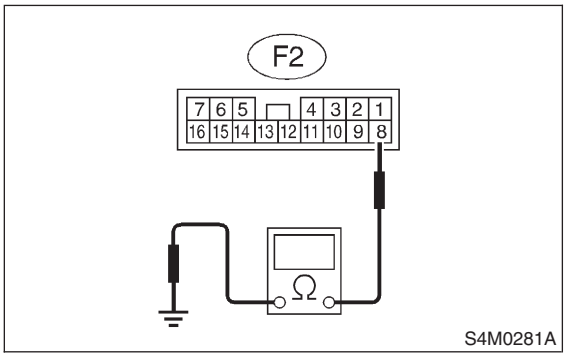


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **7B10**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

7B10 : CHECK WIRING HARNESS.

Measure resistance between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 — Chassis ground:

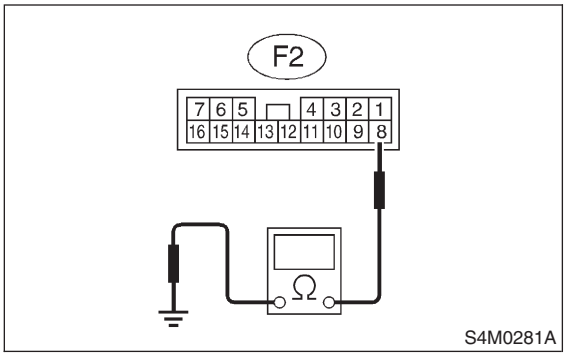


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **7B11**.
NO : Repair harness.

7B11 : CHECK WIRING HARNESS.

1) Connect connector to ABSCM&H/U.
2) Measure resistance between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **7B12**.
NO : Repair harness.

7B12 : CHECK POOR CONTACT IN ABSCM&H/U CONNECTOR.

CHECK : ***Is there poor contact in ABSCM&H/U connector? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

C: TROUBLE CODE DOES NOT APPEAR.

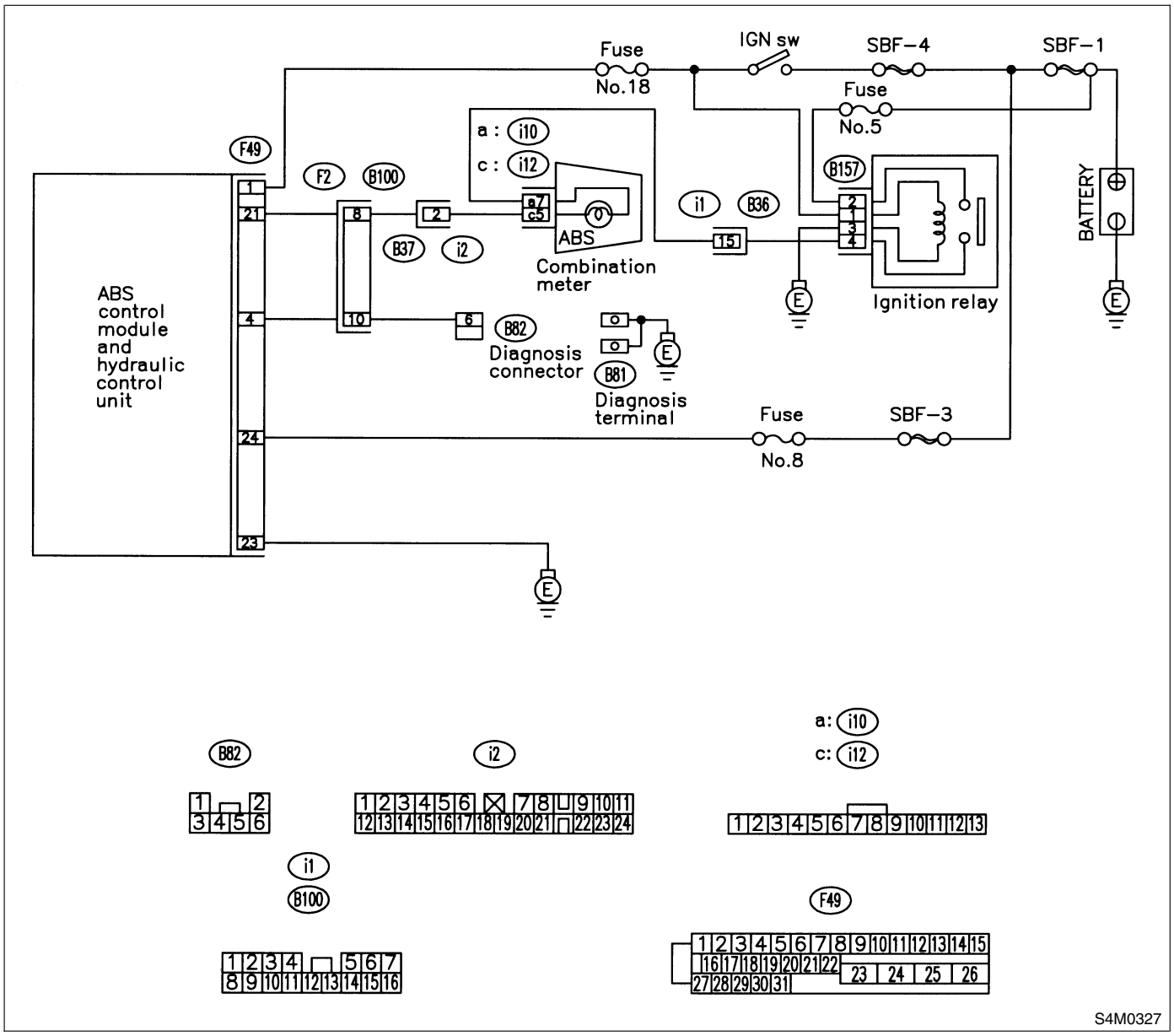
DIAGNOSIS:

- Diagnosis circuit is open.

TROUBLE SYMPTOM:

- The ABS warning light turns on or off normally but the start code cannot be read out in the diagnostic mode.

WIRING DIAGRAM:



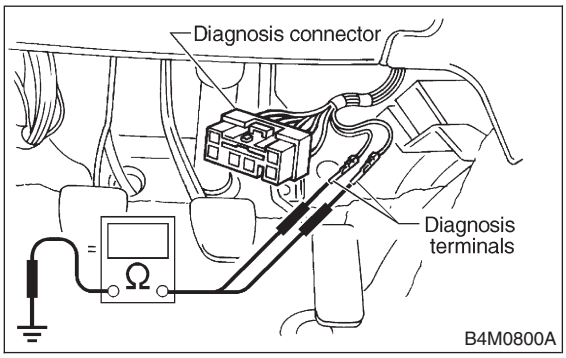
7C1 : CHECK DIAGNOSIS TERMINAL.

Measure resistance between diagnosis terminals (B81) and chassis ground.

Terminals

Diagnosis terminal (A) — Chassis ground:

Diagnosis terminal (B) — Chassis ground:



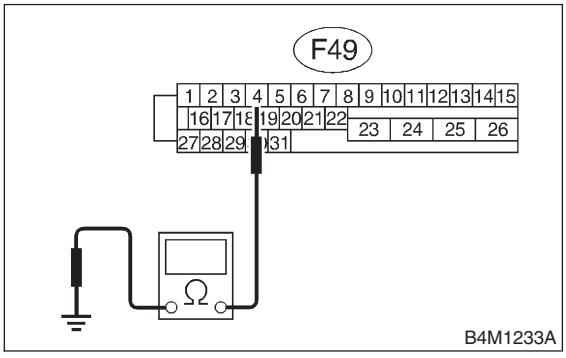
CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **7C2**.
NO : Repair diagnosis terminal harness.

7C2 : CHECK DIAGNOSIS LINE.

1) Turn ignition switch to OFF.
2) Connect diagnosis terminal (B81) to diagnosis connector (B82) No. 6.
3) Disconnect connector from ABSCM&H/U.
4) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal

(F49) No. 4 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **7C3**.
NO : Repair harness connector between ABSCM&H/U and diagnosis connector.

7C3 : CHECK POOR CONTACT IN ABSCM&H/U CONNECTOR.

CHECK : ***Is there poor contact in ABSCM&H/U connector? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

MEMO:

8. Diagnostics Chart with Trouble Code by ABS Warning Light

A: LIST OF TROUBLE CODE

Trouble code	Contents of diagnosis		Ref. to
11	Start code ● Trouble code is shown after start code. ● Only start code is shown in normal condition.		—
21	Abnormal ABS sensor (Open circuit or input voltage too high)	Front right ABS sensor	<Ref. to 4-4 [T8B0].>
23		Front left ABS sensor	<Ref. to 4-4 [T8C0].>
25		Rear right ABS sensor	<Ref. to 4-4 [T8D0].>
27		Rear left ABS sensor	<Ref. to 4-4 [T8E0].>
22	Abnormal ABS sensor (Abnormal ABS sensor signal)	Front right ABS sensor	<Ref. to 4-4 [T8F0].>
24		Front left ABS sensor	<Ref. to 4-4 [T8G0].>
26		Rear right ABS sensor	<Ref. to 4-4 [T8H0].>
28		Rear left ABS sensor	<Ref. to 4-4 [T8I0].>
29		Any one of four	<Ref. to 4-4 [T8J0].>
31	Abnormal solenoid valve circuit(s) in ABS control module and hydraulic unit	Front right inlet valve	<Ref. to 4-4 [T8K0].>
32		Front right outlet valve	<Ref. to 4-4 [T8O0].>
33		Front left inlet valve	<Ref. to 4-4 [T8L0].>
34		Front left outlet valve	<Ref. to 4-4 [T8P0].>
35		Rear right inlet valve	<Ref. to 4-4 [T8M0].>
36		Rear right outlet valve	<Ref. to 4-4 [T8Q0].>
37		Rear left inlet valve	<Ref. to 4-4 [T8N0].>
38		Rear left outlet valve	<Ref. to 4-4 [T8R0].>
41	Abnormal ABS control module		<Ref. to 4-4 [T8S0].>
42	Source voltage is abnormal.		<Ref. to 4-4 [T8T0].>
44	A combination of AT control abnormal		<Ref. to 4-4 [T8U0].>
51	Abnormal valve relay		<Ref. to 4-4 [T8V0].>
52	Abnormal motor and/or motor relay		<Ref. to 4-4 [T8W0].>
54	Abnormal stop light switch		<Ref. to 4-4 [T8X0].>
56	Abnormal G sensor output voltage		<Ref. to 4-4 [T8Y0].>

B: TROUBLE CODE 21 (FRONT RH)

C: TROUBLE CODE 23 (FRONT LH)

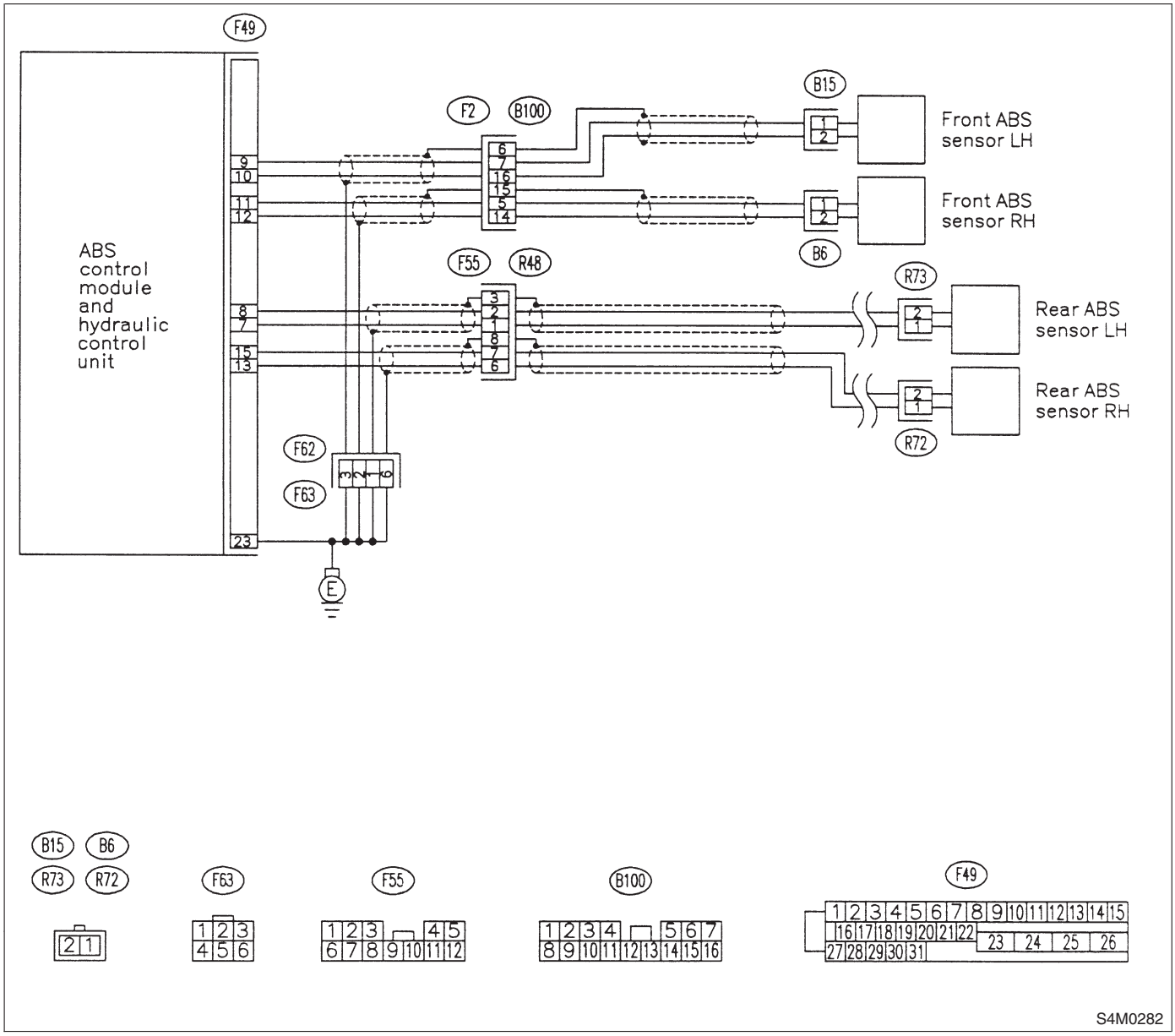
D: TROUBLE CODE 25 (REAR RH)

E: TROUBLE CODE 27 (REAR LH) — ABNORMAL ABS SENSOR (OPEN CIRCUIT OR INPUT VOLTAGE TOO HIGH) —

DIAGNOSIS:
- Faulty ABS sensor (Broken wire, input voltage too high)
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



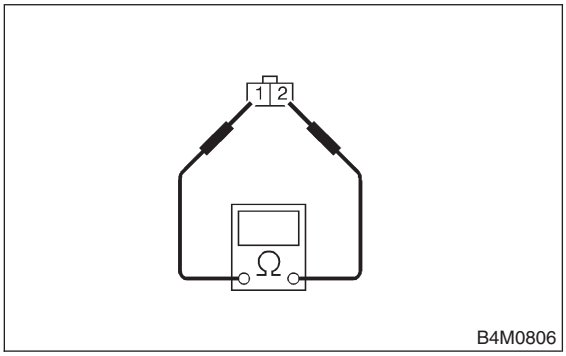
S4M0282

8E1 : CHECK ABS SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABS sensor.
3) Measure resistance of ABS sensor connector terminals.

Terminal

Front RH No. 1 — No. 2:
Front LH No. 1 — No. 2:
Rear RH No. 1 — No. 2:
Rear LH No. 1 — No. 2:



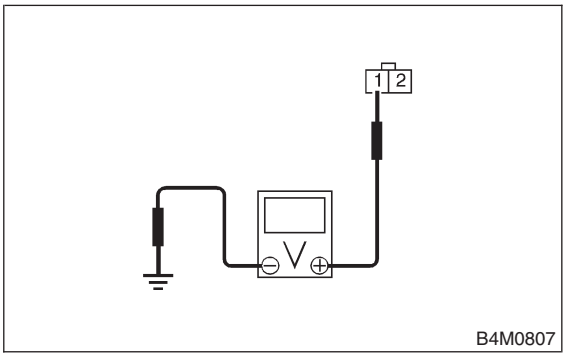
CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **8E2**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

8E2 : CHECK BATTERY SHORT OF ABS SENSOR.

1) Disconnect connector from ABSCM&H/U.
2) Measure voltage between ABS sensor and chassis ground.

Terminal

Front RH No. 1 (+) — Chassis ground (–):
Front LH No. 1 (+) — Chassis ground (–):
Rear RH No. 1 (+) — Chassis ground (–):
Rear LH No. 1 (+) — Chassis ground (–):



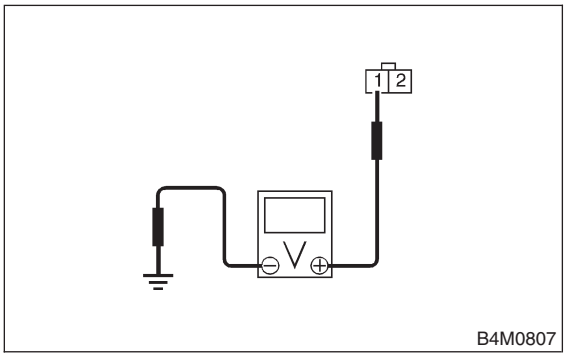
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8E3**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

8E3 : CHECK BATTERY SHORT OF ABS SENSOR.

1) Turn ignition switch to ON.
2) Measure voltage between ABS sensor and chassis ground.

Terminal

Front RH No. 1 (+) — Chassis ground (–):
Front LH No. 1 (+) — Chassis ground (–):
Rear RH No. 1 (+) — Chassis ground (–):
Rear LH No. 1 (+) — Chassis ground (–):



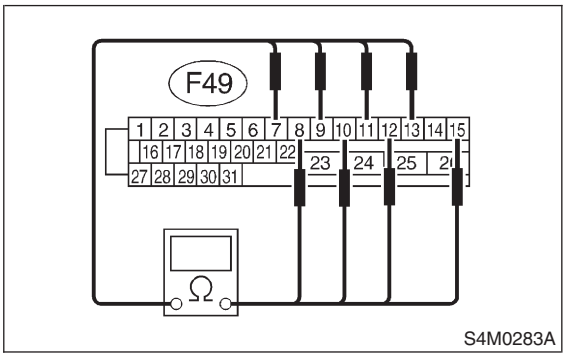
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8E4**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

8E4 : CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR.

1) Turn ignition switch to OFF.
2) Connect connector to ABS sensor.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal

Trouble code 21 / (F49) No. 11 — No. 12:
Trouble code 23 / (F49) No. 9 — No. 10:
Trouble code 25 / (F49) No. 13 — No. 15:
Trouble code 27 / (F49) No. 7 — No. 8:



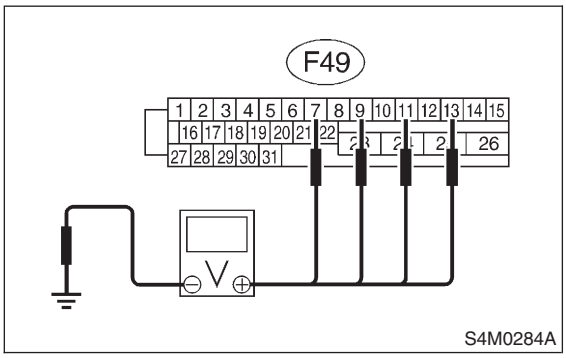
CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **8E5**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

8E5 : CHECK BATTERY SHORT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal

Trouble code 21 / (F49) No. 11 (+) — Chassis ground (–):
Trouble code 23 / (F49) No. 9 (+) — Chassis ground (–):
Trouble code 25 / (F49) No. 13 (+) — Chassis ground (–):
Trouble code 27 / (F49) No. 7 (+) — Chassis ground (–):



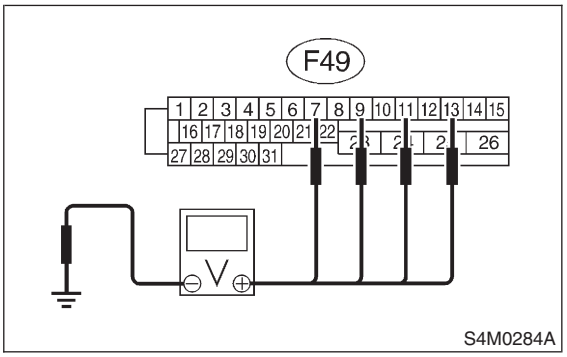
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8E6**.
NO : Repair harness between ABSCM&H/U and ABS sensor.

8E6 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal

Trouble code 21 / (F49) No. 11 (+) — Chassis ground (–):
Trouble code 23 / (F49) No. 9 (+) — Chassis ground (–):
Trouble code 25 / (F49) No. 13 (+) — Chassis ground (–):
Trouble code 27 / (F49) No. 7 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8E7**.
NO : Repair harness between ABSCM&H/U and ABS sensor.

8E7 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***
YES : Go to step **8E8**.
NO : Tighten ABS sensor installation bolts securely.

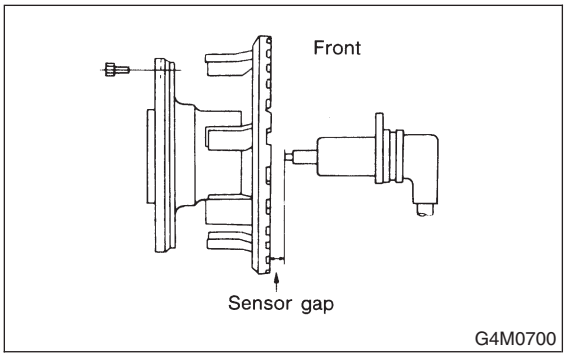
8E8 : CHECK INSTALLATION OF TONE WHEEL.

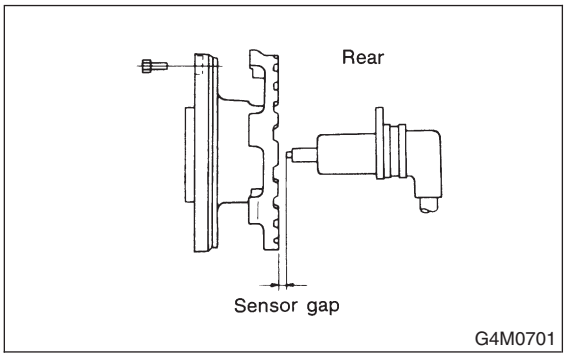
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

CHECK : ***Are the tone wheel installation bolts tightened securely?***
YES : Go to step **8E9**.
NO : Tighten tone wheel installation bolts securely.

8E9 : CHECK ABS SENSOR GAP.

Measure tone wheel-to-pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***
YES : Go to step **8E10**.
NO : Adjust the gap.

NOTE:
Adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

8E10 : CHECK HUB RUNOUT.

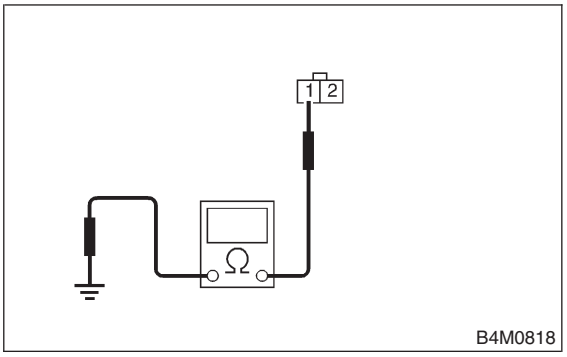
Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **8E11**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>

8E11 : CHECK GROUND SHORT OF ABS SENSOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ABS sensor and chassis ground.

Terminal
Front RH No. 1 — Chassis ground:
Front LH No. 1 — Chassis ground:
Rear RH No. 1 — Chassis ground:
Rear LH No. 1 — Chassis ground:



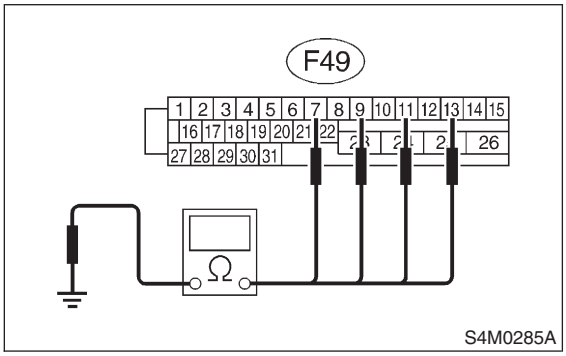
CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8E12**.
NO : Replace ABS sensor and ABSCM&H/U. <Ref. to 4-4 [W13A0].> and <Ref. to 4-4 [W14A0].>

8E12 : CHECK GROUND SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Connect connector to ABS sensor.
3) Measure resistance between ABSCM&H/U connector terminal and chassis ground.

Connector & terminal

Trouble code 21 / (F49) No. 11 — Chassis ground:
Trouble code 23 / (F49) No. 9 — Chassis ground:
Trouble code 25 / (F49) No. 13 — Chassis ground:
Trouble code 27 / (F49) No. 7 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8E13**.
NO : Repair harness between ABSCM&H/U and ABS sensor.
Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

8E13 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8E14**.

8E14 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8E15**.

8E15 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

NOTE:
Check harness and connectors between ABSCM&H/U and ABS sensor.

F: TROUBLE CODE 22 (FRONT RH)

G: TROUBLE CODE 24 (FRONT LH)

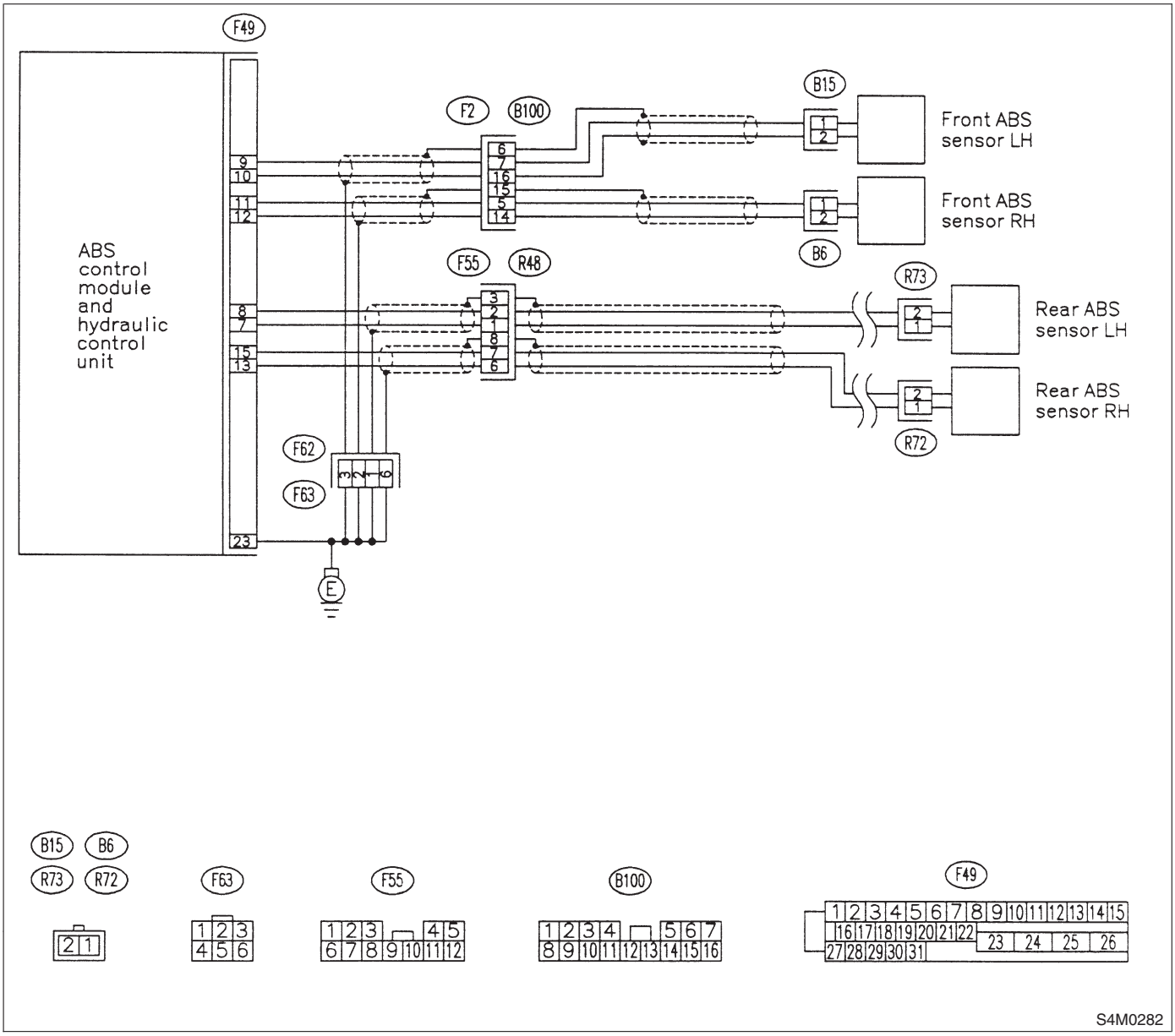
H: TROUBLE CODE 26 (REAR RH)

I: TROUBLE CODE 28 (REAR LH) — ABNORMAL ABS SENSOR (ABNORMAL ABS SENSOR SIGNAL) —

DIAGNOSIS:
- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty harness/connector

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



8I1 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***
YES : Go to step **8I2**.
NO : Tighten ABS sensor installation bolts securely.

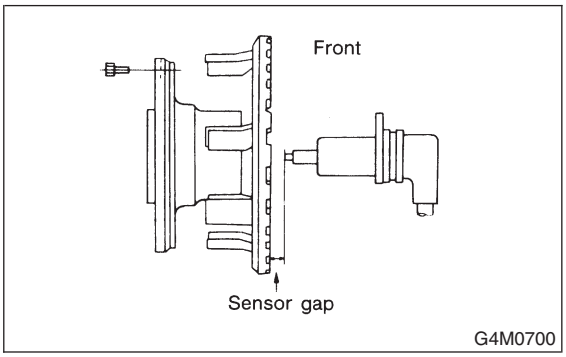
8I2 : CHECK INSTALLATION OF TONE WHEEL.

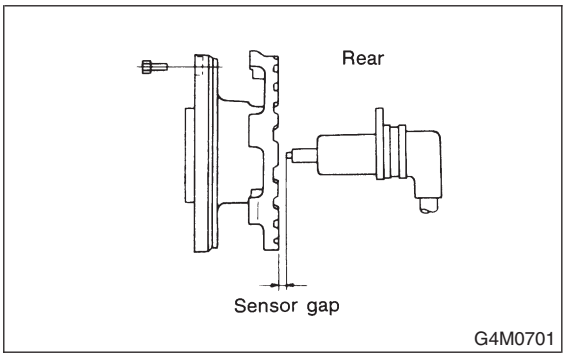
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

CHECK : ***Are the tone wheel installation bolts tightened securely?***
YES : Go to step **8I3**.
NO : Tighten tone wheel installation bolts securely.

8I3 : CHECK ABS SENSOR GAP.

Measure tone wheel to pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***
YES : Go to step **8I4**.
NO : Adjust the gap.

NOTE:
Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

8I4 : PREPARE OSCILLOSCOPE.

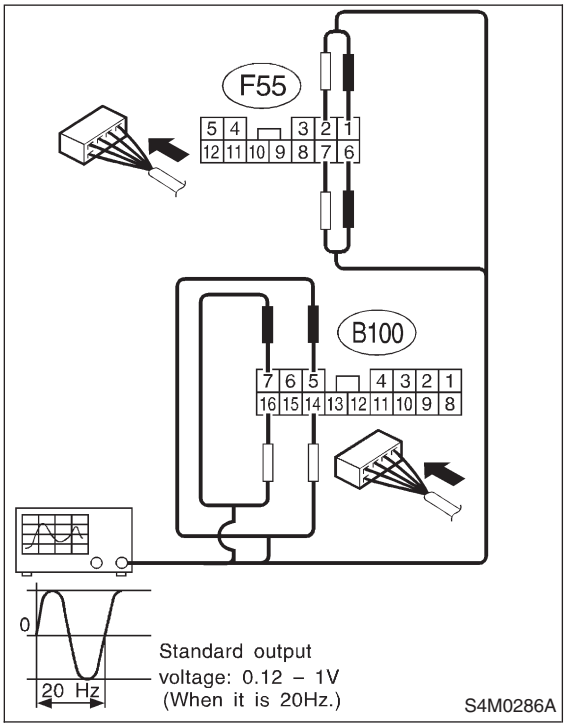
CHECK : ***Is an oscilloscope available?***
YES : Go to step **8I5**.
NO : Go to step **8I6**.

8I5 : CHECK ABS SENSOR SIGNAL.

1) Raise all four wheels of ground.
2) Turn ignition switch OFF.
3) Connect the oscilloscope to the connector.
4) Turn ignition switch ON.
5) Rotate wheels and measure voltage at specified frequency.

NOTE:
When this inspection is completed, the ABSCM&H/U sometimes stores the trouble code 29.

Connector & terminal
Trouble code 22 / (B100) No. 5 (+) — No. 14 (–):
Trouble code 24 / (B100) No. 7 (+) — No. 16 (–):
Trouble code 26 / (F55) No. 6 (+) — No. 7 (–):
Trouble code 28 / (F55) No. 1 (+) — No. 2 (–):
Specified voltage: 0.12 — 1 V (When it is 20 Hz.)



CHECK : ***Is oscilloscope pattern smooth, as shown in figure?***
YES : Go to step **8I9**.
NO : Go to step **8I6**.

8I6 : CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL.

Remove disc rotor or drum from hub in accordance with trouble code.

CHECK : ***Is the ABS sensor pole piece or the tone wheel contaminated by dirt or other foreign matter?***
YES : Thoroughly remove dirt or other foreign matter.
NO : Go to step **8I7**.

8I7 : CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.

CHECK : ***Are there broken or damaged in the ABS sensor pole piece or the tone wheel?***
YES : Replace ABS sensor or tone wheel. <Ref. to 4-4 [W13A0].>, <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>
NO : Go to step **8I8**.

8I8 : CHECK HUB RUNOUT.

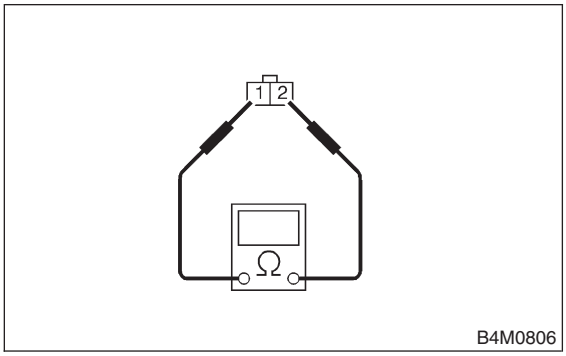
Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **8I9**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> and <Ref. to 4-2 [W2A0].>

8I9 : CHECK RESISTANCE OF ABS SENSOR.

1) Turn ignition switch OFF.
2) Disconnect connector from ABS sensor.
3) Measure resistance between ABS sensor connector terminals.

Terminal
Front RH No. 1 — No. 2:
Front LH No. 1 — No. 2:
Rear RH No. 1 — No. 2:
Rear LH No. 1 — No. 2:

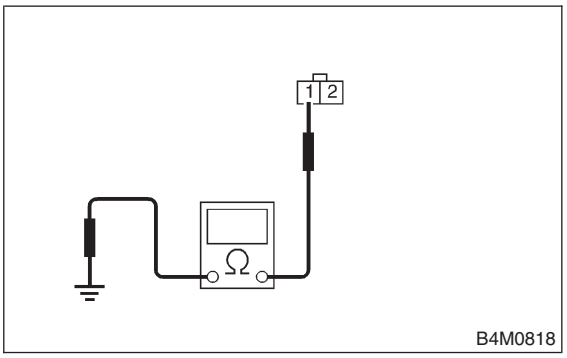


CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **8I10**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

8I10 : CHECK GROUND SHORT OF ABS SENSOR.

Measure resistance between ABS sensor and chassis ground.

Terminal
Front RH No. 1 — Chassis ground:
Front LH No. 1 — Chassis ground:
Rear RH No. 1 — Chassis ground:
Rear LH No. 1 — Chassis ground:

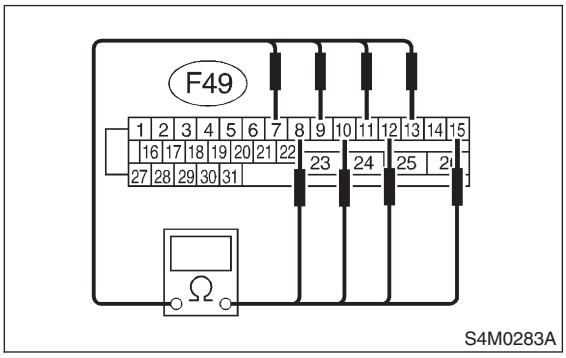


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8I11**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

8I11 : CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR.

1) Connect connector to ABS sensor.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance at ABSCM&H/U connector terminals.

Connector & terminal
Trouble code 22 / (F49) No. 11 — No. 12:
Trouble code 24 / (F49) No. 9 — No. 10:
Trouble code 26 / (F49) No. 13 — No. 15:
Trouble code 28 / (F49) No. 7 — No. 8:

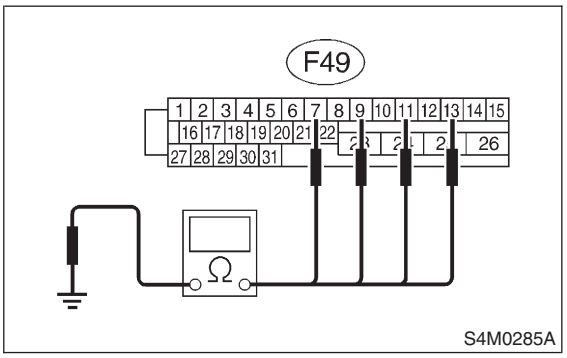


CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **8I12**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

8I12 : CHECK GROUND SHORT OF HARNESS.

Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
Trouble code 22 / (F49) No. 11 — Chassis ground:
Trouble code 24 / (F49) No. 9 — Chassis ground:
Trouble code 26 / (F49) No. 13 — Chassis ground:
Trouble code 28 / (F49) No. 7 — Chassis ground:

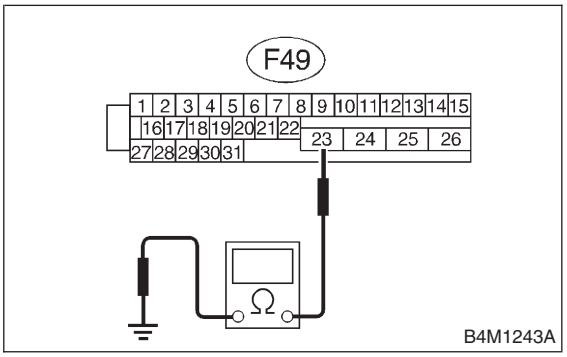


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8I13**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

8I13 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

Measure resistance between ABSCM&H/U and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8I14**.
NO : Repair ABSCM&H/U ground harness.

8I14 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **8I15**.

8I15 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Is the car telephone or the wireless transmitter properly installed?***
YES : Go to step **8I16**.
NO : Properly install the car telephone or the wireless transmitter.

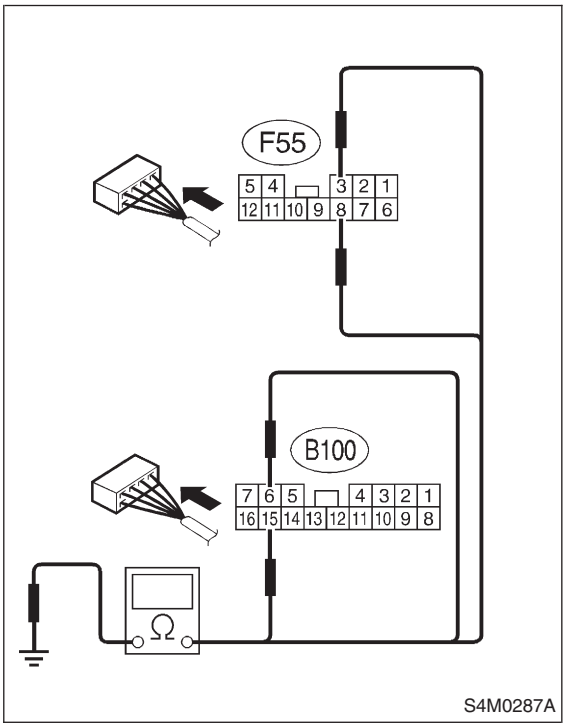
8I16 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Are noise sources (such as an antenna) installed near the sensor harness?***
YES : Install the noise sources apart from the sensor harness.
NO : Go to step **8I17**.

8I17 : CHECK SHIELD CIRCUIT.

1) Connect all connectors.
2) Measure resistance between shield connector and chassis ground.

Connector & terminal
Trouble code 22 / (B100) No. 15 — Chassis ground:
Trouble code 24 / (B100) No. 6 — Chassis ground:
Trouble code 26 / (F55) No. 8 — Chassis ground:
Trouble code 28 / (F55) No. 3 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8I18**.
NO : Repair shield harness.

8I18 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8I19**.

8I19 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary noise interference.

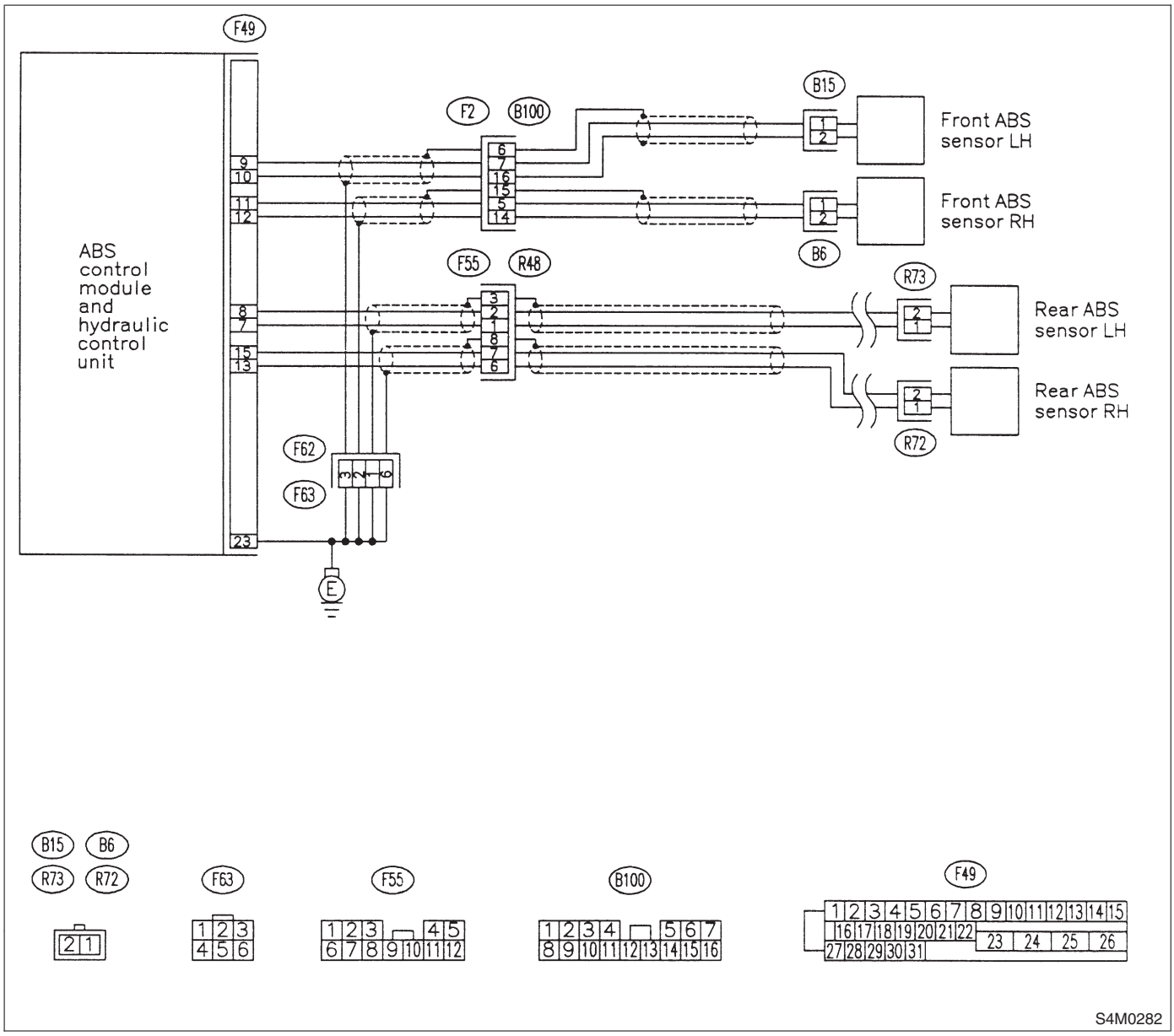
MEMO:

J: TROUBLE CODE 29
— ABNORMAL ABS SENSOR SIGNAL (ANY ONE OF FOUR) —

DIAGNOSIS:
- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty tone wheel
- Wheels turning freely for a long time

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



8J1 : CHECK IF THE WHEELS HAVE TURNED FREELY FOR A LONG TIME.

CHECK : ***Check if the wheels have been turned freely for more than one minute, such as when the vehicle is jacked-up, under full-lock cornering or when tire is not in contact with road surface.***

YES : The ABS is normal. Erase the trouble code. <Ref. to 4-4 [T6D2].>

NOTE:
When the wheels turn freely for a long time, such as when the vehicle is towed or jacked-up, or when steering wheel is continuously turned all the way, this trouble code may sometimes occur.

NO : Go to step **8J2**.

8J2 : CHECK TIRE SPECIFICATIONS.

CHECK : ***Are the tire specifications correct?***

YES : Go to step **8J3**.

NO : Replace tire. <Ref. to 4-2 [W900].>

8J3 : CHECK WEAR OF TIRE.

CHECK : ***Is the tire worn excessively?***

YES : Replace tire. <Ref. to 4-2 [W900].>

NO : Go to step **8J4**.

8J4 : CHECK TIRE PRESSURE.

CHECK : ***Is the tire pressure correct?***

YES : Go to step **8J5**.

NO : Adjust tire pressure.

8J5 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***

YES : Go to step **8J6**.

NO : Tighten ABS sensor installation bolts securely.

8J6 : CHECK INSTALLATION OF TONE WHEEL.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

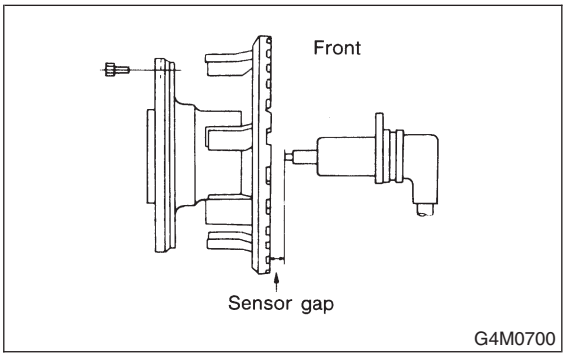
CHECK : ***Are the tone wheel installation bolts tightened securely?***

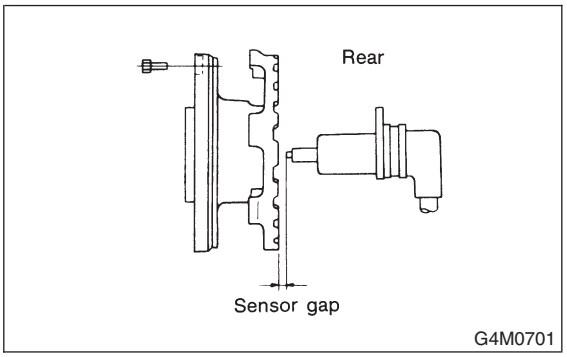
YES : Go to step **8J7**.

NO : Tighten tone wheel installation bolts securely.

8J7 : CHECK ABS SENSOR GAP.

Measure tone wheel to pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***

YES : Go to step **8J8**.

NO : Adjust the gap.

NOTE:
Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

8J8 : PREPARE OSCILLOSCOPE.

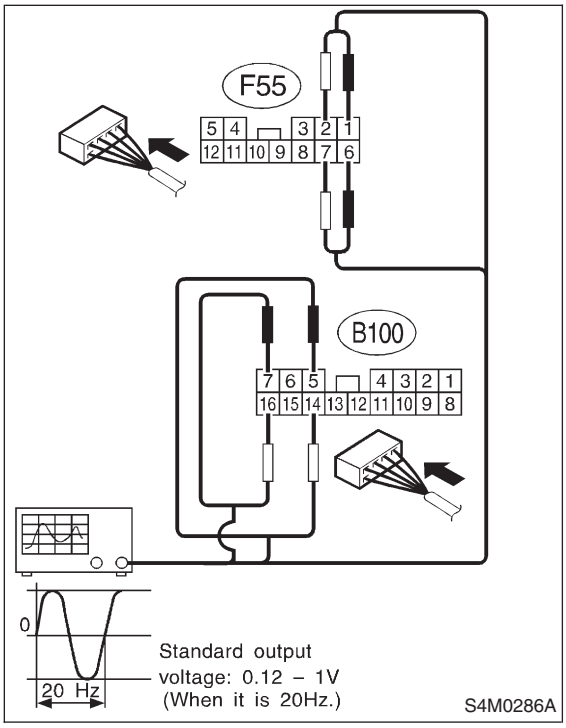
CHECK : ***Is an oscilloscope available?***
YES : Go to step **8J9**.
NO : Go to step **8J10**.

8J9 : CHECK ABS SENSOR SIGNAL.

1) Raise all four wheels of ground.
2) Turn ignition switch OFF.
3) Connect the oscilloscope to the connector.
4) Turn ignition switch ON.
5) Rotate wheels and measure voltage at specified frequency.

NOTE:
When this inspection is completed, the ABS control module sometimes stores the trouble code 29.

Connector & terminal
(B100) No. 5 (+) — No. 14 (–) (Front RH):
(B100) No. 7 (+) — No. 16 (–) (Front LH):
(F55) No. 6 (+) — No. 7 (–) (Rear RH):
(F55) No. 1 (+) — No. 2 (–) (Rear LH):
Specified voltage: 0.12 — 1 V (When it is 20 Hz.)



CHECK : ***Is oscilloscope pattern smooth, as shown in figure?***
YES : Go to step **8J13**.
NO : Go to step **8J10**.

8J10 : CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL.

Remove disc rotor from hub.

CHECK : ***Is the ABS sensor pole piece or the tone wheel contaminated by dirt or other foreign matter?***
YES : Thoroughly remove dirt or other foreign matter.
NO : Go to step **8J11**.

8J11 : CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.

CHECK : ***Are there broken or damaged teeth in the ABS sensor pole piece or the tone wheel?***
YES : Replace ABS sensor or tone wheel. <Ref. to 4-4 [W13A0].>, <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>
NO : Go to step **8J12**.

8J12 : CHECK HUB RUNOUT.

Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **8J13**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> and <Ref. to 4-2 [W2A0].>

8J13 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8J14**.

8J14 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

K: TROUBLE CODE 31 (FRONT RH)

L: TROUBLE CODE 33 (FRONT LH)

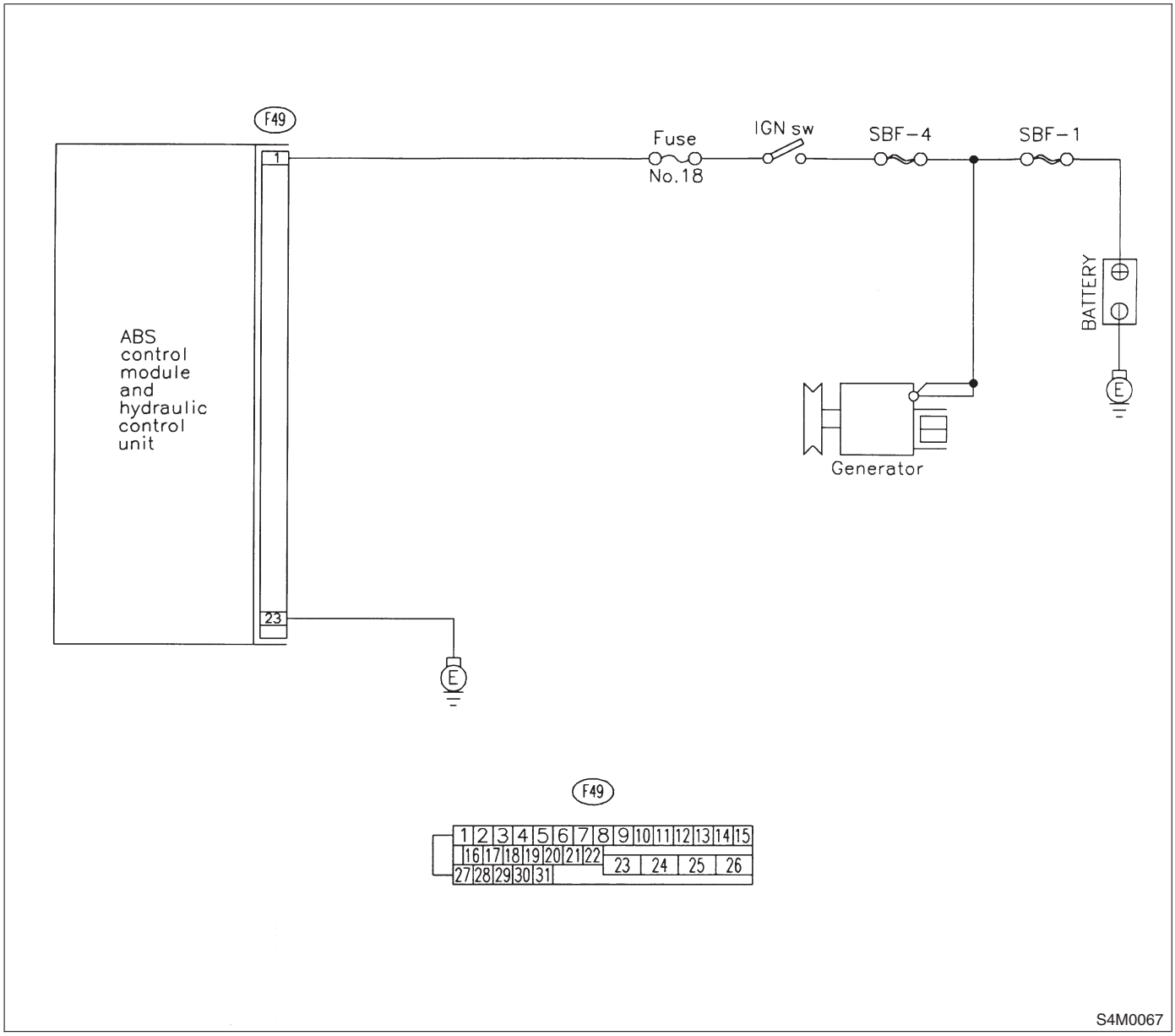
M: TROUBLE CODE 35 (REAR RH)

N: TROUBLE CODE 37 (REAR LH)
— ABNORMAL INLET SOLENOID VALVE CIRCUIT(S) IN ABSCM&H/U —

DIAGNOSIS:
- Faulty harness/connector
- Faulty inlet solenoid valve in ABSCM&H/U

TROUBLE SYMPTOM:
- ABS does not operate.

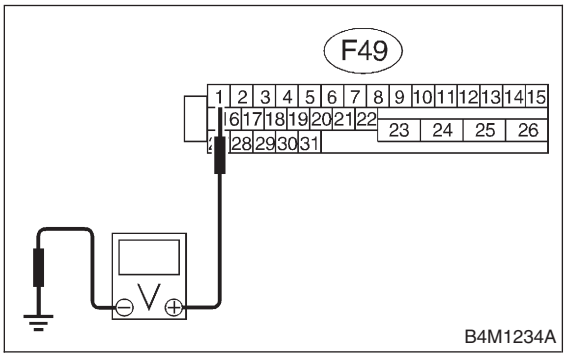
WIRING DIAGRAM:



8N1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

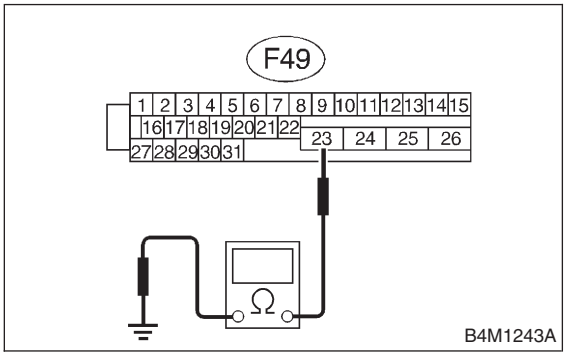


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8N2**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

8N2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8N3**.
NO : Repair ABSCM&H/U ground harness.

8N3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8N4**.

8N4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8N5**.

8N5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

O: TROUBLE CODE 32 (FRONT RH)

P: TROUBLE CODE 34 (FRONT LH)

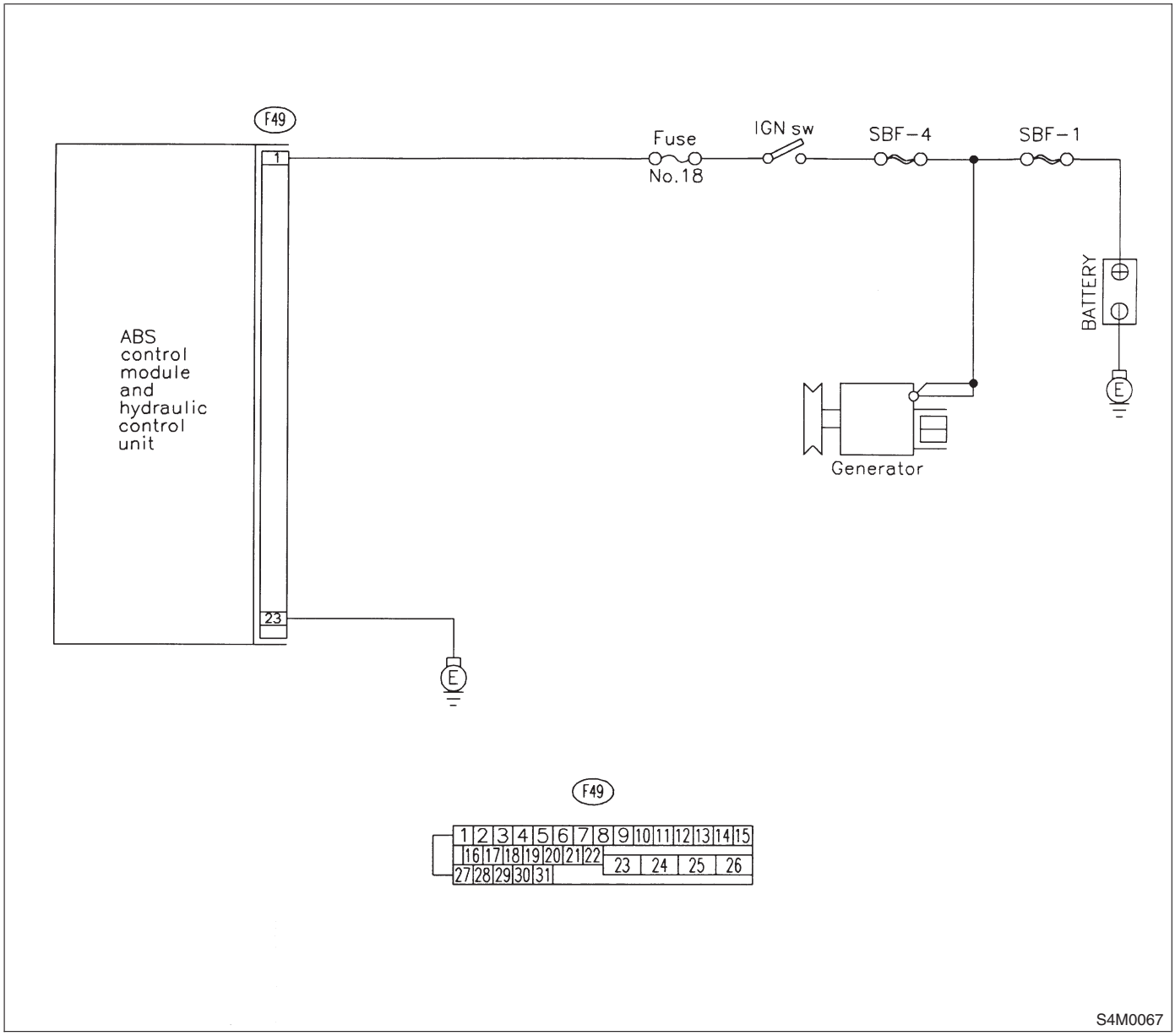
Q: TROUBLE CODE 36 (REAR RH)

R: TROUBLE CODE 38 (REAR LH)
— ABNORMAL OUTLET SOLENOID VALVE CIRCUIT(S) IN ABSCM&H/U —

DIAGNOSIS:
- Faulty harness/connector
- Faulty outlet solenoid valve in ABSCM&H/U

TROUBLE SYMPTOM:
- ABS does not operate.

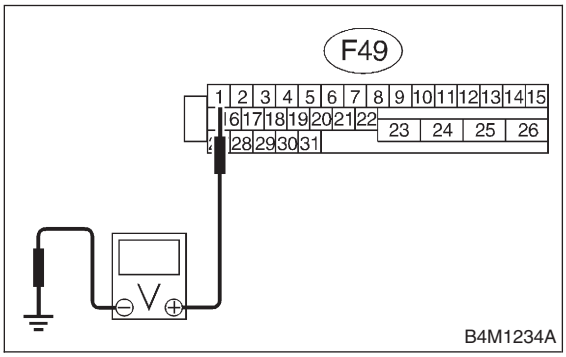
WIRING DIAGRAM:



8R1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

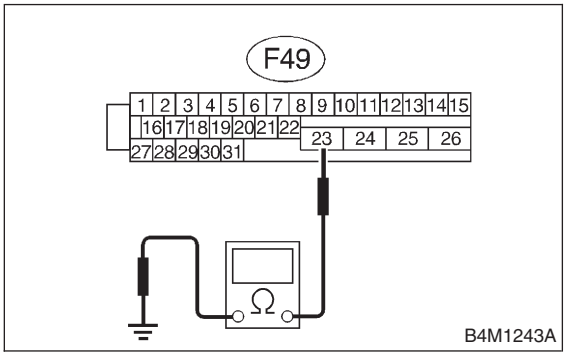


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8R2**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

8R2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8R3**.
NO : Repair ABSCM&H/U ground harness.

8R3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8R4**.

8R4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8R5**.

8R5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

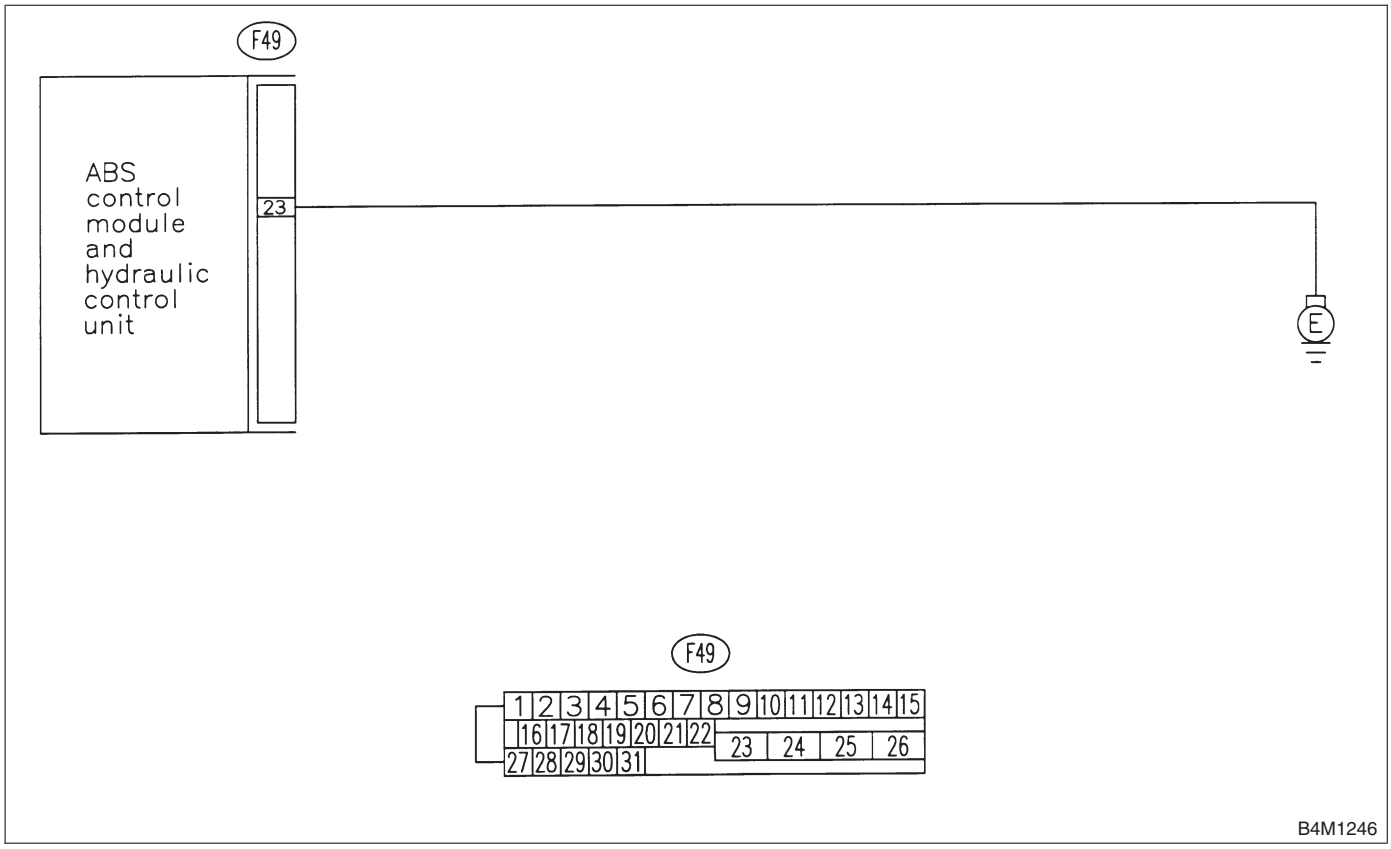
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

S: TROUBLE CODE 41
— ABNORMAL ABS CONTROL MODULE —

DIAGNOSIS:
- Faulty ABSCM&H/U.

TROUBLE SYMPTOM:
- ABS does not operate.

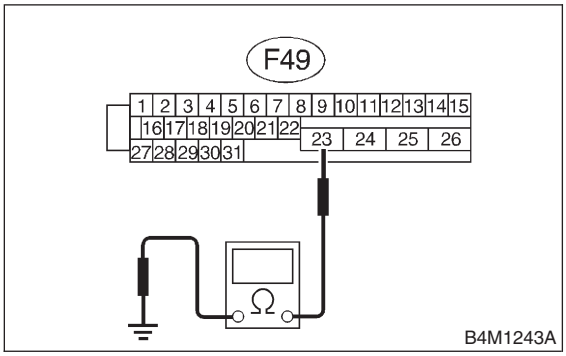
WIRING DIAGRAM:



8S1 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8S2**.
NO : Repair ABSCM&H/U ground harness.

8S2 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between battery, ignition switch and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8S3**.

8S3 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Is the car telephone or the wireless transmitter properly installed?***
YES : Go to step **8S4**.
NO : Properly install the car telephone or the wireless transmitter.

8S4 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Are noise sources (such as an antenna) installed near the sensor harness?***
YES : Install the noise sources apart from the sensor harness.
NO : Go to step **8S5**.

8S5 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8S6**.

8S6 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

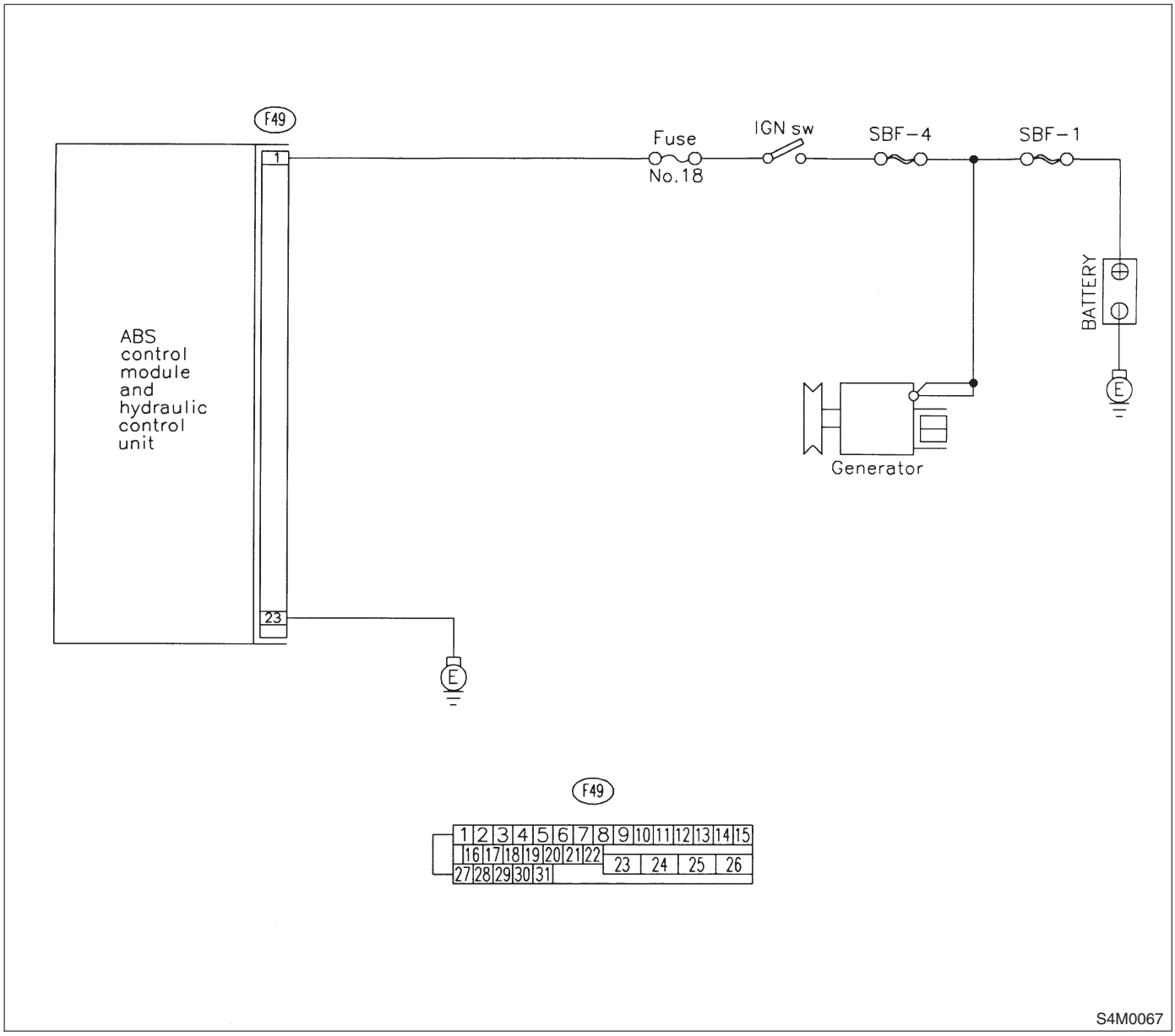
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

T: TROUBLE CODE 42
— SOURCE VOLTAGE IS ABNORMAL. —

DIAGNOSIS:
- Power source voltage of the ABSCM&H/U is low or high.

TROUBLE SYMPTOM:
- ABS does not operate.

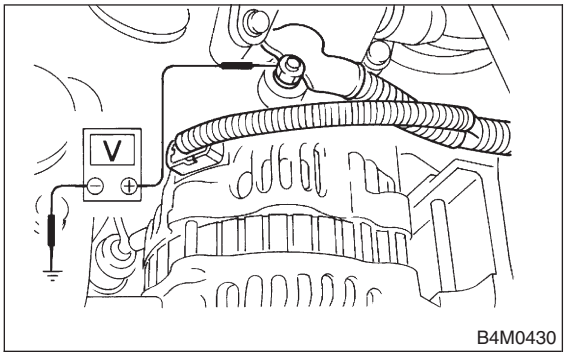
WIRING DIAGRAM:



8T1 : CHECK GENERATOR.

1) Start engine.
2) Idling after warm-up.
3) Measure voltage between generator B terminal and chassis ground.

Terminal
Generator B terminal — Chassis ground:



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8T2**.
NO : Repair generator. <Ref. to 6-1 [W2A0].>

8T2 : CHECK BATTERY TERMINAL.

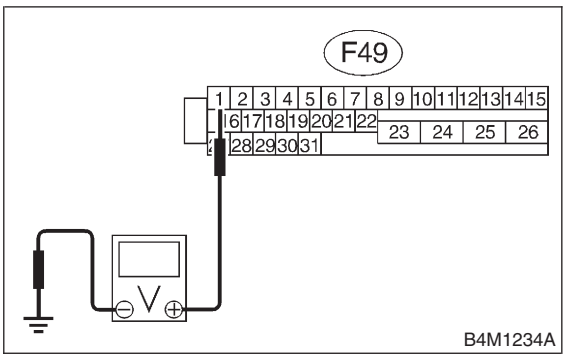
Turn ignition switch to OFF.

CHECK : ***Are the positive and negative battery terminals tightly clamped?***
YES : Go to step **8T3**.
NO : Tighten the clamp of terminal.

8T3 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Disconnect connector from ABSCM&H/U.
2) Run the engine at idle.
3) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

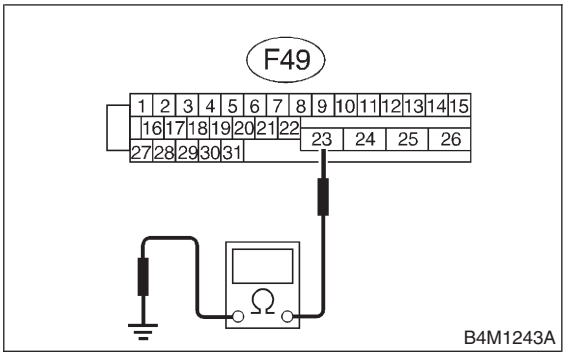


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8T4**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

8T4 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8T5**.
NO : Repair ABSCM&H/U ground harness.

8T5 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***

YES : Repair connector.

NO : Go to step **8T6**.

8T6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **8T7**.

8T7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

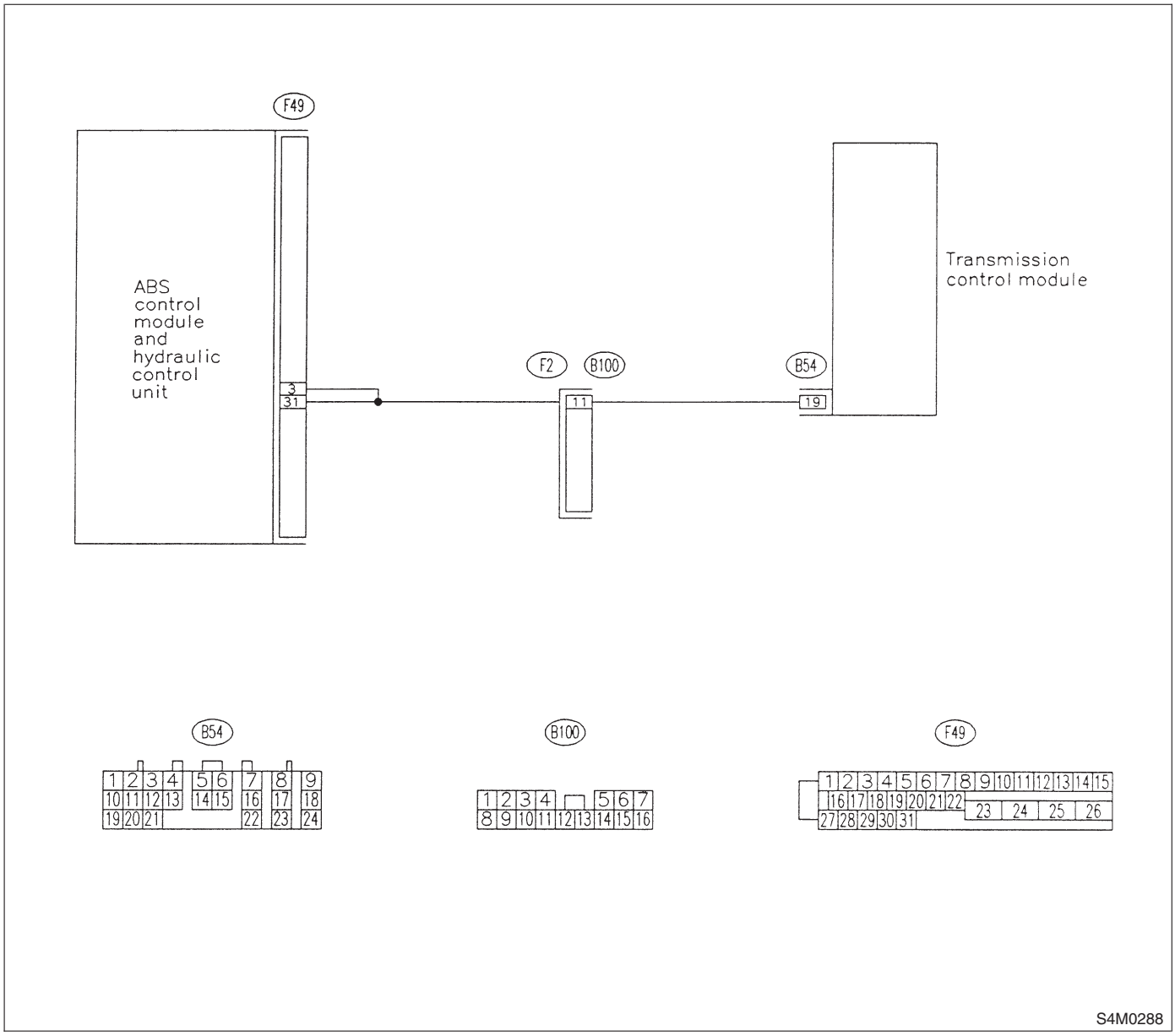
MEMO:

U: TROUBLE CODE 44
— A COMBINATION OF AT CONTROL ABNORMAL —

DIAGNOSIS:
- Combination of AT control faults

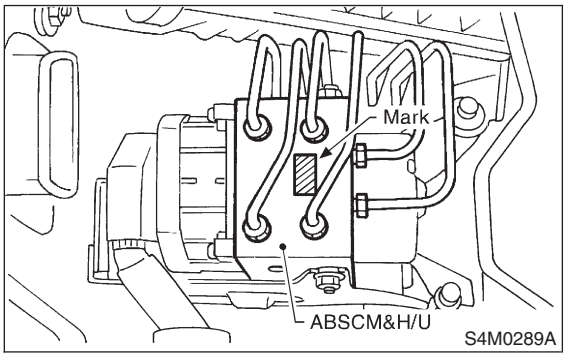
TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



8U1 : CHECK SPECIFICATIONS OF THE ABSCM&H/U.

Check specifications of the mark to the ABSCM&H/U.



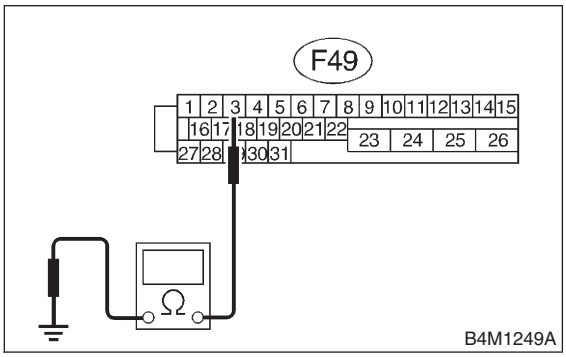
Mark	Model
C7	AWD AT
C8	AWD MT

CHECK : ***Is an ABSCM&H/U for AT model installed on a MT model?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8U2**.

8U2 : CHECK GROUND SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect two connectors from TCM.
3) Disconnect connector from ABSCM&H/U.
4) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 — Chassis ground:

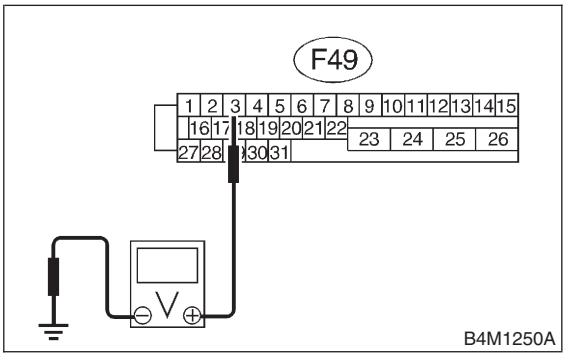


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8U3**.
NO : Repair harness between TCM and ABSCM&H/U.

8U3 : CHECK BATTERY SHORT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):

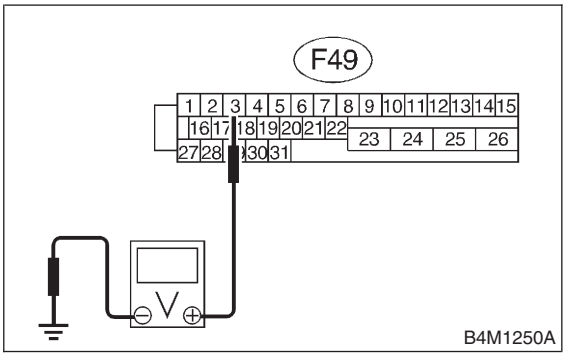


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8U4**.
NO : Repair harness between TCM and ABSCM&H/U.

8U4 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):

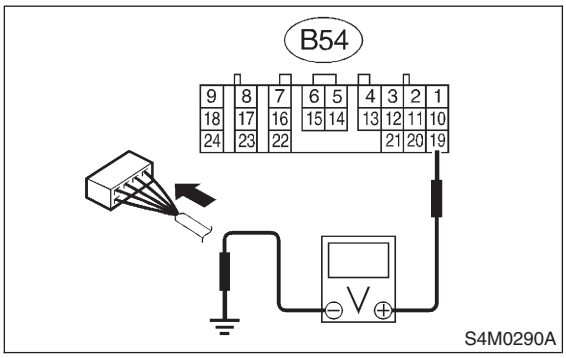


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8U5**.
NO : Repair harness between TCM and ABSCM&H/U.

8U5 : CHECK TCM.

1) Turn ignition switch to OFF.
2) Connect all connectors to TCM.
3) Turn ignition switch to ON.
4) Measure voltage between TCM connector terminal and chassis ground.

Connector & terminal
(B54) No. 19 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 6 and 15 V?***
YES : Go to step **8U7**.
NO : Go to step **8U6**.

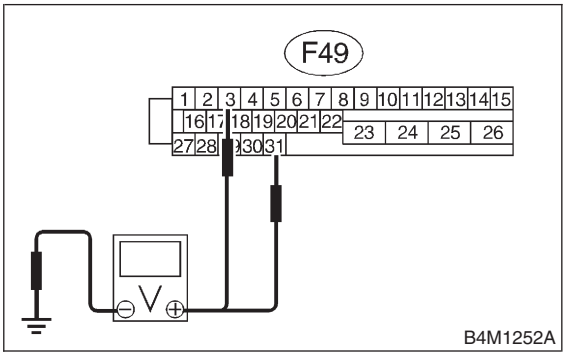
8U6 : CHECK AT.

CHECK : ***Is the AT functioning normally?***
YES : Replace TCM. <Ref. to 3-2 [W23A0].>
NO : Repair AT. <Ref. to 3-2 [T100].>

8U7 : CHECK OPEN CIRCUIT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):
(F49) No. 31 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 5.5 and 15 V?***
YES : Go to step **8U8**.
NO : Repair harness/connector between TCM and ABSCM&H/U.

8U8 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between TCM and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8U9**.

8U9 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8U10**.

8U10 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

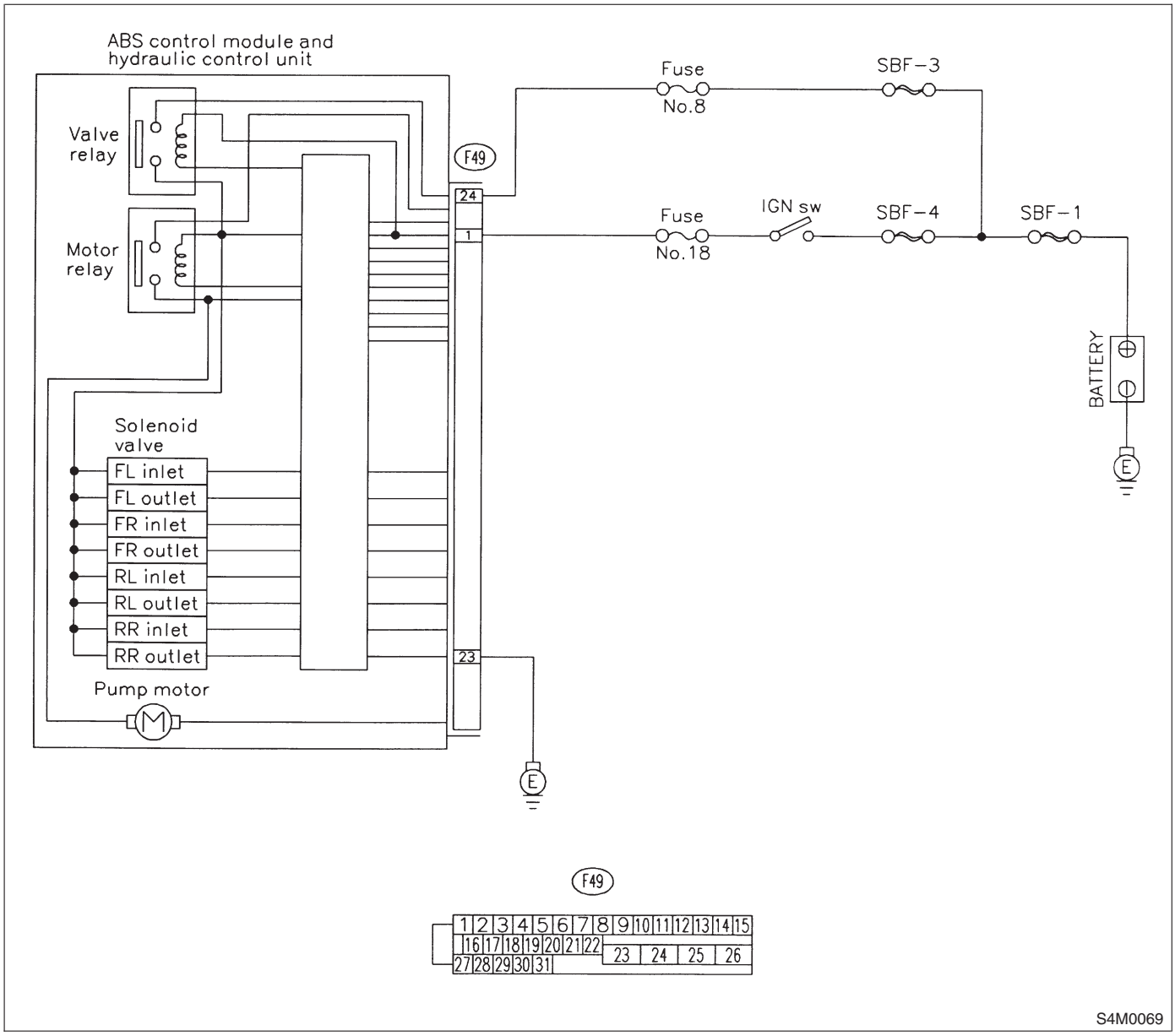
NO : A temporary poor contact.

V: TROUBLE CODE 51
— ABNORMAL VALVE RELAY —

DIAGNOSIS:
- Faulty valve relay

TROUBLE SYMPTOM:
- ABS does not operate.

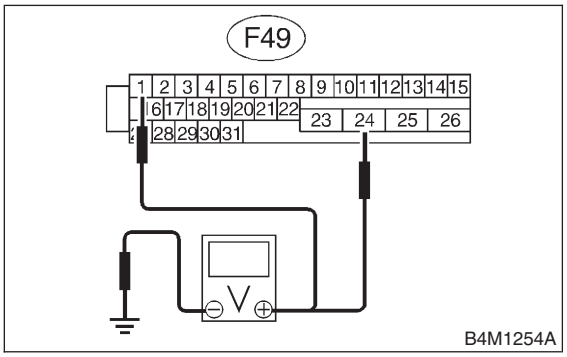
WIRING DIAGRAM:



8V1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):
(F49) No. 24 (+) — Chassis ground (–):

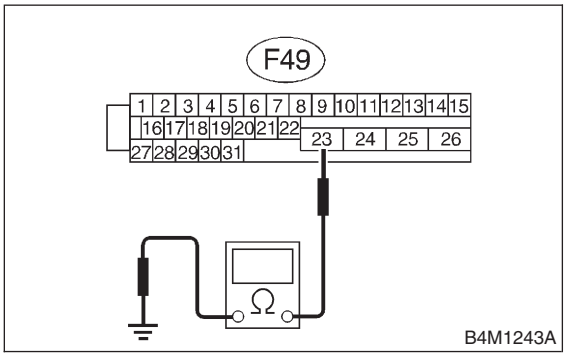


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8V2**.
NO : Repair harness connector between battery and ABSCM&H/U.

8V2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:

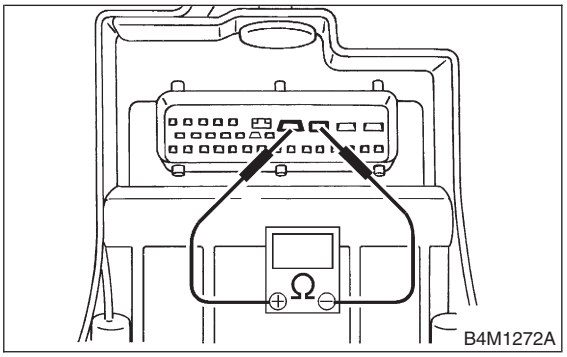


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8V3**.
NO : Repair ABSCM&H/U ground harness.

8V3 : CHECK VALVE RELAY IN ABSCM&H/U.

Measure resistance between ABSCM&H/U and terminals.

Terminals
No. 23 (+) — No. 24 (–):



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8V4**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

8V4 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8V5**.

8V5 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8V6**.

8V6 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

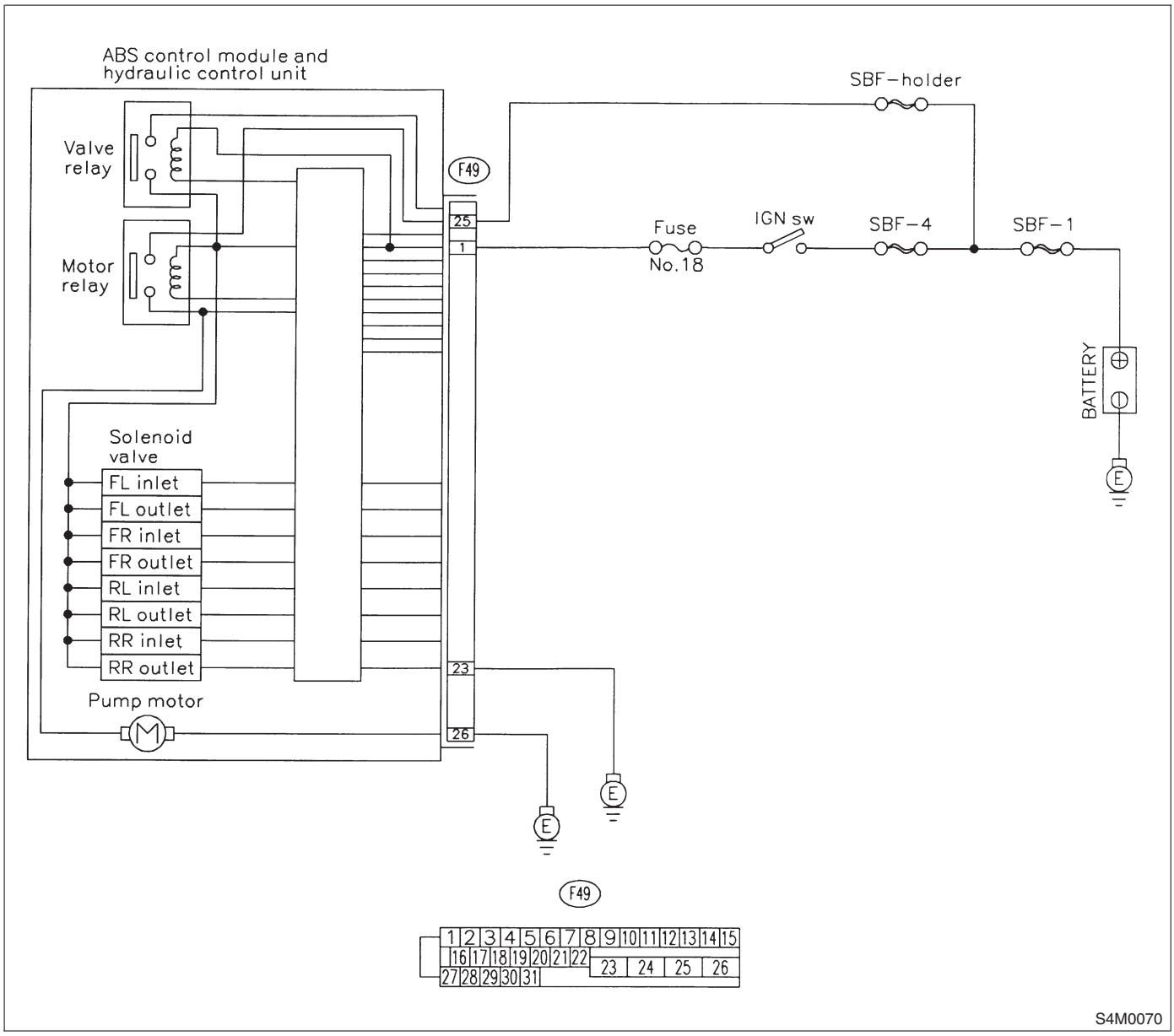
MEMO:

W: TROUBLE CODE 52
— ABNORMAL MOTOR AND/OR MOTOR RELAY —

DIAGNOSIS:
- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

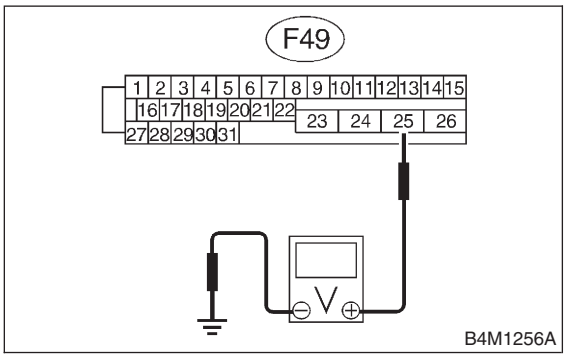
WIRING DIAGRAM:



8W1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Turn ignition switch to ON.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 25 (+) — Chassis ground (–):

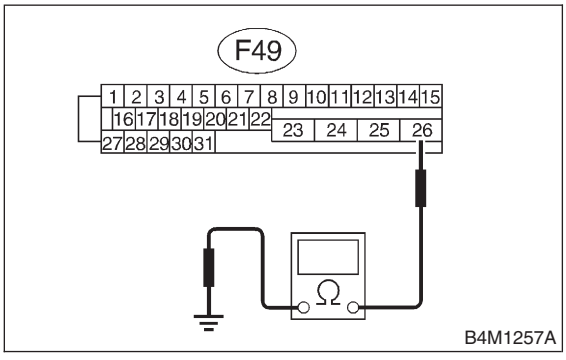


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8W2**.
NO : Repair harness/connector between battery and ABSCM&H/U and check fuse SBF-holder.

8W2 : CHECK GROUND CIRCUIT OF MOTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 26 — Chassis ground:

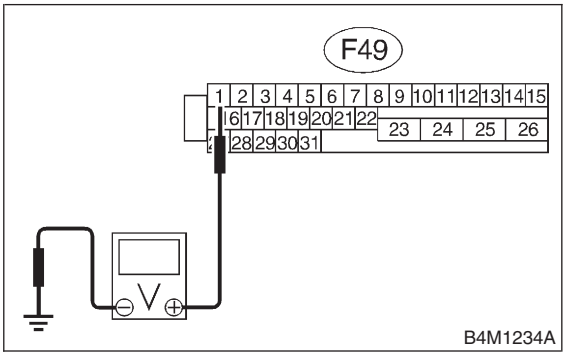


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8W3**.
NO : Repair ABSCM&H/U ground harness.

8W3 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Run the engine at idle.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

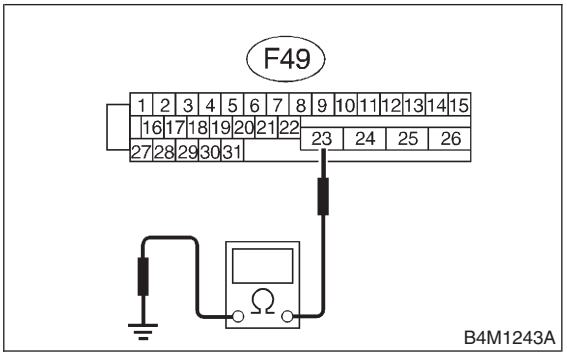


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8W4**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

8W4 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **8W5**.
NO : Repair ABSCM&H/U ground harness.

8W5 : CHECK MOTOR OPERATION.

Operate the sequence control. <Ref. to 4-4 [W14D1].>

NOTE:
Use the diagnosis connector to operate the sequence control.

CHECK : ***Can motor revolution noise (buzz) be heard when carrying out the sequence control?***

YES : Go to step **8W6**.

NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

8W6 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***

YES : Repair connector.

NO : Go to step **8W7**.

8W7 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **8W8**.

8W8 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

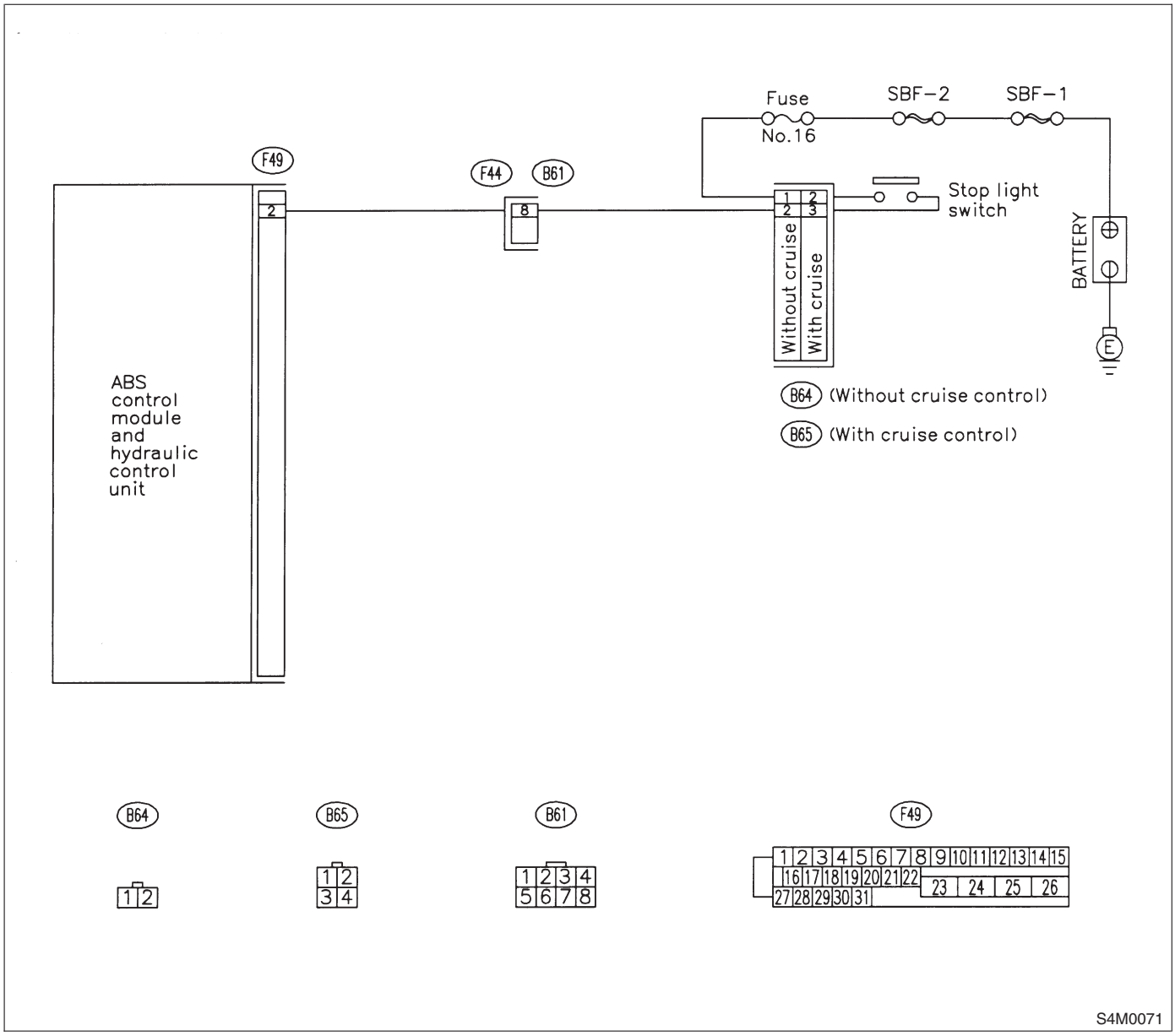
MEMO:

X: TROUBLE CODE 54
— ABNORMAL STOP LIGHT SWITCH —

DIAGNOSIS:
- Faulty stop light switch

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



8X1 : CHECK STOP LIGHTS COME ON.

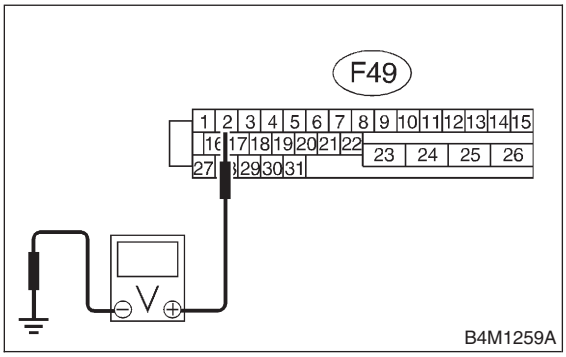
Depress the brake pedal.

CHECK : ***Do stop lights come on?***
YES : Go to step **8X2**.
NO : Repair stop lights circuit.

8X2 : CHECK OPEN CIRCUIT IN HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Depress brake pedal.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 2 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **8X3**.
NO : Repair harness between stop light switch and ABSCM&H/U.

8X3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between stop light switch and ABSCM&H/U? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8X4**.

8X4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8X5**.

8X5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

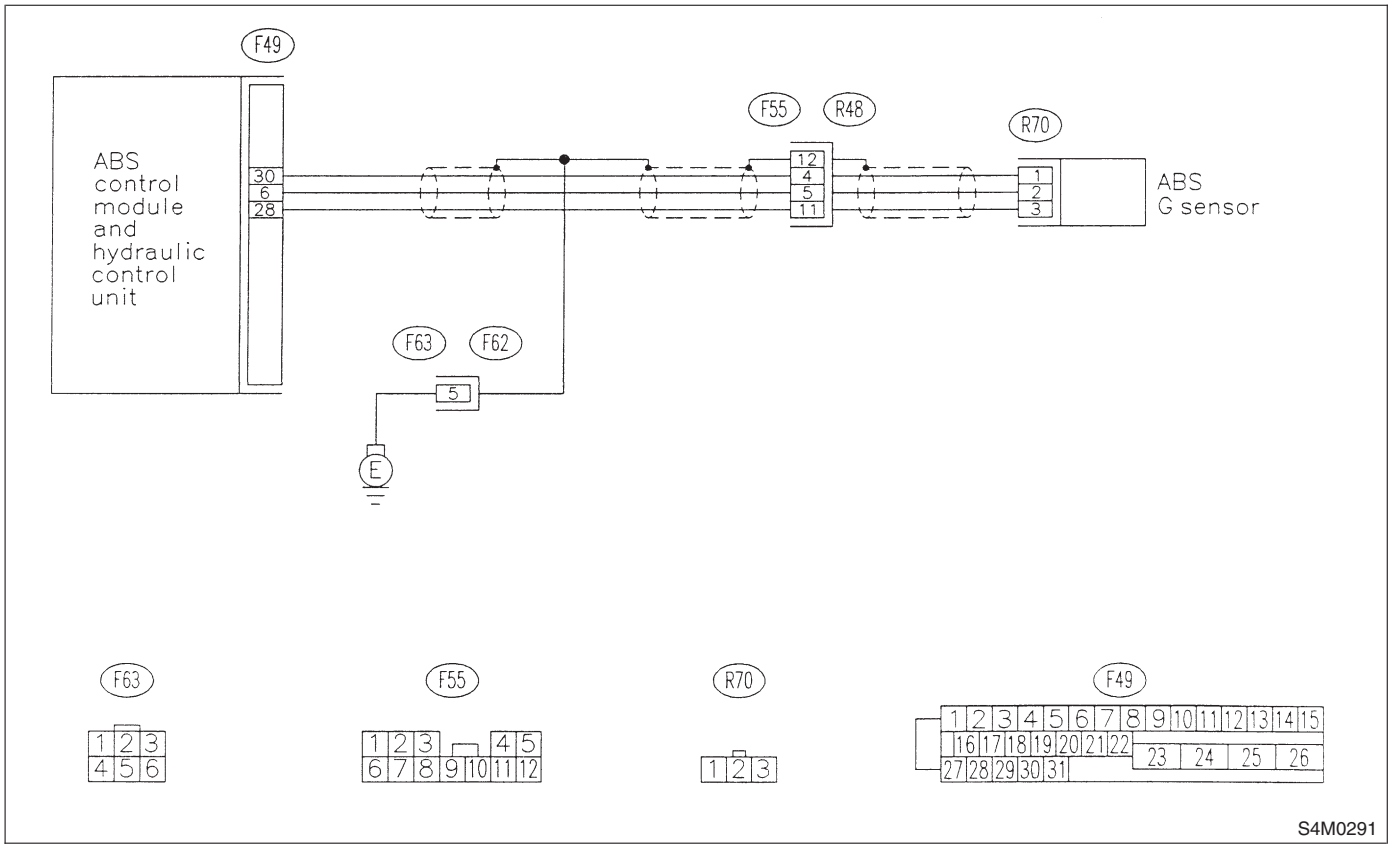
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

Y: TROUBLE CODE 56
— ABNORMAL G SENSOR OUTPUT VOLTAGE —

DIAGNOSIS:
- Faulty G sensor output voltage

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



8Y1 : CHECK ALL FOUR WHEELS FOR FREE TURNING.

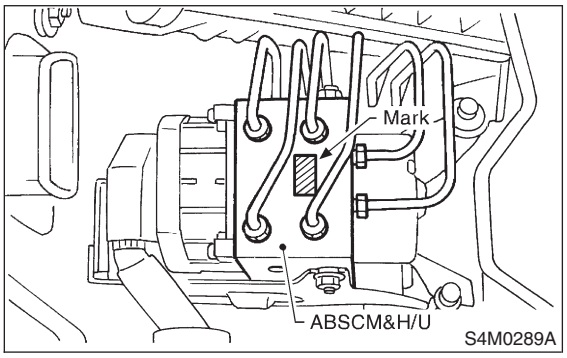
CHECK : ***Have the wheels been turned freely such as when the vehicle is lifted up, or operated on a rolling road?***

YES : The ABS is normal. Erase the trouble code. <Ref. to 4-4 [T6D2].>

NO : Go to step **8Y2**.

8Y2 : CHECK SPECIFICATIONS OF ABSCM&H/U.

Check specifications of the mark to the ABSCM&H/U.



Mark	Model
C7	AWD AT
C8	AWD MT

CHECK : ***Does the vehicle specification and the ABSCM&H/U specification match?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

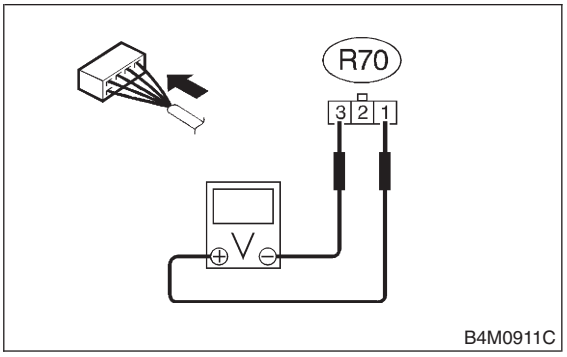
CAUTION:
Be sure to turn ignition switch to OFF when removing ABSCM&H/U.

NO : Go to step **8Y3**.

8Y3 : CHECK INPUT VOLTAGE OF G SENSOR.

1) Turn ignition switch to OFF.
2) Remove console box.
3) Disconnect G sensor from body. (Do not disconnect connector.)
4) Turn ignition switch to ON.
5) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 1 (+) — No. 3 (–):



CHECK : ***Is the voltage between 4.75 and 5.25 V?***

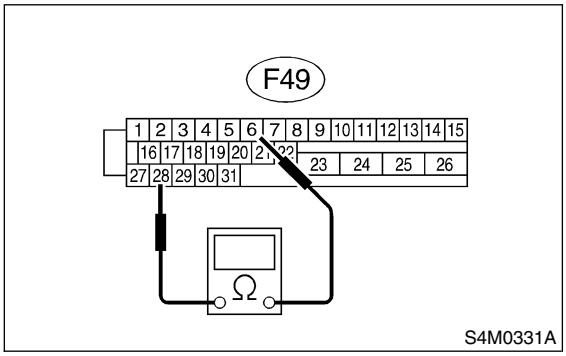
YES : Go to step **8Y4**.

NO : Repair harness/connector between G sensor and ABSCM&H/U.

8Y4 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:

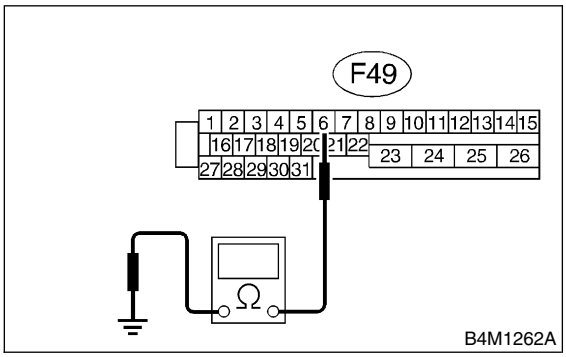


CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***
YES : Go to step **8Y5**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

8Y5 : CHECK GROUND SHORT IN G SENSOR OUTPUT HARNESS.

1) Disconnect connector from G sensor.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 — Chassis ground:

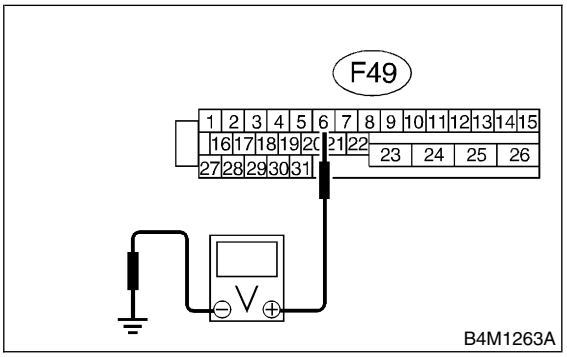


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8Y6**.
NO : Repair harness between G sensor and ABSCM&H/U.

8Y6 : CHECK BATTERY SHORT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 (+) — Chassis ground (–):

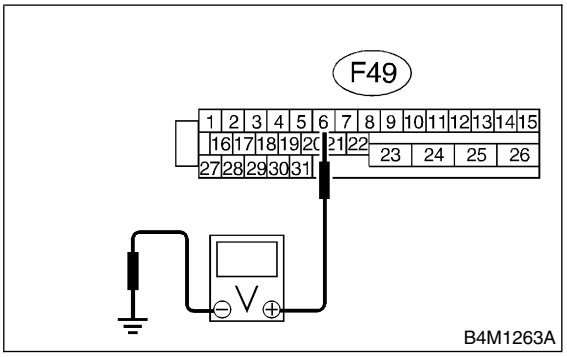


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8Y7**.
NO : Repair harness between G sensor and ABSCM&H/U.

8Y7 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 (+) — Chassis ground (–):

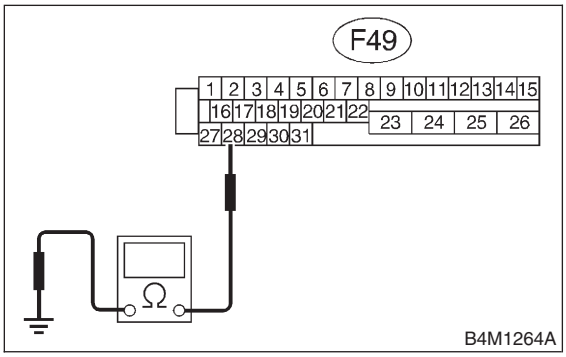


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **8Y8**.
NO : Repair harness between G sensor and ABSCM&H/U.

8Y8 : CHECK GROUND SHORT OF HARNESS.

Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 28 — Chassis ground:

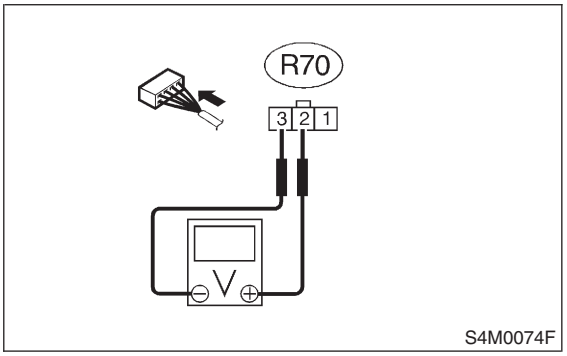


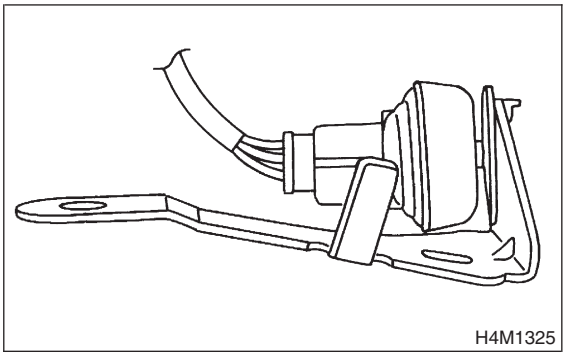
CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **8Y9**.
NO : Repair harness between G sensor and ABSCM&H/U.
Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

8Y9 : CHECK G SENSOR.

1) Turn ignition switch to OFF.
2) Remove G sensor from vehicle.
3) Connect connector to G sensor.
4) Connect connector to ABSCM&H/U.
5) Turn ignition switch to ON.
6) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



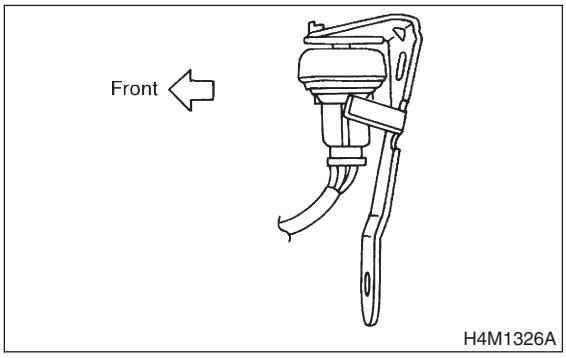


CHECK : ***Is the voltage between 2.1 and 2.5 V when G sensor is horizontal?***
YES : Go to step **8Y10**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

8Y10 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):

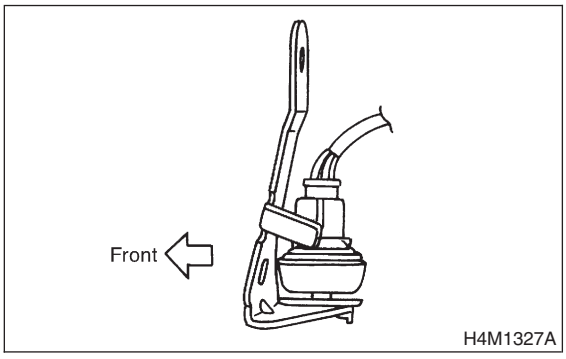


CHECK : ***Is the voltage between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **8Y11**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

8Y11 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



CHECK : ***Is the voltage between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **8Y12**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

8Y12 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1]. >***
YES : Repair connector.
NO : Go to step **8Y13**.

8Y13 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **8Y14**.

8Y14 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

MEMO:

9. Select Monitor Function Mode

Applicable cartridge of select monitor. <Ref. to 1-6 [G1100].>

NOTE:
For basic handling of the select monitor, refer to its Operation Manual.

A: LIST OF FUNCTION MODE

1. ANALOG DATA ARE DISPLAYED

Display screen	Contents to be monitored
FR wheel speed	Wheel speed detected by the Front Right ABS sensor is displayed in km/h or mile/h.
FL wheel speed	Wheel speed detected by the Front Left ABS sensor is displayed in km/h or mile/h.
RR wheel speed	Wheel speed detected by the Rear Right ABS sensor is displayed in km/h or mile/h.
RL wheel speed	Wheel speed detected by the Rear Left ABS sensor is displayed in km/h or mile/h.
Stop light switch	Stop light switch monitor voltage is displayed.
G sensor output voltage	Refers to vehicle acceleration detecting by the analog G sensor. It appears on the select monitor display in volts.

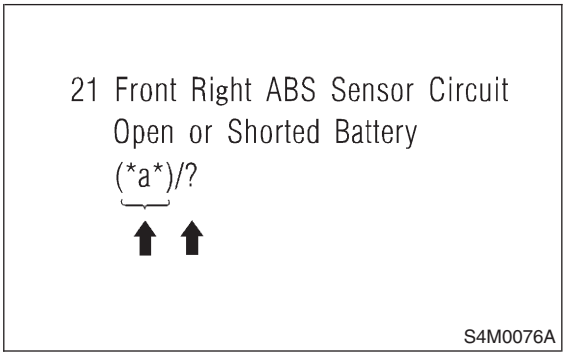
2. ON/OFF DATA ARE DISPLAYED

Display screen	Contents to be monitored
Stop light switch	Stop light switch signal
Valve relay signal	Valve relay signal
Motor relay signal	Motor relay signal
ABS signal to TCM	ABS operation signal from ABS control module to TCM
ABS warning light	ABS warning light
Valve relay monitor	Valve relay operation monitor signal
Motor relay monitor	Motor relay operation monitor signal
CCM signal	ABS operation signal from ABS control module to TCM (ABS operation signal monitor)

3. TROUBLE CODES ARE DISPLAYED

A maximum of 3 trouble codes are displayed in order of occurrence.

- If a particular trouble code is not properly stored in memory (due to a drop in ABSCM&H/U power supply, etc.) when a problem occurs, the trouble code, followed by a question mark "?", appears on the select monitor display. This shows it may be an unreliable reading.



- *a* refers to the troubles in order of occurrence (Latest, Old, Older and Reference).

Display screen	Contents to be monitored
Latest	The most recent trouble code appears on the select monitor display.
Old	The second most recent trouble code appears on the select monitor display.
Older	The third most recent trouble code appears on the select monitor display.
Reference	A specified period of time proceeding trouble code appears on the select monitor display.

4. CLEAR MEMORY

Display screen	Contents to be monitored
Clear memory?	Function of clearing trouble code and freeze frame data.

5. ABS SEQUENCE CONTROL

Display screen	Contents to be monitored	Ref. to
ABS sequence control	Perform ABS sequence control by operating valve and pump motor sequentially.	<Ref. to 4-4 [W14D2].>

6. FREEZE FRAME DATA

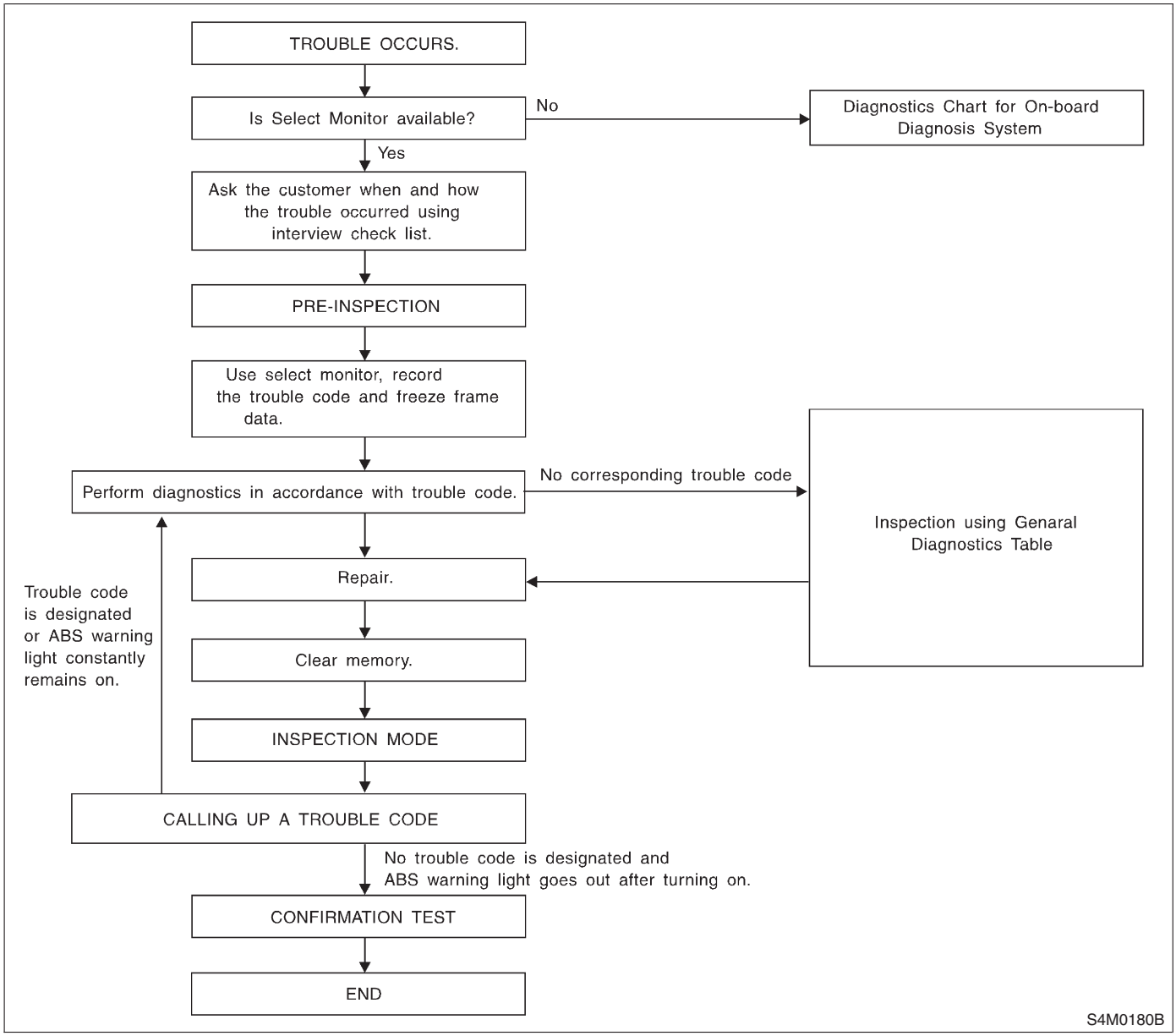
NOTE:
- Data stored at the time of trouble occurrence is shown on display.
- Each time trouble occurs, the latest information is stored in the freeze frame data in memory.
- If freeze frame data is not properly stored in memory (due to a drop in ABSCM power supply, etc.), a freeze frame data, preceded by a question mark "?", appears on the select monitor display. This shows it may be an unreliable reading.

The value of the freeze frame data will be written over, and the memory cannot be cleared.

Display screen	Contents to be monitored
FR wheel speed	Wheel speed detected by the Front Right ABS sensor is displayed in km/h or mile/h.
FL wheel speed	Wheel speed detected by the Front Left ABS sensor is displayed in km/h or mile/h.
RR wheel speed	Wheel speed detected by the Rear Right ABS sensor is displayed in km/h or mile/h.
RL wheel speed	Wheel speed detected by the Rear Left ABS sensor is displayed in km/h or mile/h.
ABSCM power voltage	Power (in volts) supplied to ABSCM&H/U appears on the select monitor display.
G sensor output voltage	Refers to vehicle acceleration detected by the analog G sensor. It appears on the select monitor display in volts.
Motor relay monitor	Motor relay operation monitor signal
Stop light switch	Stop light switch signal
ABS signal to TCM	ABS operation signal from ABS control module to TCM (Output signal)
ABS-AT control	ABS operation signal from ABS control module to TCM (ABS operation signal monitor)
ABS operation signal	ABS operation signal

10. Diagnostics Chart with Select Monitor

A: BASIC DIAGNOSTIC CHART



CAUTION:
Remove foreign matter (dust, water, etc.) from the ABSCM&H/U connector during removal and installation.

NOTE:
To check harness for broken wires or short circuits, shake it while holding it or the connector.

B: LIST OF DIAGNOSTIC TROUBLE CODE

Code	Display screen	Contents of diagnosis	Ref. to
—	Communication for initializing impossible	Select monitor communication failure	<Ref. to 4-4 [T10C0].>
—	No trouble code	Although no trouble code appears on the select monitor display, the ABS warning light remains on.	<Ref. to 4-4 [T10D0].>
21	Open or short circuit in front right ABS sensor circuit	Open or short circuit in front right ABS sensor circuit	<Ref. to 4-4 [T10E0].>
22	Front right ABS sensor abnormal signal	Front right ABS sensor abnormal signal	<Ref. to 4-4 [T10I0].>
23	Open or short circuit in front left ABS sensor circuit	Open or short circuit in front left ABS sensor circuit	<Ref. to 4-4 [T10F0].>
24	Front left ABS sensor abnormal signal	Front left ABS sensor abnormal signal	<Ref. to 4-4 [T10J0].>
25	Open or short circuit in rear right ABS sensor circuit	Open or short circuit in rear right ABS sensor circuit	<Ref. to 4-4 [T10K0].>
26	Rear right ABS sensor abnormal signal	Rear right ABS sensor abnormal signal	<Ref. to 4-4 [T10C0].>
27	Open or short circuit in rear left ABS sensor circuit	Open or short circuit in rear left ABS sensor circuit	<Ref. to 4-4 [T10H0].>
28	Rear left ABS sensor abnormal signal	Rear left ABS sensor abnormal signal	<Ref. to 4-4 [T10L0].>
29	Abnormal ABS sensor signal on any one of four sensor	Abnormal ABS sensor signal on any one of four	<Ref. to 4-4 [T10M0].>
31	Front right inlet valve malfunction	Front right inlet valve malfunction	<Ref. to 4-4 [T10N0].>
32	Front right outlet valve malfunction	Front right outlet valve malfunction	<Ref. to 4-4 [T10R0].>
33	Front left inlet valve malfunction	Front left inlet valve malfunction	<Ref. to 4-4 [T10O0].>
34	Front left outlet valve malfunction	Front left outlet valve malfunction	<Ref. to 4-4 [T10S0].>
35	Rear right inlet valve malfunction	Rear right inlet valve malfunction	<Ref. to 4-4 [T10P0].>
36	Rear right outlet valve malfunction	Rear right outlet valve malfunction	<Ref. to 4-4 [T10T0].>
37	Rear left inlet valve malfunction	Rear left inlet valve malfunction	<Ref. to 4-4 [T10Q0].>
38	Rear left outlet valve malfunction	Rear left outlet valve malfunction	<Ref. to 4-4 [T10U0].>
41	ABS control module malfunction	ABS control module and hydraulic control unit malfunction	<Ref. to 4-4 [T10V0].>
42	Power supply voltage too low	Power supply voltage too low	<Ref. to 4-4 [T10W0].>
42	Power supply voltage too high	Power supply voltage too high	<Ref. to 4-4 [T10X0].>
44	ABS-AT control (Non Controlled)	ABS-AT control (Non Controlled)	<Ref. to 4-4 [T10Y0].>
44	ABS-AT control (Controlled)	ABS-AT control (Controlled)	<Ref. to 4-4 [T10Z0].>
51	Valve relay malfunction	Valve relay malfunction	<Ref. to 4-4 [T10AA0].>
51	Valve relay ON failure	Valve relay ON failure	<Ref. to 4-4 [T10AB0].>
52	Open circuit in motor relay circuit	Open circuit in motor relay circuit	<Ref. to 4-4 [T10AC0].>
52	Motor relay ON failure	Motor relay ON failure	<Ref. to 4-4 [T10AD0].>
52	Motor malfunction	Motor malfunction	<Ref. to 4-4 [T10AE0].>
54	Stop light switch signal circuit malfunction	Stop light switch signal circuit malfunction	<Ref. to 4-4 [T10AF0].>
56	Open or short circuit in G sensor circuit	Open or short circuit in G sensor circuit	<Ref. to 4-4 [T10AG0].>
56	Battery short in G sensor circuit	Battery short in G sensor circuit	<Ref. to 4-4 [T10AH0].>
56	Abnormal G sensor high μ output	Abnormal G sensor high μ output	<Ref. to 4-4 [T10AI0].>
56	Detection of G sensor stick	Detection of G sensor stick	<Ref. to 4-4 [T10AJ0].>

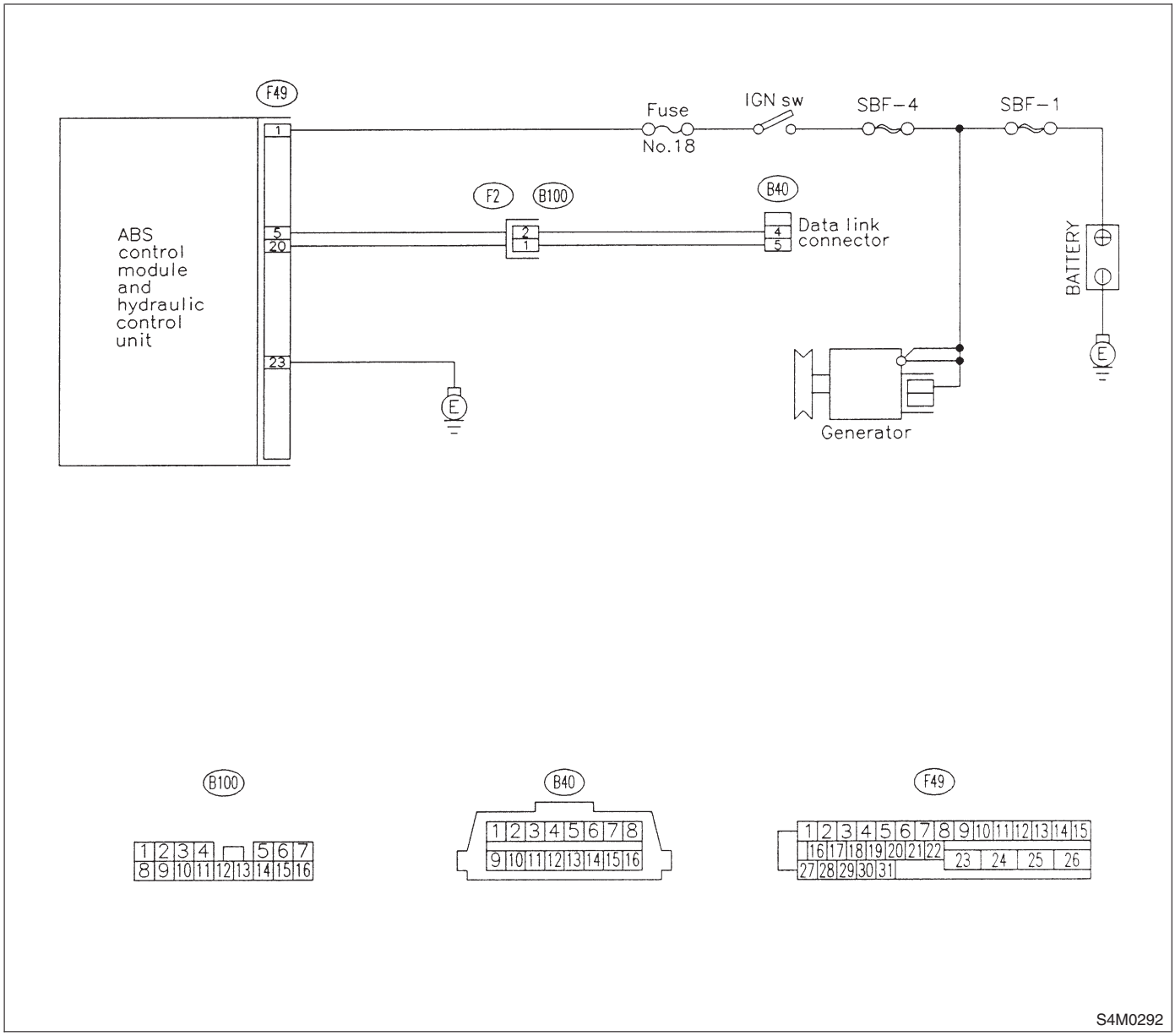
NOTE:
High μ means high friction coefficient against road surface.

C: COMMUNICATION FOR INITIALIZING IMPOSSIBLE — SELECT MONITOR COMMUNICATION FAILURE —

DIAGNOSIS:
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS warning light remains on.

WIRING DIAGRAM:



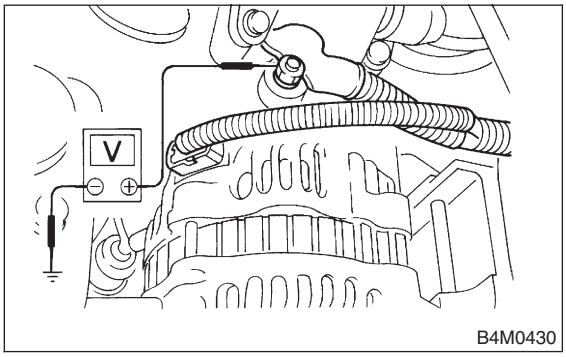
10C1 : CHECK IGNITION SWITCH.

CHECK : ***Is ignition switch ON?***
YES : Go to step **10C2**.
NO : Turn ignition switch ON, and select brake control mode using the select monitor.

10C2 : CHECK GENERATOR.

1) Start the engine.
2) Idle the engine.
3) Measure voltage between generator and chassis ground.

Terminal
Generator B terminal (+) — Chassis ground (–):



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10C3**.
NO : Repair generator. <Ref. to 6-1 [W2A0].>

10C3 : CHECK BATTERY TERMINAL.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact at battery terminal?***
YES : Repair battery terminal.
NO : Go to step **10C4**.

10C4 : CHECK COMMUNICATION OF SELECT MONITOR.

Using the select monitor, check whether communication to other system (such as engine, AT, etc.) can be executed normally.

CHECK : ***Are the name and year of the system displayed on the select monitor?***
YES : Go to step **10C5**.
NO : Repair select monitor communication cable and connector.

10C5 : CHECK INSTALLATION OF ABSCM&H/U CONNECTOR.

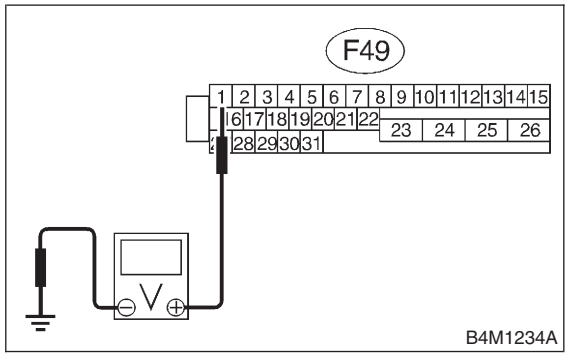
Turn ignition switch to OFF.

CHECK : ***Is ABSCM&H/U connector inserted into ABSCM&H/U until the clamp locks onto it?***
YES : Go to step **10C6**.
NO : Insert ABSCM&H/U connector into ABSCM&H/U until the clamp locks onto it.

10C6 : CHECK POWER SUPPLY OF ABSCM&H/U.

1) Disconnect connector from ABSCM&H/U.
2) Start engine.
3) Idle the engine.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

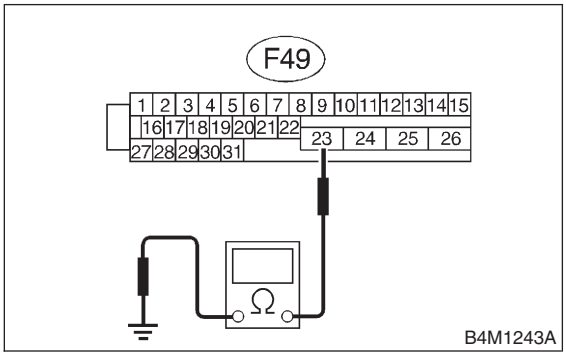


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10C7**.
NO : Repair ABSCM&H/U power supply circuit.

10C7 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:

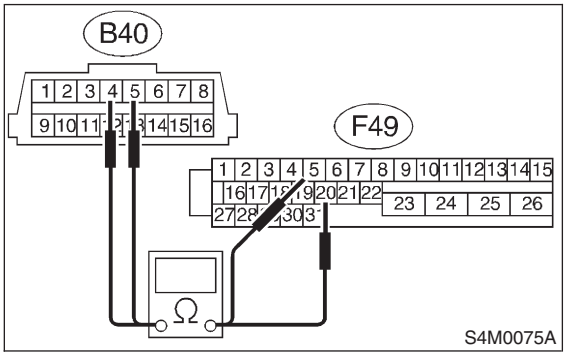


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Repair harness/connector between ABSCM&H/U and select monitor.
NO : Go to step **10C8**.

10C8 : CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND DATA LINK CONNECTOR.

1) Turn ignition switch OFF.
2) Measure resistance between ABSCM&H/U connector and data link connector.

Connector & terminal
(F49) No. 20 — (B40) No. 5:
(F49) No. 5 — (B40) No. 4:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Repair harness and connector between ABSCM&H/U and data link connector.
NO : Go to step **10C9**.

10C9 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and data link connector? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

MEMO:

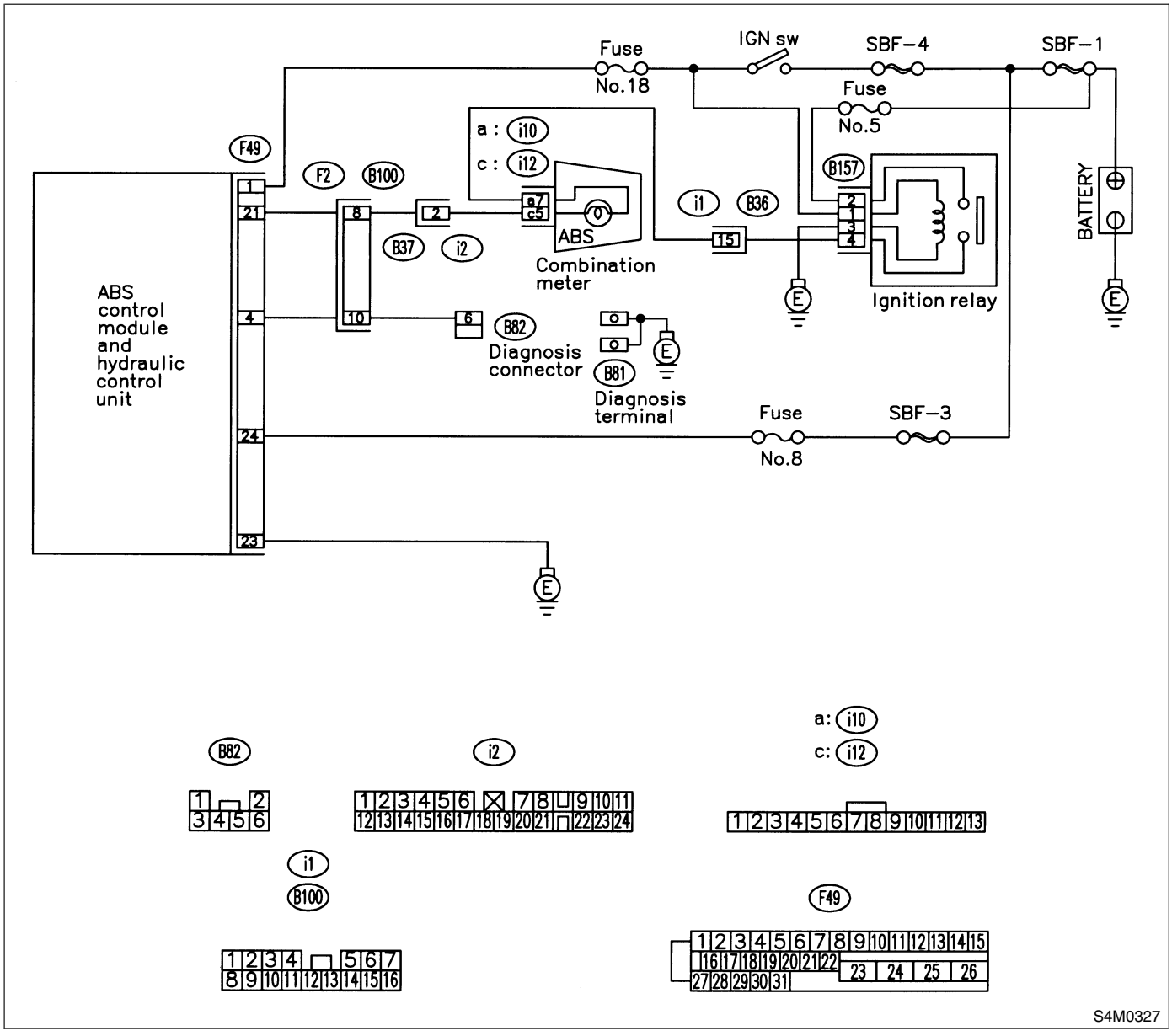
D: NO TROUBLE CODE
— ALTHOUGH NO TROUBLE CODE APPEARS ON THE SELECT MONITOR DISPLAY, THE ABS WARNING LIGHT REMAINS ON. —

DIAGNOSIS:
- ABS warning light circuit is shorted.

TROUBLE SYMPTOM:
- ABS warning light remains on.
- NO TROUBLE CODE displayed on the select monitor.

NOTE:
When the ABS warning light is OFF and “NO TROUBLE CODE” is displayed on the select monitor, the system is in normal condition.

WIRING DIAGRAM:



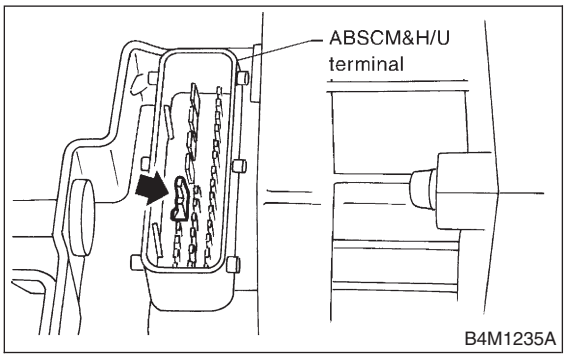
10D1 : CHECK WIRING HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector (F2) from connector (B100).
3) Turn ignition switch to ON.

CHECK : ***Does the ABS warning light remain off?***
YES : Go to step **10D2**.
NO : Repair front wiring harness.

10D2 : CHECK PROJECTION AT ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Check for broken projection at the ABSCM&H/U terminal.

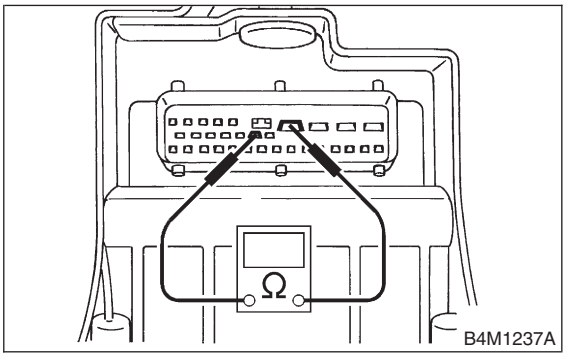


CHECK : ***Are the projection broken?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10D3**.

10D3 : CHECK ABSCM&H/U.

Measure resistance between ABSCM&H/U terminals.

Terminals
No. 21 — No. 23:

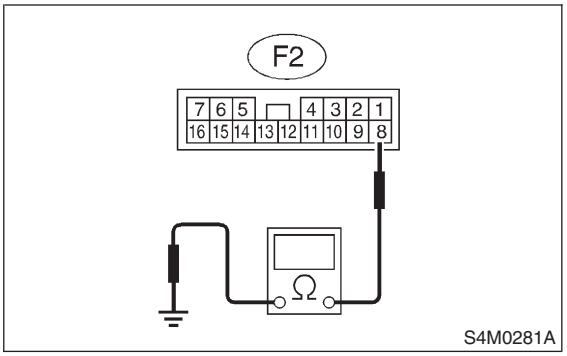


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10D4**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10D4 : CHECK WIRING HARNESS.

Measure resistance between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 — Chassis ground:

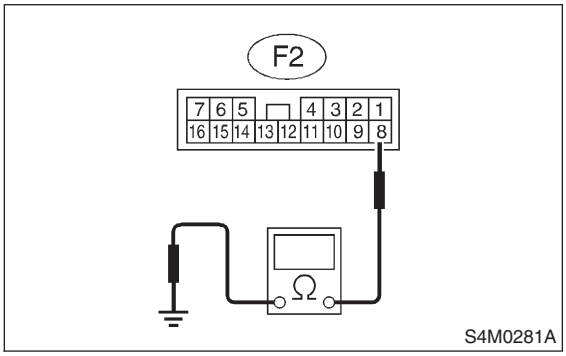


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10D5**.
NO : Repair harness.

10D5 : CHECK WIRING HARNESS.

1) Connect connector to ABSCM&H/U.
2) Measure resistance between connector (F2) and chassis ground.

Connector & terminal
(F2) No. 8 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10D6**.
NO : Repair harness.

10D6 : CHECK POOR CONTACT IN ABSCM&H/U CONNECTOR.

CHECK : ***Is there poor contact in ABSCM&H/U connector? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

MEMO:

E: TROUBLE CODE 21 OPEN OR SHORT CIRCUIT IN FRONT RIGHT ABS SENSOR CIRCUIT

F: TROUBLE CODE 23 OPEN OR SHORT CIRCUIT IN FRONT LEFT ABS SENSOR CIRCUIT

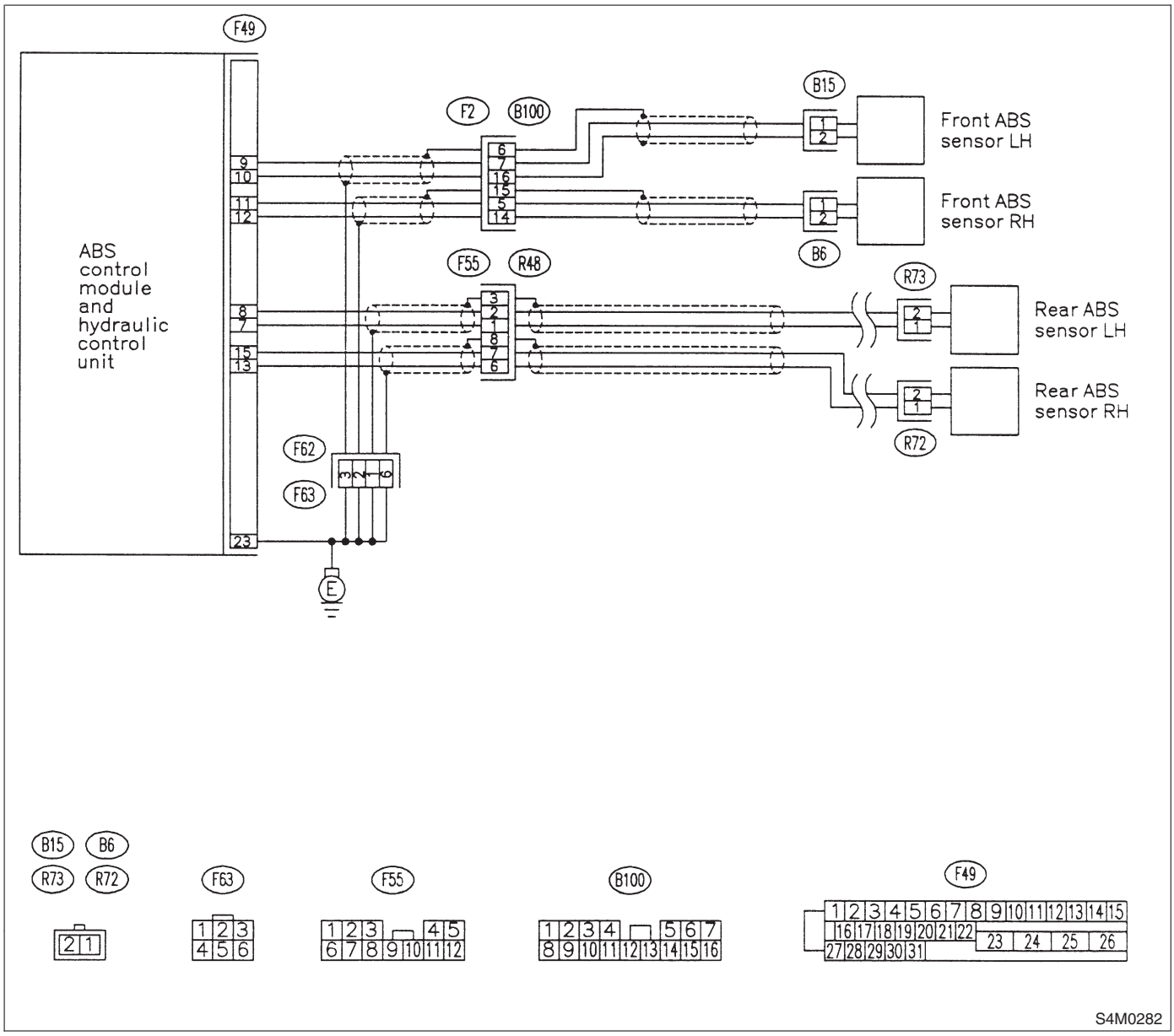
G: TROUBLE CODE 25 OPEN OR SHORT CIRCUIT IN REAR RIGHT ABS SENSOR CIRCUIT

H: TROUBLE CODE 27 OPEN OR SHORT CIRCUIT IN REAR LEFT ABS SENSOR CIRCUIT
— ABNORMAL ABS SENSOR (OPEN OR SHORT CIRCUIT IN ABS SENSOR CIRCUIT) —

DIAGNOSIS:
- Faulty ABS sensor (Broken wire, input voltage too high)
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10H1 : CHECK OUTPUT OF ABS SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read the ABS sensor output corresponding to the faulty system in the select monitor data display mode.

CHECK : ***Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?***
YES : Go to step **10H2**.
NO : Go to step **10H9**.

10H2 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***
YES : Go to step **10H3**.
NO : Tighten ABS sensor installation bolts securely.

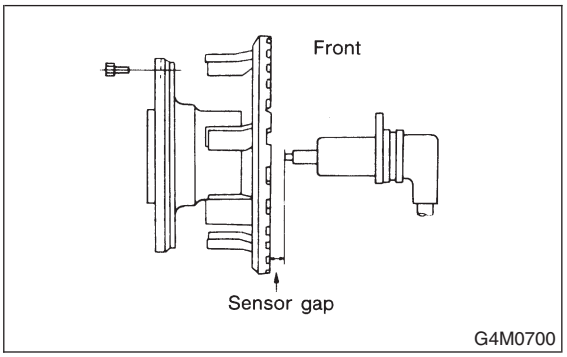
10H3 : CHECK INSTALLATION OF TONE WHEEL.

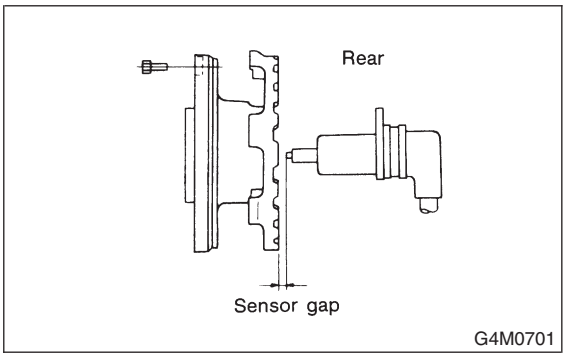
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

CHECK : ***Are the tone wheel installation bolts tightened securely?***
YES : Go to step **10H4**.
NO : Tighten tone wheel installation bolts securely.

10H4 : CHECK ABS SENSOR GAP.

Measure tone wheel-to-pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***
YES : Go to step **10H5**.
NO : Adjust the gap.

NOTE:
Adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

10H5 : CHECK HUB RUNOUT.

Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **10H6**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>

10H6 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10H7**.

10H7 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10H8**.

10H8 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

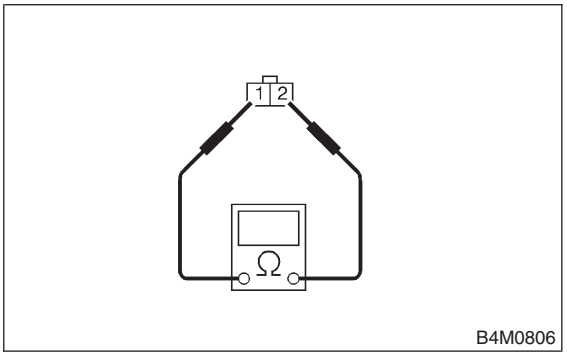
NO : A temporary poor contact.

NOTE:
Check harness and connectors between ABSCM&H/U and ABS sensor.

10H9 : CHECK ABS SENSOR.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABS sensor.
3) Measure resistance of ABS sensor connector terminals.

Terminal
Front RH No. 1 — No. 2:
Front LH No. 1 — No. 2:
Rear RH No. 1 — No. 2:
Rear LH No. 1 — No. 2:



CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***

YES : Go to step **10H10**.

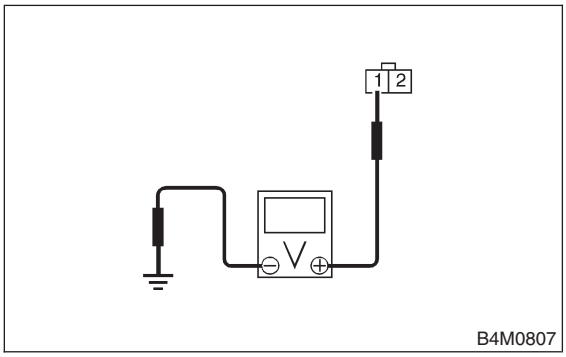
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

10H10 : CHECK BATTERY SHORT OF ABS SENSOR.

1) Disconnect connector from ABSCM&H/U.
2) Measure voltage between ABS sensor and chassis ground.

Terminal

Front RH No. 1 (+) — Chassis ground (–):
Front LH No. 1 (+) — Chassis ground (–):
Rear RH No. 1 (+) — Chassis ground (–):
Rear LH No. 1 (+) — Chassis ground (–):



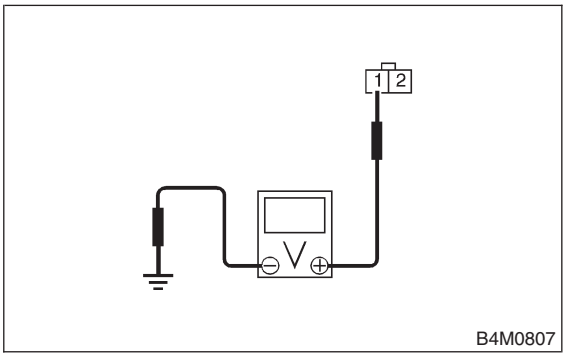
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10H11**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

10H11 : CHECK BATTERY SHORT OF ABS SENSOR.

1) Turn ignition switch to ON.
2) Measure voltage between ABS sensor and chassis ground.

Terminal

Front RH No. 1 (+) — Chassis ground (–):
Front LH No. 1 (+) — Chassis ground (–):
Rear RH No. 1 (+) — Chassis ground (–):
Rear LH No. 1 (+) — Chassis ground (–):



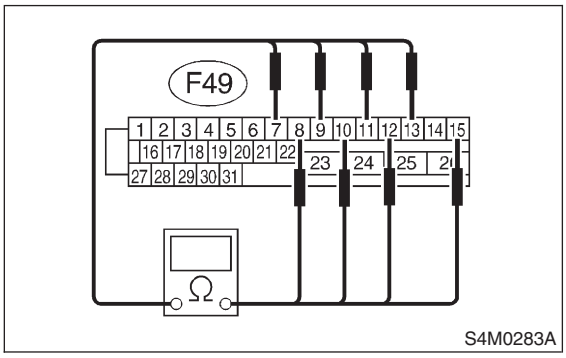
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10H12**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

10H12 : CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR.

1) Turn ignition switch to OFF.
2) Connect connector to ABS sensor.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal

Trouble code 21 / (F49) No. 11 — No. 12:
Trouble code 23 / (F49) No. 9 — No. 10:
Trouble code 25 / (F49) No. 13 — No. 15:
Trouble code 27 / (F49) No. 7 — No. 8:



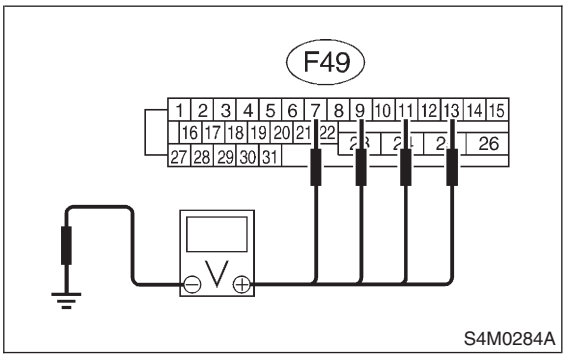
CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **10H13**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

10H13 : CHECK BATTERY SHORT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal

Trouble code 21 / (F49) No. 11 (+) — Chassis ground (–):
Trouble code 23 / (F49) No. 9 (+) — Chassis ground (–):
Trouble code 25 / (F49) No. 13 (+) — Chassis ground (–):
Trouble code 27 / (F49) No. 7 (+) — Chassis ground (–):

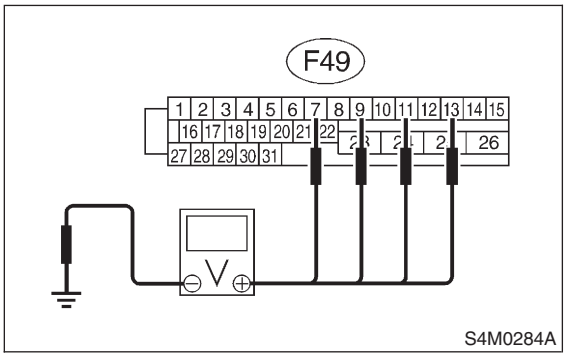


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10H14**.
NO : Repair harness between ABSCM&H/U and ABS sensor.

10H14 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
Trouble code 21 / (F49) No. 11 (+) — Chassis ground (–):
Trouble code 23 / (F49) No. 9 (+) — Chassis ground (–):
Trouble code 25 / (F49) No. 13 (+) — Chassis ground (–):
Trouble code 27 / (F49) No. 7 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10H15**.
NO : Repair harness between ABSCM&H/U and ABS sensor.

10H15 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***
YES : Go to step **10H16**.
NO : Tighten ABS sensor installation bolts securely.

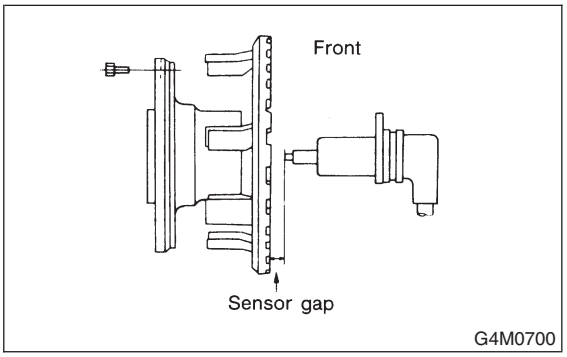
10H16 : CHECK INSTALLATION OF TONE WHEEL.

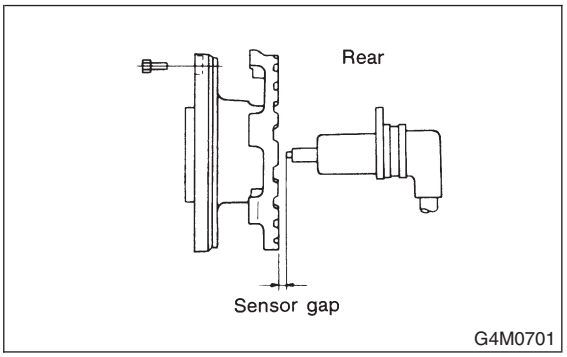
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

CHECK : ***Are the tone wheel installation bolts tightened securely?***
YES : Go to step **10H17**.
NO : Tighten tone wheel installation bolts securely.

10H17 : CHECK ABS SENSOR GAP.

Measure tone wheel-to-pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specificationss?***
YES : Go to step **10H18**.
NO : Adjust the gap.

NOTE:
Adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

10H18 : CHECK HUB RUNOUT.

Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***

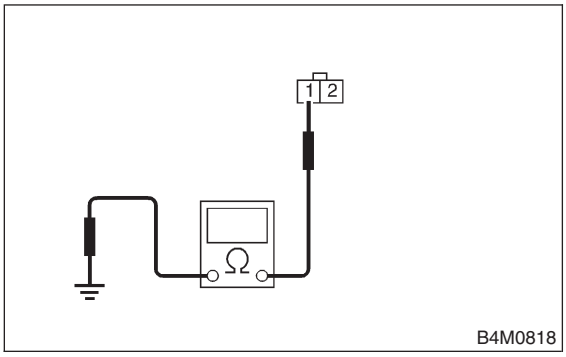
YES : Go to step **10H19**.

NO : Repair hub. <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>

10H19 : CHECK GROUND SHORT OF ABS SENSOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ABS sensor and chassis ground.

Terminal
Front RH No. 1 — Chassis ground:
Front LH No. 1 — Chassis ground:
Rear RH No. 1 — Chassis ground:
Rear LH No. 1 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***

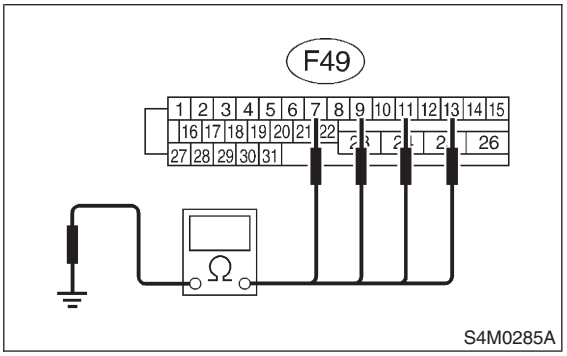
YES : Go to step **10H20**.

NO : Replace ABS sensor and ABSCM&H/U. <Ref. to 4-4 [W13A0].> and <Ref. to 4-4 [W14A0].>

10H20 : CHECK GROUND SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Connect connector to ABS sensor.
3) Measure resistance between ABSCM&H/U connector terminal and chassis ground.

Connector & terminal
Trouble code 21 / (F49) No. 11 — Chassis ground:
Trouble code 23 / (F49) No. 9 — Chassis ground:
Trouble code 25 / (F49) No. 13 — Chassis ground:
Trouble code 27 / (F49) No. 7 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***

YES : Go to step **10H21**.

NO : Repair harness between ABSCM&H/U and ABS sensor.
And replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10H21 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10H22**.

10H22 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10H23**.

10H23 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

NOTE:
Check harness and connectors between ABSCM&H/U and ABS sensor.

MEMO:

I: TROUBLE CODE 22 FRONT RIGHT ABS SENSOR ABNORMAL SIGNAL

J: TROUBLE CODE 24 FRONT LEFT ABS SENSOR ABNORMAL SIGNAL

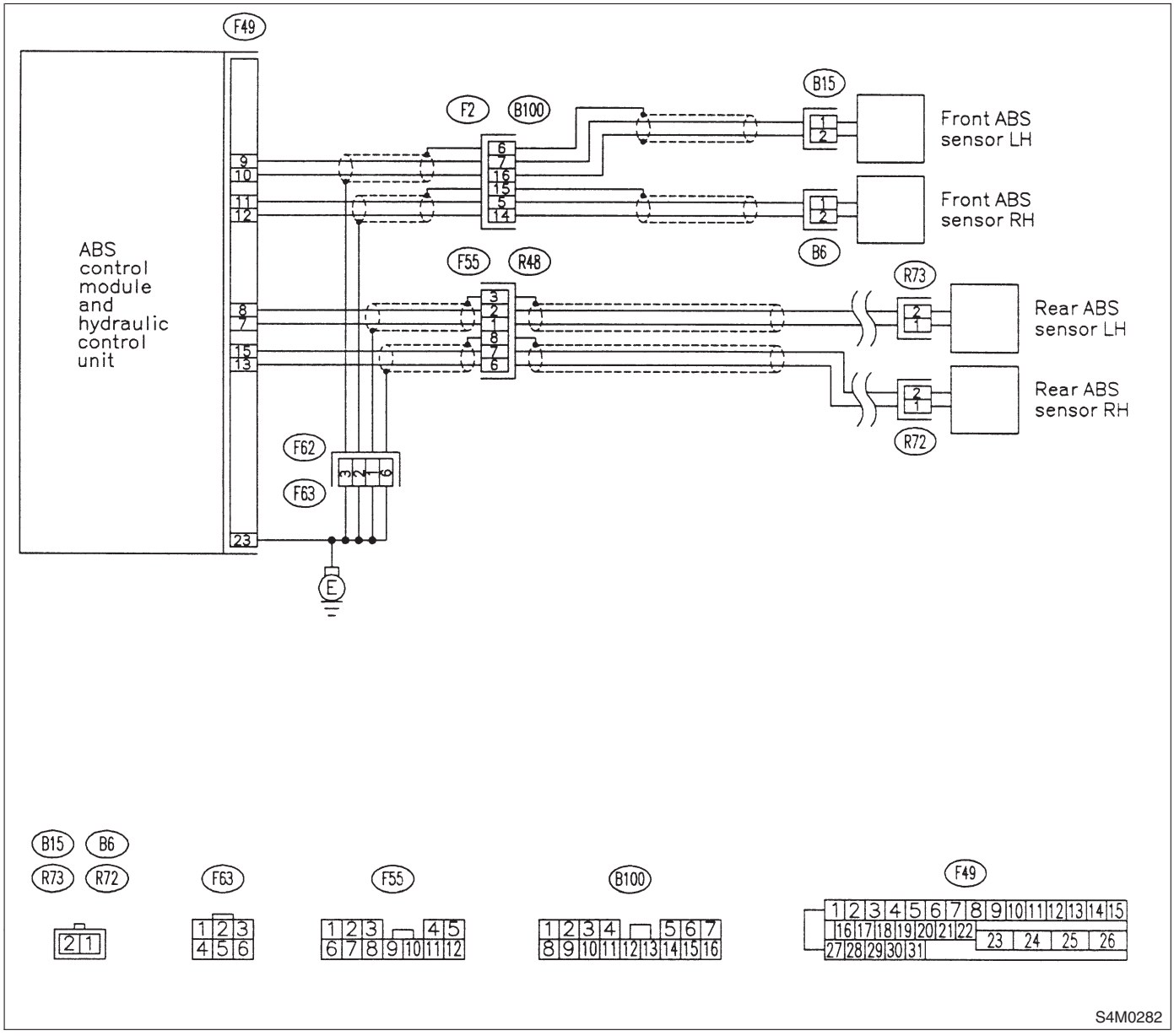
K: TROUBLE CODE 26 REAR RIGHT ABS SENSOR ABNORMAL SIGNAL

L: TROUBLE CODE 28 REAR LEFT ABS SENSOR ABNORMAL SIGNAL — ABNORMAL ABS SENSOR (ABS SENSOR ABNORMAL SIGNAL) —

DIAGNOSIS:
- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty harness/connector

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10L1 : CHECK OUTPUT OF ABS SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read the ABS sensor output corresponding to the faulty system in the select monitor data display mode.

CHECK : ***Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?***
YES : Go to step **10L2**.
NO : Go to step **10L8**.

10L2 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor?***
YES : Repair connector.
NO : Go to step **10L3**.

10L3 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Is the car telephone or the wireless transmitter properly installed?***
YES : Go to step **10L4**.
NO : Properly install the car telephone or the wireless transmitter.

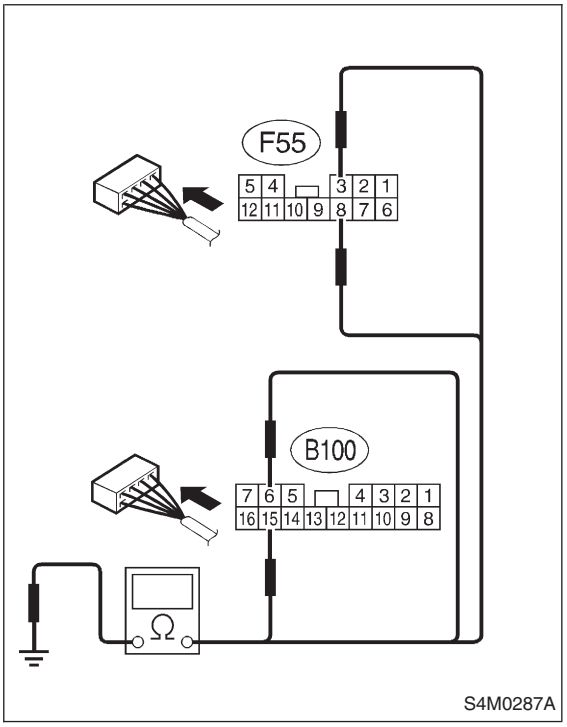
10L4 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Are noise sources (such as an antenna) installed near the sensor harness?***
YES : Install the noise sources apart from the sensor harness.
NO : Go to step **10L5**.

10L5 : CHECK SHIELD CIRCUIT.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Measure resistance between shield connector and chassis ground.

Connector & terminal
Trouble code 22 / (B100) No. 15 — Chassis ground:
Trouble code 24 / (B100) No. 6 — Chassis ground:
Trouble code 26 / (F55) No. 8 — Chassis ground:
Trouble code 28 / (F55) No. 3 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10L6**.
NO : Repair shield harness.

10L6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10L7**.

10L7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary noise interference.

10L8 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***
YES : Go to step **10L9**.
NO : Tighten ABS sensor installation bolts securely.

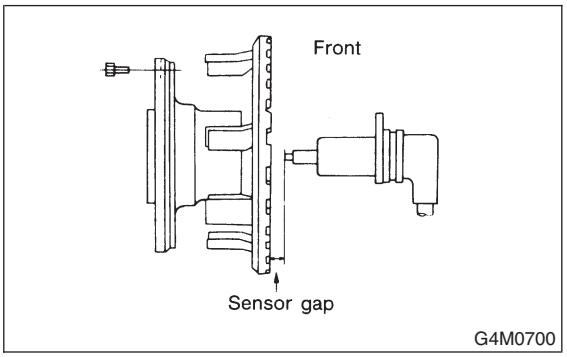
10L9 : CHECK INSTALLATION OF TONE WHEEL.

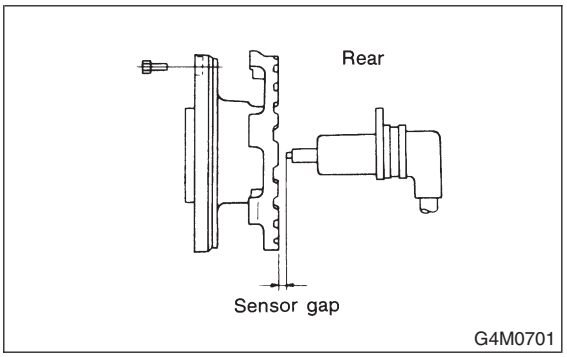
Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

CHECK : ***Are the tone wheel installation bolts tightened securely?***
YES : Go to step **10L10**.
NO : Tighten tone wheel installation bolts securely.

10L10 : CHECK ABS SENSOR GAP.

Measure tone wheel to pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***
YES : Go to step **10L11**.
NO : Adjust the gap.

NOTE:
Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

10L11 : PREPARE OSCILLOSCOPE.

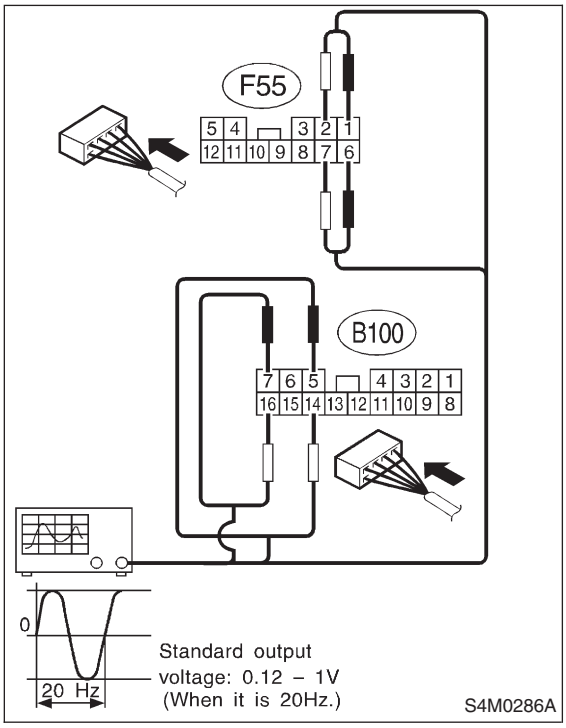
CHECK : ***Is an oscilloscope available?***
YES : Go to step **10L12**.
NO : Go to step **10L13**.

10L12 : CHECK ABS SENSOR SIGNAL.

1) Raise all four wheels of ground.
2) Turn ignition switch OFF.
3) Connect the oscilloscope to the connector in accordance with trouble code.
4) Turn ignition switch ON.
5) Rotate wheels and measure voltage at specified frequency.

NOTE:
When this inspection is completed, the ABSCM&H/U sometimes stores the trouble code 29.

Connector & terminal
Trouble code 22 / (B100) No. 5 (+) — No. 14 (–):
Trouble code 24 / (B100) No. 7 (+) — No. 16 (–):
Trouble code 26 / (F55) No. 6 (+) — No. 7 (–):
Trouble code 28 / (F55) No. 1 (+) — No. 2 (–):
Specified voltage: 0.12 — 1 V (When it is 20 Hz.)



CHECK : ***Is oscilloscope pattern smooth, as shown in figure?***
YES : Go to step **10L16**.
NO : Go to step **10L13**.

10L13 : CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL.

Remove disc rotor or drum from hub in accordance with trouble code.

CHECK : ***Is the ABS sensor pole piece or the tone wheel contaminated by dirt or other foreign matter?***
YES : Thoroughly remove dirt or other foreign matter.
NO : Go to step **10L14**.

10L14 : CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.

CHECK : ***Are there broken or damaged in the ABS sensor pole piece or the tone wheel?***
YES : Replace ABS sensor or tone wheel. <Ref. to 4-4 [W13A0].>, <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>
NO : Go to step **10L15**.

10L15 : CHECK HUB RUNOUT.

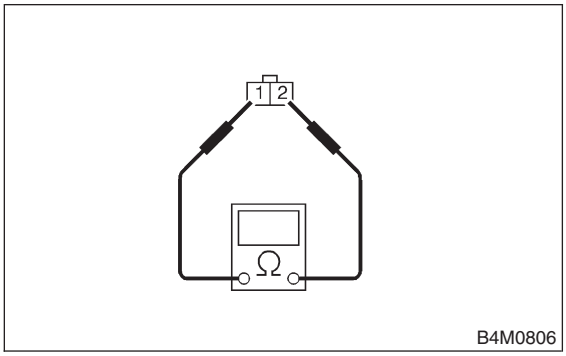
Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **10L16**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> and <Ref. to 4-2 [W2A0].>

10L16 : CHECK RESISTANCE OF ABS SENSOR.

1) Turn ignition switch OFF.
2) Disconnect connector from ABS sensor.
3) Measure resistance between ABS sensor connector terminals.

Terminal
Front RH No. 1 — No. 2:
Front LH No. 1 — No. 2:
Rear RH No. 1 — No. 2:
Rear LH No. 1 — No. 2:

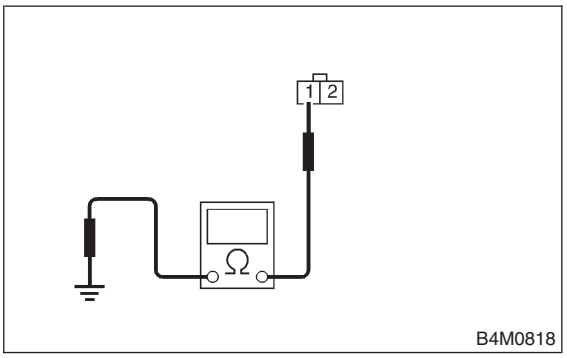


CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **10L17**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

10L17 : CHECK GROUND SHORT OF ABS SENSOR.

Measure resistance between ABS sensor and chassis ground.

Terminal
Front RH No. 1 — Chassis ground:
Front LH No. 1 — Chassis ground:
Rear RH No. 1 — Chassis ground:
Rear LH No. 1 — Chassis ground:

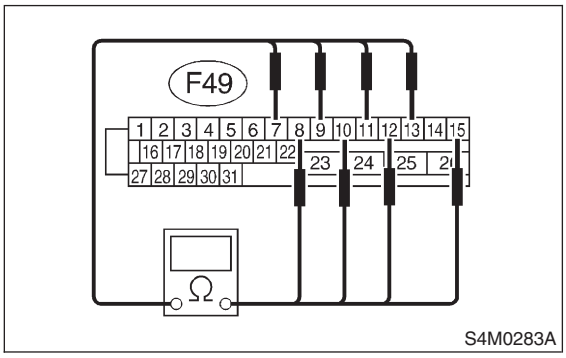


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10L18**.
NO : Replace ABS sensor. <Ref. to 4-4 [W13A0].>

10L18 : CHECK HARNESS/CONNECTOR BETWEEN ABSCM&H/U AND ABS SENSOR.

1) Connect connector to ABS sensor.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance at ABSCM&H/U connector terminals.

Connector & terminal
Trouble code 22 / (F49) No. 11 — No. 12:
Trouble code 24 / (F49) No. 9 — No. 10:
Trouble code 26 / (F49) No. 13 — No. 15:
Trouble code 28 / (F49) No. 7 — No. 8:

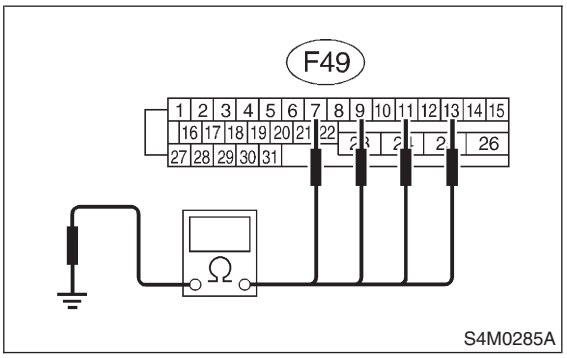


CHECK : ***Is the resistance between 0.8 and 1.2 kΩ?***
YES : Go to step **10L19**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

10L19 : CHECK GROUND SHORT OF HARNESS.

Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
Trouble code 22 / (F49) No. 11 — Chassis ground:
Trouble code 24 / (F49) No. 9 — Chassis ground:
Trouble code 26 / (F49) No. 13 — Chassis ground:
Trouble code 28 / (F49) No. 7 — Chassis ground:

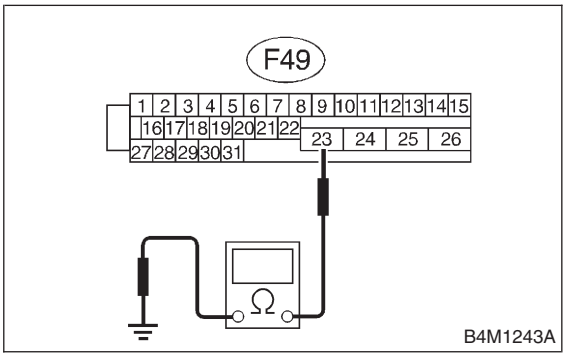


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10L20**.
NO : Repair harness/connector between ABSCM&H/U and ABS sensor.

10L20 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

Measure resistance between ABSCM&H/U and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10L21**.
NO : Repair ABSCM&H/U ground harness.

10L21 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between ABSCM&H/U and ABS sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10L22**.

10L22 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Is the car telephone or the wireless transmitter properly installed?***
YES : Go to step **10L23**.
NO : Properly install the car telephone or the wireless transmitter.

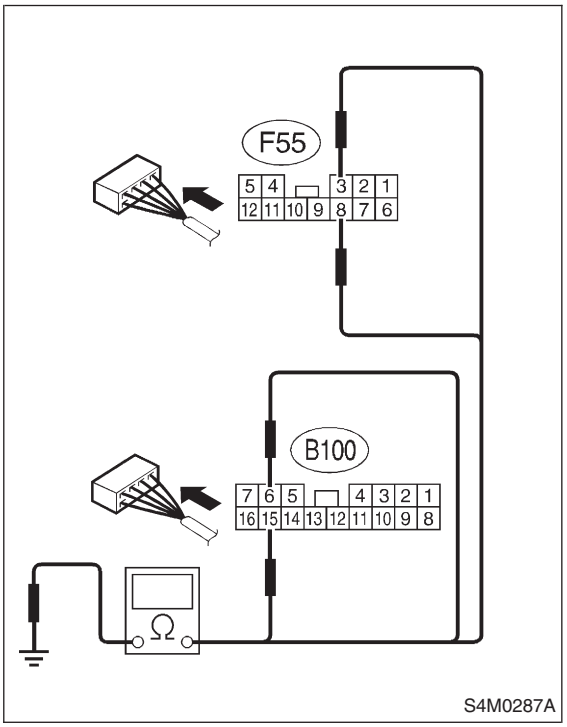
10L23 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Are noise sources (such as an antenna) installed near the sensor harness?***
YES : Install the noise sources apart from the sensor harness.
NO : Go to step **10L24**.

10L24 : CHECK SHIELD CIRCUIT.

1) Connect all connectors.
2) Measure resistance between shield connector and chassis ground.

Connector & terminal
Trouble code 22 / (B100) No. 15 — Chassis ground:
Trouble code 24 / (B100) No. 6 — Chassis ground:
Trouble code 26 / (F55) No. 8 — Chassis ground:
Trouble code 28 / (F55) No. 3 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10L25**.
NO : Repair shield harness.

10L25 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10L26**.

10L26 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

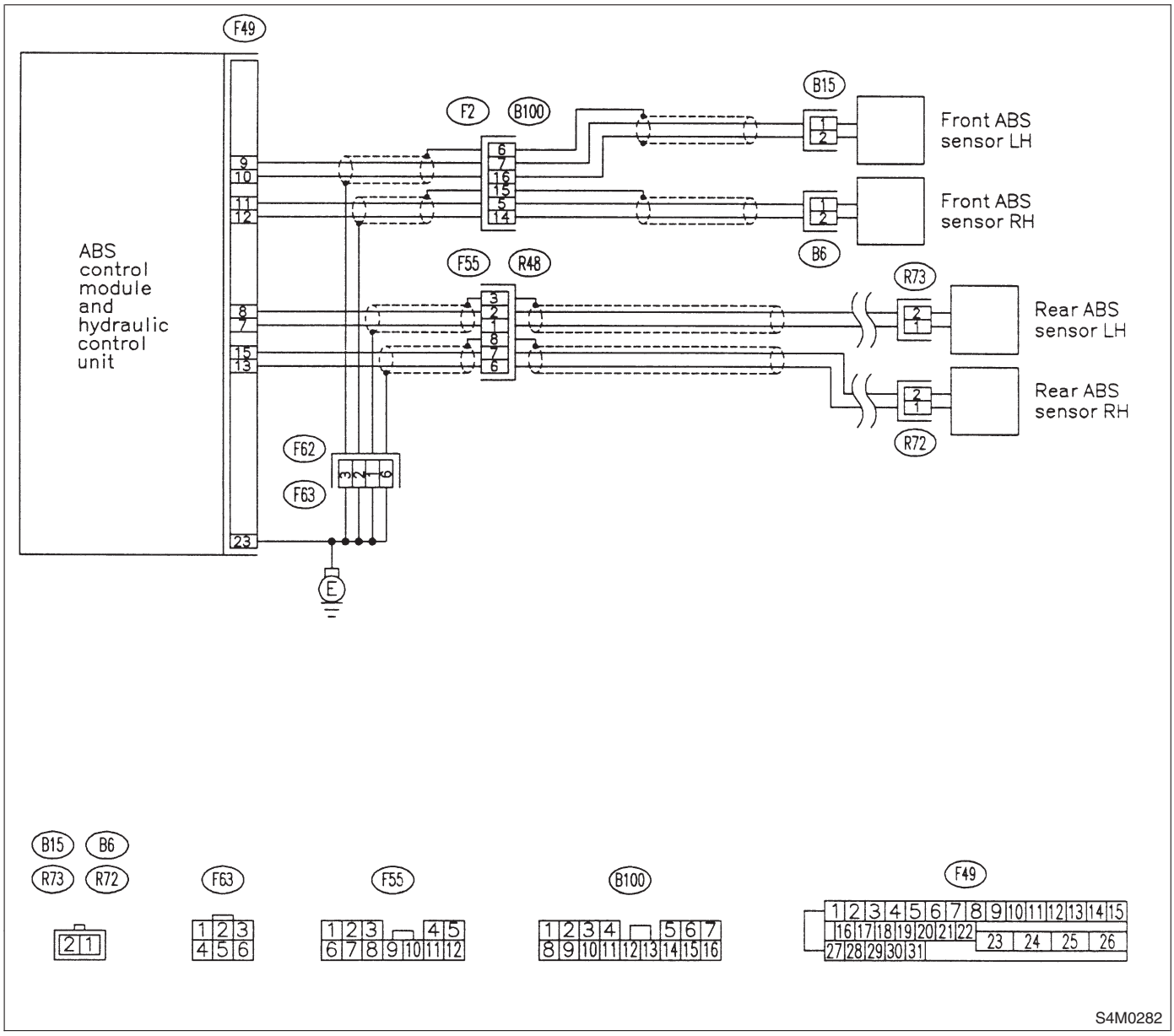
NO : A temporary noise interference.

M: TROUBLE CODE 29 ABNORMAL ABS SENSOR SIGNAL ON ANY ONE OF FOUR SENSOR
— ABNORMAL ABS SENSOR SIGNAL ON ANY ONE OF FOUR —

DIAGNOSIS:
- Faulty ABS sensor signal (noise, irregular signal, etc.)
- Faulty tone wheel
- Wheels turning freely for a long time

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10M1 : CHECK IF THE WHEELS HAVE TURNED FREELY FOR A LONG TIME.

CHECK : ***Check if the wheels have been turned freely for more than one minute, such as when the vehicle is jacked-up, under full-lock cornering or when tire is not in contact with road surface.***

YES : The ABS is normal. Erase the trouble code. <Ref. to 4-4 [T9A4].>

NOTE:
When the wheels turn freely for a long time, such as when the vehicle is towed or jacked-up, or when steering wheel is continuously turned all the way, this trouble code may sometimes occur.

NO : Go to step **10M2**.

10M2 : CHECK TIRE SPECIFICATIONS.

Turn ignition switch to OFF.

CHECK : ***Are the tire specifications correct?***

YES : Go to step **10M3**.

NO : Replace tire. <Ref. to 4-2 [W900].>

10M3 : CHECK WEAR OF TIRE.

CHECK : ***Is the tire worn excessively?***

YES : Replace tire. <Ref. to 4-2 [W900].>

NO : Go to step **10M4**.

10M4 : CHECK TIRE PRESSURE.

CHECK : ***Is the tire pressure correct?***

YES : Go to step **10M5**.

NO : Adjust tire pressure.

10M5 : CHECK INSTALLATION OF ABS SENSOR.

Tightening torque:
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)

CHECK : ***Are the ABS sensor installation bolts tightened securely?***

YES : Go to step **10M6**.

NO : Tighten ABS sensor installation bolts securely.

10M6 : CHECK INSTALLATION OF TONE WHEEL.

Tightening torque:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

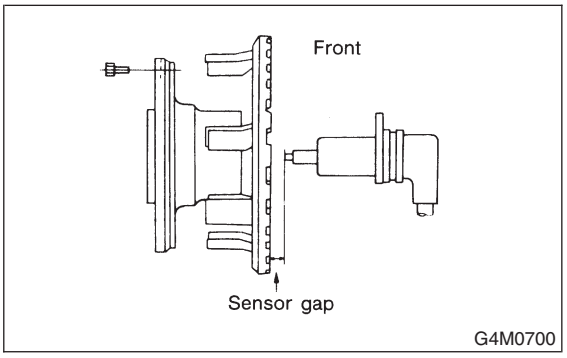
CHECK : ***Are the tone wheel installation bolts tightened securely?***

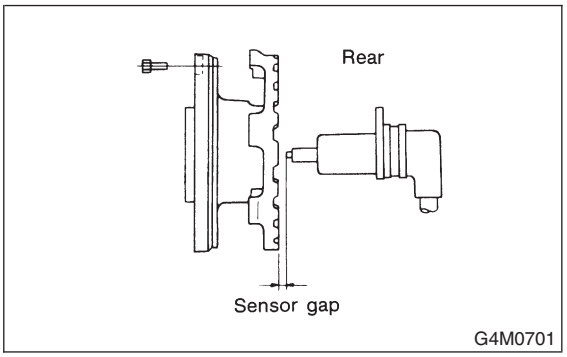
YES : Go to step **10M7**.

NO : Tighten tone wheel installation bolts securely.

10M7 : CHECK ABS SENSOR GAP.

Measure tone wheel to pole piece gap over entire perimeter of the wheel.





	Front wheel	Rear wheel
Specifications	0.9 — 1.4 mm (0.035 — 0.055 in)	0.7 — 1.2 mm (0.028 — 0.047 in)

CHECK : ***Is the gap within the specifications?***

YES : Go to step **10M8**.

NO : Adjust the gap.

NOTE:
Adjust the gap using spacer (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.

10M8 : PREPARE OSCILLOSCOPE.

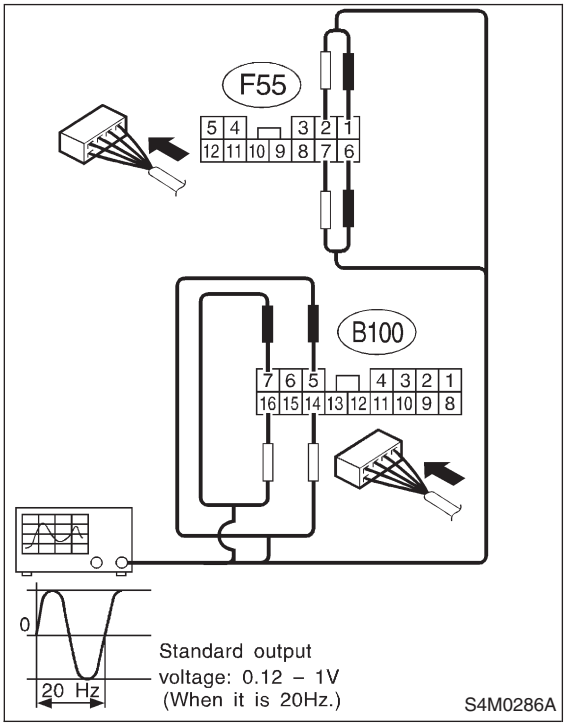
CHECK : ***Is an oscilloscope available?***
YES : Go to step **10M9**.
NO : Go to step **10M10**.

10M9 : CHECK ABS SENSOR SIGNAL.

1) Raise all four wheels of ground.
2) Turn ignition switch OFF.
3) Connect the oscilloscope to the connector.
4) Turn ignition switch ON.
5) Rotate wheels and measure voltage at specified frequency.

NOTE:
When this inspection is completed, the ABSCM&H/U sometimes stores the trouble code 29.

Connector & terminal
(B100) No. 5 (+) — No. 14 (–) (Front RH):
(B100) No. 7 (+) — No. 16 (–) (Front LH):
(F55) No. 6 (+) — No. 7 (–) (Rear RH):
(F55) No. 1 (+) — No. 2 (–) (Rear LH):
Specified voltage: 0.12 — 1 V (When it is 20 Hz.)



CHECK : ***Is oscilloscope pattern smooth, as shown in figure?***
YES : Go to step **10M13**.
NO : Go to step **10M10**.

10M10 : CHECK CONTAMINATION OF ABS SENSOR OR TONE WHEEL.

Remove disc rotor from hub.

CHECK : ***Is the ABS sensor pole piece or the tone wheel contaminated by dirt or other foreign matter?***
YES : Thoroughly remove dirt or other foreign matter.
NO : Go to step **10M11**.

10M11 : CHECK DAMAGE OF ABS SENSOR OR TONE WHEEL.

CHECK : ***Are there broken or damaged teeth in the ABS sensor pole piece or the tone wheel?***
YES : Replace ABS sensor or tone wheel. <Ref. to 4-4 [W13A0].>, <Ref. to 4-2 [W1A0].> or <Ref. to 4-2 [W2A0].>
NO : Go to step **10M12**.

10M12 : CHECK HUB RUNOUT.

Measure hub runout.

CHECK : ***Is the runout less than 0.05 mm (0.0020 in)?***
YES : Go to step **10M13**.
NO : Repair hub. <Ref. to 4-2 [W1A0].> and <Ref. to 4-2 [W2A0].>

10M13 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10M14**.

10M14 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

N: TROUBLE CODE 31 FRONT RIGHT INLET VALVE MALFUNCTION

O: TROUBLE CODE 33 FRONT LEFT INLET VALVE MALFUNCTION

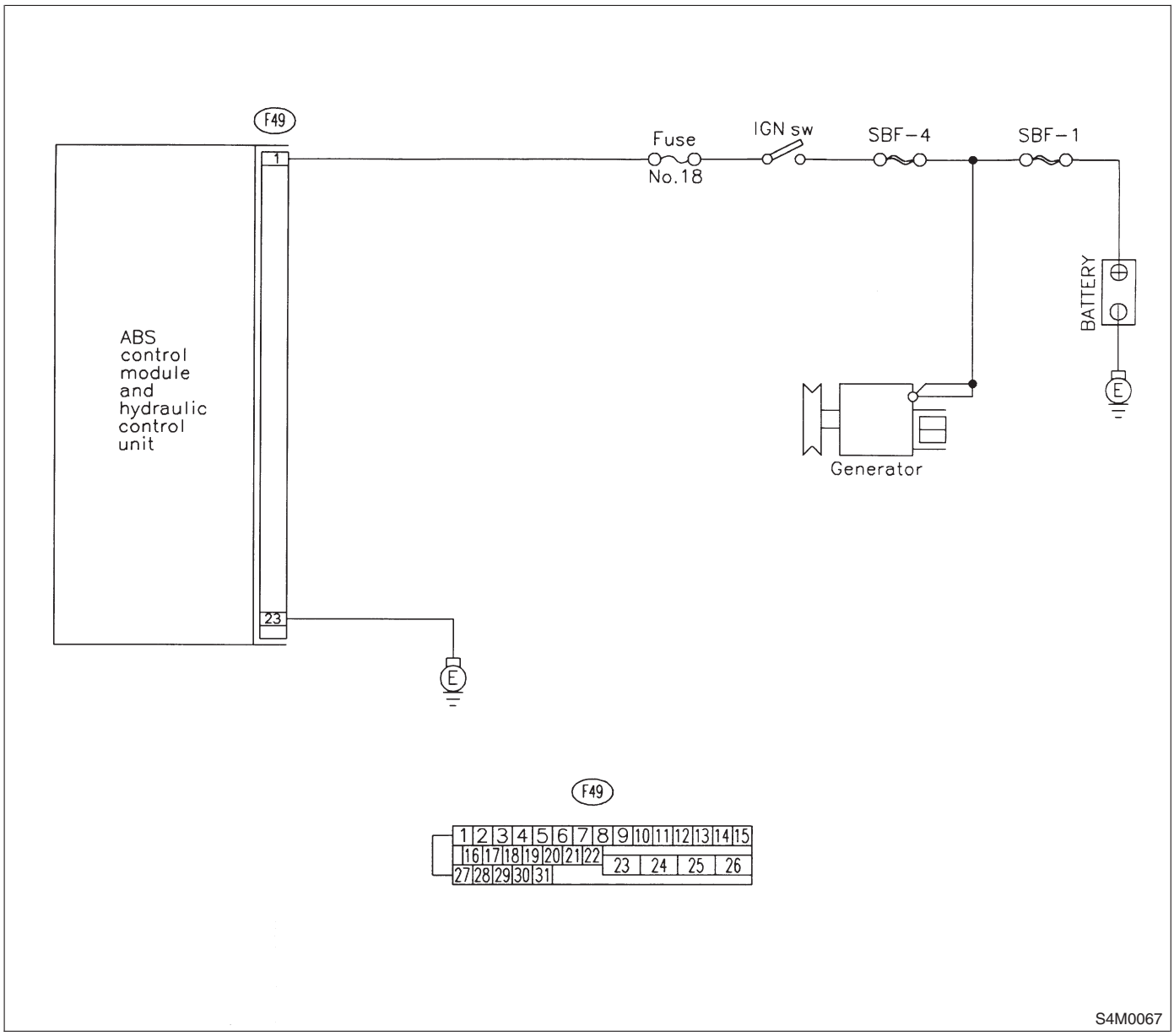
P: TROUBLE CODE 35 REAR RIGHT INLET VALVE MALFUNCTION

Q: TROUBLE CODE 37 REAR LEFT INLET VALVE MALFUNCTION — INLET SOLENOID VALVE MALFUNCTION —

DIAGNOSIS:
- Faulty harness/connector
- Faulty inlet solenoid valve

TROUBLE SYMPTOM:
- ABS does not operate.

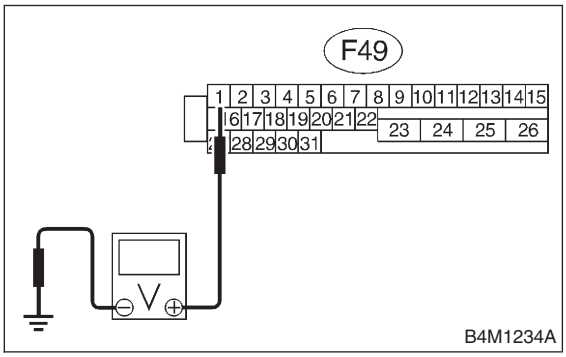
WIRING DIAGRAM:



10Q1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

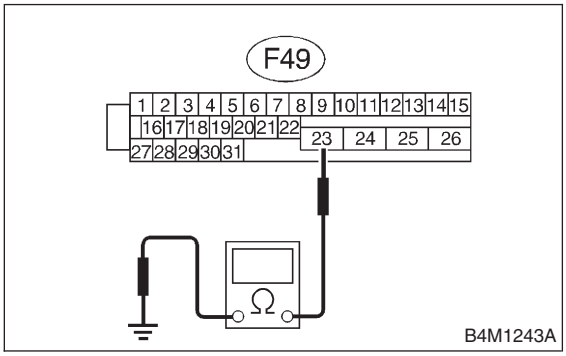


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10Q2**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

10Q2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10Q3**.
NO : Repair ABSCM&H/U ground harness.

10Q3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10Q4**.

10Q4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10Q5**.

10Q5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

R: TROUBLE CODE 32 FRONT RIGHT OUTLET VALVE MALFUNCTION

S: TROUBLE CODE 34 FRONT LEFT OUTLET VALVE MALFUNCTION

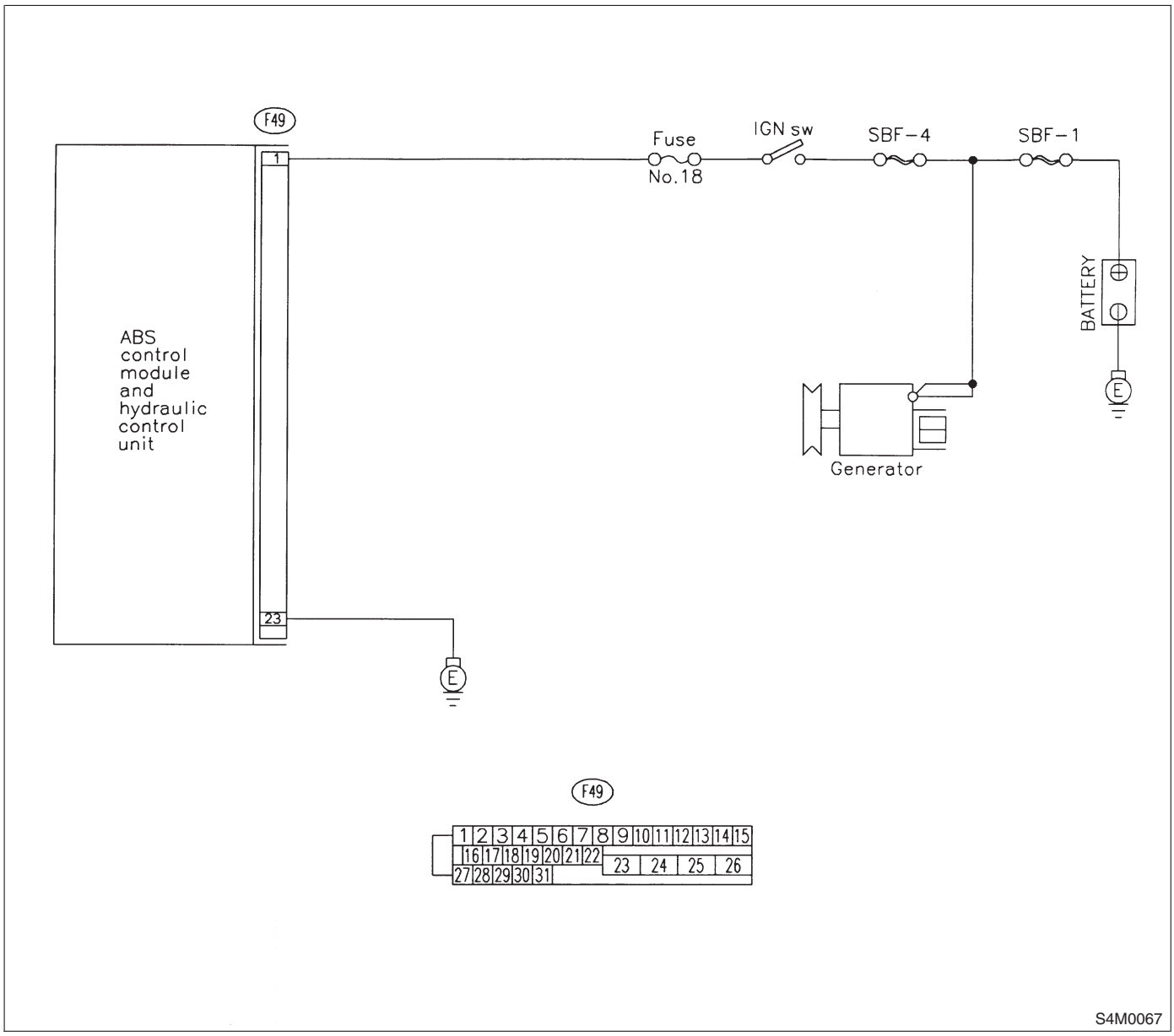
T: TROUBLE CODE 36 REAR RIGHT OUTLET VALVE MALFUNCTION

U: TROUBLE CODE 38 REAR LEFT OUTLET VALVE MALFUNCTION — OUTLET SOLENOID VALVE MALFUNCTION —

DIAGNOSIS:
- Faulty harness/connector
- Faulty outlet solenoid valve

TROUBLE SYMPTOM:
- ABS does not operate.

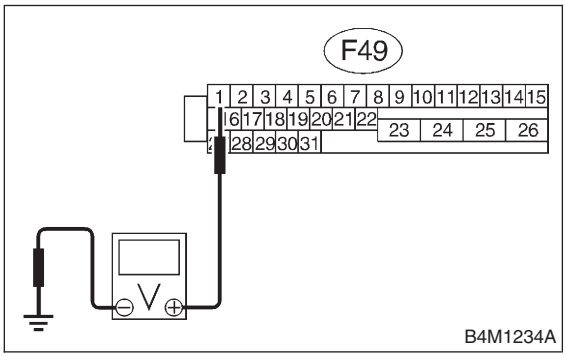
WIRING DIAGRAM:



10U1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

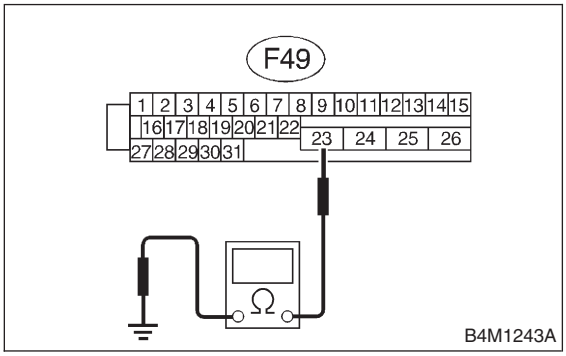


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10U2**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

10U2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10U3**.
NO : Repair ABSCM&H/U ground harness.

10U3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10U4**.

10U4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10U5**.

10U5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

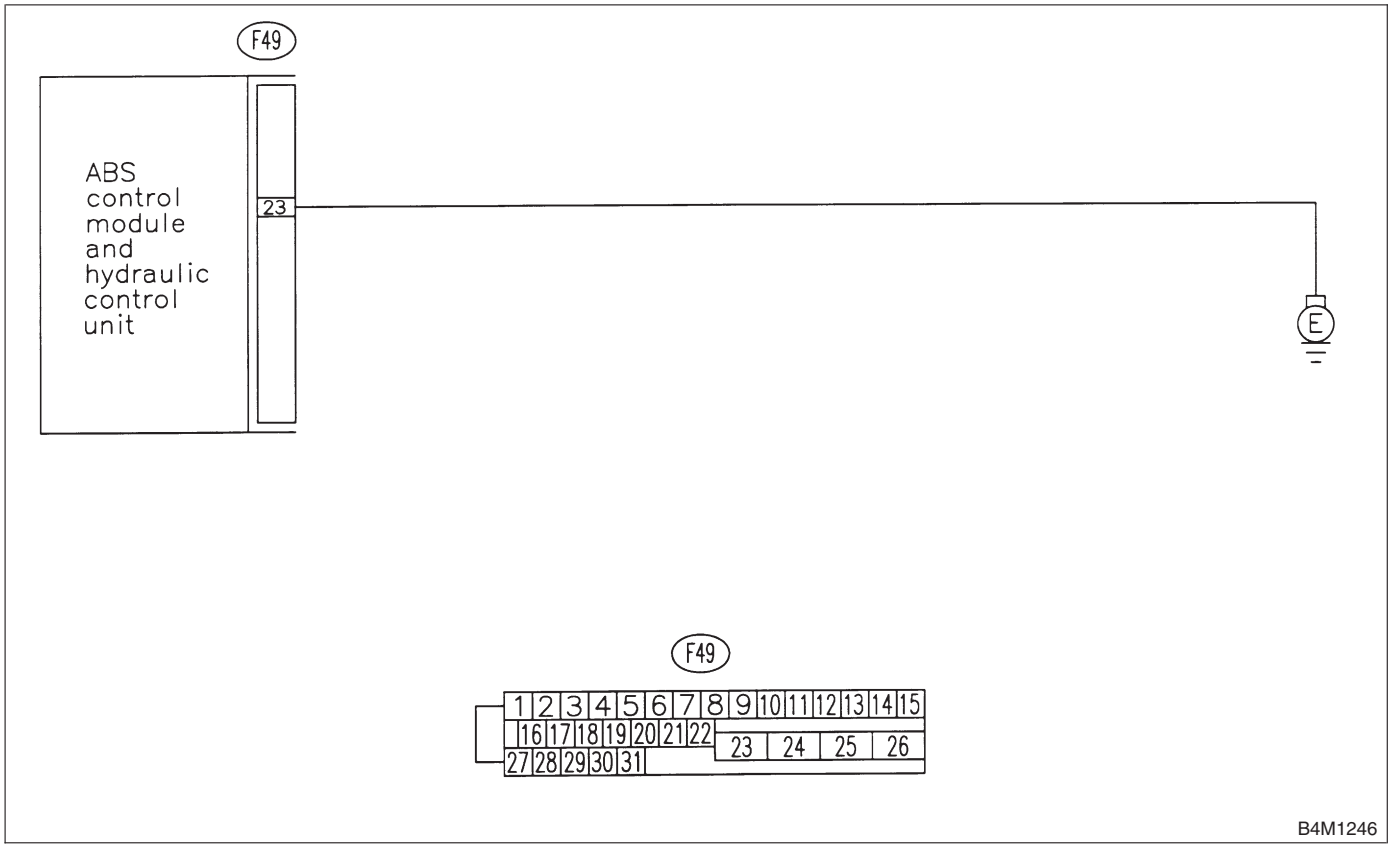
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

V: TROUBLE CODE 41 ABS CONTROL MODULE MALFUNCTION — ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT MALFUNCTION —

DIAGNOSIS:
- Faulty ABSCM&H/U

TROUBLE SYMPTOM:
- ABS does not operate.

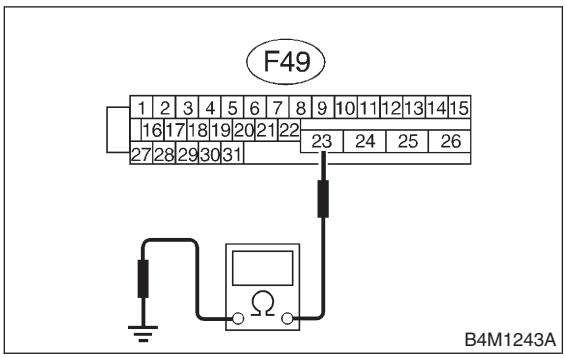
WIRING DIAGRAM:



10V1 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10V2**.
NO : Repair ABSCM&H/U ground harness.

10V2 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between battery, ignition switch and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10V3**.

10V3 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Is the car telephone or the wireless transmitter properly installed?***
YES : Go to step **10V4**.
NO : Properly install the car telephone or the wireless transmitter.

10V4 : CHECK SOURCES OF SIGNAL NOISE.

CHECK : ***Are noise sources (such as an antenna) installed near the sensor harness?***
YES : Install the noise sources apart from the sensor harness.
NO : Go to step **10V5**.

10V5 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10V6**.

10V6 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

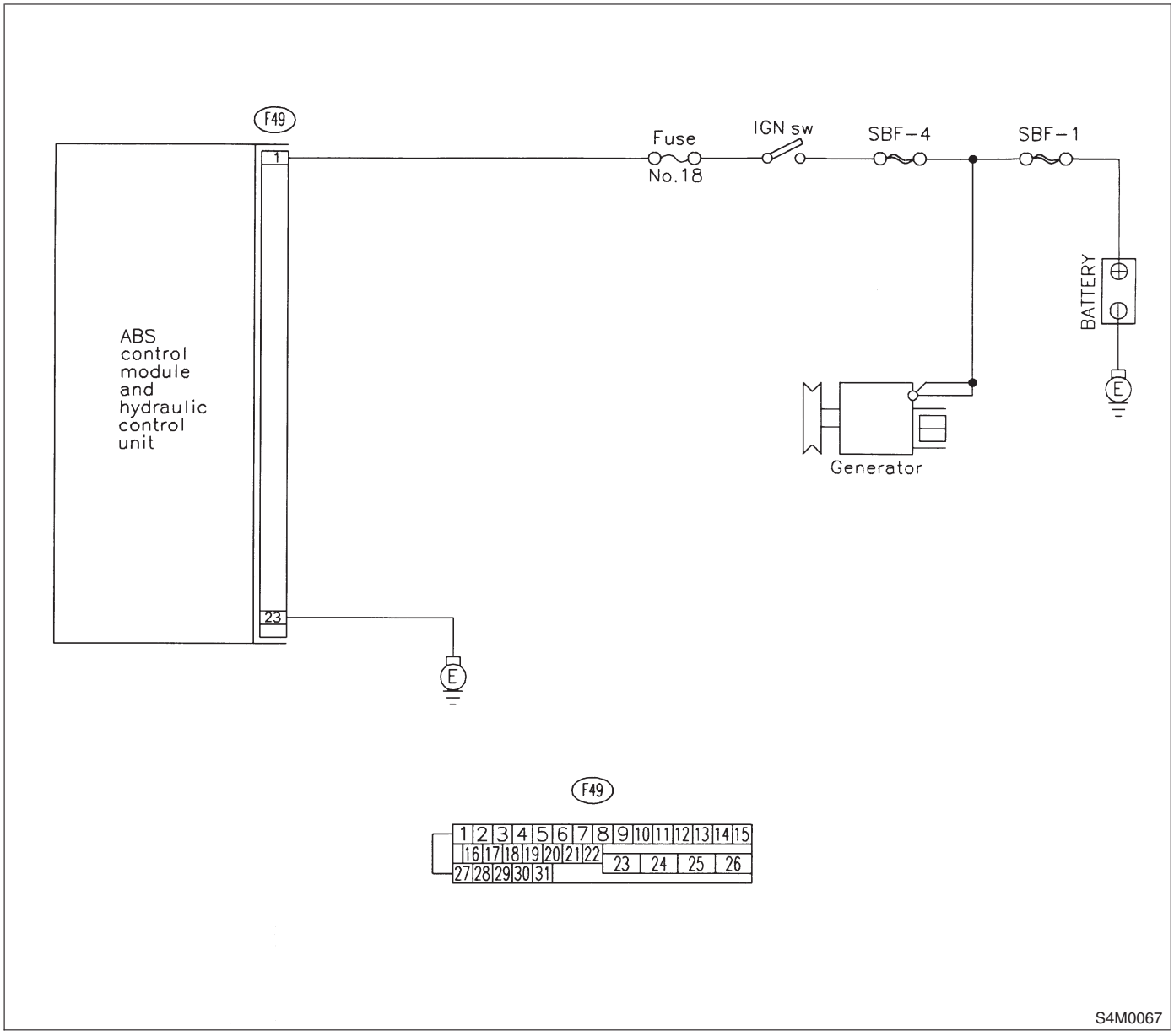
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

W: TROUBLE CODE 42 POWER SUPPLY VOLTAGE TOO LOW — POWER SUPPLY VOLTAGE TOO LOW —

DIAGNOSIS:
- Power source voltage of the ABSCM&H/U is low.

TROUBLE SYMPTOM:
- ABS does not operate.

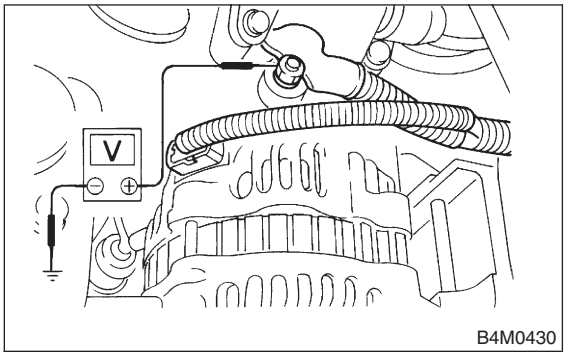
WIRING DIAGRAM:



10W1 : CHECK GENERATOR.

1) Start engine.
2) Idling after warm-up.
3) Measure voltage between generator B terminal and chassis ground.

Terminal
Generator B terminal — Chassis ground:



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10W2**.
NO : Repair generator. <Ref. to 6-1 [W2A0].>

10W2 : CHECK BATTERY TERMINAL.

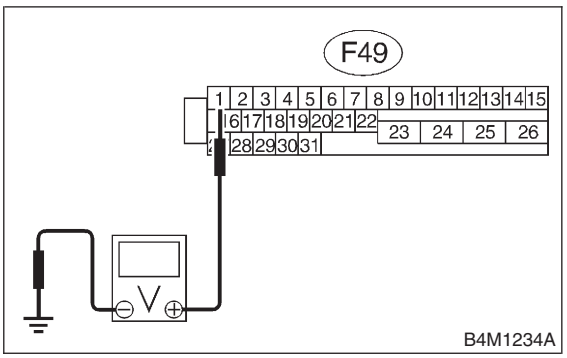
Turn ignition switch to OFF.

CHECK : ***Are the positive and negative battery terminals tightly clamped?***
YES : Go to step **10W3**.
NO : Tighten the clamp of terminal.

10W3 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Disconnect connector from ABSCM&H/U.
2) Run the engine at idle.
3) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

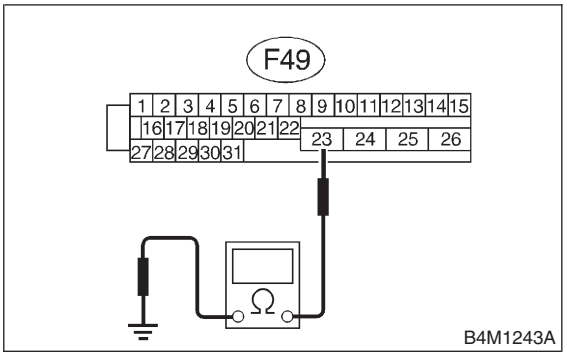


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10W4**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

10W4 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10W5**.
NO : Repair ABSCM&H/U ground harness.

10W5 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10W6**.

10W6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10W7**.

10W7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

MEMO:

X: TROUBLE CODE 42 POWER SUPPLY VOLTAGE TOO HIGH — POWER SUPPLY VOLTAGE TOO HIGH —

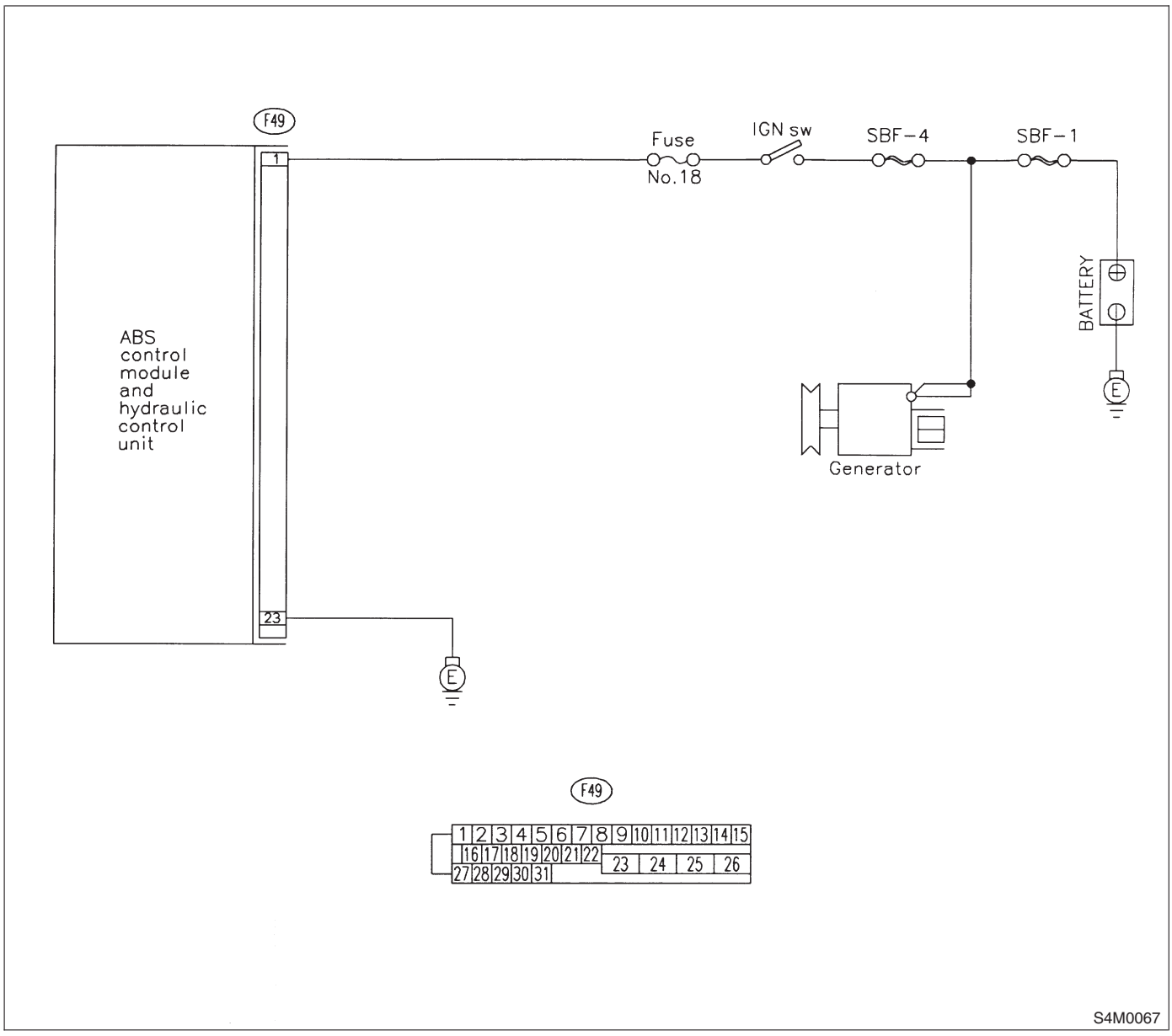
DIAGNOSIS:

- Power source voltage of the ABSCM&H/U is high.

TROUBLE SYMPTOM:

- ABS does not operate.

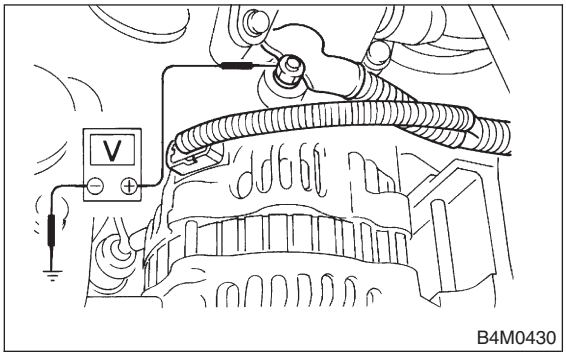
WIRING DIAGRAM:



10X1 : CHECK GENERATOR.

1) Start engine.
2) Idling after warm-up.
3) Measure voltage between generator B terminal and chassis ground.

Terminal
Generator B terminal — Chassis ground:



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10X2**.
NO : Repair generator. <Ref. to 6-1 [W2A0].>

10X2 : CHECK BATTERY TERMINAL.

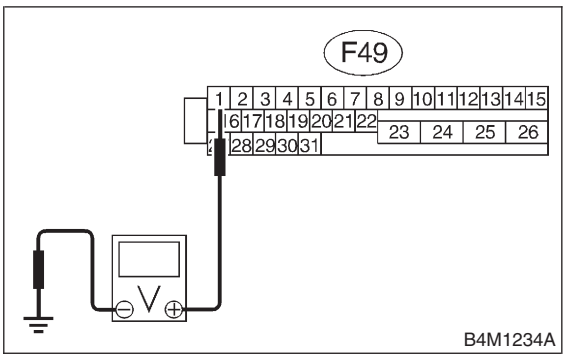
Turn ignition switch to OFF.

CHECK : ***Are the positive and negative battery terminals tightly clamped?***
YES : Go to step **10X3**.
NO : Tighten the clamp of terminal.

10X3 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Disconnect connector from ABSCM&H/U.
2) Run the engine at idle.
3) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

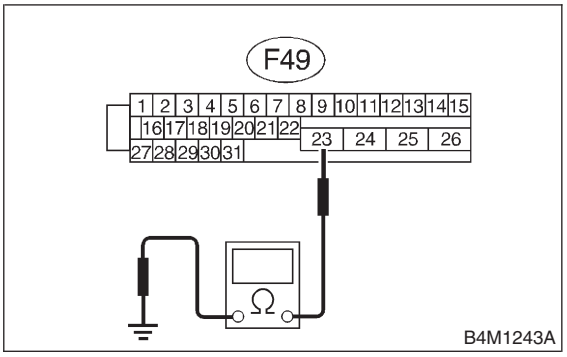


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10X4**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

10X4 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10X5**.
NO : Repair ABSCM&H/U ground harness.

10X5 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10X6**.

10X6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10X7**.

10X7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

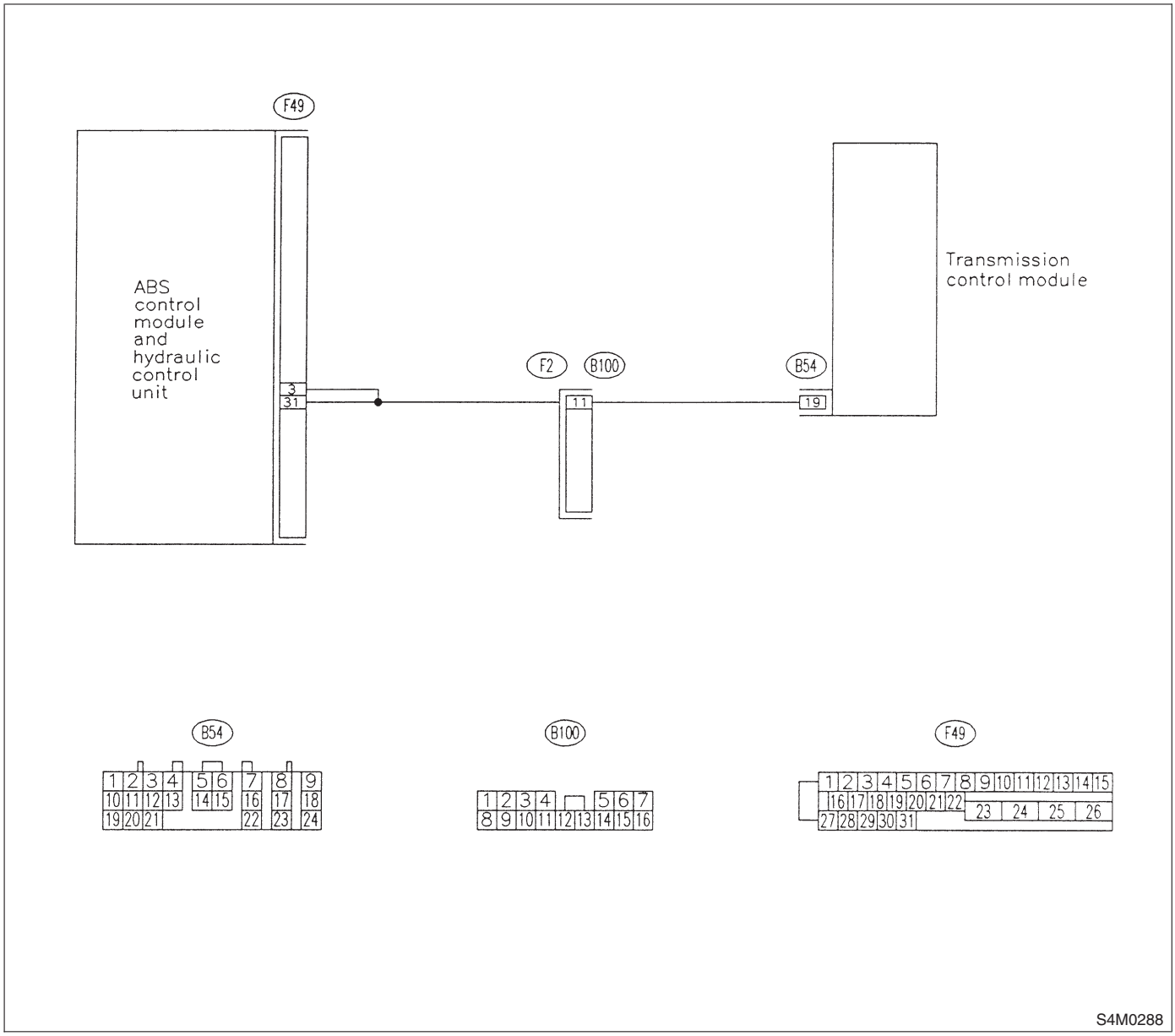
MEMO:

Y: TROUBLE CODE 44 ABS-AT CONTROL (NON CONTROLLED) — ABS-AT CONTROL (NON CONTROLLED) —

DIAGNOSIS:
- Combination of AT control faults

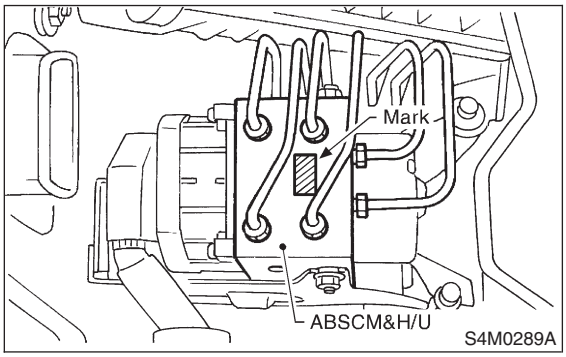
TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10Y1 : CHECK SPECIFICATIONS OF THE ABSCM&H/U.

Check specifications of the mark to the ABSCM&H/U.



Mark	Model
C7	AWD AT
C8	AWD MT

CHECK : ***Is an ABSCM&H/U for AT model installed on a MT model?***

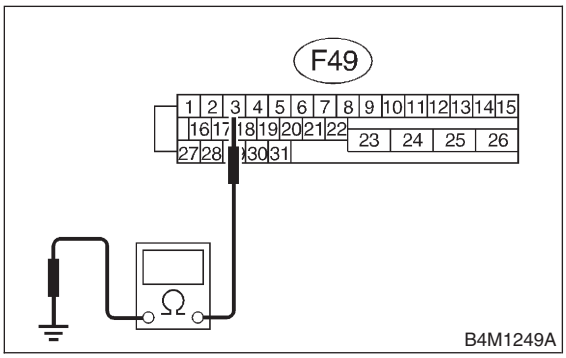
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10Y2**.

10Y2 : CHECK GROUND SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect two connectors from TCM.
3) Disconnect connector from ABSCM&H/U.
4) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 — Chassis ground:



CHECK : ***Is the resistance more than 1 MΩ?***

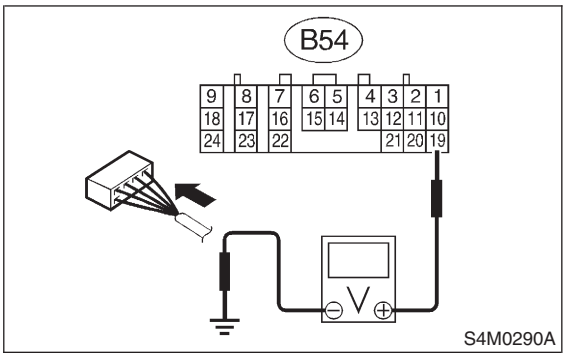
YES : Go to step **10Y3**.

NO : Repair harness between TCM and ABSCM&H/U.

10Y3 : CHECK TCM.

1) Connect all connectors to TCM.
2) Turn ignition switch to ON.
3) Measure voltage between TCM connector terminal and chassis ground.

Connector & terminal
(B54) No. 19 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 6 and 15 V?***

YES : Go to step **10Y5**.

NO : Go to step **10Y4**.

10Y4 : CHECK AT.

CHECK : ***Is the AT functioning normally?***

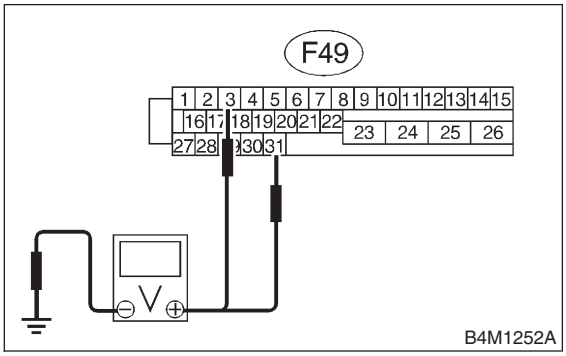
YES : Replace TCM. <Ref. to 3-2 [W23A0].>

NO : Repair AT. <Ref. to 3-2 [T100].>

10Y5 : CHECK OPEN CIRCUIT OF HARNESS.

Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):
(F49) No. 31 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 5.5 and 15 V?***
YES : Go to step **10Y6**.
NO : Repair harness/connector between TCM and ABSCM&H/U.

10Y6 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between TCM and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10Y7**.

10Y7 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10Y8**.

10Y8 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

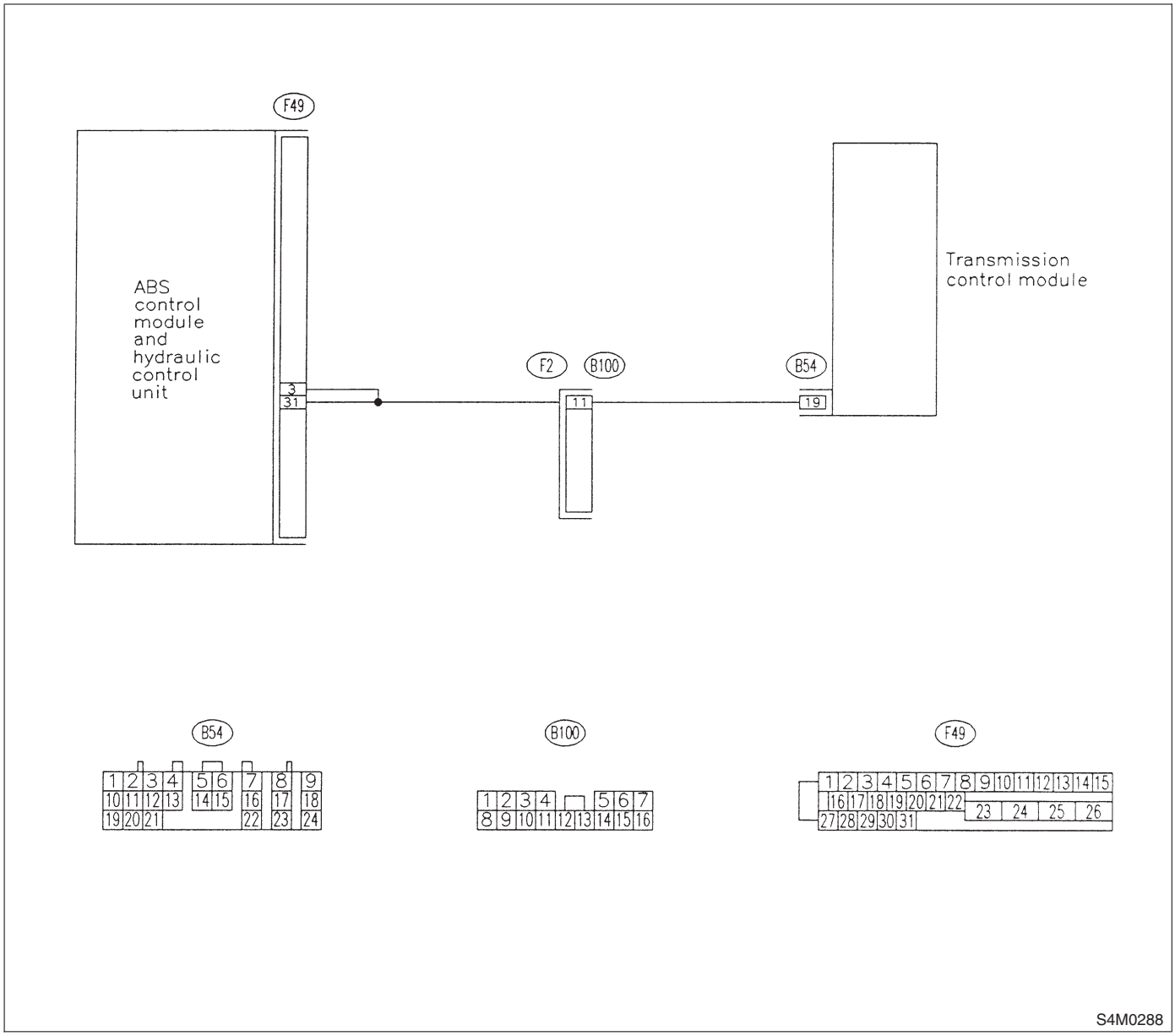
MEMO:

Z: TROUBLE CODE 44 ABS-AT CONTROL (CONTROLLED) — ABS-AT CONTROL (CONTROLLED) —

DIAGNOSIS:
- Combination of AT control faults

TROUBLE SYMPTOM:
- ABS does not operate.

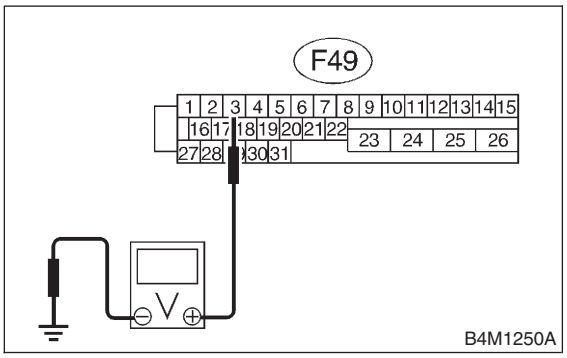
WIRING DIAGRAM:



10Z1 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect two connectors from TCM.
3) Disconnect connector from ABSCM&H/U.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):

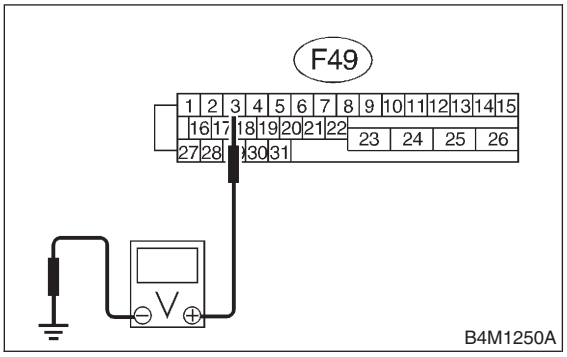


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10Z2**.
NO : Repair harness between TCM and ABSCM&H/U.

10Z2 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):

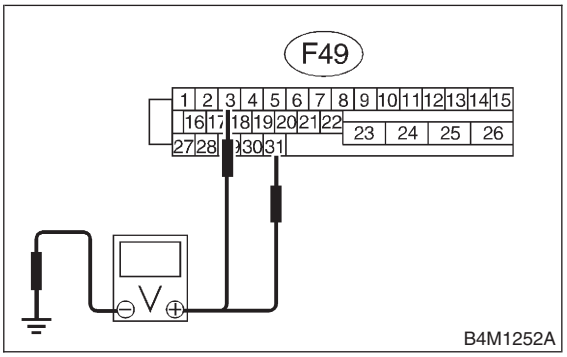


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10Z3**.
NO : Repair harness between TCM and ABSCM&H/U.

10Z3 : CHECK OPEN CIRCUIT OF HARNESS.

1) Turn ignition switch to OFF.
2) Connect all connectors to TCM.
3) Turn ignition switch to ON.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 3 (+) — Chassis ground (–):
(F49) No. 31 (+) — Chassis ground (–):



CHECK : ***Is the voltage between 5.5 and 15 V?***
YES : Go to step **10Z4**.
NO : Repair harness/connector between TCM and ABSCM&H/U.

10Z4 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connectors between TCM and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10Z5**.

10Z5 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10Z6**.

10Z6 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

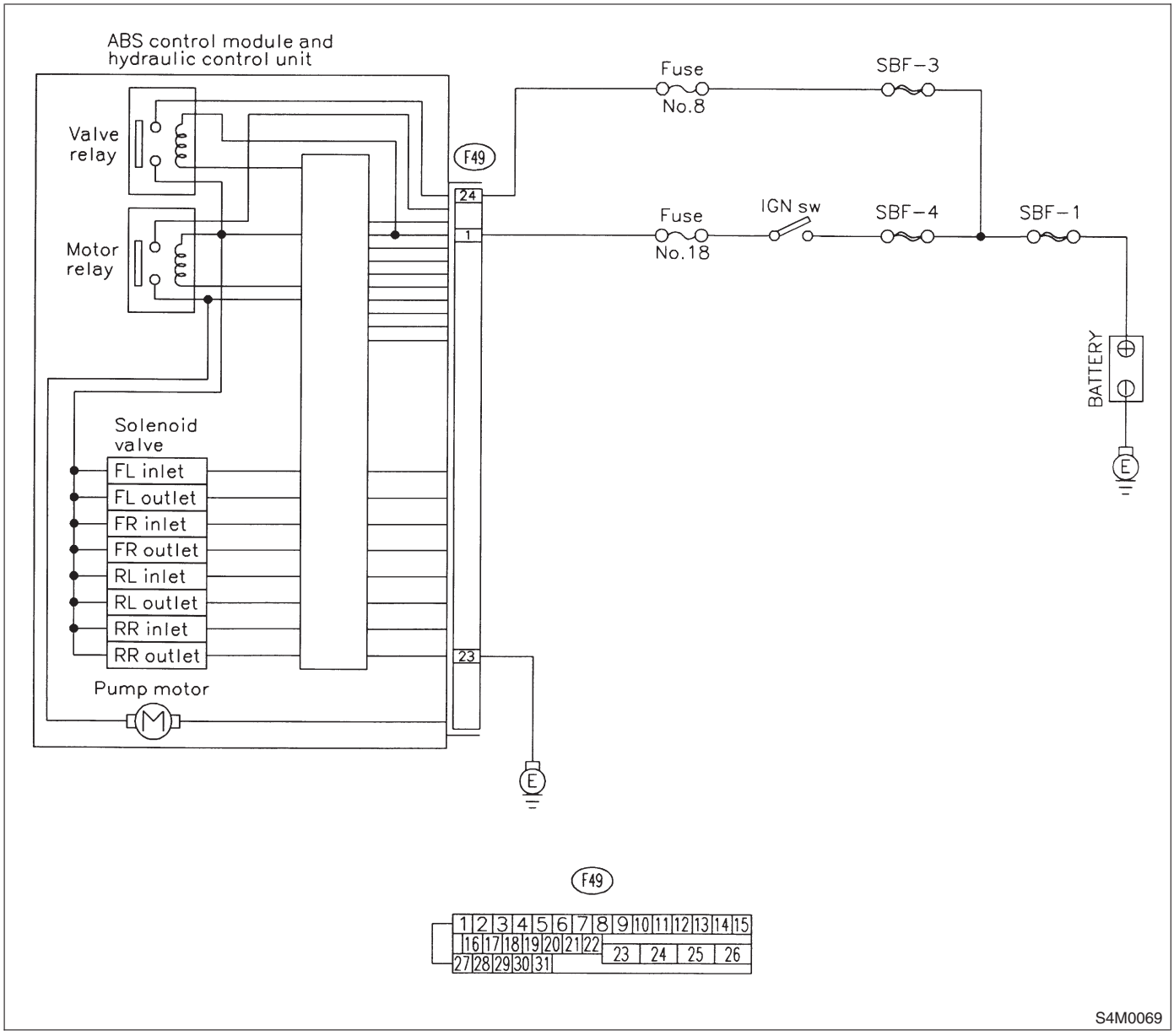
MEMO:

AA: TROUBLE CODE 51 VALVE RELAY MALFUNCTION — VALVE RELAY MALFUNCTION —

DIAGNOSIS:
- Faulty valve relay

TROUBLE SYMPTOM:
- ABS does not operate.

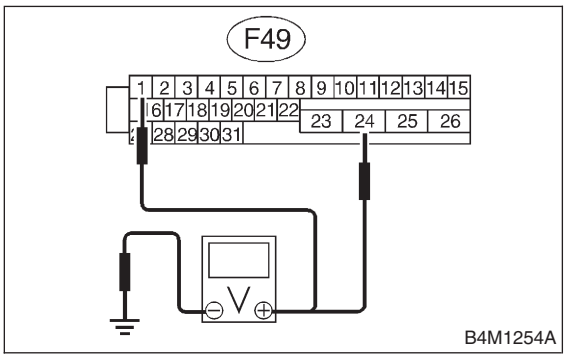
WIRING DIAGRAM:



10AA1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Run the engine at idle.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):
(F49) No. 24 (+) — Chassis ground (–):

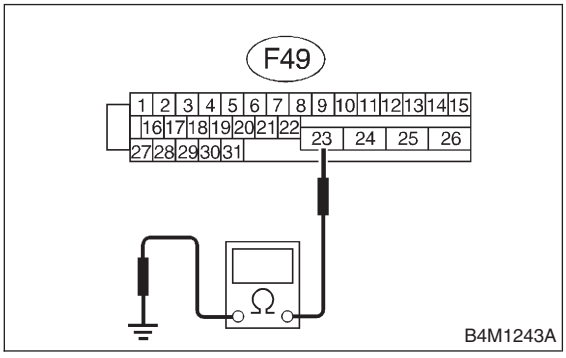


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10AA2**.
NO : Repair harness connector between battery and ABSCM&H/U.

10AA2 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10AA3**.
NO : Repair ABSCM&H/U ground harness.

10AA3 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AA4**.

10AA4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AA5**.

10AA5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

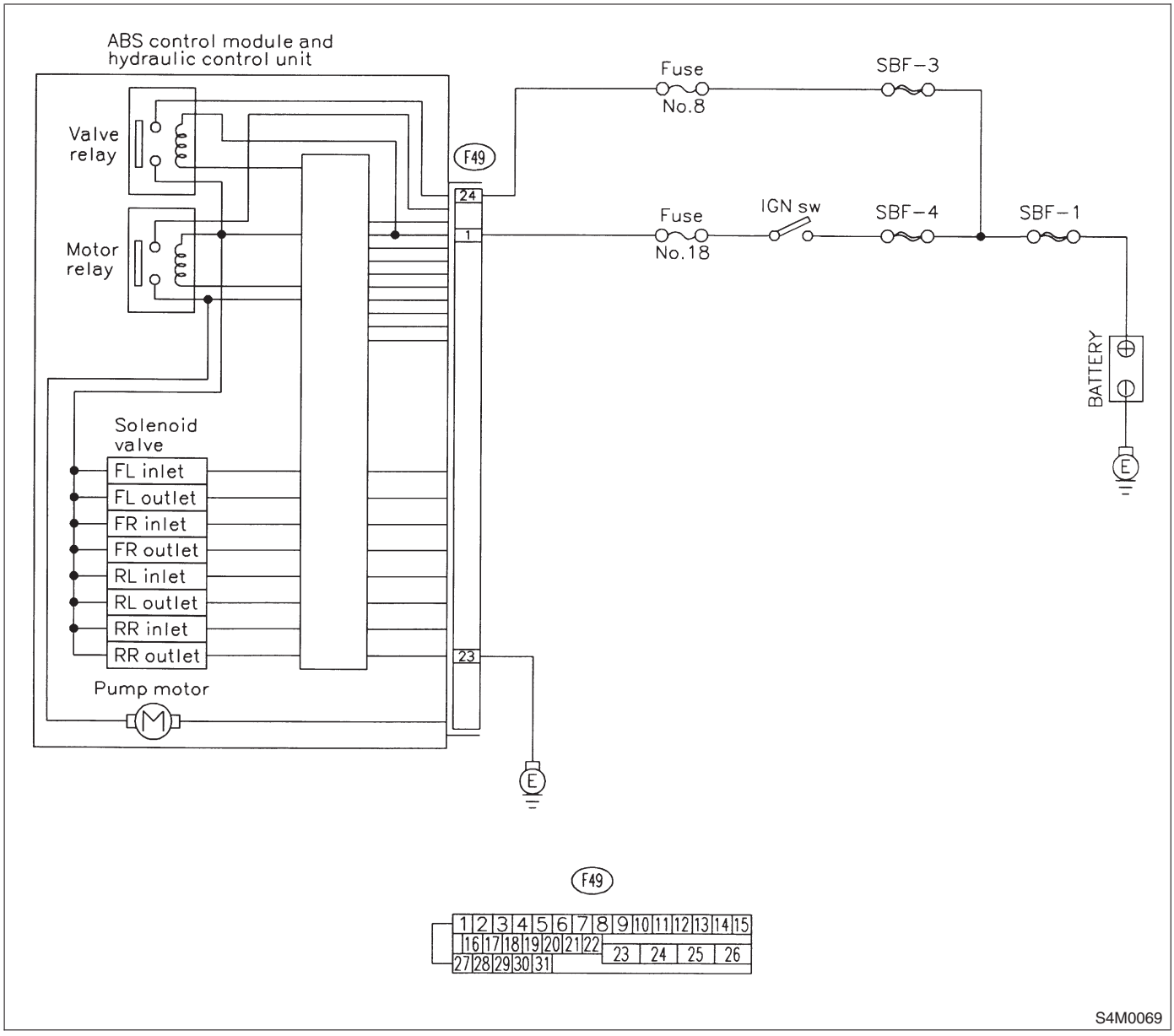
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

AB: TROUBLE CODE 51 VALVE RELAY ON FAILURE — VALVE RELAY ON FAILURE —

DIAGNOSIS:
- Faulty valve relay

TROUBLE SYMPTOM:
- ABS does not operate.

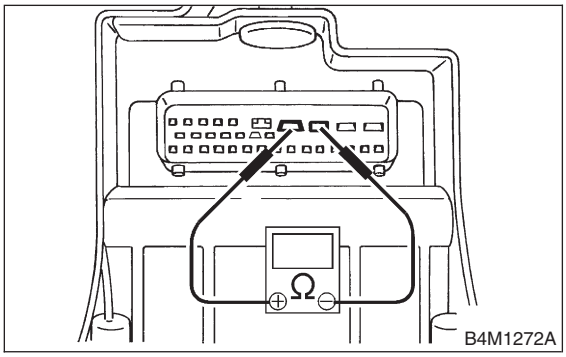
WIRING DIAGRAM:



10AB1 : CHECK VALVE RELAY IN ABSCM&H/U.

Measure resistance between ABSCM&H/U terminals.

Terminals
No. 23 (+) — No. 24 (–):



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AB2**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10AB2 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connectors between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AB3**.

10AB3 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AB4**.

10AB4 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

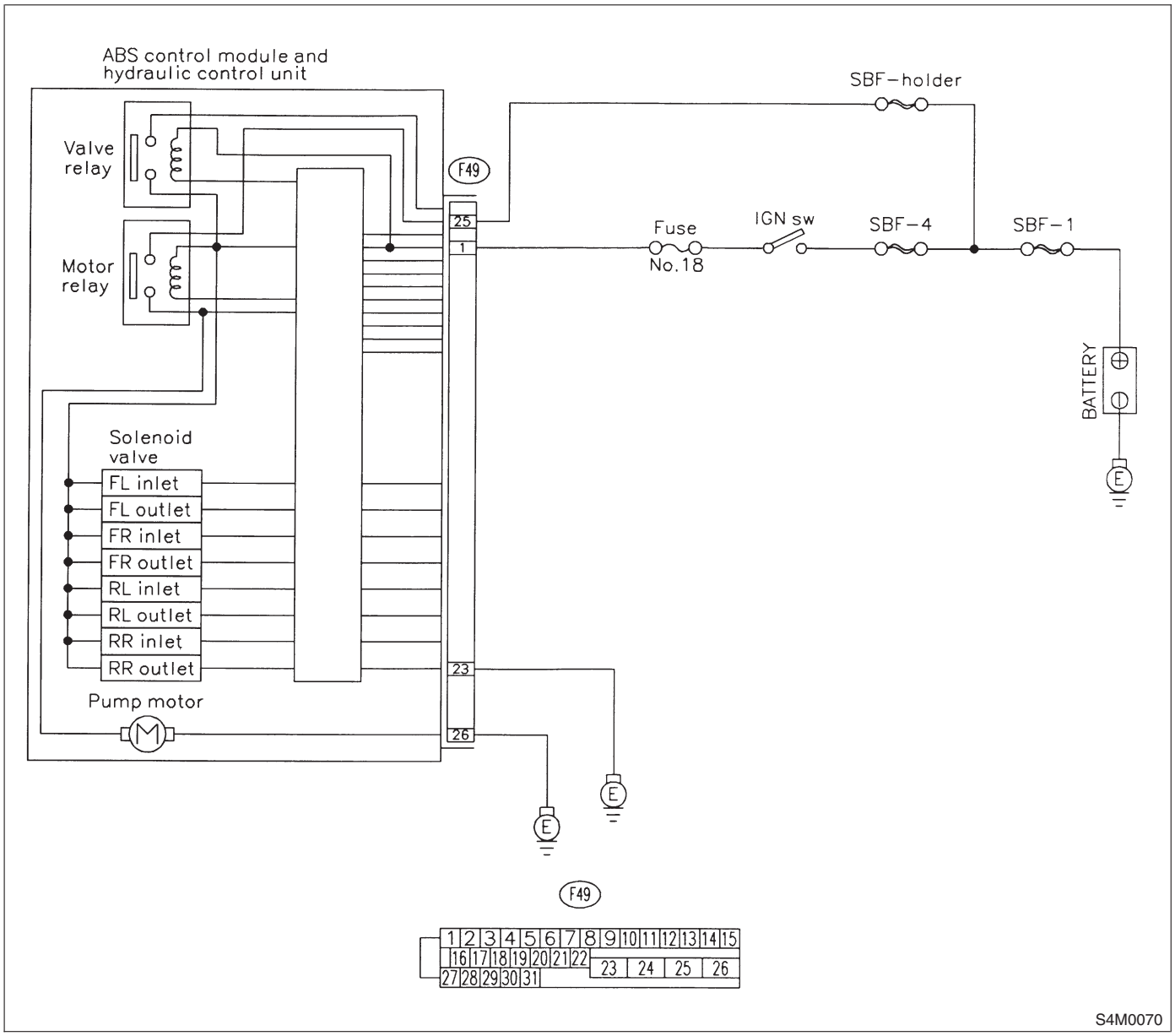
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

AC: TROUBLE CODE 52 OPEN CIRCUIT IN MOTOR RELAY CIRCUIT — OPEN CIRCUIT IN MOTOR RELAY CIRCUIT —

DIAGNOSIS:
- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

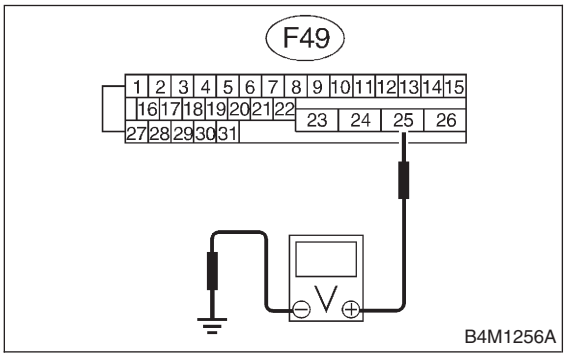
WIRING DIAGRAM:



10AC1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Turn ignition switch to ON.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 25 (+) — Chassis ground (–):

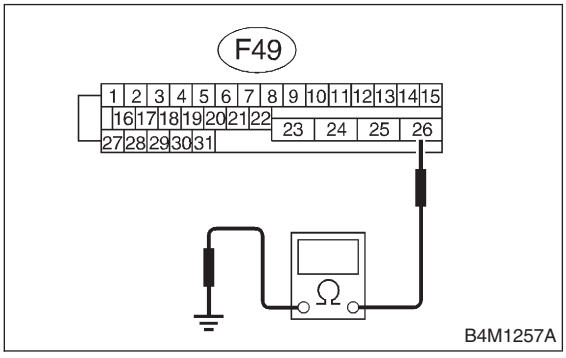


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10AC2**.
NO : Repair harness/connector between battery and ABSCM&H/U and check fuse SBF6.

10AC2 : CHECK GROUND CIRCUIT OF MOTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 26 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10AC3**.
NO : Repair ABSCM&H/U ground harness.

10AC3 : CHECK MOTOR OPERATION.

Operate the sequence control. <Ref. to 4-4 [W14D1].>

NOTE:
Use the diagnosis connector to operate the sequence control.

CHECK : ***Can motor revolution noise (buzz) be heard when carrying out the check sequence?***
YES : Go to step **10AC4**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10AC4 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between hydraclic unit, relay box and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AC5**.

10AC5 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AC6**.

10AC6 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

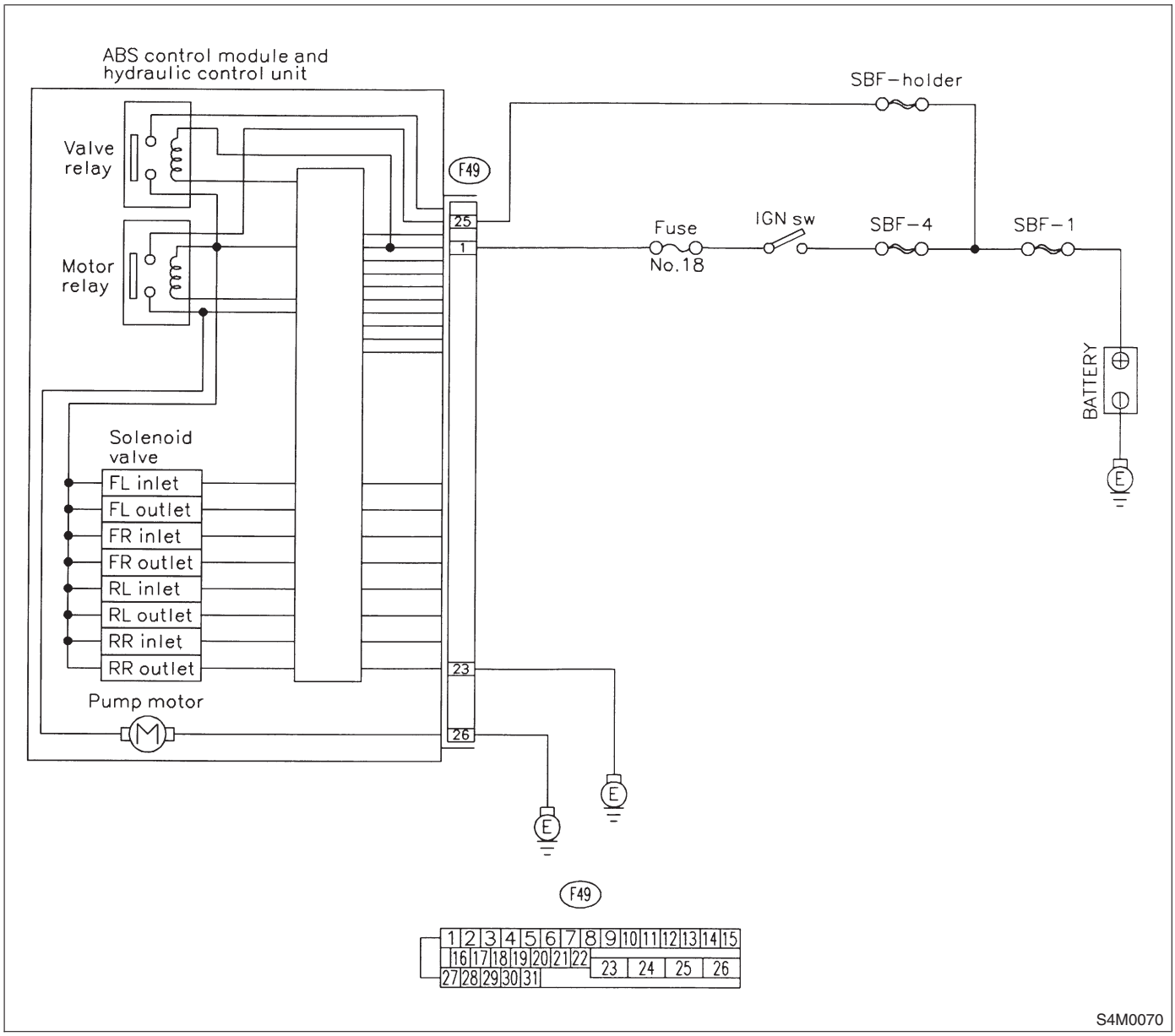
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

AD: TROUBLE CODE 52 MOTOR RELAY ON FAILURE — MOTOR RELAY ON FAILURE —

DIAGNOSIS:
- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

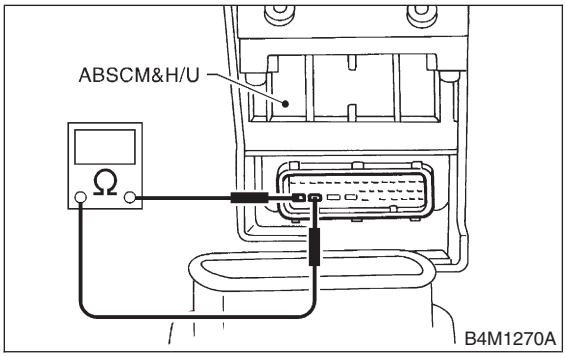
WIRING DIAGRAM:



10AD1 : CHECK MOTOR RELAY IN ABSCM&H/U.

Measure resistance between ABSCM&H/U terminals.

Terminals
No. 25 — No. 26:



CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AD2**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10AD2 : CHECK MOTOR OPERATION.

Operate the sequence control. <Ref. to 4-4 [W14D1].>

NOTE:
Use the diagnosis connector to operate the sequence control.

CHECK : ***Can motor revolution noise (buzz) be heard when carrying out the sequence control?***
YES : Go to step **10AD3**.
NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10AD3 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between hydraulic unit, relay box and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AD4**.

10AD4 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AD5**.

10AD5 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

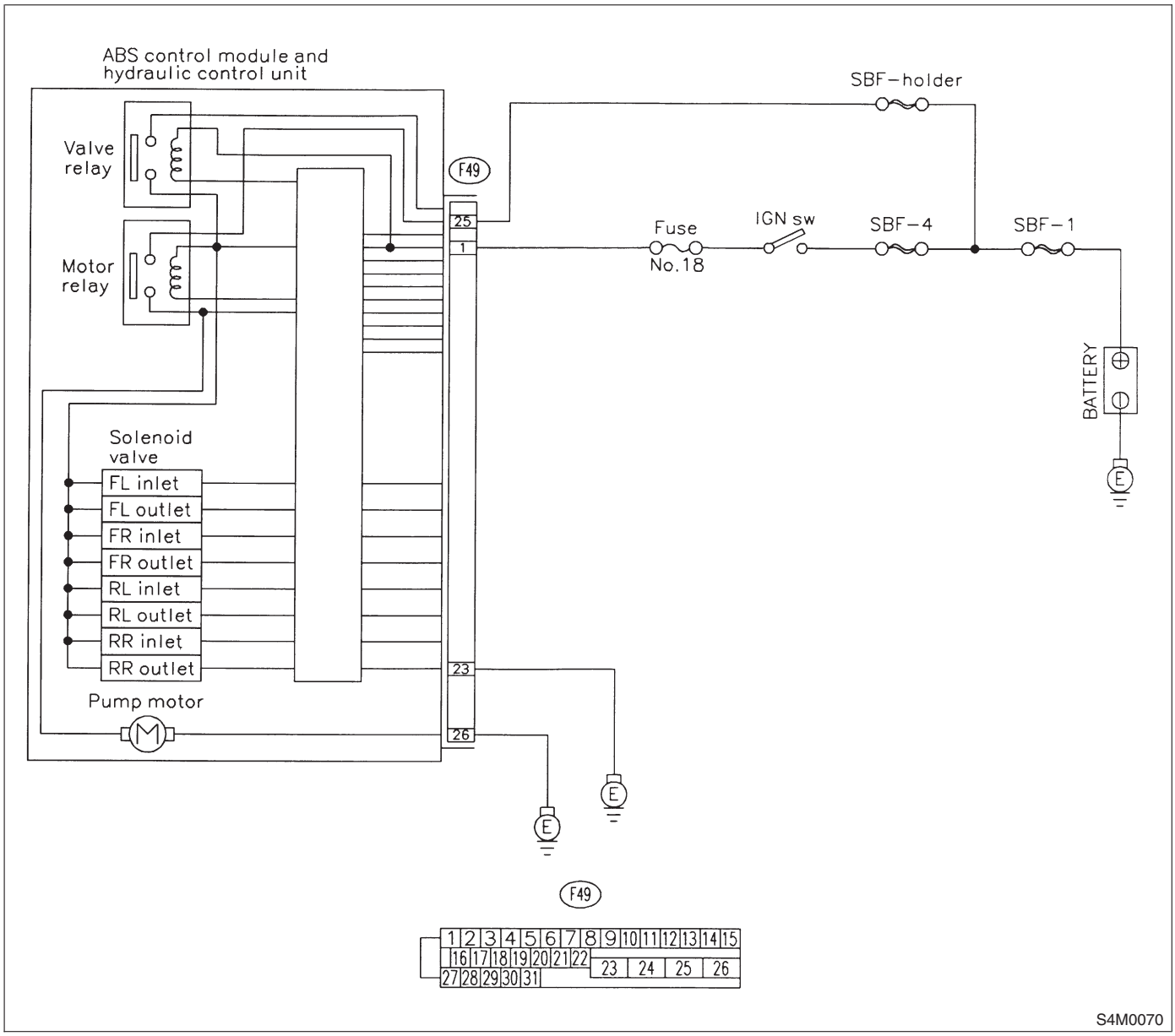
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

AE: TROUBLE CODE 52 MOTOR MALFUNCTION — MOTOR MALFUNCTION —

DIAGNOSIS:
- Faulty motor
- Faulty motor relay
- Faulty harness connector

TROUBLE SYMPTOM:
- ABS does not operate.

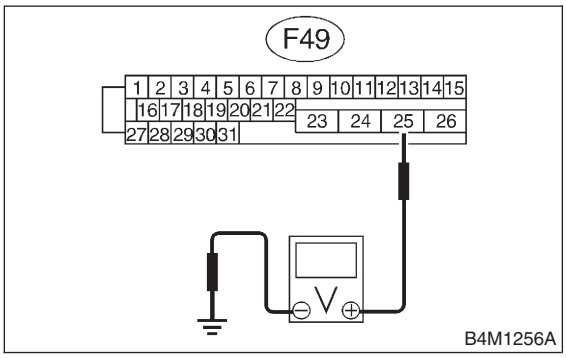
WIRING DIAGRAM:



10AE1 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Turn ignition switch to ON.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 25 (+) — Chassis ground (–):

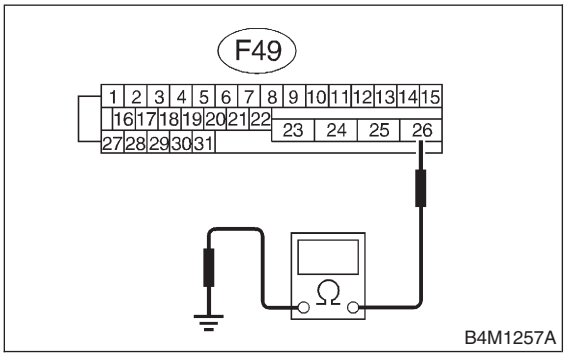


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10AE2**.
NO : Repair harness/connector between battery and ABSCM&H/U and check fuse SBF6.

10AE2 : CHECK GROUND CIRCUIT OF MOTOR.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 26 — Chassis ground:

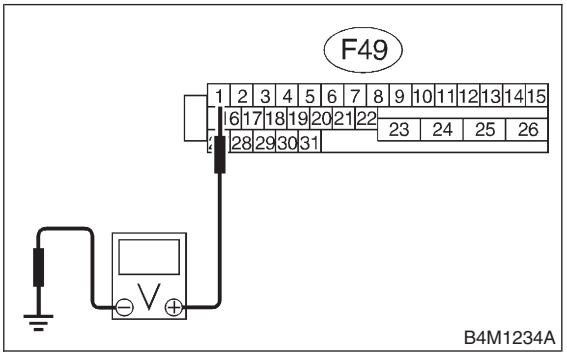


CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10AE3**.
NO : Repair ABSCM&H/U ground harness.

10AE3 : CHECK INPUT VOLTAGE OF ABSCM&H/U.

1) Run the engine at idle.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 1 (+) — Chassis ground (–):

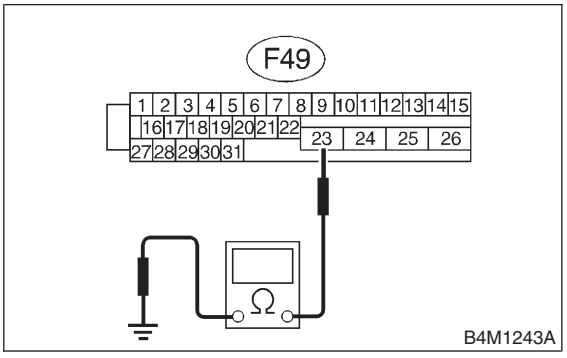


CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10AE4**.
NO : Repair harness connector between battery, ignition switch and ABSCM&H/U.

10AE4 : CHECK GROUND CIRCUIT OF ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 23 — Chassis ground:



CHECK : ***Is the resistance less than 0.5 Ω?***
YES : Go to step **10AE5**.
NO : Repair ABSCM&H/U ground harness.

10AE5 : CHECK MOTOR OPERATION.

Operate the sequence control. <Ref. to 4-4 [W14D1].>

NOTE:
Use the diagnosis connector to operate the sequence control.

CHECK : ***Can motor revolution noise (buzz) be heard when carrying out the sequence control?***

YES : Go to step **10AE6**.

NO : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

10AE6 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between generator, battery and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10AE7**.

10AE7 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10AE8**.

10AE8 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

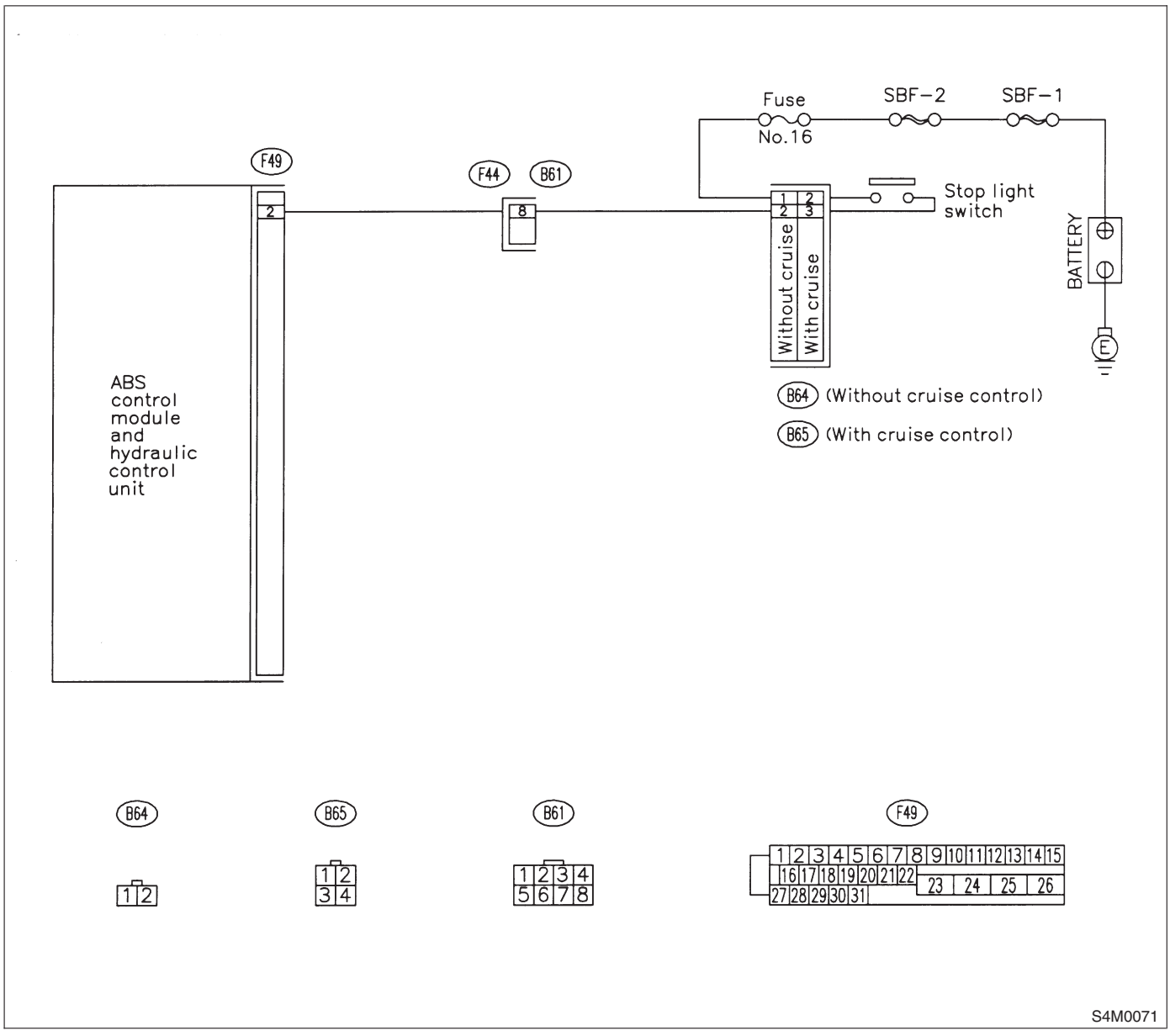
MEMO:

AF: TROUBLE CODE 54 STOP LIGHT SWITCH SIGNAL CIRCUIT MALFUNCTION
— STOP LIGHT SWITCH SIGNAL CIRCUIT MALFUNCTION —

DIAGNOSIS:
- Faulty stop light switch

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10AF1 : CHECK OUTPUT OF STOP LIGHT SWITCH USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Release the brake pedal.
3) Read the stop light switch output in the select monitor data display.

CHECK : ***Is the reading indicated on monitor display less than 1.5 V?***
YES : Go to step **10AF2**.
NO : Go to step **10AF3**.

10AF2 : CHECK OUTPUT OF STOP LIGHT SWITCH USING SELECT MONITOR.

1) Depress the brake pedal.
2) Read the stop light switch output in the select monitor data display.

CHECK : ***Is the reading indicated on monitor display between 10 and 15 V?***
YES : Go to step **10AF5**.
NO : Go to step **10AF3**.

10AF3 : CHECK IF STOP LIGHTS COME ON.

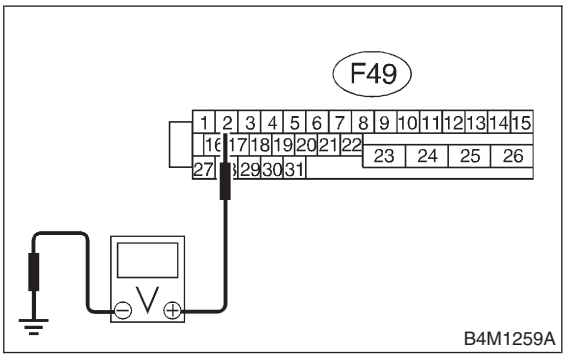
Depress the brake pedal.

CHECK : ***Do stop lights turn on?***
YES : Go to step **10AF4**.
NO : Repair stop lights circuit.

10AF4 : CHECK OPEN CIRCUIT IN HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Depress brake pedal.
4) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 2 — Chassis ground:



CHECK : ***Is the voltage between 10 and 15 V?***
YES : Go to step **10AF5**.
NO : Repair harness between stop light switch and ABSCM&H/U connector.

10AF5 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between stop light switch and ABSCM&H/U? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AF6**.

10AF6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AF7**.

10AF7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

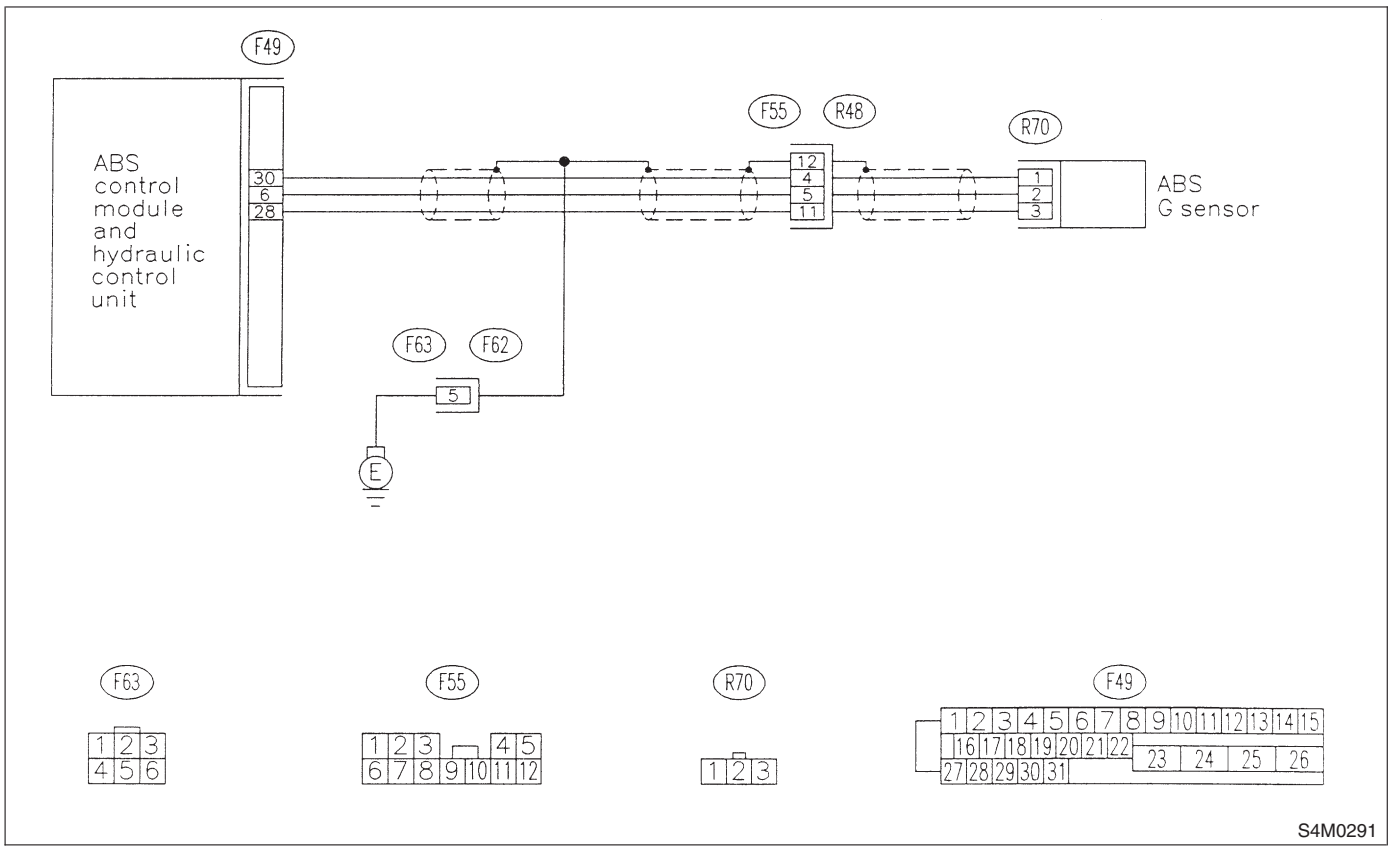
MEMO:

AG: TROUBLE CODE 56 OPEN OR SHORT CIRCUIT IN G SENSOR CIRCUIT — OPEN OR SHORT CIRCUIT IN G SENSOR CIRCUIT —

DIAGNOSIS:
- Faulty G sensor output voltage

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10AG1 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read the G sensor output in select monitor data display.

CHECK : ***Is the G sensor output on the monitor display between 2.1 and 2.5 V when the G sensor is in horizontal position?***
YES : Go to step **10AG2**.
NO : Go to step **10AG5**.

10AG2 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AG5**.

10AG3 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AG4**.

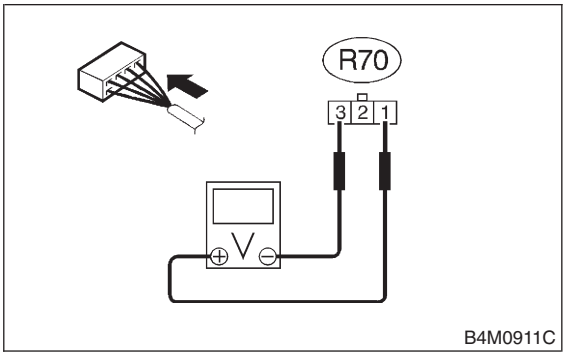
10AG4 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

10AG5 : CHECK INPUT VOLTAGE OF G SENSOR.

1) Turn ignition switch to OFF.
2) Remove console box.
3) Disconnect G sensor from body. (Do not disconnect connector.)
4) Turn ignition switch to ON.
5) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 1 (+) — No. 3 (–):

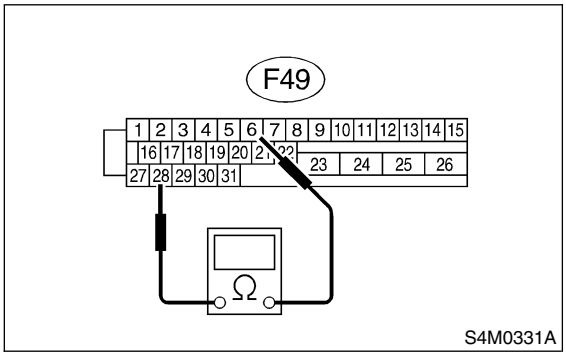


CHECK : ***Is the voltage between 4.75 and 5.25 V?***
YES : Go to step **10AG6**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AG6 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:

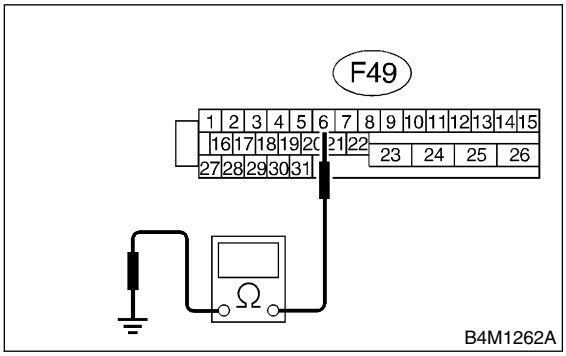


CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***
YES : Go to step **10AG7**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AG7 : CHECK GROUND SHORT IN G SENSOR OUTPUT HARNESS.

1) Disconnect connector from G sensor.
2) Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 — Chassis ground:

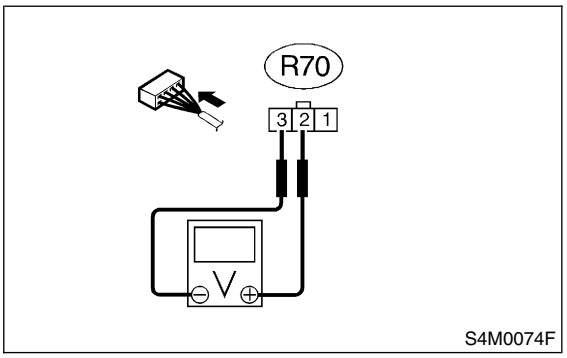


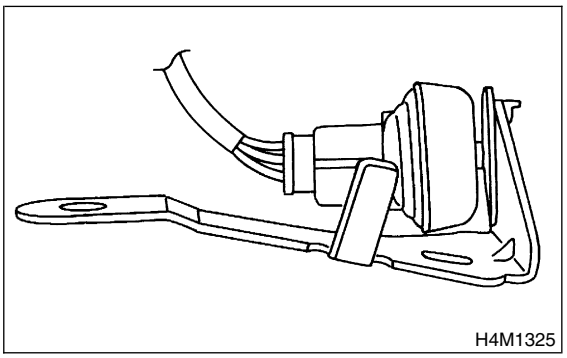
CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AG8**.
NO : Repair harness between G sensor and ABSCM&H/U.

10AG8 : CHECK G SENSOR.

1) Connect connector to G sensor.
2) Connect connector to ABSCM&H/U.
3) Turn ignition switch to ON.
4) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



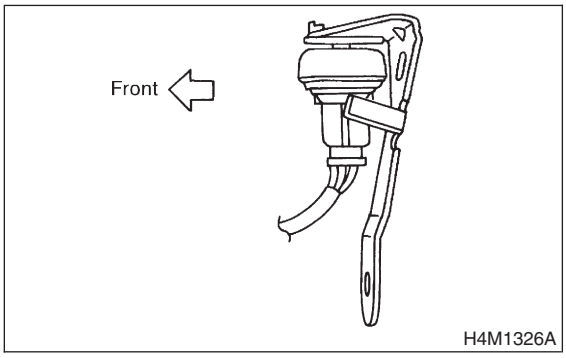


CHECK : ***Is the voltage between 2.1 and 2.5 V when G sensor is horizontal?***
YES : Go to step **10AG9**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AG9 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):

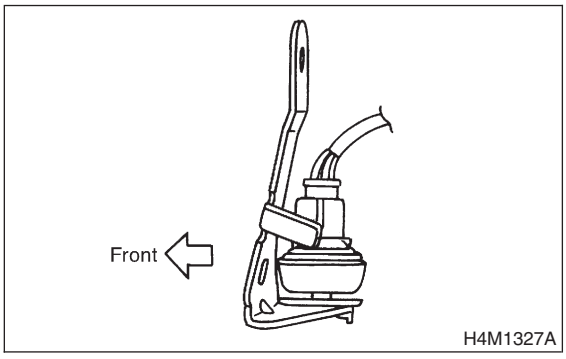


CHECK : ***Is the voltage between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **10AG10**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AG10 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



CHECK : ***Is the voltage between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **10AG11**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AG11 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AG12**.

10AG12 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AG13**.

10AG13 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

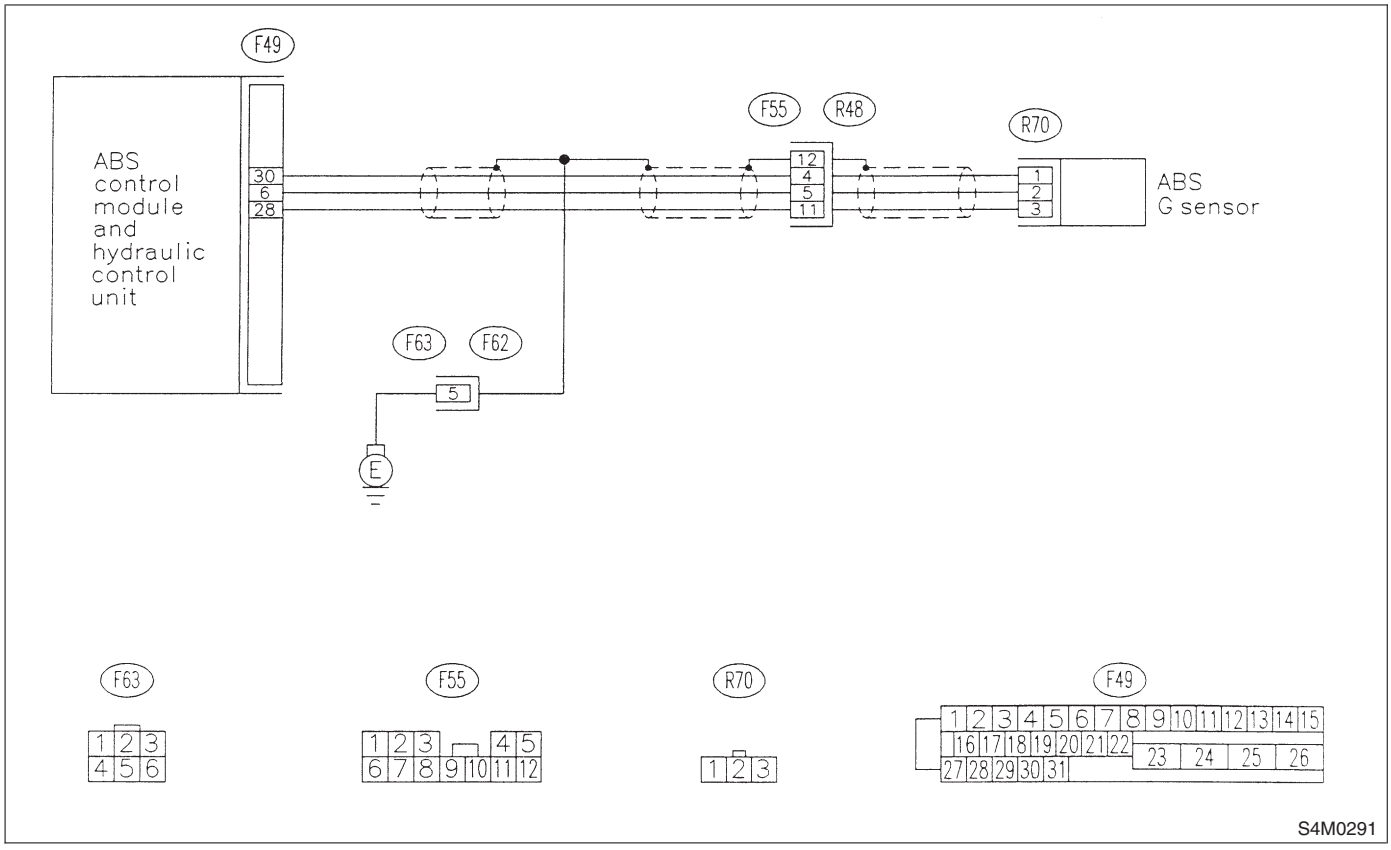
CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

AH: TROUBLE CODE 56 BATTERY SHORT IN G SENSOR CIRCUIT — BATTERY SHORT IN G SENSOR CIRCUIT —

DIAGNOSIS:
- Faulty G sensor output voltage

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10AH1 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read the G sensor output in select monitor data display.

CHECK : ***Is the G sensor output on the monitor display between 2.1 and 2.5 V when the G sensor is in horizontal position?***
YES : Go to step **10AH2**.
NO : Go to step **10AH5**.

10AH2 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AH3**.

10AH3 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AH4**.

10AH4 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

10AH5 : CHECK FREEZE FRAME DATA.

1) Select “Freeze frame data” on the select monitor.
2) Read front right wheel speed on the select monitor display.

CHECK : ***Is the front right wheel speed on monitor display 0 km?***
YES : Go to step **10AH6**.
NO : Go to step **10AH14**.

10AH6 : CHECK FREEZE FRAME DATA.

Read front left wheel speed on the select monitor display.

CHECK : ***Is the front left wheel speed on monitor display 0 km?***
YES : Go to step **10AH7**.
NO : Go to step **10AH14**.

10AH7 : CHECK FREEZE FRAME DATA.

Read rear right wheel speed on the select monitor display.

CHECK : ***Is the rear right wheel speed on monitor display 0 km?***
YES : Go to step **10AH8**.
NO : Go to step **10AH14**.

10AH8 : CHECK FREEZE FRAME DATA.

Read rear left wheel speed on the select monitor display.

CHECK : ***Is the rear left wheel speed on monitor display 0 km?***
YES : Go to step **10AH9**.
NO : Go to step **10AH14**.

10AH9 : CHECK FREEZE FRAME DATA.

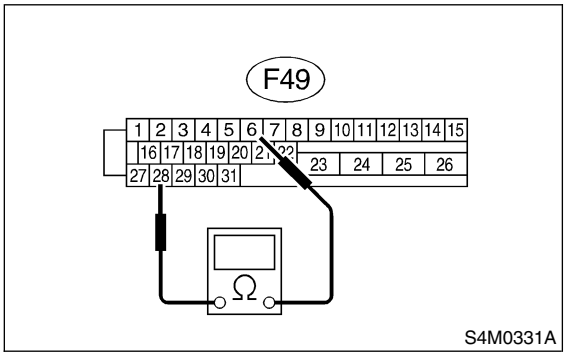
Read G sensor output on the select monitor display.

CHECK : ***Is the G sensor output on monitor display more than 3.65 V?***
YES : Go to step **10AH10**.
NO : Go to step **10AH14**.

10AH10 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:



CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***
YES : Go to step **10AH11**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AH11 : CHECK POOR CONTACT IN CONNECTORS.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AH12**.

10AH12 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AH13**.

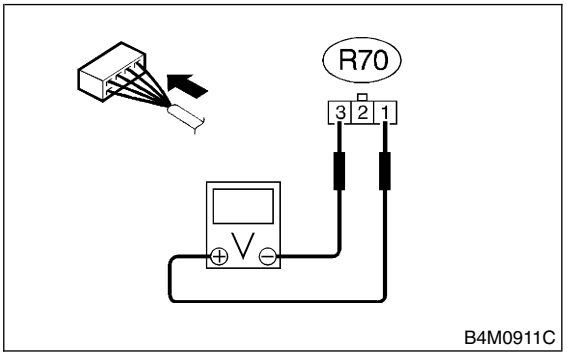
10AH13 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

10AH14 : CHECK INPUT VOLTAGE OF G SENSOR.

1) Turn ignition switch to OFF.
2) Remove console box.
3) Disconnect G sensor from body. (Do not disconnect connector.)
4) Turn ignition switch to ON.
5) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 1 (+) — No. 3 (–):

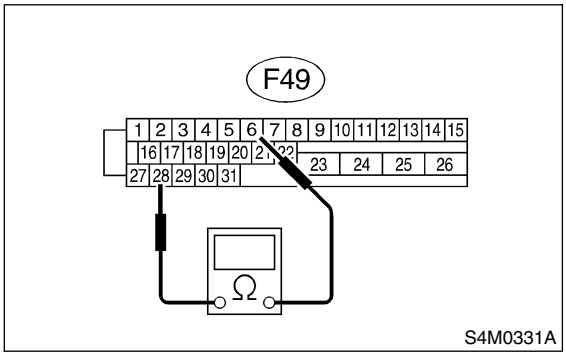


CHECK : ***Is the voltage between 4.75 and 5.25 V?***
YES : Go to step **10AH15**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AH15 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:

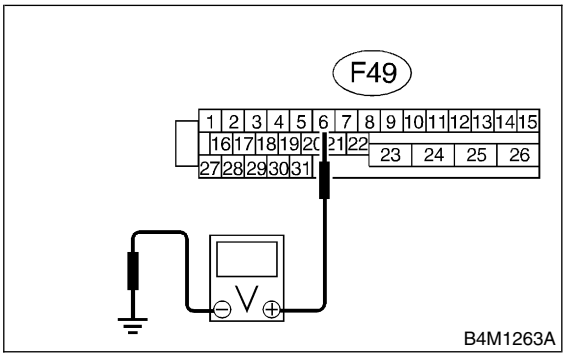


CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***
YES : Go to step **10AH16**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AH16 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to OFF.
2) Remove console box.
3) Disconnect connector from G sensor.
4) Disconnect connector from ABSCM&H/U.
5) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 (+) — Chassis ground (–):

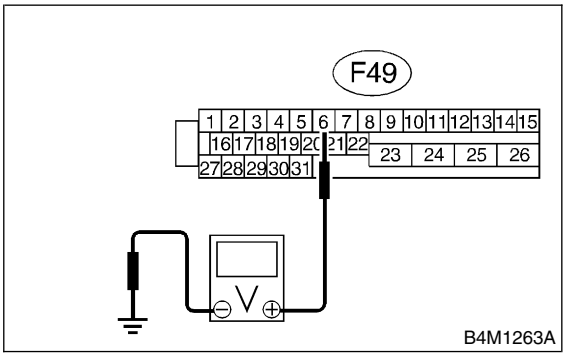


CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10AH17**.
NO : Repair harness between G sensor and ABSCM&H/U.

10AH17 : CHECK BATTERY SHORT OF HARNESS.

1) Turn ignition switch to ON.
2) Measure voltage between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 6 (+) — Chassis ground (–):

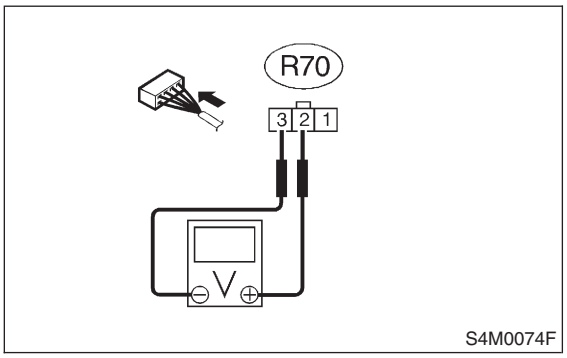


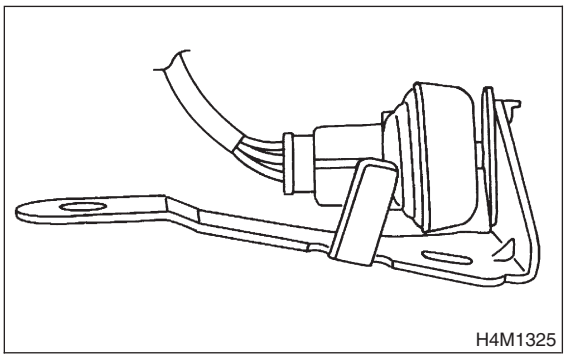
CHECK : ***Is the voltage less than 1 V?***
YES : Go to step **10AH18**.
NO : Repair harness between G sensor and ABSCM&H/U.

10AH18 : CHECK G SENSOR.

1) Connect connector to G sensor.
2) Connect connector to ABSCM&H/U.
3) Turn ignition switch to ON.
4) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



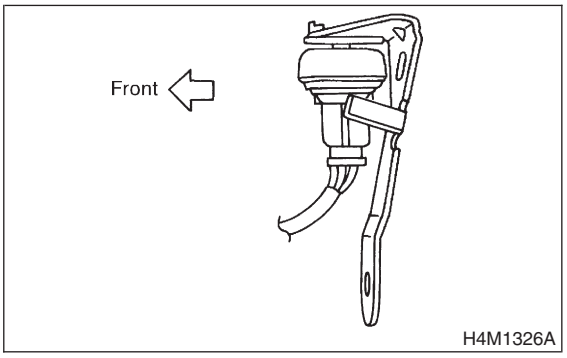


CHECK : ***Is the voltage between 2.1 and 2.5 V when G sensor is horizontal?***
YES : Go to step **10AH19**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AH19 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):

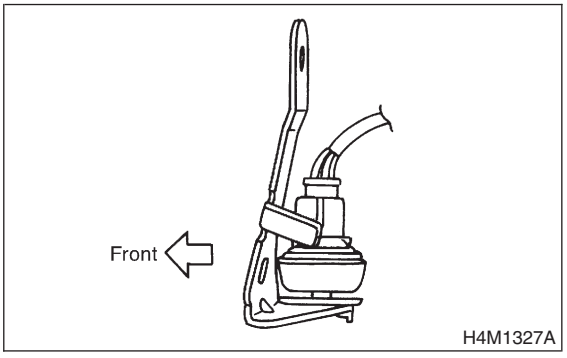


CHECK : ***Is the voltage between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **10AH20**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AH20 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



CHECK : ***Is the voltage between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **10AH21**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AH21 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***

YES : Repair connector.

NO : Go to step **10AH22**.

10AH22 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10AH23**.

10AH23 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

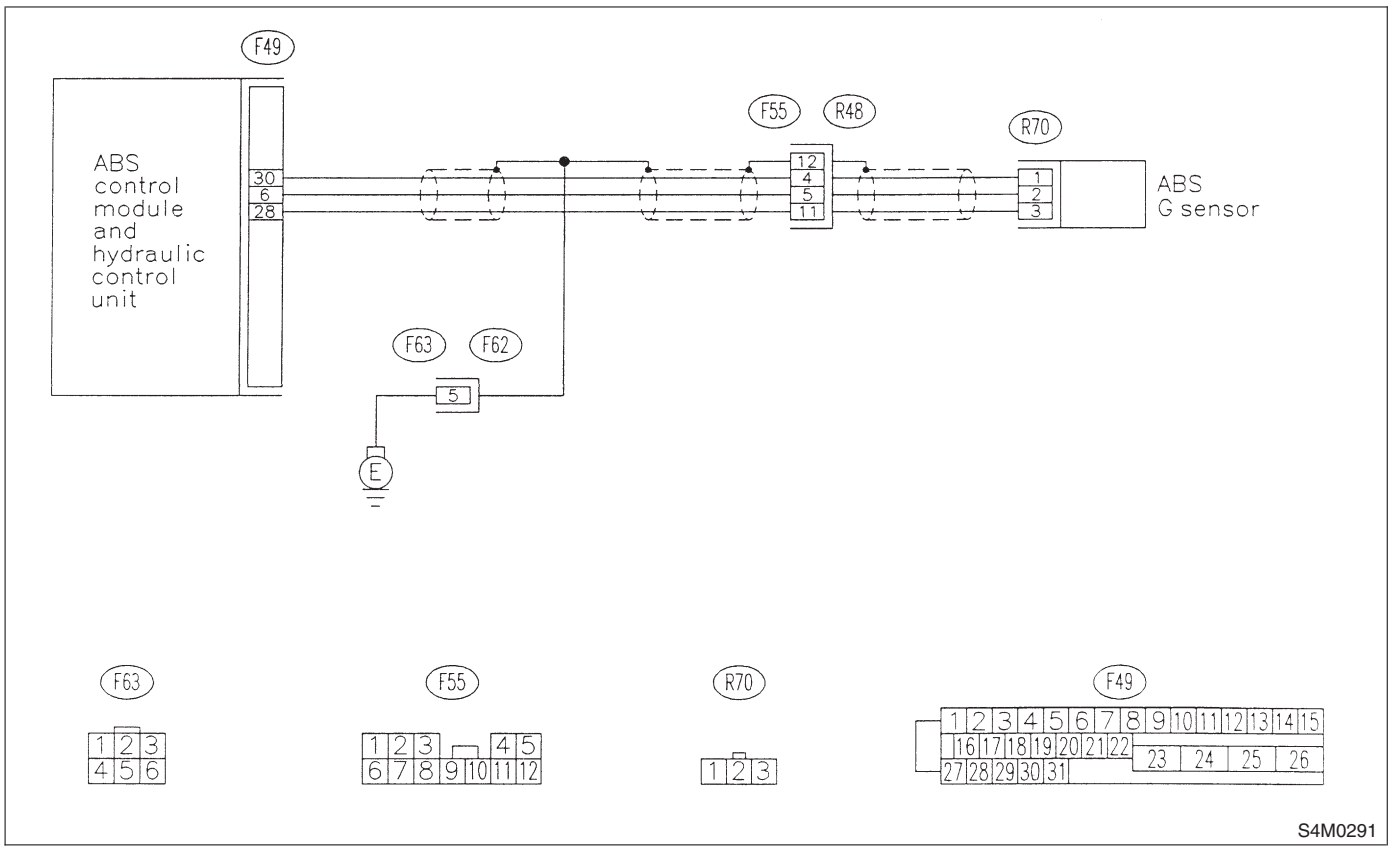
NO : A temporary poor contact.

AI: TROUBLE CODE 56 ABNORMAL G SENSOR HIGH μ OUTPUT — ABNORMAL G SENSOR HIGH μ OUTPUT —

DIAGNOSIS:
- Faulty G sensor output voltage

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10AI1 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read G sensor output on the select monitor display.

CHECK : ***Is the G sensor output on monitor display between 2.1 and 2.5 V when the G sensor is in horizontal position?***
YES : Go to step **10AI2**.
NO : Go to step **10AI5**.

10AI2 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AI3**.

10AI3 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AI4**.

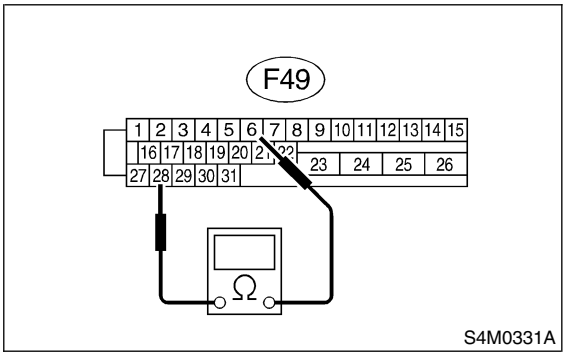
10AI4 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

10AI5 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:

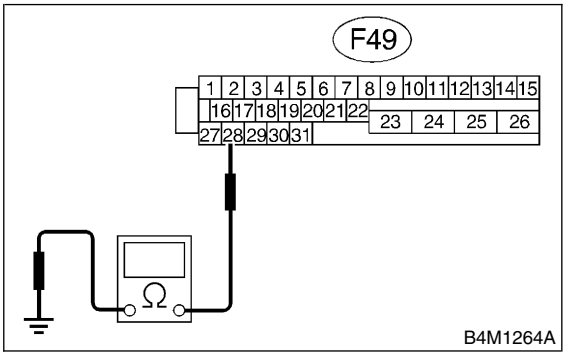


CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***
YES : Go to step **10AI6**.
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AI6 : CHECK GROUND SHORT OF HARNESS.

Measure resistance between ABSCM&H/U connector and chassis ground.

Connector & terminal
(F49) No. 28 — Chassis ground:

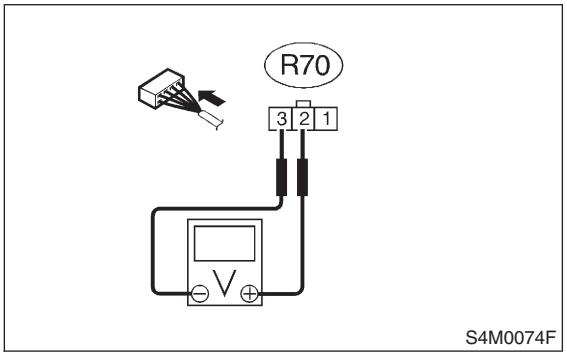


CHECK : ***Is the resistance more than 1 MΩ?***
YES : Go to step **10AI7**.
NO : Repair harness between G sensor and ABSCM&H/U.

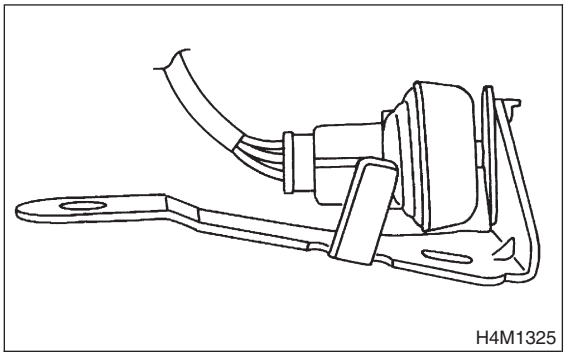
10AI7 : CHECK G SENSOR.

1) Remove console box.
2) Remove G sensor from vehicle.
3) Connect connector to G sensor.
4) Connect connector to ABSCM&H/U.
5) Turn ignition switch to ON.
6) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



S4M0074F

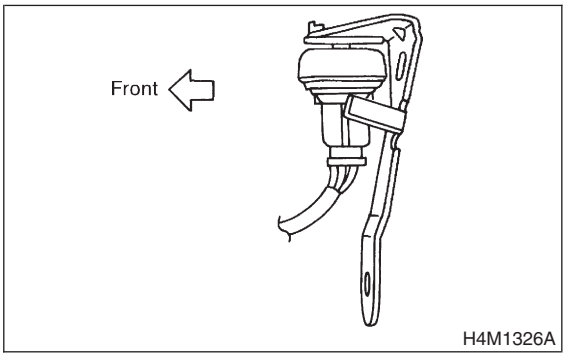

H4M1325

CHECK : ***Is the voltage between 2.1 and 2.5 V when G sensor is horizontal?***
YES : Go to step **10AI8**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AI8 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



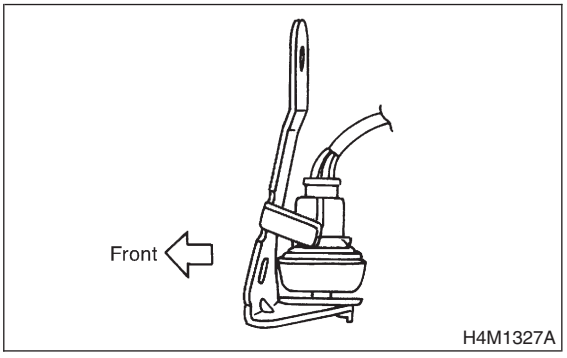
H4M1326A

CHECK : ***Is the voltage between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **10AI9**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AI9 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 3 (–):



H4M1327A

CHECK : ***Is the voltage between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **10AI10**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AI10 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***

YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>

NO : Go to step **10AI11**.

10AI11 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

YES : Proceed with the diagnosis corresponding to the trouble code.

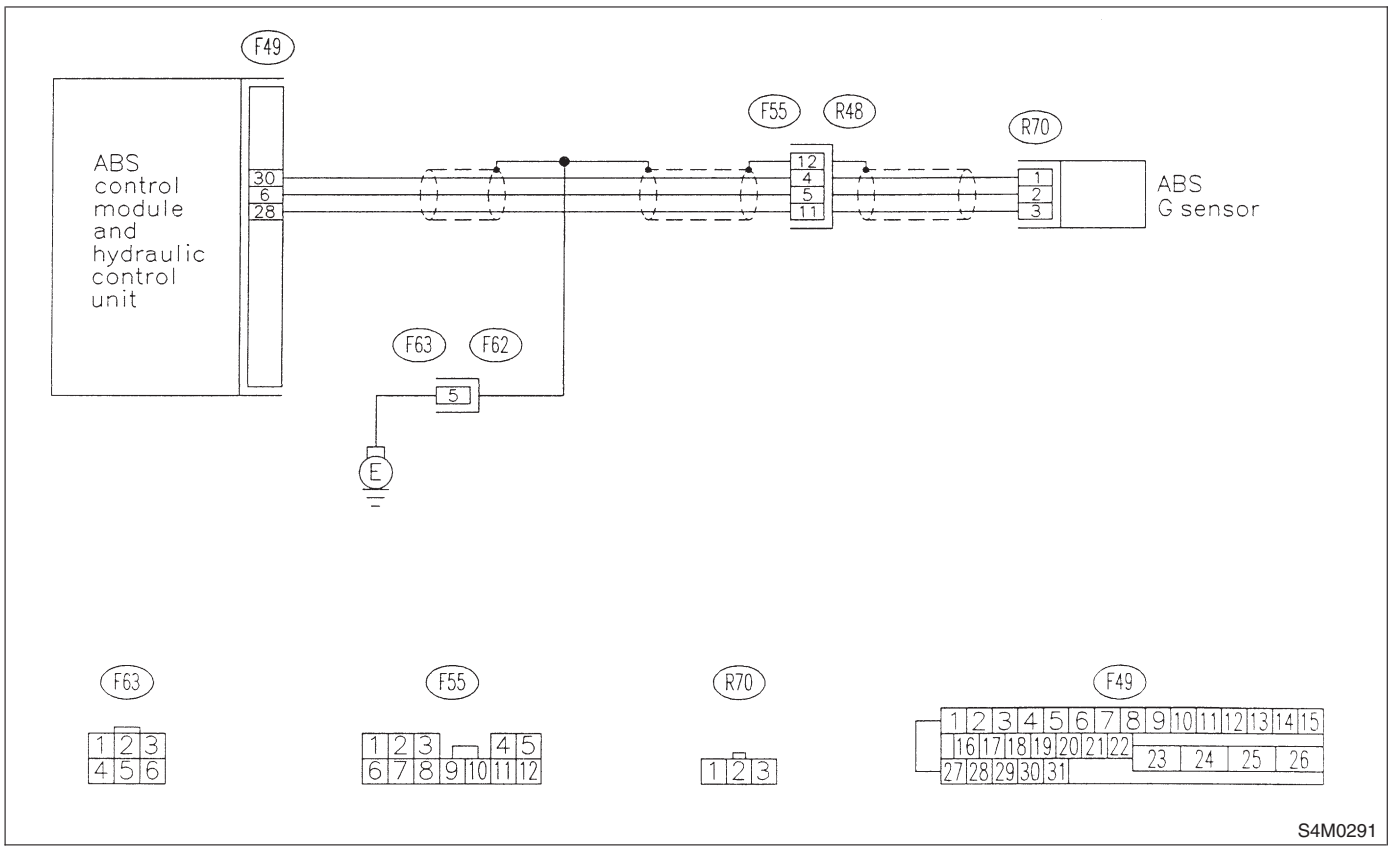
NO : A temporary poor contact.

AJ: TROUBLE CODE 56 DETECTION OF G SENSOR STICK — DETECTION OF G SENSOR STICK —

DIAGNOSIS:
- Faulty G sensor output voltage

TROUBLE SYMPTOM:
- ABS does not operate.

WIRING DIAGRAM:



10AJ1 : CHECK ALL FOUR WHEELS FOR FREE TURNING.

CHECK : ***Have the wheels been turned freely such as when the vehicle is lifted up, or operated on a rolling road?***
YES : The ABS is normal. Erase the trouble code.
NO : Go to step **10AJ2**.

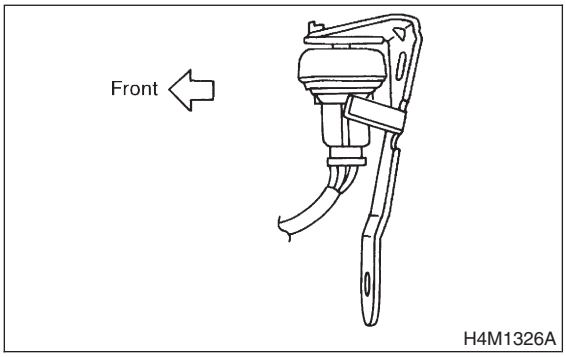
10AJ2 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

1) Select “Current data display & Save” on the select monitor.
2) Read the select monitor display.

CHECK : ***Is the G sensor output on the monitor display between 2.1 and 2.5 V when the vehicle is in horizontal position?***
YES : Go to step **10AJ3**.
NO : Go to step **10AJ8**.

10AJ3 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

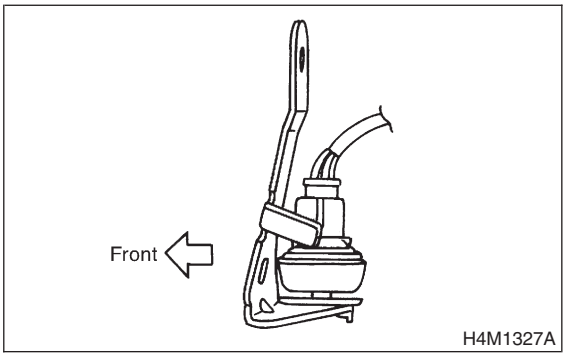
1) Turn ignition switch to OFF.
2) Remove console box.
3) Remove G sensor from vehicle. (Do not disconnect connector.)
4) Turn ignition switch to ON.
5) Select “Current data display & Save” on the select monitor.
6) Read the select monitor display.



CHECK : ***Is the G sensor output on the monitor display between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **10AJ4**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AJ4 : CHECK OUTPUT OF G SENSOR USING SELECT MONITOR.

Read the select monitor display.



CHECK : ***Is the G sensor output on the monitor display between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **10AJ5**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AJ5 : CHECK POOR CONTACT IN CONNECTORS.

Turn ignition switch to OFF.

CHECK : ***Is there poor contact in connector between ABSCM&H/U and G sensor? <Ref. to FOREWORD [W3C1].>***
YES : Repair connector.
NO : Go to step **10AJ6**.

10AJ6 : CHECK ABSCM&H/U.

1) Connect all connectors.
2) Erase the memory.
3) Perform inspection mode.
4) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AJ7**.

10AJ7 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***

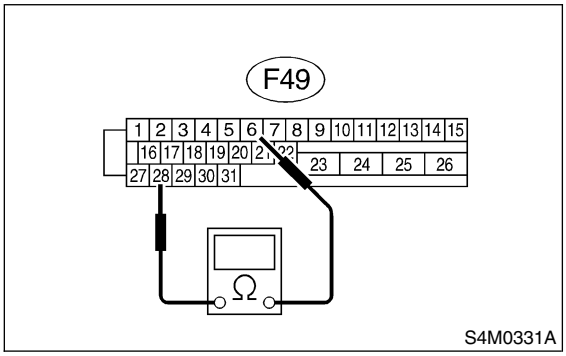
YES : Proceed with the diagnosis corresponding to the trouble code.

NO : A temporary poor contact.

10AJ8 : CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.

1) Turn ignition switch to OFF.
2) Disconnect connector from ABSCM&H/U.
3) Measure resistance between ABSCM&H/U connector terminals.

Connector & terminal
(F49) No. 6 — No. 28:



CHECK : ***Is the resistance between 4.3 and 4.9 kΩ?***

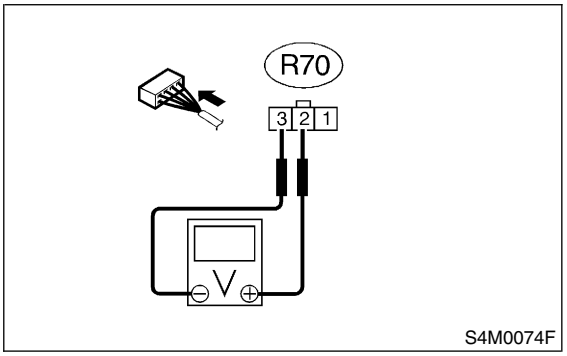
YES : Go to step **10AJ9**.

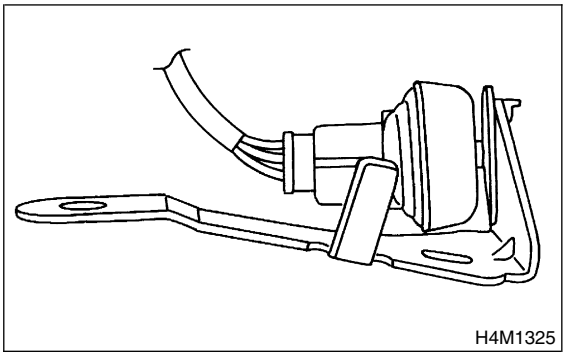
NO : Repair harness/connector between G sensor and ABSCM&H/U.

10AJ9 : CHECK G SENSOR.

1) Remove console box.
2) Remove G sensor from vehicle.
3) Connect connector to G sensor.
4) Connect connector to ABSCM&H/U.
5) Turn ignition switch to ON.
6) Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 1 (–):





CHECK : ***Is the voltage between 2.1 and 2.5 V when G sensor is horizontal?***

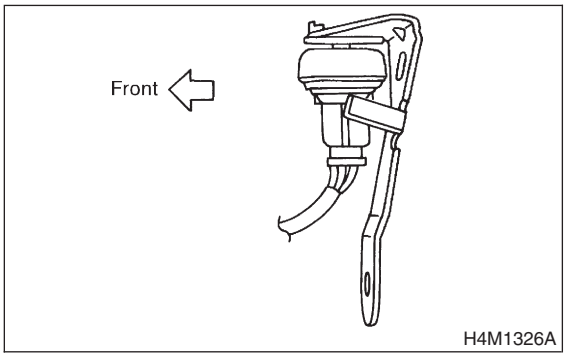
YES : Go to step **10AJ10**.

NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AJ10 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 1 (–):

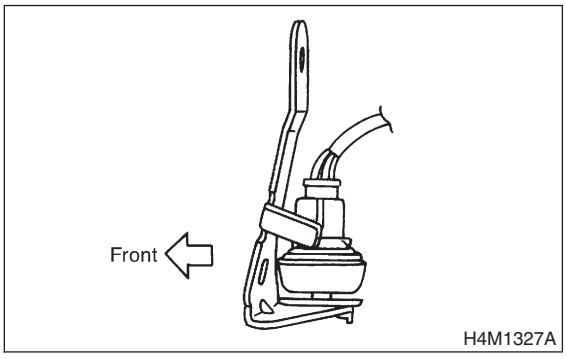


CHECK : ***Is the voltage between 3.7 and 4.1 V when G sensor is inclined forwards to 90°?***
YES : Go to step **10AJ11**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AJ11 : CHECK G SENSOR.

Measure voltage between G sensor connector terminals.

Connector & terminal
(R70) No. 2 (+) — No. 1 (–):



CHECK : ***Is the voltage between 0.5 and 0.9 V when G sensor is inclined backwards to 90°?***
YES : Go to step **10AJ12**.
NO : Replace G sensor. <Ref. to 4-4 [W15A0].>

10AJ12 : CHECK ABSCM&H/U.

1) Turn ignition switch to OFF.
2) Connect all connectors.
3) Erase the memory.
4) Perform inspection mode.
5) Read out the trouble code.

CHECK : ***Is the same trouble code as in the current diagnosis still being output?***
YES : Replace ABSCM&H/U. <Ref. to 4-4 [W14A0].>
NO : Go to step **10AJ13**.

10AJ13 : CHECK ANY OTHER TROUBLE CODES APPEARANCE.

CHECK : ***Are other trouble codes being output?***
YES : Proceed with the diagnosis corresponding to the trouble code.
NO : A temporary poor contact.

11. General Diagnostics Table

A: SYMPTOMS AND PROBABLE CAUSES

Symptom		Probable faulty units/parts
Vehicle instability during braking	Vehicle pulls to either side.	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (caliper & piston, pads) • Wheel alignment • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Road surface (uneven, camber)
	Vehicle spins.	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (pads) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections
Poor braking	Long braking/stopping distance	• ABSCM&H/U (solenoid valve) • Brake (pads) • Air in brake line • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections
	Wheel locks.	• ABSCM&H/U (solenoid valve, motor) • ABS sensor • Incorrect wiring or piping connections
	Brake dragging	• ABSCM&H/U (solenoid valve) • ABS sensor • Master cylinder • Brake (caliper & piston) • Parking brake • Axle & wheels • Brake pedal play
	Long brake pedal stroke	• Air in brake line • Brake pedal play
	Vehicle pitching	• Suspension play or fatigue (reduced damping) • Incorrect wiring or piping connections • Road surface (uneven)
	Unstable or uneven braking	• ABSCM&H/U (solenoid valve) • ABS sensor • Brake (caliper & piston, pads) • Tire specifications, tire wear and air pressures • Incorrect wiring or piping connections • Road surface (uneven)
Vibration and/or noise (while driving on slippery roads)	Excessive pedal vibration	• Incorrect wiring or piping connections • Road surface (uneven)
	Noise from ABSCM&H/U	• ABSCM&H/U (mount bushing) • ABS sensor • Brake piping
	Noise from front of vehicle	• ABSCM & H/U (mount bushing) • ABS sensor • Master cylinder • Brake (caliper & piston, pads, rotor) • Brake piping • Brake booster & check valve • Suspension play or fatigue
	Noise from rear of vehicle	• ABS sensor • Brake (caliper & piston, pads, rotor) • Parking brake • Brake piping • Suspension play or fatigue

B: CHECKING THE HYDRAULIC UNIT OPERATION

11B1 : PREPARING THE BRAKE TESTER.

CHECK : ***Is the brake tester available?***

YES : CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH BRAKE TESTER <Ref. to 4-4 [W14C2].>

NO : CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE <Ref. to 4-4 [W14C1].>

MEMO:

PEDAL SYSTEM AND CONTROL CABLES 4-5

Page

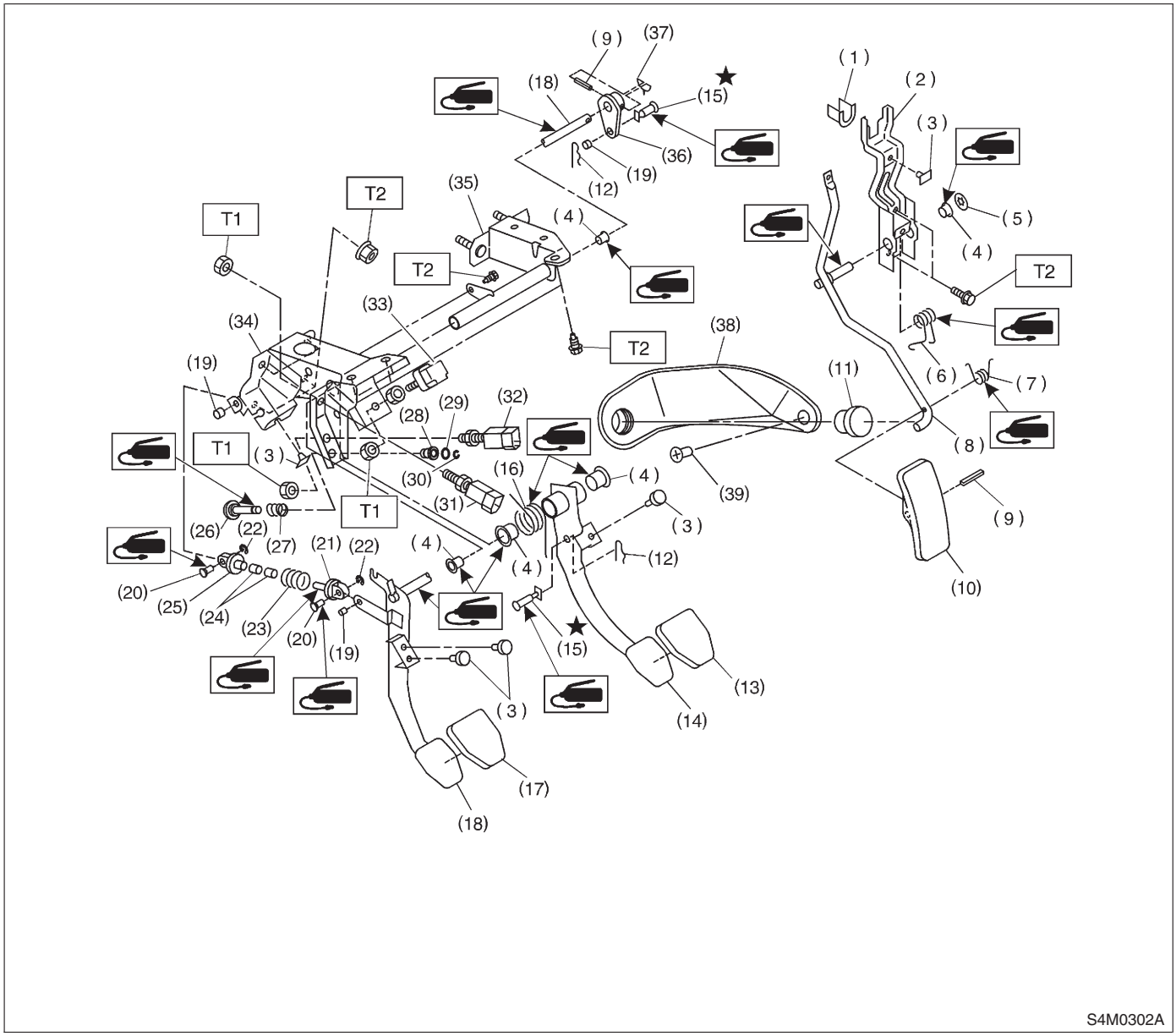
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1. Pedal System

Brake pedal	Free play		1 — 3 mm (0.04 — 0.12 in) [Depress brake pedal pad with a force of less than 10 N (1 kg, 2 lb).]
Clutch pedal	Free play	At clutch pedal pad	4 — 13 mm (0.16 — 0.51 in)
	Full stroke	At clutch pedal pad	130 — 135 mm (5.11 — 5.31 in)
Accelerator pedal	Free play	At pedal pad	1 — 4 mm (0.04 — 0.16 in)
	Stroke	At pedal pad	50 — 55 mm (1.97 — 2.17 in)

1. Pedal

A: MT MODEL

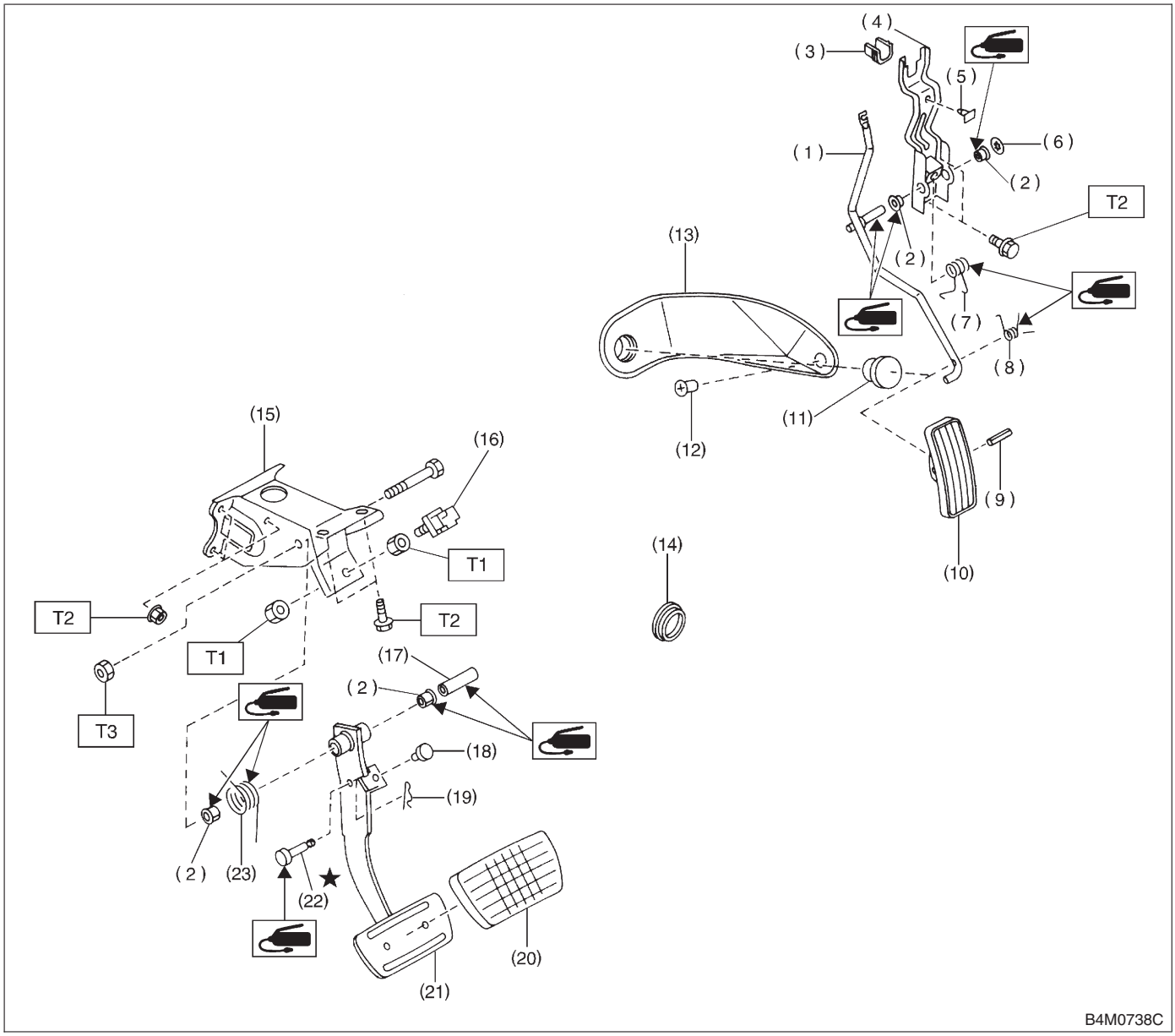


S4M0302A

(1) Holder
(2) Accelerator bracket
(3) Stopper
(4) Bushing
(5) Clip
(6) Accelerator spring
(7) Accelerator pedal spring
(8) Accelerator pedal
(9) Spring pin
(10) Accelerator pedal pad
(11) Accelerator stopper
(12) Snap pin
(13) Brake pedal pad
(14) Brake pedal
(15) Clevis pin
(16) Brake pedal spring
(17) Clutch pedal pad
(18) Clutch pedal
(19) Bushing C
(20) Clutch clevis pin
(21) Assist rod A
(22) Clip
(23) Assist spring
(24) Assist bushing
(25) Assist rod B
(26) Rod S
(27) Spring S
(28) Bushing S
(29) O-ring
(30) Clip
(31) Clutch switch (Starter interlock)
(32) Clutch switch (With cruise control)
(33) Stop light switch
(34) Pedal bracket
(35) Clutch master cylinder bracket
(36) Lever
(37) Lock wire
(38) Accelerator plate
(39) Clip

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±2 (0.8±0.2, 5.8±1.4)
T2: 18±5 (1.8±0.5, 13.0±3.6)

B: AT MODEL



(1) Accelerator pedal
(2) Bushing
(3) Holder
(4) Accelerator bracket
(5) Stopper
(6) Clip
(7) Accelerator spring
(8) Accelerator pedal spring
(9) Spring pin
(10) Accelerator pedal pad
(11) Accelerator stopper
(12) Clip
(13) Accelerator plate
(14) Plug
(15) Pedal bracket
(16) Stop light switch
(17) Spacer
(18) Stopper
(19) Snap pin
(20) Brake pedal pad
(21) Brake pedal
(22) Clevis pin
(23) Brake pedal spring

Tightening torque: N·m (kg-m, ft-lb)
T1: 8±2 (0.8±0.2, 5.8±1.4)
T2: 18±5 (1.8±0.5, 13.0±3.6)
T3: 29±7 (3.0±0.7, 21.7±5.1)

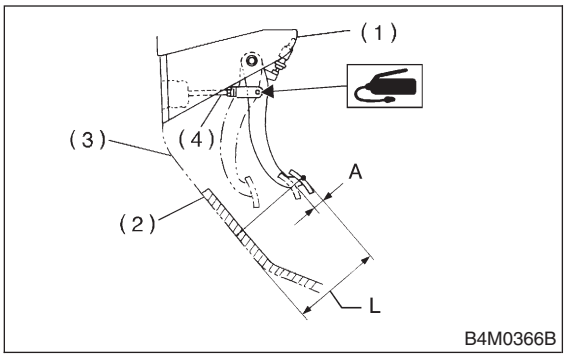
1. Pedal

A: ON-CAR SERVICE

1. BRAKE PEDAL

1) Check position of pedal pad.

Pedal height: L
148 mm (5.83 in)



(1) Stop light switch
(2) Mat
(3) Toe board
(4) Brake booster operating rod

2) If it is not in specified value, adjust it by adjusting brake booster operating rod length.
3) Check free play by operating pedal by hand. If it is not in specified value, adjust it by adjusting position of stop light switch.

CAUTION:
Be careful not to rotate stop light switch.

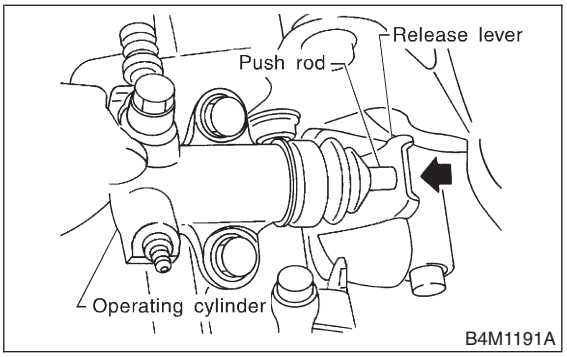
Brake pedal free play: A
1 — 3 mm (0.04 — 0.12 in) [Depress brake pedal pad with a force of less than 10 N (1 kg, 2 lb).]

Stop light switch lock nut tightening torque:
8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)

4) Apply grease to operating rod connecting pin to prevent it from wearing.

2. CLUTCH PEDAL

1) Push release fork until operating cylinder push rod retracts. Check that clutch fluid level in reservoir tank increases.



2) If clutch fluid level increases, hydraulic clutch play is correct.
3) If clutch fluid level does not increase or push rod does not retract, clutch pedal must be adjusted. <Ref. to 4-5 [W1F1].>
4) Check the fluid level on the outside of the clutch master cylinder tank. If the level is below “MIN”, add clutch fluid to bring it up to “MAX”.

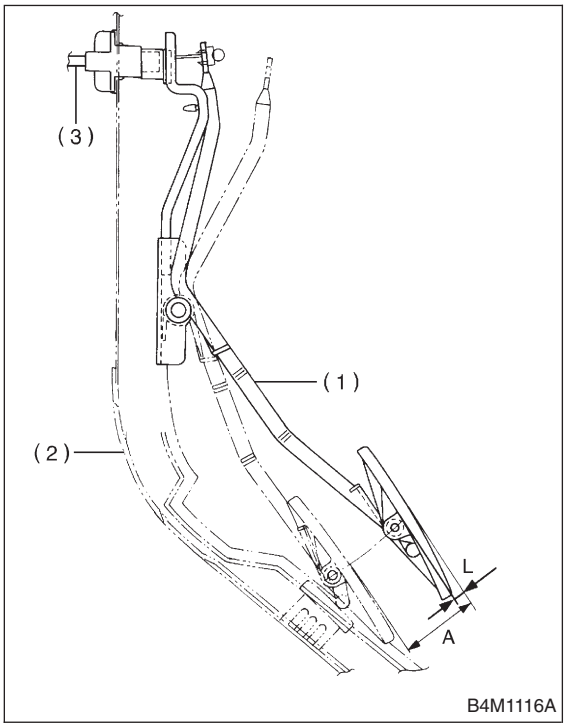
Recommended clutch fluid:
FMVSS No. 116, fresh DOT 3 or DOT 4 brake fluid

3. ACCELERATOR PEDAL

Check pedal stroke and free play by operating accelerator pedal by hand.
If it is not within specified value, adjust it by turning nut connecting accelerator cable to throttle body.

Free play at pedal pad: L
1 — 4 mm (0.04 — 0.16 in)

Stroke at pedal pad: A
50 — 55 mm (1.97 — 2.17 in)



(1) Accelerator pedal
(2) Toe board
(3) Accelerator cable

Accelerator cable lock nut tightening torque:
14±4 N·m (1.4±0.4 kg-m, 10.1±2.9 ft-lb)

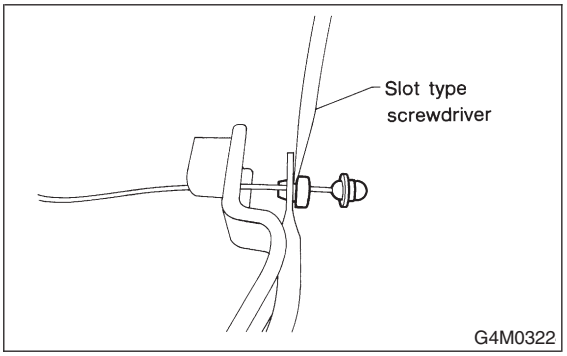
B: REMOVAL

1. ACCELERATOR PEDAL

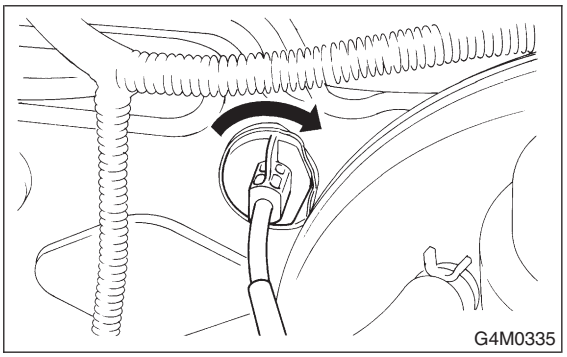
1) Disconnect ground cable from battery.
2) Disconnect accelerator cable from throttle body.

CAUTION:
Be careful not to kink accelerator cable.

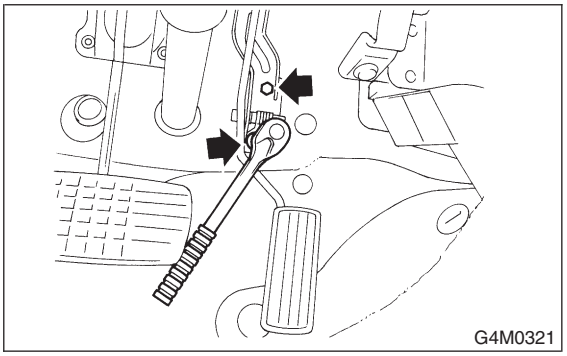
3) Remove instrument panel lower cover from instrument panel, and connector.
4) Disconnect accelerator cable from accelerator pedal lever.



5) Working inside engine compartment, remove casing cap out of the toe board by turning it clockwise.



6) Pull out the cable from the toe board hole.
7) Remove accelerator pedal connecting bolt from accelerator pedal bracket.



2. BRAKE AND CLUTCH PEDAL

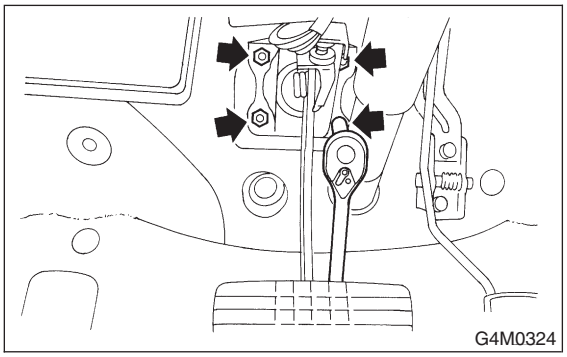
1) Disconnect ground cable from battery.
2) Remove instrument panel lower cover from instrument panel.
3) Disconnect the following parts from pedal bracket.
- Operating rod of brake booster
- Electrical connectors (for stop light switch, etc.)

4) Remove clevis pin which secures lever to push rod.
5) Remove nut which secures clutch master cylinder.

6) Remove bolts and nuts which secure brake and clutch pedals, and remove pedal assembly.

3. BRAKE PEDAL

1) Disconnect ground cable from battery.
2) Remove instrument panel lower cover from instrument panel.
3) Remove clevis pin which secures brake pedal to brake booster operating rod. Also disconnect stop light switch connector.
4) Remove two bolts and four nuts which secure brake pedal to pedal.


G4M0324

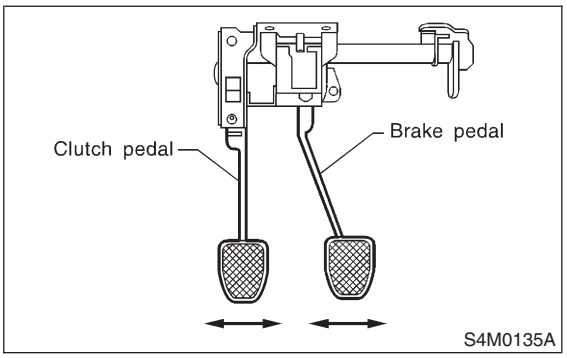
C: INSPECTION

1. BRAKE AND CLUTCH PEDALS

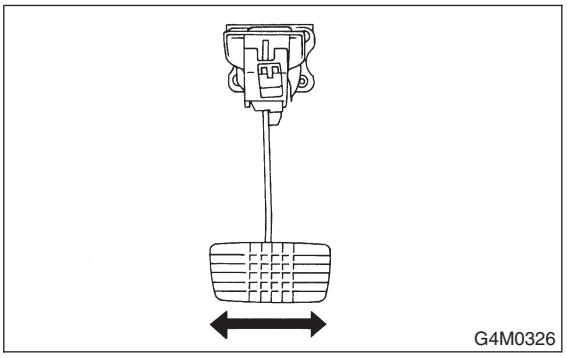
Move brake and clutch pedal pads in the lateral direction with a force of approximately 10 N (1 kg, 2 lb) to ensure pedal deflection is in specified range.

Deflection of brake and clutch pedal:
Service limit
5.0 mm (0.197 in) or less

CAUTION:
If excessive deflection is noted, replace bushings with new ones.



S4M0135A

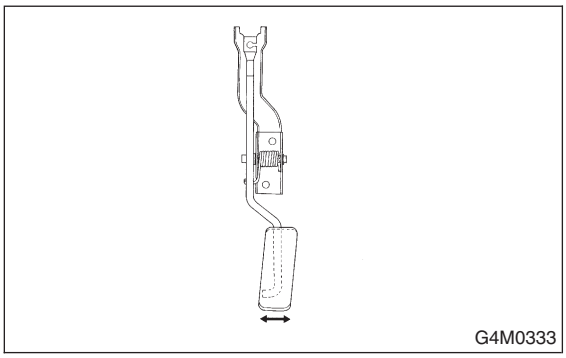

G4M0326

2. ACCELERATOR PEDAL

Lightly move pedal pad in lateral the direction to ensure pedal deflection is in specified range.

Deflection of accelerator pedal:
Service limit
5.0 mm (0.197 in) or less

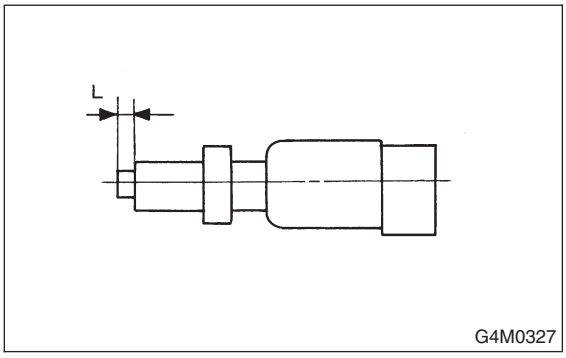
CAUTION:
If excessive deflection is noted, replace bushing and clip with new ones.


G4M0333

3. STOP LIGHT SWITCH

If stop light switch does not operate properly (or if it does not stop at the specified position), replace with a new one.

Specified position: L
$2.8^{+1.5}_{0}$ mm ($0.110\ ^{+0.059}_{0}$ in)



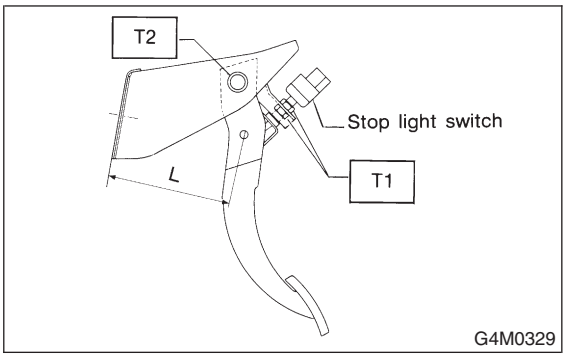
G4M0327

D: ASSEMBLY

1. BRAKE AND CLUTCH PEDAL

1) Attach stop light switch, etc. to pedal bracket temporarily.
2) Clean inside of bores of clutch pedal and brake pedal, apply grease, and set bushings into bores.
3) Align bores of pedal bracket, clutch pedal and brake pedal, attach brake pedal return spring and clutch pedal effort reducing spring (vehicle with hill holder), and then install pedal bolt.

Tightening torque:
T2: 29±7 N·m (3.0±0.7 kg-m, 21.7±5.1 ft-lb)



G4M0329

NOTE:
Clean up inside of bushings and apply grease before installing spacer.

4) Set brake pedal position by adjusting position of stop light switch.

Pedal position: L
125.9 mm (4.96 in)

Tightening torque:
T1: 8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)

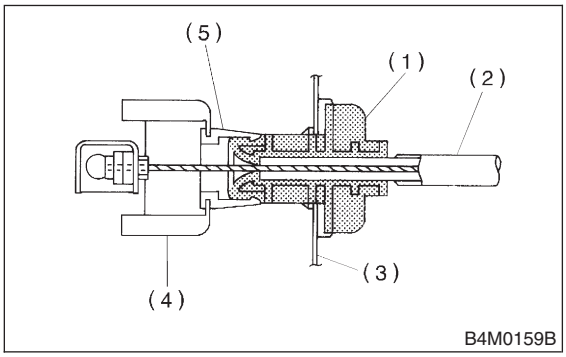
2. ACCELERATOR PEDAL

Clean and apply grease to spacer and inside bore of accelerator pedal. Install accelerator pedal onto pedal bracket.

E: INSTALLATION

1) Installation is in the reverse order of removal procedures.

CAUTION:
• Be careful not to bend clutch cable too much.
• Never fail to cover outer cable end with boot.
• Be careful not to kink accelerator cable.
• Make sure that holder and casing cap are securely connected.



(1) Casing cap
(2) Accelerator cable
(3) Toe board
(4) Accelerator pedal bracket
(5) Holder

2) Adjust clutch pedal. <Ref. to 4-5 [W1F1].>
3) Adjustment after pedal installation <Ref. to 4-5 [W1A0].>

F: ADJUSTMENT

1. CLUTCH PEDAL

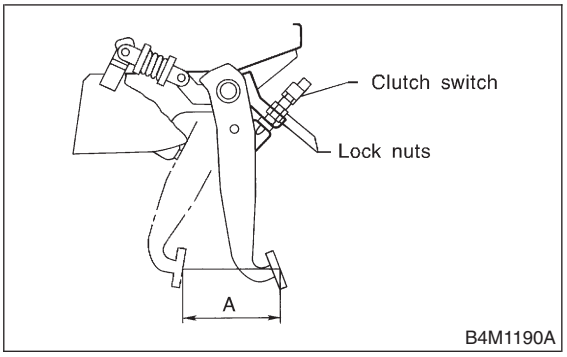
1) Turn cruise control clutch switch lock nuts until clutch pedal full stroke length is within specifications.

CAUTION:
Do not attempt to turn clutch switch to adjust clutch pedal full stroke length.

NOTE:
If lock nuts cannot adjust clutch pedal full stroke length to specifications, turn master cylinder push rod to adjust it.

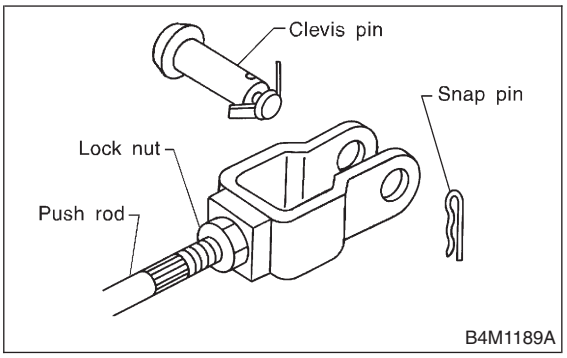
Specified clutch pedal full stroke: A
130 — 135 mm (5.11 — 5.31 in)

Tightening torque (Clutch switch lock nut):
8±2 N·m (0.8±0.2 kg-m, 5.8±1.4 ft-lb)



2) Turn master cylinder push rod so that clevis pin moves to the left and then to the right. Clevis pin must move without resistance while it is rattling.

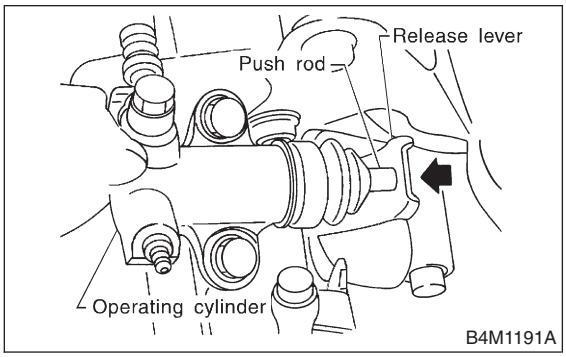
Tightening torque (Push rod lock nut):
10±2 N·m (1.0±0.2 kg-m, 7.2±1.4 ft-lb)



3) Depress and release clutch pedal 2 to 3 times to ensure that clutch pedal and release fork operate smoothly. If clutch pedal and release fork do not operate smoothly, bleed air from clutch hydraulic system. <Ref. to 2-10 [W2A0].>
4) Measure clutch pedal full stroke length again to ensure that it is within specifications. If it is not, repeat adjustment procedures again from the beginning.

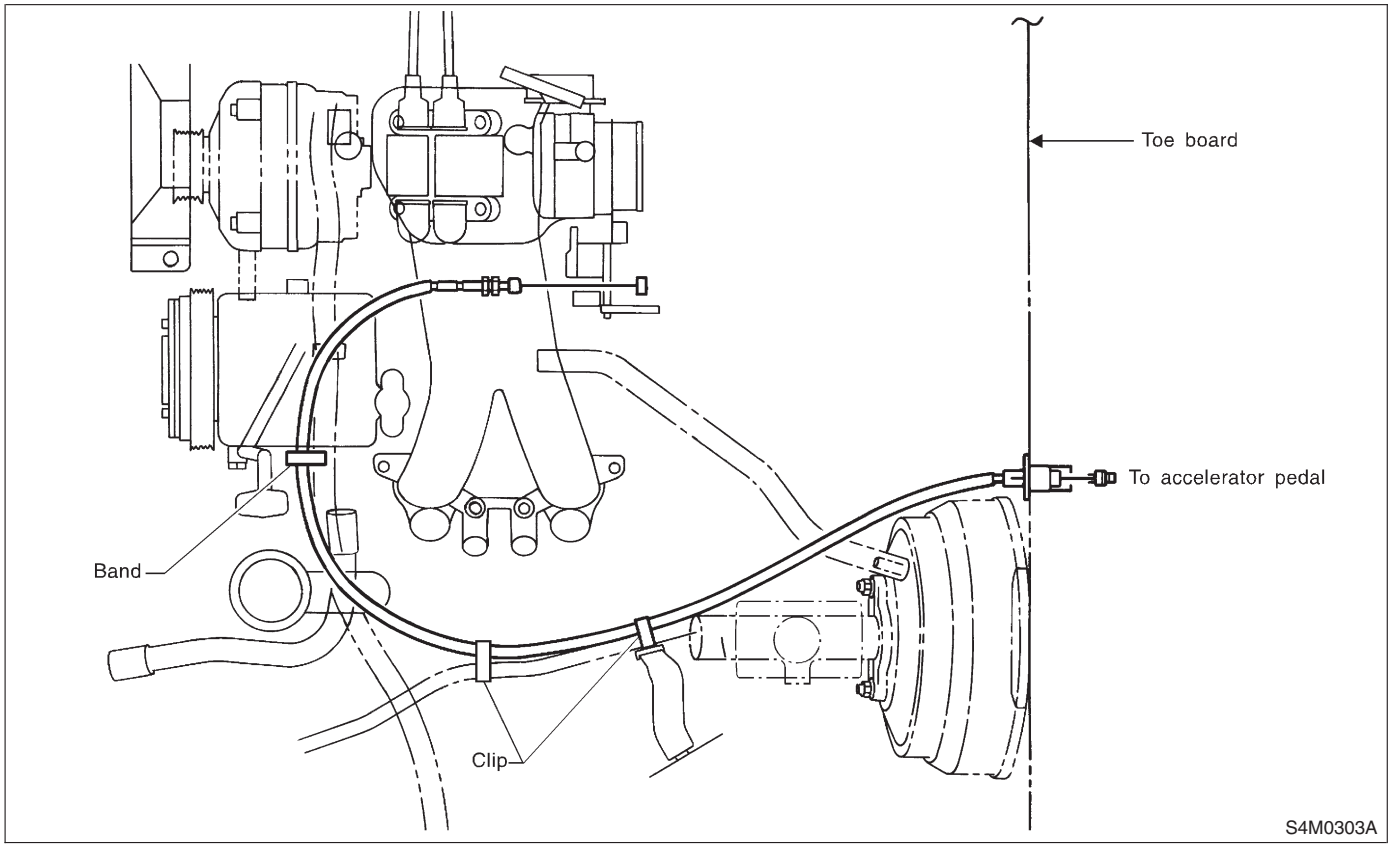
Specified clutch pedal full stroke:
130 — 135 mm (5.11 — 5.31 in)

5) Move clevis pin to the left and then to the right. It should move without resistance while it is rattling. If resistance is felt, repeat adjustment procedures again from the beginning.
6) Push release lever until operating cylinder push rod retracts. Ensure that clutch fluid level in reservoir tank increases. If clutch fluid level increases, hydraulic clutch is properly adjusted; if fluid level does not increase or push rod does not retract, replace master cylinder with new one. <Ref. to 2-10 [W600].>

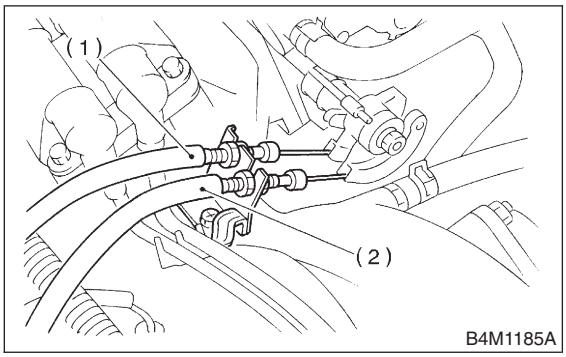


2. Accelerator Cable

A: REMOVAL



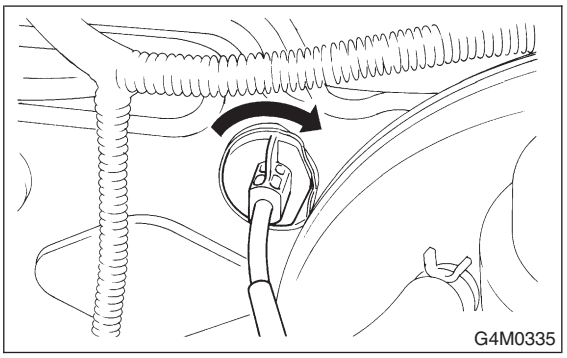
1) Disconnect accelerator cable from connector inside engine compartment first.
2) Remove lock nut from accelerator cable bracket.
3) Separate accelerator cable (1) from bracket, then unlock inner cable.



4) Remove cable end from throttle cam using your fingertips.

CAUTION:
Be careful not to bend inner cable.

5) Disconnect cable end from accelerator cable bracket inside driver compartment.
6) Remove clip inside engine compartment.
7) Working inside engine compartment, remove the casing cap out of the toe board by turning it clockwise.

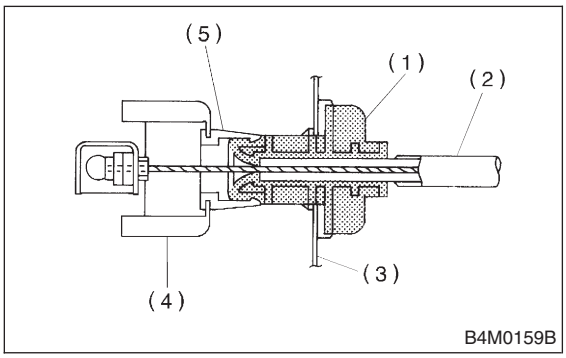


8) Pull out the cable from the toe board hole.

B: INSTALLATION

1) Installation is in the reverse order of removal procedures.

CAUTION:
- **Be careful not to kink accelerator cable.**
- **Make sure that holder and casing cap are securely connected.**



(1) Casing cap
(2) Accelerator cable
(3) Toe board
(4) Accelerator pedal bracket
(5) Holder

2) Adjustment after cable installation <Ref. to 4-5 [W1A3].>

1. Pedal System and Control Cables

Trouble	Corrective action
Excessively worn brake pedal pad	Replace.
Failure of accelerator pedals to operate	Connect cables correctly.
Stop light switch does not light up.	Adjust position of stop light switch.
Stop light switch is not smooth and/or stroke is not correct.	Replace.
Insufficient pedal play	Adjust pedal play.
Clutch and/or brake pedal free play insufficient	Adjust pedal free play.
Maladjustment of brake pedal or booster push rod	Inspect and adjust.
Excessively worn and damaged pedal shaft and/or bushing	Replace bushing and/or shaft with new one.

MEMO:

HEATER AND VENTILATOR 4-6

Page

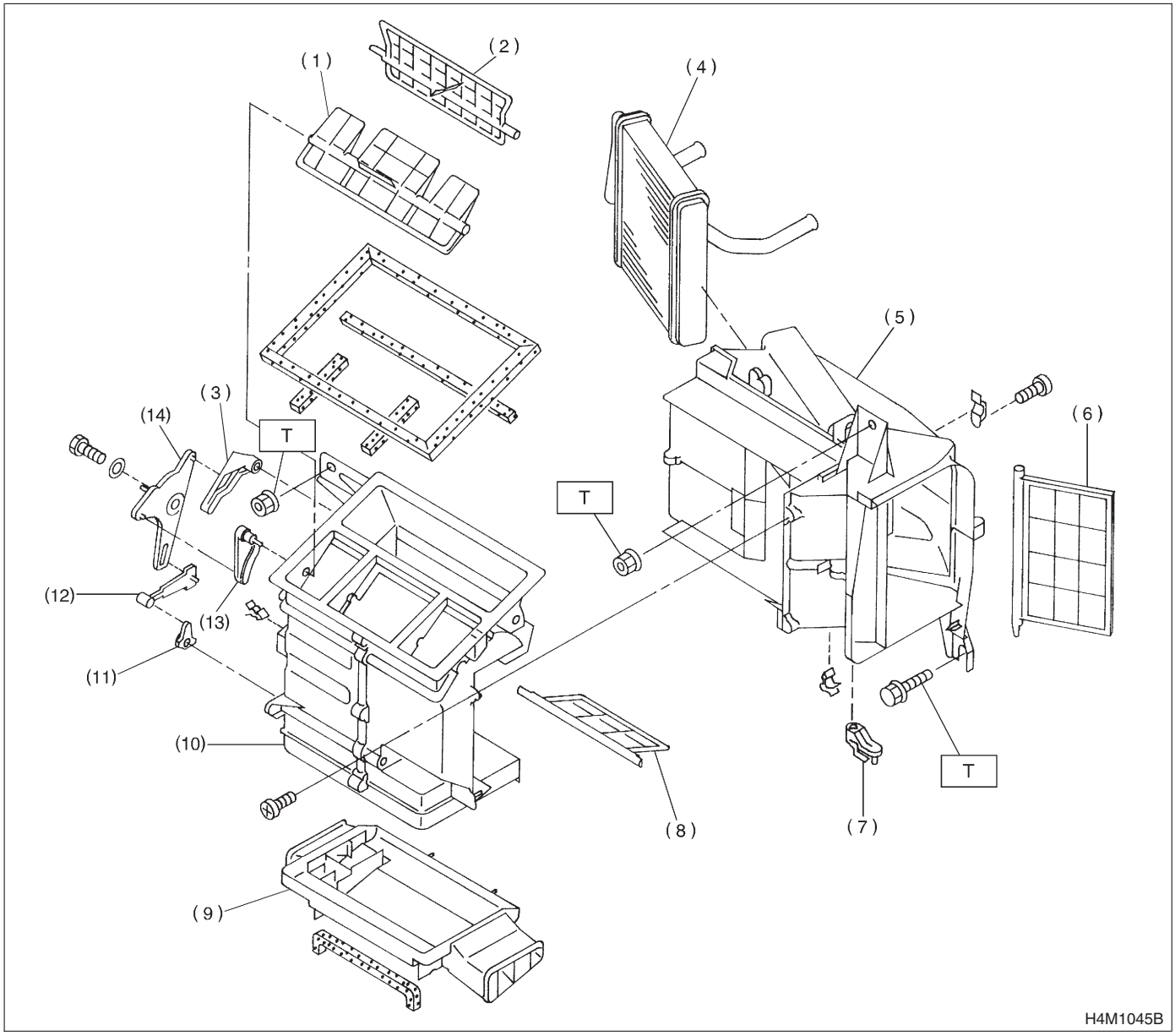
S SPECIFICATIONS AND SERVICE DATA 2
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2. Intake Unit 4
3. Control Unit 5
W SERVICE PROCEDURE 6
1. Precaution 6
2. Heater Unit 6
3. Blower Motor Assembly 7
4. Control Unit 7

1. Specifications

A: HEATER SYSTEM

Item		Specifications	Condition	
Heating capacity		5.0 kW (4,300 kcal/h, 17,062 BTU/h) or more	• Mode selector switch	: HEAT
			• Temperature control switch	: FULL HOT
			• Temperature difference between hot water and inlet air	: 65°C (149°F)
			• Hot water flow rate	: 360 ℓ (95.1 US gal, 79.2 Imp gal)/h
Air flow rate		280 m^3 (9,888 cu ft)/h	Heat mode (FRESH), FULL HOT at 12.5 V	
Max air flow rate		480 m^3 (16,949 cu ft)/h	• Temperature control switch	: FULL COLD
			• Blower fan speed	: 4th position
			• Mode selector lever	: RECIRC
Heater core size (height × length × width)		193.5 × 152 × 35 mm (7.62 × 5.98 × 1.38 in)	—	
Blower motor	Type	Magnet motor 200 W or less	at 12 V	
	Fan type and size (diameter × width)	Sirocco fan type 150 × 70 mm (5.91 × 2.76 in)	—	

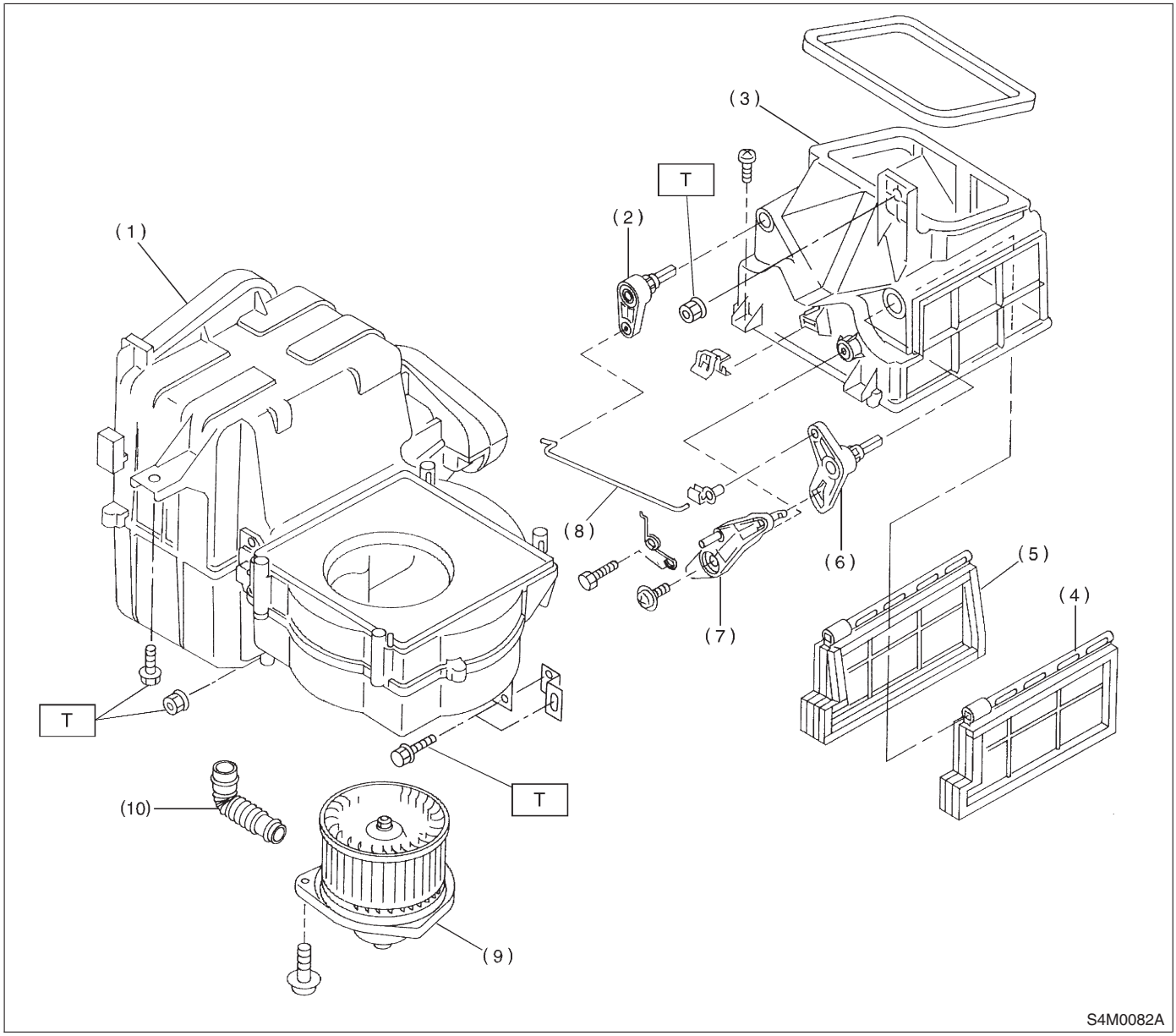
1. Heater Unit



(1) Vent door
(2) DEF door
(3) DEF lever
(4) Heater core
(5) Heater case FRONT
(6) Mix door
(7) Mix lever
(8) Foot door
(9) Foot duct
(10) Heater case REAR
(11) Foot lever lower
(12) Foot lever upper
(13) Vent lever
(14) Side link

Tightening torque: N·m (kg-m, ft-lb)
T: 7.35±1.96
(0.750±0.200, 5.421±1.446)

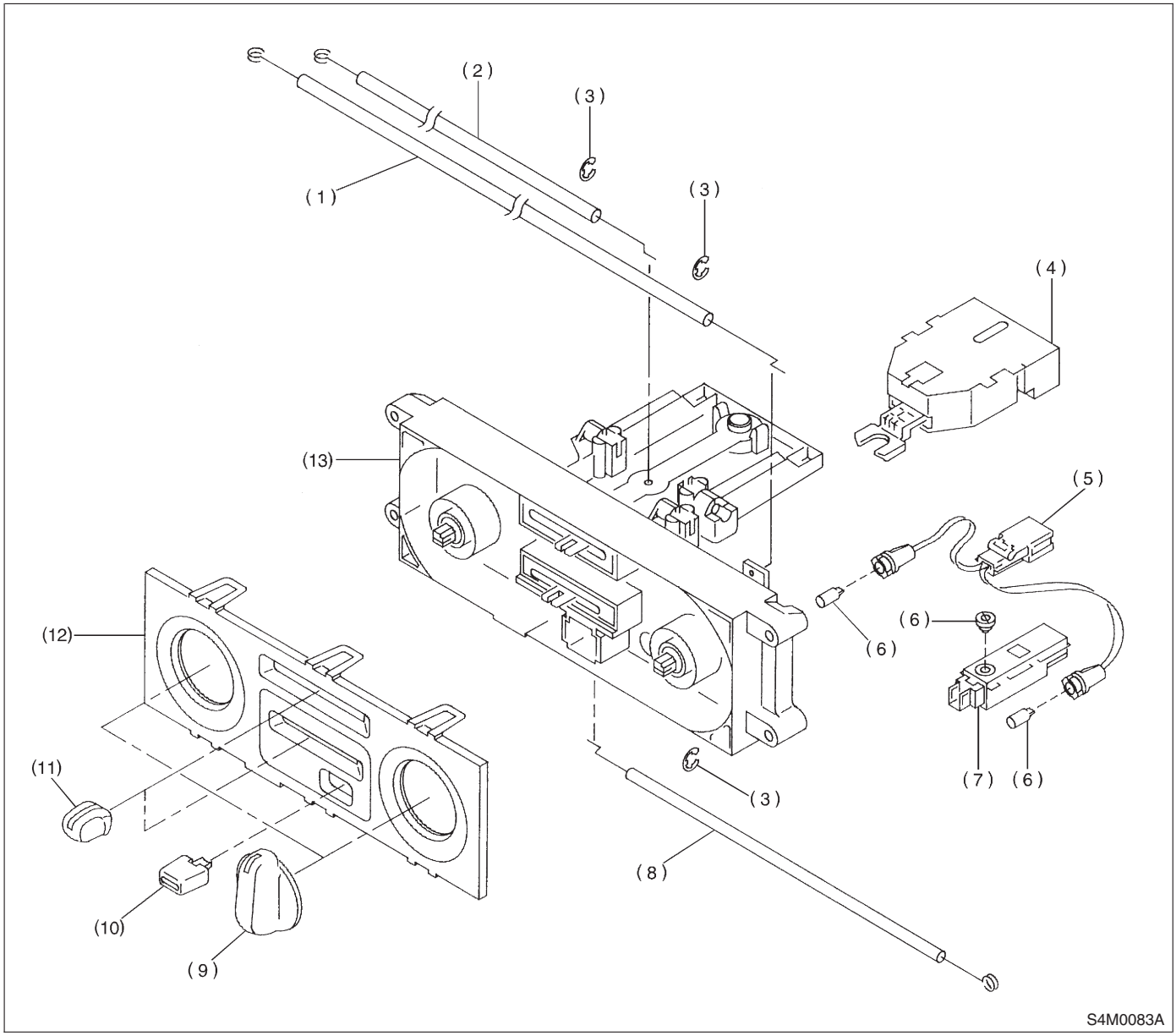
2. Intake Unit



(1) Intake unit case lower
(2) Lever (B)
(3) Intake unit case upper
(4) Door (A)
(5) Door (B)
(6) Lever (A)
(7) Link
(8) Rod
(9) Blower motor ASSY
(10) Aspirator pipe

Tightening torque: N·m (kg-m, ft-lb)
T: 7.35±1.96
(0.750±0.200, 5.421±1.446)

3. Control Unit



(1) Temperature control cable
(2) Recirc control cable
(3) Clip
(4) Blower switch ASSY
(5) Harness ASSY
(6) Bulb
(7) A/C switch ASSY
(8) Mode control cable
(9) Control dial knob
(10) A/C switch knob
(11) Control lever knob
(12) Plate
(13) Base unit

1. Precaution

A: SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the instrument panel, heater unit, blower motor and control unit.

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
• Be careful not to damage Airbag system wiring harness when servicing the instrument panel, heater unit, blower motor and control unit.

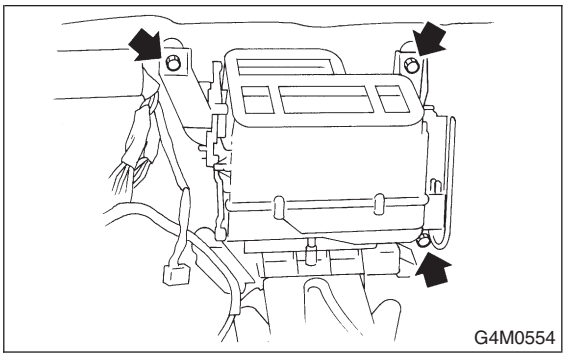
2. Heater Unit

A: REMOVAL AND INSTALLATION

1) Disconnect GND cable from battery.
2) Remove heater hoses (inlet, outlet) in engine compartment.

NOTE:
Drain as much coolant from heater unit as possible, and plug disconnected hose with cloth. <Ref. to 2-2 [W800].>

3) Remove instrument panel.
<Ref. to 5-4 [W1A0].>
4) Remove steering support beam.
<Ref. to 5-1 [C500].>
5) Remove cooling unit.
<Ref. to 4-7 [W14A0].>
6) Remove heater unit.



7) Installation is in the reverse order of removal.

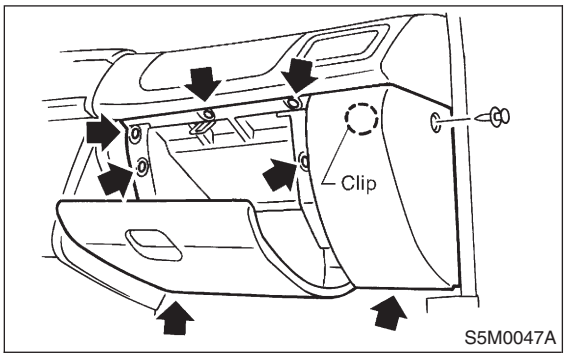
Fitted length of heater hose over pipe: 27.5±2.5 mm (1.083±0.098 in)

8) Pour coolant.
<Ref. to 2-2 [W800].>

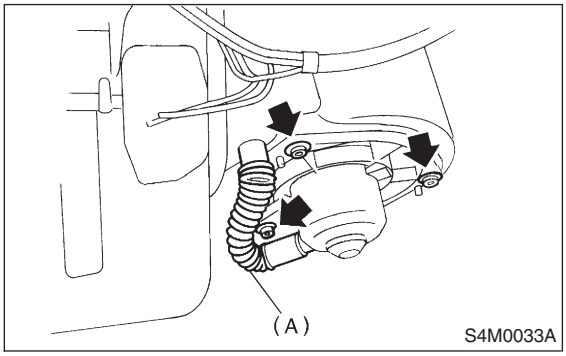
3. Blower Motor Assembly

A: REMOVAL AND INSTALLATION

1) Disconnect GND cable from battery.
2) Remove glove box.



3) Disconnect blower motor harness connector.
4) Disconnect aspirator pipe (A).
5) Remove blower motor mounting screw.



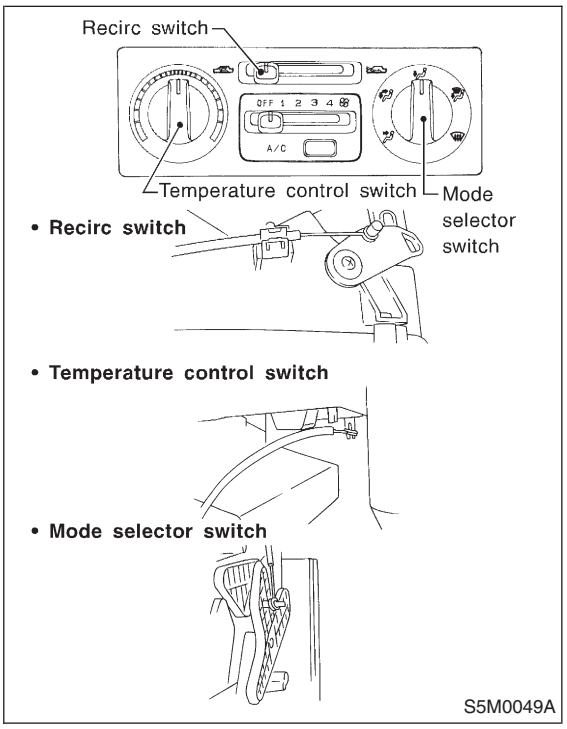
6) Remove blower motor assembly.
7) Installation is in the reverse order of removal.

4. Control Unit

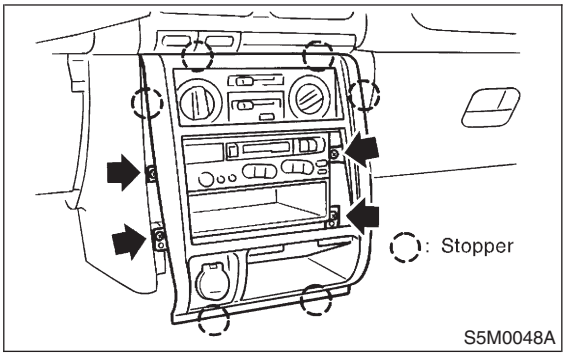
A: REMOVAL AND INSTALLATION

1) Disconnect GND cable from battery.
2) Set temperature control switch to “FULL HOT” and mode selector switch to “DEF” position and recirc switch to “FRESH” position.
3) Disconnect temperature control cable and mode door control cable from heater unit then disconnect recirc control cable from intake unit.

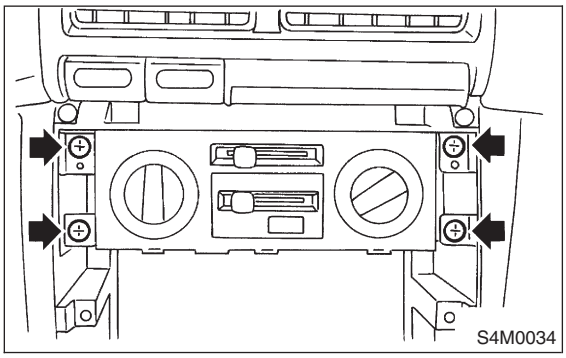
NOTE:
Do not attempt to move links during installation.



4) Remove console box. <Ref. to 5-4 [W1A0].>
5) Remove center panel and then disconnect connector.
6) Remove audio.



7) Remove control unit assembly from center console.



8) Installation is in the reverse order of removal.

NOTE:
Before installing control unit, set temperature control switch to “FULL HOT” and mode selector switch to “DEF” position and recirc switch to “FRESH” position.

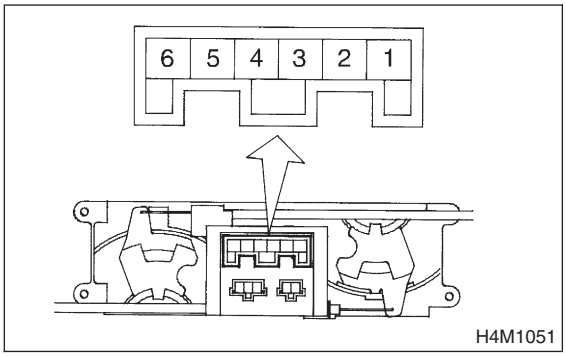
B: INSPECTION

1. FAN SWITCH

Check continuity between terminals at each switch position.

Switch position	Terminals					
	1	2	3	4	5	6
1	○				○	○
2	○			○		○
3	○		○			○
4	○	○				○
	IGN					GND

H5M1280A

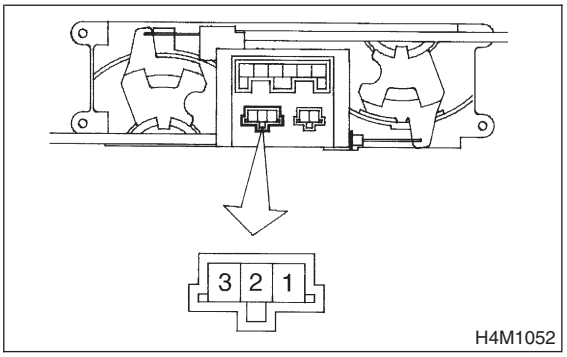


2. A/C SWITCH

Check A/C switch continuity between each terminal.

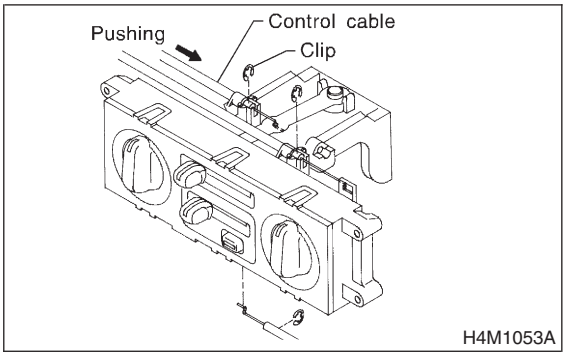
Terminal	Switch ON	Illumi.
1		○
2	○	○
3	○	○

H5M1281A



C: ADJUSTMENT

1) Operate temperature control switch to “FULL COLD” and mode selector switch to “VENT” position and recirc switch to “RECIRC” position.
2) Install control cable to lever. While pushing outer cable, secure control cable with clip.

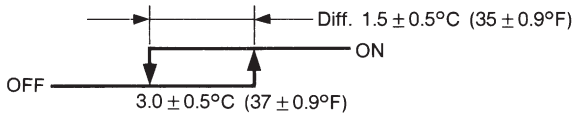


AIR CONDITIONING SYSTEM 4-7

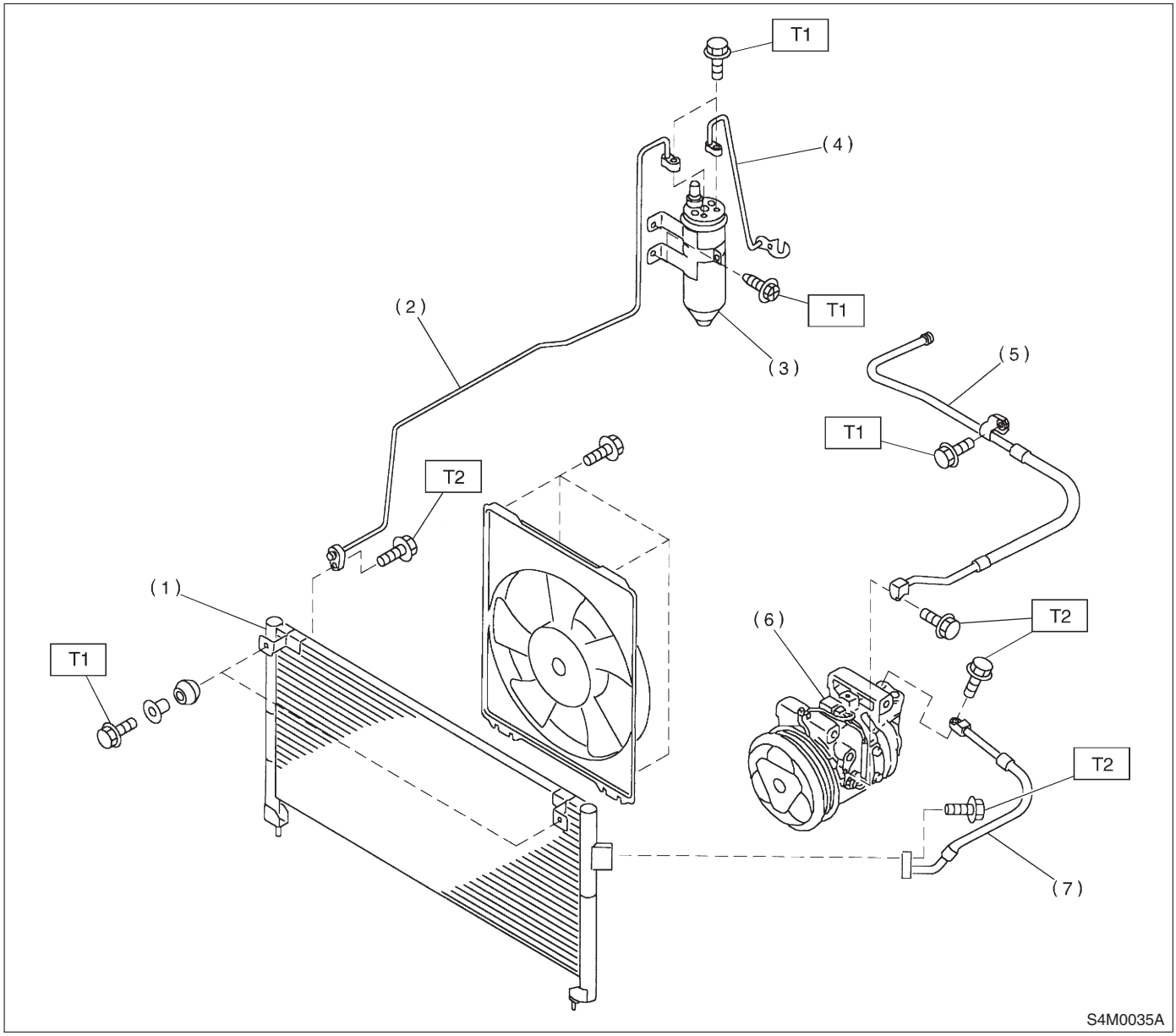
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1. Specifications

Item			Specifications
Type of air conditioner			Reheat air-mix type
Cooling capacity			5.23 kW (4,500 kcal/h, 17,856 BTU/h)
Refrigerant			HFC-134a (CH_2FCF_3) [0.6±0.05 kg (1.3±0.11 lb)]
Compressor		Type	5-vane rotary, fix volume (CR-14)
		Discharge	144 cm^3 (8.79 cu in)/rev
		Max. permissible speed	7,000 rpm
Magnet clutch		Type	Dry, single-disc type
		Power consumption	47 W
		Type of belt	V-Ribbed 4 PK
		Pulley dia. (effective dia.)	125 mm (4.92 in)
		Pulley ratio	1.064
Condenser		Type	Corrugated fin (Multi-flow)
		Core face area	0.241 m^2 (2.59 sq ft)
		Core thickness	19 mm (0.75 in)
		Radiation area	6.52 m^2 (70 sq ft)
Receiver drier		Effective inner capacity	250 cm^3 (15.26 cu in)
Expansion valve		Type	Internal equalizing
Evaporator		Type	Single tank
		Dimensions (W × H × T)	74 × 222 × 235 mm (2.91 × 8.74 × 9.25 in)
Blower fan		Fan type	Sirocco fan
		Outer diameter × width	140 × 75 mm (5.51 × 2.95 in)
		Power consumption	200 W at 12 V
Condenser fan (Sub fan)		Motor type	Magnet
		Power consumption	70 W at 12 V
		Fan outer diameter	320 mm (12.60 in)
Radiator fan (Main fan)		Motor type	Magnet
		Power consumption	70 W at 12 V
		Fan outer diameter	320 mm (12.60 in)
Idling speed (A/C ON)		MPFI model	850±50 rpm (700±50 rpm "D" range in AT model)
Dual switch (Pressure switch)	Low-pressure switch operating pressure	ON → OFF	176±29 kPa (1.80±0.30 kg/cm^2, 25.5±4.3 psi)
		OFF → ON	$186^{+39}/_{-25}$ kPa ($1.90^{+0.4}/_{-0.25}$ kg/cm^2, $27.0^{+5.7}/_{-3.6}$ psi)
	High-pressure switch operating pressure	ON → OFF	2,942±98 kPa (30±1 kg/cm^2, 427±14 psi)
		DIFF	588±196 kPa (6±2 kg/cm^2, 85±28 psi)
Compressor relief valve blow-out pressure			3,727±196 kPa (38±2.0 kg/cm^2, 540±28 psi)
Thermo control amplifier working temperature (Evaporator outlet air)			 G4M0938
Compressor thermocut temperature			150±5°C (302±9°F) Diff. −3±5°C (27±9°F)

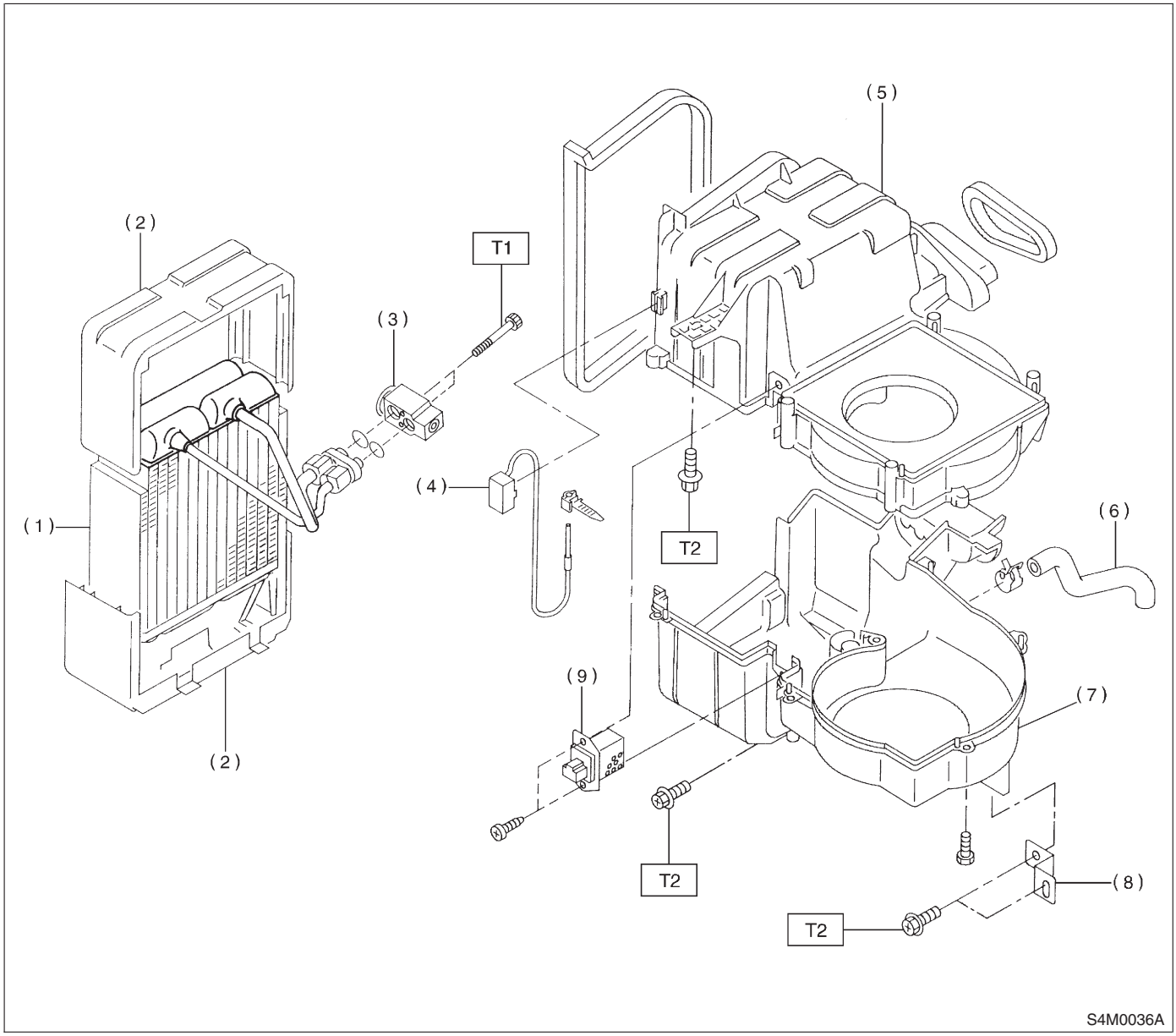
1. Air Conditioning System



(1) Condenser
(2) Pipe (Condenser — Receiver drier)
(3) Receiver drier
(4) Pipe (Receiver drier — C/unit)
(5) Hose (Low-pressure)
(6) Compressor
(7) Hose (High-pressure)

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 18±5 (1.8±0.5, 13±3.6)

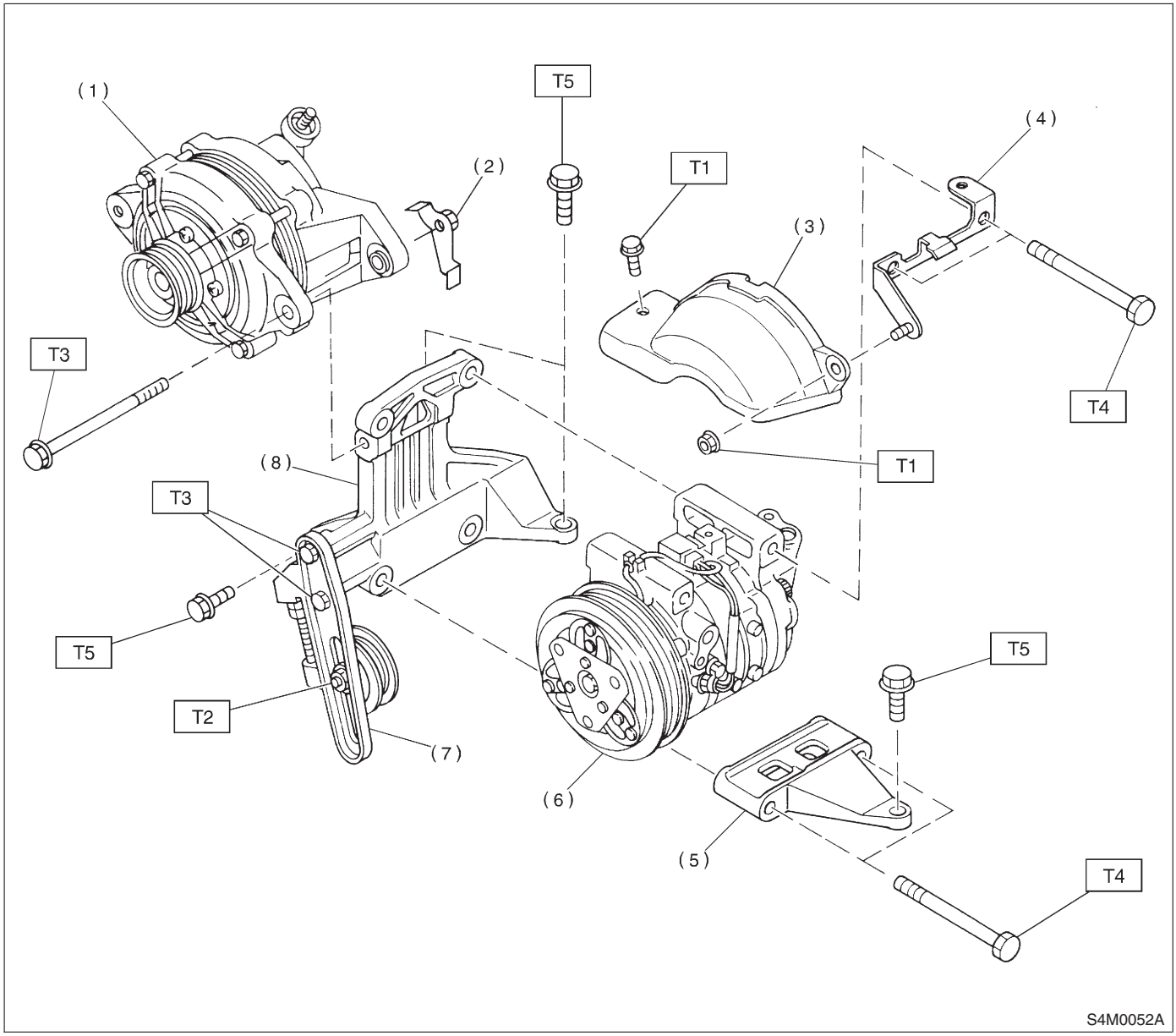
2. Intake Unit with Evaporator



(1) Evaporator
(2) Insulator
(3) Block expansion valve
(4) Thermo control amplifier
(5) Intake unit case upper
(6) Drain hose
(7) Intake unit case lower
(8) Mount bracket
(9) Resistor

Tightening torque: N·m (kg-m, ft-lb)
T1: 4±1 (0.4±0.1, 2.9±0.7)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)

3. Compressor



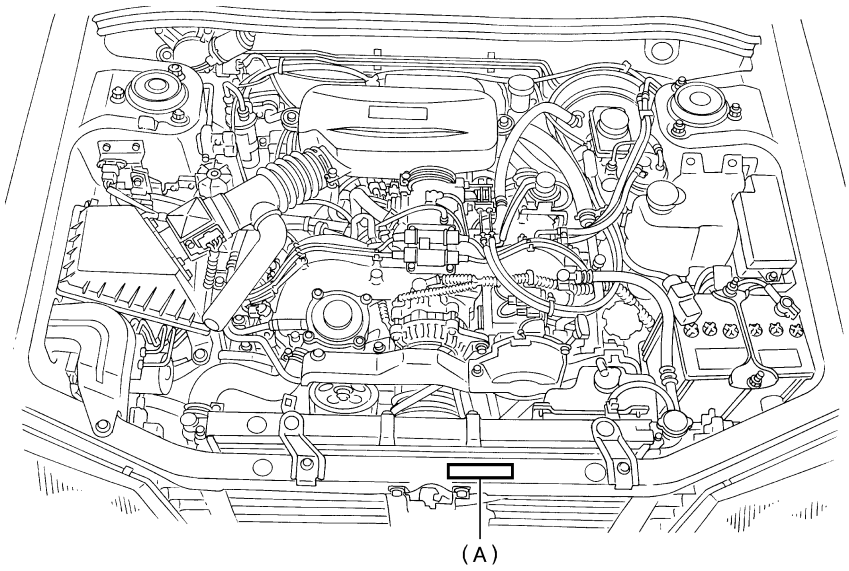
(1) Alternator
(2) Alternator bracket nut
(3) Compressor belt cover
(4) Bracket
(5) Compressor bracket lower
(6) Compressor
(7) Idler pulley ASSY
(8) Compressor bracket upper

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2 (0.75±0.2, 5.4±1.4)
T2: 23±3 (2.3±0.3, 16.6±2.2)
T3: 23.0±3 (2.35±0.3, 17.0±2.2)
T4: 28.9±4.4 (2.95±0.45, 21.3±3.3)
T5: 35±4 (3.6±0.4, 26.0±2.9)

1. Safety Precautions

A: HFC-134a AIR CONDITIONING SYSTEM

Component parts of the cooling system, refrigerant, compressor oil, and other parts are not the same for the HFC-134a system and the older CFC-12 system. Do not interchange parts or liquid. Vehicles with HFC-134a air conditioning systems, use only HFC-134a parts that are indicated on a label (A) attached to the vehicle. Before performing any maintenance, verify the type of air conditioning system installed in the vehicle.



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B: COMPRESSOR OIL

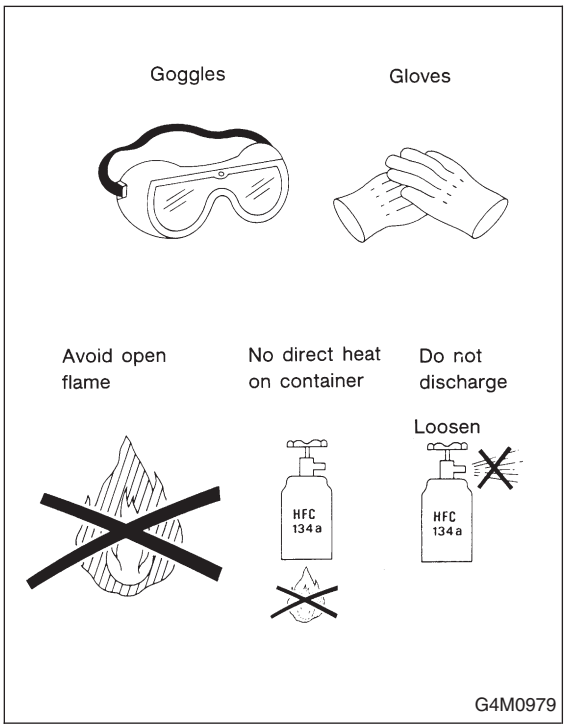
Do not use any compressor oil that is not specifically designated for the HFC-134a air conditioning system; only use DH-PR. Also, do not use HFC-134a compressor oil in the CFC-12 air conditioning system. If compression oils are mixed, poor lubrication will result and the compressor itself may be damaged.
Because HFC-134a compressor oil is very hygroscopic (easily absorbs moisture), when parts of the air conditioning system are being removed, quickly install a blind plug to prevent contact with the outside air. Also, always make sure that the service container for compressor oil is tightly closed except when in use. Store compressor oil in a tightly closed steel container.

C: REFRIGERANT

Do not put CFC-12 refrigerant into a HFC-134a air conditioning system. Also, do not put HFC-134a refrigerant into a CFC-12 air conditioning system. If the wrong refrigerant is used, poor lubrication will result and the compressor itself may be destroyed.

D: HANDLING OF REFRIGERANT

Because refrigerant boils at approx. –30°C (–22°F) at sea level, it is cold enough to give you severe frostbite. Always wear goggles to protect your eyes and gloves to protect your hands. Also, even under the pressures normally found in CFC-12 containers, refrigerant will boil with the addition of heat. This could raise the pressure inside the container to a dangerous level.
Never expose a can of HFC-134a to direct sunlight, or to temperatures over 40°C (104°F). One more thing to remember about HFC-134a is that when it is exposed to an open flame or to hot metal, it forms phosgene, a deadly gas. Do not discharge HFC-134a into the atmosphere on purpose. Always read and follow the precautions on the HFC-134a bottle.



2. Basic Information

1) The combination of moisture and refrigerant forms acid, therefore, moisture should not be allowed to enter the refrigerant.
2) Refrigerant oil readily absorbs moisture, therefore, keep refrigerant oil containers tightly capped.
3) The process of evacuating the system is performed to remove small amounts of moisture. This is accomplished by lowering the pressure inside the system, which allows the moisture to boil off, in much the same way that a pot of water will boil away to nothing given enough time. The evacuation process does not suck the moisture out of the system.
4) A minimum level of vacuum must be reached to satisfactorily evacuate the system. This minimum level of vacuum depends on the temperature inside the system. The chart below shows the level of vacuum required to boil water at various temperatures.
Additionally, the vacuum level shown on a gauge will read approx. 4 kPa (25 mmHg, 1 inHg) less for each 304.8 m (1,000 ft) above sea level, due to the decrease in atmospheric pressure at altitude.

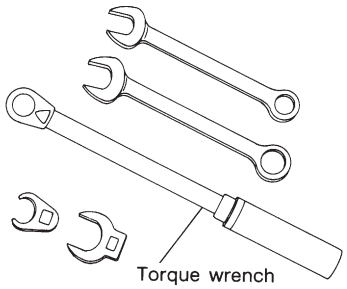
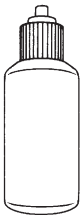
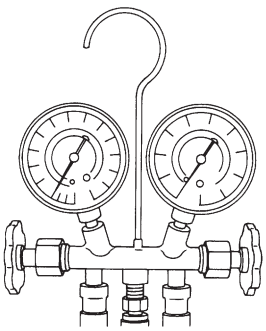
Vacuum level required to boil water (at sea level)	
Temperature	Vacuum
1.7°C (35°F)	100.9 kPa (757 mmHg, 29.8 inHg)
7.2°C (45°F)	100.6 kPa (754 mmHg, 29.7 inHg)
12.8°C (55°F)	99.9 kPa (749 mmHg, 29.5 inHg)
18.3°C (65°F)	99.2 kPa (744 mmHg, 29.3 inHg)
23.9°C (75°F)	98.5 kPa (739 mmHg, 29.1 inHg)
29.4°C (85°F)	97.2 kPa (729 mmHg, 28.7 inHg)
35°C (95°F)	95.8 kPa (719 mmHg, 28.3 inHg)

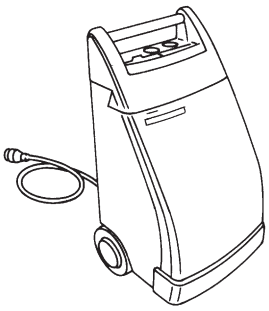
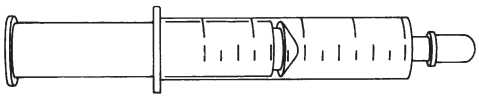
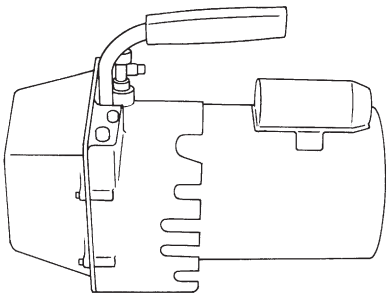
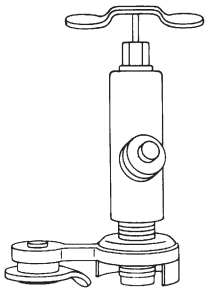
3. Tools and Equipment

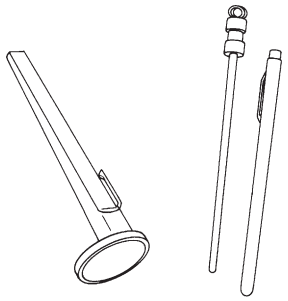
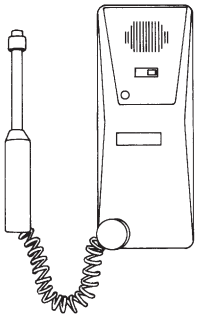
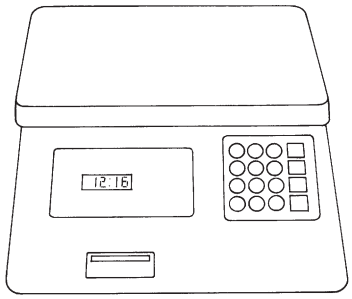
The following section provides information about the tools and equipment that will be necessary to properly service the A/C system.
Since equipment may vary slightly depending on the manufacturer, it is important to always read and follow the manufacturer's instructions.

CAUTION:
When working on vehicles with the HFC-134a system, only use HFC-134a specified tools and parts. Do not mix with CFC-12 tools and parts. If HFC-134a and CFC-12 refrigerant or compressor oil is mixed, poor lubrication will result and the compressor itself may be destroyed. In order to help prevent mixing HFC-134a and CFC-12 parts and liquid, the tool and screw type and the type of service valves used are different. The gas leak detectors for the HFC-134a and CFC-12 systems must also not be interchanged.

	HFC-134a	CFC-12
Tool & screw type	Millimeter size	Inch size
Valve type	Quick joint type	Screw-in type

Tools and Equipment	Description
• WRENCH Various **WRENCHES** will be required to service any A/C system. A 7 to 40 N·m (0.7 to 4.1 kg-m, 5 to 30 ft-lb) torque wrench with various crowfoot wrenches will be needed. Open end or flare nut wrenches will be needed for back-up on the tube and hose fittings.	 G4M0571
• APPLICATOR BOTTLE A small **APPLICATOR BOTTLE** is recommended to apply refrigerant oil to the various parts. They can be obtained at a hardware or drug store.	 G4M0572
• MANIFOLD GAUGE SET A **MANIFOLD GAUGE SET** (with hoses) can be obtained from either a commercial refrigeration supply house or from an auto shop equipment supplier.	 G4M0573

Tools and Equipment	Description
● REFRIGERANT RECOVERY SYSTEM A **REFRIGERANT RECOVERY SYSTEM** is used for the recovery and reuse of A/C system refrigerant after contaminants and moisture have been removed from the refrigerant.	 G4M0574
● SYRINGE A graduated plastic **SYRINGE** will be needed to add oil back into the system. The syringe can be found at a pharmacy or drug store.	 G4M0575
● VACUUM PUMP A **VACUUM PUMP** (in good working condition) is necessary, and may be obtained from either a commercial refrigeration supply house or an automotive equipment supplier.	 G4M0576
● CAN TAP A **CAN TAP** for the 397 g (14 oz) can is available from an auto supply store.	 G4M0577

Tools and Equipment	Description
● THERMOMETER Pocket **THERMOMETERS** are available from either industrial hardware store or commercial refrigeration supply houses.	 G4M0578
● ELECTRONIC LEAK DETECTOR An **ELECTRONIC LEAK DETECTOR** can be obtained from either a specialty tool supply or an A/C equipment supplier.	 G4M0579
● WEIGHT SCALE A **WEIGHT SCALE** such as an electronic charging scale or a bathroom scale with digital display will be needed if a 13.6 kg (30 lb) refrigerant container is used.	 G4M0580

4. O-ring Connections

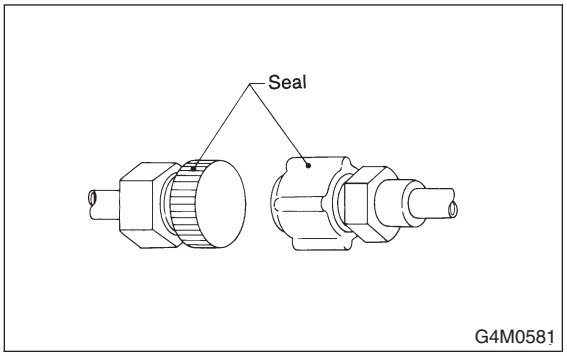
A: GENERAL

The following points should be kept in mind when assembling O-ring connections:
1) Avoid unnecessary handling and contact of O-rings with your hands, since even clean fingers contain body acids, which can contaminate the O-ring surface.
2) Do not handle O-rings with gloves, shop towels, etc., since lint particles may cling to the O-ring, possibly causing a leak upon assembly.
3) Always lubricate O-rings before assembly to allow the O-ring to seat itself properly.
4) Be certain to use torque wrenches when tightening O-ring fittings, because overtightening can not only damage the O-ring, but it can distort the tube end as well.

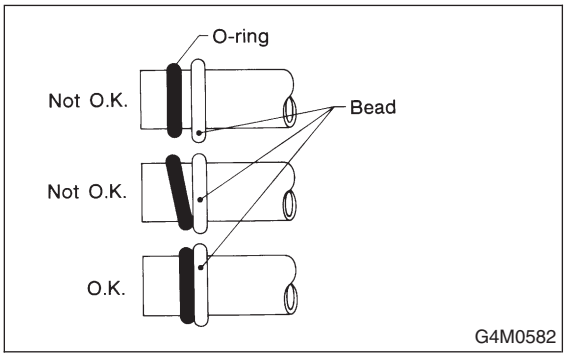
B: REMOVE PROTECTIVE SEALS

1) Just prior to making the connection, remove the protective seals.

CAUTION:
If for any reason you have to stop before making a connection, recap the tube, component or fitting.

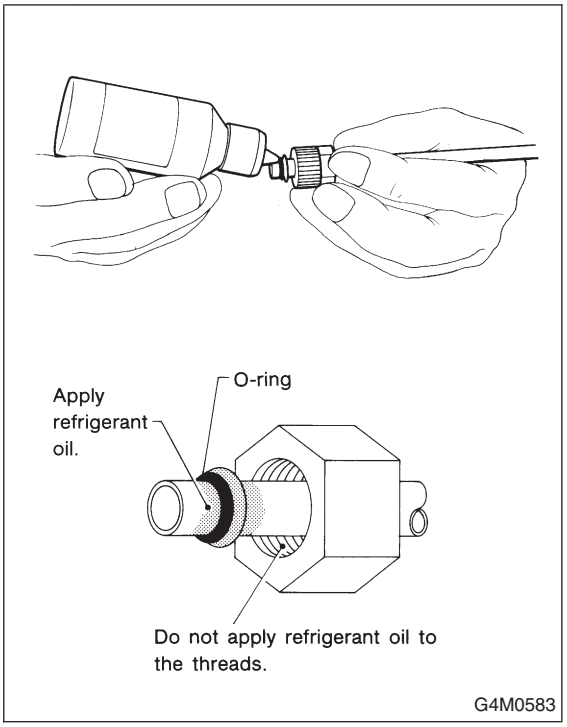


2) Visually inspect the O-ring surface, the O-ring mating surface, the threads and the connection points. If a defective part is found, replace it.
The O-ring must sit square against the tube bead. If necessary, slide the O-ring into proper position with clean hands.



C: LUBRICATE THE COMPONENTS

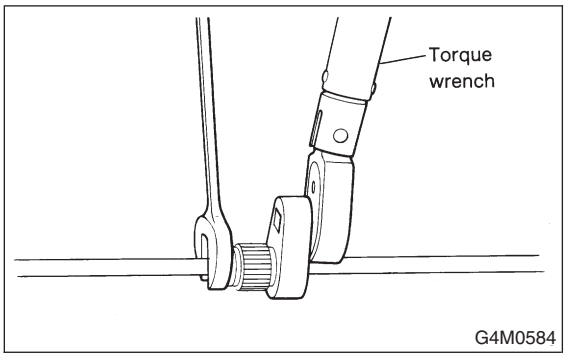
For lubrication of the components, use only refrigerant oil as described in the appropriate service manual. Apply oil from an oil squirt gun or other closed container. Do not use your finger to spread the oil over the O-ring.
Apply a small amount of refrigerant oil to the top and sides of the O-ring. The area covered by oil should include the O-ring and the tube bead.



D: TORQUE THE FITTING

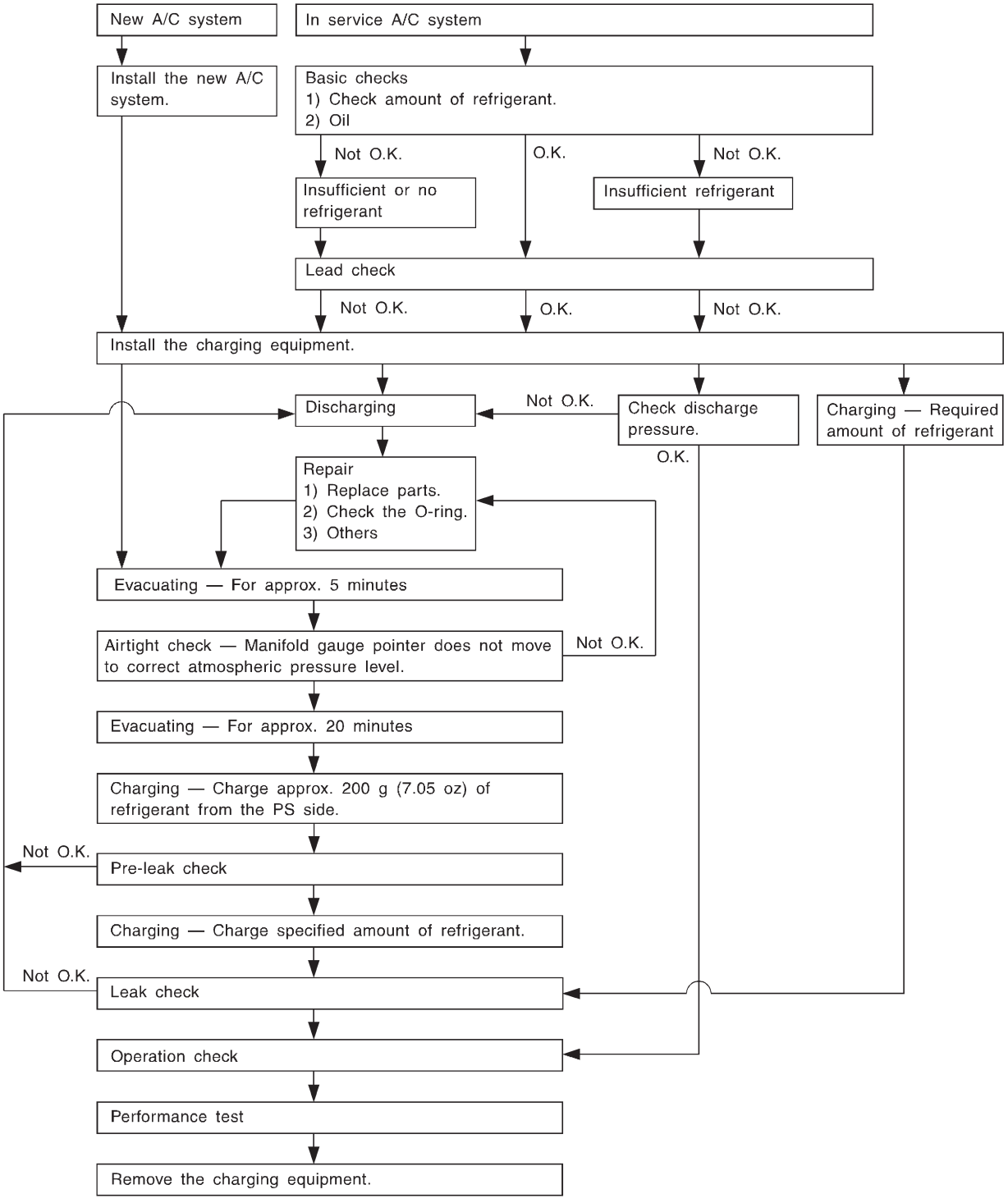
Using a back-up wrench in conjunction with a calibrated torque wrench, torque the connection to the midrange of the specification.
After completion of torquing, use a clean shop towel to remove any excess oil from the connection or any oil that may have dripped on the vehicle body or other parts.

CAUTION:
If a leak is suspected after torquing, do not retighten or retorque the connection. Instead, disassemble the connection, remove the O-ring, and inspect the O-ring, threads, joints and seating surfaces.



5. Refrigerant Service Procedure

A: WORK FLOW



H4M1261A

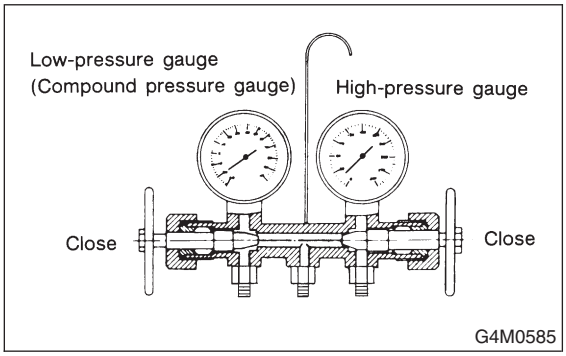
6. Discharge the System

CAUTION:
The following points must be kept in mind when discharging the system.
- **Be certain that goggles and gloves are worn.**
- **Connect refrigerant recovery system to manifold gauge set and remove recycle refrigerant from the A/C system.**

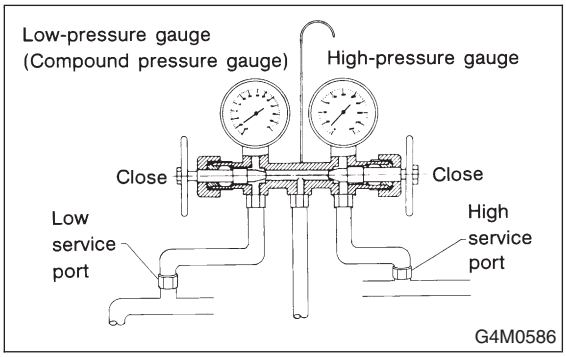
NOTE:
Refer to that refrigerant recovery system instruction manual for operating procedures.

A: CONNECTING THE MANIFOLD GAUGE SET

1) Close the high and low side manifold valves.



2) Turn the A/C system ON and turn the IG switch OFF.
3) Attach the high- and low-pressure manifolds to the high and low services port on the vehicle.



B: PREPARE FOR DISCHARGING

Connect center manifold hose to refrigerant recovery system to recycle refrigerant.

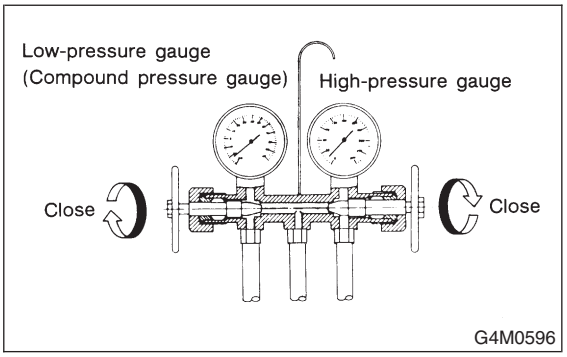
7. Evacuating and Charging

The following points should be kept in mind when evacuating and charging with a manifold gauge set:
1) Be certain that goggles and gloves are worn.
2) If bulk refrigerant [13.6 kg (30 lb) canister] is used, be certain to weigh the charge amount carefully, using the correct equipment, to avoid overcharging the system.
3) The charging procedure described in this section begins by charging liquid refrigerant into the high-pressure side of the system with the engine off. The procedure is completed by charging refrigerant vapor into the low-pressure side of the system with the engine running.

CAUTION:
Never open the high-pressure manifold valve when the engine is running.

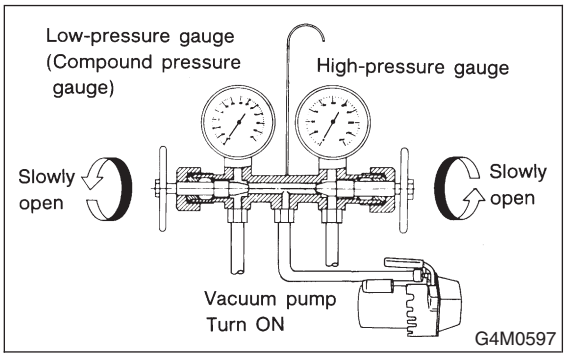
A: CONNECT THE GAUGE SET

1) Close the high- and low-pressure manifold valves.



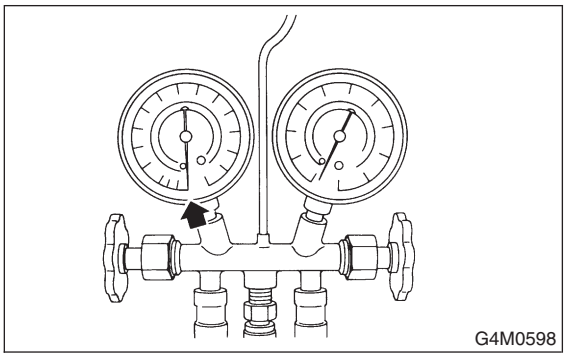
2) Attach the low-pressure manifold hose to the low-pressure service port on the vehicle. Check the low-pressure gauge. If more than 68.6 kPa (0.70 kg/cm^2, 10 psi) is indicated, discharge the system prior to charging.
3) Attach the high-pressure manifold hose to the high-pressure service port on the vehicle.
4) Connect the center hose from the manifold to the vacuum pump.
5) Turn on the vacuum pump.

6) Slowly open the low-pressure manifold valve.



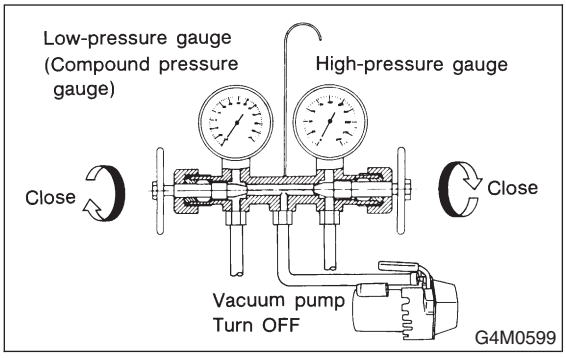
7) When the low-pressure gauge reaches approximately 66.43 kPa (498.3 mmHg, 19.62 inHg), slowly open the high-pressure manifold valve.
8) Maintain a minimum vacuum level of 100.56 kPa (754.4 mmHg, 29.70 inHg) for a minimum of 15 minutes on a new system or 30 minutes for an in-service system.

NOTE:
The gauge will read 4 kPa (25 mmHg, 1 inHg) less for every 304.8 m (1,000 ft) above sea level.



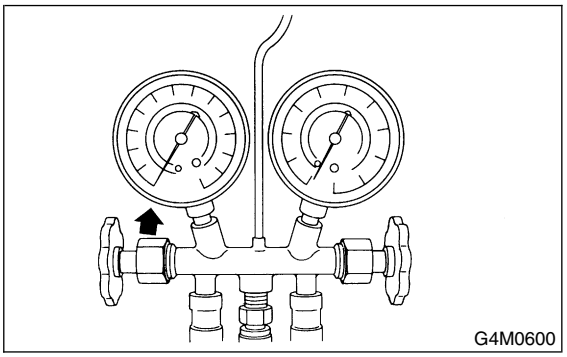
B: PERFORM A VACUUM LEAK TEST

1) After 15 minutes (or more) of evacuation, close the high-pressure manifold valve.
2) Close the low-pressure manifold valve.

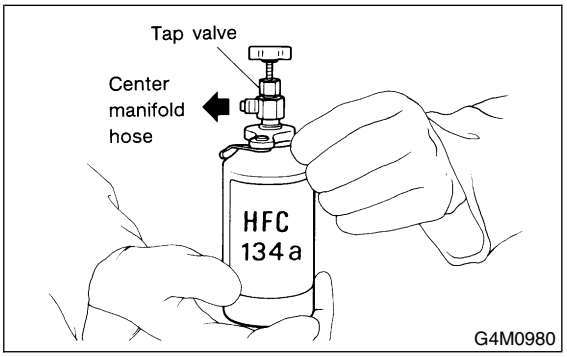


3) Turn off the vacuum pump.

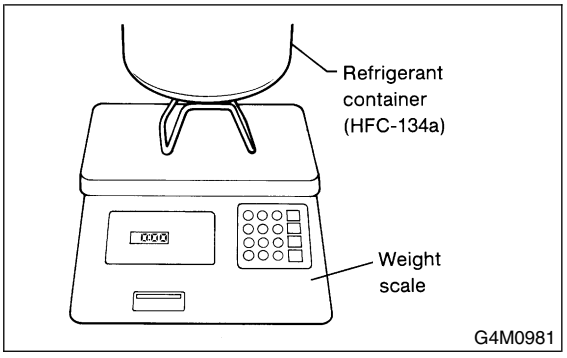
4) Note the low side gauge reading.



5) After 5 minutes, re-check the low-pressure gauge reading.
If the vacuum level has changed more than 4 kPa (25 mmHg, 1 inHg), perform an HFC-134a leak test.
If the vacuum reading is about the same as noted in step 4), continue on to next step.
6) Carefully attach the can tap to the refrigerant can by following the can tap manufacturer's instructions.



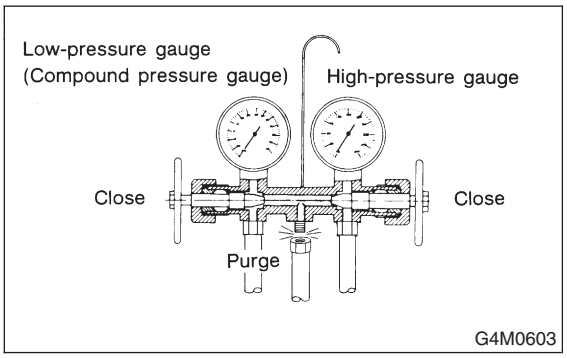
7) Disconnect the center manifold hose from the vacuum pump and connect the hose to the tap valve.
8) If a 13.6 kg (30 lb) container of refrigerant is used a weight scale will be needed. This scale is to determine the amount of refrigerant that is used. Connect the center hose from the manifold to the valve. Place the 13.6 kg (30 lb) container on the scale, valve end down.



C: PURGE THE CENTER HOSE

CAUTION:
Be certain that goggle and glove are worn.

1) Verify that all three hose connections are tight at the manifold gauge set.

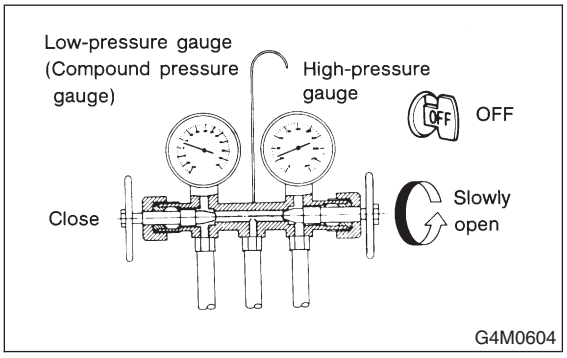


2) Open the valve on the HFC-134a source.
3) Loosen the center hose connection at the manifold and allow the HFC-134a to escape for no more than two or three seconds, then quickly retighten the hose fitting at the manifold.

D: INITIAL CHARGING THROUGH THE HIGH SIDE

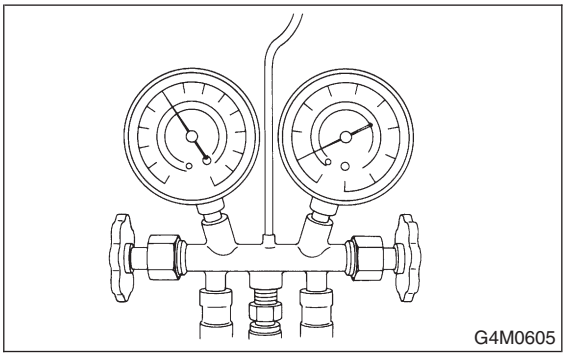
1) Connect a tachometer to the engine.
2) With the engine off, start charging by slowly opening the high-pressure manifold valve.

NOTE:
The initial charge rate can be increased by immersing the can in lukewarm [below 38°C (100°F)] water for a short time.



E: CHECK THE GAUGE READINGS

When both the high- and low-pressure gauge readings are about equal, or the HFC-134a source is empty, or the system has been filled to specifications, close the high-pressure manifold valve.

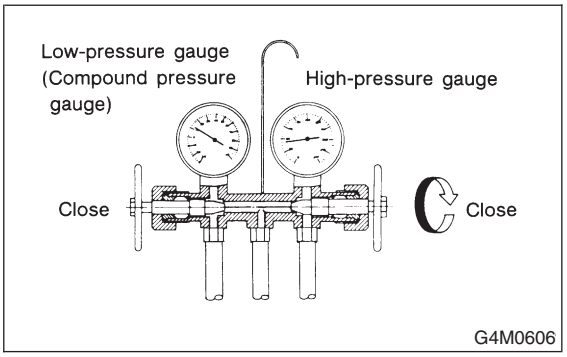


F: ADD ADDITIONAL CANS

If the HFC-134a source is exhausted, first close the high-pressure manifold valve, second, close the can tap valve, then slowly purge the refrigerant from the service hose by loosening the fitting at the can tap.

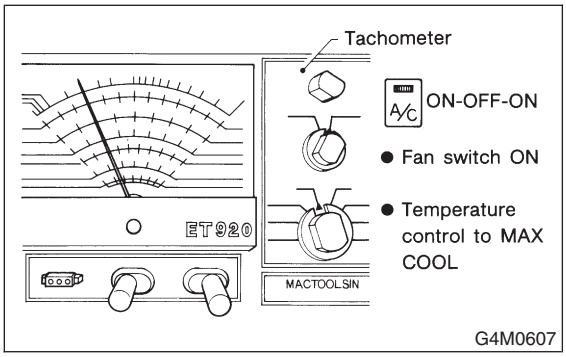
G: COMPLETE CHARGING THROUGH THE LOW SIDE

1) Verify that the high-pressure manifold valve is closed (should have already been closed).
2) Verify that the low-pressure manifold valve is closed (should have already been closed).



3) With the A/C switch off and the windows rolled down, start the engine and run at idle rpm.
4) Set the A/C controls on maximum cool and set the blower speed on the highest setting.

5) Quickly turn the A/C switch on-off-on-off a few times to prevent initial compressor damage due to “load shock”. Finish this operation with the A/C switch in the ON position.

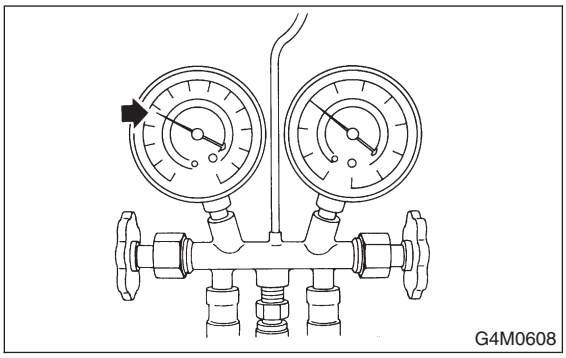


6) Raise engine rpm to approximately 1,500 rpm.

H: CHARGE THE SYSTEM

1) With the refrigerant source connected and the service hose purged, slowly open the low-pressure manifold valve, while checking the low-pressure gauge reading.

CAUTION:
The refrigerant source must be positioned for vapor (valve up).



2) Keep the low side pressure below 276 kPa (2.81 kg/cm^2, 40 psi) by using the low-pressure manifold valve to regulate the flow of refrigerant into the system.
3) When the system is fully charged, close the low-pressure manifold valve.
4) Close the valve at the refrigerant source.
● Refrigerant capacity

Refrigerant	Minimum	Maximum
HFC-134a	0.55 kg (1.21 lb)	0.65 kg (1.43 lb)

I: COMPLETE ALL SYSTEM CHECKS

1) Evaluate the system performance. <Ref. to 4-7 [K200].>
2) Perform leak detection test. <Ref. to 4-7 [W800].>

CAUTION:
Always perform leak checking in an environment free of refrigerant pollution.
Do not disconnect the high- or low-pressure hoses from the vehicle before leak checking.

J: DISCONNECT THE MANIFOLD GAUGE SET

Remove the high- or low-pressure hoses from the service ports and install the service port caps.

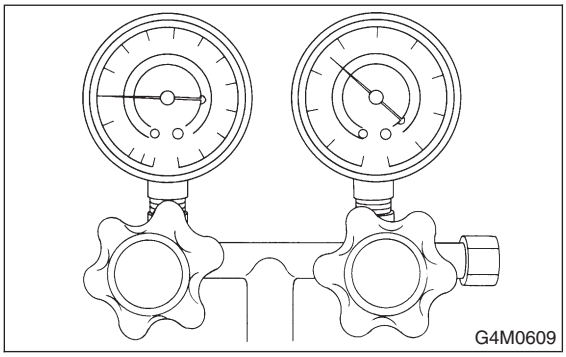
8. Leak Testing

A: INSPECTION

The following points should be kept in mind when conducting a refrigerant leak test.
1) The A/C system to be tested must have an adequate refrigerant charge to begin with.
2) The area where the leak test is conducted must be free of wind and drafts, with still air being the ideal condition.
3) The atmosphere where the leak test is conducted must be free of refrigerant contamination.
4) Operate the A/C system for approx. 10 minutes, then turn the engine off and begin the leak test.
5) Refrigerant gas is heavier than air, therefore always hold the probe below the connection being tested.
6) When checking for a leak along a length of hose or tube, the leak detector probe must be moved slowly, approx. 25 mm (1 in) per second making sure probe does not come in contact with the component being tested.
7) When checking for a leak at a certain point, the leak detector probe must be held at that point for at least 5 seconds.

1. CHECK THE SYSTEM PRESSURE

With gauges connected to the A/C system, operate the A/C and confirm that the high side pressure is above 690 kPa (7.03 kg/cm^2, 100 psi). If not, evacuate and charge the system before leak checking. <Ref. to 4-7 [W700].>


G4M0609

2. CLEAN CONNECTIONS BEFORE TESTING

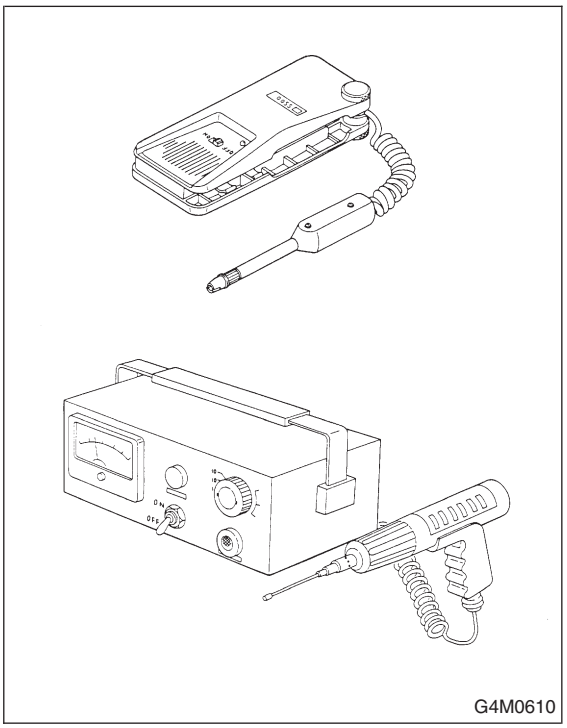
Before testing, use a clean shop towel to wipe off refrigerant oil, dirt, or foreign material from all of the connections and components to be tested.

NOTE:
Since refrigerant oil absorbs refrigerant, excess oil on or near a connection may falsely signal a leak.

3. CALIBRATE LEAK DETECTOR

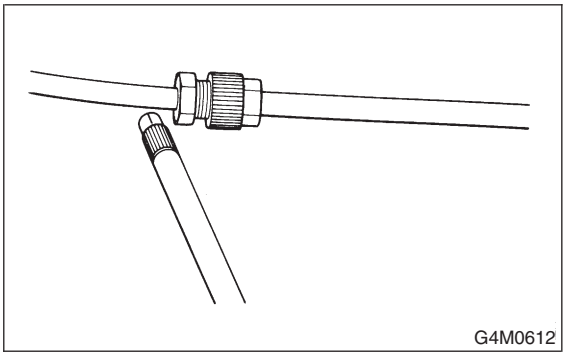
Refer to the manufacturer's instructions for the particular type of detector used and calibrate the instrument.

CAUTION:
Always make sure that the probe tip filter is clean and free of contamination.

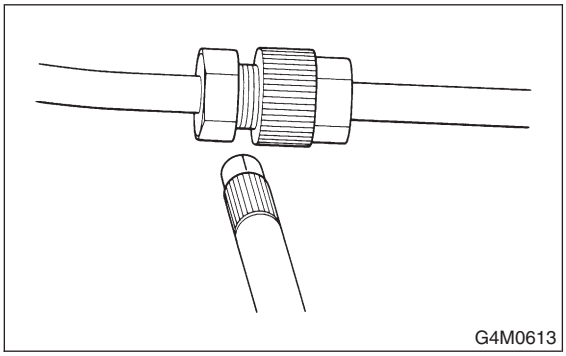

G4M0610

4. LEAK TEST — HIGH-PRESSURE SIDE

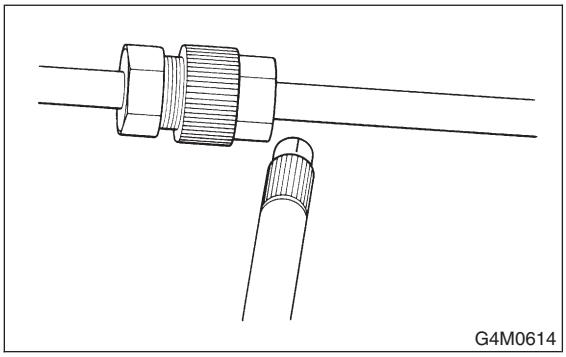
Operate the A/C system for approx. 10 minutes, then turn the engine off and begin the leak test.
1) Begin at the connection of the high-pressure tube to the evaporator, and work your way along the high-pressure side of the system to the compressor. There are three places to check each tube connection.
2) Check the area.
- Check the area where the fitting meets the tube.


G4M0612

● Check the area where the two parts of the fitting join each other.


G4M0613

● Check the area where the nut meets the tube.


G4M0614

3) Check the area of the pressure switch (dual switch), and also check the seams of the receiver drier.
4) Check the connections of the tubes to the condenser, and also check any welded joints on the condenser.

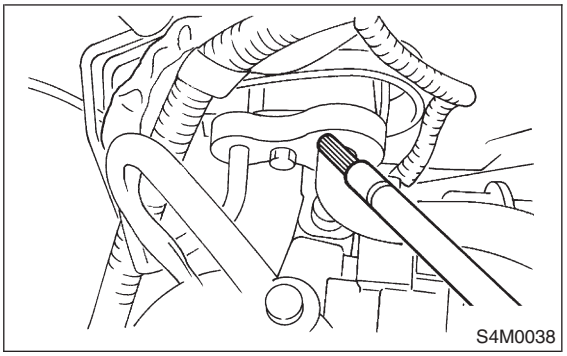
CAUTION:
An oily area on the fins of the condenser may indicate a leak.

5) Check the area where the hoses attach to the compressor.
6) Check around the machined portions of the compressor (where the compressor sections join each other).
7) If equipped, check the thermal limiter on the compressor housing.
8) Check the compressor shaft seal by probing near the center of the compressor clutch pulley.

NOTE:
Some shaft seals have a very slight amount of normal leakage [approximately 28 g (1.0 oz) per year].

5. LEAK TEST — LOW-PRESSURE SIDE

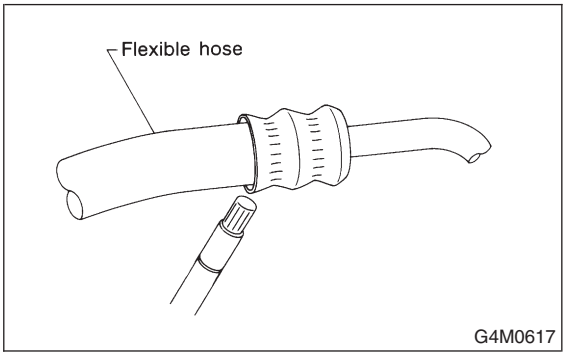
1) Begin at the connection of the low pressure tube to the evaporator, and work your way along the low-pressure of the system to the compressor. There are three places to check on each tube connection.
2) Check the area.
(1) Check the area where the fitting joins the tube.
(2) Check the area where the two parts of the fitting join each other.


S4M0038

6. CHECK THE FLEXIBLE HOSES

Visually inspect the rubber portions of the flexible hoses for cracking. Probe the rubber section, including the ends of any insulators or protectors which may cover sections of the rubber hose, and near the ends where the rubber meets the metal collar.

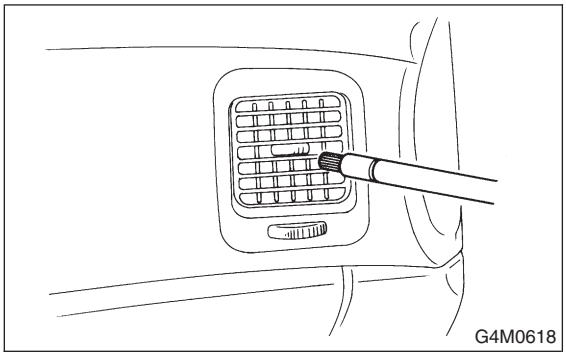
NOTE:
Be certain to move the probe slowly [approximately 25 mm (1 in) per second] when probing along any length of hose or tube.



G4M0617

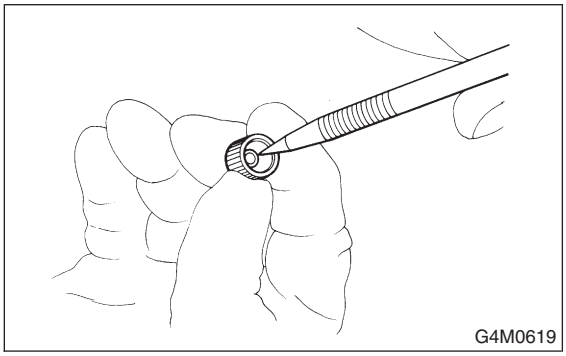
7. CHECK THE EVAPORATOR ASSEMBLY

1) Use one or both of the following methods to check the evaporator assembly.
2) Remove the drain hose from the case drain nipple. Hold the probe at the end of the case drain nipple for at least 10 seconds. Be certain to reconnect the drain hose when finished.
3) With the ignition key in the “ACC” position, run the blower on high speed for 1 minute, then turn the blower off. Place the probe in the center instrument panel vent, an turn the blower on low speed for 1 to 2 seconds, then turn the blower off. Leave the probe in the vent for at least 10 seconds.


G4M0618

8. CHECK THE SERVICE PORT CAPS

Visually inspect the inside of the service port caps. Make sure the rubber seal is in place on the inside of the caps. Disconnect the gauges from the vehicle and install the service port caps.


G4M0619

9. Lubrication

A: ADJUSTMENT

1. SYSTEM OIL STABILIZATION

1) Prior to opening the refrigerant system for repairs (except compressor seizure) the system must be stabilized for correct oil replenishment.
2) Follow these procedures:
(1) Engine speed set to 1,500 rpm.
(2) A/C “ON”.
(3) Air source to recirculate
(4) Blower 4th position
● Make sure the air entering the evaporator is above 26.7°C (80°F).
● The discharge (high) side pressure must be above 588 kPa (6 kg/cm^2, 85 psi).
(5) Operate the A/C for 10 minutes.

2. SYSTEM DISCHARGE

Slowly, discharge the system starting with the high-pressure side until the pressure drops below 345 kPa (3.52 kg/cm^2, 50 psi), then open the low-pressure side.

B: REPLACEMENT

1. OIL REPLACEMENT

1) After stabilization and discharge, replace the component, adding the appropriate amount of oil (DH-PR) to the new component before installation.

Evaporator	114 mℓ (3.9 US fl oz, 4.0 Imp fl oz)
Receiver drier	5 mℓ (0.2 US fl oz, 0.2 Imp fl oz)
Condenser	2 mℓ (0.07 US fl oz, 0.07 Imp fl oz)
Hose	1 mℓ (0.03 US fl oz, 0.04 Imp fl oz)

2) If the compressor is replaced (after stabilization):
(1) Drain and measure the oil from the original compressor.
(2) Drain the oil from the replacement compressor and refill with the same amount that was drained from the original [20 mℓ (0.7 US fl oz, 0.7 Imp fl oz) minimum]. Always use DH-PR for the replacement oil.

10. Performance Test

A: INSPECTION

1. VEHICLE SET UP

In order to obtain meaningful test results, the vehicle must be set up to meet the following conditions:
- Vehicle in shade
- No wind
- All vehicle doors closed
- Front windows open
- Hood open
- Engine speed set at 1,500 rpm.
- A/C ON
- Temperature control dial — Maximum cold
- Air source — Recirculation
- Blower speed — 4th position (High)
- Operate A/C for 10 minutes (Minimum) before taking measurement.

2. MEASUREMENTS

After 10 minutes (Minimum) of A/C operation and using accurate test equipment, take the following measurements (in order):
1) Evaporator intake air temperature at recirculation door.
2) Evaporator discharge air temperature at center grill.
3) Condenser (Ambient) intake air temperature measured 0.9 m (3 ft) in front and in line with the center of the condenser
4) Suction (Low) side pressure
5) Discharge (High) side pressure

NOTE:
If only one thermometer is available; 1) take the ambient measurement first; then 2) the intake air; and 3) discharge air temperature.

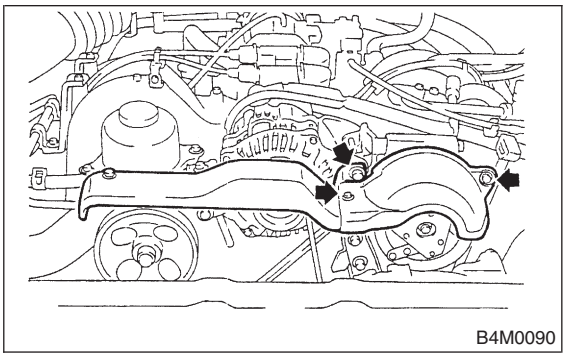
11. Compressor

A: INSPECTION

1. COMPRESSOR CLUTCH

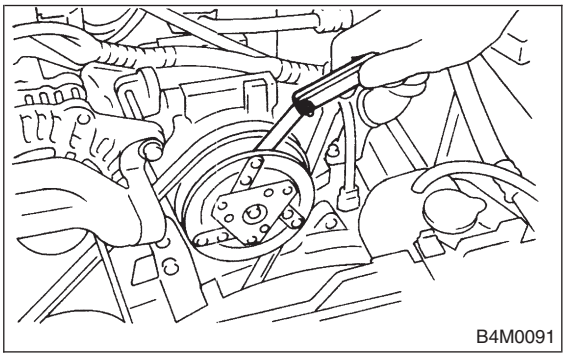
NOTE:
- Compressor is a 5-vane rotary type. When trouble occurs, replace compressor as a single unit.
- Compressor clutch trouble is often caused by clutch slippage and noise. Check and take corrective measures, as required.

1) Remove belt cover.


B4M0090

2) Check that clearance between drive plate and pulley over the entire perimeter is within specifications.

Clearance:
0.45±0.15 mm (0.0177±0.0059 in)

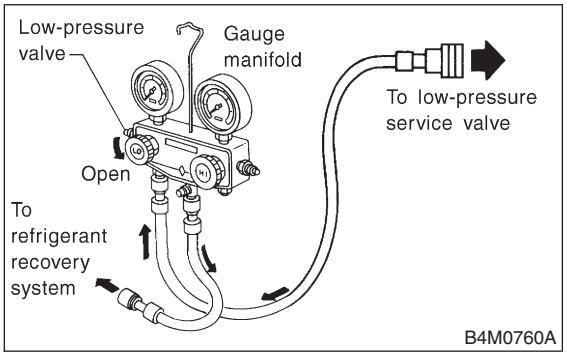

B4M0091

3) Check that voltage applied to magnetic coil is at least 10.5 volts.
4) When noise is noted, check that it originates in either compressor or pulley bearing.

B: REMOVAL

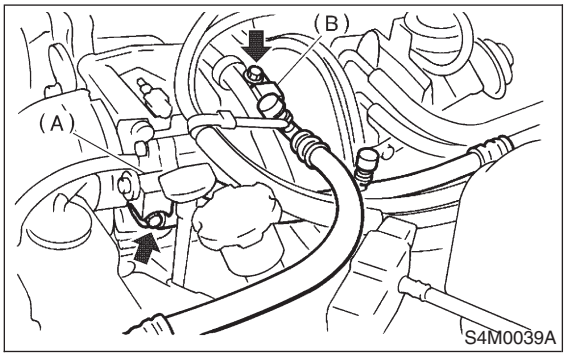
1) Disconnect ground cable from battery.
2) Discharge refrigerant using refrigerant recovery system. <Ref. to 4-7 [W600].>
   (1) Fully close low-pressure valve of manifold gauge.
   (2) Connect low-pressure charging hose of manifold gauge to low-pressure service valve.
   (3) Open low-pressure manifold gauge valve slightly, and slowly discharge refrigerant from system.

CAUTION:
Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.

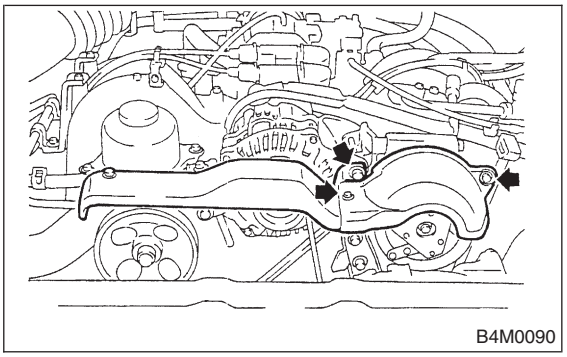


3) Remove low-pressure hose (A) (Flexible hose Ps) and high-pressure hose (B) (Flexible hose Pd).

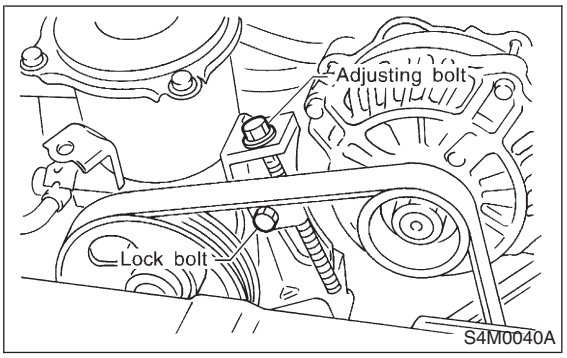
CAUTION:
● Be careful not to lose O-ring of low-pressure hose.
● Plug the opening to prevent foreign matter from entering.



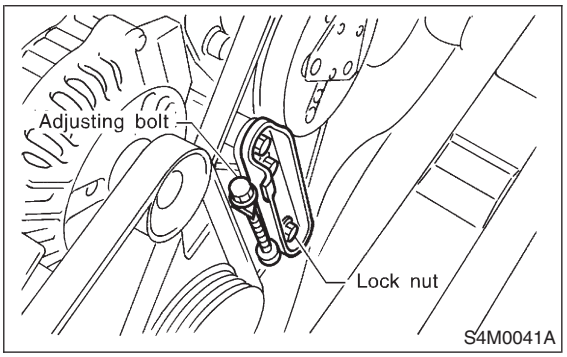
4) Compressor belt cover and generator belt cover:
Remove bolts which secure belt covers.



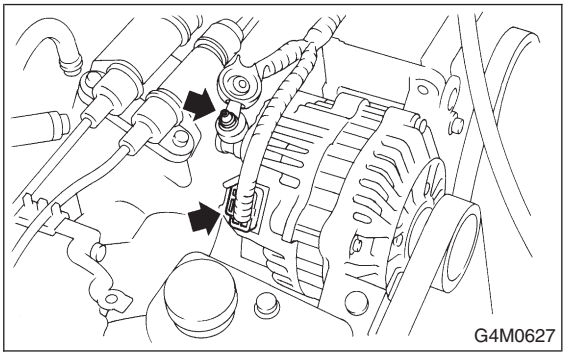
5) Remove alternator V-belt:
   (1) Loosen lock bolt on generator bracket.
   (2) Turn adjusting bolt and remove V-belt.



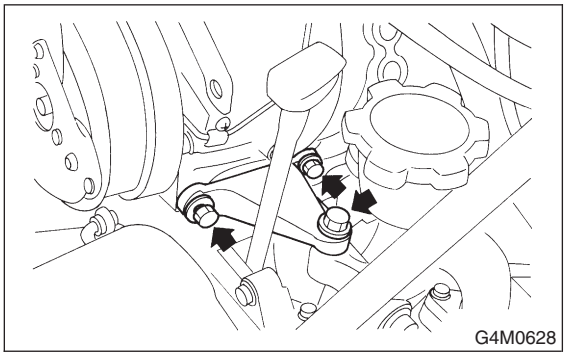
6) Remove compressor V-belt:
   (1) Loosen lock bolt on idler pulley.
   (2) Turn adjusting bolt and remove V-belt.



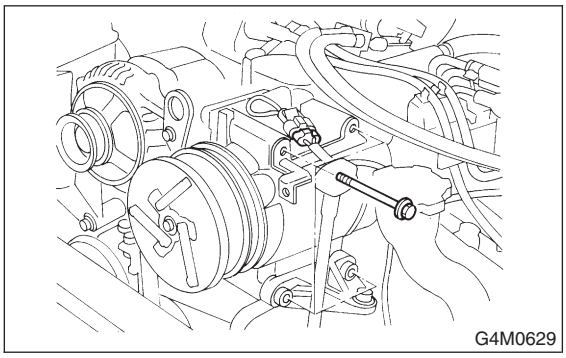
7) Disconnect alternator harness.



8) Disconnect compressor harness:
Disconnect compressor harness from body harness.
9) Remove lower bracket:
Remove bolts which secure lower compressor bracket.

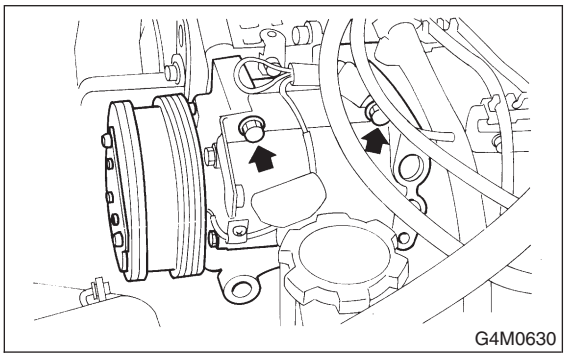

G4M0628

10) Remove compressor:
(1) Remove bolts which secure compressor.
(2) Remove compressor from bracket.


G4M0629

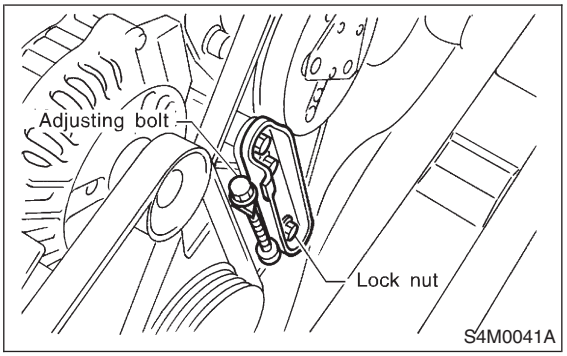
C: INSTALLATION

1) Install compressor:
Install compressor on bracket.


G4M0630

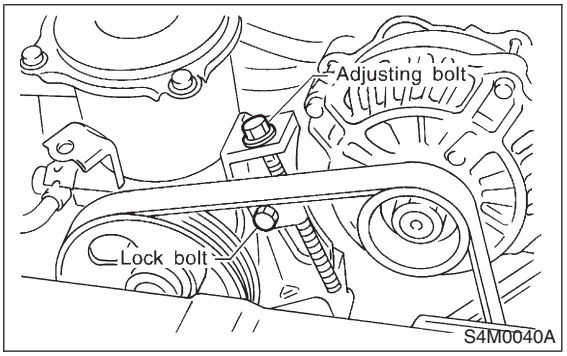
2) Connect compressor harness.
3) Connect alternator harness.

4) Install compressor V-belt (Rear):
After adjusting belt tension, tighten tension pulley lock bolt securely.



S4M0041A

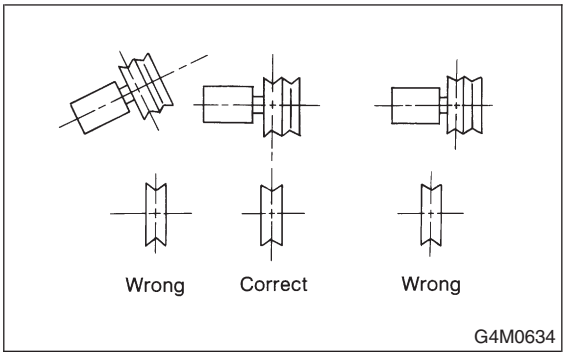
5) Install alternator V-belt:
After adjusting V-belt tension, tighten alternator bracket lock bolt securely.



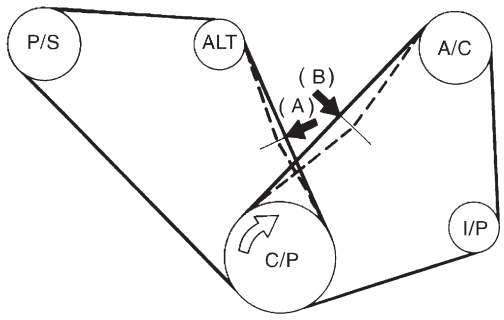
S4M0040A

6) Check drive belt tension and adjust it if necessary by changing alternator position and/or idler pulley position.

CAUTION:
• Ensure that the V-belt is aligned correctly. If it is not, check for loose bolts.
• The V-belt should not be too tight or too loose. A belt which is too tight may break bearing or cause gas to leak from the shaft seal. A belt which is too loose slips, thereby causing the belt cut.
• After completing the compressor installation and testing the system operation, check and adjust the tension of both V-belts again.



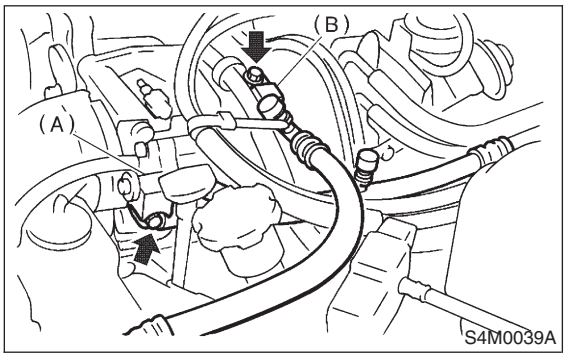
G4M0634

Pulley arrangement	Tension mm (in)/98N (10 kg, 22 lb)	
	(A)	(B)
	*New belt: 7.0 – 9.0 (0.276 – 0.354) Existing belt: 9.0 – 11.0 (0.354 – 0.433)	*New belt: 7.5 – 8.5 (0.295 – 0.335) Existing belt: 9.0 – 10.0 (0.354 – 0.394)
Figures in table refer to the number of grooves in pulleys. C/P: Crankshaft pulley ALT: Alternator pulley P/S: Power steering oil pump pulley A/C: Air conditioner compressor pulley I/P: Idler pulley	*When replacing belts with new ones, adjust tensions to specification and then readjust to the same specification after running engine for 5 minutes.	

B4M1098A

7) Install high-pressure hose (B) (Flexible hose Pd) and low-pressure hose (A) (Flexible hose Ps): Connect high-pressure hose (B) and low-pressure hose (A) with compressor.

CAUTION:
Be sure to apply compressor oil to the periphery of O-ring.



8) Install belt cover.

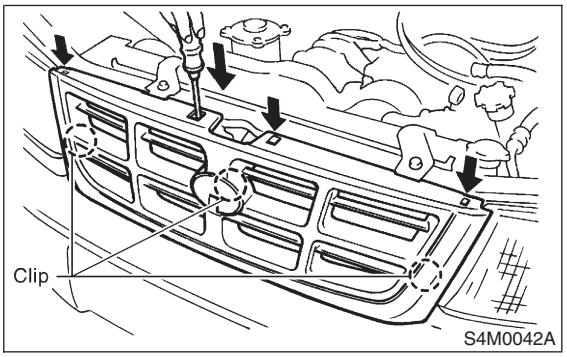
CAUTION:
- **After installing belt cover, make sure it is not misaligned or twisted.**
- **After installing belt cover, check the clearance between pulley and belt cover.**

9) Connect ground cable to negative terminal of battery.
10) Charging refrigerant. <Ref. to 4-7 [W700].>

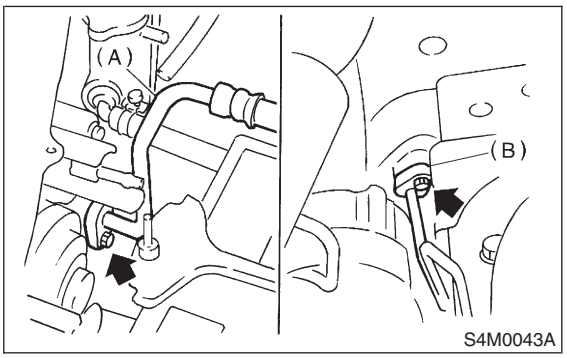
12. Condenser

A: REMOVAL AND INSTALLATION

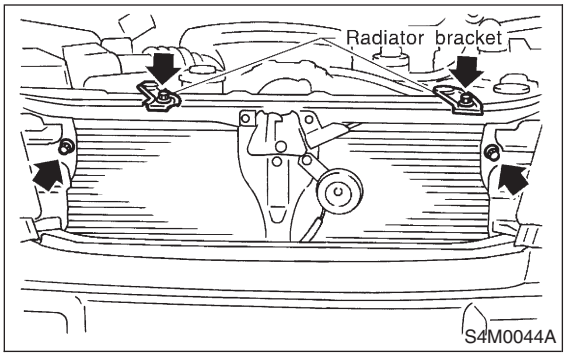
1) Disconnect battery negative terminal.
2) Discharge refrigerant using refrigerant recovery system. <Ref. to 4-7 [W600].>
3) Remove front grille.



4) Remove the radiator bracket.
5) Disconnect high-pressure hose (A) and high-pressure pipe (B) from condenser.



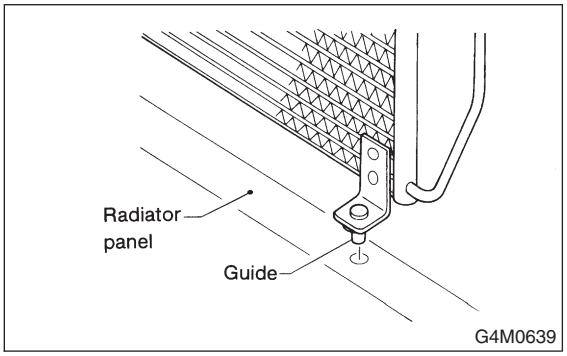
6) Remove radiator brackets.
7) Remove the two bolts which secure condenser. While lifting condenser, remove it through space between radiator and radiator panel.



8) The condenser should be installed in the reverse order in which it was removed.
When installing the condenser, pay attention to the following:

CAUTION:
Before connecting the pipe, be sure to apply oil to the periphery of O-ring.

NOTE:
After installing condenser, ensure that guide on lower side of condenser is inserted into hole in radiator panel. Tighten attaching bolts.



9) Charge refrigerant. <Ref. to 4-7 [W700].>

B: INSPECTION

1) Make sure the condenser fins are free from dust and insects. If the fins are clogged, clean by blowing air or water through them.

NOTE:
To prevent dust and water from getting into the condenser, this work must be done when the condenser is installed in an actual vehicle.

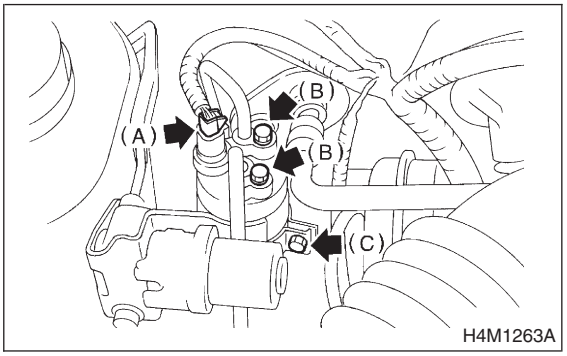
2) Check the condenser to see if it shows any sign of oil. If oil ooze or gas leak occur from the condenser, replace it with a new one.

13. Receiver Drier

A: REMOVAL AND INSTALLATION

1) Disconnect battery negative terminal.
2) Discharge refrigerant using refrigerant recovery system. <Ref. to 4-7 [W600].>
3) Disconnect pressure switch connector (A).
4) Disconnect pipes (B).
5) Remove mounting bolt (C) and remove receiver drier.

CAUTION:
The receiver drier contains a desiccant. Be sure to put a blind plug in the detached receiver drier to protect it from moisture.

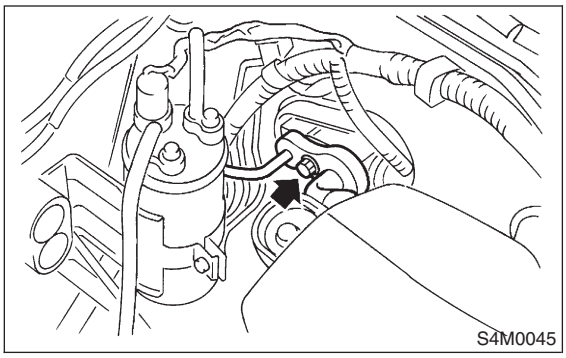


6) Install the receiver drier in the reverse order of removal.
7) Charge refrigerant. <Ref. to 4-7 [W700].>

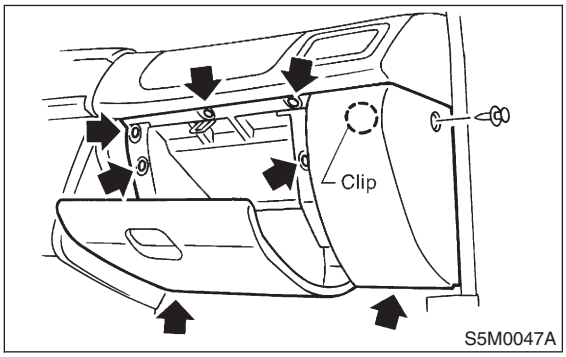
14. Intake Unit with Evaporator

A: REMOVAL AND INSTALLATION

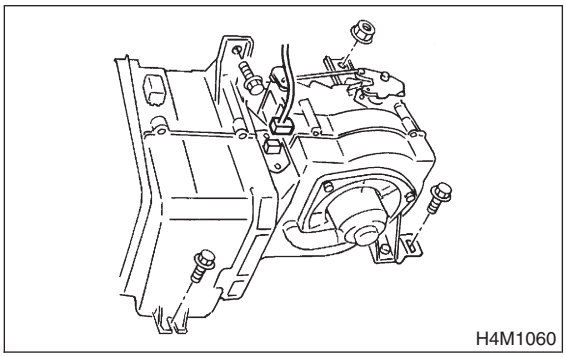
1) Disconnect battery negative terminal.
2) Discharge refrigerant using refrigerant recovery system. <Ref. to 4-7 [W600].>
3) Remove bolt then disconnect discharge pipe and suction pipe.



4) Remove glove box.



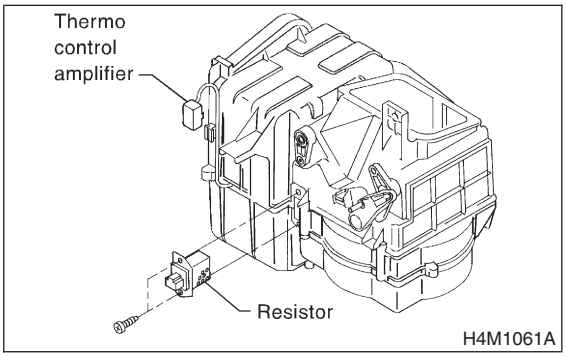
5) Disconnect the harness connector from evaporator.
6) Disconnect drain hose.
7) Remove intake unit mounting bolt and nut.



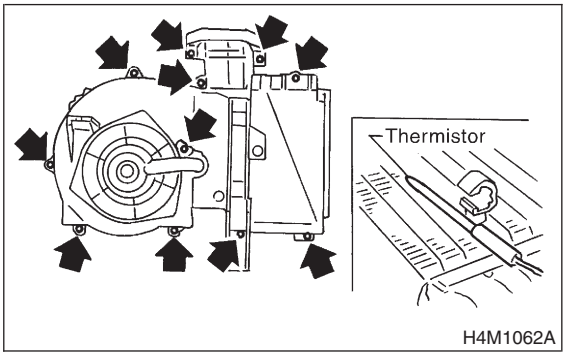
8) Install the intake unit in the reverse order of removal.
9) Charge refrigerant. <Ref. to 4-7 [W700].>

B: DISASSEMBLY AND ASSEMBLY

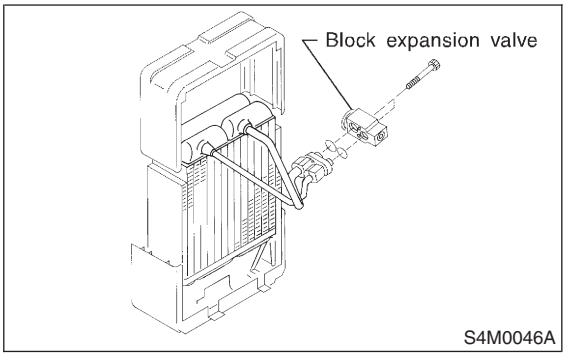
1) Remove resistor assembly and remove thermo control amplifier from intake unit case.



2) Remove some screws then separate intake unit case.
3) Remove thermistor from clip with the evaporator.



4) Remove the block expansion valve from pipes.



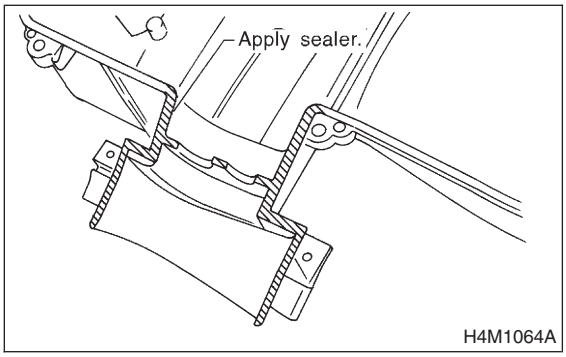
5) Check to see if the evaporator fins are clogged. If they are, clean them with compressed air.

CAUTION:
Water must never be used to clean the evaporator.

6) Check parts that have been removed for cracks or scratches, and repair or replace them with new ones, if necessary.

7) Before assembling intake unit, apply sealer to flange of intake unit case.

Sealer:
THREE BOND 1215 or equivalent



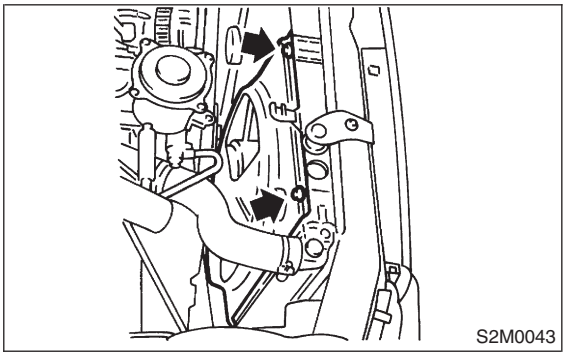
8) Reassemble the intake unit in the reverse order of disassembly.

NOTE:
Confirm that the O-ring is inserted in the specified position.

15. Condenser Fan Assembly

A: REMOVAL AND INSTALLATION

1) Disconnect battery negative terminal.
2) Disconnect harness connector from fan motor.
3) Remove condenser fan bolt from radiator.



4) Pull condenser fan assembly.
5) Install the condenser fan assembly in the reverse order of removal.

16. Flexible Hose

A: REMOVAL AND INSTALLATION

CAUTION:
With the following cautions, replace flexible hoses with new ones if they are damaged or swollen.
● The flexible hoses should be free from twists and tension after they have been connected.
● The flexible hoses must not be bent or twisted forcibly.

1) Disconnect battery negative terminal.
2) Discharge refrigerant using refrigerant recovery system. <Ref. to 4-7 [W600].>
3) Remove low-pressure hose (A):

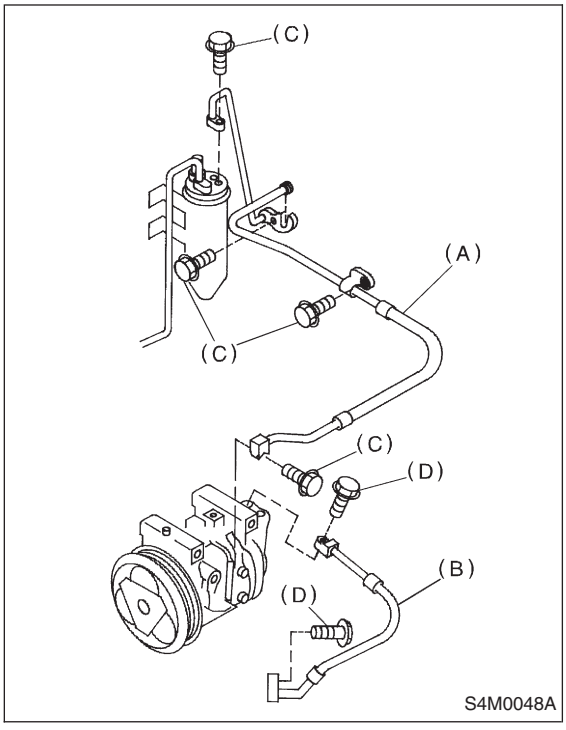
CAUTION:
Plug the opening to prevent foreign matter from getting in.

(1) Remove hose attaching bolts (C).
(2) Remove hose clip.
(3) Remove the hose assembly from evaporator unit.
(4) Disconnect the low-pressure hose from the hose assembly.

4) Remove high-pressure hose (B):

CAUTION:
Plug the opening to prevent foreign matter from getting in.

Disconnect hose attaching bolt (D).

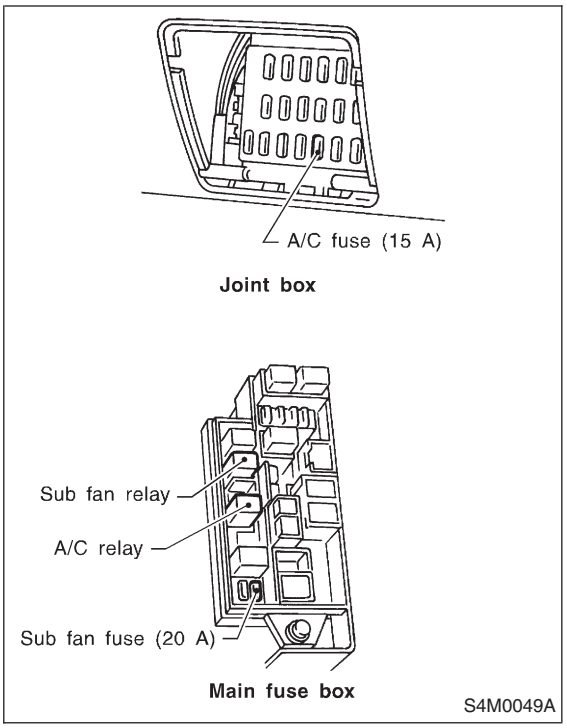


5) Installation is in the reverse order of removal.
6) Charge refrigerant. <Ref. to 4-7 [W700].>

17. Relay and Fuse

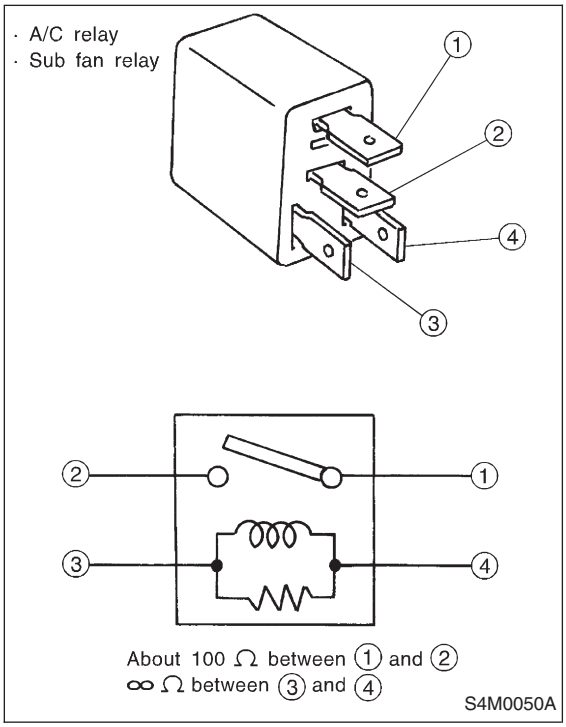
A: LOCATION

Relays used with A/C system are located as shown in figure.
- A/C relay
- Sub fan (condenser fan) relay
- Fuses (15 A and 20 A)



B: INSPECTION

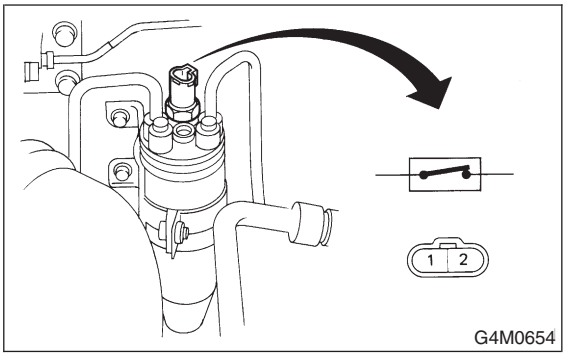
Check conduction with a circuit tester (ohm range) according to the following table in figure.



18. Pressure Switch (Dual Switch)

A: INSPECTION

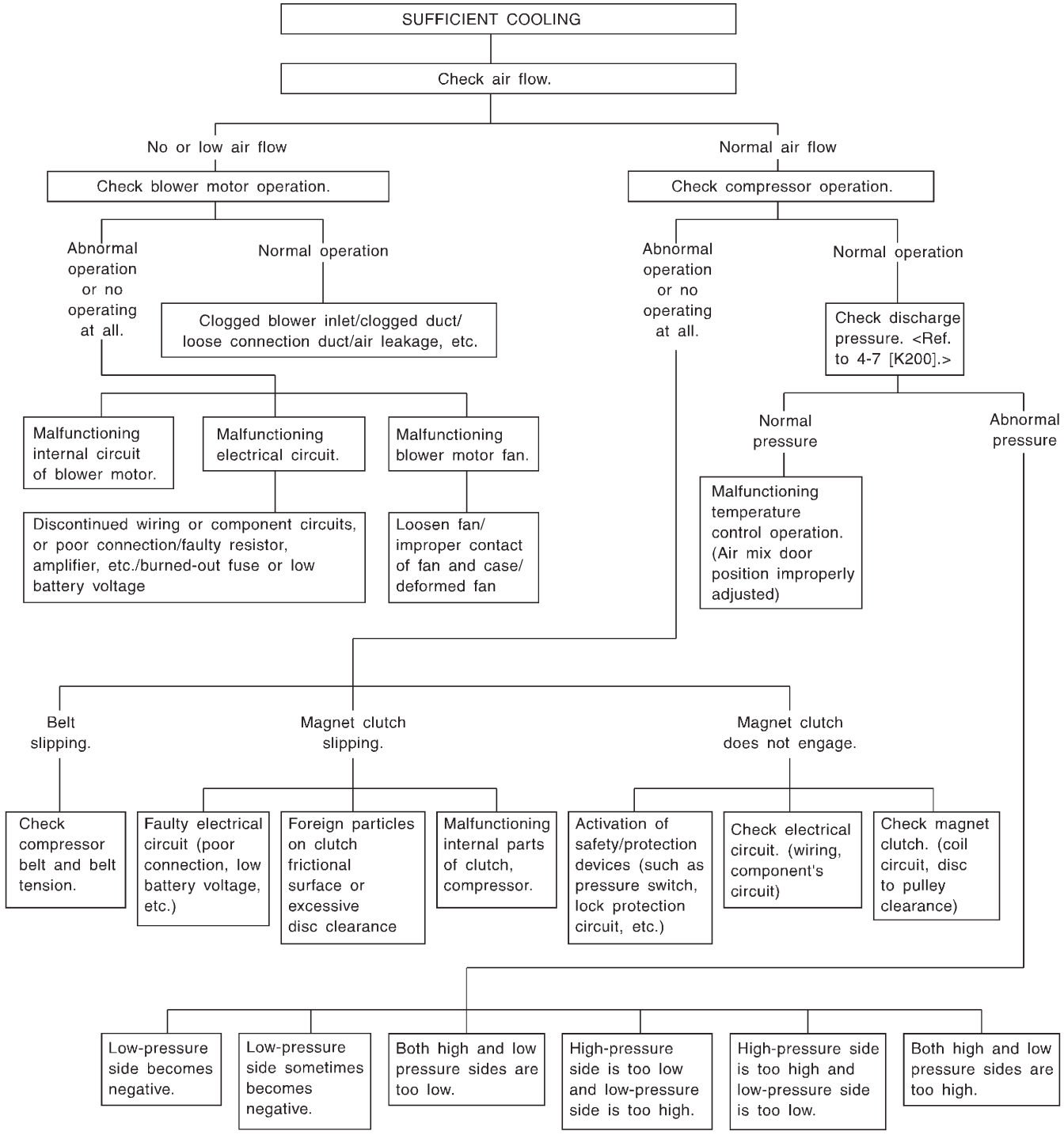
NOTE:
Pressure switch is attached to receiver dryer. It has two built-in switches.



1) Remove cap from high-pressure line service valve, and connect gauge manifold to service valve.
2) Disconnect pressure switch harness connector, and check pressure switch for proper ON-OFF operation. Use a circuit tester.

	Terminal	Operation	High-pressure side line pressure
High and low pressure switch	1 — 2	Turns OFF.	Increasing to 2,942±98 kPa (30±1 kg/cm^2, 427±14 psi)
			Decreasing to 176±29 kPa (1.8±0.3 kg/cm^2, 25.5±4 psi)
		Turns ON.	Increasing to $186^{+39}/_{-25}$ kPa ($1.9^{+0.4}/_{-0.25}$ kg/cm^2, $27.0^{+5.7}/_{-3.6}$ psi)
			Decreasing to 2,354±196 kPa (24±2 kg/cm^2, 341±28 psi)

1. Air Conditioning System Diagnosis

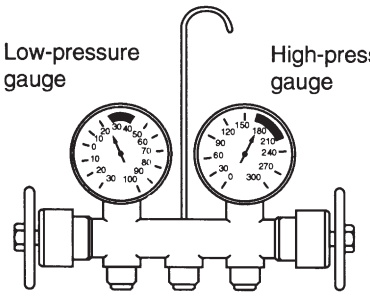
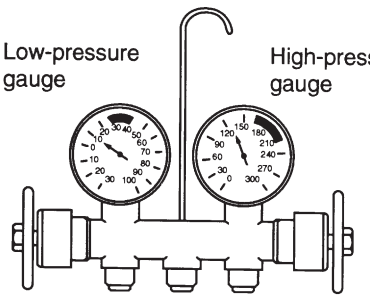
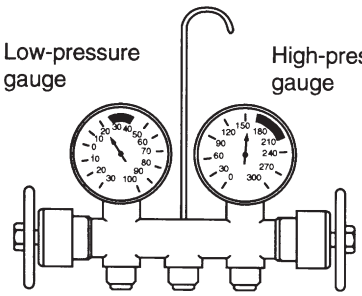


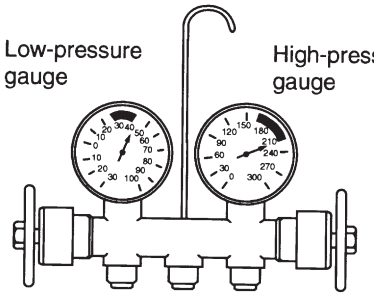
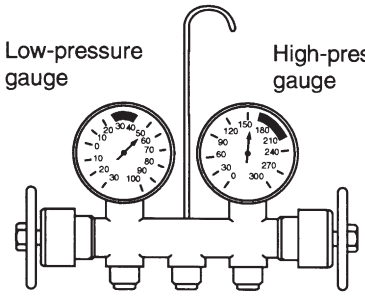
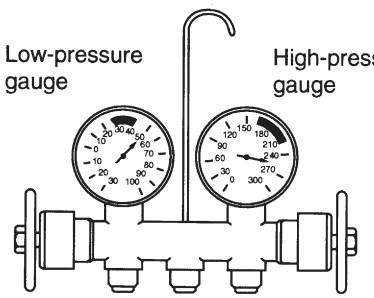
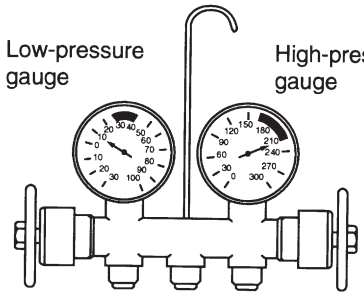
H4M1265A

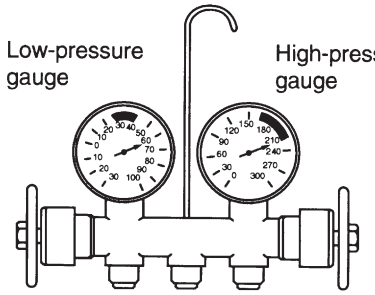
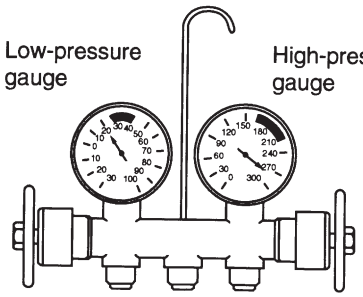
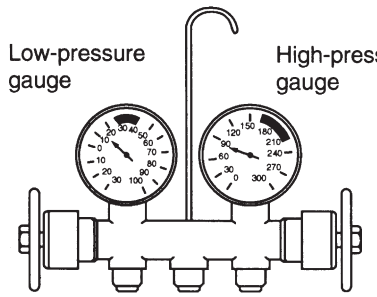
2. Performance Test Diagnosis

If various conditions caused to other air conditioning system, the characteristics revealed on manifold gauge reading are shown in the following.
As to the method of a performance test, refer to the item of “Performance Test”.

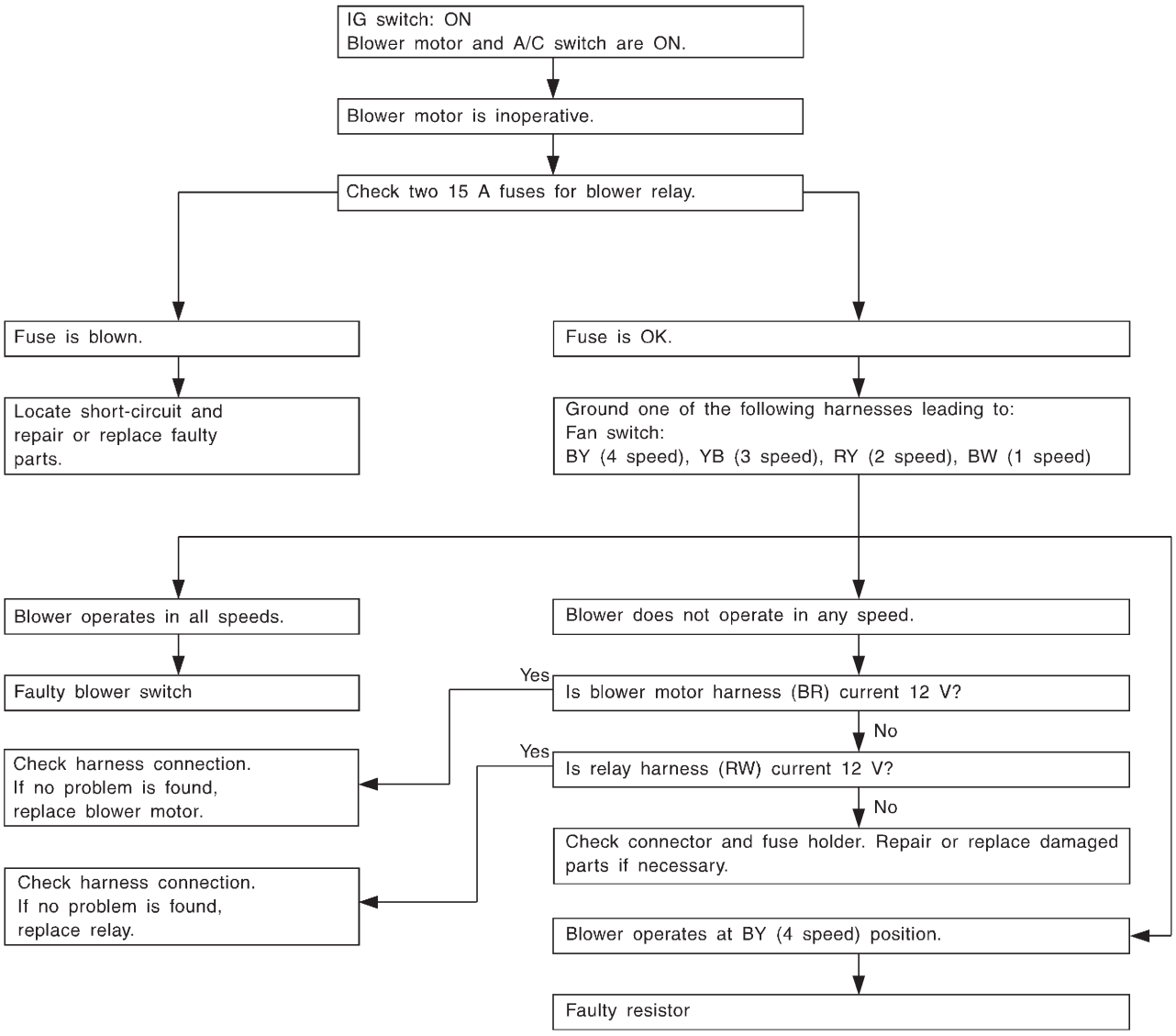
Each shaded area on the following tables indicates a reading of the normal system when the temperature of outside air is 32.5°C (91°F).

Condition		Probable cause	Corrective action
INSUFFICIENT REFRIGERANT CHARGE  G4M0673	Insufficient cooling.	Refrigerant is small, or leaking a little.	1. Leak test. 2. Repair leak. 3. Charge system. Evacuate, as necessary, and recharge system.
ALMOST NO REFRIGERANT  G4M0674	No cooling action.	Serious refrigerant leak.	Stop compressor immediately. 1. Leak test. 2. Discharge system. 3. Repair leak(s). 4. Replace receiver drier if necessary. 5. Check oil level. 6. Evacuate and recharge system.
FAULTY EXPANSION VALVE  G4M0675	Slight cooling. Sweating or frosted expansion valve inlet.	Expansion valve restricts refrigerant flow. ● Expansion valve is clogged. ● Expansion valve is inoperative. ● Valve stuck closed. Thermal bulb has lost charge.	If valve inlet reveals sweat or frost: 1. Discharge system. 2. Remove valve and clean it. Replace it if necessary. 3. Evacuate system. 4. Charge system. If valve does not operate: 1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.

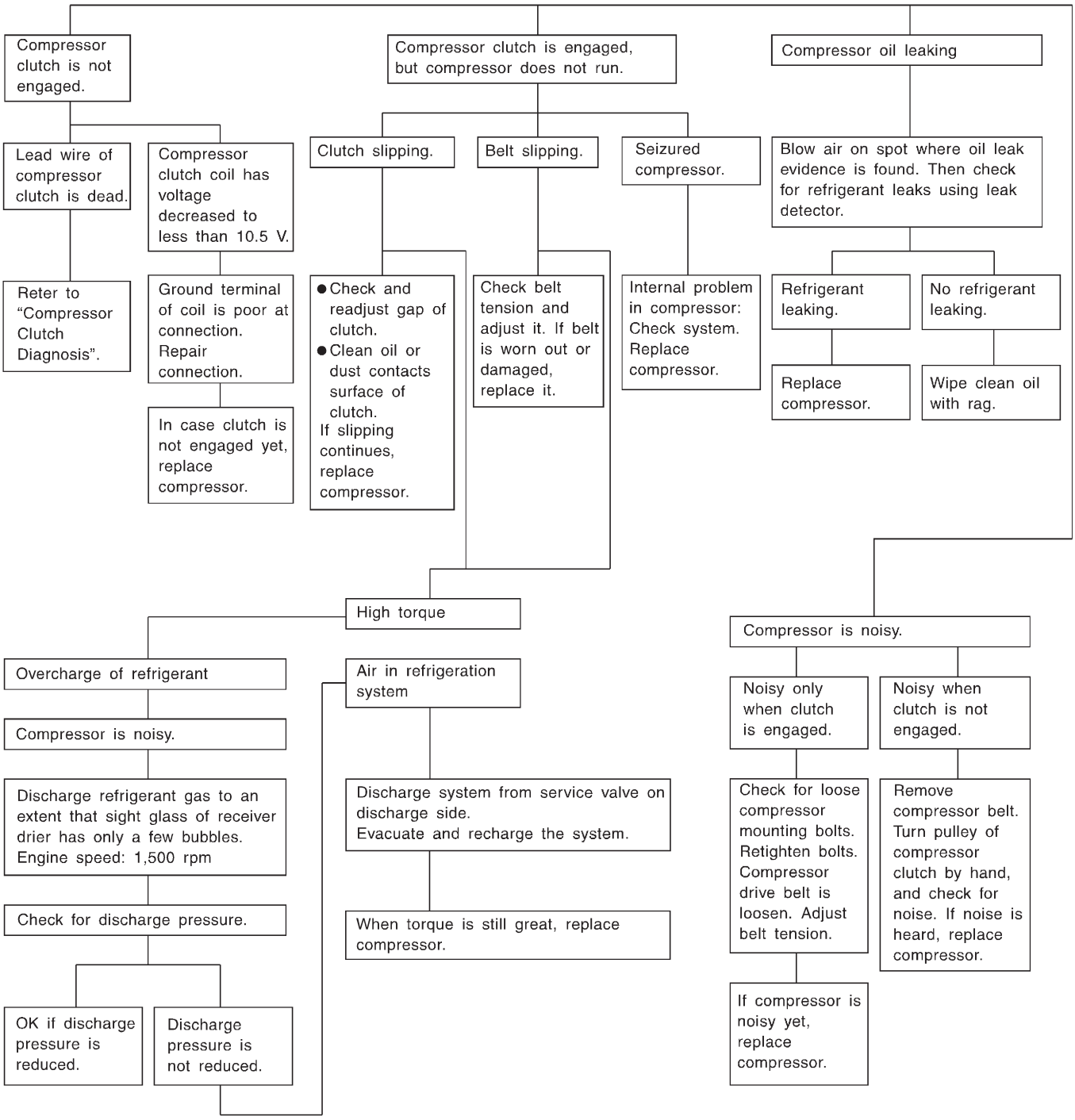
Condition		Probable cause	Corrective action
 G4M0676  G4M0677	Insufficient cooling. Sweated suction line. No cooling. Sweating or frosted suction line.	Expansion valve allows too much refrigerant through evaporator. Faulty seal of O-ring in expansion valve.	Check valve for operation. If suction side does not show a pressure decrease, replace valve. 1. Discharge system. 2. Remove expansion valve and replace O-ring. 3. Evacuate and replace system.
AIR IN SYSTEM  G4M0678	Insufficient cooling.	Air mixed with refrigerant in system.	1. Discharge system. 2. Replace receiver drier. 3. Evacuate and charge system.
MOISTURE IN SYSTEM  G4M0679	After operation for a while, pressure on suction side may show vacuum pressure reading. During this condition, discharge air will be warm. As warning of this, reading shows 39 kPa (0.4 kg/cm^2, 6 psi) vibration.	Drier is saturated with moisture. Moisture has frozen at expansion valve. Refrigerant flow is restricted.	1. Discharge system. 2. Replace receiver drier (twice if necessary). 3. Evacuate system completely (Repeat 30 minute evacuating three times.). 4. Recharge system.

Condition		Probable cause	Corrective action
FAULTY CONDENSER  G4M0680	No cooling action. Engine may overheat. Suction line is very hot.	Condenser is often found not functioning well.	● Check condenser cooling fan. ● Check condenser for dirt accumulation. ● Check engine cooling system for overheat. ● Check for refrigerant overcharge. If pressure remains high in spite of all above actions taken, remove and inspect the condenser for possible oil clogging.
HIGH-PRESSURE LINE BLOCKED  G4M0681	Insufficient cooling. Frosted high-pressure liquid line.	Drier clogged, or restriction in high-pressure line.	1. Discharge system. 2. Remove receiver drier or strainer and replace it. 3. Evacuate and charge system.
FAULTY COMPRESSOR  G4M0682	Insufficient cooling.	Internal problem in compressor, or damaged gasket and valve.	1. Discharge system. 2. Remove and check compressor. 3. Repair or replace compressor. 4. Check oil level. 5. Replace receiver drier. 6. Evacuate and charge system.

3. Blower Motor Diagnosis

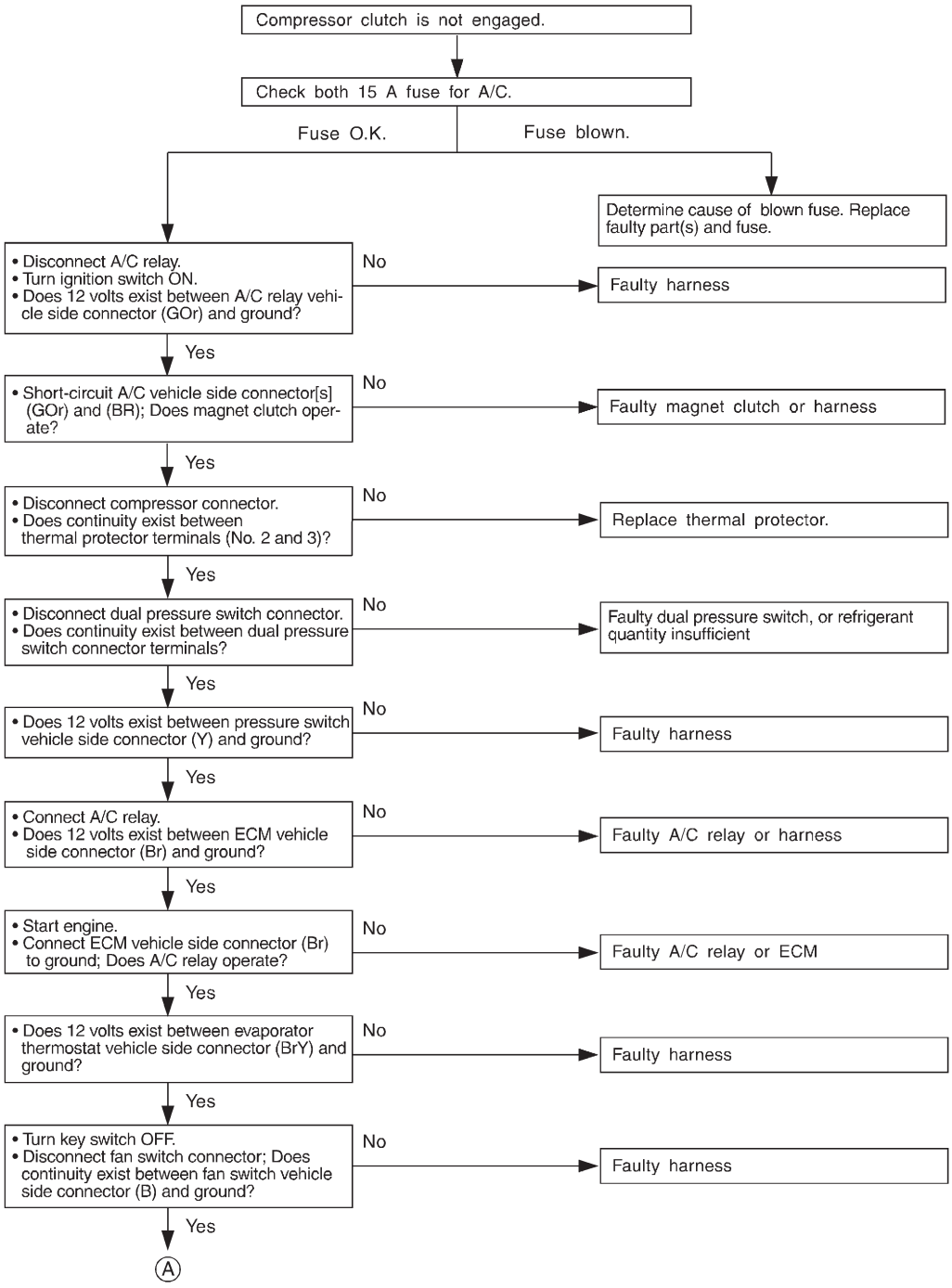


4. Compressor Diagnosis

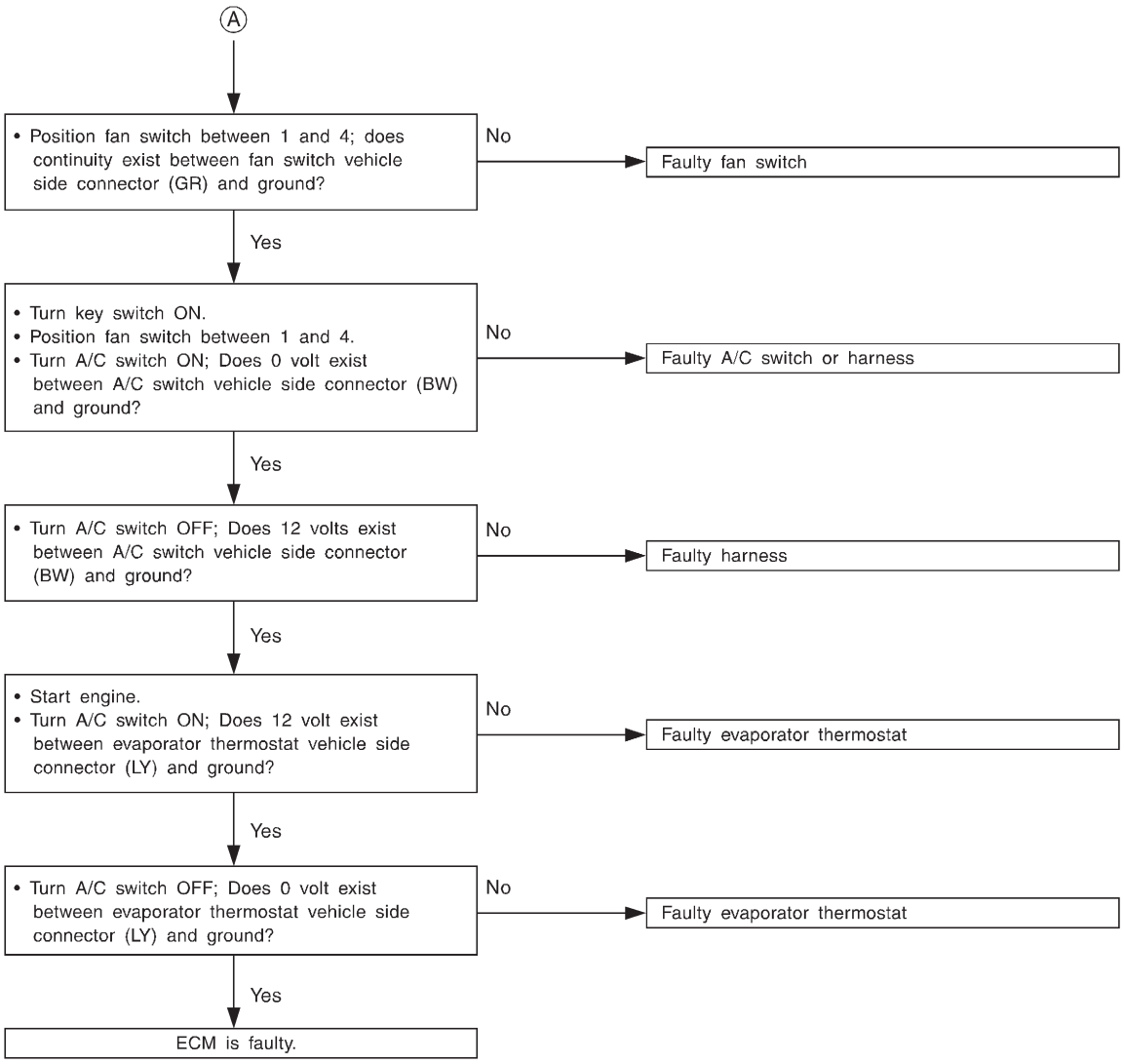


H4M1267A

5. Compressor Clutch Diagnosis

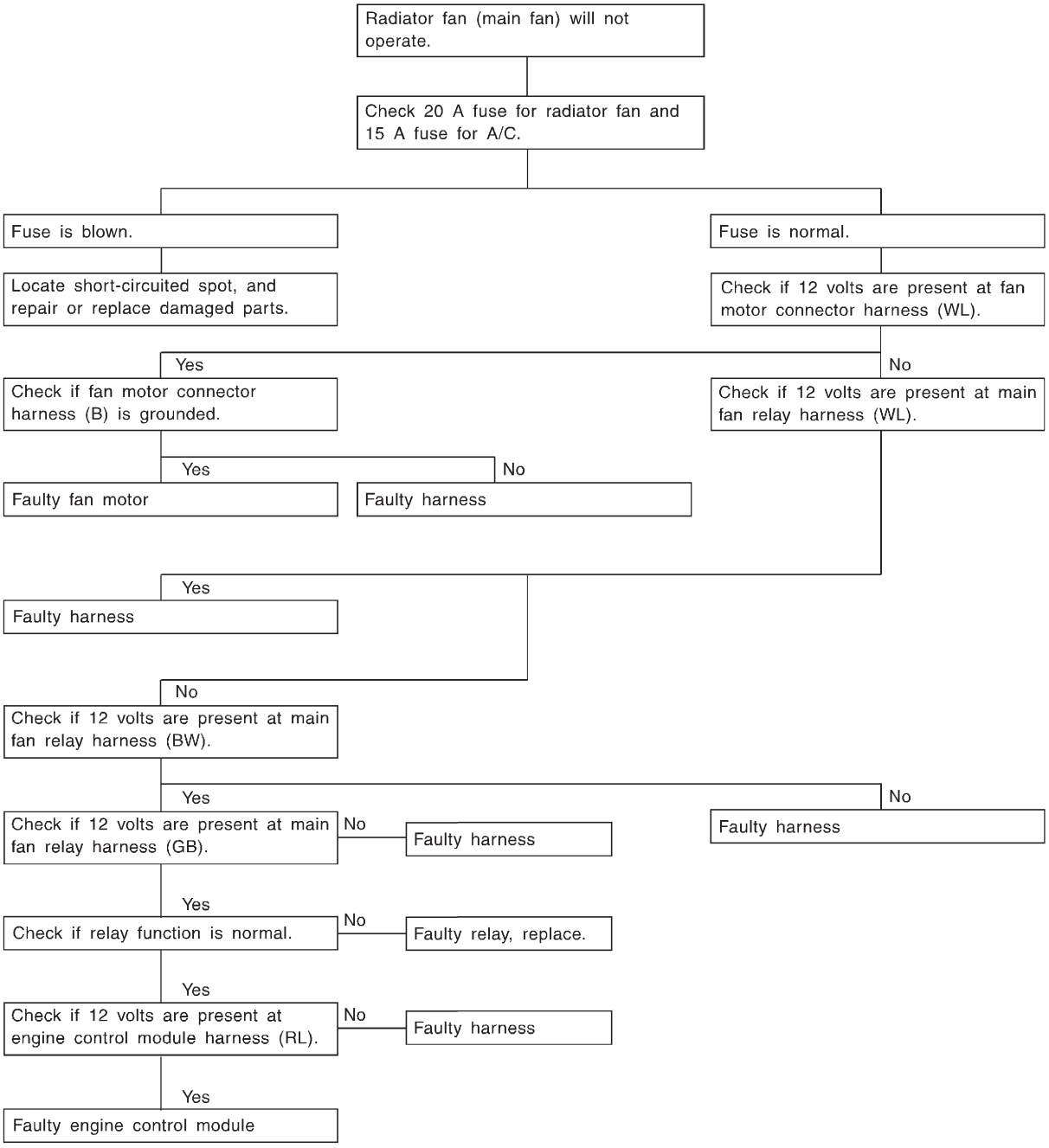


S4M0295A


A
• Position fan switch between 1 and 4; does continuity exist between fan switch vehicle side connector (GR) and ground?
No
Faulty fan switch
Yes
• Turn key switch ON.
• Position fan switch between 1 and 4.
• Turn A/C switch ON; Does 0 volt exist between A/C switch vehicle side connector (BW) and ground?
No
Faulty A/C switch or harness
Yes
• Turn A/C switch OFF; Does 12 volts exist between A/C switch vehicle side connector (BW) and ground?
No
Faulty harness
Yes
• Start engine.
• Turn A/C switch ON; Does 12 volt exist between evaporator thermostat vehicle side connector (LY) and ground?
No
Faulty evaporator thermostat
Yes
• Turn A/C switch OFF; Does 0 volt exist between evaporator thermostat vehicle side connector (LY) and ground?
No
Faulty evaporator thermostat
Yes
ECM is faulty.

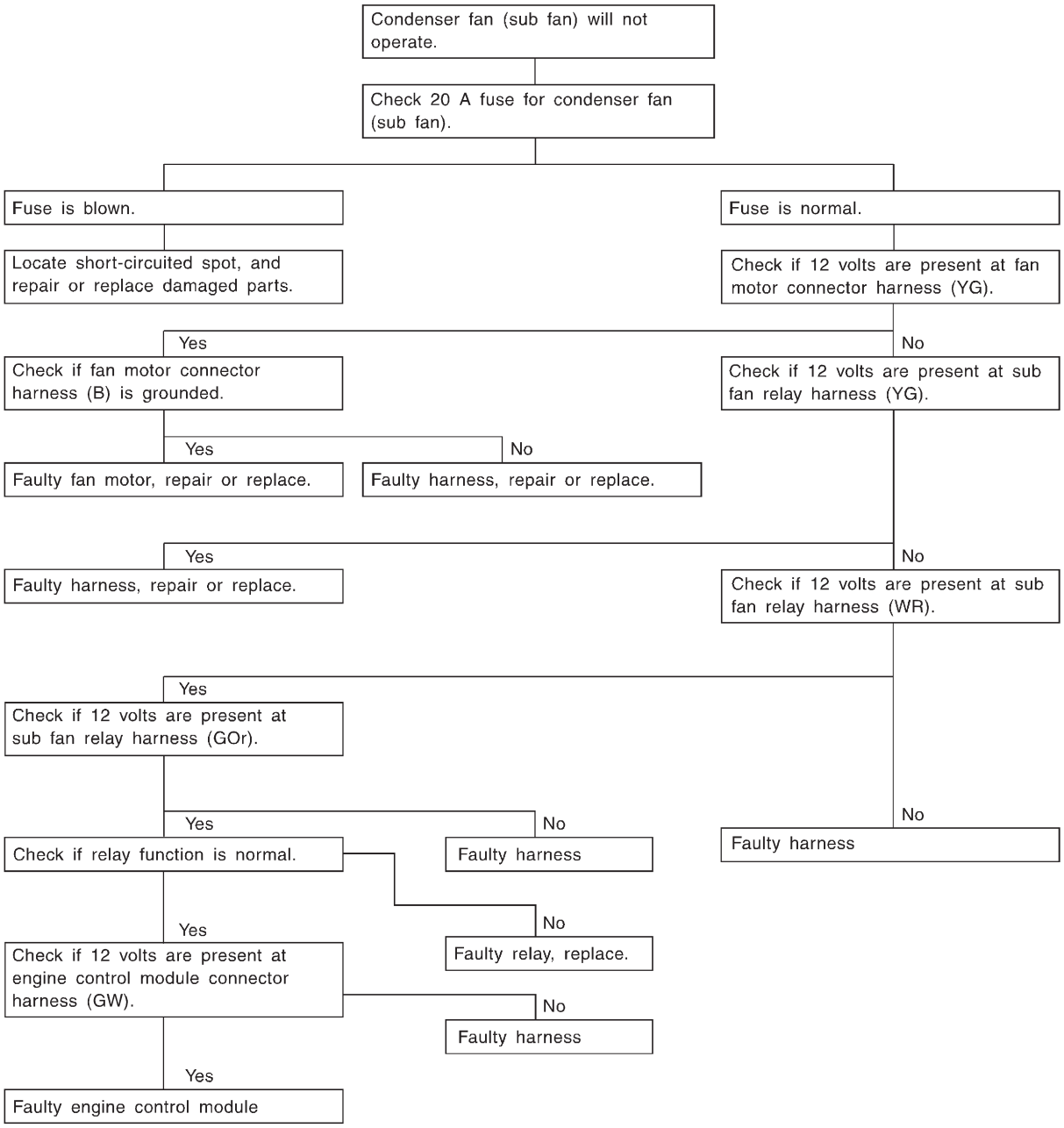
S4M0296A

6. Radiator Fan (Main Fan) Diagnosis



S4M0297A

7. Condenser Fan (Sub Fan) Diagnosis



S4M0298A

MEMO:

BODY AND ELECTRICAL SECTION

FOREWORD

This portion of the service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of both the fully qualified and the less-experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

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1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into six volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- ENGINE SECTION
- TRANSMISSION AND DIFFERENTIAL SECTION
- MECHANICAL COMPONENTS SECTION
- BODY AND ELECTRICAL SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following six types of areas.

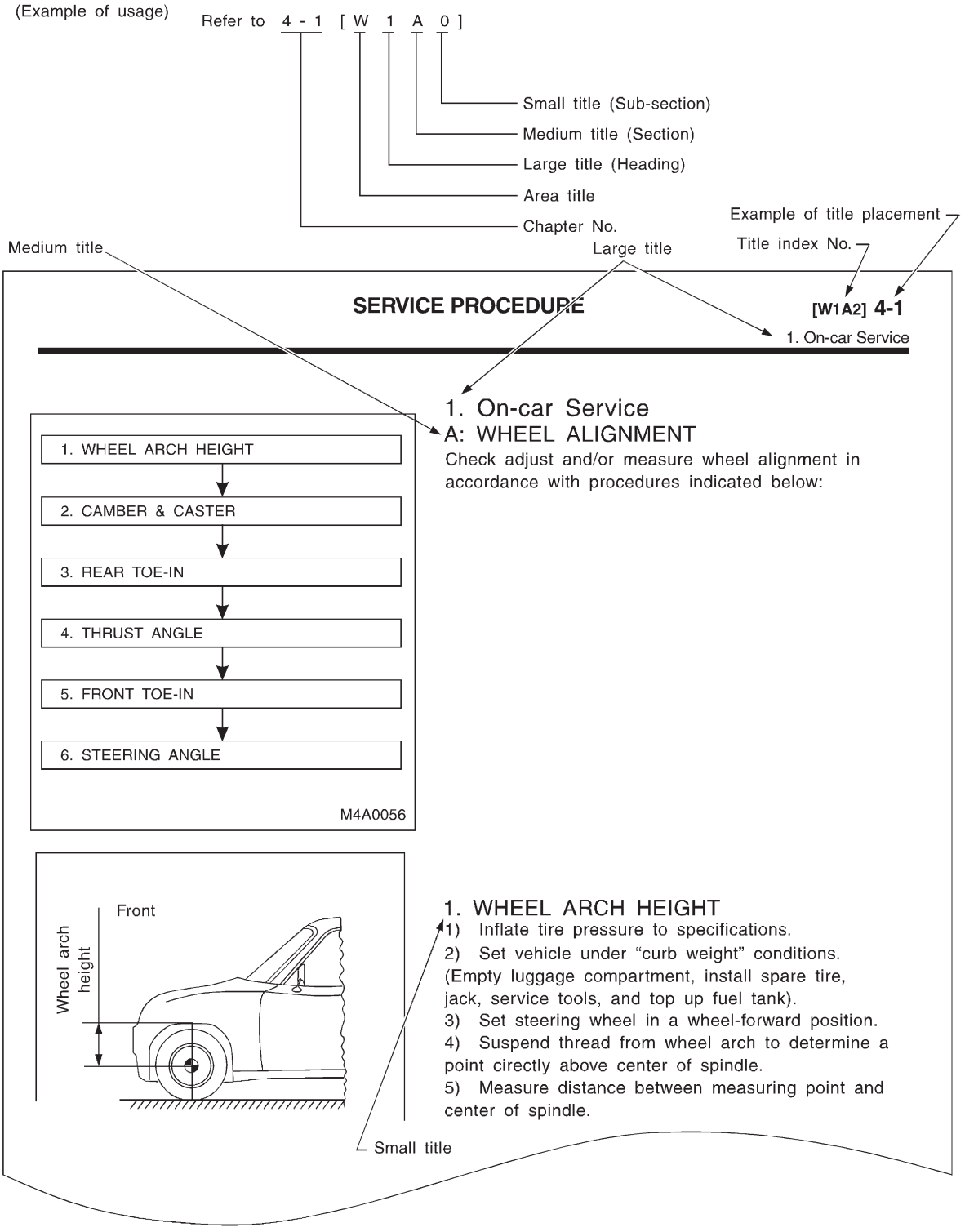
S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS (MECHANICAL)
T	DIAGNOSTICS (ELECTRICAL)
D	WIRING DIAGRAM

● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the six types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

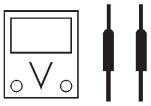
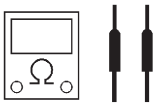
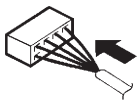
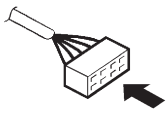
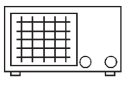
● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.



H0M0010

- In this manual, the following symbols are used.

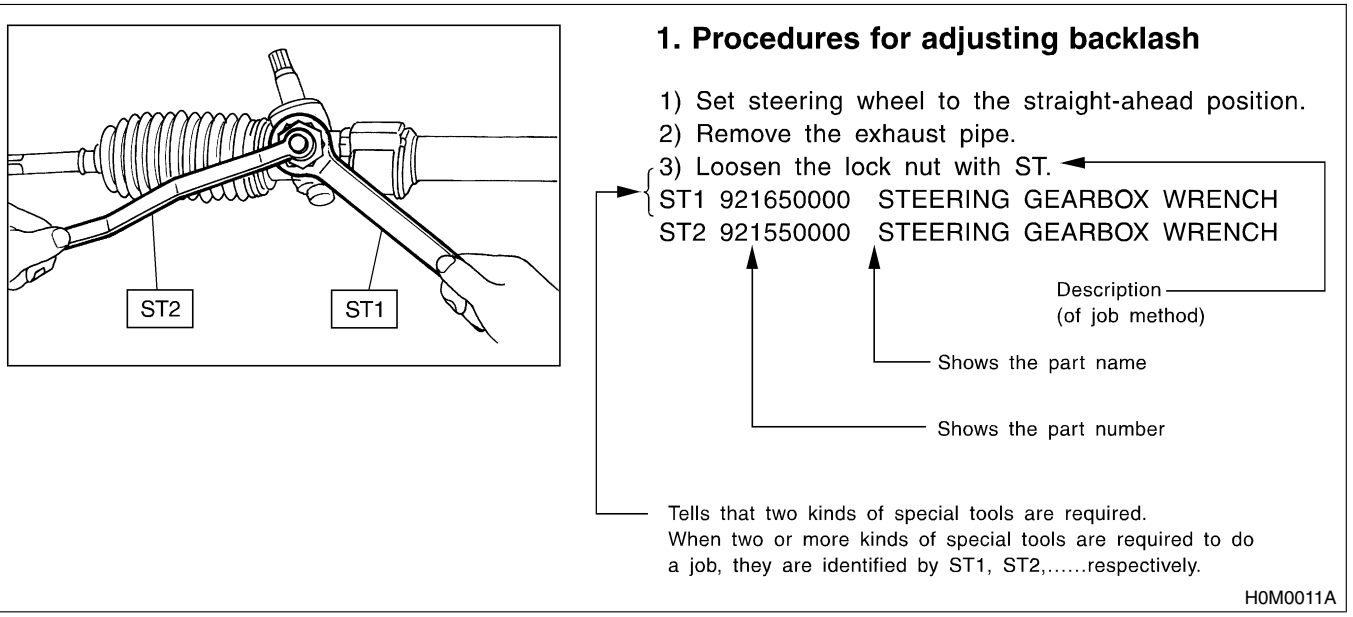
Symbol	Description
*	Selective part
★	Replacement part
 S0M0001	Should be lubricated with oil.
 S0M0002	Should be lubricated with grease.
 S0M0003	Sealing point
T S0M0004	Tightening torque

Character	Description
 B0M0002	Circuit tester ● Voltage measurement
 B0M0003	Circuit tester ● Resistance measurement
 B0M0004	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0005	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0006	Oscilloscope
B0M0007	Oscilloscope positive probe
B0M0008	Oscilloscope earth head

● **WARNING, CAUTION,** NOTE

WARNING:	Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
CAUTION:	Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
NOTE:	Indicates the hints, knacks, etc. which make the maintenance job easier.

● SPECIAL TOOLS
When any special tool is required to perform the job, it is identified by “ST” in the applicable illustration and its part number is shown in the manual.

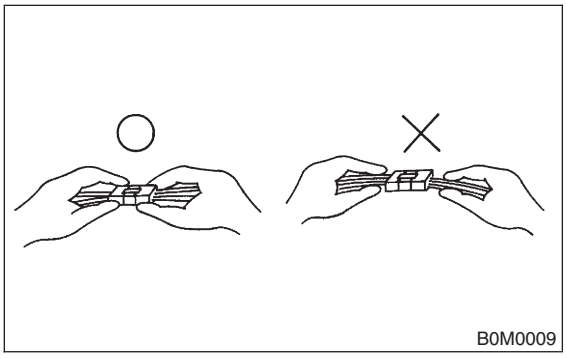


3. Basic Checks for Diagnostics

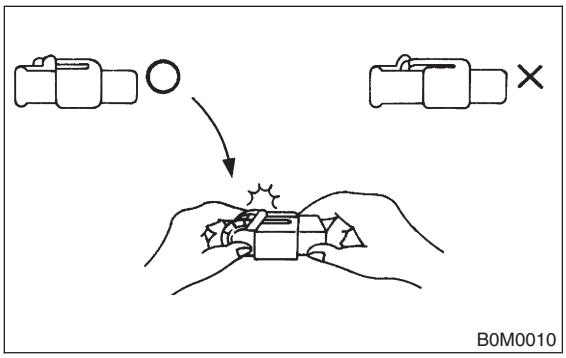
A: DISCONNECTING CONNECTORS

- Always hold the connector itself.

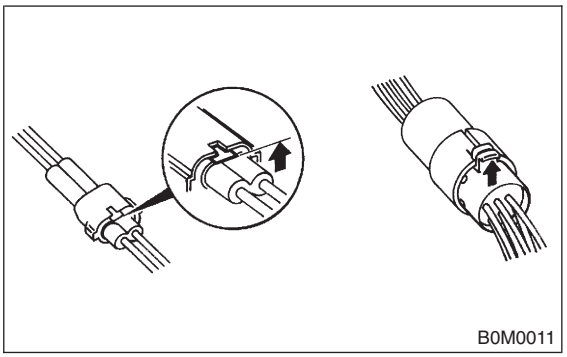
CAUTION:
Don't pull the harness.



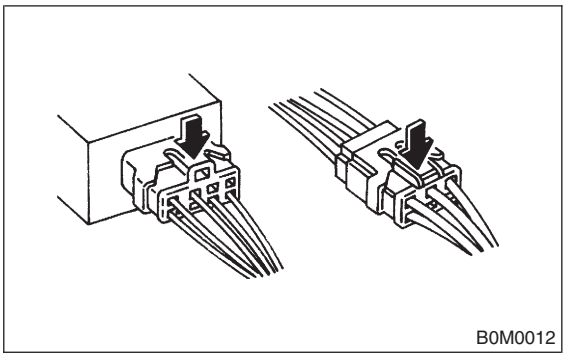
- Inspect a connector by pushing it all the way in. If the connector is equipped with a locking device, push it in until a clicking sound is heard.



- To disconnect a locking connector, first release the lock, then pull the connector off.
<Unlock by pulling the locking tab.>



<Unlock by pushing the locking tab.>

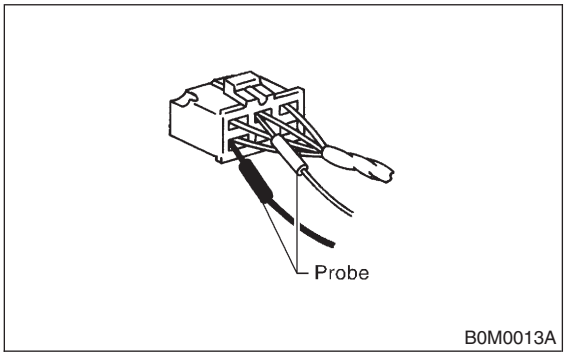


NOTE:
- After disconnecting connectors, visually check for contamination, distortion, or damage of connectors before reconnecting them. Also, check for loose or missing terminals.
- If there are any contamination, or water droplets on the contact points of the terminals, wipe them off using an air gun or a waste cloth. Never polish the contact points using sandpaper. If polished with sandpaper, the surface plating may peel off.
- Avoid excessive impact and twisting force to connectors when connecting. Otherwise, connector housings or terminals may be damaged.
- When disconnecting waterproof connectors, be sure to prevent the inner waterproof seal from collapsing.

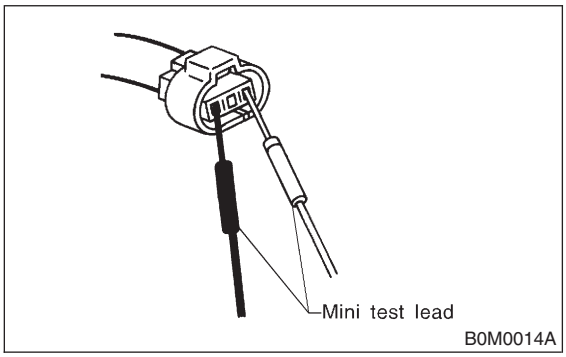
B: INSERTING A PROBE

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

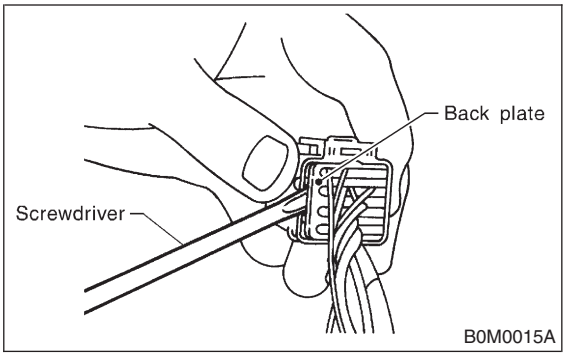
- Generally, probes are inserted into connectors from the rear side (wire side).
- When removing the shock protector take care not to deform it; this also applies to waterproof connectors, which cannot be tested from the wire side.



- Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.



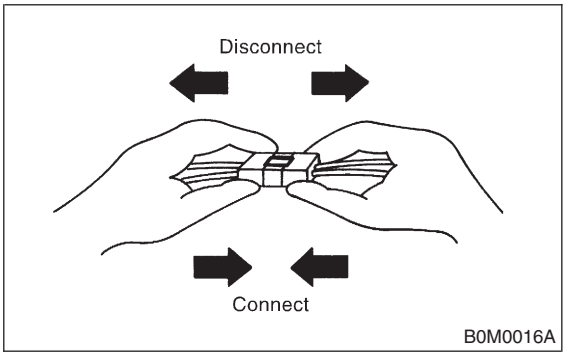
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, since the terminals might brake off.)



C: CHECKING FOR POOR CONTACT ON PLUG-IN CONNECTORS

1. POOR CONTACT

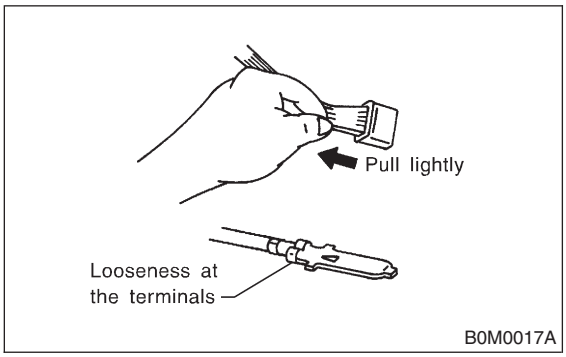
Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. Quite often a plug with poor contact will work perfectly again after it has been pulled off and reconnected. If harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of trouble.



2. VISUAL INSPECTION

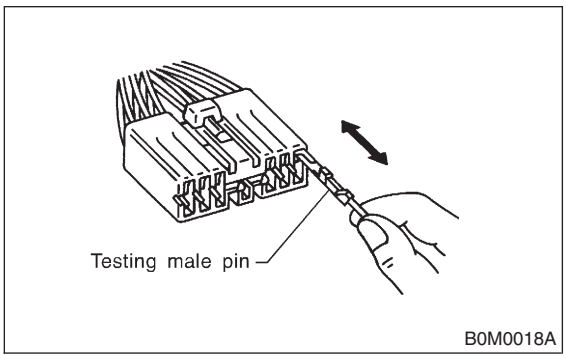
1) Disconnect the two connector halves.
2) Check the connector pins for signs of corrosion or foreign material.
3) Check the connector for loose and damaged terminals, and make sure they are set correctly in the connector.

NOTE:
When the harness is pulled lightly, the terminals should not come out.

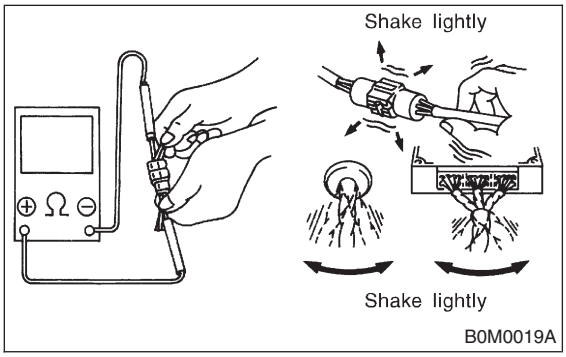


4) Insert the male pin of the connector into the female pin, then pull it out.

NOTE:
If one of the pins allows to pull out easily, it is a likely source of a malfunction.



5) Shake lightly the connector and the harness, and check for sudden changes in voltage or resistance.



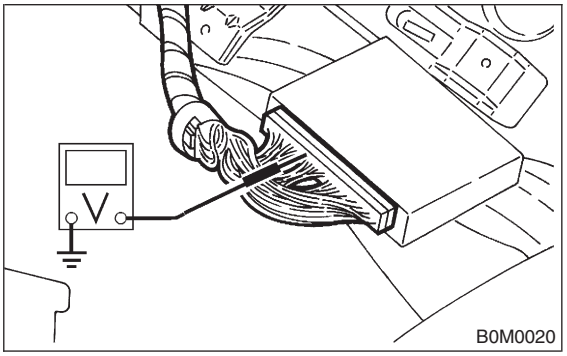
4. Diagnosis and Checking Procedure Using Instruments

A: USING A CIRCUIT TESTER

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

1. VOLTAGE CHECK (range set to DC V)

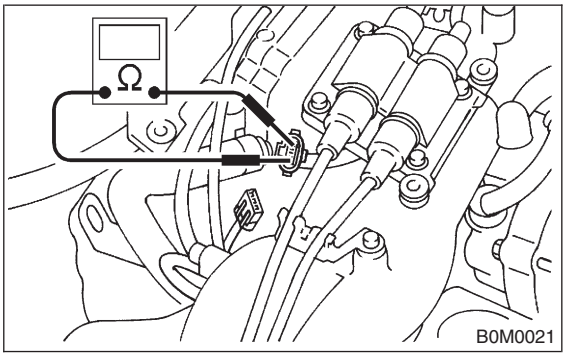
Connect the positive probe to the terminal to be tested, and the negative probe to body ground. (or the ground terminal of the ECM)



2. CHECKING THE CONNECTION (range set to Ω)

Measure the resistance and check for open or shorted wire in the harness or the connector.

NOTE:
This check must be carried out with both connectors disconnected.
(This avoids by-passing the connection through other circuits.)



1) Check for open circuit. (range: Ω × 1K)
Measure the resistance between the respective pins in both connectors.

Specified resistance:
More than 1 MΩ (No continuity) Open circuit
Less than 10 Ω (Continuity) O.K.

2) Check for correct insulation value. (range: Ω × 1K)
Measure the resistance between the pins in both connectors, as well as between the suspected pin and the body. (body short)

Specified resistance:
More than 1 MΩ (No continuity) O.K.
Less than 10 Ω (Continuity) Short circuit

3) Resistance measurement (range set to Ω)
Measuring the internal resistance of sensors, solenoid valves etc. to check the operating condition of components.

NOTE:
● Select the appropriate range for measuring the internal resistance, or the measurement will result in an incorrect reading.
● Before changing the measurement range the gauge must be reset to zero.

B: USING A SUBARU SELECT MONITOR

With this testing procedure the defective component can be determined by directly monitoring input/output signals of the ECM or the trouble codes.

1. FEATURES

● A variety of data can be checked without movements from the drivers seat, passenger's seat or from outside the vehicle.
● This unit allows the identification of the type of malfunction, for example whether the cause is an open or shorted wire in the input/output signal line, or whether the breakdown of a component is caused by a lack of maintenance.

2. DIAGNOSIS

● Refer to the reference values for input/output and control data to determine whether the malfunction is caused by a worn out component, an open wire, a short etc.
● Perform the diagnostics procedure as described in chapter "Check based on trouble codes" by monitoring the trouble codes.

NOTE:
It will be easier to determine a malfunction if the vehicle data for normal conditions are available for comparison.

C: USING AN OSCILLOSCOPE

A malfunction can be determined by displaying the waveforms of input/output signals on the oscilloscope.

1. DIAGNOSIS

A simple comparison of the waveforms may lead to an incorrect diagnosis. To exactly determine the sources of the malfunction it will be necessary to determine them under consideration about information other than waveforms.

2. APPLYING INPUT/OUTPUT SIGNALS

Connect the probe directly with the terminal of the signal.

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1. Precaution

A: SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

Airbag system wiring harness is routed on and along body panels.

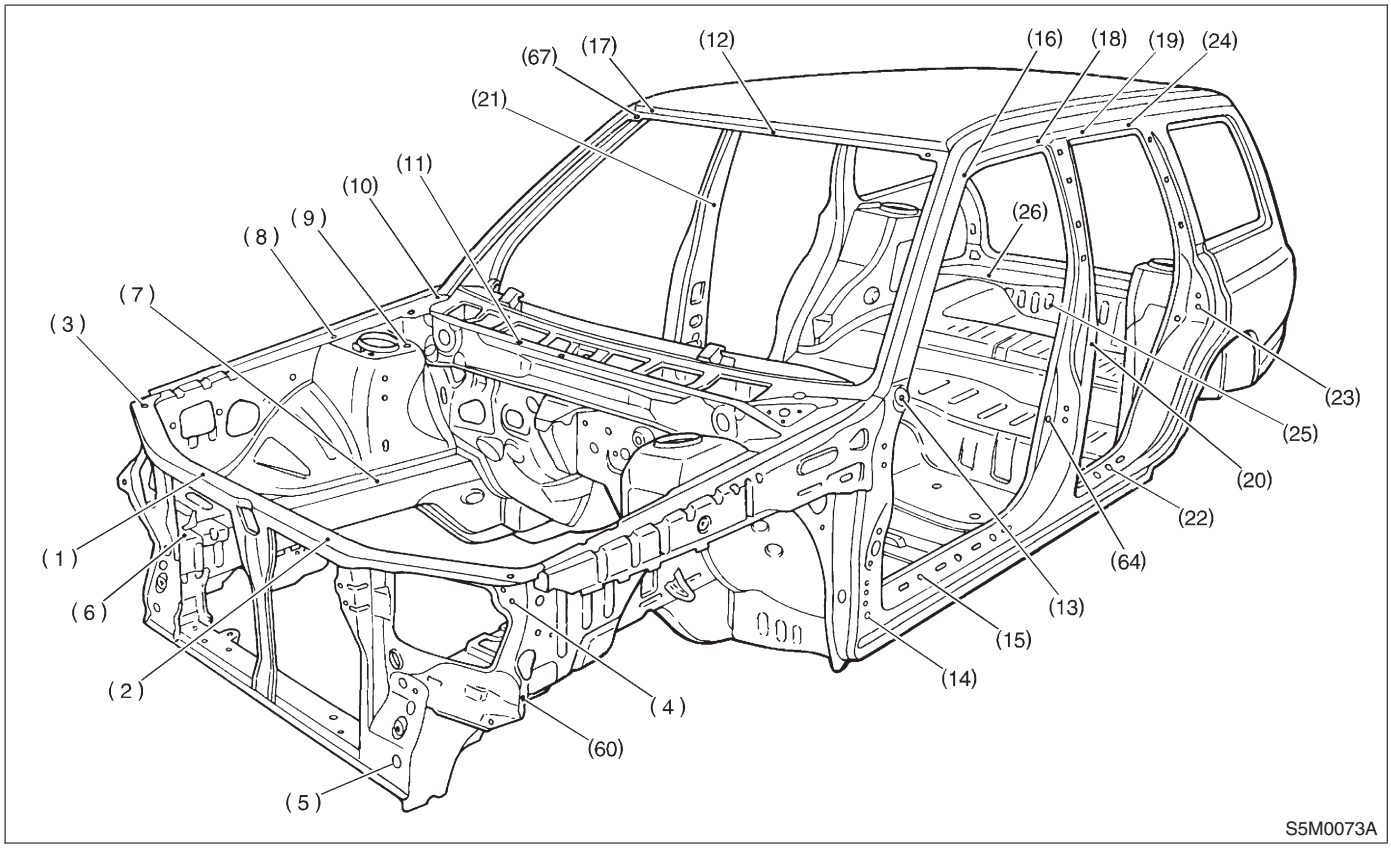
CAUTION:
- All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
- Be careful not to damage Airbag system wiring harness when repairing the body panel.

2. Body Datum Points

Various master repair locations are established as datum points used during body repairs. In addition, guide holes, locators and indents are provided to facilitate panel replacement and achieve alignment accuracy.

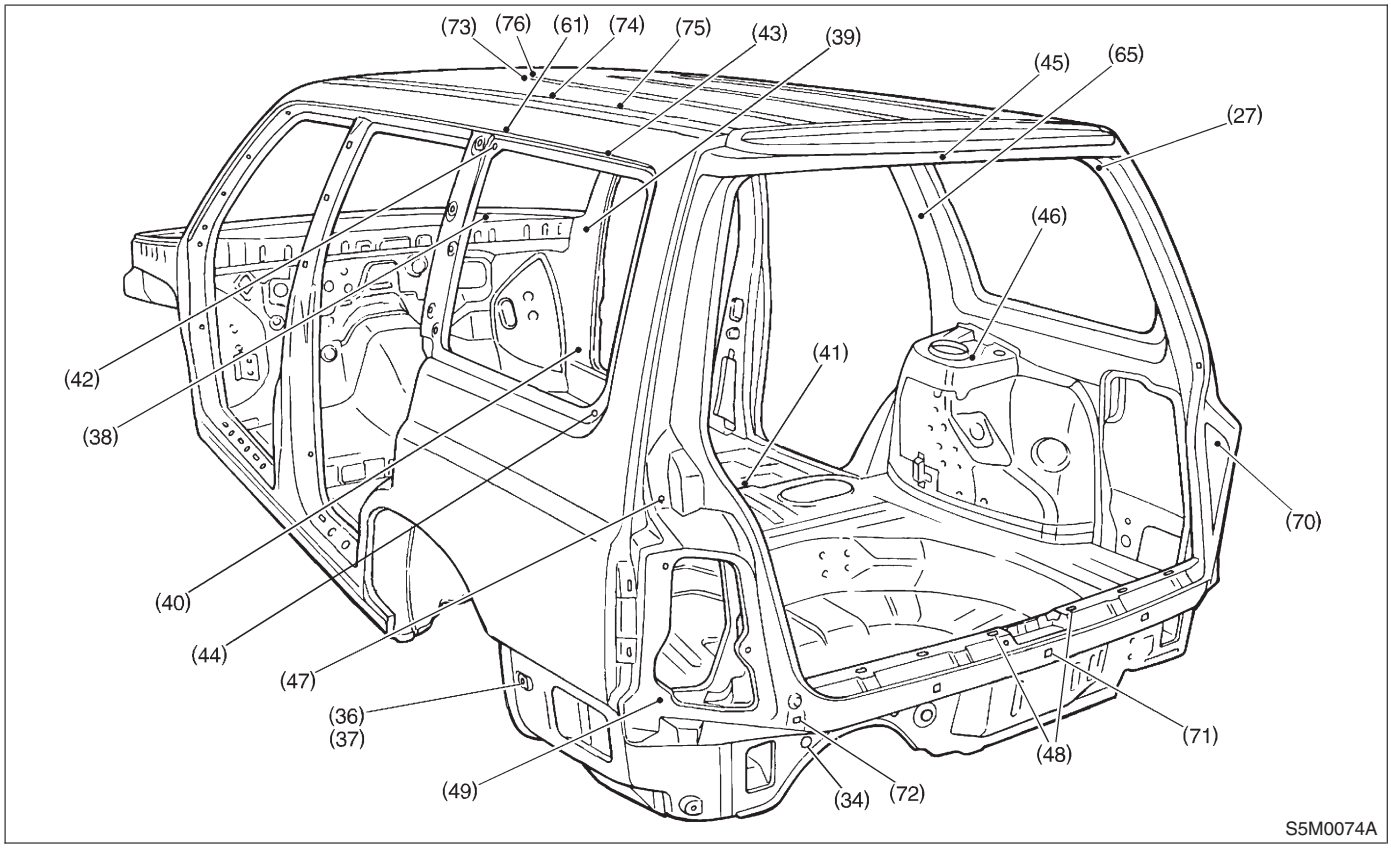
NOTE:
Left and right datum points are all symmetrical to each other.

A: ENGINE COMPARTMENT AND ROOM



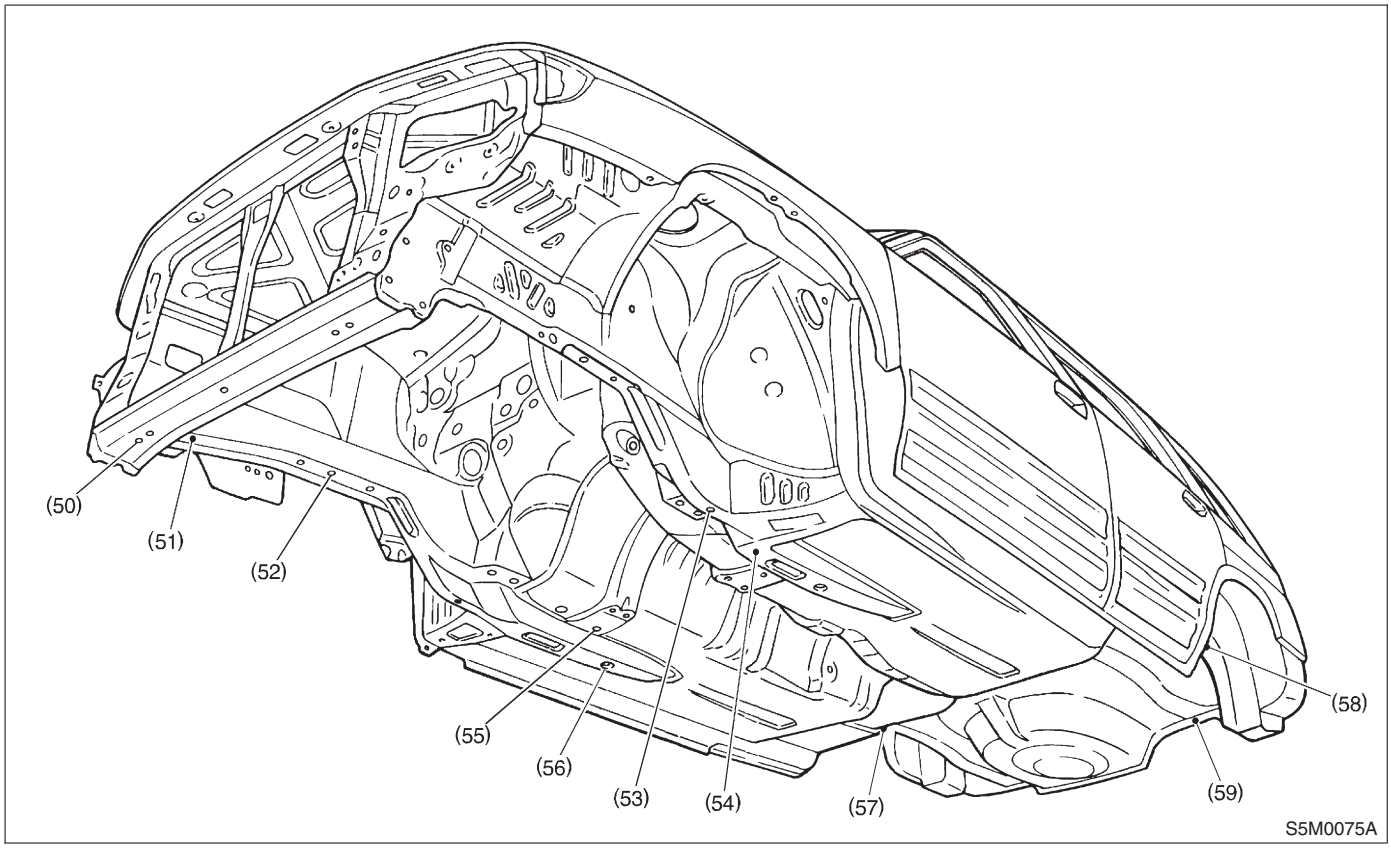
(1) Radiator panel (UPR) repair bolt hole M8 (Right)
(2) Radiator panel (UPR) repair bolt hole M8 (Left)
(3) Fender attaching bolt hole M6 (Symmetrical)
(4) Repair locator 8 mm (0.31 in) dia. (Symmetrical)
(5) Radiator panel side gauge hole 24 mm (0.94 in) dia. (Symmetrical)
(6) Front bumper mounting hole 14 × 17 mm (0.55 × 0.67 in) dia. (Symmetrical)
(7) Front crossmember attaching bolt hole 12.4 mm (0.488 in) dia. (Symmetrical)
(8) Fender attaching bolt hole M6 (Symmetrical)
(9) Front strut mounting hole 10 mm (0.39 in) dia. (Symmetrical)
(10) Hood hinge attaching bolt hole M8 (Symmetrical)
(11) Cowl panel mounting hole 6 mm (0.24 in) dia. (Symmetrical)
(12) Roof inner trim attaching bolt hole 8 mm (0.31 in) dia.
(13) Fender attaching bolt hole M6 (Symmetrical)
(14) Front pillar gauge hole 20 mm (0.79 in) dia. (Symmetrical)
(15) Wax coat hole, 20 mm (0.79 in) dia. (Symmetrical)
(16) Retainer attaching square hole 7 mm (0.28 in) (Symmetrical)
(17) Sun visor attaching hole 20 mm (0.79 in) dia. (Symmetrical)
(18) Retainer attaching square hole 7 mm (0.28 in) (Symmetrical)
(19) Retainer attaching square hole 7 mm (0.28 in) (Symmetrical)
(20) Center pillar gauge hole 12 mm (0.47 in) dia. (Symmetrical)
(21) Belt anchor attaching bolt hole 12 mm (0.47 in) dia. (Symmetrical)
(22) Wax coat hole, 20 mm (0.79 in) dia. (Symmetrical)
(23) Rear door switch attaching hole 20 mm (0.79 in) dia. (Symmetrical)
(24) Retainer attaching square hole 7 mm (0.28 in) (Symmetrical)
(25) Spare tire attaching bolt hole M8
(26) Air draw hole 7 mm (0.28 in) dia. (Symmetrical)
(60) Fender attaching bolt hole M6 (Symmetrical)
(64) Door switch attaching hole 13.5 mm (0.531 in) dia. (Symmetrical)
(67) Front glass attaching hole Right 6.5 mm (0.256 in) dia. Left 6.5 × 10 mm (0.256 × 0.39 in) dia.

B: LUGGAGE COMPARTMENT AND ROOM



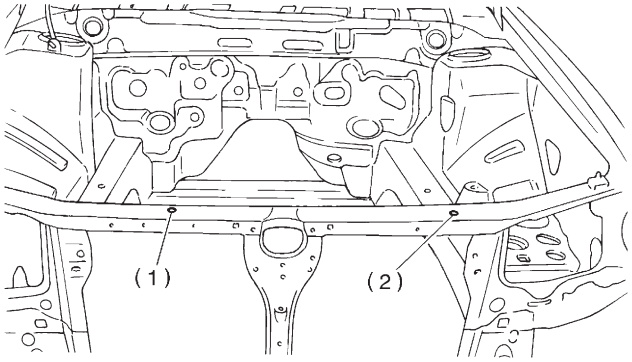
(27) Rear pillar (Inner) harness clip attaching hole 8 mm (0.31 in) dia. (Symmetrical)
(34) Rear skirt gauge hole 20 mm (0.79 in) dia. (Symmetrical)
(36) Rear quarter bumper side gauge hole 20 mm (0.79 in) dia. (Left)
(37) Rear quarter bumper side gauge hole 20 mm (0.79 in) dia. (Right)
(38) Instrument panel attaching square hole 22 × 34.5 mm (0.87 × 1.358 in) (Right)
(39) Steering support beam attaching bolt hole M8 (Symmetrical)
(40) Front pillar (Inner) gauge hole 10 mm (0.39 in) dia. (Symmetrical)
(41) Floor mat attaching clip hole 8 mm (0.31 in) dia. (Symmetrical)
(42) Rear quarter glass attaching hole 8 × 15 mm (0.31 × 0.59 in) dia. (Symmetrical)
(43) Roof rail attaching square hole 9 mm (0.35 in) dia. (Symmetrical)
(44) Rear quarter glass attaching hole 8 mm (0.31 in) dia. (Symmetrical)
(45) Rear locator hollow 4 mm (0.16 in) dia.
(46) Rear strut mounting hole 10 mm (0.39 in) dia. (Symmetrical)
(47) Rear gate stay attaching bolt hole M8 (Symmetrical)
(48) Inner trim clip attaching hole 8 × 20 mm (0.31 × 0.79 in) dia. (Symmetrical)
(49) Rear combination light mounting hole 8 mm (0.31 in) dia. (Symmetrical)
(61) Side rail (Inner) gauge hole 8 mm (0.31 in) dia. (Symmetrical)
(65) Seat belt anchor attaching bolt hole 12 mm (0.47 in) dia. (Symmetrical)
(70) Buffer attaching hole M6 (Symmetrical)
(71) Bumper face attaching square hole 8 × 9 mm (0.31 × 0.35 in)
(72) Rear quarter and square hole 8 × 9 mm (0.31 × 0.35 in) (Symmetrical)
(73) Head console attaching hole 8 mm (0.31 in) dia.
(74) Inner shim carrier attaching bolt hole M6 (Symmetrical)
(75) Inner shim carrier attaching bolt hole M6 (Symmetrical)
(76) Head console attaching hole 8 mm (0.31 in) dia.

C: UNDER BODY

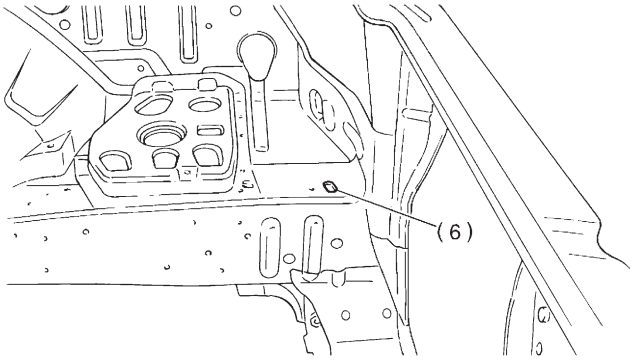


(50) Radiator panel (LWR) frame gauge hole 15 mm (0.59 in) dia. (Symmetrical)
(51) Front side frame gauge hole 20 mm (0.79 in) dia. (Symmetrical)
(52) Front crossmember attaching hole 12.4 mm (0.488 in) dia. (Symmetrical)
(53) Front suspension attaching bolt hole M14
(54) Side frame gauge hole 20 mm (0.79 in) dia. (Symmetrical)
(55) Transmission mount attaching bolt hole 10 mm (0.39 in) dia. (Symmetrical)
(56) Side frame gauge hole 15 mm (0.59 in) dia. (Symmetrical)
(57) Rear differential attaching bolt hole 12 mm (0.47 in) dia. (Symmetrical)
(58) Rear suspension attaching bolt hole M12 (Symmetrical)
(59) Rear side frame gauge hole 15 mm (0.59 in) dia. (Symmetrical)

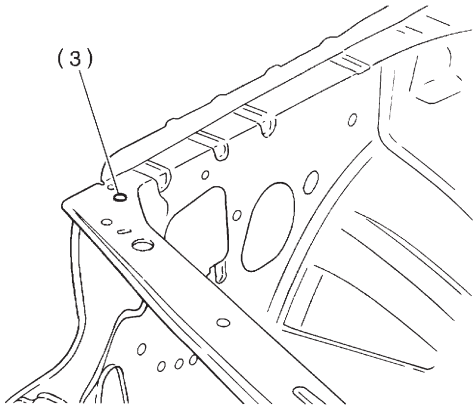
D: DATUM POINT LOCATION



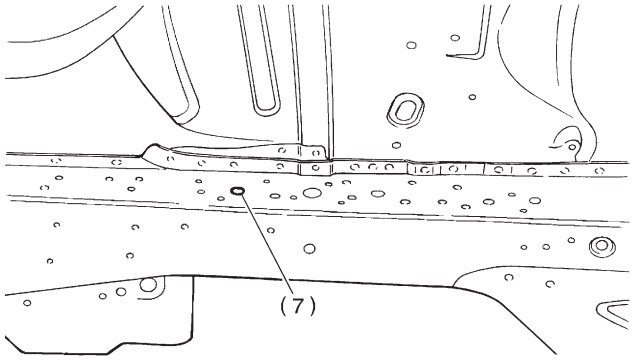
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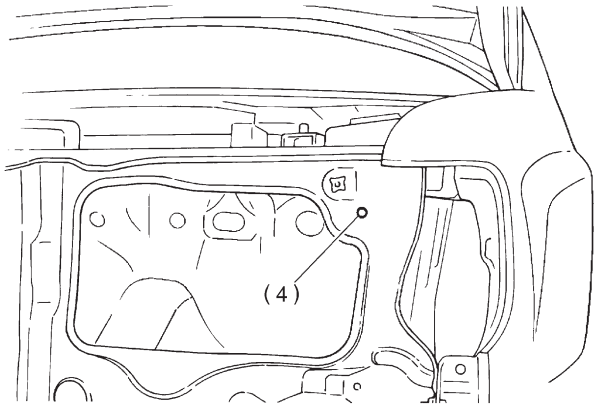
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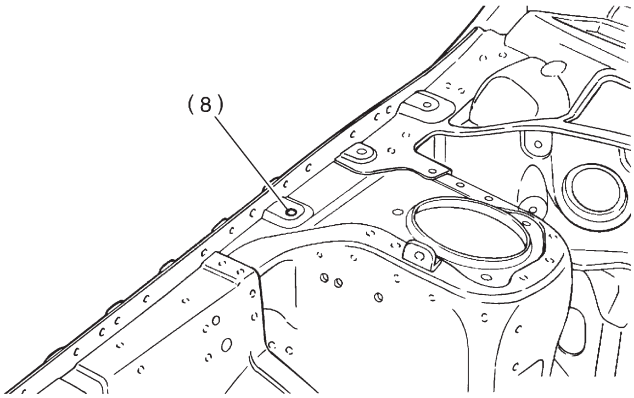
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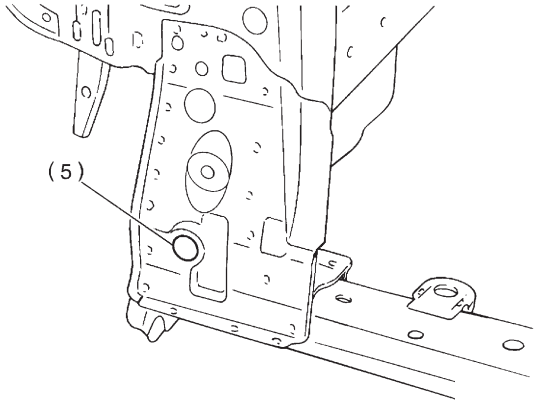
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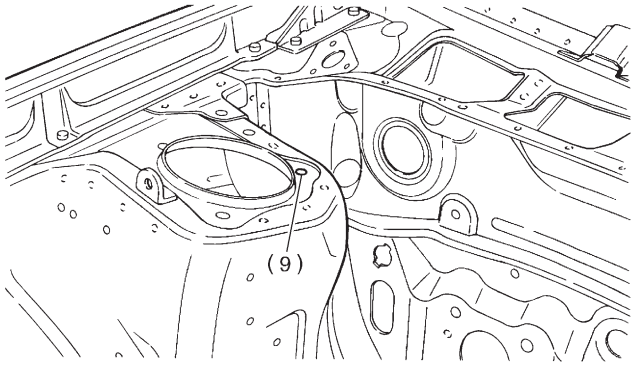
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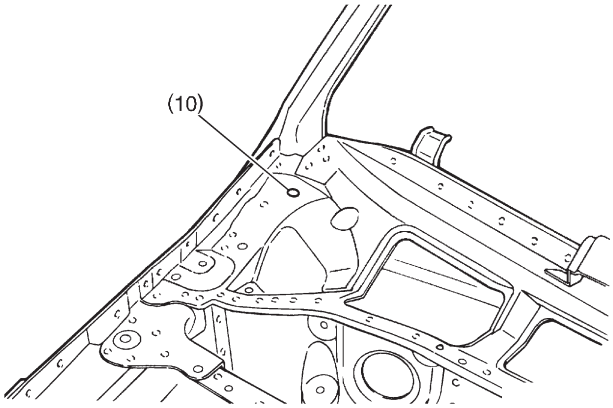
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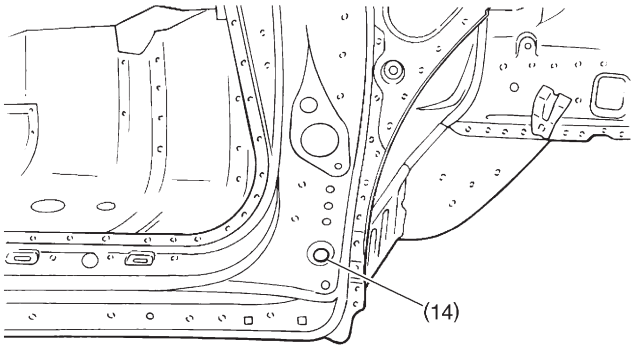
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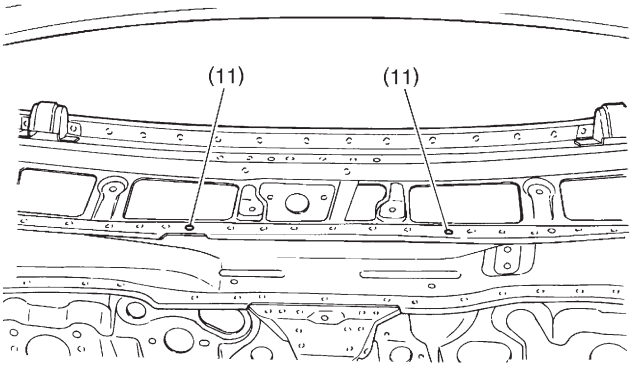
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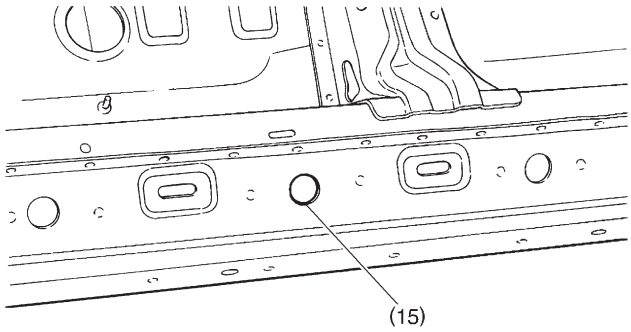
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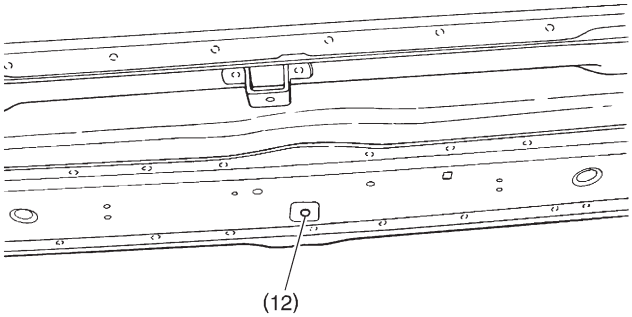
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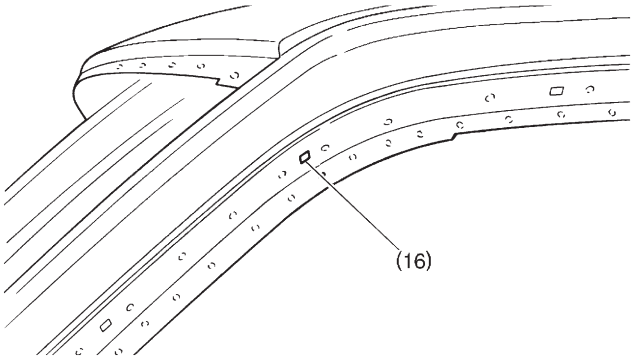
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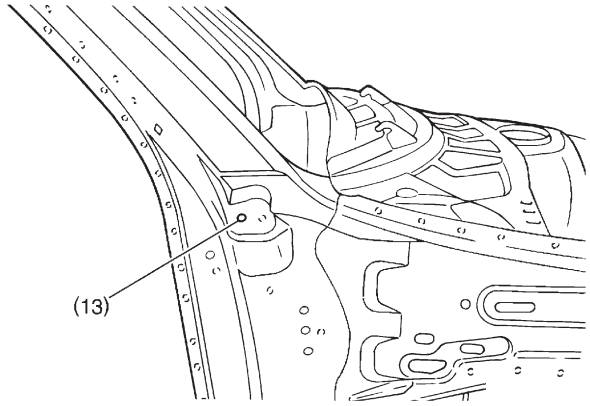
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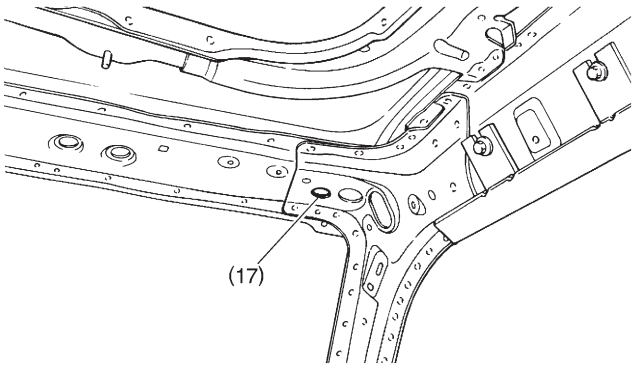
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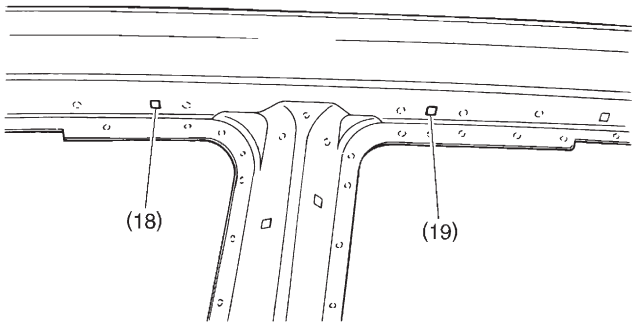
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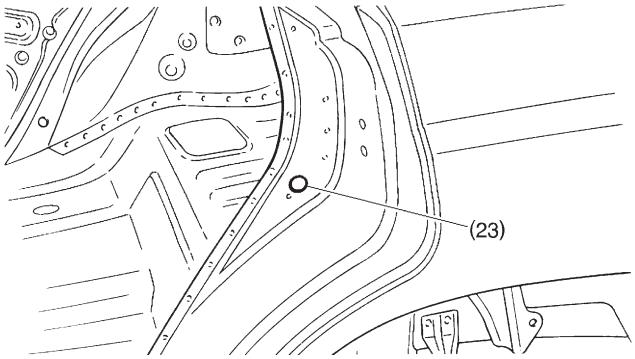
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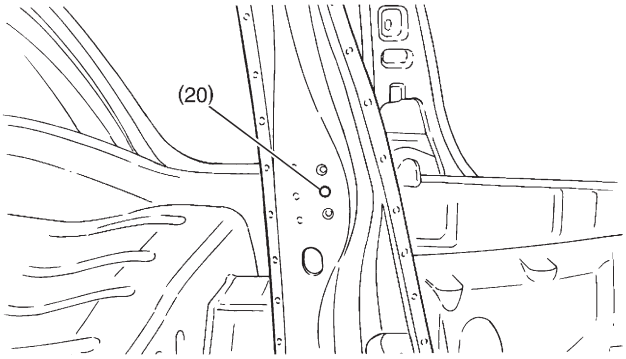
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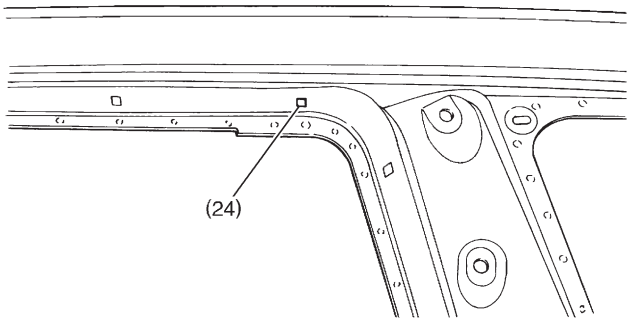
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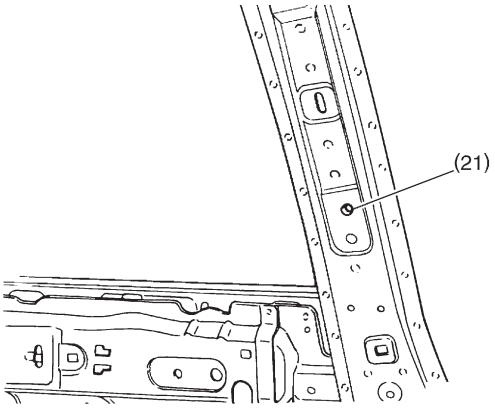
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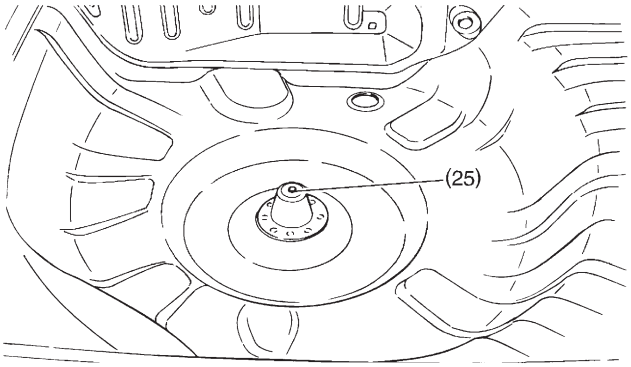
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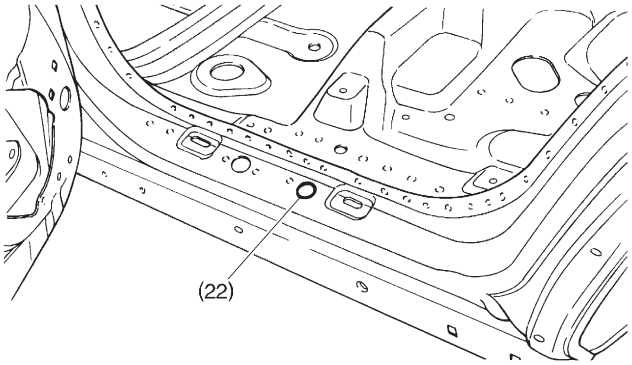
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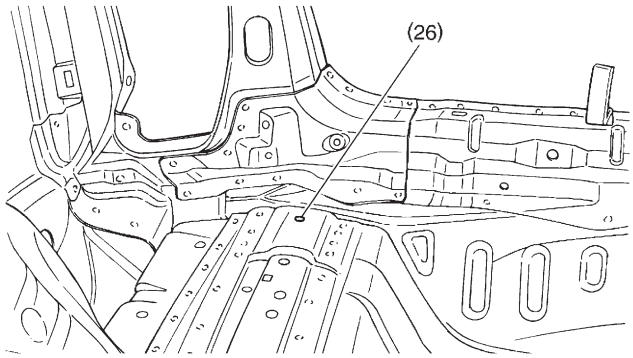
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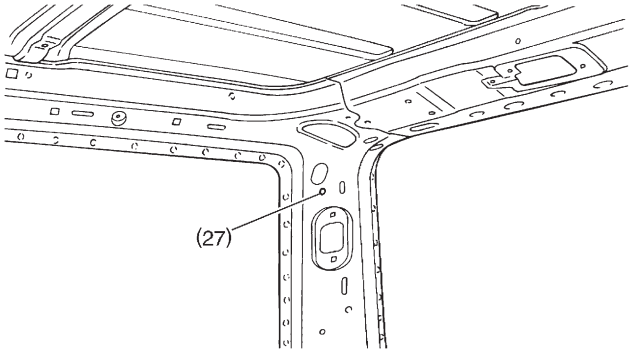
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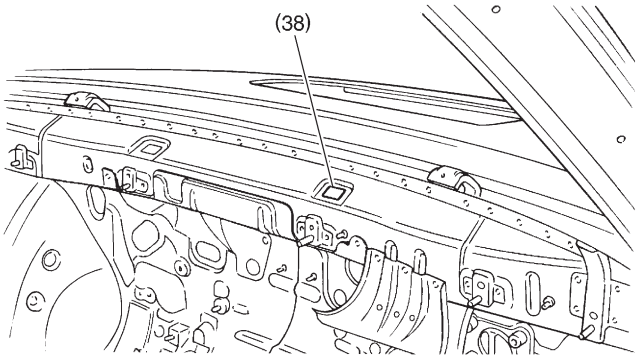
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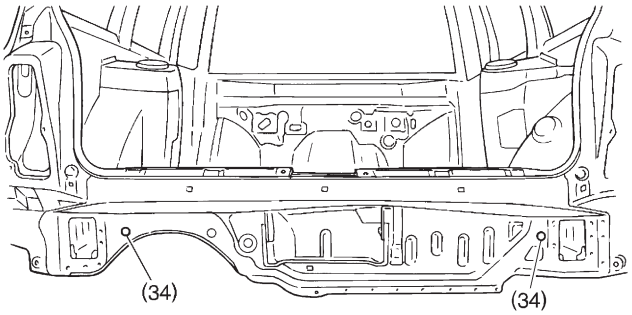
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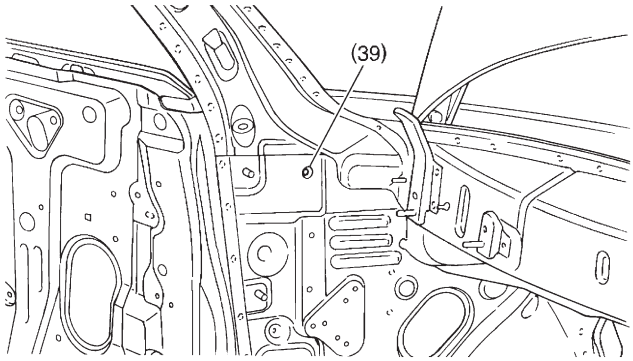
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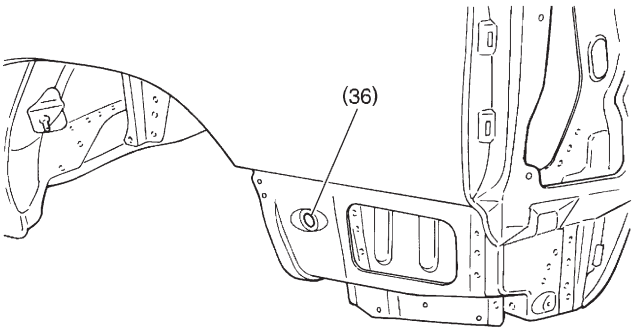
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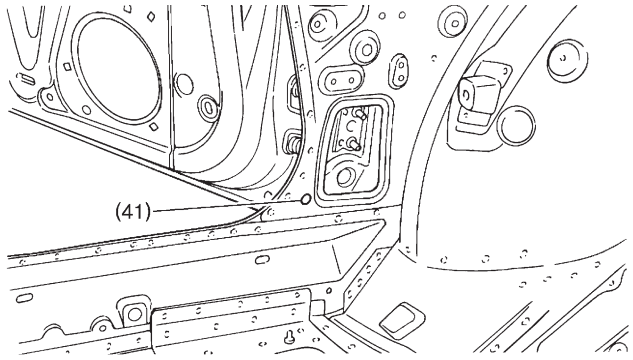
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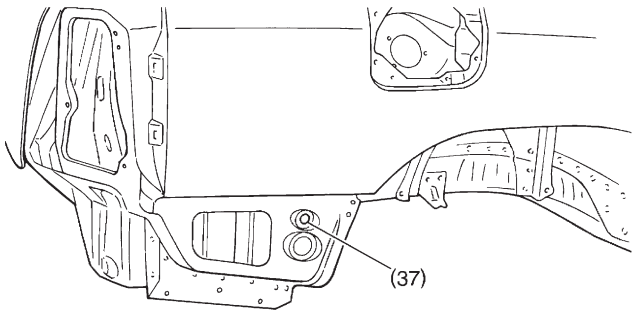
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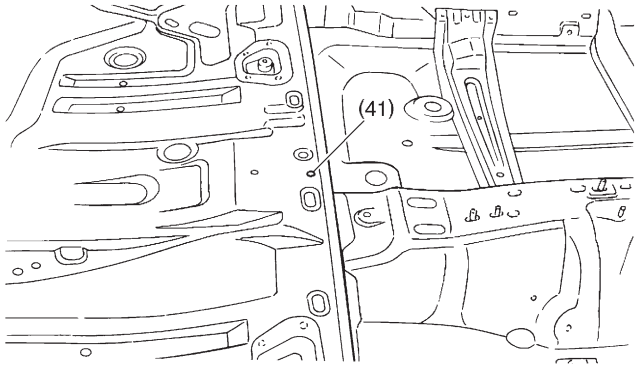
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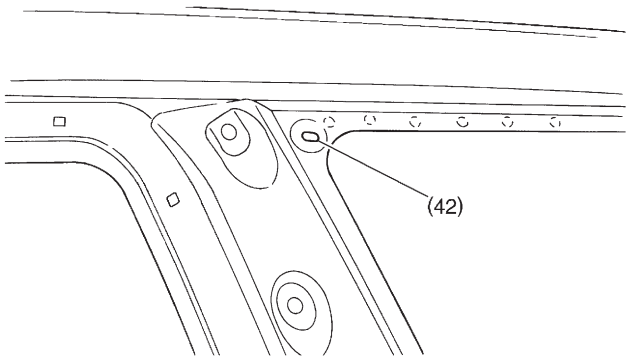
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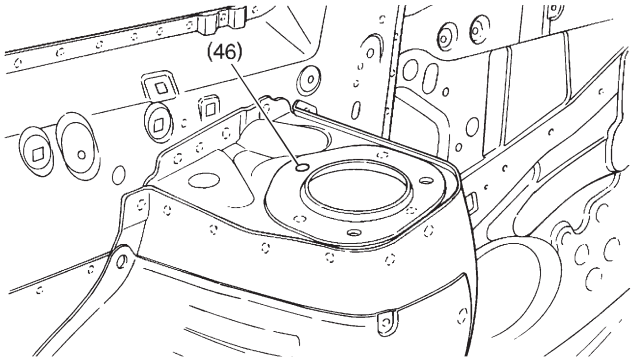
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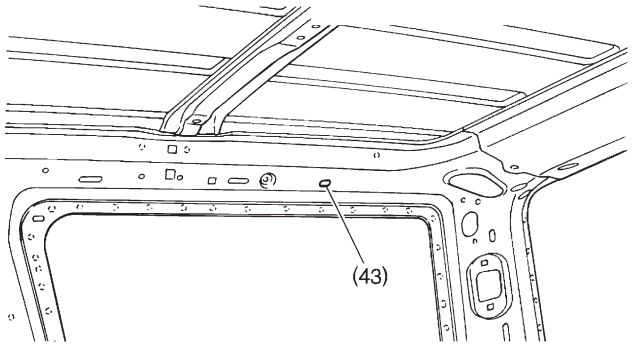
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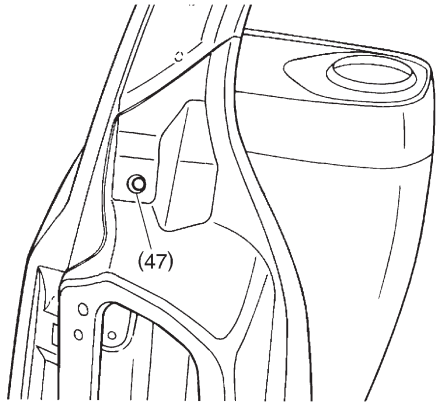
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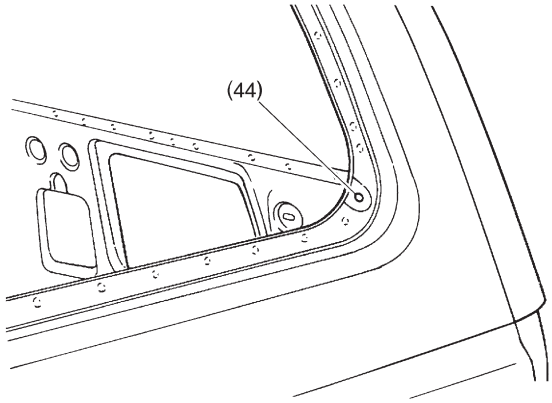
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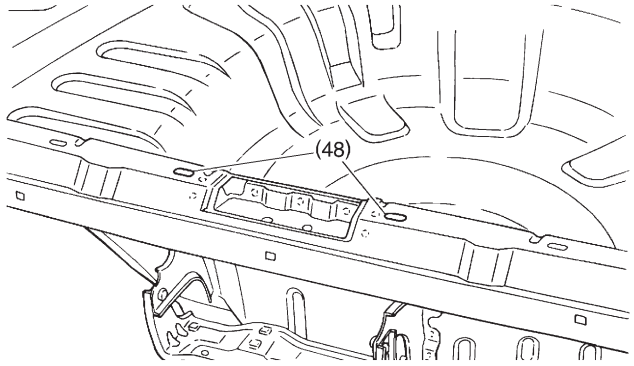
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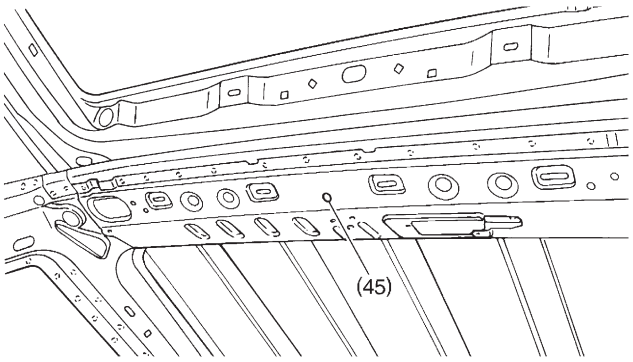
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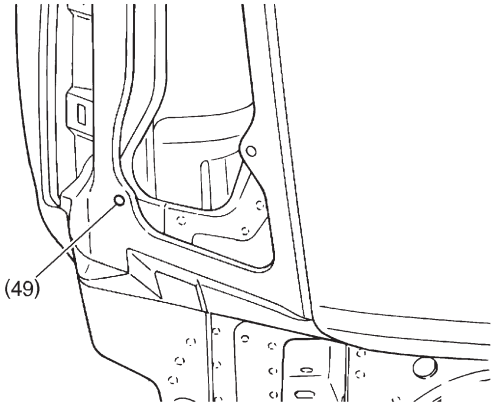
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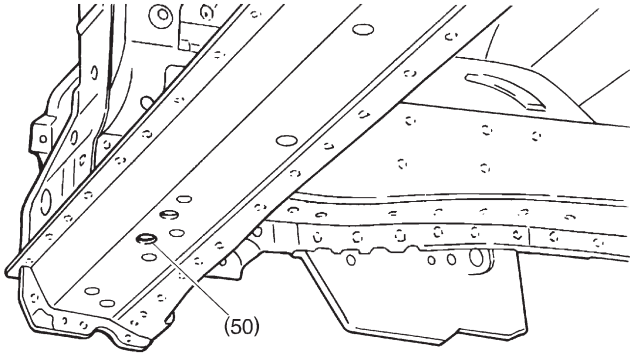
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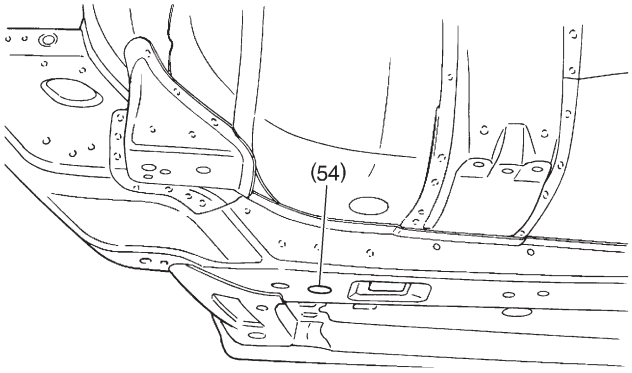
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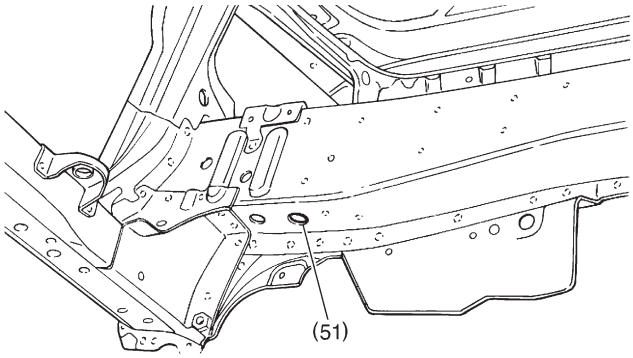
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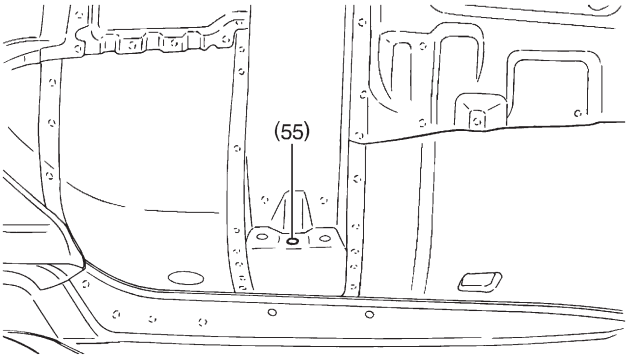
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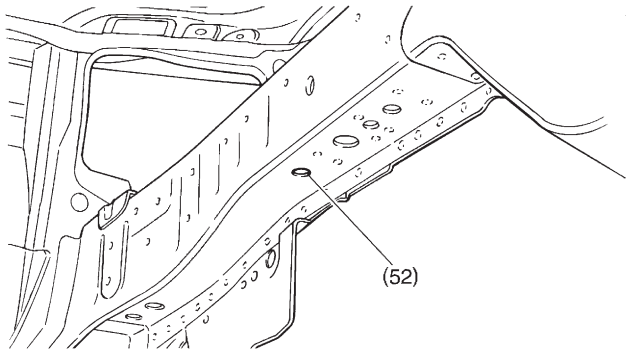
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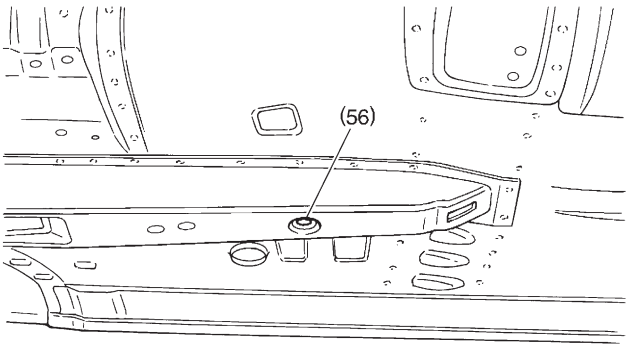
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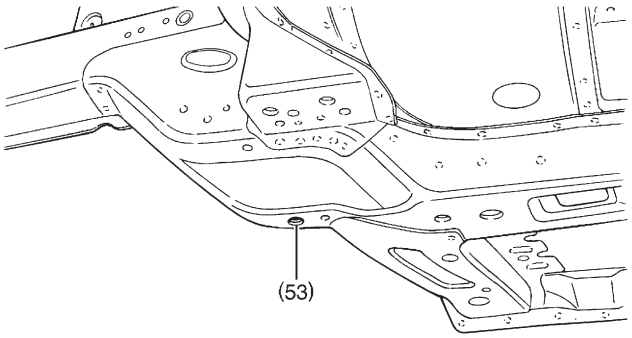
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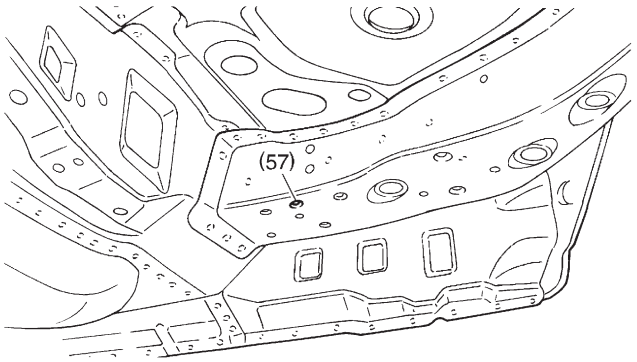
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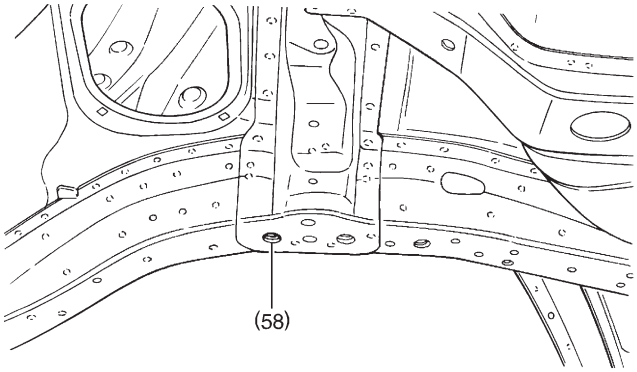
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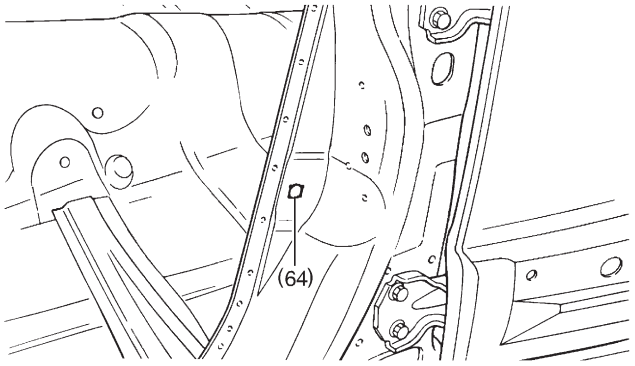
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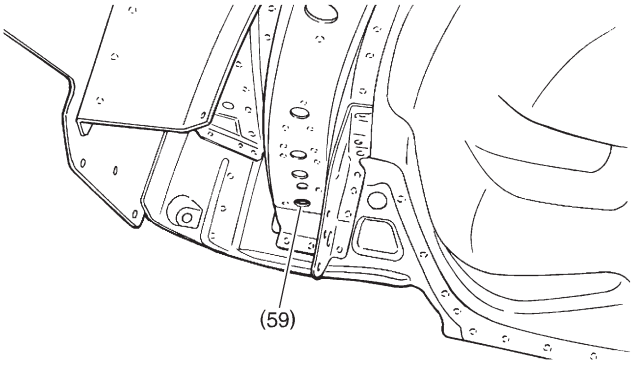
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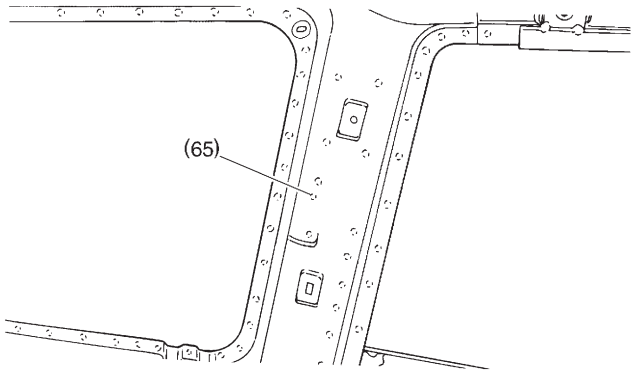
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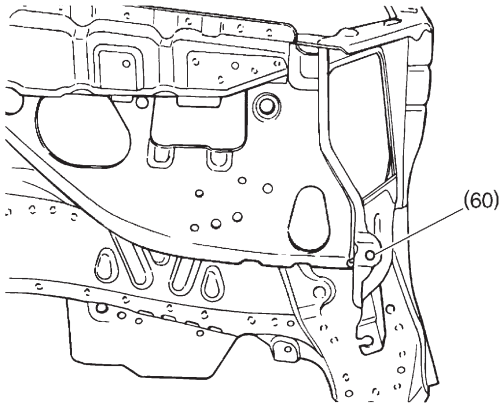
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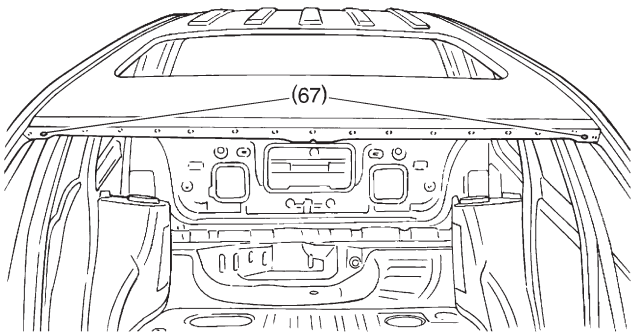
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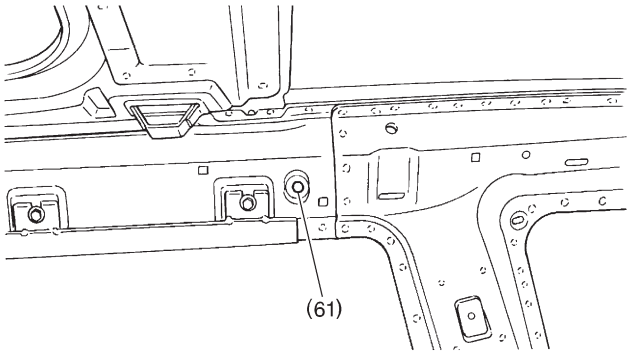
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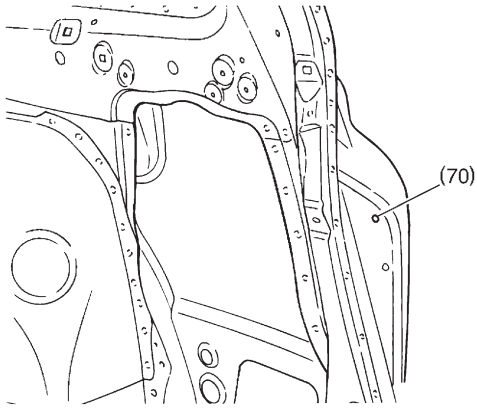
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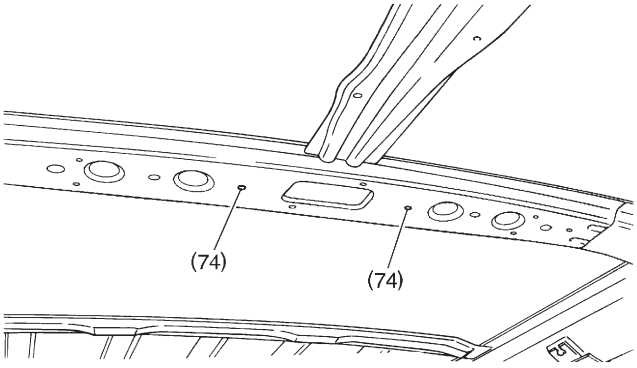
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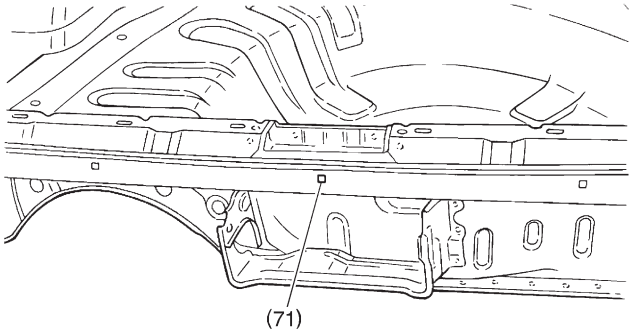
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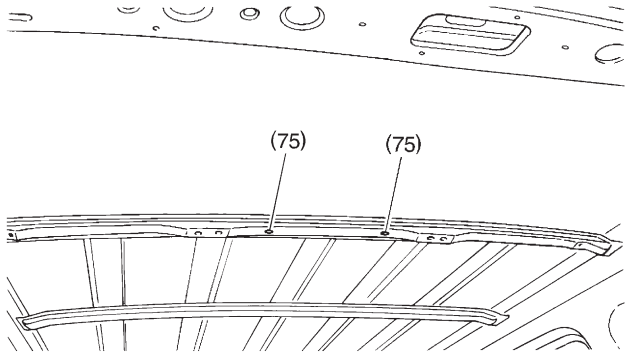
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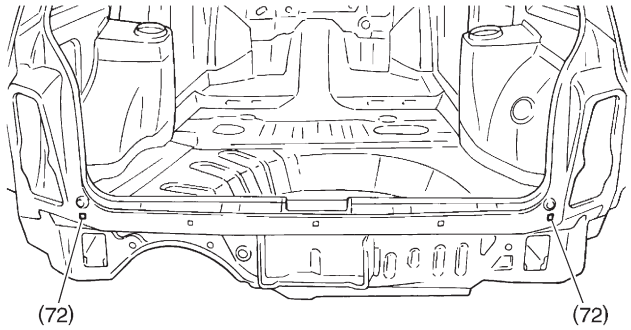
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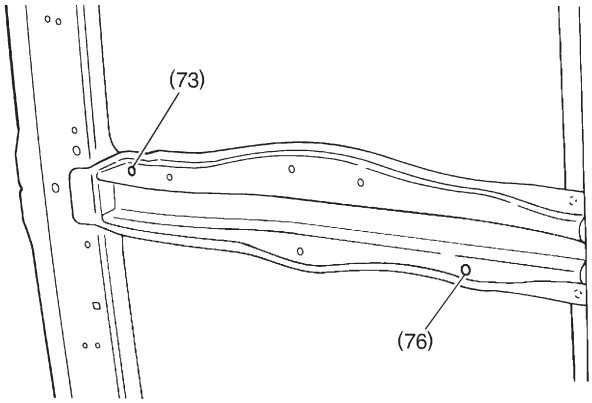
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S5M0134A



S5M0135A



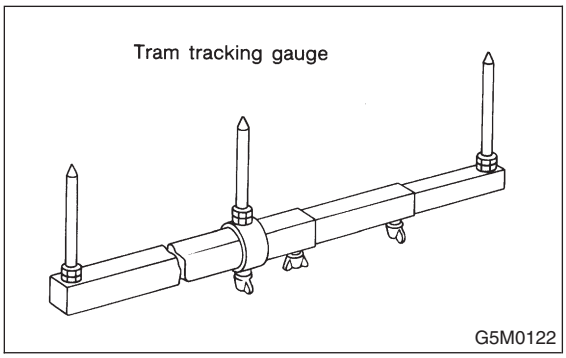
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MEMO:

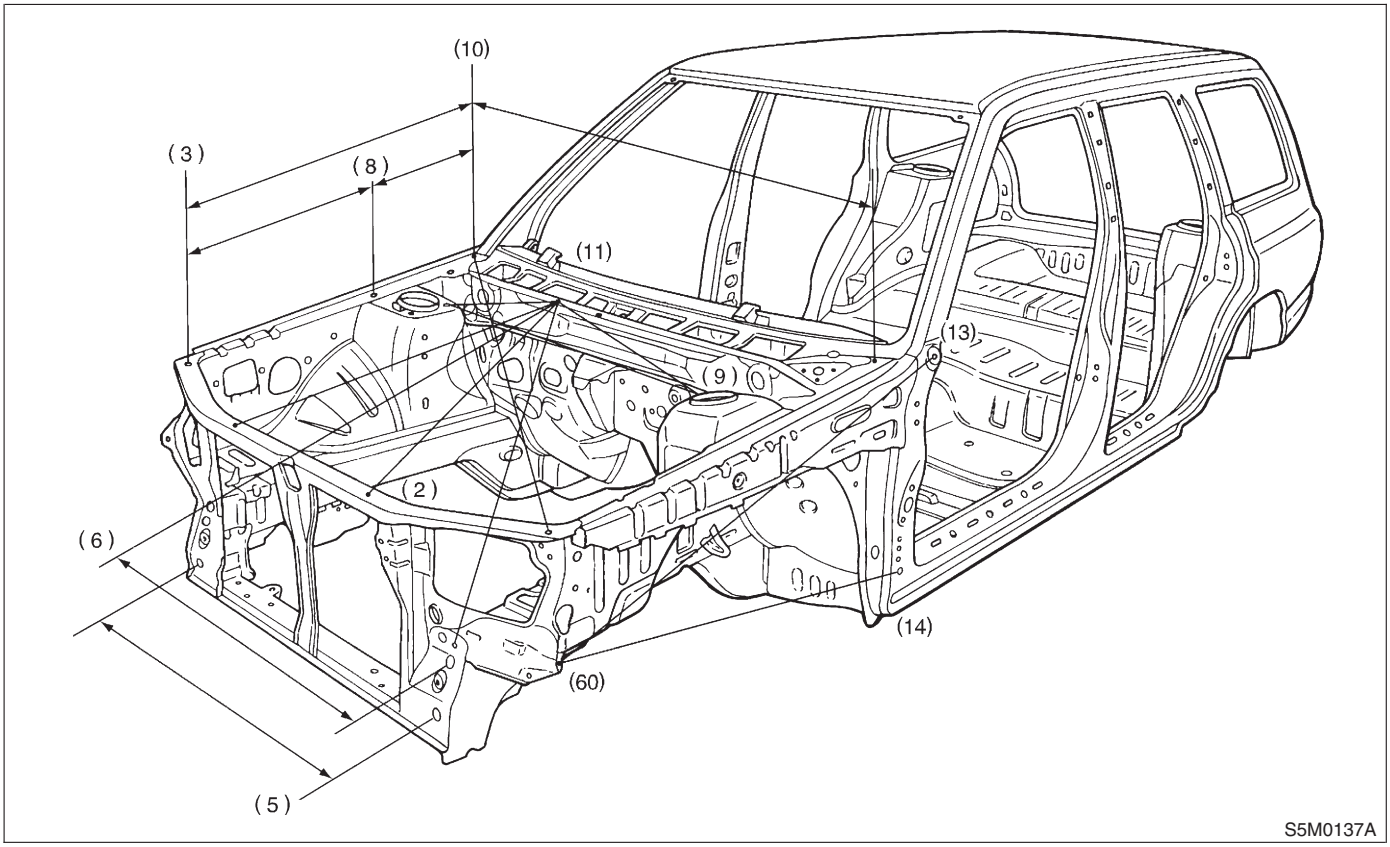
3. Datum Dimensions

Use a tram tracking gauge to measure all dimensions. If a measuring tape is used, be extremely careful because it tends to deflect or twist, which results in a false reading.

NOTE:
- A suffix character “R” or “L” refers to the right or the left.
- All dimensions refer to the distance between the centers of holes measured in a straight line
- Each dimension indicates a projected dimension between hole centers.



A: FRONT STRUCTURE

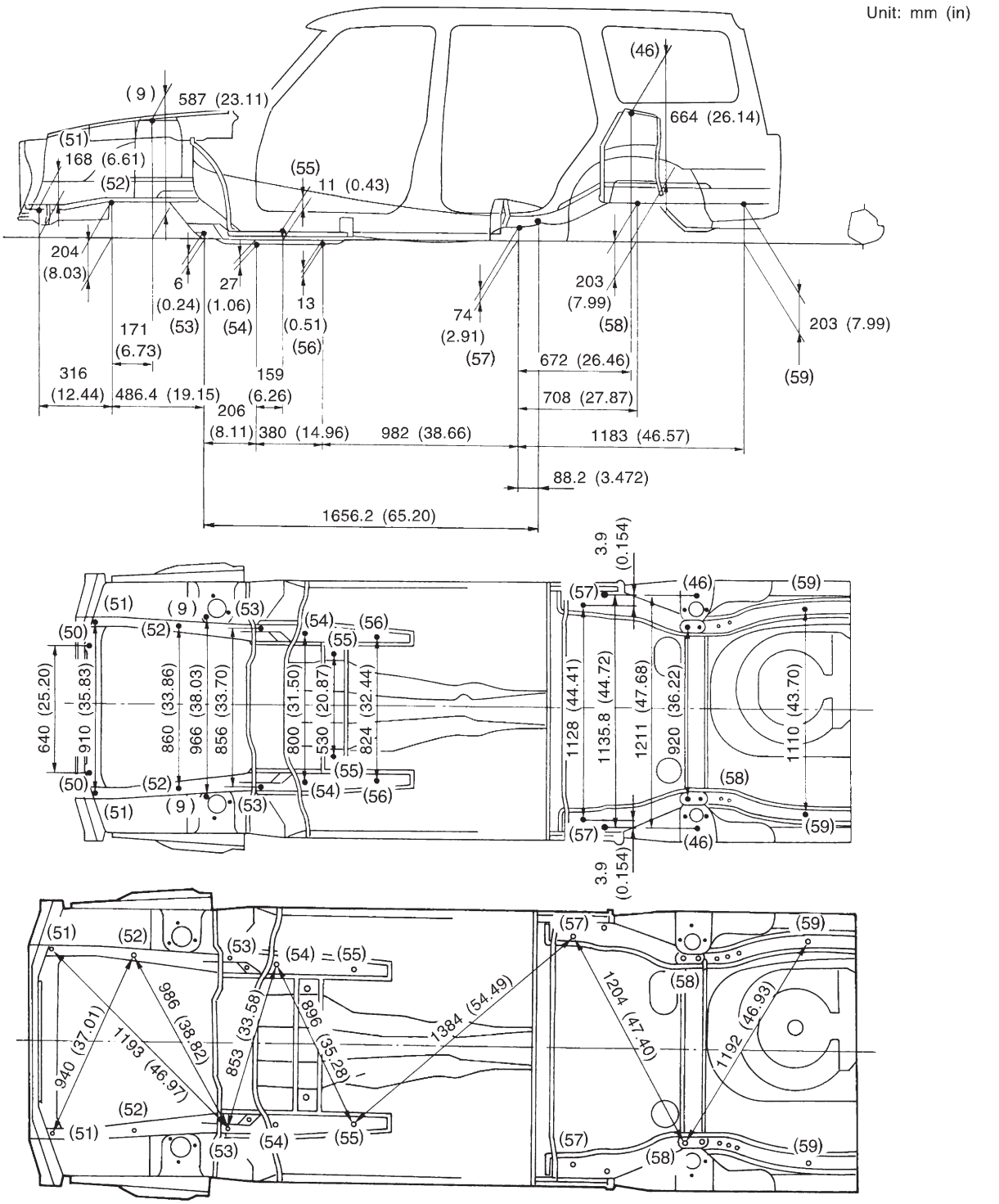


Unit: mm (in)

Point to point	Dimension		Point to point	Dimension
(11) R to (1)	851 (33.50)		(10) R to (8) R	388 (15.28)
(11) L to (1)	912 (35.91)		(10) L to (8) L	388 (15.28)
(11) R to (2)	960 (37.80)		(11) L to (9) R	658 (25.91)
(11) L to (2)	864 (34.02)		(11) R to (9) L	658 (25.91)
(11) R to (9) R	391 (15.39)		(9) R to (9) L	965 (37.99)
(11) L to (9) L	391 (15.39)		(11) L to (6) R	1,058 (41.65)
(11) R to (6) R	924 (36.38)		(11) R to (6) L	1,058 (41.65)
(11) L to (6) L	924 (36.38)		(6) R to (6) L	914 (35.98)
(11) R to (3) R	891 (35.08)		(6) R to (10) L	1,549 (60.98)
(11) L to (3) L	891 (35.08)		(6) L to (10) R	1,549 (60.98)
(10) R to (3) R	915 (36.02)		(8) R to (3) R	528 (20.79)
(10) L to (3) L	915 (36.02)		(8) L to (3) L	528 (20.79)
(10) R to (10) L	1,374 (54.09)		(10) L to (3) R	1,636 (64.41)
(3) R to (3) L	1,338 (52.68)		(8) R to (8) L	1,396 (54.96)
(5) R to (5) L	924 (36.38)		(8) R to (10) L	1,438 (56.61)
(4) R to (4) L	1,296 (51.02)		(8) L to (10) R	1,438 (56.61)
(5) R to (4) L	1,167 (45.94)		(3) R to (8) L	1,465 (57.68)
(5) L to (4) R	1,167 (45.94)		(3) L to (8) R	1,465 (57.68)
(60) R to (13) R	1,174 (46.22)		(7) R to (7) L	860 (33.86)
(60) L to (13) L	1,174 (46.22)		(7) R to (6) L	982 (38.66)
(60) R to (14) R	1,076 (42.36)		(7) L to (6) R	982 (38.66)
(60) L to (14) L	1,076 (42.36)		(7) R to (10) L	1,301 (51.22)
(10) R to (3) L	1,636 (64.41)		(7) L to (10) R	1,301 (51.22)

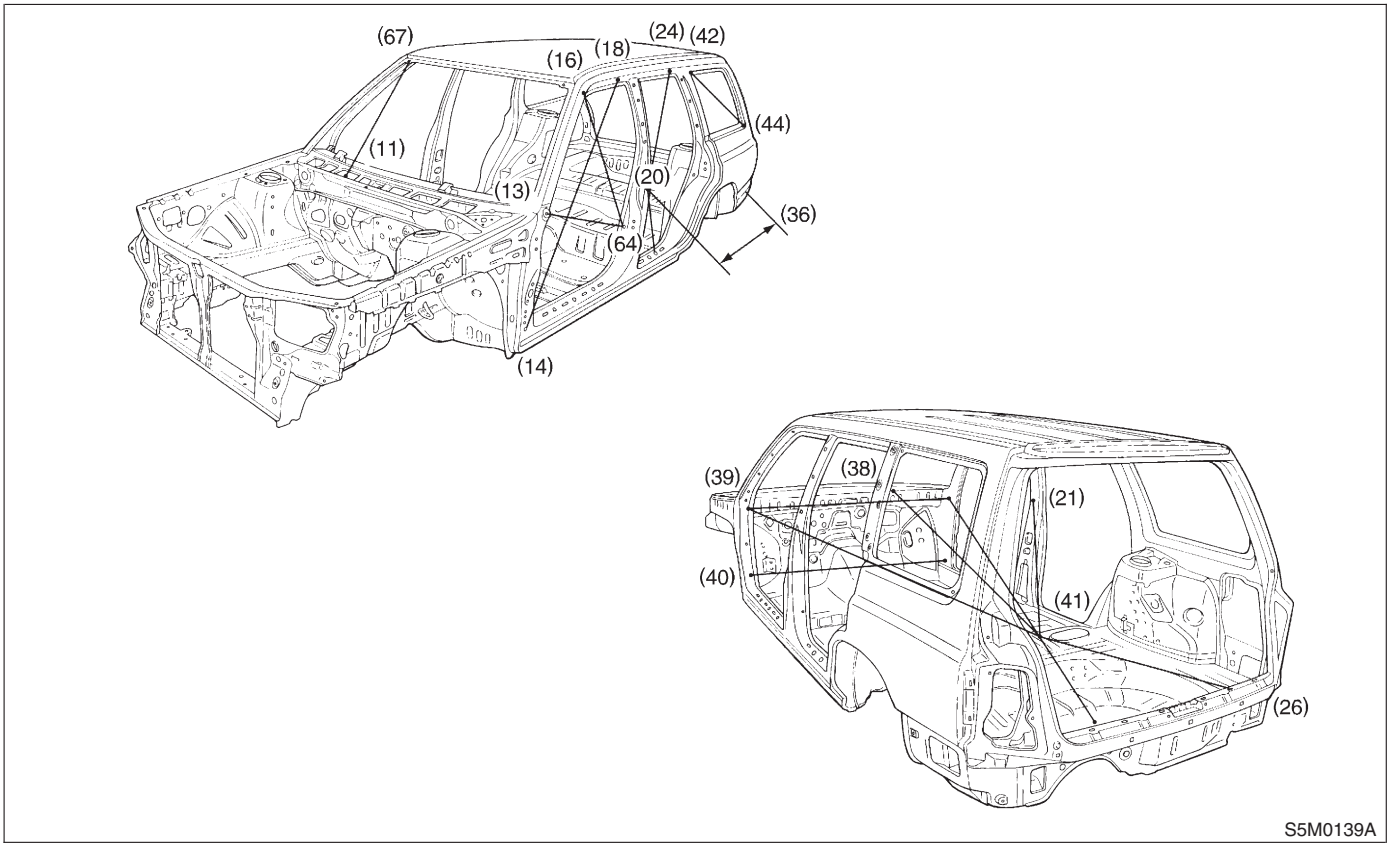
B: CENTER STRUCTURE

Unit: mm (in)



S5M0138A

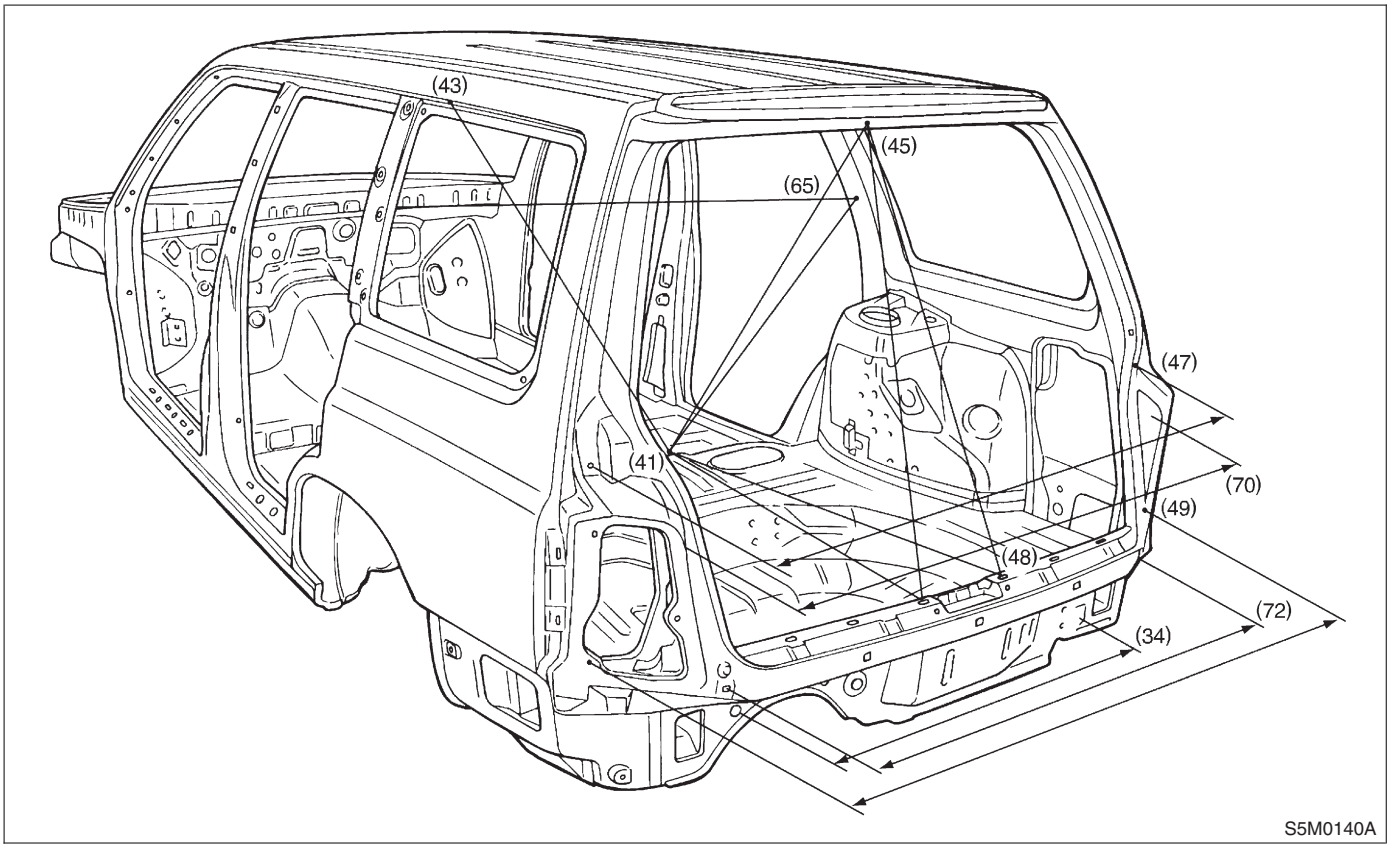
C: DOORS AND PASSENGER COMPARTMENT



Unit: mm (in)

Point to point	Dimension		Point to point	Dimension
(14) L to (18) L	1,454 (57.24)		(16) L to (64) L	860 (33.86)
(14) R to (18) R	1,454 (57.24)		(16) R to (64) R	860 (33.86)
(13) L to (64) L	944 (37.17)		(20) L to (23) L	845 (33.27)
(13) R to (64) R	944 (37.17)		(20) R to (23) R	845 (33.27)
(20) L to (24) L	660 (25.98)		(19) L to (23) L	885 (34.84)
(20) R to (24) R	660 (25.98)		(19) R to (23) R	885 (34.84)
(20) L to (36)	1,484 (58.43)		(11) L to (67) R	1,170 (46.06)
(20) R to (37)	1,487 (58.54)		(11) R to (67) L	1,170 (46.06)
(42) L to (44) L	769 (30.28)		(41) to (38)	1,518 (59.76)
(42) R to (44) R	769 (30.28)		(41) to (39) R	1,581 (62.24)
(11) R to (12)	920 (36.22)		(41) to (39) L	1,581 (62.24)
(11) L to (12)	920 (36.22)		(41) to (40) R	1,499 (59.02)
(67) R to (67) L	1,045 (41.14)		(41) to (40) L	1,499 (59.02)
(11) R to (67) R	1,040 (40.94)		(41) to (15) R	1,186 (46.69)
(11) L to (67) L	1,040 (49.94)		(41) to (15) L	1,186 (46.69)
(12) to (67) L	503 (19.80)		(41) to (22) R	733 (28.86)
(12) to (67) R	503 (19.80)		(41) to (22) L	733 (28.86)
(12) to (10) L	1,027 (40.43)		(41) to (26) R	1,568 (61.73)
(12) to (10) R	1,027 (40.43)		(41) to (26) L	1,568 (61.73)
(21) R to (21) L	1,322 (52.05)		(41) to (25)	1,211 (47.68)
(15) R to (15) L	1,452 (57.17)		(41) to (12)	1,299 (51.14)
(22) R to (22) L	1,452 (57.17)		(41) to (21) R	962 (37.87)
(39) R to (39) L	1,392 (54.80)		(41) to (21) L	962 (37.87)
(40) R to (40) L	1,402 (55.20)		(41) to (17) R	1,333 (52.48)
(11) L to (17) R	1,149 (45.24)		(41) to (17) L	1,333 (52.48)
(11) R to (17) L	1,149 (45.24)			

D: LUGGAGE COMPARTMENT



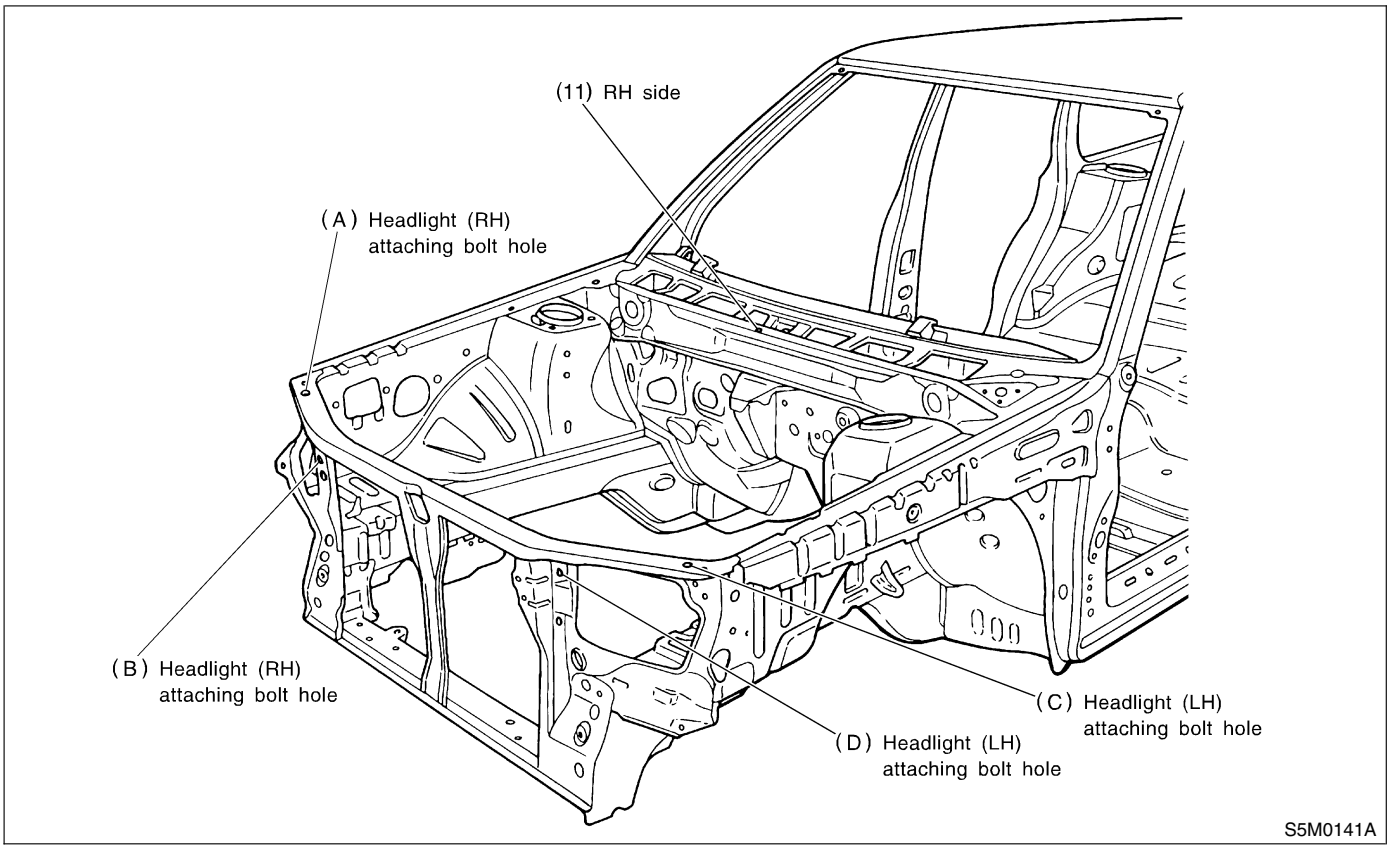
Unit: mm (in)

Point to point	Dimension		Point to point	Dimension
(45) to (48) L	913 (35.94)		(41) to (65) R	1,105 (43.05)
(45) to (48) R	913 (35.94)		(41) to (65) L	1,105 (43.05)
(45) to (47) L	876 (34.49)		(41) to (45)	1,570 (61.81)
(45) to (47) R	876 (34.49)		(41) to (43) R	1,436 (56.54)
(47) R to (47) L	1,426 (56.14)		(41) to (43) L	1,436 (56.54)
(49)R to (49) L	1,478 (58.19)		(41) to (48) L	1,576 (62.05)
(34) R to (34) L	945 (37.20)		(41) to (48) R	1,576 (62.05)
(48) R to (46) R	992 (39.06)		(65) R to (65) L	1,268 (49.92)
(48) L to (46) L	992 (39.06)		(17) R to (76)	627 (24.68)
(70) R to (70) L	1,218 (47.95)		(17) L to (76)	680 (26.77)
(61) R to (75) R	448 (17.64)		(72) R to (72) L	1,118 (44.02)
(61) L to (75) L	448 (17.64)		(74) R to (75) R	480 (18.90)
(17) R to (75) R	705 (27.76)		(74) L to (75) L	480 (18.90)
(17) L to (75) L	705 (27.76)		(17) R to (73)	518 (20.39)
(45) to (71)	913 (35.94)		(17) L to (73)	476 (18.74)

4. Datum Points and Dimensions Concerning On-Board Aiming Adjustment

If headlight aiming is misaligned due to damaged body panel, repair headlight mating surface using body and headlight datum points as a guide.

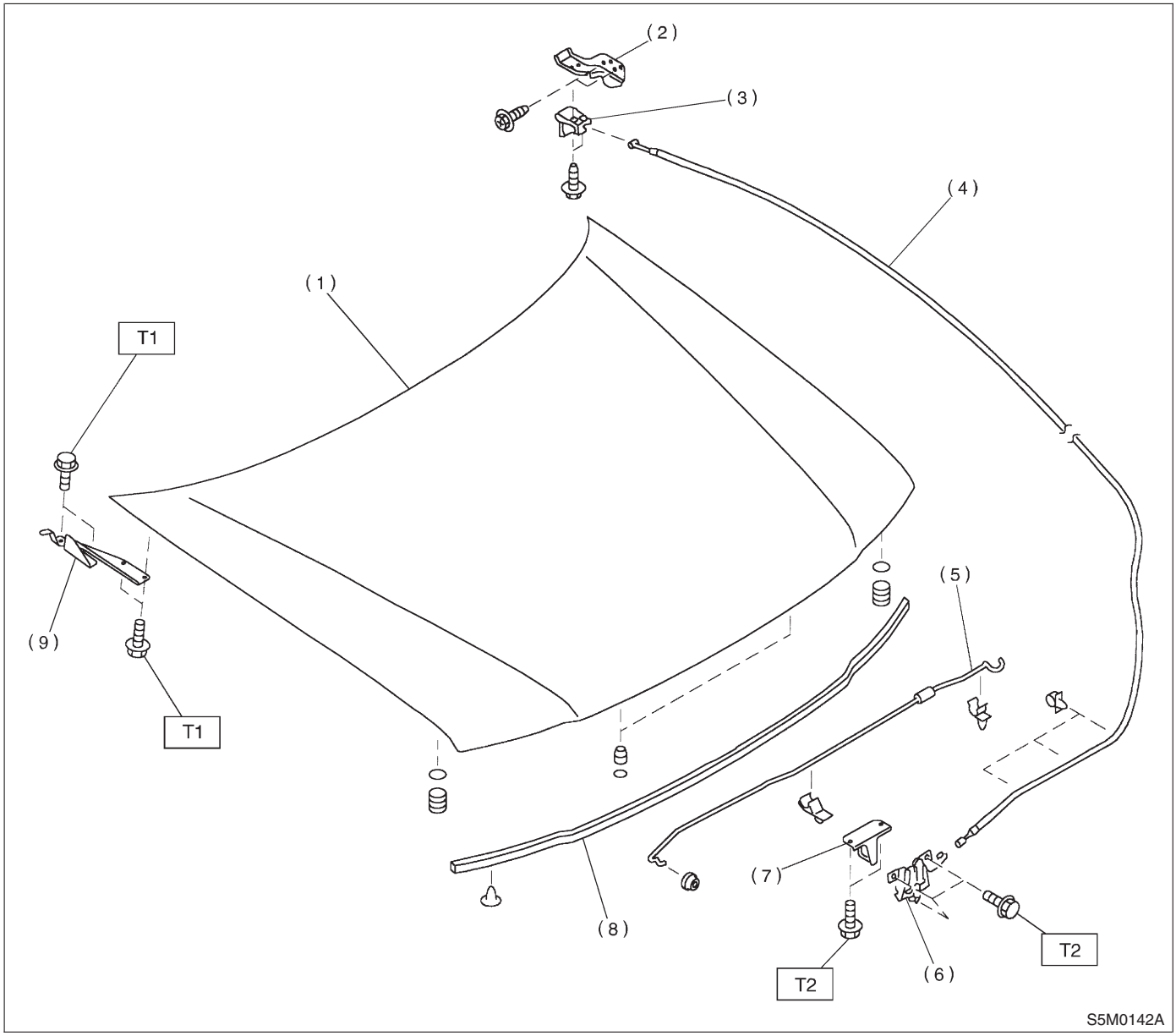
NOTE:
It is recommended to conduct On-board aiming adjustment with headlights turned OFF. If turned ON during the adjustment, the duration should be within two minutes.



Unit: mm (in)

Point to point	Dimension		Point to point	Dimension
(11) to (A)	890.6 (35.06)		(11) to (C)	1,087.7 (42.82)
(11) to (B)	913.4 (35.96)		(11) to (D)	1,023.7 (40.30)

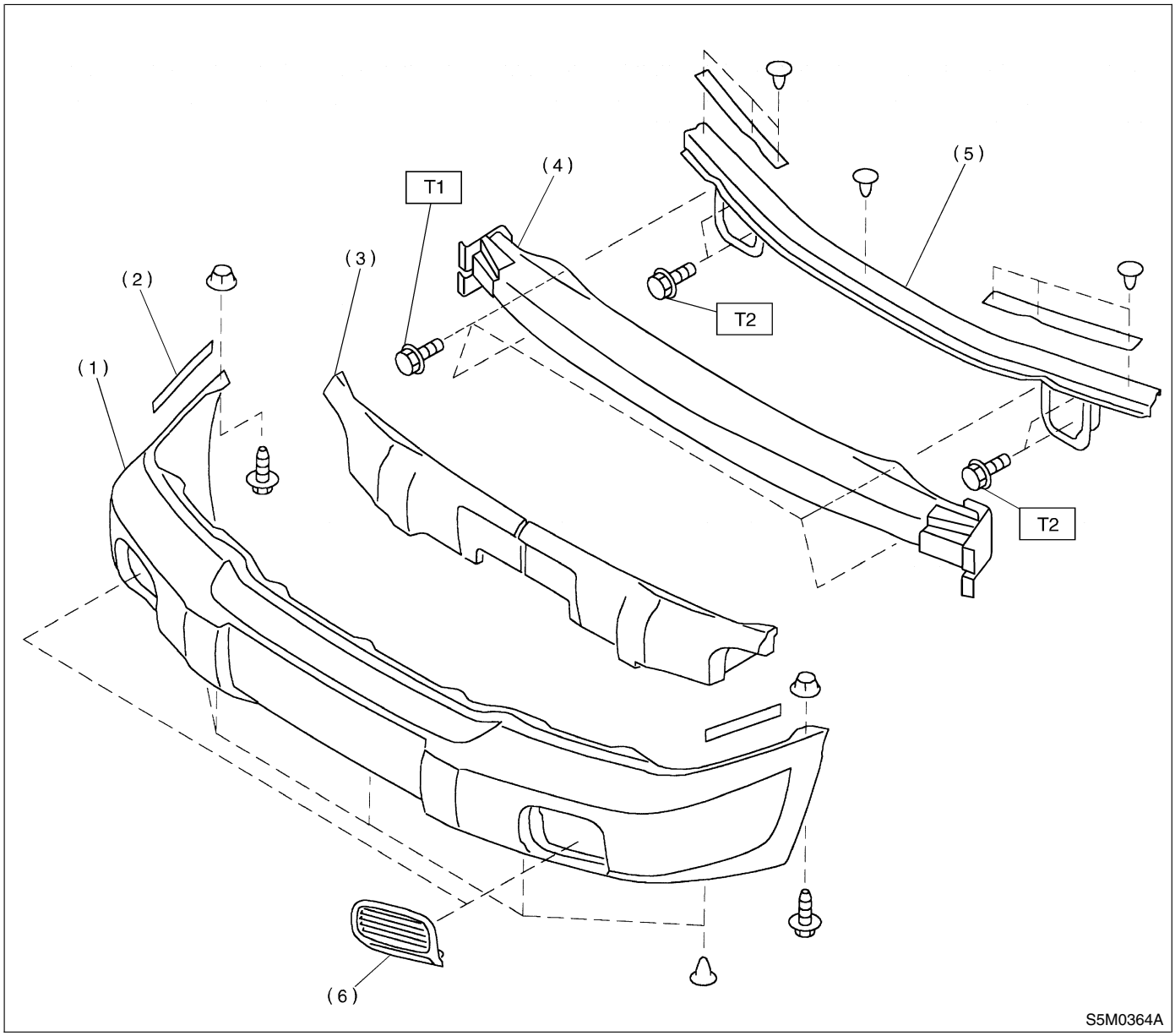
1. Front Hood and Hood Lock



(1) Front hood
(2) Hinge bracket
(3) Lever ASSY
(4) Cable
(5) Front hood stay
(6) Hood lock ASSY
(7) Striker
(8) Seal (Front hood)
(9) Hinge (RH, LH)

Tightening torque: N·m (kg-m, ft-lb)
T1: 14±1 (1.4±0.1, 10.1±0.7)
T2: 32±1 (3.3±0.1, 23.9±0.7)

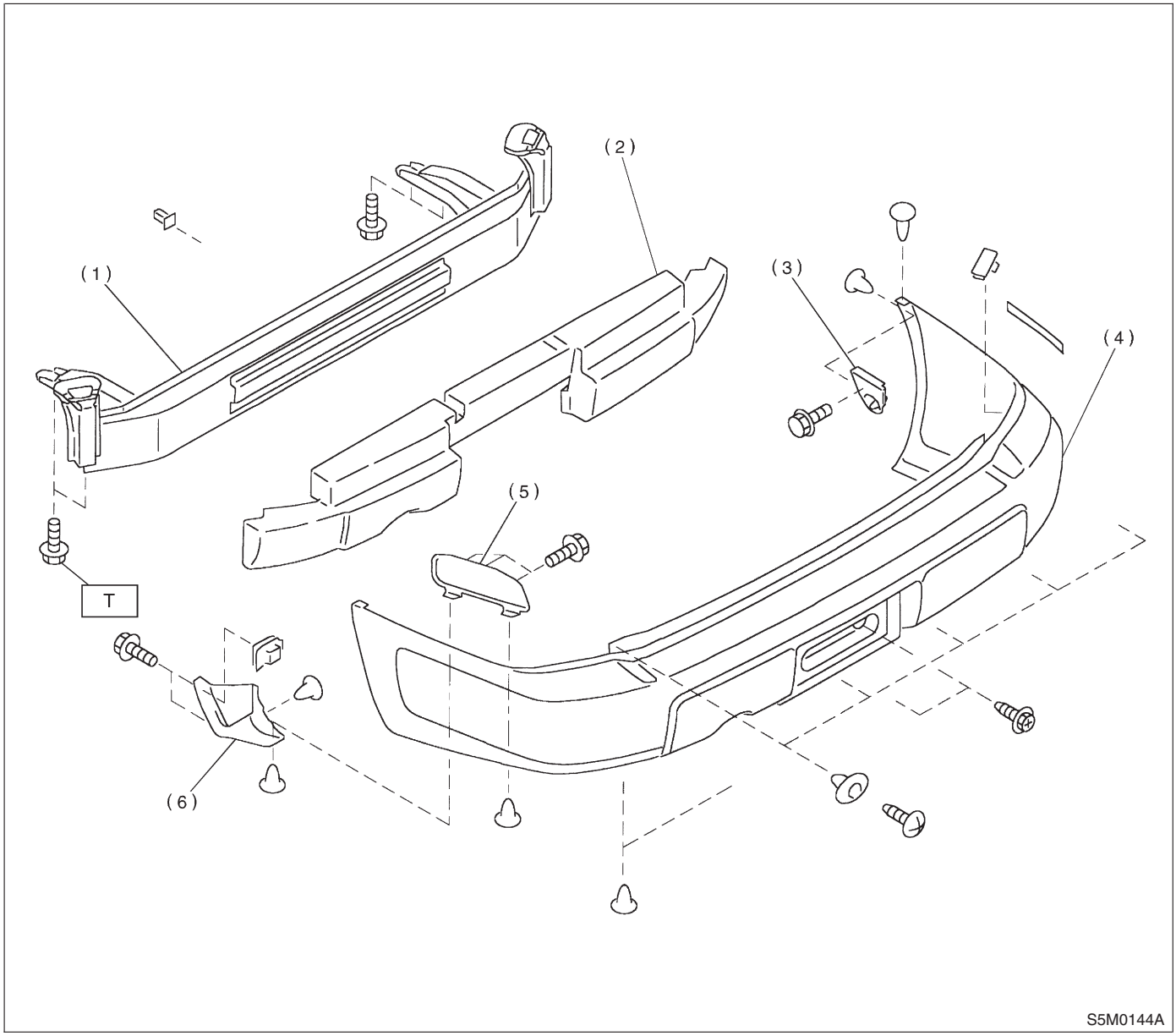
2. Front Bumper



(1) Bumper face
(2) Spacer
(3) E/A form
(4) Back beam
(5) Beam upper
(6) Fog light cover

Tightening torque: N·m (kg-m, ft-lb)
T1: 33±1 (3.4±0.1, 24.6±0.7)
T2: 70±1 (7.1±0.1, 51.4±0.7)

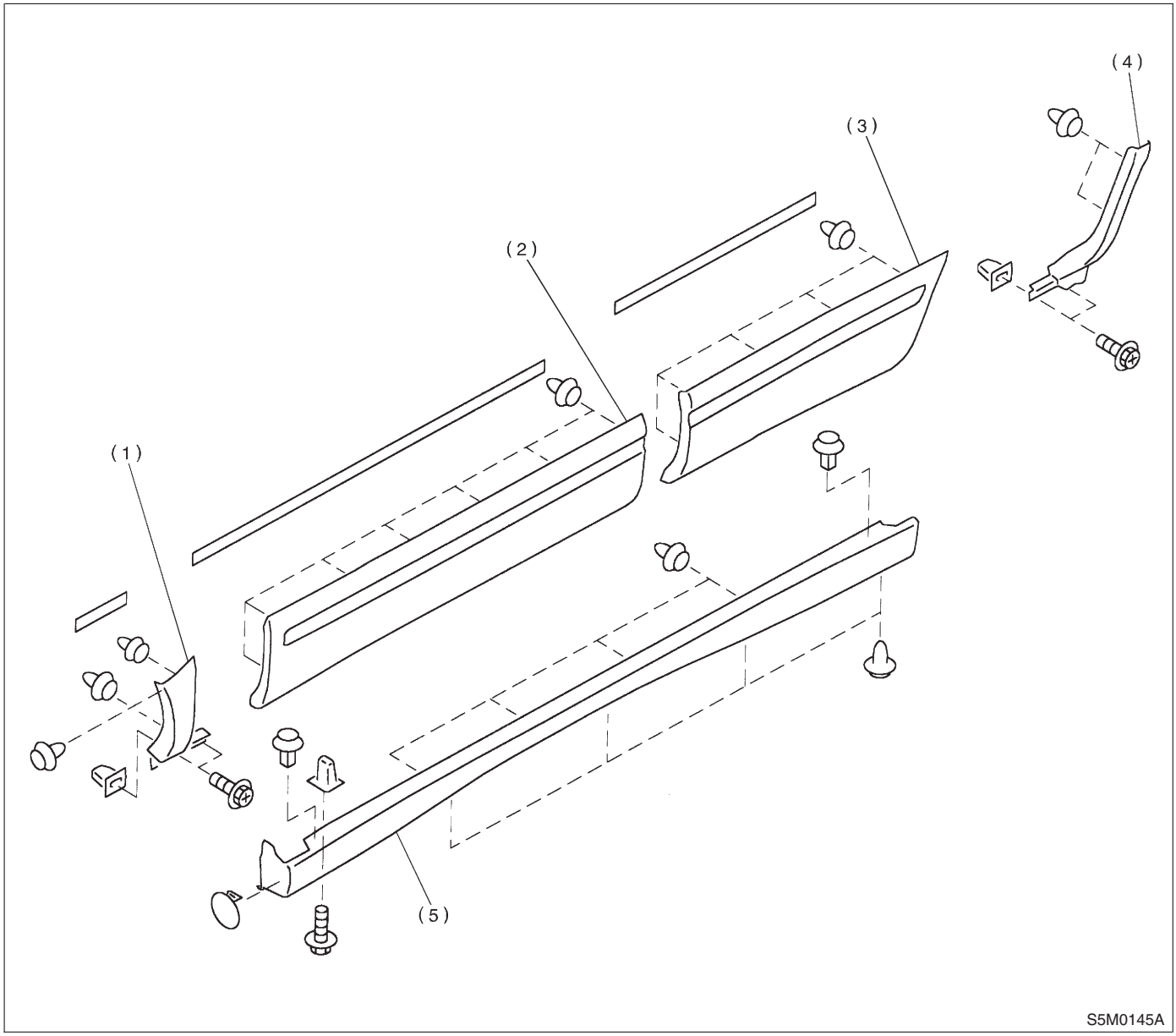
3. Rear Bumper



(1) Bumper beam
(2) E/A form
(3) Side upper bracket
(4) Bumper face
(5) Bumper side plate
(6) Rear arch cover

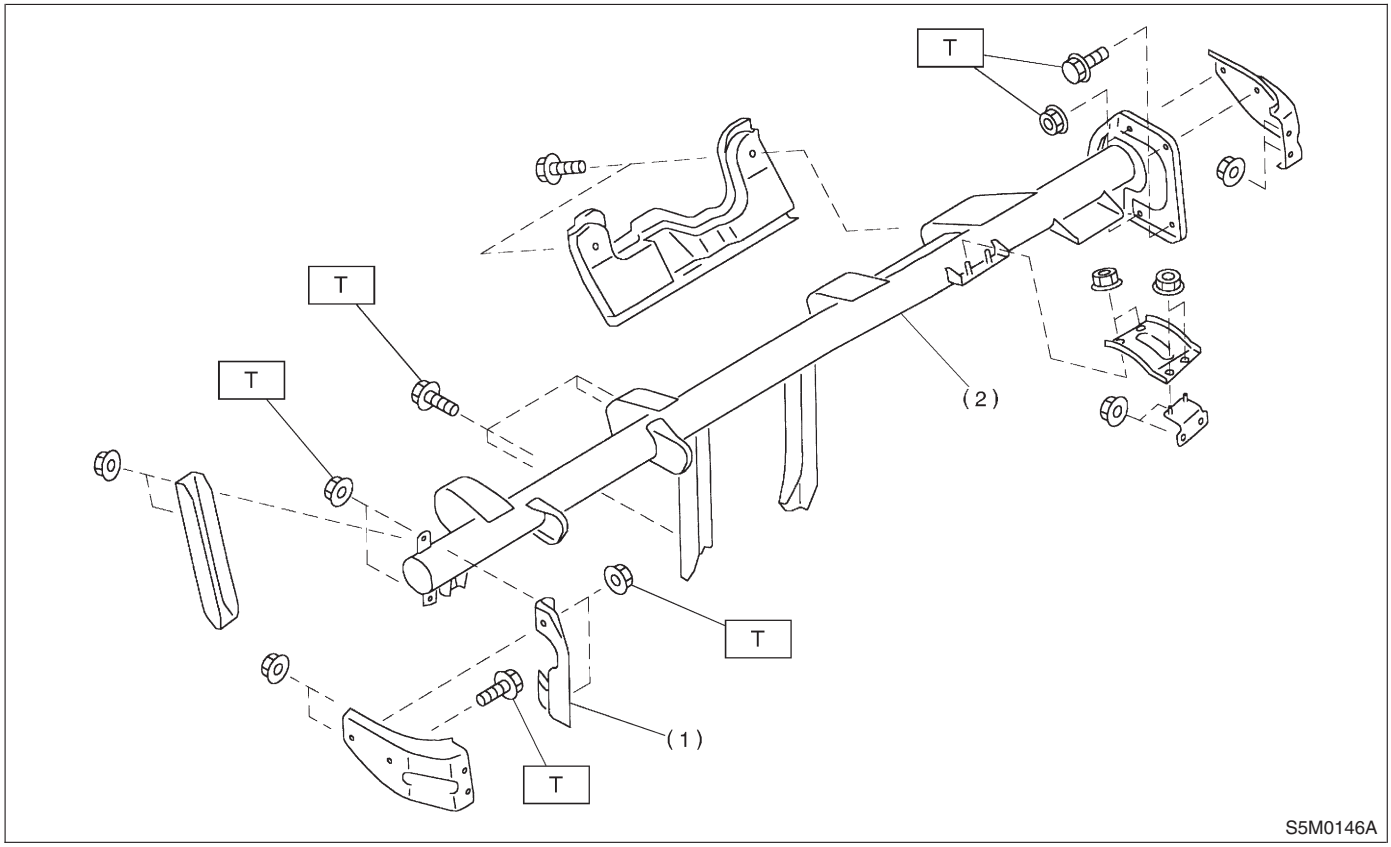
Tightening torque: N·m (kg-m, ft-lb)
T: 93±25 (9.5±2.5, 69±18)

4. Side Protector



(1) Side protector (Front fender)
(2) Side protector (Front door)
(3) Side protector (Rear door)
(4) Side protector (Rear quarter)
(5) Side protector (Side sill)

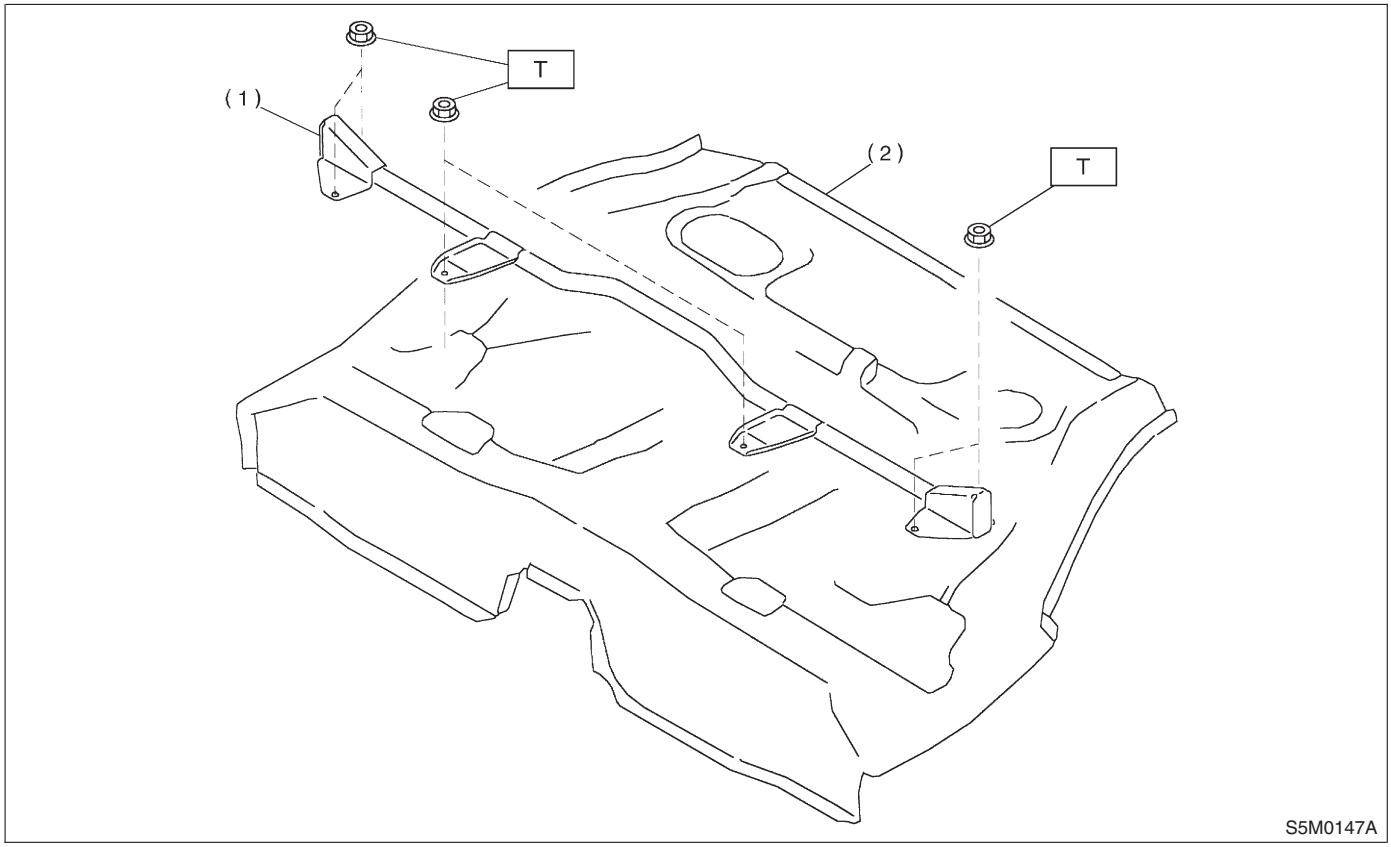
5. Steering Support Beam



(1) Bracket
(2) Steering beam

Tightening torque: N·m (kg-m, ft-lb)
T: 18±5 (1.8±0.5, 13.0±3.6)

6. Guard Pipe



(1) Guard pipe
(2) Rear floor panel

Tightening torque: N·m (kg-m, ft-lb)
T: 32±10 (3.3±1.0, 23.9±7.2)

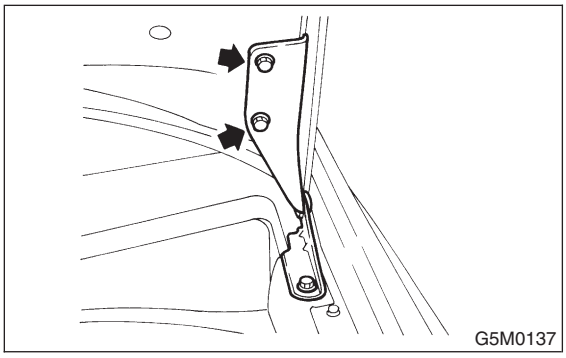
1. Hood

A: REMOVAL AND INSTALLATION

NOTE:
The hood lock has a dual locking design which consists of a main lock and a safety lock mechanism. When the release knob located at the front pillar on the driver's side is pulled back, the main lock is released through the cable attached to the knob.
The safety lock can be released by pushing the lever protruding above the front grill while opening the hood.

1. HOOD

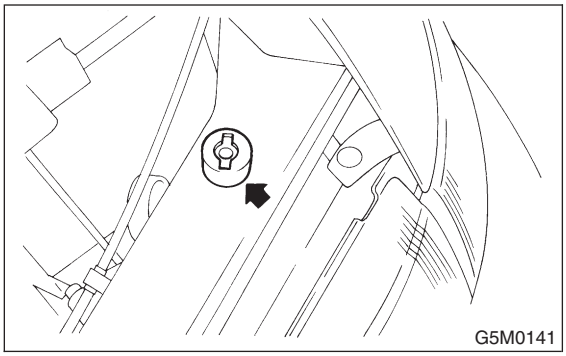
1) Open front hood, and remove washer hose.
2) Remove attaching bolts.



3) Detach front hood from hinges.
4) Installation is in the reverse order of removal.

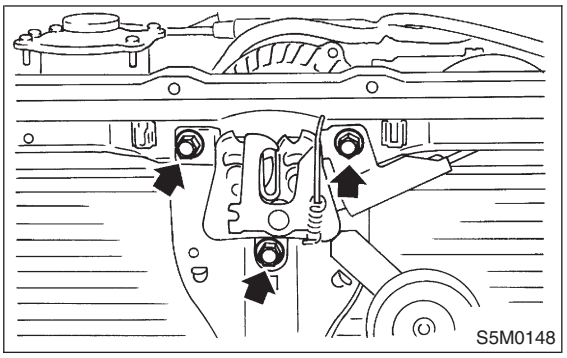
CAUTION:
Adjust buffer assembly on each end so that main lock is applied securely when hood is released from a height of approx. 20 mm (0.79 in).

NOTE:
Align the center of striker with lock during installation. Make sure safety lever is properly caught by striker under the hood's own weight.



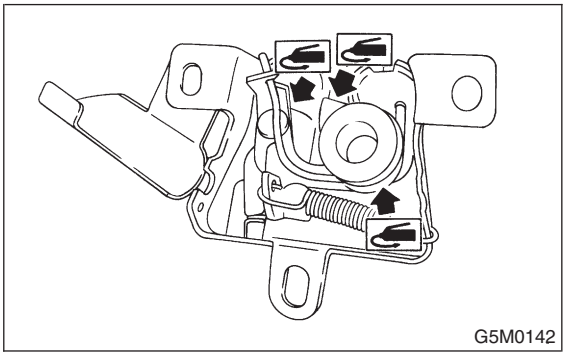
2. HOOD LOCK

1) Open front hood and remove front grille.
2) Remove bolts which secure lock assembly to radiator panel, and remove lock assembly.



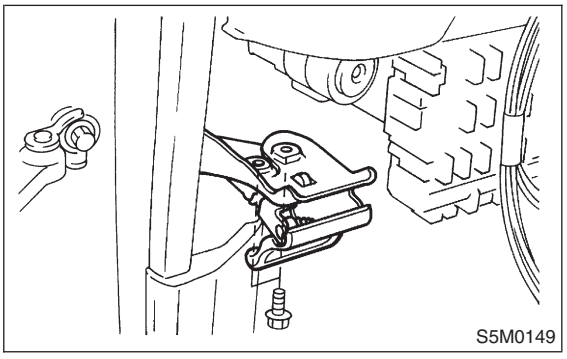
3) Disconnect release cable from lock assembly.
4) Installation is in the reverse order of removal.

NOTE:
● Route hood lock release cable and hold with clips.
● After installing release cable, ensure it operates smoothly.
● Apply grease to sliding surfaces of parts.



3. RELEASE CABLE

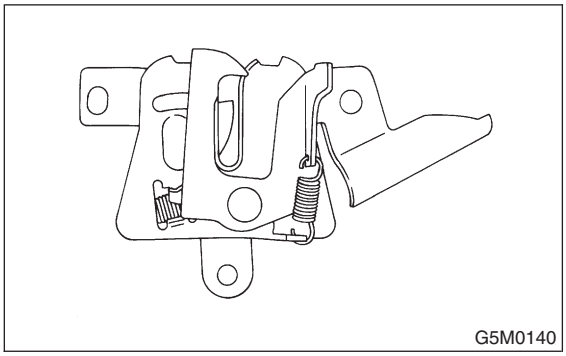
1) Remove front grille.
2) Remove release cable from lock assembly.
3) Remove cable clip from engine compartment.
4) Remove bracket from front pillar.



5) Installation is in the reverse order of removal.

B: POINTS TO CHECK

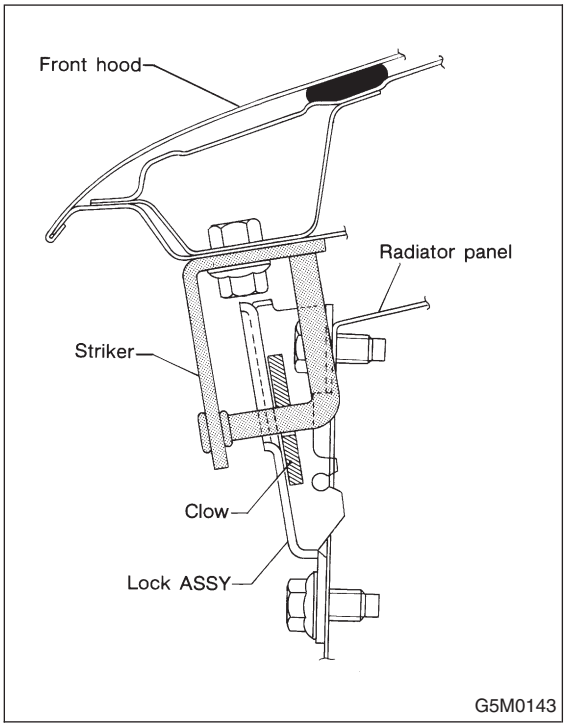
1) Check striker for bending or abnormal wear.
2) Check safety lever for improper movement.
3) Check other levers and spring for rust formation and unsmooth movement.



C: ADJUSTMENT

1) Fore-aft and left-right adjustments Loosen striker mounting bolts and adjust fore-and-aft position of striker.

CAUTION:
Do not adjust striker position using the lock. Doing so may result in a misaligned front grille.

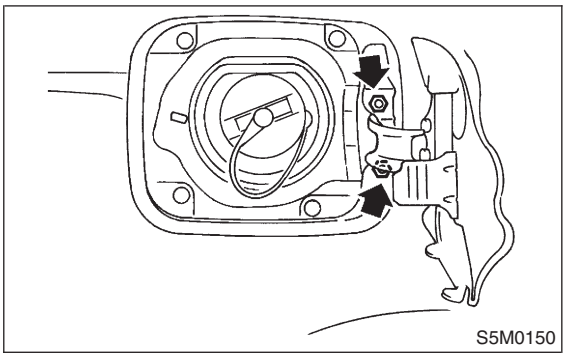


2) Up-down adjustment
Make up-and-down adjustment of striker only when hood does not properly contact buffer or hood is not flush with fender, or when release cable does not properly operate. Adjustment can be made by adjusting the stroke length of striker after lock assembly mounting screws are removed.

2. Fuel Flap

A: REMOVAL AND INSTALLATION

1) Remove bolts which hold hinge to car body, and detach fuel flap and hinge as a unit.



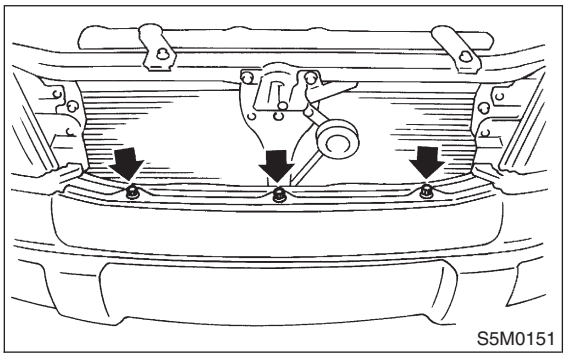
2) Installation is in the reverse order of removal.

CAUTION:
Make sure the clearance between fuel flap and car body is equal at all points.

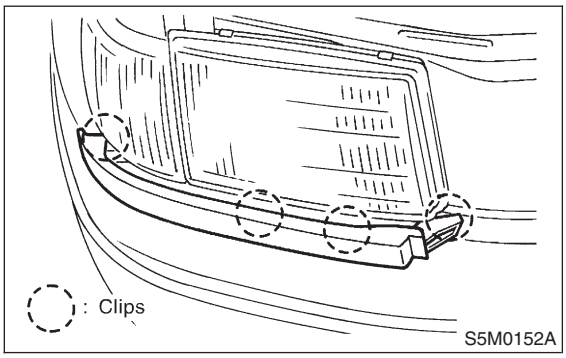
3. Front Bumper

A: REMOVAL AND INSTALLATION

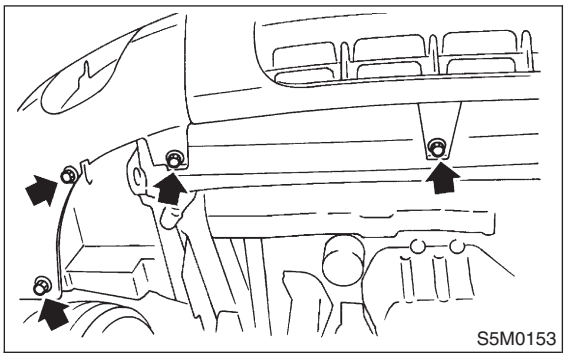
1) Disconnect the ground cable from the battery.
2) Remove front fog light.
3) Remove the front grille.
4) Remove three clips from upper side of bumper.



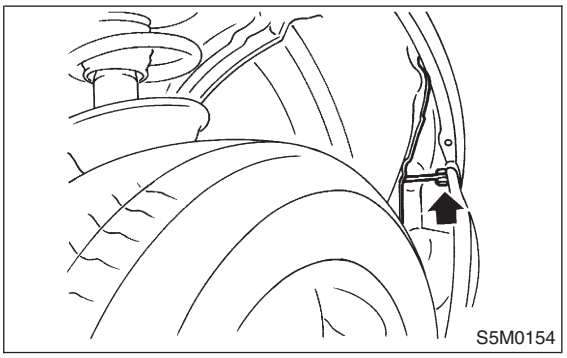
5) Remove the extension of both sides.



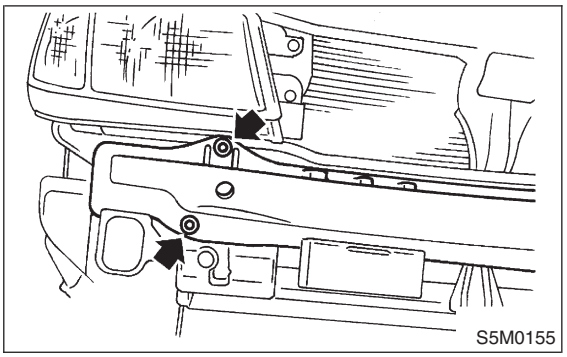
6) Remove under cover.
7) Remove seven clips from under side of bumper.



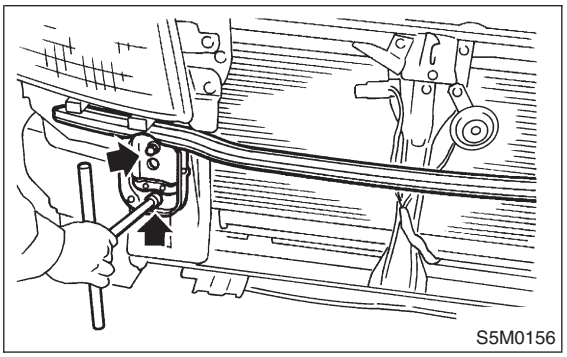
8) Turn over the front mud guard of the front portion and then remove bolt.



9) Remove bumper face and E/A form.
10) Remove back beam.



11) Remove beam upper.



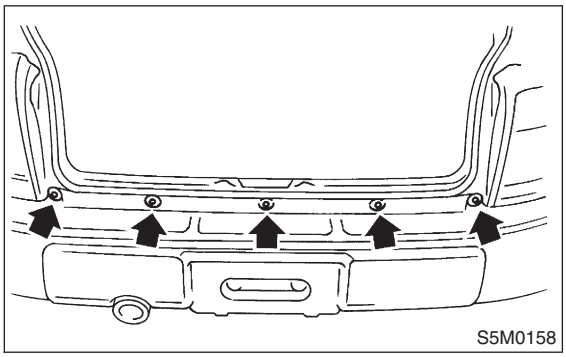
12) Installation is in the reverse order of removal.

CAUTION:
• Be extremely careful to prevent scratches on bumper face as it is made of resin.
• Be careful not to scratch the body when removing or installing the bumper.

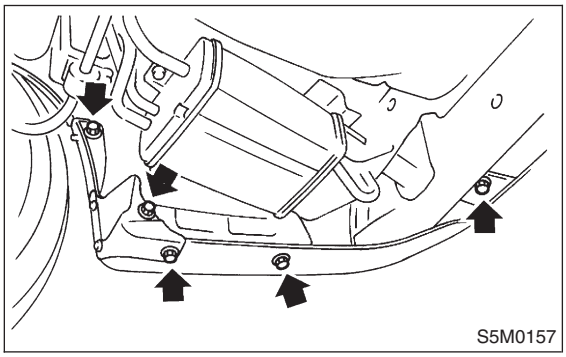
4. Rear Bumper

A: REMOVAL AND INSTALLATION

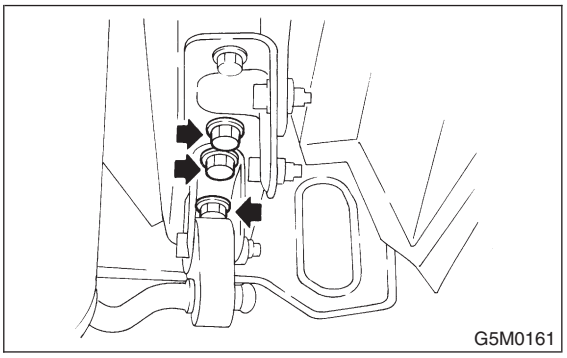
1) Disconnect the ground cable from the battery.
2) Open rear gate.
3) Remove five screws from upper side of bumper.


S5M0158

4) Disconnect license plate light connector.
5) Remove bolts and clips from under side of bumper.


S5M0157

6) Remove bumper face and E/A form.
7) Remove canister. <Ref. to 2-1 [W3A0].>
8) Remove bolts from bumper stay.

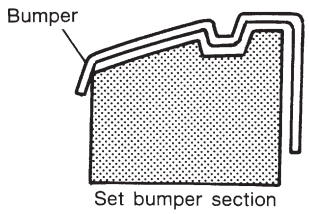

G5M0161

9) Remove rear bumper beam.
10) Installation is in the reverse order of removal.

CAUTION:
• Be extremely careful to prevent scratches on bumper face as it is made of resin.
• Be careful not to scratch the body when removing or installing bumper.

5. Coating Method for PP Bumper

A: PROCESS STEPS

<table>
<tr><th>Process No.</th><th>Process name</th><th colspan="2">Job contents</th></tr>
<tr><td>1</td><td>Bumper mounting</td><td>Set bumper on paint worktable if required. Use paint worktable conforming to inner shape of bumper when possible.</td><td> 

G5M0164</td></tr>
<tr><td>2</td><td>Masking</td><td colspan="2">Mask specified part (black base) with masking tape. Use masking tape for PP (example, Nichiban No. 533, etc.).</td></tr>
<tr><td>3</td><td>Degreasing, cleaning</td><td colspan="2">Clean all parts to be painted with white gasoline, normal alcohol, etc. to remove dirt, oil, fat, etc.</td></tr>
<tr><td>4</td><td>Primer paint</td><td colspan="2">Apply primer one to all parts to be painted, using air gun. Use primer (clear).</td></tr>
<tr><td>5</td><td>Drying</td><td colspan="2">Dry at normal temperature [10 to 15 min. at 20°C (68°F)]. In half-dried condition, PP primer paint is dissolved by solvent, e.g. thinner, etc. Therefore, if dust or dirt must be removed, use ordinary alcohol, etc.</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Top coat paint (I)</td><td>Solid color</td><td>Metallic color</td></tr>
<tr><td>Use section (block) paint for top coat.
● Paint in use (for each color):
Solid paint
Hardener PB
Thinner T-301
● Mixing ratio: Main agent vs. hardener = 4:1
● Viscosity: 10 — 13 sec/20°C (68°F)
● Film thickness: 35 — 45μ
● Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)</td><td>Use section (block) paint for top coat.
● Paint in use (for each color):
Metallic paint
Hardener PB
Thinner T-306
● Mixing ratio: Main agent vs. hardener = 10:1
● Viscosity: 10 — 13 sec/20°C (68°F)
● Film thickness: 15 — 20μ
● Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)</td></tr>
<tr><td>7</td><td>Drying</td><td>Not required.</td><td>Dry at normal temperature [10 min. or more at 20°C (68°F)]. In half-dried condition, avoid dust, dirt.</td></tr>
<tr><td>8</td><td>Top coat paint (II)</td><td>Not required.</td><td>Apply a clear coat to parts with top coat paint (I), three times, at 5 — 7 minute intervals.
● Paint in use
Metallic paint
Hardener PB
Thinner T-301
● Mixing ratio: Clear vs. hardener = 6:1
● Viscosity: 14 — 16 sec/20°C (68°F)
● Film thickness: 25 — 30μ
● Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)</td></tr>
<tr><td>9</td><td>Drying</td><td colspan="2">60°C (140°F), 60 min. or 80°C (176°F), 30 min. If higher than 80°C (176°F), PP may be deformed. Keep maximum temperature of 80°C (176°F).</td></tr>
<tr><td>10</td><td>Inspection</td><td colspan="2">Paint check.</td></tr>
<tr><td>11</td><td>Masking removal</td><td colspan="2">Remove masking in process No. 2.</td></tr>
</table>

6. Repair Instructions for Colored PP Bumper

All PP bumpers are provided with a grained surface, and if the surface is damaged, it cannot normally be restored to its former condition. Damage limited to shallow scratches that cause only a change in the lustre of the base material or coating, can be almost fully restored. Before repairing a damaged area, explain this point to the customer and get an understanding about the matter. Repair methods are outlined below, based on a classification of the extent of damage.

A: MINOR DAMAGE CAUSING ONLY A CHANGE IN THE LUSTRE OF THE BUMPER DUE TO A LIGHT TOUCH

Almost restorable.

Process No.	Process name	Job contents	
1	Cleaning	Clean the area to be repaired using water.	
2	Sanding	Grind the repairing area with #500 sandpaper in a “feathering” motion.	
3	Finish	Resin section	Coated section
		Repeatedly apply wax to the affected area using a soft cloth (such as flannel). Recommended wax: NITTO KASEI Soft 99 TIRE WAX BLACK, or equivalent.	Perform either the same operation as for the resin section or process No. 18 and subsequent operations in the “(3)” section, depending on the degree and nature of damage.
		Polish the waxed area with a clean cloth after 5 to 10 minutes.	

B: DEEP DAMAGE CAUSED BY SCRATCHING FENCES, ETC.

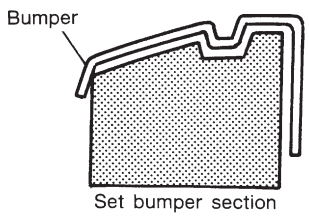
A dent cannot be repaired but a whitened or swelled part can be removed.

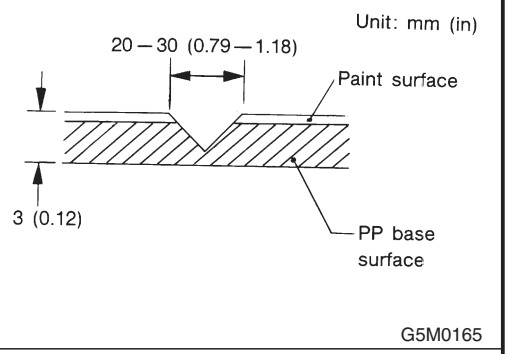
Process No.	Process name	Job contents	
1	Cleaning	Clean damaged area with water.	
2	Removal of damaged area	Cut off protruding area, if any, due to collision, using a putty knife.	
3	Sanding	Grind the affected area with #100 to #500 sandpaper.	
4	Finish	Resin section	Coated section
		Same as Process No. 3 in the “(1)” section.	Perform Process No. 12 and subsequent operations in the “(3)” section.

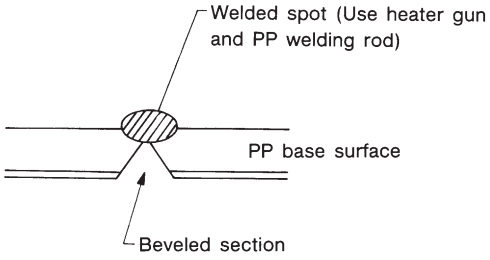
C: DEEP DAMAGE SUCH AS A BREAK OR HOLE THAT REQUIRES FILLING

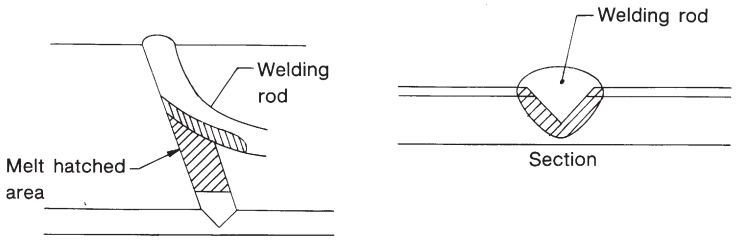
Much of the peripheral grained surface must be sacrificed for repair, and the degree of restoration is not really worth the expense. (The surface, however, will become almost flush with adjacent areas.)

Recommended repair kit: PP Part Repair Kit (NRM)

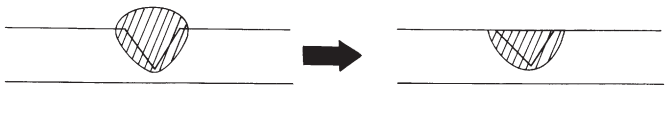
Process No.	Process name	Job contents	
1	Job contents	Remove bumper as required.	
2	Part removal	Remove parts built into bumper as required.	
3	Bumper placement	Place bumper on a paint worktable as required. It is recommended that contour of worktable accommodate internal shape of bumper.	 G5M0164
4	Surface preparation	Remove dust, oil, etc. from areas to be repaired and surrounding areas, using a suitable solvent (NRM No. 900 Precleno, white gasoline, or alcohol).	

<table>
<tr><th>Process No.</th><th>Process name</th><th colspan="2">Job contents</th></tr>
<tr><td>5</td><td>Cutting</td><td>If nature of damage is cracks or holes, cut a guide slit of 20 to 30 mm (0.79 to 1.18 in) in length along the crack or hole up to the bumper's base surface. Then, bevel or "vee-out" the affected area using a knife or grinder.</td><td> 

G5M0165</td></tr>
<tr><td>6</td><td>Sanding (I)</td><td colspan="2">Grind beveled surface with sandpaper (#40 to #60) to smooth finish.</td></tr>
<tr><td>7</td><td>Cleaning</td><td colspan="2">Clean the sanded surface with the same solvent as used in Process No. 4.</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Temporary welding</td><td colspan="2">Grind the side just opposite the beveled area with sandpaper (#40 to #60) and clean using a solvent. Temporarily spot-weld the side, using a PP welding rod and heater gun.</td></tr>
<tr><td colspan="2"> 

G5M0166
NOTE:
● Do not melt welding rod until it flows out. This results in reduced strength.
● Leave the welded spot unattended until it cools completely.</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Welding</td><td colspan="2">Using a heater gun and PP welding rod, weld the beveled spot while melting the rod and damaged area.</td></tr>
<tr><td colspan="2"> 

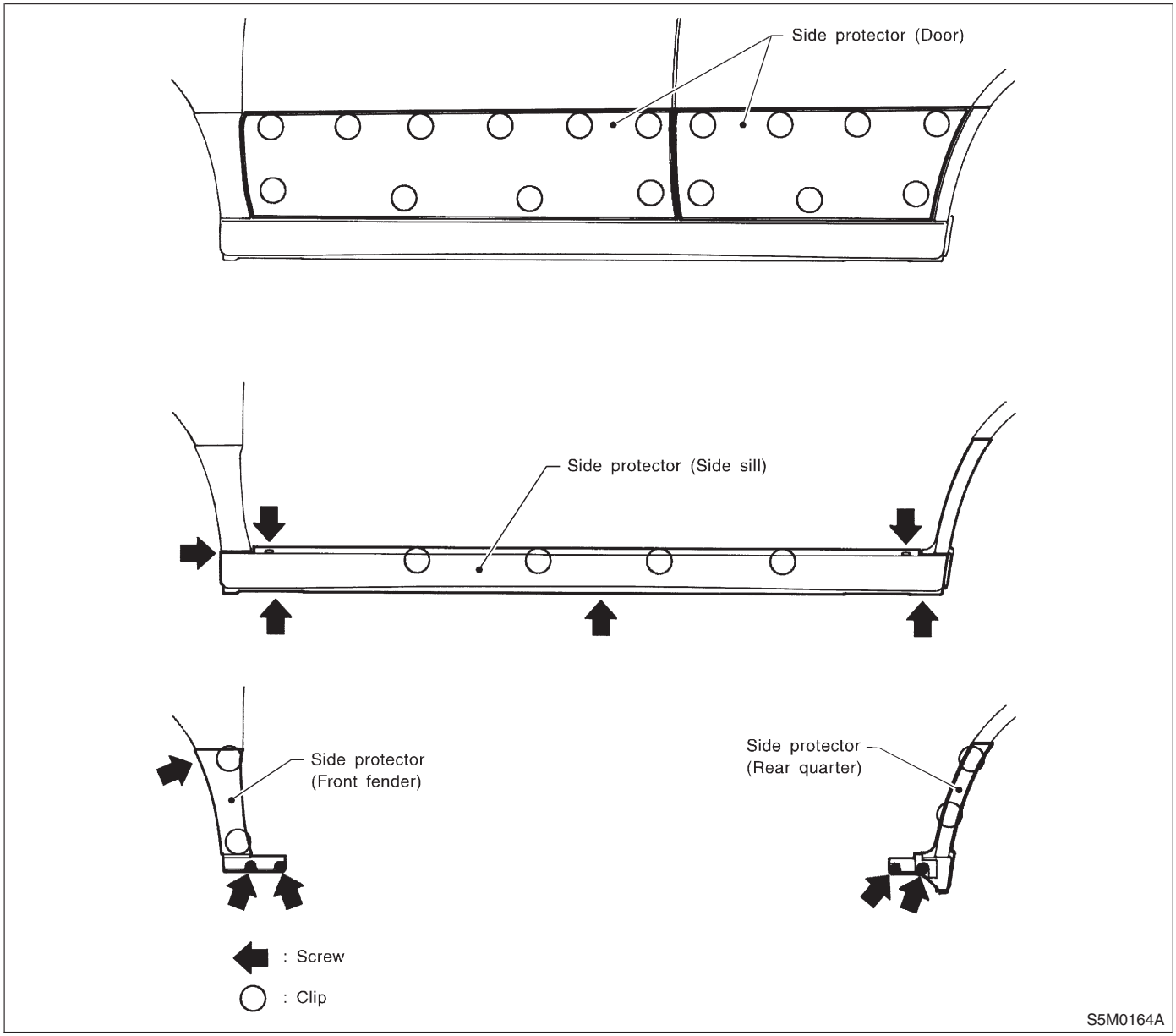
G5M0167
NOTE:
● Melt the sections indicated by hatched area.
● Do not melt welding rod until it flows out, in order to provide strength.
● Always keep the heater gun 1 to 2 cm (0.4 to 0.8 in) away from the welding spot.
● Leave the welded spot unattended until it cools completely.</td></tr>
</table>

Process No.	Process name	Job contents	
10	Sanding (II)	Remove excess part of weld with a putty knife. If a drill or disc wheel is used instead of the knife, operate it at a rate lower than 1,500 rpm and grind the excess part little by little. A higher rpm will cause the PP substrate to melt from the heat.	
		 G5M0168	
		Sand the welded spot smooth with #240 sand paper.	
11	Masking	Mask the black substrate section using masking tape. Recommended masking tape: Nichiban No. 533 or equivalent	
12	Cleaning/ degreasing	Completely clean the entire coated area, using solvent similar to that used in Process No. 4.	
13	Primer coating	Apply a coat of primer to the repaired surface and its surrounding areas. Mask these areas, if necessary. Recommended primer: Mp/ 364 PP Primer NOTE: Be sure to apply one coat of primer at a spraying pressure of 245 to 343 kPa (2.5 to 3.5 kg/cm^2, 36 to 50 psi) with a spray gun.	
14	Leave unattended.	Leave the repaired area unattended at 20°C (68°F) for 10 to 15 minutes until primer is half-dry. NOTE: If dirt or dust comes in contact with the coated area, wipe it off with a cloth damp-ended with alcohol. (Do not use thinner since the coated area tends to melt.)	
15	Primer surfacer coating	Apply a coat of primer surfacer to the repaired area two or three times at an interval of 3 to 5 minutes. Recommended surfacer: ● UPS 300 Flex Primer ● No. 303 UPS 300 Exclusive hardener ● NPS 725 Exclusive Reducer (thinner) ● Mixing ratio: 2 : 1 (UPS 300: No. 303) ● Viscosity: 12 — 14 sec/20°C (68°F) ● Coated film thickness: 40 — 50μ	
16	Drying	Allow the coated surface to dry for 60 minutes at 20°C (68°F) [or 30 minutes at 60°C (140°F)].	
17	Sanding (III)	Sand the coated surface and its surrounding areas using #400 sandpaper and water.	
18	Cleaning/ degreasing	Same as Process No. 12.	
19	Top coat (I)	Solid color	Metallic color
		Use a “block” coating method. ● Recommended paint: Suncryl (SC) No. 307 Flex Hardener SC Reducer (thinner) ● Mixing ratio: 3 : 1 (Suncryl: No. 307) ● Viscosity: 11 — 13 sec/20°C (68°F) ● Coated film thickness: 40 — 50μ ● Spraying thickness: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)	Use a “block” coating method. ● Recommended paint: Suncryl (SC) No. 307 Flex Hardener SC Reducer (thinner) ● Mixing ratio: 3 : 1 (Suncryl: No. 307) ● Viscosity: 11 — 13 sec/20°C (68°F) ● Coated film thickness: 20 — 30μ ● Spraying thickness: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)
20	Leave unattended.	Not required.	Leave unattended at 20°C (68°F) for at least 10 minutes until the top coated area is half-dry. NOTE: Be careful to keep dust or dirt from coming in contact with the affected area.

Process No.	Process name	Job contents	
21	Top coat (II)	Not required.	Apply a clear coat three times at an interval of 3 to 5 minutes. ● Recommended paint: SC710 Overlay Clear No. 307 Flex Hardener SC Reducer (thinner) ● Mixing ratio: 3 : 1 (SC710: No. 307) ● Viscosity: 10 — 13 sec/20°C (68°F) ● Coated film thickness: 20 — 30μ ● Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm^2, 36 — 50 psi)
22	Drying	Allow the coated surface to dry at 20°C (68°F) for two hours or 60°C (140°F) for 30 minutes. NOTE: Do not allow the temperature to exceed 80°C (176°F) since this will deform the PP substrate.	
23	Inspection	Carefully check the condition of the repaired area.	
24	Masking removal	Remove masking tape applied in Process No. 11 and 13.	
25	Parts installation	Install parts on bumper in reverse order of removal.	
26	Bumper installation	Install bumper.	

7. Side Protector

A: REMOVAL AND INSTALLATION

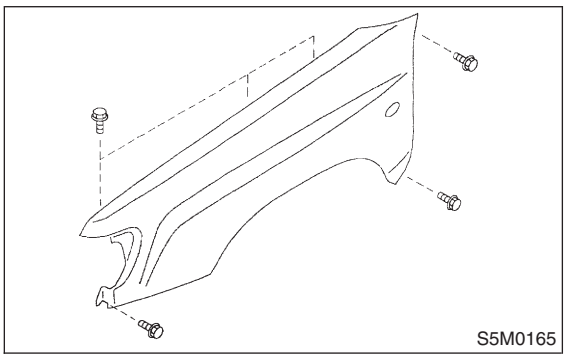


8. Front Fender

A: REMOVAL AND INSTALLATION

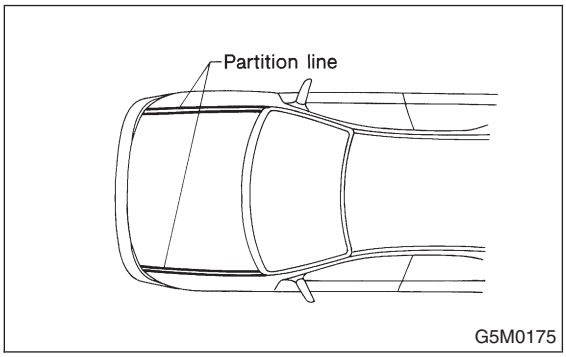
1) Disconnect ground cable from battery.
2) Remove mud guard.
3) Remove parking light and headlight.
4) Remove front bumper face.
5) Remove side protector. (Front fender)
6) Remove attaching bolt then remove fender.

CAUTION:
Be careful not to scratch body panels with fender edges when removing it.

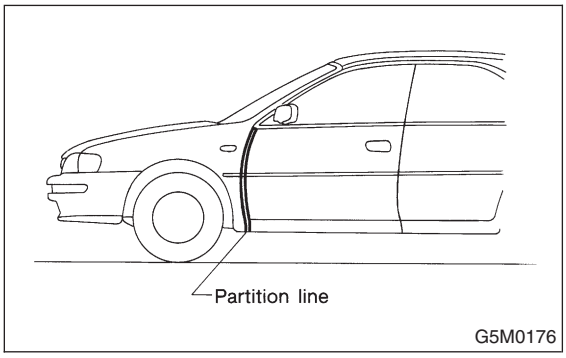

S5M0165

7) Installation is in the reverse order of removal.

NOTE:
Check for alignment of front fender with hood and front door with front fender at all points. Adjust, if necessary.



G5M0175

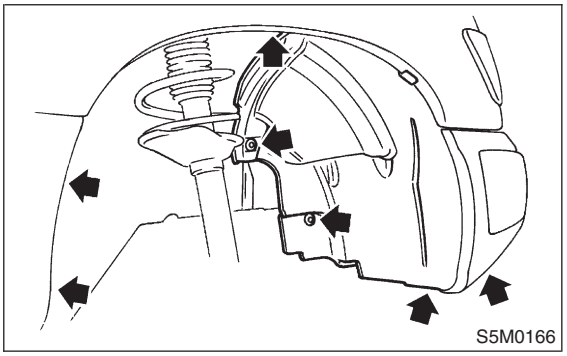


G5M0176

9. Mud Guard

A: REMOVAL AND INSTALLATION

1) Jack-up vehicle to remove tire.
2) Remove screws and clips. Move mud guard toward the center of the body and remove mud guard.


S5M0166

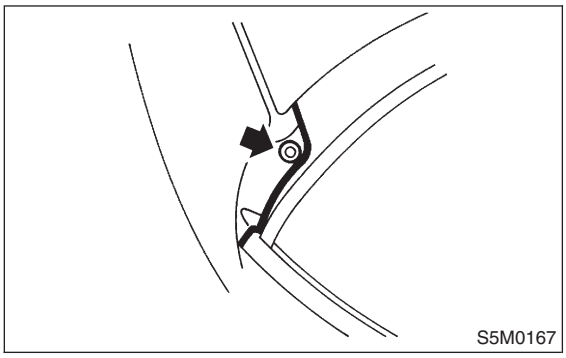
3) Installation is in the reverse order of removal.

CAUTION:
Only use new nuts and clips.

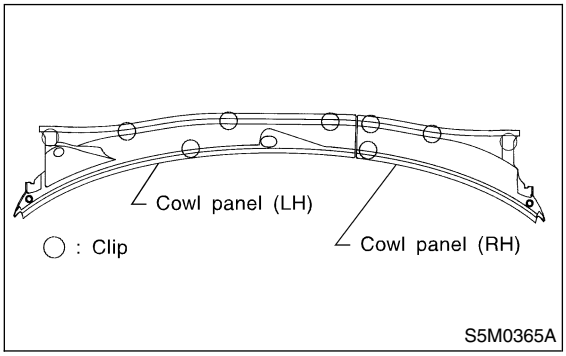
10. Cowl Panel

A: REMOVAL AND INSTALLATION

1) Remove cowl panel side.



2) Open front hood.
3) Remove wiper arms.
4) Lift cowl panel (RH) and then lift cowl panel (LH).

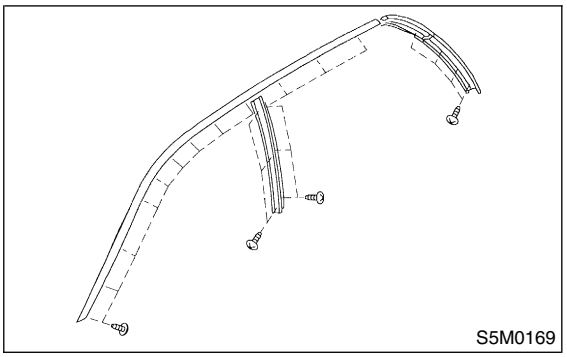


5) Installation is in the reverse order of removal.

11. Molding and Retainer

A: REMOVAL AND INSTALLATION

1) Remove weatherstrip.
2) Remove tapping screws.

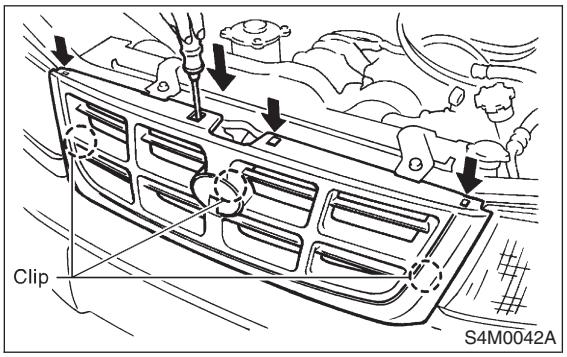


3) Installation is in the reverse order of removal.

12. Front Grille

A: REMOVAL AND INSTALLATION

1) Remove four upper clips from body panel. To facilitate removal, press portion shown in figure using screwdriver while lightly pulling front grille.



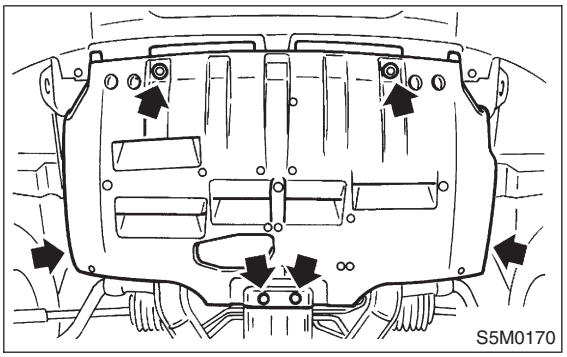
2) Installation is in the reverse order of removal.

NOTE:
Attach all clips to grille. Align them with clip hole in body and push them into place.

13. Under Cover

A: REMOVAL AND INSTALLATION

1) Lift-up the vehicle.
2) Remove bolts and clips then detach under cover.

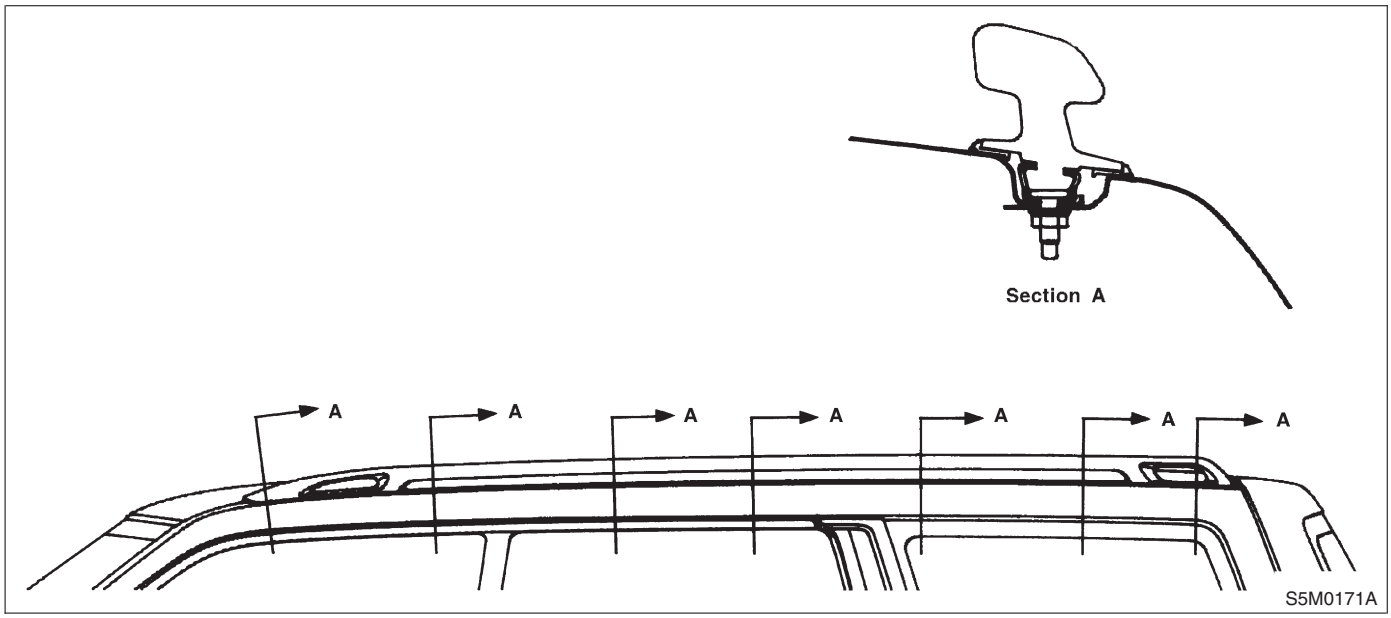


3) Installation is in the reverse order of removal.

14. Roof Rail

A: REMOVAL AND INSTALLATION

1) Remove roof trim.
2) Remove seven attaching bolts and then carefully detach roof rail.



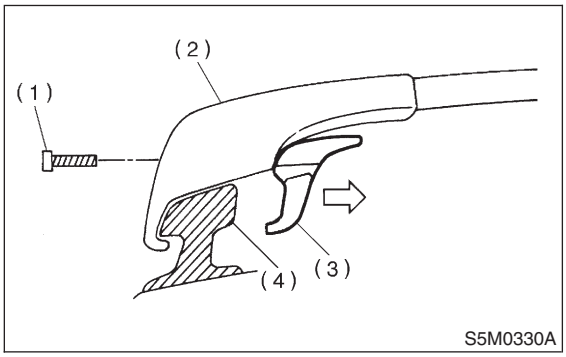
3) Installation is in the reverse order of removal.

CAUTION:
Be careful not to scratch body panels with roof rail stud bolts when removing and installing them.

15. Crossbar

A: REMOVAL

1) Loosen and remove TORX bolt T30 from the top of each crossbar end support, and then remove inner clamp.



(1) TORX bolt T30
(2) End support
(3) Inner clamp
(4) Roof rail

2) Remove crossbar.

NOTE:
When removing the front crossbar from the roof rail, first move the front crossbar to the center of the roof rail.

B: INSTALLATION

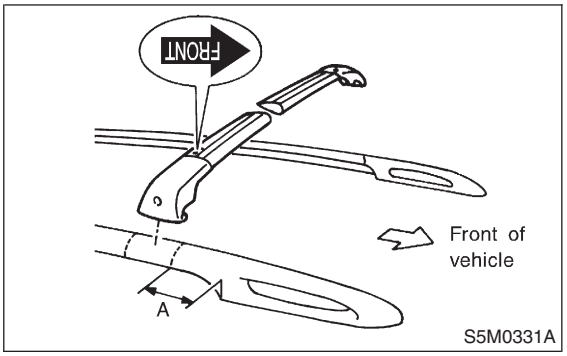
1. FRONT CROSSBAR

NOTE:
Front crossbar has “MAXIMUM LOAD ROOF RACK-150LBS. EVENLY DISTRIBUTED ROOF SURFACE-100LBS. EVENLY DISTRIBUTED” label on LH side.

1) Loosen and remove TORX bolt T30 from the top of each crossbar end support, and then remove the inner clamp.

2) With the front direction arrow label on the top right side of the crossbar pointing toward the front of the vehicle, carefully place the crossbar across the top of the vehicle so that the crossbar end supports rest on the top of the roof rails approximately 152.4 mm (6 in) rearward in the front radius of the roof rail.

Length:
A: 152.4 mm (6 in)

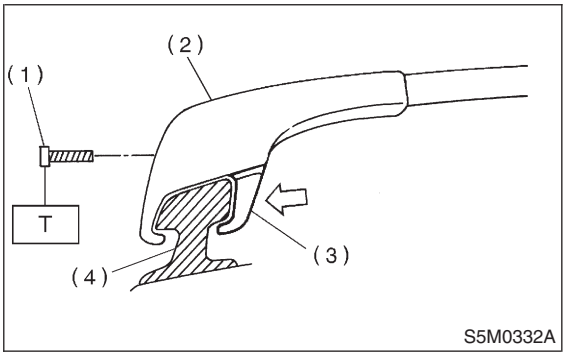


3) Rotate the end support and inner clamp to hook under the bottom of the roof rail on both sides and loose assemble the TORX bolt T30, through the side of the end support and into the threaded insert in the inner clamp on each end of the crossbar.

NOTE:
It may be necessary to start the inner clamp and the end support at the center of the roof rail for better installation of the pieces, then move the crossbar forward.

4) Tighten TORX bolt T30.

Tightening torque:
3.7±0.3 N·m (0.38±0.03 kg-m, 2.75±0.22 ft-lb)



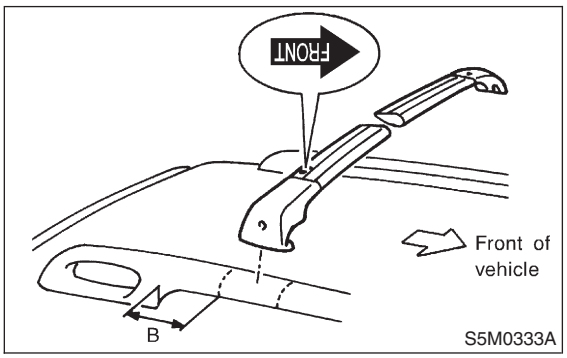
(1) TORX bolt T30
(2) End support
(3) Inner clamp
(4) Roof rail

2. REAR CROSSBAR

NOTE:
Rear crossbar does not have the “MAXIMUM LOAD ROOF RACK-150LBS. EVENLY DISTRIBUTED ROOF SURFACE-100LBS. EVENLY DISTRIBUTED” label.

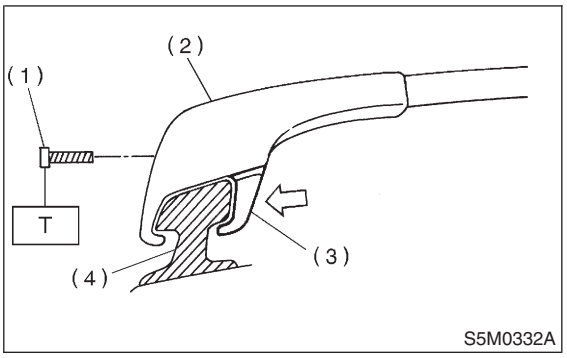
1) Loosen and remove TORX bolt T30 from the top of each crossbar end support, and then remove the inner clamp.
2) With the front direction arrow label on the top right side of the crossbar pointing toward the front of the vehicle, carefully place the crossbar across the top of the vehicle so that the crossbar end supports rest on the top of the roof rails approximately 152.4 mm (6 in) forward in the rear radius of the roof rail.

Length:
B: 152.4 mm (6 in)



3) Rotate the end support and inner clamp to hook under the bottom of the roof rail on both sides and loose assemble the TORX bolt T30, through the side of the end support and into the threaded insert in the inner clamp on each end of the crossbar.
4) Tighten TORX bolt T30.

Tightening torque:
3.7±0.3 N·m (0.38±0.03 kg-m, 2.75±0.22 ft-lb)



(1) TORX bolt T30
(2) End support
(3) Inner clamp
(4) Roof rail

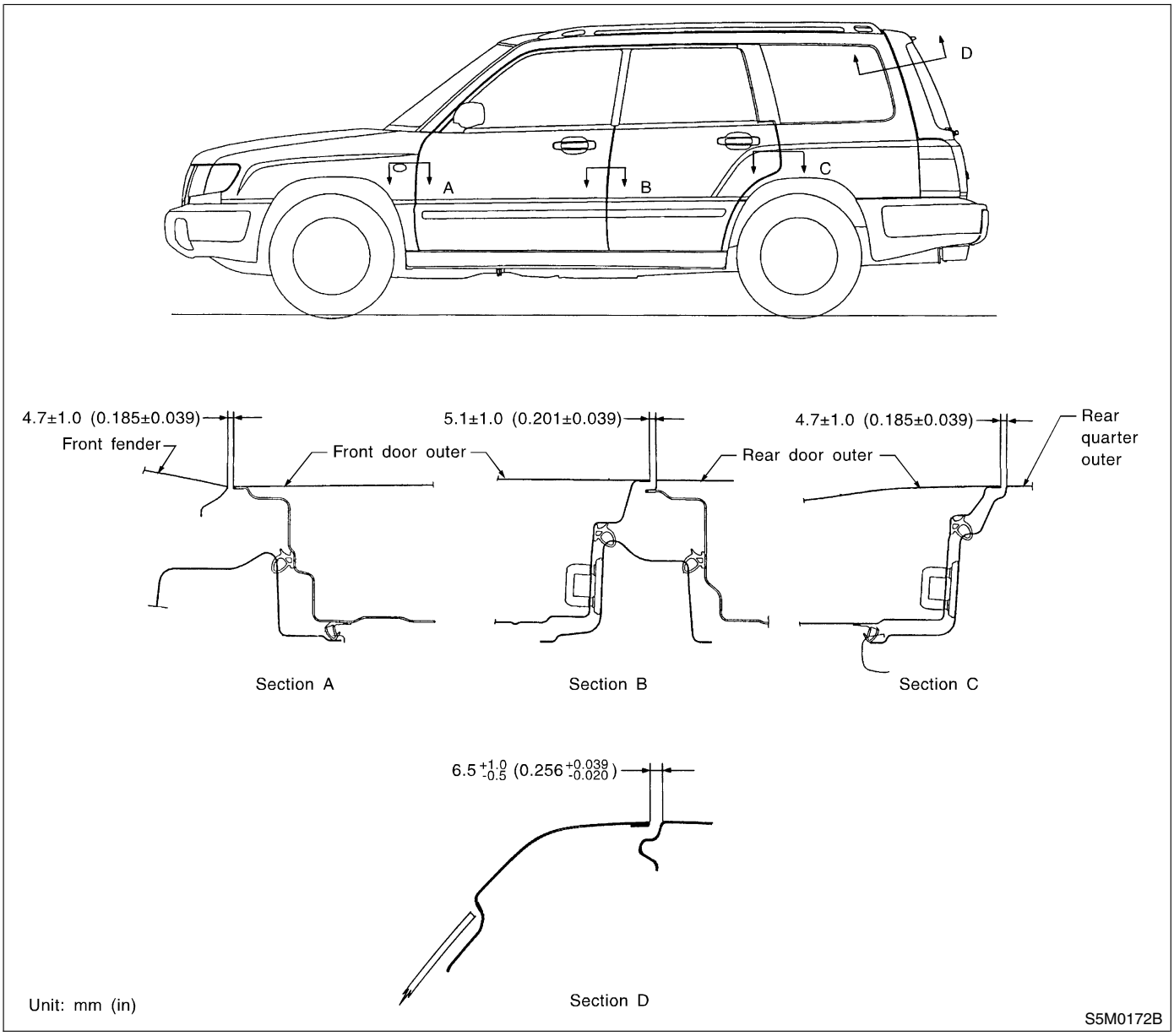
MEMO:

DOORS AND WINDOWS 5-2

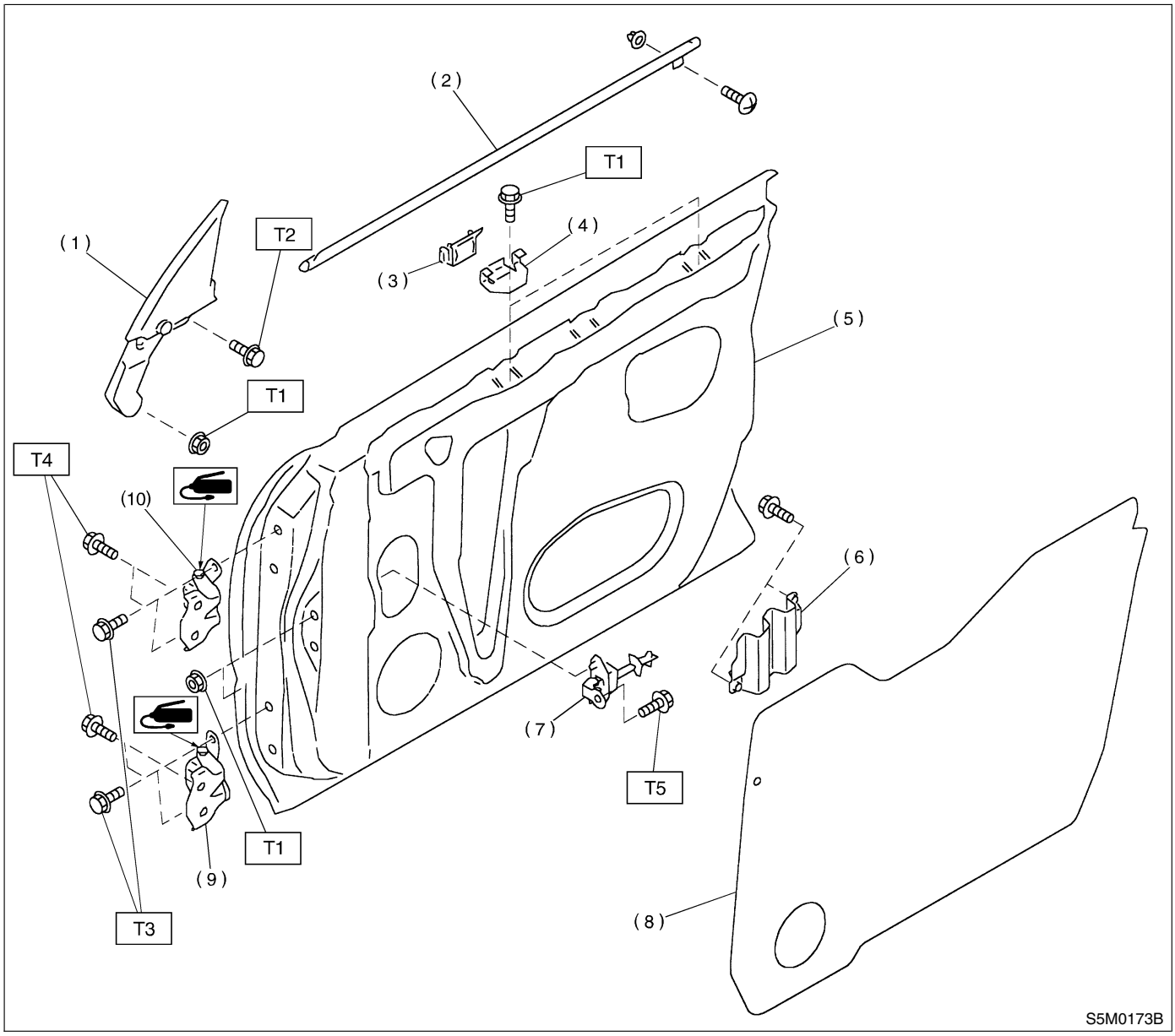
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1. Door Alignment



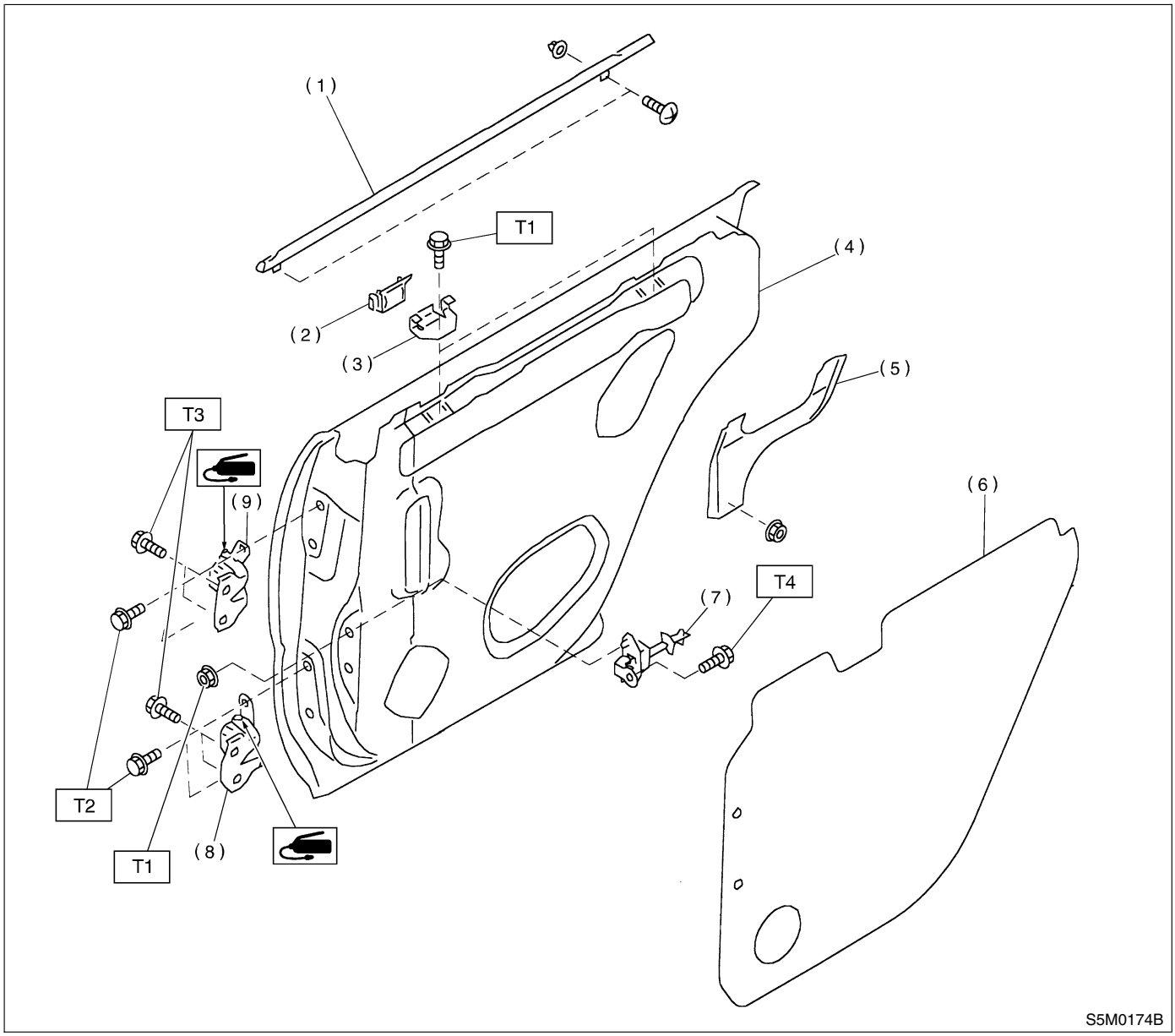
1. Front Door



(1) Gusset
(2) Weatherstrip
(3) Stabilizer (Outer)
(4) Stabilizer (Inner)
(5) Door panel
(6) Plate
(7) Checker
(8) Sealing cover
(9) Lower hinge
(10) Upper hinge

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 13±3 (1.3±0.3, 9.4±2.2)
T3: 25±3 (2.5±0.3, 18.1±2.2)
T4: 29±5 (3.0±0.5, 21.7±3.6)
T5: 32±10 (3.3±1.0, 23.9±7.2)

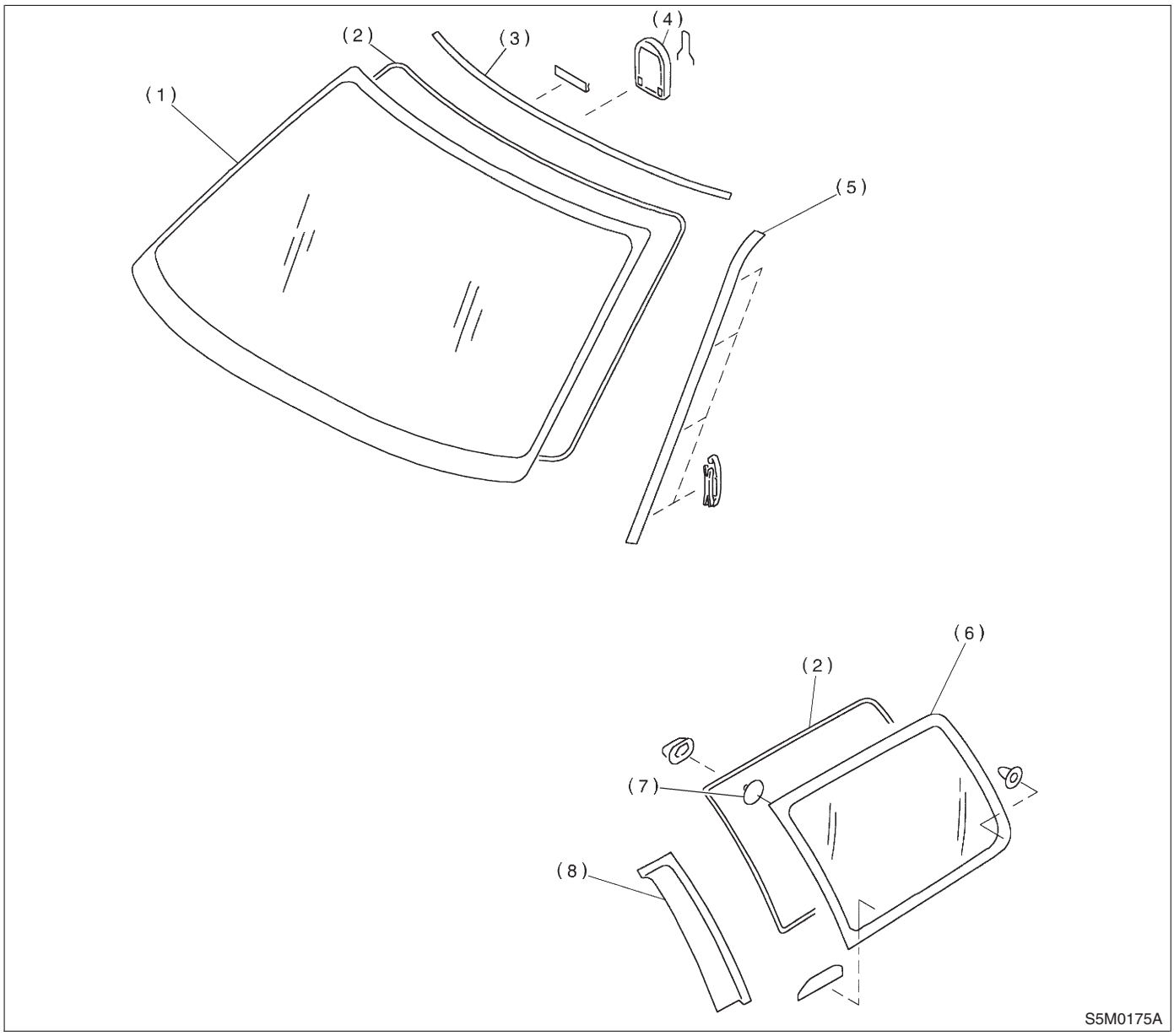
2. Rear Door



(1) Weatherstrip
(2) Stabilizer (Outer)
(3) Stabilizer (Inner)
(4) Door panel
(5) Plate
(6) Seating cover
(7) Checker
(8) Lower hinge
(9) Upper hinge

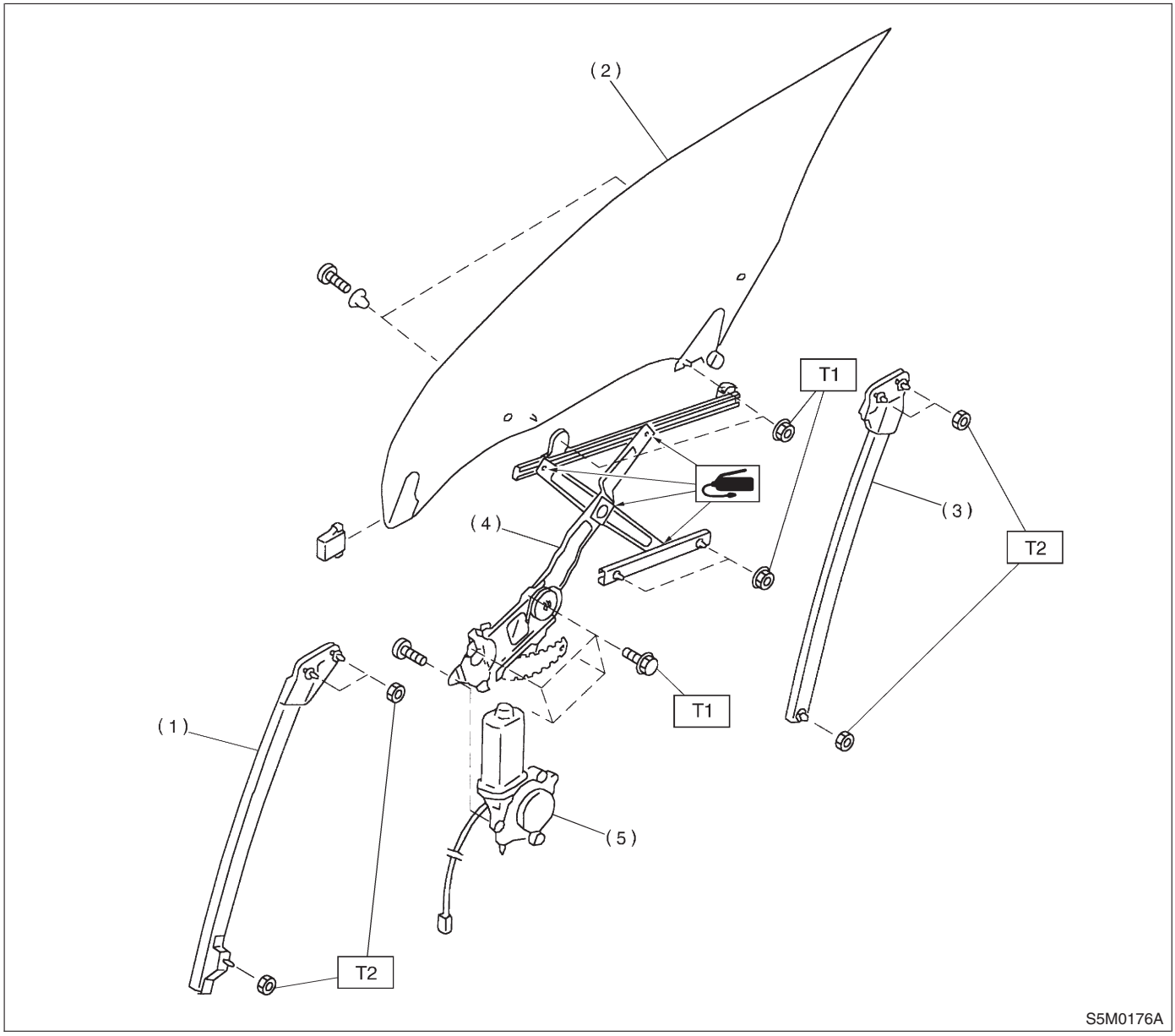
Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 25±3 (2.5±0.3, 18.1±2.2)
T3: 29±5 (3.0±0.5, 21.7±3.6)
T4: 32±10 (3.3±1.0, 23.9±7.2)

3. Fixed Glass



(1) Windshield glass
(2) Dam rubber
(3) Molding
(4) Rearview mirror mount
(5) Side molding
(6) Rear quarter glass
(7) Locate pin
(8) Rear quarter garnish

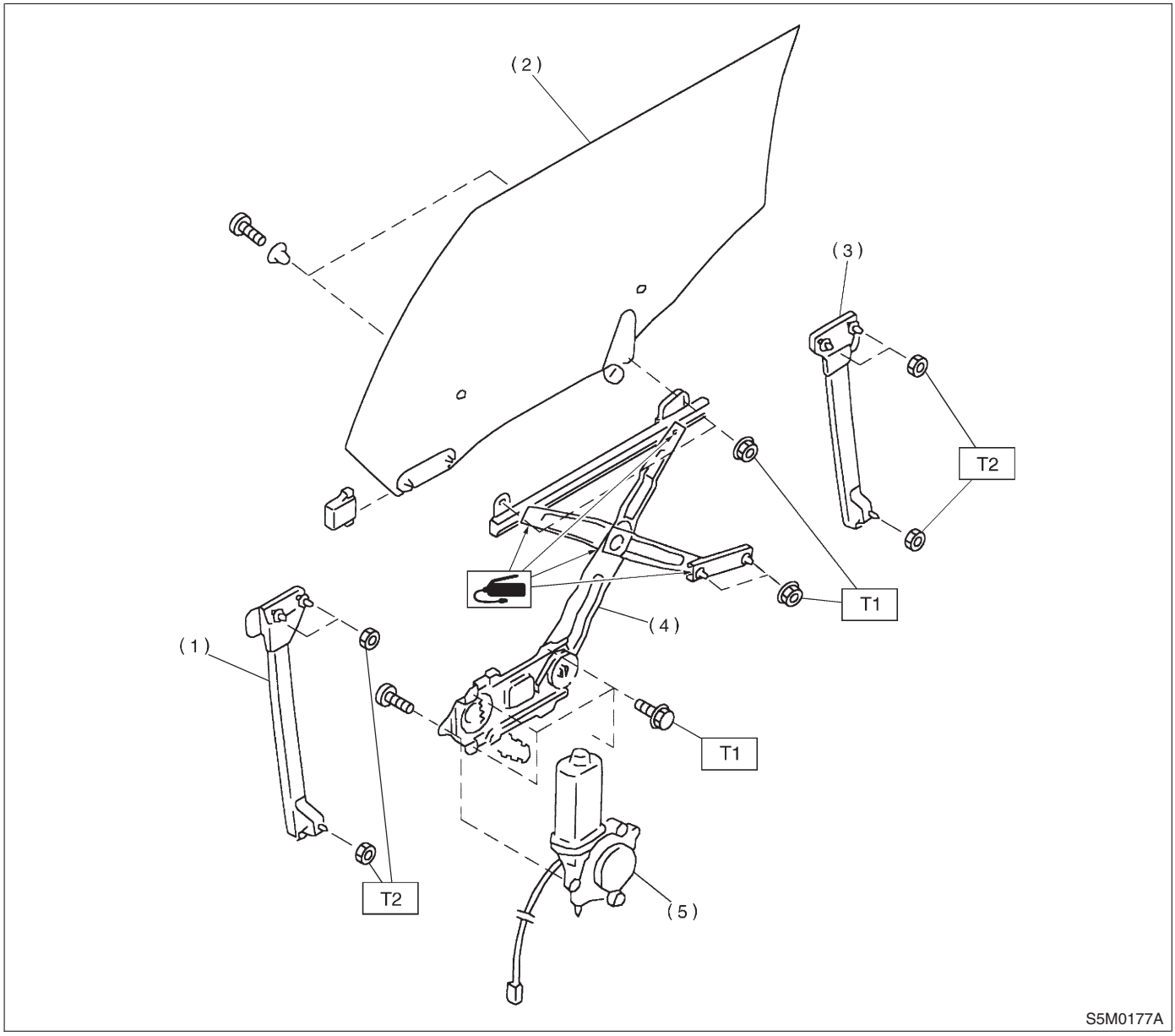
4. Front Door Glass



(1) Door sash (Front)
(2) Glass
(3) Door sash (Rear)
(4) Regulator ASSY
(5) Motor ASSY

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 14±4 (1.4±0.4, 10.1±2.9)

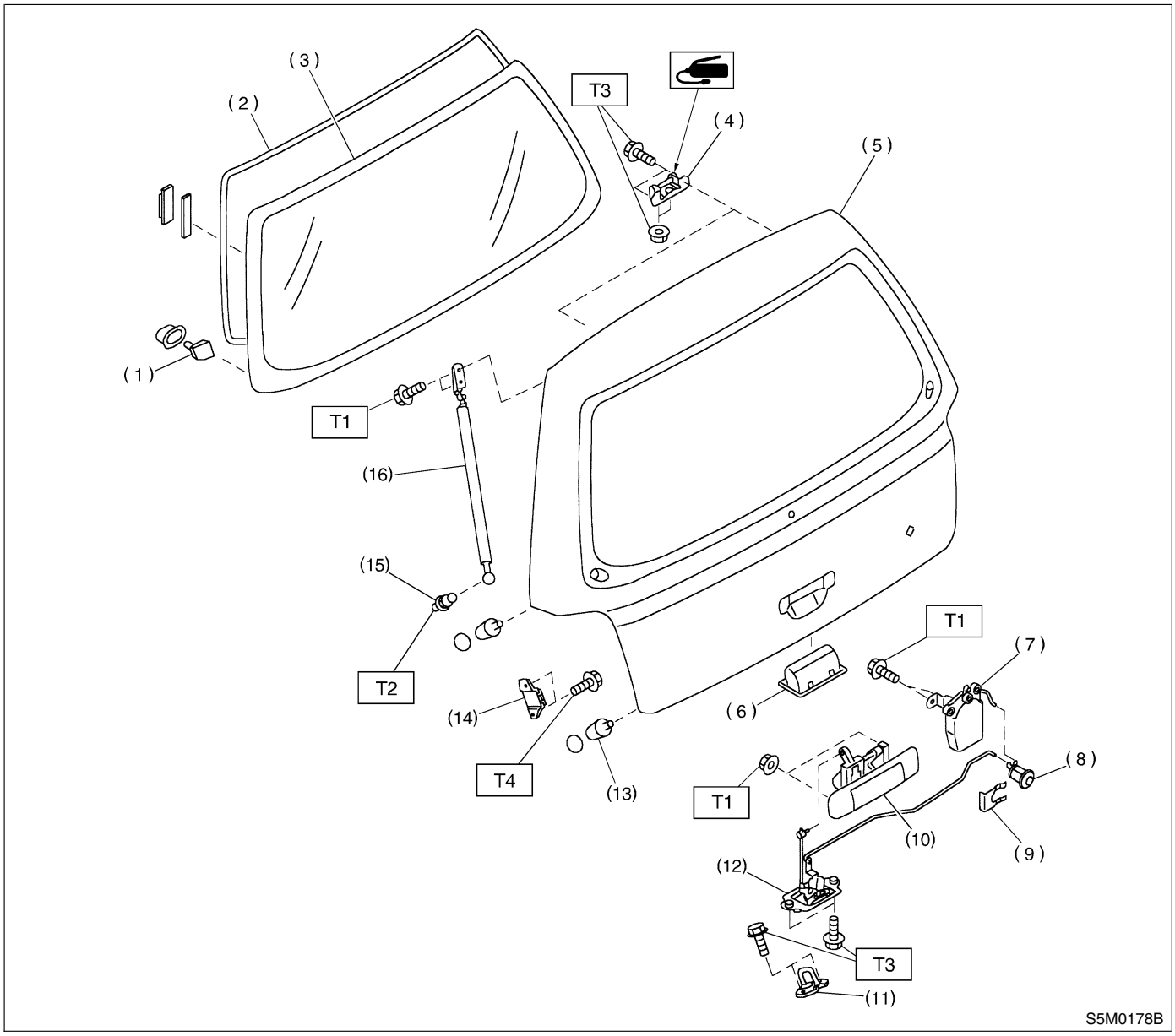
5. Rear Door Glass



(1) Door sash (Front)
(2) Glass
(3) Door sash (Rear)
(4) Regulator ASSY
(5) Motor ASSY

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 14±4 (1.4±0.4, 10.1±2.9)

6. Rear Gate and Glass

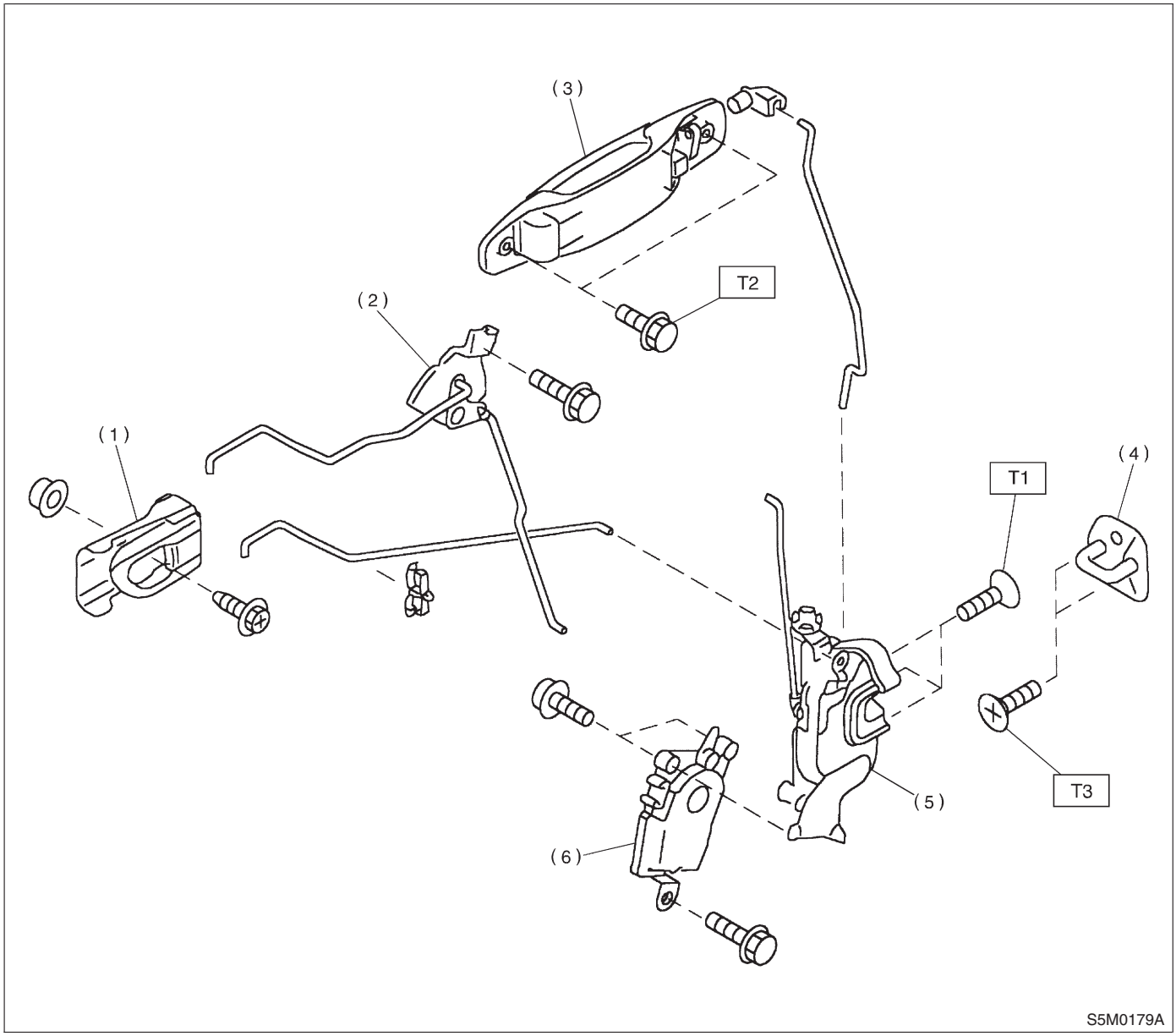


(1) Locate pin
(2) Dam rubber
(3) Glass
(4) Hinge
(5) Rear gate
(6) Handle
(7) Auto-door lock actuator
(8) Key cylinder
(9) Clip
(10) Outer handle
(11) Striker
(12) Latch
(13) Stopper
(14) Buffer
(15) Stud
(16) Gas stay

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 14±4 (1.4±0.4, 10.1±2.9)
T3: 25±5 (2.5±0.5, 18.1±3.6)
T4: 13±3 (1.3±0.3, 9.4±2.2)

7. Door Lock Assembly

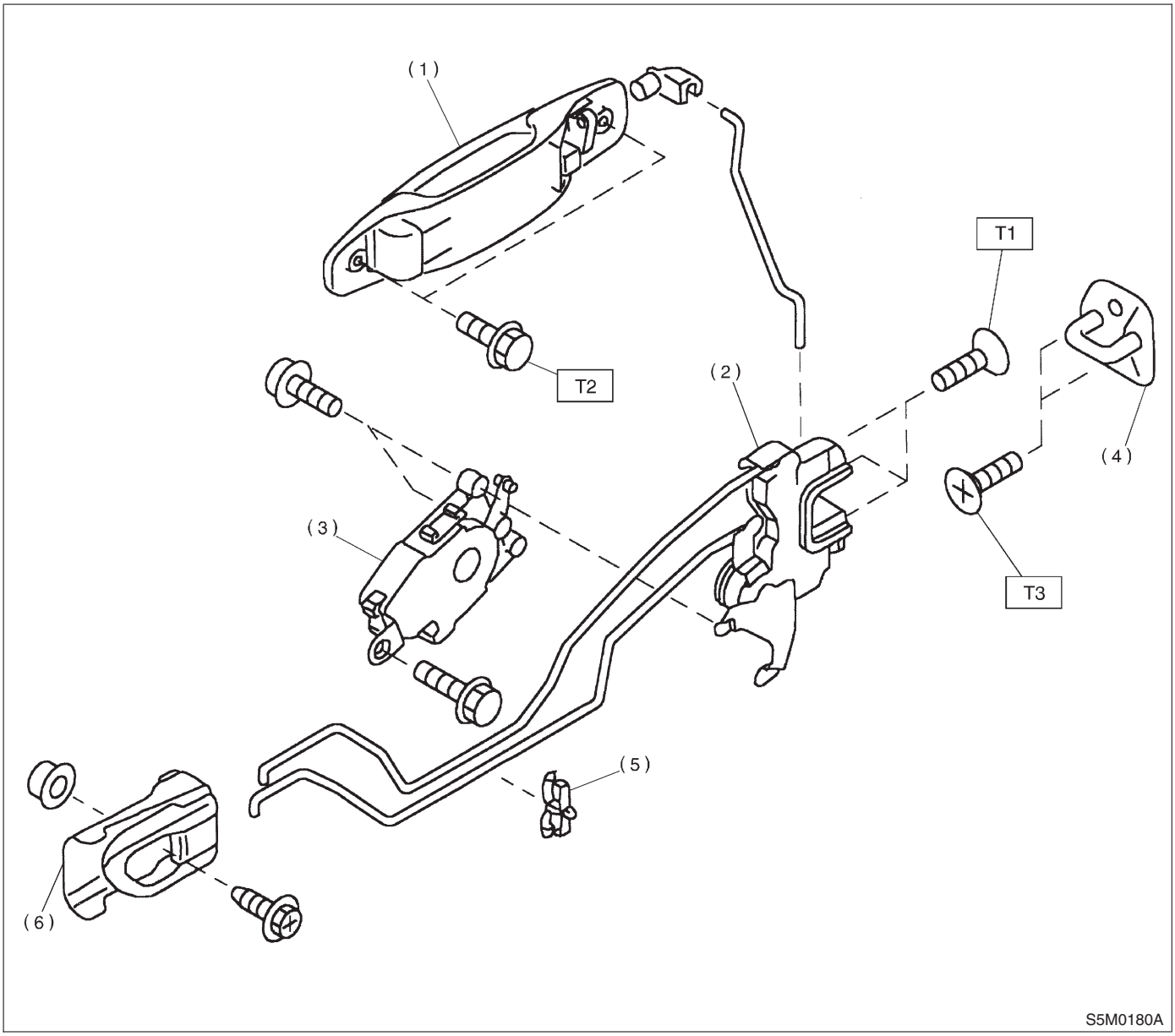
A: FRONT DOOR



(1) Inner remote ASSY
(2) Bell crank
(3) Door outer handle
(4) Striker
(5) Door latch
(6) Auto-door lock actuator

Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4±2.0 (0.65±0.2, 4.7±1.4)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T3: 18±4 (1.8±0.4, 13.0±2.9)

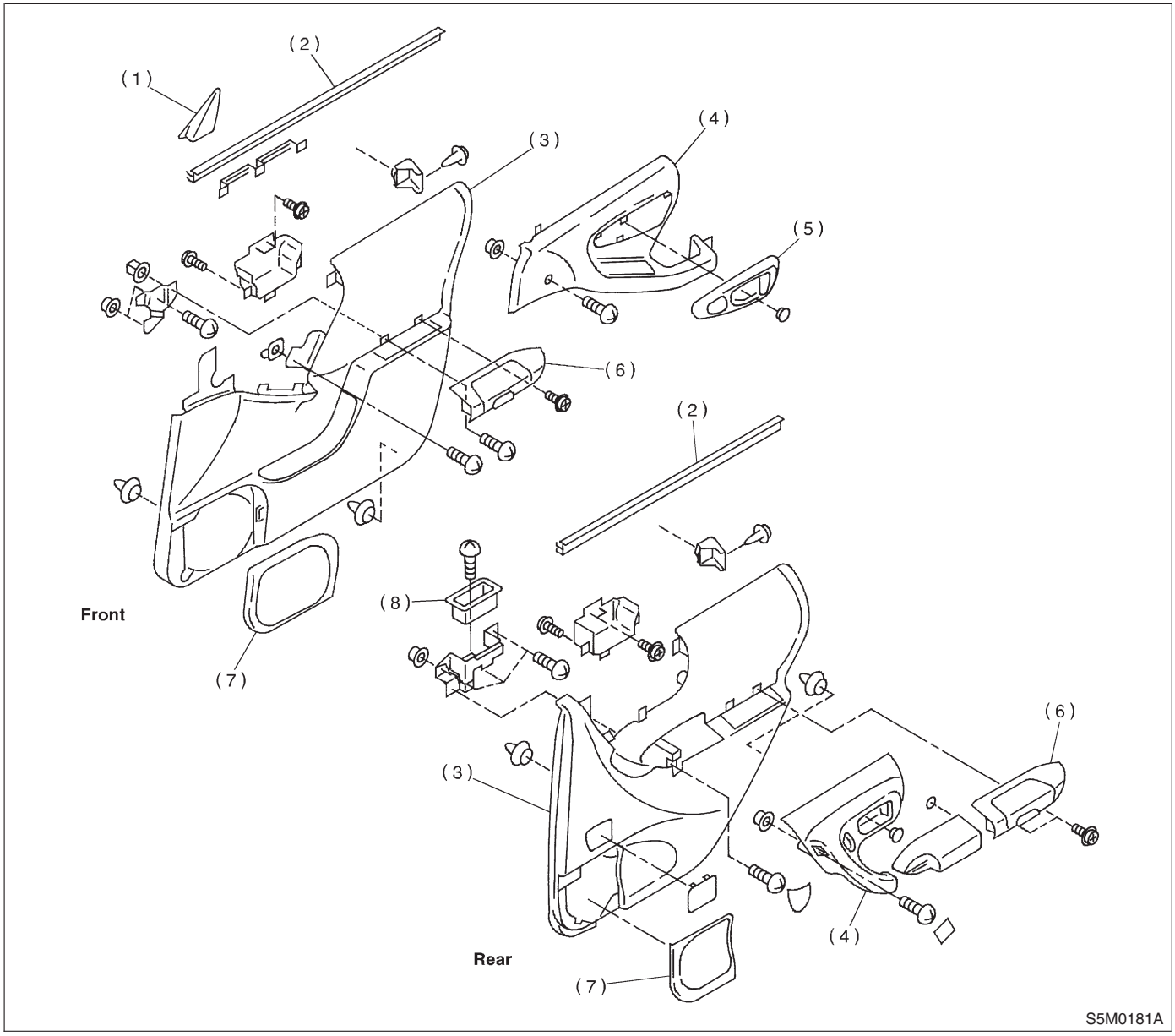
B: REAR DOOR



(1) Door outer handle
(2) Door latch
(3) Auto-door lock actuator
(4) Striker
(5) Rod holder
(6) Inner remote ASSY

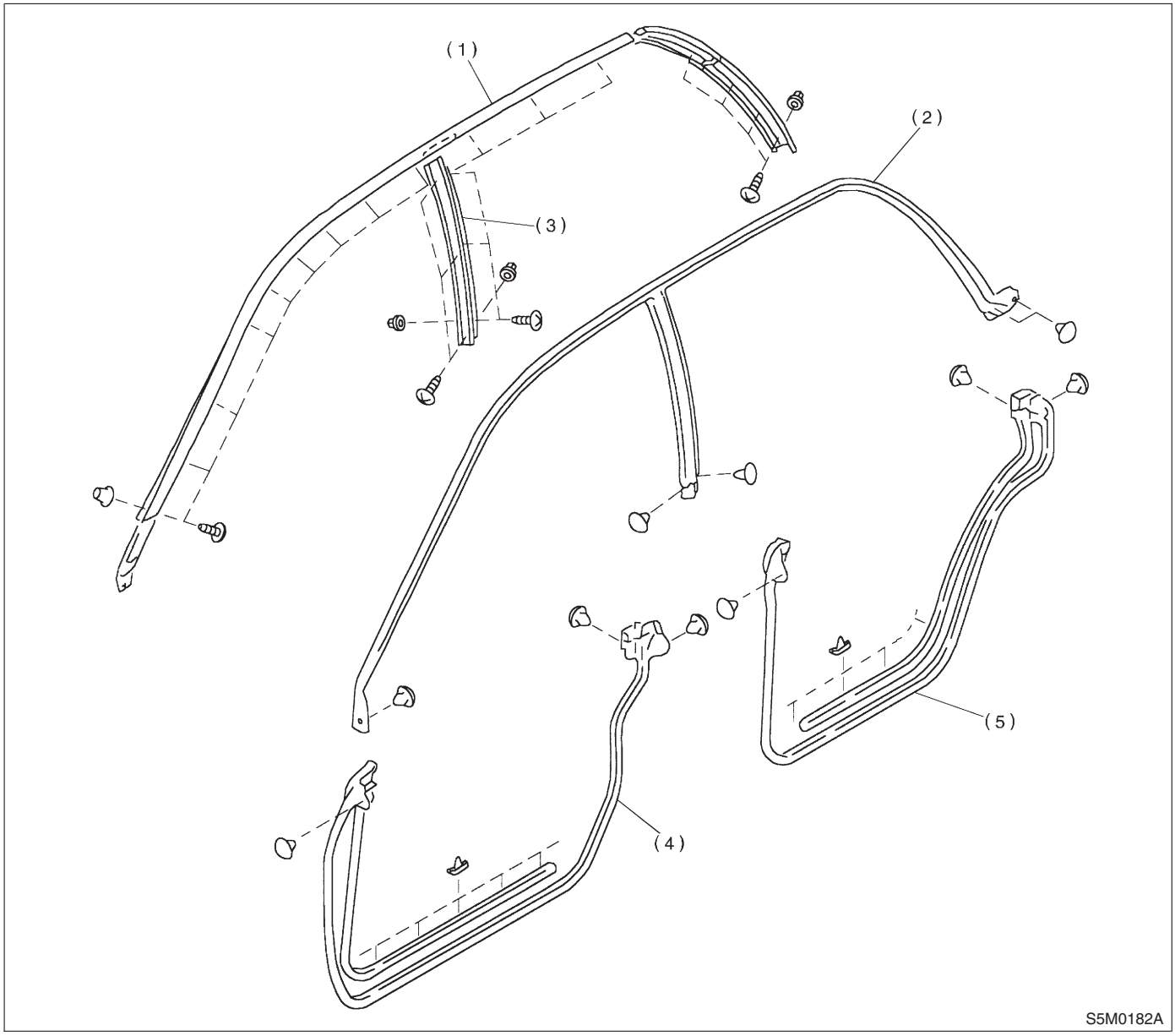
Tightening torque: N·m (kg-m, ft-lb)
T1: 6.4±2.0 (0.65±0.2, 4.7±1.4)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T3: 18±4 (1.8±0.4, 13.0±2.9)

8. Door Trim



(1) Gusset cover
(2) Weatherstrip
(3) Trim panel
(4) Pull handle
(5) Inner remote cover
(6) Pocket
(7) Speaker grille
(8) Handle

9. Weatherstrip

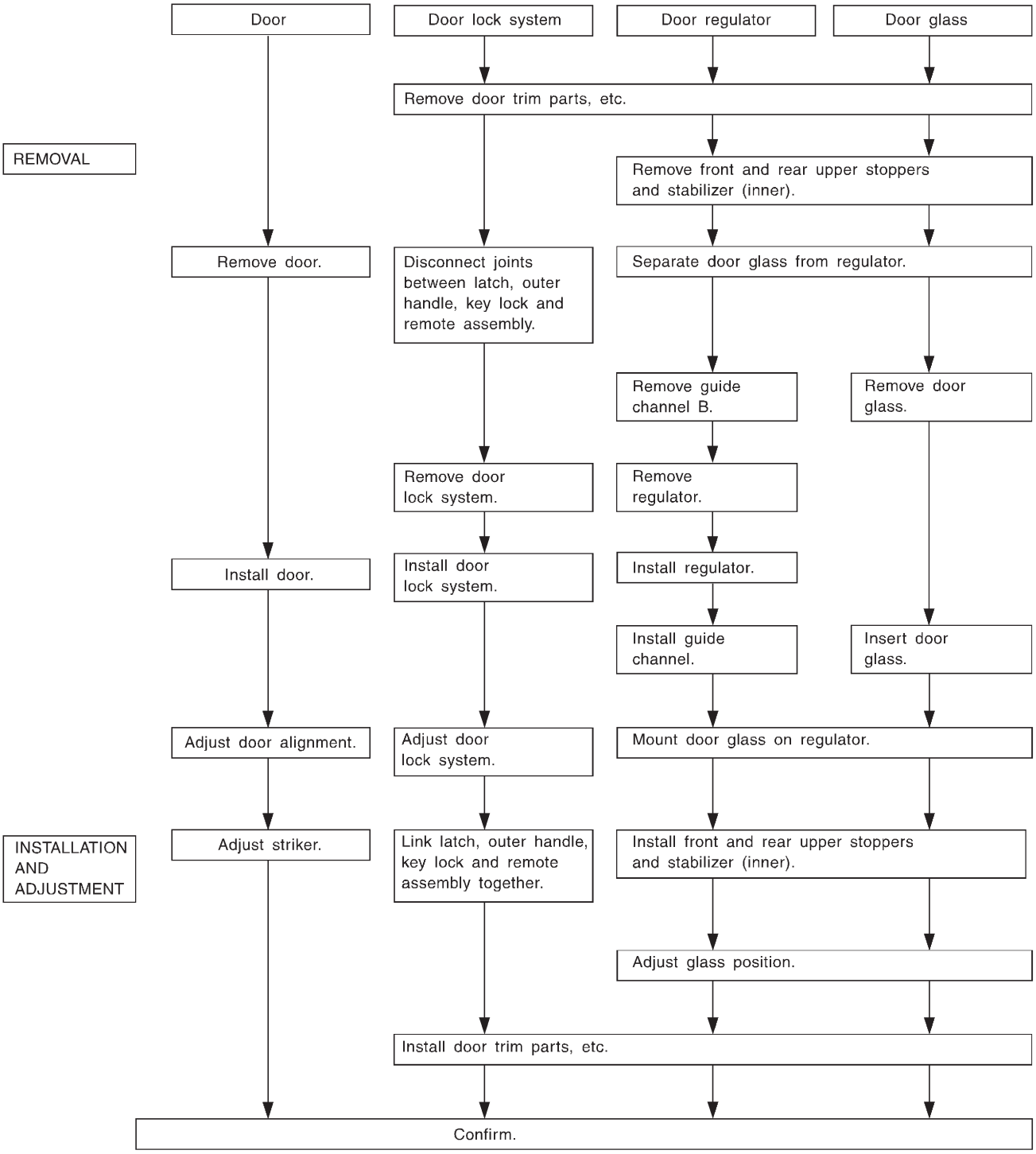


(1) Retainer and molding
(2) Upper and side weatherstrip
(3) Retainer (Center)
(4) Weatherstrip (Front door)
(5) Weatherstrip (Rear door)

1. Door and Related Parts

A: PROCEDURE CHART FOR REMOVING AND INSTALLING

NOTE:
This flowchart shows the main procedures for removing and installing the door and its related parts. For details, refer to the text.



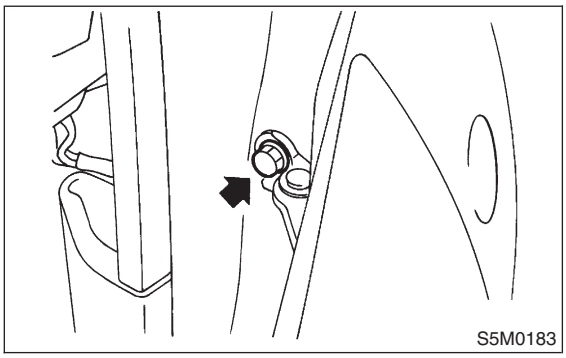
H5M0910A

2. Door

A: REMOVAL AND INSTALLATION

1. DOOR ASSEMBLY

1) Remove lower trim and disconnect connectors from body harness.
2) Place a cloth or a wood block under door to prevent damage, and support it with a jack.
3) Remove checker bolt.



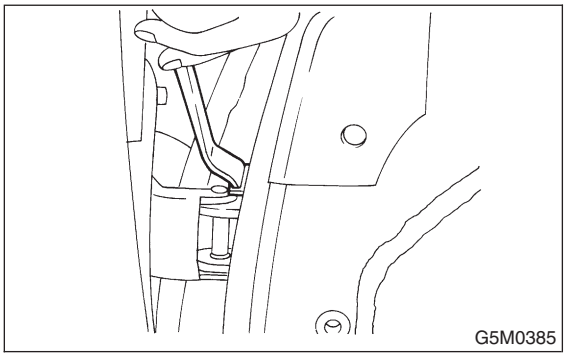
4) Remove bolts (M8) securing upper and lower hinges to door, and remove door from hinges.

Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)

5) Remove hinges by loosening hinges mounting bolt (M8) off of body.

Tightening torque:
29±5 N·m (3.0±0.5 kg-m, 21.7±3.6 ft-lb)

CAUTION:
Work carefully to avoid damaging door.



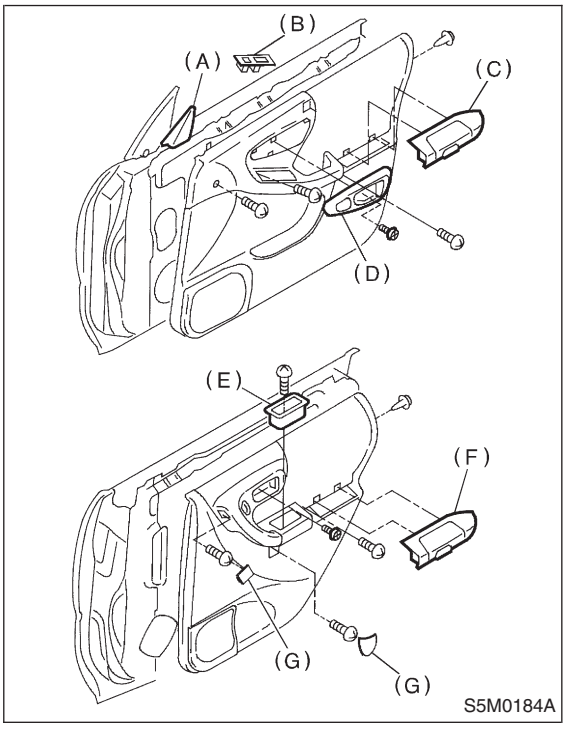
6) Installation is in the reverse order of removal.

NOTE:
Apply grease to moving parts of door hinges.

2. TRIM PANEL

CAUTION:
Be careful not to break clip by applying undue force.

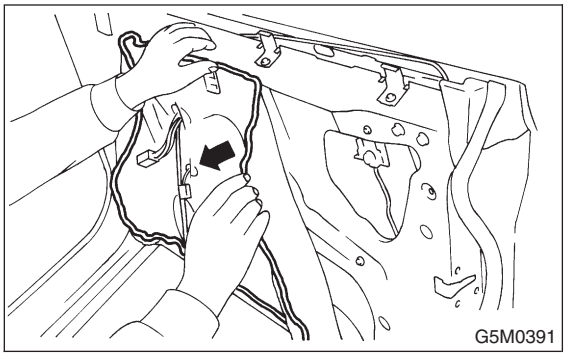
1) Front door trim:
   (1) Remove gusset cover (A), power window switch assembly (B), pocket (C) and inner remote cover (D).
   (2) Remove screws and then disengage the clips.
   (3) Detach trim panel and then disconnect connector.
   (4) Installation is in the reverse order of removal.
2) Rear door trim:
   (1) Remove handle (E), pocket (F) and clips (G).
   (2) Remove screws and then disengage the clips.
   (3) Detach trim panel and then disconnect connector.
   (4) Installation is in the reverse order of removal.



3. SEALING COVER

1) Remove trim panel. <Ref. to 5-2 [W2A2].>
2) Remove speaker, trim bracket, remote assembly and disconnect connectors.
3) Remove sealer with a spatula.

CAUTION:
Be careful because cover may break if sealer is removed forcefully.



4) Installation is in the reverse order of removal.

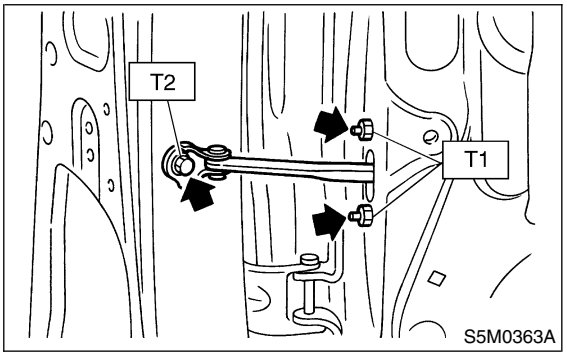
NOTE:
● Confirm that sealer is properly applied without breaks. Then install sealing cover.
● When repairing or replacing sealing cover, use "CEMEDINE 5430L" as sealer. It may be overlaid on existing sealer.

Sealer:
CEMEDINE 5430L

CAUTION:
● Any breaks in sealer can cause water leakage or entry of air and dust. Be sure sealer is applied in a continuous line.
● Make sure sealing cover bonded areas are free from wrinkles or openings.

4. CHECKER

1) Completely close door glass.
2) Remove trim panel.
3) Remove sealing cover.
4) Remove attaching bolt to body.
5) Loosen two nuts securing checker, and take out checker through access hole in underside.

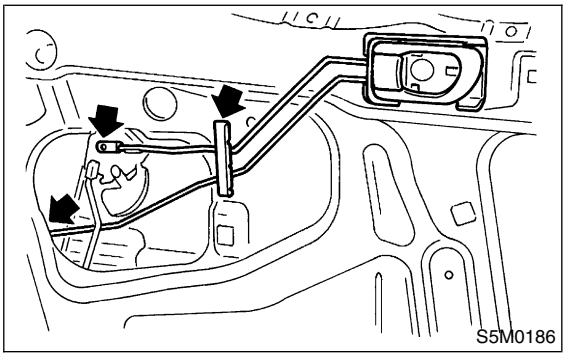


6) Installation should be made in the reverse order of removal.

Tightening torque:
T1: 7.5±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)
T2: 32±10 N·m (3.3±1.0 kg-m, 23.9±7.2 ft-lb)

5. INNER REMOTE

1) Remove trim panel.
2) Remove sealing cover.
3) Disconnect joints of two rods.
4) Unlatch rod holder.
5) Remove inner remote assembly.

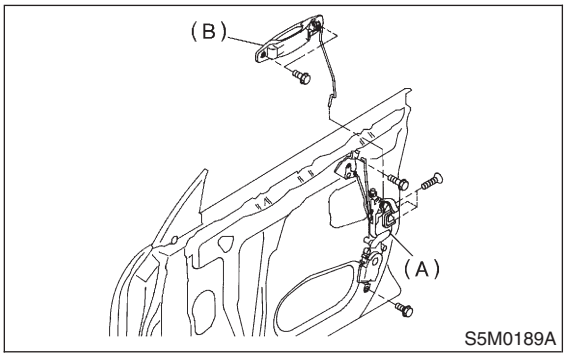


6) Installation is in the reverse order of removal.

NOTE:
If rear door is equipped with child safety lock, check that child lock lever moves without dragging.

6. DOOR LATCH AND OUTER HANDLE

1) Completely close door glass.
2) Remove door trim panel.
3) Remove inner remote assembly.
4) Remove sealing cover around latch service hole.
5) Remove latch and actuator assembly (A):
   (1) Turn rod holder to disconnect joint between key lock and rod.
   (2) Turn rod holder to disconnect joint between outer handle and rod.
   (3) Turn rod holder to disconnect joint between crank and rod.
   (4) Loosen screws securing both latch and actuator, then remove latch and actuator assembly through service hole in bottom.



   (5) Installation is in the reverse order of removal.

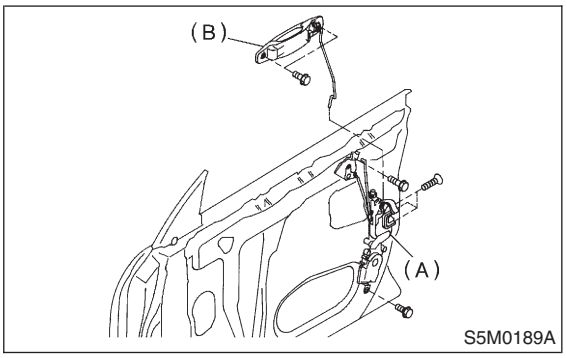
Tightening torque (screw):
6.4±2.0 N·m (0.65±0.2 kg-m, 4.7±1.4 ft-lb)

NOTE:
- Check operation of each part.
- Check each sliding part for proper lubrication.

CAUTION:
After installation, be sure lock mechanism operates normally.

6) Remove outer handle (B):
   (1) Remove trim panel.
   (2) Remove sealing cover.
   (3) Loosen bolts securing outer handle and then remove outer handle from outside.

CAUTION:
Be careful not to damage door.



   (4) Installation is in the reverse order of removal.

Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)

7. KEY LOCK

1) Remove trim panel.
2) Remove sealing cover.
3) Completely close door glass.
4) Remove outer handle.
5) Loosen spring securing key lock.
6) Remove key lock from outer handle.
7) Installation is in the reverse order of removal.

8. GUSSET

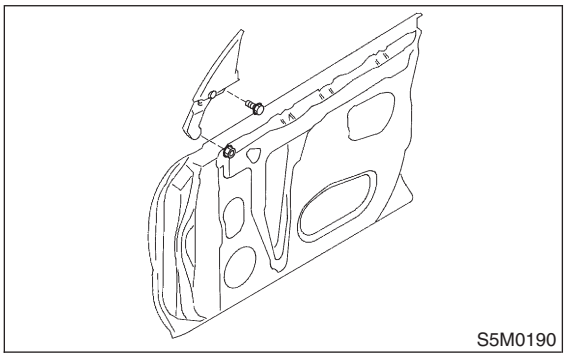
1) Be sure window is all the way down.
2) Remove gusset cover.
3) Remove trim panel.
4) Remove door rearview mirror.
5) Remove outer weatherstrip.
6) Remove sealing cover.

NOTE:
Be careful not to drop nuts on the “IN” side.

7) Remove bolts and nuts which secure gusset.

Tightening torque: Bolt
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)

Tightening torque: Nut
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)

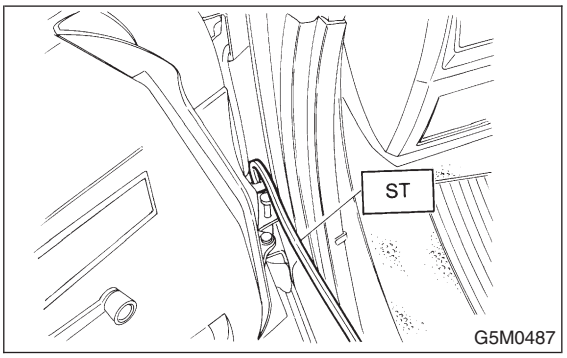


8) Lift out gusset.
9) Installation is in the reverse order of removal.

B: ADJUSTMENT

1. DOOR ASSEMBLY

1) Using ST, loosen bolts securing upper and lower hinges to body, and adjust fore-and-aft and vertical alignment of door.
ST 925610000 DOOR HINGE WRENCH



2) Loosen screw one complete rotation, and adjust opening/closing direction of door using a hammer covered with a cloth.

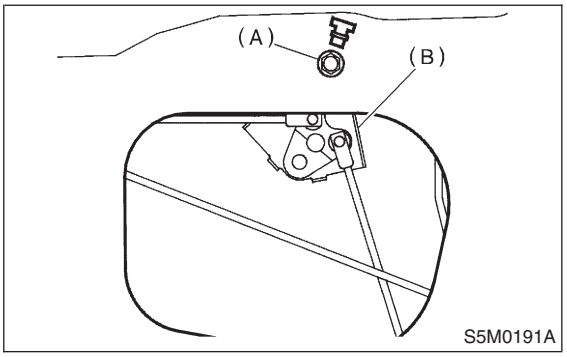
CAUTION:
Be careful not to damage striker.

Hinge tightening torque (body side):
29±5 N·m (3.0±0.5 kg-m, 21.7±3.6 ft-lb)

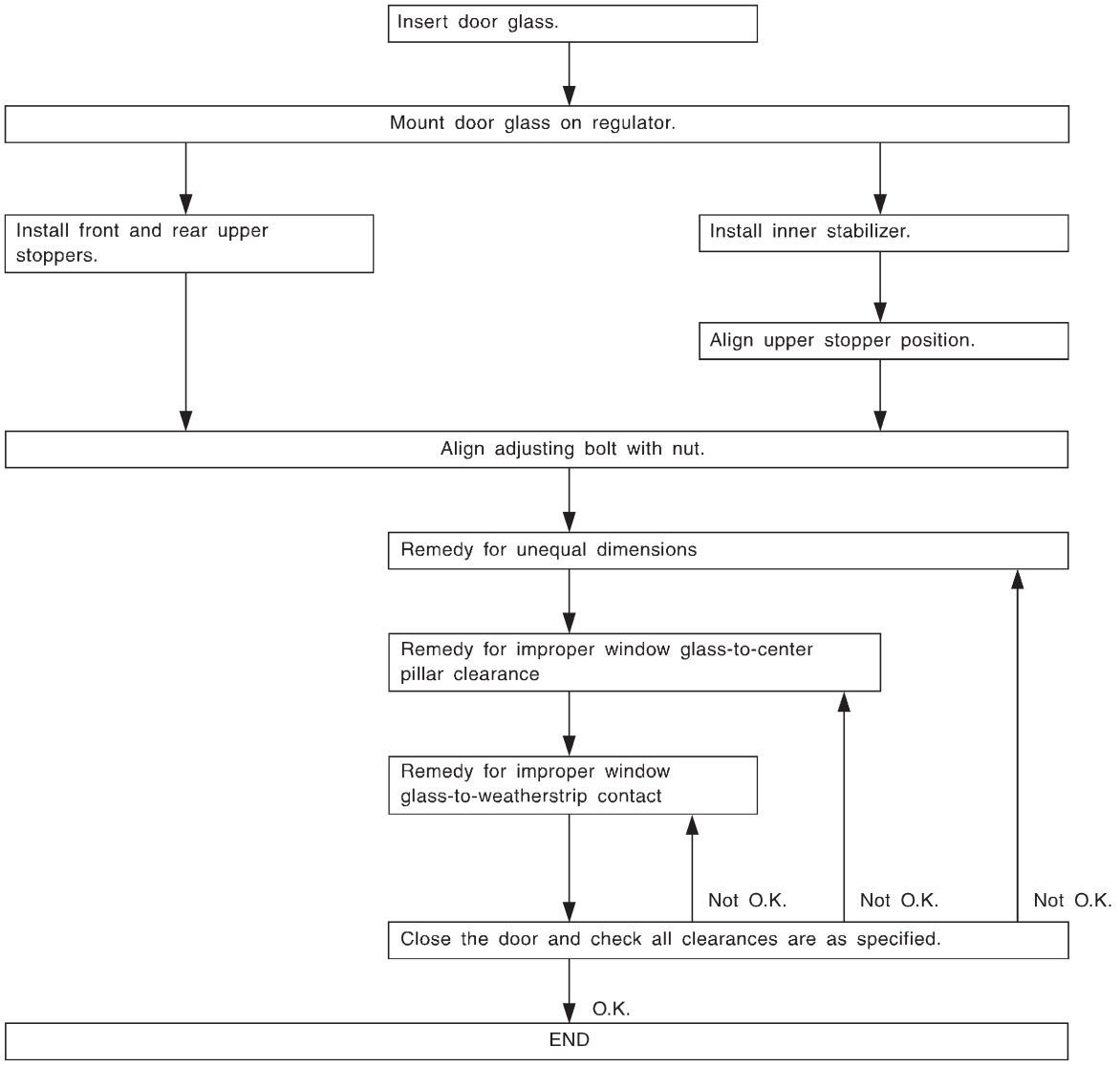
Striker tightening torque:
18±4 N·m (1.8±0.4 kg-m, 13.0±2.9 ft-lb)

2. INNER REMOTE

1) Lock the door.
2) Loosen bolt (A).
3) Lower bell crank (B) and then tighten bolt (A).

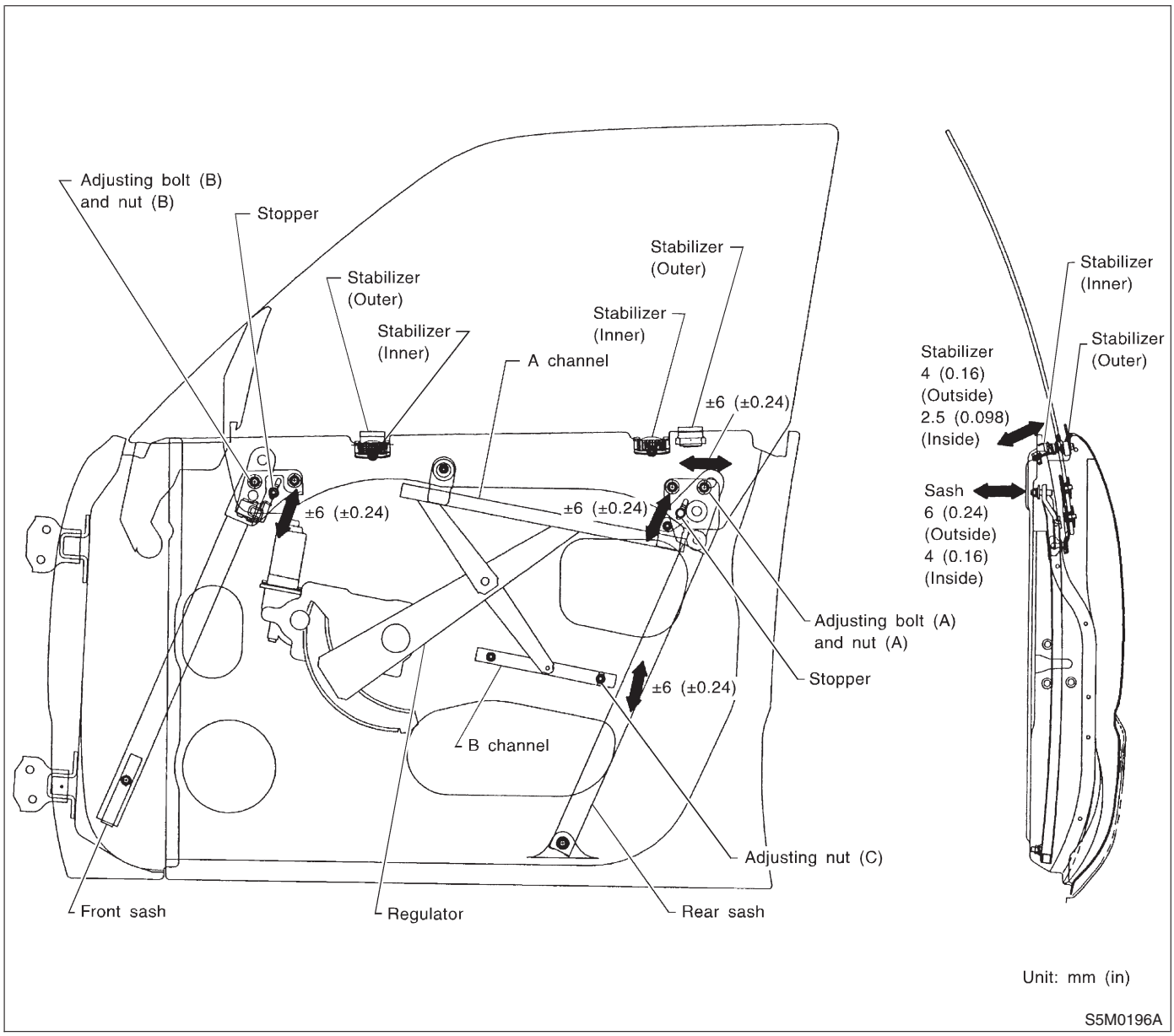


3. PROCEDURE CHART FOR ADJUSTING DOOR GLASS



H5M0912A

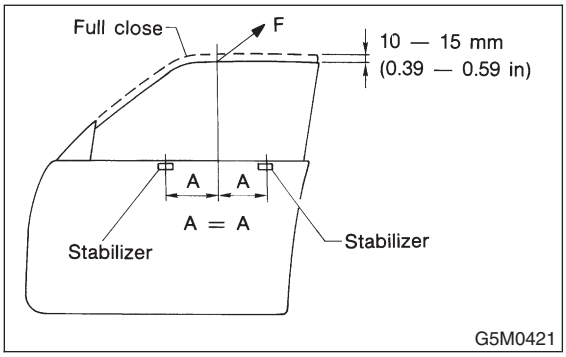
4. FRONT DOOR GLASS



• Door glass fit adjustment

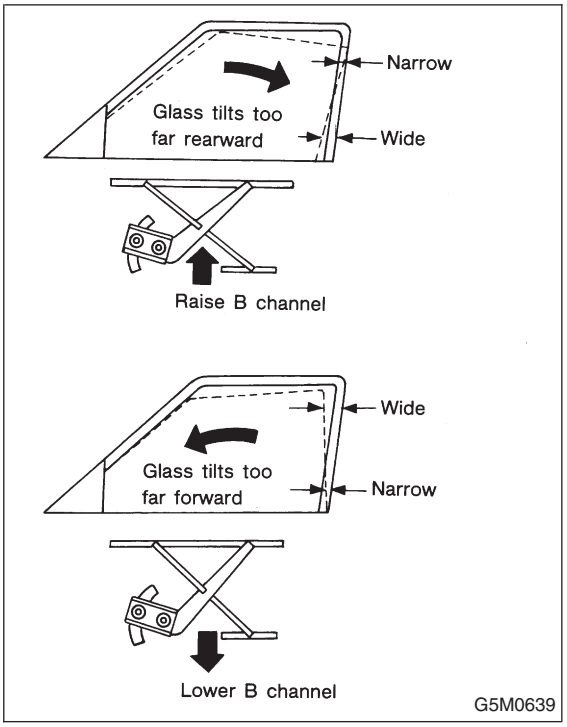
Before adjusting door glass alignment, ensure adjusting bolts for stabilizers, upper stoppers and sashes are loose and glass is raised so that it is in contact with upper and side weatherstrip.
1) Temporarily tighten one of the two rear sash adjusting bolts, at midpoint of oblong hole on inner panel.
2) Temporarily tighten regulator B channel at a position slightly lower than midpoint of oblong hole on inner panel.
3) Lower door glass 10 to 15 mm (0.39 to 0.59 in) from fully closed position. While applying outward pressure (load) to upper edge of glass above midpoint of two outer stabilizers, push in inner stabilizer to glass with 10±5 N (1.0±0.5 kg, 2.2±1.1 lb) force, then secure it.

Load: F
Front door glass 44.1±4.9 N (4.5±0.5 kg, 9.9±1.1 lb)
Rear door glass 44.1±4.9 N (4.5±0.5 kg, 9.9±1.1 lb)



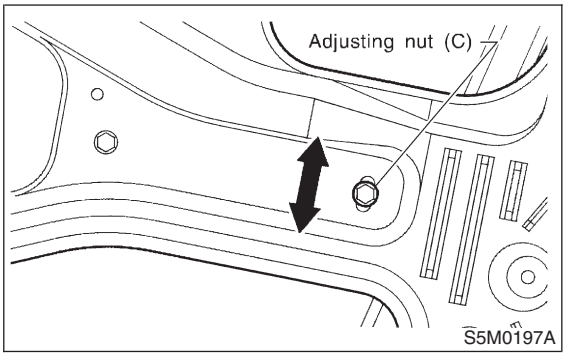
• Remedy for unequal dimensions, between upper, lower and center pillar sides

1) Close front door and raise door glass.
2) Make sure of unequal dimensions.



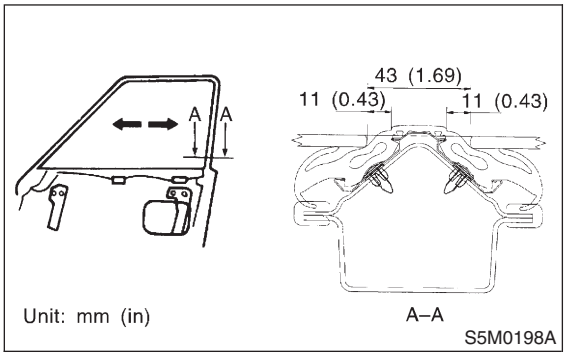
3) If glass tilts to far rearward, loosen adjusting nut (C) and adjust glass to be parallel with center pillar, then after adjustment, tighten adjusting nut (C).

Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)

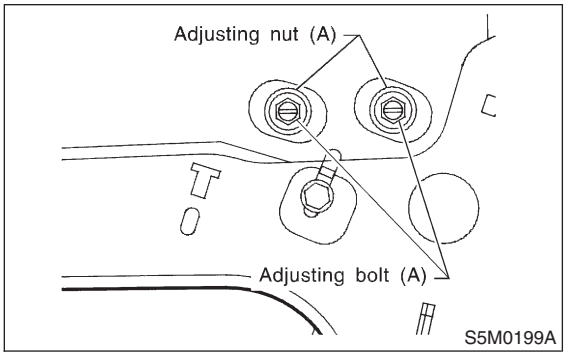


• Remedy for improper glass to center pillar clearance

1) Close front door and raise door glass.
2) Make sure of improper clearance.

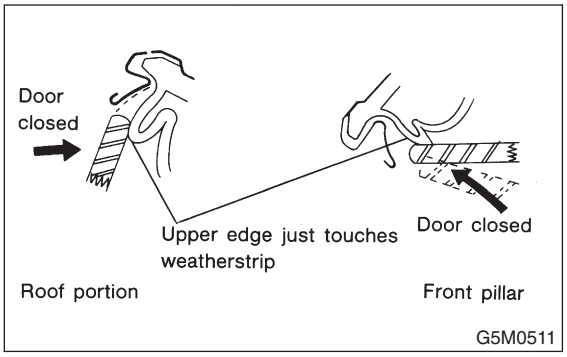


3) If clearance is improper, loosen adjusting nut (A), bolt (A) and adjust glass to center pillar.



• Remedy for improper upper stop point of door glass

1) Loosen front and rear sash stoppers.
2) Increase the upward travel of window glass up to the position where upper edge just touches weatherstrip surface with door closed.

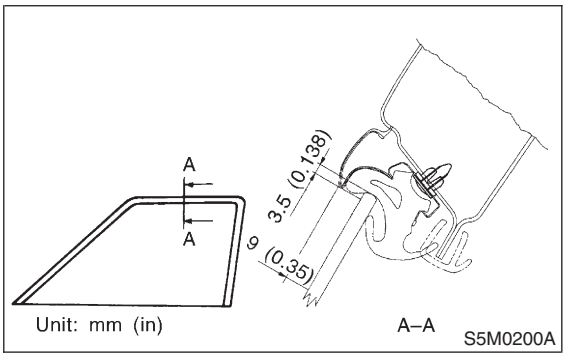


3) After adjustment, temporarily tighten stoppers.

NOTE:
Make sure that each glass stopper is touched.

• Remedy for incorrect contact of door glass to weatherstrip

1) Close front door and raise door glass.
2) If clearance is below specifications, loosen bolt (A) and bolt (B).
3) If clearance is over specifications, tighten bolt (A) and bolt (B).



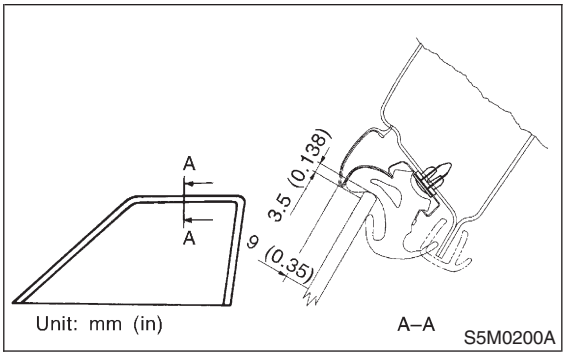
• Fit adjustment

Door glass fit is adjusted by displacing the glass front edge with a stabilizer.

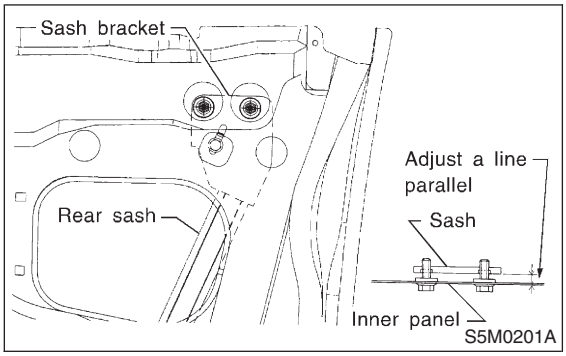
NOTE:
Before adjusting glass fit, visually check to determine relative adjusting positions of retainer and molding (on roof side) and glass surface.

1) Alternately adjust two rear sash adjusting bolts (A) until dimensions are obtained.

CAUTION:
Do not loosen two adjusting nuts (A) at the same time, as this moves sash fore and aft, creating unequal glass-to-sash clearance. During adjustment, loosen only one nut and keep the other tightened.



NOTE:
Always adjust two rear sash adjusting bolts (A) by the same amount. Do not adjust the adjusting bolts with sash bracket inclined toward inner panel, as this increases effort required to operate regulator.



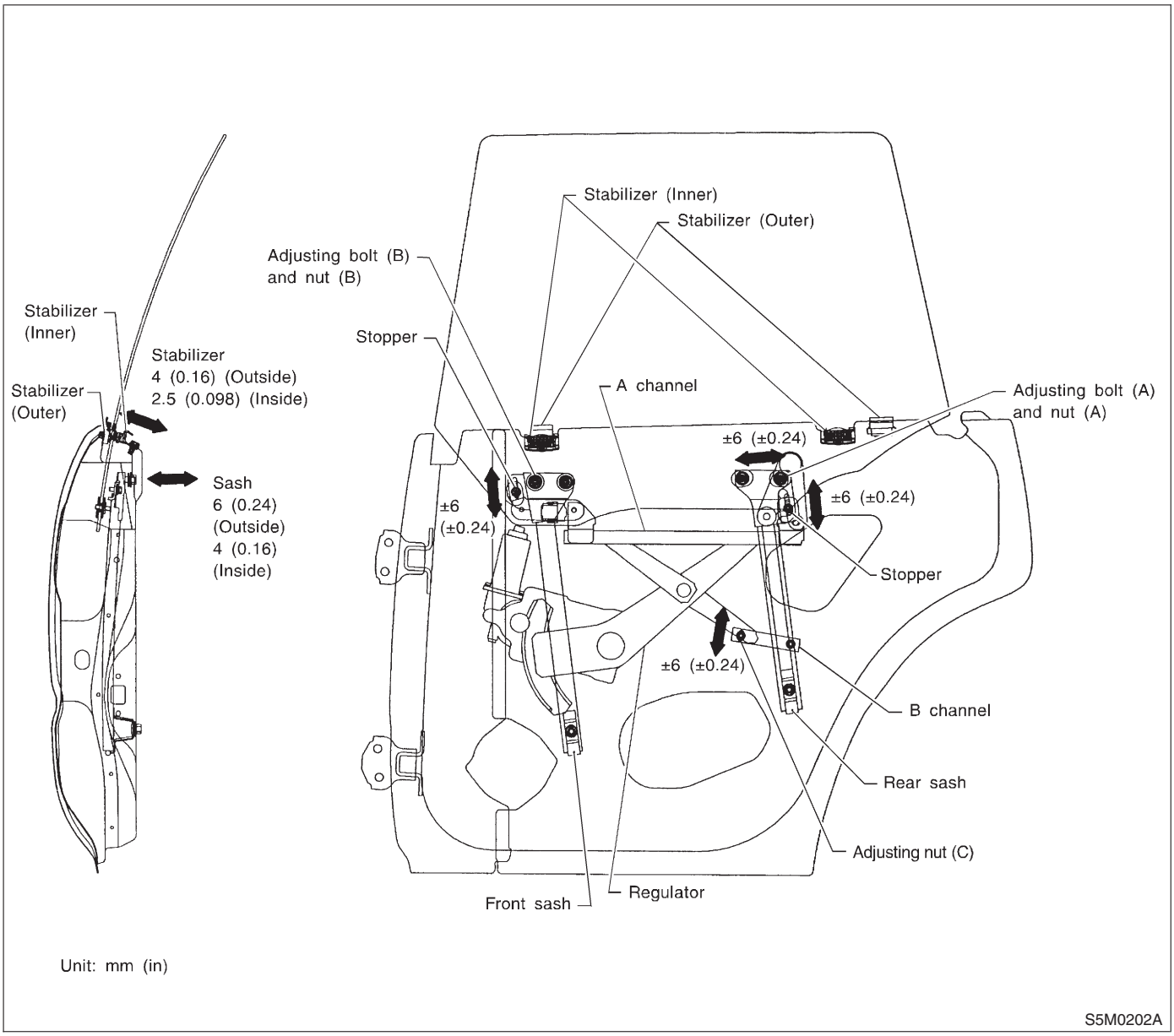
2) Adjust front sash fit using rear sash adjustment procedure outlined in the former procedure as a guide. Two adjusting bolts must be adjusted by the same amount.

NOTE:
● Front and rear sash adjustment procedures are basically the same; however, the amount of adjustment is not always the same due to alignment dispersion of individual doors.
● Adjust front and rear sash fit, as equally as possible. Otherwise, effort required to operate regulator may increase.

3) After adjusting front sash-to-glass fit, secure front sash.

5. REAR DOOR GLASS

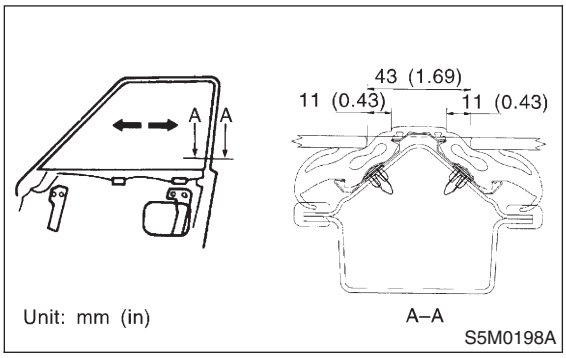
Alignment of rear door glass is basically the same as for the front door glass. Due to slight difference in adjustment dimensions for fore-aft, up-down, and in-out alignments, key points for rear door adjustment are described.



● Fore-aft adjustment

1) Door glass alignment must be adjusted so that glass-to-center pillar fit is equal at all points. Always use dimensions as a guide during adjustment.

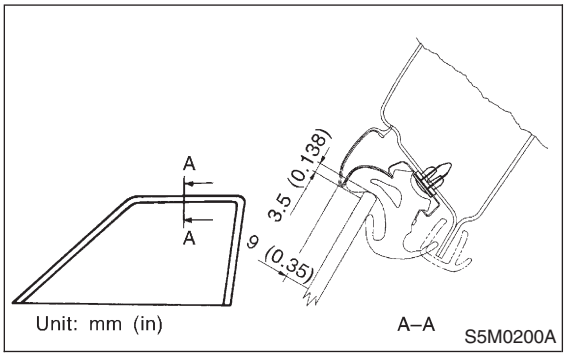
NOTE:
If dimensions are smaller than those indicated, glass will be caught in weatherstrip and may not raise to the fully closed position.



2) After making fore-aft adjustment, raise and lower glass to ensure it is free from any binding.

● Fit adjustment

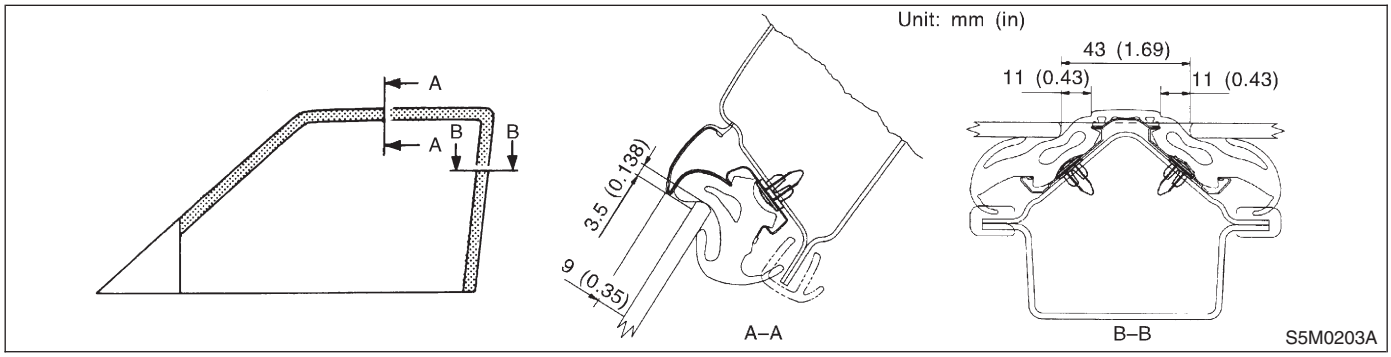
Increasing contact pressure causes rear door glass to be caught in center pillar upper and lower weatherstrip; this will cause premature weatherstrip wear. For this reason, always use dimensions indicated below as a guide during glass fit adjustment.



C: INSPECTION

1. FRONT DOOR GLASS

1) Close front door and make sure of all clearances.

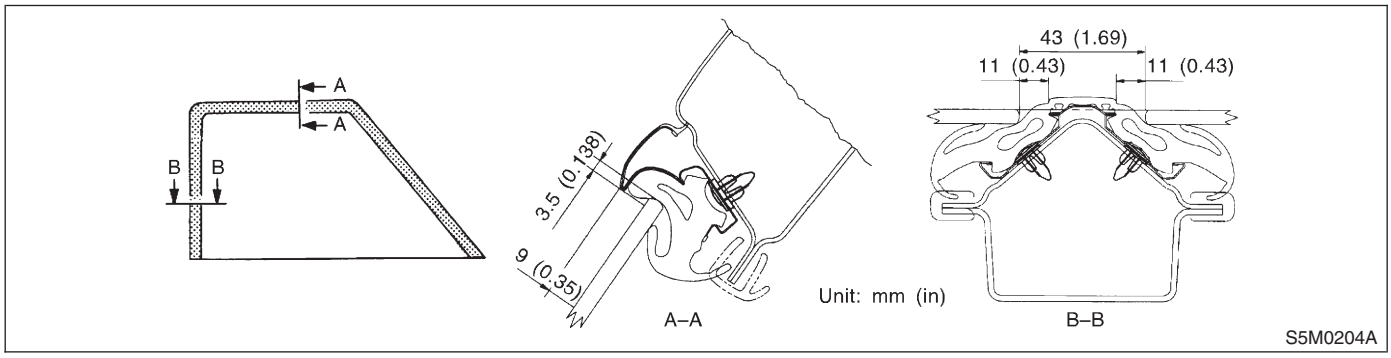


2) If any clearance is not correct, adjust affected parts. Re-check that all clearances are correct.

CAUTION:
• Repeatedly adjust parts until all clearances are correct.
• After clearance adjustment, make sure that all adjusting bolts and nuts are tightened.

2. REAR DOOR GLASS

1) Close rear door and make sure of all clearances.



2) If any clearance is not correct, adjust affected parts. Re-check that all clearances are correct.

CAUTION:
• Repeatedly adjust parts until all clearances are correct.
• After clearance adjustment, make sure that all adjusting bolts and nuts are tightened.

3. Rear Gate

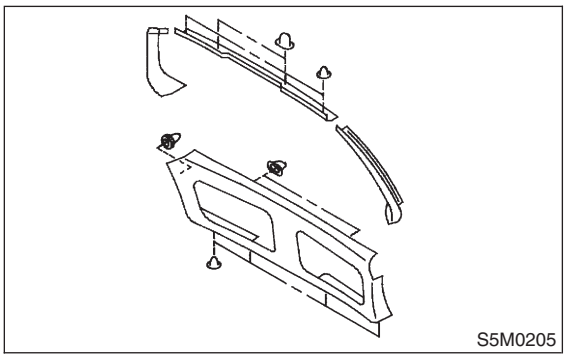
A: REMOVAL AND INSTALLATION

CAUTION:
• Be careful not to scratch coated surfaces of vehicle body and window glass during removal. Place a cloth over the affected area.
• Be careful not to damage trim panels.
• Use an assistant when handling heavy parts.
• Be careful not to damage or lose small parts.

1. REAR GATE ASSEMBLY

1) Remove clips from trim panel and detach trim panel.

CAUTION:
Be careful not to damage clips or their holes.


S5M0205

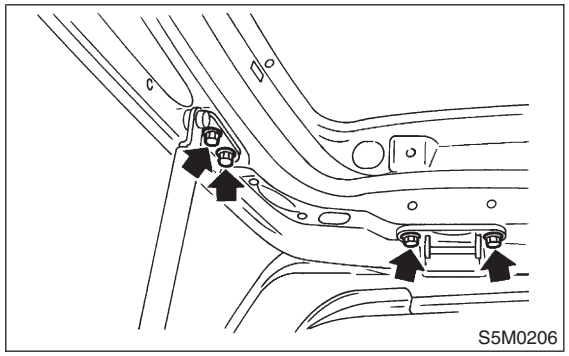
2) Disconnect connectors and terminal.
3) Disconnect rear washer hose from wiper motor.
4) If disconnected harness is re-used, tie connector with a string and place on the upper side of rear gate for ready use.

CAUTION:
Do not forcefully pull cords, lead wires, etc. since damage may result; carefully extract them in a wavy motion while holding connectors.

5) Remove both rubber ducts and then extract washer hose and harness connector.
6) Gas stay:
   (1) Completely open rear gate.
   (2) Remove bolts which hold gas stay to rear gate.

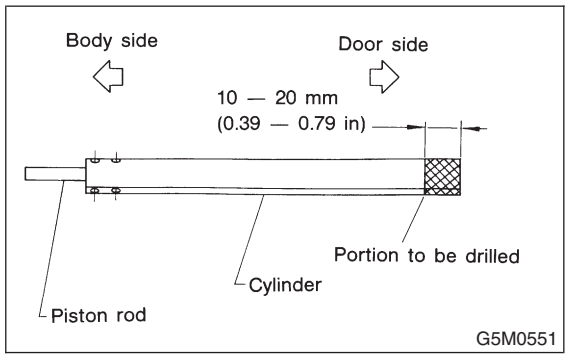
CAUTION:
• Be careful because rear gate drops while removing bolts. Have an assistant support it while removing bolts.
• Be sure to place a folded cloth between rear gate and body to prevent scratches.

7) Remove the bolts which hold rear gate to hinge and then detach rear gate.


S5M0206

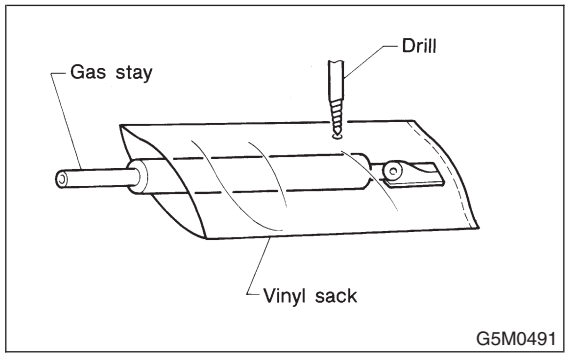
8) General precautions in handling rear gate gas stay are as follows.

CAUTION:
• Do not attempt to disassemble gas stay because its cylinder is filled with gas.
• Before discarding gas stay, place it at a slight angle with the cylinder body side facing up and drill a 2 to 3 mm (0.08 to 0.12 in) dia. hole to completely discharge the content. (Gas is odorless, colorless and harmless; however, metal powder may come out of the hole.)



G5M0551

• It is good practice to place a vinyl sack over it before drilling the hole because oil may spurt out. Be careful to prevent vinyl cover from becoming entangled on the drill.



G5M0491

• Be careful not to scratch the exposed section of piston rod or allow oil or paint to come in contact with it.

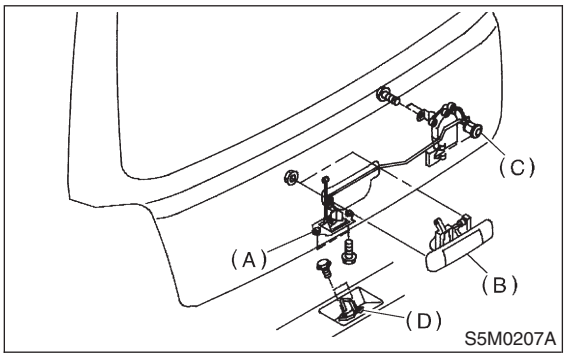
• Do not attempt to rotate the extended piston rod.

9) Installation is in the reverse order of removal.

CAUTION:
• Be careful not to mistake RH and LH body side buffers.
• Be sure to add sealer to hinge.
• When installing rear gate, be careful not to damage coating on body and rear gate.

2. LATCH

1) Remove trim panel.
2) Disengage rod from holder (= key cylinder).
3) Remove bolts from auto-door lock actuator.
4) Remove bolts from latch (A), and detach latch.



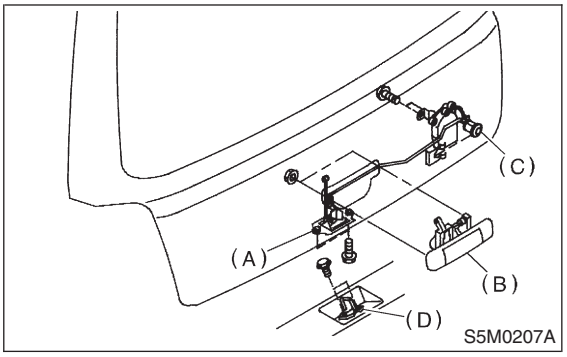
5) Disconnect rear gate switch connector.
6) Disconnect auto-door lock actuator connector.
7) Detach latch.
8) Installation is in the reverse order of removal.

CAUTION:
Firmly join latch with key cylinder, and outer handle.

3. OUTER HANDLE

1) Remove trim panel.
2) Remove latch (A).
3) Remove two nuts used to hold outer handle (B) to the inside of rear gate, and detach outer handle.

CAUTION:
Be careful not to damage packing when removing outer handle.

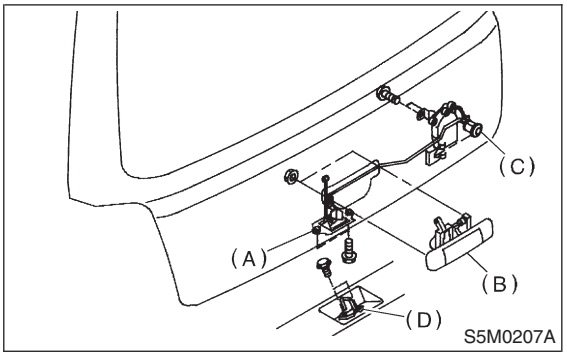


4) Installation is in the reverse order of removal.

CAUTION:
Completely insert latch pin into handle lever.

4. KEY CYLINDER

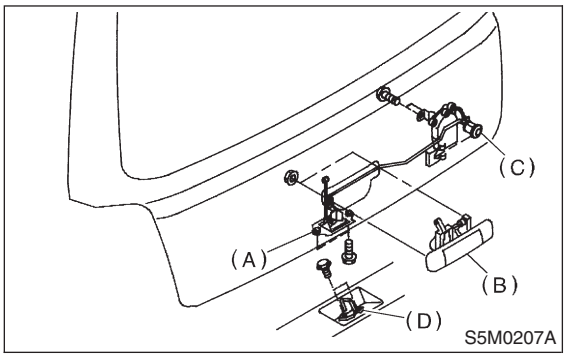
1) Remove trim panel.
2) Disengage rod from holder.
3) Remove retaining spring from key cylinder (C), and detach key cylinder from outside.



4) Installation is in the reverse order of removal.

5. STRIKER

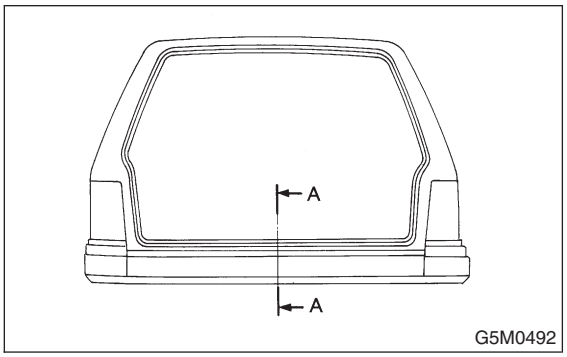
1) Remove rear skirt trim.
2) Remove two bolts from striker (D) and detach striker.



3) Installation is in the reverse order of removal.

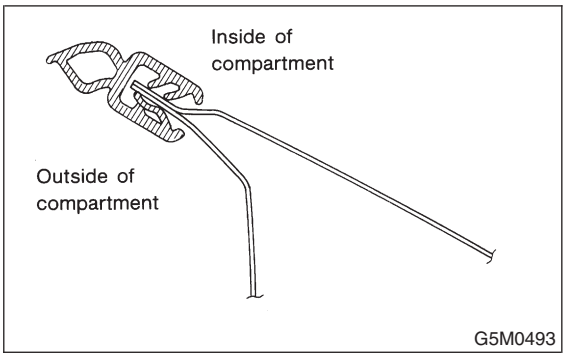
6. WEATHERSTRIP

1) Place weatherstrip so that its joints meet at lower center of vehicle body, and install by inserting flanged portion from below, as shown in section A—A in figure.



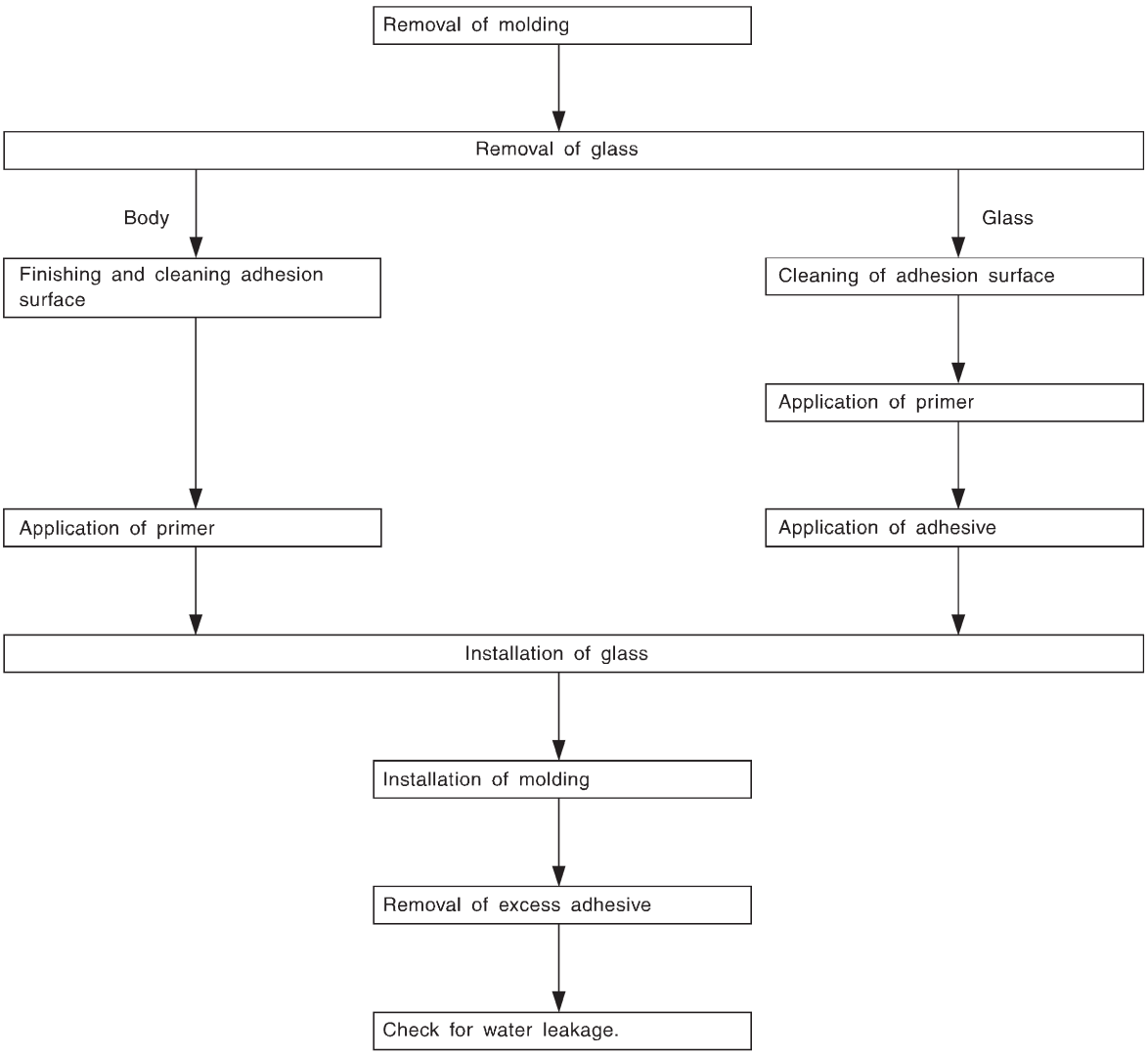
2) Tap along entire length with a rubber hammer to firmly insert body flange into weatherstrip.

CAUTION:
- **Be careful not to install in wrong direction.**
- **Install weatherstrip carefully and firmly.**



4. Procedure Chart for Removal and Installation of Window Glass

A: REMOVAL AND INSTALLATION



H5M0914A

1. MATERIALS REQUIRED FOR APPLICATION

Description	Remarks
Repair adhesive set ● Cartridge of single liquid urethane adhesive ● Primer for glass and body	Sunstar No. 580 or Essex Chemical Corp's Urethane E Sunstar No. 435-580
Windshield knife or piano wire	For cutting windshield.
Sealant gun	For applying adhesive.
Suction cups	For holding glass.
Putty knife	For finishing adhesion surface and cutting spacer.
Sponge	For applying primer.
Gauze or cloth	For cleaning.
Alcohol or white gasoline	For cleaning adhesion surface.
Tape	For preventing damage to painted surface.

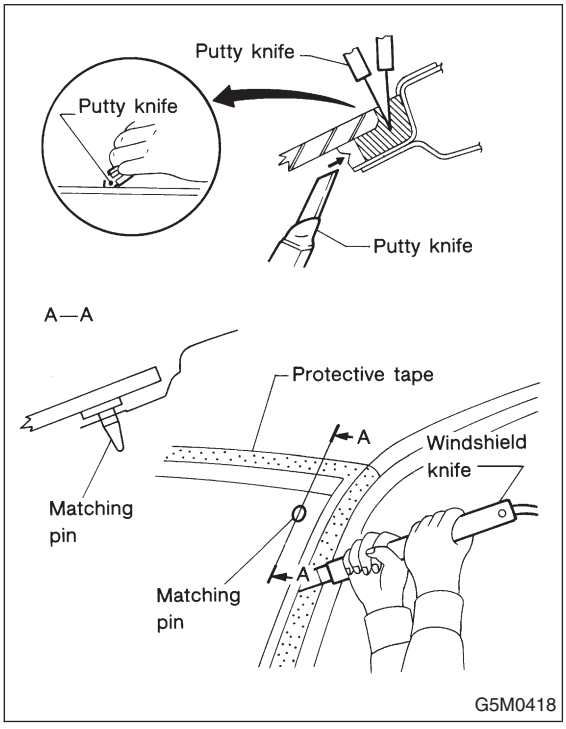
5. Windshield

A: REMOVAL

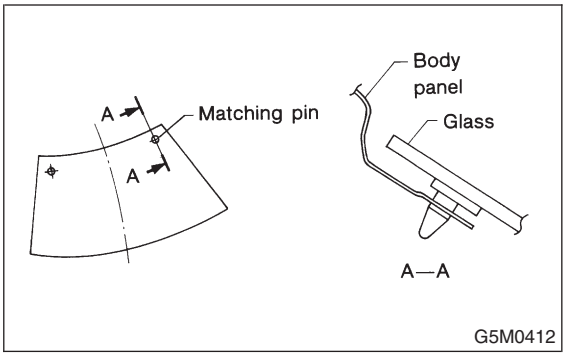
1. USING WINDSHIELD KNIFE

The following procedure for the front windshield can also be applied to other window glass.
1) Remove wiper arm and cowl panel.
2) Remove front side molding and front molding upper.
3) Remove glass:
   (1) Put protective tape on body to prevent damage.
   (2) Apply soapy water to the surface of the adhesive agent so the knife blade slides smoothly.
   (3) Cut off excess adhesive agent.
   (4) Put windshield knife into layer of adhesive.
   (5) Cut adhesive layer with the windshield knife.

CAUTION:
● Keep knife edge along glass surface and end face.
● When first putting knife into layer of adhesive, select point with wide gap between body and glass.

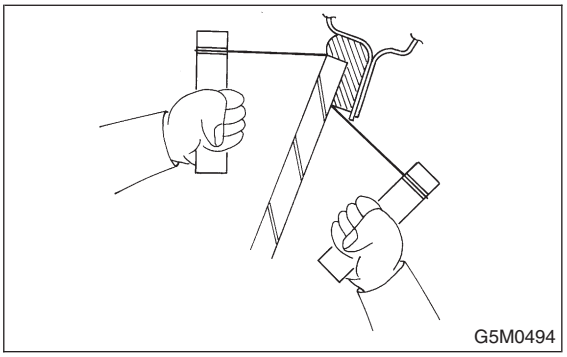


NOTE:
A matching pin is cemented to corners of glass on compartment side.
Use a piano wire when cutting each pin.



2. USING PIANO WIRE

1) Remove wiper arm and cowl panel.
2) Remove roof molding and front window molding upper.
3) Remove glass:
   (1) Put protective tape on body to prevent damage.
   (2) Using drill or putty knife, make through-hole (one place) in adhesive agent.
   (3) Pass piano wire through the hole from inside the compartment, and connect both ends of wire securely to wooden blocks.



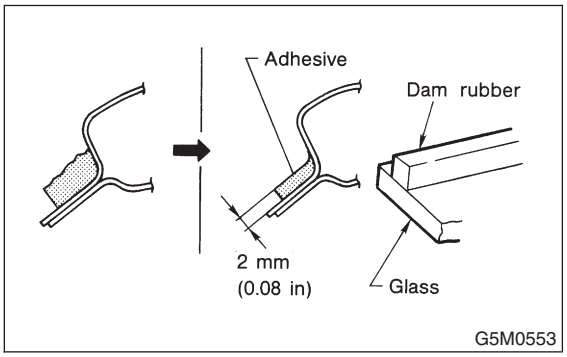
   (4) Cut adhesive layer with the wire by pulling it back and forth.

CAUTION:
When making through-hole into adhesive layer and cutting the adhesive, be careful not to damage interior and exterior parts.

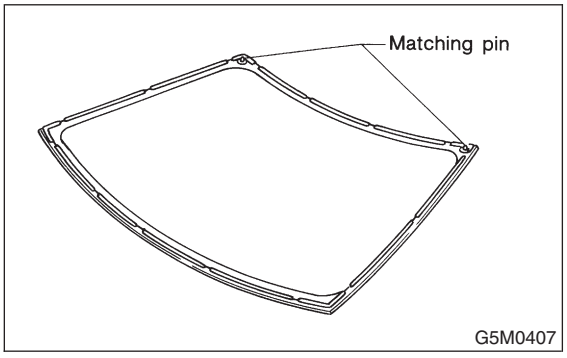
B: INSTALLATION

1) After cutting layer of adhesive, remove dam rubber remaining on body.
2) Finishing adhesion surface on body side:
Using a cutter knife etc., cut layer of adhesive sticking firmly to body, and finish it to a smooth surface of about 2 mm (0.08 in) in thickness.

CAUTION:
Take extra care not to cause damage to body paint.

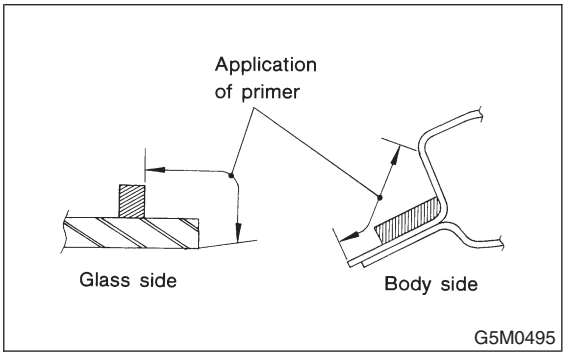


3) Cleaning body surface:
(1) Thoroughly remove chips, dirt and dust from body surface.
(2) Clean body wall surface and upper surface of layer of adhesive with a solvent such as alcohol or white gasoline.
4) Positioning glass:
(1) Mount glass on body.
(2) Adjust position of glass so that gap between body and glass is uniform on all sides.
(3) Put matching pin on body and glass in several places.

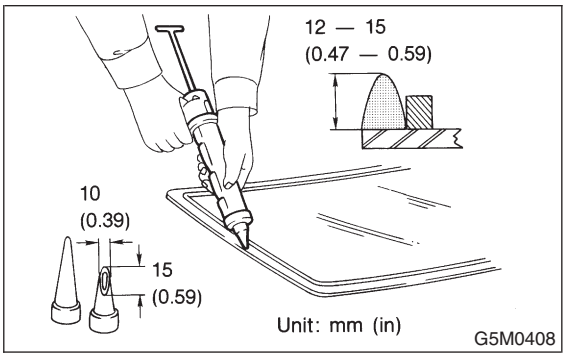


5) Cleaning glass:
(1) Dismount glass from body.
(2) Clean surface of glass to be adhered with alcohol or white gasoline.
6) Application of primer:
(1) Using a sponge, apply primer to part of glass to be adhered.
(2) Apply primer to part of body to be adhered.

CAUTION:
● Primer is hard to wipe off of body paint, instrument panel, inner trim, etc. So put masking around these areas for protection.
● After application, let 1st primer dry spontaneously for about 10 minutes.
● Do not touch primer-coated surface under any circumstances.

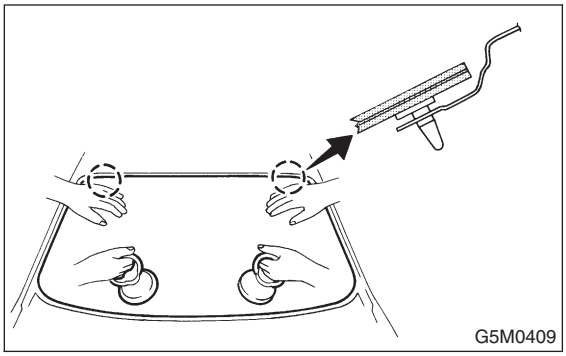


7) Application of adhesive:
(1) Cut nozzle tip of cartridge as shown in figure.



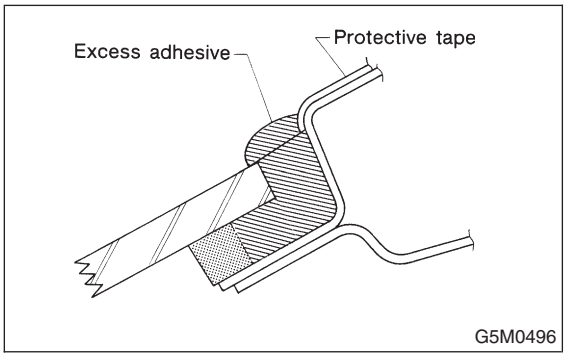
(2) Open cartridge and put it into a gun with nozzle attached.
(3) Apply adhesive uniformly to all sides of adhesion surface while operating gun along glass end face.

8) Installation of glass:
(1) Hold glass with rubber suction cups.
(2) Mount glass on body with matching pin aligned.



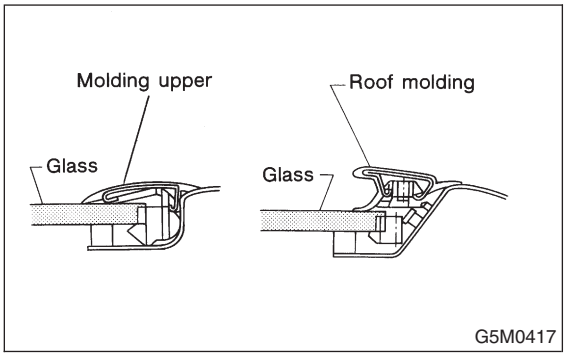
(3) Stick them fast by pressing all sides lightly.

9) Installation of molding:
(1) Remove adhesive overflowing from outside of glass until it becomes level with outer height of glass. Then, add adhesive to portions that need it, and clean with alcohol or white gasoline.



(2) Firstly, press-fit front window molding upper and lastly, roof molding.

CAUTION:
Do not open and close door after moldings have been installed. When opening and closing door for unavoidable reason, lower door glass and gently move door.



10) Water leakage test:
Test for water leakage about one hour after installation.

CAUTION:
- **Move vehicle very gently.**
- **Do not squirt strong hose stream on vehicle.**

11) Spontaneous drying:
After completing all operations, leave vehicle alone for 24 hours.

CAUTION:
When delivering vehicle to user, tell him that vehicle should not be subjected to heavy shocks for at least three days.

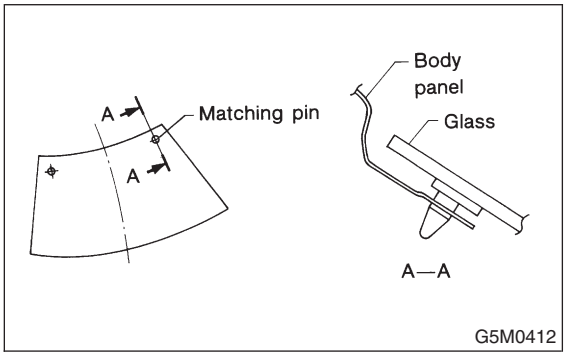
12) Install cowl panel and wiper arm.

6. Rear Gate Glass

A: REMOVAL

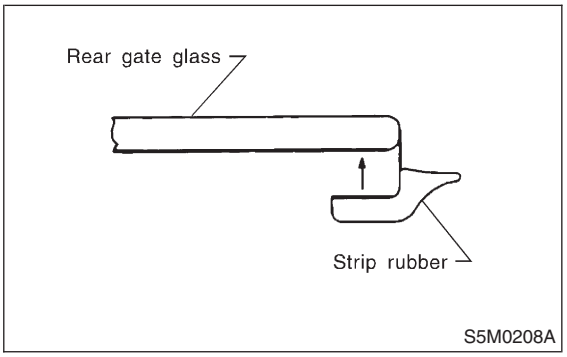
1) Remove rear wiper and rear gate trim.
2) Disconnect connector from rear defogger terminal.
3) Remove glass in the same manner as in windshield.

NOTE:
A matching pin is cemented to corners of glass on compartment side. Use a piano wire when cutting each pin.

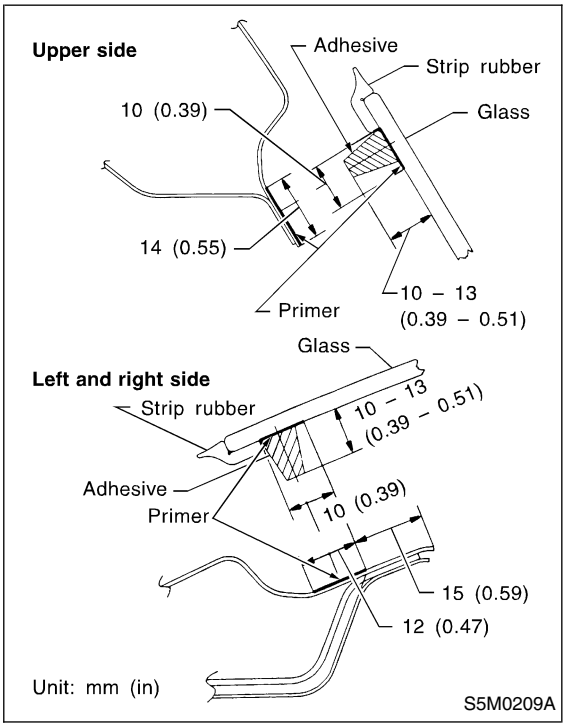


B: INSTALLATION

1) Install a new rubber strip by aligning it with the end of the gate glass.



2) Install glass in same manner as windshield.

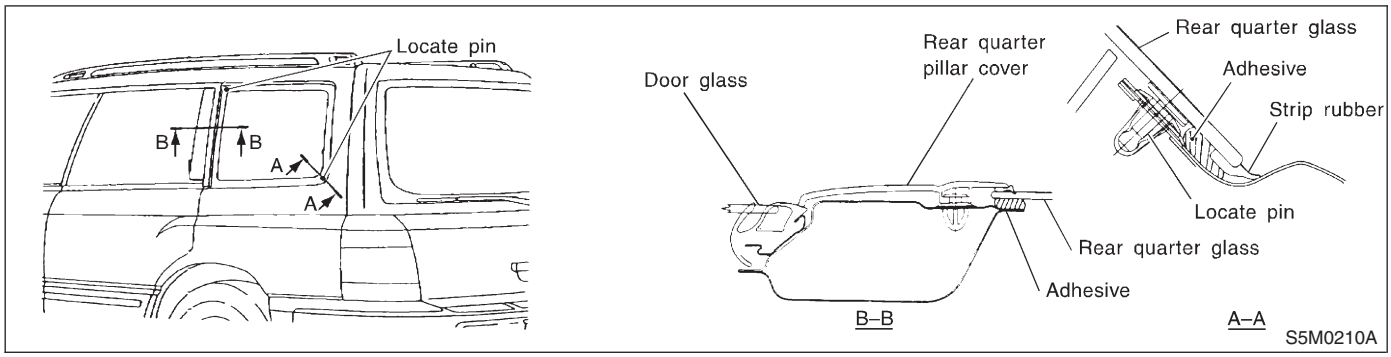


3) About one hour after installation, test for water leakage. Leave vehicle for 24 hours before using it.
4) Connect rear defogger connections.
5) Install rear gate trim and rear wiper.

7. Rear Quarter Glass

A: REMOVAL

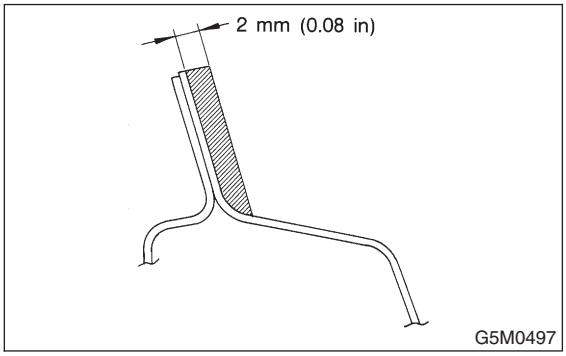
1) Remove rear quarter molding on corner.
2) Remove glass in the same manner as in windshield.



B: INSTALLATION

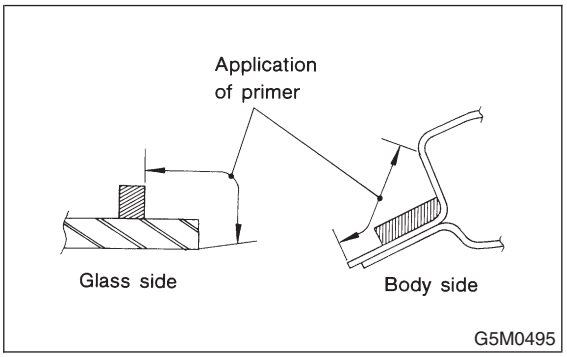
1) Finish surface of adhesive layer on body:
Using a putty knife, etc., cut layer of adhesive stick firmly to body and finish it into a smooth surface of about 2 mm (0.08 in) in thickness.

CAUTION:
Be careful not to damage body finish.

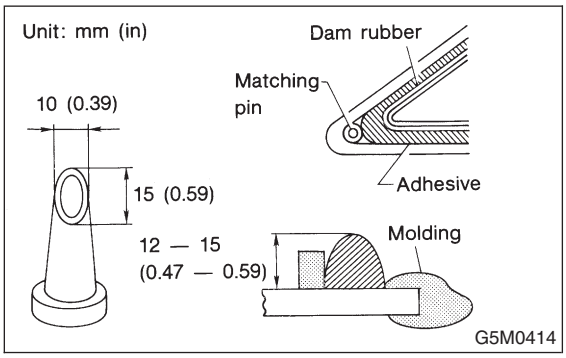


2) Cleaning of body surface:
   (1) Remove chips, dirt and dust from body surface.
   (2) Clean body wall surface and upper surface of adhesive layer with a solvent such as alcohol or white gasoline.
3) Cleaning glass:
   (1) Remove dirt and dust from surface of glass to be adhered.
   (2) Clean surface of glass to be adhered with alcohol or white gasoline.
4) Application of primer:
   (1) Using a sponge, apply primer to surface of glass to be adhered.
   (2) Apply primer to surface of body to be adhered.

CAUTION:
● If primer has dropped on body finish, it is hard to wipe it off. So protect with masking.
● Primer must not project from black frame of glass.
● After applying primer, let it dry spontaneously for about 10 minutes.

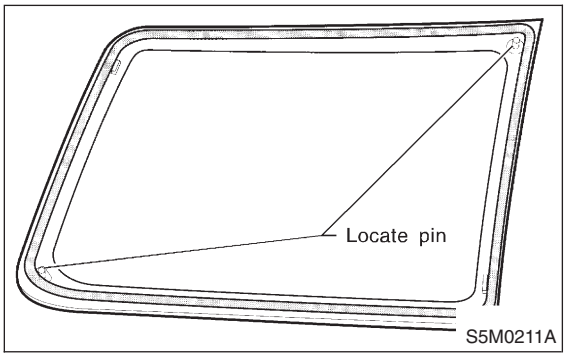


5) Application of adhesive:
(1) Cut nozzle tip as shown in figure.



(2) Open cartridge and put it into a gun with nozzle attached.
(3) Apply adhesive uniformly to all sides of adhesion surface while operating gun along glass end face.

6) Installation of glass:
(1) Hold glass with rubber suction cups.
(2) Mount glass on body with matching pin aligned.



(3) Stick them fast by pressing all sides lightly.

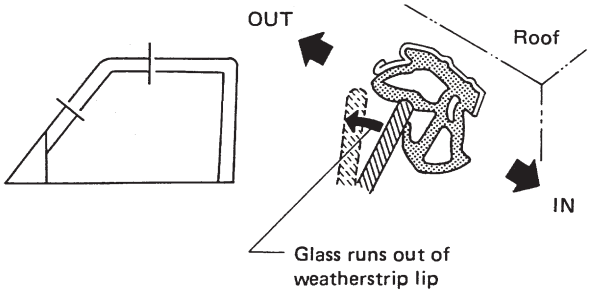
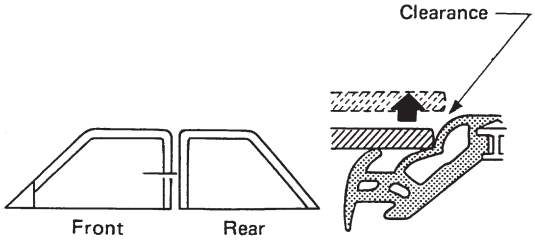
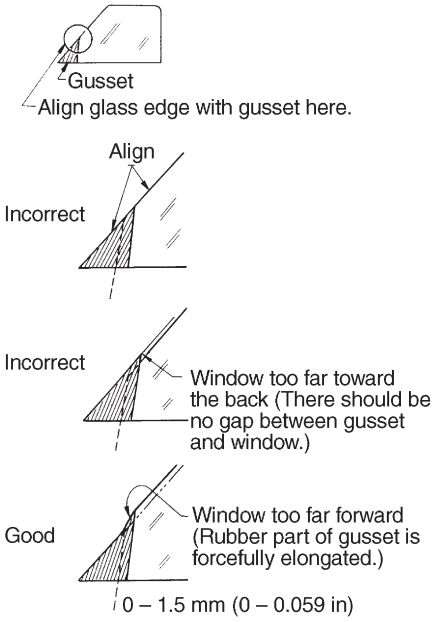
7) Water leakage test:
After installing glass, test for water leakage after about one hour.

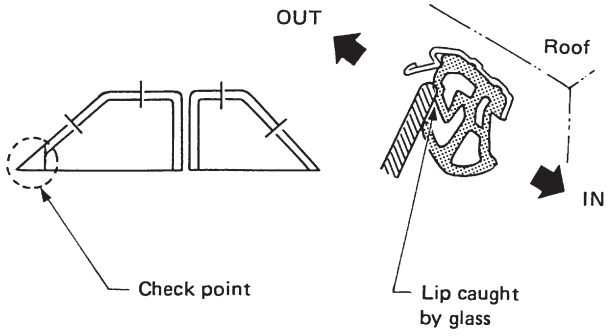
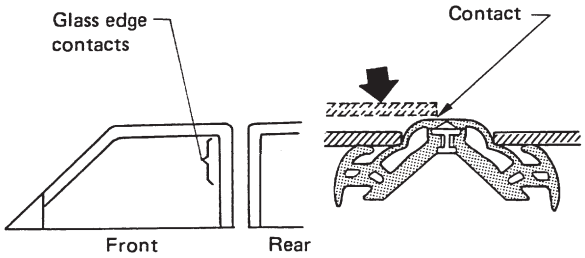
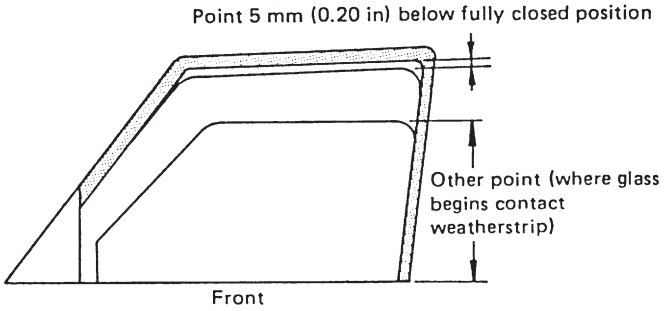
CAUTION:
- **Move vehicle slowly.**
- **When opening and closing door, lower door glass and move door gently.**
- **Do not squirt strong hose stream on vehicle.**

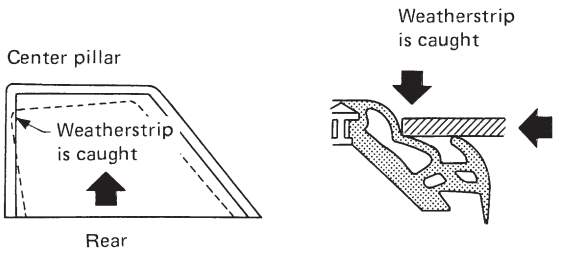
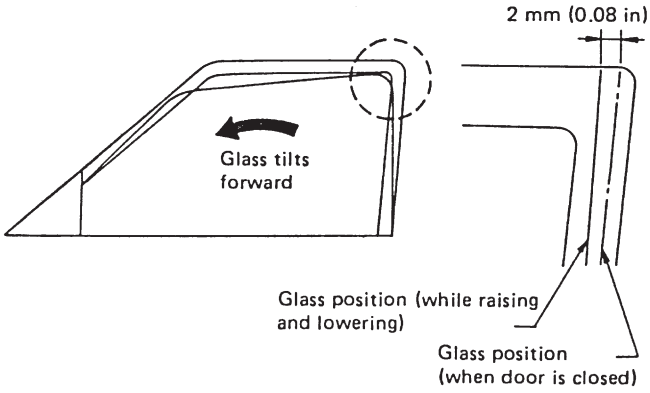
8) Spontaneous drying:
After completing all operations, leave vehicle alone for 24 hours.

CAUTION:
When delivering vehicle to user, tell him or her that vehicle should not be subjected to heavy shocks for at least three days.

1. Door Glass

	Condition	Apparent cause/Correction
Glass in fully closed position	1) Glass runs out of weatherstrip lip when considerable hand pressure is applied to it from inside.  G5M0502 (This condition may cause wind/booming noise during high-speed operation.)	• Insufficient upward travel of glass Increase upward travel of glass.
	2) Clearance exists between glass and weatherstrip when light hand pressure is applied to it at center and rear pillar locations.  G5M0503 (This condition may cause wind noise and/or water leakage.)	• Insufficient glass-to-door weather-strip contact Check stabilizer and glass for proper contact. Increase contact using upper sash adjustment bolt. • Improper adjustment of striker in in-out direction Close door and check for alignment of striker with vehicle body.
	3) Adjust door glass so that it is aligned with door rearview mirror gusset.  H5M0672A	• Window is not properly adjusted in up-down/fore-aft direction. Adjust window. If necessary, move B channel regulator to eliminate window tilt. • Gusset is not properly adjusted in fore-aft direction. Adjust gusset after loosing all bolts and nuts witch tightening it.

	Condition	Apparent cause/Correction
Door in fully closed/ open position	1) Glass rides over weatherstrip lip when door is closed.  G5M0505 (This condition increases wind/booming noise, leakage and/or effort required to close door.)	• Improper up-down and in-out glass alignments Adjust glass for up-down and in-out alignments (incl. rear sash, upper stopper adjustment, etc.). If necessary, correct glass tilt by moving B channel regulator.
	2) Edge of glass contacts retainer when door is fully closed.  G5M0506	• Improper glass-to-center pillar weatherstrip or excessive glass contact to weatherstrip • Excessive adjusting in contact to weatherstrip Causes rear edge of glass to tilt inboard closer to center pillar. Adjust rear sash adjustment bolt to reduce glass contact to weatherstrip.
Raise or lower window glass	1) Considerable effort or time is required to operate regulator. Standard operating effort: • Entire up-down travel except for point 5 mm (0.20 in) below fully closed position: 29.4 N (3.0 kg, 6.6 lb) • Point 5 mm (0.20 in) below fully closed position: 44.1 N (4.5 kg, 9.9 lb)  G5M0507	• Sliding resistance increased due to high stabilizer-to-glass contact pressure. Reduce contact by mounting inner stabilizer to inside of the vehicle. • High glass-to-windshield contact pressure Reduce contact using upper sash adjustment bolt. • Unequal contact adjustment stroke between front and rear sashes Set to equal stroke. • Tilt of rear sash adjustment bolt mounting bracket Correct tilt of bracket so it is parallel to inner panel.

	Condition	Apparent cause/Correction
Raise or lower window glass	2) Center pillar weatherstrip is caught by rear window glass when glass is raised.  G5M0508	• Improper fore-aft or in-out alignment of window glass Lower B channel regulator to tilt window glass back.
	3) Window glass tilts forward by more than 2 mm (0.08 in).  G5M0509 Excessive tilt of glass forward is due to excessive glass "contact" which causes reaction of center pillar weatherstrip. Glass can be tilted forward due to increase in reaction of shoulder weatherstrip or free play between sash and roller. Taking these symptoms into account, glass should be aligned.	• Excessive glass contact pressure or improper in-out alignment 1) Lower B channel regulator to tilt window glass rearward. 2) Reduce contact pressure using upper sash adjustment bolt.

2. Door Lock System

No.	Trouble	Possible cause	Remedy
1	Door cannot be opened by outer handle. (Door can be opened by inner handle.)	Disconnect outer handle rod.	Connect firmly.
2	Door cannot be opened by inner handle. (Door can be opened by outer handle.)	a. Joint of upper rod is disconnected. b. Rear door child lock lever is set to lock side.	Connect firmly. Functionally normal.
3	Door does not open when outer or inner handle is operated with inner lock knob set to unlock position.	a. Joint of lower rod is disconnected. b. Lock is not released due to improper adjustment of lower rod.	Connect firmly. Remove rod from latch. Adjust rod so that lock knob is set in “lock” position is locked.
4	Door opens even when inner lock knob is set to lock position. (Keyless locking is impossible.)	a. Lower rod joint is separated. b. Door is not locked due to improperly adjusted lower rod.	Same as a in No. 3. Same as a in No. 3.
5	Child lock lever will not come up.	a. Inner handle fails to return completely. b. Joint of upper rod is disconnected.	Refer to No. 6.
6	Inner handle stops halfway.	Contact of upper rod with inner handle mounting case.	Eliminate contact by bending upper rod properly.
7	Door cannot be locked or unlocked by key.	Joint of key lock rod is disconnected.	Connect firmly.
8	Auto door-lock switch does not act when inner lock knob is pushed.	Auto door-lock switch does not act due to improperly adjusted lower rod.	Same as a in No. 3.

3. Power Window

	Symptom			
	All windows do not move.	The window of driver side does not move.	The window of driver side does not move “AUTO” down.	The window of each passenger sides does not move.
Battery	(1)			
Fuse in fuse box	(2)			
Circuit breaker and relay	(3)			
Main switch	(4)	(1)	(1)	(1)
Sub switch of each passenger sides				(2)
Motor of driver side		(2)	(2)	
Motor of each passenger sides				(3)
Regulator assembly of each windows				(4)
Power supply line of main switch	(5)	(3)	(3)	
Ground line	(6)			
Haness and connector	(7)	(4)	(4)	(5)
( ): Figures in a parenthesis refer to diagnostics procedures.				

MEMO:

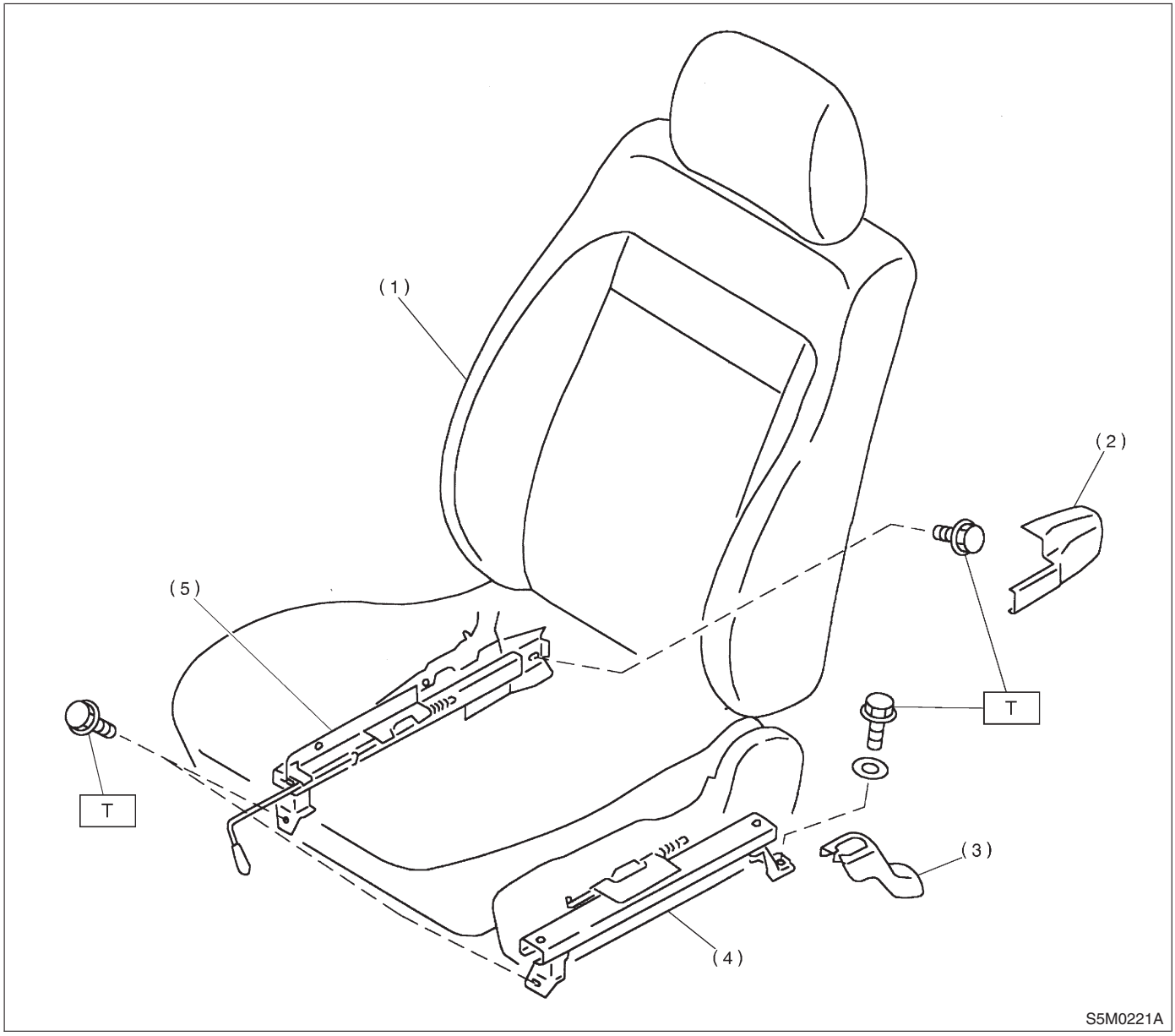
SEATS, SEAT BELTS AND INTERIOR 5-3

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3. Front Seat Belt 4
4. Rear Seat Belt 5
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6. Inner Trim 7

W SERVICE PROCEDURE 8
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3. Front Seat Belt 10
4. Rear Seat Belt 11
5. Inner Trim Panel 12

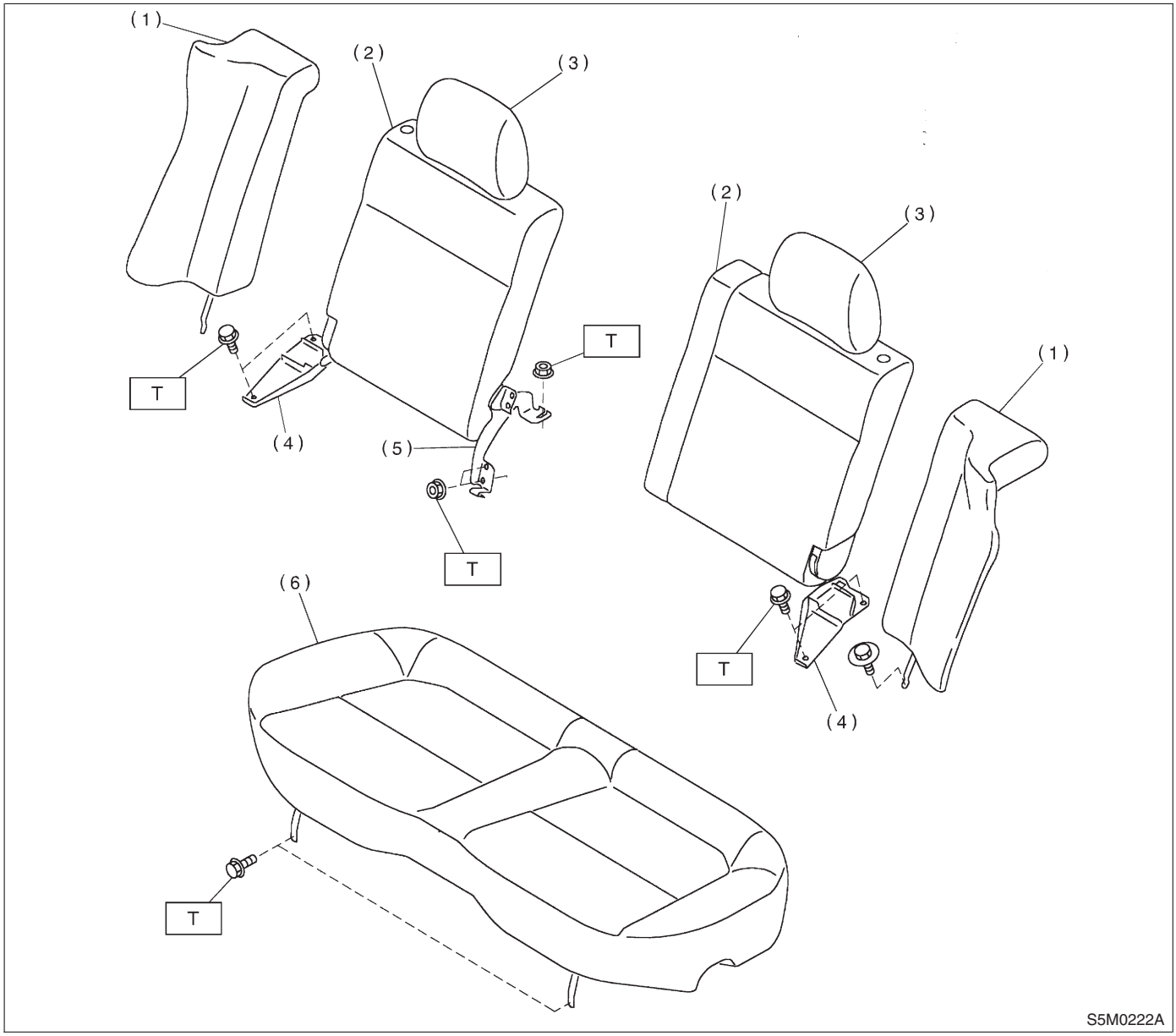
1. Front Seat



(1) Front seat ASSY
(2) Rail cover RH
(3) Rail cover LH
(4) Slide rail LH
(5) Slide rail RH

Tightening torque: N·m (kg-m, ft-lb)
T: 52±10 (5.3±1.0, 38±7)

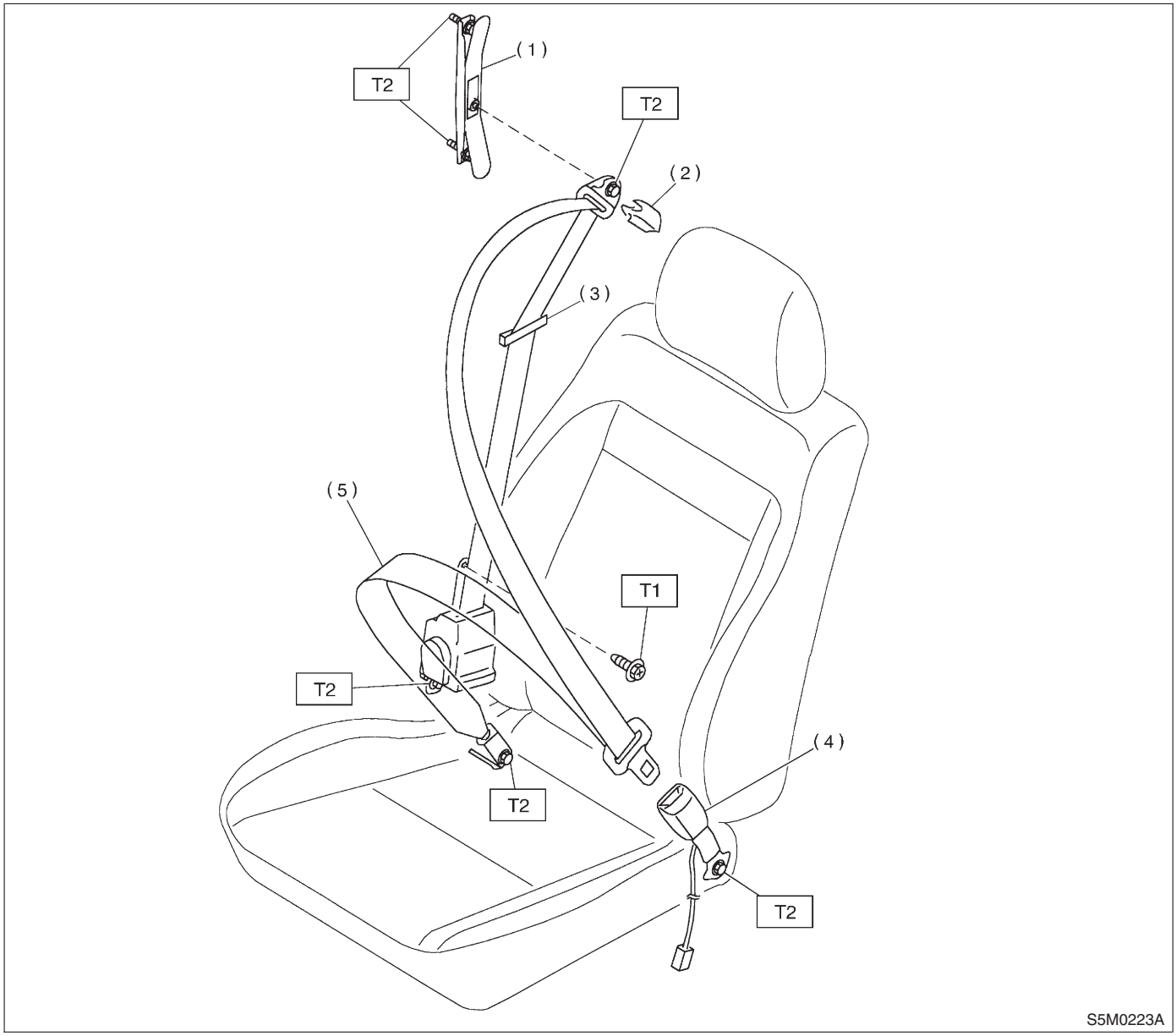
2. Rear Seat



(1) Side pad
(2) Backrest
(3) Pillow
(4) Side hinge
(5) Center hinge
(6) Cushion

Tightening torque: N·m (kg-m, ft-lb)
T: 25±7 (2.5±0.7, 18.1±5.1)

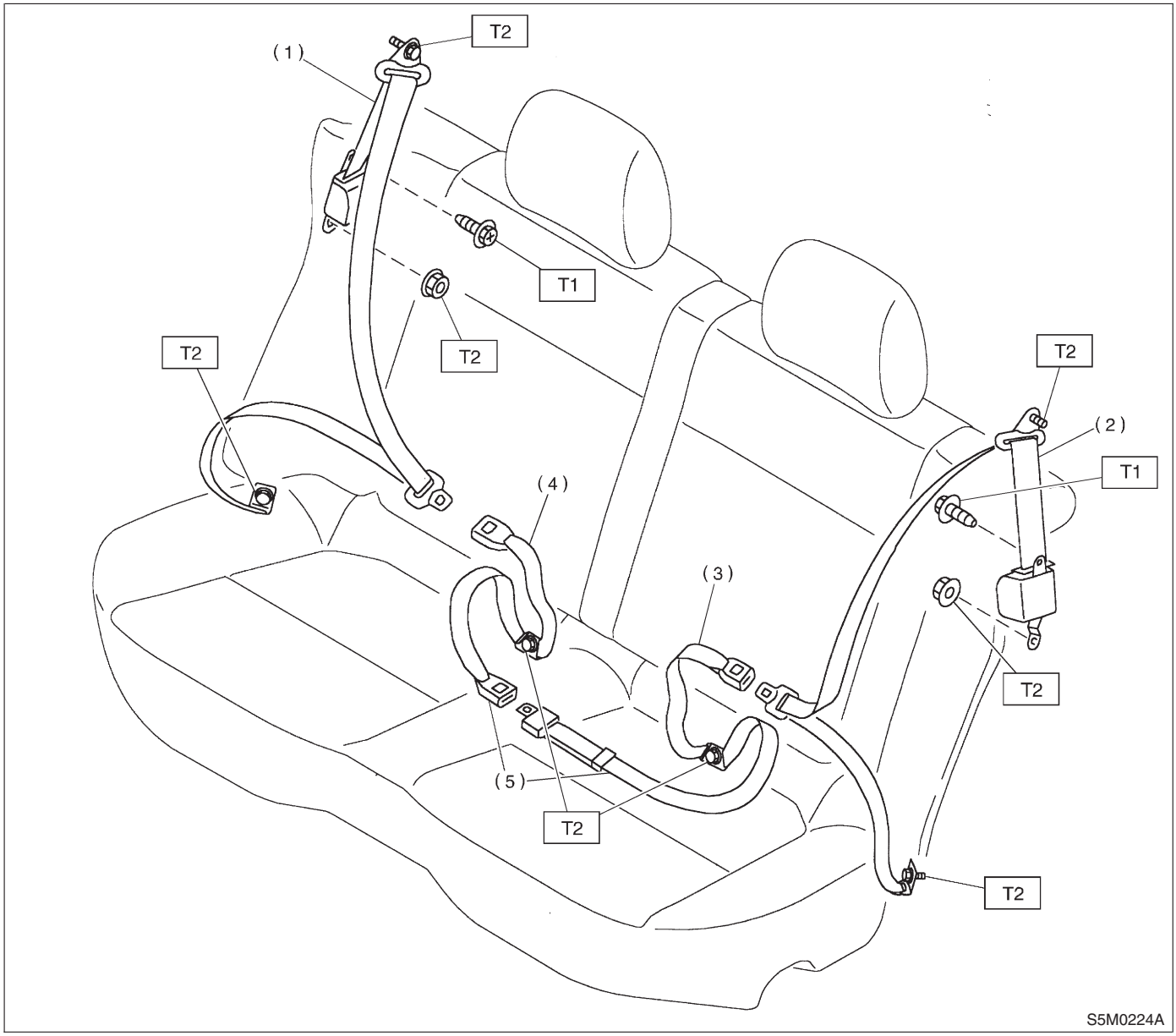
3. Front Seat Belt



(1) Adjuster anchor ASSY
(2) Anchor cover
(3) Webbing guide
(4) Inner belt ASSY
(5) Outer belt ASSY

Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 29^{+20}_{-7} ($3.0^{+2.0}_{-0.7}$, $21.7^{+14.5}_{-5.1}$)

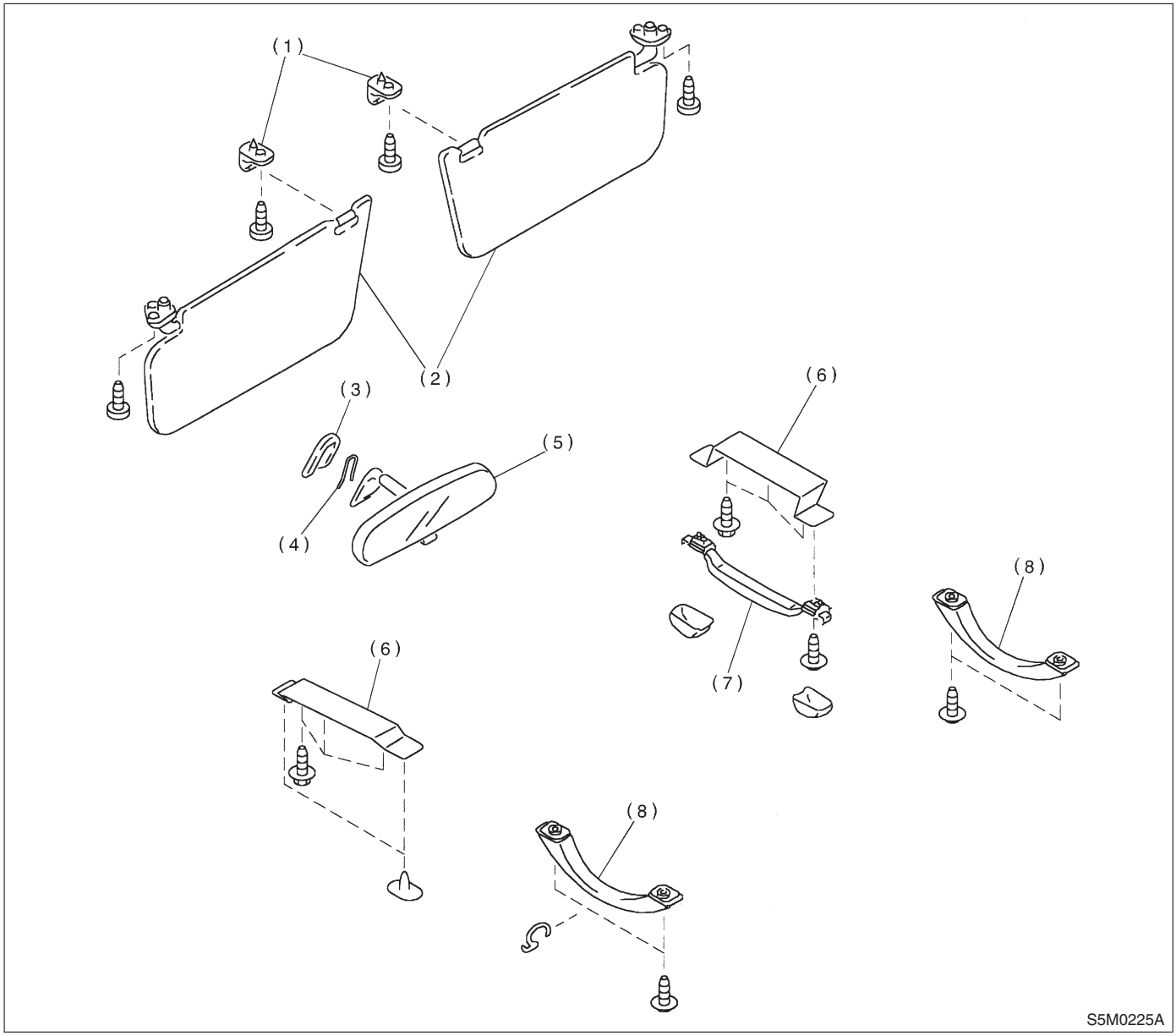
4. Rear Seat Belt



(1) Outer seat belt RH
(2) Outer seat belt LH
(3) Inner seat belt LH
(4) Inner seat belt RH
(5) Center seat belt

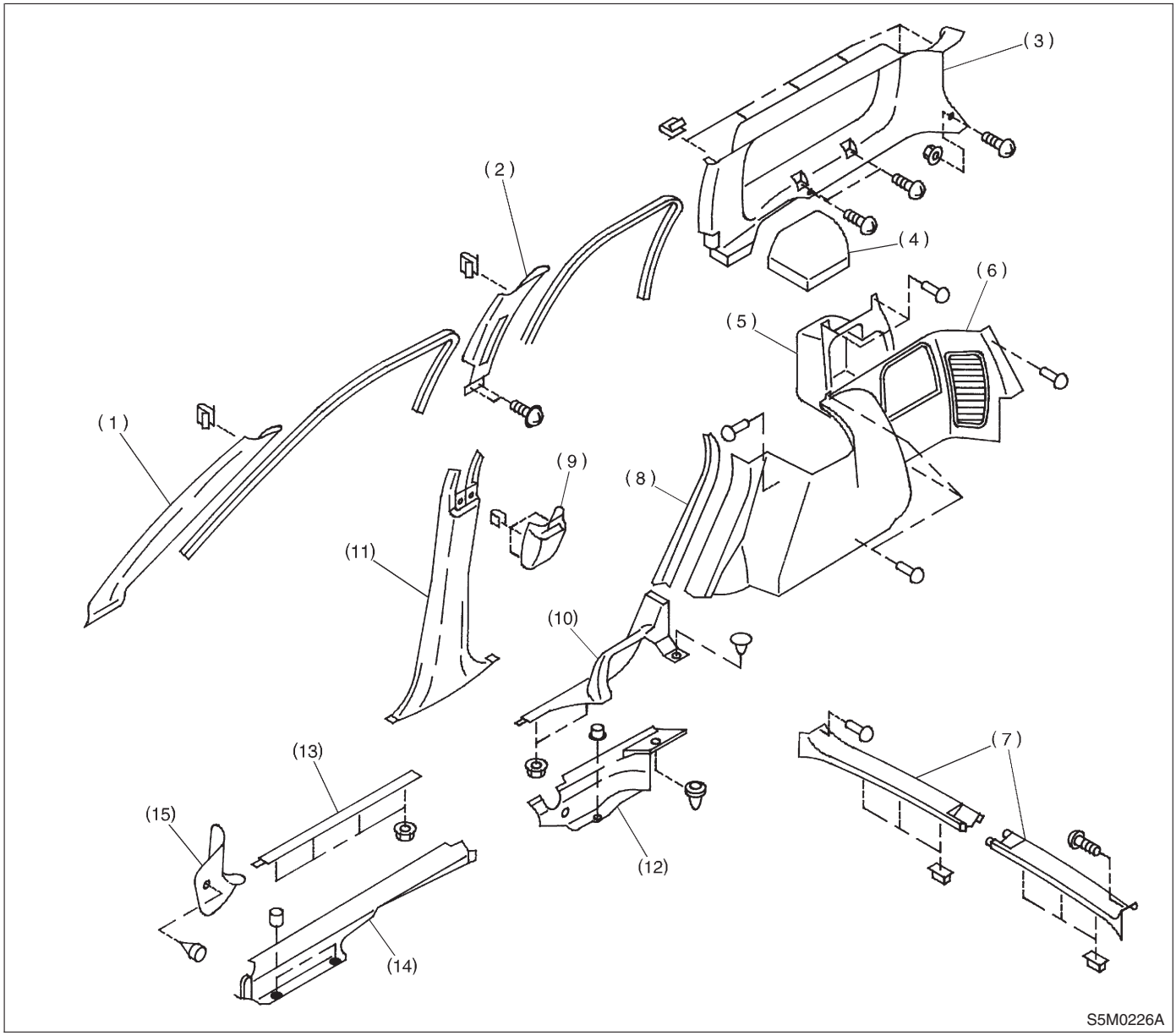
Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 29^{+20}_{-7} ($3.0^{+2.0}_{-0.7}$, $21.7^{+14.5}_{-5.1}$)

5. Inner Accessories



(1) Hook
(2) Sun visor
(3) Mount
(4) Spring
(5) Rearview mirror
(6) Assist rail bracket
(7) Assist grip (retractable)
(8) Assist grip (fixed)

6. Inner Trim

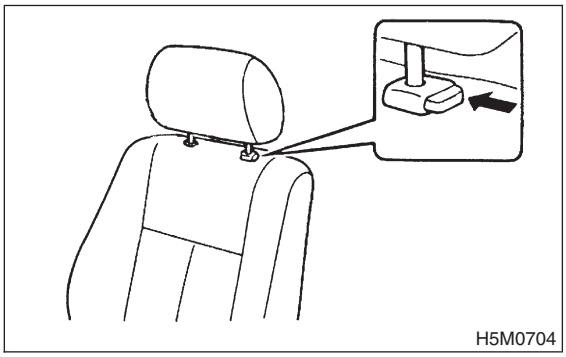


(1) Front pillar upper trim
(2) Center pillar upper trim
(3) Rear quarter upper trim
(4) Cover
(5) Pocket
(6) Rear quarter lower trim
(7) Rear skirt trim
(8) Rear pillar lower trim
(9) Center pillar cover
(10) Side sill rear upper cover
(11) Center pillar lower trim
(12) Side sill rear lower cover
(13) Side sill front upper cover
(14) Side sill front lower cover
(15) Front pillar lower trim

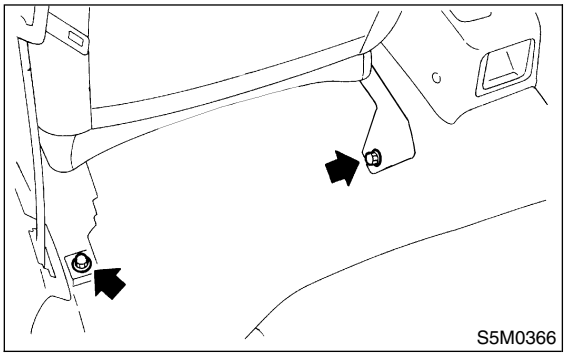
1. Front Seat

A: REMOVAL

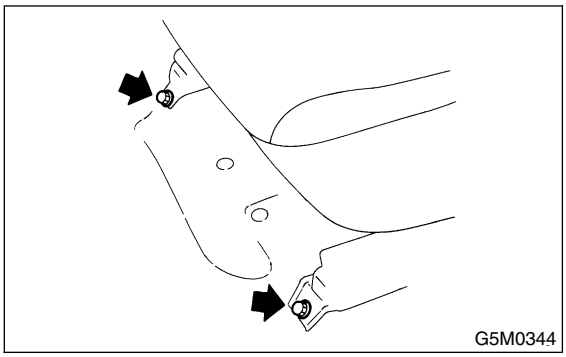
1) While operating button (located on top of backrest), lift headrest out with hand placed between backrest and headrest.



2) Pull reclining lever back to fold backrest all the way forward. While pulling slide adjuster lever, move seat all the way forward.
3) Remove bolt cover at rear end of slide rail.
4) Remove bolts securing seat rear.



5) While pulling slide adjuster lever, slide seat all the way back.
6) Remove bolts securing front of seat.

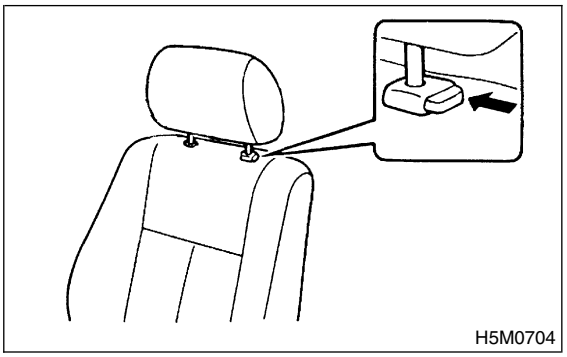


7) Remove front seat from vehicle.

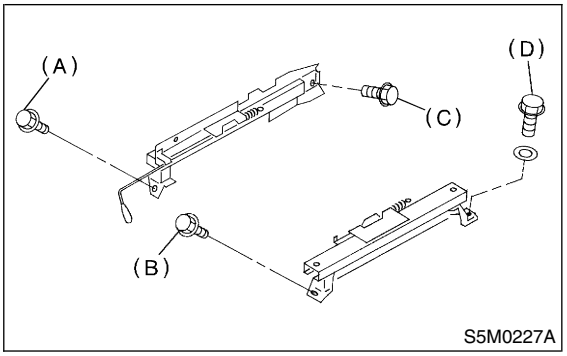
CAUTION:
Be careful not to scratch seat when removing it from vehicle.

B: INSTALLATION

1) While operating button (located on top of backrest), lift headrest out by placing your hand between backrest and headrest.



2) Pull reclining lever back to fold backrest all the way forward. Pull slide adjuster lever and move lower slide rail all the way backward.
3) Position seat in compartment and align the holes on the seat with the holes on the car body side.
4) Secure the front of seat using inward and outward bolts (A) and (B) in that order.
5) While pulling slide adjuster lever, move seat all the way forward.
6) Secure the rear of seat using inward and outward bolts (C) and (D).



7) Connect connector under driver's seat.

CAUTION:
Check that all lock plate pawls are completely and equally inserted into the holes in the slide rail brackets.

8) After installation, ensure that all mechanisms operate properly and lock.
9) If any mechanism does not function properly, loosen bolts (C) and (D), slide seat as required, insert all lock plate pawls into holes in slide rail brackets, and tighten bolts (C) and (D) in that order.
10) Install bolt cover on rear end of slide rail.
11) Install headrest on backrest.

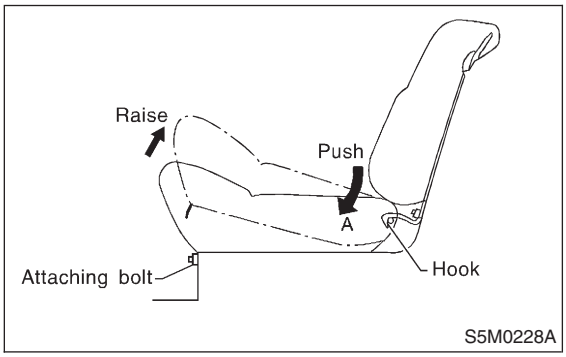
NOTE:
Tighten bolts in the designated order.

2. Rear Seat

A: REMOVAL AND INSTALLATION

1. CUSHION

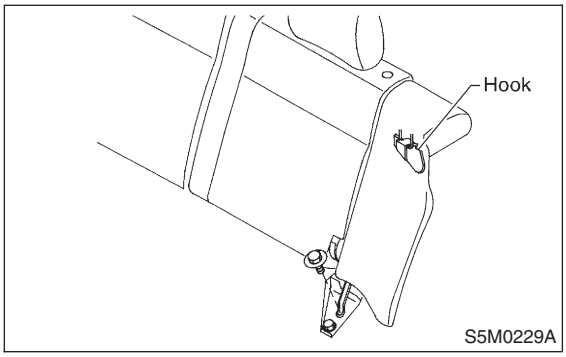
1) Remove bolts securing hinges (located at front of cushion) to body.
2) Slightly raise front of cushion while pushing down on cushion in the direction of “A”. With cushion held in that position, move it forward until it is unhooked.



3) Installation is in the reverse order of removal.

2. SIDE PAD

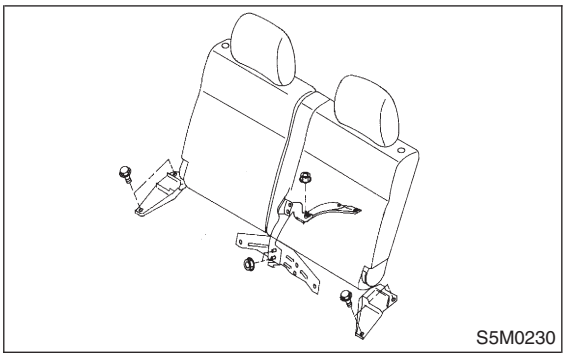
1) Remove cushion.
2) Remove bolt and then release hook.
3) Detach side pad.



4) Installation is in the reverse order of removal.

3. BACKREST

1) Remove cushion.
2) Remove side pad.
3) Remove bolts and nuts.
4) Detach backrest.



5) Installation is in the reverse order of removal.

CAUTION:
● Before installing seat, ensure that seat belt is placed on cushion.
● Confirm that winding of three-point type seat belt can operate regularly.

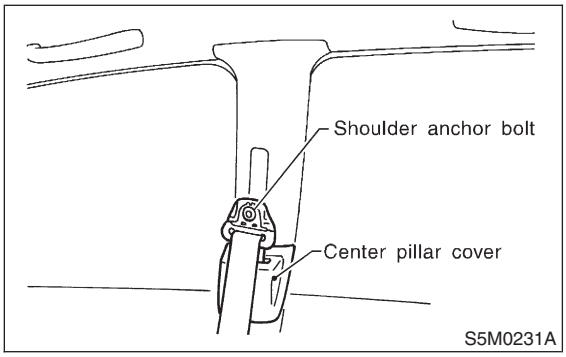
3. Front Seat Belt

A: REMOVAL AND INSTALLATION

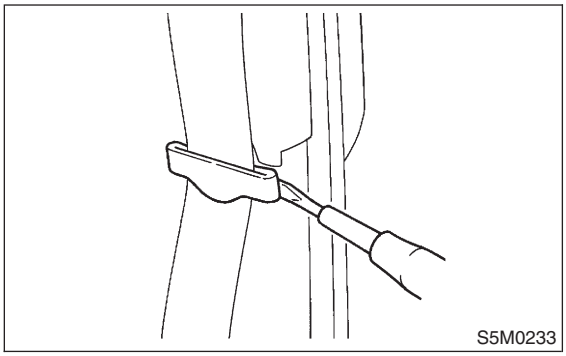
WARNING:
Replace front seat belt worn by occupants of a vehicle that has been in a serious accident. The entire assembly should be replaced even if damage is not obvious.

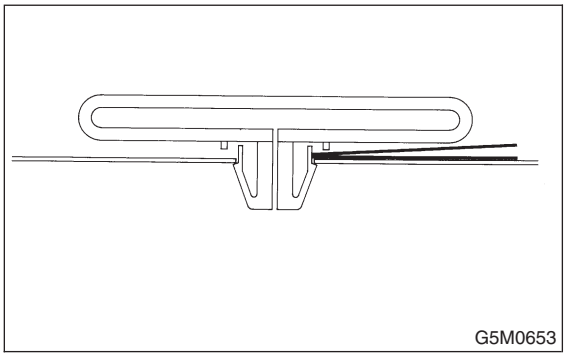
1. OUTER BELT

1) Remove anchor cover.
2) Remove shoulder anchor bolt.
3) Remove center pillar cover.

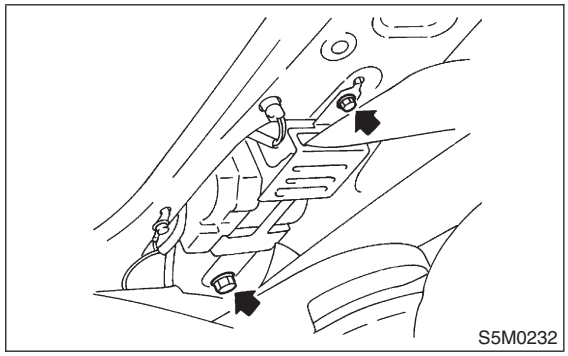


4) Remove center lower pillar trim panel.
5) Remove webbing guide.





6) Remove lap anchor bolt.
7) Remove belt retractor and outer belt.

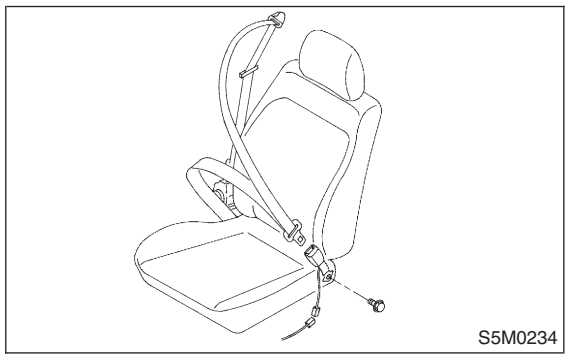


8) Installation is in the reverse order of removal.

CAUTION:
• The left and right ELR's are not mutually interchangeable because different sensors are used.
• Be careful not to twist belts during installation.

2. INNER BELT

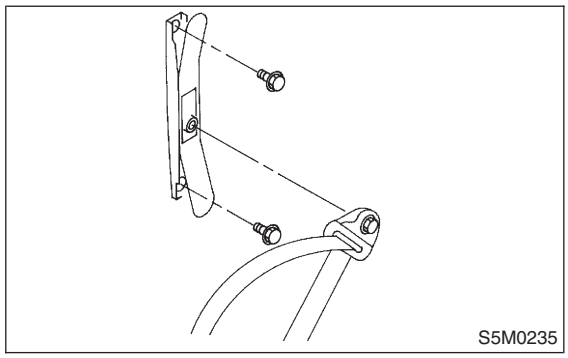
1) Disconnect connector.
2) Remove anchor bolt and then detach inner belt.



3) Installation is in the reverse order of removal.

3. ADJUSTABLE SHOULDER ANCHOR

1) Remove shoulder anchor bolt.
2) Remove center pillar cover.
3) Remove center pillar upper trim.
4) Remove adjustable shoulder anchor assembly.



5) Installation is in the reverse order of removal.

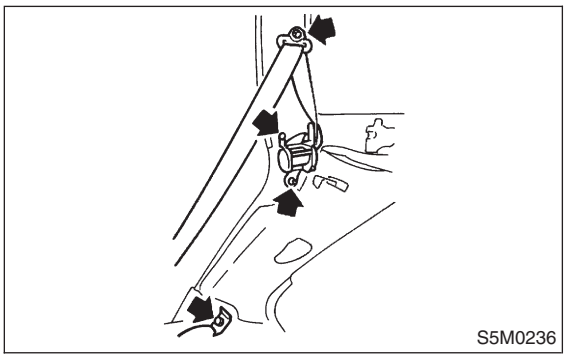
4. Rear Seat Belt

A: REMOVAL AND INSTALLATION

WARNING:
Replace rear seat belt worn by occupants of a vehicle that has been in a serious accident. The entire assembly should be replaced even if damage is not obvious.

1. OUTER BELT

1) Remove rear cushion and side pad.
2) Remove rear backrest.
3) Remove rear quarter upper trim and rear quarter lower trim.
4) Remove anchor bolts.
5) Remove bolt and nut and then detach outer belt assembly.



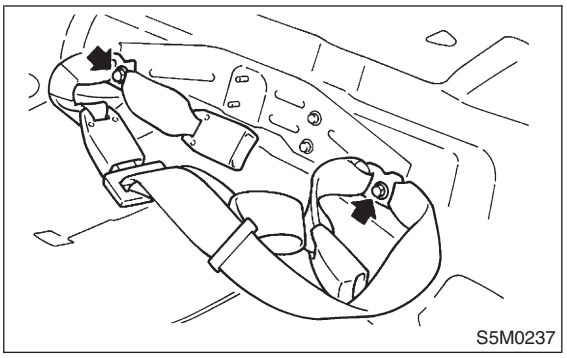
6) Installation is in the reverse order of removal.

NOTE:
Ensure that seat belt is properly reeled on and off after installation of ELR.

CAUTION:
• Be extremely careful not to confuse center seat anchor plate with outer seat anchor plate during installation.
• Ensure that seat belts are free from twisting after installation.
• Ensure that tongues, buckles and belts are properly placed on seat.

2. INNER BELT AND CENTER BELT

1) Remove rear cushion.
2) Remove bolts and then remove inner belt and center belt.



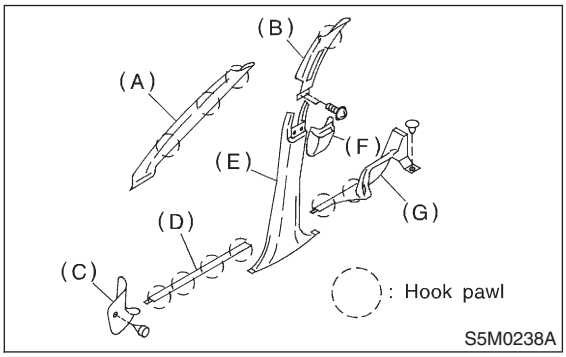
3) Installation is in the reverse order of removal.

5. Inner Trim Panel

A: REMOVAL AND INSTALLATION

1. FRONT SECTION

1) Removal order of trim panel:
   (1) Remove front pillar upper trim (A).
   (2) Remove front pillar lower trim (C).
   (3) Remove side sill front upper cover (D).
   (4) Remove rear seat cushion and then remove side sill rear upper cover (G).
   (5) Remove center pillar cover (F).
   (6) Remove screws and then remove center pillar upper trim (B).
   (7) Remove center pillar lower trim (E).

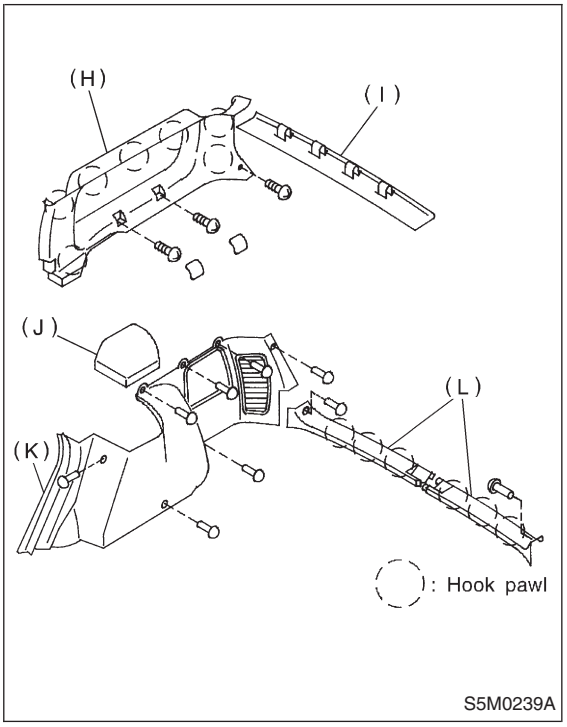


2) Installation is in the reverse order of removal.

CAUTION:
Be sure to securely hook pawls of inner trim panel on body flange.

2. REAR SECTION

1) Removal order of trim panel:
   (1) Remove rear rail trim (I).
   (2) Remove strut cover (J).
   (3) Remove caps and screws then remove rear quarter upper trim (H).
   (4) Remove rear skirt trim (L).
   (5) Remove rear floor box and then remove rear quarter lower trim (K).



2) Installation is in the reverse order of removal.

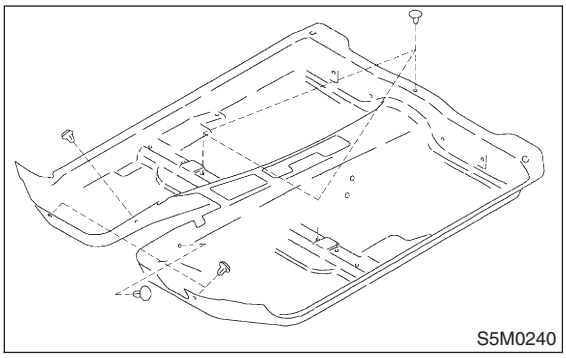
CAUTION:
Be sure to securely hook pawls of inner trim panel on body flange.

3. FLOOR SECTION

1) Removal order of floor mat:
   (1) Remove front seats.
   (2) Remove rear seat cushion.
   (3) Remove console box, depending on the specifications.
   (4) Remove front pillar lower trim panel.
   (5) Remove center pillar lower trim panel.
   (6) Remove side sill cover.
   (7) Remove clips from floor mat.

NOTE:
When pulling out edge, do not pull mat alone; pull mat together with edge. Pry off two steel clips on side sill front cover and one on side sill rear cover using screwdriver.

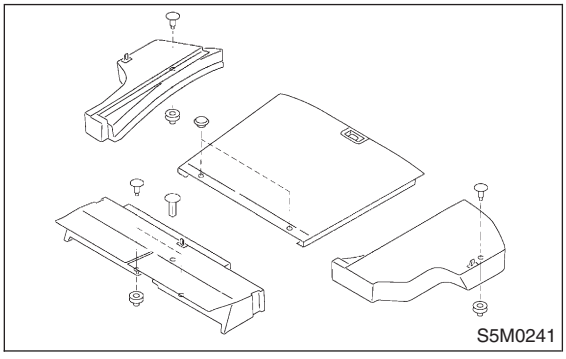
   (8) Remove mat hook.
   (9) Remove mat from toe board area.
   (10) Remove mat from rear heater duct.
   (11) Roll mat, and take it out of opened rear door.


S5M0240

   (12) Installation is in the reverse order of removal.

NOTE:
- Secure mat firmly with hook and velcro tape.
- Insert mat edge firmly into the groove of side sill cover.

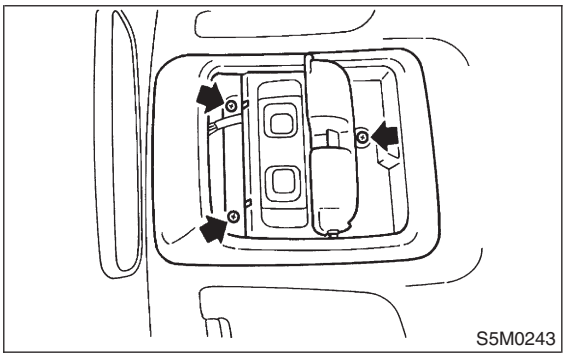
2) Removal order of rear floor box:
   (1) Remove clips and then detach rear floor boxes.


S5M0241

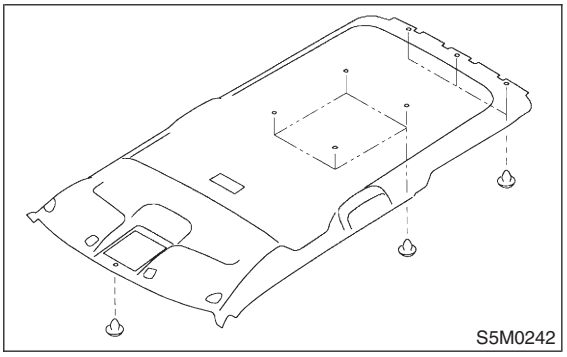
   (2) Installation is in the reverse order of removal.

4. ROOF TRIM

1) Remove head console.


S5M0243

2) Remove sunvisor and assist rail.
3) Remove front pillar upper trim, center pillar upper trim, rear quarter upper trim and rear rail trim.
4) Using ST, remove clips and then detach roof trim.
ST 925580000 PULLER


S5M0242

5) Installation is in the reverse order of removal.

CAUTION:
When removing clip, use great care to prevent damaging the roof trim.

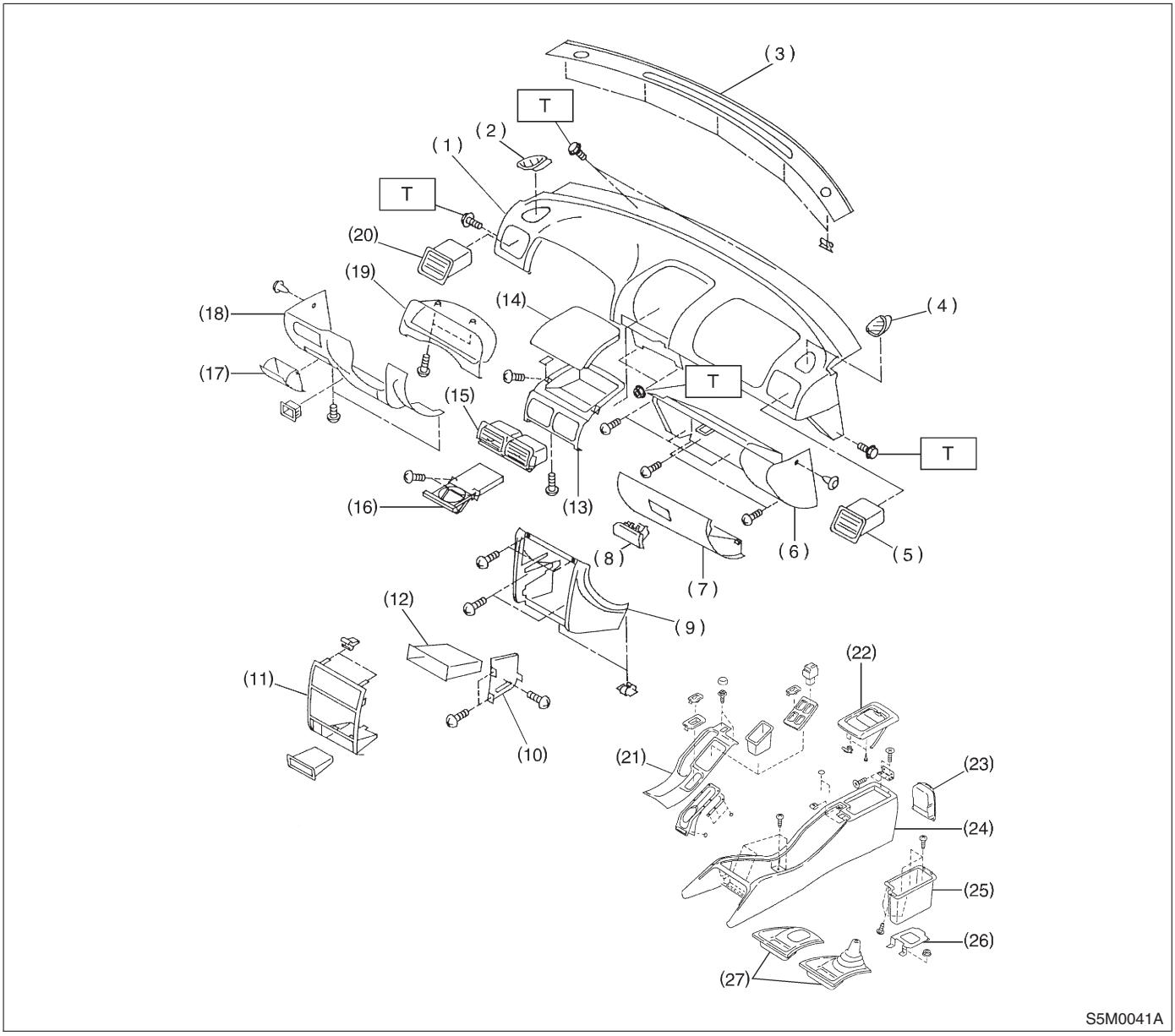
MEMO:

INSTRUMENT PANEL 5-4

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C COMPONENT PARTS 2
1. Instrument Panel 2
W SERVICE PROCEDURE 3
1. Instrument Panel AIRBAG 3

1. Instrument Panel



(1) Pad & frame
(2) Grille side (D)
(3) Front def. grille
(4) Grille side (P)
(5) Grille vent (P)
(6) Glove box panel
(7) Glove box lid
(8) Knob
(9) Instrument panel center console
(10) BRKT (Radio)
(11) Center console cover
(12) Pocket
(13) Panel center
(14) Center pocket lid
(15) Grille center
(16) Cup holder
(17) Side pocket
(18) Lower cover ASSY
(19) Meter visor
(20) Grille vent (D)
(21) Console cover
(22) Console lid
(23) Rear cup holder
(24) Console box
(25) Console pocket
(26) Rear console BRKT
(27) Front cover

Tightening torque: N·m (kg-m, ft-lb)
T: 7±1 (0.7±0.1, 5.1±0.7)

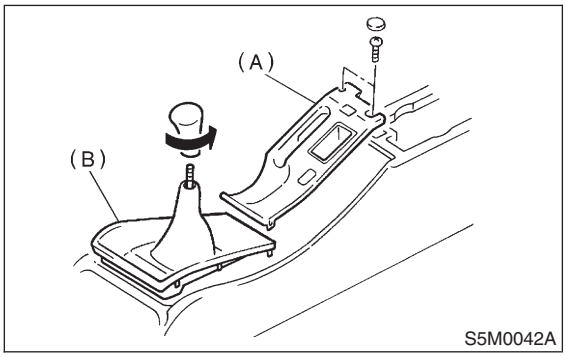
1. Instrument Panel AIRBAG

A: REMOVAL

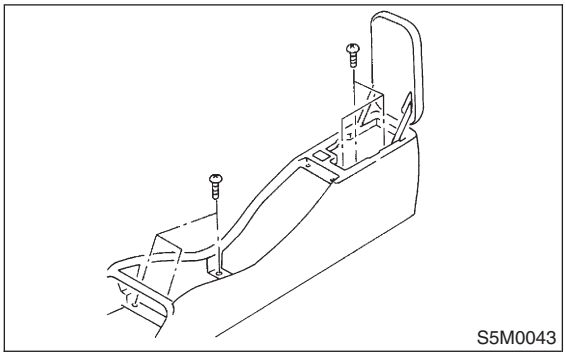
Airbag system wiring harness is routed on steering support beam.

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
• Be careful not to damage Airbag system wiring harness when servicing the instrument panel.

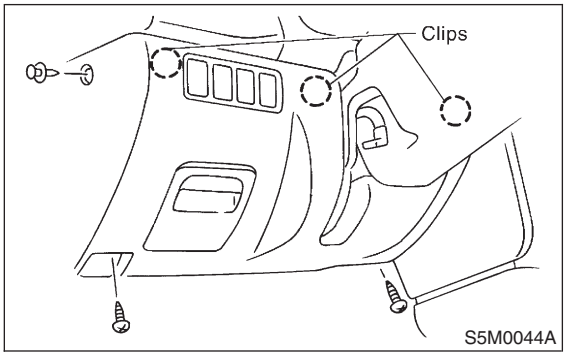
1) Disconnect GND cable from battery.
2) Remove shift knob (MT model).
3) Remove console cover (A) and front cover (B).



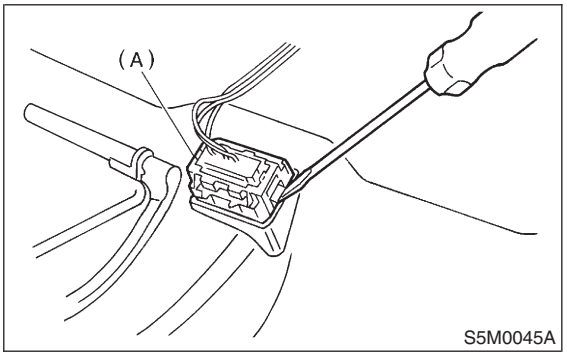
4) Remove console box.



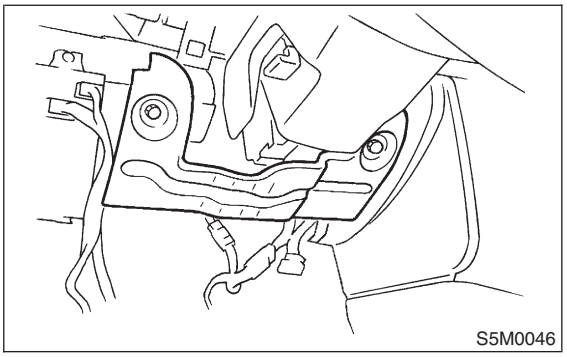
5) Remove lower cover and then disconnect connector.



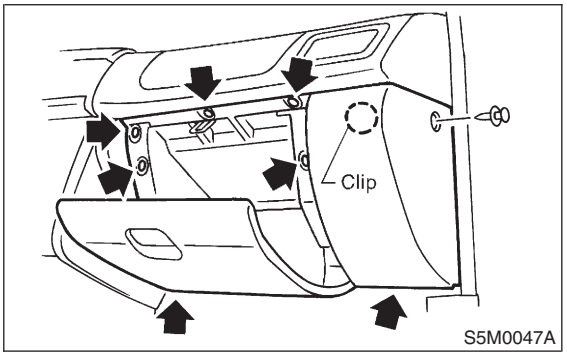
6) Disconnect data link connector (A) from lower cover.



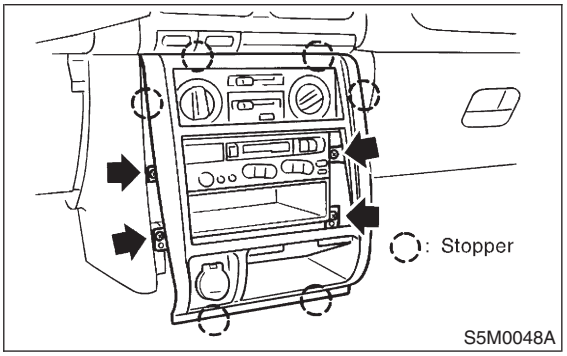
7) Remove knee panel.



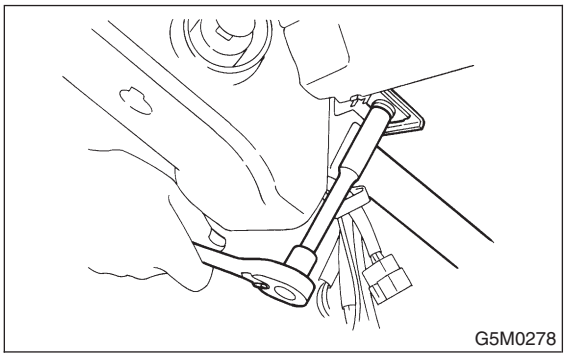
8) Remove glove box.



9) Remove center panel and disconnect connector.
10) Remove audio.



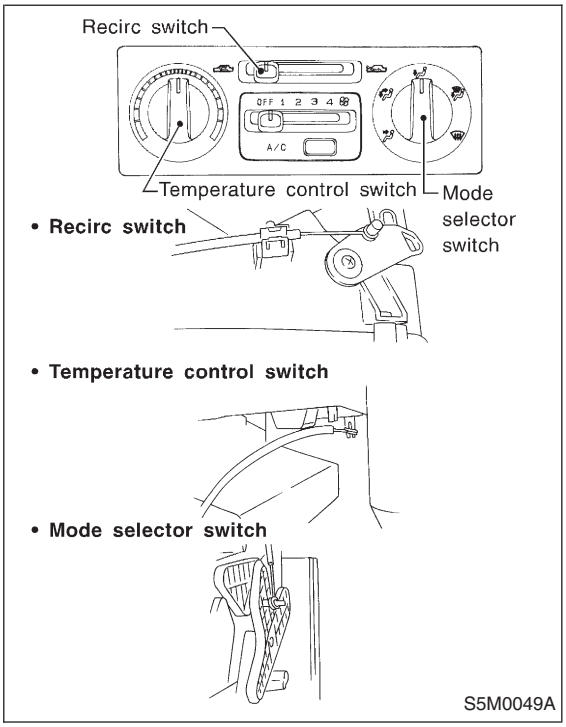
11) Remove two bolts and lower steering column.



12) Set temperature control switch to “FULL HOT”, mode selector switch to “DEF” position and recirc switch to “FRESH” position.

13) Disconnect temperature control cable and mode control cable from heater unit then disconnect recirc control cable from intake unit.

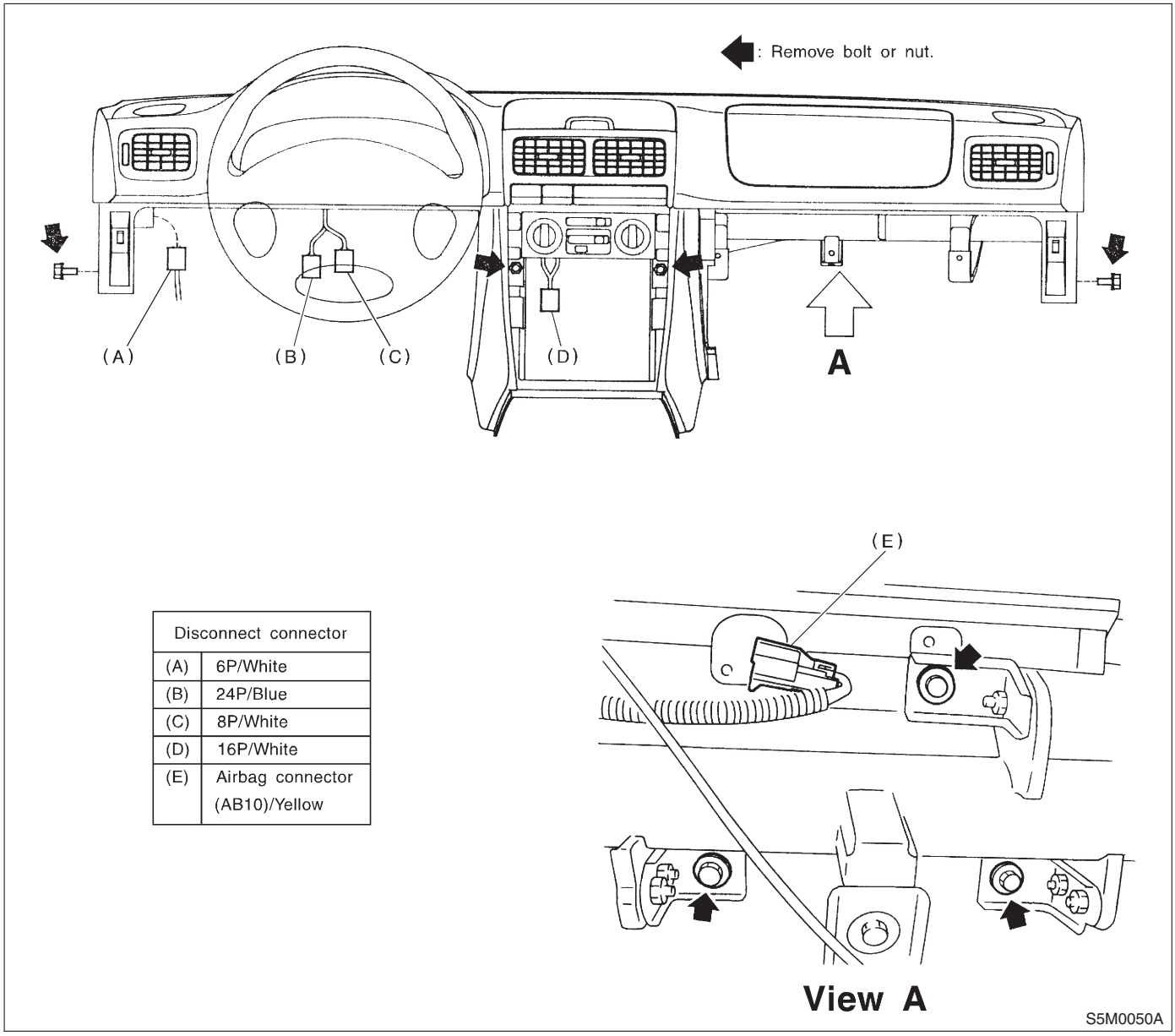
NOTE:
Do not move switch and link when installing.



14) Disconnect harness connectors and then remove the installing bolts and nuts.

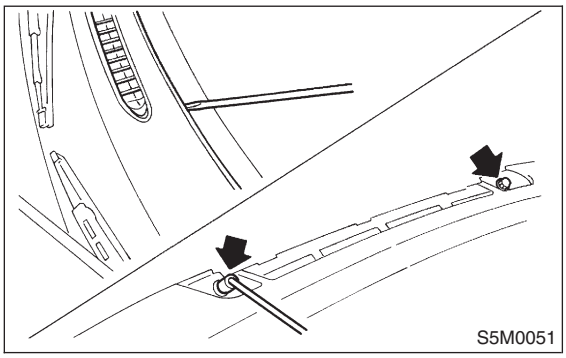
CAUTION:
Be sure to hold socket section and not harness when disconnecting.

NOTE:
Put matching mark, if necessary, for easy reassembly.



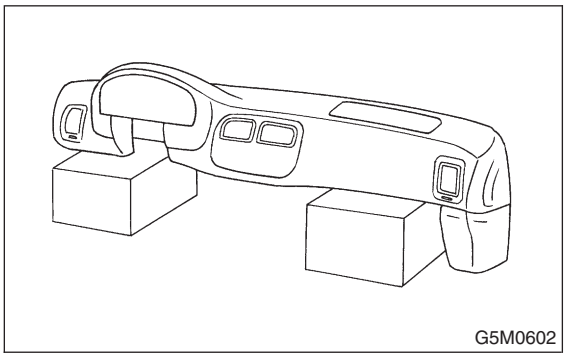
Disconnect connector	
(A)	6P/White
(B)	24P/Blue
(C)	8P/White
(D)	16P/White
(E)	Airbag connector (AB10)/Yellow

15) Remove front defroster grille and two bolts.



16) Remove instrument panel carefully from the body.

CAUTION:
- **Take care not to scratch the instrument panel and related parts.**
- **When storing removed instrument panel with passenger airbag module, place it standing up on the floor.**

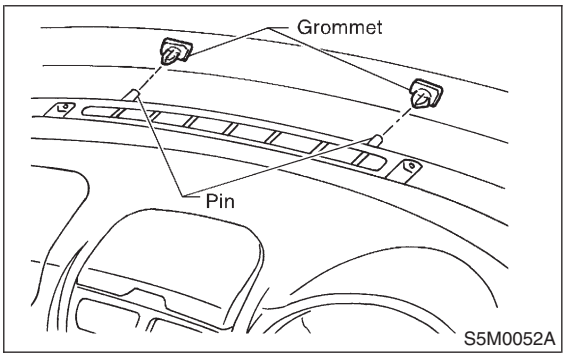


B: INSTALLATION

Installation is in the reverse order of removal.

CAUTION:
- **Be careful not to snag the harness.**
- **Make sure to connect harness connectors.**
- **Take care not to scratch the instrument panel and related parts.**

NOTE:
When setting instrument panel into position, push two pins into grommet on body panel.



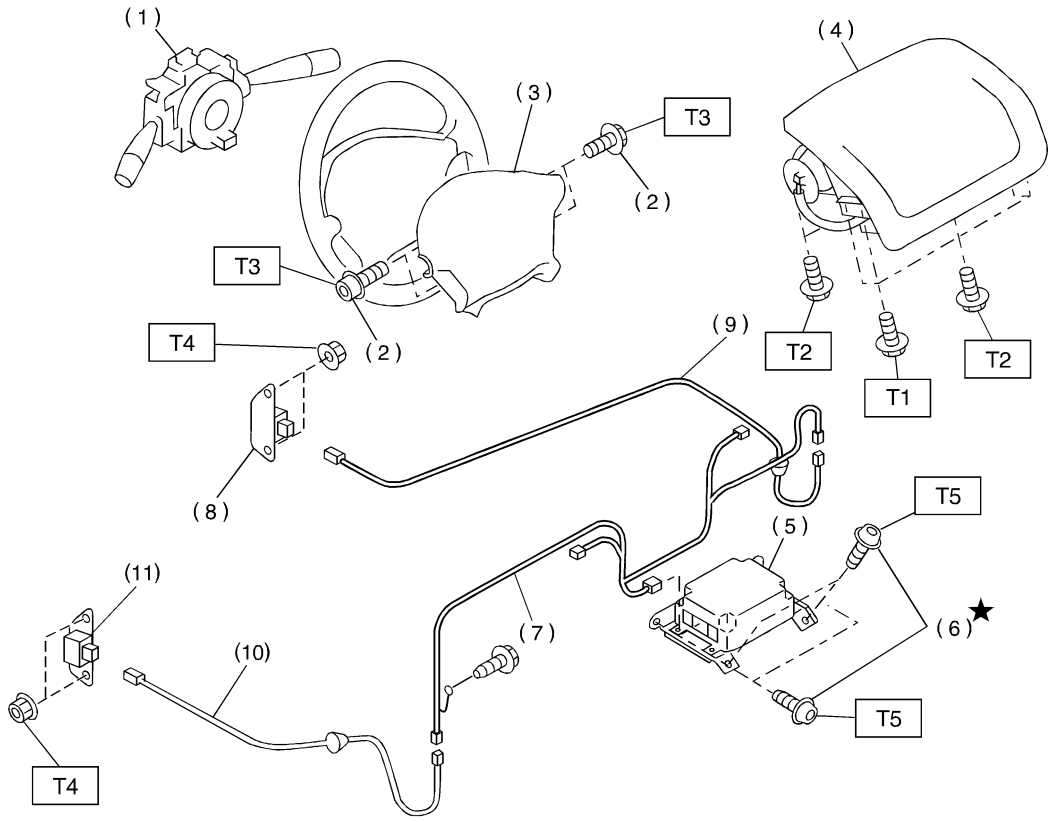
SUPPLEMENTAL RESTRAINT SYSTEM 5-5

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2. Inspection and Replacement Standards 5
3. Airbag Module 8
4. Main Harness 11
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6. Combination Switch 13
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1. SRS Airbag



S5M0360A

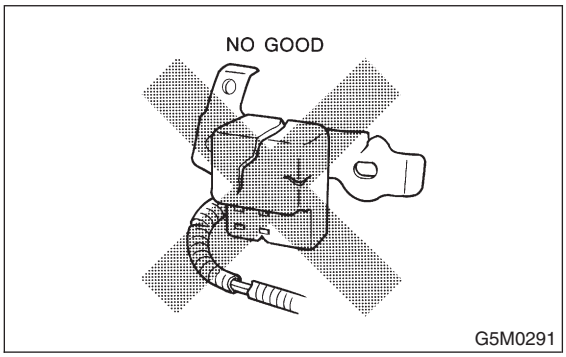
(1) Combination switch ASSY with roll connector
(2) TORX® bolt T30
(3) Airbag module ASSY (Driver)
(4) Airbag module ASSY (Passenger)
(5) Airbag control module
(6) TORX® bolt T40
(7) Airbag main harness
(8) Front sub sensor (RH)
(9) Front sub sensor harness (RH)
(10) Front sub sensor harness (LH)
(11) Front sub sensor (LH)

Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4±1.5 (0.45±0.15, 3.3±1.1)
T2: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T3: 10±2 (1.0±0.2, 7.2±1.4)
T4: 20±4 (2.0±0.4, 14.5±2.9)
T5: 25±2 (2.5±0.2, 18.1±1.4)

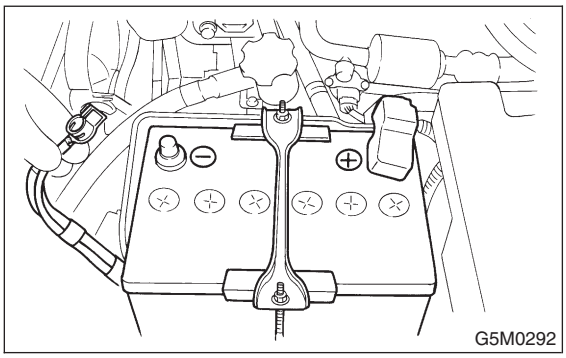
1. General

A: PRECAUTION

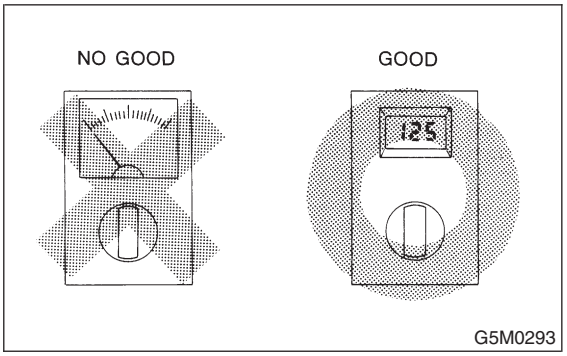
● If any of the airbag system parts such as sensors, airbag module, airbag control module and harness are damaged or deformed, replace with new genuine parts.

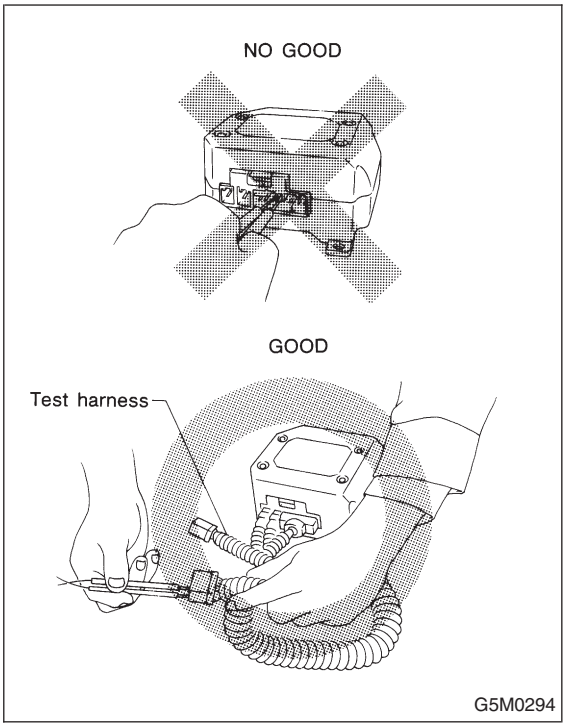


● When servicing, be sure to turn the ignition switch off, disconnect the negative (–) battery terminal then the positive (+) terminal in advance, and wait for more than 20 seconds before starting work.

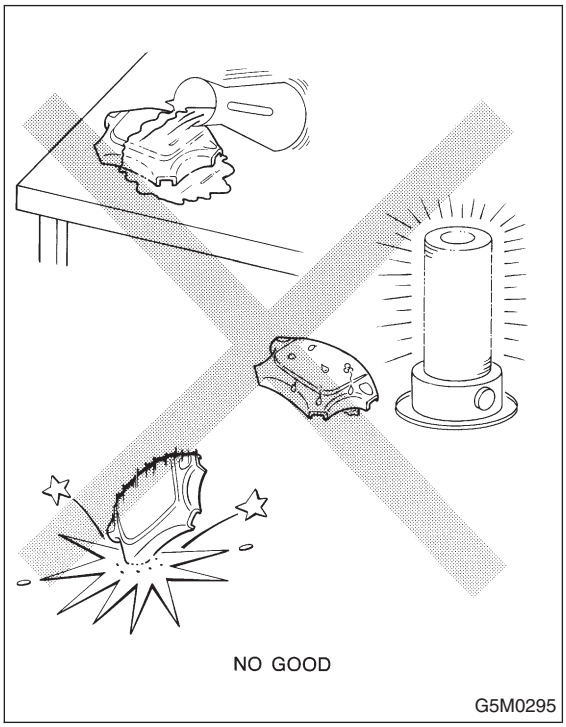


● When checking the system, be sure to use a digital circuit tester. Use of an analog circuit tester may cause the airbag to activate erroneously. Do not directly apply the tester probe to any connector terminal of the airbag. When checking, use a test harness.

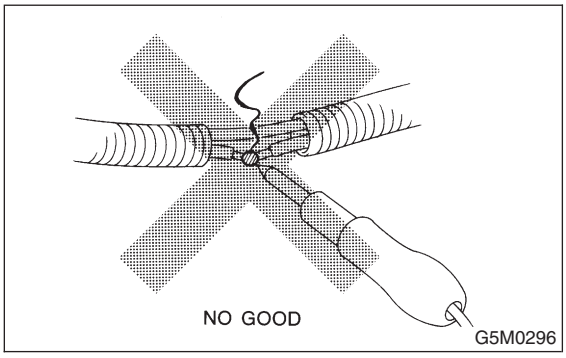




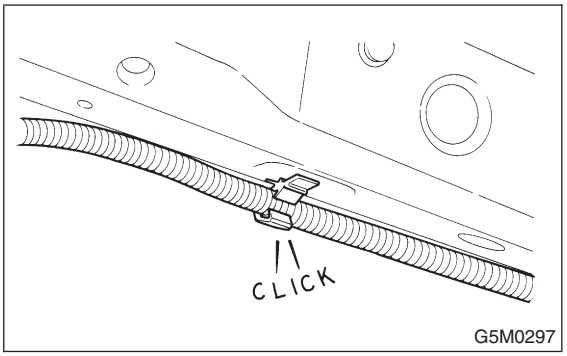
● Do not drop the airbag modulator parts, subject it to high temperatures over 90°C (194°F), or apply oil, grease, or water to it; otherwise, the internal parts may be damaged and its reliability greatly lowered.



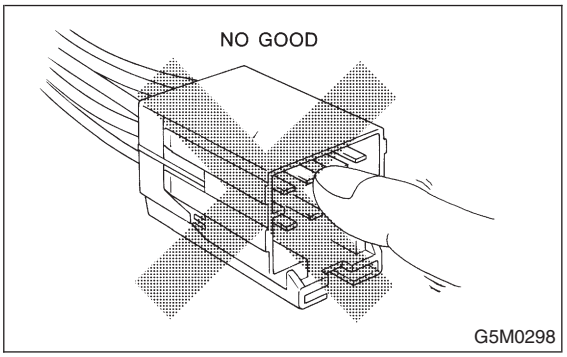
● If any damage or open is found on the SRS airbag system wire harness, do not attempt to repair using soldering, etc. Be sure to replace the faulty harness with a new genuine part.



● Install the wire harness securely with the specified clips so as to avoid interference or jamming with other parts.



● Before connecting the airbag system to ground, make sure that the grounding terminal is free from paint and contamination.
● Do not allow water or oil to come in contact with the connector terminals. Do not touch the connector terminals.



● When connecting or disconnecting airbag connector, make sure ignition switch is OFF.

2. Inspection and Replacement Standards

A: VEHICLES WHICH BECOME INVOLVED IN A COLLISION

If the vehicle equipped with an SRS airbag system is damaged in a collision, the airbag system parts must be checked and replaced in accordance with the following standards:
- After faulty parts are replaced, the warning light operation must be checked.
- When the ignition switch is turned ON, it lights up for about 7 seconds and then it goes out for at least 30 seconds.
- The trouble code stored in memory must be erased after the check.

B: AIRBAG MODULE (DRIVER AND PASSENGER)

1. INSPECTION STANDARD

- The vehicle damaged in a collision (regardless of whether or not airbag is deployed).
- The designated trouble code is output during self-diagnosis. <Ref. to 5-5 [T4A0].>

2. REPLACEMENT STANDARD

- Airbag is deployed.
- The pad surface is scratched or cracked.
- Harness and/or connector is deformed or cracked, their circuits are broken, lead wire is exposed, etc.
- Mounting bracket is cracked or deformed.
- The module surface is fouled with foreign matter. (grease, oil, water, cleaning solvent, etc.)
- Airbag module dropped to the floor/ground.
- Airbag module determined as faulty during self-diagnosis.

C: MAIN HARNESS

1. INSPECTION STANDARD

- A vehicle damaged in a collision (regardless of whether or not airbag is deployed).
- The designated trouble code is output during self-diagnosis. <Ref. to 5-5 [T4A0].>

2. REPLACEMENT STANDARD

- Harness circuit is broken, lead wire is exposed, corrugated tube is cracked, etc.
- Connector is scratched or cracked.
- The designated trouble code is output during self-diagnosis.

D: AIRBAG CONTROL MODULE

1. INSPECTION STANDARD

- A vehicle damaged in a collision (regardless of whether or not airbag is deployed).
- The designated trouble code is output during self-diagnosis. <Ref. to 5-5 [T4A0].>

2. REPLACEMENT STANDARD

- Control module is cracked or deformed.
- Mounting bracket is cracked or deformed.
- Connector is scratched or cracked.
- Control module dropped to the floor/ground.
- Control module determined as faulty during diagnostics.
- Airbag is deployed.

E: COMBINATION SWITCH

1. INSPECTION STANDARD

- A vehicle damaged in a collision (regardless of whether or not airbag is deployed).
- The designated trouble code is output during self-diagnosis. <Ref. to 5-5 [T4A0].>

2. REPLACEMENT STANDARD

- Combination switch or steering roll connector is deformed or cracked.

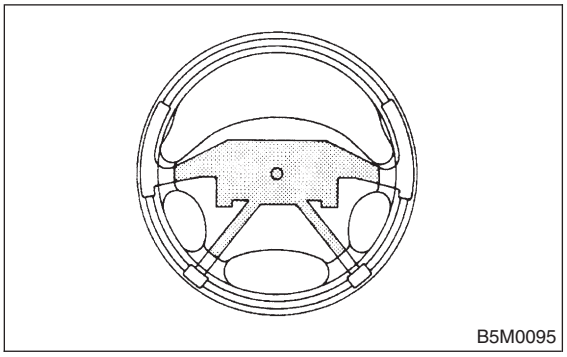
F: STEERING WHEEL

1. INSPECTION STANDARD

● A vehicle damaged in a collision (regardless of whether or not airbag is deployed).

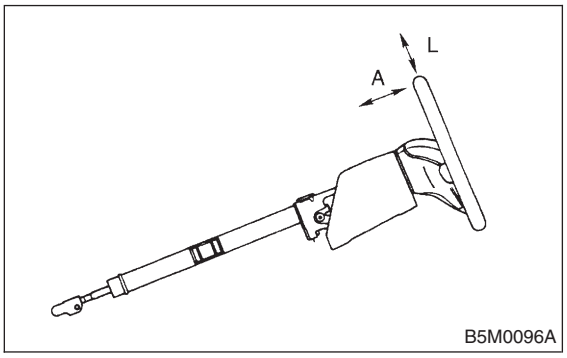
2. REPLACEMENT STANDARD

● Check steering wheel insert for cracks or deformities.
● Check to ensure that new airbag module is properly installed in steering wheel.
● After installing airbag module, check to ensure that it is free of interference with steering wheel and that clearance between the two is equal at all points.



● Check steering wheel distortion in axial and radial directions.

Specifications:
Axial free play A
Less than ±6 mm (0.24 in)
Radial free play L
Less than ±7 mm (0.28 in)



G: STEERING COLUMN ASSEMBLY

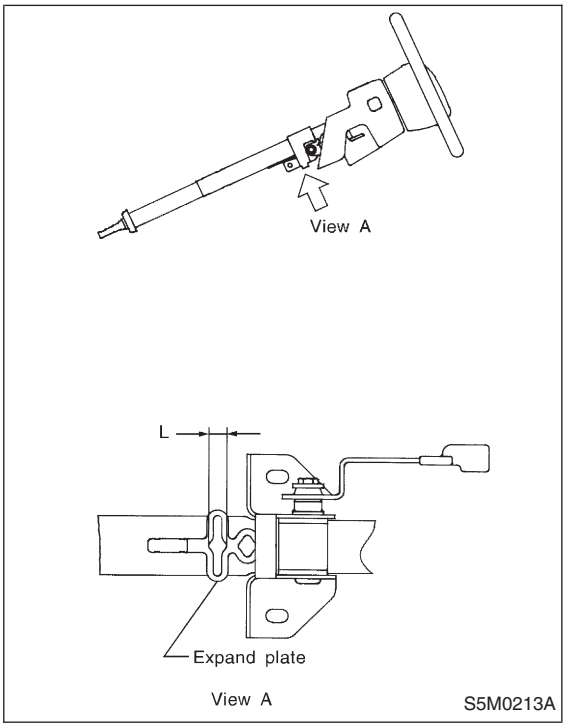
1. INSPECTION STANDARD

● A vehicle damaged in a collision (regardless of whether or not airbag is deployed).

2. REPLACEMENT STANDARD

● Check to ensure that clearance of expand plate on steering column under side is within specifications.

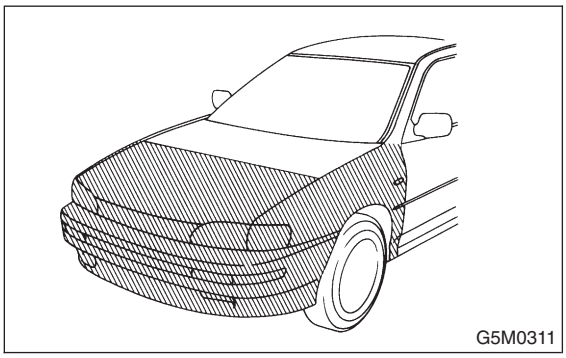
Clearance of expand plate: L
More than 15 mm (0.59 in)



H: FRONT SUB SENSOR

1. INSPECTION STANDARD

● Check the front section (Refer to shaded area of vehicle in figure) for damage, regardless of whether or not airbag is deployed.



● The designated trouble code is output during self-diagnosis. <Ref. to 5-5 [T4A0].>

2. REPLACEMENT STANDARD

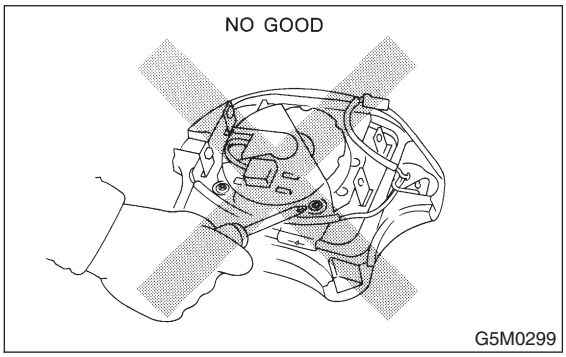
● Bracket is deformed.
● Housing is cracked or deformed.
● The label (that identifies the manufacturing number) is peeled or deteriorated.
● Harness circuit is broken, lead wire is exposed, corrugated tube is cracked, etc.
● Front sub sensor determined as faulty as a result of Diagnostics.
● Airbag is deployed.
● Front sub sensor dropped to the floor/ground.

3. Airbag Module

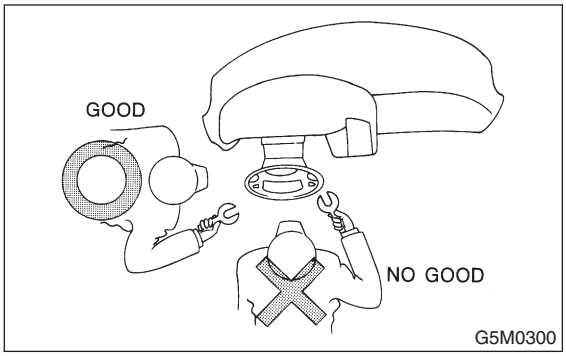
A: REMOVAL AND INSTALLATION

CAUTION:

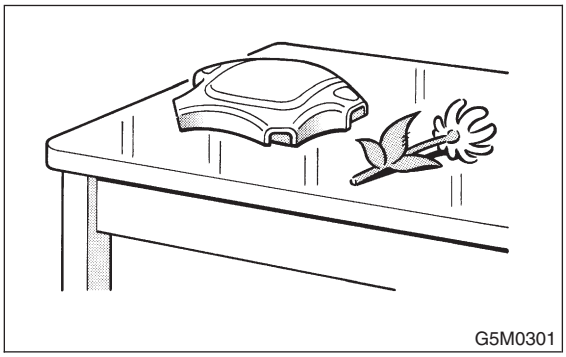
• The airbag module (driver and passenger) must not be disassembled. The airbag module cannot be used again once inflated.



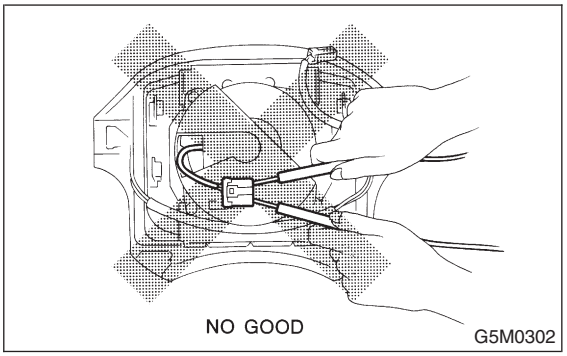
• When removing and installing the airbag module (driver and passenger) the operator should stand, as much as possible, on the side of the airbag module.



• After removal, the airbag module (driver and passenger) should be kept away from heat and light sources, and stored on a clean, flat surface to prevent from any damage to its lower structure.



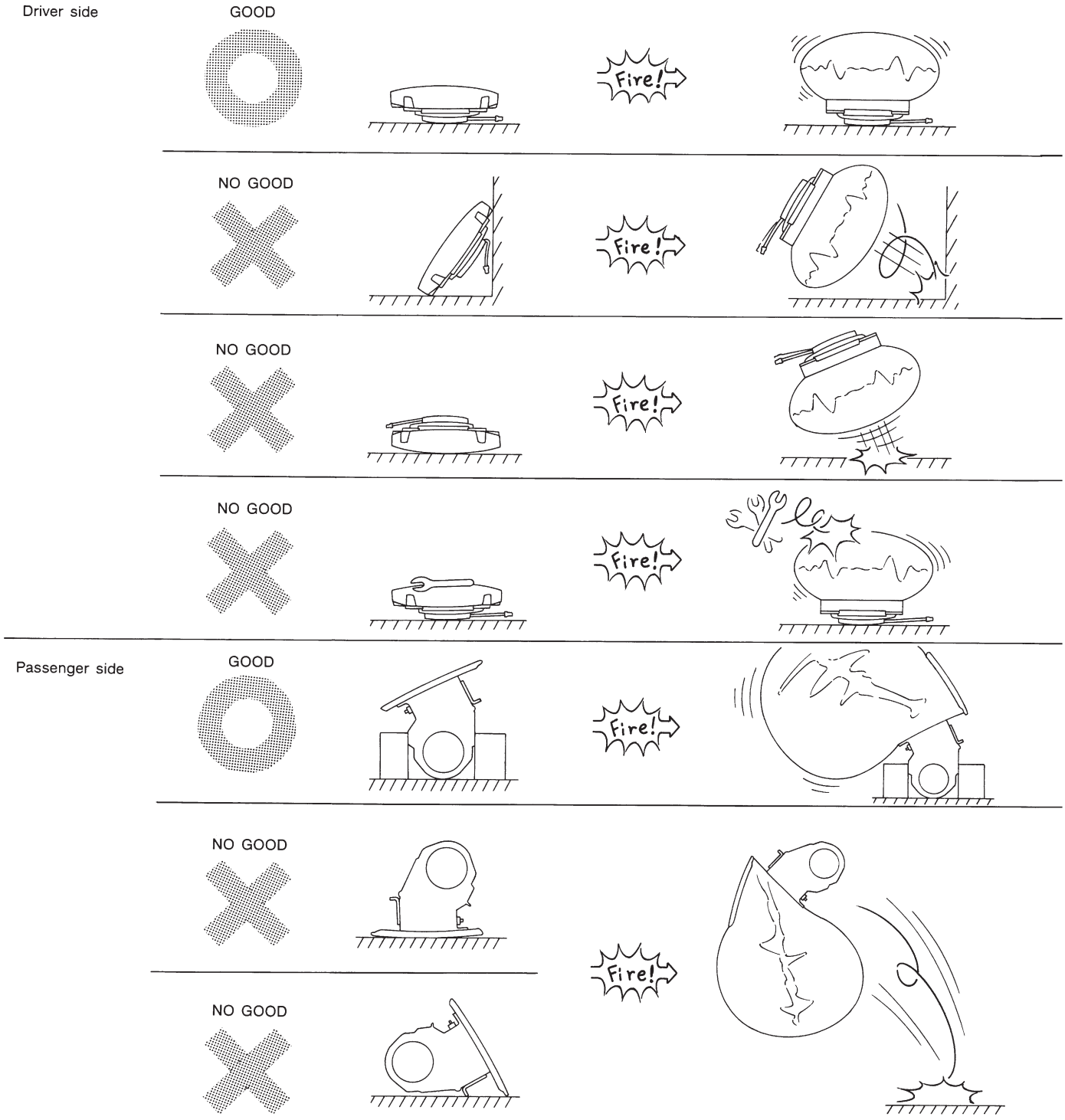
• Do not check airbag module (driver and passenger) continuity with airbag removed from the vehicle body.



• Replace airbag module (driver and passenger) with a new one, should any of the following conditions develop:

- **Pad surface is scratched or cracked.**
- **Connector harness is damaged.**
- **Inflator side structure of module is cracked or deformed.**
- **Module is excessively stained with water, oil, etc.**
- **Module was accidentally dropped.**

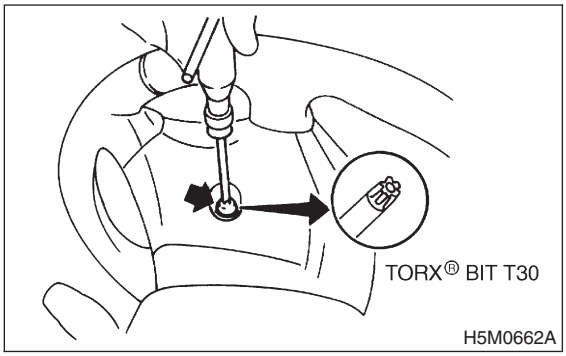
• When storing a removed airbag module (driver and passenger), be sure to place it in parallel with floor with the pad facing up. Do not place it against a wall, or place anything on the pad; otherwise, a dangerous condition may be created if the module malfunctions.



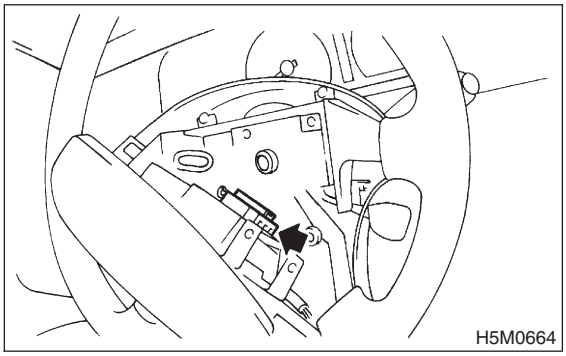
G5M0604

1. DRIVER'S AIRBAG MODULE

1) Set front wheels in straight ahead position.
2) Turn ignition switch off.
3) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
4) Using TORX® BIT T30, remove two TORX® bolts.



5) Disconnect airbag connector on back of airbag module. <Ref. to 5-5 [M2F2].>

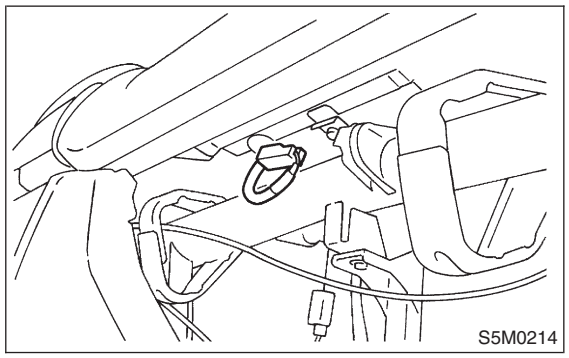


6) Refer to **"CAUTION"** for handling of a removed airbag module. <Ref. to 5-5 [W3A0].>
7) Installation is in the reverse order of removal.

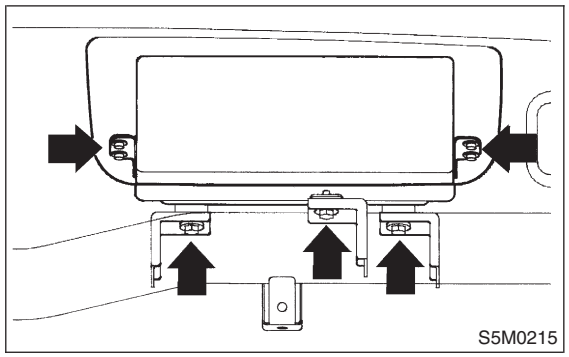
CAUTION:
Do not allow harness and connectors to interfere or get caught with other parts.

2. PASSENGER'S AIRBAG MODULE

1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove glove box. <Ref. to 5-4 [W1A0].>
4) Disconnect airbag connector. <Ref. to 5-5 [M2F2].>



5) Remove seven bolts and then carefully remove airbag module.



6) Refer to "**CAUTION**" for handling of a removed airbag module. <Ref. to 5-5 [W3A0].>
7) Installation is in the reverse order of removal.

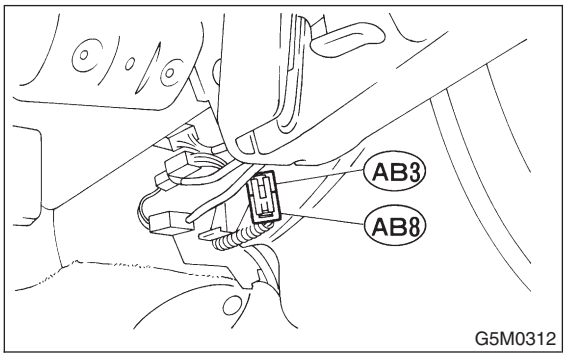
CAUTION:
Do not allow harness and connectors to interfere or get caught with other parts.

4. Main Harness

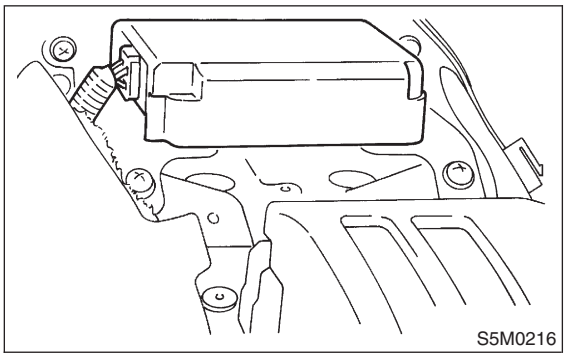
A: REMOVAL AND INSTALLATION

1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove lower cover. <Ref. to 5-4 [W1A0].>
4) Disconnect airbag connector (AB3) and (AB8) below steering column. <Ref. to 5-5 [M2F2].>

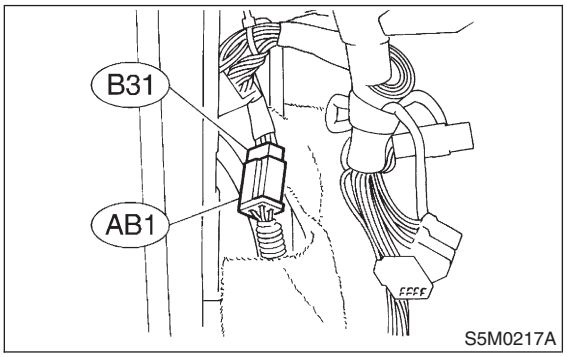
CAUTION:
Do not reconnect airbag connector at steering column until main harness are securely re-installed.



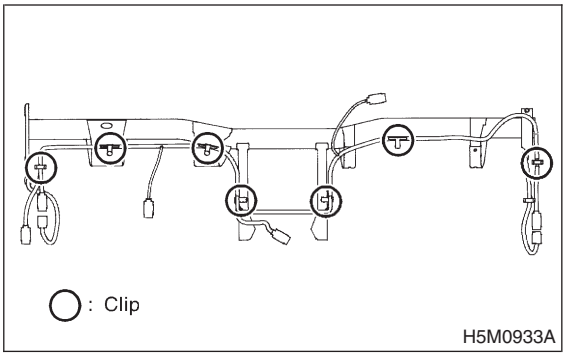
5) Remove instrument panel. <Ref. to 5-4 [W1A0].>
6) Disconnect connector from airbag control module.



7) Disconnect body harness connector (B31) from connector (AB1).



8) Disconnect front sub sensor connector (blue) from airbag main harness.
9) Detach clips from steering support beam and remove main harness.

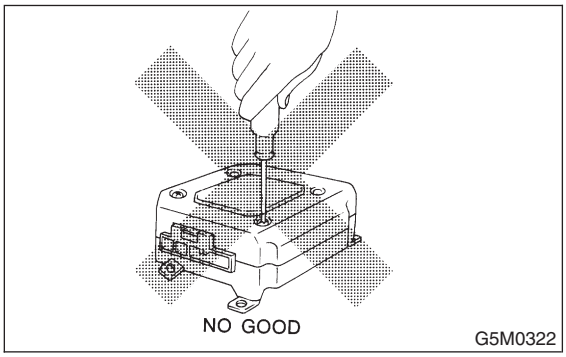


10) Installation is in the reverse order of removal.

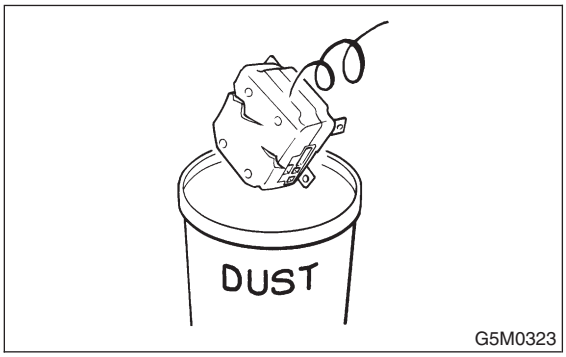
5. Airbag Control Module

A: REMOVAL AND INSTALLATION

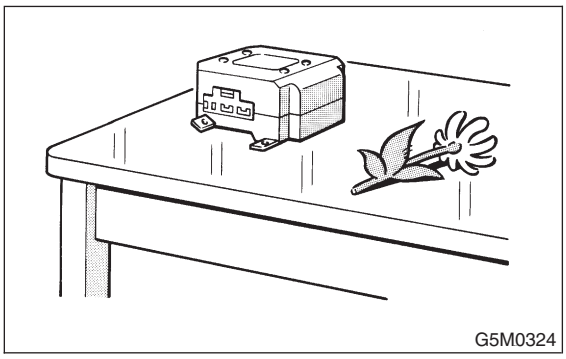
CAUTION:
• Do not disassemble the airbag control module.



• If the airbag control module is deformed, or if water damage is suspected, replace the airbag control module with a new genuine part.

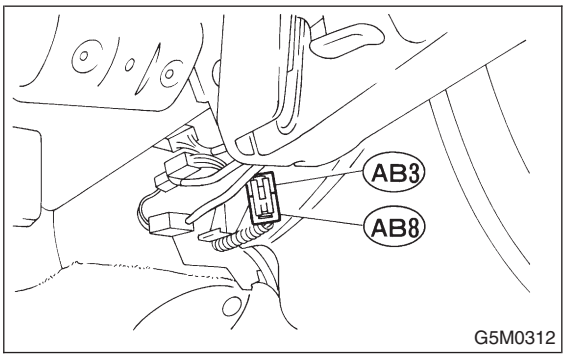


• After removal, keep the airbag control module on a dry, clean surface away from heat and light sources, and moisture and dust.



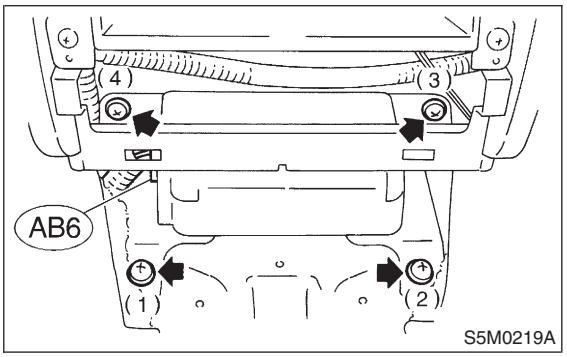
1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove lower cover. <Ref. to 5-4 [W1A0].>
4) Disconnect airbag connector (AB3) and (AB8) below steering column. <Ref. to 5-5 [M2F2].>

CAUTION:
Do not reconnect airbag connector at steering column until airbag control module is securely re-installed.



5) Remove instrument panel console. <Ref. to 5-4 [W1A0].>
6) Disconnect connector from airbag control module.
7) Using T40 TORX® bit (Tamper resistant type), remove four TORX® bolts in numerical sequence shown in figure. Discard the old TORX® bolts.

CAUTION:
Use new TORX® bolts during re-assembly.



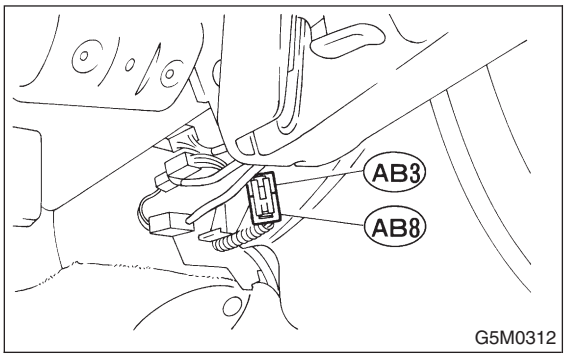
8) Installation is in the reverse order of removal.

6. Combination Switch

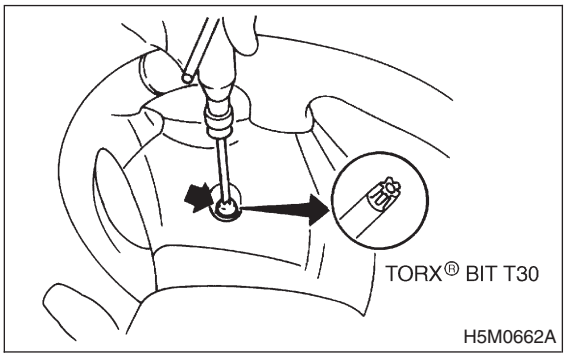
A: REMOVAL

1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove lower cover. <Ref. to 5-4 [W1A0].> Disconnect airbag connector (AB3) and (AB8) below steering column. <Ref. to 5-5 [M2F2].>

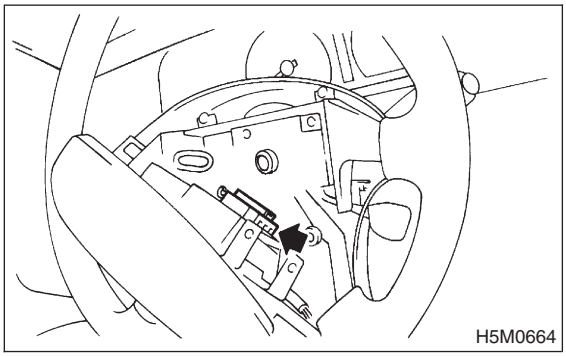
CAUTION:
Do not reconnect airbag connector at steering column until combination switch is securely re-installed.



4) Disconnect combination switch connectors from body harness connector.
5) Set front wheels in straight ahead position. Using T30 TORX® bit, remove two TORX® bolts.

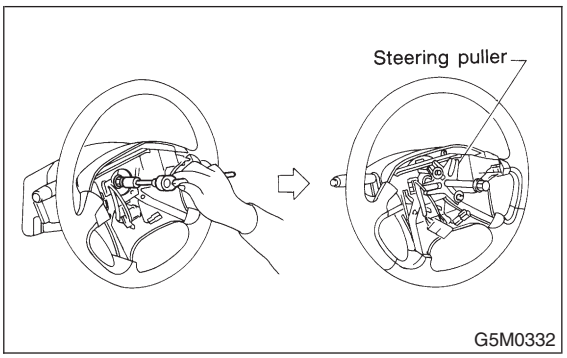


6) Disconnect airbag connector on back of airbag module. <Ref. to 5-5 [M2F2].> Remove airbag module, and place it with pad side facing upward. <Ref. to 5-5 [W3A0].>

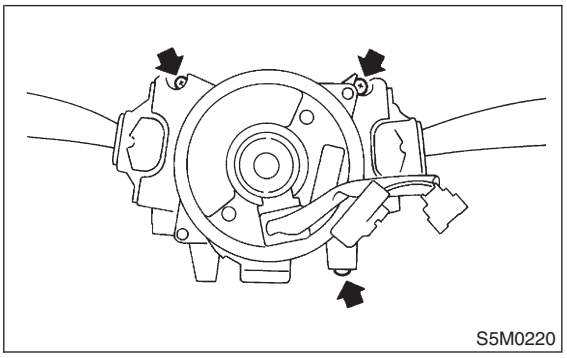


7) Using steering puller, remove steering wheel.

CAUTION:
Do not allow connector to interfere when removing steering wheel.



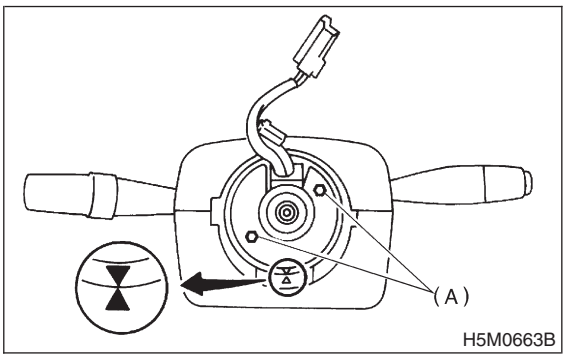
8) Remove steering column covers.
9) Removing three retaining screws, remove combination switch.



B: ADJUSTMENT

1. CENTERING ROLL CONNECTOR

Before installing steering wheel, make sure to center roll connector built into combination switch.
1) Make sure that front wheels are positioned straight ahead.
2) Install steering gearbox, steering shaft and combination switch properly. Turn roll connector pin (A) clockwise until it stops.
3) Then, back off roll connector pin (A) approximately 2.5 turns until "▲" marks aligned.

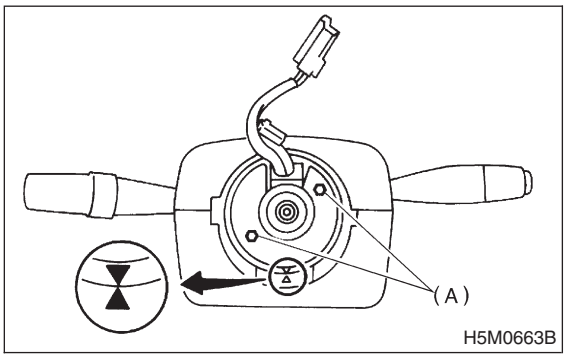


C: INSTALLATION

CAUTION:
Failure to do this might damage roll connector.

1) Before installing combination switch, check to ensure that combination switch is off and front wheels are set in the straight ahead position.
2) Install column cover and center roll connector. <Ref. to 5-5 [W6B1].>
3) Install steering wheel in neutral position. Carefully insert roll connector pin (A) into hole on steering wheel.

NOTE:
If steering wheel angle requires fine adjustment, adjust tie-rod.

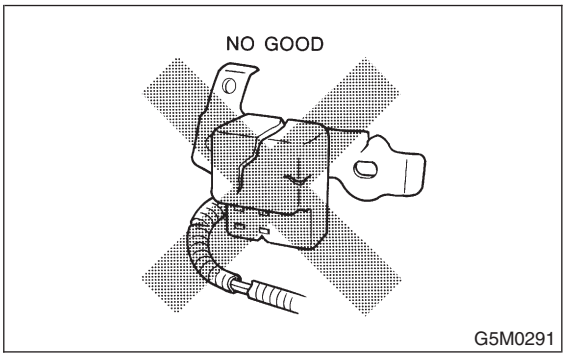


4) Install airbag module and lower cover in the reverse order of removal.

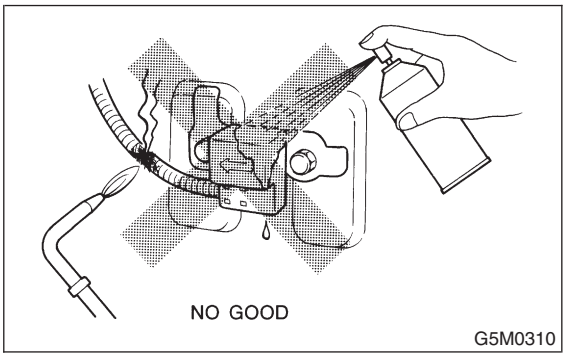
7. Front Sub Sensor

A: REMOVAL AND INSTALLATION

CAUTION:
• If the front end of the vehicle body is damaged by a collision, be sure to check the left and right front sub sensors, even if the airbag was not inflated. If any damage to the sensor or any deformation of the sensor mount is found, replace with a new genuine part.



• When painting or performing sheet metal work on the front part of vehicle body, including the front wheel apron, front fender and front side frame, take utmost care not to apply dryer heat, painting mist, or the flame of the welding burner directly to the front sub sensors and wire harness of the airbag system.

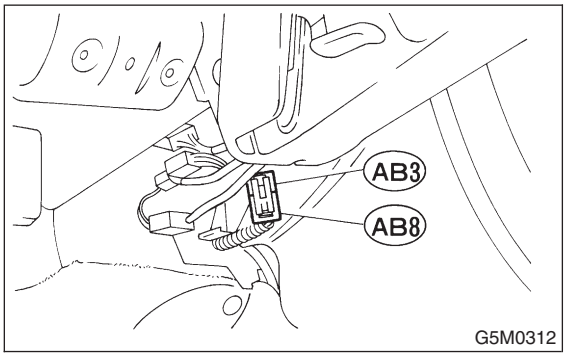


1. FRONT SUB SENSOR HARNESS

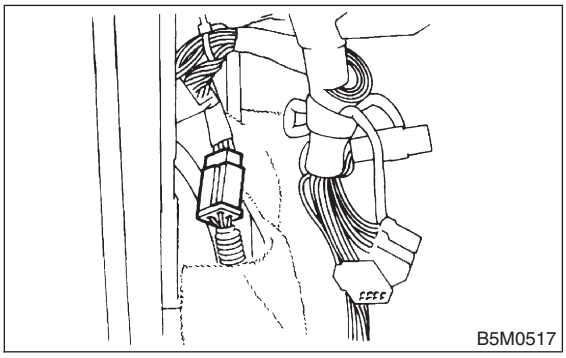
1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove lower cover. <Ref. to 5-4 [W1A0].>

4) Disconnect airbag connector (AB3) and (AB8) below steering column.

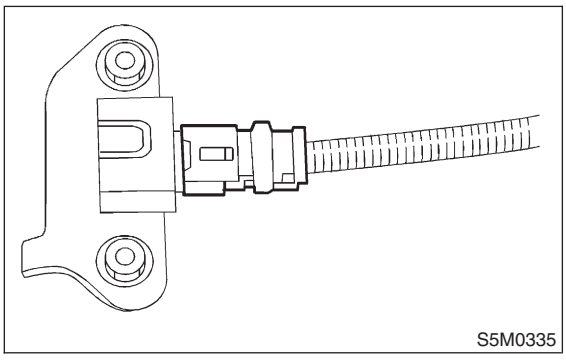
CAUTION:
Do not reconnect airbag connector at steering column until front sub sensors are securely re-installed.



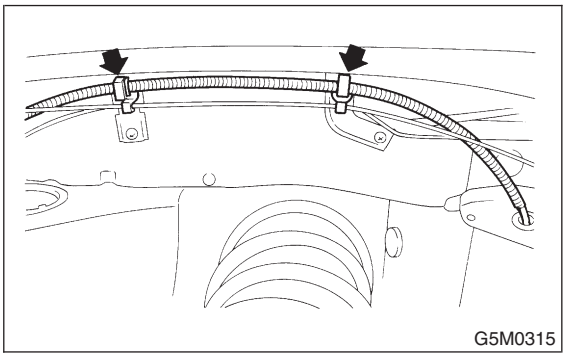
5) Remove front side sill cover and then disconnect front sub sensor connector. <Ref. to 5-5 [M2F2].>



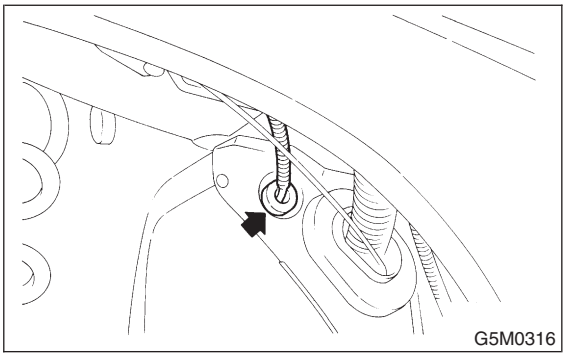
6) Remove front wheel and mud guard.
7) Disconnect connector from front sub sensor assembly. <Ref. to 5-5 [M2F3].>



8) Remove wiring harness clips.

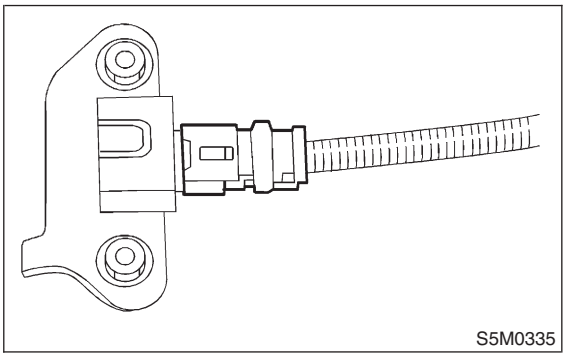


9) Remove grommet and then detach front sub sensor harness.

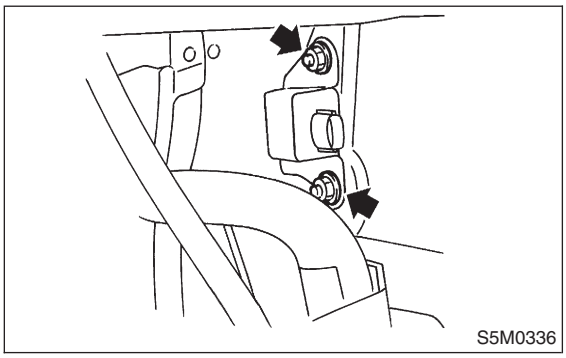


2. FRONT SUB SENSOR ASSEMBLY

1) Turn ignition switch off.
2) Disconnect ground cable from battery and wait for at least 20 seconds before starting work.
3) Remove front wheel and mud guard.
4) Disconnect connector from front sub sensor assembly. <Ref. to 5-5 [M2F3].>



5) Remove front sub sensor.



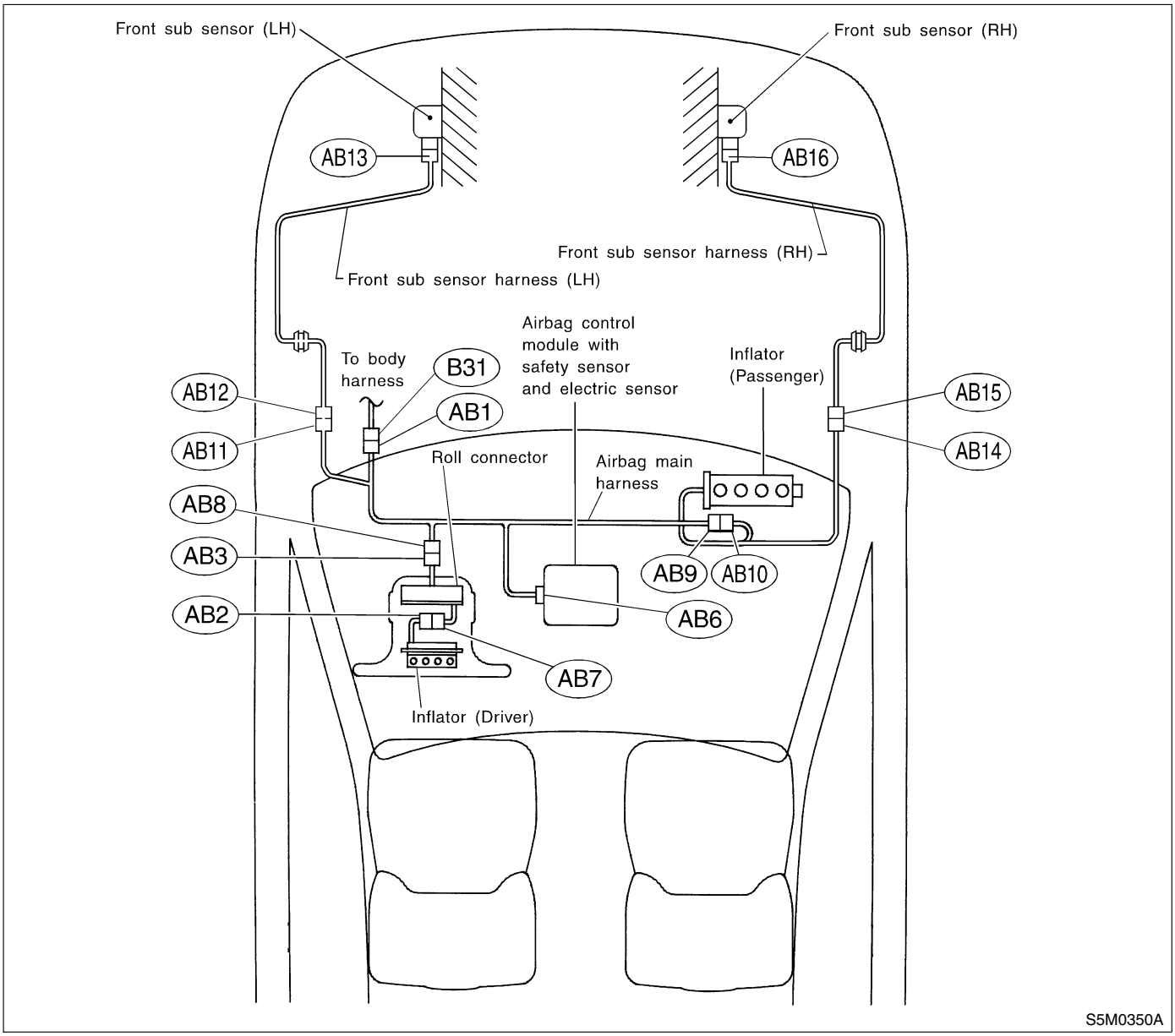
6) Installation is in the reverse order of removal.

SUPPLEMENTAL RESTRAINT SYSTEM 5-5

Page

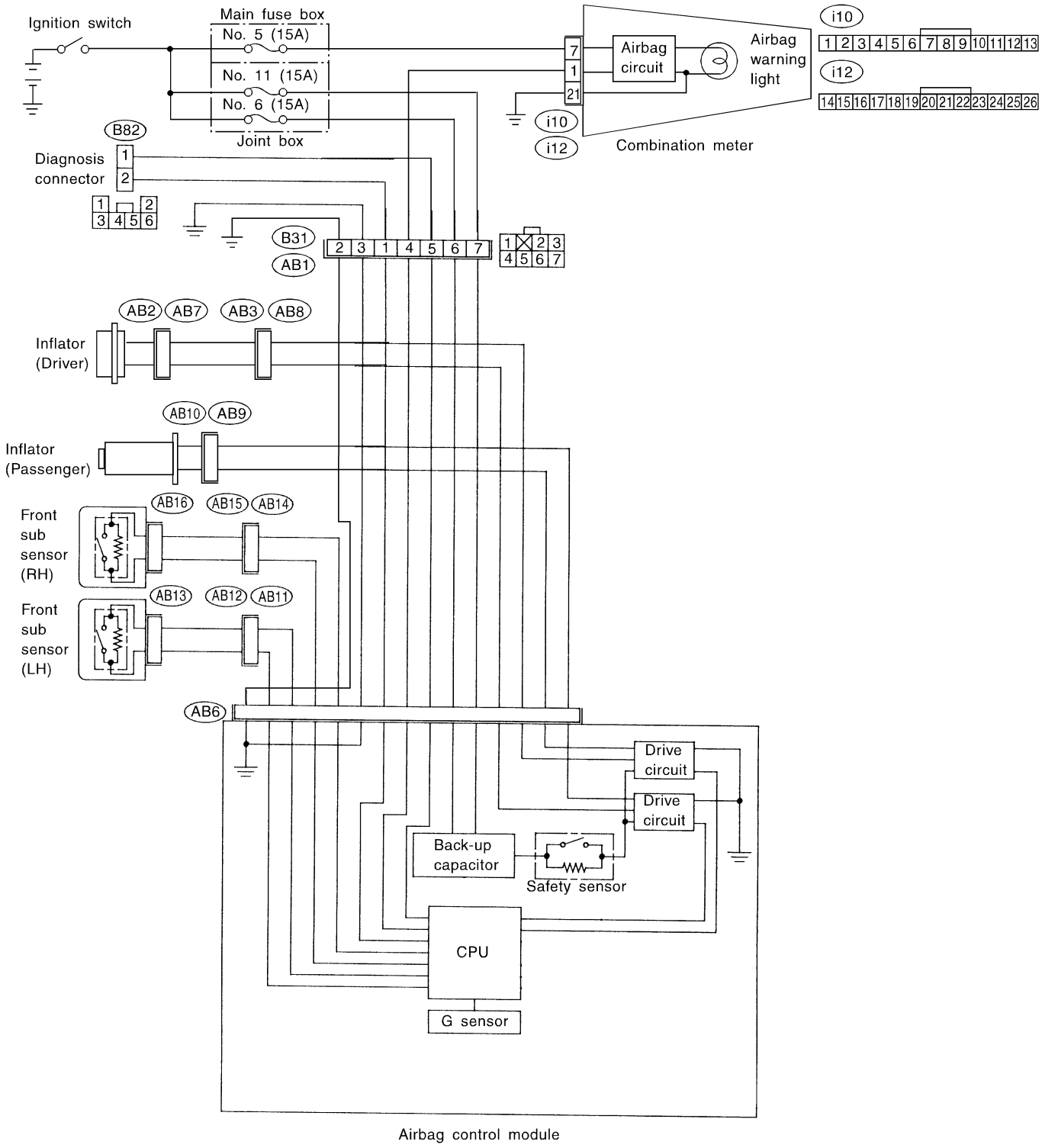
T DIAGNOSTICS 2
1. Electrical Components Location 2
2. Schematic 3
3. Tools for Diagnostics 4
4. Diagnostics Chart for On-board Diagnostic System 10
5. Diagnostics Chart with Trouble Code 14

1. Electrical Components Location



Connector No.	(AB1)	(AB2)	(AB3)	(AB6)	(AB7)	(AB8)	(AB9)
Pole	7	2	2	28	2	2	2
Color	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Male/Female	Male	Male	Male	Female	Female	Female	Female
Connector No.	(AB10)	(AB11)	(AB12)	(AB13)	(AB14)	(AB15)	(AB16)
Pole	2	2	2	2	2	2	2
Color	Yellow	Blue	Blue	Yellow	Blue	Blue	Yellow
Male/Female	Male	Female	Male	Female	Female	Male	Female

2. Schematic



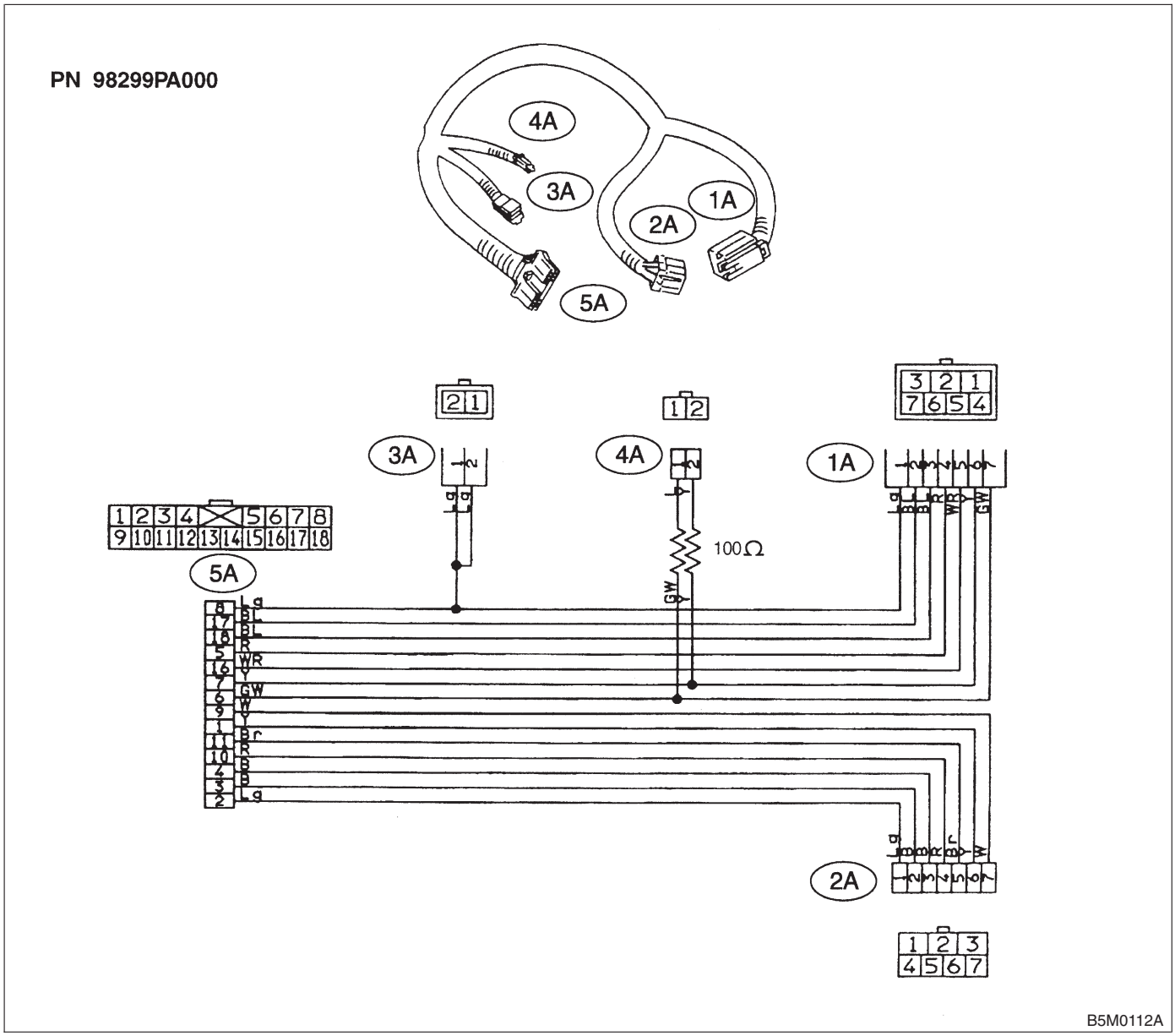
S5M0351A

3. Tools for Diagnostics

CAUTION:
Be sure to use specified test harness A, F, H and I or I2 when measuring voltage, resistance, etc. of AIRBAG system component parts.

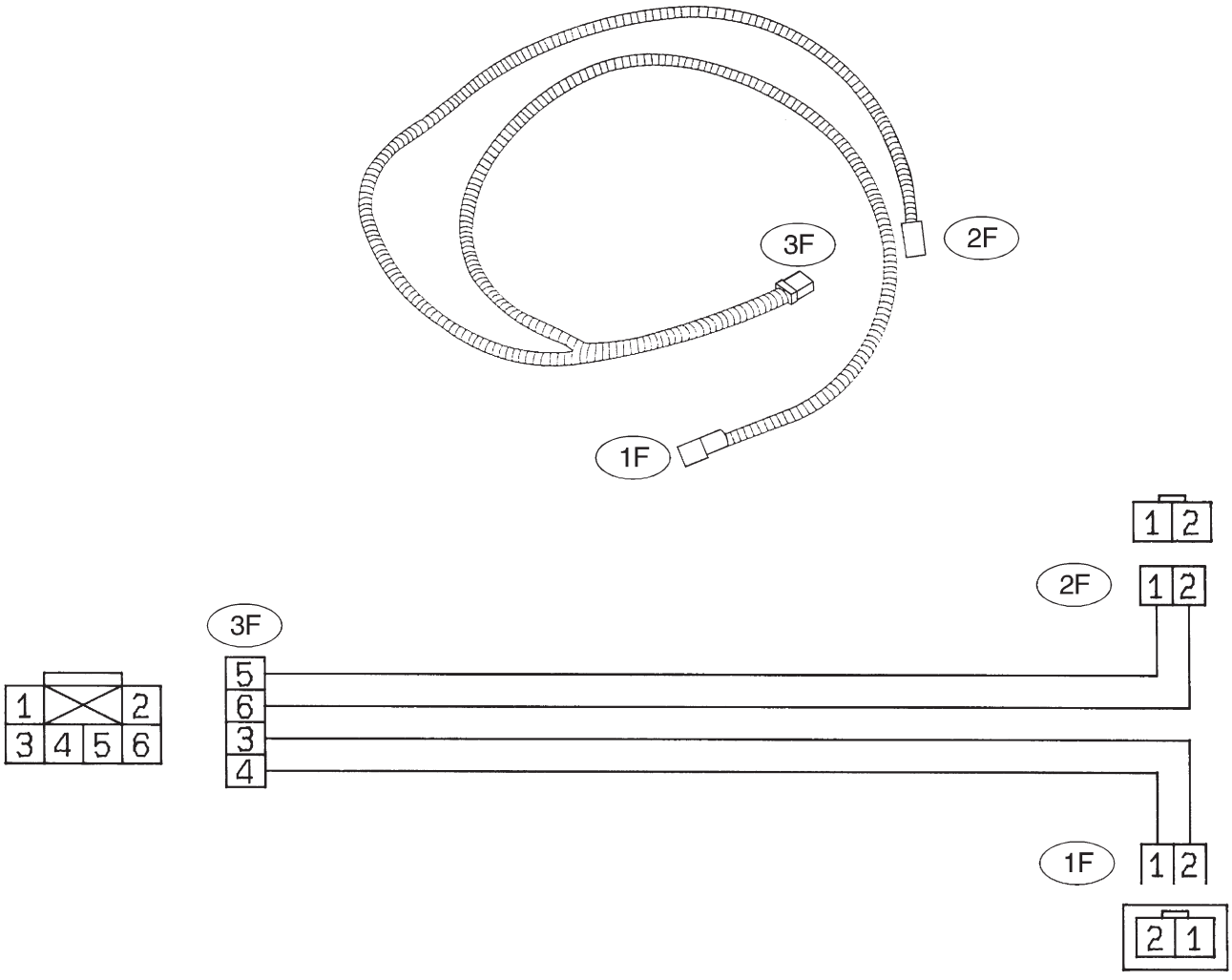
A: TEST HARNESS A

PN 98299PA000



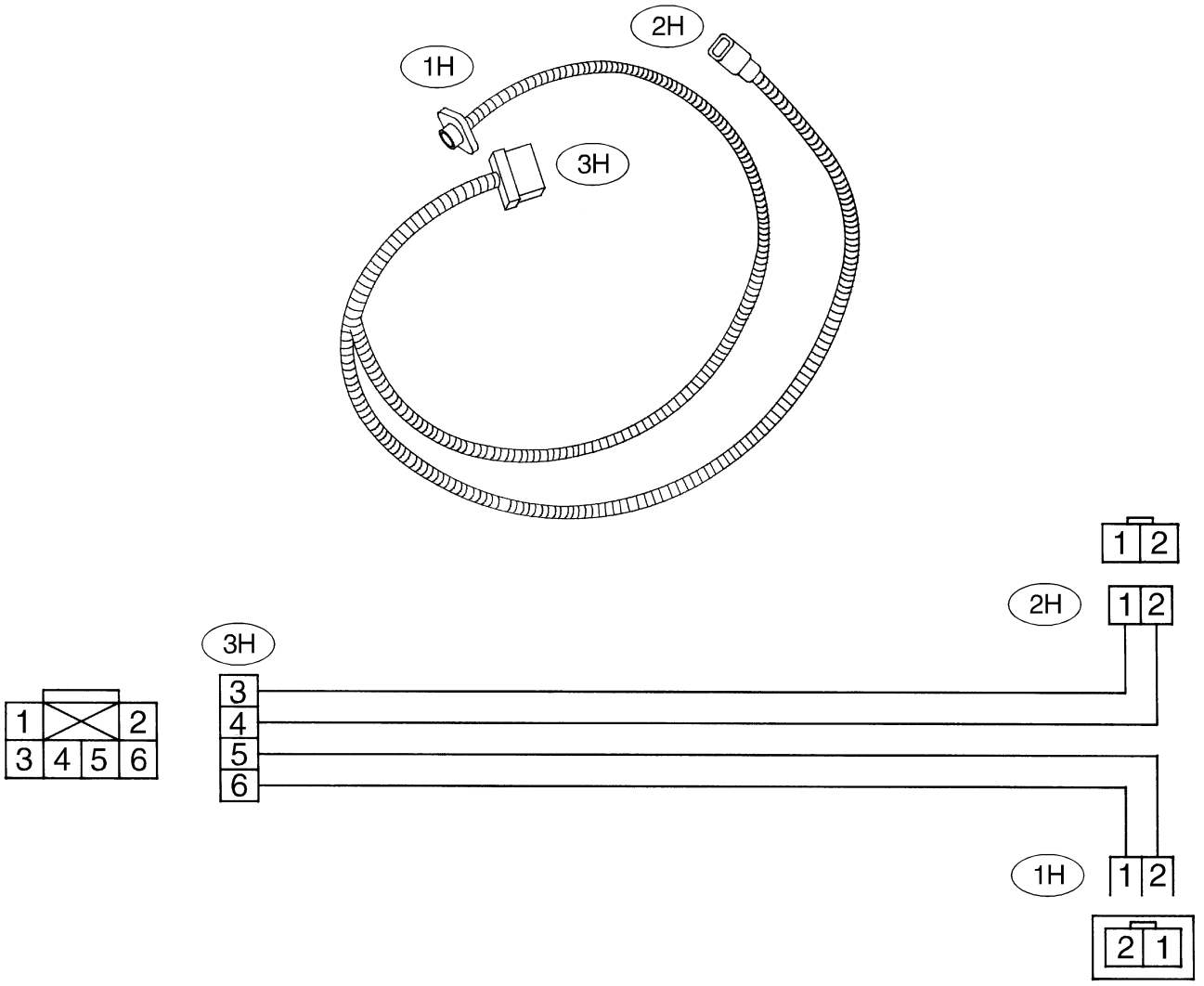
B: TEST HARNESS F

PN 98299FC010



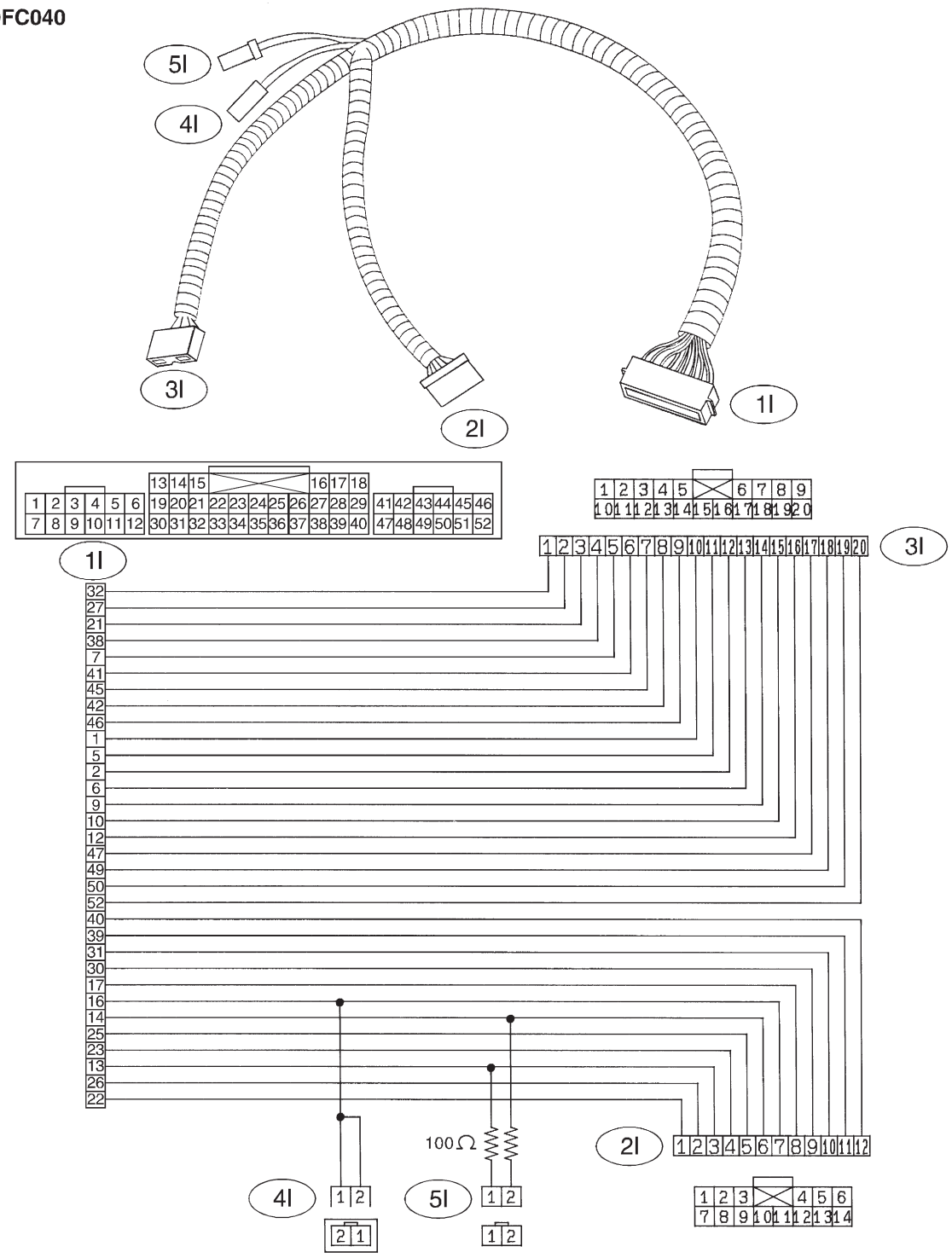
C: TEST HARNESS H

PN 98299FA030



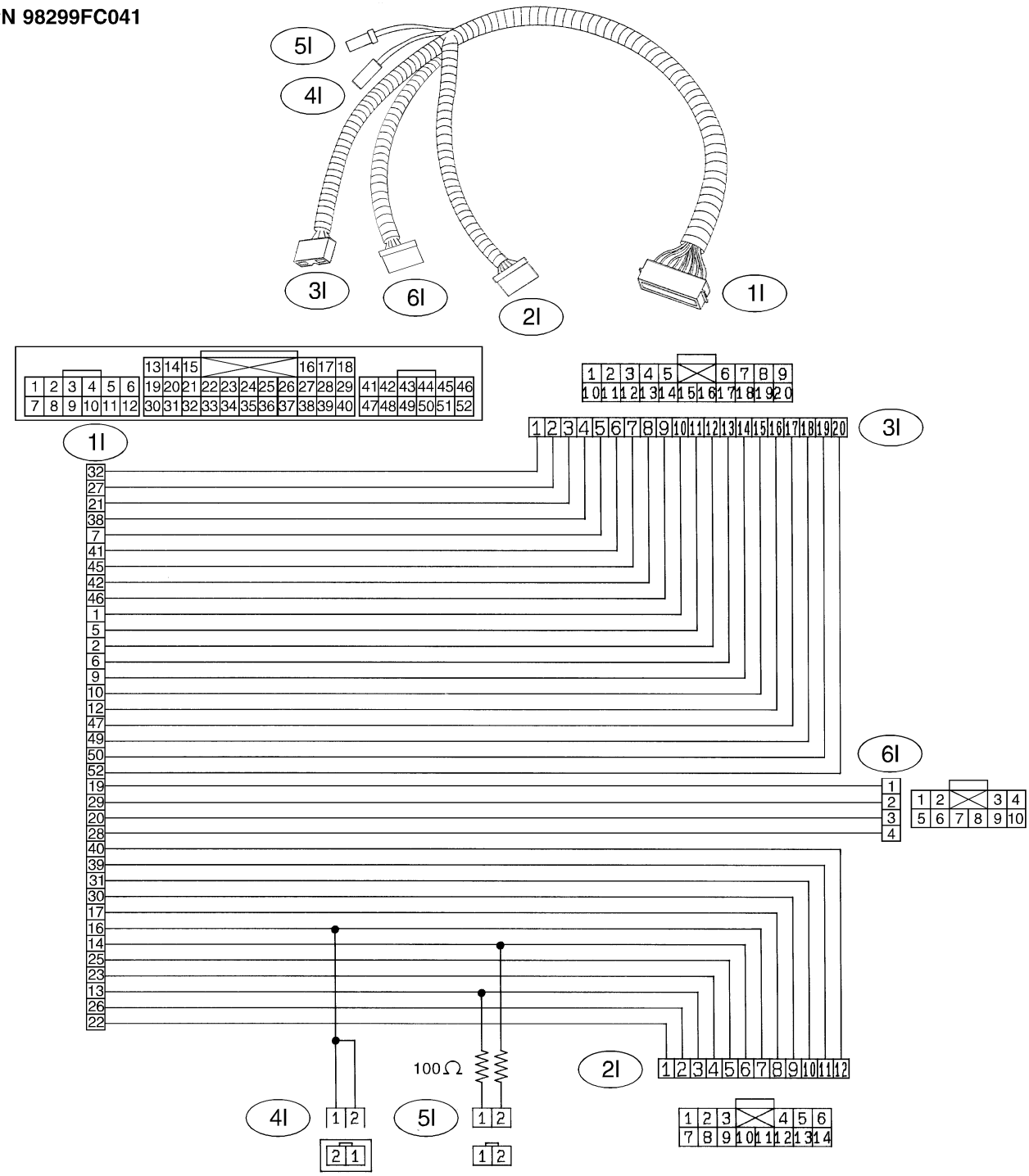
D: TEST HARNESS I

PN 98299FC040



E: TEST HARNESS I2

PN 98299FC041

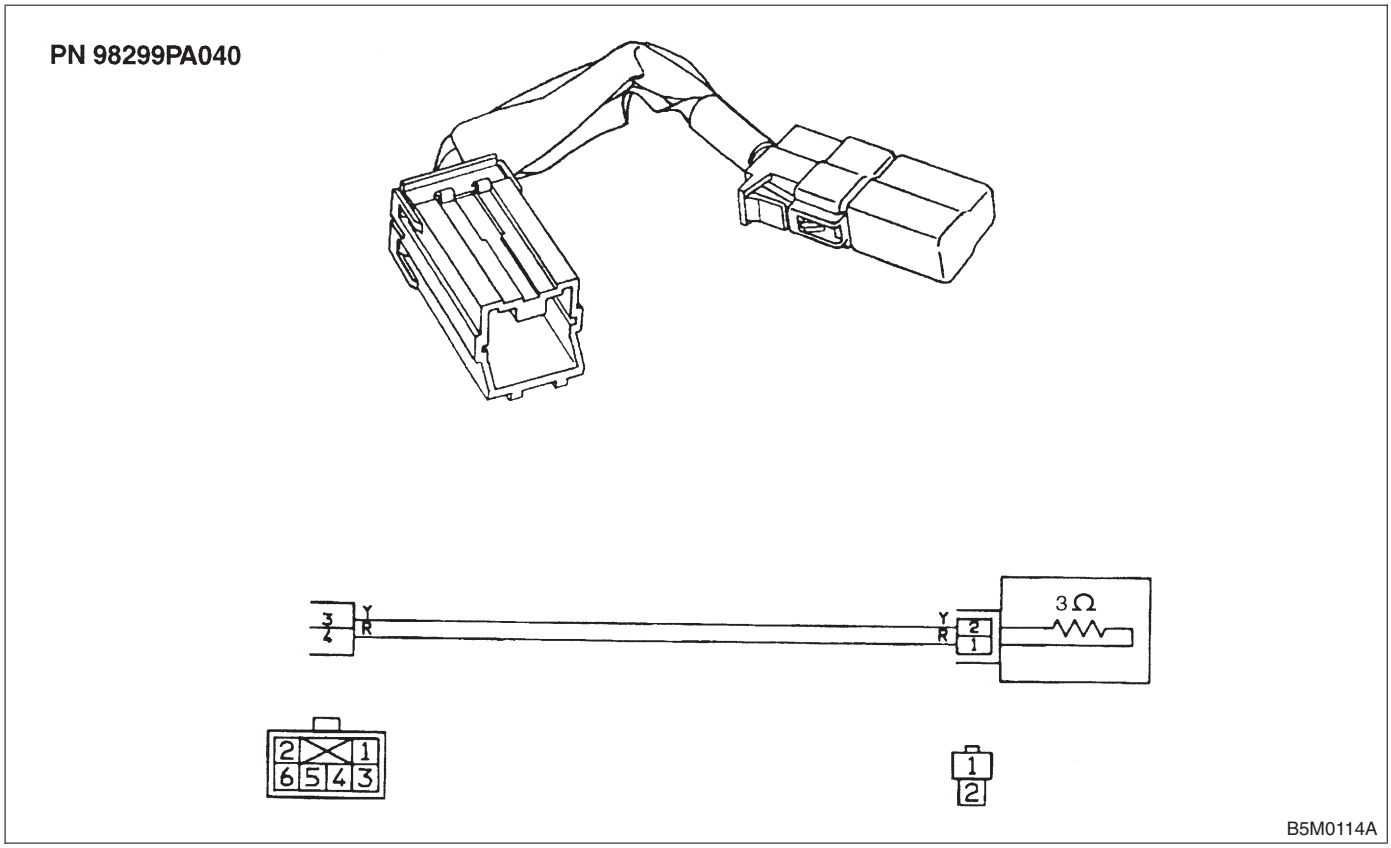


B5M0927A

F: AIRBAG RESISTOR

The airbag resistor is used during diagnostics. The airbag resistor has the same resistance as the airbag module and thus provides safety when used instead of the airbag module. It also makes it possible to finish, diagnostics in less time.

PN 98299PA040



4. Diagnostics Chart for On-board Diagnostic System

A: BASIC DIAGNOSTICS PROCEDURE

4A1 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Airbag warning light comes ON.
2) Turn ignition switch to ON (engine OFF).
3) Check airbag warning light illuminates.

CHECK : ***Does airbag warning light stay ON after about 7 seconds or remain OFF, or come back ON after 30 seconds?***

YES : Repair and replace. <Ref. to 5-5 [T4D0].>

NO : Go to step **4A2**.

4A2 : CHECK TROUBLE CODE INDICATES.

Perform ON-BOARD DIAGNOSTICS. <Ref. to 5-5 [T4B0].>

CHECK : ***Does trouble code indicate? <Ref. to 5-5 [T5A0].>***

YES : Repair and replace. <Ref. to 5-5 [T5O0].> Go to step **4A3**.

NO : Repair and replace. <Ref. to 5-5 [T5P0].> Go to step **4A3**.

4A3 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Turn ignition switch to ON (engine OFF).
2) Check airbag warning light illuminates.

CHECK : ***Does airbag warning light stay ON after about 7 seconds or come back ON after 30 seconds?***

YES : Repair and replace. <Ref. to 5-5 [T4D0].>

NO : Go to step **4A4**.

4A4 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

Check airbag warning light illuminates.

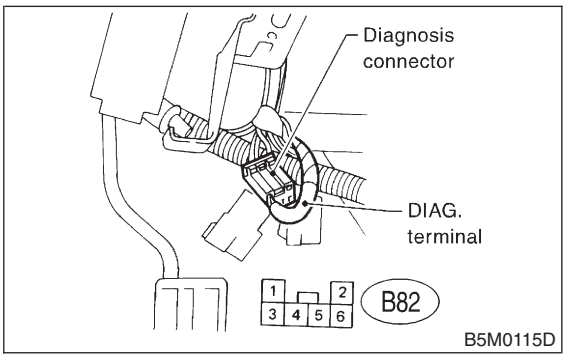
CHECK : ***Does airbag warning light come ON for about 7 seconds, then go out and stay out?***

YES : Perform clear memory. <Ref. to 5-5 [T4C0].>

NO : Go to step **4A1**.

B: ON-BOARD DIAGNOSTIC

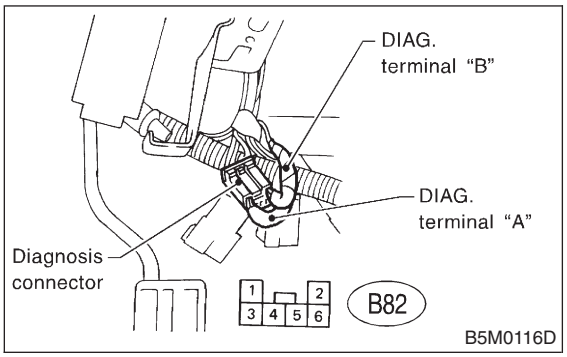
When the airbag system is in functioning condition, the airbag warning light will remain on for about 7 seconds and go out when the ignition switch is set to ON.
If there is any malfunction, the airbag warning light will either stay on or off continuously. In such cases, perform on-board diagnostic in accordance with the specified procedure to determine trouble codes.
1) Turn ignition switch ON (with engine OFF).
2) Connect DIAG. terminal to No. 1 terminal of diagnosis connector located inside lower cover.



3) Check in accordance with the trouble code indicated by the AIRBAG warning light, and record the trouble codes.
4) Turn the ignition switch “OFF” and remove the DIAG. terminal from No. 1 terminal of diagnosis connector.

C: CLEAR MEMORY

After eliminating problem as per trouble code, clear memory as follows:
1) Make sure ignition switch is ON (and engine off). Connect one DIAG. terminal “A” on diagnosis connector terminal No. 1.
While warning light is flashing, contact the other DIAG. terminal “B” on terminal No. 2 for at least three seconds.



2) After memory is cleared, normal warning light flashing rate resumes. (Warning light flashes every 0.6 seconds ON-OFF operation.) Memory cannot be cleared if any problem exists.
3) After clear memory and then DIAG. terminals “A” and “B”, extract from diagnosis connector.

D: DIAGNOSTICS PROCEDURE

4D1 : CHECK TROUBLE CODE INDICATES.

1) Perform on-board diagnostic. <Ref. to 5-5 [T4B0].>
2) Check trouble code indicates.

CHECK : ***Are trouble codes 11, 12, 15 or 16 indicated? <Ref. to 5-5 [T5A2].>***
YES : Go to step **4D2**.
NO : Perform diagnostics and repair according to indicated trouble code. <Ref. to 5-5 [T5A0].>

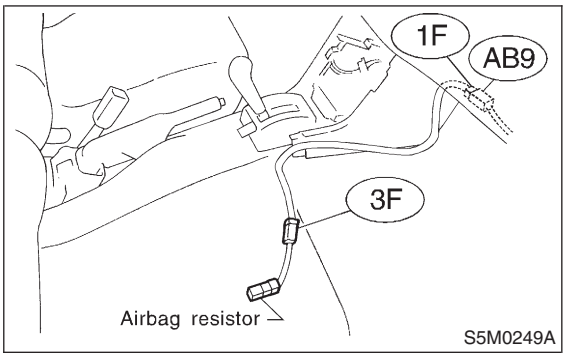
4D2 : CHECK TROUBLE CODE INDICATES.

Check trouble code indicates.

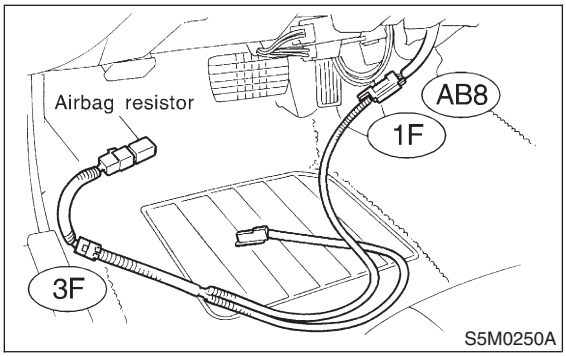
CHECK : ***Are trouble codes 12, 16 indicated? <Ref. to 5-5 [T5A2].>***
YES : Go to step **4D3**.
NO : Go to step **4D4**.

4D3 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Turn ignition switch to OFF. Disconnect battery ground cable, and wait 20 seconds.
2) Remove glove box <Ref. to 5-4 [W1A0].> and disconnect passenger’s airbag module connector (AB9) to (AB10). <Ref. to 5-5 [W3A2].>
3) Connect test harness F connector (1F) to (AB9).
4) Connect airbag resistor to test harness F connector (3F).



5) Remove lower cover panel <Ref. to 5-4 [W1A0].> and connect test harness F connector (1F) to (AB8) with airbag resistor attached to test harness F connector (3F).



6) Connect battery ground cable and turn ignition switch to ON.
7) Check airbag warning light illuminates.

NOTE:
In some cases the airbag warning light will go OFF after about 7 seconds but will turn ON again within 30 seconds. In this case continue diagnostics with the basic diagnostics procedures or trouble code procedures.

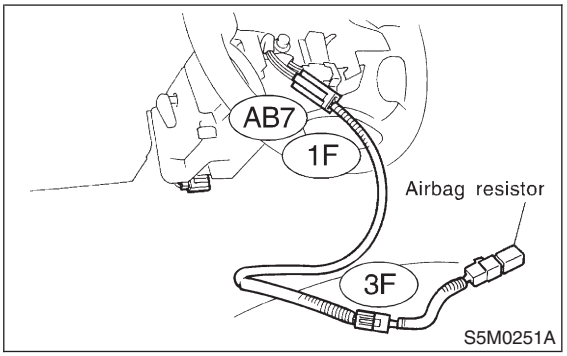
CHECK : ***Does airbag warning light go off after about 7 seconds and remain off for more than 30 seconds?***

YES : Replace with a new passenger's airbag module. <Ref. to 5-5 [W3A2].> Go to step **4D6**.

NO : Perform diagnostics and repair according to indicated trouble code. <Ref. to 5-5 [T5A0].>

4D4 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Turn ignition switch to "OFF". Disconnect battery ground cable, and wait 20 seconds.
2) Connect connector (AB8) to (AB3).
3) Remove driver's airbag module and connect test harness F connector (1F) to (AB7). <Ref. to 5-5 [W3A1].>
4) Connect airbag resistor to test harness F connector (3F).



5) Connect battery ground cable and turn ignition switch to ON.
6) Check airbag warning light illuminates.

NOTE:
In some cases the airbag warning light will go OFF after about 7 seconds but will turn ON again within 30 seconds. In this case continue diagnostics with the basic diagnostics procedures or trouble code procedures.

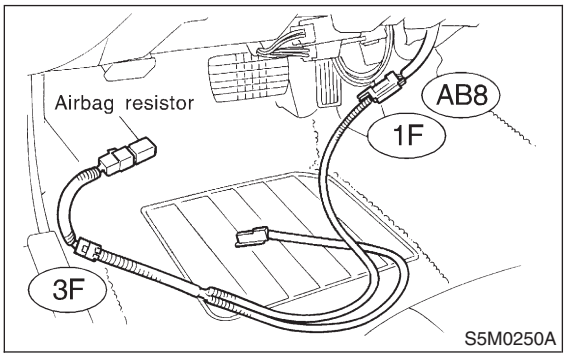
CHECK : ***Does airbag warning light go off after about 7 seconds and remain off for more than 30 seconds?***

YES : Replace with a new driver's airbag module. <Ref. to 5-5 [W3A1].> Go to step **4D6**.

NO : Go to step **4D5**.

4D5 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Turn ignition switch to OFF. Disconnect battery ground cable, and wait 20 seconds.
2) Remove lower cover panel and connect test harness F connector (1F) to (AB8) <Ref. to 5-4 [W1A0].> with airbag resistor attached to test harness F connector (3F).



3) Connect battery ground cable and turn ignition switch to ON.
4) Check airbag warning light illuminates.

NOTE:
In some cases the airbag warning light will go OFF after about 7 seconds but will turn ON again within 30 seconds. In this case continue diagnostics with the basic diagnostics procedures or trouble code procedures.

CHECK : ***Does airbag warning light go off after about 7 seconds and remain off for more than 30 seconds?***

YES : Replace with a new combination switch. <Ref. to 5-5 [W600].> Go to step **4D6**.

NO : Perform diagnostics and repair according to indicated trouble code. <Ref. to 5-5 [T5A0].>

4D6 : CHECK AIRBAG WARNING LIGHT ILLUMINATES.

1) Connect battery ground cable and turn ignition switch to ON.
2) Check airbag warning light illuminates.

NOTE:
In some cases the airbag warning light will go OFF after about 7 seconds but will turn ON again within 30 seconds. In this case continue diagnostics with the basic diagnostics procedures or trouble code procedures.

CHECK : ***Does airbag warning light go off after about 7 seconds and remain off for more than 30 seconds?***

YES : Perform clear memory. <Ref. to 5-5 [T4C0].>

NO : Go to step **4D1**.

5. Diagnostics Chart with Trouble Code

A: TROUBLE CODES

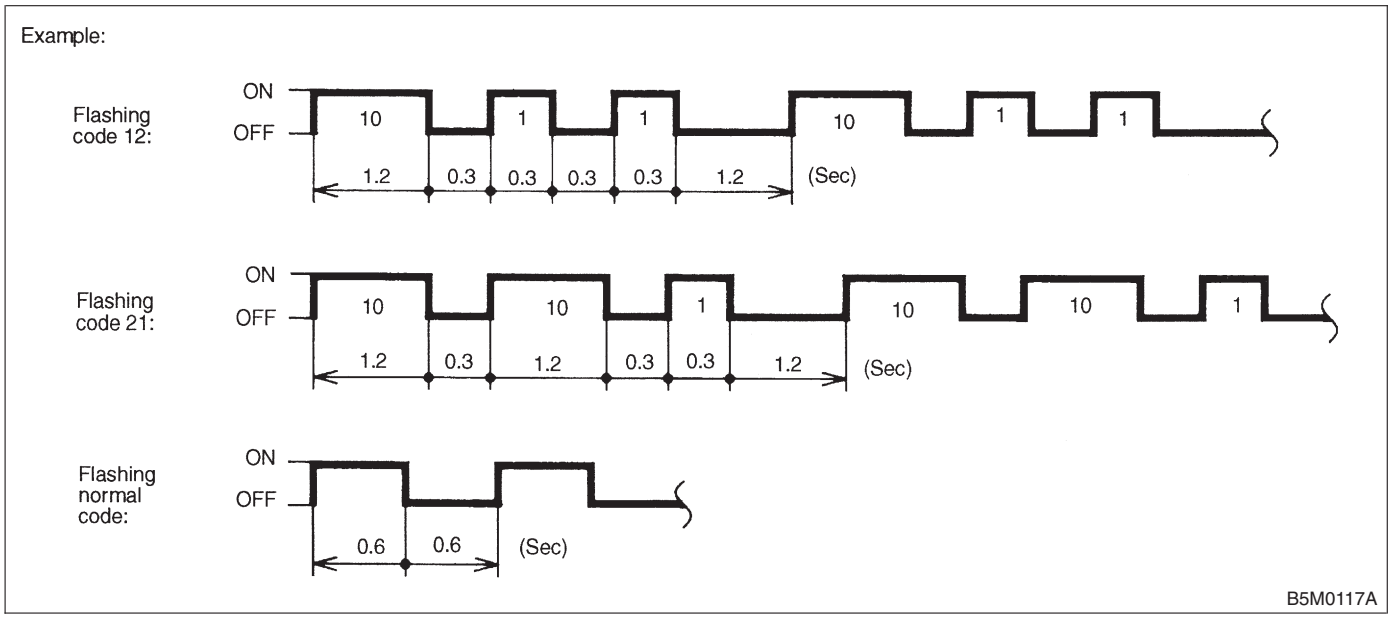
1. LIST OF TROUBLE CODES

Trouble code/ Contents of troubles	Memory function	Contents of diagnosis	Index No.
11	Provided.	● Airbag main harness circuit is open, shorted or shorted to ground. ● Airbag module harness (driver) circuit is open, shorted or shorted to ground. ● Roll connector circuit is open, shorted or shorted to ground. ● Airbag control module is faulty.	<Ref. to 5-5 [T5B0].>
12	Provided.	● Airbag main harness circuit is open, shorted or shorted to ground. ● Airbag module harness (passenger) circuit is open, shorted or shorted to ground. ● Airbag control module is faulty.	<Ref. to 5-5 [T5C0].>
15	Provided.	● Airbag main harness circuit (driver) is shorted to power supply. ● Airbag module harness (driver) is shorted to power supply. ● Roll connector is shorted to power supply. ● Airbag control module is faulty.	<Ref. to 5-5 [T5D0].>
16	Provided.	● Airbag main harness circuit (passenger) is shorted to power supply. ● Airbag module harness (passenger) is shorted to power supply. ● Airbag control module is faulty.	<Ref. to 5-5 [T5E0].>
21	Provided.	Airbag control module is faulty.	<Ref. to 5-5 [T5F0].>
22	Provided.	Front airbag module is inflated.	<Ref. to 5-5 [T5G0].>
23	Not provided.	(AB6) is not connected properly to airbag control module.	<Ref. to 5-5 [T5H0].>
24	Not provided.	● Airbag control module is faulty. ● Airbag main harness circuit is open. ● Fuse No. 11 (in joint box) is blown. ● Body harness circuit is open.	<Ref. to 5-5 [T5I0].>
25	Provided.	● Airbag control module is faulty. ● Airbag main harness circuit is open. ● Fuse No. 6 (in joint box) is blown. ● Body harness circuit is open.	<Ref. to 5-5 [T5J0].>
31	Provided.	● Front sub sensor harness (RH) circuit is shorted. ● Front sub sensor harness (RH) circuit is open. ● Front sub sensor (RH) is faulty. ● Airbag control module is faulty.	<Ref. to 5-5 [T5K0].>
32	Provided.	● Front sub sensor harness (LH) circuit is shorted. ● Front sub sensor harness (LH) circuit is open. ● Front sub sensor (LH) is faulty. ● Airbag control module is faulty.	<Ref. to 5-5 [T5L0].>
Airbag warning light remains on.	Not provided.	● Airbag warning light is faulty. ● Airbag control module to airbag warning light harness circuit is shorted or open. ● Grounding circuit is faulty. ● Airbag control module is faulty. ● (AB1) and (B31) are not connected properly. ● (AB6) is not connected properly to airbag control module.	<Ref. to 5-5 [T5M0].>

Trouble code/ Contents of troubles	Memory function	Contents of diagnosis	Index No.
Airbag warning light remains off.	Not provided.	• Fuse No. 5 (in main fuse box) is blown. • Body harness circuit is open. • Airbag warning light is faulty. • Airbag main harness is faulty. • Airbag control module is faulty.	<Ref. to 5-5 [T5N0].>
Warning light indicates trouble code, then normal code. (Flashing trouble code.)	Provided.	Airbag system component parts are faulty.	<Ref. to 5-5 [T5O0].>
Warning light indicates trouble code, then normal code. (Flashing normal code.)	Not provided.	• Airbag connector is faulty. • Fuse No. 11 (in joint box) is blown. • Airbag main harness is faulty. • Airbag control module is faulty. • Body harness is faulty.	<Ref. to 5-5 [T5P0].>

2. HOW TO READ TROUBLE CODES

The AIRBAG warning light flashes a code corresponding to the faulty parts.
The long segment (1.2 sec on) indicates a “ten”, and the short segment (0.3 sec on) indicates a “one”.



B: TROUBLE CODE 11

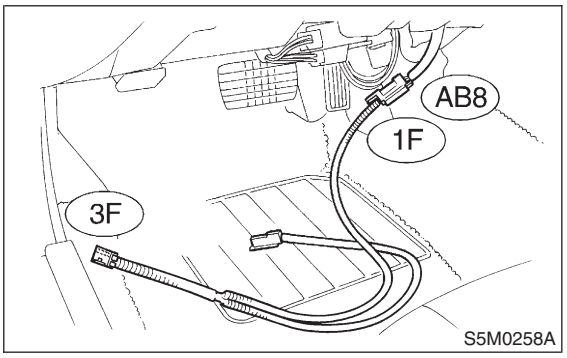
DIAGNOSIS:

- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (Driver) circuit is open, shorted or shorted to ground.
- Roll connector circuit is open, shorted or shorted to ground.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

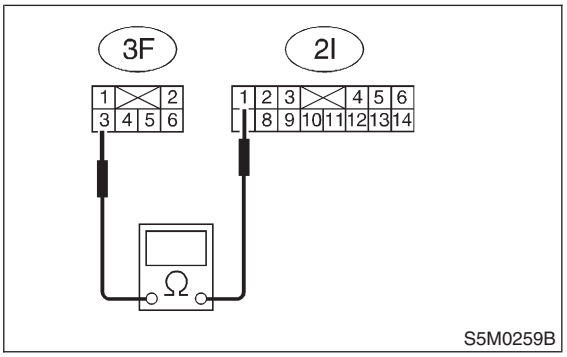
5B1 : AIRBAG MAIN HARNESS INSPECTION

1) Remove lower cover panel <Ref. to 5-4 [W1A0].>, and connect connector (AB8) below steering column to test harness F connector (1F).



2) Disconnect connector (AB6) <Ref. to 5-5 [W5A0].> from airbag control module, and connect it to test harness I or I2 connector (1I) terminal.
3) Measure resistance between test harness I or I2 connector (2I) and test harness F connector (3F) terminals.

Connector & terminal
(2I) No. 1 — (3F) No. 3:

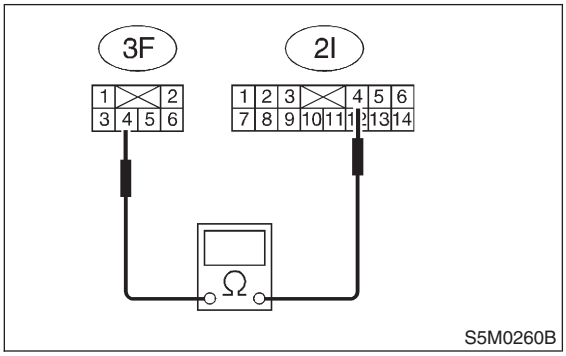


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5B2**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5B2 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between test harness I or I2 connector (2I) and test harness F connector (3F) terminals.

Connector & terminal
(2I) No. 4 — (3F) No. 4:

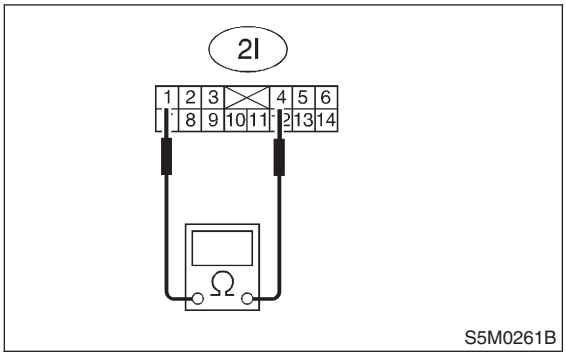


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5B3**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5B3 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (2I) terminal.

Connector & terminal
(2I) No. 1 — No. 4:

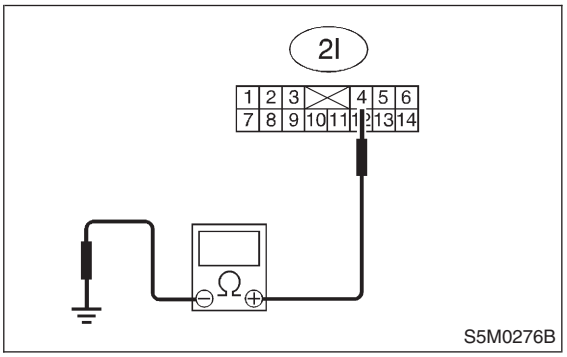


CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5B4**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5B4 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (2I) terminals and chassis ground.

Connector & terminal
(2I) No. 4 (+) — Chassis ground (–):

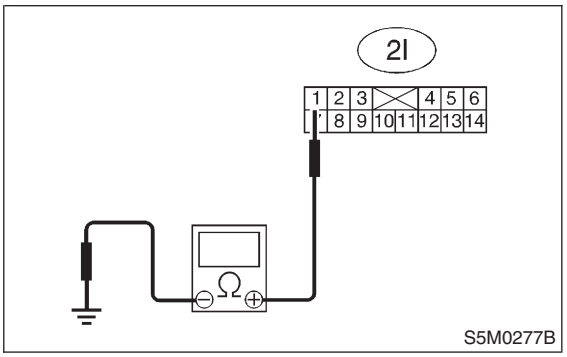


CHECK : ***Is resistance more than 200 Ω?***
YES : Go to step **5B5**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5B5 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between test harness I or I2 connector (2I) terminals and chassis ground.

Connector & terminal
(2I) No. 1 (+) — Chassis ground (–):



CHECK : ***Is resistance more than 200 Ω?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

C: TROUBLE CODE 12

DIAGNOSIS:

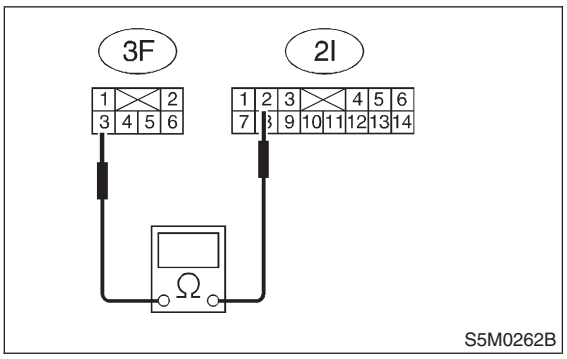
- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (Passenger) circuit is open, shorted or shorted to ground.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

5C1 : AIRBAG MAIN HARNESS INSPECTION

1) Remove glove box. <Ref. to 5-4 [W1A0].>
2) Disconnect connector (AB9) and (AB10) <Ref. to 5-5 [W3A2].> and connect connector (AB9) to test harness F connector (1F).
3) Disconnect connector (AB6) <Ref. to 5-5 [W5A0].> from airbag control module, and connect it to test harness I or I2 connector (1I) terminal.
4) Measure resistance between test harness I or I2 connector (2I) and test harness F connector (3F) terminals.

Connector & terminal
(2I) No. 2 — (3F) No. 3:

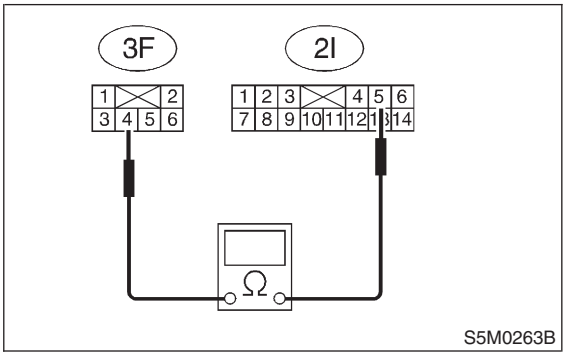


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5C2**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5C2 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between test harness I or I2 connector (2I) and test harness F connector (3F) terminals.

Connector & terminal
(2I) No. 5 — (3F) No. 4:

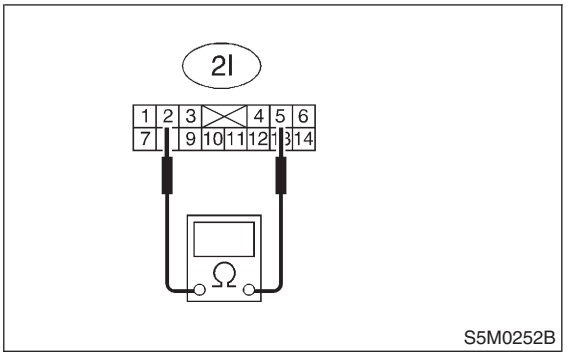


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5C3**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5C3 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (2I) terminal.

Connector & terminal
(2I) No. 2 — No. 5:

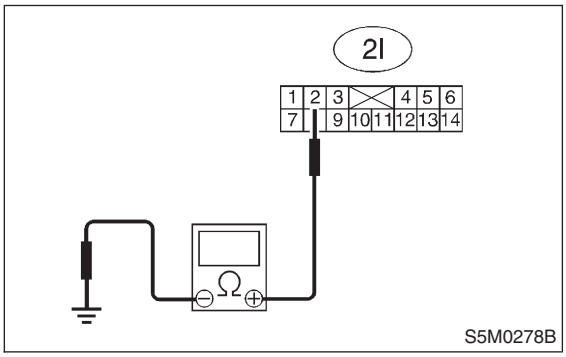


CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5C4**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5C4 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (2I) terminals and chassis ground.

Connector & terminal
(2I) No. 2 (+) — Chassis ground (–):

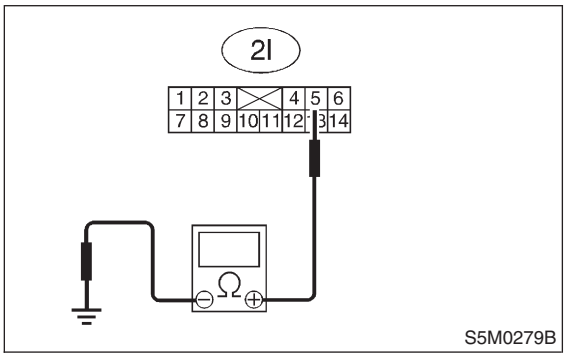


CHECK : ***Is resistance more than 200 Ω?***
YES : Go to step **5C5**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5C5 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between test harness I or I2 connector (2I) terminals and chassis ground.

Connector & terminal
(2I) No. 5 (+) — Chassis ground (–):



CHECK : ***Is resistance more than 200 Ω?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

D: TROUBLE CODE 15

DIAGNOSIS:

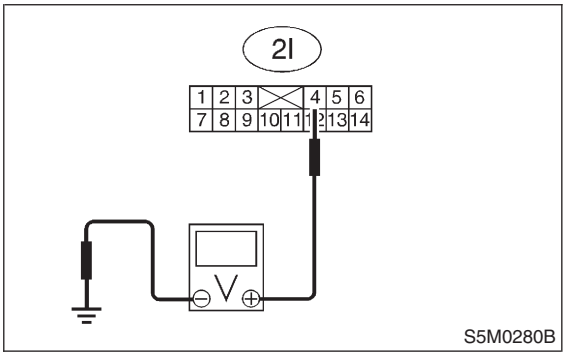
- Airbag main harness circuit (Driver) is shorted to power supply.
- Airbag module harness (Driver) is shorted to power supply.
- Roll connector is shorted to power supply.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

5D1 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Connect battery ground cable and turn ignition switch "ON" (engine off).
3) Measure voltage across each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 4 (+) — Chassis ground (–):

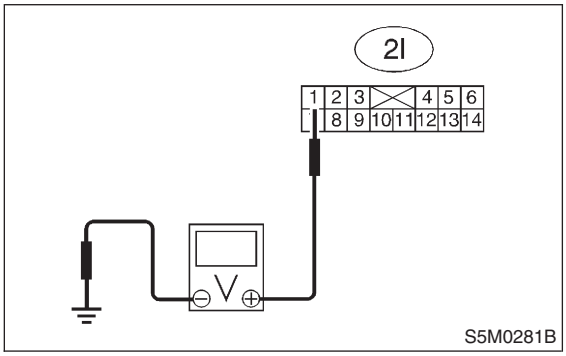


CHECK : ***Is voltage less than 1 V?***
YES : Go to step **5D2**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5D2 : AIRBAG MAIN HARNESS INSPECTION

Measure voltage across each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 1 (+) — Chassis ground (–):



CHECK : ***Is voltage less than 1 V?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

E: TROUBLE CODE 16

DIAGNOSIS:

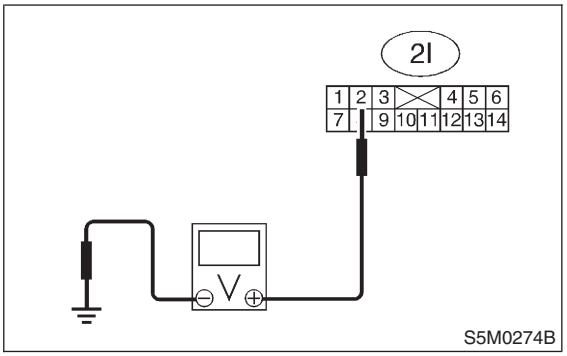
- Airbag main harness circuit (Passenger) is shorted to power supply.
- Airbag module harness (Passenger) is shorted to power supply.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

5E1 : AIRBAG MAIN HARNESS INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Connect battery ground cable and turn ignition switch "ON" (engine off).
3) Measure voltage across each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 2 (+) — Chassis ground (–):

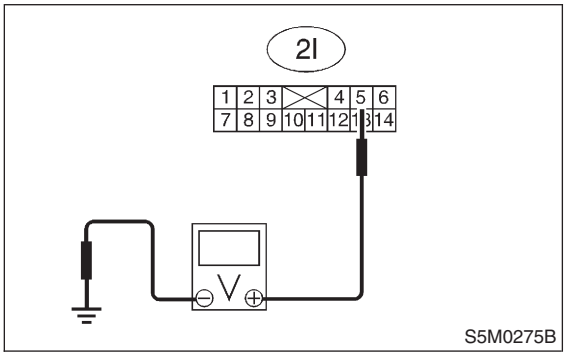


CHECK : ***Is voltage less than 1 V?***
YES : Go to step **5E2**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5E2 : AIRBAG MAIN HARNESS INSPECTION

Measure voltage across each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 5 (+) — Chassis ground (–):



CHECK : ***Is voltage less than 1 V?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

F: TROUBLE CODE 21

DIAGNOSIS:

Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal, and then wait at least 20 seconds.

5F1 : CHECK IF TROUBLE CODE 21 IS INDICATED.

Confirm flashing trouble code according to "BASIC DIAGNOSTICS PROCEDURE". <Ref. to 5-5 [T4A0].>

CHECK : ***Is airbag warning light trouble code 21 indicated?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Perform clear memory. <Ref. to 5-5 [T4C0].>

G: TROUBLE CODE 22

DIAGNOSIS:

Front airbag module is inflated.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal, and then wait at least 20 seconds.

5G1 :	**CHECK IF TROUBLE CODE 22 IS INDICATED.**

Confirm flashing trouble code according to "BASIC DIAGNOSTICS PROCEDURE". <Ref. to 5-5 [T4A0].>

CHECK : ***Is airbag warning light trouble code 22 indicated?***

YES : Replace airbag control module <Ref. to 5-5 [W5A0].>, front sub sensor <Ref. to 5-5 [W7A0].> and front airbag module of both sides. <Ref. to 5-5 [W3A0].>

NO : Perform clear memory. <Ref. to 5-5 [T4C0].>

H: TROUBLE CODE 23

DIAGNOSIS:

(AB6) is not connected properly to airbag control module.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.

5H1 :	**CHECK POOR CONTACT IN CONNECTOR (AB6).**

Check connector (AB6) connected to airbag control module. <Ref. to 5-5 [W5A0].>

CHECK : ***Is there poor contact in connector (AB6)?***

YES : Repair poor contact in connector (AB6).

NO : Replace airbag control module. <Ref. to 5-5 [W5A0].>

I: TROUBLE CODE 24

DIAGNOSIS:

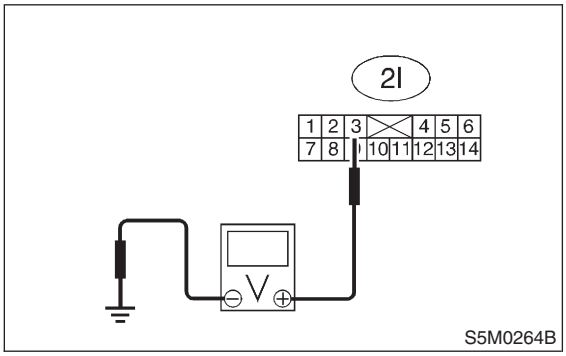
- Airbag control module is faulty.
- Airbag main harness circuit is open.
- Fuse No. 11 (in joint box) is blown.
- Body harness circuit is open.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

5I1 : AIRBAG CONTROL MODULE INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Connect battery ground cable and turn ignition switch "ON" (engine off).
3) Measure voltage across connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 3 (+) — Chassis ground (–):

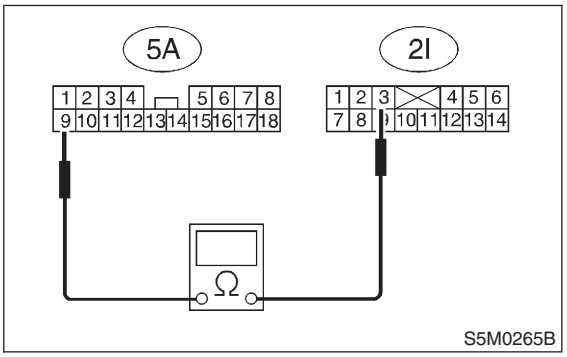


CHECK : ***Is voltage more than 10 V?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5I2**.

5I2 : AIRBAG MAIN HARNESS INSPECTION

1) Go to following procedure after performing diagnostics on airbag system as per diagnosis procedure under "5I1 AIRBAG CONTROL MODULE INSPECTION" <Ref. to 5-5 [T5I1].> previously outlined.
2) Turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
3) Disconnect connector (AB1) from body harness connector (B31) at front lower pillar (driver side), and connect connector (AB1) to test harness A connector (2A).
4) Measure resistance between test harness A connector (5A) and test harness I or I2 connector (2I) terminals.

Connector & terminal
(5A) No. 9 — (2I) No. 3:

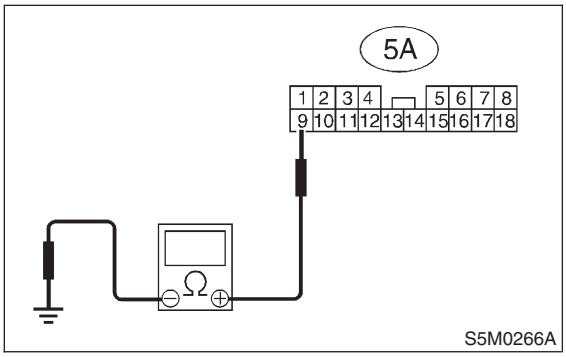


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5I3**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5I3 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between each terminal of connectors (5A) and chassis ground.

Connector & terminal
(5A) No. 9 (+) — Chassis ground (–):

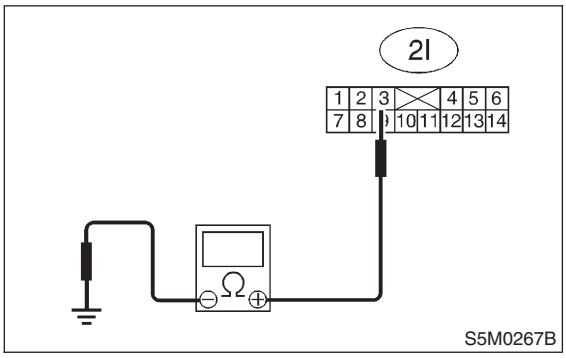


CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5I4**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5I4 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between each terminal of connectors (2I) and chassis ground.

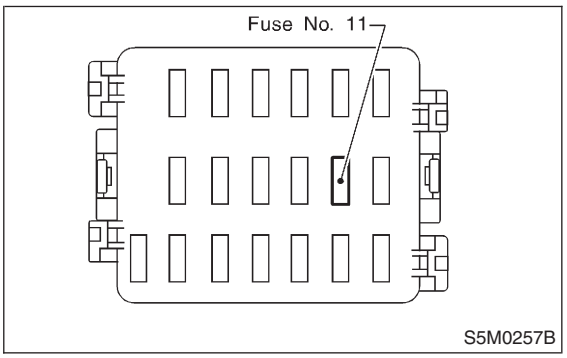
Connector & terminal
(2I) No. 3 (+) — Chassis ground (–):



CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5I5**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5I5 : FUSE NO. 11 (IN JOINT BOX) INSPECTION

Make sure ignition switch is turned “OFF”, then remove and visually check fuse No. 11 (in joint box).



CHECK : ***Is fuse No. 11 blown?***
YES : Replace fuse No. 11. If fuse No. 11 blows again, repair body harness.
NO : Repair body harness.

J: TROUBLE CODE 25

DIAGNOSIS:

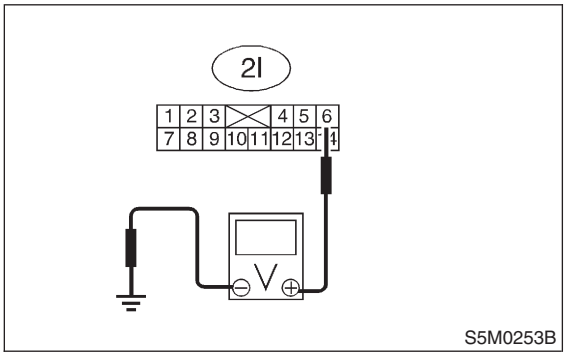
- Airbag control module is faulty.
- Airbag main harness circuit is open.
- Fuse No. 6 (in joint box) is blown.
- Body harness circuit is open.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
After 20 seconds elapse, remove instrument panel lower cover, and disconnect (AB3) and (AB8), (AB9) and (AB10).

5J1 : AIRBAG CONTROL MODULE INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].> and connect it to test harness I or I2 connector (1I).
2) Connect battery ground cable and turn ignition switch "ON". (engine off)
3) Measure voltage across connector (2I) terminal and chassis ground.

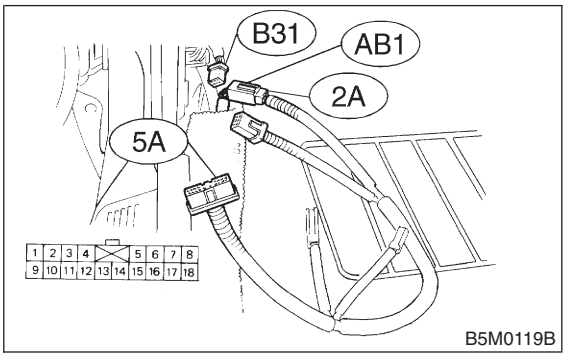
Connector & terminal
(2I) No. 6 (+) — Chassis ground (–):



CHECK : ***Is voltage more than 10 V?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5J2**.

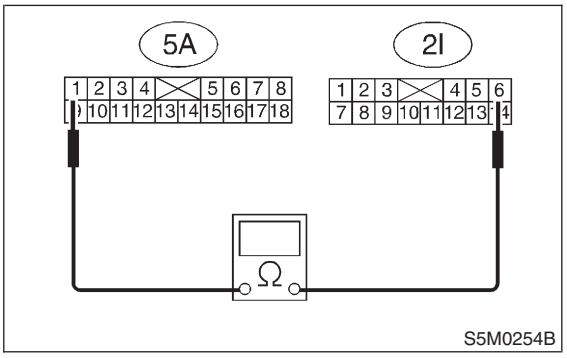
5J2 : AIRBAG MAIN HARNESS INSPECTION

1) Go to following procedure after performing diagnostics on airbag system as per diagnosis procedure under "5J1 AIRBAG CONTROL MODULE INSPECTION" <Ref. to 5-5 [T5J1].> previously outlined.
2) Turn ignition switch "OFF", disconnect battery ground terminal and then wait at least 20 seconds.
3) Disconnect body harness connector (B31) from connector (AB1) at front lower pillar, and connect connector (AB1) to test harness A connector (2A).



4) Measure resistance between test harness A connector (5A) terminal and test harness I or I2 connector (2I) terminal.

Connector & terminal
(5A) No. 1 — (2I) No. 6:

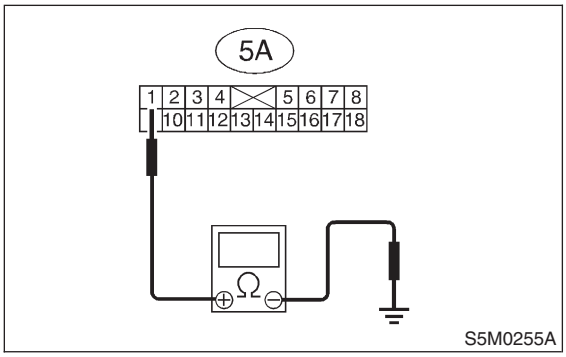


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5J3**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5J3 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between (5A) connector terminal and chassis ground.

Connector & terminal
(5A) No. 1 (+) — Chassis ground (–):

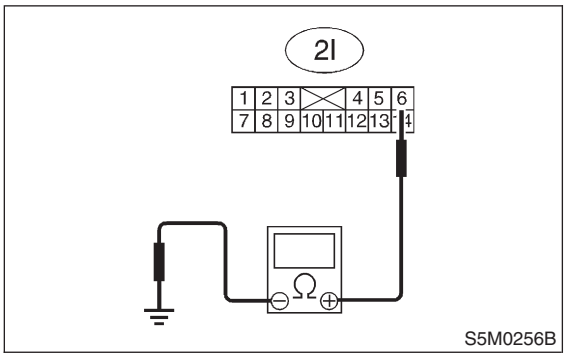


CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5J4**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5J4 : AIRBAG MAIN HARNESS INSPECTION

Measure resistance between (2I) connector terminal and chassis ground.

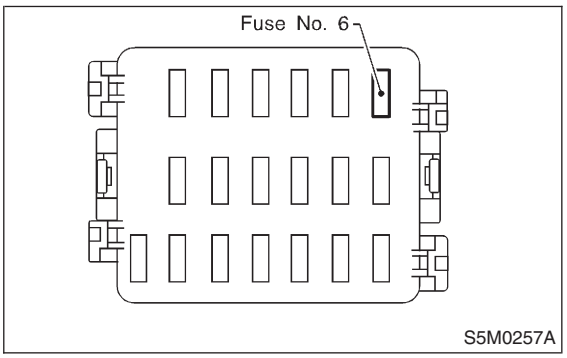
Connector & terminal
(2I) No. 6 (+) — Chassis ground (–):



CHECK : ***Is resistance more than 10 kΩ?***
YES : Go to step **5J5**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5J5 : FUSE NO. 6 (IN JOINT BOX) INSPECTION

1) Turn ignition switch “OFF”.
2) Remove and visually check fuse No. 6 (in joint box).



CHECK : ***Is fuse No. 6 blown?***
YES : Replace fuse No. 6 if fuse No. 6 blows again, repair body harness.
NO : Repair body harness.

K: TROUBLE CODE 31

DIAGNOSIS:

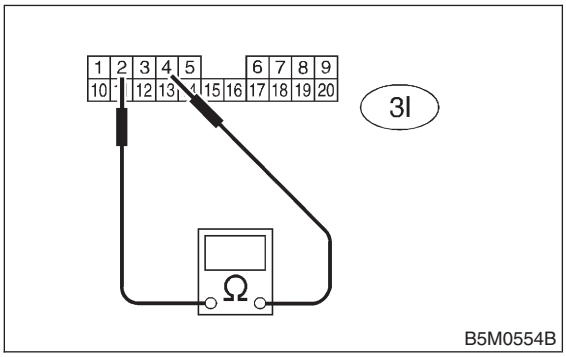
- Front sub sensor harness (RH) circuit is shorted.
- Front sub sensor harness (RH) circuit is open.
- Front sub sensor (RH) is faulty.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal, and then wait at least 20 seconds.

5K1 : FRONT SUB SENSOR (RH) AND FRONT SUB SENSOR HARNESS (RH) INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (3I) terminal.

Connector & terminal
(3I) No. 2 — No. 4:

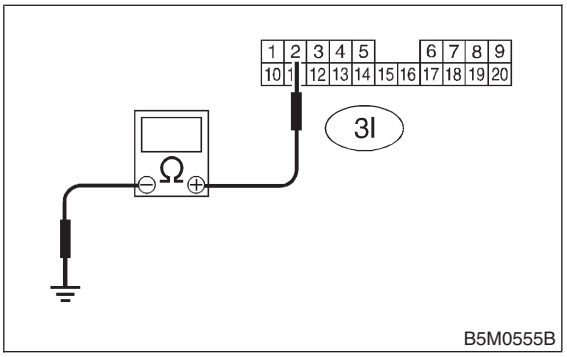


CHECK : ***Is the resistance between 750 Ω and 1 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5K2**.

5K2 : FRONT SUB SENSOR (RH) AND FRONT SUB SENSOR HARNESS (RH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 2 (+) — Chassis ground (–):

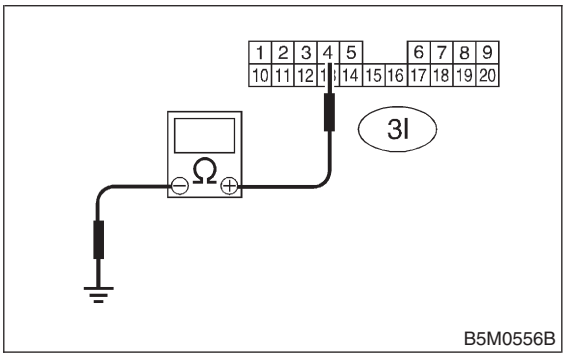


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5K3**.

5K3 : FRONT SUB SENSOR (RH) AND FRONT SUB SENSOR HARNESS (RH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 4 (+) — Chassis ground (–):

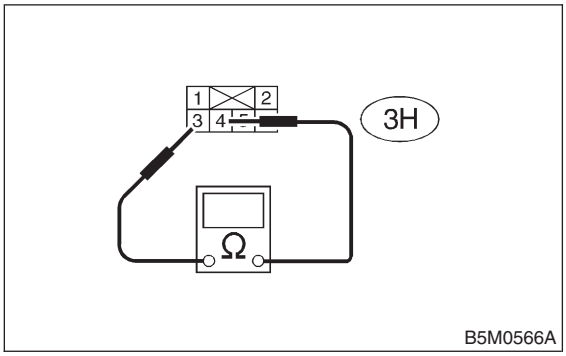


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5K4**.

5K4 : FRONT SUB SENSOR (RH) INSPECTION

1) Connect test harness H connector (2H) and front sub sensor (RH).
2) Measure resistance between test harness H connector (3H) terminal.

Connector & terminal
(3H) No. 3 — No. 4:

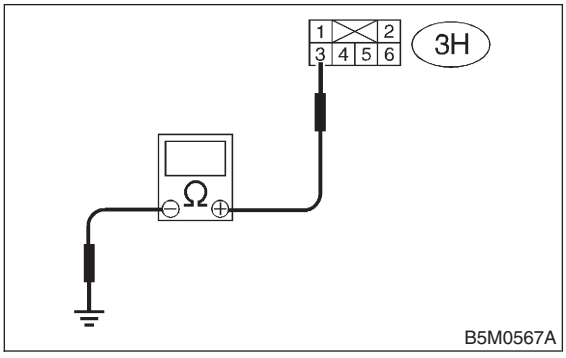


CHECK : ***Is the resistance between 750 Ω and 1 kΩ?***
YES : Go to step **5K5**.
NO : Replace front sub sensor (RH). <Ref. to 5-5 [W7A0].>

5K5 : FRONT SUB SENSOR (RH) INSPECTION

Measure resistance across test harness H connector (3H) terminal and chassis ground.

Connector & terminal
(3H) No. 3 (+) — Chassis ground (–):

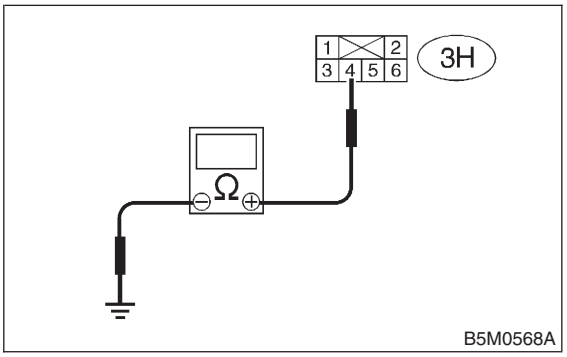


CHECK : ***Is the resistance less than 10 kΩ?***
YES : Go to step **5K6**.
NO : Replace front sub sensor (RH). <Ref. to 5-5 [W7A0].>

5K6 : FRONT SUB SENSOR (RH) INSPECTION

Measure resistance across test harness H connector (3H) terminal and chassis ground.

Connector & terminal
(3H) No. 4 (+) — Chassis ground (–):

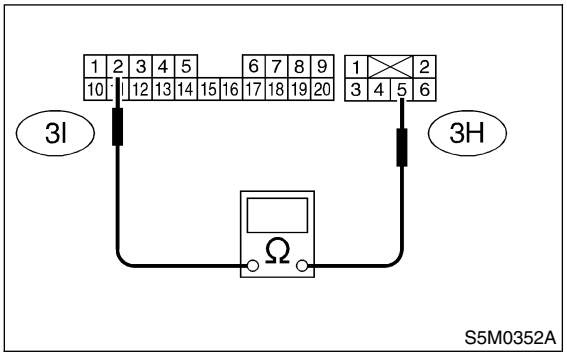


CHECK : ***Is the resistance less than 10 kΩ?***
YES : Go to step **5K7**.
NO : Replace front sub sensor (RH). <Ref. to 5-5 [W7A0].>

5K7 : FRONT SUB SENSOR HARNESS (RH) INSPECTION

1) Connect test harness I or I2 connector (1I) and connector (AB6).
2) Disconnect connector (AB16) from front sub sensor (RH) <Ref. to 5-5 [W7A0].> and then test harness H connector (1H) and connector (AB16).
3) Measure resistance between test harness I or I2 connector (3I) terminal and test harness H connector (3H) terminal.

Connector & terminal
(3I) No. 2 — (3H) No. 5:

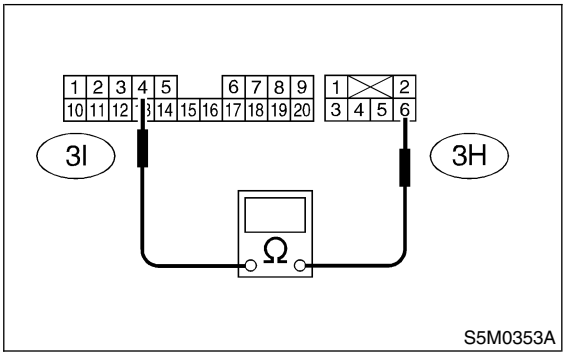


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **5K8**.
NO : Replace front sub sensor harness (RH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5K8 : FRONT SUB SENSOR HARNESS (RH) INSPECTION

Measure resistance between test harness I or I2 connector (3I) terminal and test harness H connector (3H) terminal.

Connector & terminal
(3I) No. 4 — (3H) No. 6:

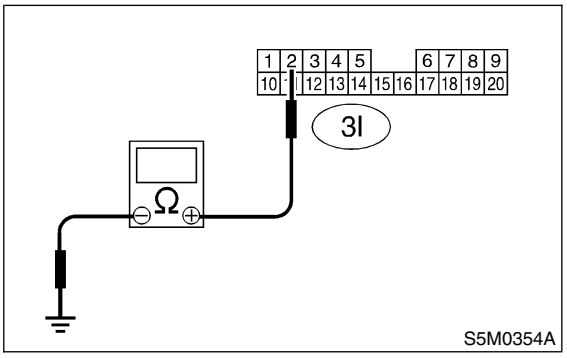


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **5K9**.
NO : Replace front sub sensor harness (RH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5K9 : FRONT SUB SENSOR HARNESS (RH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 2 (+) — Chassis ground (–):

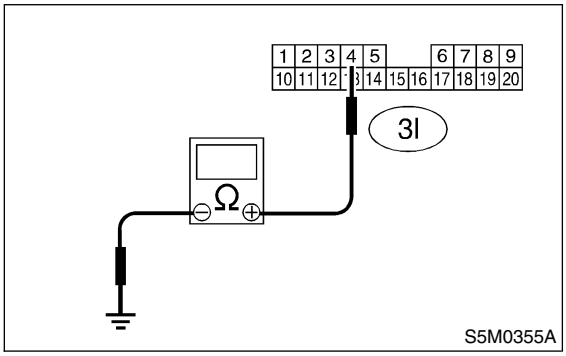


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Go to step **5K10**.
NO : Replace front sub sensor harness (RH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5K10 : FRONT SUB SENSOR HARNESS (RH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 4 (+) — Chassis ground (–):



CHECK : ***Is the resistance more than 10 kΩ?***
YES : Go to step **5K11**.
NO : Replace front sub sensor harness (RH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5K11 : CHECK POOR CONTACT IN CONNECTORS (AB14) AND (AB15).

Check connectors (AB14) and (AB15).

CHECK : ***Is there poor contact in connectors (AB14) and (AB15)?***
YES : Repair poor contact in connectors (AB14) and (AB15).
NO : Replace front sub sensor harness (RH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

L: TROUBLE CODE 32

DIAGNOSIS:

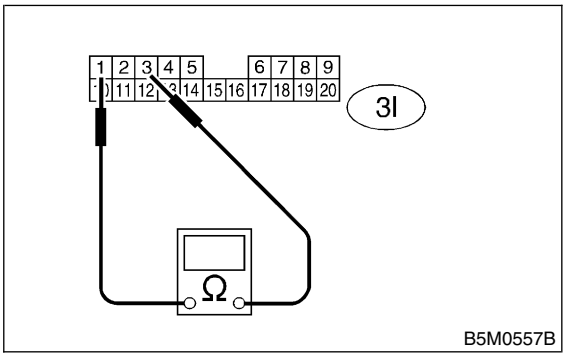
- Front sub sensor harness (LH) circuit is shorted.
- Front sub sensor harness (LH) circuit is open.
- Front sub sensor (LH) is faulty.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal, and then wait at least 20 seconds.

5L1 : FRONT SUB SENSOR (LH) AND FRONT SUB SENSOR HARNESS (LH) INSPECTION

1) Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between test harness I or I2 connector (3I) terminal.

Connector & terminal
(3I) No. 1 — No. 3:

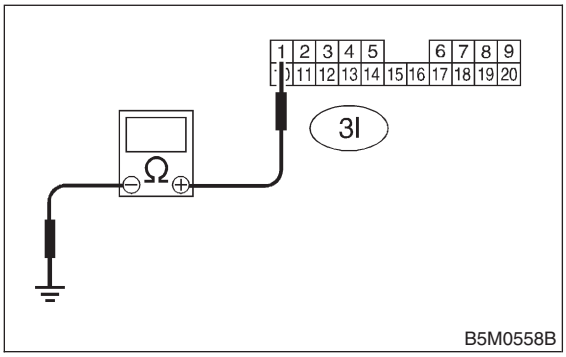


CHECK : ***Is the resistance between 750 Ω and 1 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5L2**.

5L2 : FRONT SUB SENSOR (LH) AND FRONT SUB SENSOR HARNESS (LH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 1 (+) — Chassis ground (–):

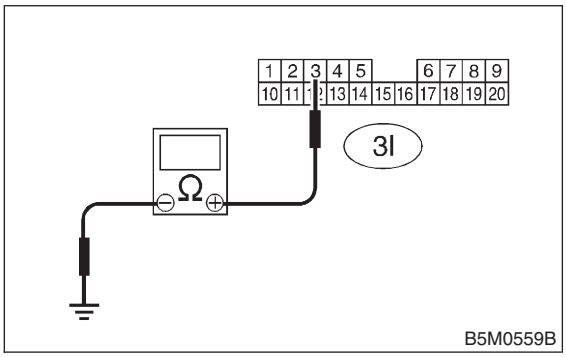


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5L3**.

5L3 : FRONT SUB SENSOR (LH) AND FRONT SUB SENSOR HARNESS (LH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 3 (+) — Chassis ground (–):

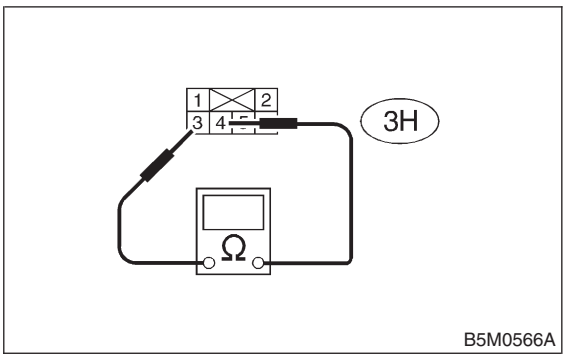


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Go to step **5L4**.

5L4 : FRONT SUB SENSOR (LH) INSPECTION

1) Connect test harness H connector (2H) and front sub sensor (LH).
2) Measure resistance between test harness H connector (3H) terminal.

Connector & terminal
(3H) No. 3 — No. 4:

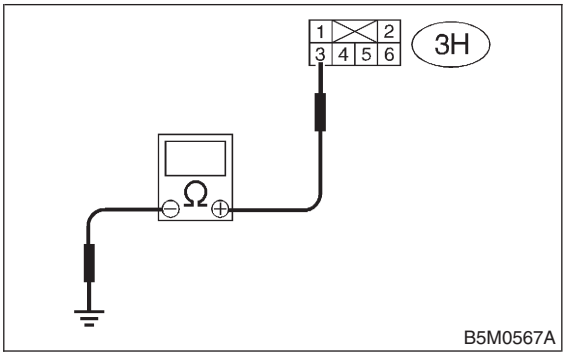


CHECK : ***Is the resistance between 750 Ω and 1 kΩ?***
YES : Go to step **5L5**.
NO : Replace front sub sensor (LH). <Ref. to 5-5 [W7A0].>

5L5 : FRONT SUB SENSOR (LH) INSPECTION

Measure resistance across test harness H connector (3H) terminal and chassis ground.

Connector & terminal
(3H) No. 3 (+) — Chassis ground (–):

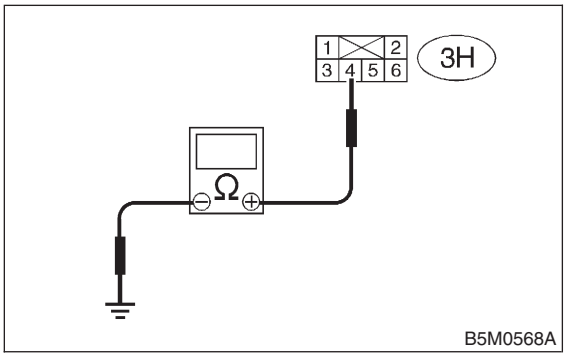


CHECK : ***Is the resistance less than 10 kΩ?***
YES : Go to step **5L6**.
NO : Replace front sub sensor (LH). <Ref. to 5-5 [W7A0].>

5L6 : FRONT SUB SENSOR (LH) INSPECTION

Measure resistance across test harness H connector (3H) terminal and chassis ground.

Connector & terminal
(3H) No. 4 (+) — Chassis ground (–):

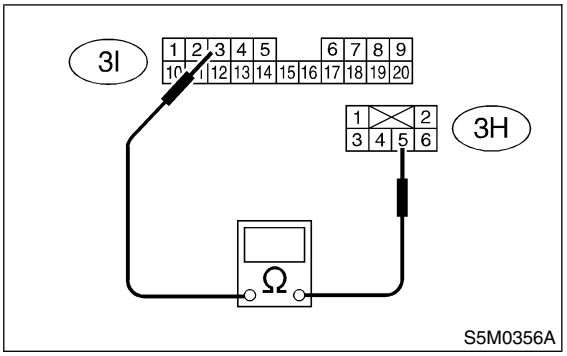


CHECK : ***Is the resistance less than 10 kΩ?***
YES : Go to step **5L7**.
NO : Replace front sub sensor (LH). <Ref. to 5-5 [W7A0].>

5L7 : FRONT SUB SENSOR HARNESS (LH) INSPECTION

1) Connect test harness I or I2 connector (1I) and connector (AB6).
2) Disconnect connector (AB13) from front sub sensor (LH) <Ref. to 5-5 [W7A0].> and then test harness H connector (1H) and connector (AB13).
3) Measure resistance between test harness I or I2 connector (3I) terminal and test harness H connector (3H) terminal.

Connector & terminal
(3I) No. 3 — (3H) No. 5:

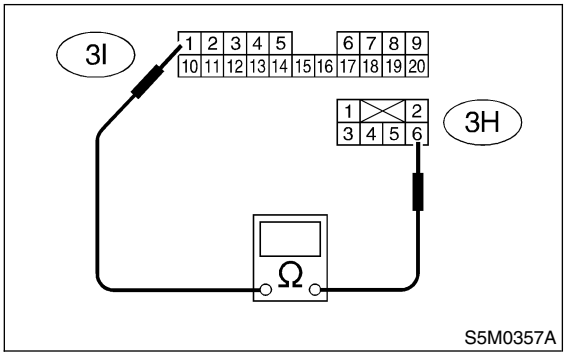


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **5L8**.
NO : Replace front sub sensor harness (LH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5L8 : FRONT SUB SENSOR HARNESS (LH) INSPECTION

Measure resistance between test harness I or I2 connector (3I) terminal and test harness H connector (3H) terminal.

Connector & terminal
(3I) No. 1 — (3H) No. 6:

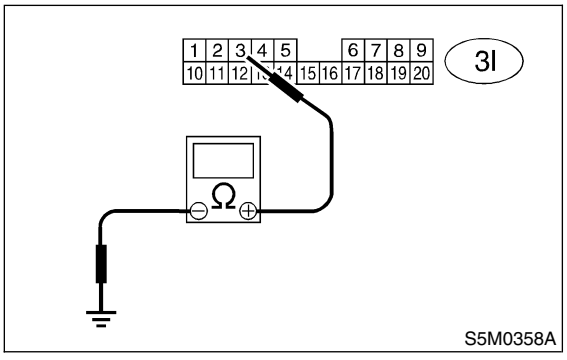


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **5L9**.
NO : Replace front sub sensor harness (LH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5L9 : FRONT SUB SENSOR HARNESS (LH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 3 (+) — Chassis ground (–):

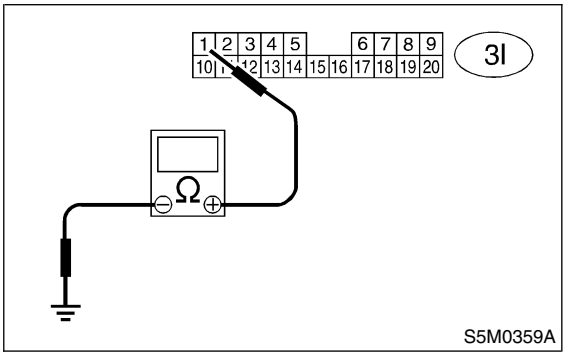


CHECK : ***Is the resistance more than 10 kΩ?***
YES : Go to step **5L10**.
NO : Replace front sub sensor harness (LH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5L10 : FRONT SUB SENSOR HARNESS (LH) INSPECTION

Measure resistance across test harness I or I2 connector (3I) terminal and chassis ground.

Connector & terminal
(3I) No. 1 (+) — Chassis ground (–):



CHECK : ***Is the resistance more than 10 kΩ?***
YES : Go to step **5L11**.
NO : Replace front sub sensor harness (LH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

5L11 : CHECK POOR CONTACT IN CONNECTORS (AB11) AND (AB12).

Check connectors (AB11) and (AB12).

CHECK : ***Is there poor contact in connectors (AB11) and (AB12)?***
YES : Repair poor contact in connectors (AB11) and (AB12).
NO : Replace front sub sensor harness (LH) <Ref. to 5-5 [W7A0].> and airbag main harness. <Ref. to 5-5 [W4A0].>

M: AIRBAG WARNING LIGHT REMAINS ON.

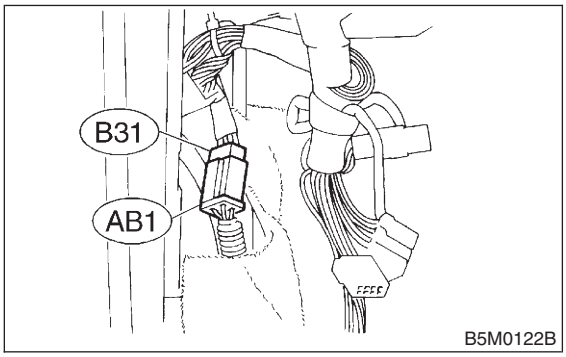
DIAGNOSIS:

- Airbag warning light is faulty.
- Airbag control module to airbag warning light harness circuit is shorted or open.
- Grounding circuit is faulty.
- Airbag control module is faulty.
- (AB1) and (B31) are not connected properly.
- (AB6) is not connected properly to airbag control module.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.

5M1 : CHECK POOR CONTACT IN CONNECTORS (AB1) AND (B31).

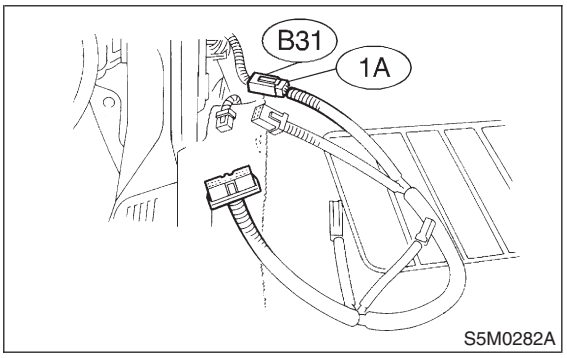
1) Remove front pillar lower trim (Driver side).
2) Check poor contact in connectors (AB1) and (B31).



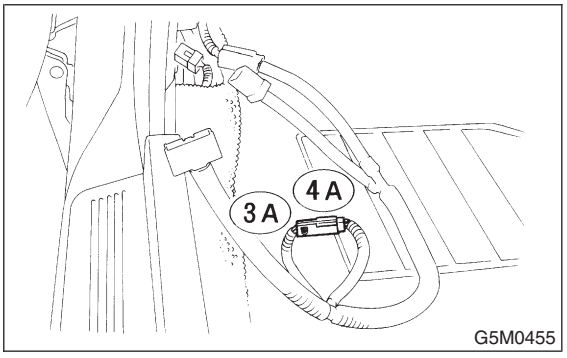
CHECK : ***Is there poor contact in double lock of connectors (AB1) and (B31)?***
YES : Repair poor contact in double lock of connectors (AB1) and (B31).
NO : Go to step **5M2**.

5M2 : INSPECTION OF AIRBAG WARNING LIGHT

1) Turn ignition switch "OFF" and connect body harness connector (B31) to test connector A connector (1A).



2) Connect battery ground cable and turn ignition switch "ON", (engine off) and connect connectors (3A) and (4A).

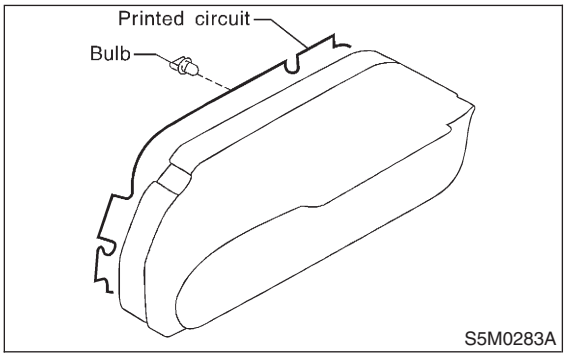


CHECK : ***Does the airbag warning light come off?***
YES : Go to step **5M4**.
NO : Go to step **5M3**.

5M3 : INSPECTION OF BODY HARNESS

Check body harness.

NOTE:
After problem has been eliminated, disconnect connectors (3A) and (4A).



CHECK : ***Is there anything unusual to body harness?***
YES : Repair body harness.
NO : Replace airbag warning light bulb <Ref. to 6-2 [W8B0].> or combination meter printed circuit.

5M4 : CHECK POOR CONTACT IN CONNECTOR (AB6).

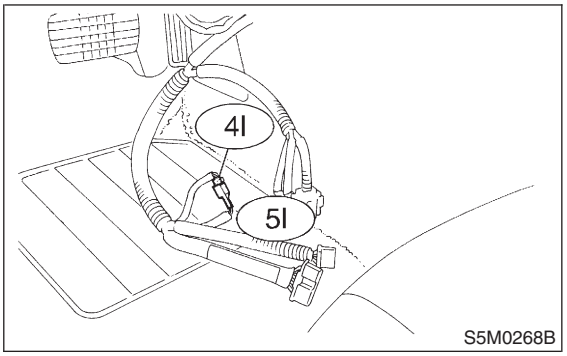
Check connector (AB6) connected to airbag control module. <Ref. to 5-5 [W5A0].>

CHECK : ***Is there poor contact in connector (AB6)?***
YES : Repair poor contact in connector (AB6).
NO : Go to step **5M5**.

5M5 : INSPECTION OF AIRBAG MAIN HARNESS

1) Turn ignition switch “OFF”, disconnect battery ground cable and then wait at least 20 seconds, and re-connect connectors (AB1) and (B31).
2) Remove instrument panel lower cover and disconnect (AB3) with (AB8), then disconnect connector (AB6) from airbag control module, <Ref. to 5-5 [W5A0].> and connect it to test harness I or I2 connector (1I).
3) Connect battery ground cable and turn ignition switch “ON”, (engine off) and connect connectors (4I) and (5I).

NOTE:
After problem has been eliminated, disconnect connectors (4I) and (5I).

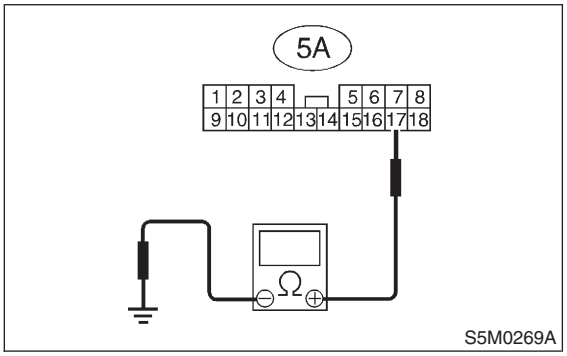


CHECK : ***Does the airbag warning light come off?***
YES : Go to step **5M6**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5M6 : GROUNDING CIRCUIT INSPECTION

1) Turn ignition switch “OFF”, disconnect battery ground cable and then wait at least 20 seconds.
2) Disconnect connector (AB1) from body harness connector (B31), and connect connector (B31) to test harness A connector (1A).
3) Measure resistance between connector (5A) terminal and chassis ground.

Connector & terminal
(5A) No. 17 (+) — Chassis ground (–):

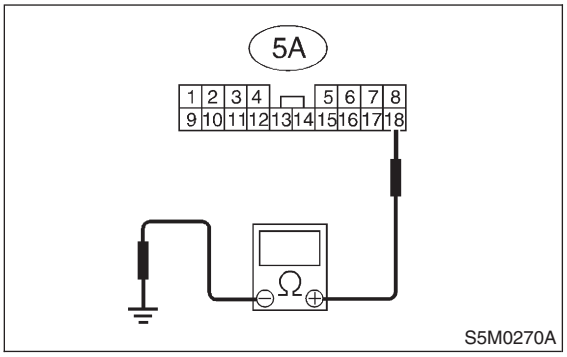


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5M7**.
NO : Repair body grounding circuit.

5M7 : GROUNDING CIRCUIT INSPECTION

Measure resistance between connector (5A) terminal and chassis ground.

Connector & terminal
(5A) No. 18 (+) — Chassis ground (–):

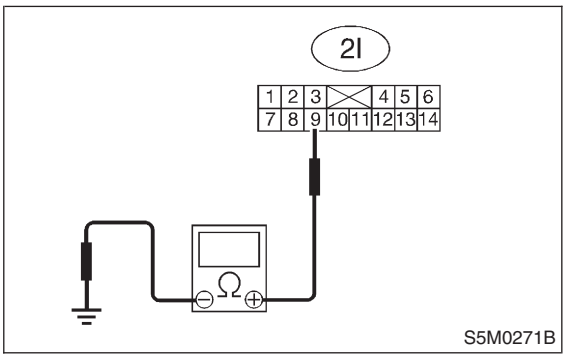


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5M8**.
NO : Repair body grounding circuit.

5M8 : INSPECTION OF AIRBAG MAIN HARNESS

1) Connect connectors (AB1) and (B31). Disconnect connector (AB6) from airbag control module <Ref. to 5-5 [W5A0].>, and connect it to test harness I or I2 connector (1I).
2) Measure resistance between each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 9 (+) — Chassis ground (–):

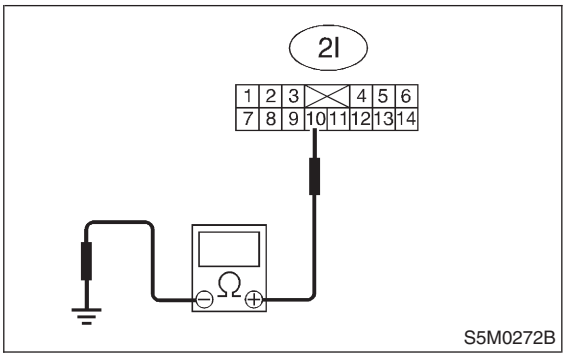


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **5M9**.
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

5M9 : INSPECTION OF AIRBAG MAIN HARNESS

Measure resistance between each test harness I or I2 connector (2I) terminal and chassis ground.

Connector & terminal
(2I) No. 10 (+) — Chassis ground (–):



CHECK : ***Is resistance less than 10 Ω?***
YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>
NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

N: AIRBAG WARNING LIGHT REMAINS OFF.

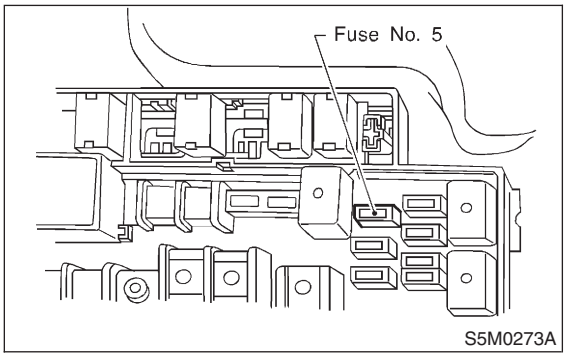
DIAGNOSIS:

- Fuse No. 5 (in main fuse box) is blown.
- Body harness circuit is open.
- Airbag warning light is faulty.
- Airbag main harness is faulty.
- Airbag control module is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground terminal, and then wait at least 20 seconds.

5N1 : FUSE NO. 5 (IN MAIN FUSE BOX) INSPECTION

Remove and visually check fuse No. 5 (In main fuse box).



CHECK : ***Is fuse No. 5 blown?***
YES : Replace fuse No. 5. If fuse No. 5 blows again, Go to step **5N2**.
NO : Go to step **5N2**.

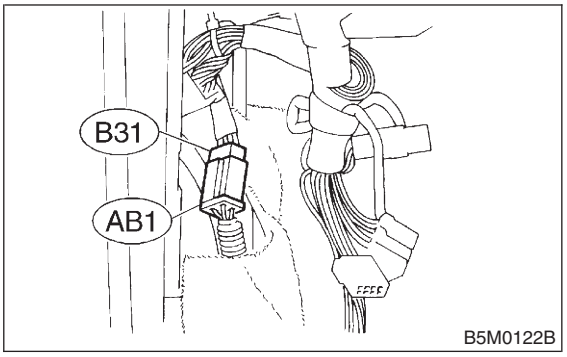
5N2 : BODY HARNESS INSPECTION

Turn ignition switch "ON" (engine off) to make sure other warning lights (in combination meter) illuminate.

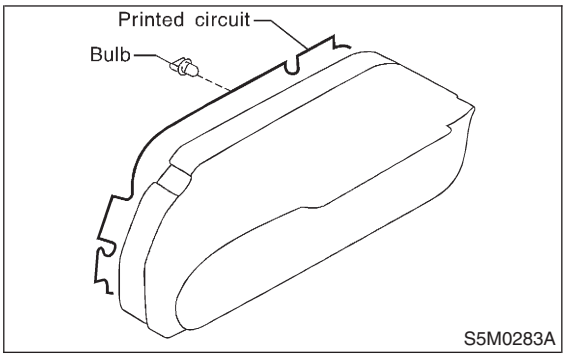
CHECK : ***Do all the warning lights (in combination meter) except airbag warning light come on?***
YES : Go to step **5N3**.
NO : Repair body harness.

5N3 : AIRBAG WARNING LIGHT MODULE (IN COMBINATION METER) INSPECTION

1) Turn ignition switch "OFF", disconnect battery ground cable and then wait at least 20 seconds.
2) Disconnect body harness connector (B31) from connector (AB1).



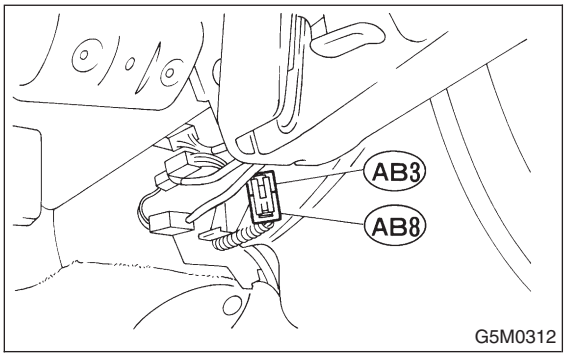
3) Connect battery ground cable and turn ignition switch "ON" (engine off) to make sure airbag warning light illuminates.



CHECK : ***Does the airbag warning light come on?***
YES : Go to step **5N4**.
NO : Replace airbag warning light bulb <Ref. to 6-2 [W8B0].> or combination meter printed circuit.

5N4 : AIRBAG MAIN HARNESS INSPECTION

1) Turn ignition switch “OFF”, disconnect battery ground cable and then wait at least 20 seconds.
2) Connect body harness connector (B31) and connector (AB1).
3) Disconnect connectors (AB3) and (AB8) below steering column. <Ref. to 5-5 [M2F2].>



4) Disconnect connector (AB6) from airbag control module. <Ref. to 5-5 [W5A0].>
5) Connect battery ground cable and turn ignition switch “ON” to make sure airbag warning light illuminates.

CHECK : ***Does the airbag warning light come on?***

YES : Replace airbag control module. <Ref. to 5-5 [W5A0].>

NO : Replace airbag main harness. <Ref. to 5-5 [W4A0].>

O: WARNING LIGHT INDICATES TROUBLE CODE, THEN NORMAL CODE. (FLASHING TROUBLE CODE.)

DIAGNOSIS:

Airbag system component parts are faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable, and then wait at least 20 seconds.

5O1 : AIRBAG COMPONENT PARTS APPEARANCE INSPECTION

1) Conduct on-board diagnostic and call up trouble codes stored in memory. <Ref. to 5-5 [T4B0].>
2) Select trouble code required to check airbag component parts from those listed in table and reproduce symptom.

Trouble codes	Check parts	Index. No.
5	• Airbag module (Driver) • Roll connector • Airbag main harness • Airbag control module	<Ref. to 5-5 [W300].> <Ref. to 5-5 [W600].> <Ref. to 5-5 [W400].> <Ref. to 5-5 [W500].>
11	• Roll connector • Airbag module (Driver) • Airbag main harness • Airbag control module	<Ref. to 5-5 [W600].> <Ref. to 5-5 [W300].> <Ref. to 5-5 [W400].> <Ref. to 5-5 [W500].>
12	• Airbag module (Passenger) • Airbag main harness • Airbag control module	<Ref. to 5-5 [W300].> <Ref. to 5-5 [W400].> <Ref. to 5-5 [W500].>
15	• Airbag module (Driver) • Roll connector • Airbag main harness • Airbag control module	<Ref. to 5-5 [W300].> <Ref. to 5-5 [W600].> <Ref. to 5-5 [W400].> <Ref. to 5-5 [W500].>
16	• Airbag main harness • Airbag module (Passenger) • Airbag control module	<Ref. to 5-5 [W400].> <Ref. to 5-5 [W300].> <Ref. to 5-5 [W500].>
21	Airbag control module	<Ref. to 5-5 [W500].>
22	Airbag control module	<Ref. to 5-5 [W500].>
25	• Fuse No. 6 • Airbag main harness • Airbag control module • Body harness	<Ref. to 5-5 [T5J5].> <Ref. to 5-5 [W400].> <Ref. to 5-5 [W500].> <Ref. to 5-3 [W100].>
26	Side airbag module LH in front seat	<Ref. to 5-3 [W100].>
31	• Airbag main harness • Front sub sensor and front sub sensor harness (RH)	<Ref. to 5-5 [W400].> <Ref. to 5-5 [W700].>
32	• Airbag main harness • Front sub sensor and front sub sensor harness (LH)	<Ref. to 5-5 [W400].> <Ref. to 5-5 [W700].>
41	Side airbag module RH in front seat	<Ref. to 5-3 [W100].>
42	Side airbag module LH in front seat	<Ref. to 5-3 [W100].>
45	• Airbag control module • Side airbag module RH in front seat	<Ref. to 5-5 [W500].> <Ref. to 5-3 [W100].>
46	• Airbag control module • Side airbag module LH in front seat	<Ref. to 5-5 [W500].> <Ref. to 5-3 [W100].>

3) Conduct appearance inspection on parts selected.

NOTE:
Also check connector terminals, wiring harness, case, etc. for damage.

CHECK : ***Is there anything unusual about the appearance of airbag component parts?***
YES : Replace faulty airbag component parts.
NO : Go to step **5O2**.

5O2 : AIRBAG COMPONENT PARTS VIBRATION INSPECTION

1) Gently shake check parts (to determine faults.).
2) To check airbag module or roll connector, turn and tilt steering wheel.

CAUTION:
Do not shake or vibrate airbag control module.

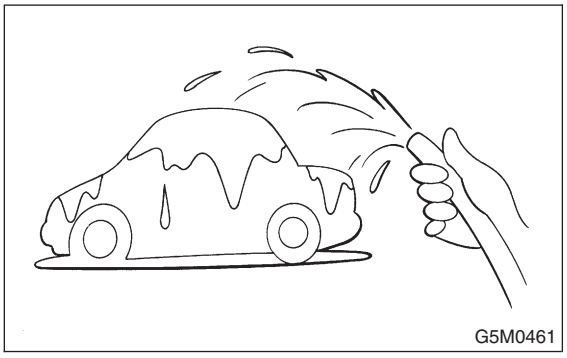
CHECK : ***Does the component malfunction again when shaking?***
YES : Replace faulty airbag component parts.
NO : Go to step **5O3**.

5O3 : SHOWERING INSPECTION TO BODY

Spray water on vehicle body.

CAUTION:
Do not directly spray water on airbag components.

NOTE:
Also check wiring harnesses as water may leak along them and get airbag component parts wet.



CHECK : ***Does water leak into the passenger compartment when showering vehicle?***
YES : Replace faulty airbag component parts.
NO : Perform clear memory. <Ref. to 5-5 [T4C0].>

P: WARNING LIGHT INDICATES TROUBLE CODE, THEN NORMAL CODE. (FLASHING NORMAL CODE.)

DIAGNOSIS:

- Airbag connector is faulty.
- Fuse No. 11 (in joint box) is blown.
- Airbag main harness is faulty.
- Airbag control module is faulty.
- Body harness is faulty.

CAUTION:
Before performing diagnostics on airbag system, turn ignition switch "OFF", disconnect battery ground cable, and then wait at least 20 seconds.

5P1 : AIRBAG CONNECTOR APPEARANCE INSPECTION

Conduct appearance inspection on airbag connectors (AB2) through (AB8). <Ref. to 5-5 [T100].>

NOTE:
Check terminals, case and wiring harnesses for damage.

CHECK : ***Is there anything unusual about the appearance of connectors (AB2) through (AB8)?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P2**.

5P2 : AIRBAG CONNECTOR VIBRATION INSPECTION

Conduct vibration inspection on airbag connectors (AB2) through (AB8). <Ref. to 5-5 [T100].>

NOTE:
Gently shake each airbag connector.

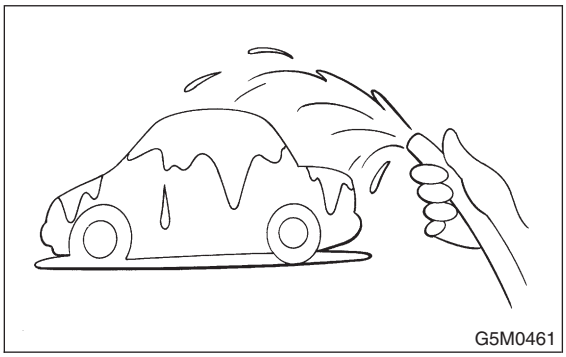
CHECK : ***Do the connectors (AB2) through (AB8) malfunction again when shaking?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P3**.

5P3 : SHOWERING INSPECTION TO BODY

Spray water on vehicle body.

CAUTION:
Do not directly spray water on airbag components.

NOTE:
If leaks are noted, also check wiring harnesses as water may leak along them and wet airbag connectors.



CHECK : ***Does water leak into the passenger compartment when showering vehicle?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P4**.

5P4 : FUSE NO. 11 (IN JOINT BOX), AIRBAG MAIN HARNESS, AIRBAG CONTROL MODULE, BODY HARNESS APPEARANCE INSPECTION

Conduct appearance inspection on fuse No. 11 <Ref. to 5-5 [T5I5].>, airbag main harness <Ref. to 5-5 [W4A0].>, airbag control module <Ref. to 5-5 [W5A0].> and body harness.

NOTE:
Also check connectors, terminals, wiring harness and case for damage.

CHECK : ***Is there anything unusual about the appearance of fuse No. 11, airbag main harness, airbag control module or body harness?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P5**.

5P5 : FUSE NO. 11 (IN JOINT BOX), AIRBAG MAIN HARNESS, BODY HARNESS VIBRATION INSPECTION

Conduct vibration inspection on fuse No. 11, airbag main harness and body harness.

CAUTION:
Do not shake or vibrate airbag control module.

NOTE:
Gently shake each part.

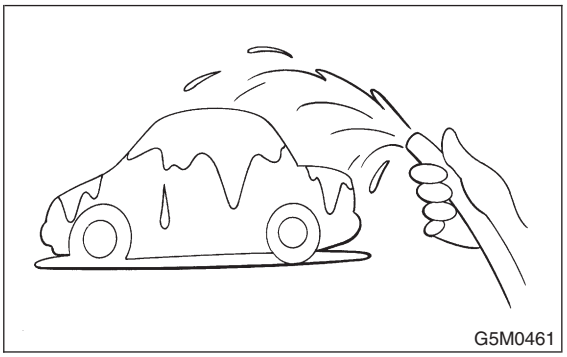
CHECK : ***Do fuse No. 11, airbag main harness or body harness malfunction again when shaking?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P6**.

5P6 : SHOWERING INSPECTION TO BODY

Spray water on vehicle body.

CAUTION:
Do not directly spray water on each part.

NOTE:
If leaks are noted, check wiring harnesses as water may leak along them and get parts wet.



CHECK : ***Does water leak into the passenger compartment when showering vehicle?***
YES : Replace faulty airbag component parts.
NO : Go to step **5P7**.

5P7 : WARNING LIGHT ILLUMINATION CHECK

Turn ignition switch “ON” (engine off) and observe airbag warning light.

CHECK : ***Does the airbag warning light come on for about 7 seconds, then go out and stay out?***

YES : Perform clear memory. <Ref. to 5-5 [T4C0].>

NO : Go to “DIAGNOSTICS PROCEDURE”. <Ref. to 5-5 [T4D0].>

ENGINE ELECTRICAL SYSTEM 6-1

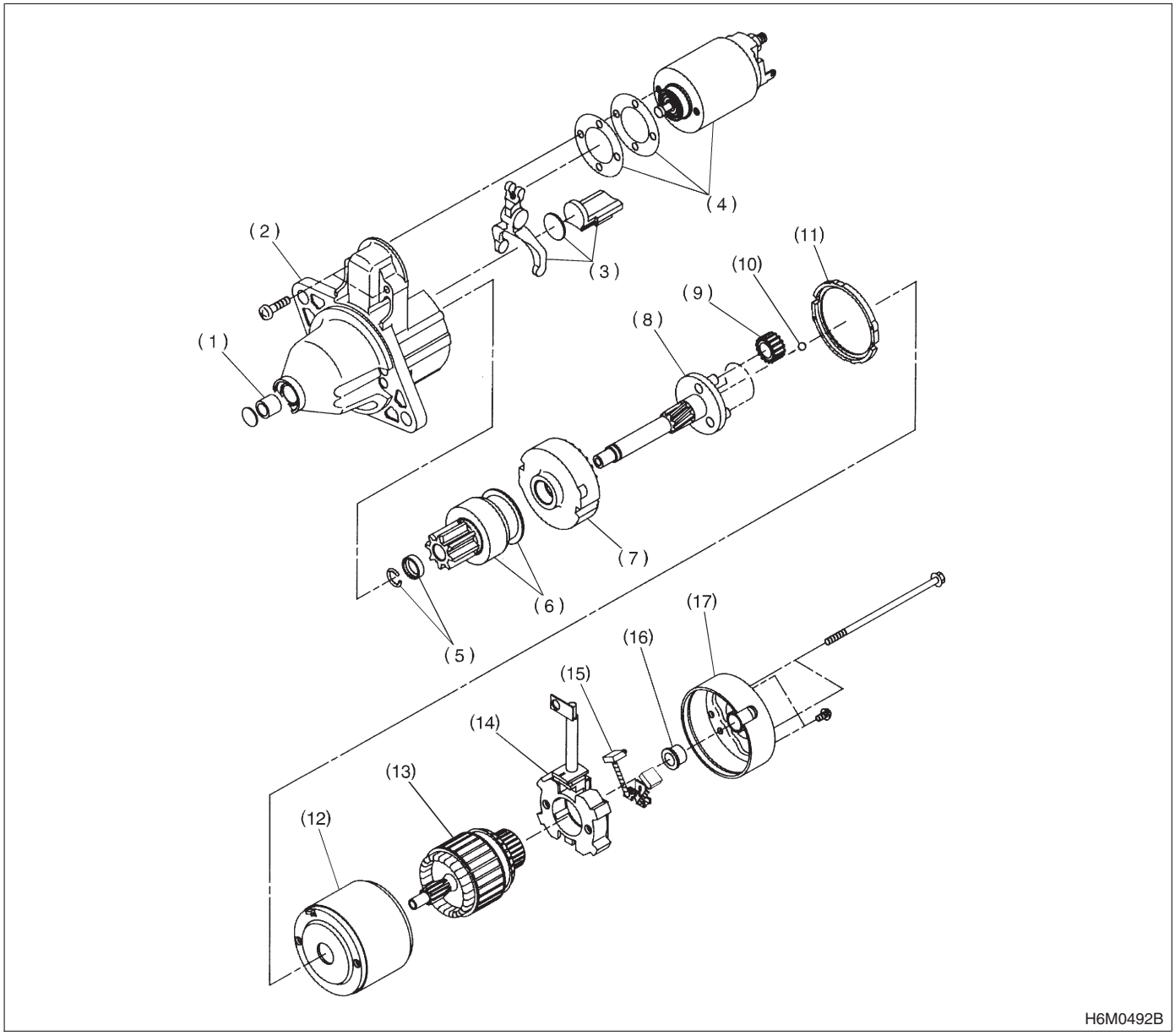
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1. Specifications

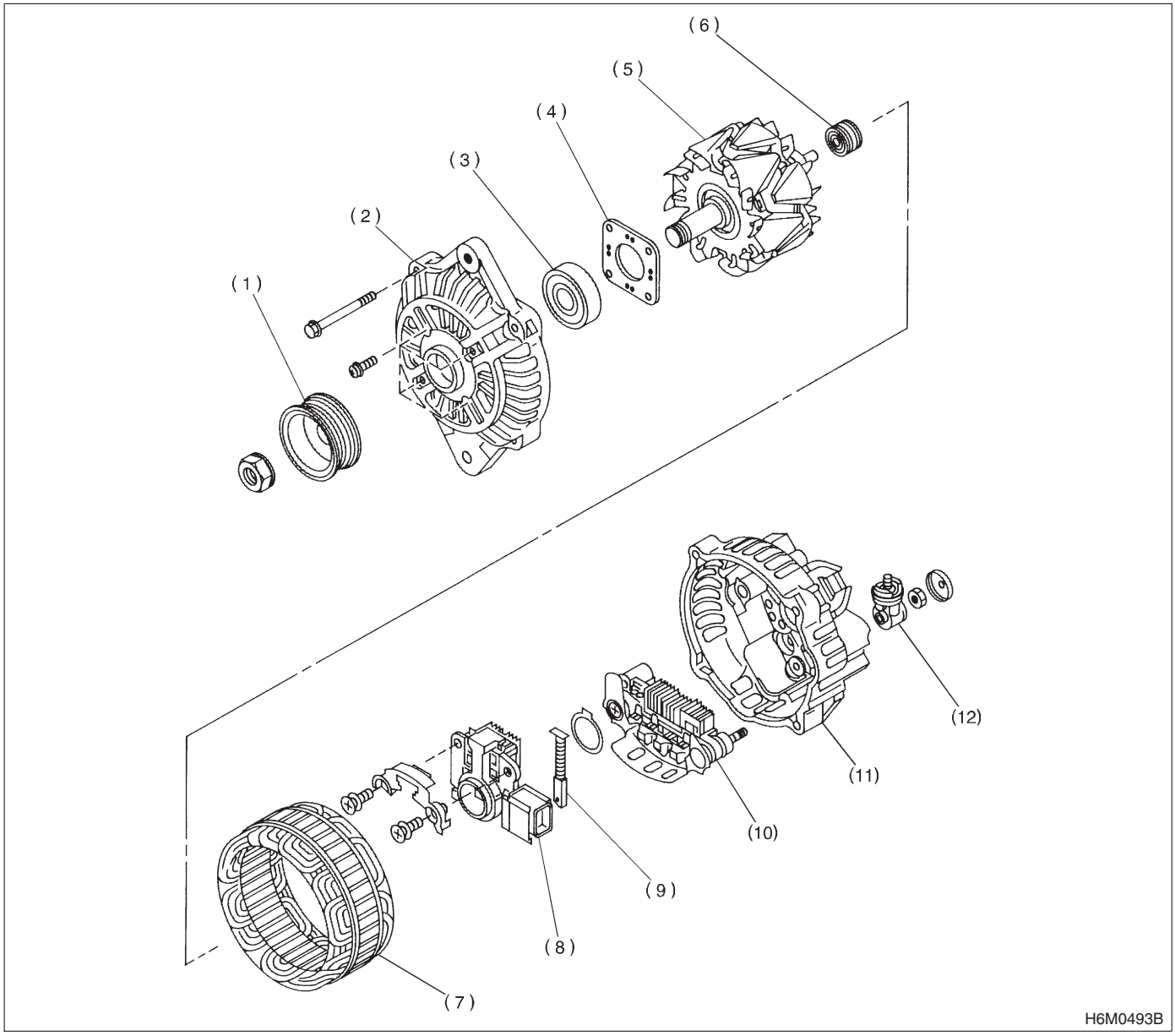
Item			Designation	
Starter	Type		Reduction type	
	Vehicle type		MT vehicles	AT vehicles
	Model		M000T81681	M000T84481, M001T84481
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	90 A or less	
		Rotating speed	2,800 rpm or more	2,400 rpm or more
	Load characteristics	Voltage	7.5 V	7.7 V
		Current	300 A	400 A
		Torque	8.73 N·m (0.89 kg-m, 6.4 ft-lb) or more	16.0 N·m (1.63 kg-m, 11.8 ft-lb) or more
		Rotating speed	890 rpm or more	740 rpm or more
	Lock characteristics	Voltage	4 V	3.5 V
		Current	780 A or less	940 A or less
		Torque	15.7 N·m (1.60 kg-m, 11.6 ft-lb) or more	28.9 N·m (2.95 kg-m, 21.3 ft-lb) or more
Generator	Type		Rotating-field three-phase type, Voltage regulator built-in type, with load response control system	Rotating-field three-phase type, Voltage regulator built-in type, with load response control system
	Model		A2TB2991	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 75 A	
	Polarity on ground side		Negative	
	Rotating direction		Clockwise (when observed from pulley side)	
	Armature connection		3-phase Y-type	
	Output current		1,500 rpm — 30 A or more 2,500 rpm — 64 A or more 5,000 rpm — 76 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
Ignition coil & Ignitor assembly	Model		FH0137-01R	
	Manufacturer		Diamond	
	Primary coil resistance		0.73 Ω±10%	
	Secondary coil resistance		12.8 kΩ±15%	
	Insulation resistance between primary terminal and case		More than 100 MΩ	
Spark plug	Type and manufacturer	Standard	RC10YC4 ..... CHAMPION	
		Alternate	RC8YC4 ..... CHAMPION, BKR6E-11 ..... NGK, K20PR-U11 ..... NIPPONDENSO	
	Thread size		14, P = 1.25 mm	
	Spark gap		1.0 — 1.1 mm (0.039 — 0.043 in)	

1. Starter



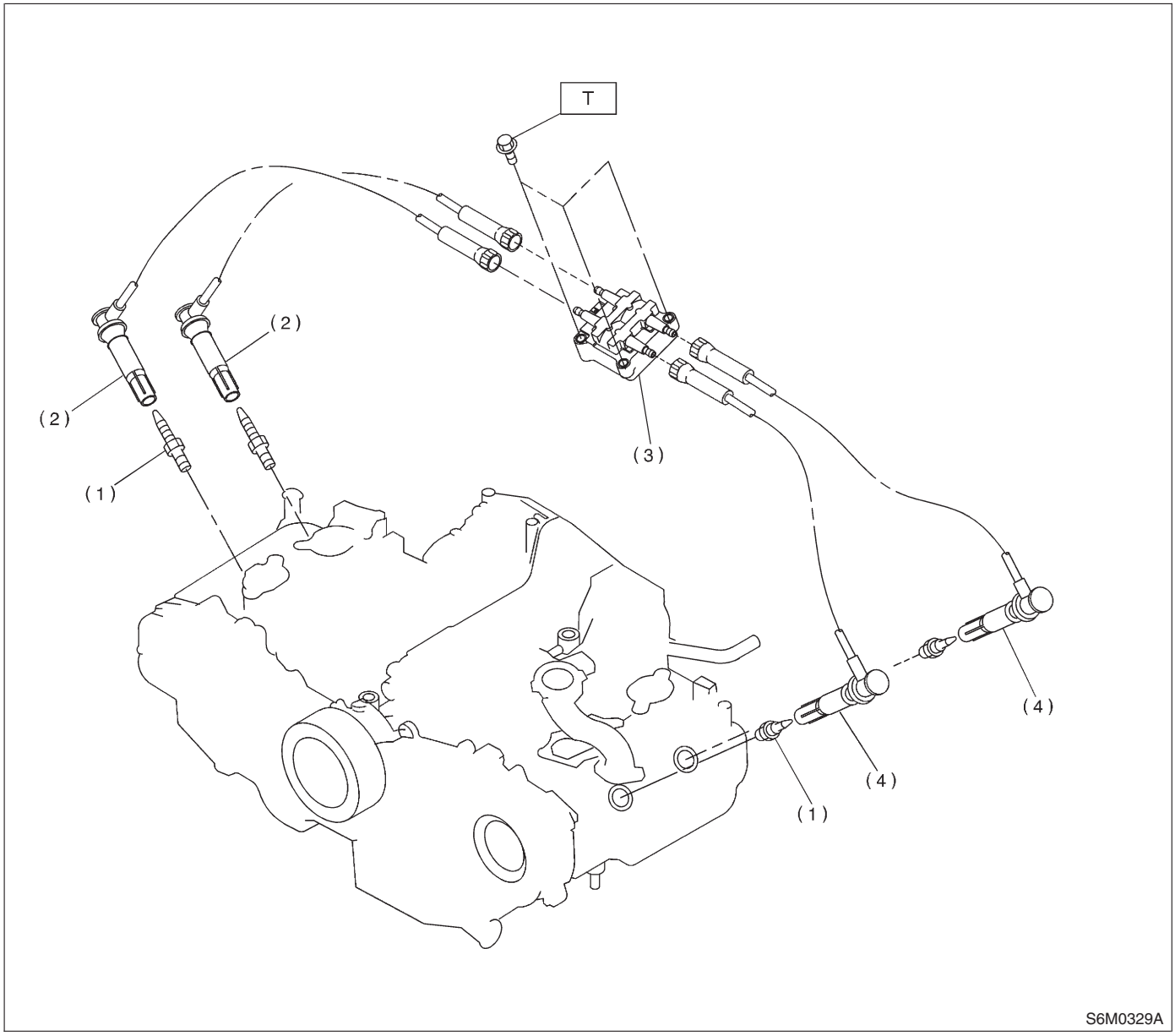
(1) Sleeve bearing
(2) Front bracket
(3) Lever set
(4) Magnet switch ASSY
(5) Stopper set
(6) Over running clutch
(7) Internal gear ASSY
(8) Shaft ASSY
(9) Gear ASSY
(10) Ball
(11) Packing
(12) Yoke
(13) Armature
(14) Brush holder
(15) Brush
(16) Sleeve bearing
(17) Rear bracket

2. Generator



(1) Pulley
(2) Front cover
(3) Ball bearing
(4) Bearing retainer
(5) Rotor
(6) Bearing
(7) Stator coil
(8) IC regulator with brush
(9) Brush
(10) Rectifier
(11) Rear cover
(12) Terminal

3. Ignition System



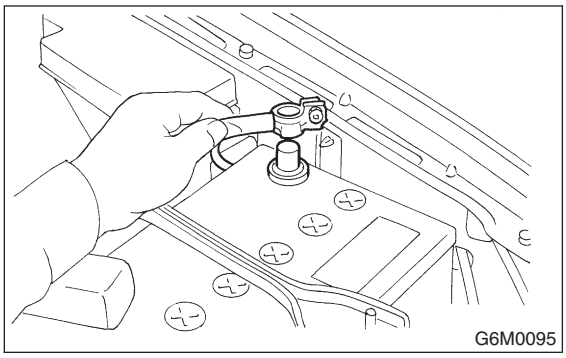
(1) Spark plug
(2) Spark plug cord (#1, #3)
(3) Ignition coil and ignitor ASSY
(4) Spark plug cord (#2, #4)

Tightening torque: N·m (kg-m, ft-lb)
T: 22±2 (2.2±0.2, 15.9±1.4)

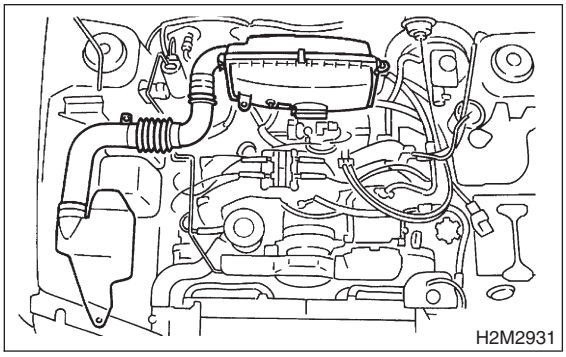
1. Starter

A: REMOVAL AND INSTALLATION

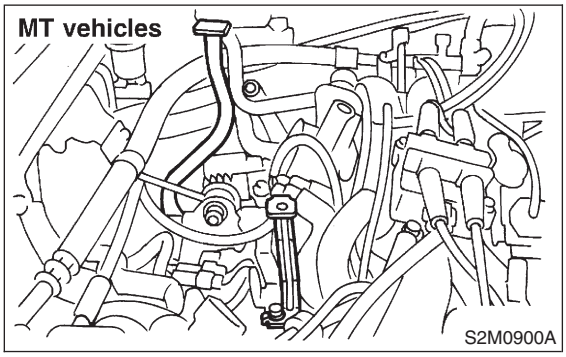
1) Disconnect battery ground cable.


G6M0095

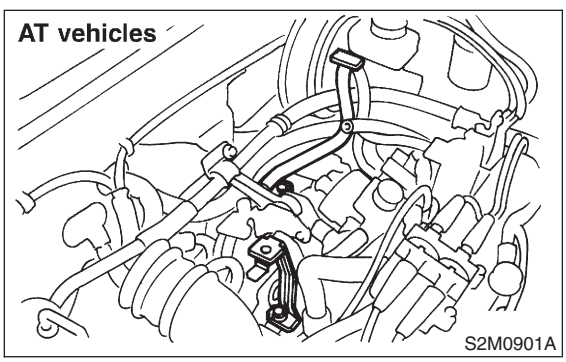
2) Remove air cleaner case and air intake duct. <Ref. to 2-7 [W1A0].>


H2M2931

3) Remove air intake chamber stay.

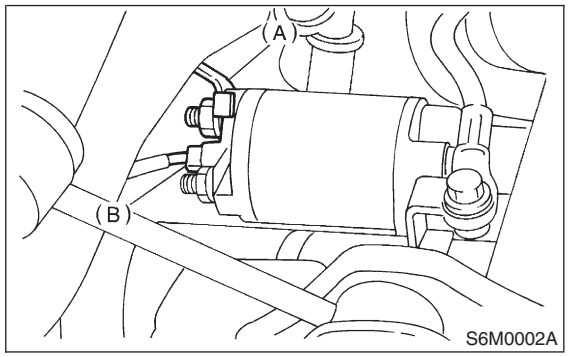


S2M0900A



S2M0901A

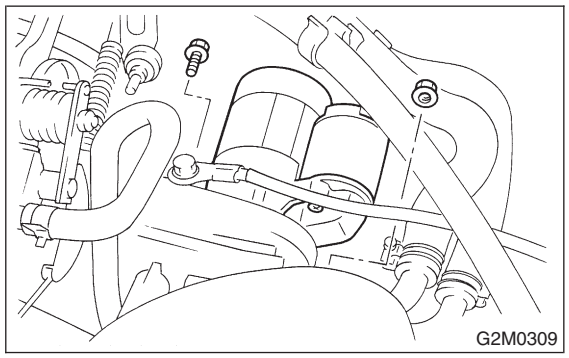
4) Disconnect connector and terminal from starter.



S6M0002A

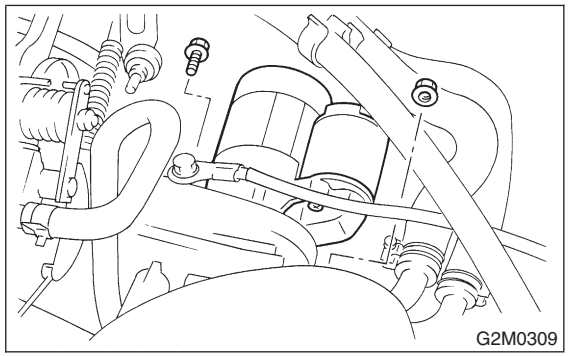
(A) Terminal
(B) Connector

5) Remove starter from transmission.


G2M0309

6) Installation is in the reverse order of removal.

Tightening torque:
50±4 N·m (5.1±0.4 kg-m, 37±2.9 ft-lb)


G2M0309

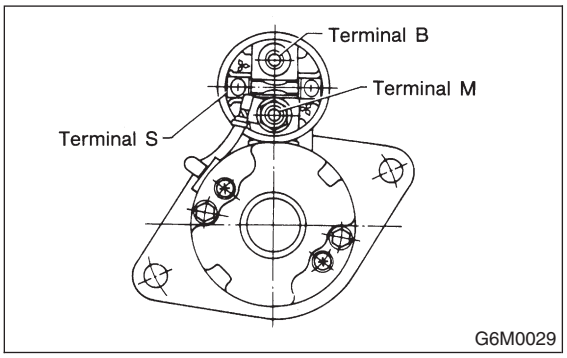
B: TEST

1. SWITCH ASSEMBLY OPERATION

1) Connect terminal S of switch assembly to positive terminal of battery with a lead wire, and starter body to ground terminal of battery. Pinion should be forced endwise on shaft.

CAUTION:
With pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.

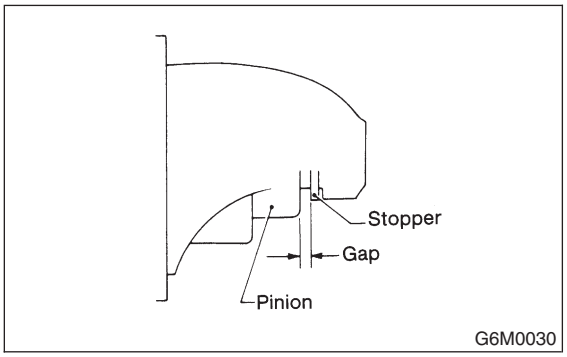
2) Disconnect connector from terminal M, and connect positive terminal of battery and terminal M using a lead wire and ground terminal to starter body.
In this test set up, pinion should return to its original position even when it is pulled out with a screwdriver.



2. PINION GAP

1) With pinion forced endwise on shaft, as outlined in step 1) before <Ref. to 6-1 [W1B1].>, measure pinion gap.

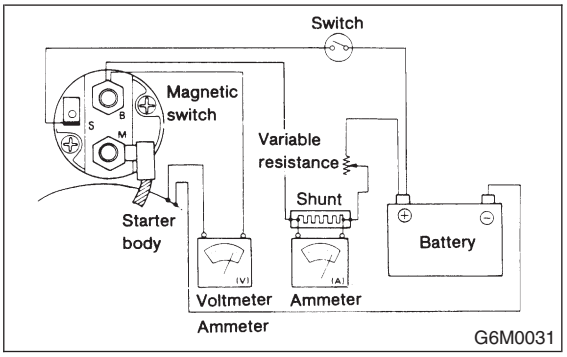
Pinion gap:
0.5 — 2.0 mm (0.020 — 0.079 in)



2) If motor is running with the pinion forced endwise on the shaft, disconnect connector from terminal M of switch assembly and connect terminal M to ground terminal (–) of battery with a lead wire. Next, gently push pinion back with your fingertips and measure pinion gap.
3) If pinion gap is outside specified range, remove or add number of adjustment washers used on the mounting surface of switch assembly until correct pinion gap is obtained.

3. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.



1) No-load test
With switch on, adjust the variable resistance to obtain 11 V, take the ammeter reading and measure the starter speed. Compare these values with the specifications.

No-load test (Standard):
Voltage / Current
11 V / 90 A or less
Rotating speed
- ***MT vehicles 2,800 rpm or more***
- ***AT vehicles 2,400 rpm or more***

2) Load test
Apply the specified braking torque to starter. The condition is satisfactory if the current draw and starter speed are within specifications.

Load test (Standard):

- ***MT vehicles***
  Voltage / Load
  7.5 V / 8.73 N·m (0.89 kg-m, 6.4 ft-lb)
  Current / Speed
  300 A / 890 rpm or more

- ***AT vehicles***
  Voltage / Load
  7.7 V / 16.00 N·m (1.63 kg-m, 11.8 ft-lb)
  Current / Speed
  400 A max. / 740 rpm or more

3) Lock test
With starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to the specified voltage.

Lock test (Standard):

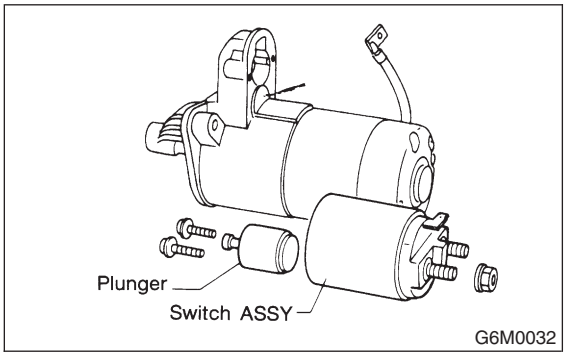
- ***MT vehicles***
  Voltage / Load
  4 V / 780 A or less
  Torque
  15.7 N·m (1.60 kg-m, 11.6 ft-lb) or more
- ***AT vehicles***
  Voltage / Current
  3.5 V / 940 A or less
  Torque
  28.9 N·m (2.95 kg-m, 21.3 ft-lb) or more

C: DISASSEMBLY

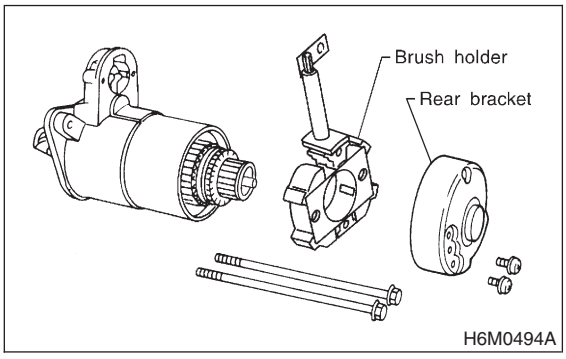
1. STARTER ASSEMBLY

1) Loosen nut which holds terminal M of switch assembly, and disconnect connector.
2) Remove bolts which hold switch assembly, and remove switch assembly, plunger and plunger spring from starter as a unit.

CAUTION:
Be careful because pinion gap adjustment washer may sometimes be used on the mounting surface of switch assembly.

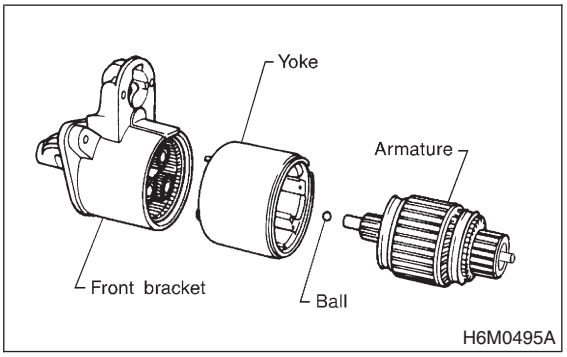


3) Remove both through-bolts and brush holder screws, and detach rear bracket and brush holder.

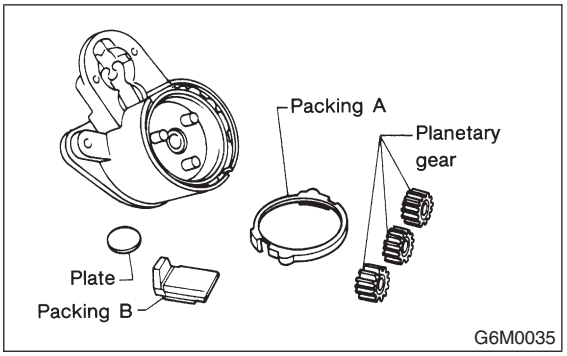


4) Remove armature and yoke. Ball used as a bearing will then be removed from the end of armature.

CAUTION:
Be sure to mark an alignment mark on yoke and front bracket before removing yoke.

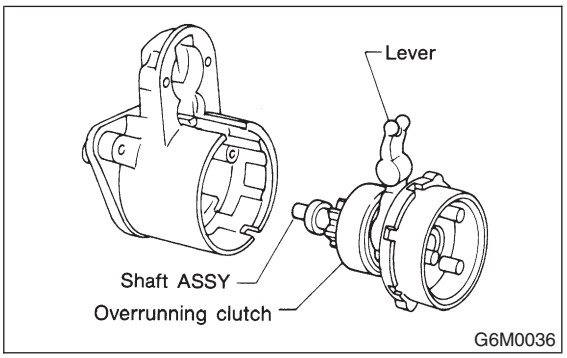


5) Remove packing A, three planetary gears, packing B and plate.

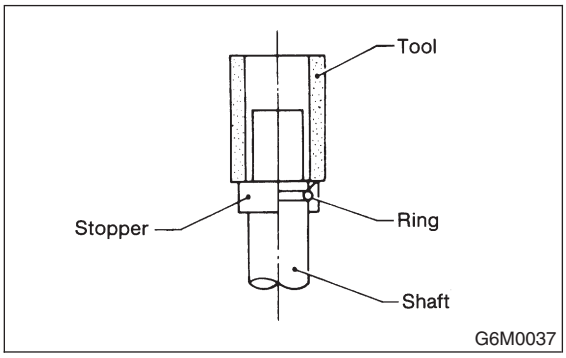


6) Remove shaft assembly and overrunning clutch as a unit.

CAUTION:
Record the direction of lever before removing.



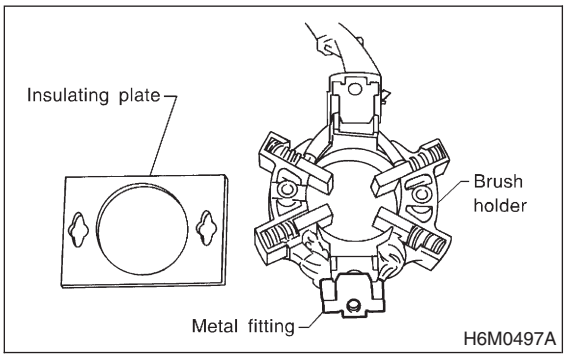
7) Remove overrunning clutch from shaft assembly as follows:
(1) Remove stopper from ring by lightly tapping a fit tool placed on stopper.
(2) Remove ring, stopper and clutch from shaft.



2. BRUSH HOLDER

Slightly open the metal fitting holding the insulating plate to the brush holder. Remove the insulating plate.

NOTE:
The brush and spring can be easily removed from the brush holder at this time.



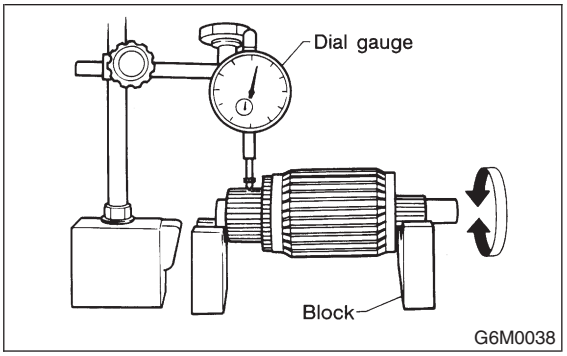
D: INSPECTION

1. ARMATURE

1) Check commutator for any sign of burns of rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

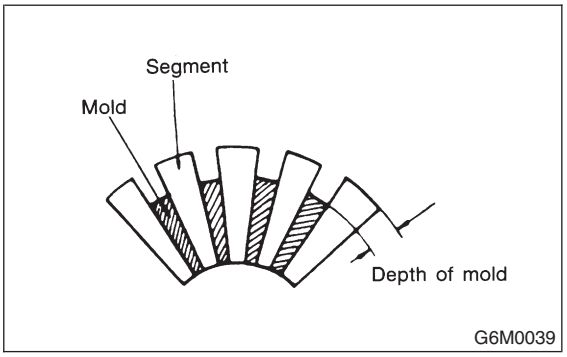
2) Run-out test
Check the commutator run-out and replace if it exceeds the limit.

Commutator run-out:
Standard
0.05 mm (0.0020 in)
Service limit
Less than 0.10 mm (0.0039 in)

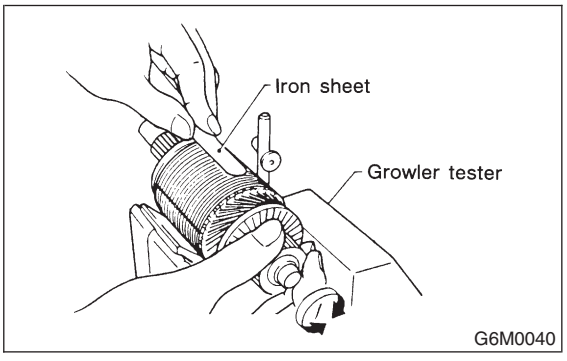


3) Depth of segment mold
Check the depth of segment mold.

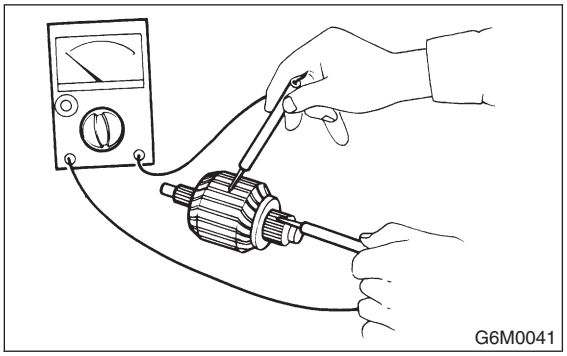
Depth of segment mold:
0.5 mm (0.020 in)



4) Armature short-circuit test
Check armature for short-circuit by placing it on growler tester. Hold a hacksaw blade against armature core while slowly rotating armature. A short-circuited armature will cause the blade to vibrate and to be attracted to core. If the hacksaw blade is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.



5) Armature ground test
Using circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is a continuity, armature is grounded.
Replace armature if it is grounded.



2. YOKE

Make sure pole is set in position.

3. OVERRUNNING CLUTCH

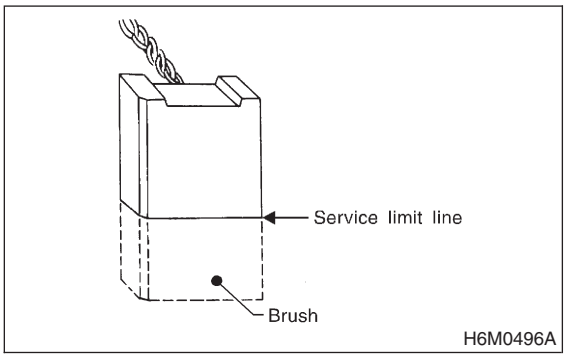
Inspect teeth of pinion for wear and damage. Replace if it damaged. Rotate pinion in direction of rotation (clockwise). It should rotate smoothly. But in opposite direction, it should be locked.

CAUTION:
Do not clean overrunning clutch with oil to prevent grease from flowing out.

4. BRUSH AND BRUSH HOLDER

1) Brush length
Measure the brush length and replace if it exceeds the service limit.
Replace if abnormal wear or cracks are noticed.

Brush length:
Standard 17.0 mm (0.669 in)
Service limit 11.5 mm (0.453 in)



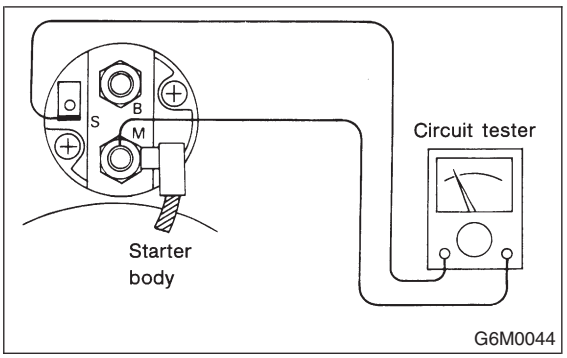
2) Brush movement
Be sure brush moves smoothly inside brush holder.
3) Brush spring force
Measure brush spring force with a spring scale. If it is less than the service limit, replace brush spring.

Brush spring force:
Standard
21.6 N (2.2 kg, 4.9 lb) (when new)
Service limit
5.9 N (0.6 kg, 1.3 lb)

5. SWITCH ASSEMBLY

Be sure there is continuity between terminals S and M, and between terminal S and ground. Use a circuit tester (set in “ohm”).
Also check to be sure there is no continuity between terminal M and B.

Terminal / Specified resistance:
S—M / Continuity
S—Ground / Continuity
M—B / No continuity



E: ASSEMBLY

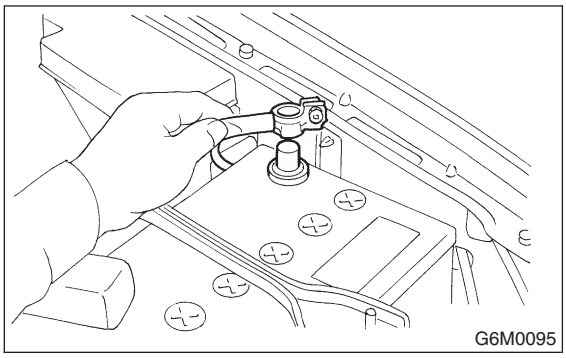
Assembly is in the reverse order of disassembly procedures. Observe the following:
1) Carefully assemble all parts in the order of assembly and occasionally inspect nothing has been overlooked.
2) Apply grease to the following parts during assembly.
- Front bracket sleeve bearing
- Armature shaft gear
- Outer periphery of plunger
- Mating surface of plunger and lever
- Gear shaft splines
- Mating surface of lever and clutch
- Ball at the armature shaft end
- Internal and planetary gears

3) After assembling parts correctly, check to be sure starter operates properly.

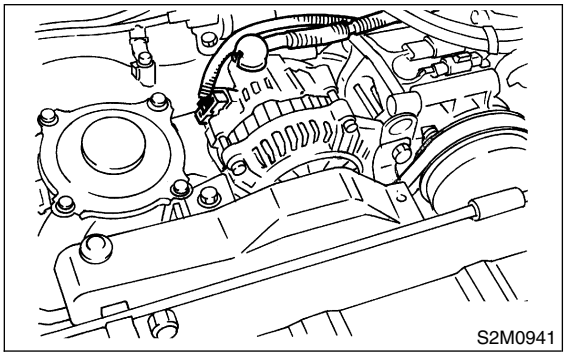
2. Generator

A: REMOVAL AND INSTALLATION

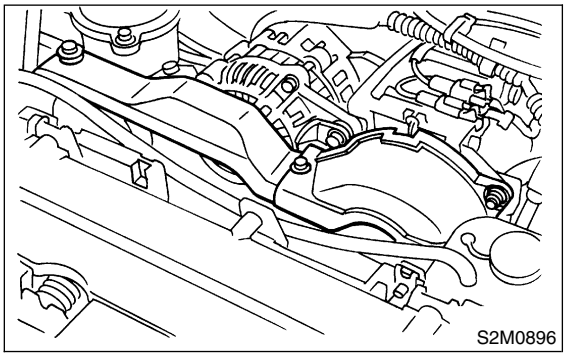
1) Disconnect battery ground cable.


G6M0095

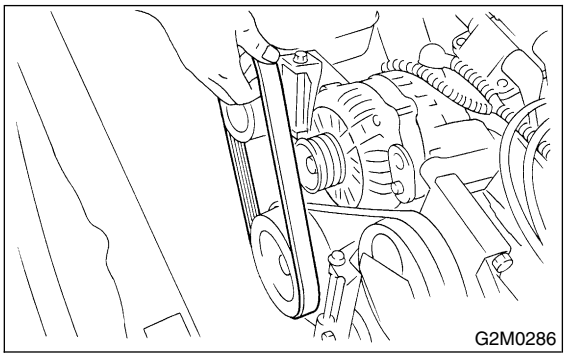
2) Disconnect connector and terminal from generator.


S2M0941

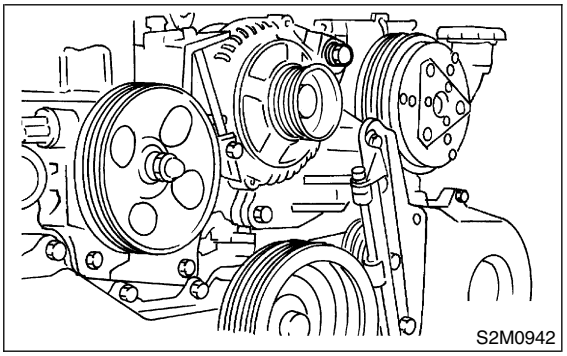
3) Remove V-belt cover.


S2M0896

4) Remove front side V-belt.

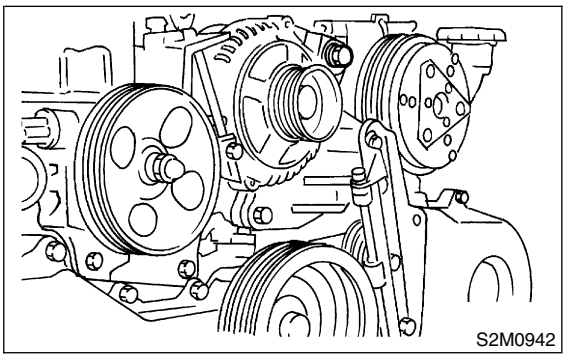

G2M0286

5) Remove bolts which install generator onto bracket.


S2M0942

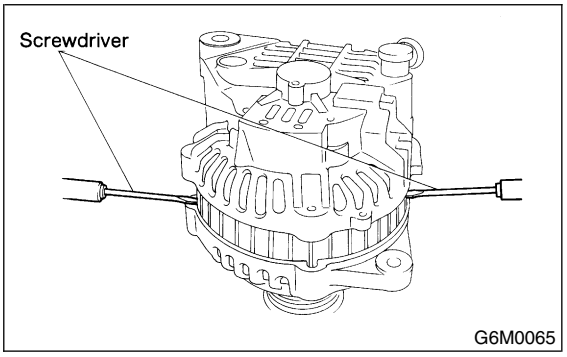
6) Installation is in the reverse order of removal.

CAUTION:
Check and adjust V-belt tension. <Ref. to 1-5 [G2A0].>


S2M0942

B: DISASSEMBLY

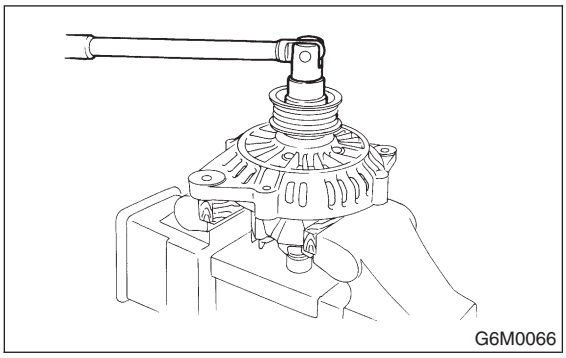
1) Remove the four through bolts. Then insert the tip of a flat-head screwdriver into the gap between the stator core and front bracket. Pry then apart to disassemble.

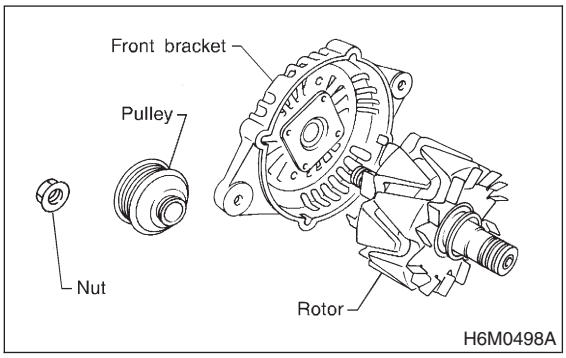


G6M0065

2) Hold rotor with a vise and remove pulley nut.

CAUTION:
When holding rotor with vise, insert aluminum plates or wood pieces on the contact surfaces of the vise to prevent rotor from damage.

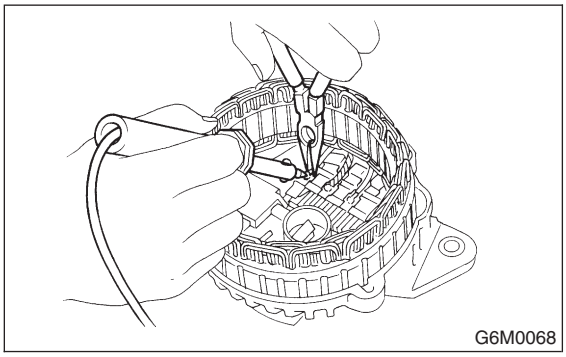

G6M0066



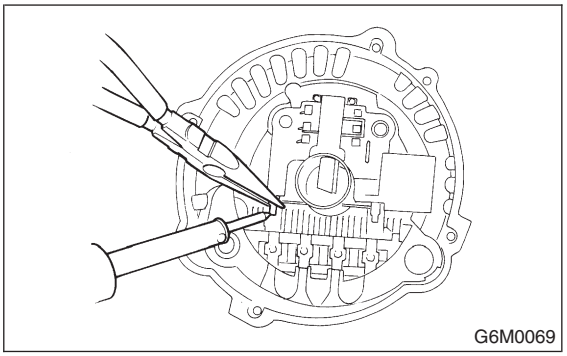
H6M0498A

3) Unsolder connection between rectifier and stator coil to remove stator coil.

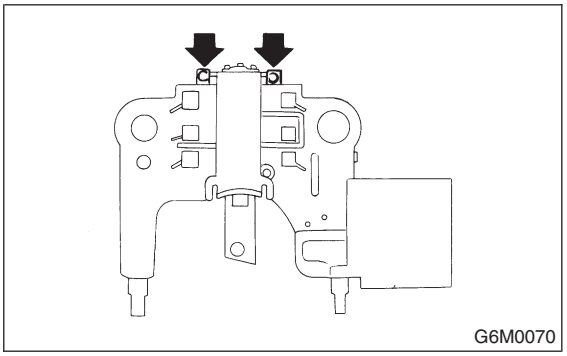
CAUTION:
Finish the work rapidly (less than three seconds) because the rectifier cannot withstand heat very well.


G6M0068

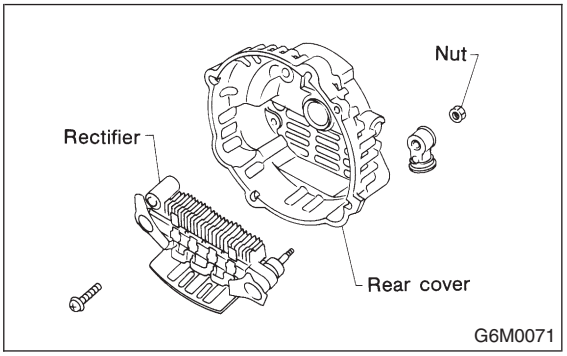
4) Remove screws which secure IC regulator to rear cover, and unsolder connection between IC regulator and rectifier to remove IC regulator.


G6M0069

5) Remove the brushes by unsoldering at the pigtails.


G6M0070

6) Remove the nut and insulating bushing at terminal B. Remove rectifier.



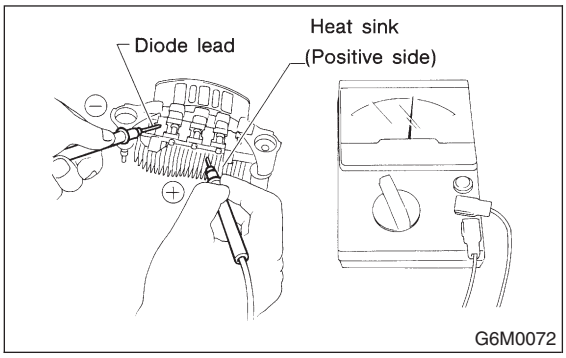
G6M0071

C: INSPECTION AND REPAIR

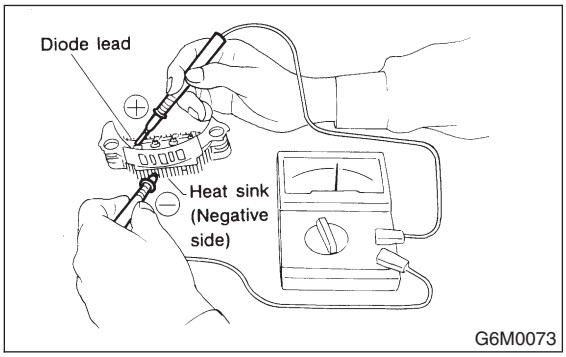
1. DIODE

CAUTION:
Never use a megger tester (measuring use for high voltage) or any other similar measure for this test; otherwise, the diodes may be damaged.

1) Checking positive diode
Check for continuity between the diode lead and the positive side heat sink. The positive diode is in good condition if continuity exists only in the direction from the diode lead to the heat sink.



2) Checking negative diode
Check for continuity between the negative side heat sink and diode lead. The negative diode is in good condition if continuity exists only in the direction from the heat sink to the diode lead.



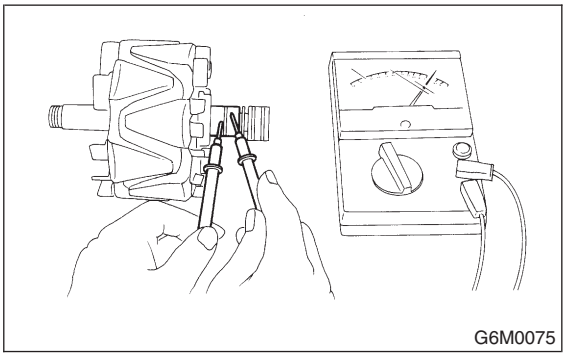
2. ROTOR

1) Slip ring surface
Inspect slip rings for contamination or any roughness of the sliding surface. Repair slip ring surface using a lathe or sand paper.
2) Slip ring outer diameter
Measure slip ring outer diameter. If slip ring is worn replace rotor assembly.

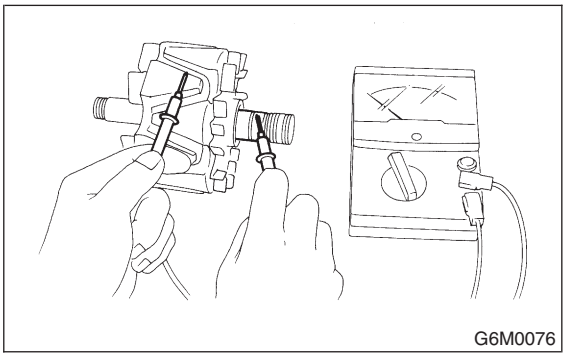
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Continuity test
Check resistance between slip rings using circuit tester. If the resistance is not within specification, replace rotor assembly.

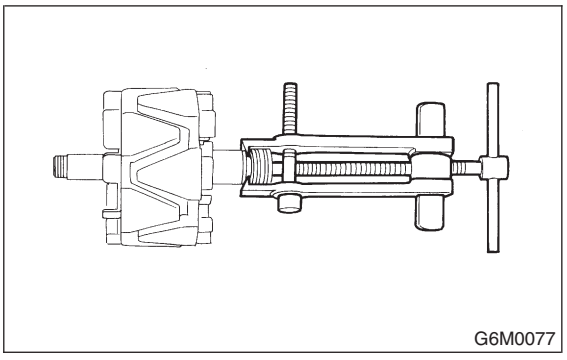
Specified resistance:
Approx. 2.7 — 3.2 Ω



4) Insulation test
Check continuity between slip ring and rotor core or shaft. If continuity exists, the rotor coil is short-circuited, and so replace rotor assembly.

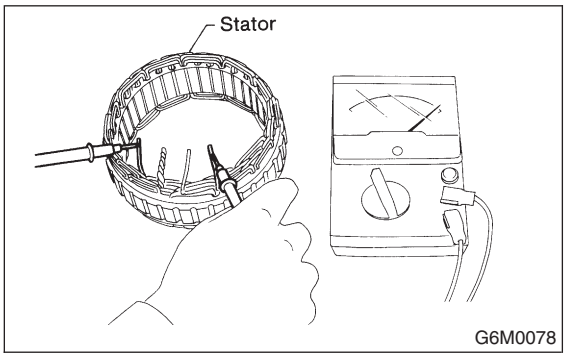


5) Ball bearing (rear side)
(1) Check rear ball bearing. Replace if it is noisy or if rotor does not turn smoothly.
(2) The rear bearing can be removed by using common bearing puller.

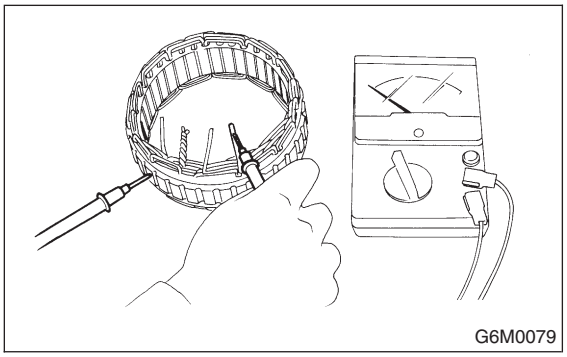


3. STATOR

1) Continuity test
Inspect stator coil for continuity between each end of the lead wires. If there is no continuity between individual lead wires, the lead wire is broken, and so replace stator assembly.



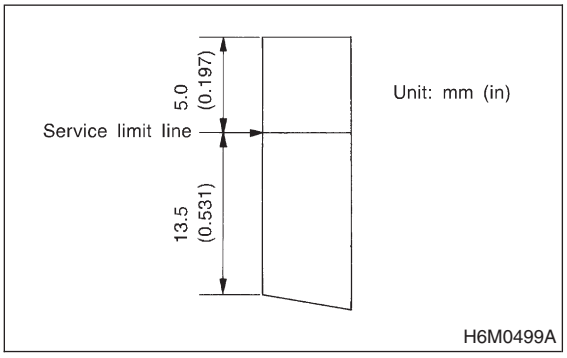
2) Insulation test
Inspect stator coil for continuity between stator core and each end of the lead wire. If there is continuity, the stator coil is short-circuited, and so replace stator assembly.



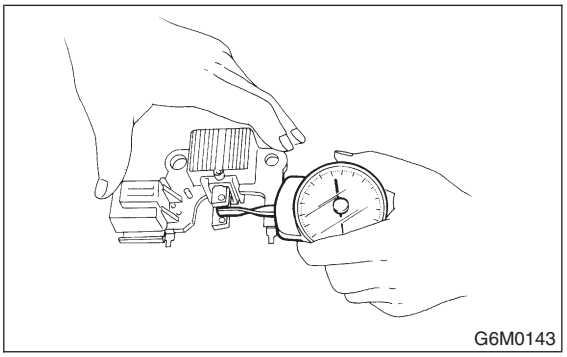
4. BRUSH

1) Measure the length of each brush. If wear exceeds the service limit, replace the brush. Each brush has the service limit mark on it.

Brush length:
Standard
18.5 mm (0.728 in)
Service limit
5.0 mm (0.197 in)

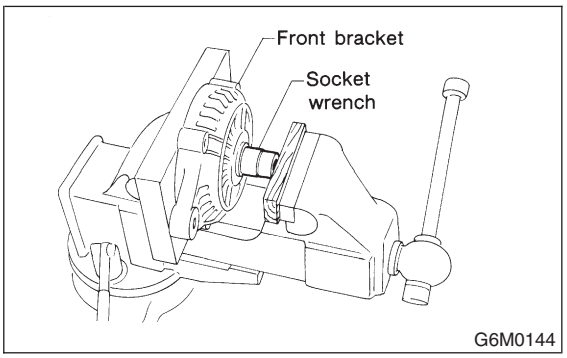


2) Checking brush spring for proper pressure
Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of the brush spring. If the pressure is less than 2.648 N (270 g, 9.52 oz), replace the brush spring with a new one. The new spring must have a pressure of 4.609 to 5.786 N (470 to 590 g, 16.58 to 20.81 oz).

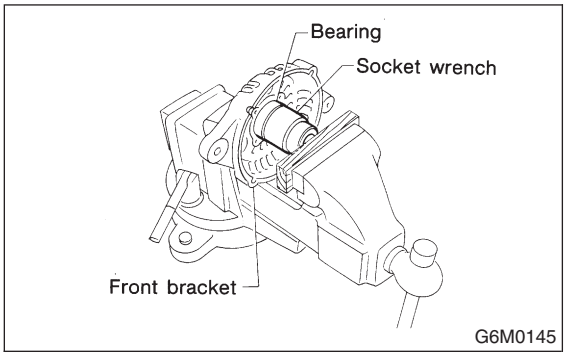


5. BEARING (FRONT SIDE)

1) Check front ball bearing. If resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.
2) Replacing front bearing
(1) Remove front bearing retainer.
(2) Closely install a fit tool on the bearing inner race. Press the bearing down out of front bracket with a hand press or vise. A socket wrench can serve as the tool.



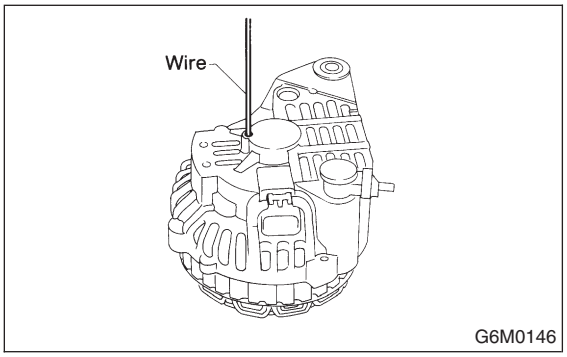
(3) Set a new bearing and closely install a fit tool on the bearing outer race. Press the bearing down into place with a hand press or vise. A socket wrench can serve as the tool.
(4) Install front bearing retainer.



D: ASSEMBLY

To assemble, reverse order of disassembly.
1) Pulling up brush
Before assembling, press the brush down into the brush holder with your finger and secure in that position by passing a [2 mm (0.08 in) dia. length 4 to 5 cm (1.6 to 2.0 in)] wire through the hole shown in the figure.

CAUTION:
Be sure to remove the wire after reassembly.



2) Heat the rear bracket [50 to 60°C (122 to 140°F)] and press the rear bearing into the rear bracket. Then lubricate the rear bracket.

CAUTION:
Grease should not be applied for the rear bearing.
Remove oil completely if it is found on the bearing box.

3) After reassembly, turn the pulley by hand to check that the rotor turns smoothly.

3. Spark Plug

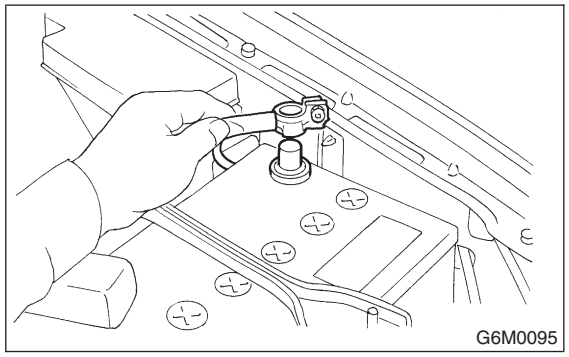
A: REMOVAL AND INSTALLATION

CAUTION:
All spark plugs installed on an engine, must be of the same heat range.

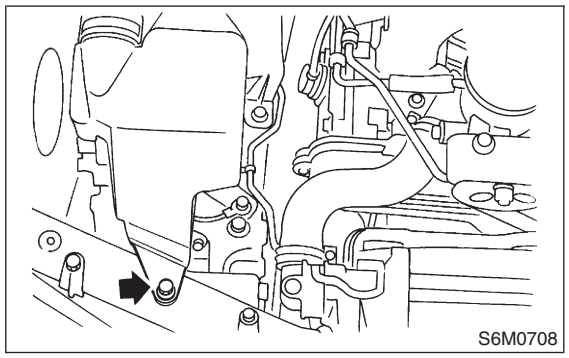
Spark plug:
CHAMPION: RC10YC4
(Alternate)
CHAMPION: RC8YC4
NGK: BKR6E-11
NIPPONDENSO: K20PR-U11

1. #1 SPARK PLUG

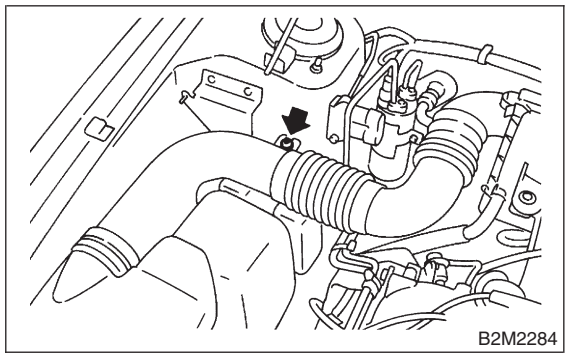
1) Disconnect battery ground cable.



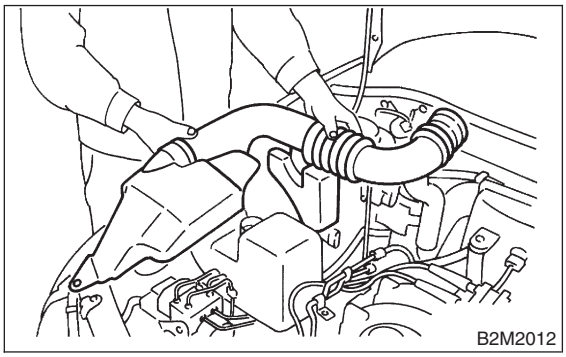
2) Remove air intake duct and resonator chamber.
(1) Remove bolt which installs air intake duct on the front side of body.



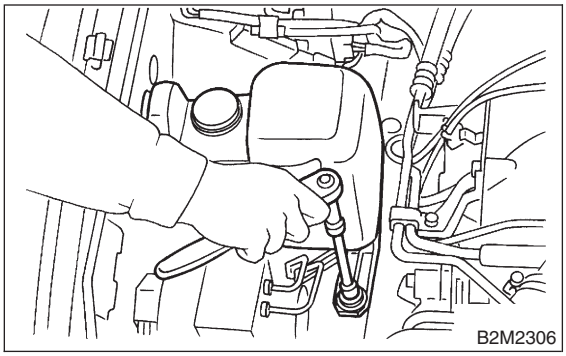
(2) Remove bolt which installs air intake duct on body.



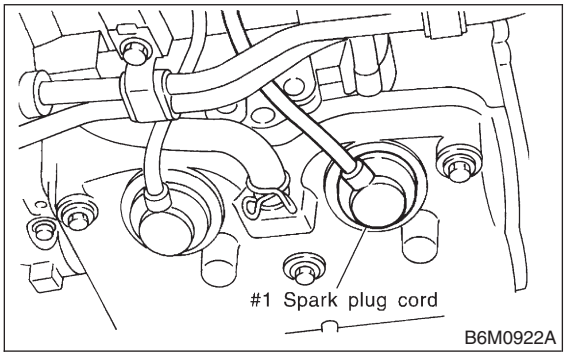
(3) Remove air intake duct as a unit.



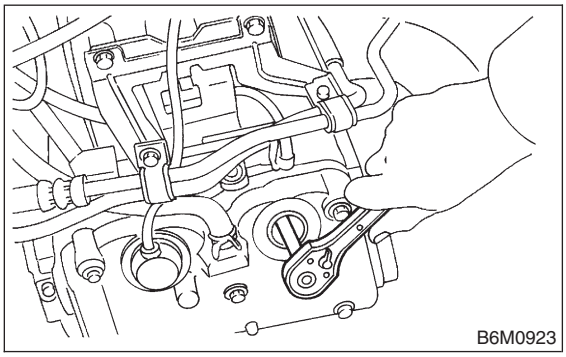
(4) Remove resonator chamber.



3) Remove #1 spark plug cord by pulling boot, not cord itself.



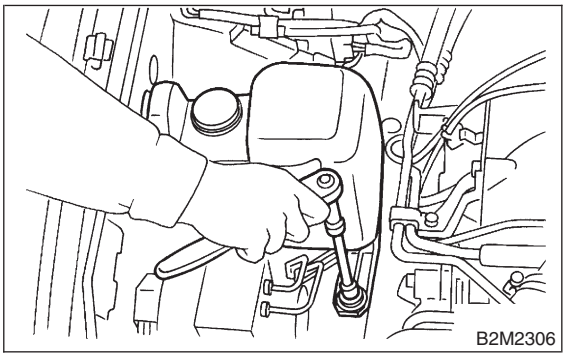
4) Remove spark plug with the spark plug socket.



5) Installation is in the reverse order of removal.

Tightening torque (Spark plug):
20.6±2.9 N·m (2.10±0.30 kg-m, 15.19±2.14 ft-lb)

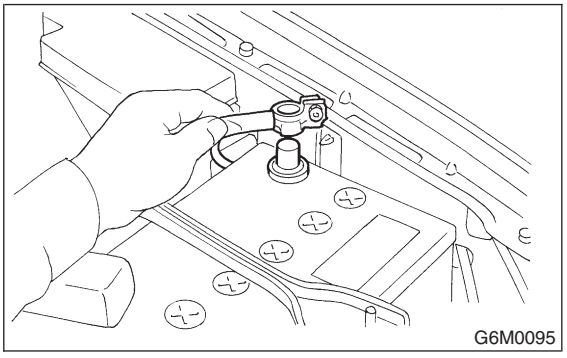
Tightening torque (Resonator chamber):
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)



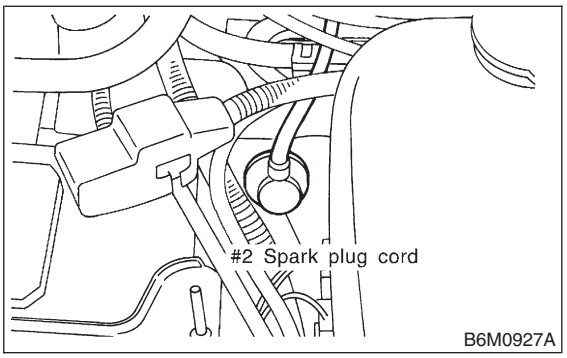
CAUTION:
The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

2. #2 SPARK PLUG

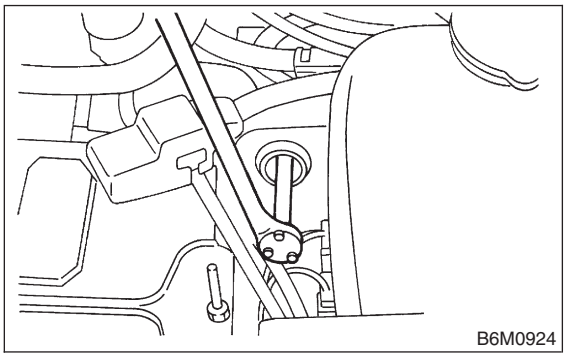
1) Disconnect battery ground cable.



2) Remove #2 spark plug cord by pulling boot, not cord itself.



3) Remove spark plug with the spark plug socket.


B6M0924

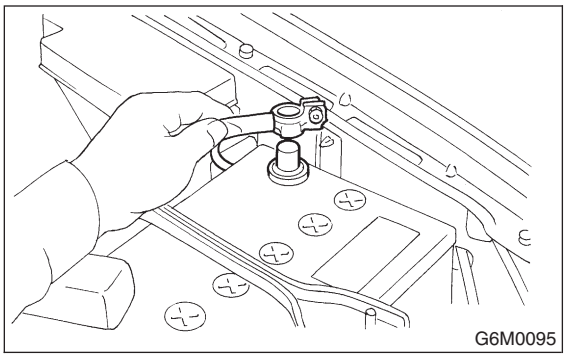
4) Installation is in the reverse order of removal.

Tightening torque (Spark plug):
20.6±2.9 N·m (2.10±0.30 kg-m, 15.19±2.14 ft-lb)

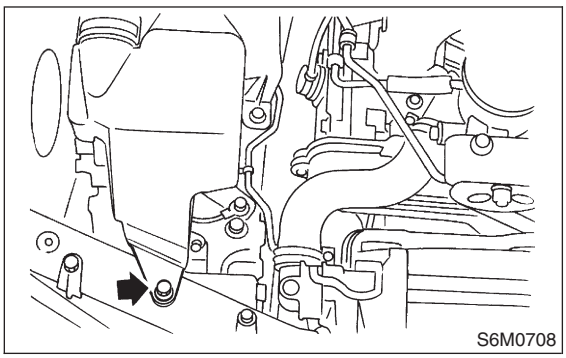
CAUTION:
The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

3. #3 SPARK PLUG

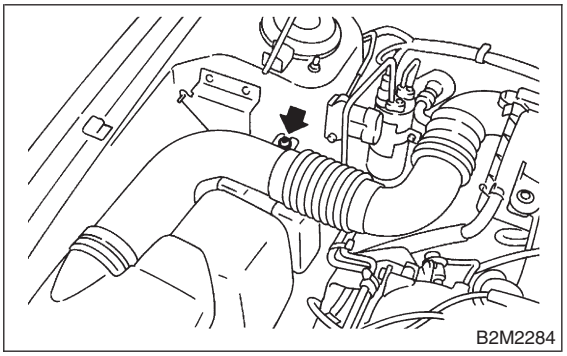
1) Disconnect battery ground cable.


G6M0095

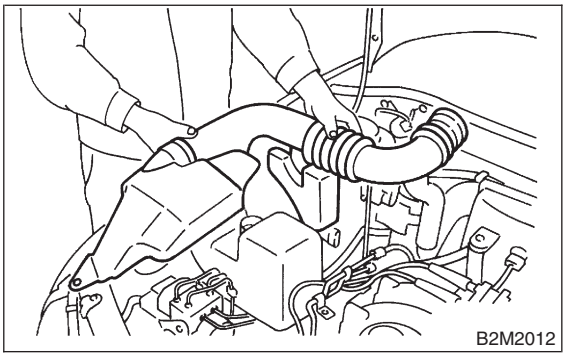
2) Remove air intake duct and resonator chamber.
(1) Remove bolt which installs air intake duct on the front side of body.


S6M0708

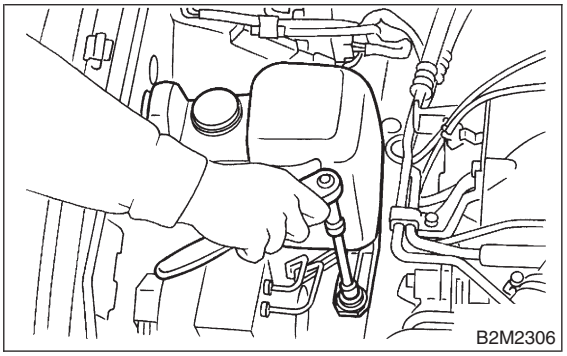
(2) Remove bolt which installs air intake duct on body.


B2M2284

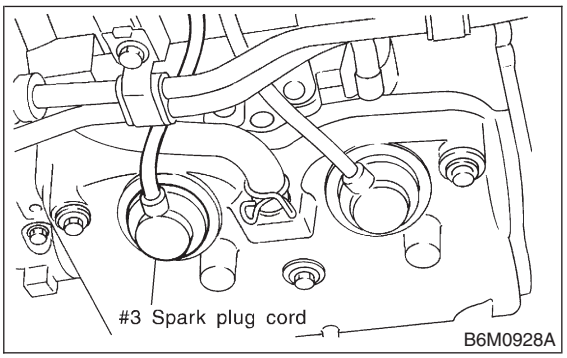
(3) Remove air intake duct as a unit.


B2M2012

(4) Remove resonator chamber.

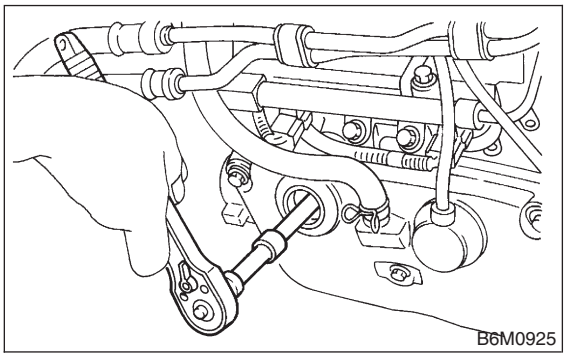

B2M2306

3) Remove #3 spark plug cord by pulling boot, not cord itself.



B6M0928A

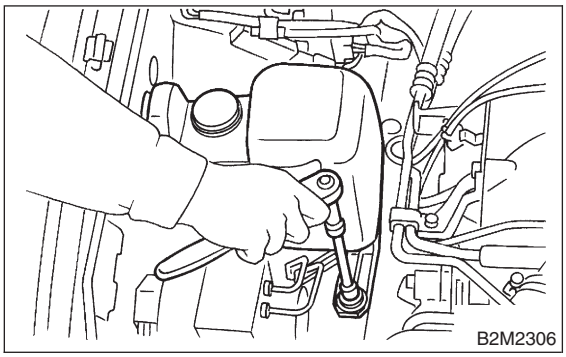
4) Remove spark plug with the spark plug socket.


B6M0925

5) Installation is in the reverse order of removal.

Tightening torque (Spark plug):
20.6±2.9 N·m (2.10±0.30 kg-m, 15.19±2.14 ft-lb)

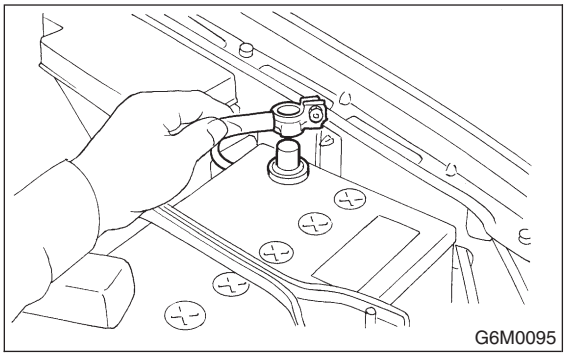
Tightening torque (Resonator chamber):
32±10 N·m (3.3±1.0 kg-m, 24±7 ft-lb)


B2M2306

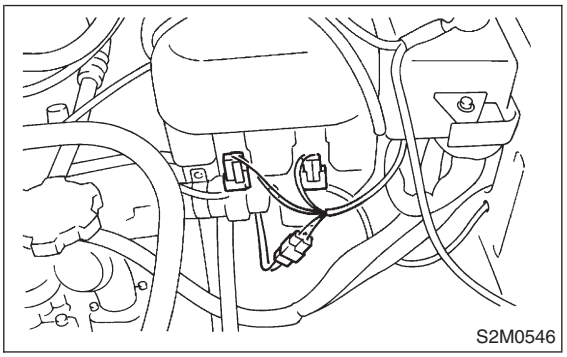
CAUTION:
The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

4. #4 SPARK PLUG

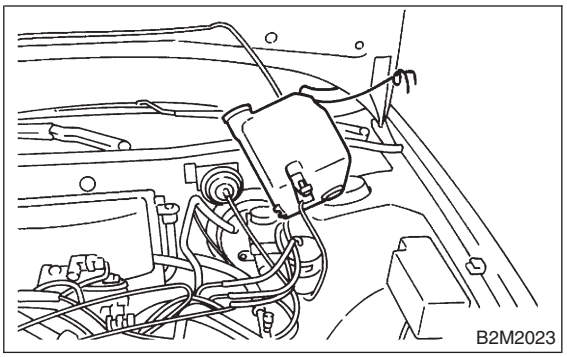
1) Disconnect battery ground cable.


G6M0095

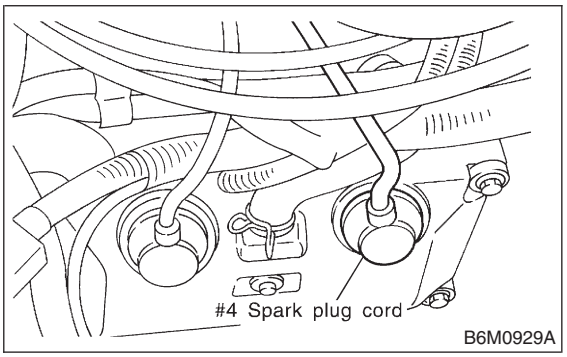
2) Disconnect washer motor connector.


S2M0546

3) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
4) Remove the two bolts which hold the washer tank, then take the tank away from the working area.

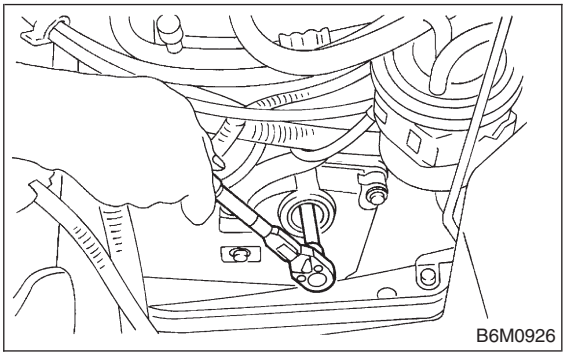

B2M2023

5) Remove #4 spark plug cord by pulling boot, not cord itself.



B6M0929A

6) Remove spark plug with the spark plug socket.


B6M0926

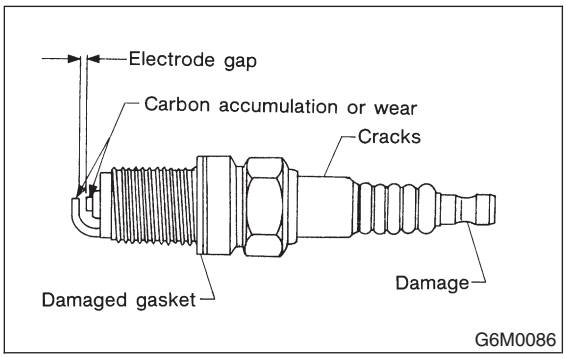
7) Installation is in the reverse order of removal.

Tightening torque (Spark plug):
20.6±2.9 N·m (2.10±0.30 kg-m, 15.19±2.14 ft-lb)

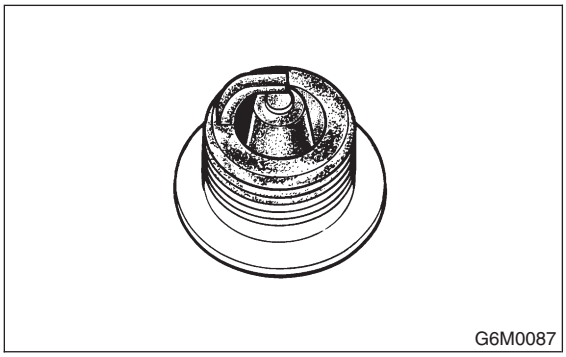
CAUTION:
The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

B: INSPECTION

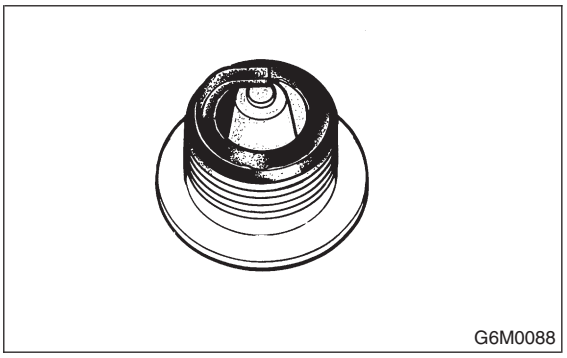
Check electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.



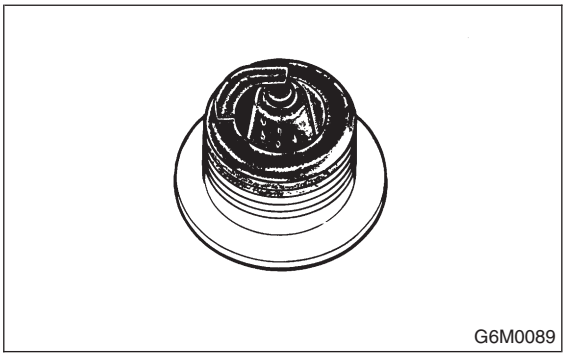
1) Normal
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



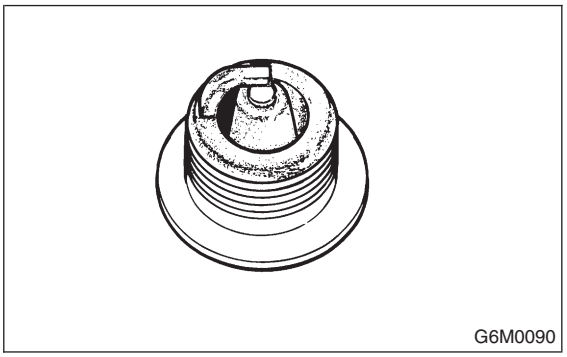
2) Carbon fouled
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.



3) Oil fouled
Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If same condition remains after repair, use a hotter plug.



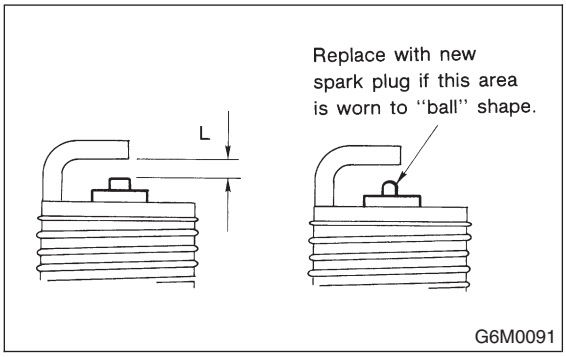
4) Overheating
White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.



C: CLEANING AND REGAPPING

Clean spark plugs in a sand blast type cleaner.
Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain.
If deposits are too stubborn, discard plugs.
After cleaning spark plugs, recondition firing surface of electrodes with file. Then correct the spark plug gap using a gap gauge.

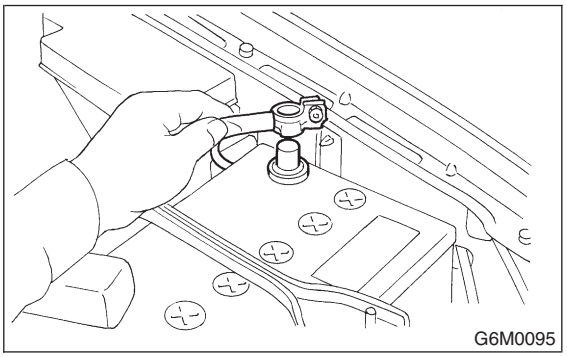
Spark plug gap: L
1.0 — 1.1 mm (0.039 — 0.043 in)



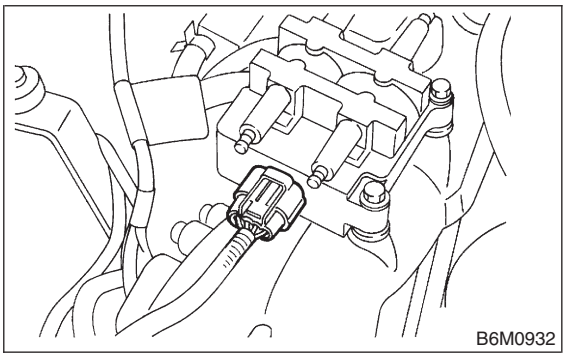
4. Ignition Coil and Ignitor Assembly

A: REMOVAL AND INSTALLATION

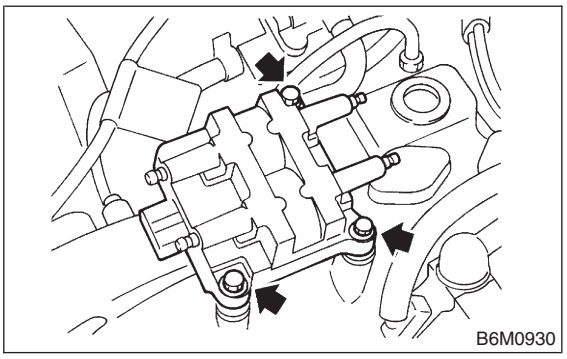
1) Disconnect battery ground cable.



2) Disconnect spark plug cords from ignition coil and ignitor assembly.
3) Disconnect connector from ignition coil and ignitor assembly.



4) Remove ignition coil and ignitor assembly.



5) Installation is in the reverse order of removal.

CAUTION:
Be sure to connect wires to their proper positions. Failure to do so will damage unit.

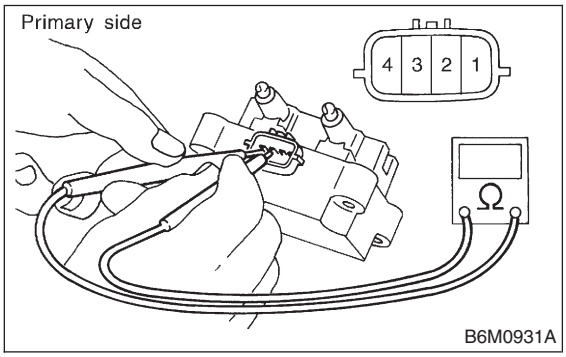
B: INSPECTION

Using accurate tester, inspect the following items, and replace if defective.
1) Primary resistance
2) Secondary coil resistance

CAUTION:
If the resistance is extremely low, this indicates the presence of a short-circuit.

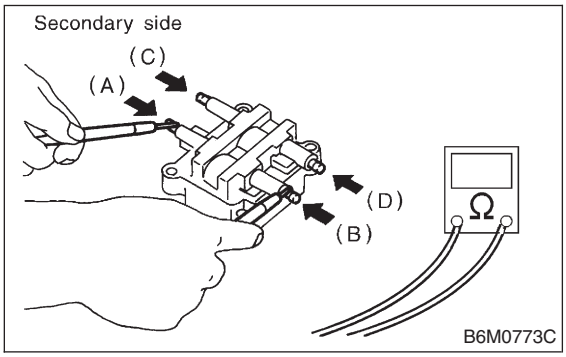
Specified resistance:

[Primary side]
Between terminal No. 1 and No. 2
0.73 Ω±10%
Between terminal No. 2 and No. 4
0.73 Ω±10%



[Secondary side]
Between (A) and (B)
12.8 kΩ±15%
Between (C) and (D)
12.8 kΩ±15%

3) Insulation between primary terminal and case: 10 MΩ or more.

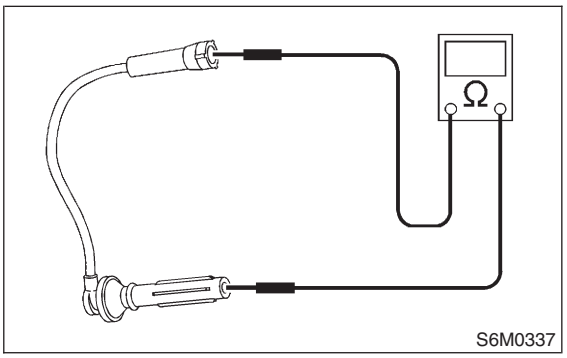


5. Spark Plug Cord

A: INSPECTION

Check for:
1) Damage to cords, deformation, burning or rust formation of terminals
2) Resistance values of cords

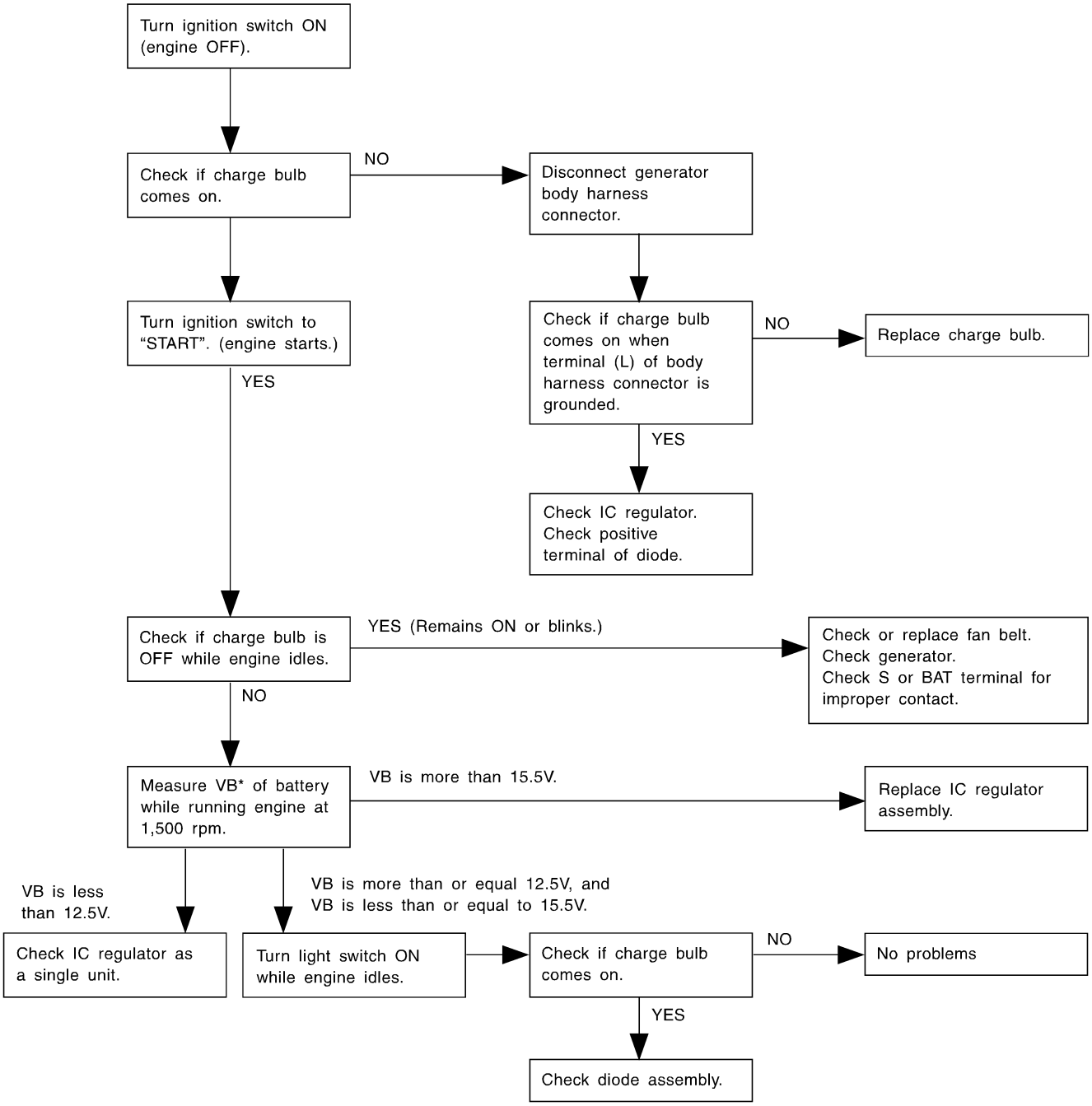
Resistance value:
#1 cord: 7.40 — 17.27
#2 cord: 6.24 — 14.56
#3 cord: 6.54 — 15.25
#4 cord: 6.59 — 15.37



1. Starter

Trouble		Probable cause
Starter does not start.	Magnet switch does not operate. (no clicks are heard.)	Magnet switch poor contact or discontinuity of pull-in coil circuit
		Improper sliding of magnet switch plunger
	Magnet switch operates. (clicks are issued.)	Poor contact of magnet switch's main contact point
		Layer short of armature
		Contaminants on armature commutator
		High armature mica
		Improper grounding of yoke field coil
		Insufficient carbon brush length
		Insufficient brush spring pressure
Starter starts but does not crank engine.	Failure of pinion gear to engage ring gear	Worn pinion teeth
		Improper sliding of overrunning clutch
		Improper adjustment of stud bolt
	Clutch slippage	Faulty clutch roller spring
Starter starts but engine cranks too slowly.		Poor contact of magnet switch's main contact point
		Layer short of armature
		Discontinuity, burning or wear of armature commutator
		Poor grounding of yoke field coil
		Insufficient brush length
		Insufficient brush spring pressure
		Abnormal brush wear
Starter overruns.		Magnet switch coil is a layer short.

2. Generator



*: Terminal voltage

B6M0771

MEMO:

BODY ELECTRICAL SYSTEM 6-2

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1. AT Shift Lock System 22
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1. Body Electrical

Battery	Type		MT model: 55D23L (MF)	AT model: 75D23L (MF)
	Capacity	Reverse capacity	MT model: 99 minutes	AT model: 118 minutes
		Cold cranking ampere	MT model: 356 amperes	AT model: 520 amperes
Combination meter	Speedometer		Electric pulse type	
	Temperature gauge		Thermistor cross coil type	
	Fuel gauge		Resistance cross coil type	
	Tachometer		Electric pulse type	
	Turn signal indicator light		12 V — 1.4 W	
	Charge indicator light		12 V — 1.4 W	
	Oil pressure indicator light		12 V — 1.4 W	
	ABS warning light		12 V — 1.4 W	
	CHECK ENGINE warning light (Malfunction indicator light)		12 V — 1.4 W	
	HI-beam indicator light		12 V — 1.4 W	
	Door open warning light		12 V — 1.4 W	
	Seat belt warning light		12 V — 1.4 W	
	Brake fluid and parking brake warning light		12 V — 1.4 W	
	FWD indicator light		12 V — 1.4 W	
	AIRBAG warning light		12 V — 1.4 W	
	Meter illumination light		12 V — 3.4 W	
	AT OIL TEMP. warning light		12 V — 1.4 W	
Headlight			12 V — 60/55 W (Halogen)	
Front turn signal light/side marker, parking light			12 V — 27 W/8 W	
Front fog light			12 V — 55 W	
Rear combination light		Tail/Stop light	12 V — 8/27 W	
		Turn signal light	12 V — 27 W	
		Back-up light	12 V — 27 W	
License plate light			12 V — 5 W	
High-mount stop light			12 V — 13 W	
Room light			12 V — 8 W	
Spot light			12 V — 8 W	
Luggage room light			12 V — 5 W	
Front wiper motor	Input		12 V — 54 W or less	
Rear wiper motor	Input		12 V — 42 W or less	
Front washer motor	Pump type		Centrifugal	
	Input		12 V — 36 W or less	
Rear washer motor	Pump type		Centrifugal	
	Input		12 V — 36 W or less	
Horn			12 V — 350 Hz	
Accessory socket	Input		12 V — 120 W	
Rear window defogger	Input		12 V — 160 W	
	Indicator light		12 V — 50 mA	
Cargo socket	Input		12 V — 120 W	

1. Precautions

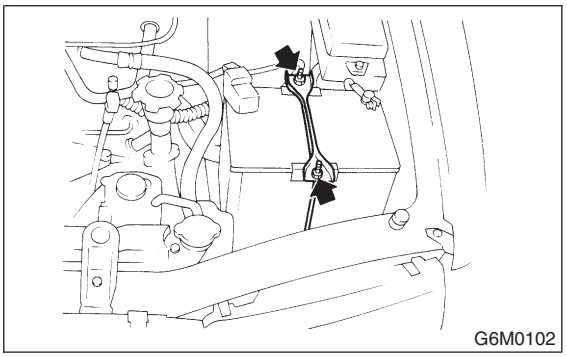
● Before disassembling or reassembling parts, always disconnect battery ground cable. When repairing radio, control modules, etc. which are provided with memory functions, record memory contents before disconnecting battery ground cable. Otherwise, these contents are cancelled upon disconnection.
● Reassemble parts in reverse order of disassembly procedure unless otherwise indicated.
● Adjust parts to specifications contained in this manual if so designated.
● Connect connectors and hoses securely during reassembly.
● After reassembly, ensure functional parts operate smoothly.

CAUTION:
● Airbag system wiring harness is routed near the electrical parts and switch.
● All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
● Be careful not to damage Airbag system wiring harness when servicing the ignition key cylinder.

2. Battery

A: REMOVAL AND INSTALLATION

1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
2) Remove flange nuts from battery rods and take off battery holder.


G6M0102

3) Remove battery.
4) Installation is in the reverse order of removal.

Tightening torque:
3.4±1.0 N·m (0.35±0.1 kg-m, 2.5±0.7 ft-lb)

NOTE:
● Clean battery cable terminals and apply grease to retard the formation of corrosion.
● Connect the positive (+) terminal of battery and then the negative (–) terminal of the battery.

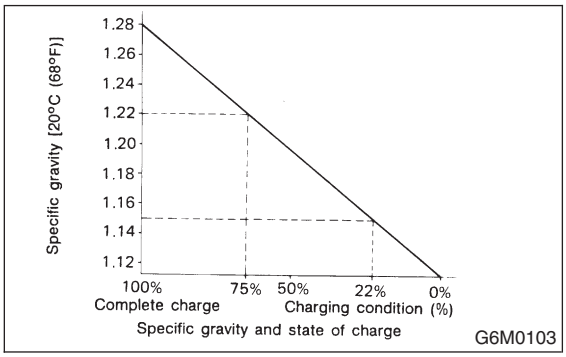
B: INSPECTION

WARNING:
● Electrolyte has toxicity; be careful handling the fluid.
● Avoid contact with skin, eyes or clothing. Especially at contact with eyes, blush with water for 15 minutes and get prompt medical attention.
● Batteries produce explosive gasses. Keep sparks, flame, cigarettes away.
● Ventilate when charging or using in enclosed space.
● For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. Never lean over a battery.
● Do not let battery fluid contact eyes, skin, fabrics, or paint-work because battery fluid is corrosive acid.
● To lessen the risk of sparks, remove rings, metal watch-bands, and other metal jewelry. Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle because a short circuit will be caused.

1. BATTERY

1) External parts:
Check for the existence of dirt or cracks on the battery case, top cover, vent plugs, and terminal posts. If necessary, clean with water and wipe with a dry cloth. Apply a thin coat of grease on the terminal posts to prevent corrosion.
2) Electrolyte level:
Check the electrolyte level in each cell. If the level is below MIN LEVEL, bring the level to MAX LEVEL by pouring distilled water into the battery cell. Do not fill beyond MAX LEVEL.
3) Specific gravity of electrolyte:
(1) Measure specific gravity of electrolyte using a hydrometer and a thermometer. Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following Equation:

S_{20} = St + 0.0007 x (t – 20)
S_{20}: Specific gravity corrected at electrolyte temperature of 20°C
St : Measured specific gravity
t : Measured temperature (°C)
Determine whether or not battery must be charged, according to corrected specific gravity.
Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]



(2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between the specific gravity and the state of charge is as shown in figure.

C: CHARGING

WARNING:
• Do not bring an open flame close to the battery at this time.

CAUTION:
• Prior to charging, corroded terminals should be cleaned with a brush and common baking soda solution.
• Be careful since battery electrolyte overflows while charging the battery.
• Observe instructions when handling battery charger.
• Before charging the battery on vehicle, disconnect battery ground terminal. Failure to follow this rule may damage alternator's diodes or other electrical units.

1. NORMAL CHARGING

Charge the battery at current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

2. QUICK CHARGING

Quick charging is a method in which the battery is charged in a short period of time with a relatively large current by using a quick charger. Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not increase the electrolyte temperature above 40°C (104°F). It should be also remembered that the quick charging is a temporary means to bring battery voltage up to a fair value and, as a rule, a battery should be charged slowly with a low current.

CAUTION:
• Observe the items in 1. NORMAL CHARGING.
• Never use more than 10 amperes when charging the battery because that will shorten battery life.

3. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte is held at a specific value in a range from 1.250 to 1.290 for more than one hour.
2) Voltage per battery cell is held at a specific value in a range from 2.5 to 2.8 volts for more than one hour.

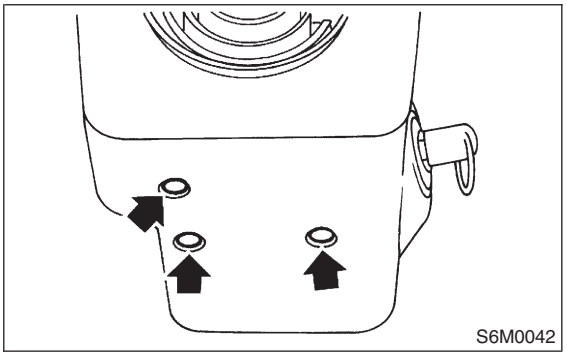
4. CHECK HYDROMETER FOR STATE OF CHARGE

Hydrometer indicator	State of charge	Required action
Green dot	Above 65%	Load test
Dark dot	Below 65%	Charge battery
Clear dot	Low electrolyte	Replace battery* (If cranking complaint)
*: Check electrical system before replacement.		

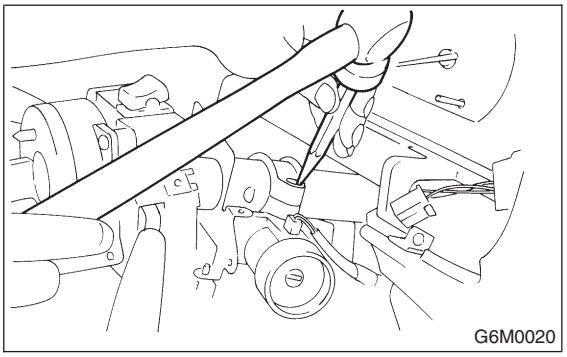
3. Ignition Switch

A: REMOVAL AND INSTALLATION

1) Remove instrument panel lower cover. <Ref. to 5-4 [W1A0].>
2) Remove screws, separate upper column cover and lower column cover.

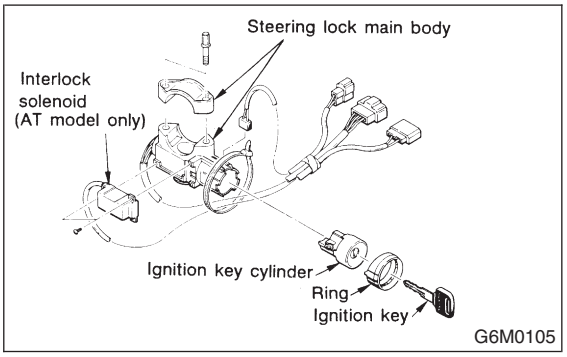

S6M0042

3) Remove knee protector.
4) Remove meter visor.
5) Disconnect ignition switch connector from body harness.
6) Using a drift and hammer, hit the torn bolt head to loosen and remove the ignition switch.


G6M0020

7) Installation is in the reverse order of removal.

NOTE:
When installing, tighten the connecting bolt until its head twists off.



G6M0105

4. Lighting

A: ADJUSTMENT

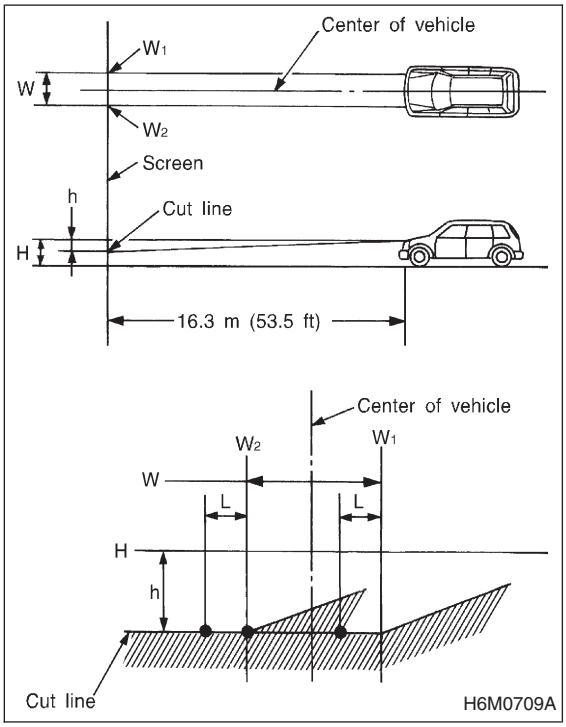
1. HEADLIGHT AIMING

CAUTION:
Turn off the light before adjusting headlight aiming. If the light is necessary to check aiming, do not turn on for more than two minutes.

NOTE:
Before checking the headlight aiming, be sure of the following:
- The area around the headlight has not sustained any accident, damage or other type of deformation.
- Vehicle is parked on level ground.
- The inflation pressure of tires is correct.
- Vehicle's gas tank is fully charged.
- Bounce the vehicle several times to normalize the suspension.
- Make certain that someone is seated in the driver's seat.

1) Place a cloth over the headlight that does not require aiming adjustment.
2) Turn the headlights on. Perform the aiming adjustment for the other headlight as follows:

CAUTION:
Do not perform lateral headlight aiming adjustment.

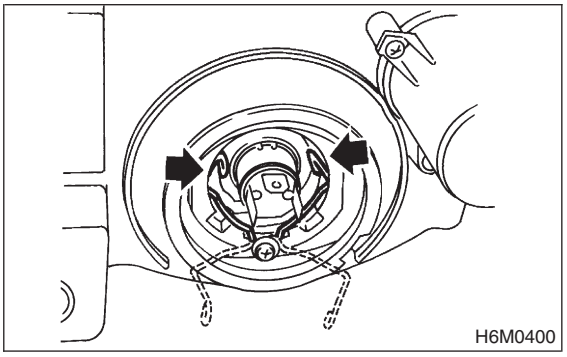


W	H	L	h
1,060 mm (41.73 in)	710 mm (27.95 in)	712 mm (28.03 in)	114 mm (4.49 in)

B: REMOVAL AND INSTALLATION

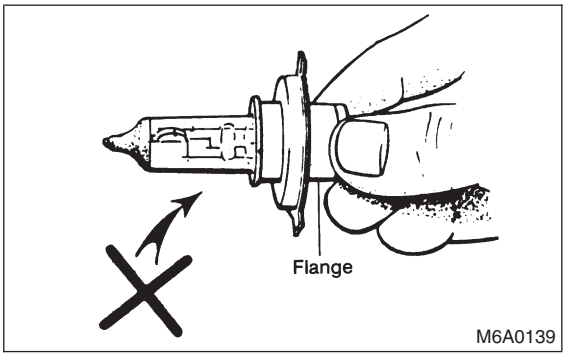
1. HEADLIGHT BULB

1) Disconnect the connector from inside of the engine compartment.
2) Remove rubber cap.
3) Remove the light bulb retaining spring to remove the bulb.

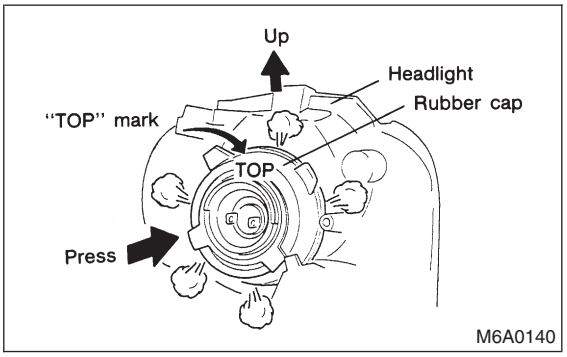


4) Replace the bulb with a new one and hook the spring.
5) Attach the rubber cap and connect the connector.

CAUTION:
- **Since the tungsten halogen bulb operates at high temperature, dirt and oil on the bulb surface decreases the bulb's useful life. When replacing the bulb, hold the flange portion and do not touch the glass portion.**



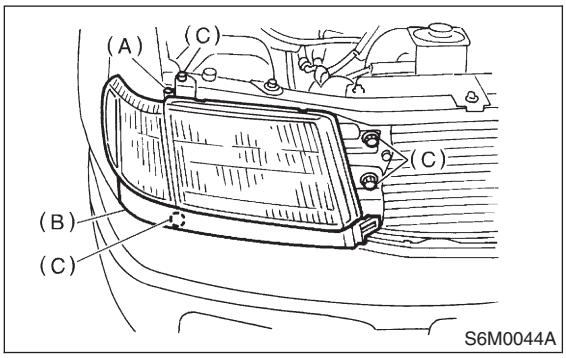
- **Attach the rubber cap with letters TOP on the top so that the drain hole will be on the lower side.**



● To keep water out, correctly engage the groove portion of the rubber cap.

2. HEADLIGHT AND SIDE MARKER LIGHT

1) Remove front grille <Ref. to 5-1 [W12A0].> and disconnect connector from headlight.
2) Remove screw (A) then remove side marker light while disconnecting connector.
3) Remove extension (B). <Ref. to 5-1 [W3A0].>
4) Remove bolts (C) which secure headlight and remove headlight.



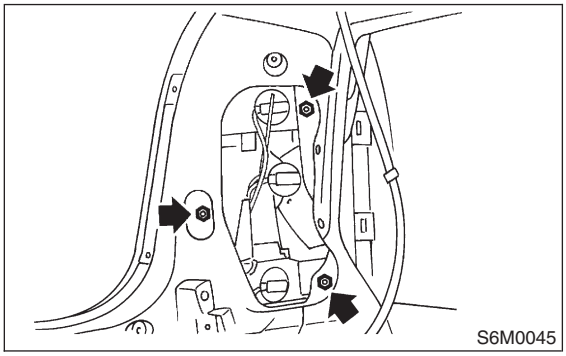
5) Installation is in the reverse order of removal.

Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)

NOTE:
When installing, securely fit clip (on fender side) into locating (on side marker light side).

3. REAR COMBINATION LIGHT

1) Remove rear quarter upper and lower trim.
2) Remove nuts and disconnect connector.



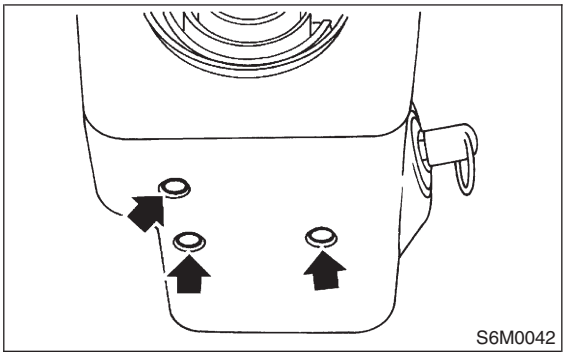
3) Attach adhesive cloth tape to body area around rear combination light.
4) Using a standard screwdriver, carefully pry rear combination light off and away from the front of vehicle.
5) Installation is in the reverse order of removal.

Tightening torque:
4.4±1.5 N·m (0.45±0.15 kg-m, 3.3±1.1 ft-lb)

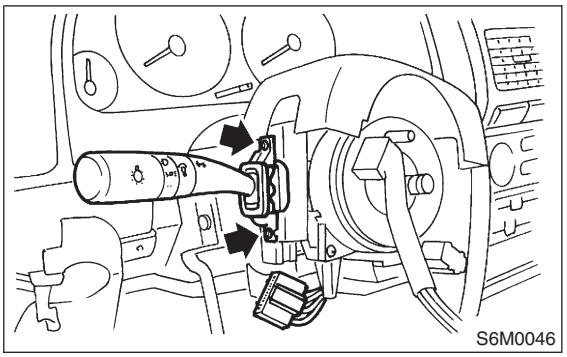
CAUTION:
● Do not pry rear combination light forcefully as this may scratch vehicle body.
● Remove all traces of adhesive tape from body before installation.
● Attach butyl rubber tape to back of rear combination light before installing rear combination light on body for sealing purposes.

4. COMBINATION SWITCH

1) Remove instrument panel lower cover. <Ref. to 5-4 [W1A0].>
2) Remove screws which secure upper column cover to lower column cover.



3) Disconnect connector from combination switch.
4) Remove screws which secure switch and remove switch.



5) Installation is in the reverse order of removal.

C: INSPECTION

1. COMBINATION SWITCH (LIGHTING)

Move combination switch to respective positions and check continuity between terminals.

• LIGHTING SWITCH

Terminal / Switch position	16	14	13
OFF			
Tail	○	○	
Head	○	○	○

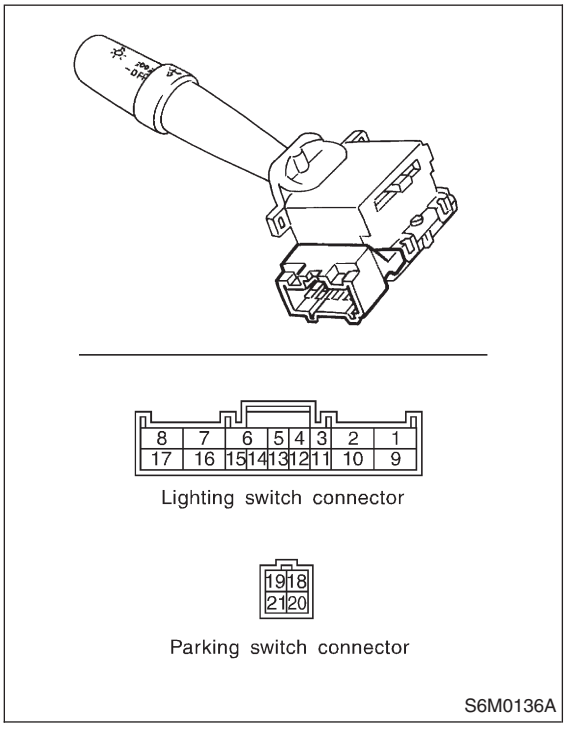
• PARKING SWITCH

Terminal / Switch position	19	21	18
OFF	○	○	
ON		○	○

• DIMMER AND PASSING SWITCH

Terminal / Switch position	16	17	7	8
Flash	○		○	○
Low beam	○	○		
HI-beam	○		○	

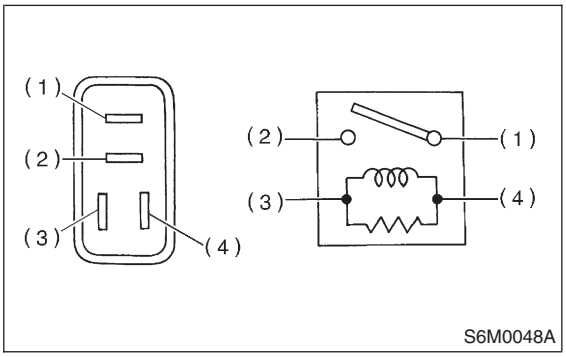
H6M0500B



2. HEADLIGHT RELAY

Check continuity between terminals when terminal No. 4 is connected to battery and terminal No. 3 is grounded.

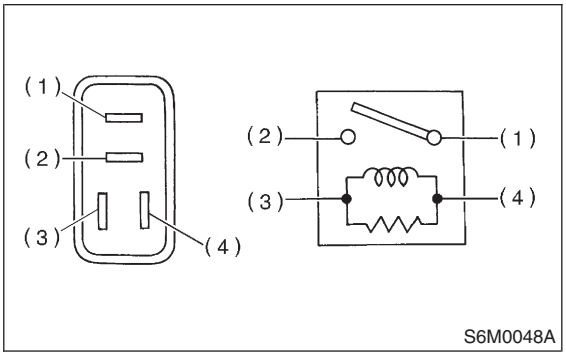
When current flows.	Between terminals No. 1 and No. 2	Continuity exists.
When current does not flow.	Between terminals No. 1 and No. 2	Continuity does not exist.
	Between terminals No. 3 and No. 4	Continuity exists.



3. TAIL AND ILLUMINATION RELAY

Check continuity between terminals (indicated in table below) when terminal No. 4 is connected to battery and terminal No. 3 is grounded.

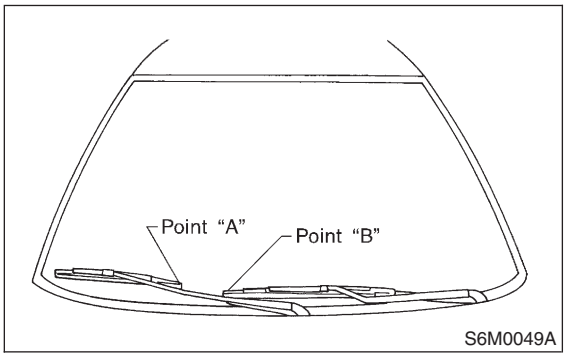
When current flows.	Between terminals No. 1 and No. 2	Continuity exists.
When current does not flow.	Between terminals No. 1 and No. 2	Continuity does not exist.
	Between terminals No. 3 and No. 4	Continuity exists.



5. Front Wiper and Washer

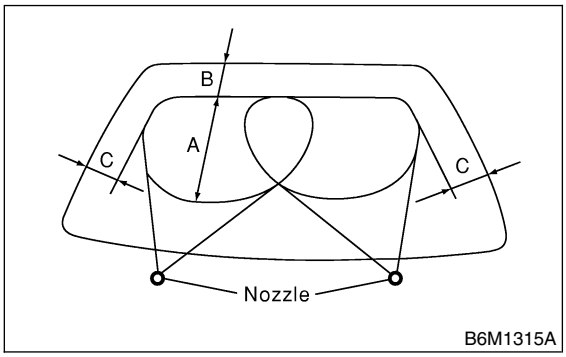
A: ADJUSTMENT

1) Turn the wiper switch to OFF position.
2) Adjust so that points “A” and “B” of the blades meet the upper end of ceramic print.



3) Adjust washer ejecting area on windshield glass as shown in figure when vehicle stops.

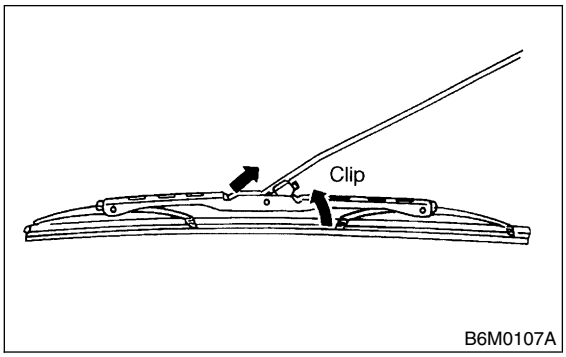
Ejecting area:
A: 350 mm (13.78 in)
B: 100 mm (3.94 in)
C: 60 mm (2.36 in)



B: REMOVAL AND INSTALLATION

1. BLADE

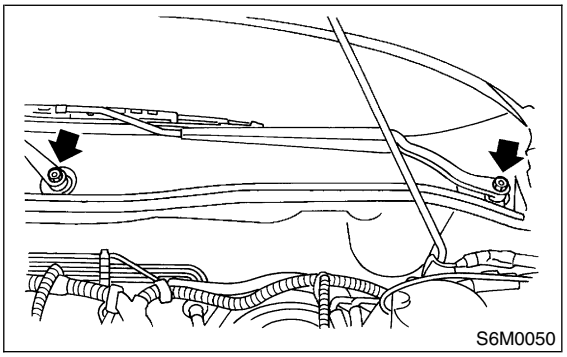
1) Pull out blade following the arrow direction, from arm while pushing up locking clip.



2) Installation is in the reverse order of removal.

2. WIPER ARM

1) Open front hood.
2) Remove cap. Remove the nut which secure wiper arm, and remove wiper arm.



3) Installation is in the reverse order of removal.

NOTE:
Remove metal sludge from the wiper arm fixture before installing it.

Tightening torque:
20±3 N·m (2.0±0.3 kg-m, 14.5±2.2 ft-lb)

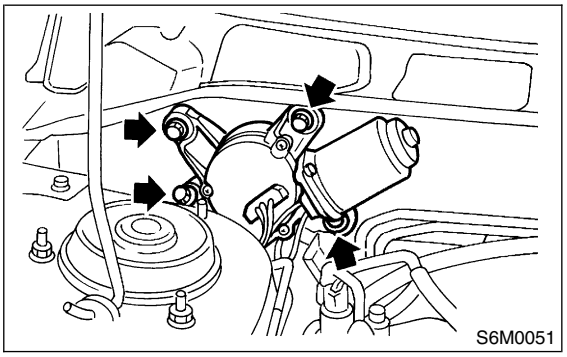
3. WIPER MOTOR AND LINK

1) Detach cowl panel. <Ref. to 5-1 [W10A0].>

NOTE:
Apply silicone oil or soap water to both sides of cowl net to facilitate removal.

2) Disconnect electric connector, and remove motor attaching bolts.

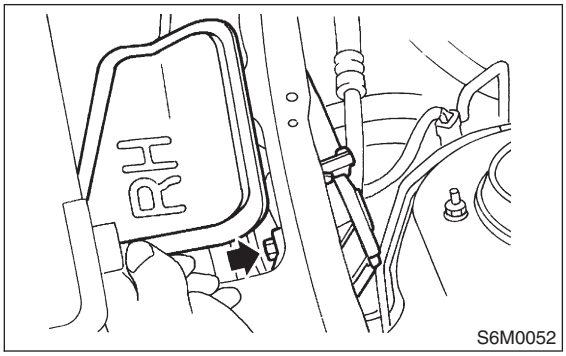
Tightening torque:
5.9±1.5 N·m (0.6±0.15 kg-m, 4.3±1.1 ft-lb)



3) Remove cowl cover.

4) Remove nut securing motor link on the back side of motor.

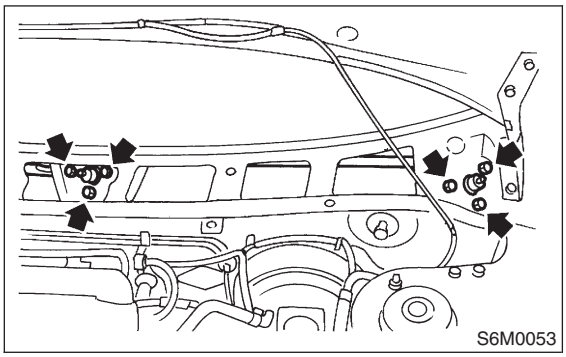
Tightening torque:
15±3 N·m (1.5±0.3 kg-m, 11±2.2 ft-lb)



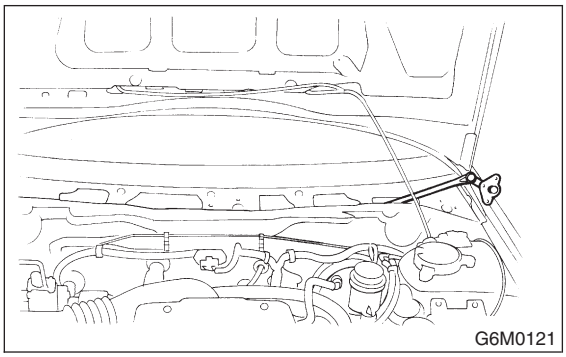
S6M0052

5) Remove bolts which secure sleeve unit.

Tightening torque:
5.9±1.5 N·m (0.6±0.15 kg-m, 4.3±1.1 ft-lb)


S6M0053

6) Remove wiper link from service hole in front panel.


G6M0121

7) Installation is in the reverse order of removal.

C: INSPECTION

1. COMBINATION SWITCH (FRONT WIPER)

Set wiper switch to each position and check continuity between terminals.

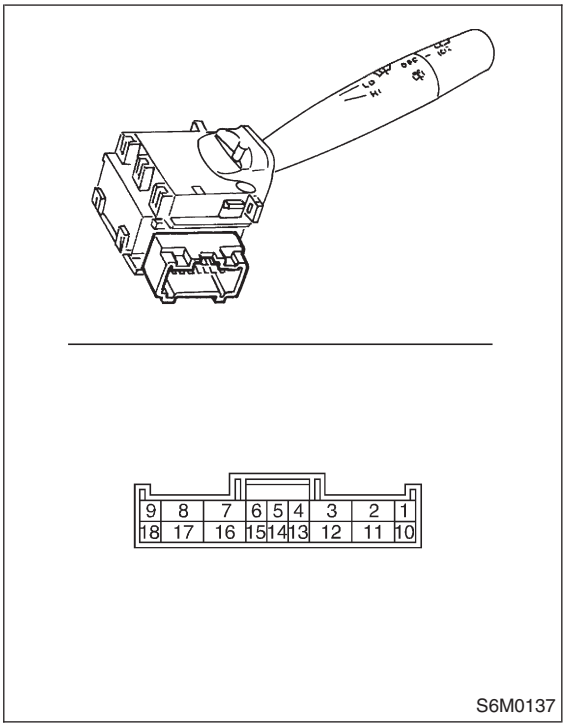
• Wiper switch

Terminal / Switch position		16	7	17	8	INT1	INT2
OFF	OFF	○	○				
		×		×			
	MIST		○	○			
INT	OFF	○	○			○	○
		×		×			
	MIST		○	○		○	○
		×		×			
LO	OFF		○	○			
	MIST		○	○			
HI	OFF			○	○		
	MIST		○	○	○		

• Washer switch

Terminal / Switch position	11	2
OFF		
ON	○	○

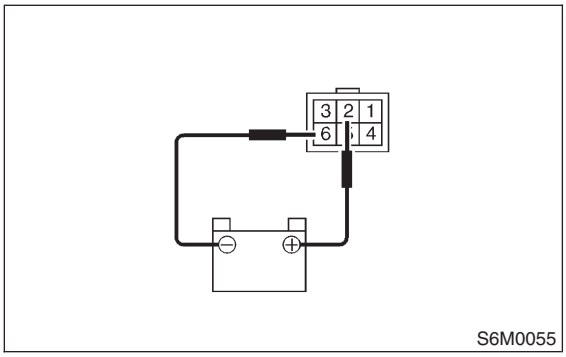
H6M0501B



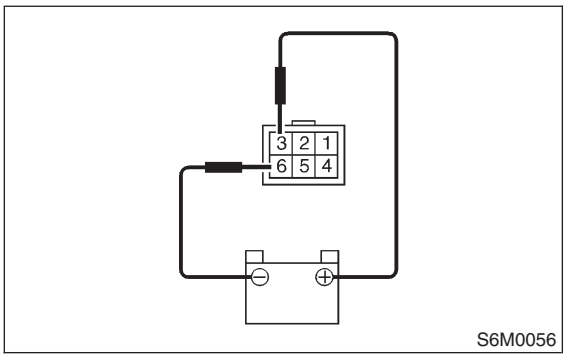
S6M0137

2. WIPER MOTOR

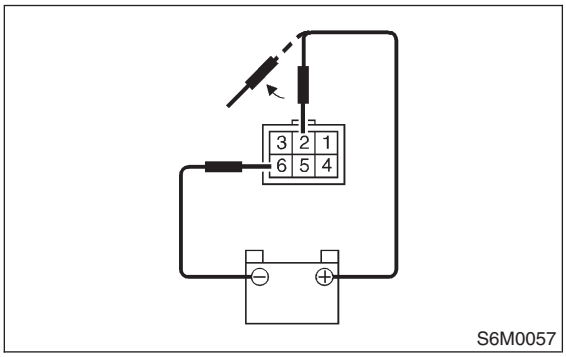
1) Check wiper motor operation at low speed: Connect battery to wiper motor. Check wiper motor for proper operation at low speed.



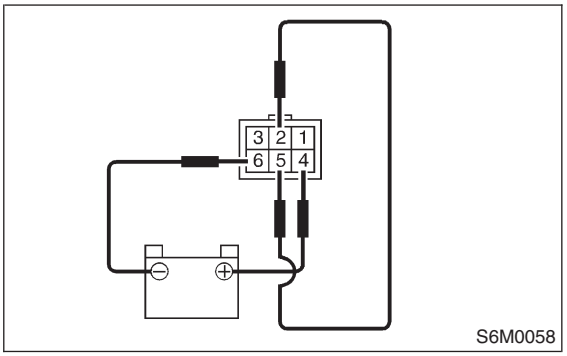
2) Check wiper motor operation at high speed: Connect battery wiper motor. Check wiper motor for proper operation at high speed.



3) Check wiper motor for proper stoppage: Connect battery to wiper motor. After operating wiper motor at low speed, disconnect battery to stop it.



4) Reconnect battery and ensure that wiper motor stops at “AUTO STOP” after operating at low speed.

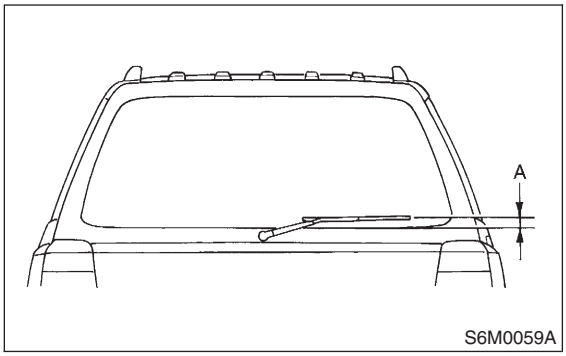


6. Rear Wiper and Washer

A: ADJUSTMENT

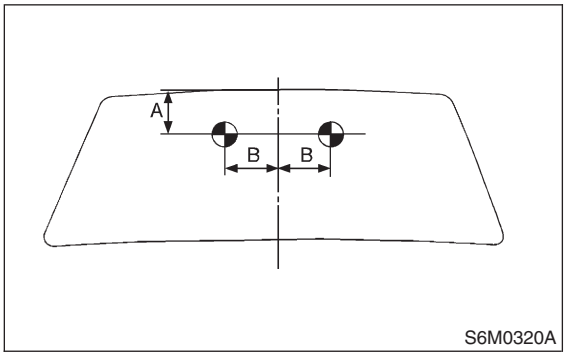
1) Adjust wiper blade in original position as shown in figure by changing wiper arm installation.

Original position:
A: 30±5 mm (1.18±0.20 in)



2) Adjust washer ejecting point on rear gate window as shown in figure when the vehicle stops.

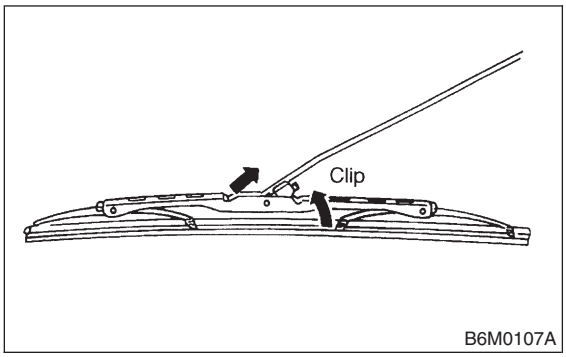
Ejecting point:
A: 80 mm (3.15 in)
B: 70 mm (2.76 in)



B: REMOVAL AND INSTALLATION

1. BLADE

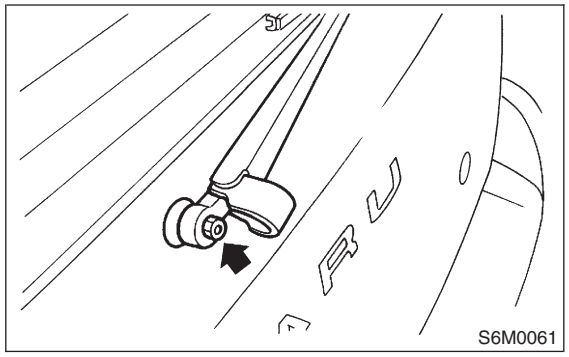
1) Pull out blade following the arrow direction, from arm while pushing up locking clip.



2) Installation is in the reverse order of removal.

2. WIPER ARM

1) Remove head cover.
2) Remove nut and wiper arm.



3) Installation is in the reverse order of removal.

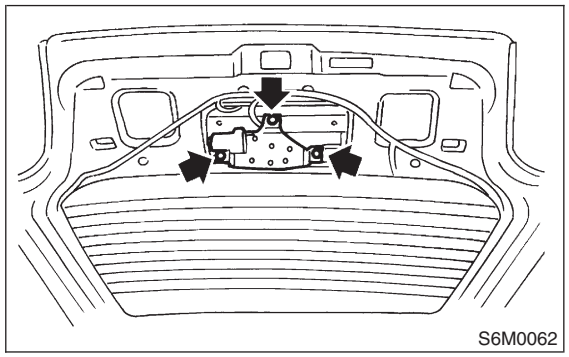
NOTE:
Remove metal sludge from the wiper arm fixture before installing it.

Tightening torque:
5.9±1.5 N·m (0.6±0.15 kg-m, 4.3±1.1 ft-lb)

3. WIPER MOTOR

1) Remove wiper arm.
2) Remove rear gate trim.
3) Undo clips which secure harness, and disconnect connector of wiper motor.
4) Remove attaching screws and take out wiper motor assembly.

CAUTION:
Be careful not to damage O-ring when removing wiper motor assembly.



5) Installation is in the reverse order of removal.

Tightening torque:
5.9±1.5 N·m (0.6±0.15 kg-m, 4.3±1.1 ft-lb)

C: INSPECTION

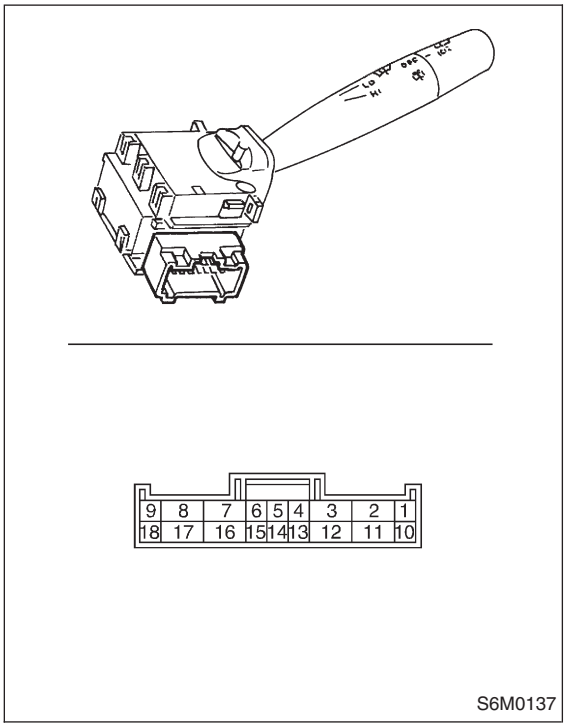
1. COMBINATION SWITCH (REAR WIPER)

Set rear wiper and washer switch to each position and check continuity between terminals.

• WITHOUT INTERMITTENT REAR WIPER

Terminal / Switch position	10	12		2
WASH	○	○		○
OFF				
ON	○			○
WASH	○	○		○

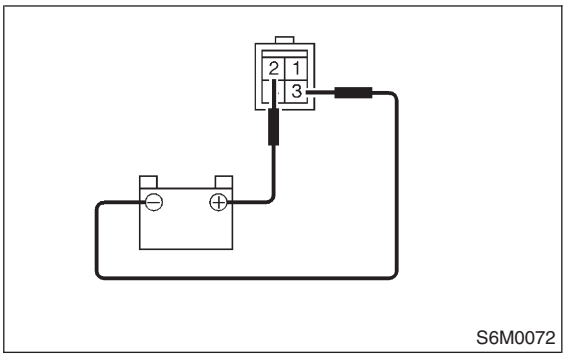
H6M0502B



S6M0137

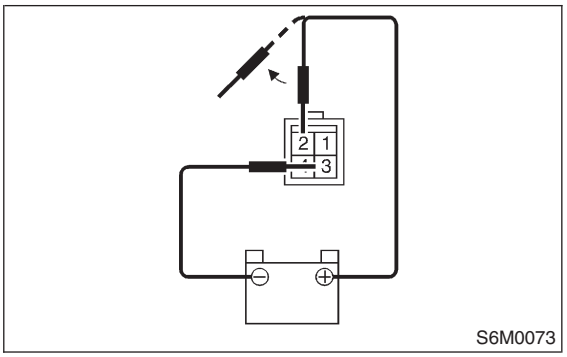
2. WIPER MOTOR

1) Operational check:
Connect battery to wiper motor and check operation of wiper motor.



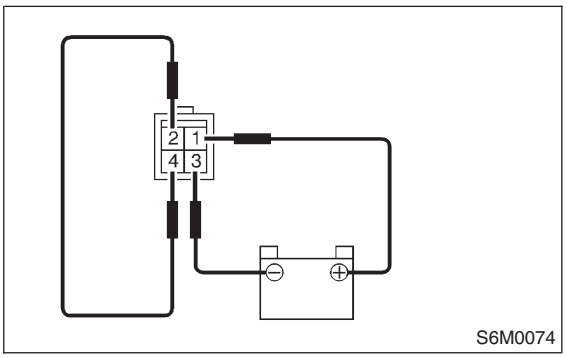
S6M0072

2) Check wiper motor for proper stoppage:
After operating wiper motor, disconnect battery from wiper motor.



S6M0073

3) Reconnect battery and ensure that wiper motor stops at “AUTO STOP” after it has been operated.

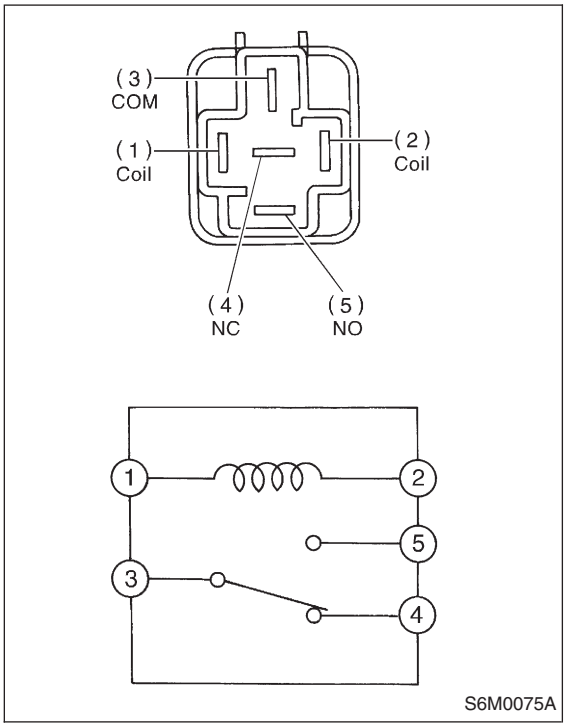


S6M0074

3. REAR WIPER RELAY

1) Connect battery to terminal No. 1 and ground terminal No. 2.
2) Check continuity between terminals.

When current flows.	Between terminals No. 3 and No. 4	Continuity does not exist.
	Between terminals No. 3 and No. 5	Continuity exists.
When current does not flow.	Between terminals No. 3 and No. 4	Continuity exists.
	Between terminals No. 3 and No. 5	Continuity does not exist.
	Between terminals No. 1 and No. 2	Continuity exists.



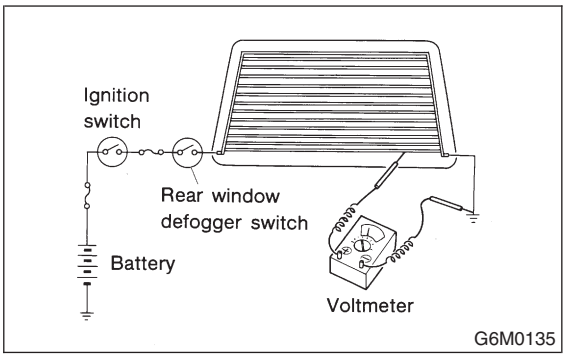
7. Rear Window Defogger

A: INSPECTION

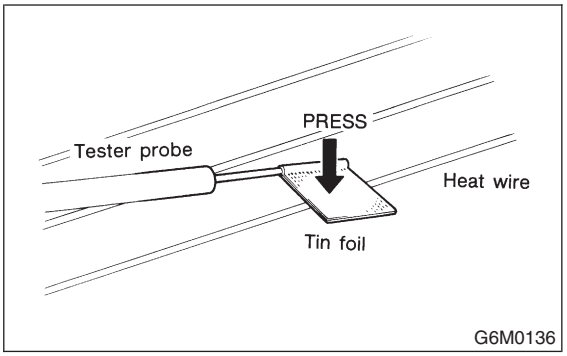
1. HEAT WIRES

1) Start the engine so that battery is being charged.
2) Turn defogger switch ON.
3) Check each heat wire at its center position for discontinuity by setting direct current voltmeter.

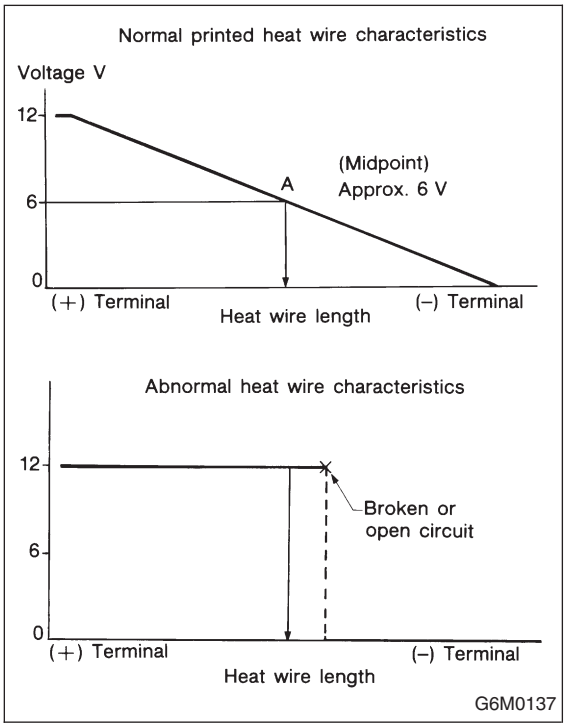
NOTE:
- Normal indication is about 6 volts.



- When measuring voltage, wind a piece of tin foil around the tip of the tester probe and press the foil against the wire with your finger.

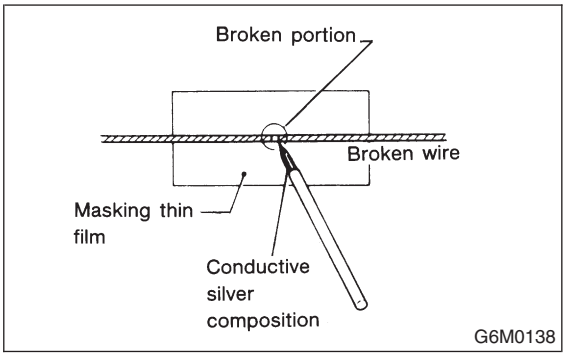


4) When tester indicates 12 volts when its probe reaches point “A”, a broken circuit occurs between point “A” and the negative terminal. Slowly move tester probe toward the negative terminal while contacting it on heat wire to locate point where tester indication changes abruptly (0 volts). This is the point where a broken circuit occurs. When tester indicates 0 volts when its probe reaches point “A”, a broken circuit occurs between point “A” and the positive terminal. Locate a point where tester indication changes abruptly (12 volts) while slowly moving tester probe toward the positive terminal.



B: REPAIR

1) Clean broken wire and its surrounding area.
2) Cut off slit on (used) thin film by 0.5 mm (0.020 in) width and 10 mm (0.39 in) length.
3) Place the slit on glass along the broken wire, and deposit conductive silver composition (DUPONT No. 4817) on the broken portion.

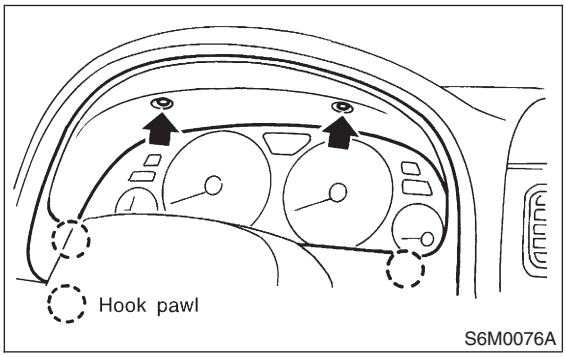


4) Dry out the deposited portion.
5) Inspect the repaired wire for continuity.

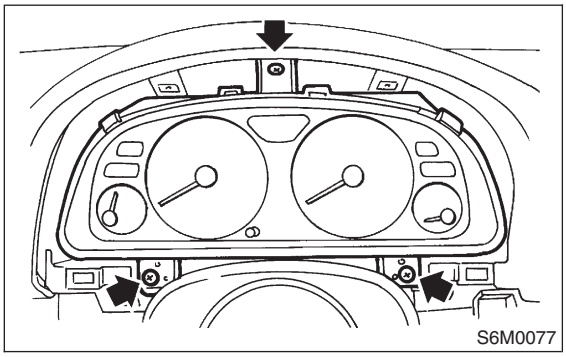
8. Combination Meter

A: REMOVAL AND INSTALLATION

1) Move steering wheel most down.
2) Remove screws which secure visor and remove visor.



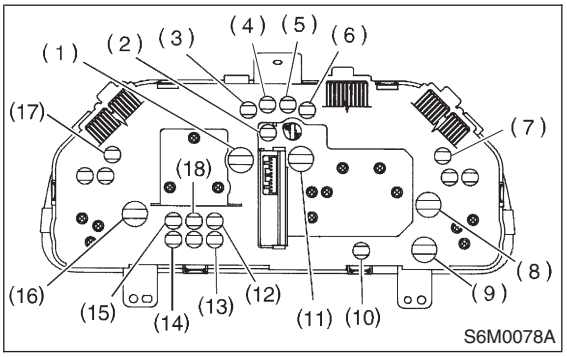
3) Remove screws which secure combination meter, and pull combination meter out.



4) Disconnect connector from back of combination meter.
5) Installation is in the reverse order of removal.

CAUTION:
When installing combination meter, be sure to connect connectors to backside of combination meter.

B: BULB REPLACEMENT



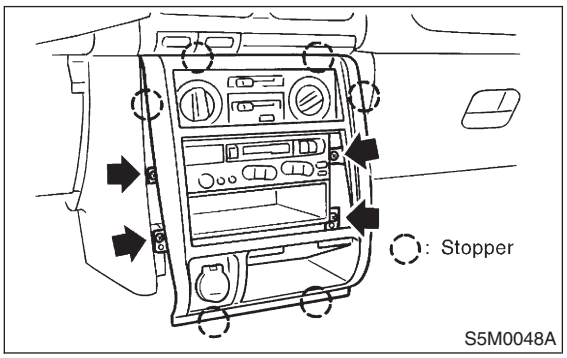
(1) Tachometer
(2) Door open
(3) Turn RH
(4) Airbag
(5) HI-beam
(6) Turn LH
(7) ABS
(8) Speedometer and fuel gauge
(9) Low fuel
(10) Seat belt
(11) Speedometer
(12) Oil pressure
(13) Brake
(14) FWD
(15) Check engine
(16) Tachometer and temperature gauge
(17) AT oil temp.
(18) Charge

9. Radio, Speaker and Antenna

A: REMOVAL AND INSTALLATION

1. RADIO BODY

1) Remove console box. <Ref. to 5-4 [W1A0].>
2) Remove AT cover (AT model).
3) Remove center panel.
4) Remove fitting screws, and slightly pull radio out from center console.



5) Disconnect electric connectors and antenna feeder cord.
6) Installation is in the reverse order of removal.

2. FRONT SPEAKER

1) Remove front door trim and disconnect connector. <Ref. to 5-2 [W2A2].>
2) Remove screws which secure front speaker.
3) Remove speaker and disconnect connector.
4) Installation is in the reverse order of removal.

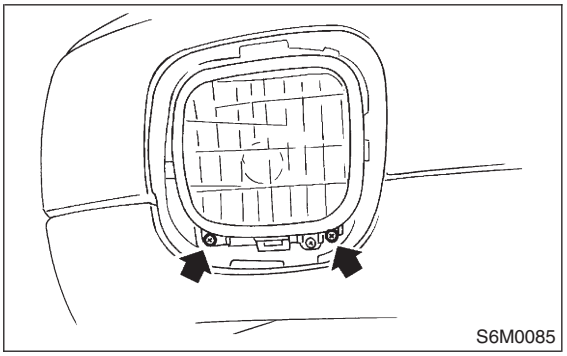
3. REAR SPEAKER

1) Remove rear door trim and disconnect connector. <Ref. to 5-2 [W2A2].>
2) Remove screws which secure rear speaker.
3) Remove speaker and disconnect connector.
4) Installation is in the reverse order of removal.

10. Front Fog Light

A: REMOVAL AND INSTALLATION

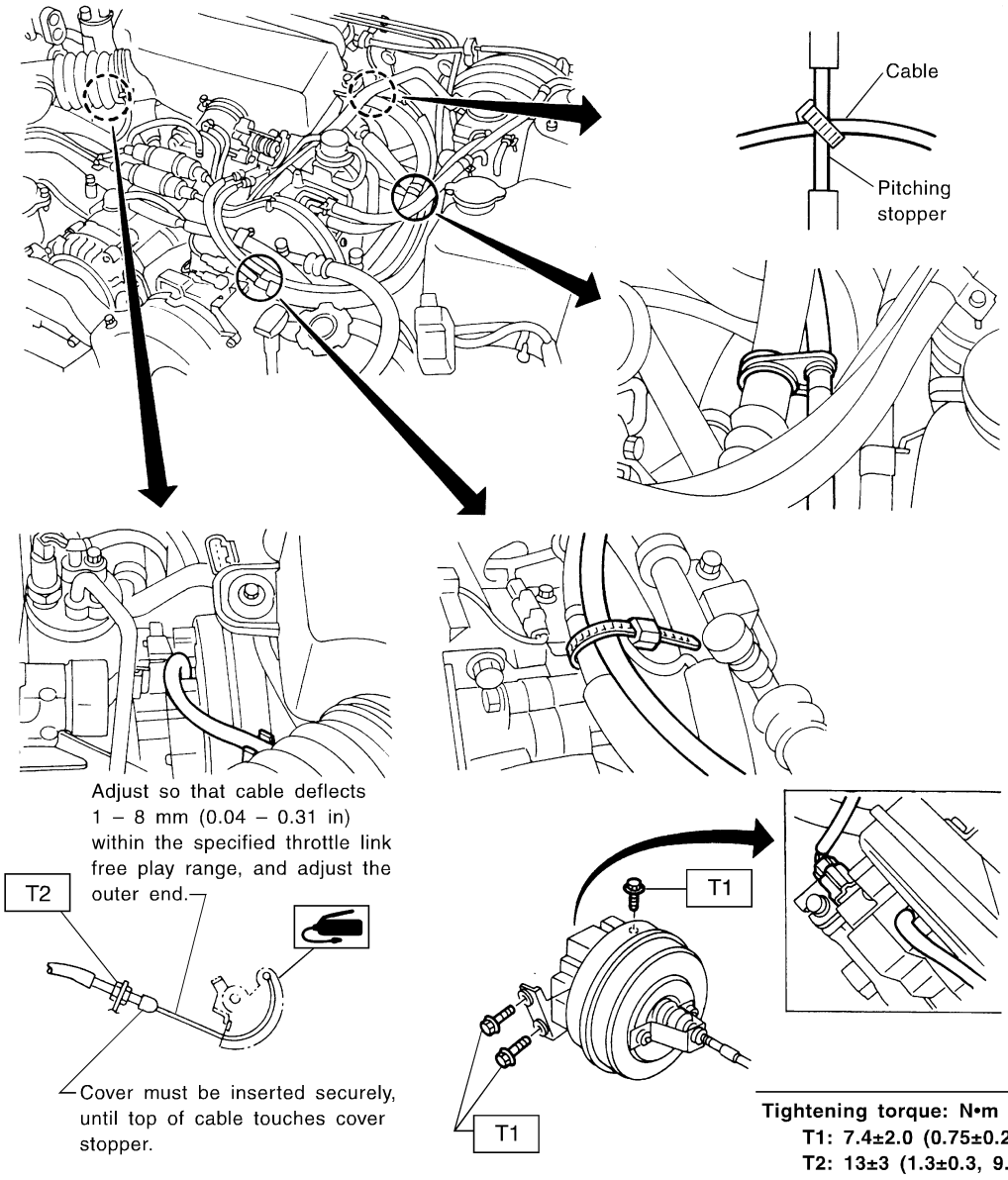
1) Disconnect ground cable from battery.
2) Remove the two screws, then draw out the front fog light from front bumper.



3) Disconnect the connector.
4) Installation is in the reverse order of removal.

11. Cruise Control

A: ADJUSTMENT



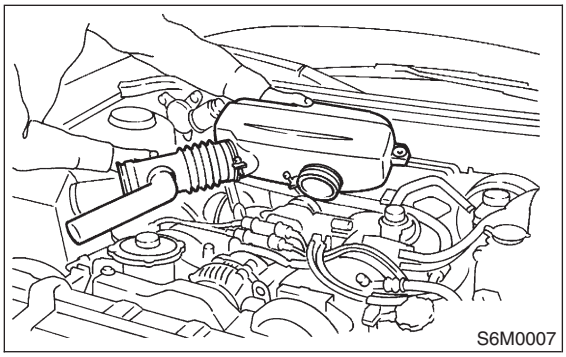
Tightening torque: N•m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 13±3 (1.3±0.3, 9.4±2.2)

S6M0387A

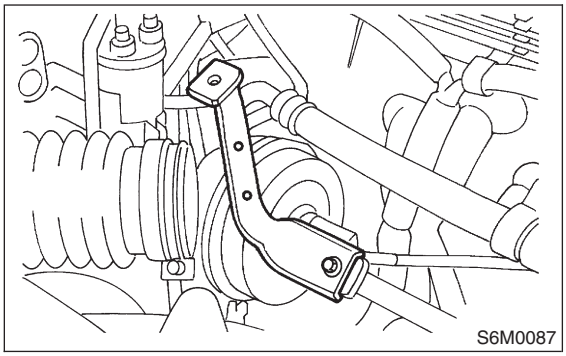
B: REMOVAL AND INSTALLATION

1. ACTUATOR

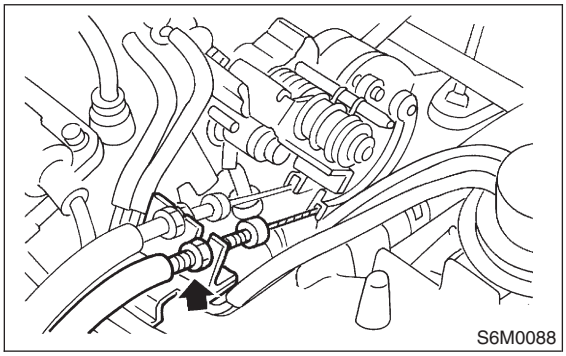
1) Remove air intake chamber.


S6M0007

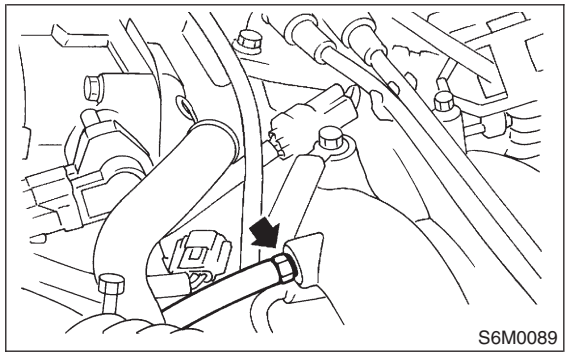
2) Remove air intake chamber stay.
3) Remove clip bands from cruise control cable.


S6M0087

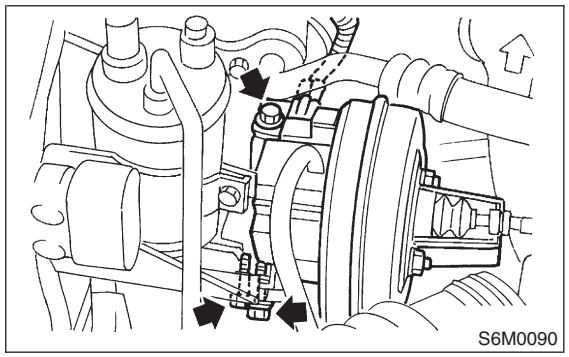
4) Remove cruise control cable end from throttle cam.


S6M0088

5) Disconnect cruise control vacuum hose from intake manifold.


S6M0089

6) Remove actuator attaching bolts.
7) Disconnect connector from actuator, then remove the actuator.


S6M0090

8) Installation is in the reverse order of removal.

Tightening torque:
7.4±2.0 N·m (0.75±0.2 kg-m, 5.4±1.4 ft-lb)

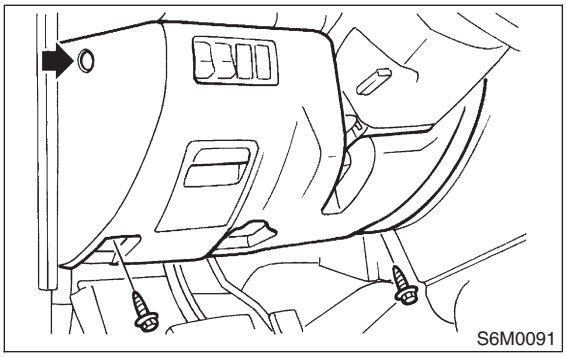
CAUTION:
When inserting vacuum hose to intake manifold, apply sealant to the fitting hose.

Fluid packing:
THREE BOND 1105 or equivalent

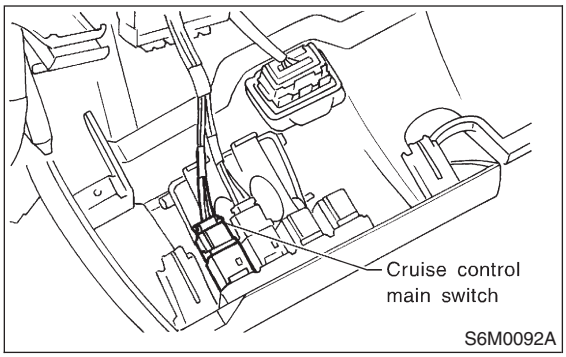
CAUTION:
• Be careful not to apply excessive load to the wire cable when adjusting and/or installing; otherwise, the actuator may be deformed or damaged.
• Do not bend cable sharply with a radius less than 100 mm (3.94 in); otherwise, cable may bend permanently, resulting in poor performance.
• When installing cable, be careful not to sharply bend or pinch the inner cable; otherwise, the cable may break.

2. CRUISE CONTROL MAIN SWITCH

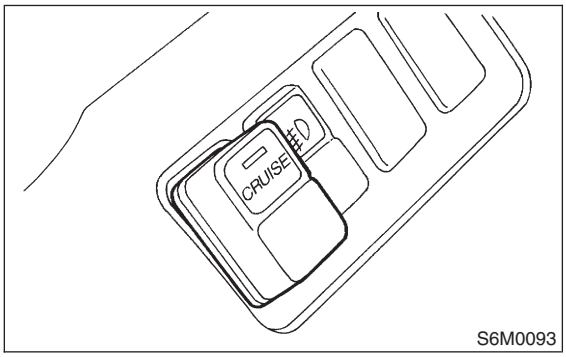
1) Remove screws and clip from instrument panel lower cover.
2) Remove panel lower cover.



3) Disconnect connector from cruise control main switch.



4) Remove main switch by pushing it outward.

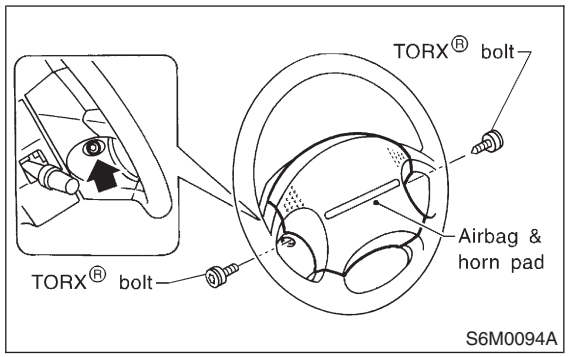


5) Installation is in the reverse order of removal.

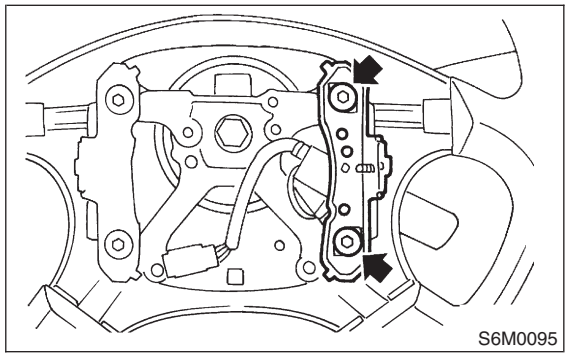
3. CRUISE CONTROL COMMAND SWITCH

CAUTION:
Before starting operation carefully read the notes given in Chapter 5-5 for proper handling of the airbag module. <Ref. to 5-5 [W3A0].>

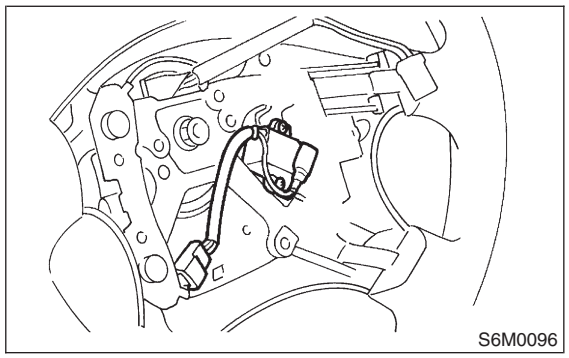
1) Set front wheels in straight ahead position.
2) Turn ignition switch OFF.
3) Disconnect battery ground cable from battery and wait for at least 20 seconds before starting work.
4) Using TORX® BIT T30 (Tamper resistant type), remove two TORX® bolts which secure driver's airbag module.



5) Disconnect airbag module connector on back of airbag module.
6) Remove horn switch from steering wheel as shown.



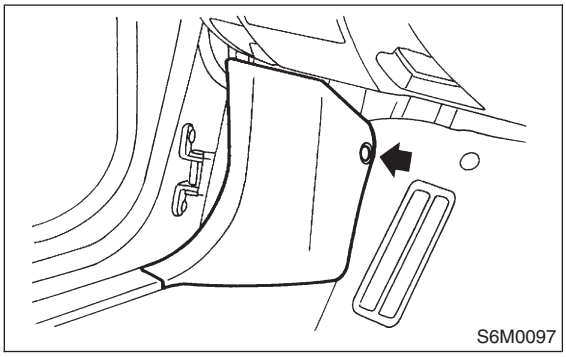
7) Disconnect horn and cruise control command switch connector, then remove cruise control command switch.



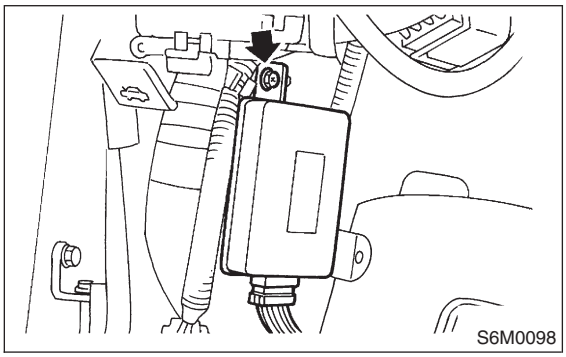
8) Installation is in the reverse order of removal.

4. CRUISE CONTROL MODULE

1) Remove front pillar lower trim.



2) Disconnect connector from cruise control module.
3) Remove bolt, then remove cruise control module.



4) Installation is in the reverse order of removal.

5. STOP AND BRAKE SWITCH

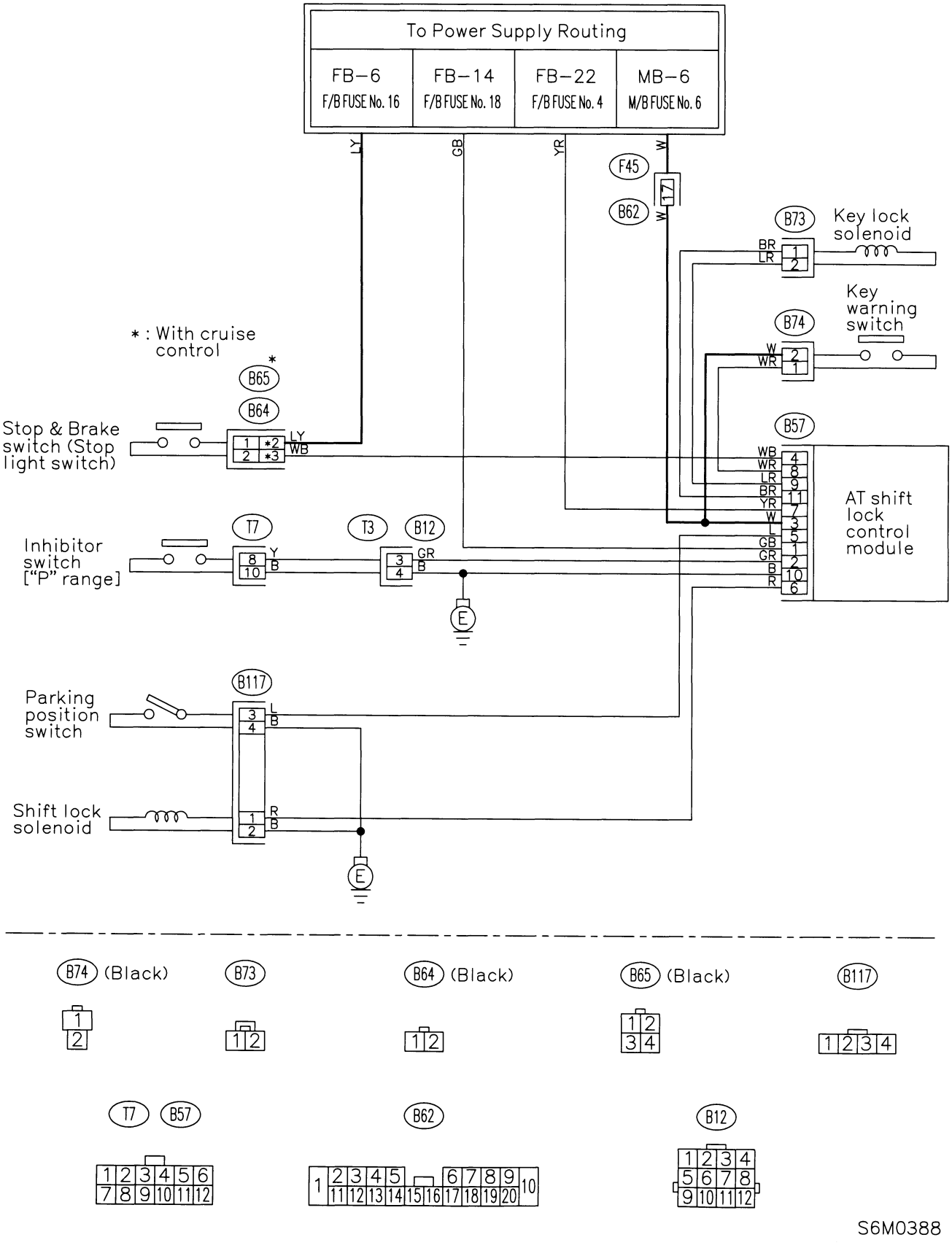
Disconnect connector from switch, then remove the switch. <Ref. to 4-5 [C1A0].>

6. CLUTCH SWITCH

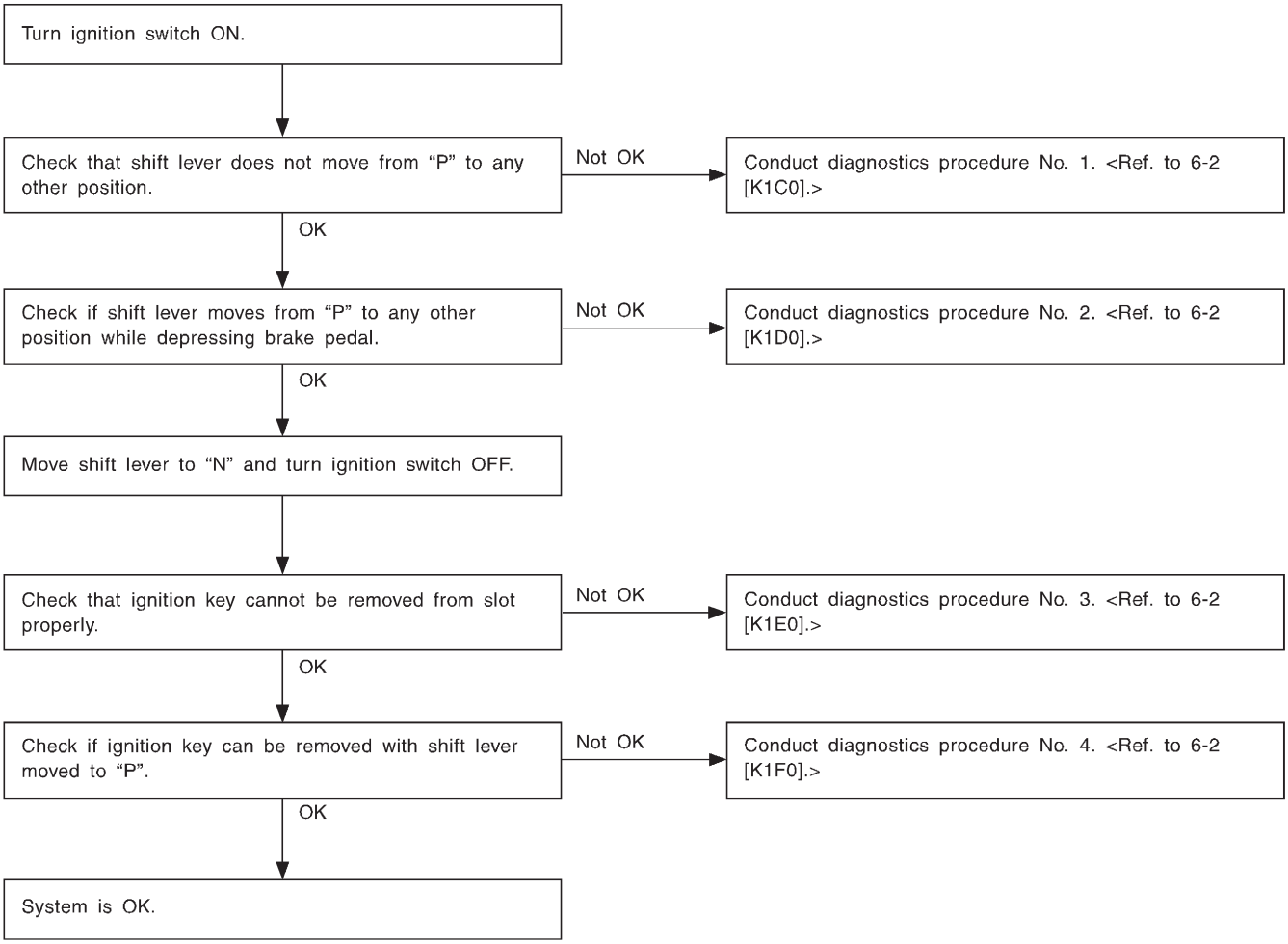
Disconnect connector from switch, then remove the switch. <Ref. to 4-5 [C1A0].>

1. AT Shift Lock System

A: WIRING DIAGRAM

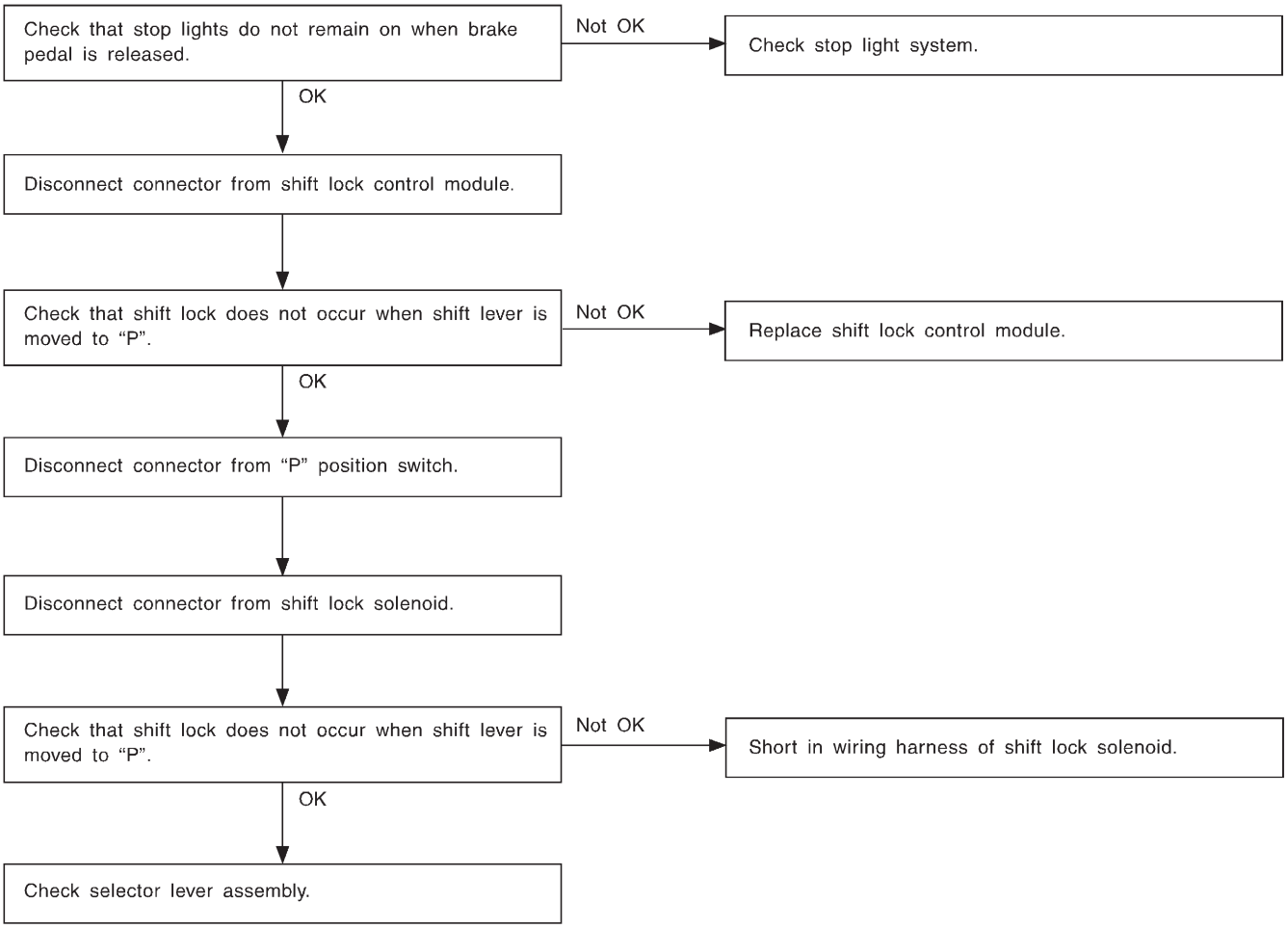


B: BASIC DIAGNOSTICS CHART



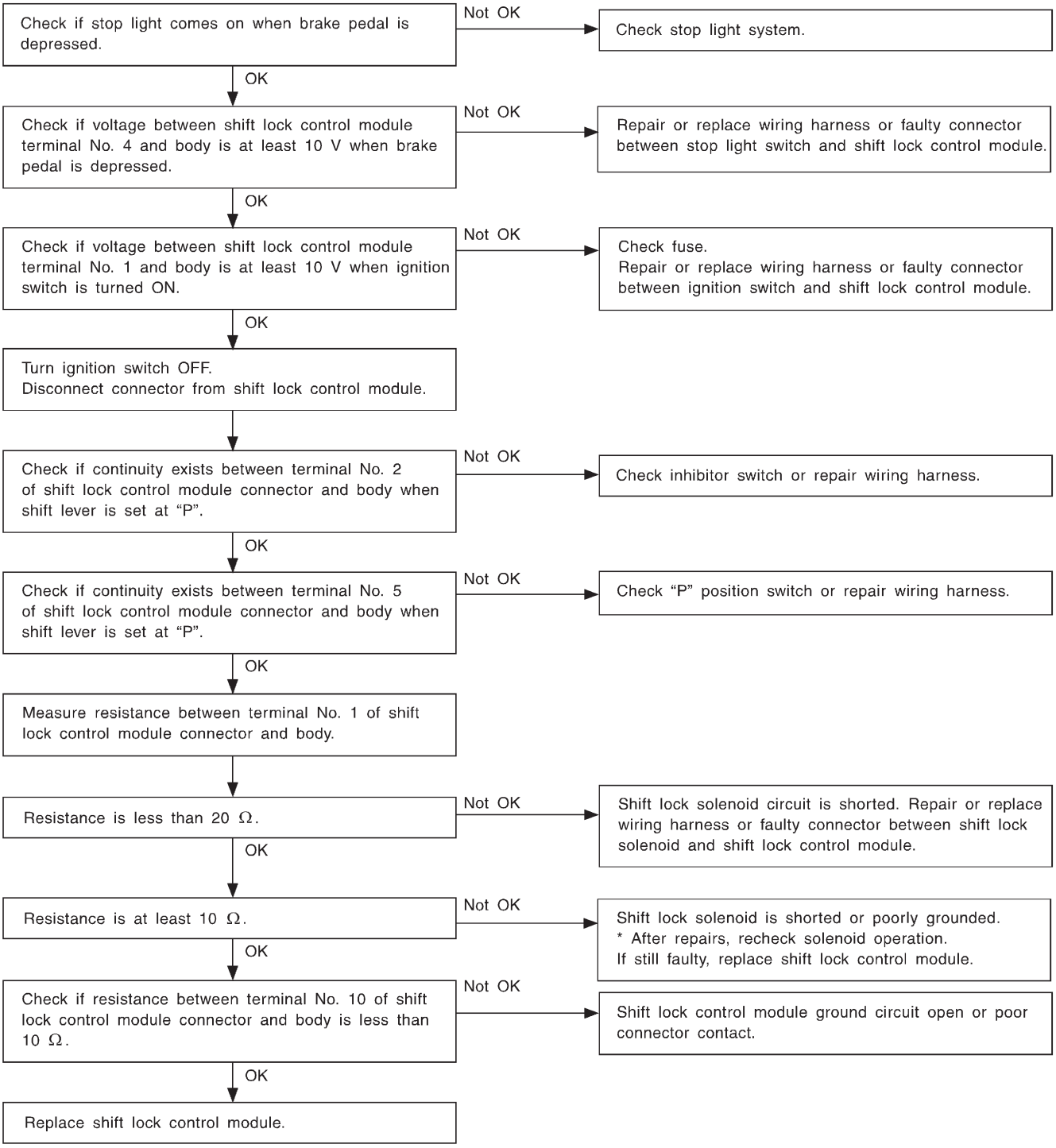
H6M0504A

C: DIAGNOSTICS PROCEDURE NO. 1



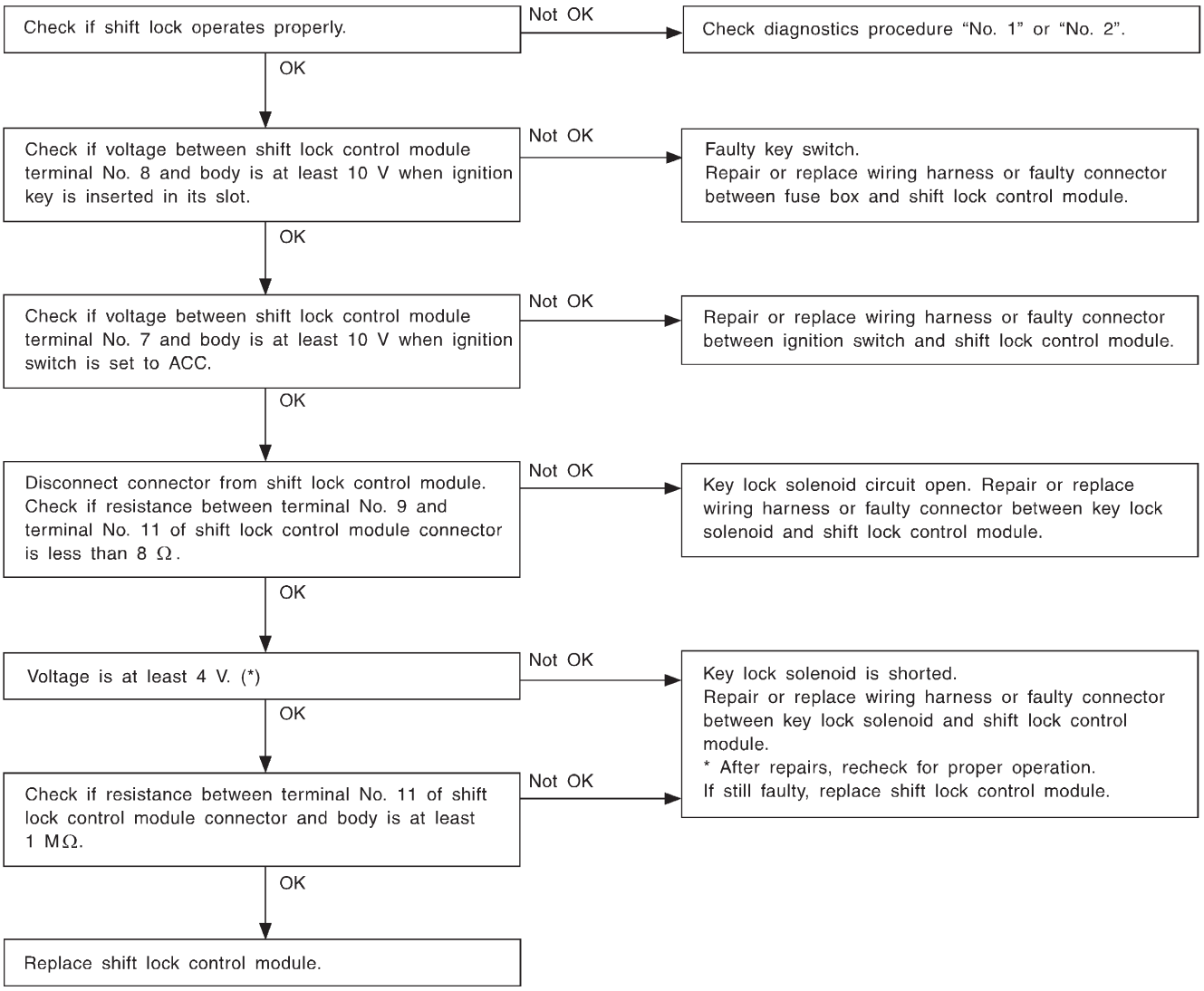
H6M0505

D: DIAGNOSTICS PROCEDURE NO. 2 (SHIFT LOCK DOES NOT RELEASE.)



H6M0506

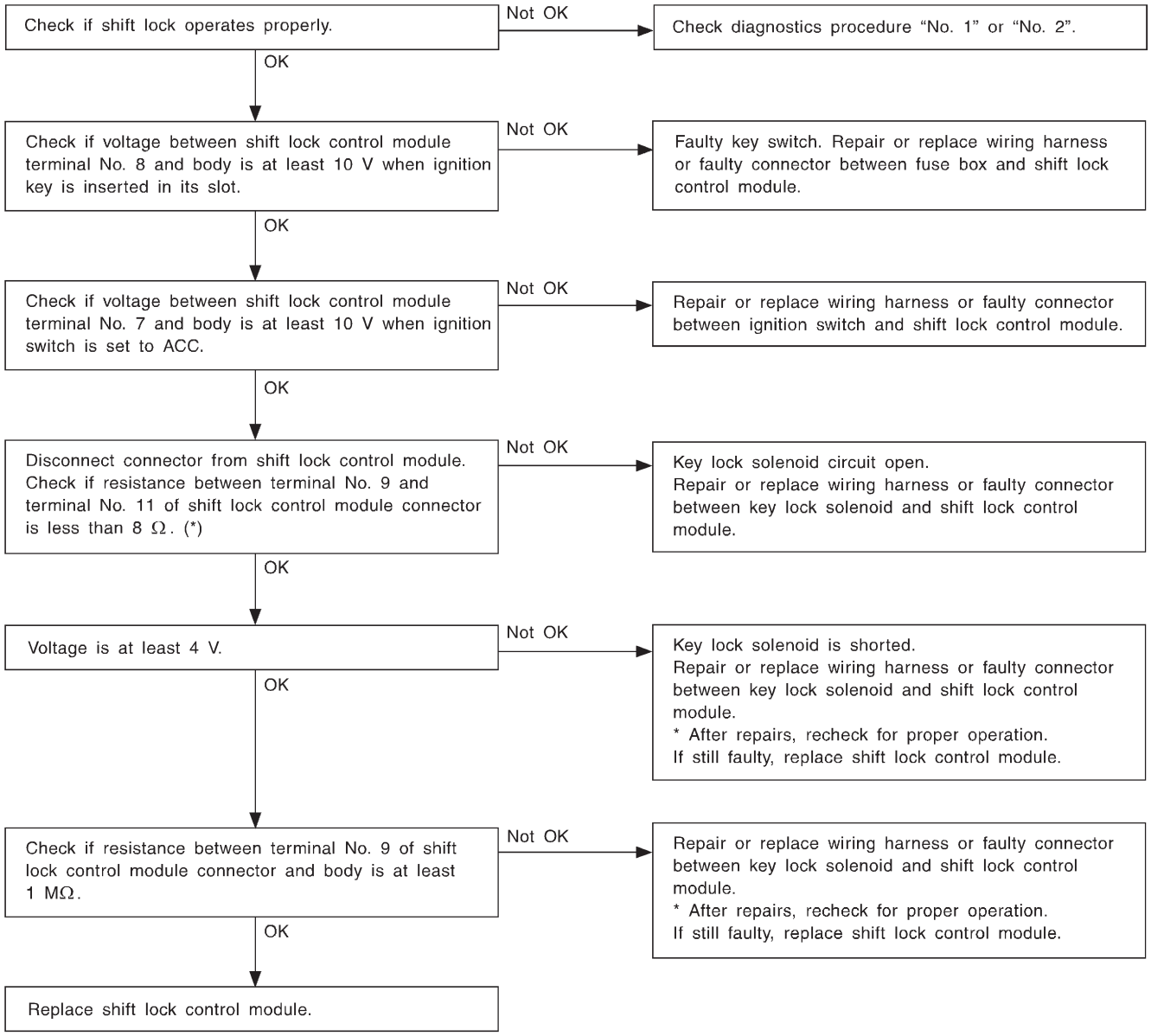
E: DIAGNOSTICS PROCEDURE NO. 3 (KEY INTERLOCK DOES NOT OPERATE.)



***: When conducting operational checks of the key lock solenoid, do not apply 12 V to solenoid for more than one second, since this may break solenoid circuit.**

H6M0507

F: DIAGNOSTICS PROCEDURE NO. 4 (KEY INTERLOCK DOES NOT RELEASE.)



***: When conducting operational checks of the key lock solenoid, do not apply 12 V to solenoid for more than one second, since this may break solenoid circuit.**

H6M0508

2. Combination Meter

A: DIAGNOSTICS PROCEDURE

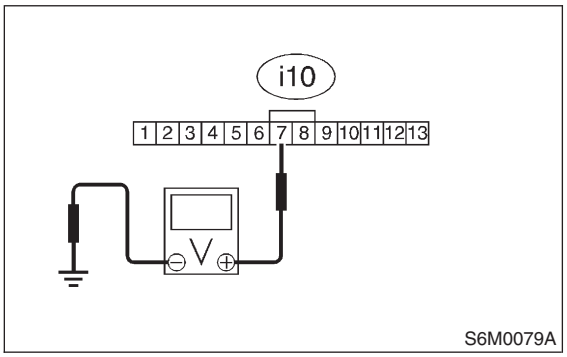
If speedometer does not operate, or operates abnormally, check combination meter circuit.

CAUTION:
Make sure that trouble code of vehicle speed sensor 2 system appears in electrical system on-board diagnosis.

2A1 : CHECK POWER SUPPLY FOR COMBINATION METER.

1) Remove combination meter.
2) Turn ignition switch to ON.
3) Measure voltage between combination meter connector and chassis ground.

Connector & terminal
(i10) No. 7 (+) — Chassis ground (–):



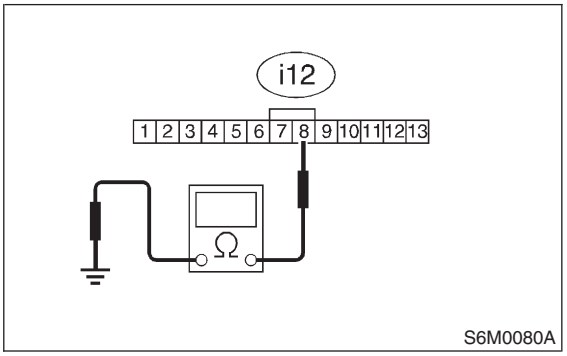
CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **2A2**.
NO : Repair harness and connector.

NOTE:
In this case, repair the following:
● Open circuit in harness between combination meter and battery.
● Poor contact in coupling connectors (i10) and combination meter connector. <Ref. to FOREWORD [W3C0].>

2A2 : CHECK GROUND CIRCUIT OF COMBINATION METER.

1) Turn ignition switch to OFF.
2) Measure resistance of harness between combination meter connector and chassis ground.

Connector & terminal
(i12) No. 8 (+) — Chassis ground (–):



CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **2A3**.
NO : Repair harness and connector.

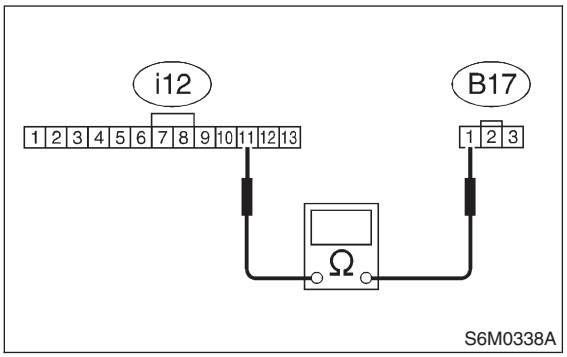
2A3 : CHECK TRANSMISSION TYPE

CHECK : ***Is the transmission type MT?***
YES : Go to step **2A4**.
NO : Go to step **2A8**.

2A4 : CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND VEHICLE SPEED SENSOR 2.

1) Disconnect connector from vehicle speed sensor 2.
2) Measure resistance of harness connector between vehicle speed sensor 2 and combination meter.

Connector & terminal
(B17) No. 1 — (i12) No. 11:

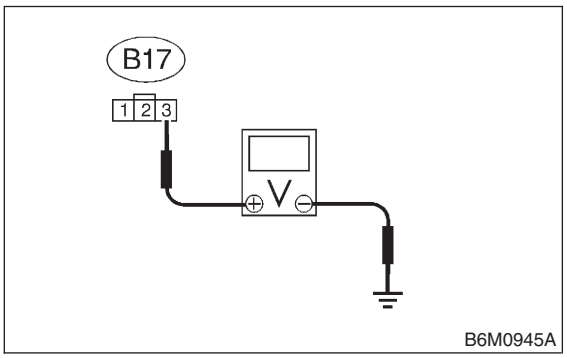


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **2A5**.
NO : Repair wiring harness.

2A5 : CHECK HARNESS CONNECTOR BETWEEN BATTERY AND VEHICLE SPEED SENSOR 2.

1) Turn ignition switch to ON.
2) Measure voltage between vehicle speed sensor 2 connector (B17) and chassis ground.

Connector & terminal
(B17) No. 3 (+) — Chassis ground (–):

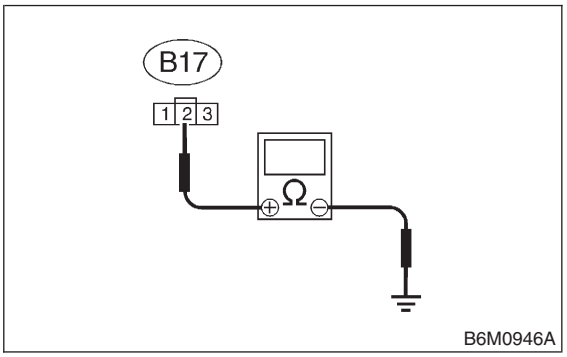


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **2A6**.
NO : Repair harness connector between battery and vehicle speed sensor 2.

2A6 : CHECK HARNESS CONNECTOR BETWEEN VEHICLE SPEED SENSOR 2 AND ENGINE GROUND.

1) Turn ignition switch to OFF.
2) Measure resistance between vehicle speed sensor 2 connector (B17) and engine ground.

Connector & terminal
(B17) No. 2 (+) — Engine ground (–):



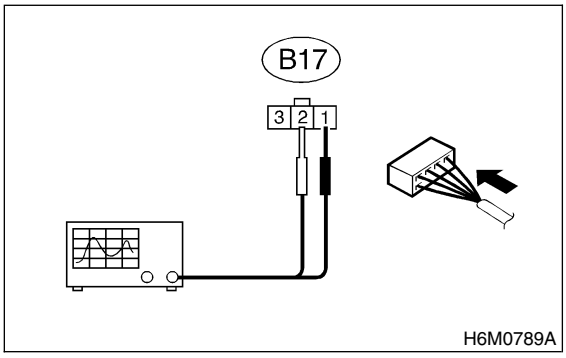
CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **2A7**.
NO : Repair harness connector between vehicle speed sensor 2 and engine ground.

2A7 : CHECK VEHICLE SPEED SENSOR 2.

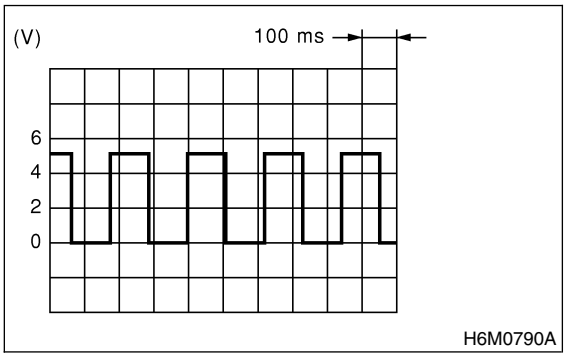
1) Connect connector to vehicle speed sensor 2.
2) Set the vehicle on free roller, or lift-up the vehicle and support with safety stands.

WARNING:
Be careful not to be caught up by the running wheels.

3) Set oscilloscope to vehicle speed sensor 2 connector terminals.
Positive probe; (B17) No. 1
Earth lead; (B17) No. 2



4) Drive the vehicle at speed greater than 20 km/h (12 MPH).
5) Measure signal voltage indicated on oscilloscope.



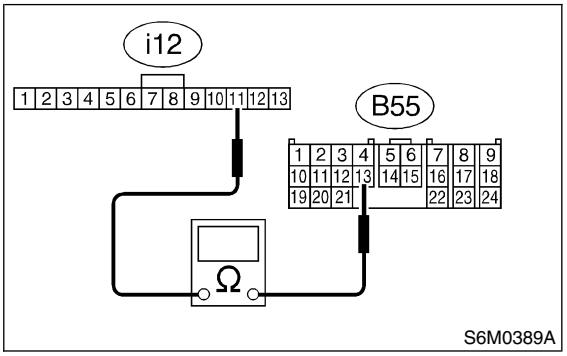
CHECK : ***Is the voltage more than 5 V?***
YES : Repair or replace speedometer.
NO : Replace vehicle speed sensor 2.

2A8 : CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND AUTOMATIC TRANSMISSION CONTROL MODULE.

1) Disconnect connector from automatic transmission control module.
2) Measure resistance between combination meter connector (i12) and automatic transmission control module connector (B55).

CAUTION:
To measure the voltage and/or resistance, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in).

Connector & terminal
(i12) No. 11 — (B55) No. 13:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **2A9**.
NO : Repair harness connector between combination meter and automatic transmission control module.

2A9 : CHECK AUTOMATIC TRANSMISSION CONTROL MODULE.

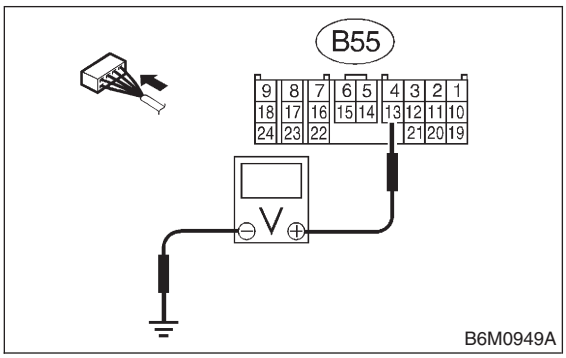
1) Connect connector to automatic transmission control module.
2) Set the vehicle on free roller, or lift-up the vehicle and support with safety stands.

WARNING:
Be careful not to be caught by the running wheels.

3) Drive the vehicle faster than 10 km/h (6 MPH).
4) Measure voltage between automatic transmission control module connector (B55) and chassis ground.

CAUTION:
To measure the voltage and/or resistance, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in).

Connector & terminal
(B55) No. 13 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V ←→ more than 4 V?***
YES : Repair or replace speedometer.
NO : Replace automatic transmission control module. <Ref. to 3-2 [W2300].>

MEMO:

BODY ELECTRICAL SYSTEM [CRUISE CONTROL] 6-2

Page

T **DIAGNOSTICS** 2
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2. Pre-inspection 2
3. Electrical Components Location 7
4. Schematic 8
5. Control Module I/O Signal 10
6. Diagnostics Chart for On-board Diagnosis System 12
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1. Precaution

A: SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the cruise control module and cruise control command switch.

CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
• Be careful not to damage Airbag system wiring harness when servicing the cruise control module and cruise control command switch.

2. Pre-inspection

A: FUNCTION TESTS

Conduct road tests by selecting a smooth, flat road or use free rollers for road test simulation.

1. CRUISE CONTROL MAIN SWITCH

1) Turn ignition switch to ON.
2) Check that cruise control main switch indicator light comes on when main switch is pressed (ON).
3) Check that main switch indicator light goes out when main switch is pressed again (OFF).
4) Turn ignition switch to OFF with main switch ON (indicated by illumination). Turn ignition switch ON again to ensure that main switch indicator light remains OFF.

2. CRUISE CONTROL COMMAND SWITCH

1) Check that cruise control command switch is properly set in "SET/COAST", "RESUME/ACCEL", or "CANCEL" mode.
2) Also check that command switch returns to the original position when released.

3. CONSTANT SPEED TEST

1) Turn cruise control main switch to ON.
2) Drive the vehicle at a speed greater than 40 km/h (25 MPH).
3) Press command switch to set in "SET/COAST" mode.
4) Ensure that vehicle is maintained at the speed set when command switch was pressed.

4. ACCELERATION TEST

1) Set vehicle speed at a speed greater that 40 km/h (25 MPH).
2) Ensure that vehicle continues to accelerate while holding command switch in "RESUME/ ACCEL" mode, and that vehicle maintains that optional speed when command switch is released.

5. DECELERATION TEST

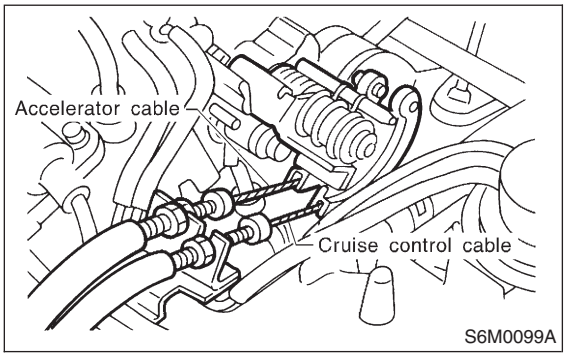
1) Set vehicle speed at an optional speed greater than 40 km/h (25 MPH).
2) Ensure that vehicle continues to decelerate while holding command switch in "SET/COAST" mode, and that it maintains that optional speed when command switch is released.

NOTE:
When vehicle speed reaches the lower speed limit of 30 km/h (19 MPH) during deceleration, cruise control will be released.

B: CRUISE CONTROL CABLE

2B1 : CHECK CRUISE CONTROL CABLE.

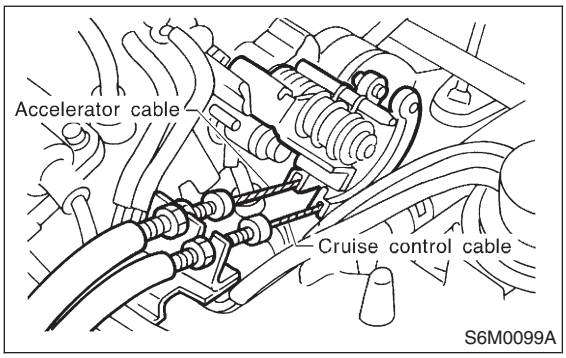
Check cruise control cable installation.



CHECK : ***Is the cruise control cable securely installed to the left of the accelerator cable?***
YES : Go to step **2B2**.
NO : Install cruise control cable securely. Go to step **2B2**.

2B2 : CHECK ACCELERATOR CABLE.

Check function of accelerator cable.



CHECK : ***Does the accelerator cable throttle cam move when the cruise control throttle is moved by hand?***
YES : Repair accelerator cable throttle cam. Go to step **2B3**.
NO : Go to step **2B3**.

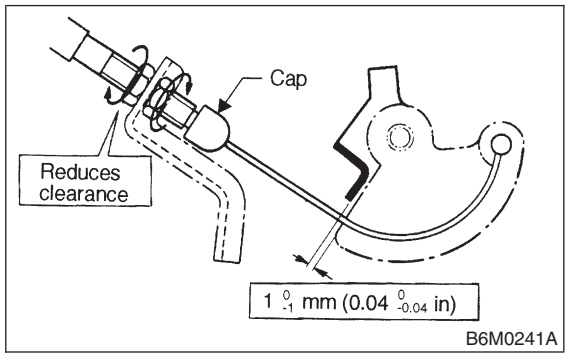
2B3 : CHECK THROTTLE CAM.

Check function of throttle cam.

CHECK : ***Does the throttle cam move smoothly?***
YES : Go to step **2B4**.
NO : Repair throttle cam. Go to step **2B4**.

2B4 : CHECK CABLE FREE PLAY.

Ensure that throttle cam-to-lever clearance is within specifications.



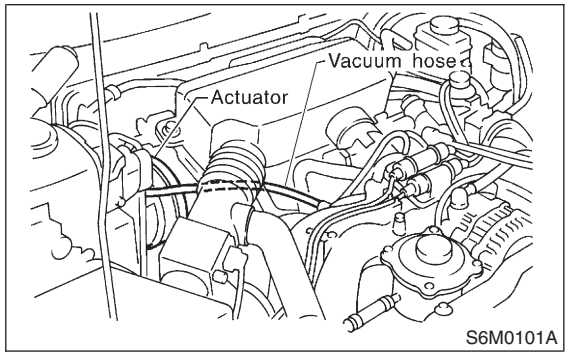
CHECK : ***Is throttle cam-to-lever clearance between 0 and 1 mm (0 and 0.04 in)?***
YES : Go to step **2C1**.
NO : Adjust cable end by adjusting nuts. Go to step **2C1**.

NOTE:
Ensure that cap is positioned in groove.

C: VACUUM HOSE

2C1 : CHECK VACUUM HOSE VISUALLY.

Check vacuum hose (which connects actuator and intake manifold).

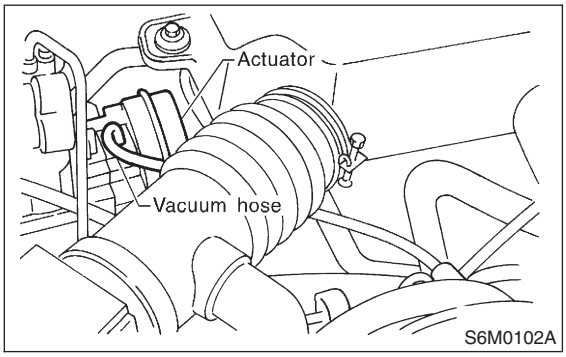


CHECK : ***Is there disconnection or cracks in vacuum hose?***
YES : Replace vacuum hose. Go to step **2D1**.
NO : Go to step **2D1**.

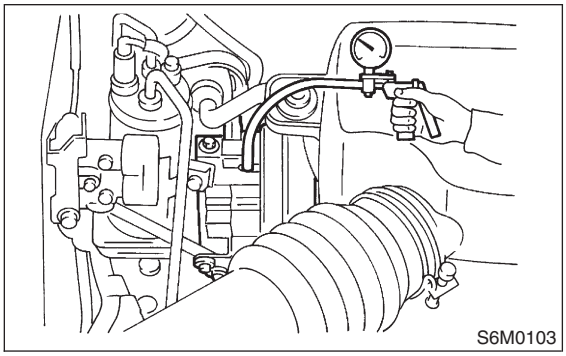
D: ACTUATOR

2D1 : CHECK FUNCTION OF ACTUATOR.

1) Disconnect vacuum hose from actuator.



2) Connect vacuum pump as shown in figure.



3) Make sure that cruise control cable moves smoothly and quickly when a vacuum pressure of 40.0 kPa (300 mmHg, 11.81 inHg) is applied to actuator.

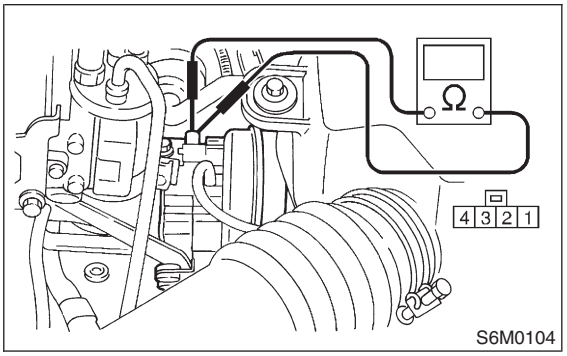
CHECK : ***Does cruise control cable have a stroke of 35 mm (1.38 in)?***
YES : Go to step **2D2**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2D2**.

NOTE:
- When vacuum pressure is released from condition 3) above, make sure the cable returns to its original position smoothly and quickly.
- After inspection, disconnect vacuum pump and connect vacuum hose.

2D2 : MEASURE RESISTANCE OF VALVE.

1) Disconnect connector from actuator.
2) Measure resistance between terminals of actuator.

Terminals
No. 2 — No. 3:

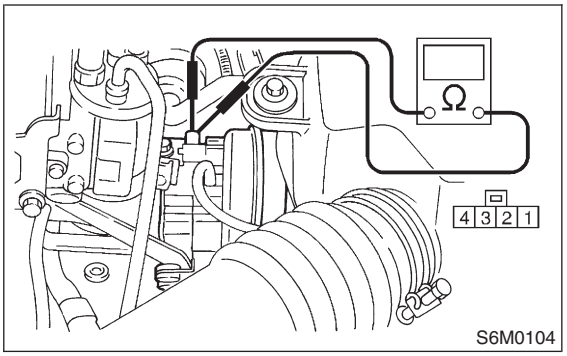


CHECK : ***Is resistance less than 100 Ω?***
YES : Go to step **2D3**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

2D3 : MEASURE RESISTANCE OF VALVE.

Measure resistance between terminals of actuator.

Terminals
No. 2 — No. 1:

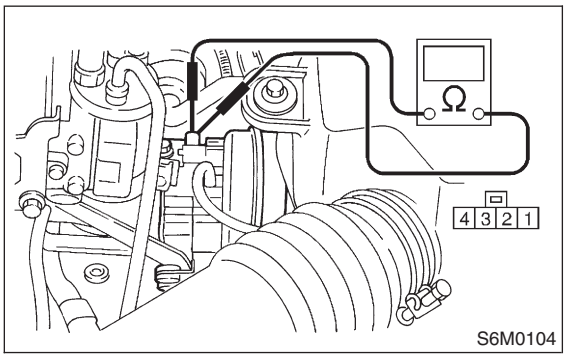


CHECK : ***Is resistance less than 69 Ω?***
YES : Go to step **2D4**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

2D4 : MEASURE RESISTANCE OF VALVE.

Measure resistance between terminals of actuator.

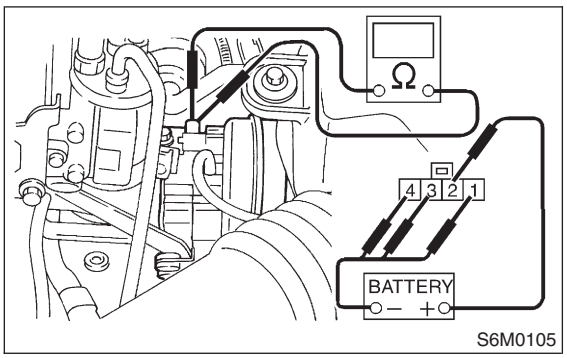
Terminals
No. 2 — No. 4:



CHECK : ***Is resistance less than 69 Ω?***
YES : Go to step **2D5**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

2D5 : CHECK FOR LEAKAGE AND STICKING OF VALVES.

1) Disconnect connector from actuator.
2) Make sure that cruise control cable moves smoothly when connecting + (positive) battery cable to terminal No. 2 and – (negative) battery cable to terminals No. 1, 3 and 4 of actuator connector.



CHECK : ***Does cruise control cable have a stroke of 35 mm (1.38 in) within 3 seconds?***
YES : Go to step **2D6**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2D6**.

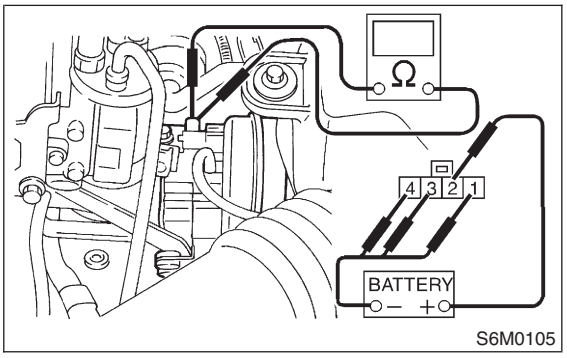
2D6 : CHECK FOR LEAKAGE AND STICKING OF VALVES.

When the battery cable is disconnected from former condition <Ref. to 6-2 [T2D5].> Step 2), make sure the cable returns to its original position smoothly.

CHECK : ***Does cruise control cable get back to its original position within 1.5 seconds?***
YES : Go to step **2D7**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2D7**.

2D7 : CHECK CABLE MOVEMENT.

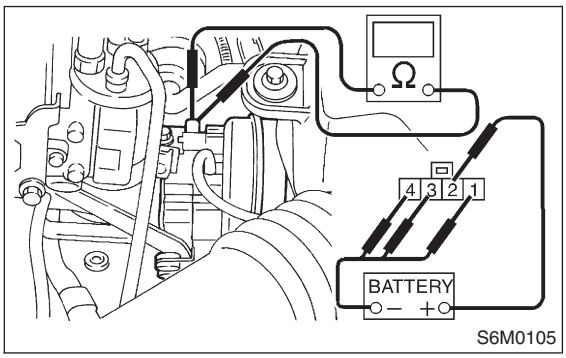
Connect + (positive) battery cable to terminal No. 2 and – (negative) battery cable to terminals No. 1, 3 and 4 of actuator connector.



CHECK : ***Does cruise control perform pull operation?***
YES : Go to step **2D8**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2D8**.

2D8 : CHECK CABLE MOVEMENT.

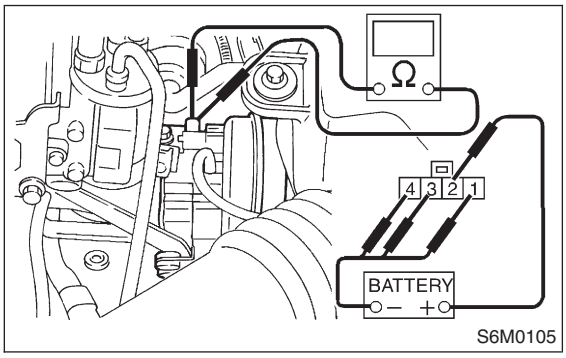
Connect + (positive) battery cable to terminal No. 2 and – (negative) battery cable to terminals No. 1 and 4 of actuator connector.



CHECK : ***Does cruise control perform hold operation?***
YES : Go to step **2D9**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2D9**.

2D9 : CHECK CABLE MOVEMENT.

Connect + (positive) battery cable to terminal No. 2 and – (negative) battery cable to terminal No. 4 of actuator connector.



CHECK : ***Does cruise control perform release operation?***
YES : Go to step **2E1**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].> Go to step **2E1**.

E: POWER SUPPLY

2E1 : CHECK BATTERY.

Measure battery specific gravity of electrolyte.

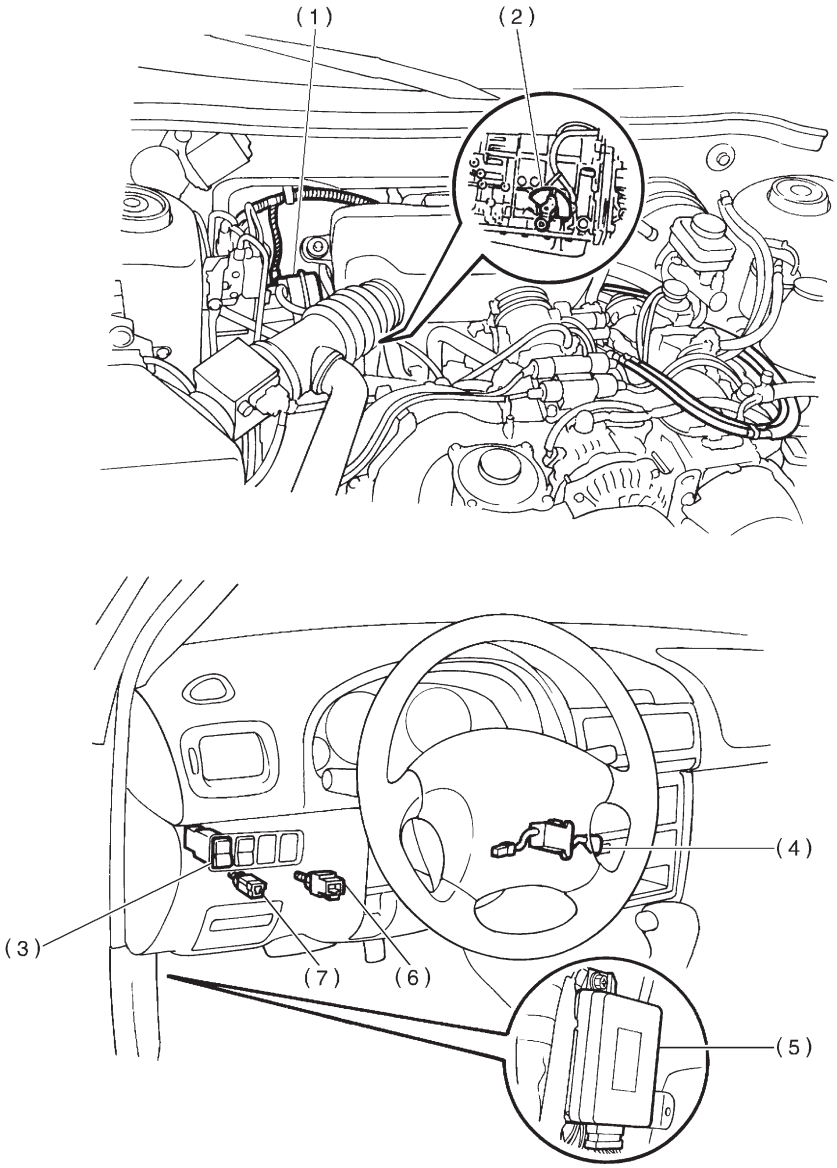
CHECK : ***Is battery specific gravity more than 1.250?***
YES : Go to step **2E2**.
NO : Charge or replace battery. <Ref. to 6-2 [W2A0].> Go to step **2E2**.

2E2 : CHECK FUSES, CONNECTORS AND HARNESSES.

Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

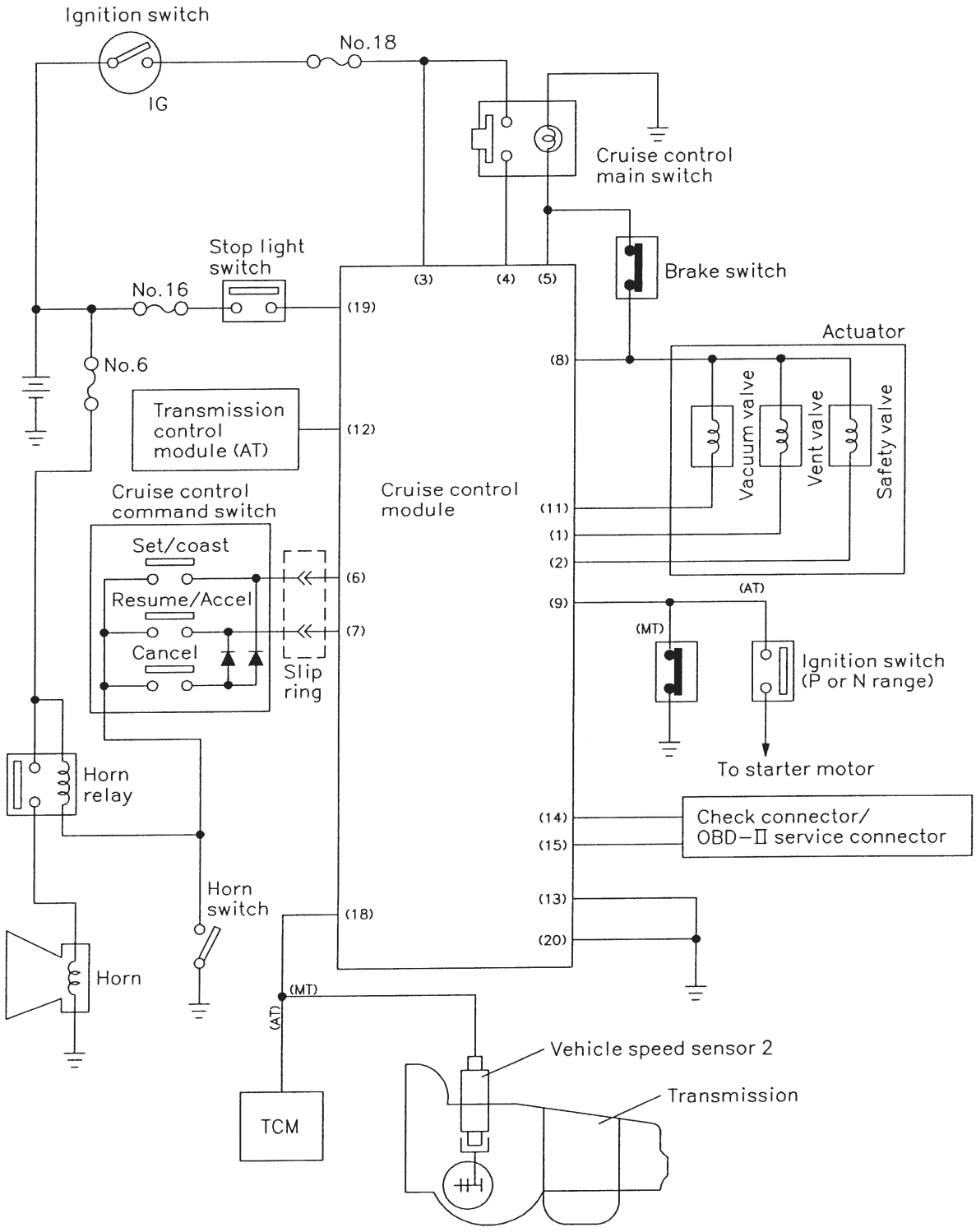
CHECK : ***Is there anything unusual about the appearance of main fuse, fuse, harness, connector and grounding?***
YES : Repair or replace faulty parts. End of pre-inspection.
NO : End of pre-inspection.

3. Electrical Components Location



(1) Actuator (with valves)
(2) Inhibitor switch (AT)
(3) Cruise control main switch
(4) Cruise control command switch
(5) Cruise control module
(6) Stop and brake switch
(7) Clutch switch (MT)

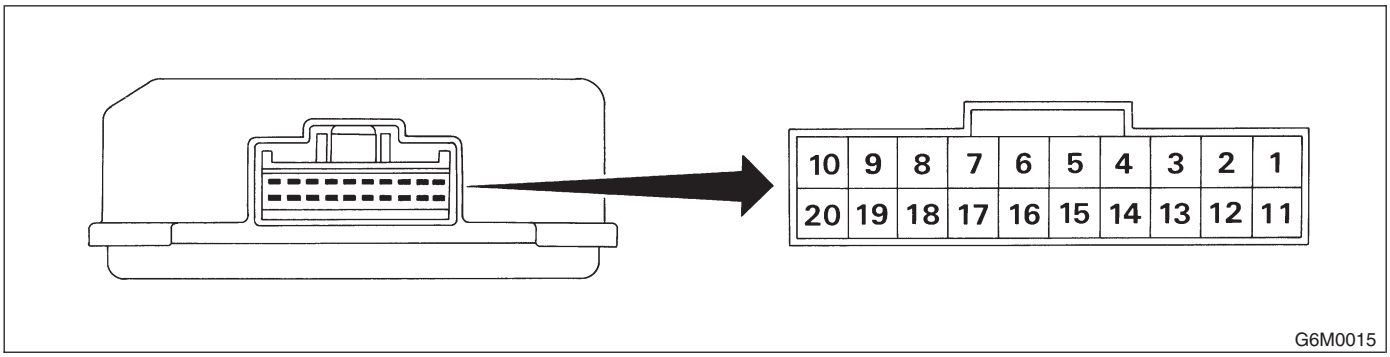
4. Schematic



S6M0325

MEMO:

5. Control Module I/O Signal



Content	Terminal No.	Measuring conditions and I/O signals (ignition switch ON and engine idling)
Vent valve	1	• Power supply is ON when vehicle is stopped. • ON-and-OFF (“0”-and-battery voltage) operation is alternately repeated while cruise control is operating.
Safety valve	2	• Power supply is ON when vehicle is stopped. • ON-and-OFF (“0”-and-battery voltage) operation is alternately repeated while cruise control is operating.
Ignition switch	3	• Battery voltage is present when ignition switch is turned ON. • “0” volt is present when ignition switch is turned OFF.
Cruise control main switch	4	• Battery voltage is present when main power is turned ON. • “0” volt is present when main power is turned OFF.
Power supply to vacuum valve, vent valve, safety valve and indicator light	5	• Battery voltage is present when main power is turned ON. • “0” volt is present when main power is turned OFF.
SET/COAST switch	6	• Battery voltage is present when command switch is turned to SET/COAST position. • “0” volt is present when command switch is released.
RESUME/ACCEL switch	7	• Battery voltage is present when command switch is turned to RESUME/ ACCEL position. • “0” volt is present when command switch is released.
Brake switch	8	Set selector lever to any position other than “P” or “N” position (AT) / leave clutch pedal released (MT), while cruise control main switch is turned ON. Then check that; • Battery voltage is present when brake pedal is released. • “0” volt is present when brake pedal is depressed, or • Battery voltage is present when clutch pedal is released (MT). • “0” volt is present when clutch pedal is depressed (MT). • Battery voltage is present when selector lever is in any position other than “P” or “N” position (AT). • “0” volt is present when selector lever is set to “P” or “N” position (AT).
Clutch switch (MT)/ Inhibitor switch (AT)	9	• Battery voltage is present when clutch pedal is released (MT). • “0” volt is present when clutch pedal is depressed (MT). • Battery voltage is present when selector lever is in any position other than “P” or “N” position (AT). • “0” volt is present when selector lever is set to “P” or “N” position (AT).
Vacuum valve	11	• Power supply is ON when vehicle is stopped. • ON-and-OFF (“0”-and-battery voltage) operation is alternately repeated while cruise control is operating.
Set signal to transmission control module (AT)	12	• TCM emits a ground-level signal while driving vehicle at least 40 km/h (25 MPH) with SET switch ON.
Ground	13	—
Check connector/ OBD-II service connector	14	—
Check connector/ OBD-II service connector	15	—

Content	Terminal No.	Measuring conditions and I/O signals (ignition switch ON and engine idling)
Vehicle speed sensor 2 (MT) Automatic transmission control module (AT)	18	Lift-up the vehicle until all four wheels are raised off ground, and then rotate any wheel manually. Approx. 5 and 0 volt pulse signals are alternately input to cruise control module.
Stop light switch	19	Turn ignition switch to OFF. Then check that; ● Battery voltage is present when brake pedal is depressed. ● “0” volt is present when brake pedal is released.
Ground	20	—
NOTE: Voltage at terminals 1, 2, 11 and 12 cannot be checked unless vehicle is driving by cruise control operation.		

6. Diagnostics Chart for On-board Diagnosis System

A: BASIC DIAGNOSTIC PROCEDURE

6A1 : CHECK CRUISE CONTROL MAIN SWITCH.

1) Trouble occurs.
2) Perform pre-inspection. <Ref. to 6-2 [T200].>
3) Check cruise control main switch.

CHECK : ***Does cruise control main switch turn ON?***
YES : Go to step **6A2**.
NO : Go to "Diagnostics Chart for Power Line". <Ref. to 6-2 [T700].>

6A2 : CHECK CRUISE SPEED IS SET.

CHECK : ***Does cruise speed properly set while driving at minimum of 40 km/h (25 MPH)?***
YES : Go to step **6A3**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A3 : CHECK CRUISE CONTROL IS RELEASED.

CHECK : ***Does cruise control properly release during operation?***
YES : Go to step **6A4**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A4 : CHECK CRUISE SPEED IS HELD WITHIN SET SPEED.

CHECK : ***Does cruise speed hold within set speed ±3 km/h (2 MPH)?***
YES : Go to step **6A5**.
NO : Go to pre-inspection of actuator. <Ref. to 6-2 [T2D0].>

6A5 : CHECK RESUME/ACCEL SWITCH.

CHECK : ***Does RESUME/ACCEL switch function properly?***
YES : Go to step **6A6**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A6 : CHECK SET/COAST SWITCH.

CHECK : ***Does SET/COAST switch function properly?***
YES : Go to step **6A7**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A7 : CHECK CANCEL SWITCH.

CHECK : ***Does CANCEL switch function properly?***
YES : Go to step **6A8**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A8 : CHECK CRUISE SPEED IS RELEASED.

CHECK : ***Does cruise speed release when brake pedal is depressed?***
YES : Go to step **6A9**.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

6A9 : CHECK CRUISE SPEED IS RELEASED.

CHECK : ***Does cruise speed release when clutch pedal is depressed?***
YES : Cruise control system is in correct order.
NO : Go to "Diagnostics Chart with Trouble Code". <Ref. to 6-2 [T800].>

B: ON-BOARD DIAGNOSIS WITH SELECT MONITOR

1. GENERAL

The on-board diagnosis function of the cruise control system uses an external select monitor.
The on-board diagnosis function operates in two categories, which are used depending on the type of problems;

NOTE:
Select monitor cartridge:
No. 24082AA130

1) Cruise cancel conditions diagnosis
(1) This category of diagnosis requires actual vehicle driving in order to determine the cause, (as when cruise speed is cancelled during driving although cruise cancel condition is not entered).
(2) Cruise control module memory stores the cancel condition (Code No.) which occurred during driving. When there are plural cancel conditions (Code No.), they are shown on the select monitor.

CAUTION:
● The cruise control memory stores not only the cruise "cancel" which occurred (although "cancel" operation is not entered by the driver), but also the "cancel" condition input by the driver.
● The content of memory is cleared when ignition switch or cruise main switch is turned OFF.

2) Real-time diagnosis
The real-time diagnosis function is used to determine whether or not the input signal system is in good order, according to signal emitted from switches, sensors, etc.
(1) Vehicle cannot be driven at cruise speed because problems occurs in the cruise control system or its associated circuits.
(2) Monitor the signal conditions from switches and sensors.

2. CRUISE CANCEL CONDITIONS DIAGNOSIS

1) Connect select monitor.
2) Start the engine and turn cruise control main switch to ON.
3) Set select monitor in "All System Diagnosis" mode.

NOTE:
The diagnostic code is also shown in the "Each System Check" mode. This mode is called up on the "Cruise Control Diagnosis" screen by selecting the item "Cancel Code(s) Display".

4) Drive vehicle at least 40 km/h (25 MPH) with cruise speed set.
5) If cruise speed is canceled itself (without doing any cancel operations), a diagnostic code will appear on select monitor display.

CAUTION:
● A diagnostic code will also appear when cruise cancel is effected by driver. Do not confuse.
● Have a co-worker ride in vehicle to assist in diagnosis during driving.

NOTE:
Diagnostic code will be cleared by turning ignition switch or cruise control main switch to OFF.

3. REAL-TIME DIAGNOSIS

1) Connect select monitor.
2) Turn ignition switch and cruise control main switch to ON.
3) Select the "Current Data Display & Save" mode on the select monitor "Cruise Control Diagnosis" screen.
4) Ensure that normal indication is displayed when controls are operated as indicated below:
● Depress/release the brake pedal. (Stop light switch and brake switch turn ON.)
● Turn ON the "SET/COAST" switch.
● Turn ON the "RESUME/ACCEL" switch.
● Depress/release the clutch pedal. (MT)
● Set the selector lever to P or N. (AT)

7. Diagnostics Chart for Power Line

A: BASIC DIAGNOSTICS PROCEDURE

7A1 : DRIVE AT CRUISE SPEED.

CHECK : ***Can cruise speed be set?***

YES : Go to “CHECK INDICATOR AND CIRCUIT IN CRUISE CONTROL MAIN SWITCH”. <Ref. to 6-2 [T7B0].>

NO : Go to “CHECK CRUISE CONTROL MAIN SWITCH”. <Ref. to 6-2 [T7C0].>

B: CHECK INDICATOR AND CIRCUIT IN CRUISE CONTROL MAIN SWITCH

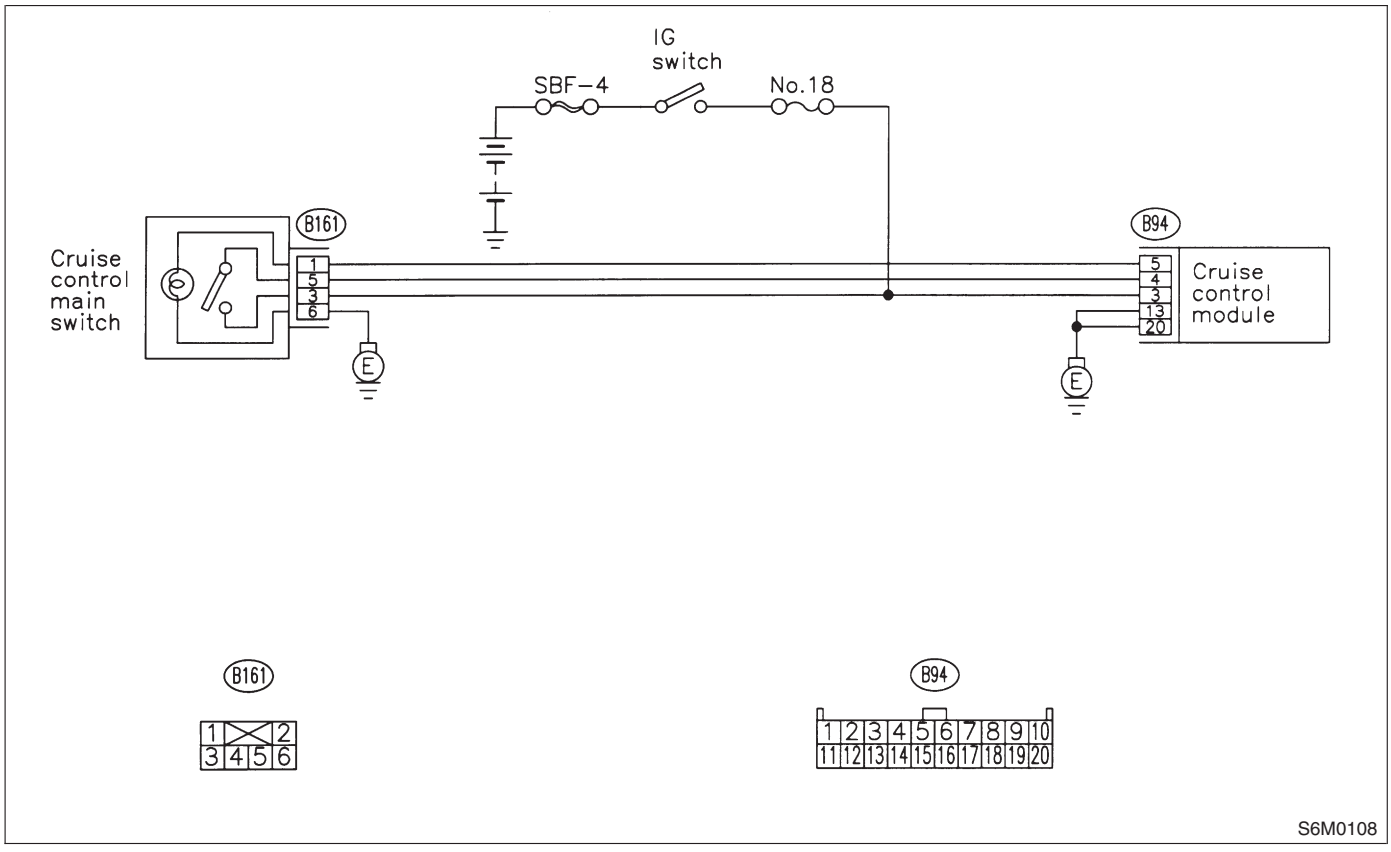
DIAGNOSIS:

- Bulb failure or open harness of the indicator circuit in the cruise control main switch.

TROUBLE SYMPTOM:

- Cruise control can be set, normally indicator does not come on. (When main switch is pressed.)

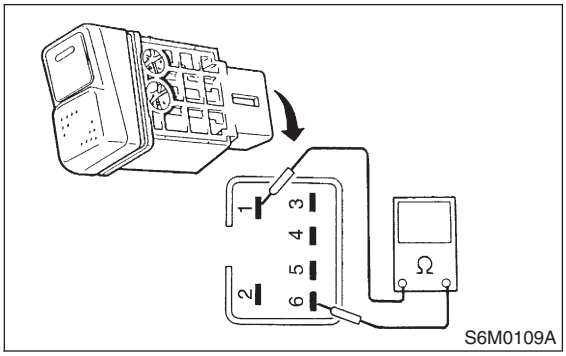
WIRING DIAGRAM:



7B1 : CHECK CRUISE CONTROL MAIN SWITCH.

1) Remove cruise control main switch.
2) Measure resistance between cruise control main switch terminals.

Terminals
No. 1 — No. 6:

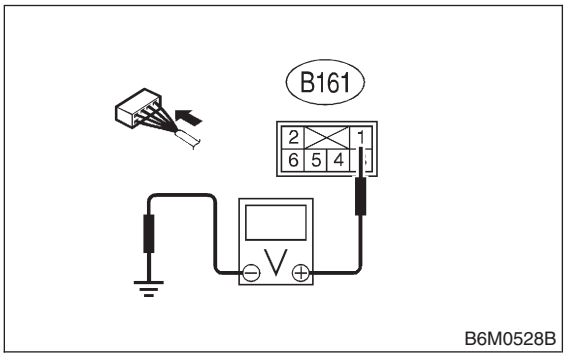


CHECK : ***Is resistance between 10 and 80 Ω?***
YES : Go to step **7B2**.
NO : Replace switch illumination bulb. <Ref. to 6-2 [W11B2].>

7B2 : CHECK CIRCUIT BETWEEN CRUISE CONTROL MODULE AND CRUISE CONTROL MAIN SWITCH INDICATOR LIGHT.

1) Turn the ignition switch to ON.
2) Turn cruise control main switch to ON.
3) Measure voltage between cruise control main switch connector and the chassis ground.

Connector & terminal
(B161) No. 1 (+) — Chassis ground (–):

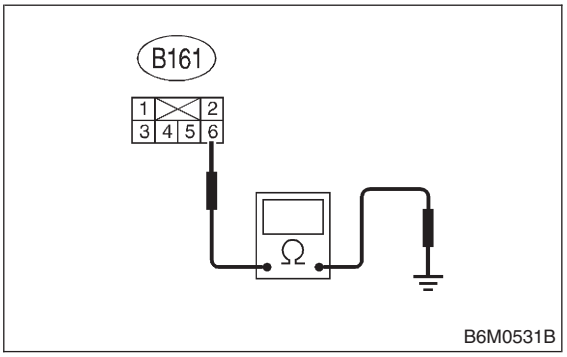


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7B3**.
NO : Repair or replace wiring harness.

7B3 : CHECK CIRCUIT BETWEEN CRUISE CONTROL MODULE AND CRUISE CONTROL MAIN SWITCH INDICATOR LIGHT.

1) Turn the ignition switch and cruise control main switch to OFF.
2) Remove the connector from the cruise control main switch.
3) Measure resistance of ground circuit between the cruise control main switch connector and chassis ground.

Connector & terminal
(B161) No. 6 (+) — Chassis ground (–):



CHECK : ***Is resistance less than 10 Ω?***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Repair or replace wiring harness.

C: CHECK CRUISE CONTROL MAIN SWITCH

DIAGNOSIS:

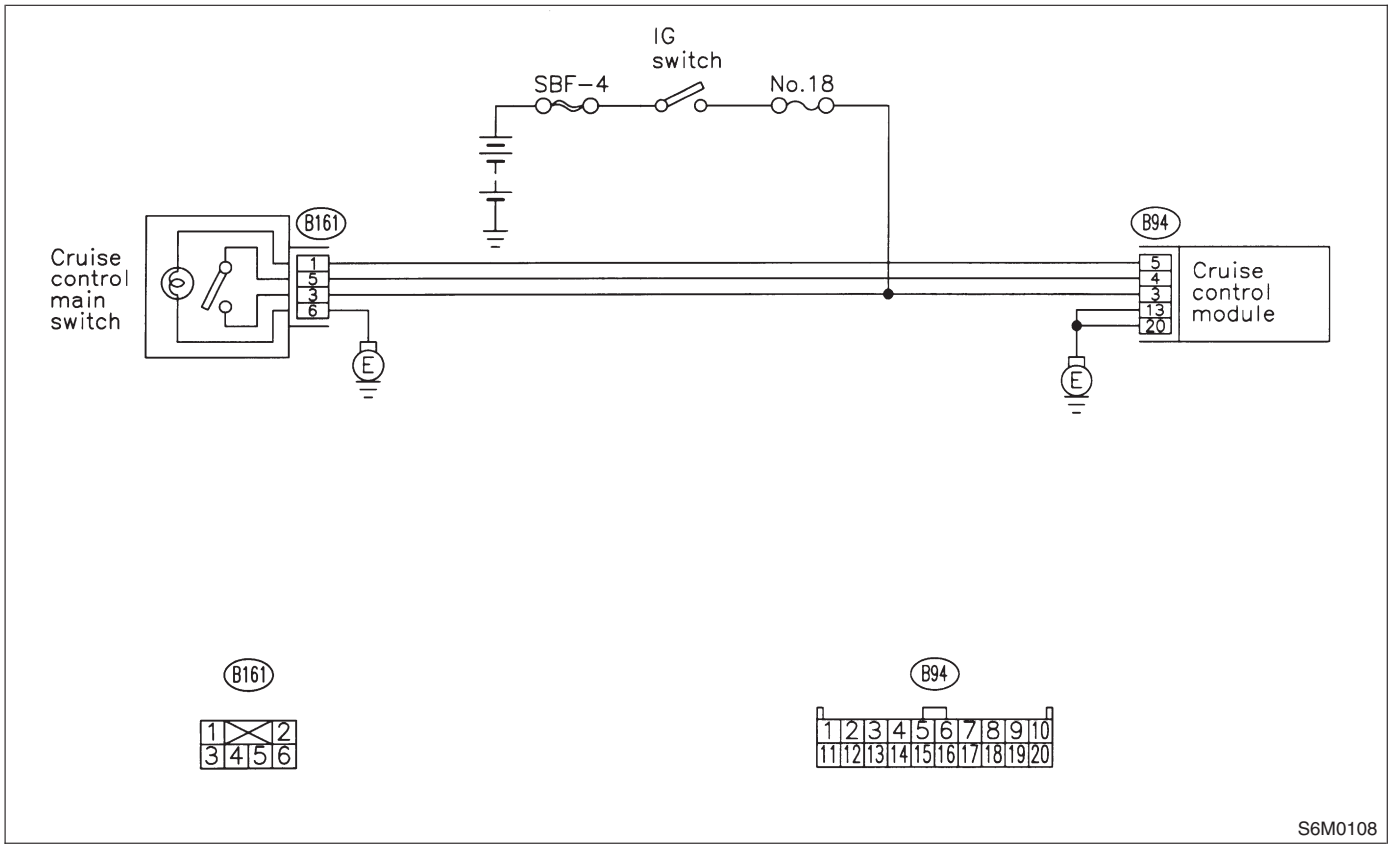
- Faulty cruise control main switch, or open harness.

TROUBLE SYMPTOM:

- Cruise control main switch is not turned ON and cruise control cannot be set.

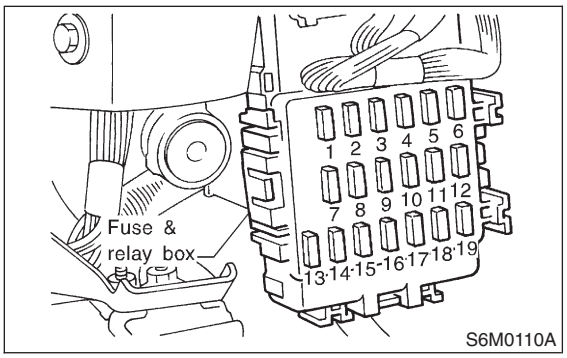
NOTE:
When the main relay (built-in cruise control module) operates, the main switch circuit is in normal condition.
The main relay operation can be checked by hearing the operation sounds.
This operation sounds will be heard when ignition switch and cruise control main switch is turned to ON.

WIRING DIAGRAM:



7C1 : CHECK FUSE.

Check fuse No. 18.



CHECK : ***Is fuse No. 18 blown?***
YES : Replace fuse No. 18. Go to step **7C2**.
NO : Go to step **7C2**.

7C2 : CHECK POWER SUPPLY.

1) Turn ignition switch to ON.
2) Measure voltage between fuse & relay box connector and chassis ground.

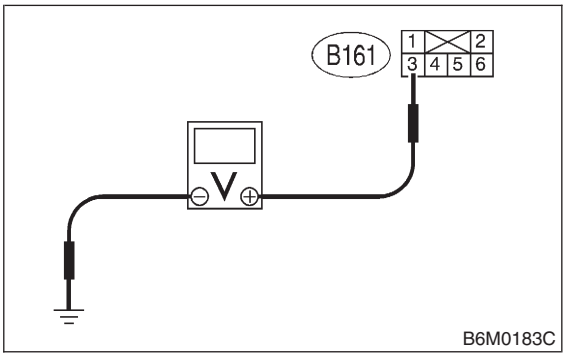
Connector & terminal
(B152) No. 5 (+) — Chassis ground (–):

CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7C3**.
NO : Replace fuse No. 18. When fuse No. 18 is blown again, repair shorted parts of circuit.

7C3 : CHECK CRUISE CONTROL MAIN SWITCH.

1) Turn ignition switch to OFF.
2) Remove cruise control main switch and disconnect connector.
3) Turn ignition switch to ON.
4) Measure voltage between cruise control main switch connector and chassis ground.

Connector & terminal
(B161) No. 3 (+) — Chassis ground (–):

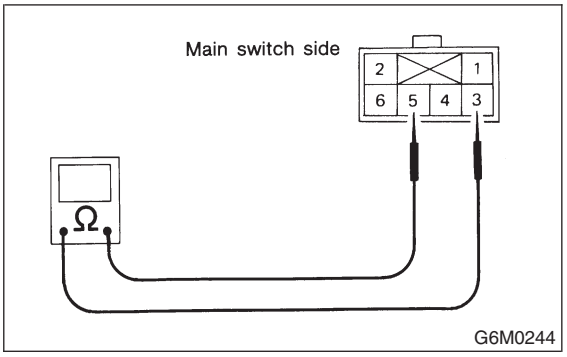


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7C4**.
NO : Replace cruise control main switch. <Ref. to 6-2 [W11B2].>

7C4 : CHECK CRUISE CONTROL MAIN SWITCH.

Measure resistance between cruise control main switch terminals.

Terminals
No. 3 — No. 5:

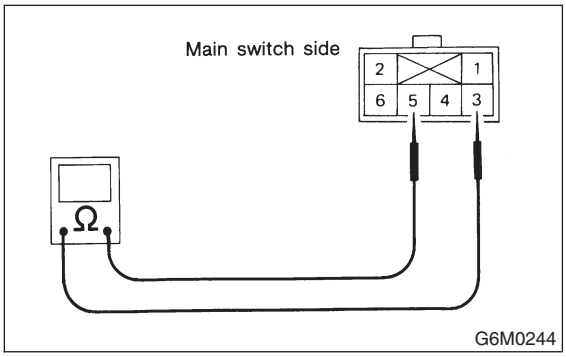


CHECK : ***Is resistance less than 10 Ω? (When switch is ON.)***
YES : Go to step **7C5**.
NO : Replace cruise control main switch. <Ref. to 6-2 [W11B2].>

7C5 : CHECK CRUISE CONTROL MAIN SWITCH.

Measure resistance between cruise control main switch terminals.

Terminals
No. 3 — No. 5:

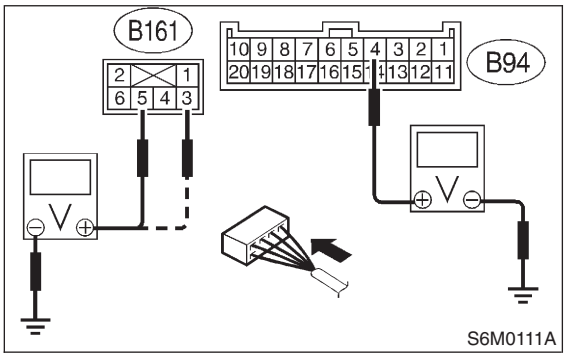


CHECK : ***Is resistance less than 1 MΩ? (When switch is OFF.)***
YES : Go to step **7C6**.
NO : Replace cruise control main switch. <Ref. to 6-2 [W11B2].>

7C6 : CHECK HARNESS BETWEEN CRUISE CONTROL MAIN SWITCH CONNECTOR AND CHASSIS GROUND.

1) Connect connector.
2) Turn ignition switch to ON.
3) Turn cruise control main switch to ON.
4) Measure voltage between terminal of cruise control main switch and chassis ground.

Connector & terminal
(B161) No. 3 (+) — Chassis ground (–):

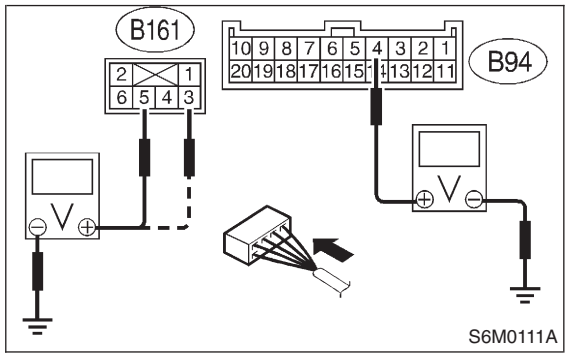


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7C7**.
NO : Repair or replace wiring harness.

7C7 : CHECK HARNESS BETWEEN CRUISE CONTROL MAIN SWITCH CONNECTOR AND CHASSIS GROUND.

Measure voltage between terminal of cruise control main switch chassis ground.

Connector & terminal
(B161) No. 5 (+) — Chassis ground (–):

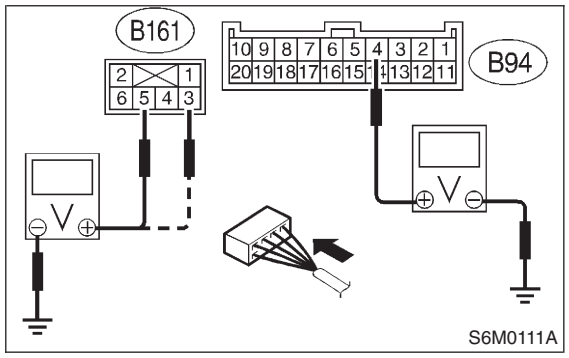


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **7C8**.
NO : Repair or replace wiring harness.

7C8 : CHECK HARNESS BETWEEN CRUISE CONTROL MODULE CONNECTOR AND CHASSIS GROUND.

Measure voltage between terminal of cruise control module and chassis ground.

Connector & terminal
(B94) No. 4 (+) — Chassis ground (–):



CHECK : ***Is voltage more than 10 V?***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Repair or replace wiring harness.

NOTE:
Depress cruise control main switch with fingers while measuring voltage between (B161) No. 5 and chassis ground.

8. Diagnostics Chart with Diagnostic Code

A: DIAGNOSTIC CODE LIST

Diagnostic code	Item	Contents of diagnosis	Index No.
11	BRAKE SW/STOP SW	Input signals from brake switch “OFF”, stop light switch “ON” (Brake pedal is depressed.)	<Ref. to 6-2 [T8B0].>
12	CLUTCH SW/INHIBITOR SW	Input signals from clutch switch “OFF” (MT), or inhibitor switch “P or N” (AT) [Clutch pedal is depressed (MT), or selector lever is set to P or N position (AT).]	<Ref. to 6-2 [T8C0].>
13	LOW SPEED LIMIT	Low-speed control limiter	<Ref. to 6-2 [T8D0].>
14	CANCEL SW	Input signal from cancel switch (faulty SET/COAST switch or RESUME/ACCEL switch)	<Ref. to 6-2 [T8E0].>
21	VACUUM VALVE	Faulty vacuum valve or valve drive system	<Ref. to 6-2 [T8F0].>
22	VENT 2 VALVE	Faulty vent 2 valve or valve drive system	<Ref. to 6-2 [T8F0].>
23	VENT 1 VALVE	Faulty vent 1 valve or valve drive system	<Ref. to 6-2 [T8F0].>
24	SPEED SENSOR	Faulty vehicle speed sensor 2 (MT) or transmission control module (AT)	<Ref. to 6-2 [T8D0].>
25	CONTROL MODULE	Faulty CPU RAM included in cruise control module	<Ref. to 6-2 [T8G0].>

B: DIAGNOSTIC CODE 11 (BRAKE SWITCH, STOP LIGHT SWITCH)

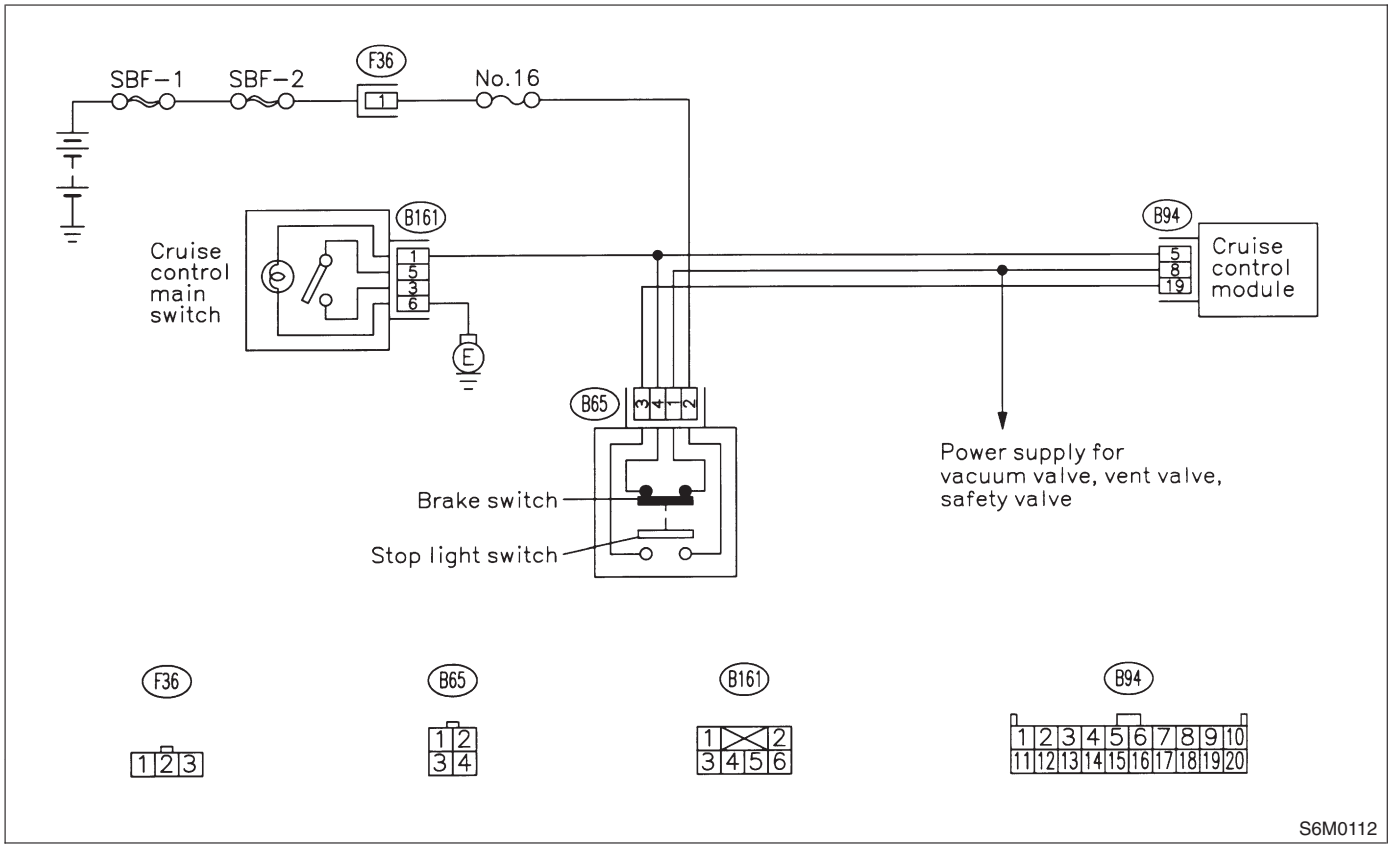
DIAGNOSIS:

- Failure or disconnection of the stop light switch and brake switch.

TROUBLE SYMPTOM:

- Cruise control cannot be set.

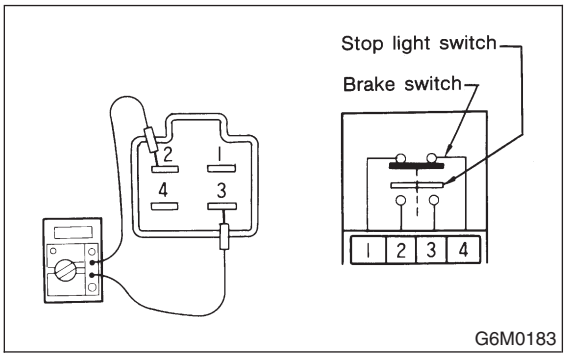
WIRING DIAGRAM:



8B1 : CHECK BRAKE SWITCH.

1) Turn ignition switch to ON.
2) Turn cruise control main switch to ON.
3) Apply parking brake securely.
4) Set select monitor in “Current Data Display & Save” mode.
5) Depress the brake pedal and check signals for proper operation.
   (1) The Stop Lamp Switch shown on the display turns from “OFF” to “ON”.
   (2) The Brake Switch shown on the display turns from “OFF” to “ON”.
6) Release the brake pedal.
7) Remove connector of stop and brake switch.
8) Check circuit between brake switch terminal.

Terminals
No. 1 — No. 4: (Brake switch)

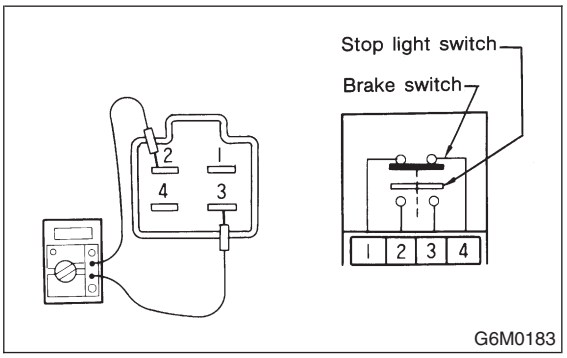


CHECK : ***Is resistance less than 1 Ω? (When brake pedal is released.)***
YES : Go to step **8B2**.
NO : Replace brake and stop light switch. <Ref. to 4-5 [C1A0].>

8B2 : CHECK BRAKE SWITCH.

Check circuit between brake switch terminal.

Terminals
No. 1 — No. 4: (Brake switch)

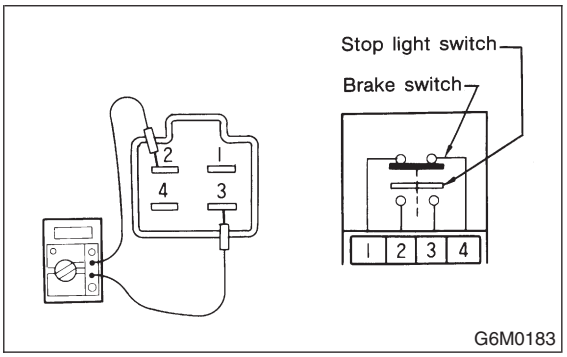


CHECK : ***Is resistance more than 1 MΩ? (When brake pedal is depressed.)***
YES : Go to step **8B3**.
NO : Replace brake and stop light switch. <Ref. to 4-5 [C1A0].>

8B3 : CHECK STOP LIGHT SWITCH.

Check circuit between stop light switch terminal.

Terminals
No. 2 — No. 3: (Stop light switch)



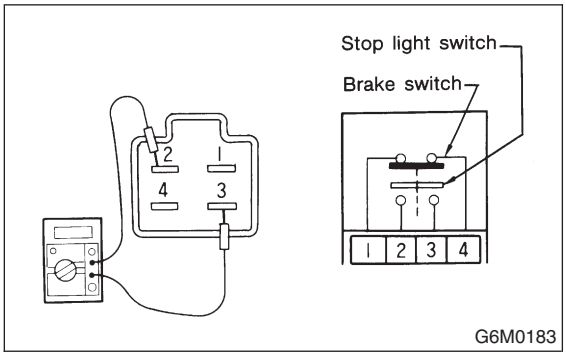
CHECK : ***Is resistance more than 1 MΩ? (When brake pedal is released.)***
YES : Go to step **8B4**.
NO : Replace brake and stop light switch. <Ref. to 4-5 [C1A0].>

8B4 : CHECK STOP LIGHT SWITCH.

Check circuit between stop light switch terminal.

Terminals

No. 2 — No. 3: (Stop light switch)



CHECK : ***Is resistance less than 1 Ω? (When brake pedal is depressed.)***

YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>

NO : Replace brake and stop light switch. <Ref. to 4-5 [C1A0].>

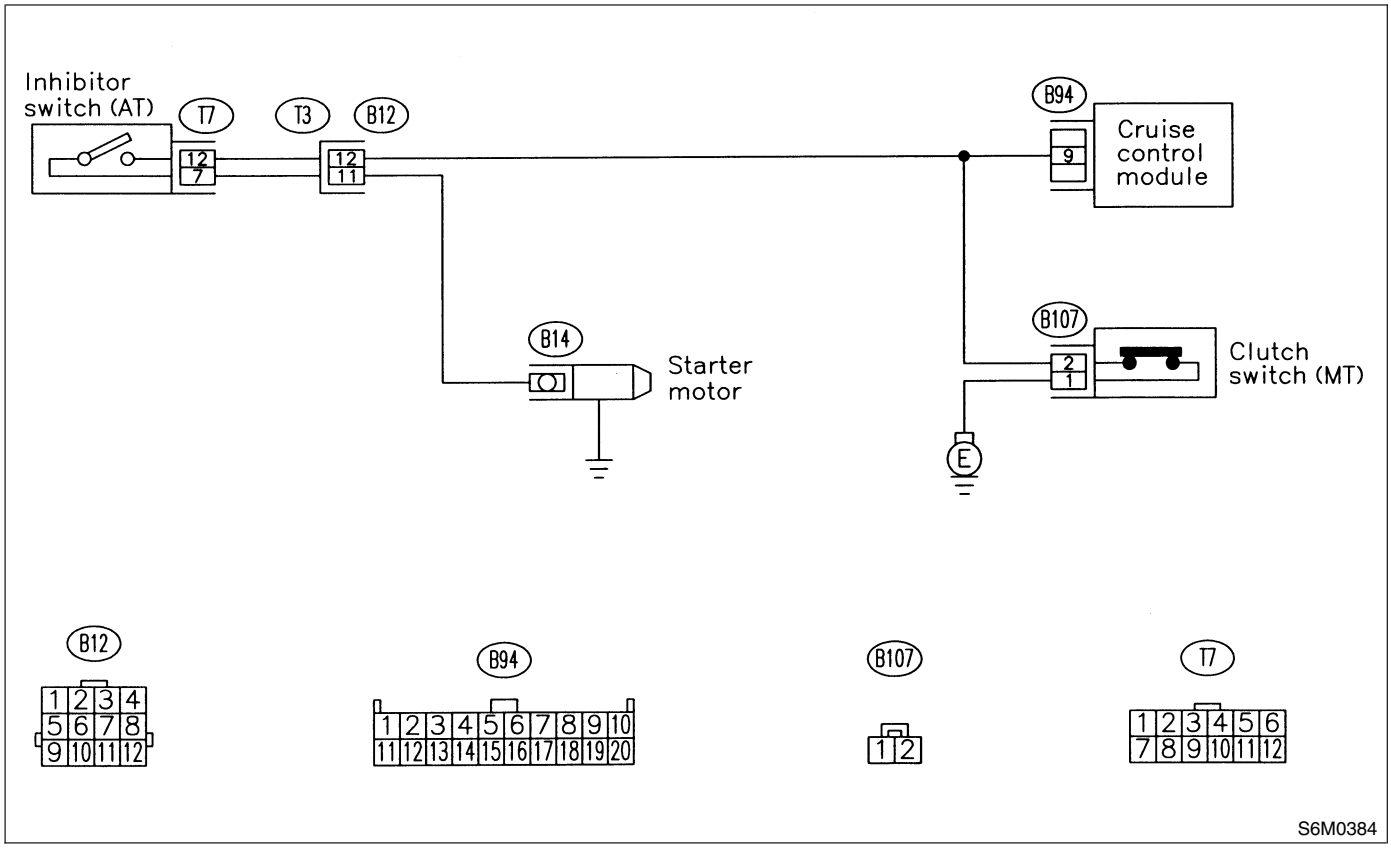
MEMO:

C: DIAGNOSTIC CODE 12 (CLUTCH SWITCH, INHIBITOR SWITCH)

DIAGNOSIS:
- Failure or disconnection of the clutch switch. (MT)
- Failure or disconnection of the inhibitor switch. (AT)

TROUBLE SYMPTOM:
- Cruise control cannot be set.

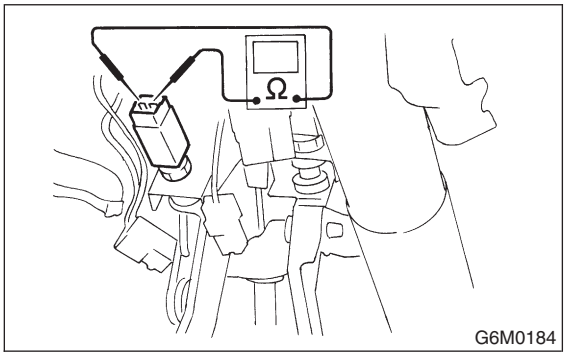
WIRING DIAGRAM:



8C1 : CHECK CLUTCH SWITCH. (MT)

1) Turn ignition switch to ON.
2) Turn cruise control main switch to ON.
3) Apply parking brake securely.
4) Set select monitor in “Current Data Display & Save” mode.
5) Depress the clutch pedal and check signal for proper operation. (MT)
The Clutch/Inhibitor Switch shown on the display turns from “ON” to “OFF”.
6) Disconnect connector of clutch switch.
7) Check continuity of the clutch switch.

Terminals
No. 1 — No. 2:

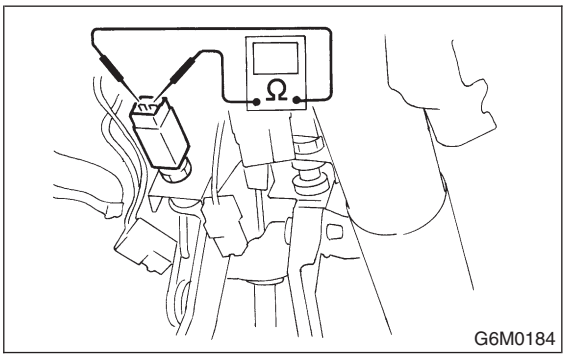


CHECK : ***Is resistance less than 10 Ω? (When clutch pedal is released.)***
YES : Go to step **8C2**.
NO : Replace clutch switch. <Ref. to 4-5 [C1A0].>

8C2 : CHECK CLUTCH SWITCH. (MT)

Check continuity of the clutch switch.

Terminals
No. 1 — No. 2:

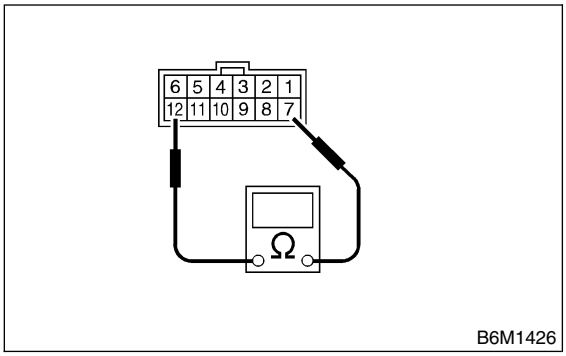


CHECK : ***Is resistance more than 1 MΩ? (When clutch pedal is depressed.)***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Replace clutch switch. <Ref. to 4-5 [C1A0].>

8C3 : CHECK INHIBITOR SWITCH. (AT)

1) Turn ignition switch to ON.
2) Turn cruise control main switch to ON.
3) Apply parking brake securely.
4) Set select monitor in “Current Data Display & Save” mode.
5) Set the selector lever from P or N position to D position and check signal for proper operation. (AT) The Clutch/Inhibitor Switch shown on the display turns from “ON” to “OFF”.
6) Set the selector lever to P or N position.
7) Disconnect connector of inhibitor switch.
8) Check continuity of the inhibitor switch.

Terminals
No. 7 — No. 12:

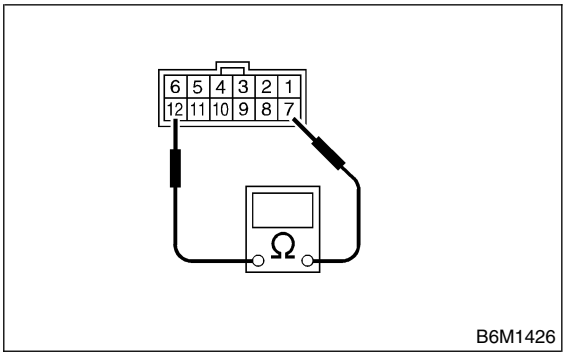


CHECK : ***Is resistance less than 10 Ω? (When selector lever is in P or N.)***
YES : Go to step **8C4**.
NO : Replace inhibitor switch. <Ref. to 3-2 [W2C0].> Repair inhibitor switch wiring harness.

8C4 : CHECK INHIBITOR SWITCH. (AT)

Check continuity of the inhibitor switch.

Terminals
No. 7 — No. 12:



CHECK : ***Is resistance more than 1 MΩ? (When selector lever is not in P or N.)***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Replace inhibitor switch. <Ref. to 3-2 [W2C0].> Repair inhibitor switch wiring harness.

MEMO:

D: DIAGNOSTIC CODE 13 AND 24 (SPEED SENSOR SYSTEM)

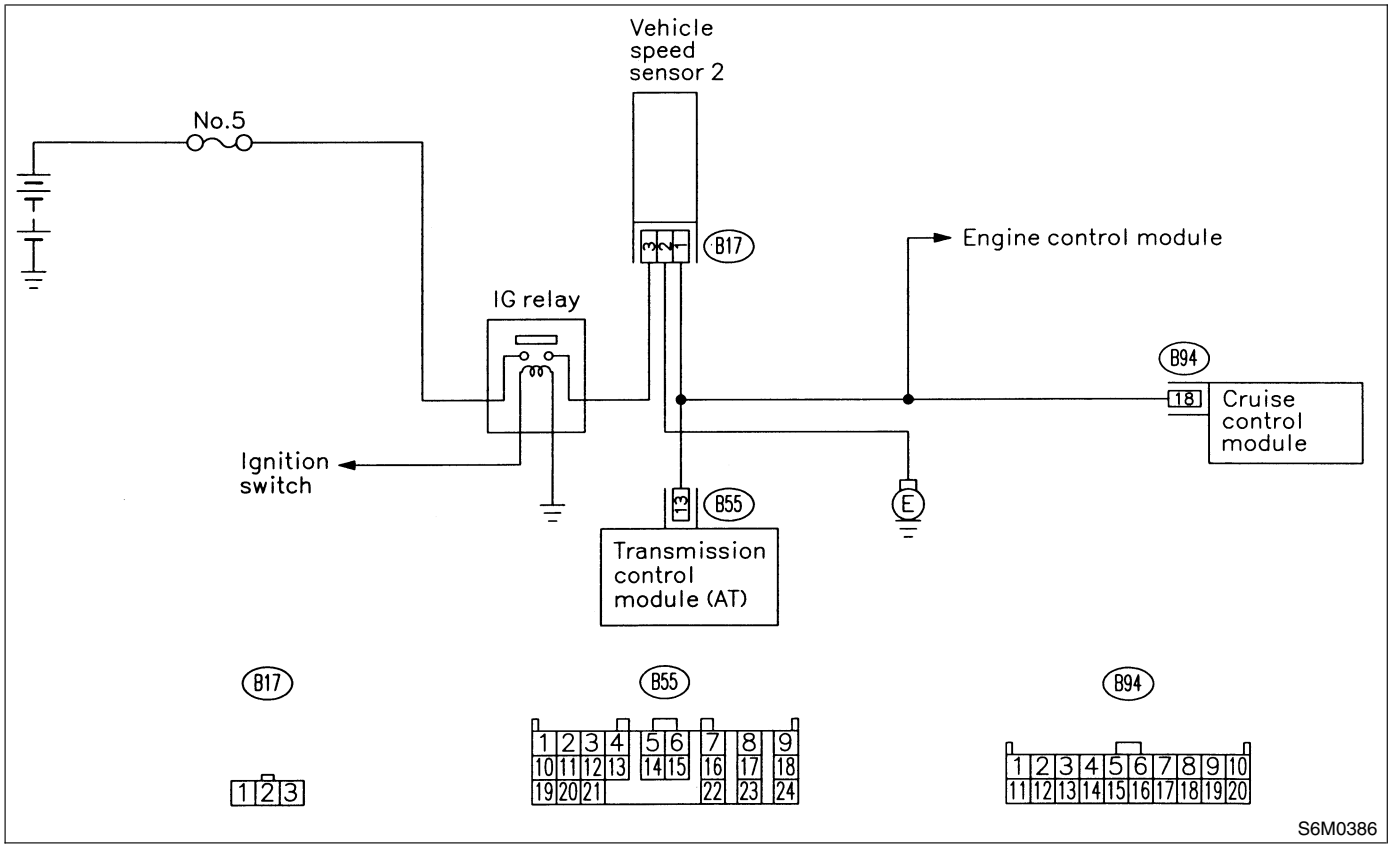
DIAGNOSIS:

● Disconnection or short circuit of vehicle speed sensor 2 (MT model) or transmission control module (AT model).

TROUBLE SYMPTOM:

● Cruise control cannot be set. (Cancelled immediately.)

WIRING DIAGRAM:



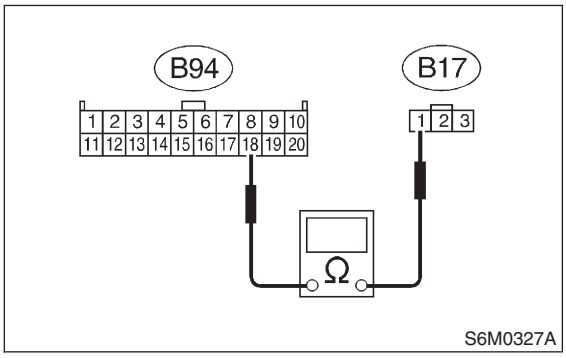
8D1 : CHECK TRANSMISSION TYPE.

CHECK : ***Is the transmission type MT?***
YES : Go to step **8D2**.
NO : Go to step **8D6**.

8D2 : CHECK HARNESS CONNECTOR BETWEEN CRUISE CONTROL MODULE AND VEHICLE SPEED SENSOR 2.

1) Disconnect connector from vehicle speed sensor 2 and cruise control module.
2) Measure resistance of harness connector between vehicle speed sensor 2 and cruise control module.

Connector & terminal
(B17) No. 1 — (B94) No. 18:

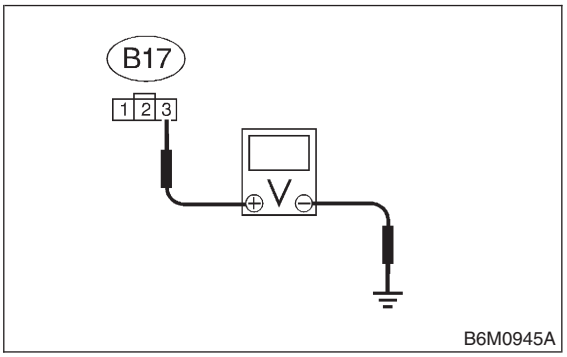


CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8D3**.
NO : Repair wiring harness.

8D3 : CHECK HARNESS CONNECTOR BETWEEN BATTERY AND VEHICLE SPEED SENSOR 2.

1) Turn ignition switch to ON.
2) Measure voltage between vehicle speed sensor 2 connector (B17) and chassis ground.

Connector & terminal
(B17) No. 3 (+) — Chassis ground (–):

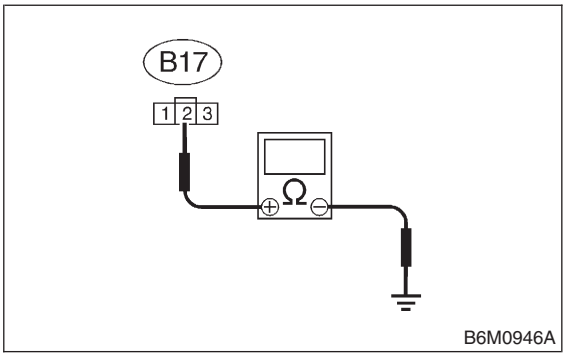


CHECK : ***Is the voltage more than 10 V?***
YES : Go to step **8D4**.
NO : Repair harness connector between battery and vehicle speed sensor 2.

8D4 : CHECK HARNESS CONNECTOR BETWEEN VEHICLE SPEED SENSOR 2 AND ENGINE GROUND.

1) Turn ignition switch to OFF.
2) Measure resistance between vehicle speed sensor 2 connector (B17) and engine ground.

Connector & terminal
(B17) No. 2 (+) — Engine ground (–):



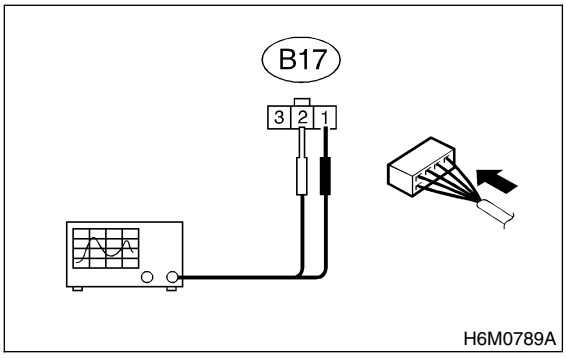
CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8D5**.
NO : Repair harness connector between vehicle speed sensor 2 and engine ground.

8D5 : CHECK VEHICLE SPEED SENSOR 2.

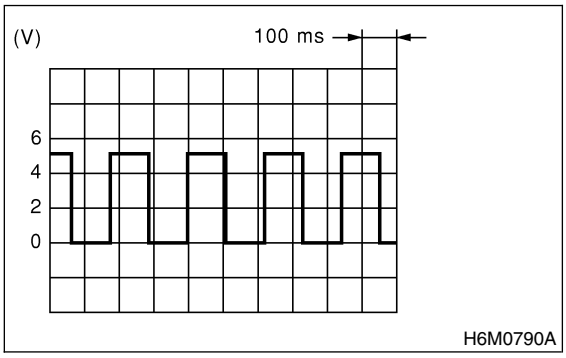
1) Connect connector to vehicle speed sensor 2.
2) Set the vehicle on free roller, or lift-up the vehicle and support with safety stands.

WARNING:
Be careful not to be caught up by the running wheels.

3) Set oscilloscope to vehicle speed sensor 2 connector terminals.
Positive probe; (B17) No. 1
Earth lead; (B17) No. 2



4) Drive the vehicle at speed greater than 20 km/h (12 MPH).
5) Measure signal voltage indicated on oscilloscope.



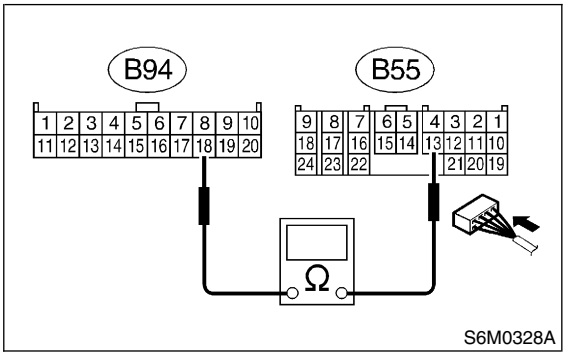
CHECK : ***Is the voltage more than 5 V?***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Replace vehicle speed sensor 2.

8D6 : CHECK HARNESS CONNECTOR BETWEEN CRUISE CONTROL MODULE AND AUTOMATIC TRANSMISSION CONTROL MODULE.

1) Disconnect connector from automatic transmission control module and cruise control module.
2) Measure resistance between cruise control module connector and automatic transmission control module connector.

CAUTION:
To measure the voltage and/or resistance, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in).

Connector & terminal
(B94) No. 18 — (B55) No. 13:



CHECK : ***Is the resistance less than 10 Ω?***
YES : Go to step **8D7**.
NO : Repair harness connector between cruise control module and automatic transmission control module.

8D7 : CHECK AUTOMATIC TRANSMISSION CONTROL MODULE.

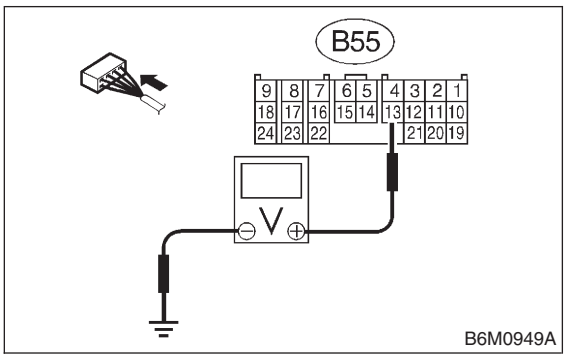
1) Connect connector to automatic transmission control module.
2) Set the vehicle on free roller, or lift-up the vehicle and support with safety stands.

WARNING:
Be careful not to be caught by the running wheels.

3) Drive the vehicle faster than 10 km/h (6 MPH).
4) Measure voltage between automatic transmission control module connector (B55) and chassis ground.

CAUTION:
To measure the voltage and/or resistance, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in).

Connector & terminal
(B55) No. 13 (+) — Chassis ground (–):



CHECK : ***Is the voltage less than 1 V ←→ more than 4 V?***

YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>

NO : Replace automatic transmission control module. <Ref. to 3-2 [W22A0].>

E: DIAGNOSTIC CODE 14 (SET/COAST SWITCH, RESUME/ACCEL SWITCH, CANCEL SWITCH)

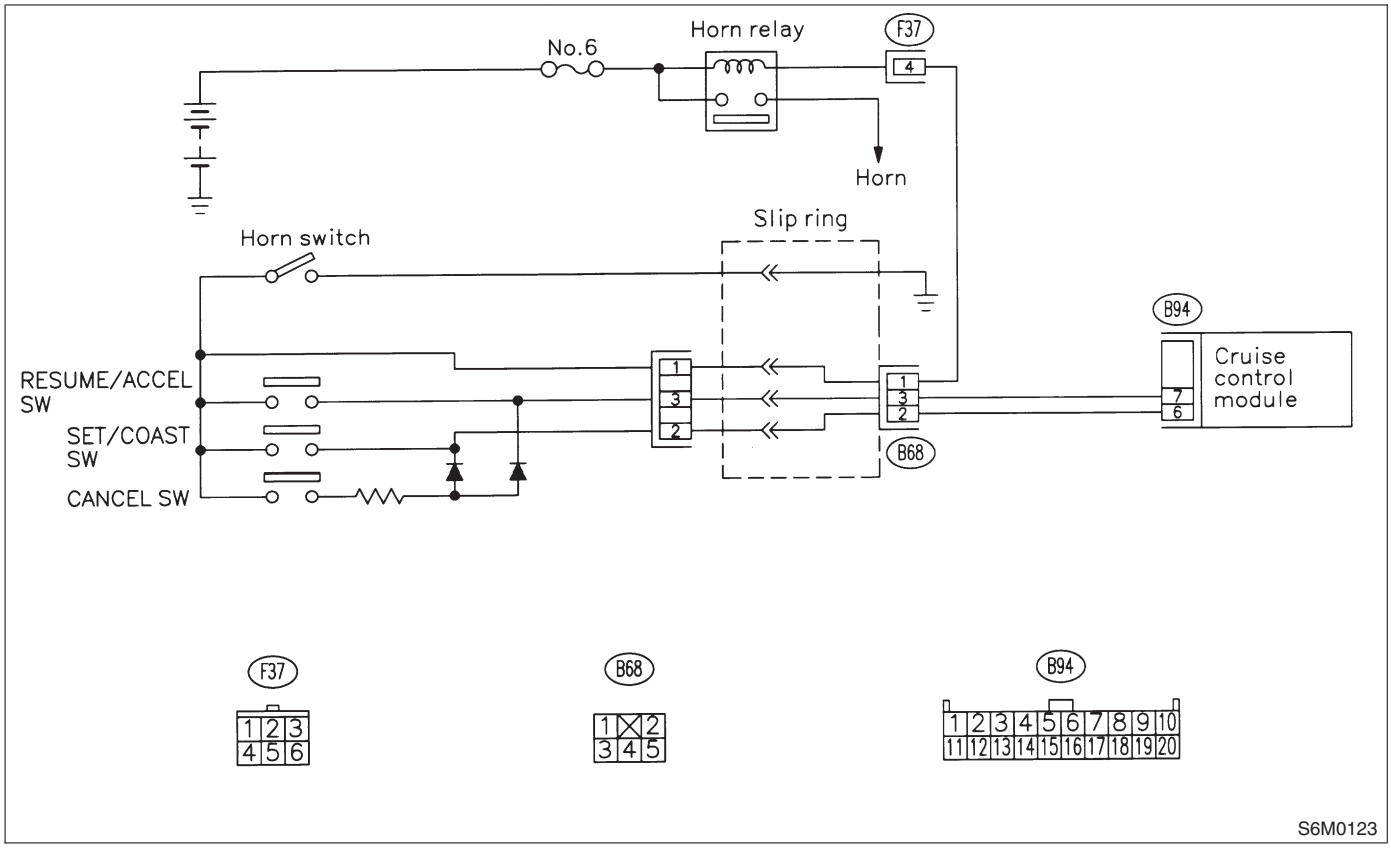
DIAGNOSIS:

- Short circuit inside the SET SW and RESUME SW.

TROUBLE SYMPTOM:

- Cruise control cannot be set. (Cancelled immediately.)

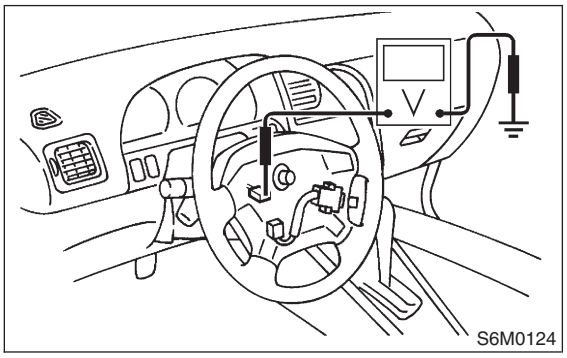
WIRING DIAGRAM:



8E1 : CHECK POWER SUPPLY.

1) Turn ignition switch to ON.
2) Turn cruise control main switch to ON.
3) Set select monitor in “Current Data Display & Save” mode.
4) Check signals for proper operation.
   (1) When pushing the SET/COAST switch:
   The SET/COAST switch shown on the display turns from “OFF” to “ON”.
   (2) When pushing the RESUME/ACCEL switch:
   The RESUME/ACCEL switch shown on the display turns from “OFF” to “ON”.
5) Turn ignition switch to OFF.
6) Disconnect connector from cruise control command switch.
7) Turn ignition switch to ON.
8) Measure voltage between cruise control command switch connector and chassis ground.

Terminals
No. 1 (+) — Chassis ground (–):

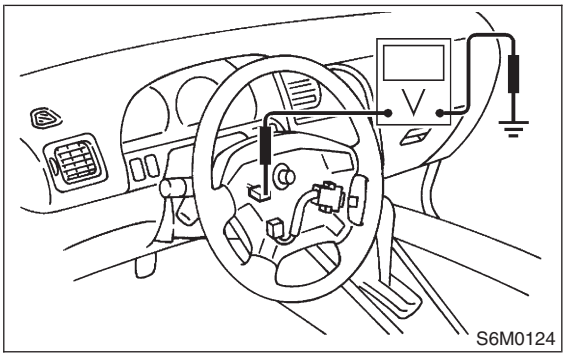


CHECK : ***Is voltage more than 10 V?***
YES : Go to step **8E2**.
NO : Repair or replace wiring harness between fuse & relay box and cruise control command switch. <Ref. to 6-2 [W11B3].>

8E2 : CHECK CRUISE CONTROL COMMAND SWITCH.

1) Turn ignition switch to OFF.
2) Connect connector of cruise control command switch.
3) Turn ignition switch to ON.
4) Measure voltage between cruise control command switch connector and chassis ground.

Terminals
No. 2 (+) — Chassis ground (–):

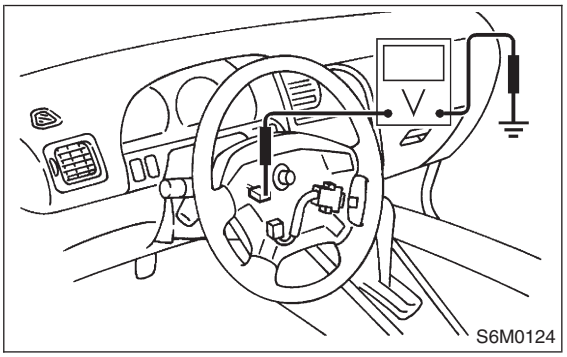


CHECK : ***Is voltage more than 10 V? (When SET/COAST switch is ON.)***
YES : Go to step **8E3**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E3 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure voltage between cruise control command switch connector and chassis ground.

Terminals
No. 3 (+) — Chassis ground (–):

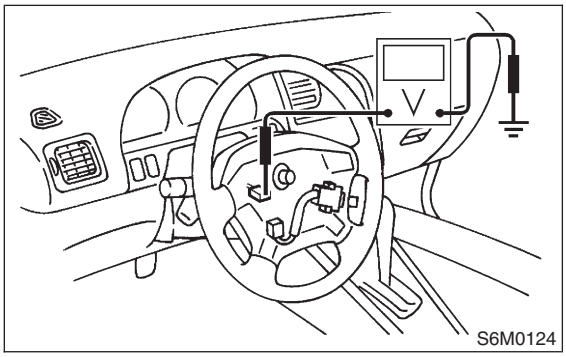


CHECK : ***Is voltage more than 10 V? (When RESUME/ACCEL switch is ON.)***
YES : Go to step **8E4**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E4 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure voltage between cruise control command switch connector and chassis ground.

Terminals
No. 2 (+) — Chassis ground (–):

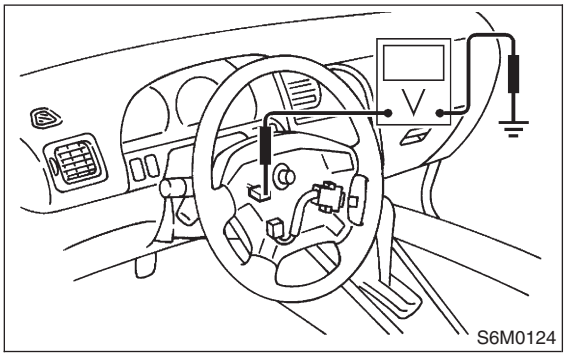


CHECK : ***Is voltage more than 10 V? (When CANCEL switch is ON.)***
YES : Go to step **8E5**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E5 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure voltage between cruise control command switch connector and chassis ground.

Terminals
No. 3 (+) — Chassis ground (–):

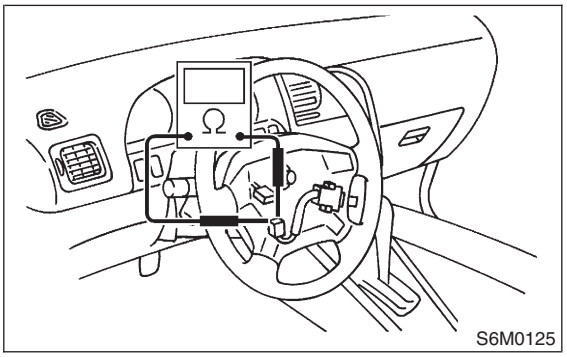


CHECK : ***Is voltage more than 10 V? (When CANCEL switch is ON.)***
YES : Go to step **8E6**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E6 : CHECK CRUISE CONTROL COMMAND SWITCH.

1) Turn ignition switch to OFF.
2) Disconnect connector from cruise control command switch.
3) Measure resistance between terminals of cruise control command switch connector (switch side) to check the switch operation.

Terminals
No. 1 — No. 2:

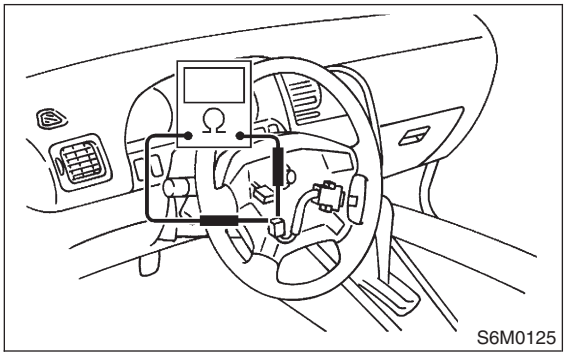


CHECK : ***Is resistance less than 10 Ω? (When SET/COAST switch is ON.)***
YES : Go to step **8E7**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E7 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure resistance between terminals of cruise control command switch connector (switch side) to check the switch operation.

Terminals
No. 1 — No. 2:

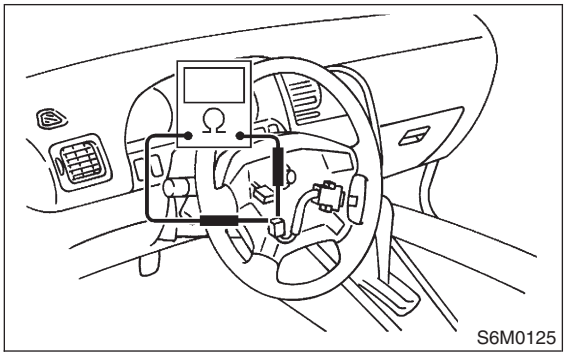


CHECK : ***Is resistance more than 1 MΩ? (When SET/COAST switch is OFF.)***
YES : Go to step **8E8**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E8 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure resistance between terminals of cruise control command switch connector (switch side) to check the switch operation.

Terminals
No. 1 — No. 3:

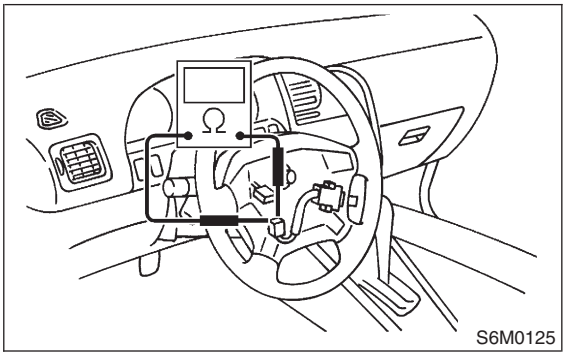


CHECK : ***Is resistance less than 10 Ω? (When RESUME/ACCEL switch is ON.)***
YES : Go to step **8E9**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E9 : CHECK CRUISE CONTROL COMMAND SWITCH.

Measure resistance between terminals of cruise control command switch connector (switch side) to check the switch operation.

Terminals
No. 1 — No. 3:

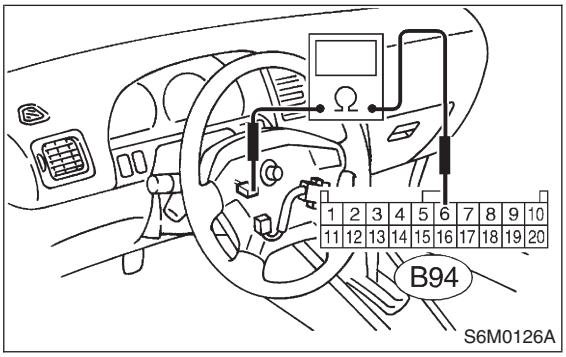


CHECK : ***Is resistance more than 1 MΩ? (When RESUME/ACCEL switch is OFF.)***
YES : Go to step **8E10**.
NO : Replace cruise control command switch. <Ref. to 6-2 [W11B3].>

8E10 : CHECK HARNESS CONNECTOR BETWEEN CRUISE CONTROL COMMAND SWITCH AND CRUISE CONTROL MODULE.

1) Disconnect connector from cruise control module.
2) Measure resistance of harness connector between cruise control command switch and cruise control module.

Connector & terminal
No. 2 (command switch) — (B94) No. 6:

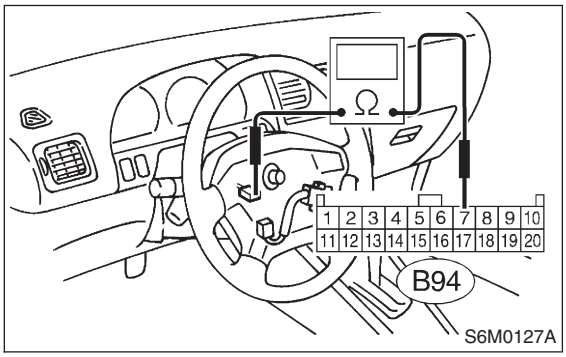


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **8E11**.
NO : Repair or replace wiring harness.

8E11 : CHECK HARNESS CONNECTOR BETWEEN CRUISE CONTROL COMMAND SWITCH AND CRUISE CONTROL MODULE.

Measure resistance of harness connector between cruise control command switch and cruise control module.

Connector & terminal
No. 3 (command switch) — (B94) No. 7:



CHECK : ***Is resistance less than 10 Ω?***
YES : Replace cruise control module. <Ref. to 6-2 [W11B4].>
NO : Repair or replace wiring harness.

MEMO:

F: DIAGNOSTIC CODE 21, 22 AND 23 (VACUUM VALVE, VENT 2 VALVE, VENT 1 VALVE)

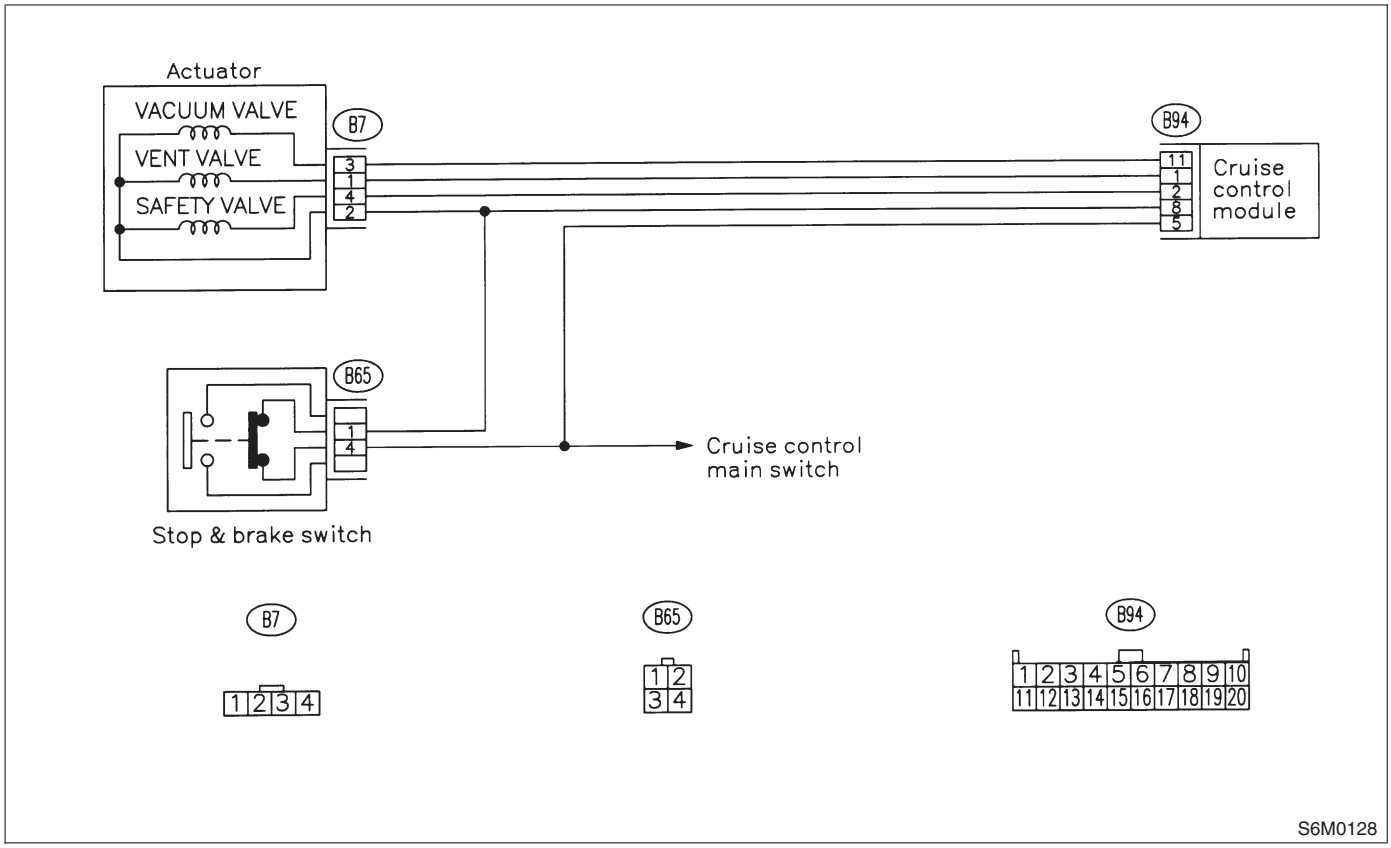
DIAGNOSIS:

- Open or poor contact of vacuum valve, vent 2 valve and vent 1 valve.

TROUBLE SYMPTOM:

- Cruise control cannot be set. (Cancels immediately.)

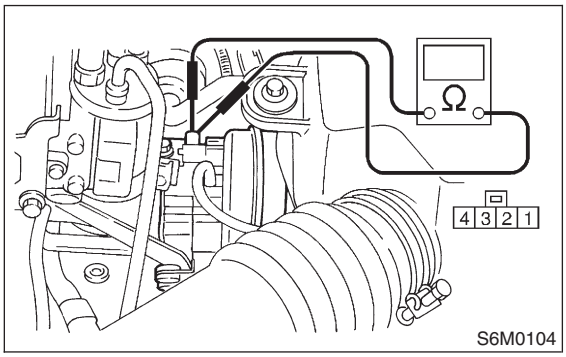
WIRING DIAGRAM:



8F1 : MEASURE RESISTANCE OF VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE.

1) Disconnect connector from actuator.
2) Measure resistance of vacuum valve, vent 2 valve and vent 1 valve.

Terminals
No. 2 — No. 3:

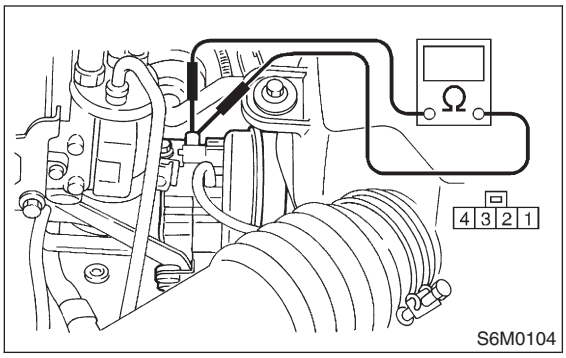


CHECK : ***Is resistance less than 22 Ω?***
YES : Go to step **8F2**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

8F2 : MEASURE RESISTANCE OF VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE.

Measure resistance of vacuum valve, vent 2 valve and vent 1 valve.

Terminals
No. 2 — No. 1:

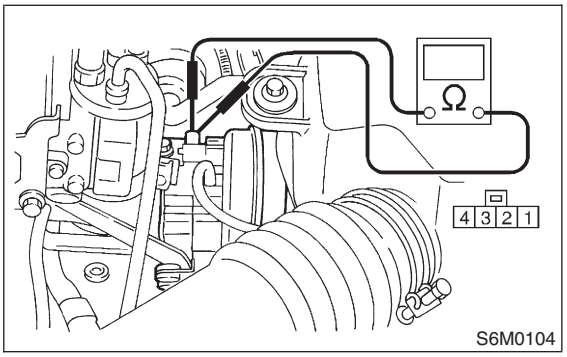


CHECK : ***Is resistance less than 55 Ω?***
YES : Go to step **8F3**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

8F3 : MEASURE RESISTANCE OF VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE.

Measure resistance of vacuum valve, vent 2 valve and vent 1 valve.

Terminals
No. 2 — No. 4:

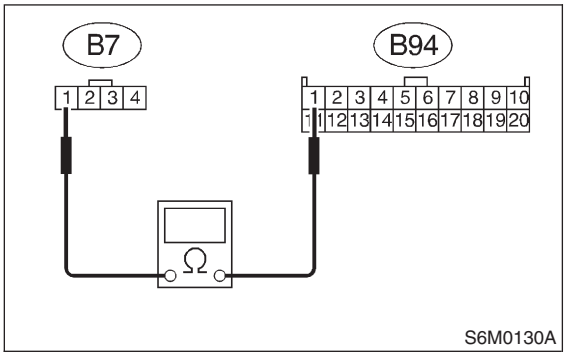


CHECK : ***Is resistance less than 55 Ω?***
YES : Go to step **8F4**.
NO : Replace actuator. <Ref. to 6-2 [W11B1].>

8F4 : PERFORM A CIRCUIT TEST IN HARNESS BETWEEN ACTUATOR (VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE) AND CRUISE CONTROL MODULE.

1) Disconnect connector from cruise control module.
2) Measure resistance of harness connector between cruise control module, vacuum valve, vent 2 valve and vent 1 valve.

Connector & terminal
(B7) No. 1 — (B94) No. 1:

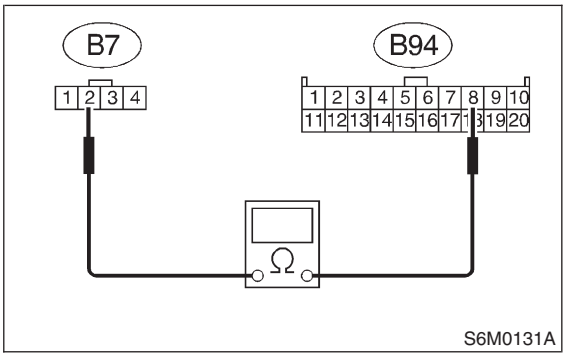


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **8F5**.
NO : Repair or replace wiring harness between actuator <Ref. to 6-2 [W11B1].> and cruise control module <Ref. to 6-2 [W11B4].>.

8F5 : PERFORM A CIRCUIT TEST IN HARNESS BETWEEN ACTUATOR (VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE) AND CRUISE CONTROL MODULE.

Measure resistance of harness connector between cruise control module, vacuum valve, vent 2 valve and vent 1 valve.

Connector & terminal
(B7) No. 2 — (B94) No. 8:

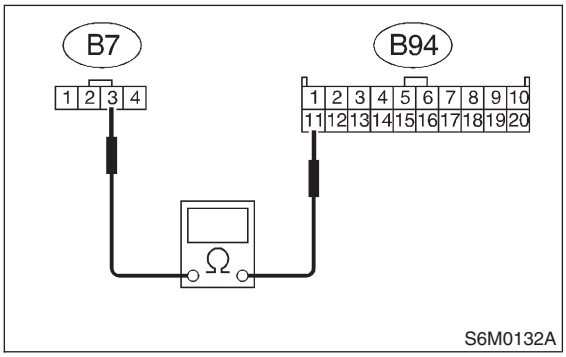


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **8F6**.
NO : Repair or replace wiring harness between actuator <Ref. to 6-2 [W11B1].> and cruise control module <Ref. to 6-2 [W11B4].>.

8F6 : PERFORM A CIRCUIT TEST IN HARNESS BETWEEN ACTUATOR (VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE) AND CRUISE CONTROL MODULE.

Measure resistance of harness connector between cruise control module, vacuum valve, vent 2 valve and vent 1 valve.

Connector & terminal
(B7) No. 3 — (B94) No. 11:

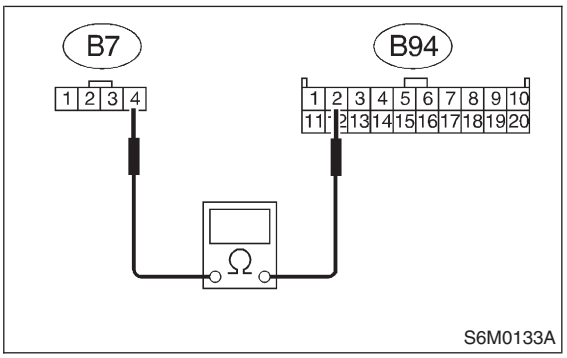


CHECK : ***Is resistance less than 10 Ω?***
YES : Go to step **8F7**.
NO : Repair or replace wiring harness between actuator <Ref. to 6-2 [W11B1].> and cruise control module <Ref. to 6-2 [W11B4].>.

8F7 : PERFORM A CIRCUIT TEST IN HARNESS BETWEEN ACTUATOR (VACUUM VALVE, VENT 2 VALVE AND VENT 1 VALVE) AND CRUISE CONTROL MODULE.

Measure resistance of harness connector between cruise control module, vacuum valve, vent 2 valve and vent 1 valve.

Connector & terminal
(B7) No. 4 — (B94) No. 2:



CHECK : ***Is resistance less than 10 Ω?***
YES : Replace cruise control module.
NO : Repair or replace wiring harness between actuator <Ref. to 6-2 [W11B1].> and cruise control module <Ref. to 6-2 [W11B4].>.

G: DIAGNOSTIC CODE 25 (CRUISE CONTROL MODULE BUILT-IN RELAY, CPU RAM)

DIAGNOSIS:

- Poor welding of built-in relay of cruise control module.
- Failure of built-in CPU RAM of cruise control module.

TROUBLE SYMPTOM:

- Cruise control is canceled and memorized cruise speed is also canceled.
- Once cruise control is canceled, cruise control cannot be set until the ignition switch and cruise control main switch turns OFF, and then turns ON again.

NOTE:
Check input/output signal and vehicle speed signal with select monitor. When signals are in good condition, failure is in cruise control module. (Check power supply and ground conditions of cruise control module.)

9. Diagnostics Chart with Select Monitor

A: FUNCTION MODE

NOTE:
Applicable select monitor cartridge:
No. 24082AA130

Select the “Cruise Control” system using the select monitor and set the “Current Data Display & Save” mode. The following parameters will then appear on the display.

- Vehicle Speed

The current vehicle speed is shown on the display.

- Stop Lamp Switch

When the brake pedal is depressed, the stop lamp switch shown on the display turns from “OFF” to “ON”.

- Brake Switch

When the brake pedal is depressed, the brake switch shown on the display turns from “OFF” to “ON”.

- “SET/COAST” Switch

When the cruise control command switch is placed in the “SET/COAST” position, the SET/COAST switch shown on the display turns from “OFF” to “ON”.

- “RESUME/ACCEL” Switch

When the cruise control command switch is placed in the “RESUME/ACCEL” position, the RESUME/ACCEL switch shown on the display turns from “OFF” to “ON”.

- Clutch/Inhibitor Switch

When the clutch pedal is depressed, the clutch/inhibitor switch shown on the display turns from “ON” to “OFF”. (MT models)
When the selector lever is moved from the “N” or “P” position to any other position, the clutch/inhibitor switch shown on the display turns from “ON” to “OFF”.

WIRING DIAGRAM SECTION

FOREWORD

This portion of the service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of both the fully qualified and the less-experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

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1. Important Safety Notice

● Providing appropriate service and repair is a matter of great importance in the serviceman's safety maintenance and safe operation, function and performance which the SUBARU vehicle possesses.

● In case the replacement of parts or replenishment of consumables is required, genuine SUBARU parts whose parts numbers are designated or their equivalents must be utilized.

● It must be made well known that the safety of the serviceman and the safe operation of the vehicle would be jeopardized if he used any service parts, consumables, special tools and work procedure manuals which are not approved or designated by SUBARU.

2. How to Use this Manual

● This Service Manual is divided into six volumes by section so that it can be used with ease at work. Refer to the Table of Contents, select and use the necessary section.

- GENERAL INFORMATION SECTION
- ENGINE SECTION
- TRANSMISSION AND DIFFERENTIAL SECTION
- MECHANICAL COMPONENTS SECTION
- BODY AND ELECTRICAL SECTION
- WIRING DIAGRAM SECTION

● Each chapter in the manual is basically made of the following six types of areas.

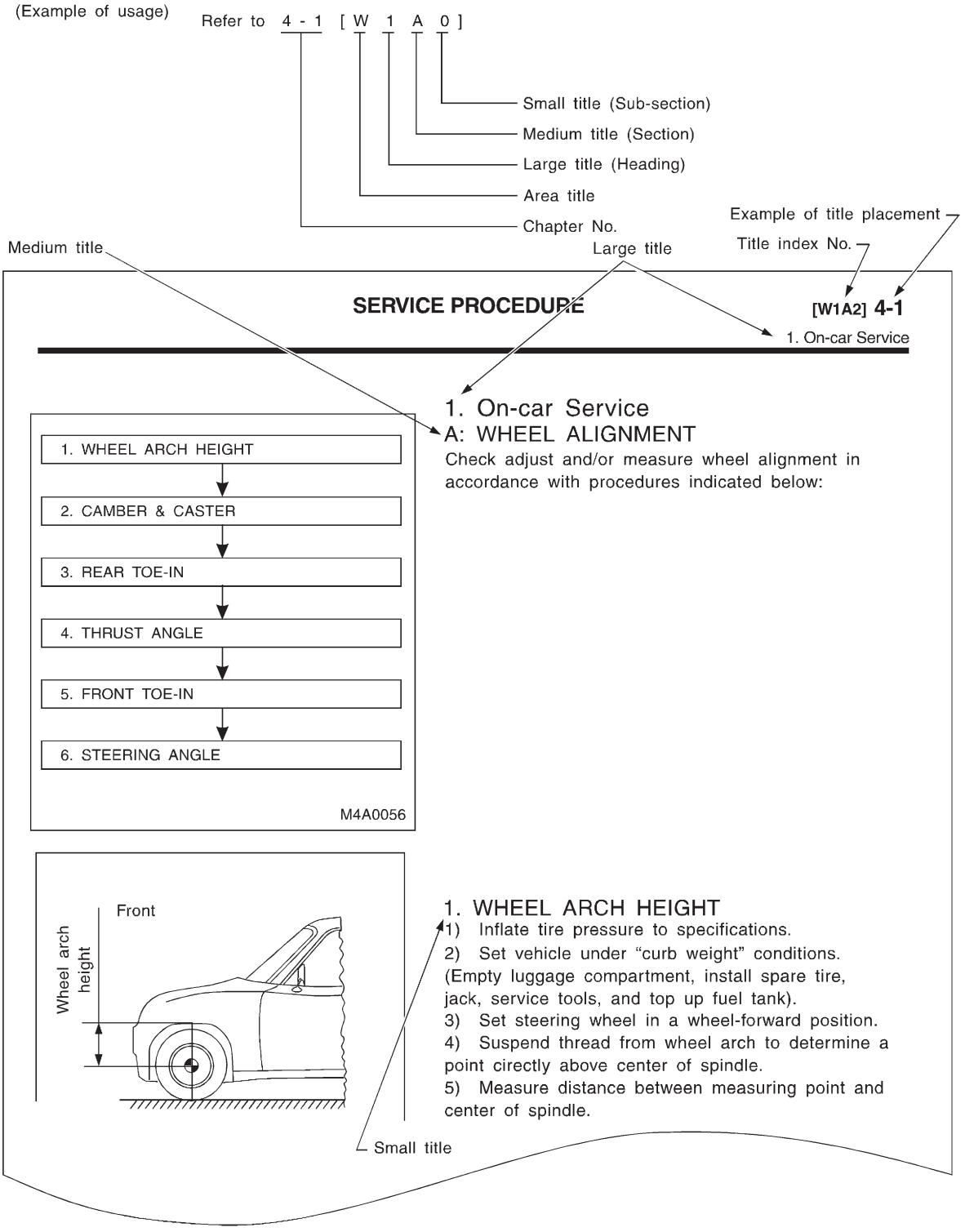
S	SPECIFICATIONS AND SERVICE DATA
C	COMPONENT PARTS
W (X (Y	SERVICE PROCEDURE SERVICE PROCEDURE) SERVICE PROCEDURE)
K	DIAGNOSTICS (MECHANICAL)
T	DIAGNOSTICS (ELECTRICAL)
D	WIRING DIAGRAM

● The description of each area is provided with four types of titles different in size as shown below. The Title No. or Symbol prefixes each title in order that the construction of the article and the flow of explanation can be easily understood.

[Example of each title]

● Area title:	W SERVICE PROCEDURE (one of the six types of areas)
● Large title (Heading):	1. Oil Pump (to denote the main item of explanation)
● Medium title (Section):	A: REMOVAL (to denote the type of work in principle)
● Small title (Sub-section):	1. INNER ROTATOR (to denote a derivative item of explanation)

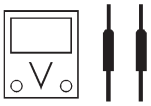
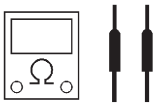
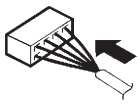
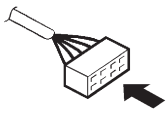
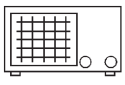
● The Title Index No. is indicated on the top left (or right) side of the page as the book is opened. This is useful for retrieving the necessary portion.



H0M0010

- In this manual, the following symbols are used.

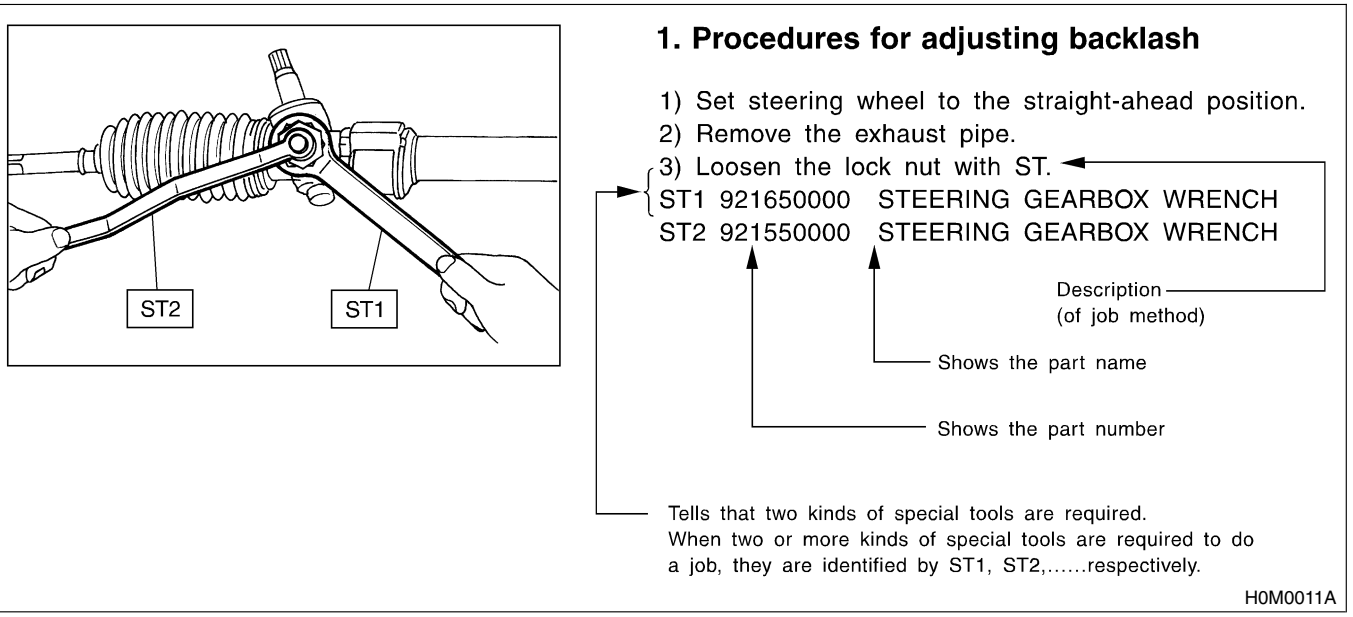
Symbol	Description
*	Selective part
★	Replacement part
 S0M0001	Should be lubricated with oil.
 S0M0002	Should be lubricated with grease.
 S0M0003	Sealing point
T S0M0004	Tightening torque

Character	Description
 B0M0002	Circuit tester ● Voltage measurement
 B0M0003	Circuit tester ● Resistance measurement
 B0M0004	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0005	The arrow indicates that insertion of the probe or numbering of the connector pins is made from the side.
 B0M0006	Oscilloscope
B0M0007	Oscilloscope positive probe
B0M0008	Oscilloscope earth head

● **WARNING, CAUTION,** NOTE

WARNING:	Indicates the item which must be observed precisely during performance of maintenance services in order to avoid injury to the mechanics and other persons.
CAUTION:	Indicates the item which must be followed precisely during performance of maintenance services so as to avoid damage and breakage to the vehicle and its parts and components.
NOTE:	Indicates the hints, knacks, etc. which make the maintenance job easier.

● SPECIAL TOOLS
When any special tool is required to perform the job, it is identified by “ST” in the applicable illustration and its part number is shown in the manual.

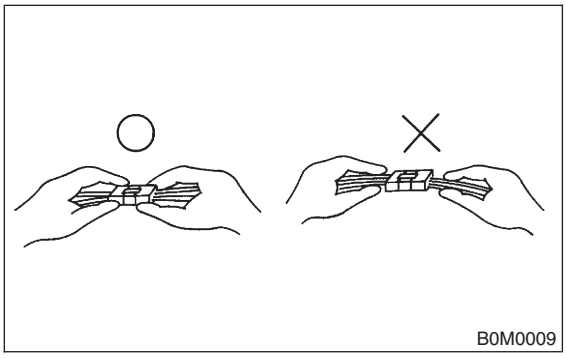


3. Basic Checks for Diagnostics

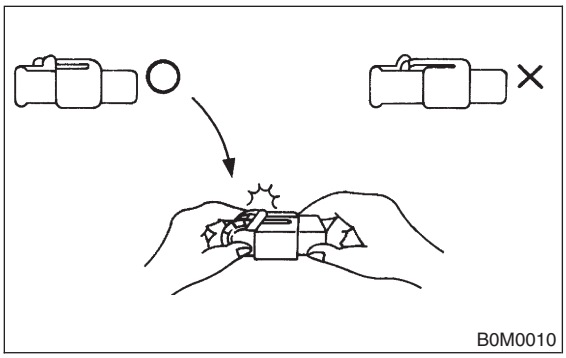
A: DISCONNECTING CONNECTORS

- Always hold the connector itself.

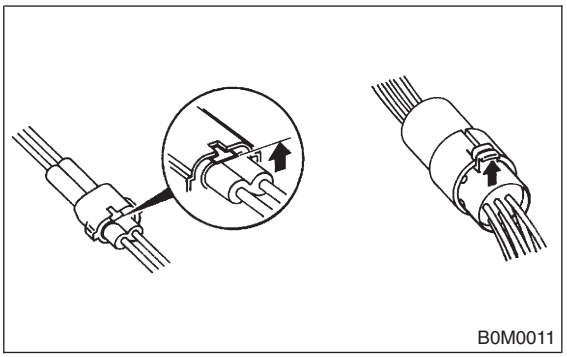
CAUTION:
Don't pull the harness.



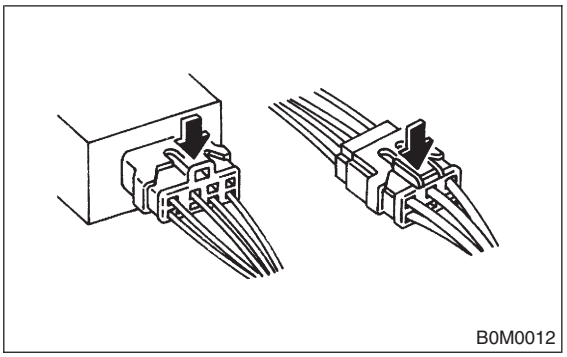
- Inspect a connector by pushing it all the way in. If the connector is equipped with a locking device, push it in until a clicking sound is heard.



- To disconnect a locking connector, first release the lock, then pull the connector off.
<Unlock by pulling the locking tab.>



<Unlock by pushing the locking tab.>

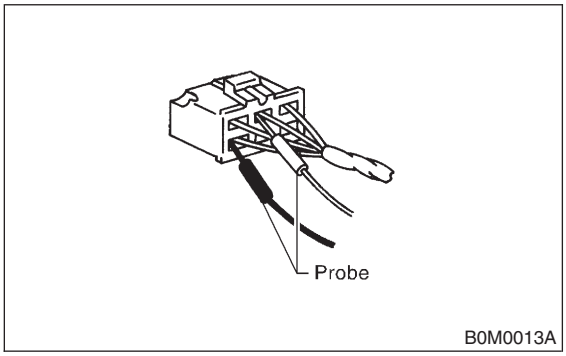


NOTE:
- After disconnecting connectors, visually check for contamination, distortion, or damage of connectors before reconnecting them. Also, check for loose or missing terminals.
- If there are any contamination, or water droplets on the contact points of the terminals, wipe them off using an air gun or a waste cloth. Never polish the contact points using sandpaper. If polished with sandpaper, the surface plating may peel off.
- Avoid excessive impact and twisting force to connectors when connecting. Otherwise, connector housings or terminals may be damaged.
- When disconnecting waterproof connectors, be sure to prevent the inner waterproof seal from collapsing.

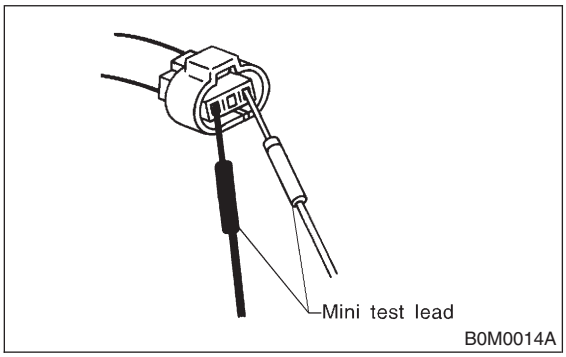
B: INSERTING A PROBE

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

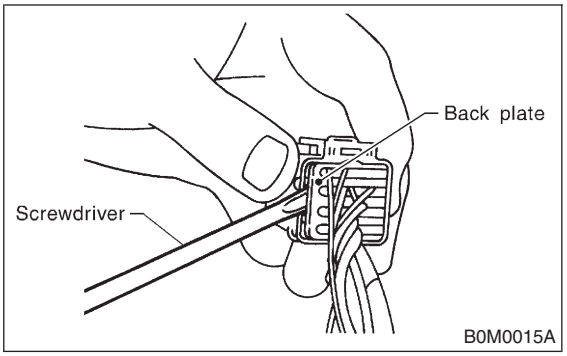
- Generally, probes are inserted into connectors from the rear side (wire side).
- When removing the shock protector take care not to deform it; this also applies to waterproof connectors, which cannot be tested from the wire side.



- Connectors equipped with shock protectors must be checked with a mini probe (thin), or it will be necessary to remove the shock protector.



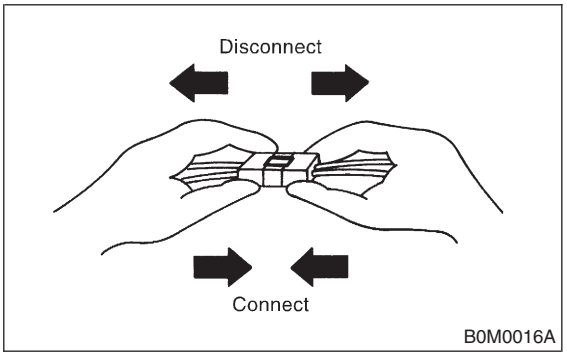
- When the connector has a back plate, remove the plate after removing the projection of the plate first. (Be careful not to use excessive force, since the terminals might brake off.)



C: CHECKING FOR POOR CONTACT ON PLUG-IN CONNECTORS

1. POOR CONTACT

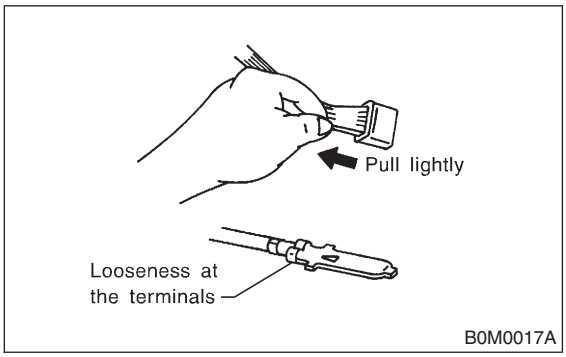
Poor contact is frequently caused by corroded terminals, dirt, foreign substances, weak contact points between male and female connectors, etc. Quite often a plug with poor contact will work perfectly again after it has been pulled off and reconnected. If harness and connector checks do not reveal any defect, it can be assumed that an intermittent contact in a connector is the source of trouble.



2. VISUAL INSPECTION

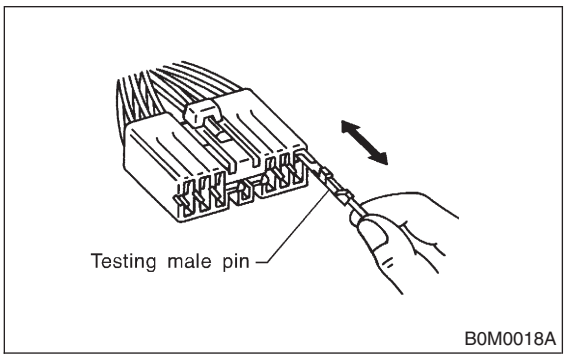
1) Disconnect the two connector halves.
2) Check the connector pins for signs of corrosion or foreign material.
3) Check the connector for loose and damaged terminals, and make sure they are set correctly in the connector.

NOTE:
When the harness is pulled lightly, the terminals should not come out.

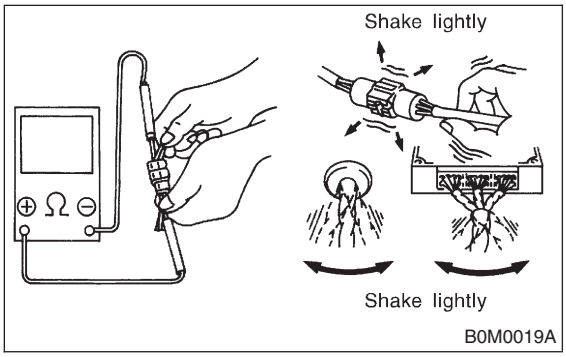


4) Insert the male pin of the connector into the female pin, then pull it out.

NOTE:
If one of the pins allows to pull out easily, it is a likely source of a malfunction.



5) Shake lightly the connector and the harness, and check for sudden changes in voltage or resistance.



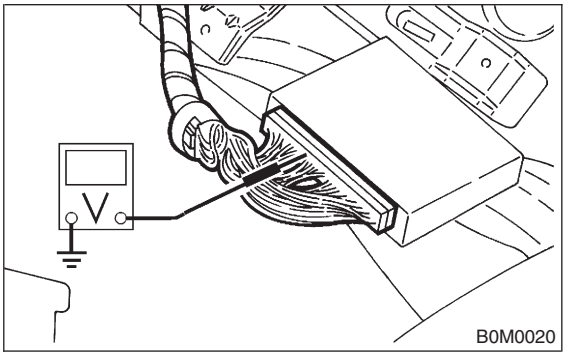
4. Diagnosis and Checking Procedure Using Instruments

A: USING A CIRCUIT TESTER

CAUTION:
Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

1. VOLTAGE CHECK (range set to DC V)

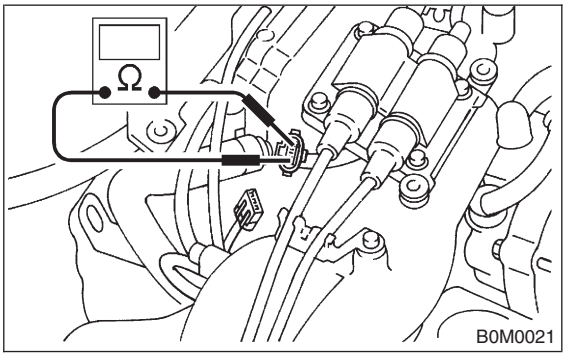
Connect the positive probe to the terminal to be tested, and the negative probe to body ground. (or the ground terminal of the ECM)



2. CHECKING THE CONNECTION (range set to Ω)

Measure the resistance and check for open or shorted wire in the harness or the connector.

NOTE:
This check must be carried out with both connectors disconnected.
(This avoids by-passing the connection through other circuits.)



1) Check for open circuit. (range: Ω × 1K)
Measure the resistance between the respective pins in both connectors.

Specified resistance:
More than 1 MΩ (No continuity) Open circuit
Less than 10 Ω (Continuity) O.K.

2) Check for correct insulation value. (range: Ω × 1K)
Measure the resistance between the pins in both connectors, as well as between the suspected pin and the body. (body short)

Specified resistance:
More than 1 MΩ (No continuity) O.K.
Less than 10 Ω (Continuity) Short circuit

3) Resistance measurement (range set to Ω)
Measuring the internal resistance of sensors, solenoid valves etc. to check the operating condition of components.

NOTE:
● Select the appropriate range for measuring the internal resistance, or the measurement will result in an incorrect reading.
● Before changing the measurement range the gauge must be reset to zero.

B: USING A SUBARU SELECT MONITOR

With this testing procedure the defective component can be determined by directly monitoring input/output signals of the ECM or the trouble codes.

1. FEATURES

● A variety of data can be checked without movements from the drivers seat, passenger's seat or from outside the vehicle.
● This unit allows the identification of the type of malfunction, for example whether the cause is an open or shorted wire in the input/output signal line, or whether the breakdown of a component is caused by a lack of maintenance.

2. DIAGNOSIS

● Refer to the reference values for input/output and control data to determine whether the malfunction is caused by a worn out component, an open wire, a short etc.
● Perform the diagnostics procedure as described in chapter "Check based on trouble codes" by monitoring the trouble codes.

NOTE:
It will be easier to determine a malfunction if the vehicle data for normal conditions are available for comparison.

C: USING AN OSCILLOSCOPE

A malfunction can be determined by displaying the waveforms of input/output signals on the oscilloscope.

1. DIAGNOSIS

A simple comparison of the waveforms may lead to an incorrect diagnosis. To exactly determine the sources of the malfunction it will be necessary to determine them under consideration about information other than waveforms.

2. APPLYING INPUT/OUTPUT SIGNALS

Connect the probe directly with the terminal of the signal.

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WIRING DIAGRAM SECTION	6-3 Wiring Diagram

WIRING DIAGRAM 6-3

Page

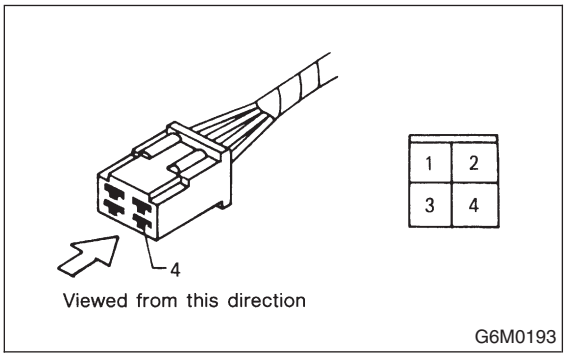
D **WIRING DIAGRAM** 2
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3. Working Precautions 8
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6. Electrical Wiring Harness and Ground Point 67

1. General Description

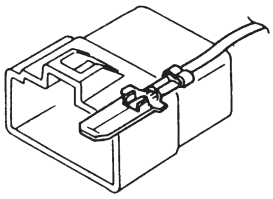
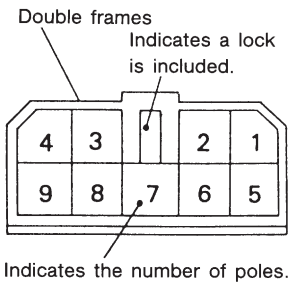
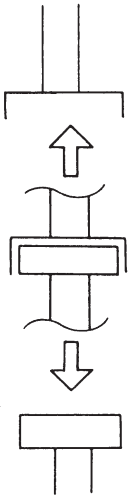
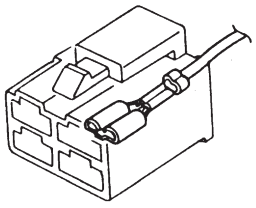
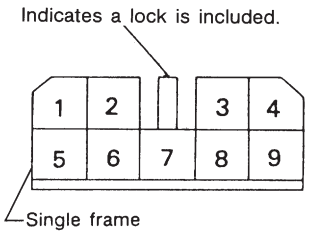
A: WIRING DIAGRAM

The wiring diagram of each system is illustrated so that you can understand the path through which the electric current flows from the battery.
Sketches and codes are used in the diagrams. They should read as follows:

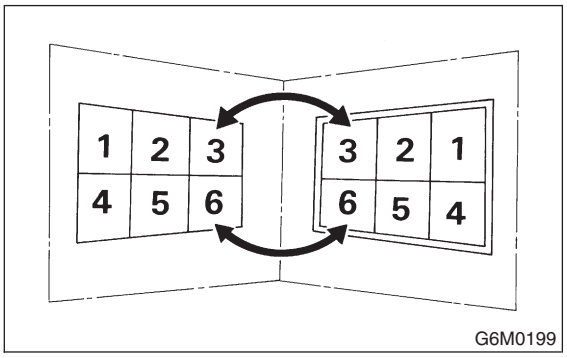
- Each connector and its terminal position are indicated by a sketch of the connector in a disconnected state which is viewed from the front.



- The number of poles or pins, presence of a lock, and pin number of each terminal are indicated in the sketch of each connector. In the sketch, the highest pole number refers to the number of poles which the connector has. For example, the sketch of the connector shown in figure indicates the connector has 9 poles.

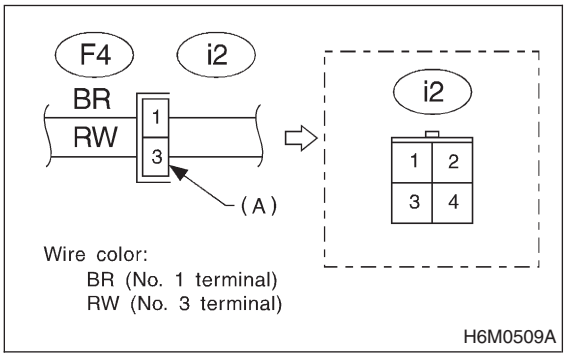
Connector used in vehicle	Connector shown in wiring diagram		
	Sketch	Symbol	Number of poles
 G6M0194	 G6M0196	 G6M0198	Numbered in order from upper right to lower left.
 G6M0195	 G6M0197		Numbered in order from upper left to lower right.

● When one set of connectors is viewed from the front side, the pole numbers of one connector are symmetrical to those of the other. When these two connectors are connected as a unit, the poles which have the same number are joined.

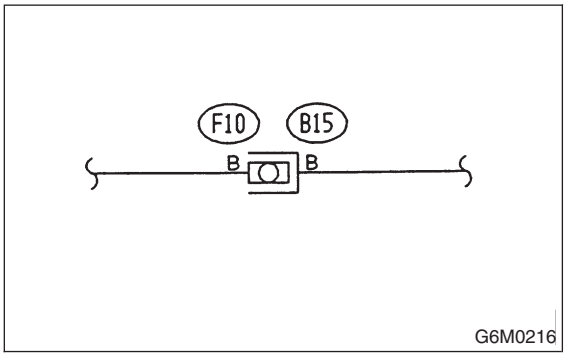


● Electrical wiring harness:
The connectors are numbered along with the number of poles, external colors, and mating connections in the accompanying list.
● The sketch of each connector in the wiring diagram usually shows the (A) side of the connector. The relationship between the wire color, terminal number and connector is described in figure.

NOTE:
A wire which runs in one direction from a connector terminal sometimes may have a different color from that which runs in the other direction from that terminal.

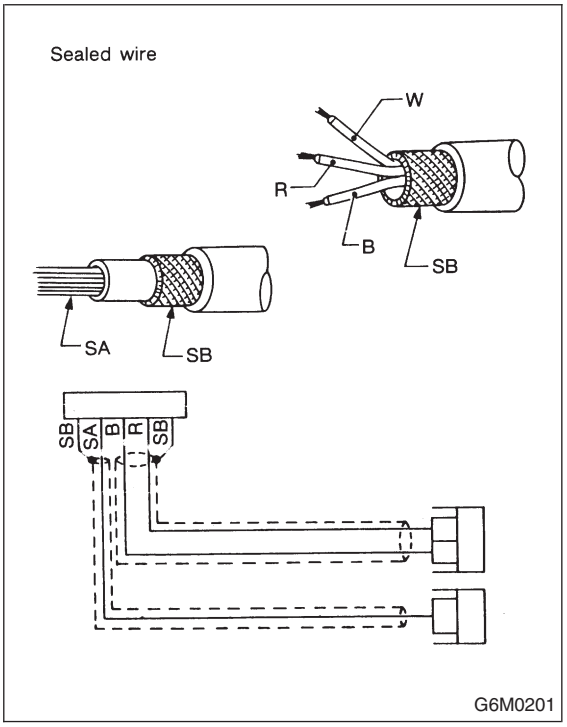


● In wiring diagram, connectors which have no terminal number refer to one-pole types. Sketches of these connectors are omitted intentionally.

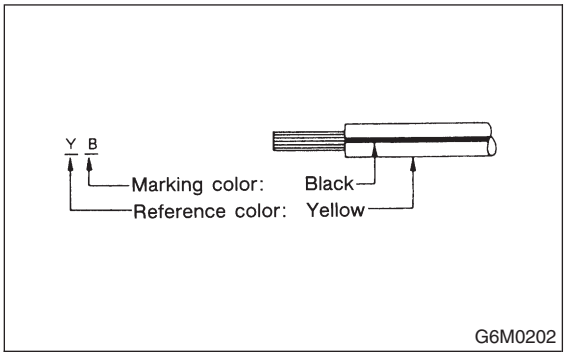


● The following color codes are used to indicate the colors of the wires used.

Color code	Color
L	Blue
B	Black
Y	Yellow
G	Green
R	Red
W	White
Br	Brown
Lg	Light green
Gr	Gray
P	Pink
Or	Orange
Lb	Light Blue
V	Violet
SA	Sealed (Inner)
SB	Sealed (Outer)



● The wire color code, which consists of two letters (or three letters including Br or Lg), indicates the standard color (base color of the wire covering) by its first letter and the stripe marking by its second letter.



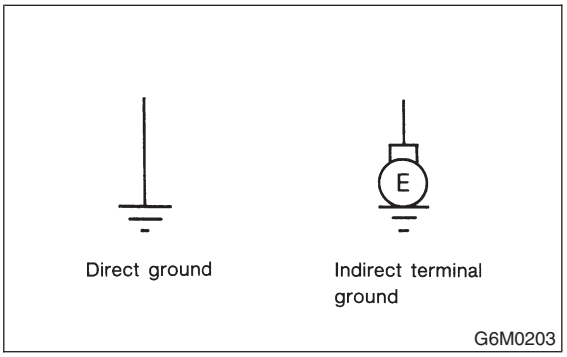
● The table lists the nominal sectional areas and allowable currents of the wires.

CAUTION:
● When replacing or repairing a wire, be sure to use the same size and type of the wire which was originally used.

NOTE:
● The allowable current in the table indicates the tolerable amperage of each wire at an ambient temperature of 40°C (104°F).
● The allowable current changes with ambient temperature. Also, it changes if a bundle of more than two wires is used.

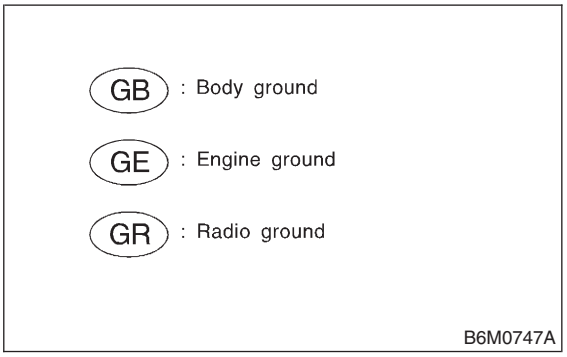
Nominal sectional area mm^2	No. of strands/ strand diameter	Outside diameter of finished wiring mm	Allowable current Amps/40°C
0.3	7/0.26	1.8	7
0.5	7/0.32	2.2 (or 2.0)	12
0.75	30/0.18	2.6 (or 2.4)	16
0.85	11/0.32	2.4 (or 2.2)	16
1.25	16/0.32	2.7 (or 2.5)	21
2	26/0.32	3.1 (or 2.9)	28
3	41/0.32	3.8 (or 3.6)	38
5	65/0.32	4.6 (or 4.4)	51
8	50/0.45	5.5	67

● Each unit is directly grounded to the body or indirectly grounds through a harness ground terminal. Different symbols are used in the wiring diagram to identify the two grounding systems.

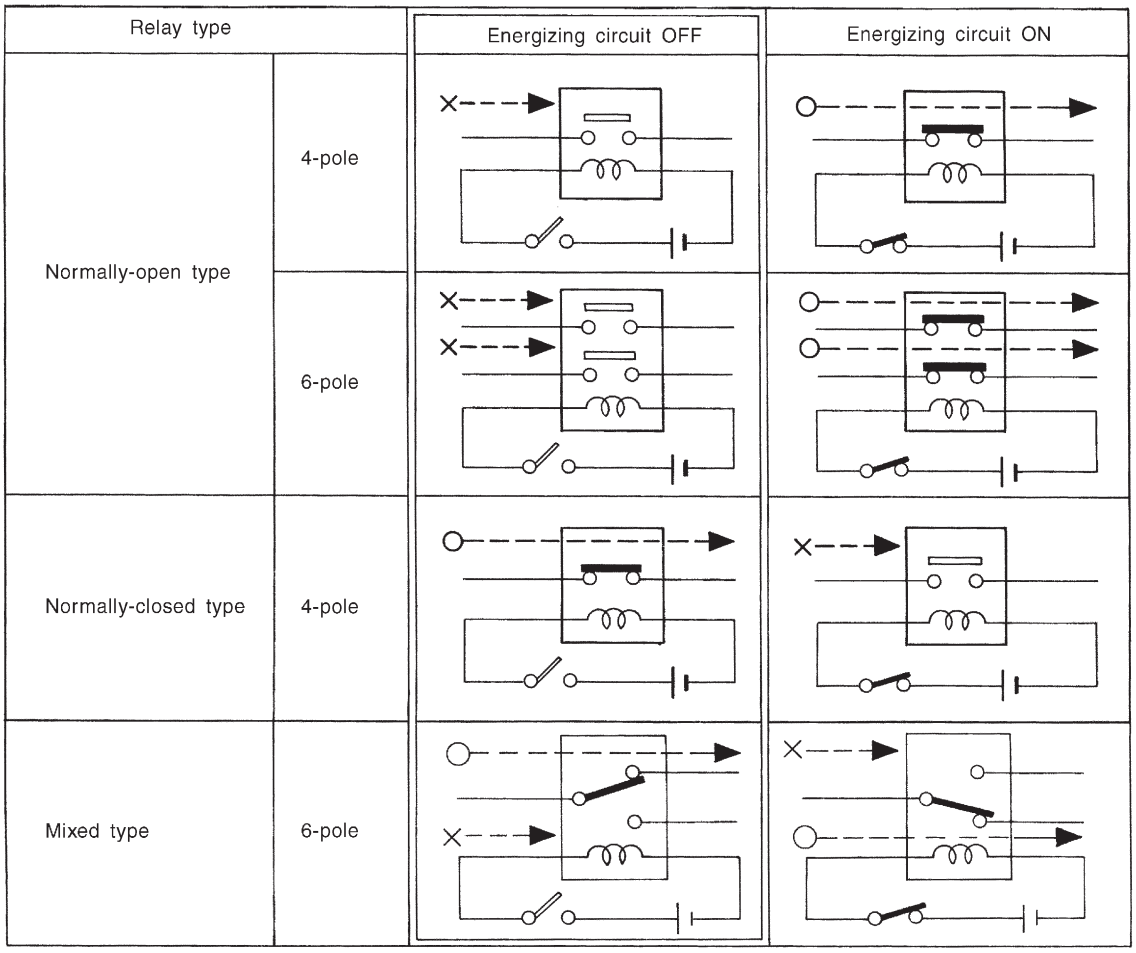


● The ground points shown in the wiring diagram refer to the following:

NOTE:
All wiring harnesses are provided with a ground point which should be securely connected.



● Relays are classified as normally-open or normally-closed. The normally-closed relay has one or more contacts.
The wiring diagram shows the relay mode when the energizing circuit is OFF.



Key to symbols:

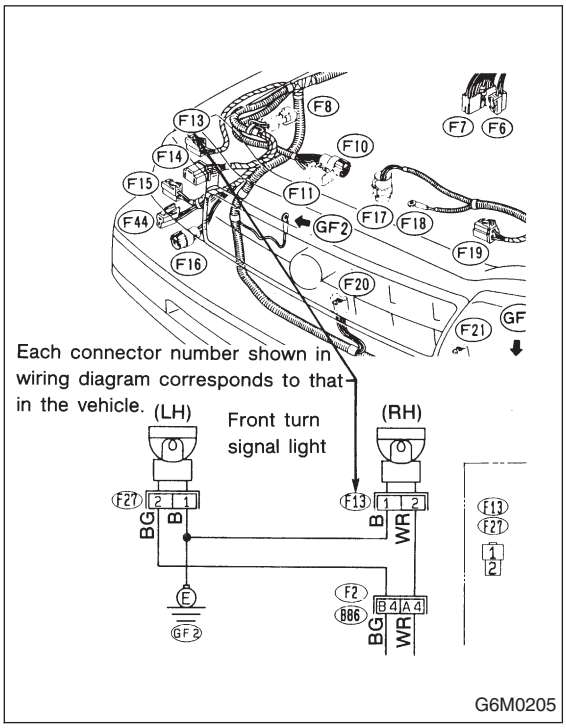
○ ⟶ : Current flows.

× ⟶ : Current does not flow.

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• Each connector number shown in the wiring diagram corresponds to that in the wiring harness. The location of each connector in the actual vehicle is determined by reading the first character of the connector (for example, a “F” for F8, “i” for i16, etc.) and the type of wiring harness.
The first character of each connector number refers to the area or system of the vehicle.

Symbol	Wiring harness and cord
F	Front wiring harness
B	Bulkhead wiring harness
E	Engine wiring harness, Oxygen sensor cord
T	Transmission cord
D	Door cord LH & RH, Rear door cord LH & RH
i	Instrument panel wiring harness
R	Rear wiring harness, Rear defogger cord (Ground) Fuel tank cord, Roof cord, Rear gate cord, Rear gate lock adapter cord



2. Basic Diagnostics Procedure

A: BASIC PROCEDURE

1. GENERAL

The most important purpose of diagnostics is to determine which part is malfunctioning quickly, to save time and labor.

2. IDENTIFICATION OF TROUBLE SYMPTOM

Determine what the problem is based on the symptom.

3. PROBABLE CAUSE OF TROUBLE

Look at the wiring diagram and check the system’s circuit. Then check the switch, relay, fuse, ground, etc.

4. LOCATION AND REPAIR OF TROUBLE

1) Using the diagnostics narrow down the causes.
2) If necessary, use a voltmeter, ohmmeter, etc.
3) Before replacing certain component parts (switch, relay, etc.), check the power supply, ground, for open wiring harness, poor connectors, etc. If no problems are encountered, check the component parts.

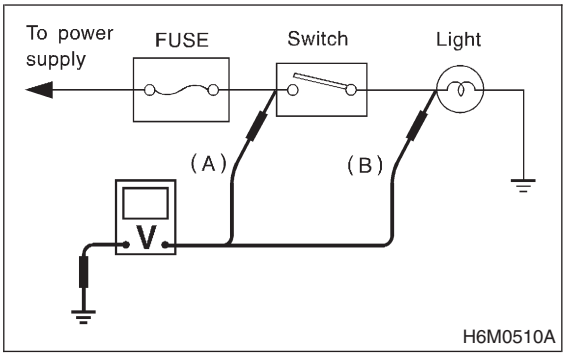
5. CONFIRMATION OF SYSTEM OPERATION

After repairing, ensure that the system operates properly.

B: INSPECTION

1. VOLTAGE MEASUREMENT

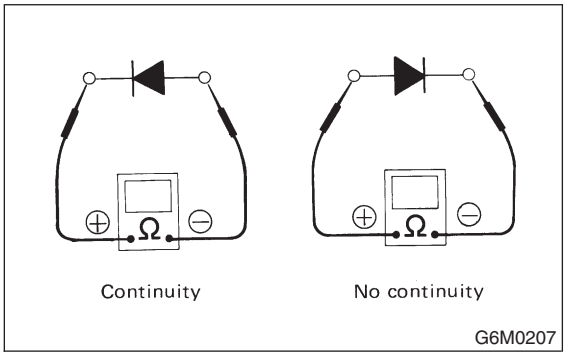
1) Using a voltmeter, connect the negative lead to a good ground point or negative battery terminal and the positive lead to the connector or component terminal.
2) Contact the positive probe of the voltmeter on connector (A).
The voltmeter will indicate a voltage.
3) Shift the positive probe to connector (B). The voltmeter will indicate no voltage.



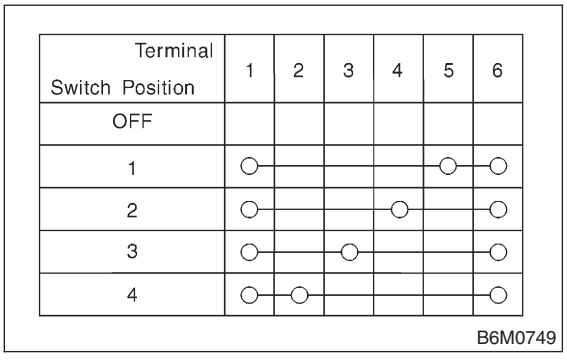
4) With test set-up held as it is, turn switch ON. The voltmeter will indicate a voltage and, at the same time, the light will come on.
5) The circuit is in good order. If a problem such as a lamp failing to light occurs, use the procedures outlined above to track down the malfunction.

2. CIRCUIT CONTINUITY CHECKS

1) Disconnect the battery terminal or connector so there is no voltage between the check points.
Contact the two leads of an ohmmeter to each of the check points.
If the circuit has diodes, reverse the two leads and check again.
2) Use an ohmmeter to check for diode continuity.
When contacting the negative lead to the diode positive side and the positive lead to the negative side, there should be continuity.
When contacting the two leads in reverse, there should be no continuity.



3) Symbol "○—○" indicates that continuity exists between two points or terminals. For example, when a switch position is "3", continuity exists among terminals 1, 3 and 6, as shown in table below.

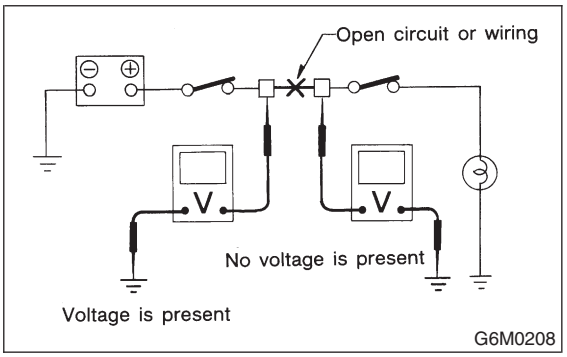


Terminal / Switch Position	1	2	3	4	5	6
OFF						
1	○				○	○
2	○			○		○
3	○		○			○
4	○	○				○

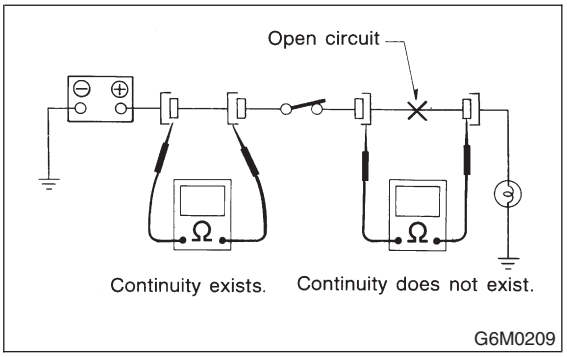
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3. HOW TO DETERMINE AN OPEN CIRCUIT

1) Voltmeter Method:
An open circuit is determined by measuring the voltage between respective connectors and ground using a voltmeter, starting with the connector closest to the power supply. The power supply must be turned ON so that current flows in the circuit. If voltage is not present between a particular connector and ground, the circuit between that connector and the previous connector is open.

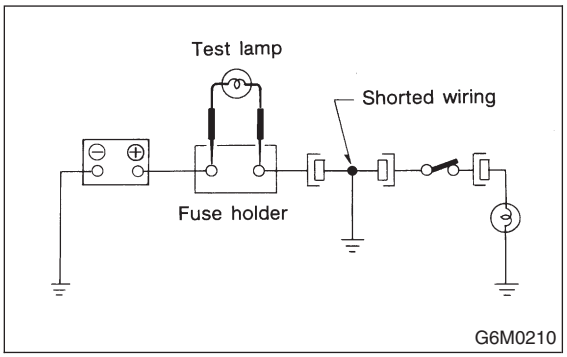


2) Ohmmeter method:
Disconnect all connectors affected, and check continuity in the wiring between adjacent connectors. When the ohmmeter indicates "infinite", the wiring is open.

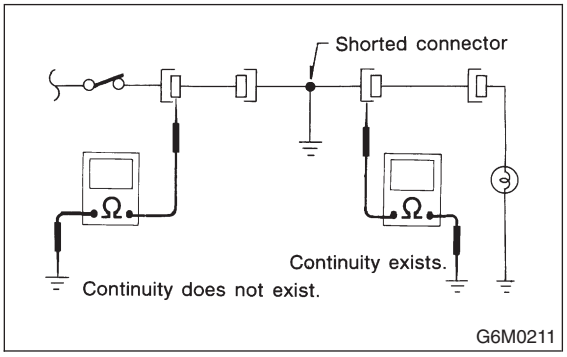


4. HOW TO DETERMINE A SHORTCIRCUIT

1) Test lamp method:
Connect a test lamp (rated at approximately 3 watts) in place of the blown fuse and allow current to flow through the circuit. Disconnect one connector at a time from the circuit, starting with the one located farthest from the power supply. If the test lamp goes out when a connector is disconnected, the wiring between that connection and the next connector (farther from the power supply) is shorted.



2) Ohmmeter method:
Disconnect all affected connectors, and check continuity between each connector and ground. When ohmmeter indicates continuity between a particular connector and ground, that connector is shorted.



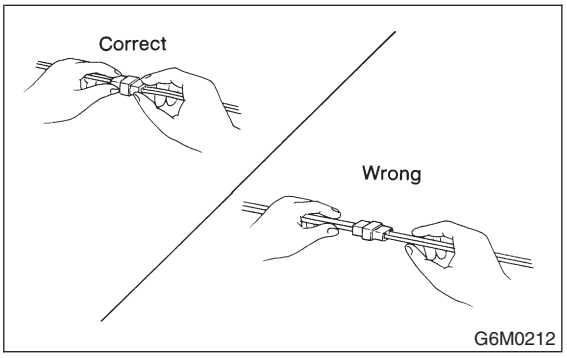
3. Working Precautions

A: PRECAUTIONS WHEN WORKING WITH THE PARTS MOUNTED ON THE VEHICLE

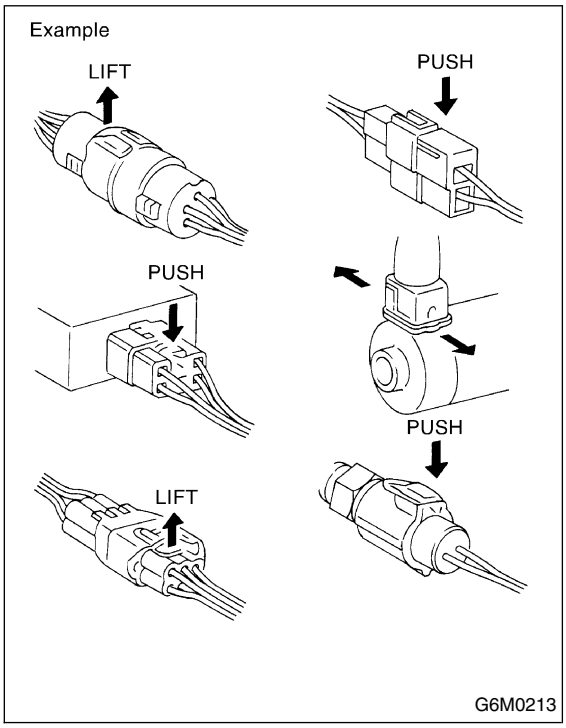
1) When working under a vehicle which is jacked-up, always be sure to use safety stands.
2) The parking brake must always be applied during working. Also, in automatic transmission vehicles, keep the select lever set to the P (Parking) range.
3) Be sure the workshop is properly ventilated when running the engine. Further, be careful not to touch the belt or fan while the engine is operating.
4) Be careful not to touch hot metal parts, especially the radiator and exhaust system immediately after the engine has been shut off.

B: PRECAUTIONS IN TROUBLE DIAGNOSIS AND REPAIR OF ELECTRIC PARTS

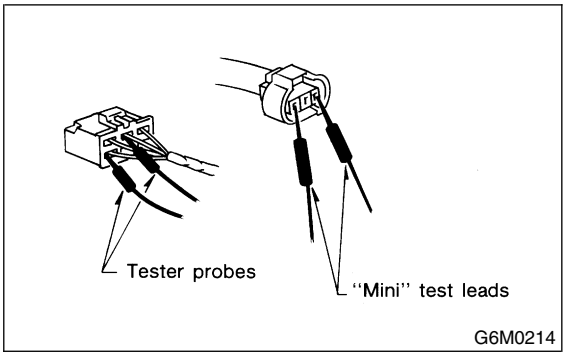
1) The battery cable must be disconnected from the battery's (–) terminal, and the ignition switch must be set to the OFF position, unless otherwise required by the diagnostics.
2) Securely fasten the wiring harness with clamps and slips so that the harness does not interfere with the body end parts or edges and bolts or screws.
3) When installing parts, be careful not to catch them on the wiring harness.
4) When disconnecting a connector, do not pull the wires, but pull while holding the connector body.



5) Some connectors are provided with a lock. One type of such a connector is disconnected by pushing the lock, and the other, by moving the lock up. In either type the lock shape must be identified before attempting to disconnect the connector.
To connect, insert the connector until it snaps and confirm that it is tightly connected.

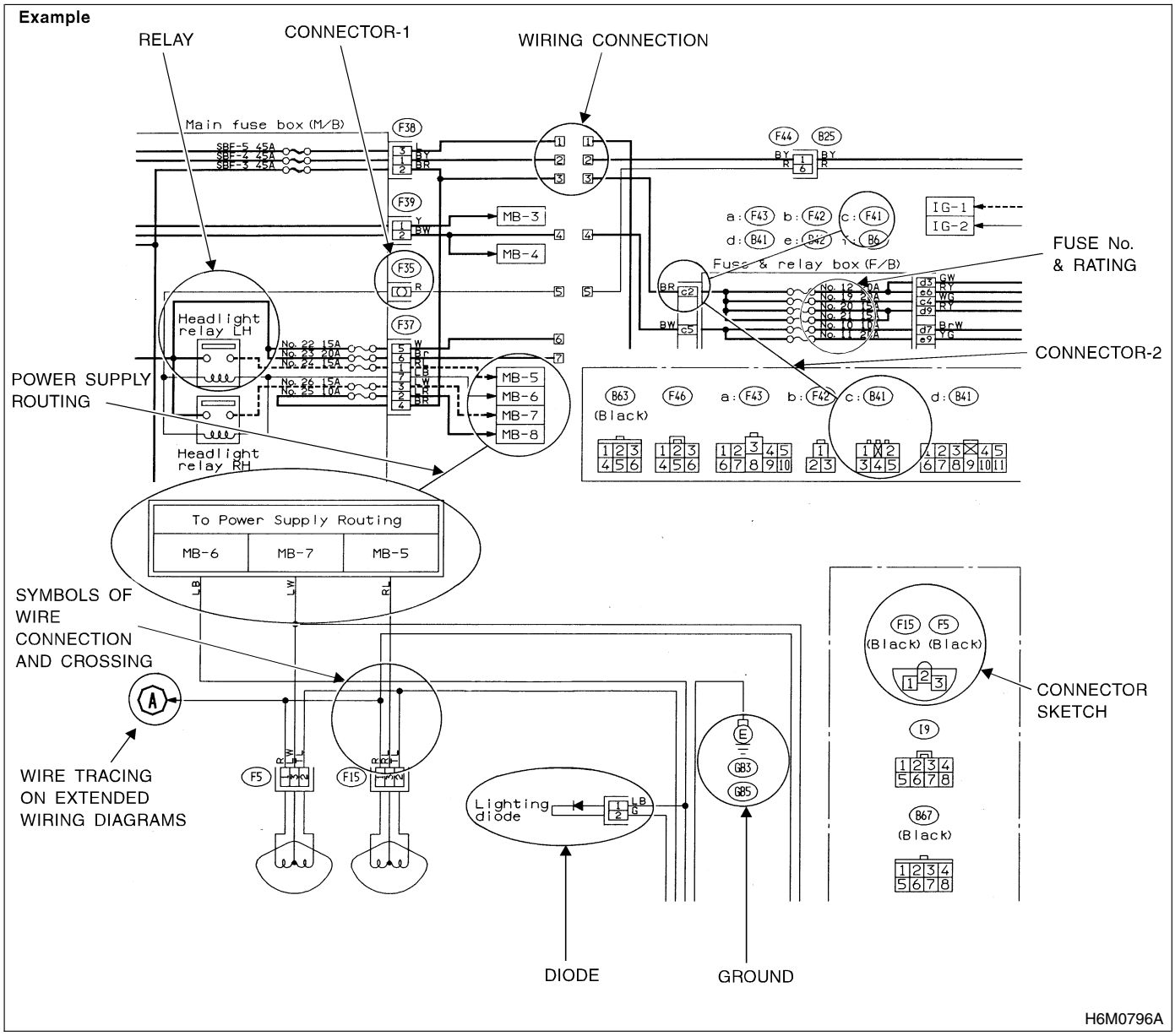


6) When checking continuity between connector terminals, or measuring voltage across the terminal and ground, always contact tester probe(s) on terminals from the wiring connection side. If the probe is too thick to gain access to the terminal, use “mini” test leads.
To check water-proof connectors (which are not accessible from the wiring side), contact test probes on the terminal side being careful not to bend or damage the terminals.



7) Sensors, relays, electrical unit, etc., are sensitive to strong impacts.
Handle them with care so that they are not dropped or mishandled.

4. How to Use Wiring Diagram



A: RELAY

A symbol used to indicate a relay.

B: CONNECTOR-1

The sketch of the connector indicates the one-pole types.

C: WIRING CONNECTION

Some wiring diagrams are indicated in foldouts for convenience. Wiring destinations are indicated where necessary by corresponding symbols (as when two pages are needed for clear indication).

D: FUSE No. & RATING

The “FUSE No. & RATING” corresponds with that used in the fuse box (main fuse box, fuse and joint box).

E: CONNECTOR-2

- Each connector is indicated by a symbol.
- Each terminal number is indicated in the corresponding wiring diagram in an abbreviated form.
- For example, terminal number “C2” refers to No. 2 terminal of connector (C: F41) shown in the connector sketch.

F: CONNECTOR SKETCH

● Each connector sketch clearly identifies the shape and color of a connector as well as terminal locations. Non-colored connectors are indicated in natural color.
● When more than two types of connector number are indicated in a connector sketch, it means that the same type connectors are used.

G: GROUND

Each grounding point can be located easily by referring to the corresponding wiring harness.

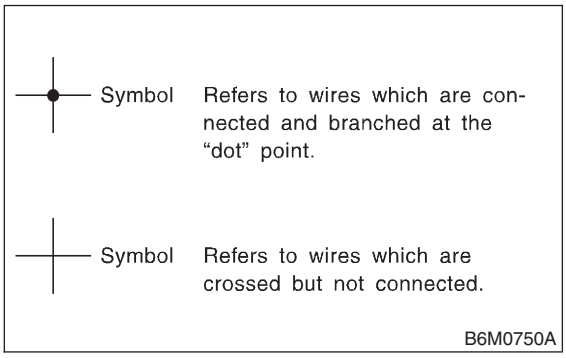
H: DIODE

A symbol is used to indicate a diode.

I: WIRE TRACING ON EXTENDED WIRING DIAGRAMS

For a wiring diagram extending over at least two pages, a symbol (consisting of the same characters with arrows), facilitates wire tracing from one page to the next.
A ←→ A, B ←→ B

J: SYMBOLS OF WIRE CONNECTION AND CROSSING



K: POWER SUPPLY ROUTING

A symbol is used to indicate the power supply in each wiring diagram.
"MB-5", "MB-6", etc., which are used as power-supply symbols throughout the text, correspond with those shown in the POWER SUPPLY ROUTING in the wiring diagram.
Accordingly, using the POWER SUPPLY ROUTING and wiring diagrams permits service personnel to understand the entire electrical arrangement of a system.

L: SYMBOLS AND ABBREVIATIONS

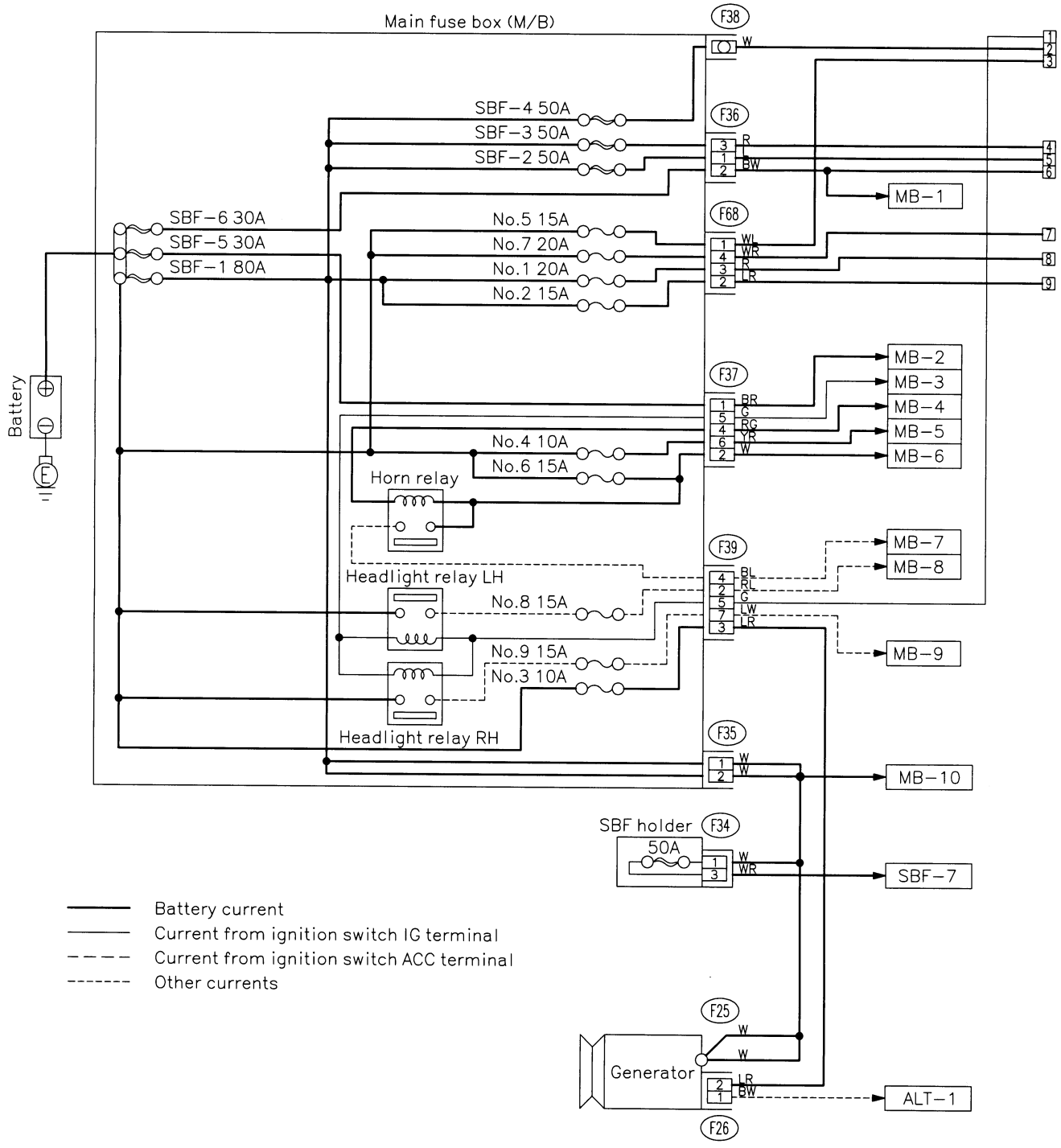
A number of symbols and abbreviations are used in each wiring diagram to easily identify parts or circuits.

M: ABBREVIATION LIST

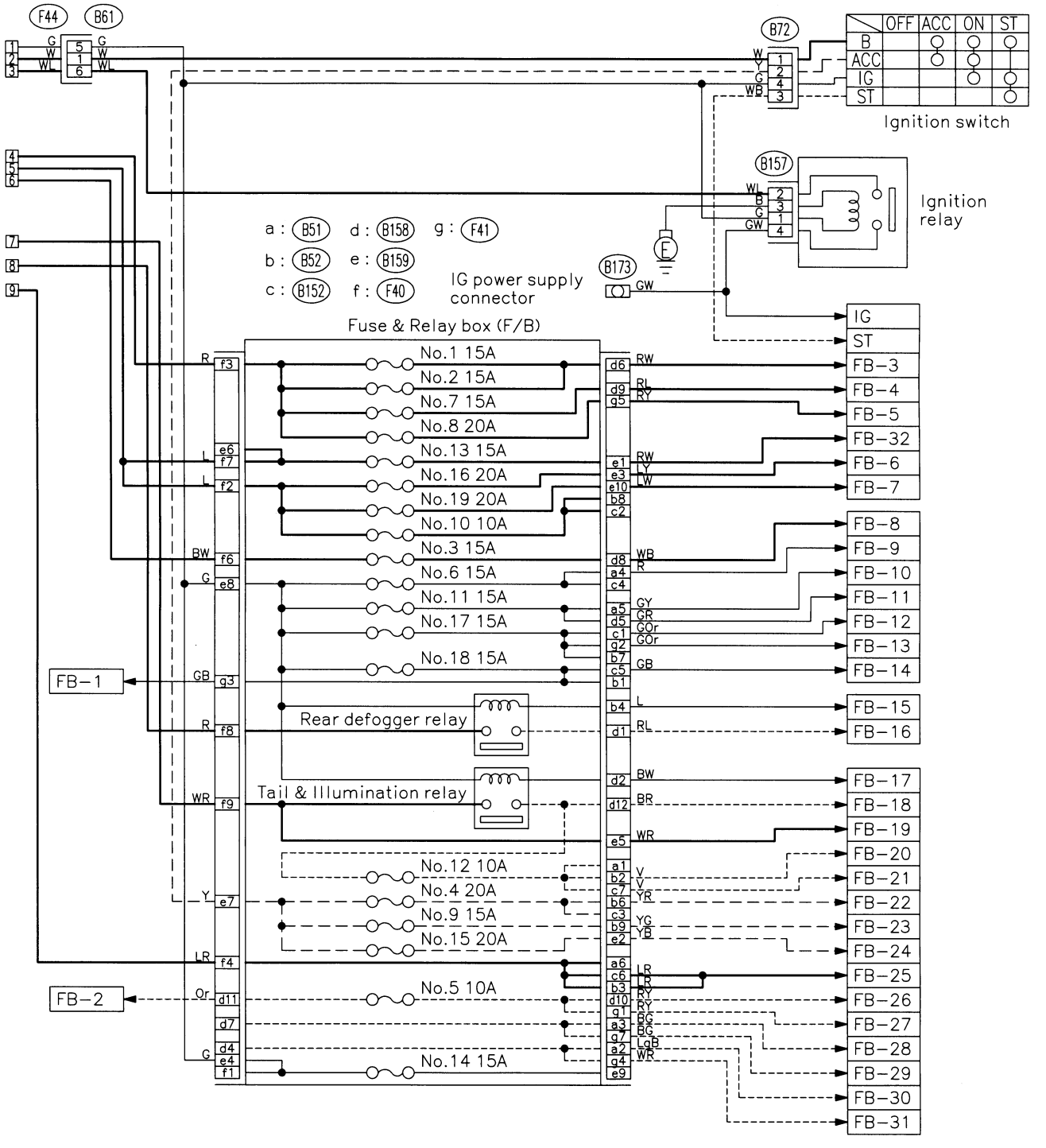
Abbr.	Full name
ABS	Antilock Brake System
ACC	Accessory
A/C	Air Conditioning
AD	Auto Down
AT	Automatic Transmission
AU	Auto Up
+B	Battery
DN	Down
E	Ground
F/B	Fuse & Joint Box
FL1.5	Fusible link 1.5 mm^2
IG	Ignition
Illumi.	Illumination
LH	Left Hand
Lo	Low
M	Motor
M/B	Main Fuse Box
MG	Magnet
Mi	Middle
OP	Optional Parts
PASS	Passing
RH	Right Hand
SBF	Slow Blow Fuse
ST	Starter
SW	Switch
UP	Up
WASH	Washer

5. Wiring Diagram

A: POWER SUPPLY ROUTING



SU01−03A



B72 (Blue) c : B152 b : B52 (Blue)

B61 B157 (Red) g : F41 (Gray) a : B51 (Blue) f : F40 (Brown) e : B159 (Gray) d : B158

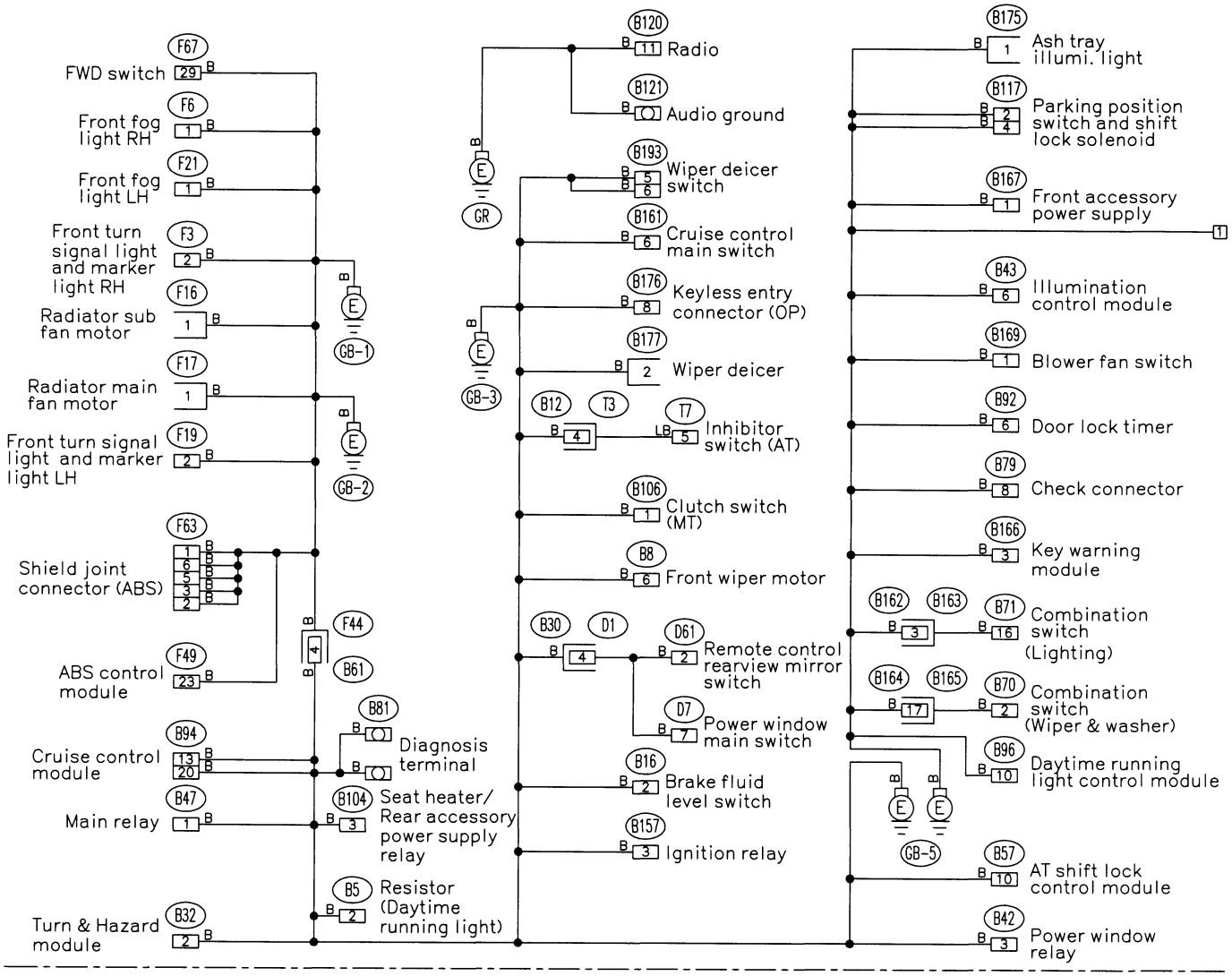
SU01-03B

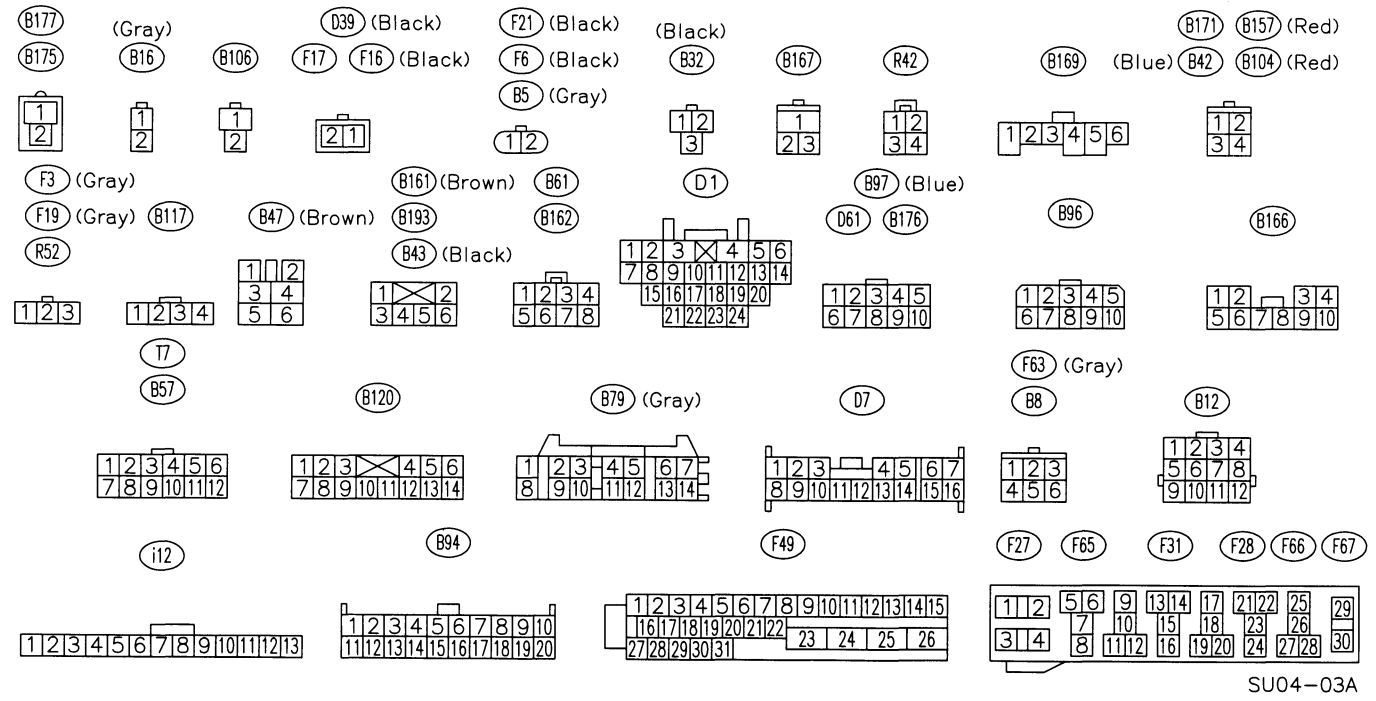
No.	Load
MB-1	Power window circuit breaker
MB-2	Data link connector Engine control module Fuel pump relay Main relay OBD-II service connector
MB-3	Diode (Daytime running light) (Daytime running light control module) Lighting switch
MB-4	Cruise control sub switch Horn switch
MB-5	Transmission control module
MB-6	AT shift lock control module Hazard switch Key warning switch
MB-7	Horn
MB-8	Headlight LH
MB-9	Combination meter Front fog light relay Front fog light switch Headlight RH
MB-10	A/C relay holder
SBF-7	ABS control module
ALT-1	Combination meter Daytime running light control module
IG	Check connector Combination meter Hazard switch Key warning module Mirror heater LH Mirror heater RH Mirror heater condenser Power window relay Vehicle speed sensor
ST	Engine control module Inhibitor switch (AT) Starter interlock relay (MT)
FB-1	ABS control module Main fan relay
FB-2	Parking switch
FB-3	Blower motor relay
FB-4	Front fog light relay
FB-5	ABS control module
FB-6	Stop light switch
FB-7	Seat heater/rear accessory power supply relay
FB-8	Door lock timer Keyless entry control module
FB-9	Airbag control module
FB-10	Airbag control module
FB-11	Engine control module Fuel pump relay Ignition coil Transmission control module

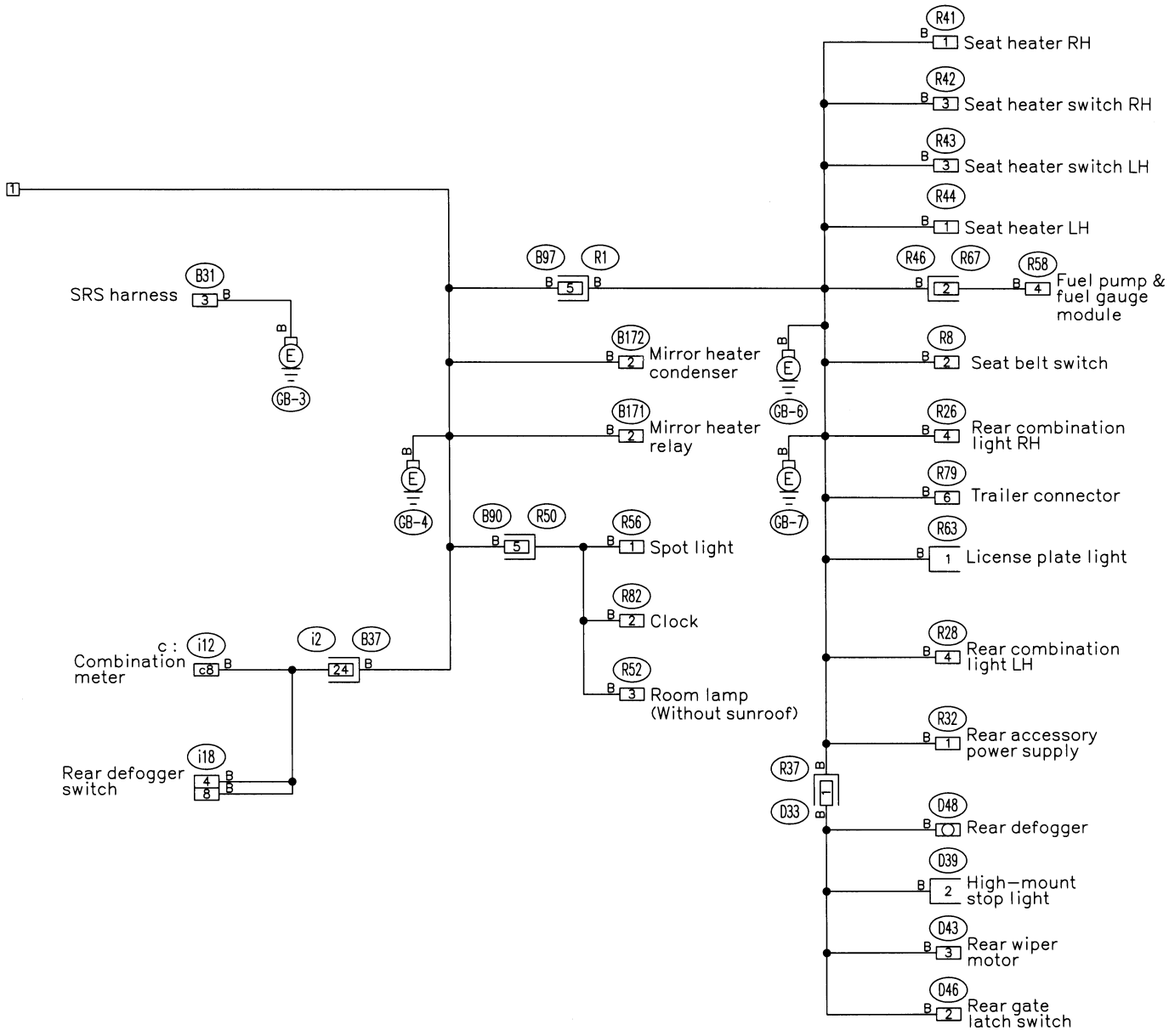
No.	Load
FB-12	Blower motor relay Mode control panel Rear defogger switch
FB-13	A/C relay Sub fan relay Thermal protector
FB-14	AT shift lock control module Back-up light switch (MT) Cruise control main switch Cruise control module Daytime running light control module Daytime running light relay Hi-beam relay Inhibitor switch (AT) Keyless entry control module Wiper deicer relay Wiper deicer timer
FB-15	Rear defogger switch
FB-16	Mirror heater relay Rear defogger Rear defogger switch
FB-17	Lighting switch
FB-18	Front fog light switch Parking switch
FB-19	Keyless entry control module Parking switch
FB-20	Illumination light Illumination control module Keyless entry control module
FB-21	Illumination light Illumination control module Keyless entry control module
FB-22	AT shift lock control module Front accessory power supply Remote control rearview mirror switch Seat heater/rear accessory power supply relay
FB-23	Clock Noise killer Radio
FB-24	Front washer motor Front wiper motor Front wiper & washer switch Rear washer motor Rear wiper motor Rear wiper relay
FB-25	Clock Combination meter Luggage room light Radio Room light Spot light Trailer connector
FB-26	License plate light Tail light LH Tail light RH Trailer connector

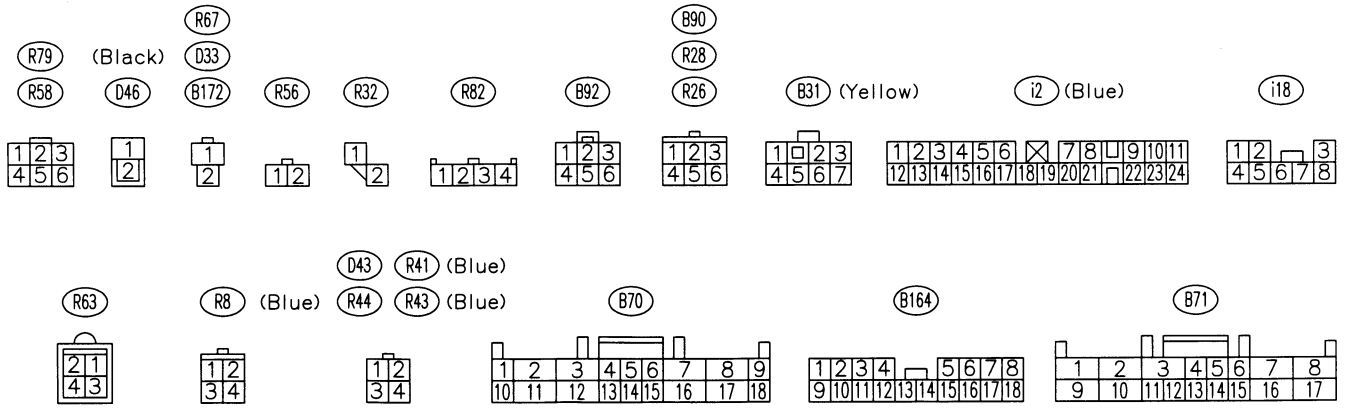
No.	Load
FB-27	Front clearance light LH Front clearance light RH
FB-28	Combination meter Hazard switch Rear turn signal light LH Trailer connector Turn signal switch
FB-29	Front turn signal light LH
FB-30	Combination meter Hazard switch Rear turn signal light RH Trailer connector Turn signal switch
FB-31	Front turn signal light RH
FB-32	Wiper deicer relay

B: GROUND DISTRIBUTION



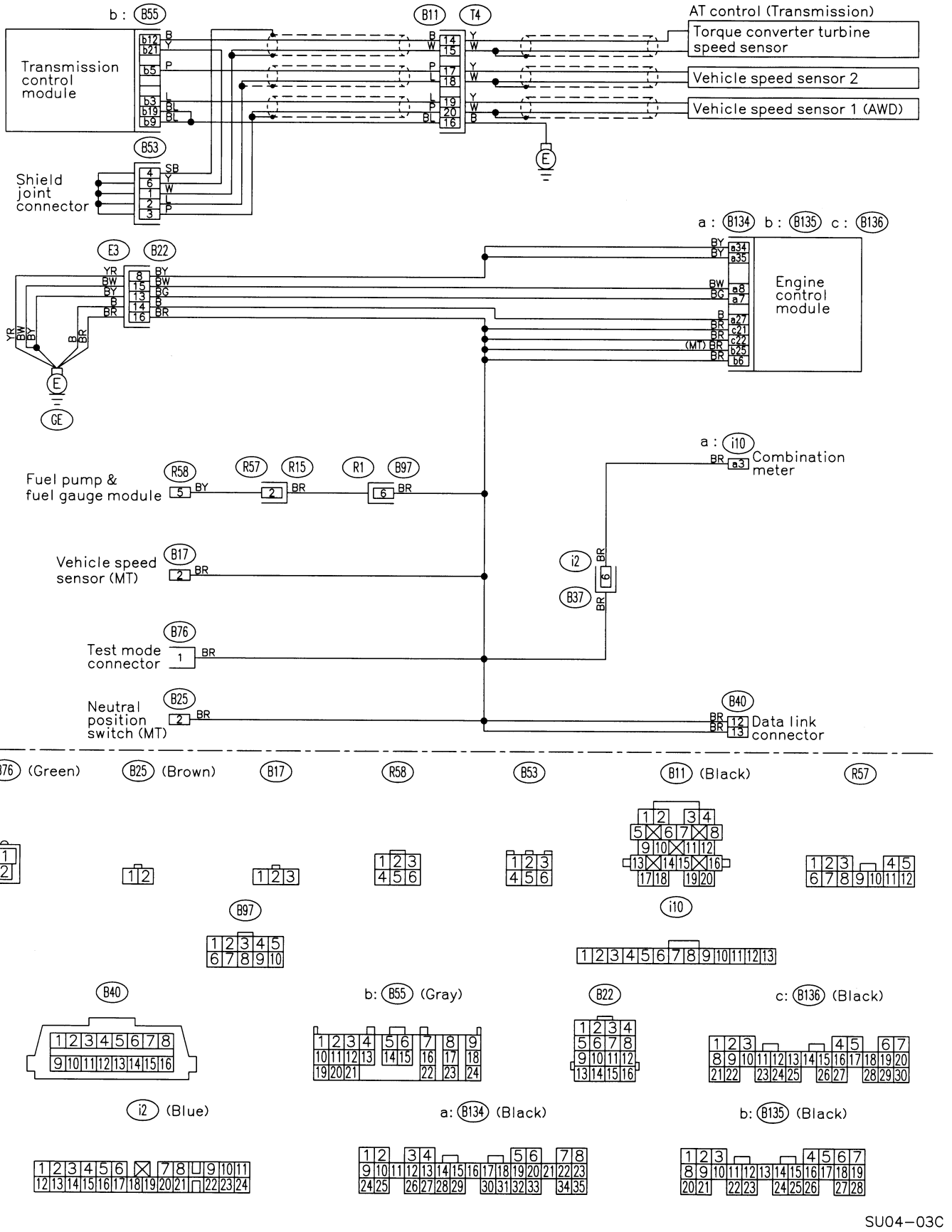



R41
Seat heater RH
R42
Seat heater switch RH
R43
Seat heater switch LH
R44
Seat heater LH
B97
R1
R46
R67
R58
Fuel pump & fuel gauge module
SRS harness
B31
GB-3
B172
Mirror heater condenser
R8
Seat belt switch
GB-6
B171
Mirror heater relay
R26
Rear combination light RH
GB-4
GB-7
R79
Trailer connector
B90
R50
R56
Spot light
R63
License plate light
R82
Clock
c : Combination meter
i12
i2
B37
R28
Rear combination light LH
R52
Room lamp (Without sunroof)
R32
Rear accessory power supply
Rear defogger switch
i18
R37
D33
D48
Rear defogger
D39
High-mount stop light
D43
Rear wiper motor
D46
Rear gate latch switch


R79
(Black)
R67
D33
R58
D46
B172
R56
R32
R82
B92
B90
R28
R26
B31
(Yellow)
i2
(Blue)
i18
R63
R8
(Blue)
D43
R41
(Blue)
R44
R43
(Blue)
B70
B164
B71

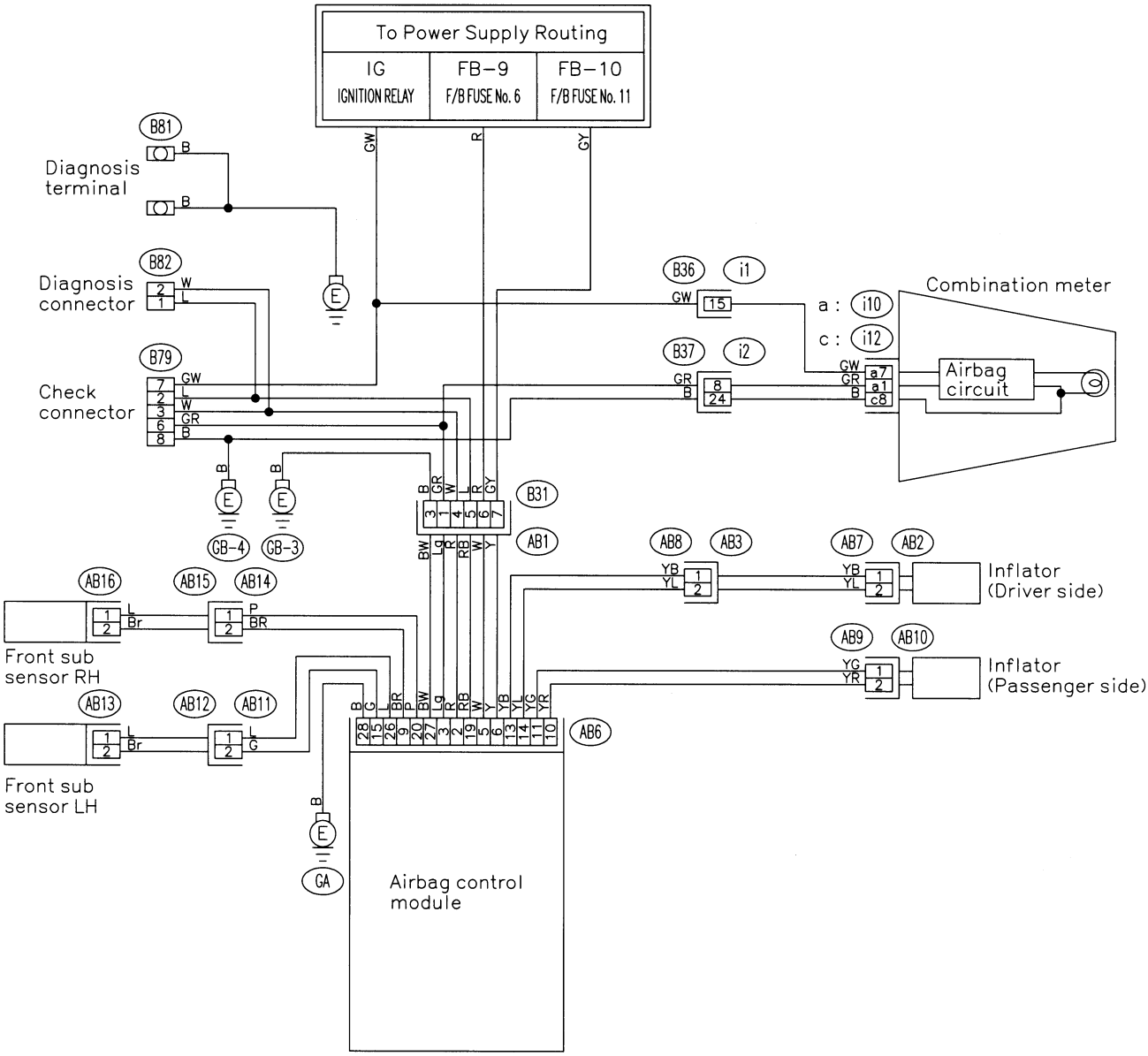
SU04-03B

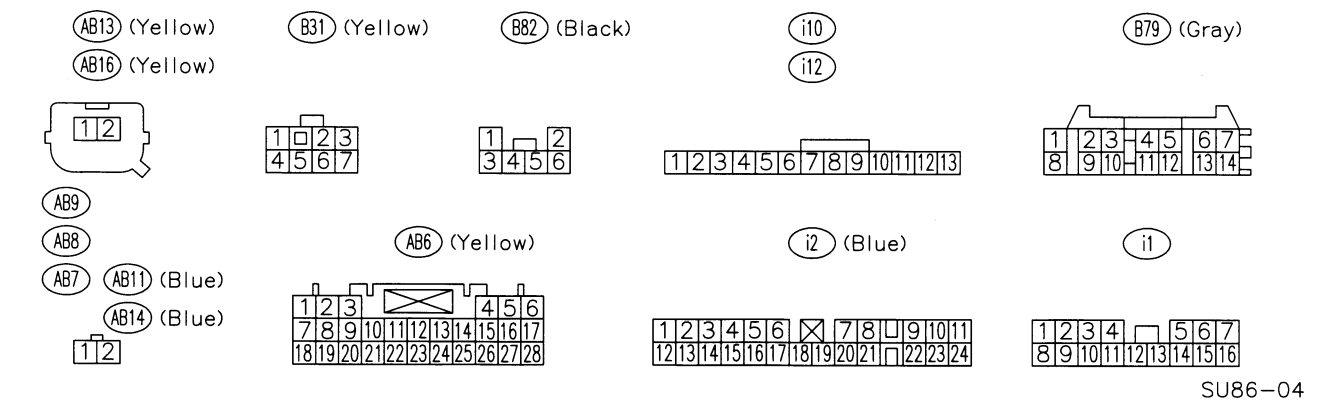
WIRING DIAGRAM



SU04–03C

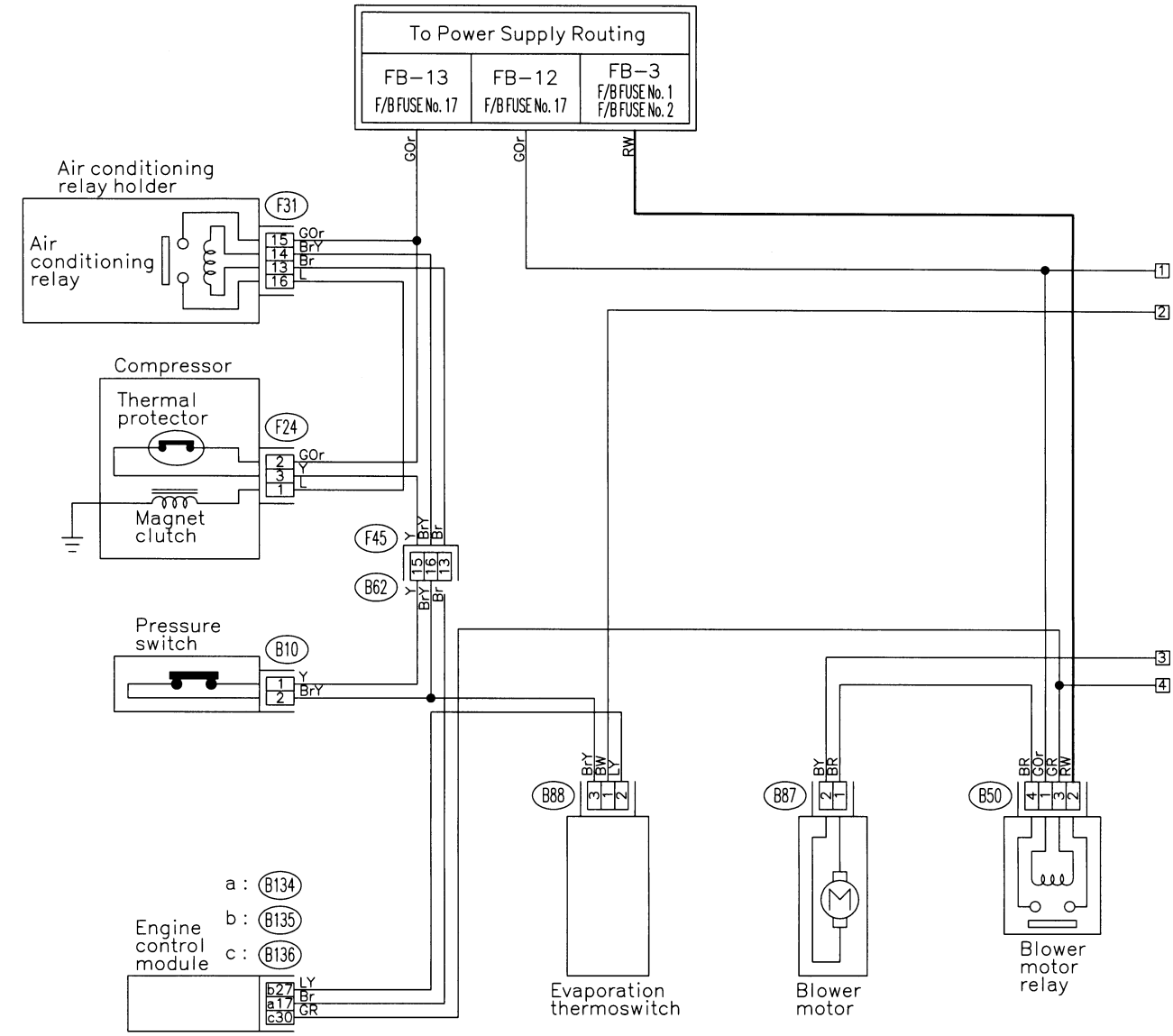
C: AIRBAG SYSTEM

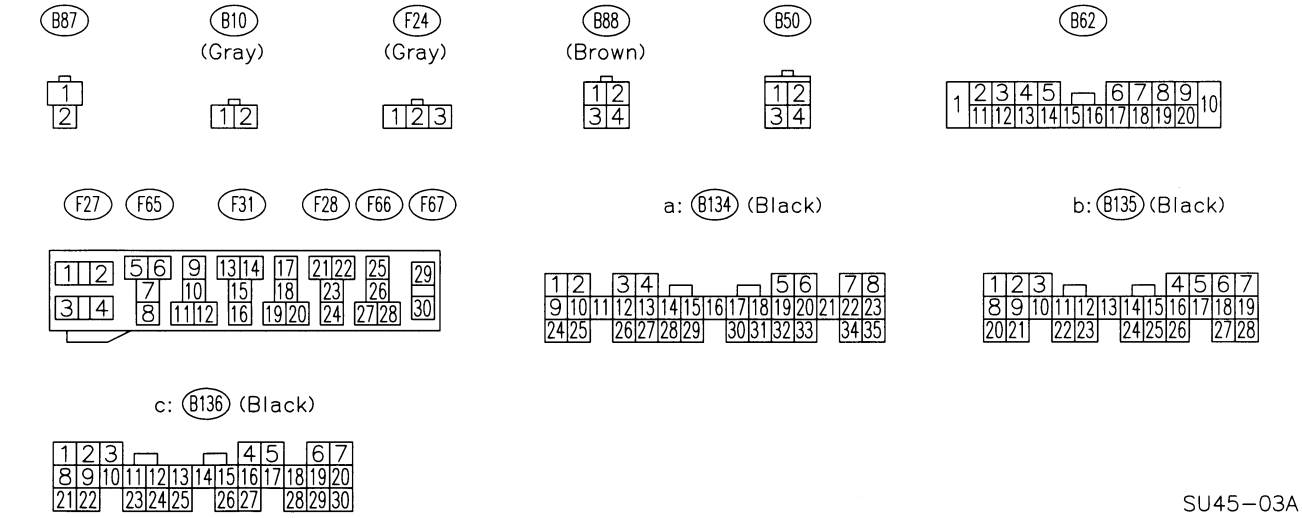




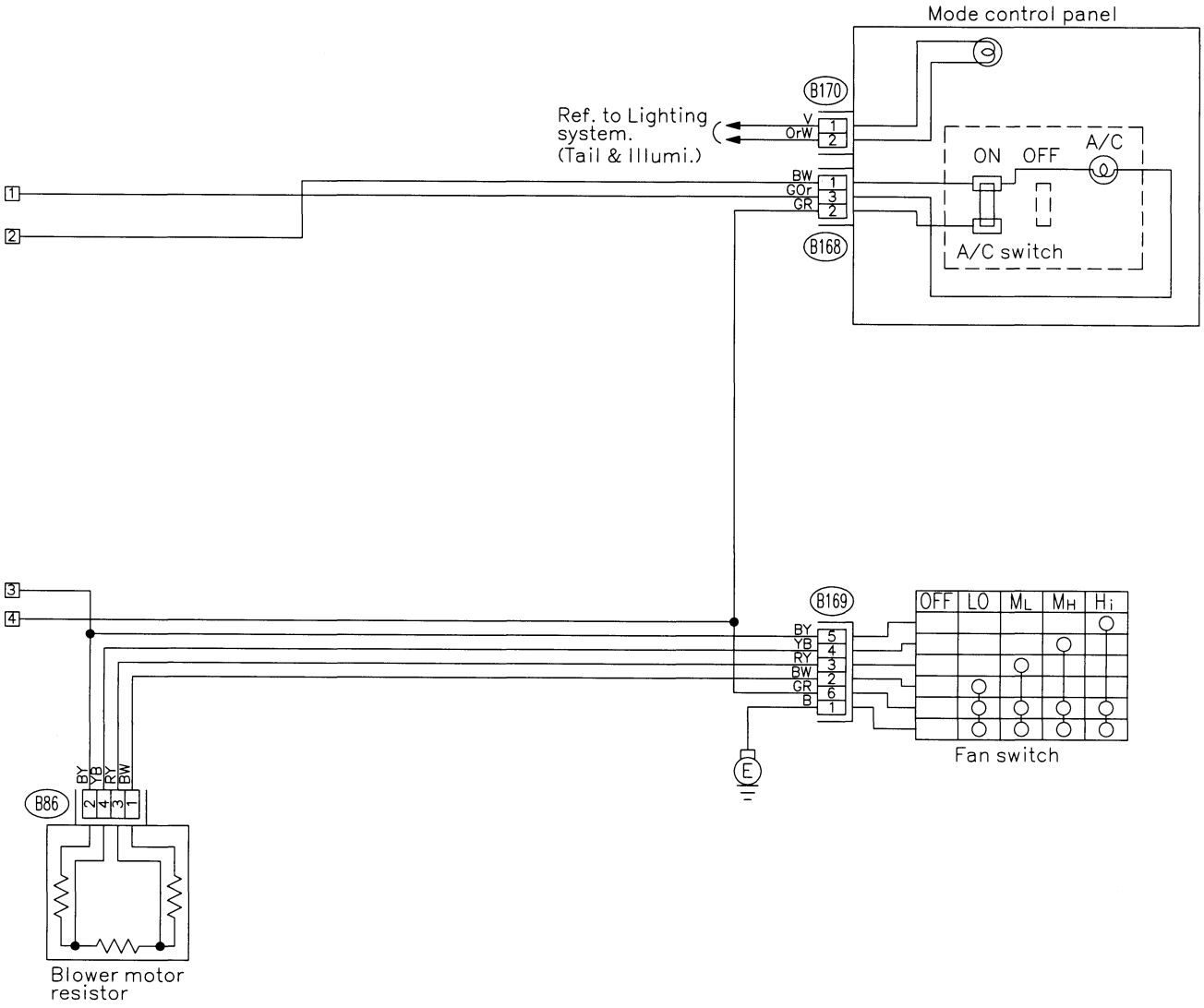
SU86−04

D: AIR CONDITIONING SYSTEM





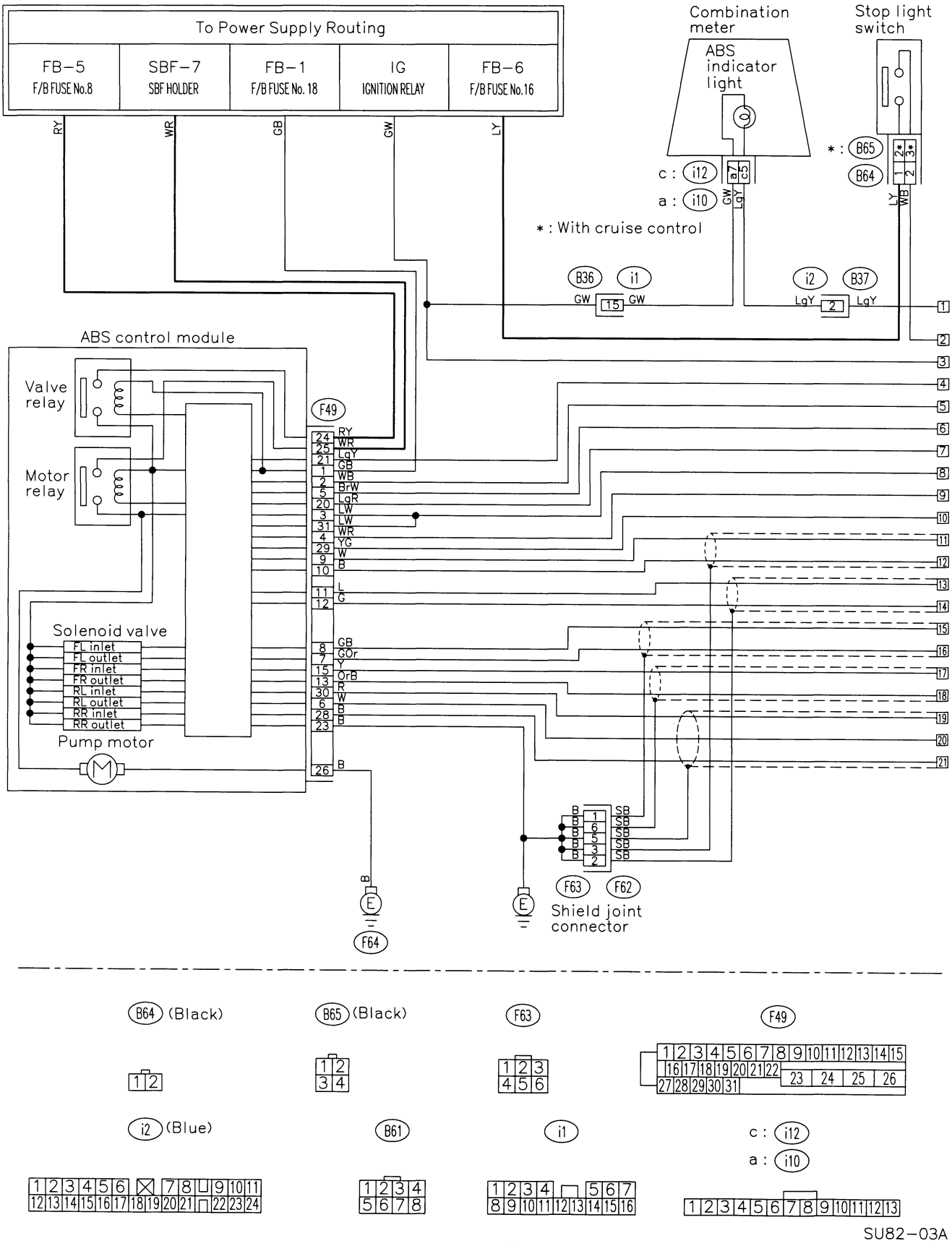
SU45−03A


Mode control panel
B170
Ref. to Lighting system. (Tail & Illumi.)
V
OrW
1
2
BW
GOr
GR
3
B168
ON
OFF
A/C
A/C switch
1
2
3
4
B169
BY
YB
RY
BW
GR
B
5
6
OFF
LO
ML
MH
Hi
Fan switch
E
B86
Blower motor resistor

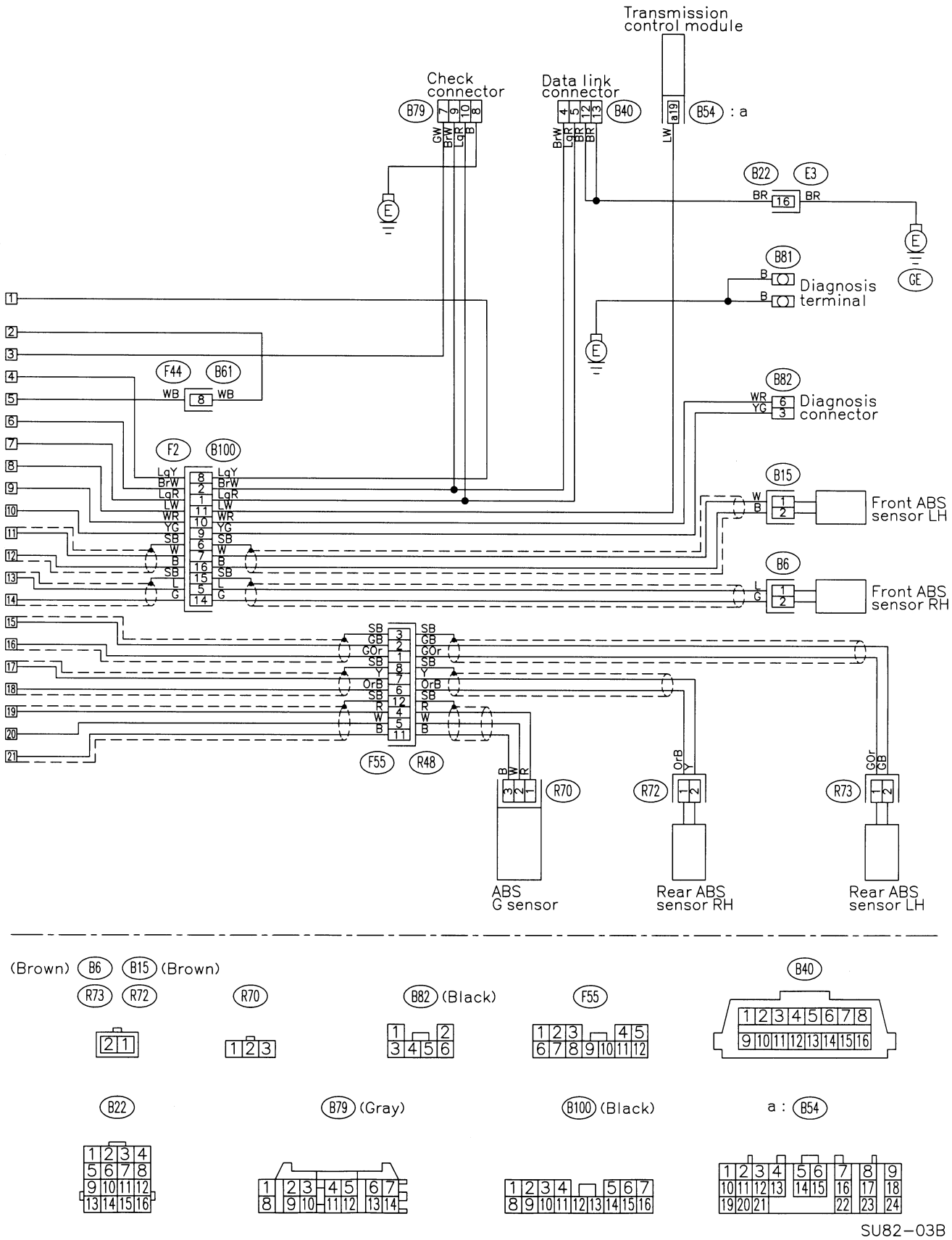

B170
1 2
B168
1 2 3
B86
1 2
3 4
B169
1 2 3 4 5 6

SU45–03B

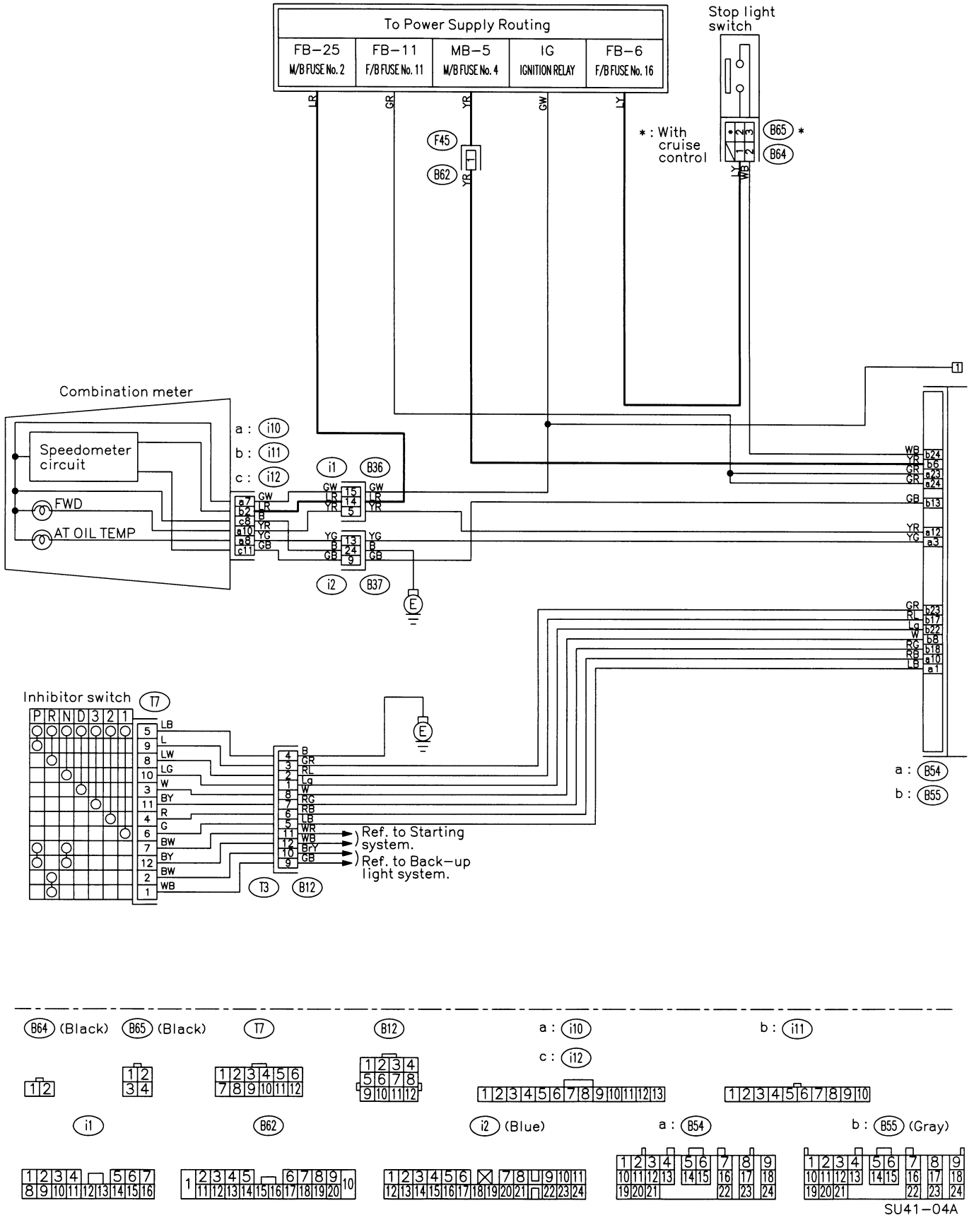
E: ANTI-LOCK BRAKE SYSTEM

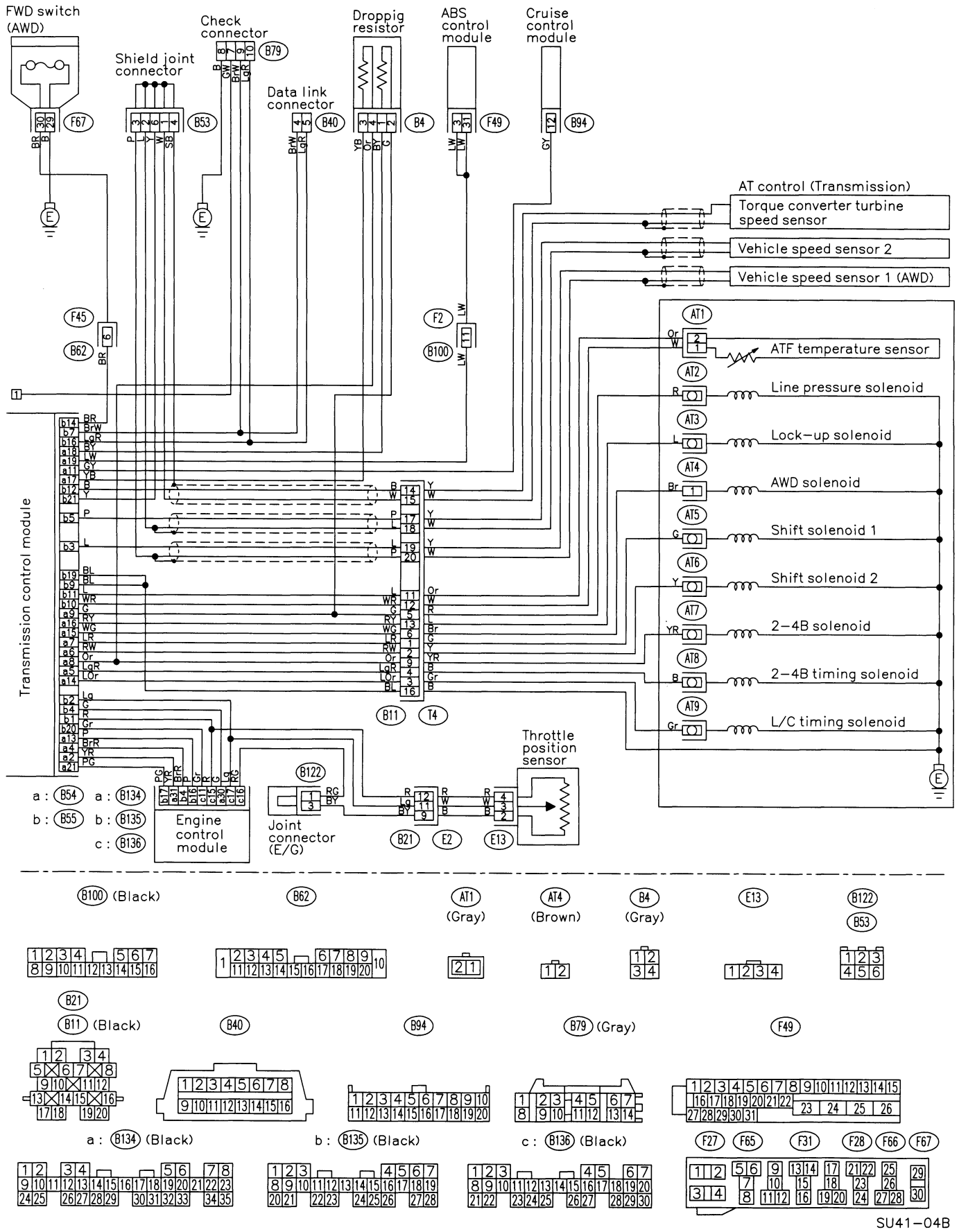


SU82−03A


Transmission control module
Check connector
Data link connector
B79
B40
B54 : a
B22
E3
B81
Diagnosis terminal
GE
F44
B61
B82
Diagnosis connector
F2
B100
B15
Front ABS sensor LH
B6
Front ABS sensor RH
F55
R48
R70
R72
R73
ABS G sensor
Rear ABS sensor RH
Rear ABS sensor LH
(Brown) B6 B15 (Brown)
R73 R72
R70
B82 (Black)
F55
B40
B22
B79 (Gray)
B100 (Black)
a : B54
SU82-03B

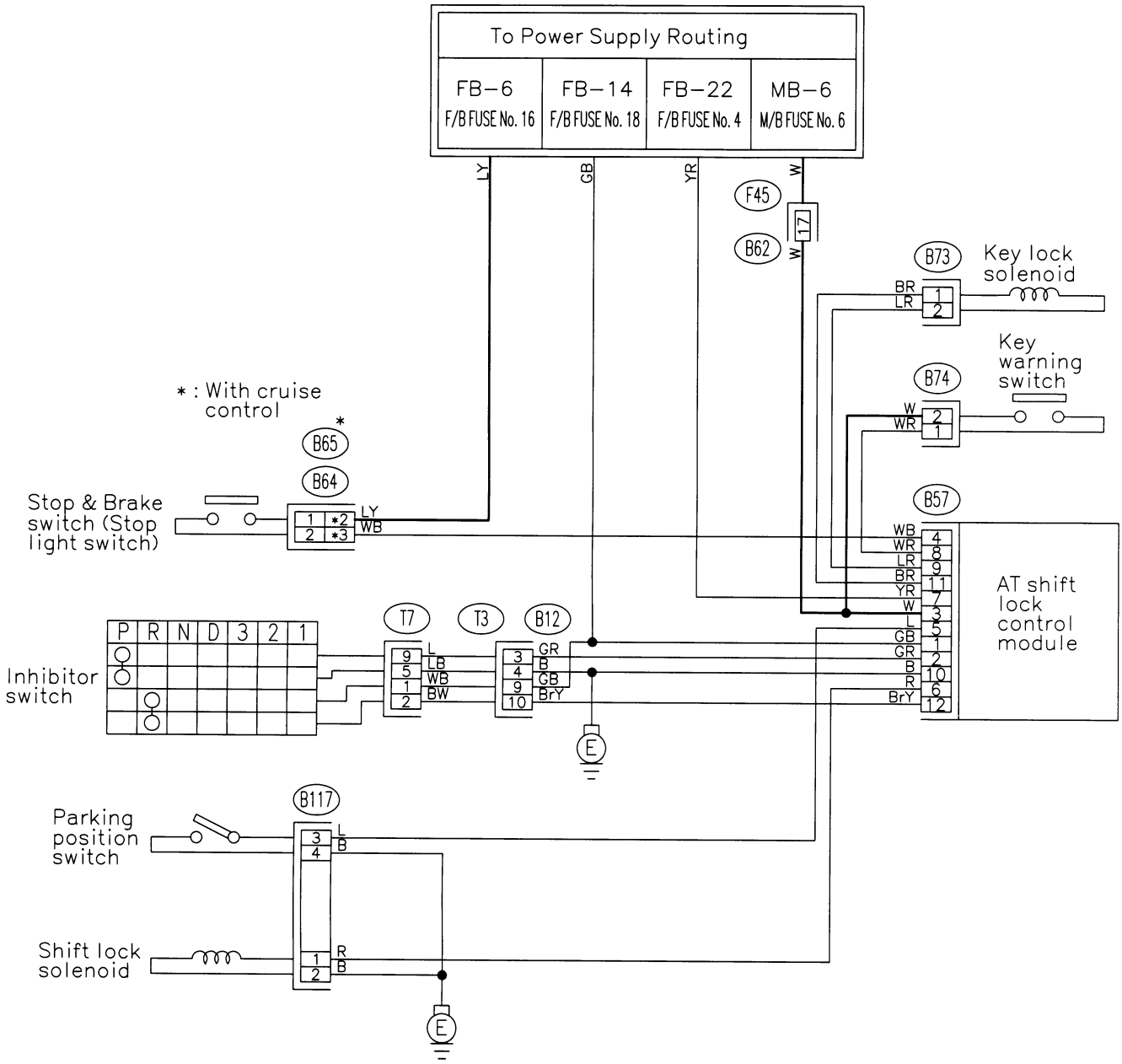
F: A/T CONTROL SYSTEM

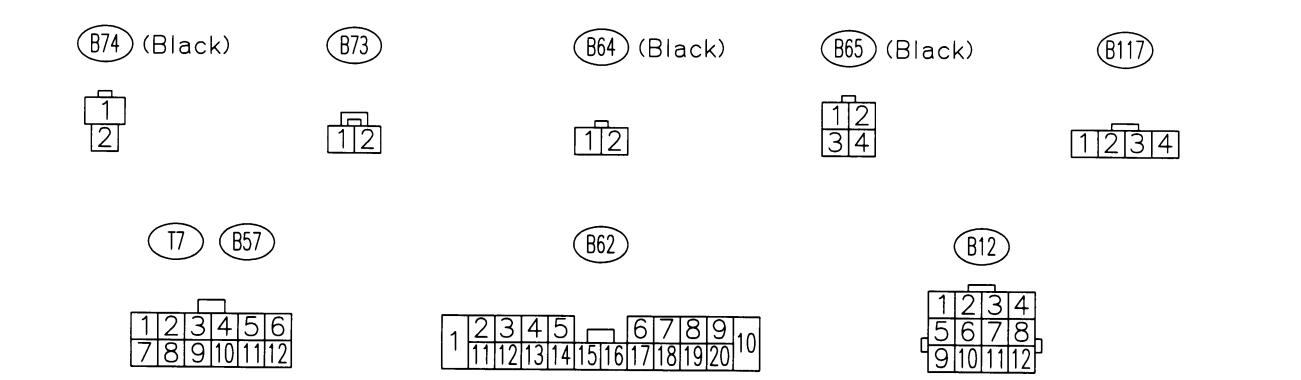



FWD switch (AWD)
Shield joint connector
Check connector
Data link connector
Droppig resistor
ABS control module
Cruise control module
AT control (Transmission)
Torque converter turbine speed sensor
Vehicle speed sensor 2
Vehicle speed sensor 1 (AWD)
ATF temperature sensor
Line pressure solenoid
Lock–up solenoid
AWD solenoid
Shift solenoid 1
Shift solenoid 2
2–4B solenoid
2–4B timing solenoid
L/C timing solenoid
Transmission control module
Engine control module
Joint connector (E/G)
Throttle position sensor
(Black)
(Gray)
(Brown)
(Gray)
(Black)
(Black)
(Black)
(Gray)

SU41–04B

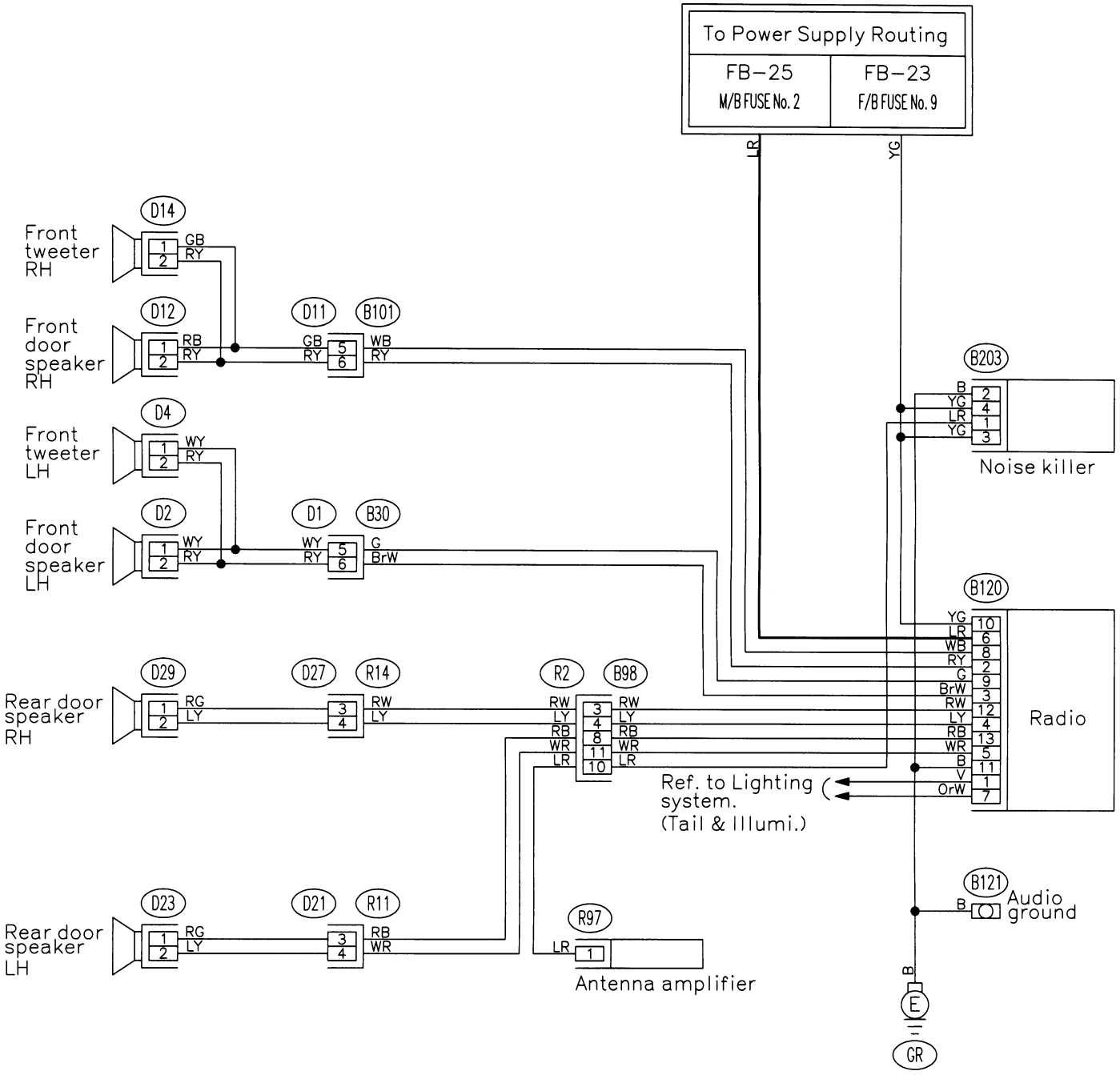
G: A/T SHIFT LOCK SYSTEM

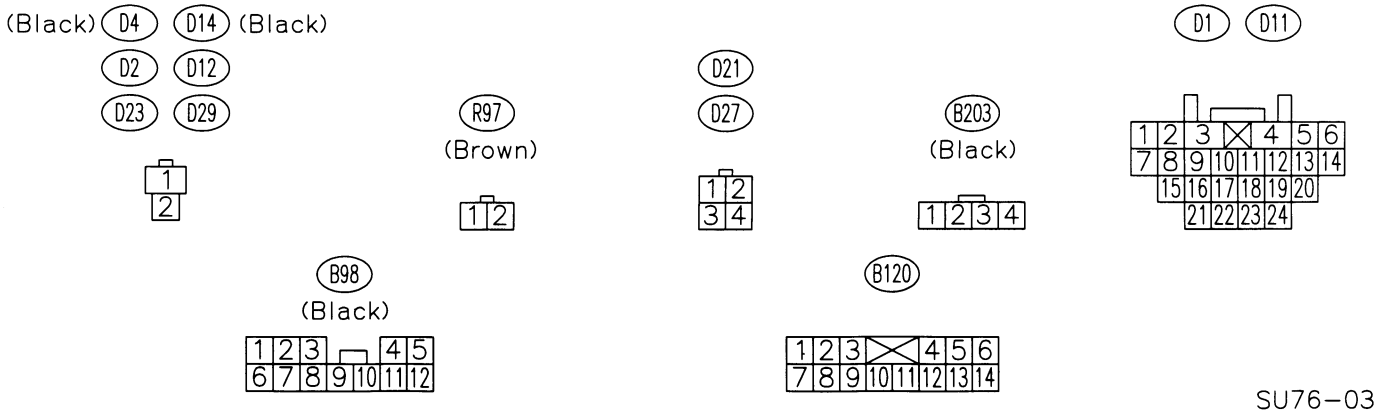




SU42−04

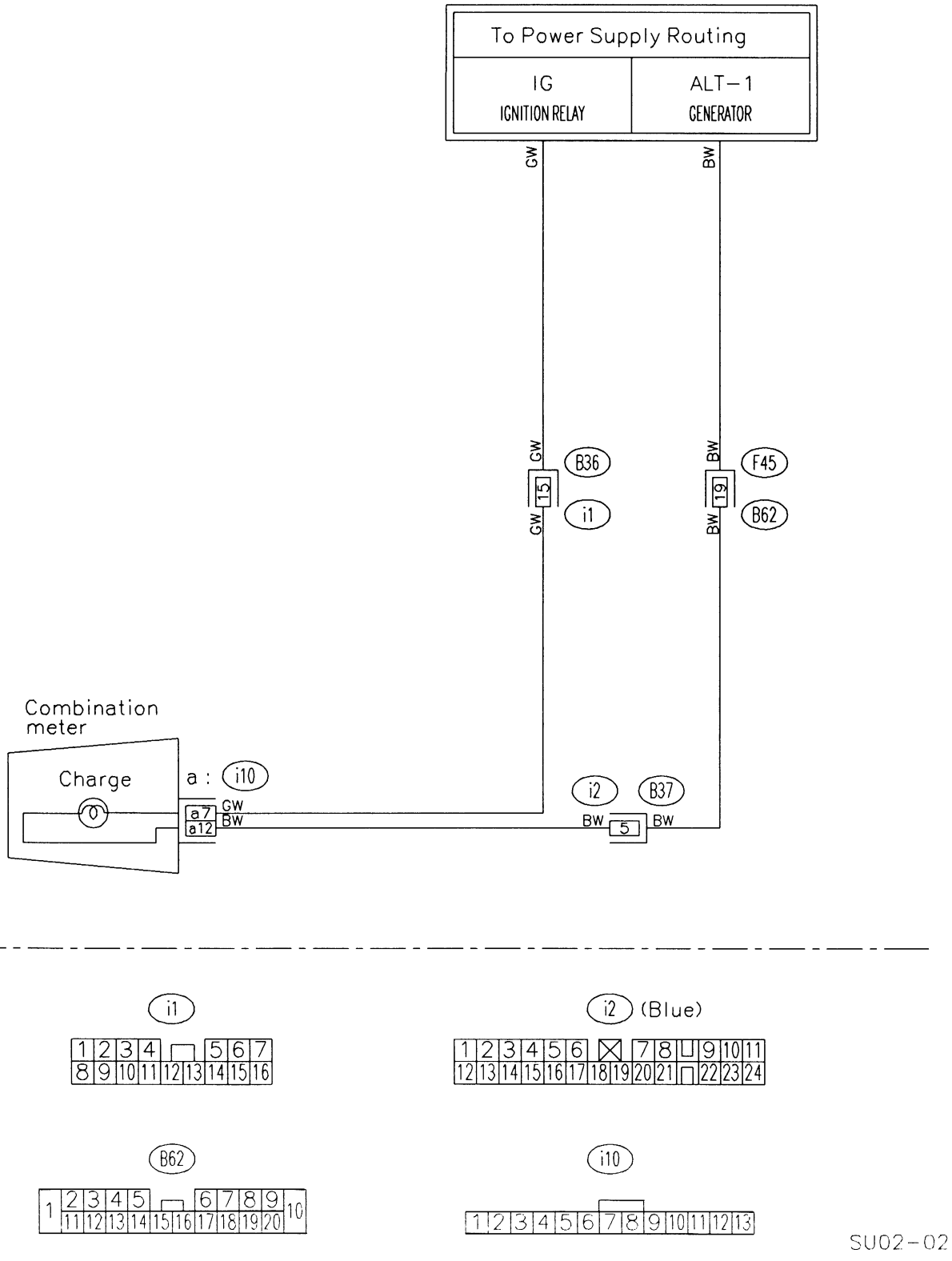
H: AUDIO SYSTEM



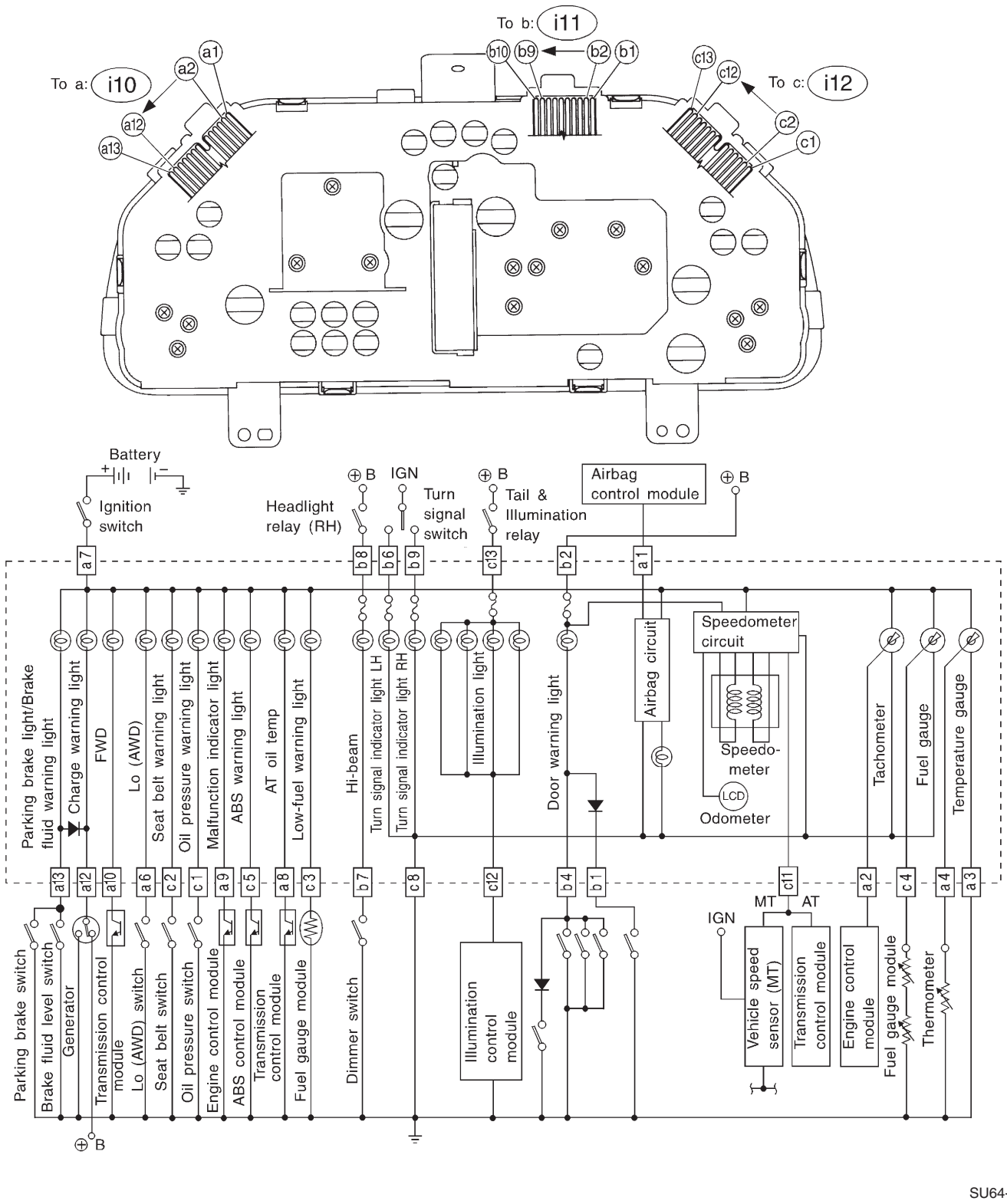


SU76−03

I: CHARGING SYSTEM

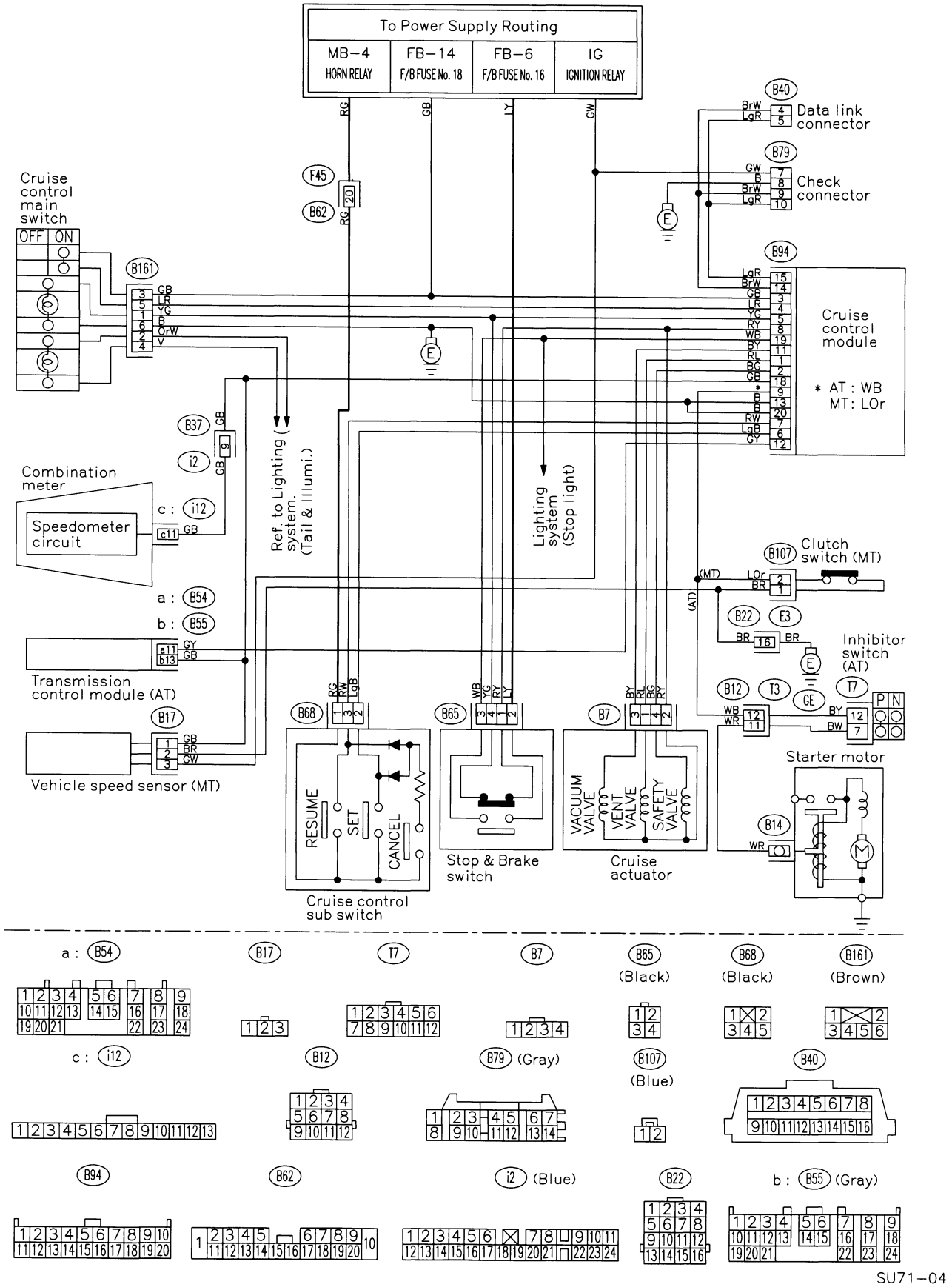


J: COMBINATION METER



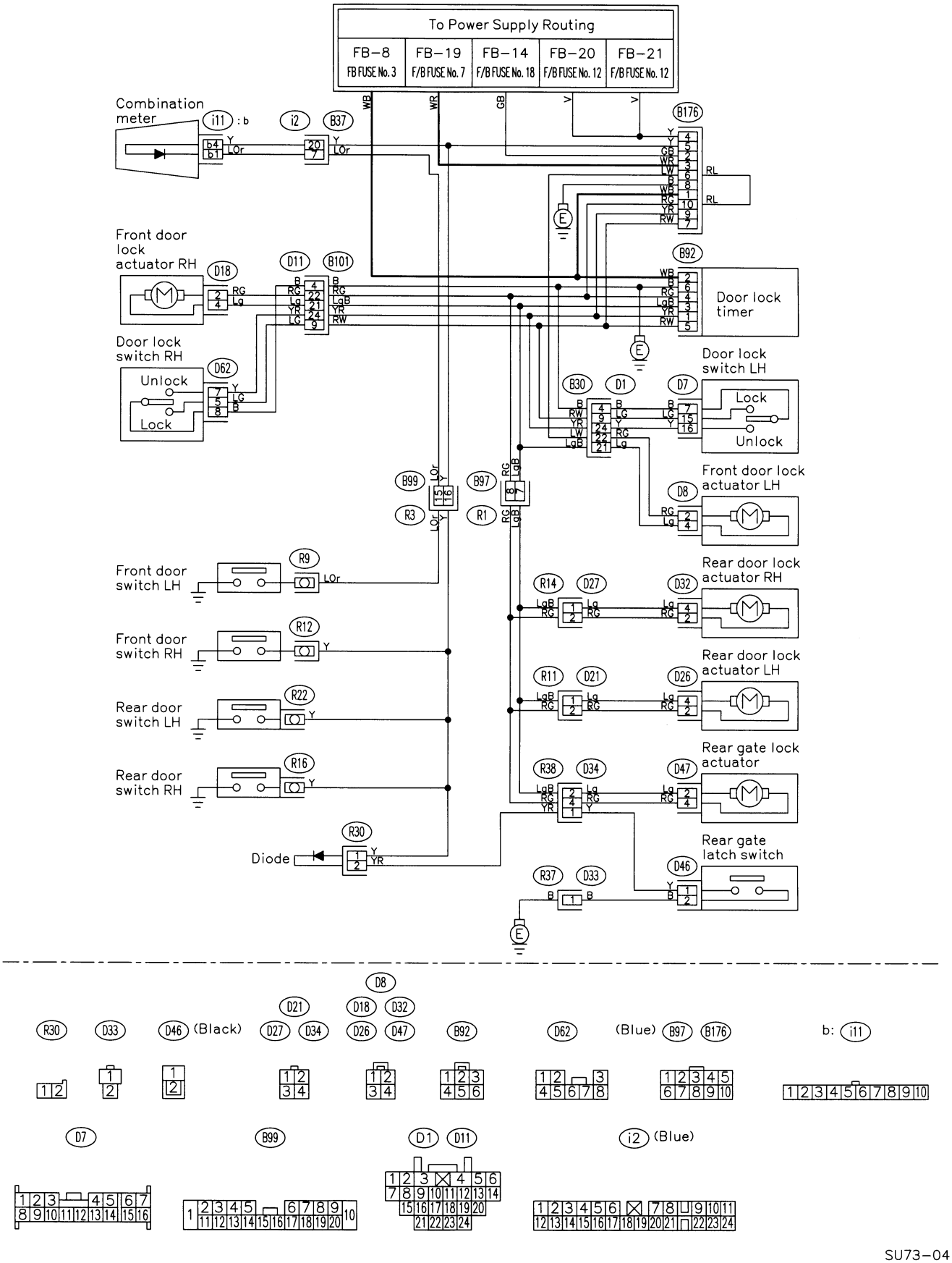
SU64-02

K: CRUISE CONTROL SYSTEM



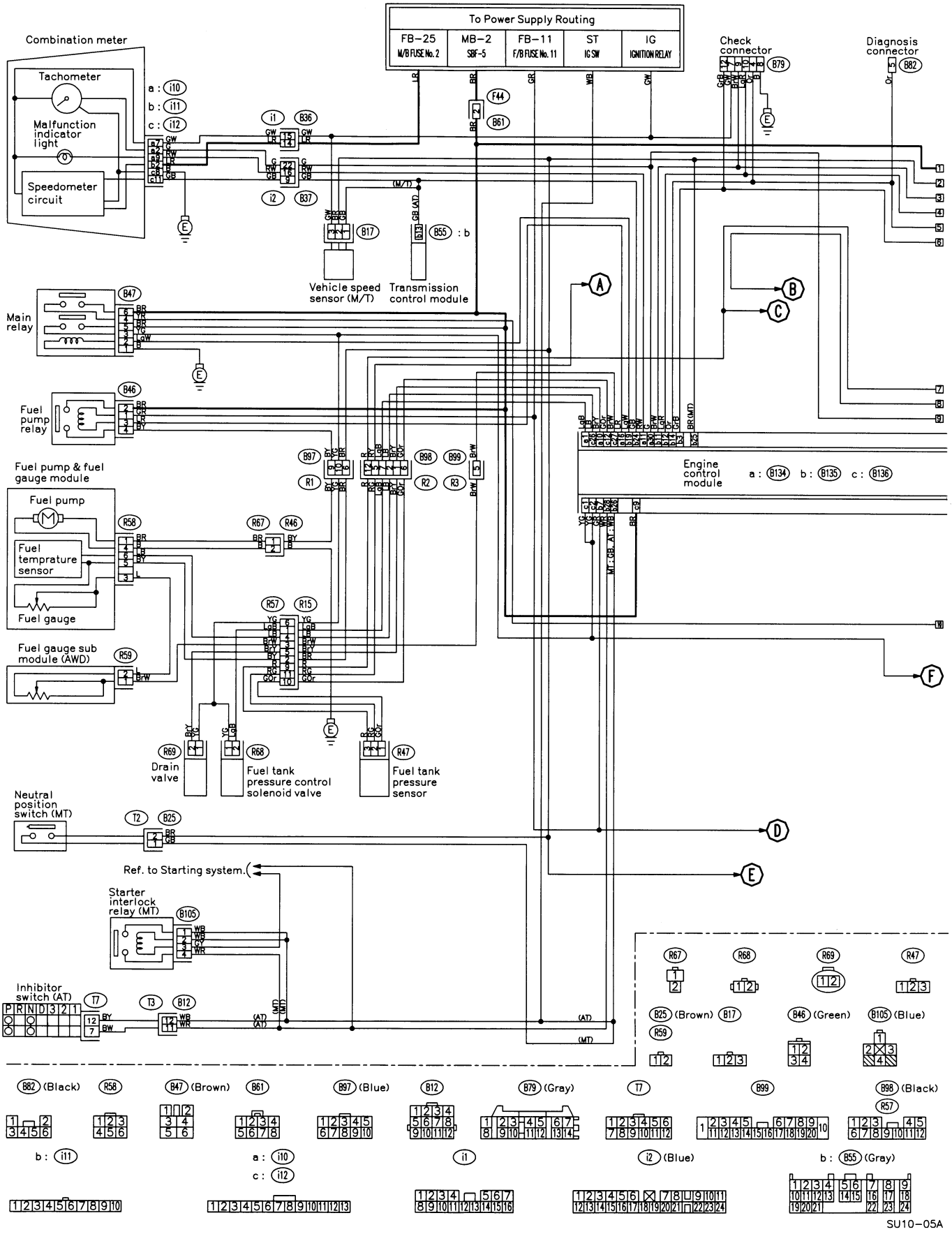
SU71−04

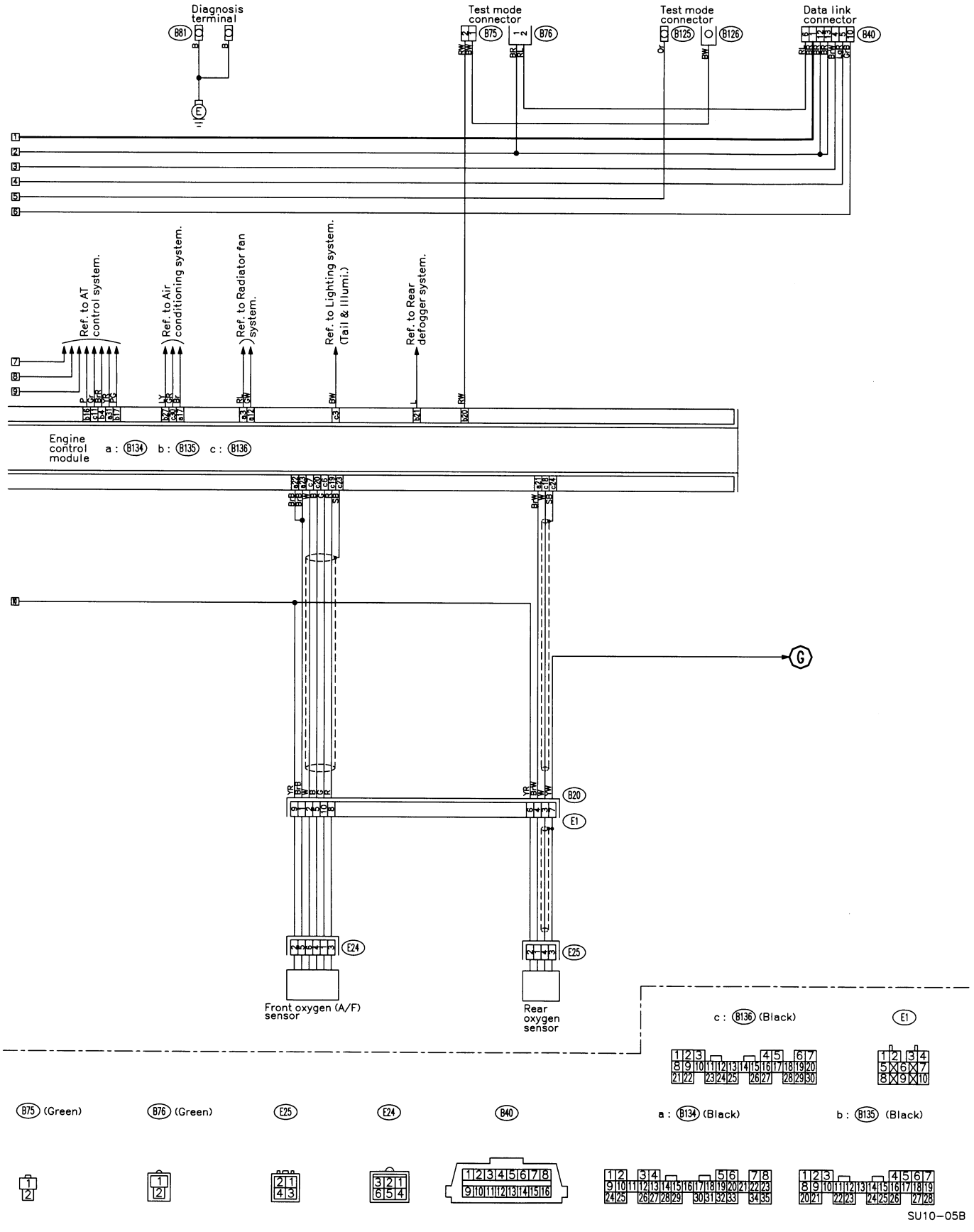
L: DOOR LOCK SYSTEM



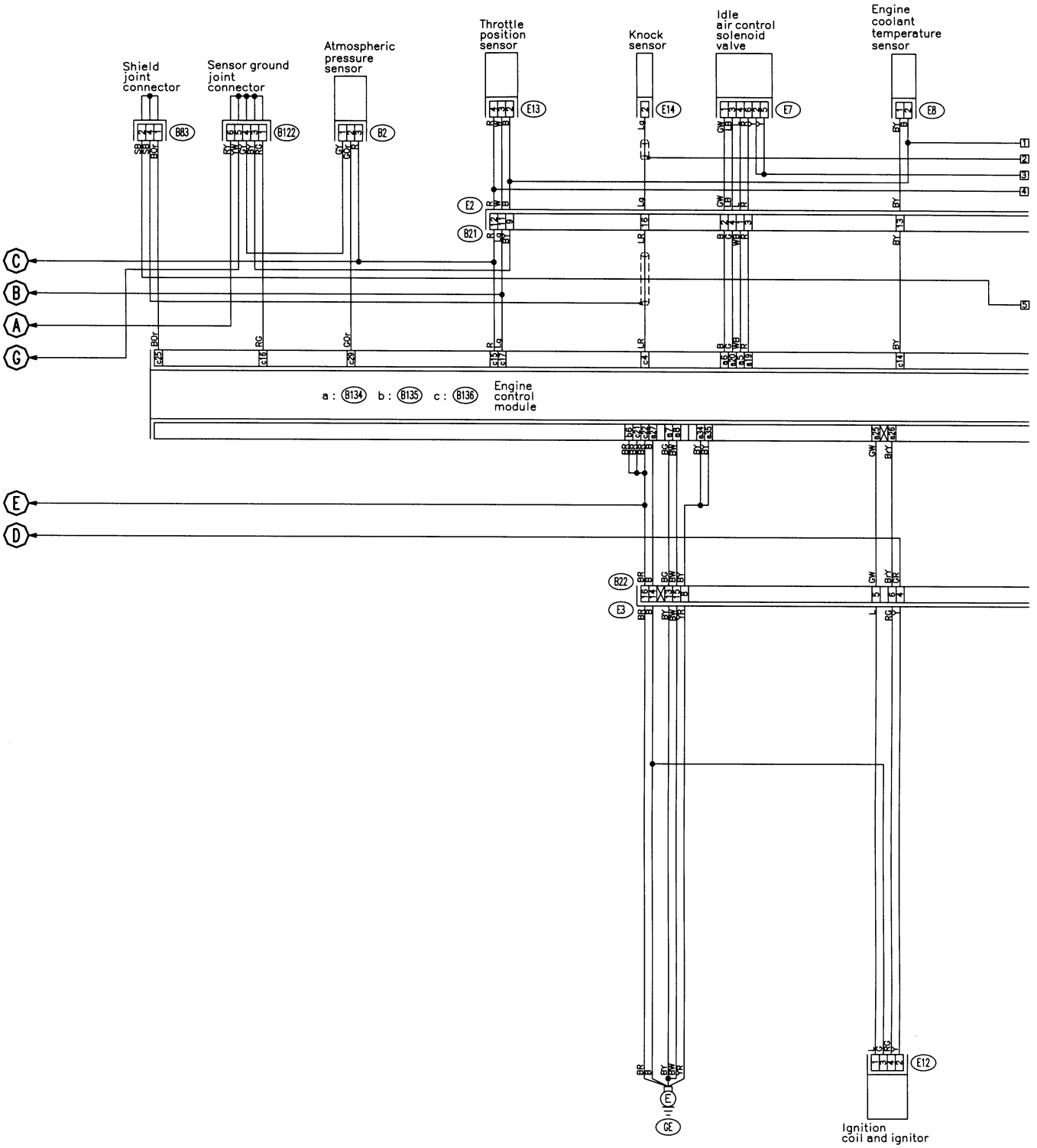
SU73−04

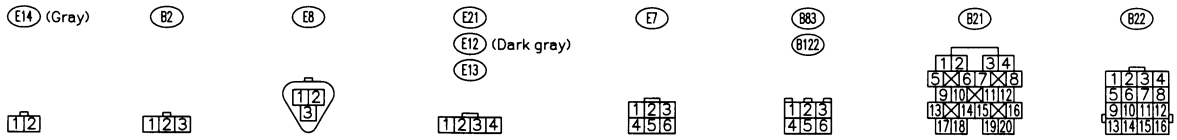
M: ENGINE ELECTRICAL SYSTEM



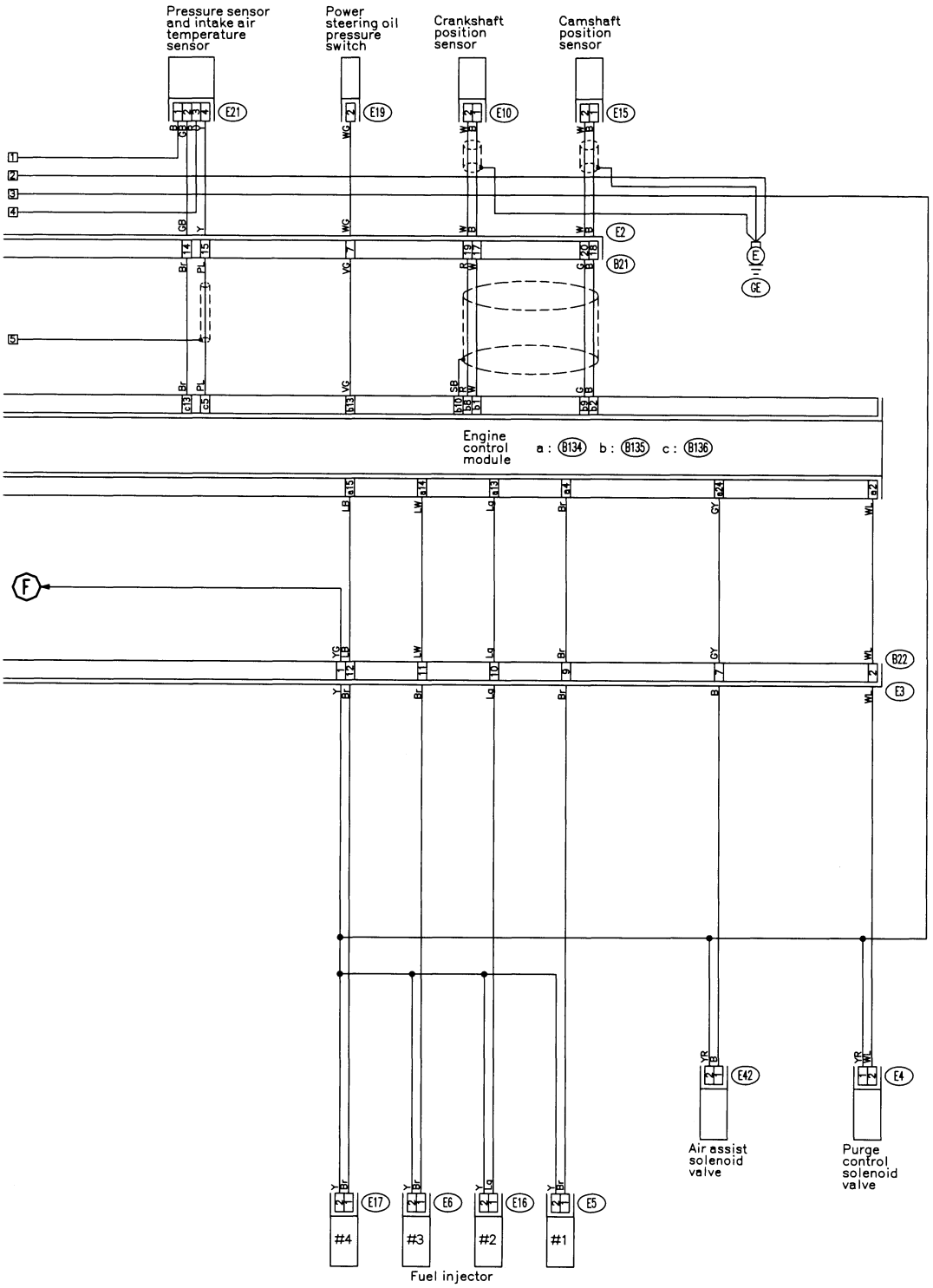

Diagnosis terminal
B81
Test mode connector
B75
B76
Test mode connector
B125
B126
Data link connector
B40
Ref. to AT control system.
Ref. to Air conditioning system.
Ref. to Radiator fan system.
Ref. to Lighting system. (Tail & Illumi.)
Ref. to Rear defogger system.
Engine control module
a : B134
b : B135
c : B136
B20
E1
E24
E25
Front oxygen (A/F) sensor
Rear oxygen sensor
c : B136 (Black)
E1
B75 (Green)
B76 (Green)
E25
E24
B40
a : B134 (Black)
b : B135 (Black)
SU10-05B

WIRING DIAGRAM





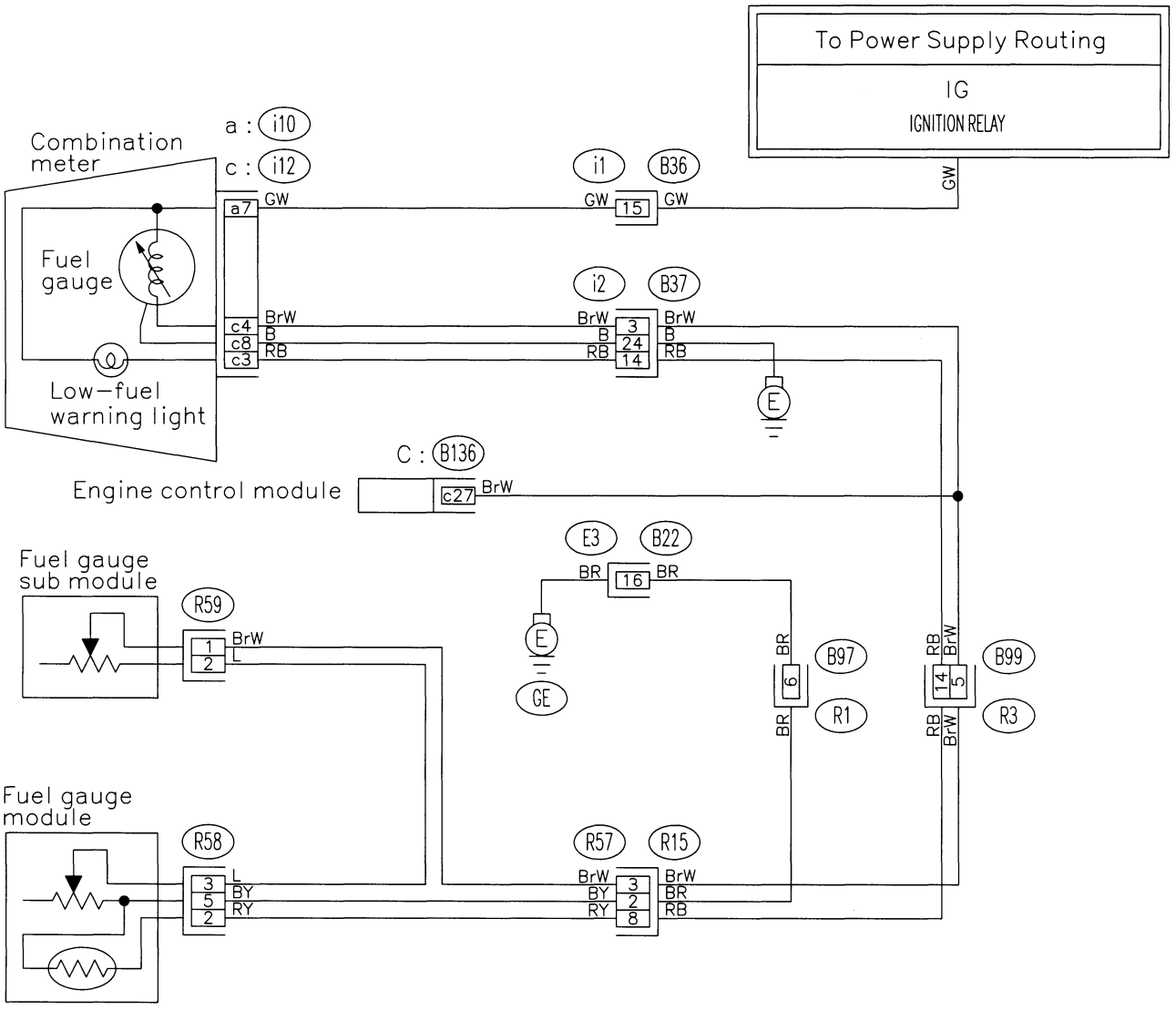
SU10–05C

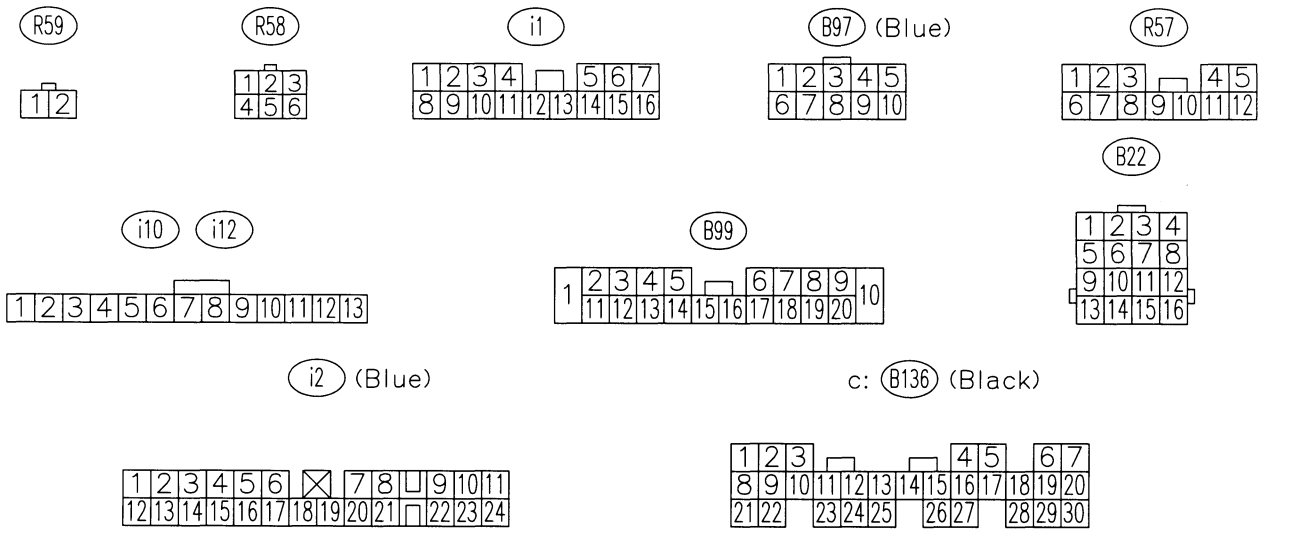

Pressure sensor and intake air temperature sensor
Power steering oil pressure switch
Crankshaft position sensor
Camshaft position sensor
E21
E19
E10
E15
E2
B21
E
GE
Engine control module
a : B134 b : B135 c : B136
F
B22
E3
E42
E4
Air assist solenoid valve
Purge control solenoid valve
E17
E6
E16
E5
#4
#3
#2
#1
Fuel injector


E5
E6
E16
E17
E10
E15
E42
E19
E4
b : B135 (Black)
c : B136 (Black)
a : B134 (Black)

SU10–05D

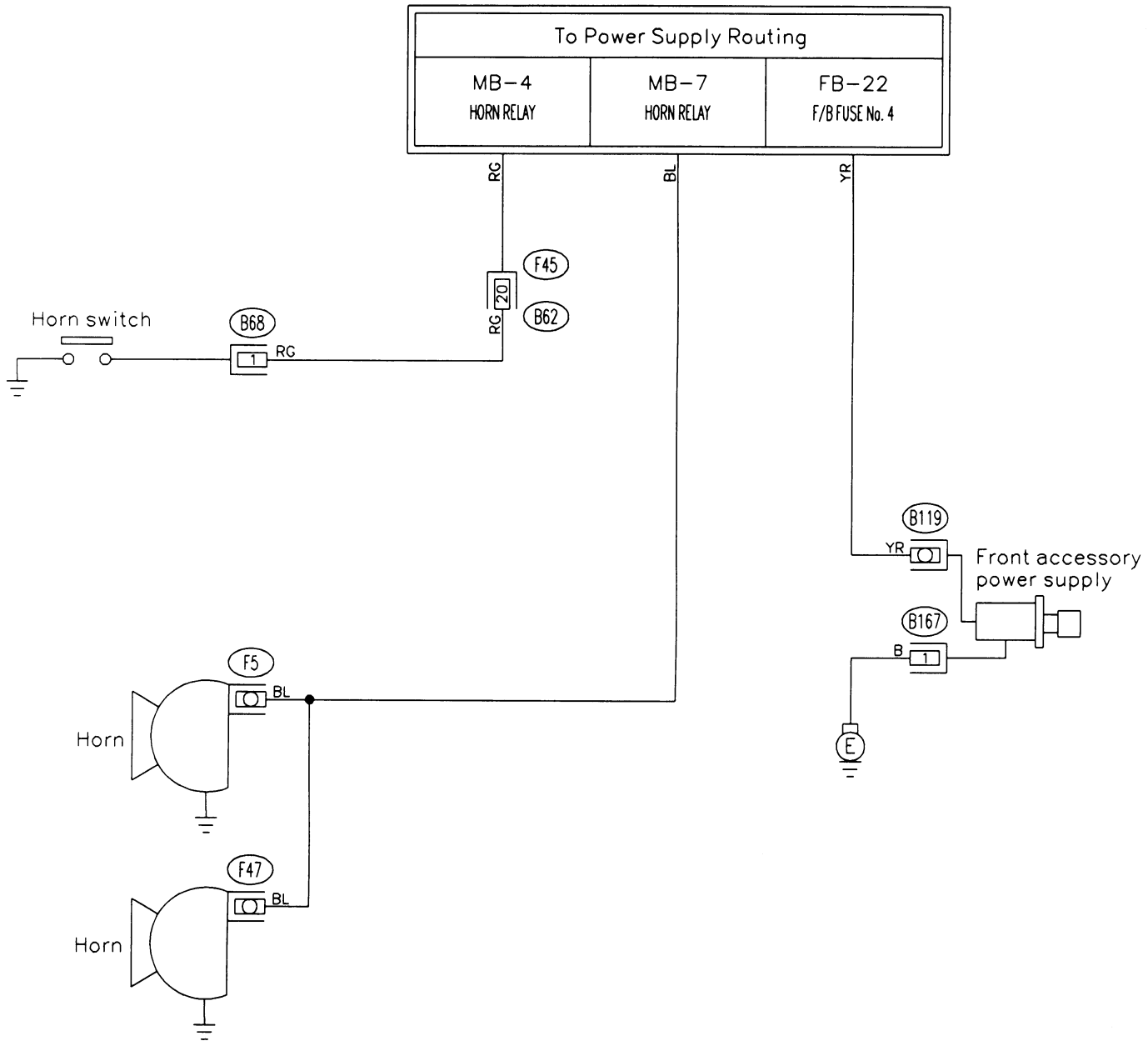
N: FUEL GAUGE SYSTEM

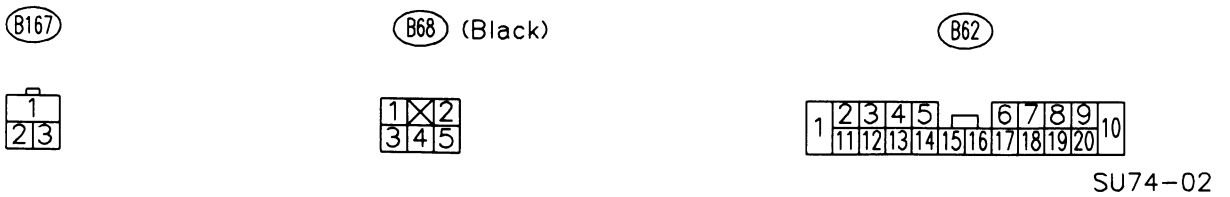




SU61-03

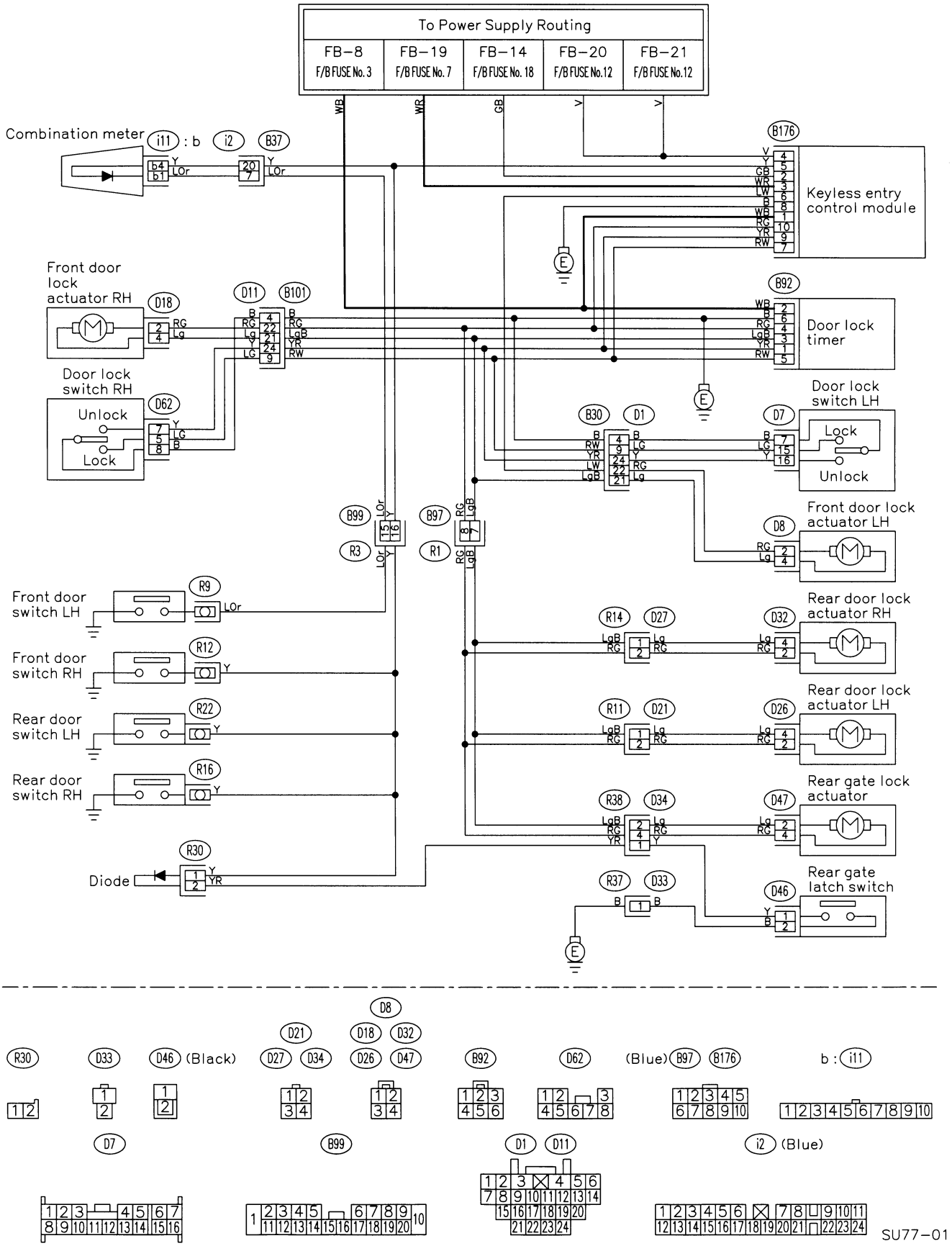
O: HORN AND FRONT ACCESSORY POWER SUPPLY SYSTEM



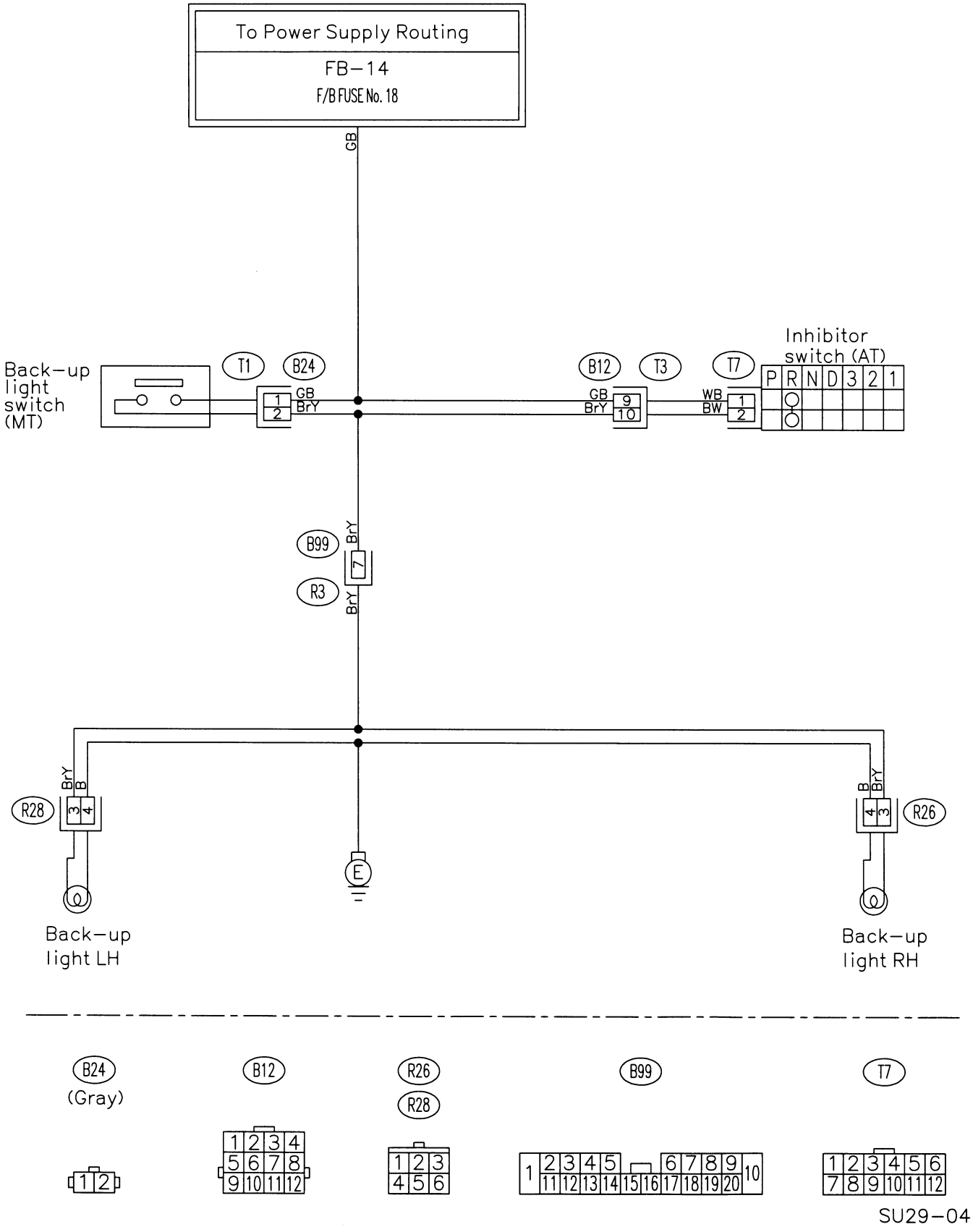


SU74−02

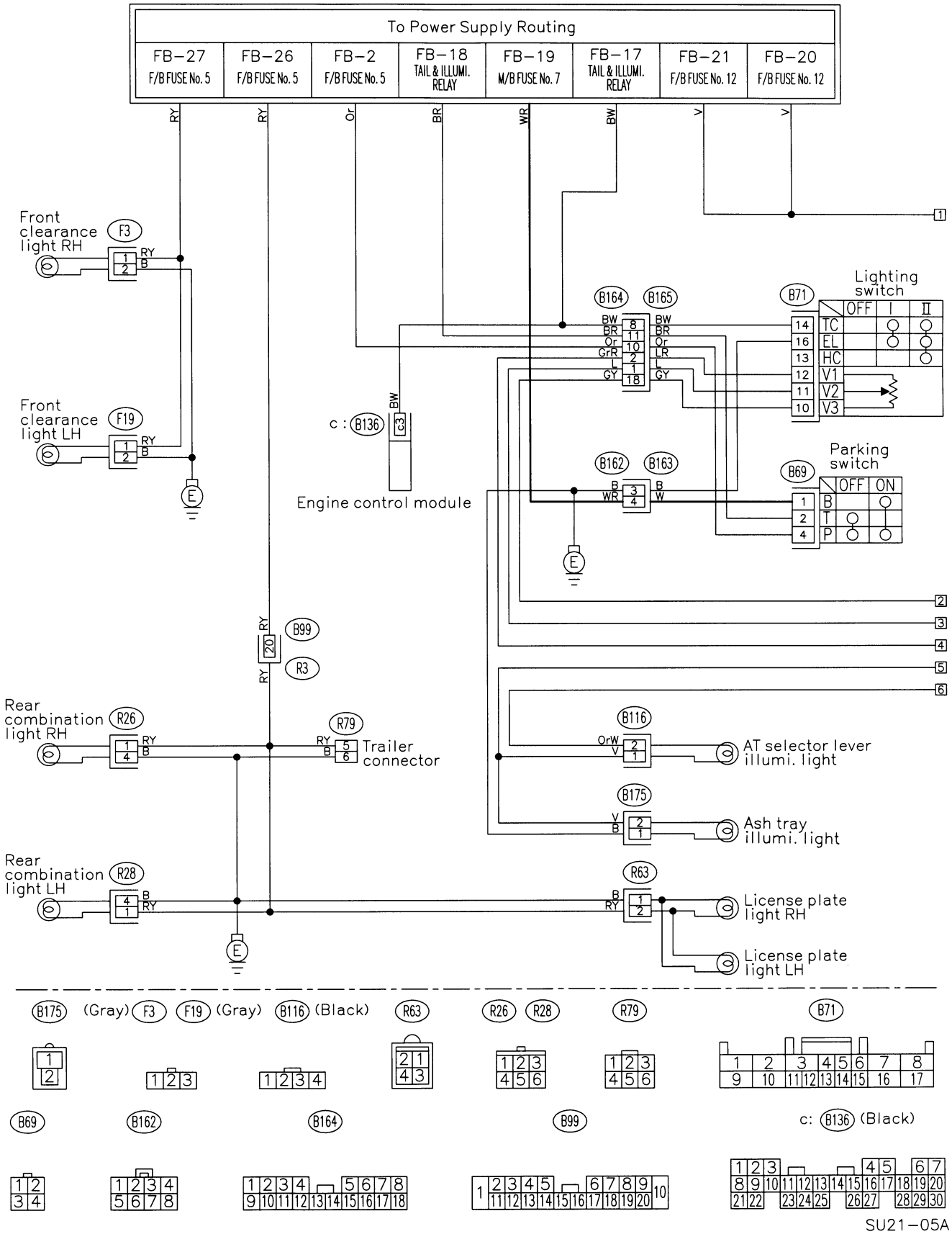
P: KEYLESS ENTRY SYSTEM



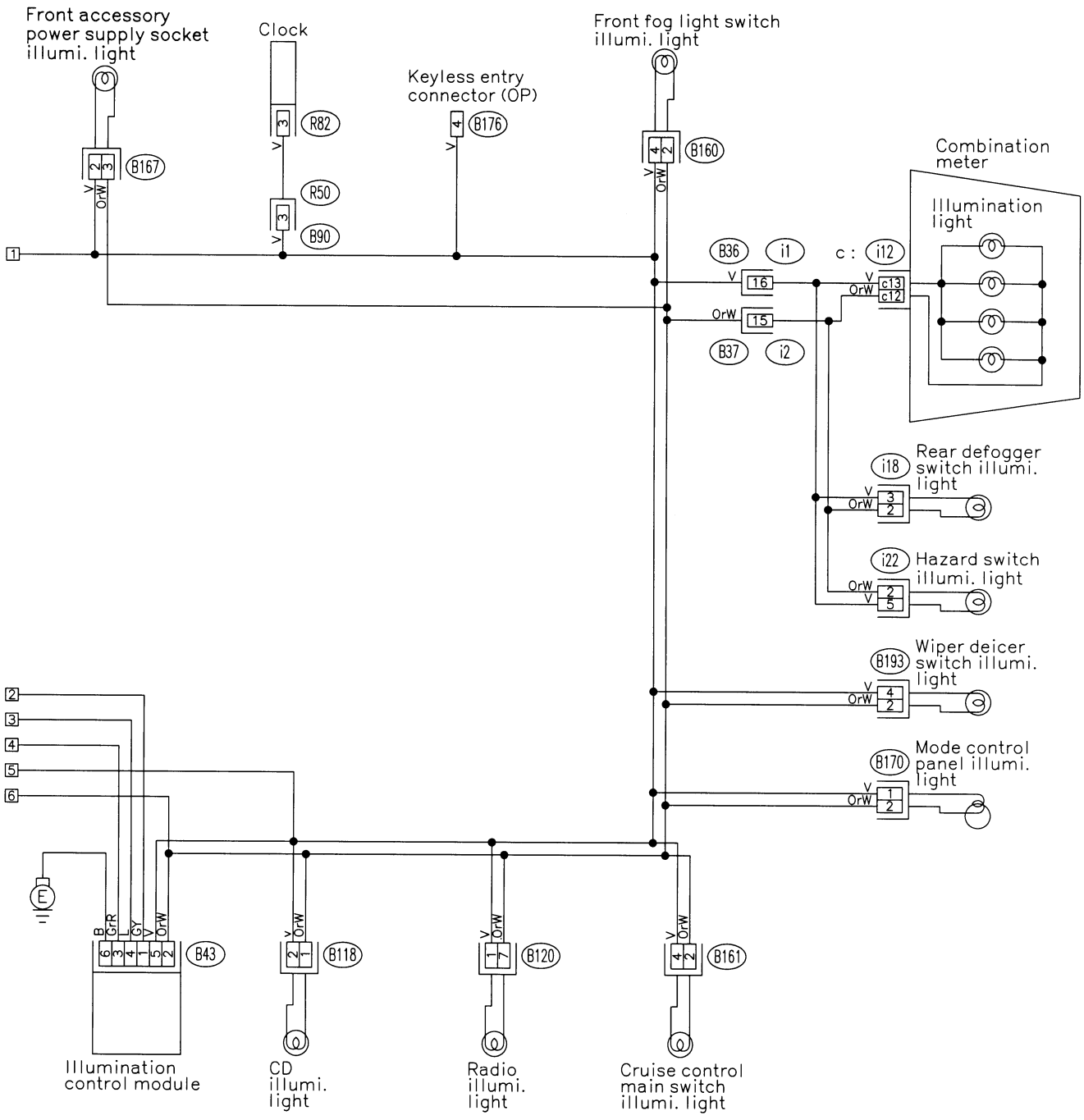
Q: LIGHTING SYSTEM (BACK-UP LIGHT)



R: LIGHTING SYSTEM (CLEARANCE LIGHT AND ILLUMINATION LIGHT)

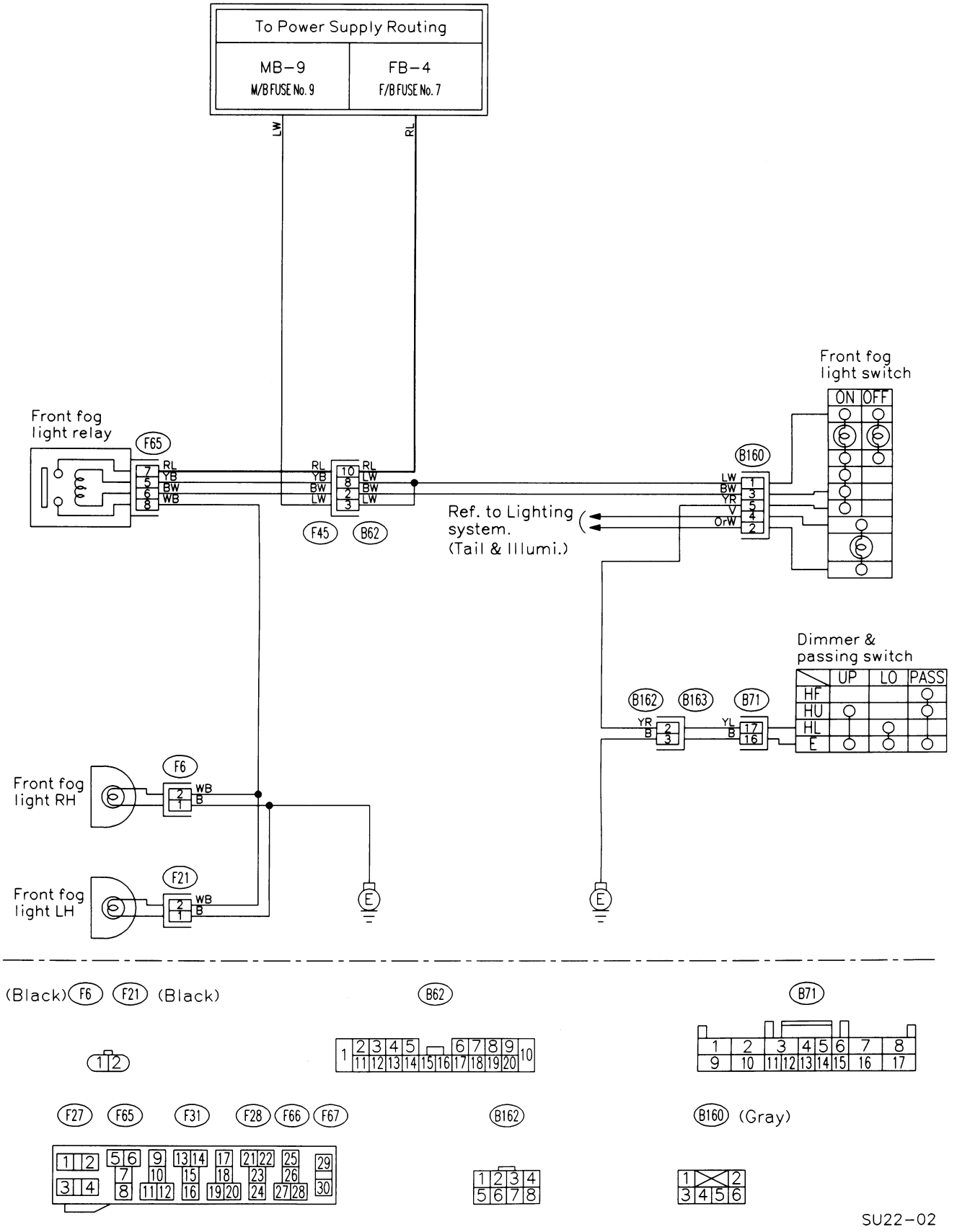


SU21−05A

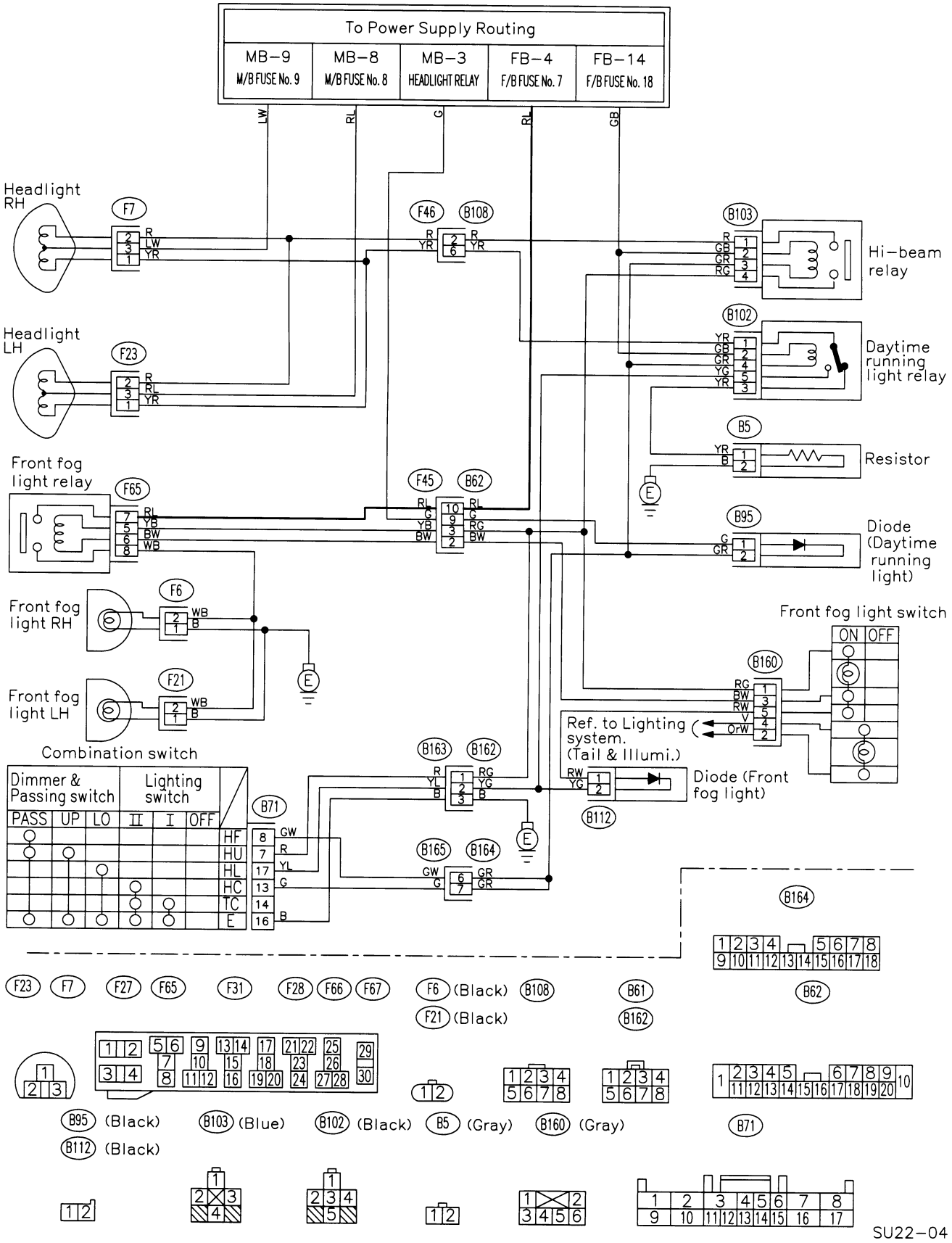

Front accessory power supply socket illumi. light
Clock
Keyless entry connector (OP)
Front fog light switch illumi. light
Combination meter
Illumination light
Rear defogger switch illumi. light
Hazard switch illumi. light
Wiper deicer switch illumi. light
Mode control panel illumi. light
Illumination control module
CD illumi. light
Radio illumi. light
Cruise control main switch illumi. light
(Gray)
(Brown)
(Black)
(Blue)
SU21−05B

S: LIGHTING SYSTEM (FRONT FOG LIGHT)

1. WITHOUT DRL MODEL

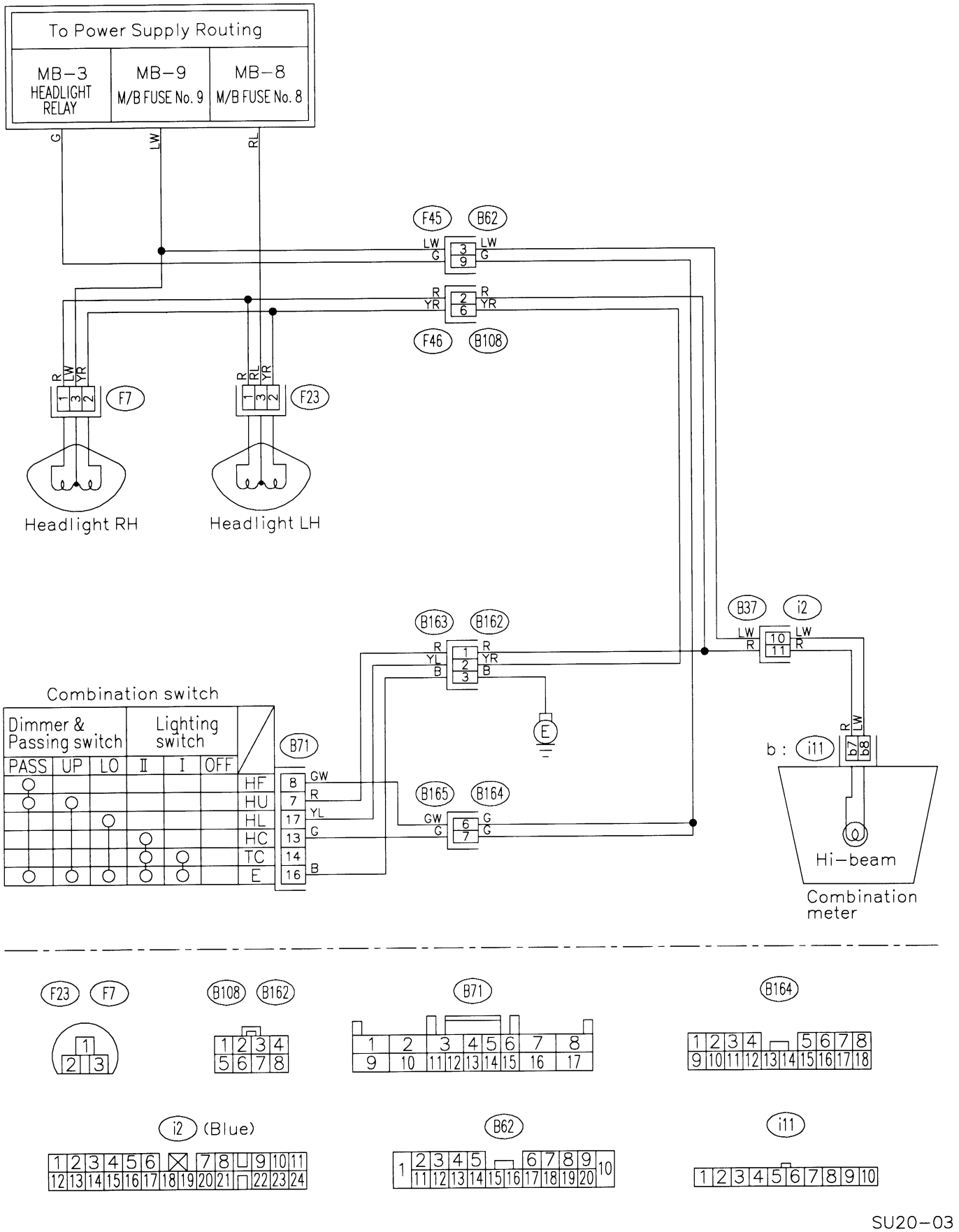


2. WITH DRL MODEL



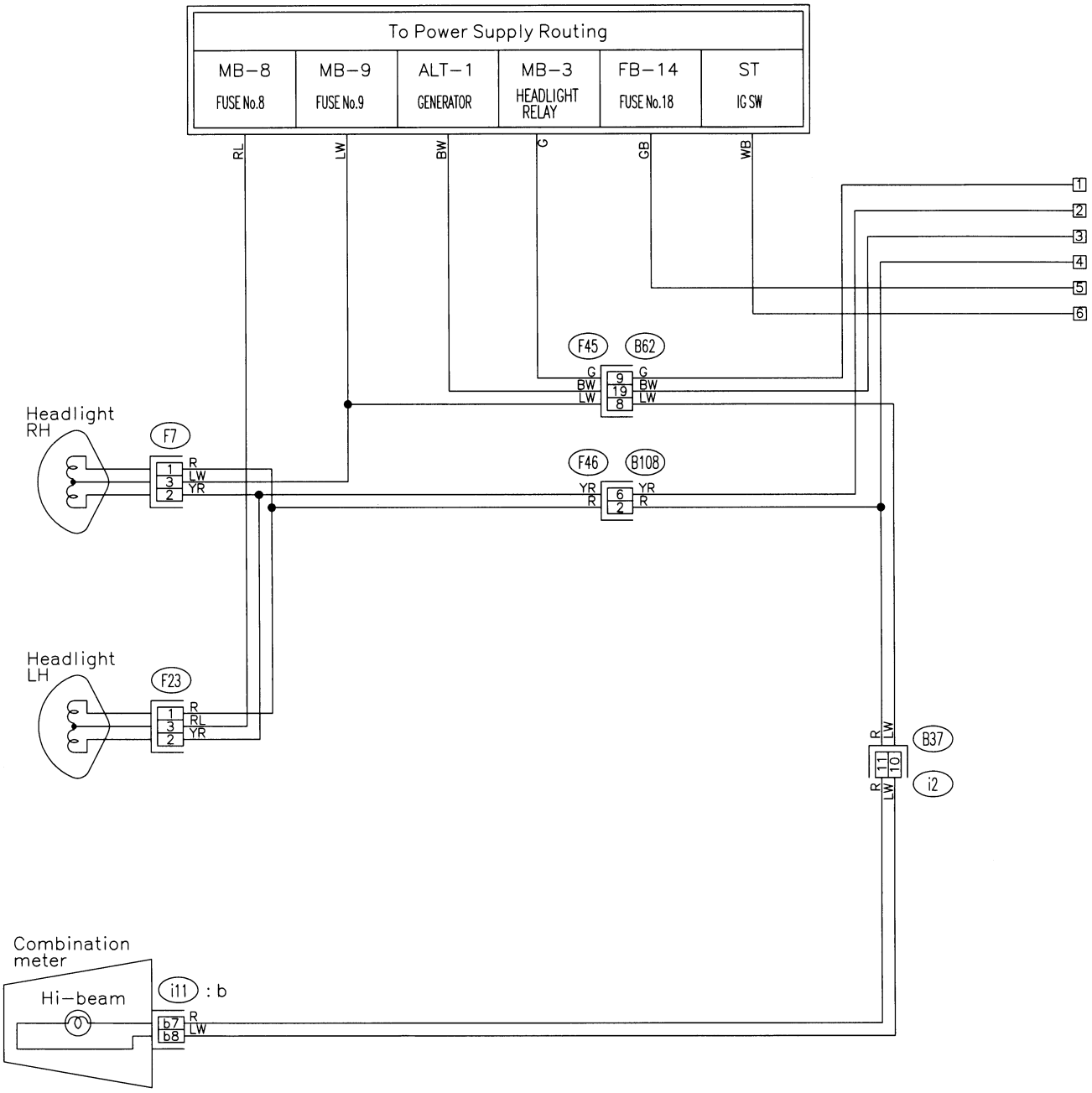
T: LIGHTING SYSTEM (HEADLIGHT)

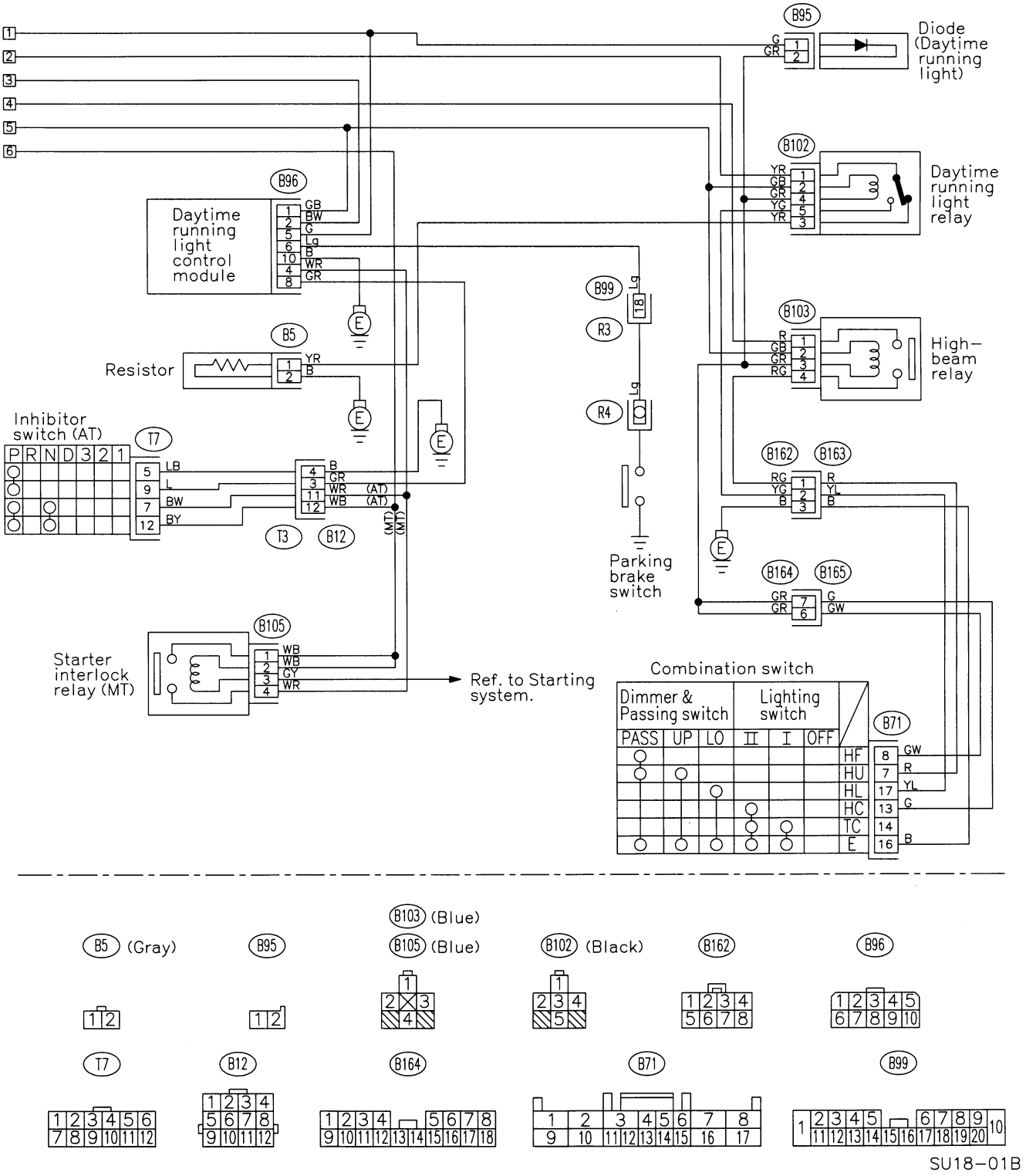
1. WITHOUT DRL MODEL



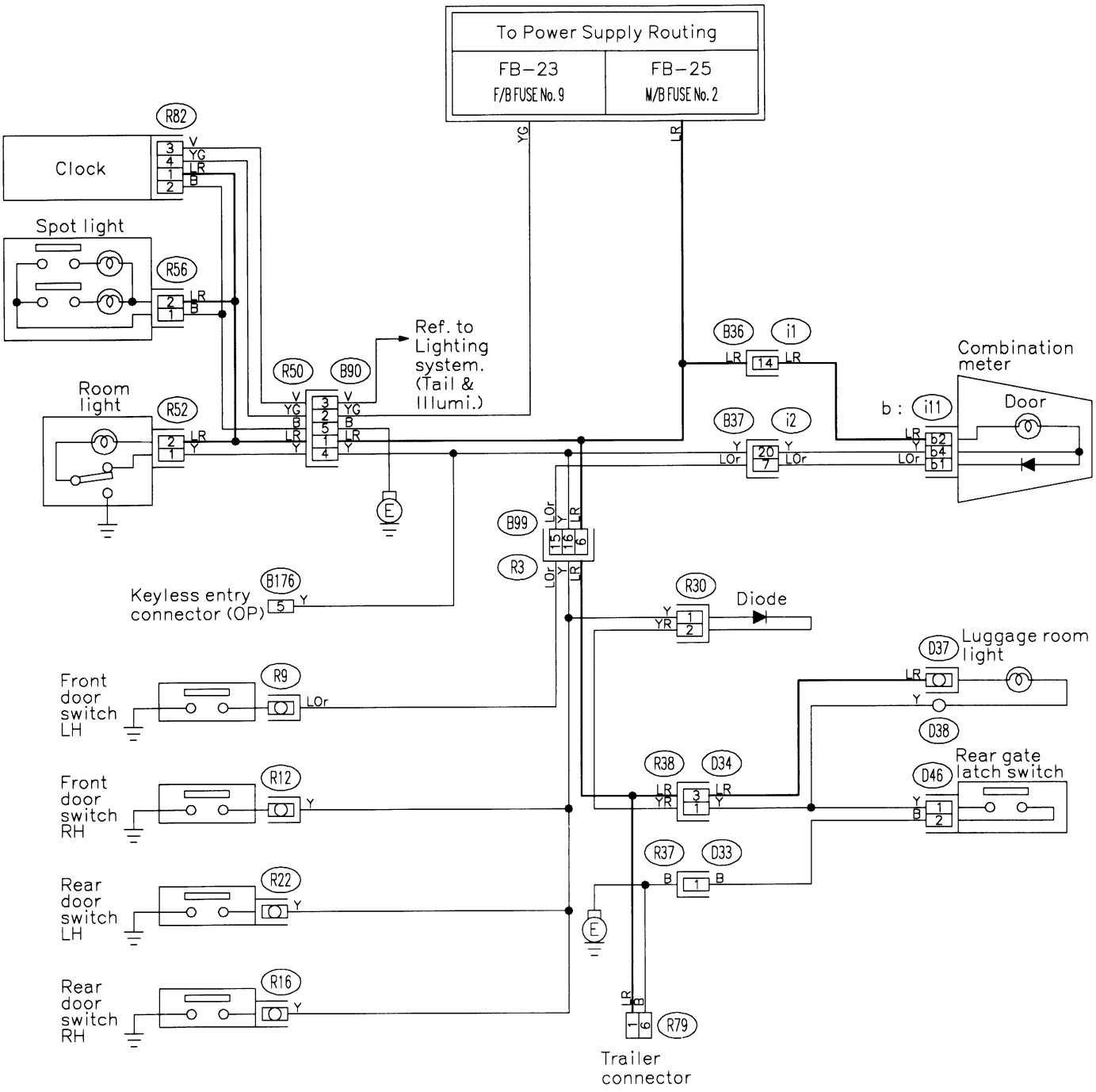
MEMO:

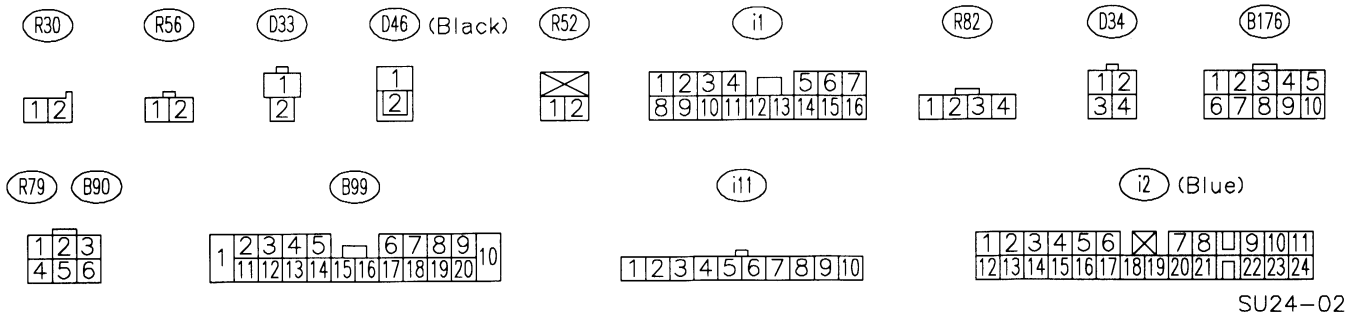
2. WITH DRL MODEL




Diode (Daytime running light)
Daytime running light relay
High-beam relay
Daytime running light control module
Resistor
Inhibitor switch (AT)
Parking brake switch
Starter interlock relay (MT)
Ref. to Starting system.
Combination switch
Dimmer & Passing switch
Lighting switch
PASS
UP
LO
II
I
OFF
HF
HU
HL
HC
TC
E
(Gray)
(Blue)
(Black)
SU18−01B

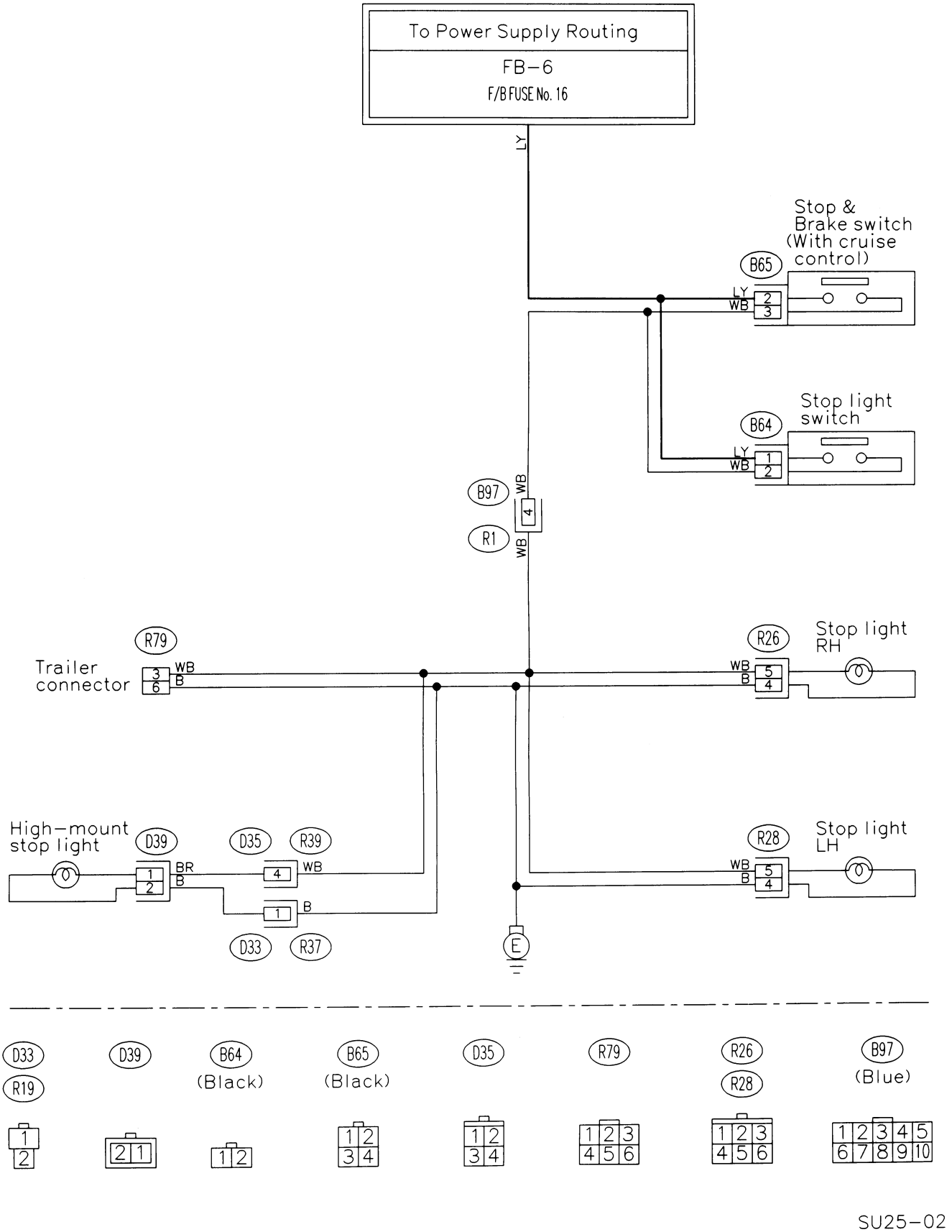
U: LIGHTING SYSTEM (IN COMPARTMENT)





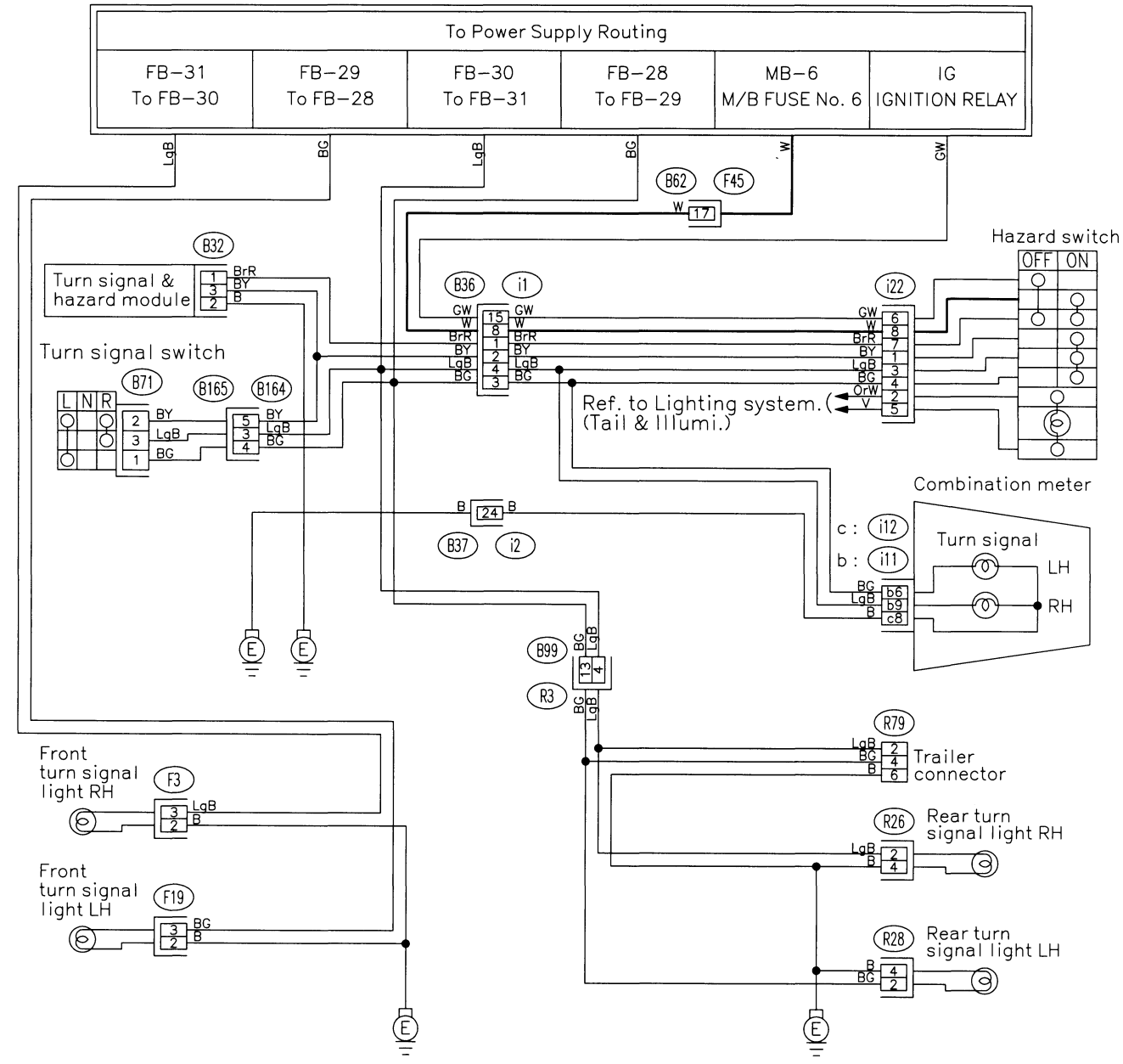
SU24−02

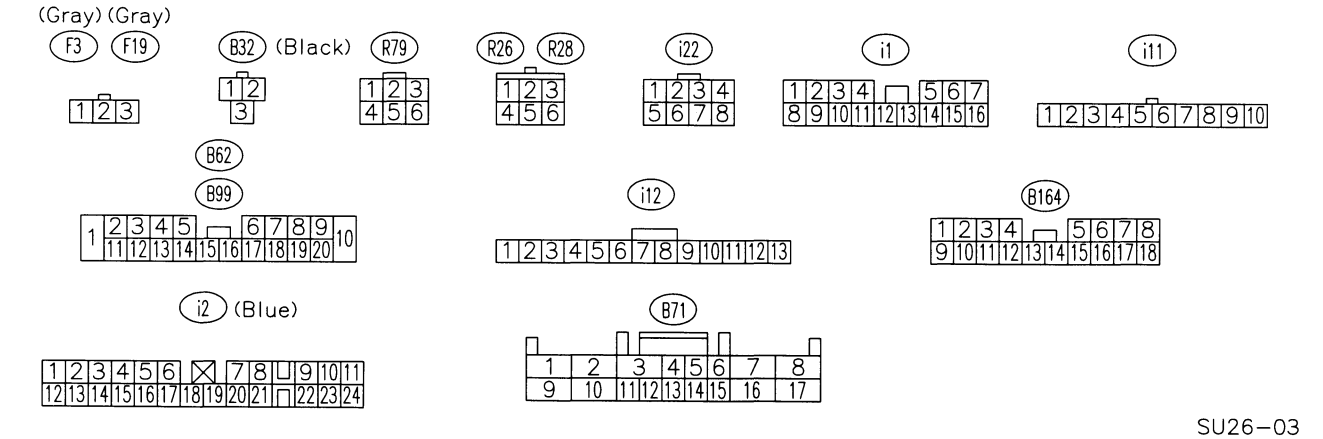
V: LIGHTING SYSTEM (STOP LIGHT)



SU25−02

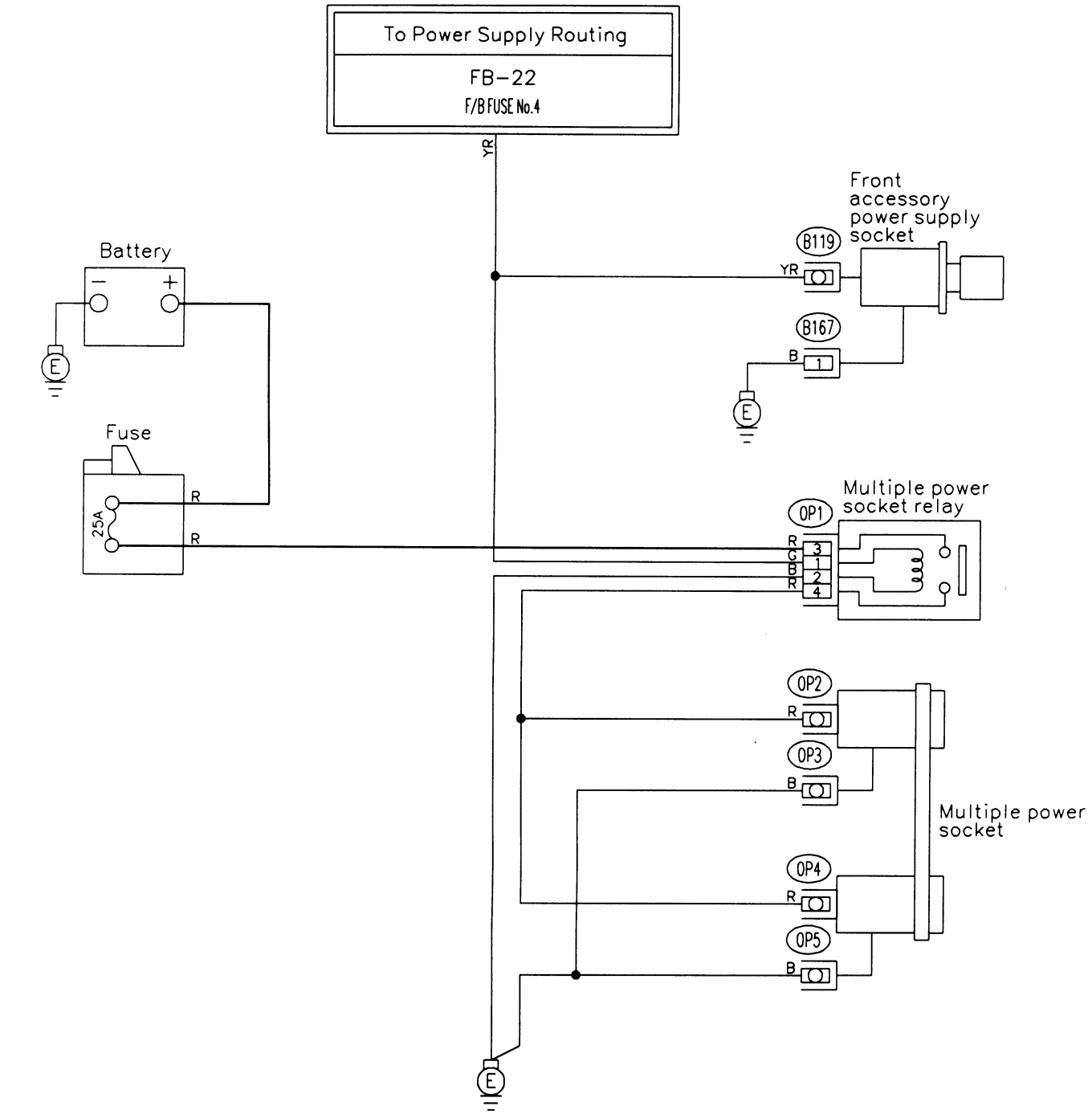
W: LIGHTING SYSTEM (TURN SIGNAL LIGHT AND HAZARD LIGHT)





SU26−03

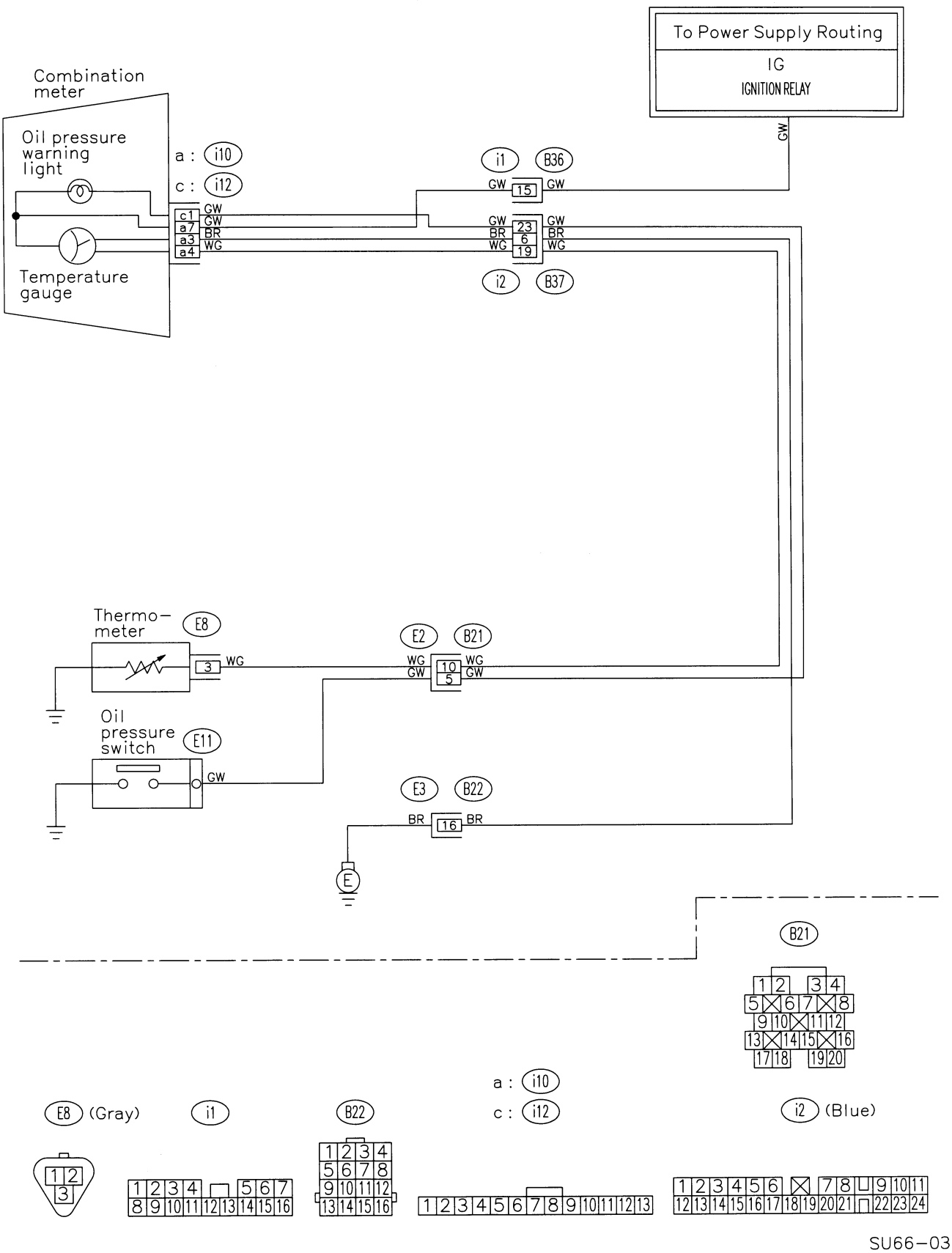
X: MULTIPLE POWER SOCKET SYSTEM (OPTION)



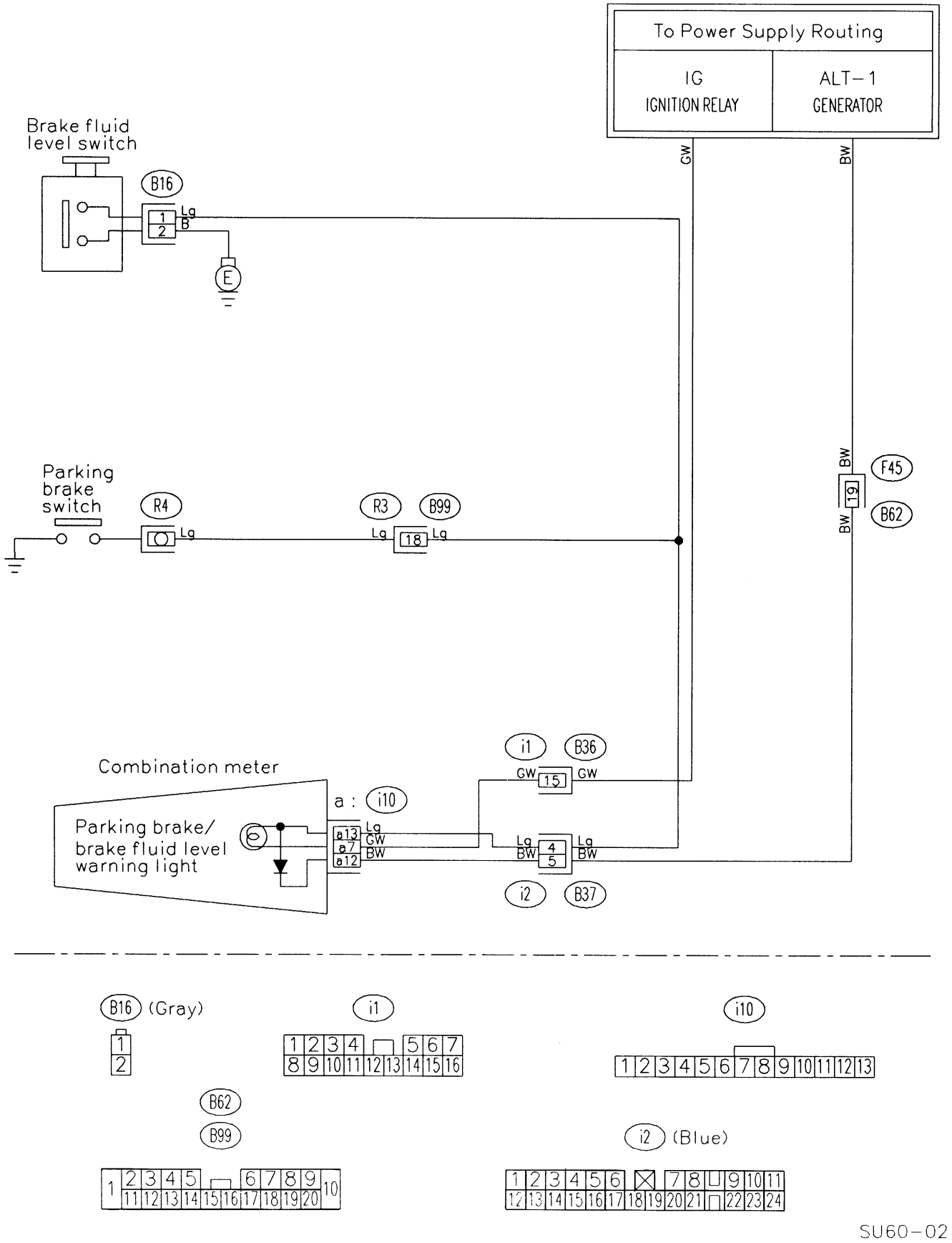


SU92−01

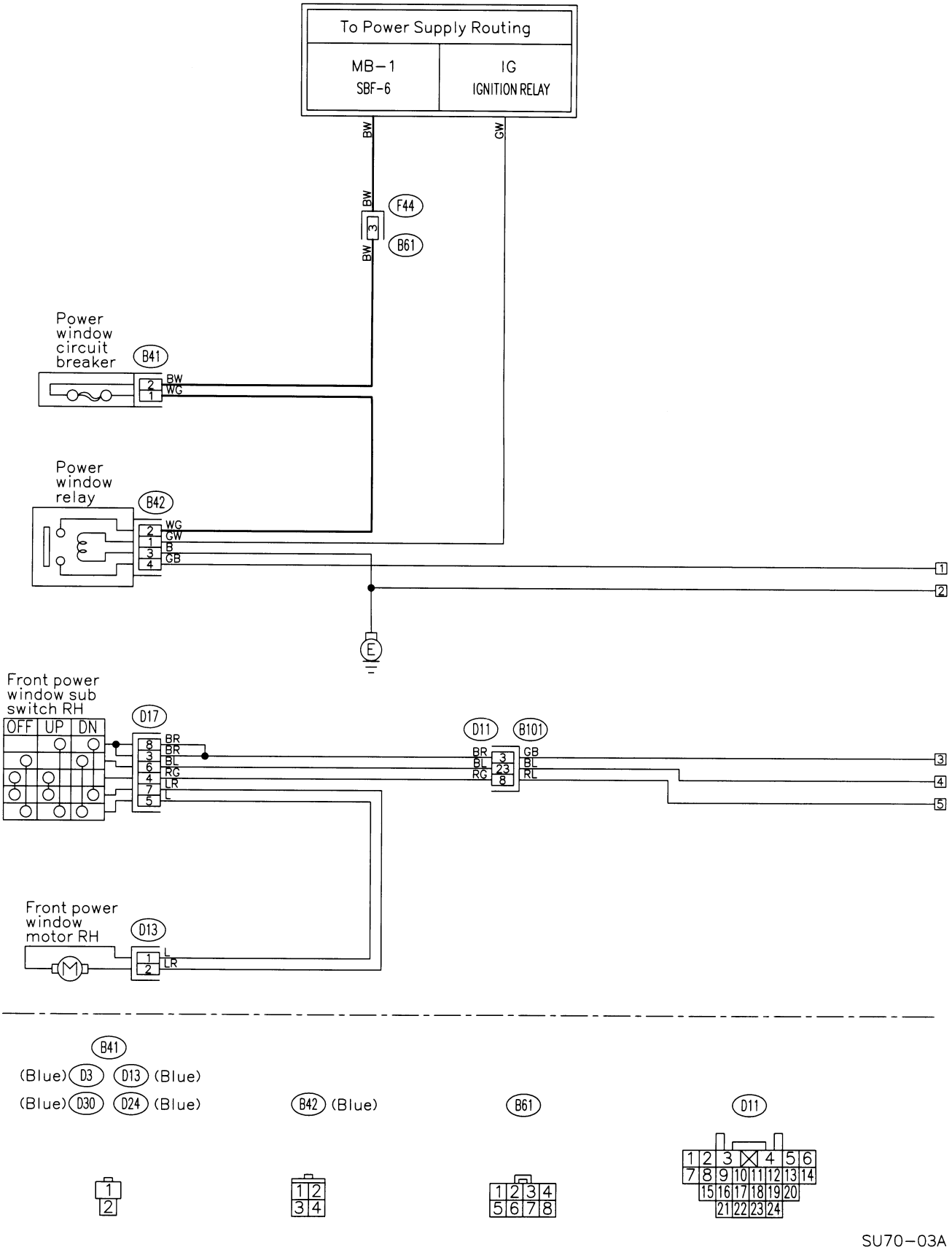
Y: OIL PRESSURE AND TEMPERATURE GAUGE SYSTEM

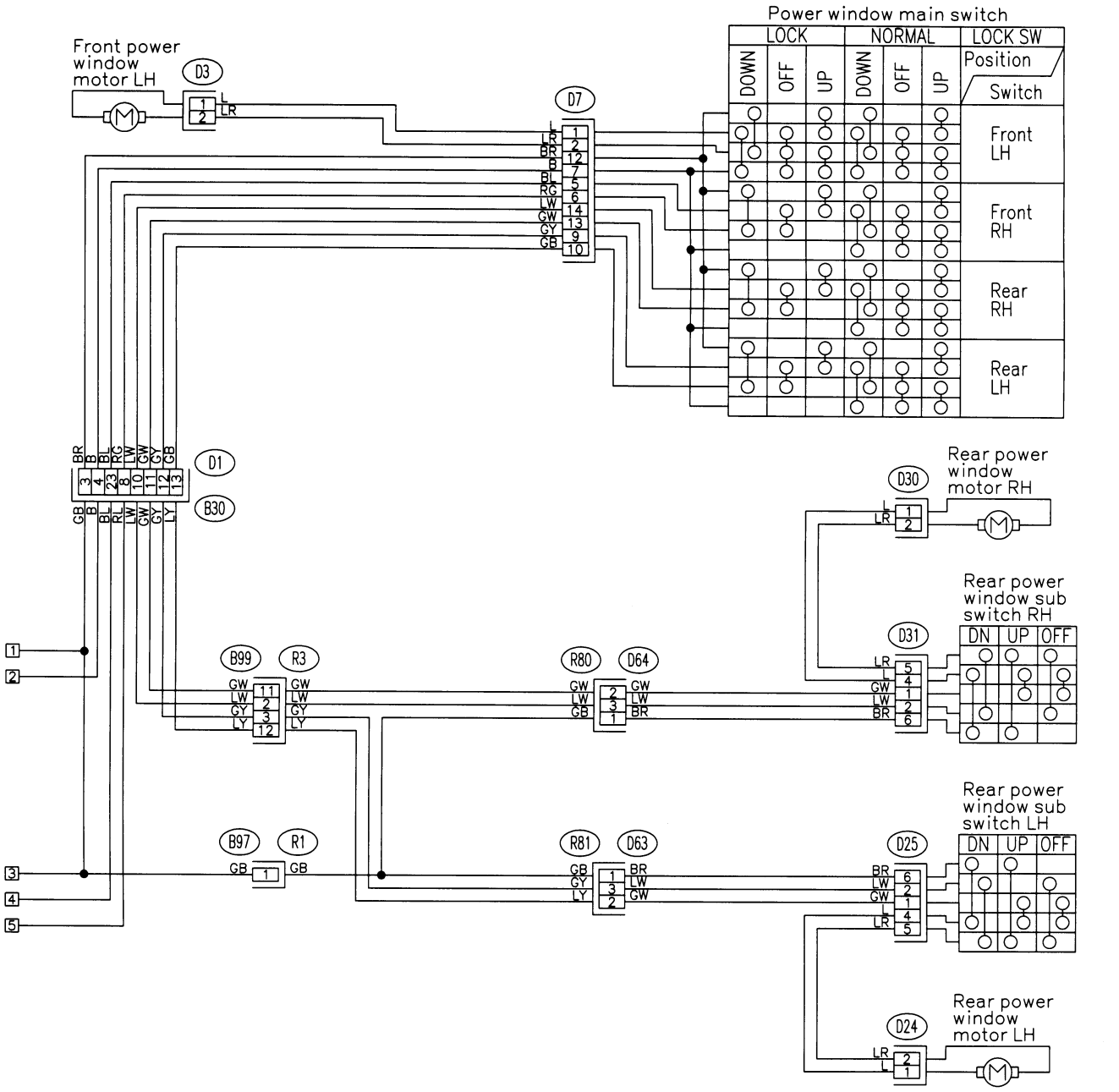


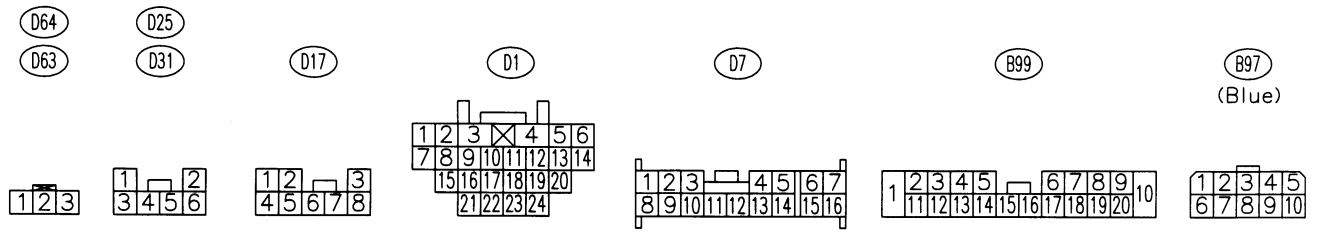
Z: PARKING BRAKE AND BRAKE FLUID LEVEL WARNING SYSTEM



AA: POWER WINDOW SYSTEM

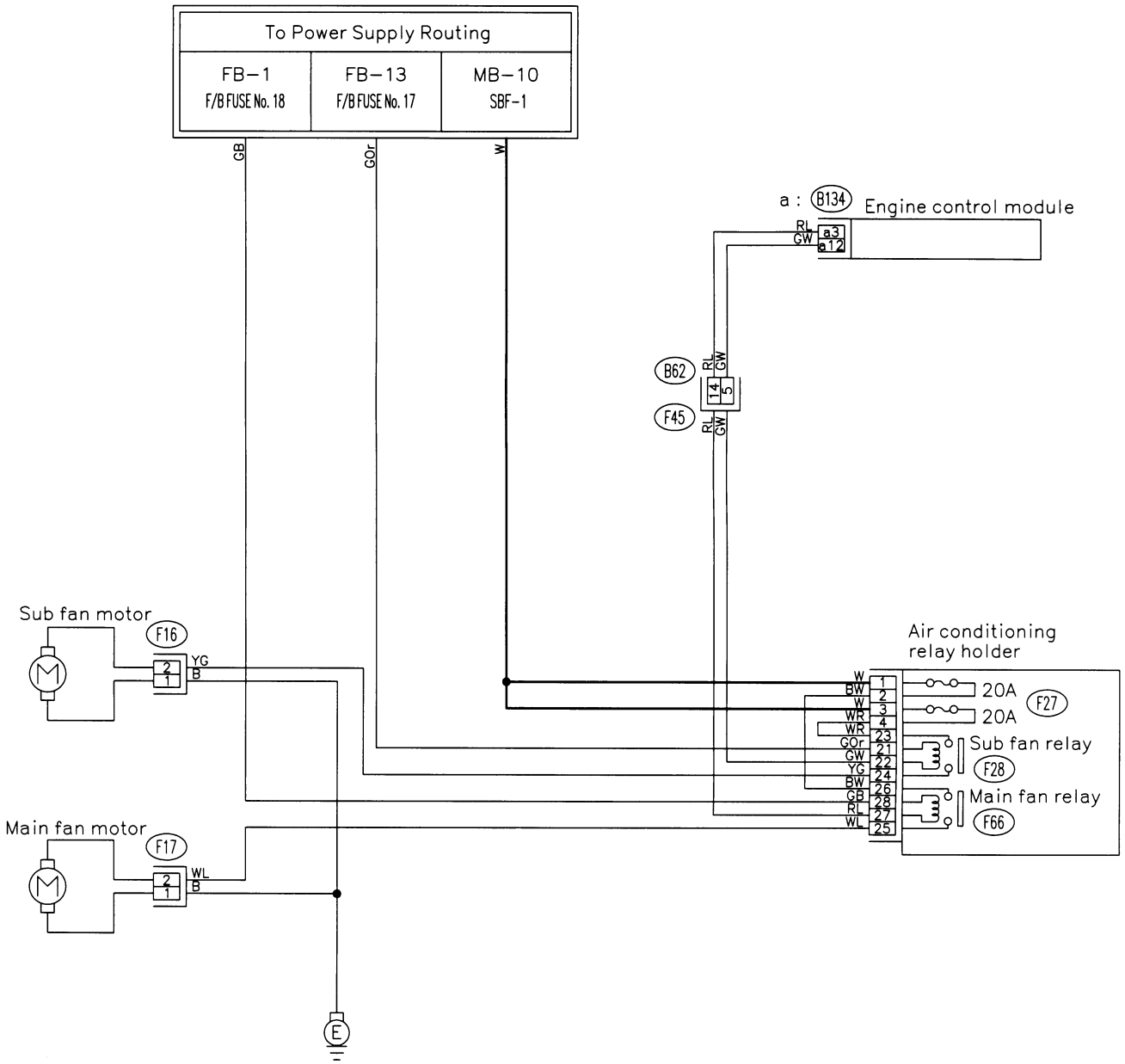


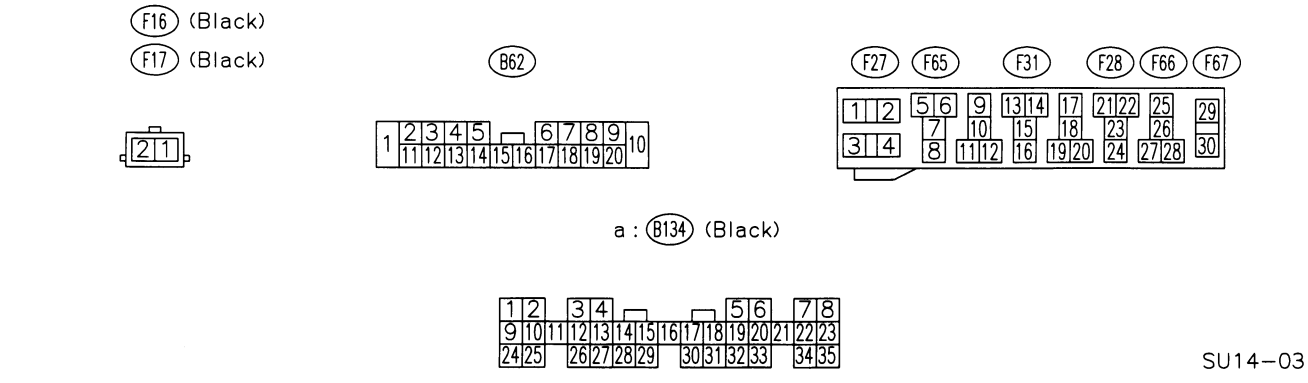

Power window main switch
LOCK
NORMAL
LOCK SW
Position
Switch
DOWN
OFF
UP
Front LH
Front RH
Rear RH
Rear LH
Front power window motor LH
Rear power window motor RH
Rear power window sub switch RH
Rear power window sub switch LH
Rear power window motor LH
DN
UP
OFF
D1
D3
D7
D17
D24
D25
D30
D31
D63
D64
B30
B97
B99
R1
R3
R80
R81


(Blue)

SU70–03B

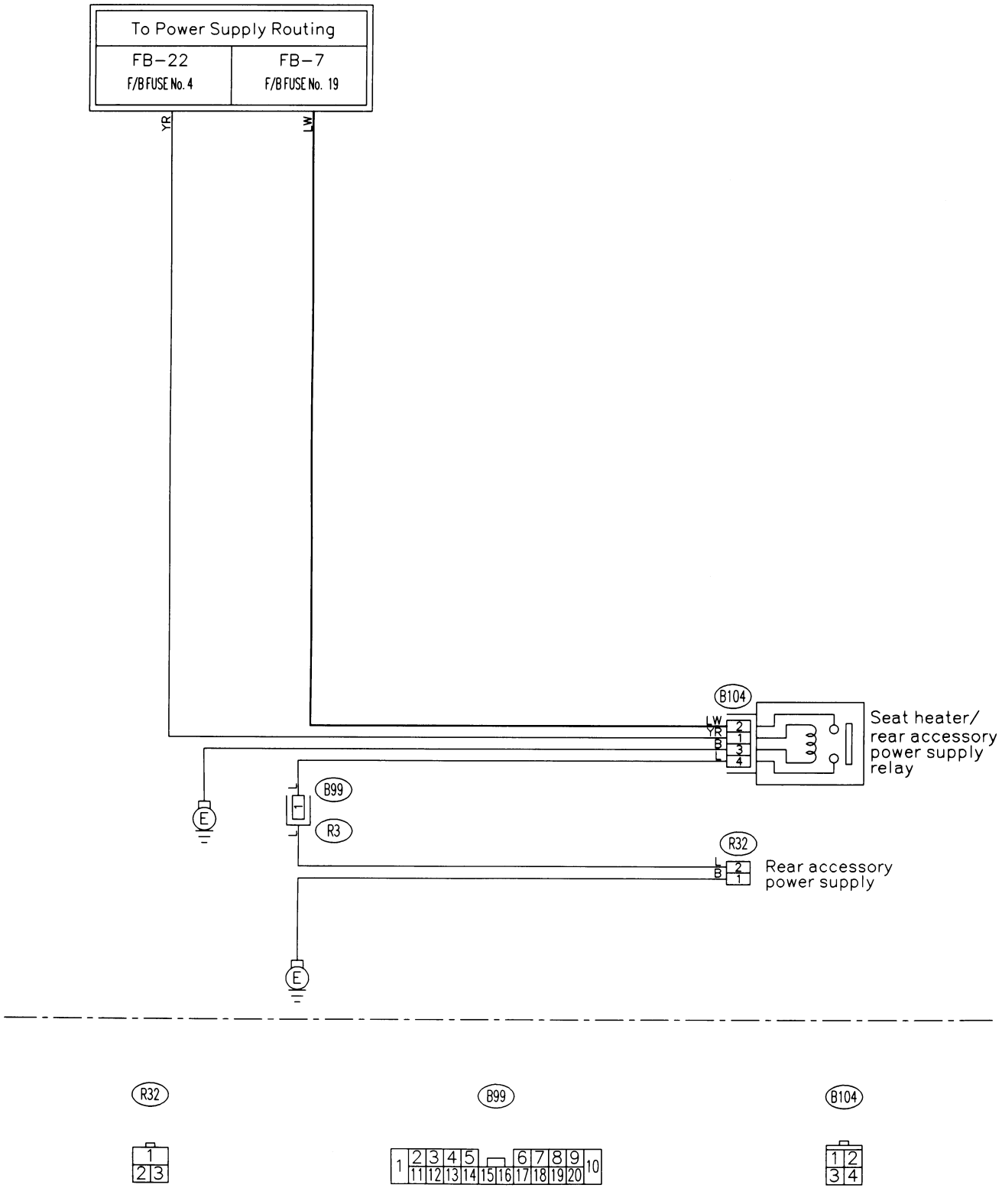
AB: RADIATOR FAN SYSTEM





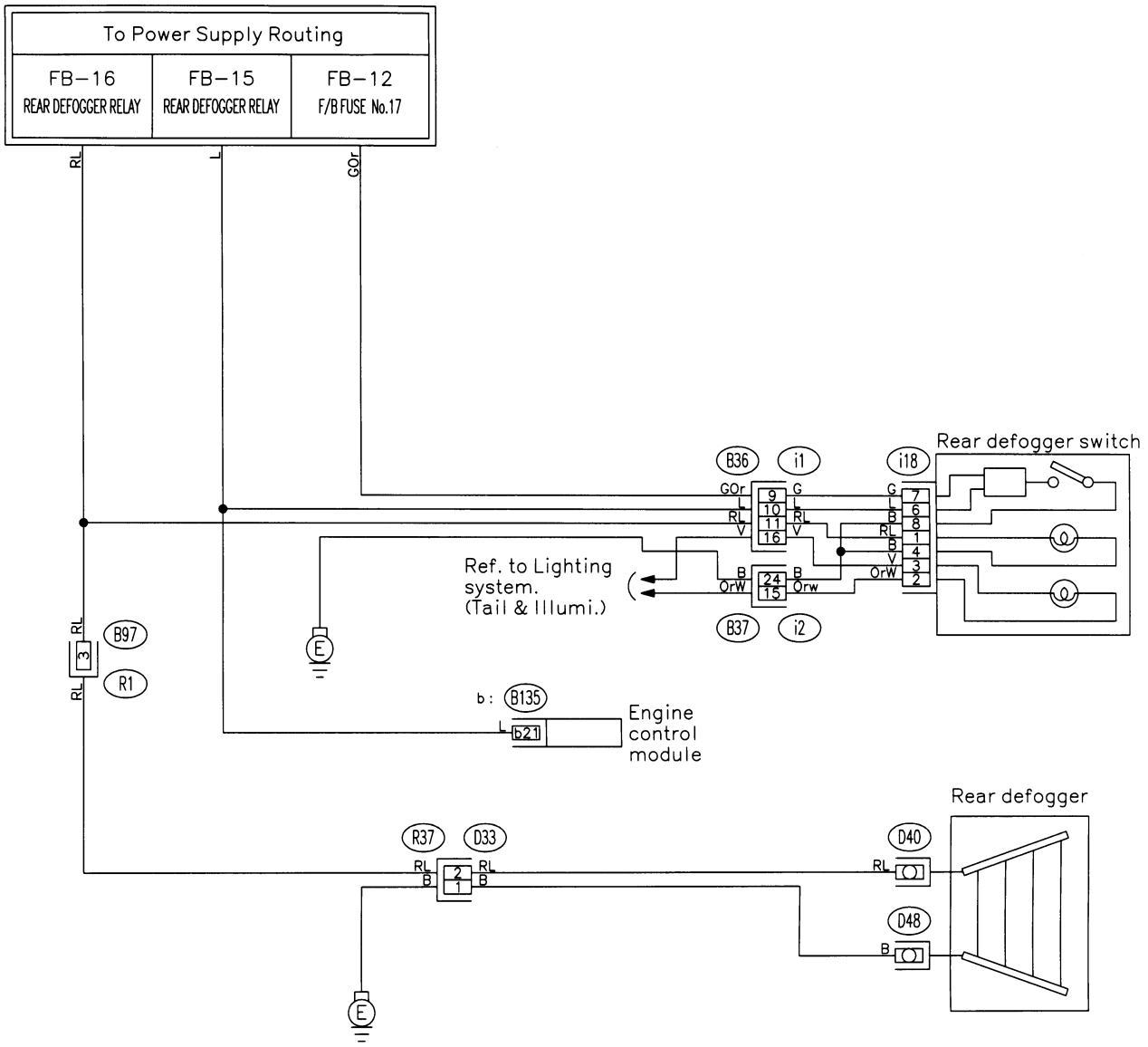
SU14−03

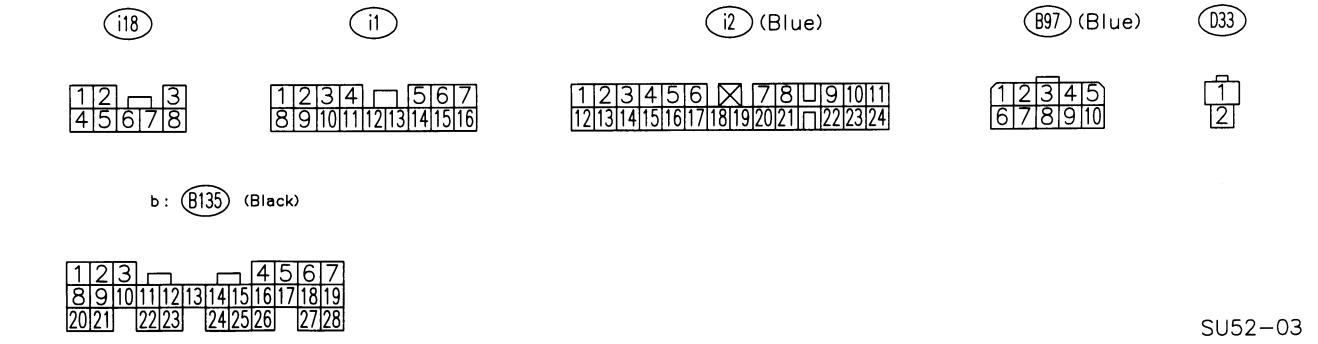
AC: REAR ACCESSORY POWER SUPPLY SYSTEM



SU90−02

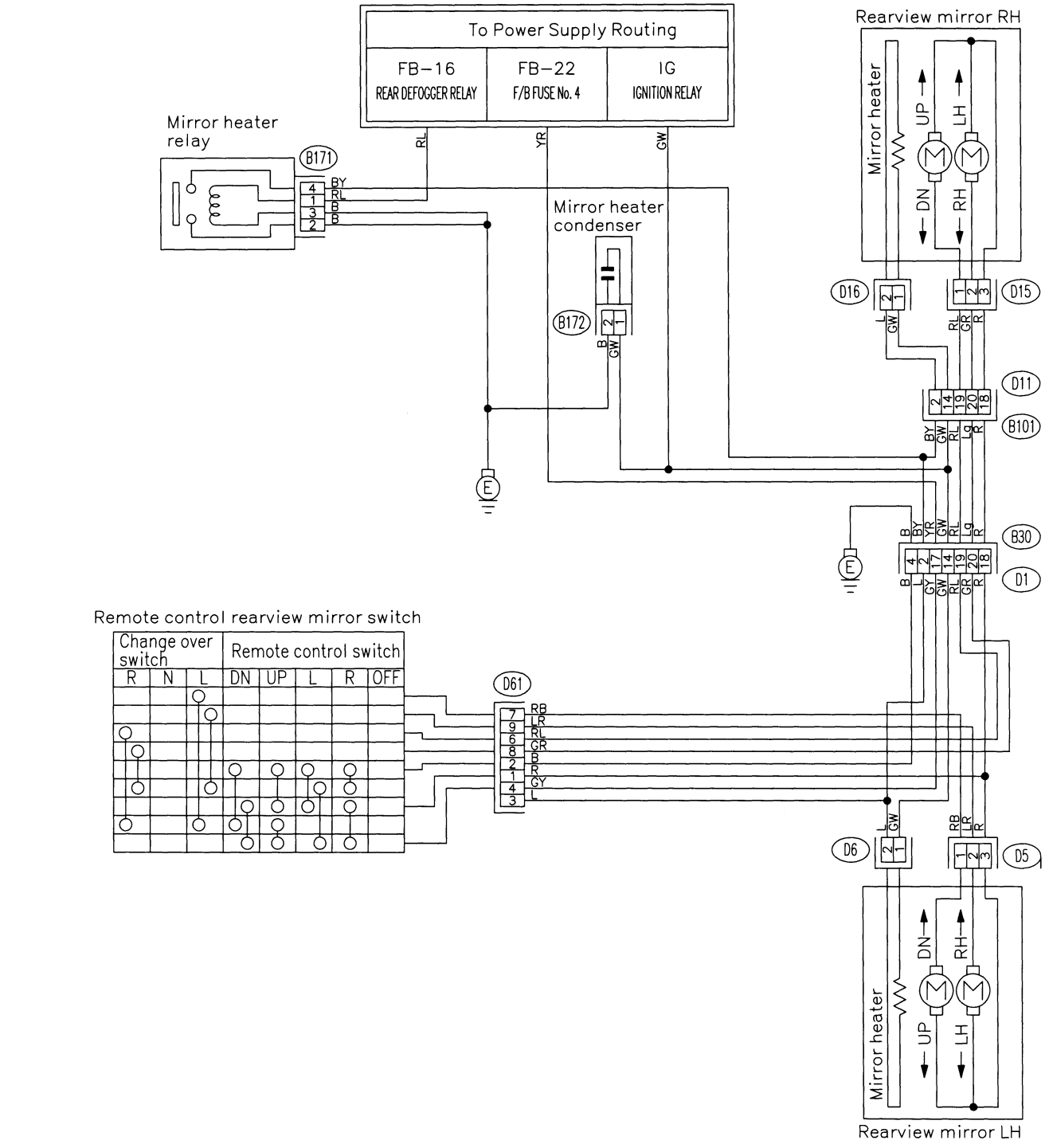
AD: REAR WINDOW DEFOGGER SYSTEM





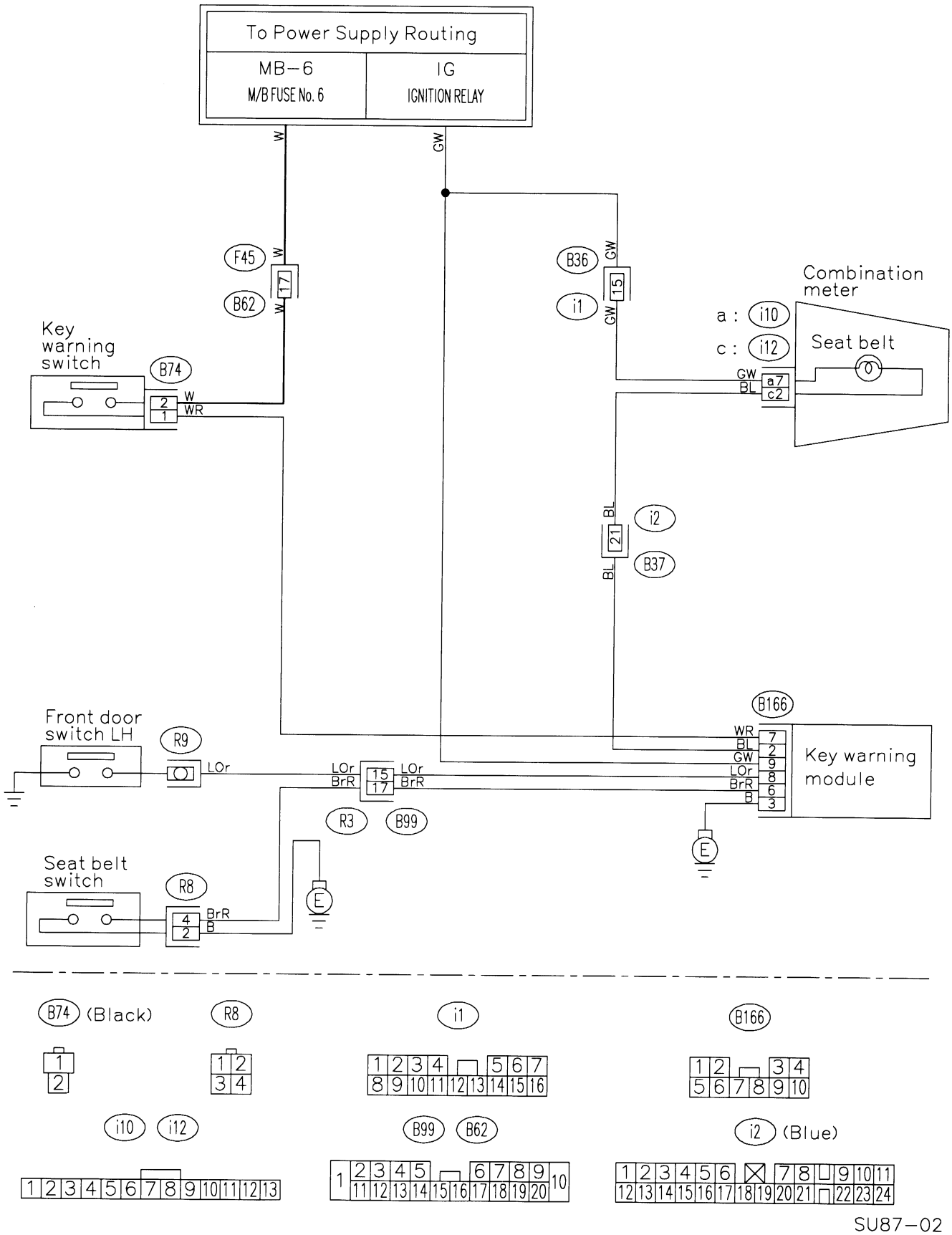
SU52−03

AE: REMOTE CONTROLLED REARVIEW MIRROR SYSTEM

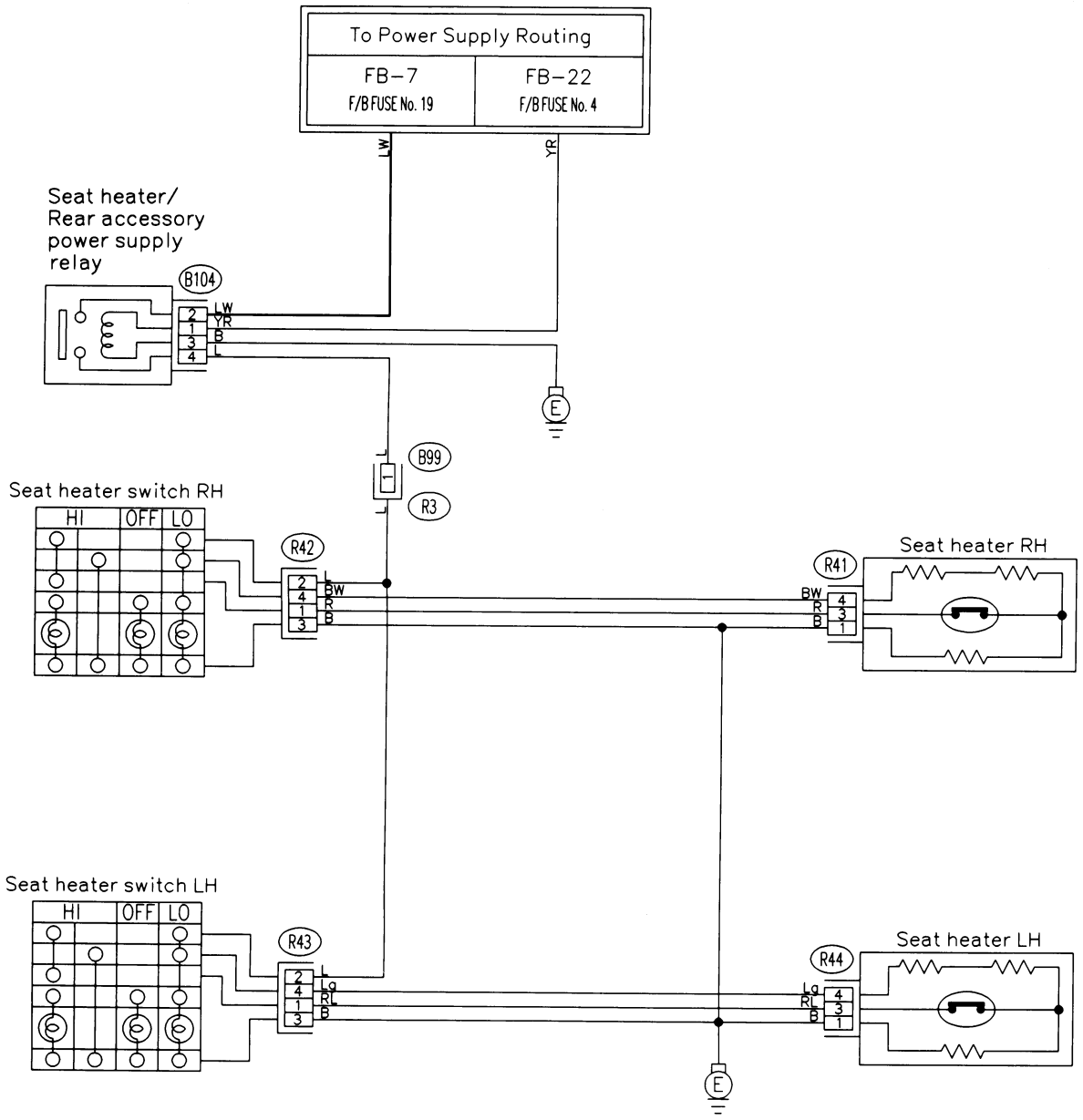


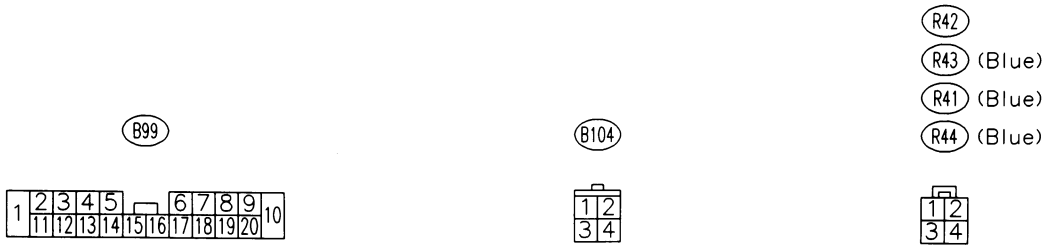
SU79−03

AF: SEAT BELT WARNING AND KEY WARNING SYSTEM



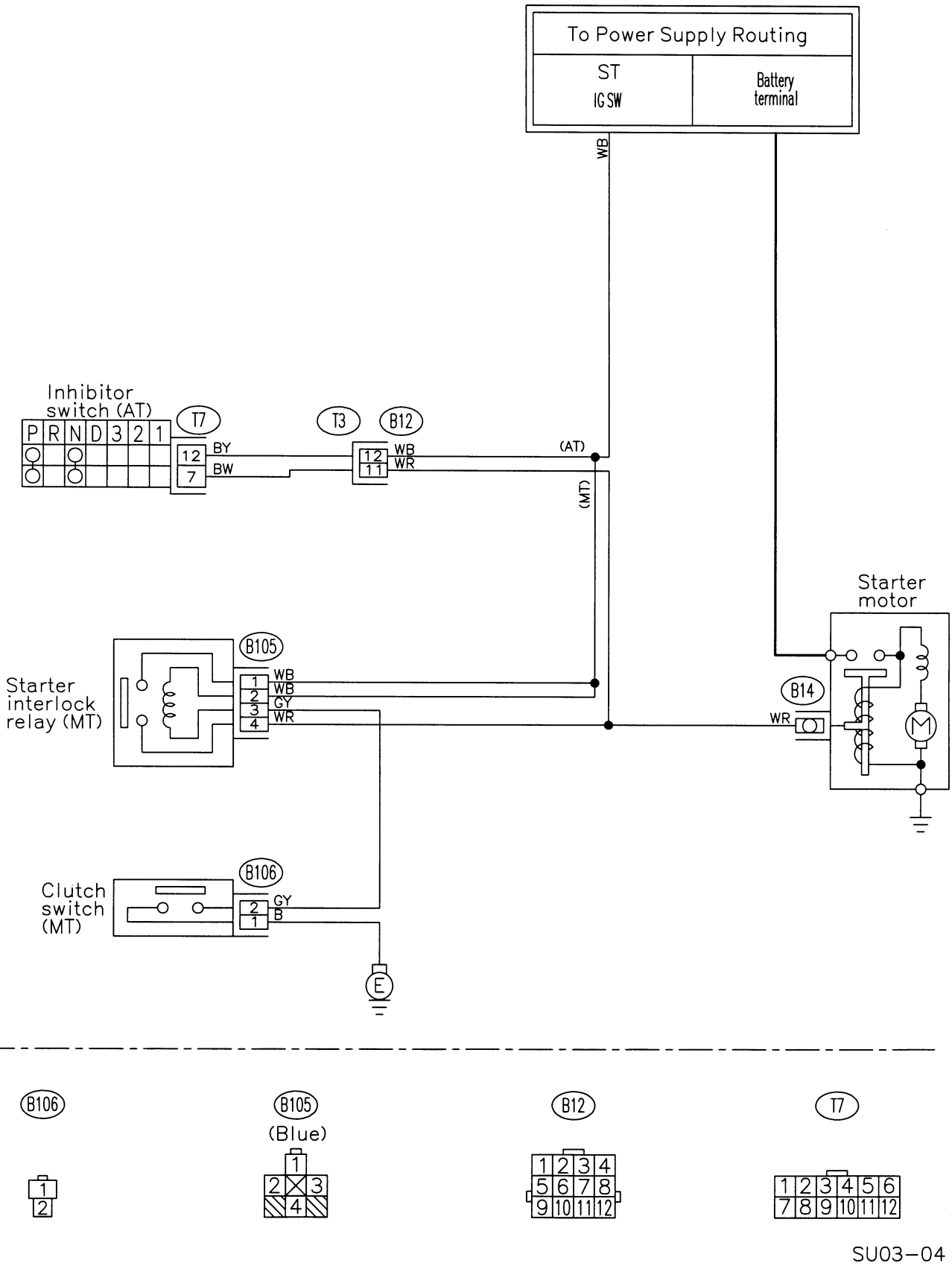
AG: SEAT HEATER SYSTEM



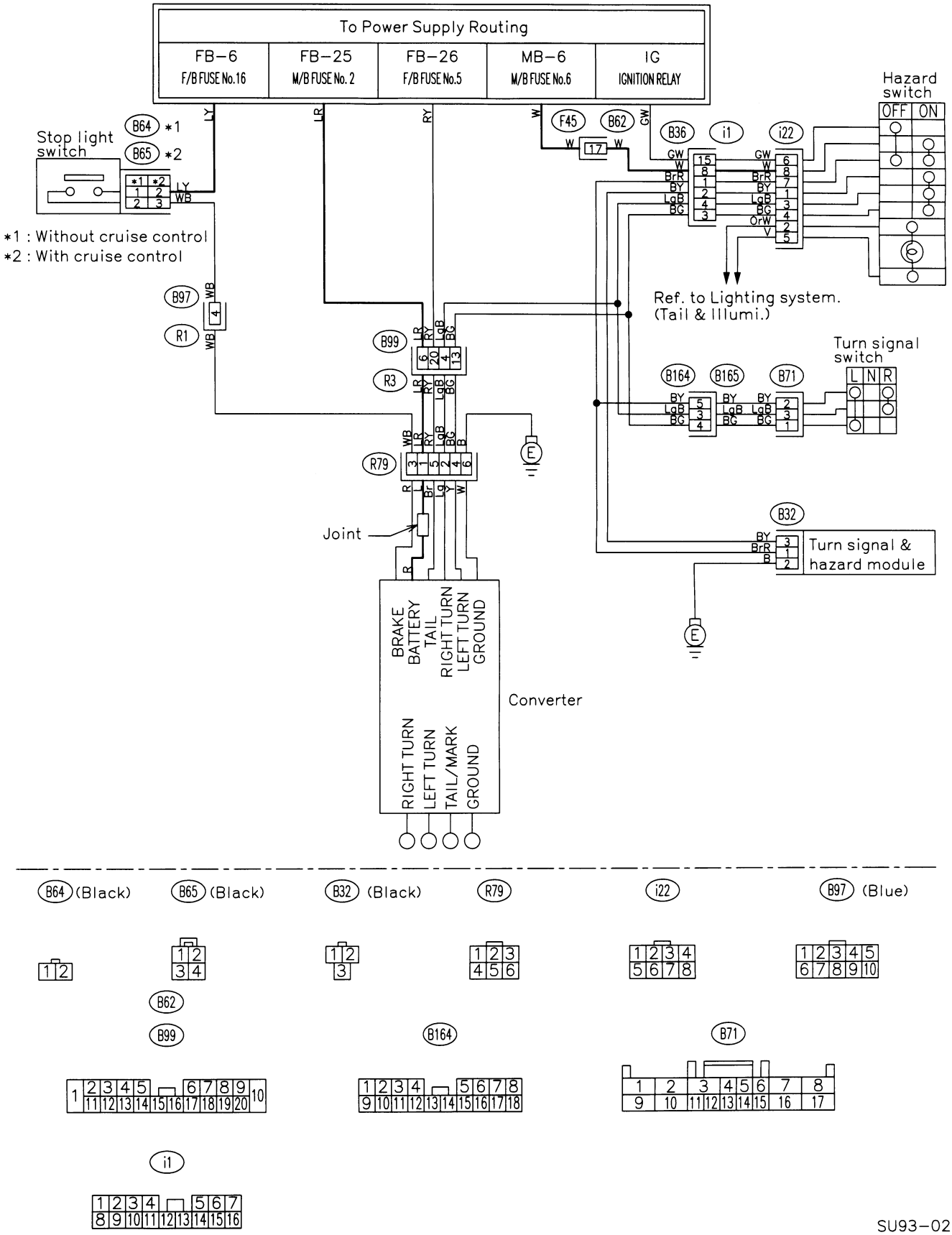


SU84-02

AH: STARTER SYSTEM

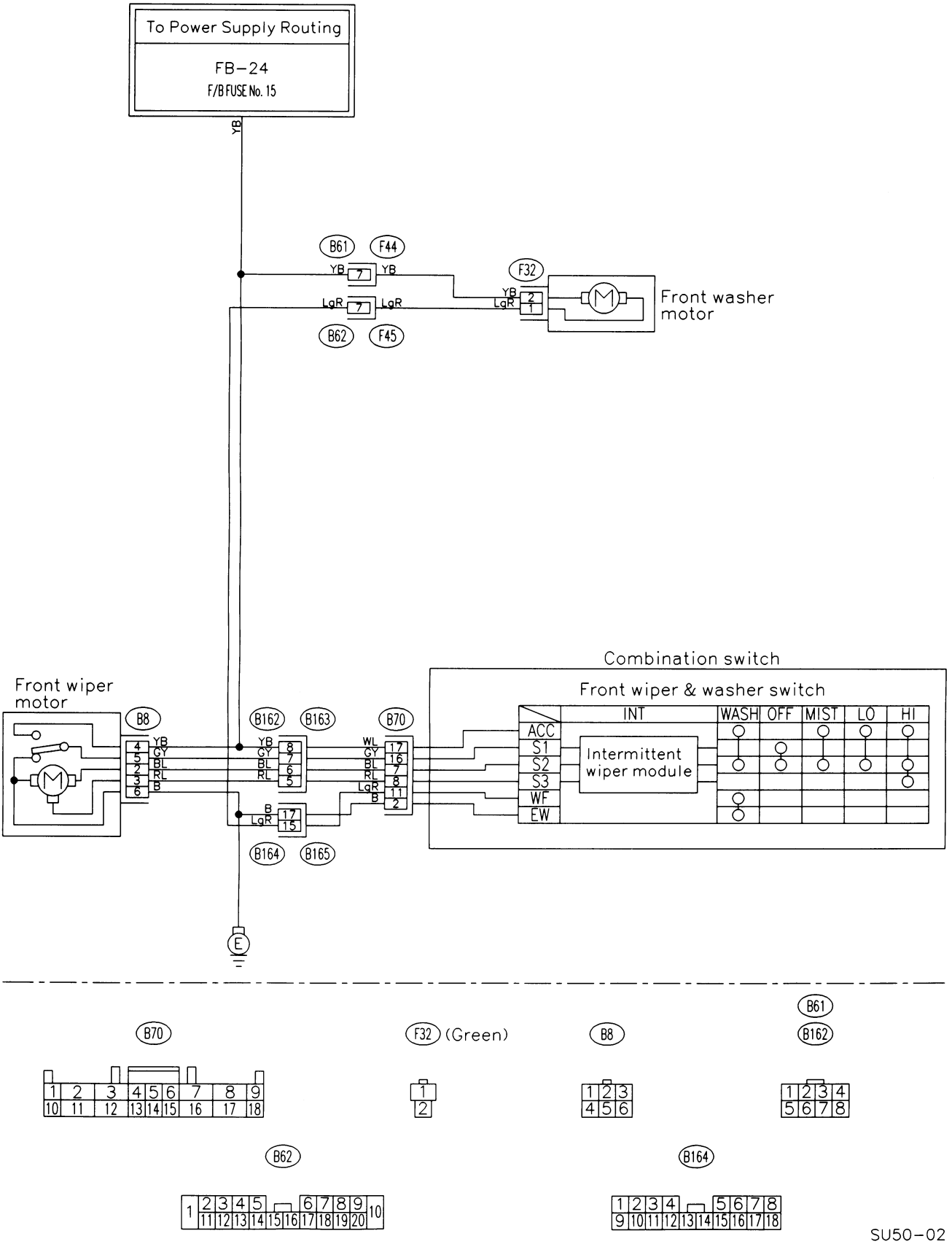


AI: TRAILER WIRE HARNESS (OPTION)

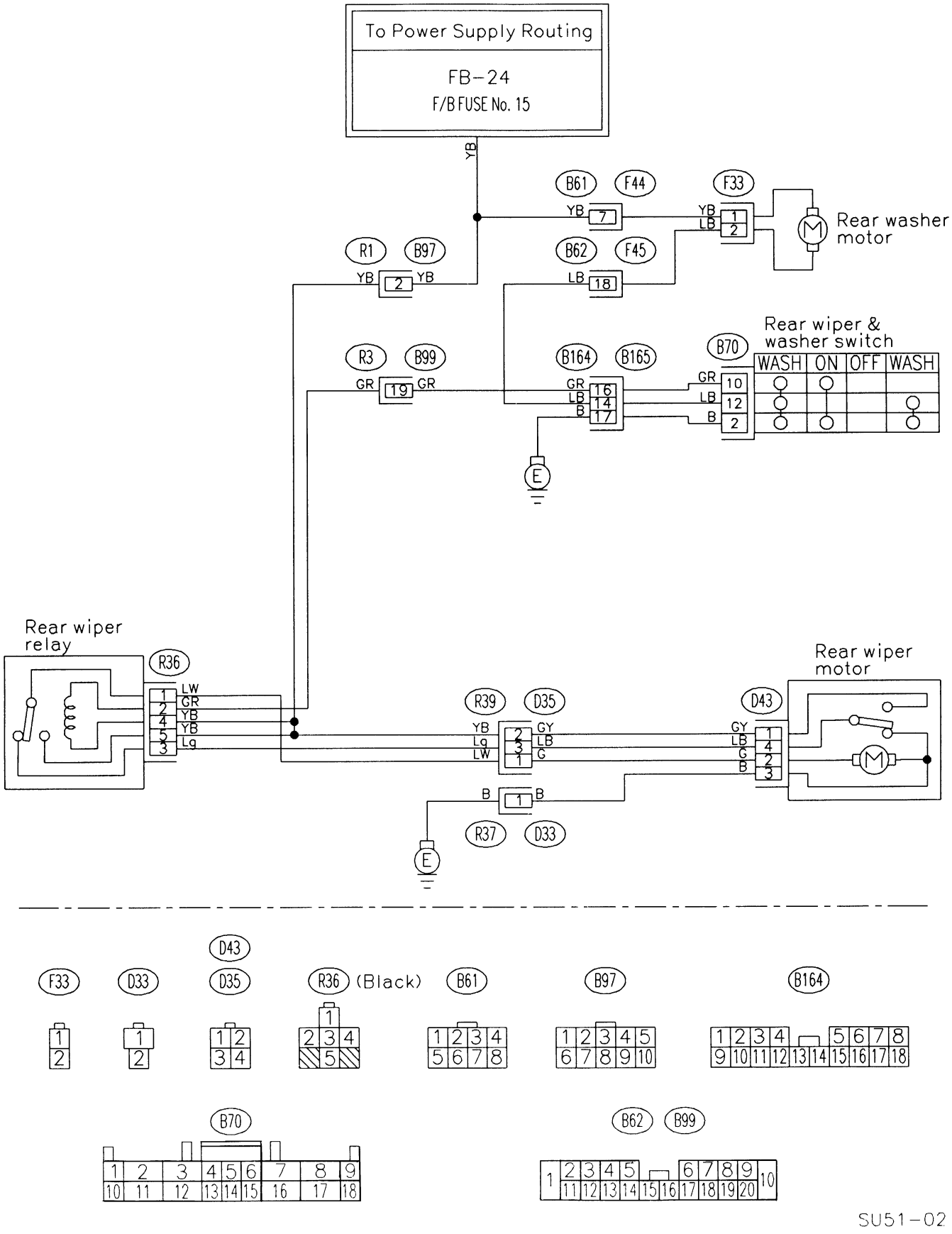


SU93−02

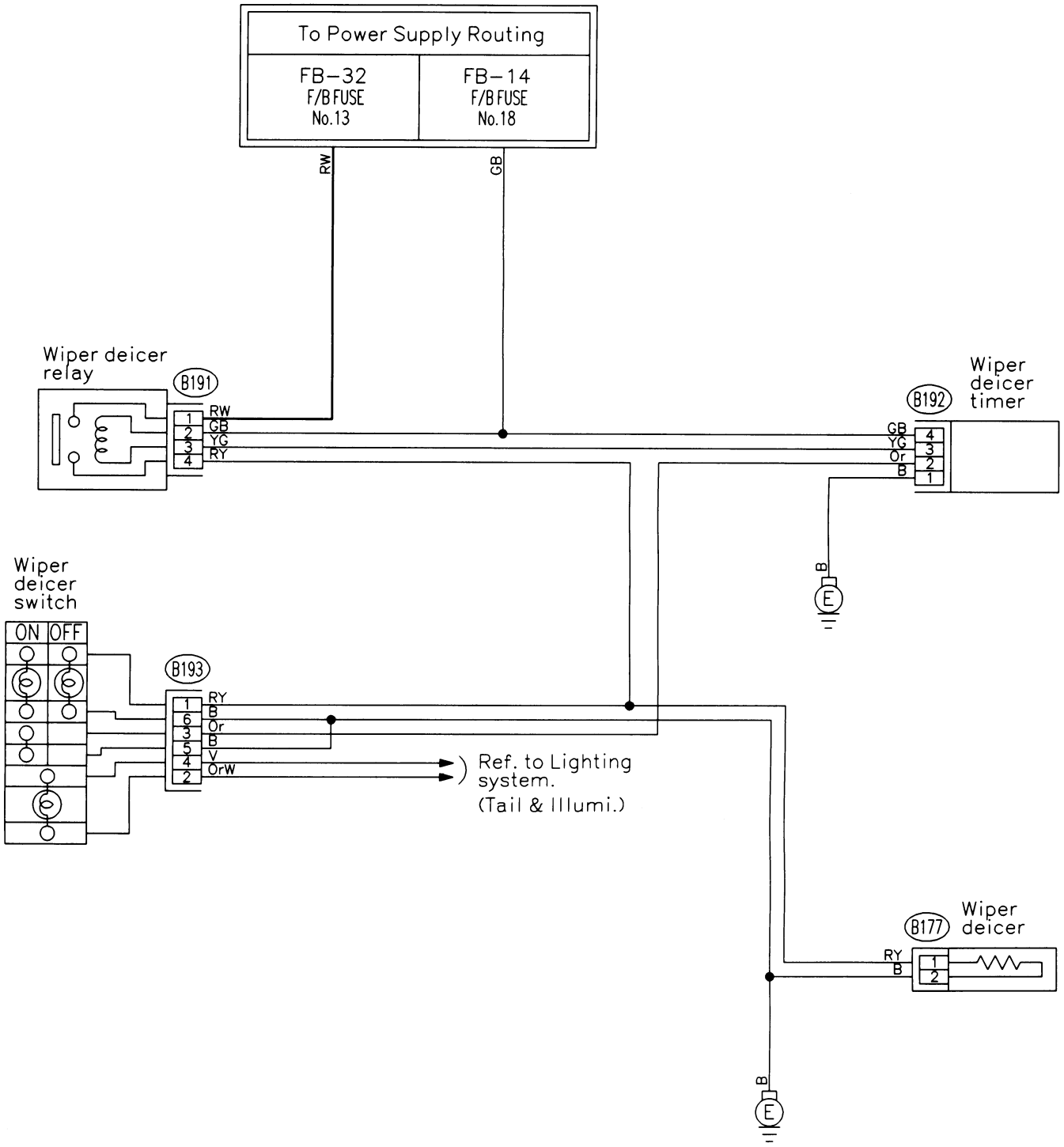
AJ: WIPER AND WASHER SYSTEM (FRONT)

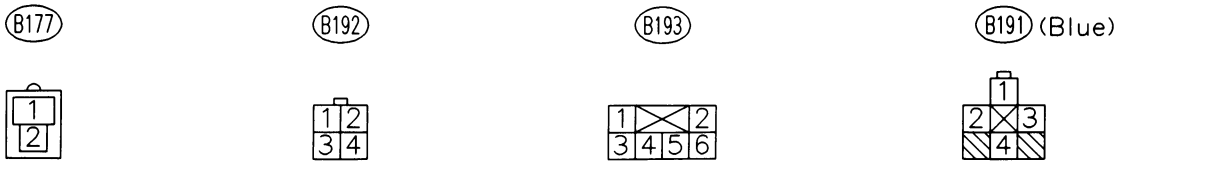


AK: WIPER AND WASHER SYSTEM (REAR)



AL: WIPER DEICER SYSTEM

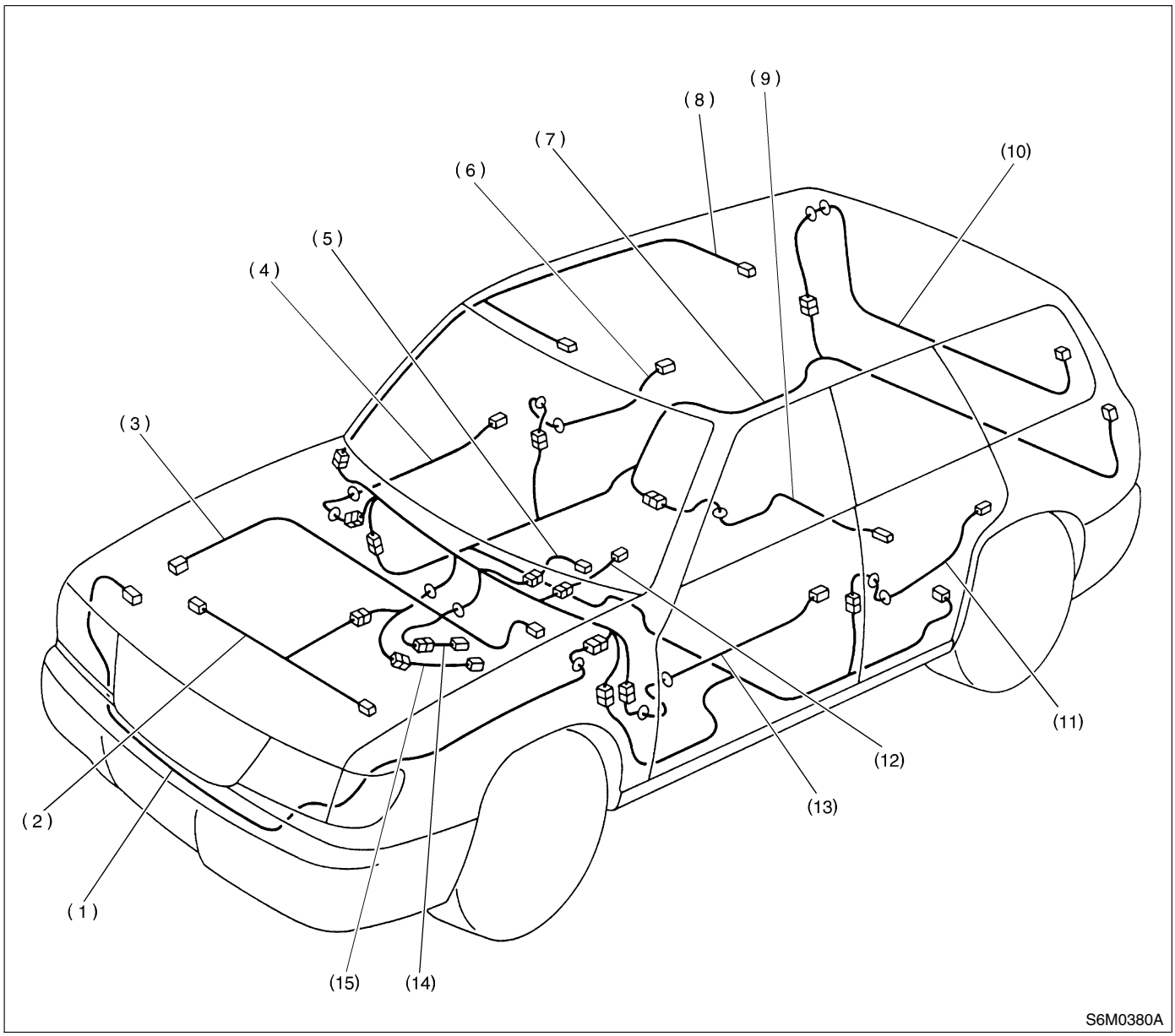




SU78−01

6. Electrical Wiring Harness and Ground Point

A: OVERALL LOCATION



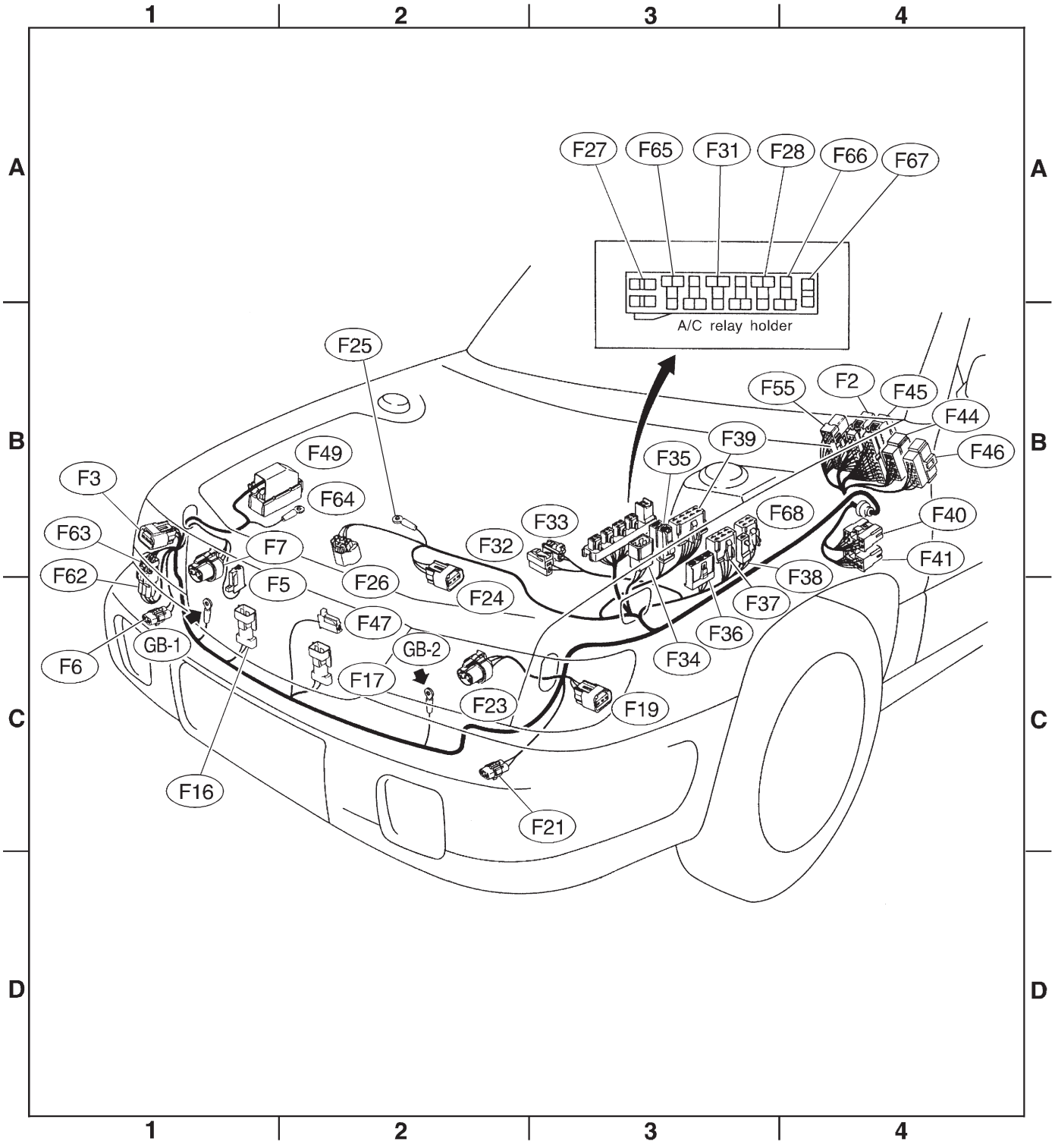
(1) Front wiring harness
(2) Engine wiring harness
(3) Bulkhead wiring harness
(4) Front door cord RH
(5) Instrument panel wiring harness
(6) Rear door cord RH
(7) Rear wiring harness
(8) Roof cord
(9) Fuel tank cord
(10) Rear gate cord
(11) Rear door cord LH
(12) Combination switch cord
(13) Front door cord LH
(14) Transmission cord
(15) Oxygen sensor cord

B: FRONT WIRING HARNESS

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
F2	16	Black	B-4	B100	Bulkhead wiring harness
F3	3	Gray	B-1		Front turn signal light & clearance light RH
F5	1	★	B-1		Horn
F6	2	Black	B-1		Front fog light RH
F7	3	★	B-1		Headlight RH
F16	2	Black	B-1		Sub fan motor
F17	2	Black	B-2	B-2	Radiator main fan motor
F19	3	Gray	C-3		Front turn signal light & clearance light LH
F21	2	Black	C-2		Front fog light LH
F23	3	★	B-2		Headlight LH
F24	3	Gray	B-2		A/C compressor
F25	1	★	B-2		Generator
F26	3	Green	B-2		
F27	4	★	B-3		A/C fuse (Relay holder)
F28	4	★	B-3		A/C sub fan relay (Relay holder)
F31	4	★	B-3		A/C relay (Relay holder)
F32	2	Green	B-3		Front washer motor
F33	2	★	B-3		Rear washer motor
F34	4	★	B-3		SBF holder (ABS)
F35	2	★	B-3		M/B
F36	3	★	B-3		
F37	6	Black	B-3		
F38	1	★	B-3		
F39	8	Black	B-3		
F40	9	Brown	B-4		F/B
F41	7	Gray	B-4		
F44	8	★	B-4	B61	Bulkhead wiring harness
F45	20	★	B-4	B62	
F46	8	★	B-4	B108	
F47	1	★	B-2		Horn
F49	31	★	B-2		ABS control module
F55	12	★	B-4	R48	Rear wiring harness (ABS)
F62	6	★	B-1	F63	Shield joint connector (ABS)
F63	6	★	B-1	F62	
F64	1	★	B-2		ABS motor ground
F65	4	★	B-3		Front fog light relay (Relay holder)
F66	4	★	B-3		Radiator main fan relay (Relay holder)
F67	2	★	B-3		FWD switch (Relay holder)
F68	4	Black	B-3		M/B
★: Non-colored					

2. LOCATION



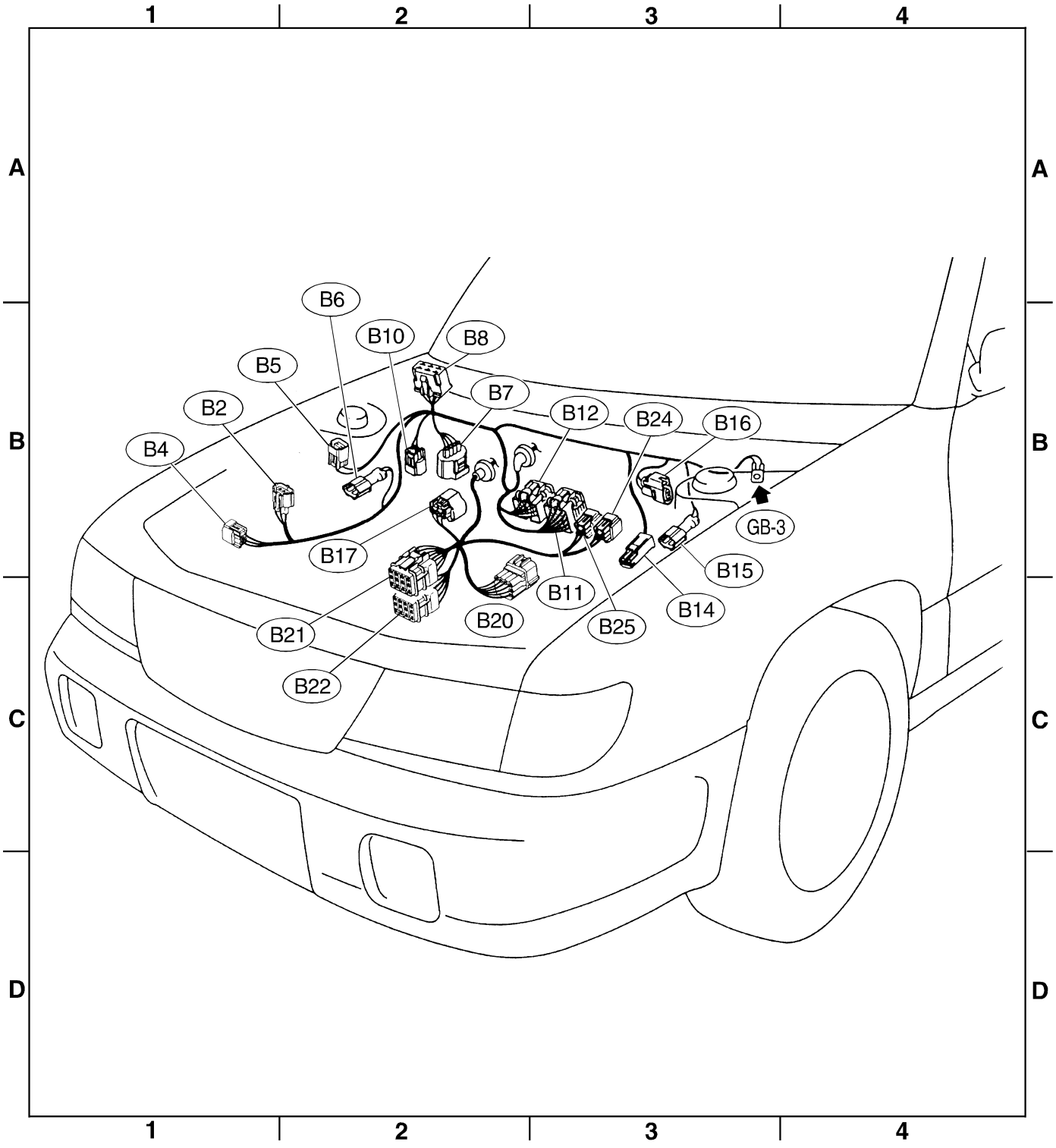
S6M0300A

C: BULKHEAD WIRING HARNESS (IN ENGINE ROOM)

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
B2	3	★	B-1		Atmospheric pressure sensor
B4	4	Gray	B-1		AT dropping resistor
B5	2	Gray	B-2		Resistor (Daytime running light)
B6	2	Brown	B-2		ABS front sensor RH
B7	4	★	B-2		Cruise control actuator
B8	6	★	A-2		Front wiper motor
B10	2	Gray	B-2		A/C pressure switch
B11	20	Black	B-3	T4	Transmission (AT)
B12	12	★	B-3	T3	
B14	1	★	B-3		Starter (Magnet)
B15	2	Brown	B-3		ABS front sensor LH
B16	2	Gray	B-3		Brake fluid level switch
B17	3	★	B-2		Vehicle speed sensor (M/T)
B20	10	★	B-2	E1	Oxygen sensor cord
B21	20	★	B-2	E2	Engine wiring harness
B22	16	★	B-2	E3	Engine wiring harness
B24	2	Gray	B-3	T1	Back-up light switch (MT)
B25	2	Brown	B-3	T2	Neutral position switch (MT)
★: Non-colored					

2. LOCATION



S6M0381A

D: BULKHEAD WIRING HARNESS (IN COMPARTMENT)

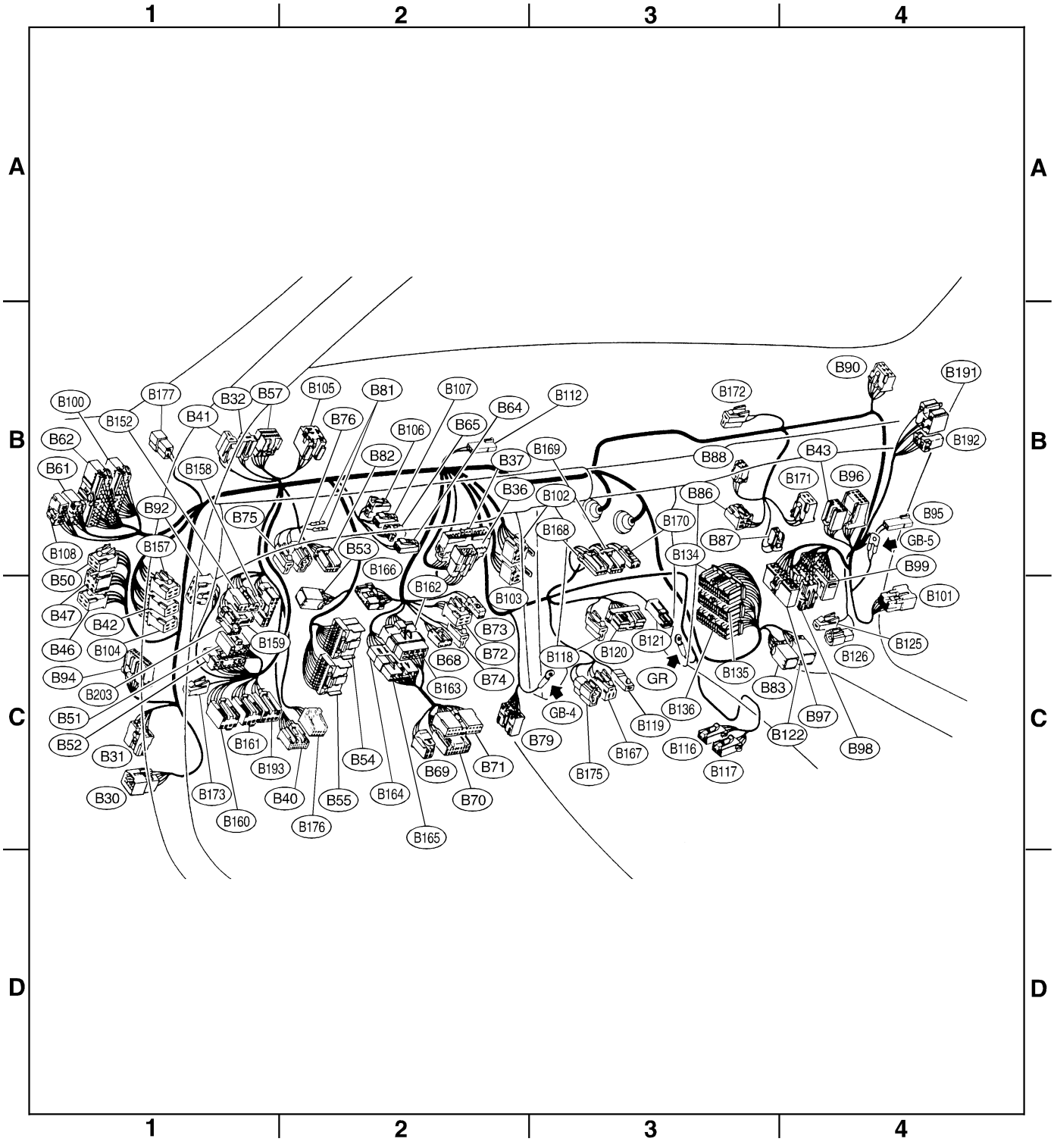
1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
B30	24	★	C-1	D1	Front door cord LH
B31	7	★	C-1	AB1	SRS (Airbag) harness
B32	3	Black	B-1		Turn & hazard module
B36	16	★	B-2	i1	Instrument panel meter harness
B37	24	Blue	B-2	i2	
B40	16	★	C-2		OBD-II service connector
B41	2	★	B-1		Power window circuit breaker
B42	4	Blue	C-1		Power window relay
B43	6	Black	B-4		Illumination control module
B46	4	Green	C-1		Fuel pump relay
B47	6	Brown	C-1		Main relay
B50	4	★	B-1		Blower relay
B51	8	Blue	C-1		F/B
B52	12	Blue	C-1		
B53	6	★	C-2		Shield joint connector (AT)
B54	24	★	C-2		Transmission control module
B55	24	Gray	C-2		
B57	12	★	B-1		Shift lock control module
B61	8	★	B-1	F44	Front wiring harness
B62	20	★	B-1	F45	
B64	2	Black	B-2		Stop light switch
B65	4	Black	B-2		Stop & brake switch (With cruise control)
B68	5	Black	C-2		Cruise control sub switch
B69	4	★	C-2		Combination switch
B70	18	★	C-2		
B71	17	★	C-2		
B72	4	Blue	C-2		Ignition switch
B73	2	★	C-2		Key lock solenoid (AT)
B74	2	Black	C-2		Key warning switch
B75	2	Green	B-2	B76	Test mode connector
B76	2	Green	B-2	B75	
B79	14	Gray	C-3		Check connector
B81	1 × 2	★	B-2		Diagnosis terminal (Ground)
B82	6	Black	B-2		Diagnosis connector
B83	6	★	C-4		Shield joint connector (E/G)
B86	4	★	B-3		Blower motor resistor
B87	2	★	B-4		Blower motor
B88	4	Brown	B-3		Evaporator thermoswitch
B90	6	★	B-4	R50	Roof cord
B92	6	★	C-1		Door lock timer
B94	20	★	C-1		Cruise control module
B95	2	★	B-4		Diode (Daytime running light)
B96	10	★	B-4		Daytime running light control module
B97	10	Blue	C-4	R1	Rear wiring harness
B98	12	Black	C-4	R2	
B99	20	★	C-4	R3	
B100	16	Black	B-1	F2	Front wiring harness (With ABS model)
B101	24	★	C-4	D11	Front door cord RH
B102	5	Black	B-2		Daytime running light relay

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
B103	4	Blue	B-2		HI-beam relay (Daytime running light)
B104	4	★	C-1		Seat heater/rear accessory power supply relay
B105	4	Blue	B-2		Starter interlock relay (MT)
B106	2	★	B-2		Clutch switch (MT)
B107	2	Blue	B-2		Clutch switch (Cruise control)
B108	8	★	B-1	F46	Front wiring harness
B112	2	★	B-2		Diode (Front fog light)
B116	4	Black	C-3		Select lever illumination light (AT)
B117	4	★	C-3		Parking position switch & shift lock solenoid (AT)
B118	2	★	C-3		CD player illumination light
B119	1	★	C-3		Front accessory power supply (Power)
B120	14	★	C-3		Radio
B121	1	★	C-3		Audio ground
B122	6	★	C-4		Sensor ground joint connector (E/G)
B125	1	Green	C-4	B126	Test mode connector
B126	1	Green	C-4	B125	
B134	35	Black	C-3		Engine control module
B135	28	Black	C-3		
B136	30	Black	C-3		
B152	7	★	C-1		F/B
B157	4	Red	C-1		Ignition relay
B158	12	★	C-1		F/B
B159	10	Gray	C-1		F/B
B160	6	Gray	C-1		Front fog light switch
B161	6	Brown	C-1		Cruise control main switch
B162	8	★	C-2	B163	Combination switch cord
B163	8	★	C-2	B162	Bulkhead wiring harness
B164	18	★	C-2	B165	Combination switch cord
B165	18	★	C-2	B164	Bulkhead wiring harness
B166	10	★	C-2		Key warning module
B167	3	★	C-3		Front accessory power supply (Ground)
B168	3	★	B-3		A/C switch
B169	6	★	B-3		Blower fan switch
B170	2	★	B-3		Mode control panel illumination light
B171	4	Black	B-4		Mirror heater relay
B172	2	★	B-3		Mirror heater condenser
B173	1	★	C-1		IG power supply connector
B175	2	★	C-3		Ash tray illumination light
B176	10	★	C-2		Keyless entry connector (OP)
B177	2	★	B-1		Wiper deicer
B191	4	Blue	B-4		Wiper deicer relay
B192	4	★	B-4		Wiper deicer timer
B193	6	★	C-1		Wiper deicer switch
B203	4	Black	C-1		Noise killer

★: Non-colored

2. LOCATION



S6M0382A

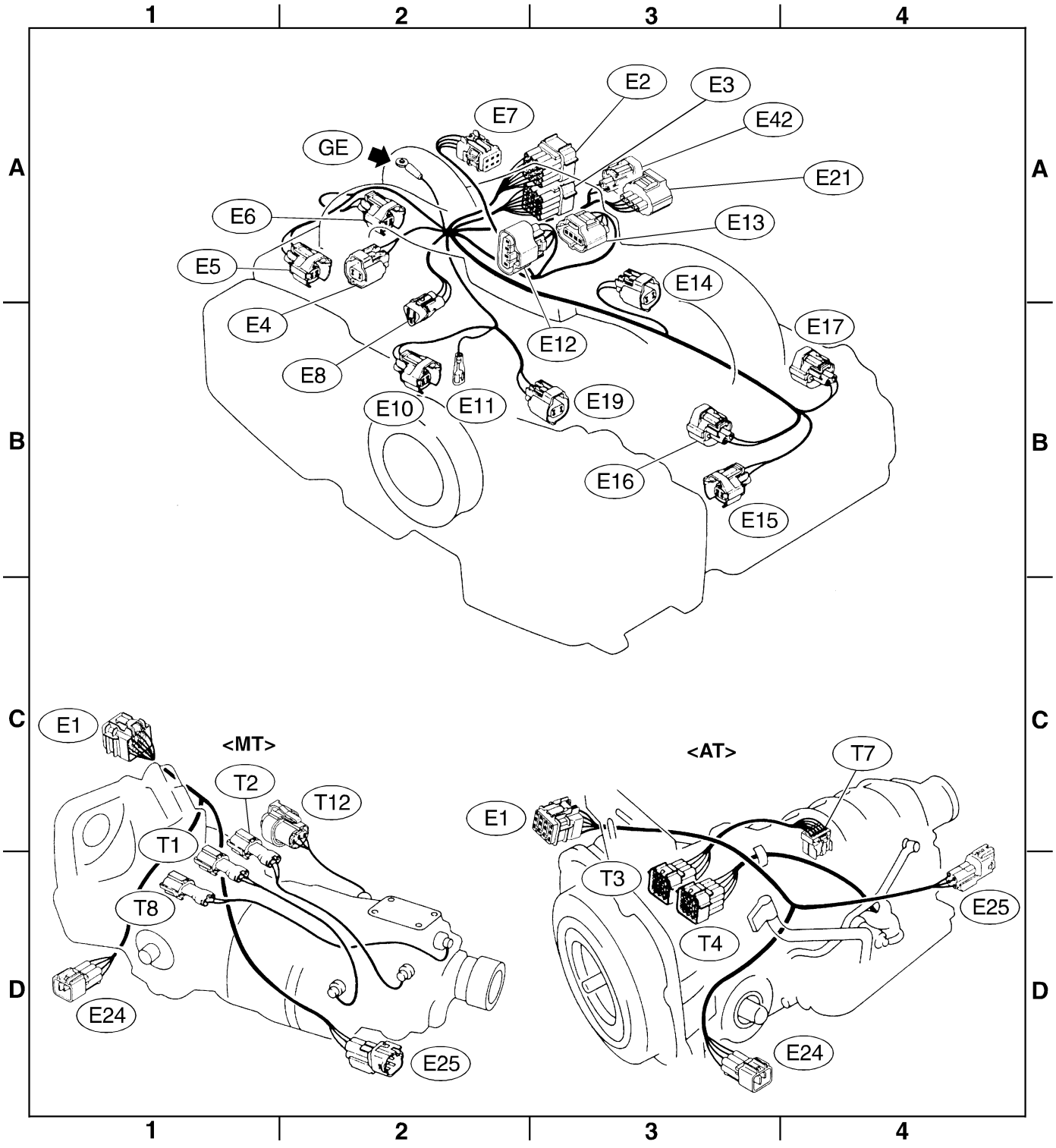
E: ENGINE WIRING HARNESS AND TRANSMISSION CORD

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
E1	10	★	C-1/C-3	B20	Bulkhead wiring harness
E2	20	Gray	A-3	B21	
E3	16	Gray	A-3	B22	
E4	2	★	A-2		Purge control solenoid valve
E5	2	★	A-2		Injector #1
E6	2	★	A-2		Injector #3
E7	6	★	A-2		Idle air control solenoid valve
E8	3	★	B-2		Engine coolant temperature sensor and thermometer
E10	2	★	B-2		Crankshaft position sensor
E11	1	★	B-2		Oil pressure switch
E12	4	Dark gray	A-3		Ignition coil and ignitor
E13	4	★	A-3		Throttle position sensor
E14	2	Gray	B-3		Knock sensor
E15	2	★	B-3		Camshaft position sensor
E16	2	★	B-3		Injector #2
E17	2	★	B-4		Injector #4
E19	2	★	B-3		Power steering oil pressure swtich
E21	4	★	A-3		Pressure sensor and intake air temperature sensor
E24	6	★	D-1/D-3		Front oxygen (A/F) sensor
E25	4	★	D-2/D-4		Rear oxygen sensor
E42	2	★	A-3		Air assist solenoid valve
★: Non-colored					

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
T1	2	Gray	C-1	B24	Bulkhead wiring harness (MT)
T2	2	Brown	C-1	B25	
T3	12	★	D-3	B12	Bulkhead wiring harness (AT)
T4	20	★	D-3	B11	
T7	12	★	C-4		Inhibitor switch (AT)
T8	2	Gray	D-1	B29	Bulkhead wiring harness (MT)
T12	3	★	C-2		Speed sensor cord (MT)
★: Non-colored					

2. LOCATION



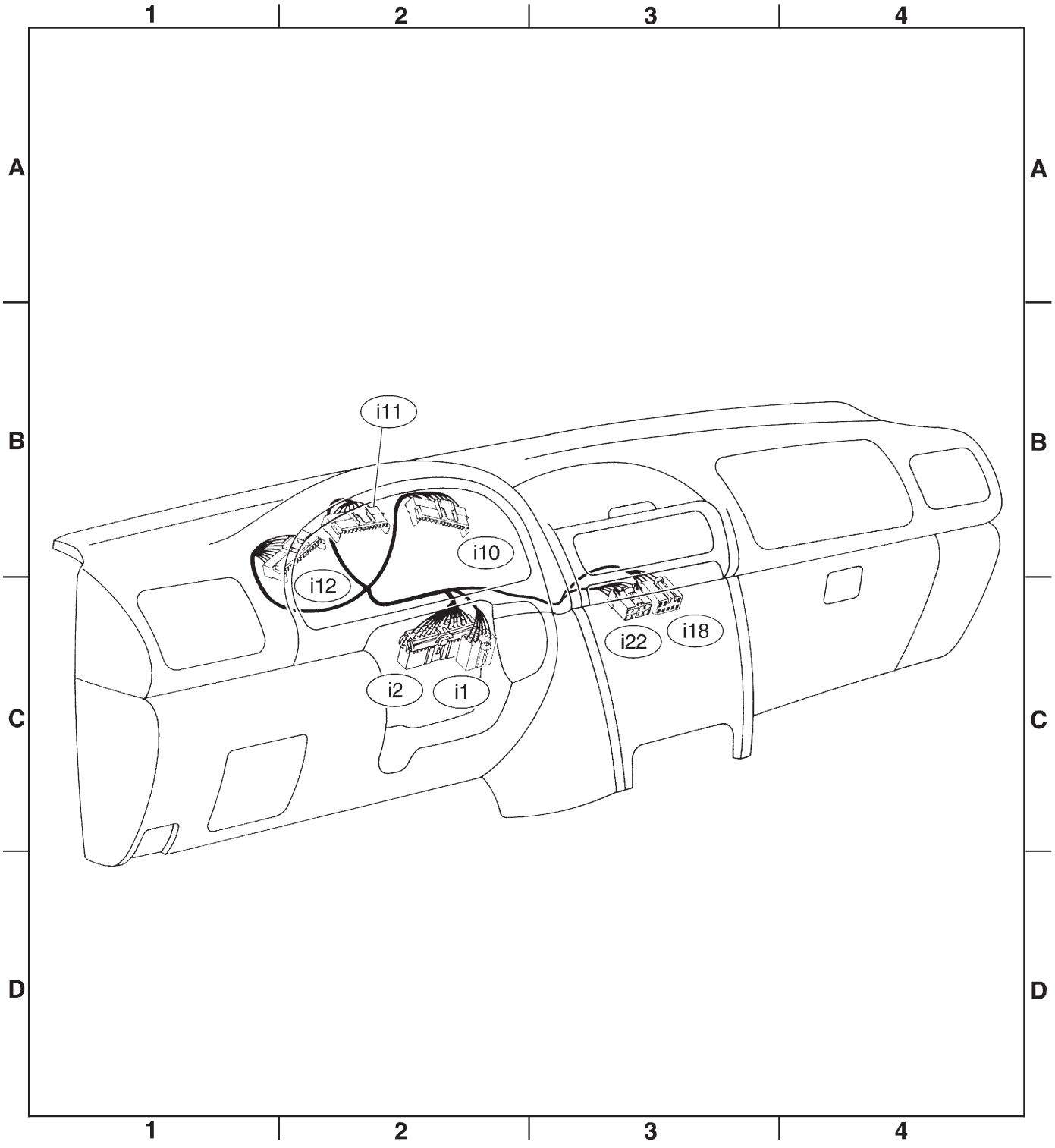
S6M0383A

F: INSTRUMENT PANEL WIRING HARNESS

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
i1	16	★	B-2	B36	Bulkhead wiring harness
i2	24	Blue	B-2	B37	
i10	13	★	B-2		Combination meter
i11	10	★	B-2		
i12	13	★	B-2		
i18	8	★	B-3		Rear defogger switch
i22	8	★	B-3		Hazard switch
★: Non-colored					

2. LOCATION



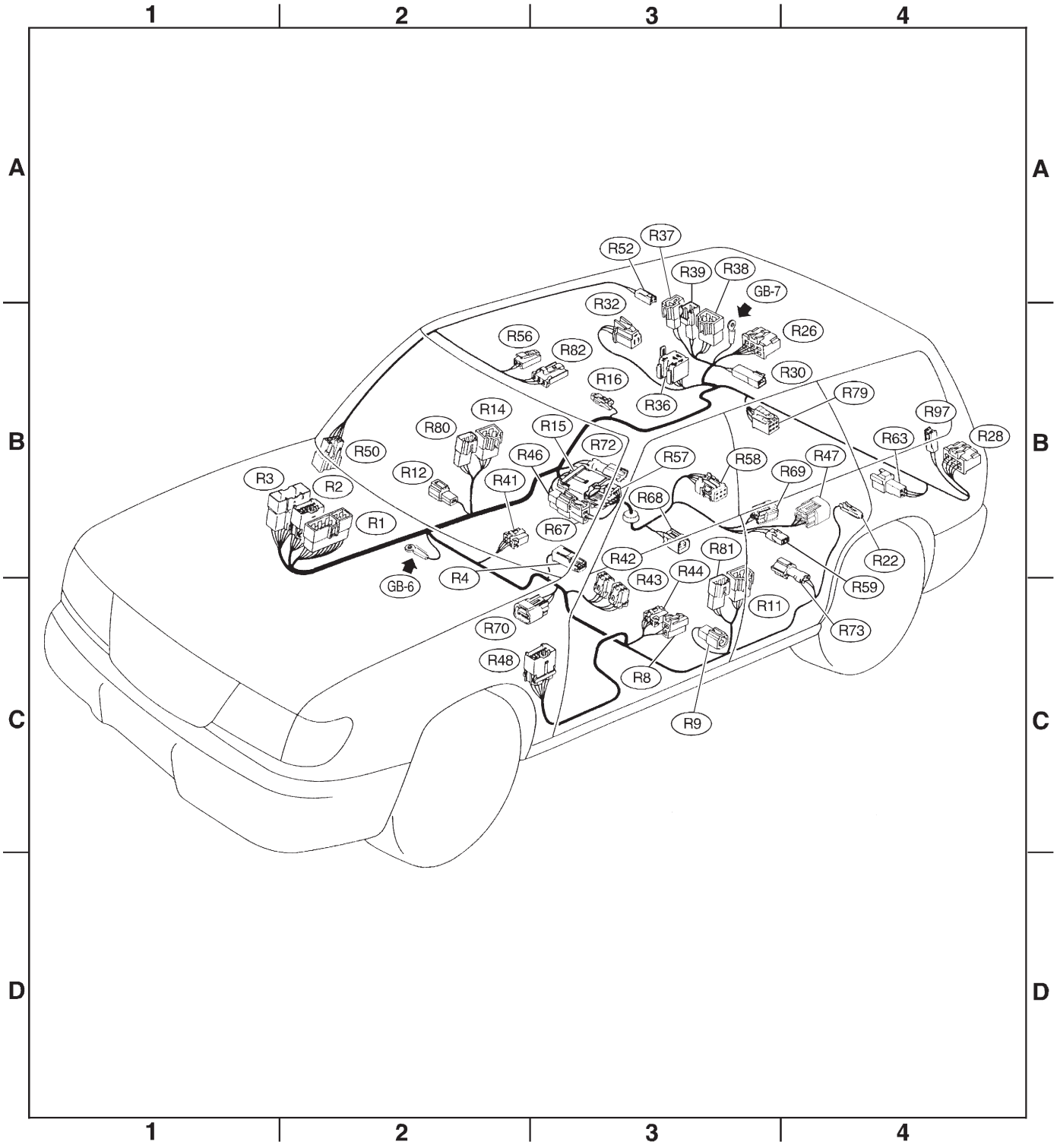
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G: REAR WIRING HARNESS

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
R1	10	Blue	B-2	B97	Bulkhead wiring harness
R2	12	Black	B-2	B98	
R3	20	★	B-2	B99	
R4	1	Black	B-3		Parking brake switch
R8	4	★	B-3		Seat belt switch
R9	1	★	B-3		Front door switch LH
R11	4	★	B-3	D21	Rear door cord LH
R12	1	★	B-2		Front door switch RH
R14	4	★	B-2	D27	Rear door cord RH
R15	12	★	B-3	R57	Fuel tank cord
R16	1	Brown	B-3		Rear door switch RH
R22	1	Brown	B-4		Rear door switch LH
R26	6	★	A-3		Rear combination light RH
R28	6	★	B-4		Rear combination light LH
R30	2	★	A-3		Diode (Luggage room light)
R32	3	★	A-3		Rear accessory power supply
R36	5	Black	A-3		Rear wiper relay
R37	2	★	A-3	D33	Rear gate cord
R38	4	★	A-3	D34	
R39	4	★	A-3	D35	
R41	4	Blue	B-2		Seat heater RH
R42	4	★	B-3		Seat heater switch RH
R43	4	Blue	B-3		Seat heater switch LH
R44	3	Blue	B-3		Seat heater LH
R46	2	★	B-3	R67	Fuel tank cord
R47	3	★	B-3		Fuel tank pressure sensor
R48	12	★	C-3	F55	Front wiring harness (ABS)
R50	6	★	B-2	B90	Bulkhead wiring harness
R52	2	★	A-3		Room light
R56	2	★	A-2		Spot light
R57	8	★	B-3	R15	Rear wiring harness
R58	6	★	B-3		Fuel gauge module & fuel pump assembly
R59	2	★	B-3		Fuel gauge sub module
R63	4	★	B-4		License plate light
R67	2	★	B-3	R46	Rear wiring harness
R68	2	★	B-3		Pressure control solenoid valve
R69	2	★	B-3		Vent control solenoid valve
R70	3	★	B-2		ABS G sensor
R72	2	★	B-3		Rear ABS sensor RH
R73	2	★	B-4		Rear ABS sensor LH
R79	6	★	B-3		Trailer connector
R80	3	★	B-2	D64	Rear door cord RH
R81	3	★	B-3	D63	Rear door cord LH
R82	4	★	A-3		Clock
R97	2	Brown	B-4		Antenna amplifier
★: Non-colored					

2. LOCATION



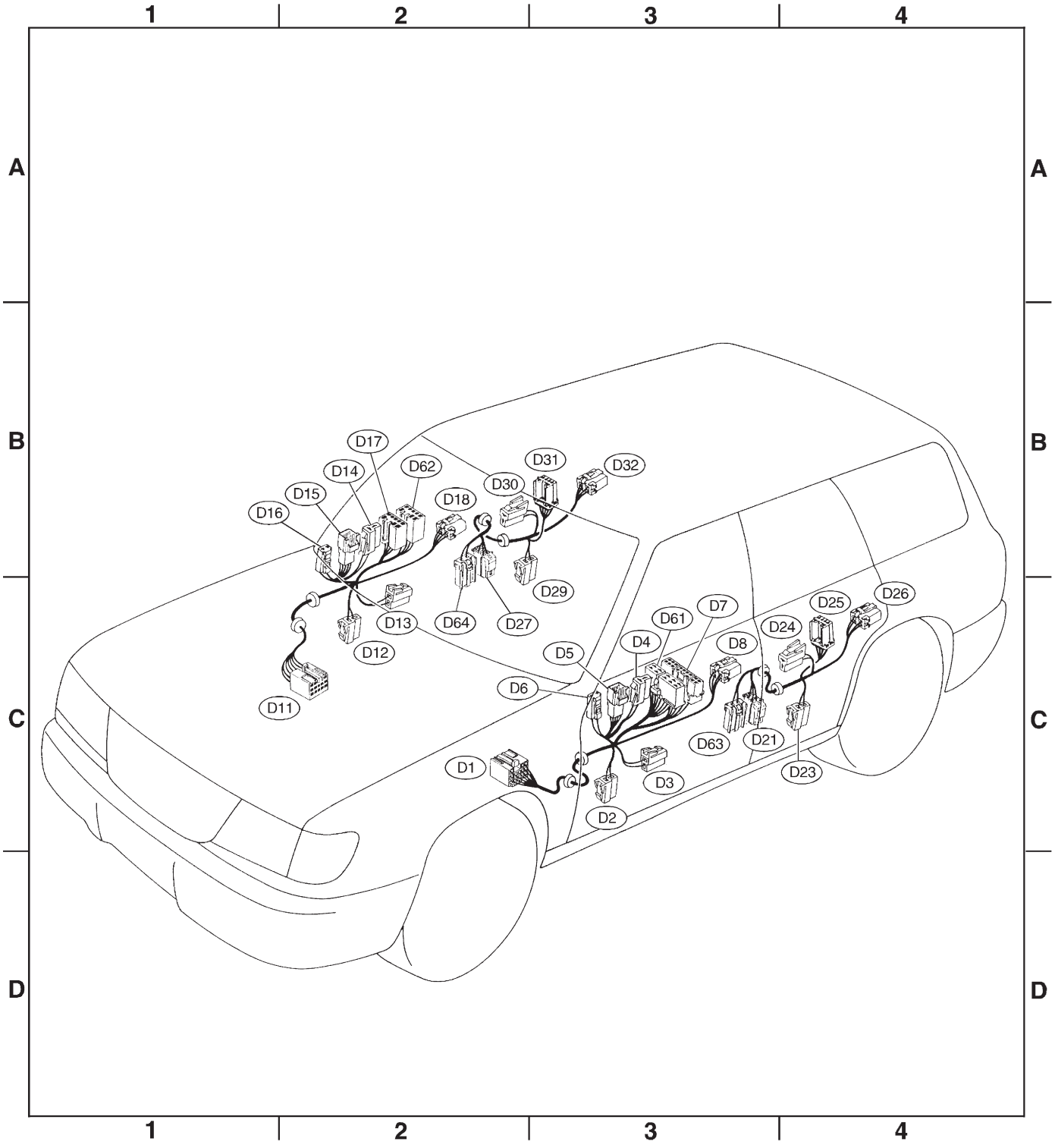
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H: DOOR CORD

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
D1	24	★	C-2	B30	Bulkhead wiring harness
D2	2	★	C-3		Front door speaker LH
D3	2	Blue	C-3		Front power window motor LH
D4	2	Black	B-3		Front door tweeter LH
D5	6	★	B-3		Remote control rearview mirror LH
D6	2	★	B-3		Mirror heater LH
D7	16	★	B-3		Power window main switch
D8	4	★	B-3		Front door lock actuator LH
D11	24	★	B-2	B101	Bulkhead wiring harness
D12	2	★	B-2		Front door speaker RH
D13	2	Blue	B-2		Front power window motor RH
D14	2	Black	B-2		Front door tweeter RH
D15	6	★	B-2		Remote control rearview mirror RH
D16	2	★	B-2		Mirror heater RH
D17	8	★	B-2		Front power window sub switch RH
D18	4	★	B-2		Front door lock actuator RH
D21	4	★	C-3	R11	Rear wiring harness
D23	2	★	C-4		Rear door speaker LH
D24	2	Blue	B-4		Rear power window motor LH
D25	6	★	B-4		Rear power window sub switch LH
D26	4	★	B-4		Rear door lock actuator LH
D27	4	★	B-2	R14	Rear wiring harness
D29	2	★	B-3		Rear door speaker RH
D30	2	Blue	B-2		Rear power window motor RH
D31	6	★	B-3		Rear power window sub switch RH
D32	4	★	B-3		Rear door lock actuator RH
D61	10	★	B-3		Remote control rearview mirror switch
D62	8	★	B-2		Door lock switch RH
D63	3	★	C-3	R81	Rear wiring harness
D64	3	★	B-2	R80	Rear wiring harness
★: Non-colored					

2. LOCATION



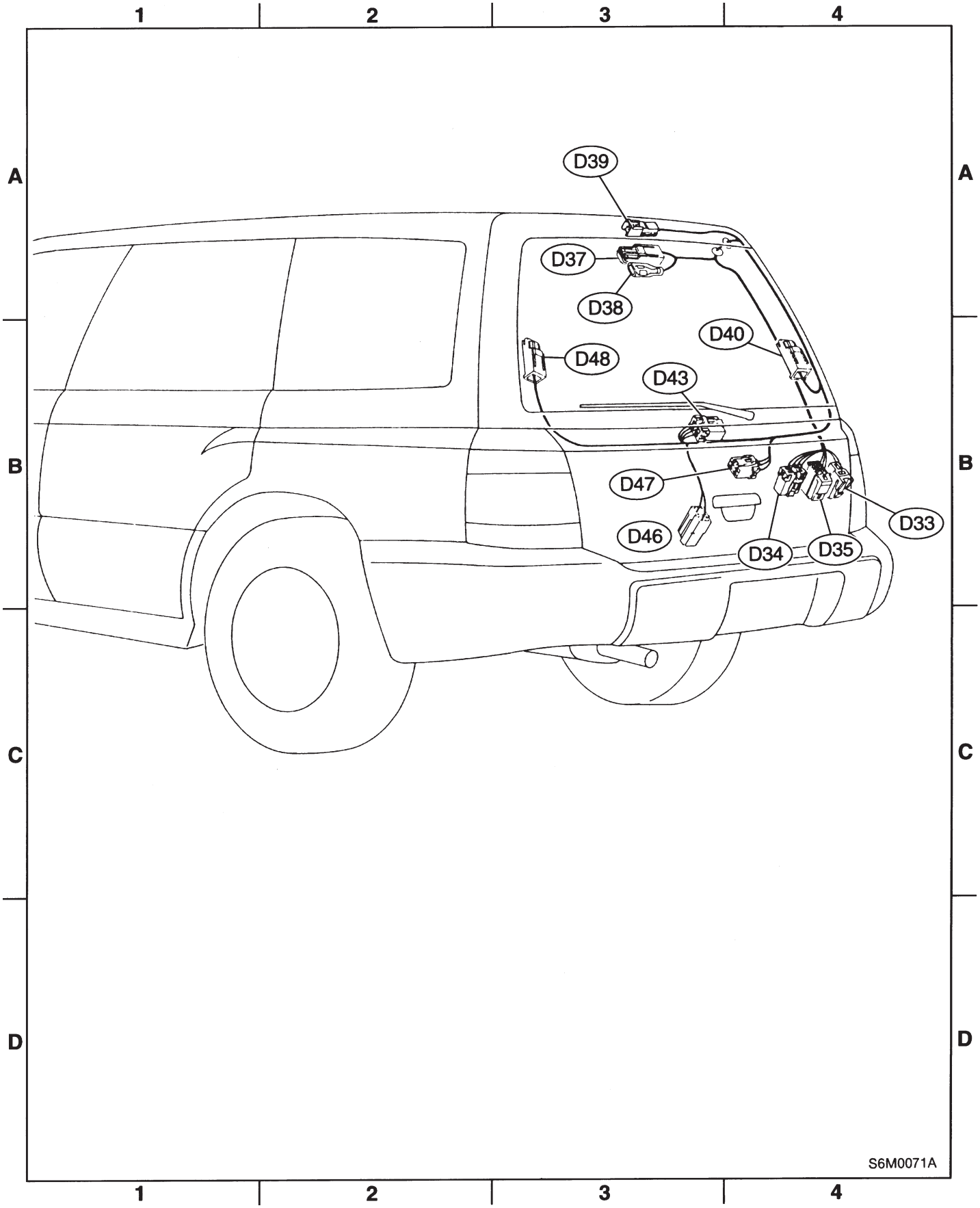
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I: REAR GATE CORD

1. LIST OF ITEMS

Connector				Connecting to	
No.	Pole	Color	Area	No.	Name
D33	2	★	B-4	R37	Rear wiring harness
D34	4	★	B-4	R38	
D35	4	★	B-4	R39	
D37	1	★	A-3		Luggage room light (Power)
D38	1	Black	A-3		Luggage room light
D39	2	Black	A-3		High-mount stop light
D40	1	Black	B-4		Rear defogger (Power)
D43	4	★	B-3		Rear wiper motor
D46	2	Black	B-3		Rear gate latch switch
D47	4	★	B-4		Rear gate lock actuator
D48	1	Black	B-3		Rear defogger (Ground)
★: Non-colored					

2. LOCATION



MEMO: