

# SERVICE BRAKES

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# BASIC BRAKE SYSTEM

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## GENERAL

### OUTLINE OF CHANGES

- Drum brakes have been changed to disc brakes to install for rear brakes.
- Due to the adoption of electronic brake-force distribution (EBD\*) system to obtain the ideal braking force, a proportioning valve has been abolished. <Vehicles with ABS>
- Due to the installation of rear disc brakes, proportioning valve specifications have been changed. <Vehicles without ABS>
- Due to the adoption of the 1900 mL diesel engine, removal and installation of brake booster has been established.
- The limit of the front brake disc runout has been changed.

#### NOTE

\*EBD: Electronic Brake-force Distribution

### REAR DISC BRAKE

Items	Specifications
Type	Floating caliper 1-piston, solid disc
Disc effective dia. × thickness mm	211.6 × 10.0
Wheel cylinder I.D. mm	35.0
Pad thickness mm	9.0
Clearance adjustment	Automatic

### SERVICE SPECIFICATIONS

Items		Standard value	Limit
Brake pedal height mm	R.H.drive vehicles-A/T	157.2 – 160.2	–
Proportioning valve <Vehicles without ABS>	Split point MPa	1.96	–
	Output fluid pressure (Input fluid pressure) MPa	3.92 ± 0.4 (9.81)	–
	Output fluid pressure difference between left and right MPa	–	0.4
Front disc brake	Pad thickness mm	10.0	2.0
	Disc thickness mm	24.0	22.4
	Disc runout mm	–	0.03 or less
	Drag force (tangential force of wheel mounting bolts) N	40 or less	–
Rear disc brake	Pad thickness mm	9.0	2.0
	Disc thickness mm	10.0	8.4
	Disc runout mm	–	0.08 or less
	Drag force (tangential force of wheel mounting bolts) N	20 or less	–

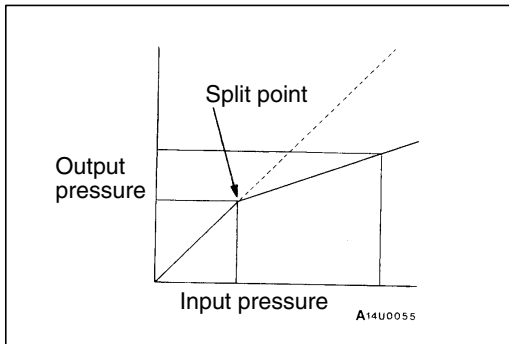
## ON-VEHICLE SERVICE

Service specifications have been established in the following. Service procedures are the same procedures as before.

### BRAKE PEDAL CHECK AND ADJUSTMENT <R.H. drive vehicles-A/T>

Brake pedal height has been established in the following.

**Standard value: 157.2 – 160.2 mm**



### PROPORTIONING VALVE FUNCTION TEST <Vehicles without ABS>

Standard values have been established in the following.

1. Standard value of input fluid pressure (Split point).
2. Standard value of output fluid pressure when the input fluid pressure is 9.81 MPa.

**Standard value: 1.96 MPa**

**Standard value: 3.92 ± 0.4 MPa**

### DISC BRAKE PAD (REAR) CHECK AND REPLACEMENT

The standard value and the limit of brake pad thickness have been established in the following.

**Standard value: 9.0 mm**

**Limit: 2.0 mm**

### BRAKE DISC THICKNESS (REAR) CHECK

The standard value and the limit of rear brake disc thickness have been established in the following.

**Standard value: 10.0 mm**

**Limit: 8.4 mm**

### BRAKE DISC RUN-OUT CHECK

The limit of brake disc runout has been established in the following.

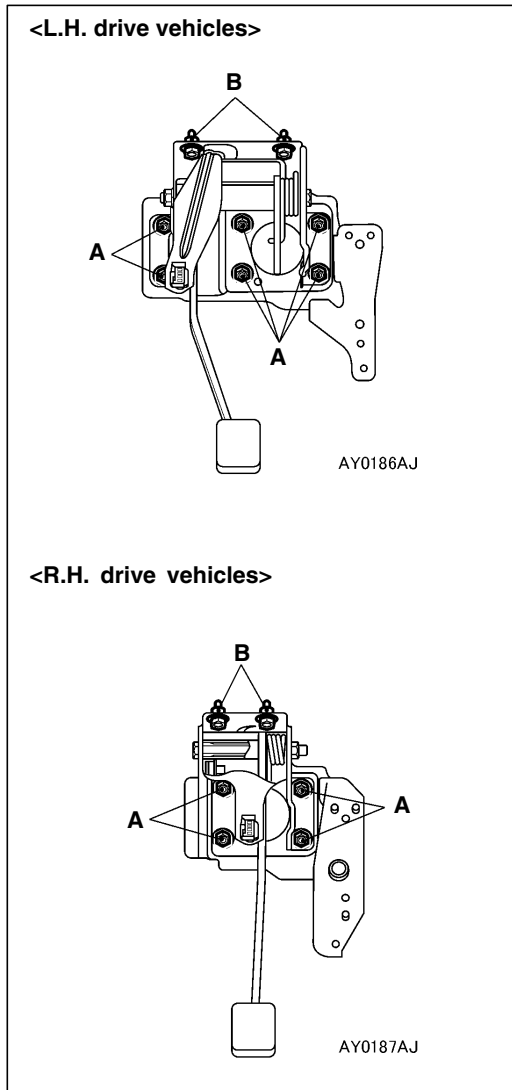
**Limit:**

**0.03 mm or less <FRONT>**

**0.08 mm or less <REAR>**

## BRAKE PEDAL

The same procedures as before are applied except for installation service points described below.



### INSTALLATION SERVICE POINT

#### ►A◄ BRAKE PEDAL ASSEMBLY INSTALLATION

Tighten the brake booster mounting nuts (A), and then the brake pedal mounting bolts (B).

#### NOTE

The pedal support member can not be positioned correctly if the pedal mounting bolts (B) are tightened first as their holes are oblong holes.

## MASTER CYLINDER AND BRAKE BOOSTER <1900>

### REMOVAL AND INSTALLATION

#### Caution

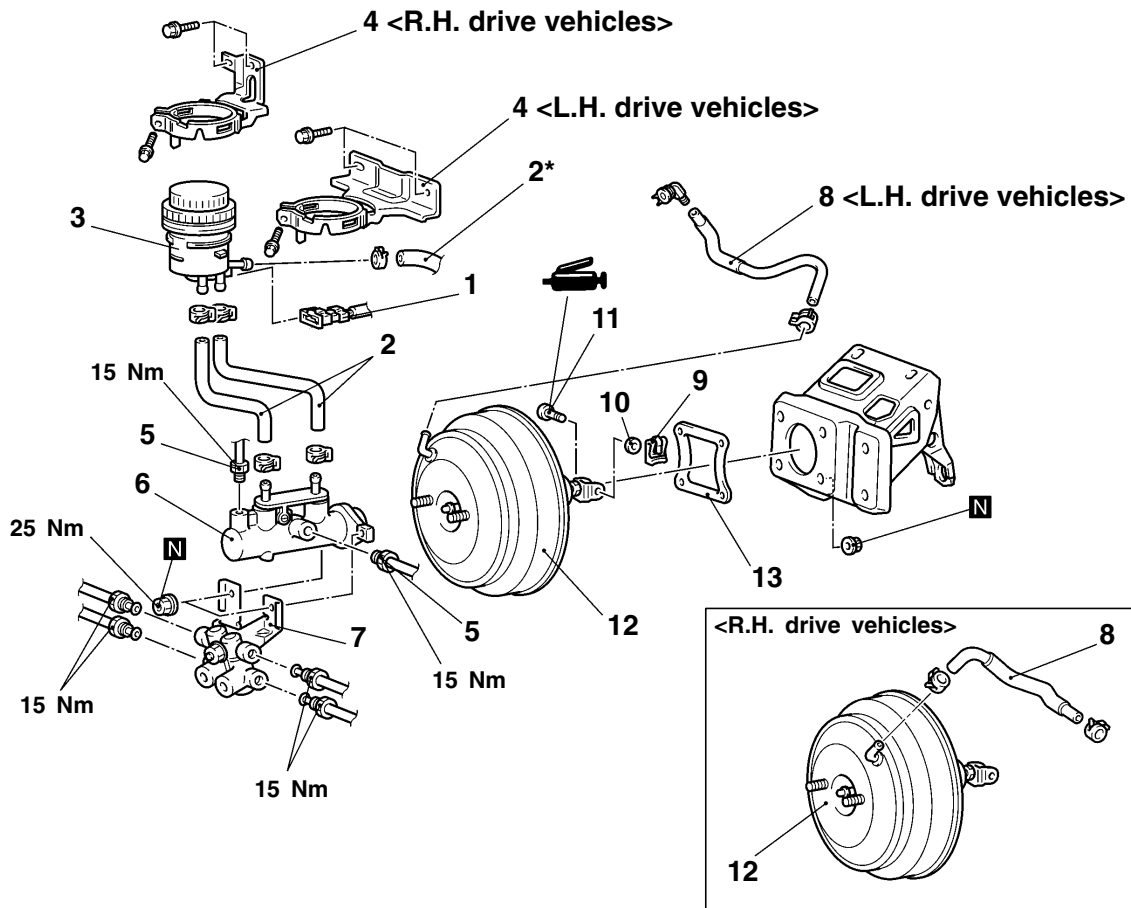
For the reservoir hose marked with \*, disconnect the reservoir assembly-side connection only and do not lower the disconnected hose below the master cylinder to prevent the air from entering into brake fluid line.

#### Pre-removal Operation

- Brake Fluid Draining
- Air Cleaner Assembly Removal <L.H. drive vehicles>
- Relay Box Removal <L.H. drive vehicles>
- Canister Removal <L.H. drive vehicles>

#### Post-installation Operation

- Canister Installation <L.H. drive vehicles>
- Relay Box Installation <L.H. drive vehicles>
- Air Cleaner Assembly Installation <L.H. drive vehicles>
- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment (Refer to P.35A-4.)



AY0195AJ

#### Removal steps

1. Brake fluid level sensor connector
2. Reservoir hose
3. Reservoir assembly
4. Reservoir bracket
5. Brake pipe connection
6. Master cylinder assembly
- ▶B◀ ● Clearance adjustment between brake booster push rod and primary piston
7. Proportioning valve bracket <L.H. drive vehicles> (Vehicles without ABS)

- ▶A◀ 8. Vacuum hose (With built-in check valve)
9. Retaining clip
10. Washer
11. Retaining ring bolt
12. Brake booster
13. Sealer

#### NOTE

The same procedures as before are applied for installation service points.

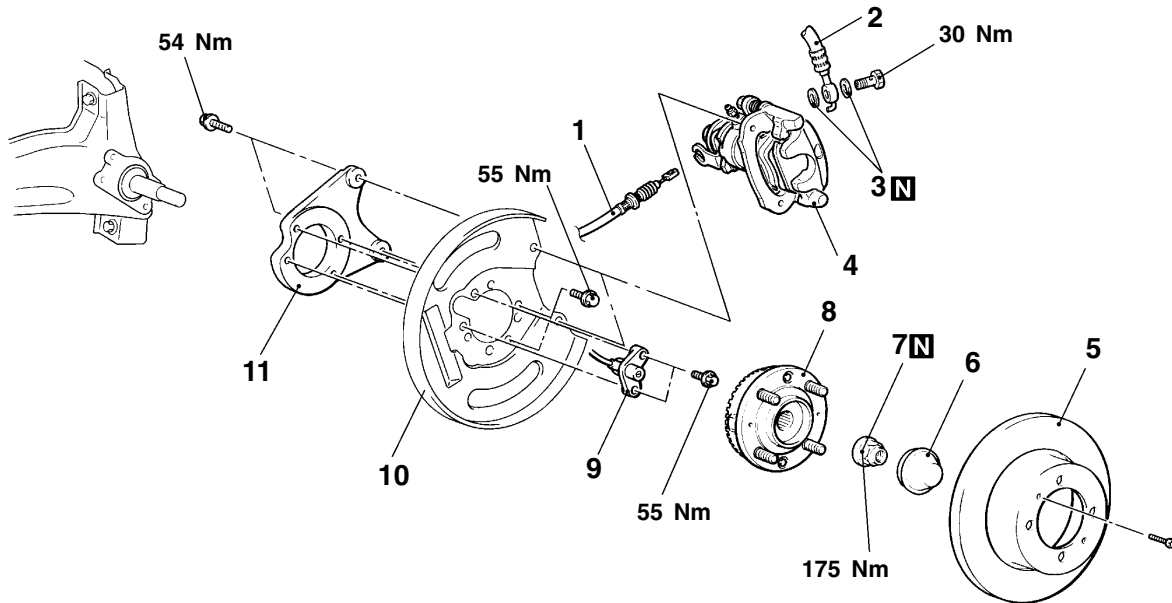
# REAR DISC BRAKE

## REMOVAL AND INSTALLATION

**Pre-removal Operation**  
 Brake Fluid Draining

**Post-installation Operation**

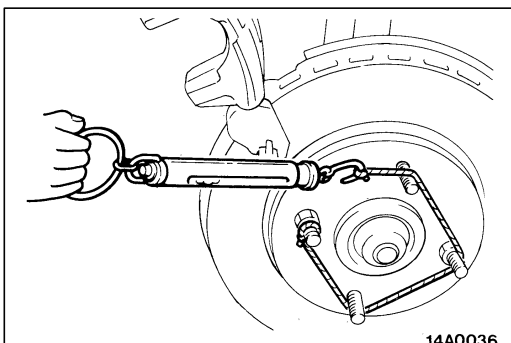
- Brake Fluid Supplying
- Brake Line Bleeding



AX0075BN

### Removal steps

- |     |   |     |  |
|-----|---|-----|--|
| ▶A◀ | <ol style="list-style-type: none"> <li>1. Parking brake cable connection</li> <li>2. Brake hose connection</li> <li>3. Gasket</li> <li>4. Disc brake assembly</li> <li>5. Brake disc</li> <li>6. Hub cap</li> </ol> | ▶B◀ | <ol style="list-style-type: none"> <li>7. Self locking nut</li> <li>8. Rear hub and rotor assembly</li> <li>9. Rear speed sensor</li> <li>10. Dust shield</li> <li>11. Disc brake adapter</li> </ol> |
|-----|---|-----|--|

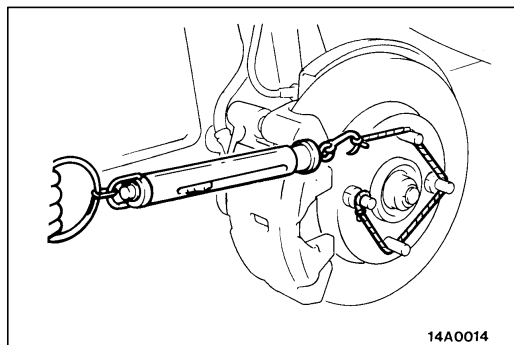
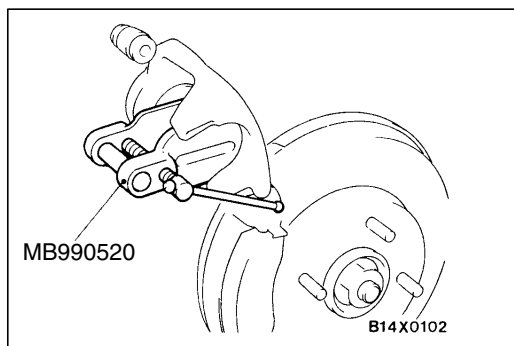


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### INSTALLATION SERVICE POINTS

#### ▶A◀ DISC BRAKE ASSEMBLY INSTALLATION

1. Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction with the brake ass’y removed so that drag force of brakes after the brake pad installation can be measured.



2. Install the caliper support, and then install the brake pad to the caliper support.

**Caution**

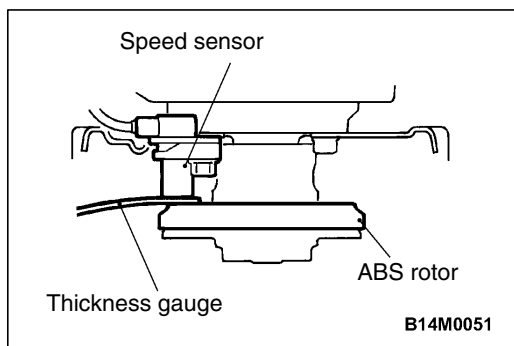
**Do not let any oil, grease or other contamination get onto the friction surfaces of the pads and brake discs.**

3. Clean piston and insert into cylinder with special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.

5. Start the engine and then depress the brake pedal 2-3 times.
6. Stop the engine.
7. Turn brake disc forward 10 times.
8. Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.
9. Calculate the drag force of the disc brake (difference between of values measured in item 8 and item 1.)

**Standard value: 20 N or less**

10. If the drag force of the disc brake exceeds the standard value, disassemble piston and clean piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.



**►B◄ REAR SPEED SENSOR INSTALLATION**

**Caution**

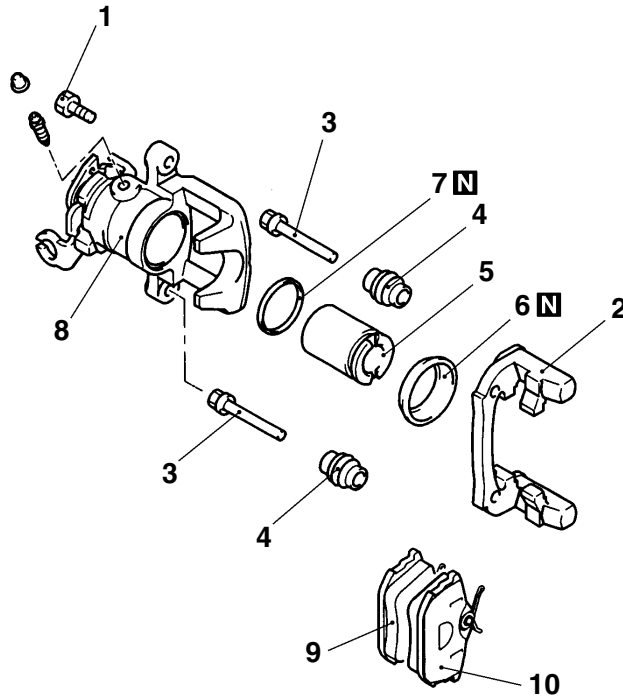
**Be sure not to damage the pole piece at the tip of the speed sensor by striking against other parts.**

Insert a thickness gauge into the space between the speed sensor's pole piece and the ABS rotor's toothed surface, and check the clearance is the standard value all around.

**Standard value: 0.1 – 1.9 mm**



DISASSEMBLY AND REASSEMBLY



AY0182AJ

<p>AY0183AJ</p>	<p>AY0184AJ</p>	<p>AY0185AJ</p>
<p>Brake caliper kit</p>	<p>Pad set</p>	<p>Seal and boots kit</p>

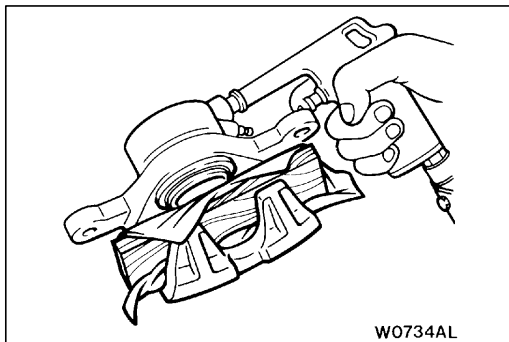
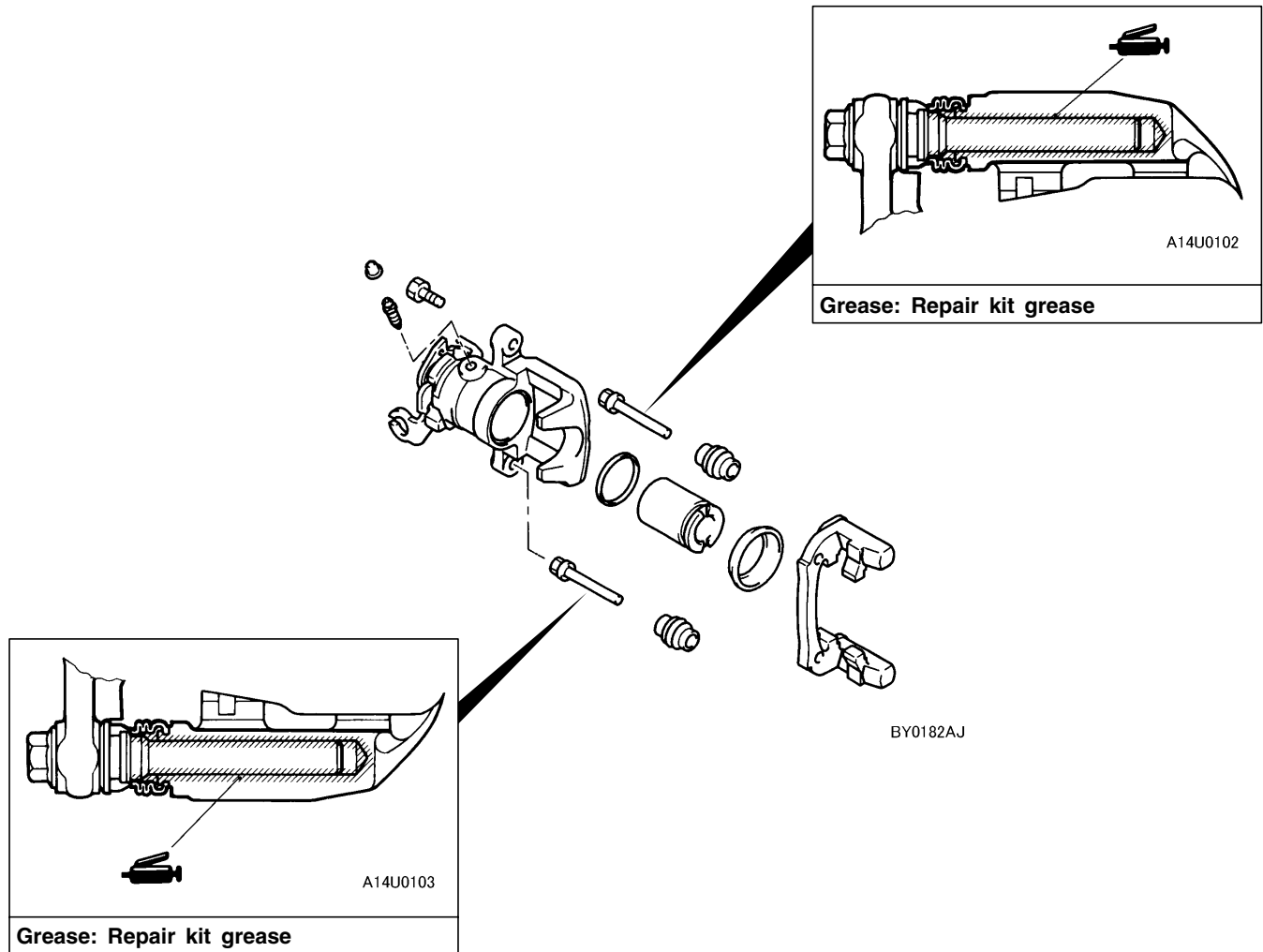
Disassembly steps

1. Bolt
2. Caliper support
3. Guide pin
4. Boot
5. Piston



6. Piston boot
7. Piston seal
8. Caliper body
9. Pad and wear indicator assembly
10. Pad assembly

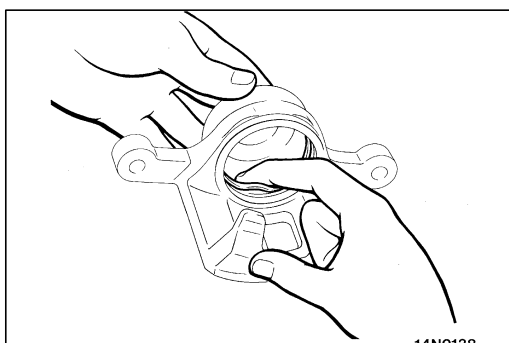
## LUBRICATION POINTS

**DISASSEMBLY SERVICE POINTS****◀A▶ PISTON BOOT/PISTON REMOVAL**

Use a piece of wood to protect the caliper body outer side, and then apply compressed air through the brake hose connection hole to withdraw the piston and piston boot.

**Caution**

If air is blown into the caliper body suddenly, the piston will pop out, causing damage to the caliper body. Be sure to apply compressed air gradually.

**◀B▶ PISTON SEAL REMOVAL**

1. Remove piston seal with finger tip.

**Caution**

Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

**Specified brake fluid: DOT3 or DOT4**

**INSPECTION**

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or guide pin for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

**PAD WEAR CHECK**

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly if pad thickness is less than the limit value.

**Standard value: 9.0 mm**

**Limit: 2.0 mm**

**Caution**

1. **Always replace the right and left brake pads as a set.**
2. **If an excessive difference is found in the thickness between the right and left brake pads, check moving parts.**

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## NOTES

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# ANTI-SKID BRAKING SYSTEM (ABS) <2WD>

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## GENERAL

### OUTLINE OF CHANGE

Due to the adoption of the electronic brake-force distribution (EBD\*) system to secure the maximum braking force regardless of laden conditions of a vehicle, the layout of the ABS-ECU terminals and ABS circuit have been changed so that the service procedures have been established.

#### NOTE

\*EBD: Electronic Brake-force Distribution

### EBD CONTROL

The vehicle with ABS can electronically control brake fluid pressure to rear brakes during applying braking force corresponding to deceleration and slip at the front/rear wheels calculated by wheel speed sensor signals using rear wheel solenoid valves. EBD

control allows braking force of the vehicle to be compatible with stability at a high level characterized by the following features:

- Since ideal braking force to rear wheels can be obtained regardless of laden conditions of the vehicle or road surface, applied force to the braking pedal on a high-friction coefficient road can be reduced especially when the vehicle is laden.
- Due to a reduction of the load on the front brakes, temperature increase in the pads during applying braking force can be suppressed. Thus, tolerance for wear is improved.
- Control valves, such as proportioning valves are unnecessary.

## TROUBLESHOOTING

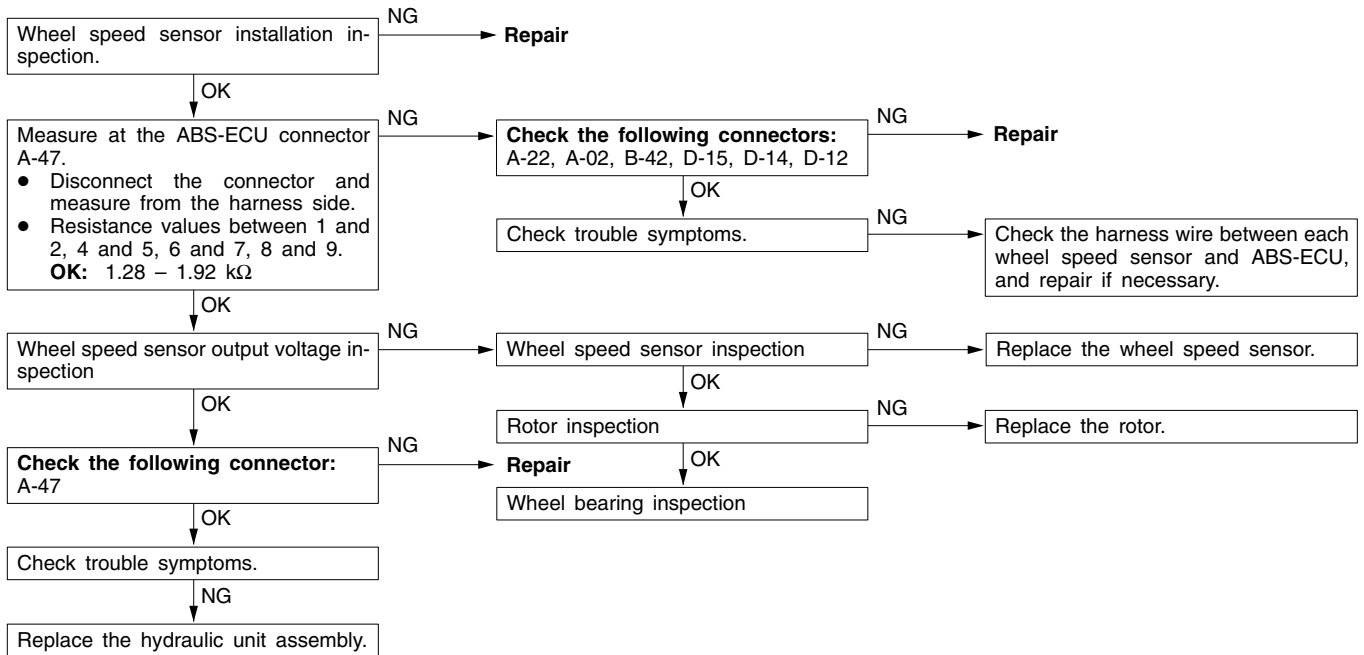
The same procedures as before are applied except for the items shown below.

### INSPECTION CHART FOR DIAGNOSIS CODES

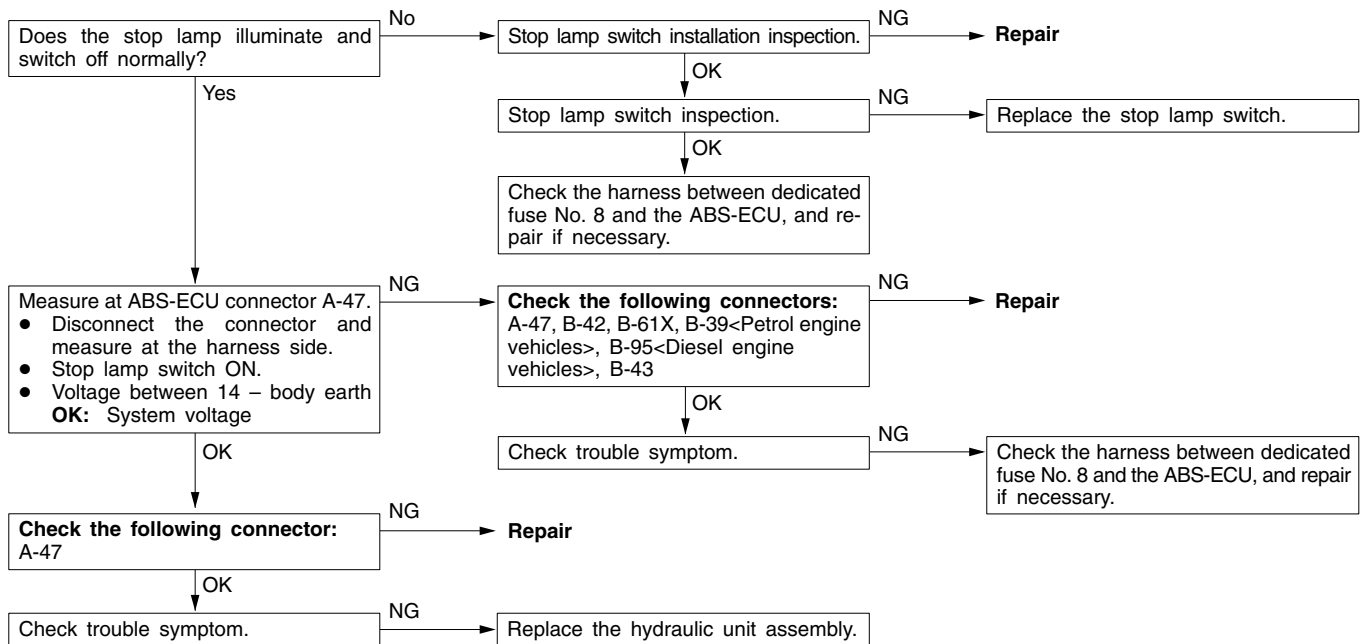
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open circuit	35B-3
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
21	Front right wheel speed sensor	Short circuit	35B-3
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
38	Stop lamp switch system		35B-4

**INSPECTION PROCEDURE FOR DIAGNOSIS CODES**

Code Nos.11, 12, 13 and 14 Wheel speed sensor open circuit	Probable cause
<b>Code Nos.21, 22, 23 and 24 Wheel speed sensor short circuit</b>	
Code Nos.11, 12, 13 and 14 are output if the ABS-ECU detects an open circuit in any one of the four wheel speed sensors.	<ul style="list-style-type: none"> <li>● Malfunction of wheel speed sensor</li> <li>● Malfunction of wiring harness or connector</li> <li>● Malfunction of ABS-ECU</li> </ul>
Code Nos.21, 22, 23 and 24 are output in the following cases. <ul style="list-style-type: none"> <li>● When there is no input from any one of the four wheel speed sensors when traveling at 12 km/h or more, even though open circuit verified.</li> <li>● When a chipped or blocked-up ABS rotor is detected during driving at 12 km/h or more.</li> </ul>	<ul style="list-style-type: none"> <li>● Malfunction of wheel speed sensor</li> <li>● Malfunction of wiring harness or connector</li> <li>● Malfunction of rotor</li> <li>● Malfunction of ABS-ECU</li> <li>● Malfunction of wheel bearing</li> </ul>



Code No. 38 Stop lamp switch system	Probable cause
These codes are output at the following times: <ul style="list-style-type: none"> <li>• When the stop lamp switch is not be turned off (when the stop lamp switch stays on for 15 minutes or more although the ABS is not operating).</li> <li>• When the ABS-ECU determines that there is an open circuit in harness of the stop lamp switch system.</li> </ul>	<ul style="list-style-type: none"> <li>• Malfunction of stop lamp switch</li> <li>• Malfunction of harness or connector</li> <li>• Malfunction of ABS-ECU</li> </ul>



### INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptoms	Inspection procedure No.	Reference page	
Communication with MUT-II is not possible.	2	35B-5	
Faulty ABS operation	Unequal braking power on both sides.	5	35B-6
	Insufficient braking power.		
	ABS operates under normal braking conditions.		
	ABS operates before vehicle stops under normal braking conditions.		
	Large brake pedal vibration (Caution 2).	–	–

#### Caution

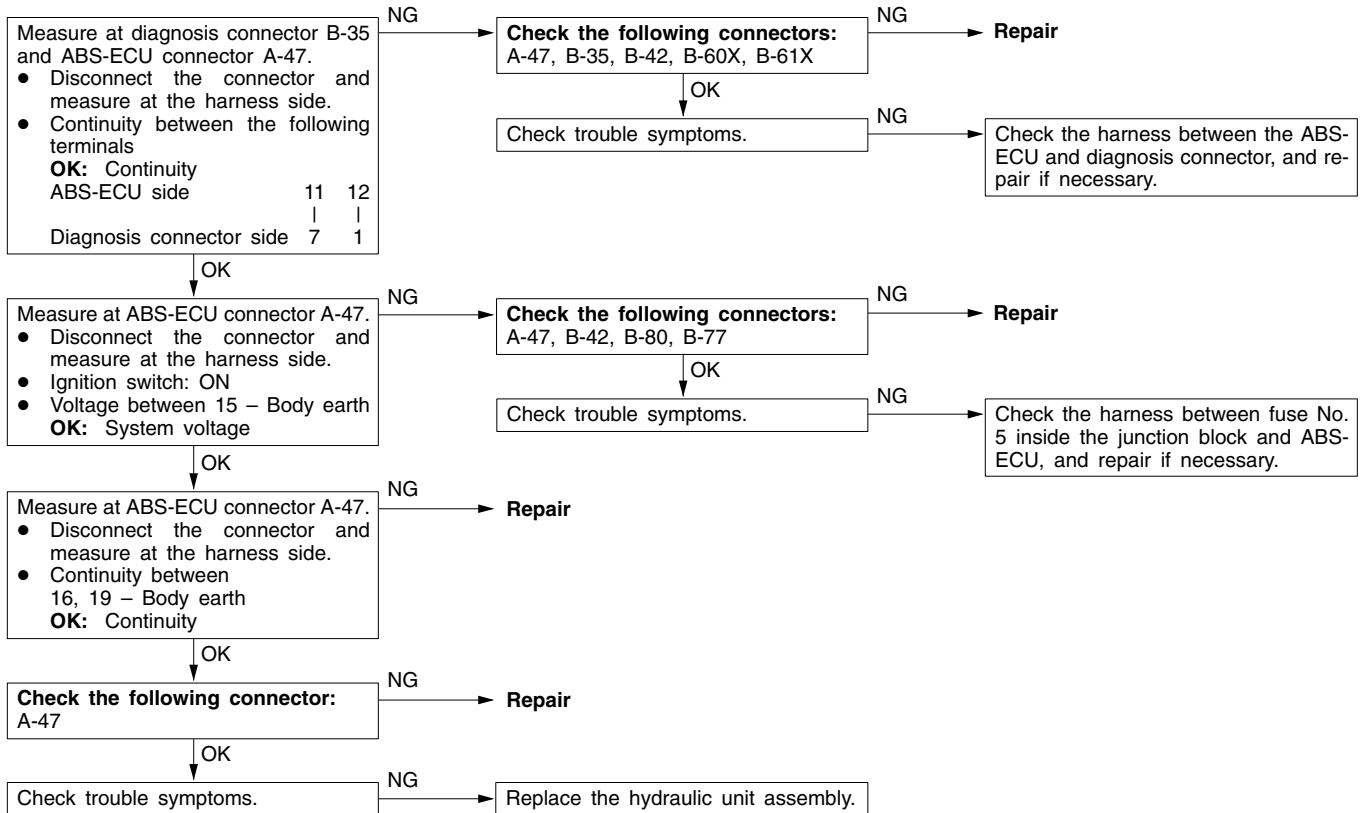
1. If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.
2. During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.



**INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS**

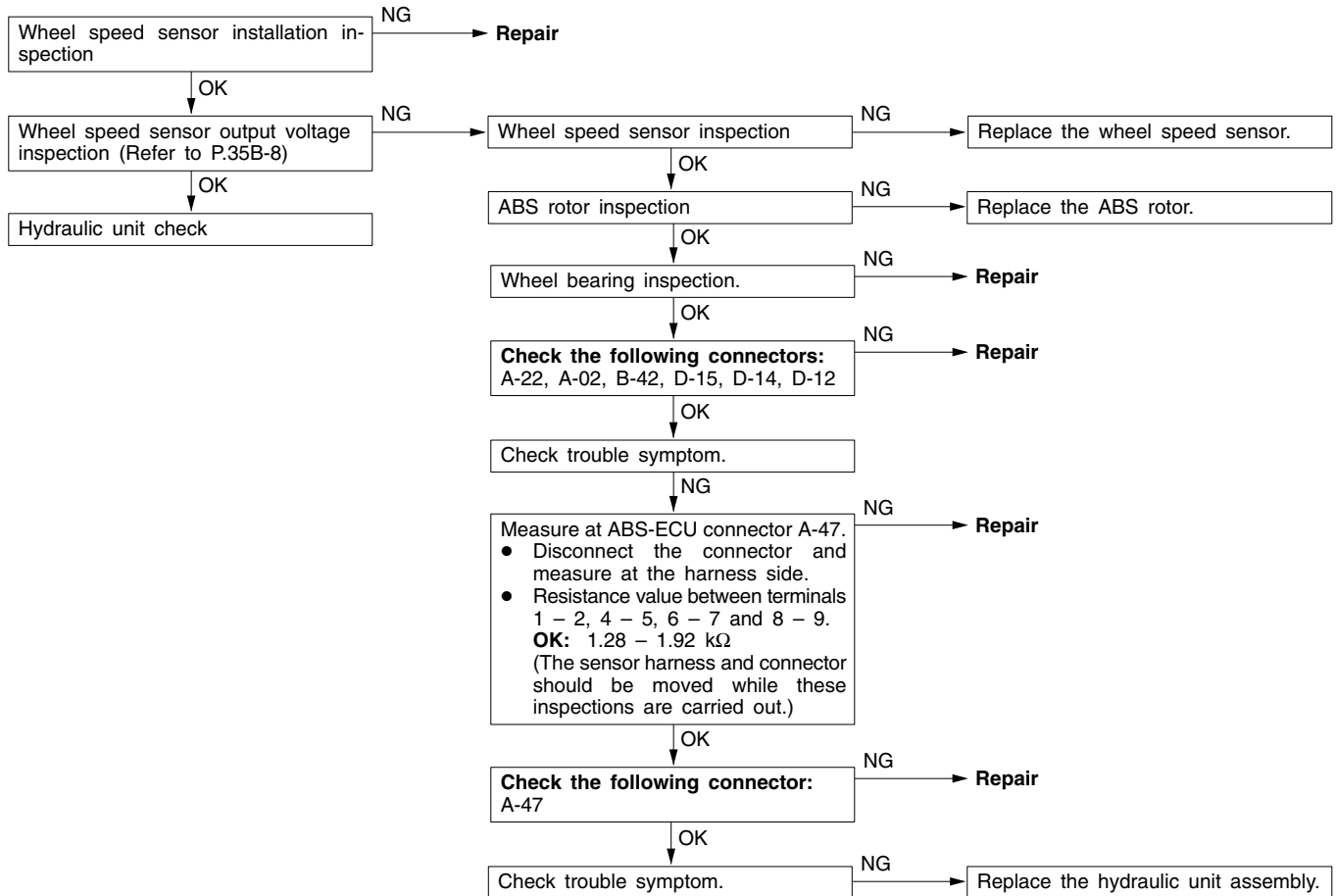
**Inspection Procedure 2**

<b>Communication with MUT-II is not possible. (Communication with ABS only is not possible.)</b>	<b>Probable cause</b>
When communication with the MUT-II is not possible, the cause is probably an open circuit in the ABS-ECU power circuit or an open circuit in the diagnosis output circuit.	<ul style="list-style-type: none"> <li>● Blown fuse</li> <li>● Malfunction of wiring harness or connector</li> <li>● Malfunction of ABS-ECU</li> </ul>



Inspection Procedure 5

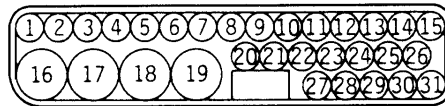
Brake operation is abnormal.	Probable cause
This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	<ul style="list-style-type: none"> <li>● Improper installation of wheel speed sensor</li> <li>● Incorrect sensor harness contact</li> <li>● Foreign material adhering to wheel speed sensor</li> <li>● Malfunction of wheel speed sensor</li> <li>● Malfunction of ABS rotor</li> <li>● Malfunction of wheel bearing</li> <li>● Malfunction of hydraulic unit</li> <li>● Malfunction of ABS-ECU</li> </ul>



**CHECK AT ABS-ECU**

**TERMINAL VOLTAGE CHECK CHART**

1. Measure the voltages between terminals (16) and (19) (earth terminals) and each respective terminal.
2. The terminal layouts are shown in the illustrations below.

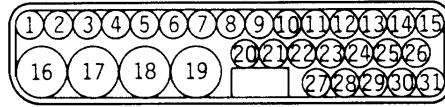


14U0122

Connector terminal No.	Signal	Checking requirements		Normal condition
11	MUT-II	Connect the MUT-II.		Serial communication with MUT-II
		Do not connect the MUT-II.		1 V or less
12	Input from diagnosis indication selection	Connect the MUT-II.		0 V
		Do not connect the MUT-II.		Approx. 12 V
14	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less
15	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
17	Pump motor power supply	Always		System voltage
18	Solenoid valve power supply	Always		System voltage
20	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off.	System voltage
			The lamp is illuminated.	0 – 2 V

**RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS**

1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check them between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustrations below.



14U0122

Connector terminal No.	Signal	Normal condition
1 – 2	Rear-right wheel speed sensor (+ wire)	1.28 – 1.92 kΩ
4 – 5	Front-right wheel speed sensor (+ wire)	1.28 – 1.92 kΩ
6 – 7	Front-left wheel speed sensor (+ wire)	1.28 – 1.92 kΩ
8 – 9	Rear-left wheel speed sensor (+ wire)	1.28 – 1.92 kΩ
16 – Body earth	ABS-ECU earth	Continuity
19 – Body earth		

**ON-VEHICLE SERVICE****WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK**

Measurement terminal No. has been changed. The same procedures as before are applied except for the items shown below.

Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	6	4	8	1
	7	5	9	2