

SERVICE BRAKES

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35109000463

BASIC BRAKE SYSTEM	35A
ANTI-SKID BRAKING SYSTEM (ABS) <2WD>	35B
ANTI-SKID BRAKING SYSTEM (ABS) <4WD>	35C



BASIC BRAKE SYSTEM

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GENERAL INFORMATION

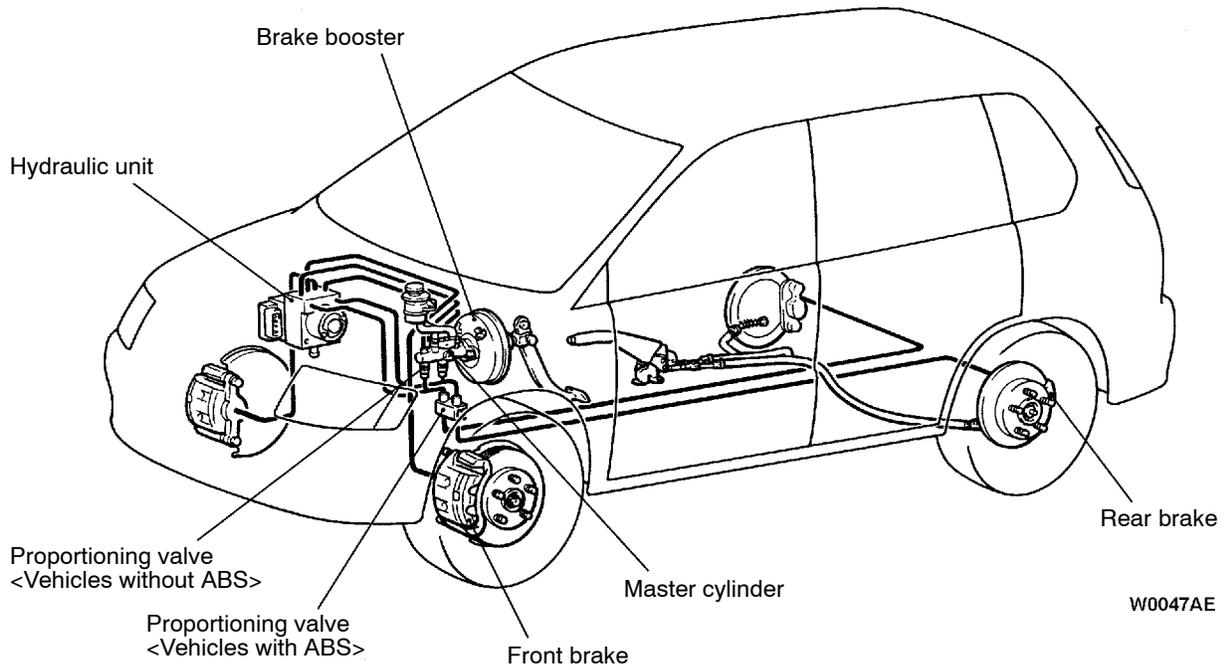
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The brake system offers high dependability and durability along with improved braking performance and brake sensitivity.

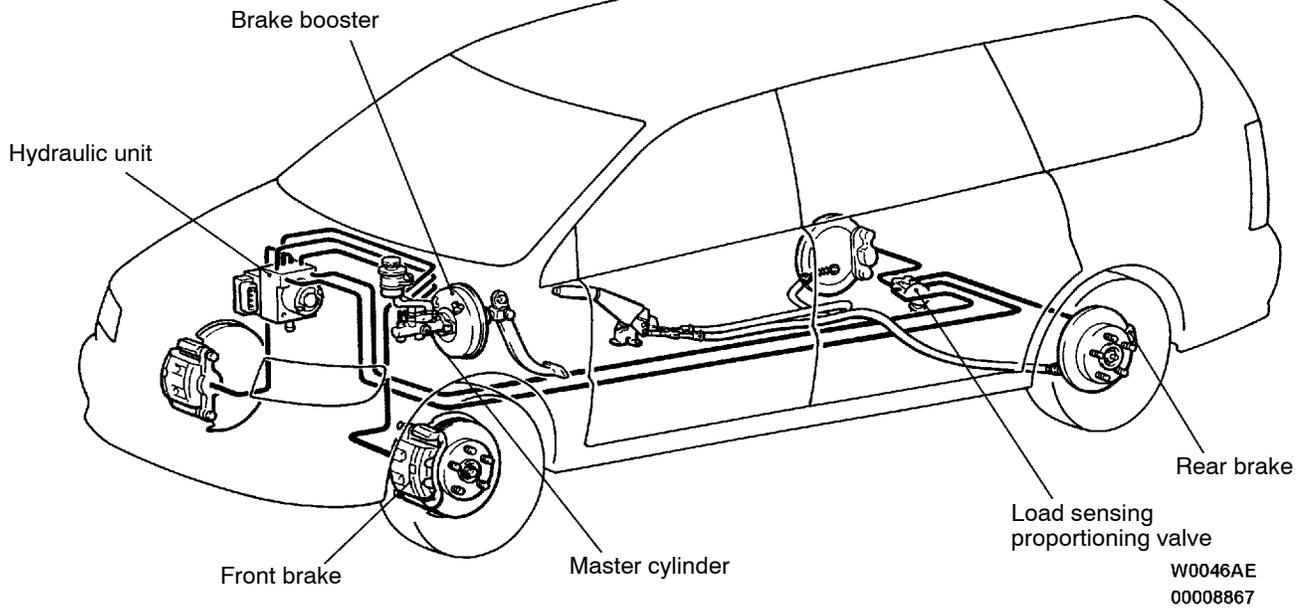
Items		Specifications
Master cylinder	Type	Tandem type
	I.D. mm	25.4
Brake booster	Type	Vacuum type, single
	Effective dia. of power cylinder mm	255
	Boosting ratio	6.5
Proportioning valve	Type	Dual type
	Decompression ratio	0.25
Front brakes	Type	Floating caliper, 2-piston, ventilated disc
	Disc effective dia. × thickness mm	227.8 × 24
	Wheel cylinder I.D. mm	42.86
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Rear disc brakes <SPACE RUNNER>	Type	Floating caliper, 1-piston, solid disc
	Disc effective dia. × thickness mm	222 × 10
	Wheel cylinder I.D. mm	34.93
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Rear disc brakes <SPACE WAGON>	Type	Floating caliper, 1-piston, ventilated disc
	Disc effective dia. × thickness mm	237 × 20
	Wheel cylinder I.D. mm	38.10
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Brake fluid		DOT3 or DOT4

CONSTRUCTION DIAGRAM

SPACE RUNNER



SPACE WAGON



SERVICE SPECIFICATIONS

35100030379

Items		Standard value	Limit
Brake pedal height mm	L.H. drive vehicles	219 - 222	-
	R.H. drive vehicles	206 - 209	-
Brake pedal free play mm		3 - 8	-
Brake pedal to floor board clearance mm		90 or more	-
Proportioning valve	Split point MPa	2.70 - 3.19	-
	Output fluid pressure (Input fluid pressure) MPa	3.68 - 3.92 (7.36)	-
	Output fluid pressure difference between left and right MPa	-	0.39
Load sensing proportioning valve output fluid pressure (Input fluid pressure) MPa	When load sensing spring length is 202 mm (when unladen)	5.9 - 6.5 (9.8)	-
	When load sensing spring length is 209 mm (when laden)	9.4 - 10.0 (9.8)	-
		10.4 - 11.0 (13.7)	-
Load sensing spring length <Distance between spring ends> mm		198 - 202	-
Front disc brake	Pad thickness mm	10.0	2.0
	Disc thickness mm	24.0	22.4
	Disc runout mm	-	0.06
	Drag force (tangential force of wheel mounting bolts) N	69 or less	-
Rear disc brake <SPACE RUNNER>	Pad thickness mm	10.0	2.0
	Disc thickness mm	10.0	8.4
	Disc runout mm	-	0.08
	Drag force (tangential force of wheel mounting bolts) N	69 or less	-
Rear disc brake <SPACE WAGON>	Pad thickness mm	10.0	2.0
	Disc thickness mm	20.0	18.4
	Disc runout mm	-	0.08
	Drag force (tangential force of wheel mounting bolts) N	69 or less	-
Front hub end play mm		-	0.06
Rear hub end play mm		-	0.08
Brake booster push rod to master cylinder piston clearance mm		9.65 - 9.90	-

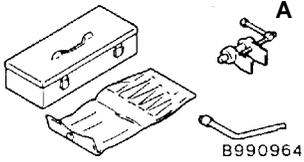
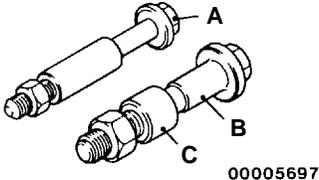
LUBRICANTS

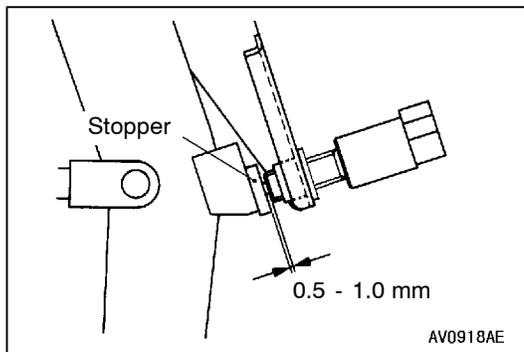
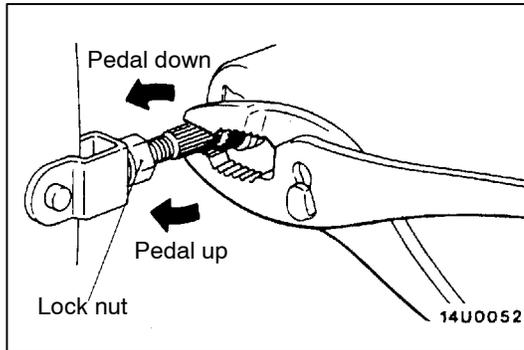
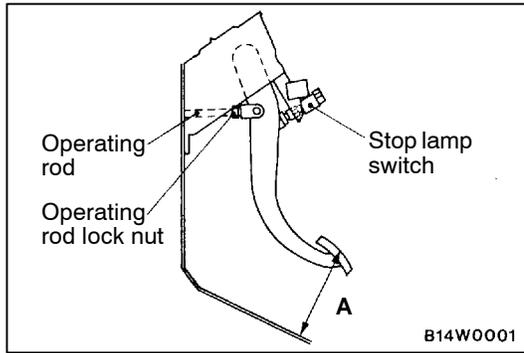
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Items	Specified Lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal	Repair kit grease
Slide pin boot and slide pin bush inner surfaces	
Brake piston boot inner surfaces	
Piston boot mounting grooves	

SPECIAL TOOLS

35100060187

Tool	Number	Name	Use
	MB990964 A: MB990520	Brake tool set A: Disc brake piston expander	Pushing-in of the disc brake piston
	A: MB991017 B: MB990998 C: MB991000	A, B: Front hub remover and installer C: Spacer	Wheel bearing provisional holding MB991000, which belongs to MB990998, should be used as a spacer.



ON-VEHICLE SERVICE

35100090285

BRAKE PEDAL CHECK AND ADJUSTMENT

BRAKE PEDAL HEIGHT

1. Turn up the carpet, etc. under the brake pedal.
2. Measure the brake pedal height as illustrated.

Standard value (A):

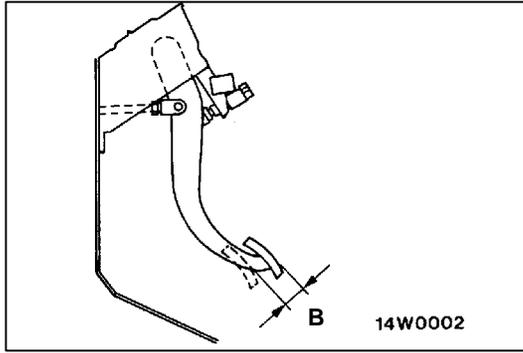
<L.H. drive vehicles> 219 - 222 mm
<R.H. drive vehicles> 206 - 209 mm

3. If the brake pedal height is not within the standard value, follow the procedure below.
 - (1) Disconnect the stop lamp switch connector.
 - (2) Loosen the stop lamp switch by turning it approx. 1/4 turns anticlockwise.
 - (3) Loosen the operating rod lock nut, and then adjust the brake pedal height to the standard value by turning the operating rod serration with a pliers.
 - (4) Screw in the stop lamp switch until it touches the stopper. At this time, support the brake pedal to the highest position by hand.
 - (5) Adjust the stop lamp switch so that the clearance between the switch plunger and the stopper is as shown, and then lock by turning it approx. 1/4 turns clockwise.
 - (6) Connect the connector to the stop lamp switch.

Caution

Check that the stop lamp does not illuminate when the brake pedal is not depressed.

4. For A/T, check the key interlock and shift lock mechanisms. (Refer to GROUP 23 - On-vehicles Service.)
5. Return the carpet etc.

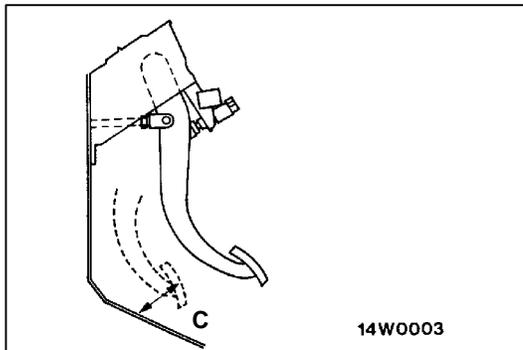


BRAKE PEDAL FREE PLAY

1. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the free play) is within the standard value range.

Standard value (B): 3 – 8 mm

2. If the brake pedal play is not within the standard value, check the following, and adjust or replace if necessary:
 - Excessive play between the brake pedal and the clevis pin, or between the clevis pin and the brake booster operating rod
 - Brake pedal height
 - Installation position of the stop lamp switch, etc.

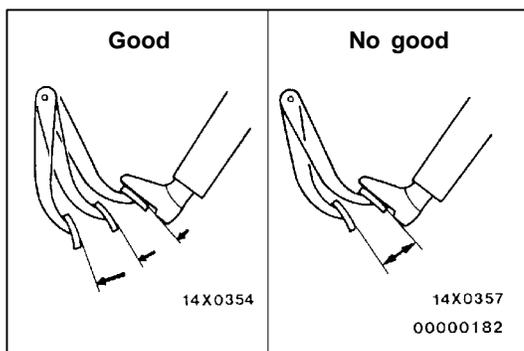


CLEARANCE BETWEEN BRAKE PEDAL AND FLOOR BOARD

1. Turn back the carpet etc. under the brake pedal.
2. Start the engine, depress the brake pedal with approximately 490 N of force, and measure the clearance between the brake pedal and the floorboard.

Standard value (C): 90 mm or more

3. If the clearance is outside the standard value, check for air trapped in the brake line, clearance between the lining and the drum and dragging in the parking brake. Adjust and replace defective parts as required.
4. Return the carpet etc.

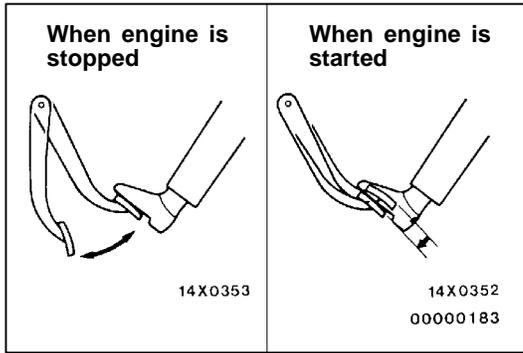


BRAKE BOOSTER OPERATING TEST

35100100117

For simple checking of the brake booster operation, carry out the following tests:

1. Run the engine for one or two minutes, and then stop it.
If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.



2. With the engine stopped, step on the brake pedal several times. Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.
3. With the engine running, step on the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective. If the above three tests are okay, the booster performance can be determined as good. If one of the above three tests is not okay at last, the check valve, vacuum hose, or booster will be defective.

CHECK VALVE OPERATION CHECK

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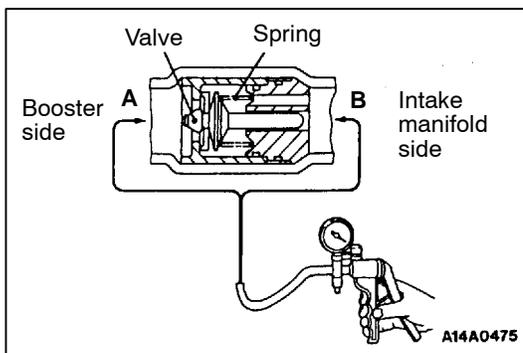
1. Remove the vacuum hose. (Refer to P.35A-17.)

Caution

The check valve should not be removed from the vacuum hose.

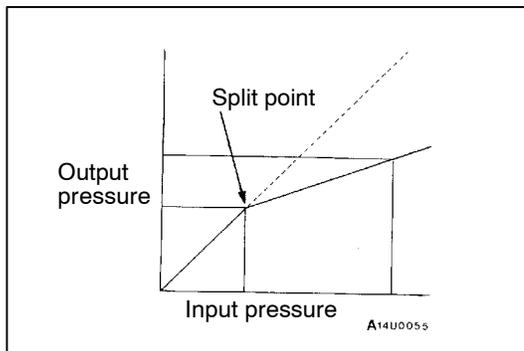
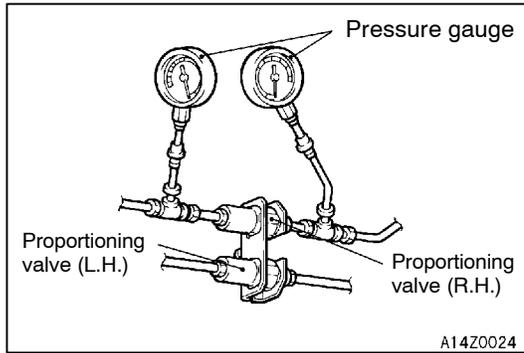
2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/reject criteria
Connection at the brake booster side (A)	A negative pressure (vacuum) is created and held.
Connection at the intake manifold side (B)	A negative pressure (vacuum) is not created.



Caution

If the check valve is defective, replace it as an assembly unit together with the vacuum hose.



PROPORTIONING VALVE FUNCTION TEST <SPACE RUNNER>

35100110257

1. Connect two pressure gauges at the input and output side of the proportioning valve as shown.

Caution

The proportioning valves are installed independently for the right and left brake lines. Always measure each valve.

2. Bleed the brake line and the pressure gauge.
3. Depress the brake pedal gradually. Then check that the split point, where the output fluid pressure begins to drop in proportion to the output fluid pressure, is at the standard value.

Standard value: 2.70 - 3.19 MPa

4. Depress the brake pedal more strongly than at the above step. Then check that the output fluid pressure is at the standard value when the input fluid pressure is 7.36 kPa.

Standard value: 3.68 - 3.92 MPa

5. Measure each output fluid pressure at both valves, and check that the difference between the two is at the limit value or less.

Limit: 0.39 MPa

6. If the measured pressure exceeds the limit, replace the proportioning valve.

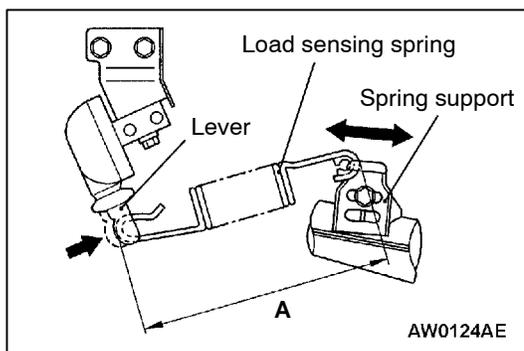
LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT <SPACE WAGON>

35100120038

1. Park the vehicle on a level ground. The vehicle should be unloaded and supported only by wheels.

Caution

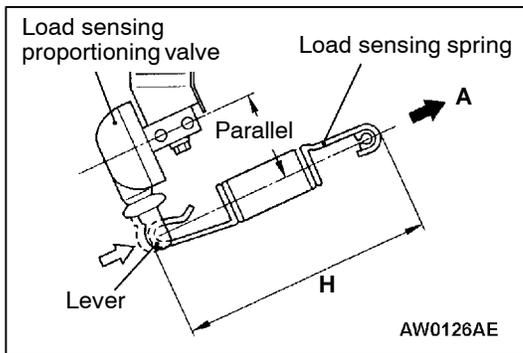
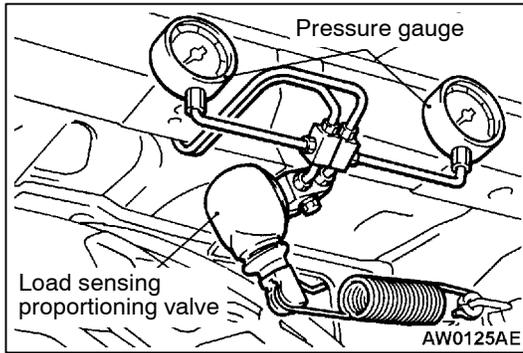
Never support the vehicle with jacks or other similar means.



2. With the lever pressed all the way to the load sensing proportioning valve side, check whether or not the length (shown in the figure) of the spring (the length between its ends) is the standard value.

Standard value (A): 198 - 202 mm

3. If the spring length is not within the standard value, loosen the bolt attaching the support and adjust the distance by moving the support.



**LOAD SENSING PROPORTIONING VALVE
FUNCTION TEST <SPACE WAGON>**

35100130048

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve.
2. Bleed the system. (Refer to P.35A-12.)
3. Disconnect the spring at the support side.

4. Place the spring so that it is in parallel with the load sensing proportioning valve, and then pull in the direction indicated by arrow A so that its length H shown in the figure (the length between its ends) is as noted below.

NOTE

At this time the lever is pressed all the way to the load sensing proportioning valve side.

5. Check at this time whether or not the output fluid's pressure, relative to the load sensing proportioning valve's input fluid pressure, is within the standard value.

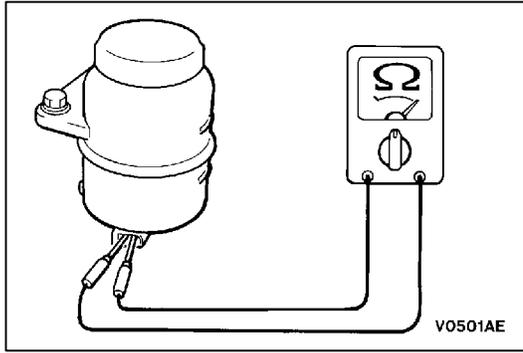
Standard value:

Spring length H mm	Input fluid pressure MPa	Output fluid pressure MPa
202*1	9.8	5.9 - 6.5
209*2	9.8	9.4 - 10.0
	13.7	10.4 - 11.0

NOTE

*1 and *2 indicate the applicable lengths for unladen and laden vehicles respectively.

6. After making the check, install the spring. Disconnect the pressure gauges from the load sensing proportioning valve and bleed the air. (Refer to P.35A-12.)



BRAKE FLUID LEVEL SENSOR CHECK

35100910147

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above "MIN" and if there is continuity when the float surface is below "MIN".

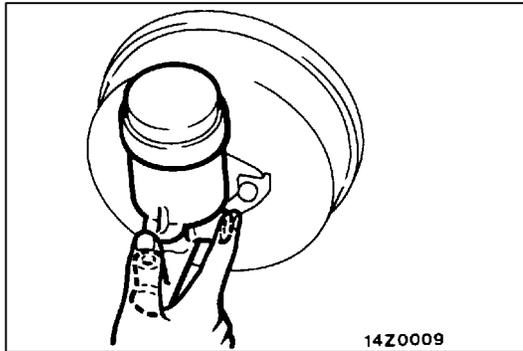
BLEEDING

35100140089

Caution

Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

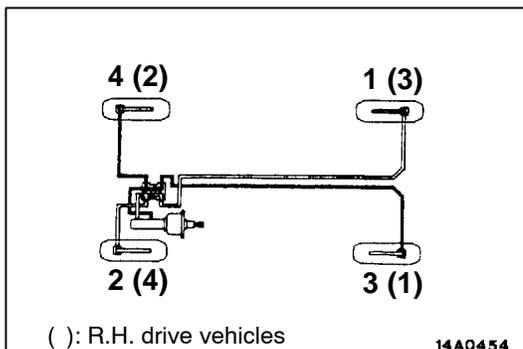
Specified brake fluid: DOT3 or DOT4



MASTER CYLINDER BLEEDING

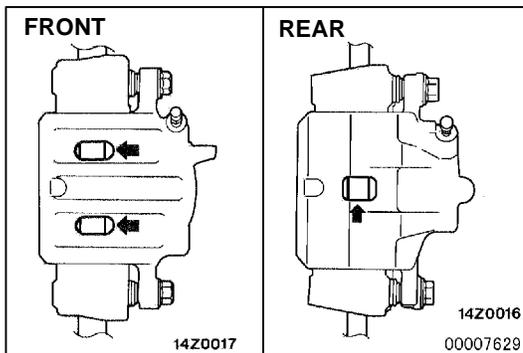
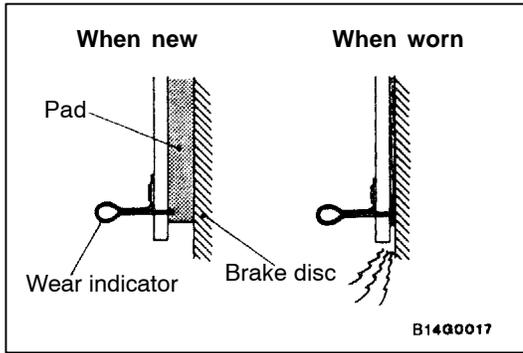
The master cylinder used has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake pipeline will become easier. (When brake fluid is not contained in the master cylinder.)

- (1) Fill the reserve tank with brake fluid.
- (2) Keep the brake pedal depressed.
- (3) Have another person cover the master cylinder outlet with a finger.
- (4) With the outlet still closed, release the brake pedal.
- (5) Repeat steps (2) - (4) three or four times to fill the inside of the master cylinder with brake fluid.



BRAKE PIPE LINE BLEEDING

Bleed the air in the sequence shown in the figure.



DISC BRAKE PAD CHECK AND REPLACEMENT

35100230045

NOTE

The left side outer brake pad has a wear indicator. The wear indicator contacts the brake disc when the brake pad thickness becomes 2 mm and emit a squealing sound to warn the driver.

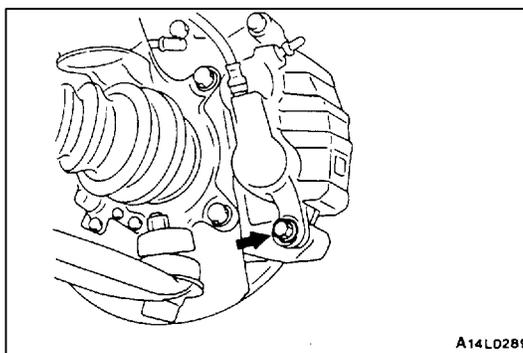
1. Check brake pad thickness through caliper body check port.

Standard value: 10 mm

Limit: 2.0 mm

Caution

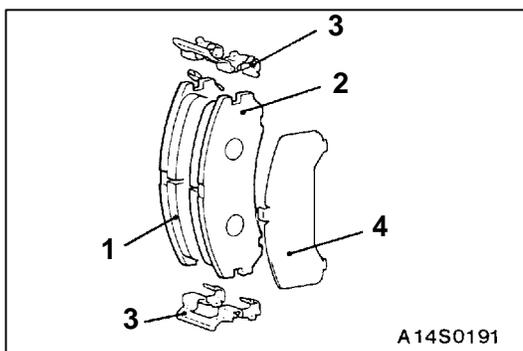
- (1) When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.
- (2) If there is a significant difference in the thickness of the pads on the left and right sides, check the sliding condition of the piston and guide pin.



2. Remove the guide pin. Lift caliper assembly and retain with wires.

Caution

Do not wipe off the special grease that is on the guide pin or allow it to contaminate the guide pin.



3. Remove the following parts from caliper support.
 - (1) Pad and wear indicator assembly
 - (2) Pad assembly
 - (3) Pad liner
 - (4) Outer shim
4. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub with the pads removed. (Refer to P.35A-20.)
5. Install the pads and the caliper assembly, and then check the brake drag force. (Refer to P.35A-20.)

DISC BRAKE ROTOR CHECK

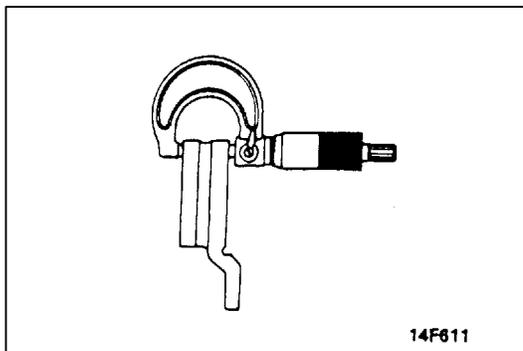
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Caution

When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	<ul style="list-style-type: none"> If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.

**BRAKE DISC THICKNESS CHECK**

35100240031

- Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm in from the outer edge of the disc.

Brake disc thickness

Item		Standard value	Limit
Front		24.0	22.4
Rear	SPACE RUNNER	10.0	8.4
	SPACE WAGON	20.0	18.4

Thickness variation (at least 8 positions)

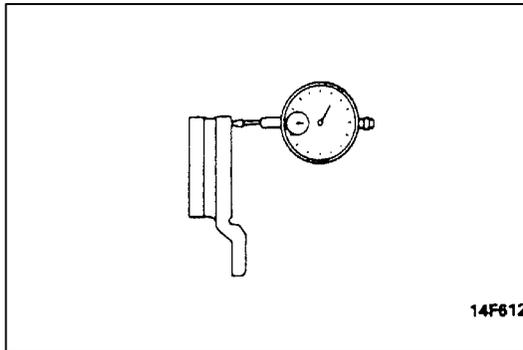
The difference between any thickness measurements should not be more than 0.015 mm.

- If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or turn rotor with on the car type brake lathe ("MAD, DL-8700PF" or equivalent).

BRAKE DISC RUN-OUT CHECK

35100250027

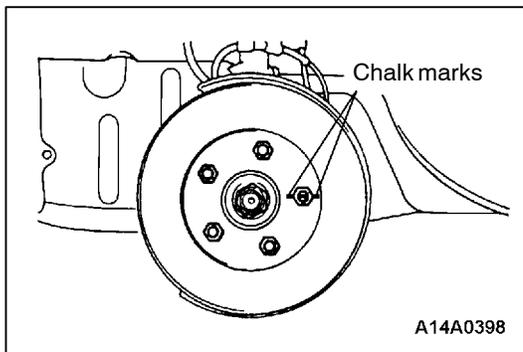
1. Remove the caliper support; then raise the caliper assembly upward and secure by using wire.
2. Inspect the disc surface for grooves, cracks and rust. Clean the disc thoroughly and remove all rust.



3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

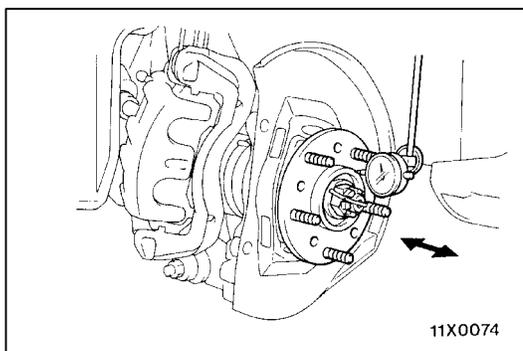
Limit:**<Front> 0.06 mm or less****<Rear> 0.08 mm or less****NOTE**

Tighten the nuts in order to secure the disc to the hub.

**BRAKE DISC RUN-OUT CORRECTION**

35100180159

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
 - (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



- (2) Remove the brake disc, and then place a dial gauge as shown in the illustration; then move the hub in the axial direction and measure the play.

Limit: <Front> 0.06 mm, <Rear> 0.08 mm

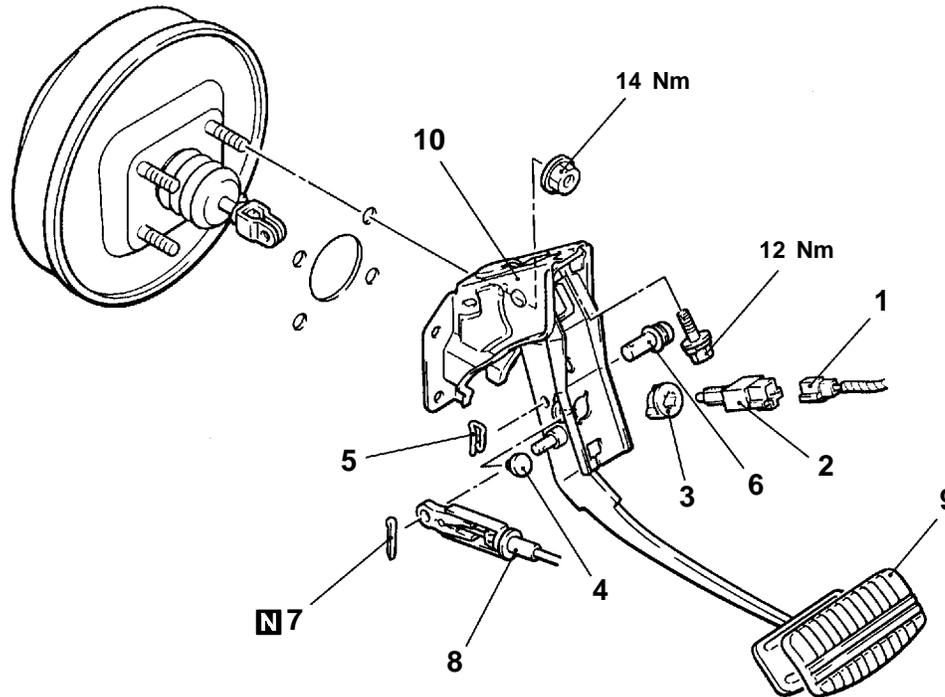
- (3) If the play is equivalent to or exceeds the limit, disassemble the hub knuckle and check each part.
 - (4) If the play does not exceed the limit specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc once again.
2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor with on the car type brake lathe ("MAD, DL-8700PF" or equivalent).

BRAKE PEDAL

35100340359

REMOVAL AND INSTALLATION

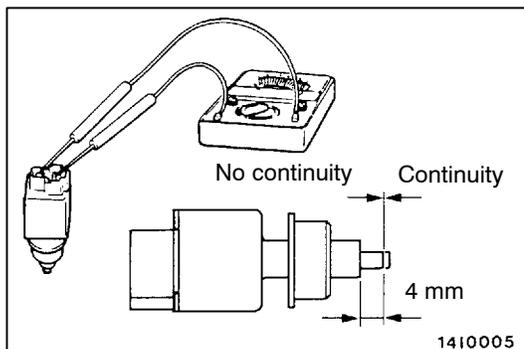
Post-installation Operation
 Brake Pedal Adjustment (Refer to P.35A-7.)



AW0140AE

Removal steps

1. Harness connector
2. Stop lamp switch
3. Adjuster
4. Pedal stopper
5. Snap pin
6. Pin assembly
7. Split pin <A/T>
8. Shift lock cable connection <A/T>
9. Pedal pad
10. Brake pedal assembly



1410005

INSPECTION

35100350062

STOP LAMP SWITCH CHECK

1. Connect an ohmmeter between the stop lamp switch terminals.
2. The stop lamp switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm from the outer case edge surface, and if there is continuity when it is released.

MASTER CYLINDER AND BRAKE BOOSTER

35100370389

REMOVAL AND INSTALLATION

Caution

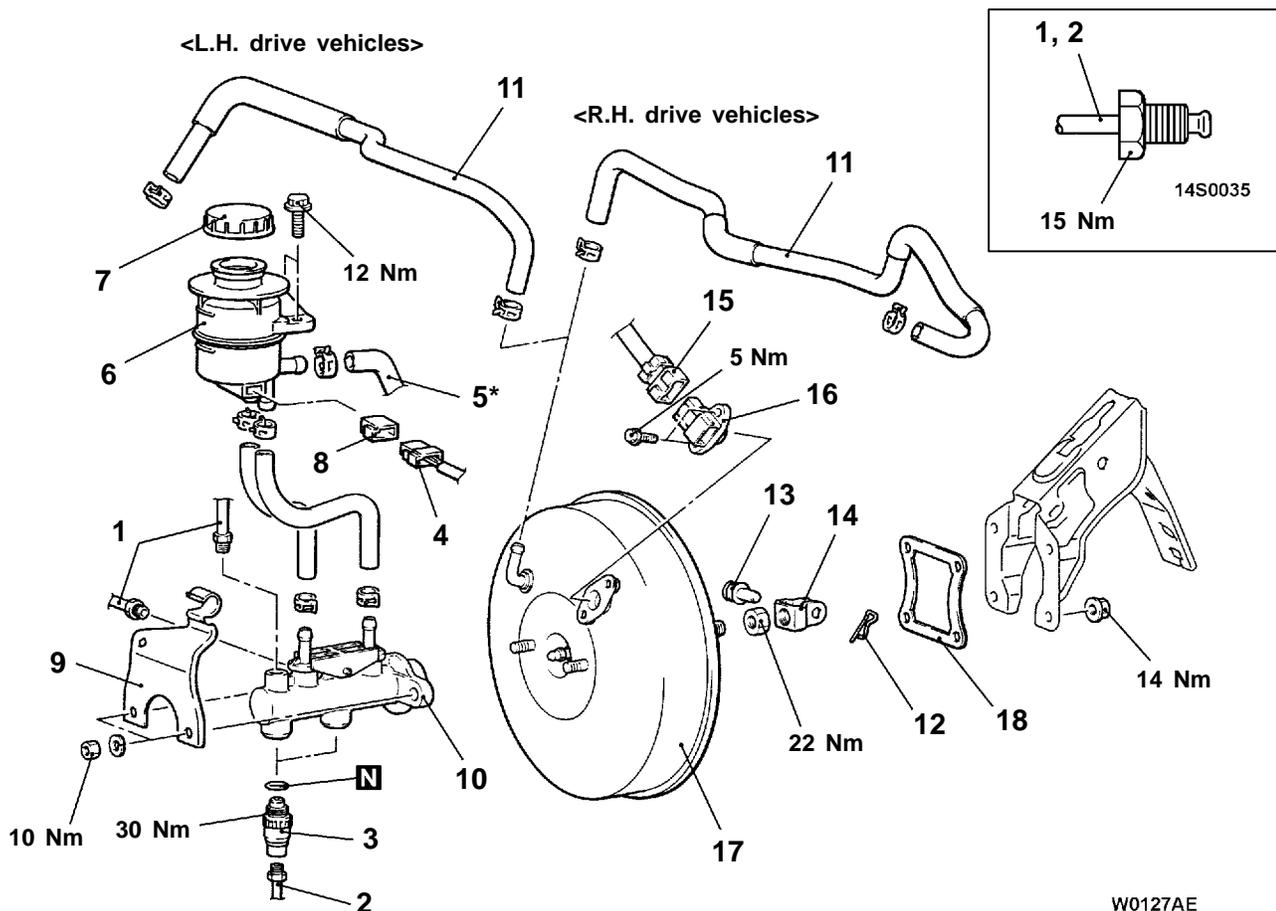
For the reservoir hose marked with *, disconnect the reservoir assembly-side connection only and do not lower the disconnected hose below the master cylinder to prevent the air from entering into brake fluid line.

Pre-removal Operation

- Brake Fluid Draining
- Air Cleaner Removal <L.H. drive vehicles>
- Rocker Cover Removal (Refer to GROUP 11 - Cylinder Head Gasket.)

Post-installation Operation

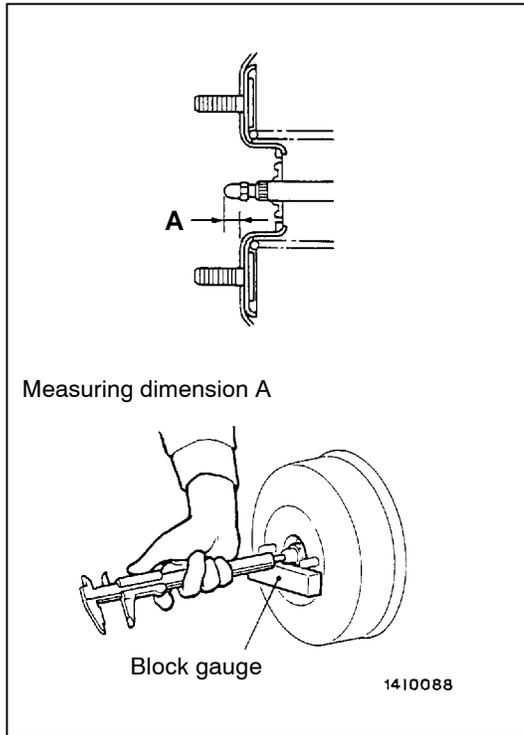
- Rocker Cover Installation (Refer to GROUP 11 - Cylinder Head Gasket.)
- Air Cleaner Installation <L.H. drive vehicles>
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-12.)
- Brake Pedal Adjustment (Refer to P.35A-7.)



W0127AE
00009237

Removal steps

1. Brake pipe connection
2. Brake pipe connection <SPACE RUNNER - Vehicles without ABS>
3. Proportioning valve <SPACE RUNNER - Vehicles without ABS>
4. Brake fluid level sensor connector
5. Reservoir hose
6. Reservoir assembly
7. Reservoir cap assembly
8. Brake fluid level sensor
9. Bracket
10. Master cylinder assembly
11. Vacuum hose (with built-in check valve)
12. Snap pin
13. Pin assembly
14. Clevis
15. Vacuum sensor connector
16. Vacuum sensor
17. Brake booster
18. Sealer

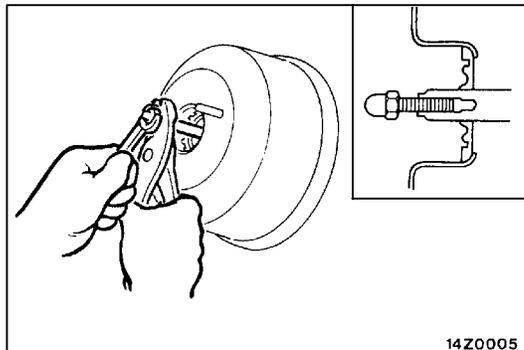


INSTALLATION SERVICE POINT

►A◄ PUSH ROD PROTRUDING LENGTH CHECK AND ADJUSTMENT

1. Measure dimension A.

Standard value: 9.98 - 10.23 mm



2. If the protruding length is not within the standard value range, adjust by changing the push rod length by turning the end of the push rod.

INSPECTION

35100380016

VACUUM SENSOR CHECK

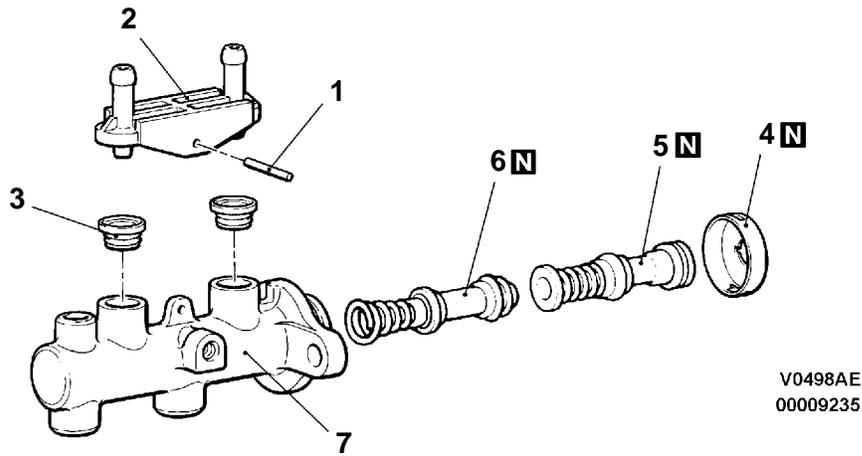
Refer to GROUP 13 - Troubleshooting.

NOTE

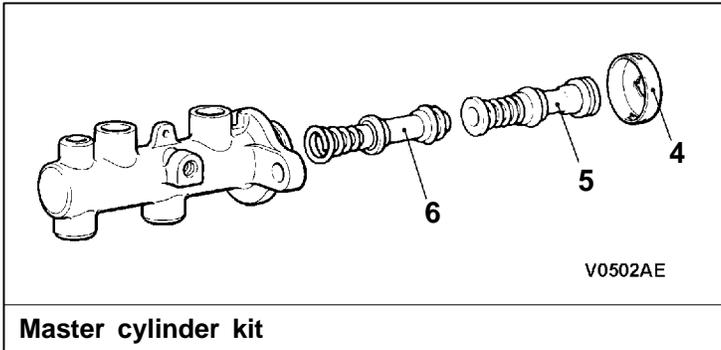
The engine-ECU monitors the vacuum sensor. If it is defective, a diagnosis code will be displayed on the MUT-II.

**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**

35100420190

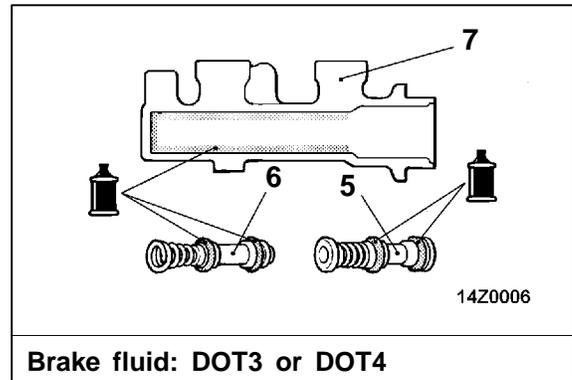


V0498AE
00009235



V0502AE

Master cylinder kit



14Z0006

Brake fluid: DOT3 or DOT4

Disassembly steps

1. Spring pin
2. Nipple
3. Reservoir seal
4. Piston retainer

5. Primary piston assembly
6. Secondary piston assembly
7. Master cylinder body

DISC BRAKE

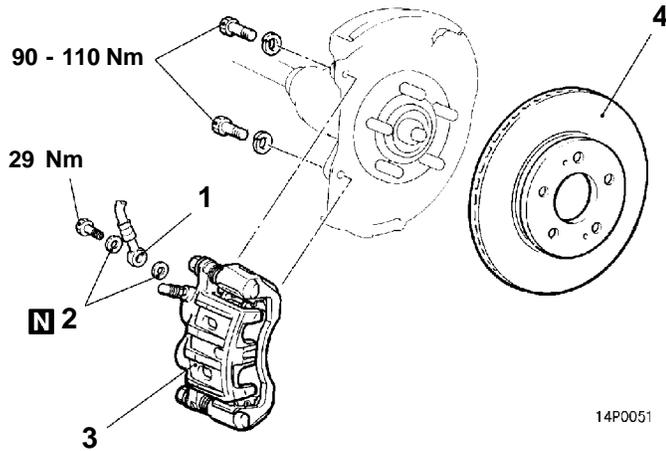
REMOVAL AND INSTALLATION

Pre-removal Operation
 Brake Fluid Draining

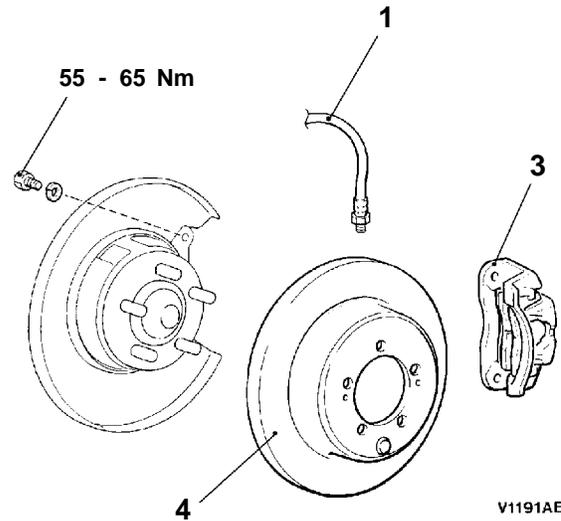
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-12.)

<FRONT>



<REAR>



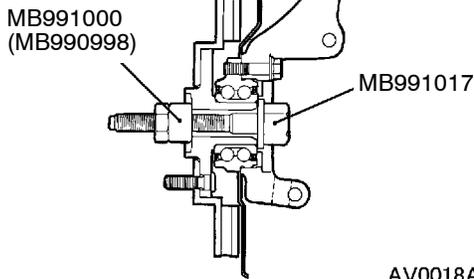
00007606

Removal steps

1. Brake hose connection
2. Gasket

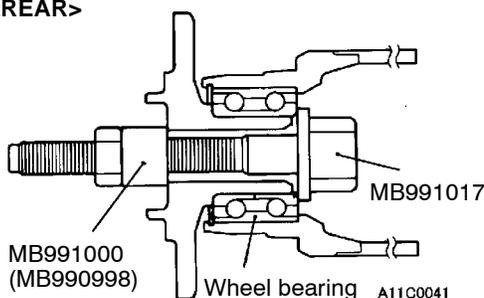
- ▶◀ 3. Disc brake assembly
 4. Brake disc

<FRONT>



AV0018AE

<REAR>

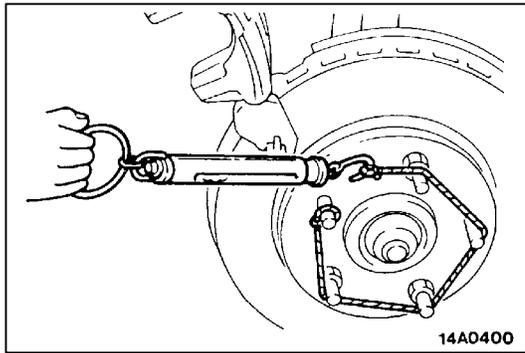


INSTALLATION SERVICE POINT

▶◀ DISC BRAKE ASSEMBLY INSTALLATION

1. In order to measure the brake drag torque after pad installation, measure the rotary-sliding resistance of the hub by the following procedure with the pads removed.
 - (1) Remove the drive shaft.
(Refer to GROUP 26, 27B.)
 - (2) Attach the special tool to the hub assembly as shown in the illustration, and tighten it to the specified torque.

Tightening torque: 196 - 255 Nm

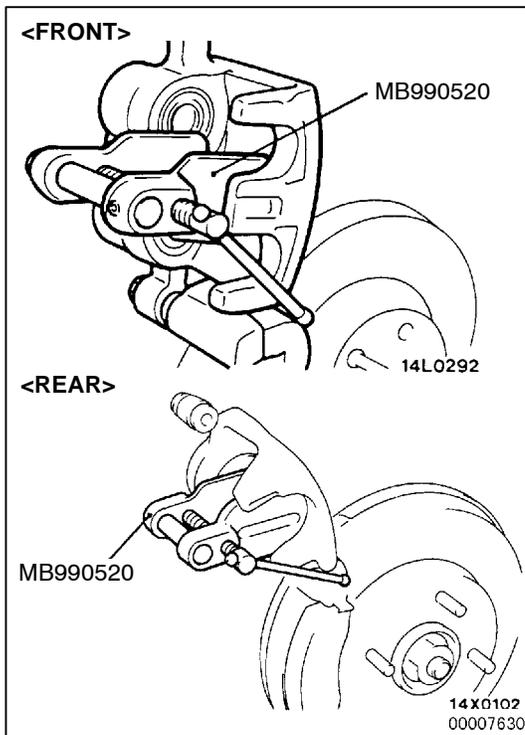


- (3) Use a spring balance to measure the rotary-sliding resistance of the hub in the forward direction.

2. After installing the caliper support to the knuckle, install the pad clips and the pads to the caliper support.

Caution

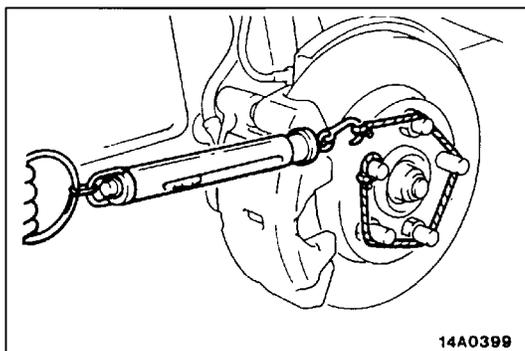
Do not let any oil, grease or other contamination get onto the friction surfaces of the pads and brake discs.



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 tighten the guide pin to the specified torque.

Tightening torque: 74 Nm

5. Start the engine and then depress the brake pedal 2-3 times.
6. Stop 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.)

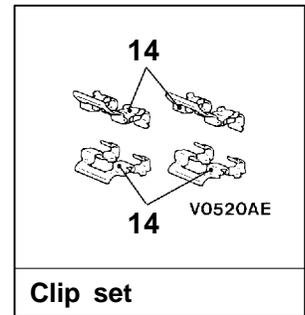
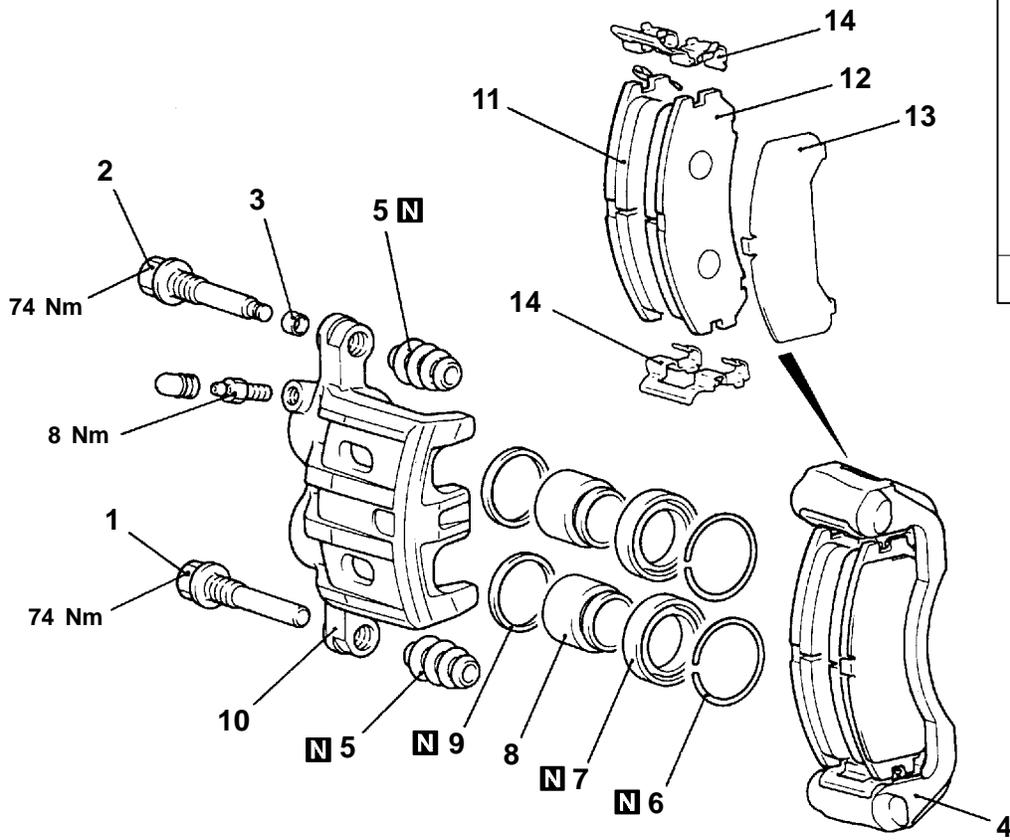
Standard value: 69 N or less

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.

DISASSEMBLY AND REASSEMBLY

35100820044

<FRONT>



14S0190
00009243

<p>14L0296</p>	<p>W0132AE</p>	<p>V0522AE</p>	<p>14L0298</p>
<p>Brake caliper kit</p>	<p>Pad set</p>	<p>Shim set</p>	<p>Seal and boots kit</p>

Disassembly steps



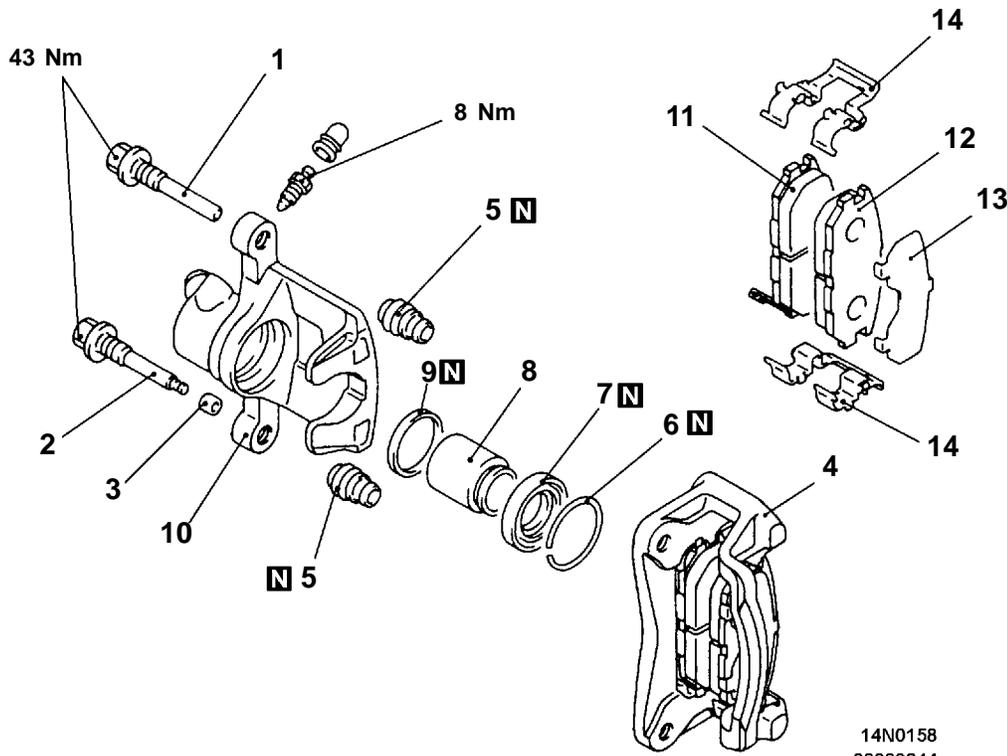
1. Guide pin
2. Lock pin
3. Bushing
4. Caliper support (pad, clip, shim)
5. Pin boot
6. Boot ring
7. Piston boot



8. Piston
9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip



<REAR>



14N0158
00009244

<p>14N0159</p>	<p>W0133AE</p>	<p>V1199AE</p>	<p>Grease 14N0161</p>
<p>Brake caliper kit</p>	<p>Pad set</p>	<p>Shim set</p>	<p>Seal and boots kit</p>

Disassembly steps



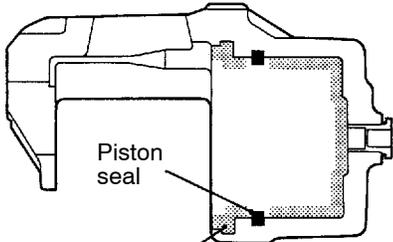
1. Guide pin
2. Lock pin
3. Bushing
4. Caliper support (pad, clip, shim)
5. Pin boot
6. Boot ring
7. Piston boot



8. Piston
9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip



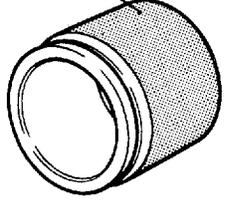
LUBRICATION POINTS



Piston seal



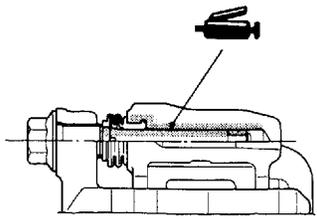
14X0302



14X0301

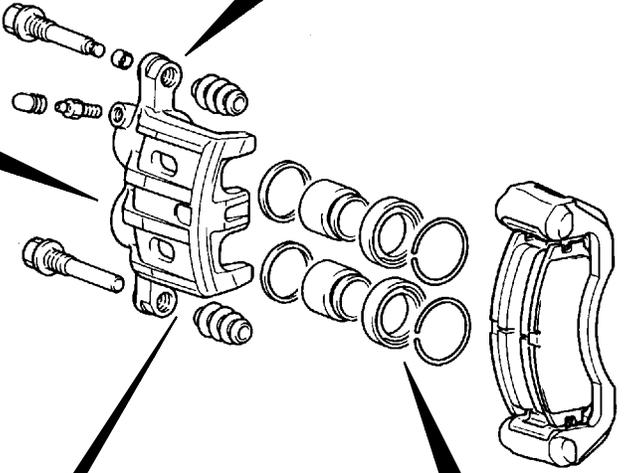
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4



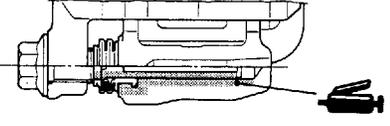
14A0541

Grease: Repair kit grease



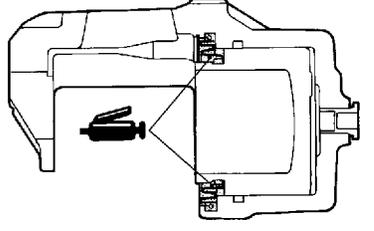
14N0286

00007215



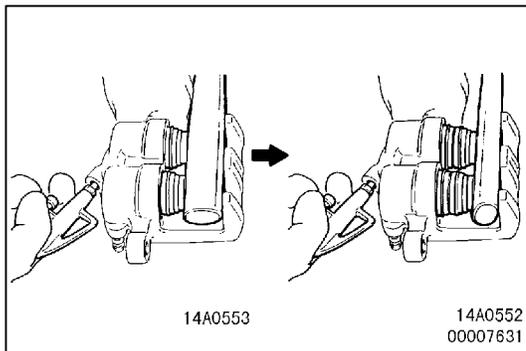
14A0541

Grease: Repair kit grease



14X0303

Grease: Repair kit grease



DISASSEMBLY SERVICE POINTS

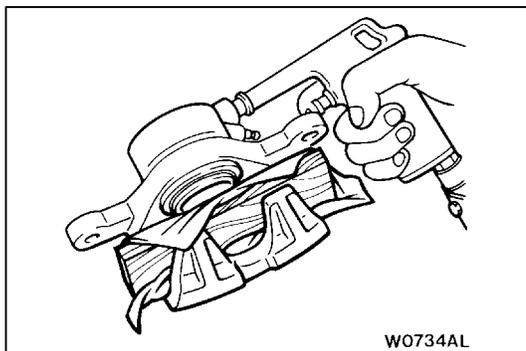
◀A▶ PISTON BOOT/PISTON REMOVAL

<FRONT>

Withdraw the piston and piston boot while applying compressed air through the brake hose connection hole. At this time, use a plastic hammer as shown to adjust so that the two pistons will protrude evenly.

Caution

If only one piston is withdrawn, the other cannot be removed.

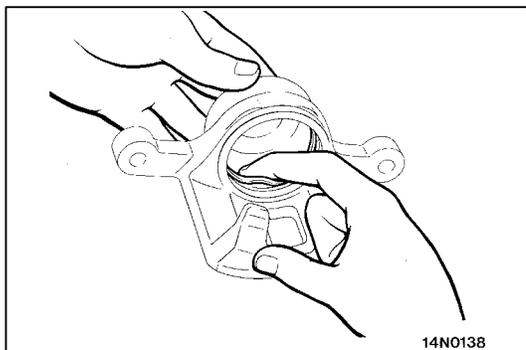


<REAR>

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

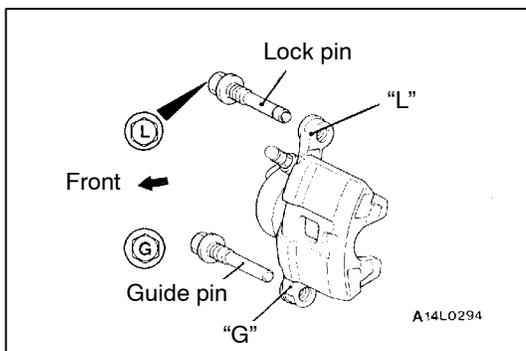
1. Remove piston seal with finger tip.

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



REASSEMBLY SERVICE POINT

▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin and lock pin as illustrated that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

INSPECTION

35100630173

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve 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: 10 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.**

PROPORTIONING VALVE <SPACE RUNNER>

35100570260

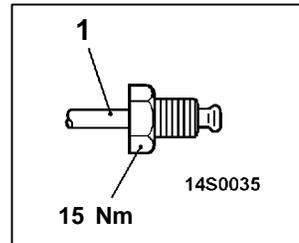
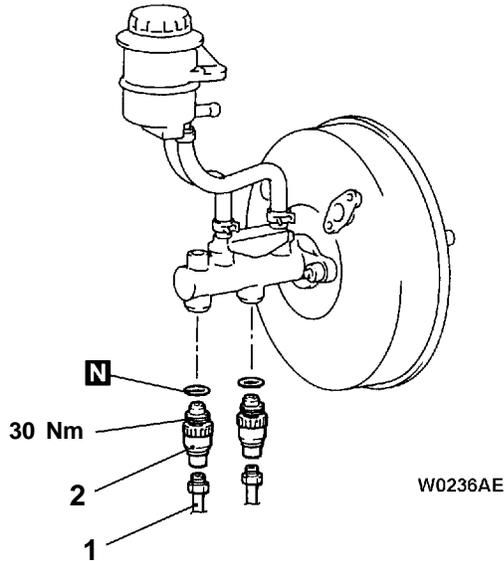
REMOVAL AND INSTALLATION

Pre-removal Operation
 Brake Fluid Draining

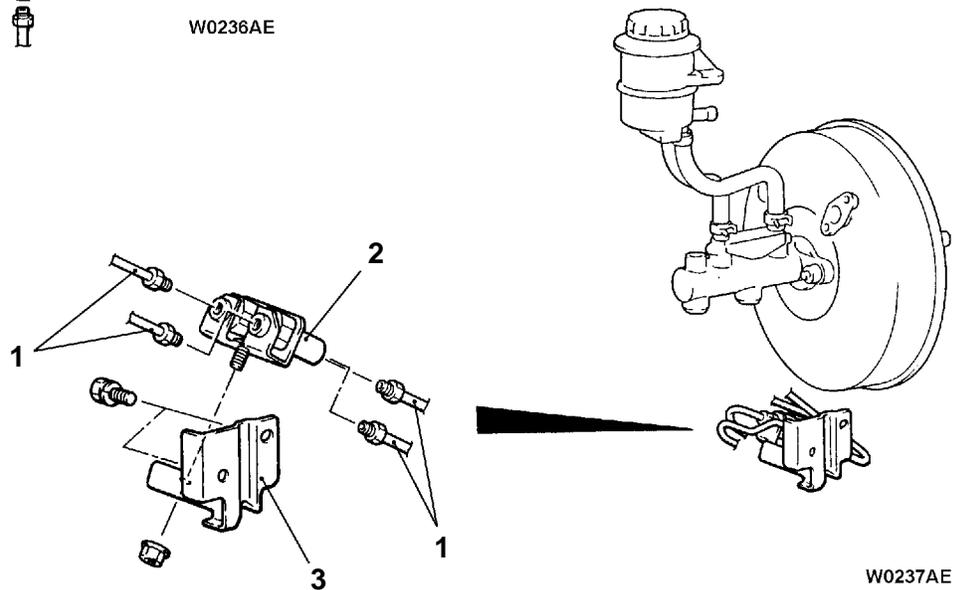
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-12.)

<Vehicles without ABS>



<Vehicles with ABS>



Removal steps

1. Brake pipe connection
2. Proportioning valve assembly

3. Bracket

LOAD SENSING PROPORTIONING VALVE <SPACE WAGON>

REMOVAL AND INSTALLATION

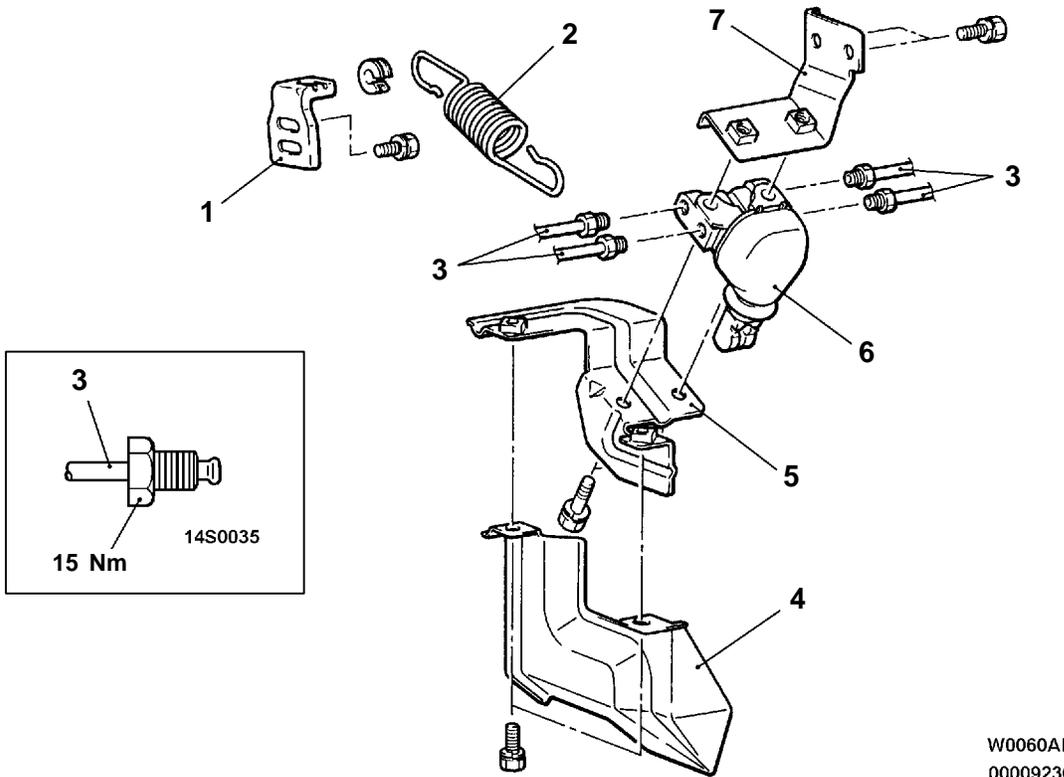
Caution

Do not disassemble the load sensing proportioning valve.

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation

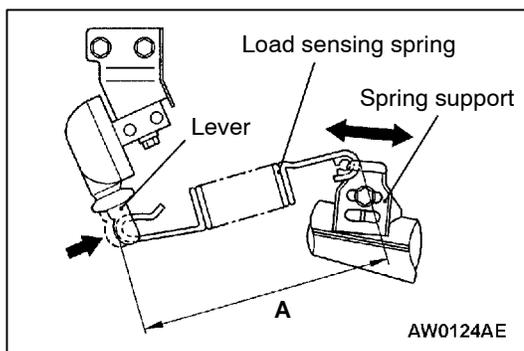
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-12.)



W0060AE
00009236

Removal steps

- | | |
|--|---|
| <p>▶A◀</p> <ol style="list-style-type: none"> 1. Spring support 2. Load sensing spring 3. Brake pipe connection 4. Cover A | <ol style="list-style-type: none"> 5. Cover B 6. Load sensing proportioning valve 7. Bracket |
|--|---|



INSTALLATION SERVICE POINT

▶A◀ SPRING SUPPORT INSTALLATION

1. Install the load sensing spring, and then tighten the spring support to the lower arm assembly temporarily.
2. Insert the lever of the load sensing proportioning valve fully into the valve side and hold it. Then adjust the spring support so that the spring length (the distance between the two ends of the spring) is at the standard value.

Standard value (A): 198 - 202 mm

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

CONTENTS

35209000299

GENERAL INFORMATION	3	Brake Fluid Level Sensor Check Refer to GROUP 35A	
SERVICE SPECIFICATIONS	3	Bleeding	Refer to GROUP 35A
LUBRICANTS	Refer to GROUP 35A	Disc Brake Pad Check and Replacement Refer to GROUP 35A	
SPECIAL TOOLS	4	Disc Brake Rotor Check Refer to GROUP 35A	
TROUBLESHOOTING	4	Brake Disc Thickness Check Refer to GROUP 35A	
ON-VEHICLE SERVICE	17	Brake Disc Run-out Check Refer to GROUP 35A	
Brake Pedal Check and Adjustment Refer to GROUP 35A		Brake Disc Run-out Correction Refer to GROUP 35A	
Brake Booster Operating Test Refer to GROUP 35A		Wheel Speed Sensor Output Voltage Check	17
Check Valve Operation Check Refer to GROUP 35A		ABS Warning Lamp Relay Continuity Check	18
Proportioning Valve Function Test <SPACE RUNNER>	Refer to GROUP 35A	Hydraulic Unit Check	19
Load Sensing Spring Length Check and Adjustment<SPACE WAGON> Refer to GROUP 35A		Remedy for a Flat Battery	20
Load Sensing Proportioning Valve Function Test<SPACE WAGON>	Refer to GROUP 35A		

CONTINUED ON NEXT PAGE

35B-2

BRAKE PEDAL Refer to GROUP 35A

MASTER CYLINDER AND BRAKE

BOOSTER Refer to GROUP 35A

DISC BRAKE Refer to GROUP 35A

PROPORTIONING VALVE

<SPACE RUNNER> Refer to GROUP 35A

LOAD SENSING PROPORTIONING VALVE

<SPACE WAGON> Refer to GROUP 35A

HYDRAULIC UNIT AND ABS-ECU 21

WHEEL SPEED SENSOR 23



GENERAL INFORMATION

35200010314

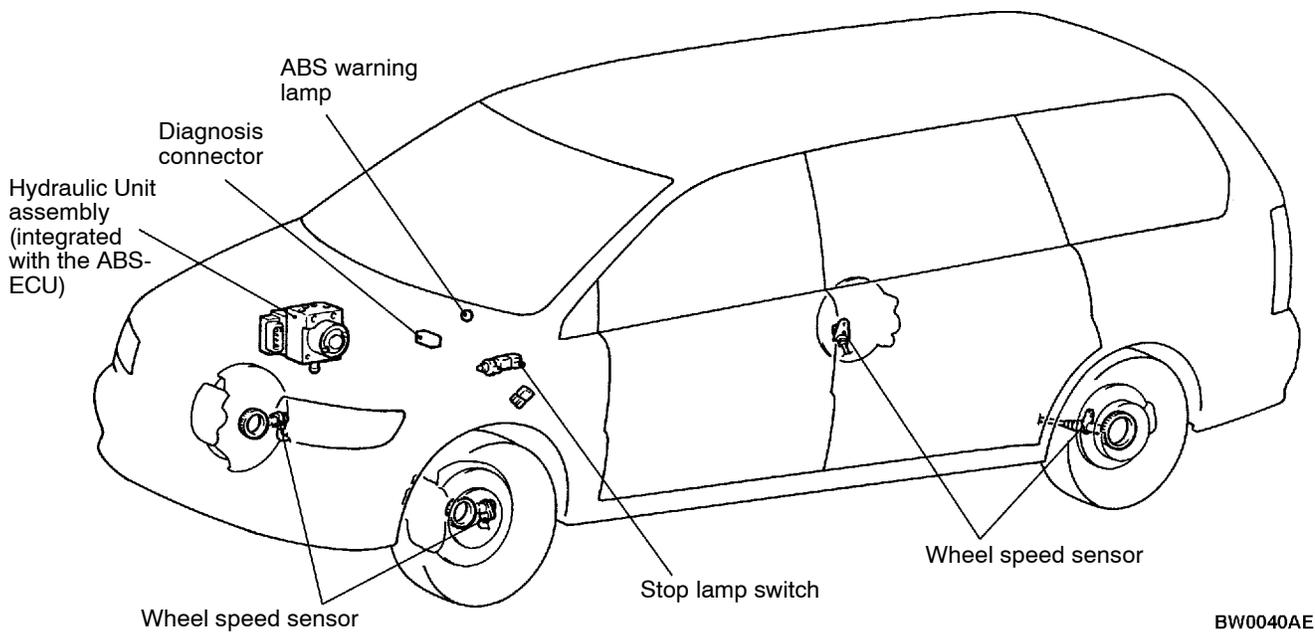
The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly (integrated with the ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be

identified and the trouble symptoms will be memorized by the diagnosis function. In addition, reading of diagnosis codes and service data and actuator testing are possible by using the MUT-II.

WHEEL SPEED SENSOR

Type	Magnet coil type
ABS rotor teeth	43

CONSTRUCTION DIAGRAM



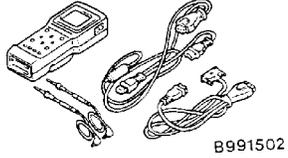
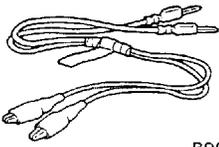
SERVICE SPECIFICATIONS

35200030334

Items		Standard value	Limit
Clearance between speed sensor and ABS rotor mm	Front	-	0.85 or less
	Rear	0.2 - 0.7	-
Wheel speed sensor internal resistance k Ω		1.0 - 1.5	-
Wheel speed sensor insulation resistance k Ω		100 or more	-

SPECIAL TOOLS

35200060210

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
 B991529	MB991529	Diagnosis code check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)

TROUBLESHOOTING

35201110129

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation of phenomenon
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, but this is because the system operation check is being performed, and is not an abnormality.
ABS operation sound	<ol style="list-style-type: none"> 1. Sound of the motor inside the ABS hydraulic unit operation. (whine) 2. Sound is the generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump: suspension; squeak: tyres)
ABS operation (Long braking distance)	For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being too overconfident.

Diagnosis detection condition can vary depending on the diagnosis code.

Make sure that checking requirements listed in the "Comment" are satisfied when checking the trouble symptom again.

DIAGNOSIS FUNCTION

35201120368

DIAGNOSIS CODES CHECK

Read a diagnosis code by the MUT-II or ABS warning lamp.
(Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

INSPECTION CHART FOR DIAGNOSIS CODES

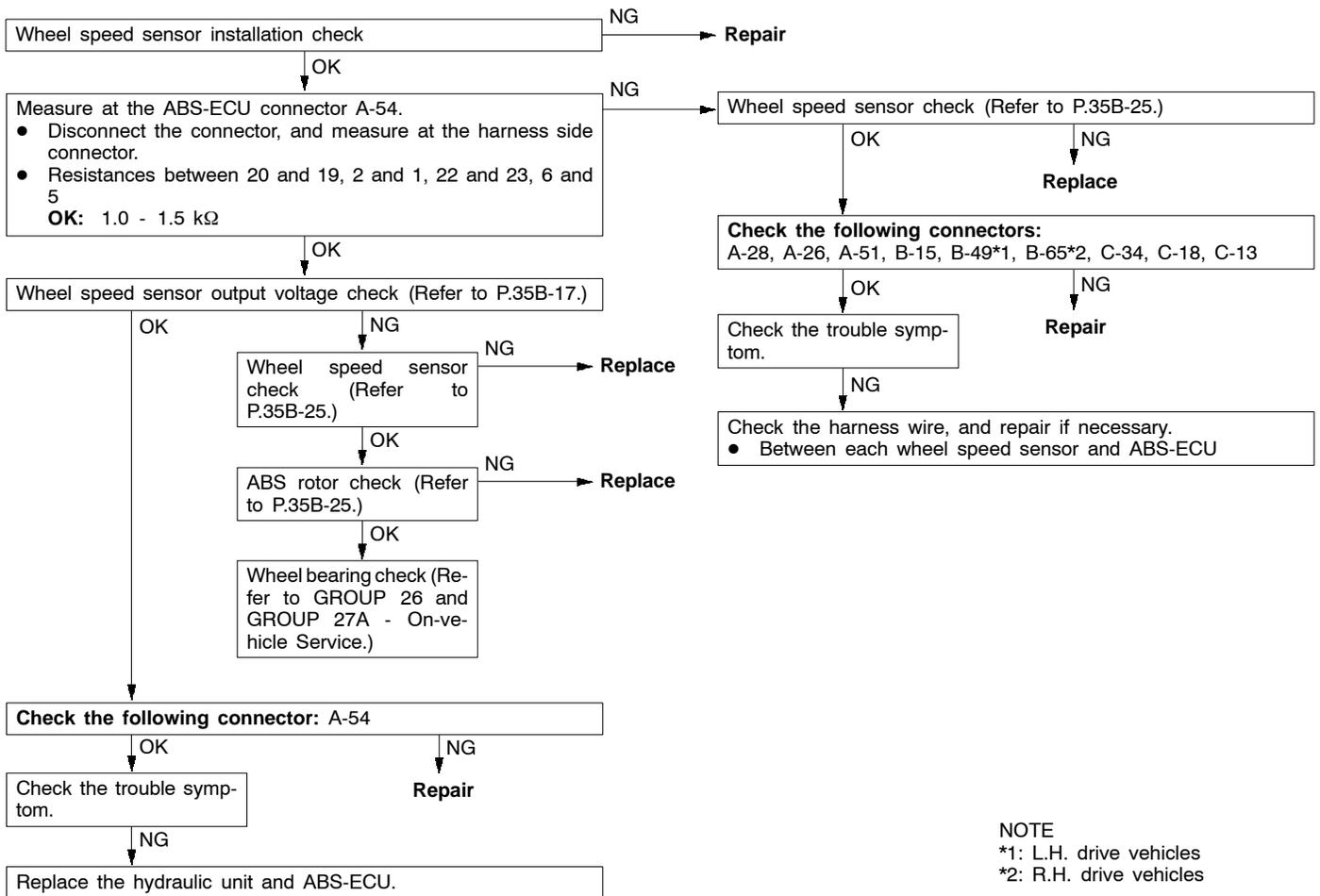
35201130583

Inspect according to the inspection chart that is appropriate for the malfunction code.

Diagnosis code No.	Inspection item	Reference page
11	Front right wheel speed sensor (Open circuit or short circuit)	35B-6
12	Front left wheel speed sensor (Open circuit or short circuit)	35B-6
13	Rear right wheel speed sensor (Open circuit or short circuit)	35B-6
14	Rear left wheel speed sensor (Open circuit or short circuit)	35B-6
16	Power supply system (abnormal voltage drop or rise)	35B-7
21	Front right wheel speed sensor	35B-6
22	Front left wheel speed sensor	35B-6
23	Rear right wheel speed sensor	35B-6
24	Rear left wheel speed sensor	35B-6
33	Stop lamp switch system (open circuit or stop lamp stays ON)	35B-7
41	Front right solenoid valve	35B-21 (Replace the hydraulic unit and ABS-ECU.)
42	Front left solenoid valve	
43	Rear right solenoid valve	
44	Rear left solenoid valve	
51	Valve relay problem (stays on)	
52	Valve relay problem (stays off)	
53	Motor relay problem (stays off)	
54	Motor relay problem (stays on)	
55	Motor system (seized pump motor)	
63	ABS-ECU	

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code Nos.11, 12, 13 and 14 Wheel speed sensor (open circuit or short circuit)	Probable cause
Code Nos.21, 22, 23 and 24 Wheel speed sensor	
Code Nos 11, 12, 13 and 14 are output if the ABS-ECU detects an open circuit or short-circuit in the (+) wire or (-) wire in any one of the four wheel speed sensors.	<ul style="list-style-type: none"> ● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit
Code Nos.21, 22, 23 and 24 are output in the following cases. <ul style="list-style-type: none"> ● When there is no input from any one of the four wheel speed sensors when travelling at several km/h or more, even though open circuit can not be verified. ● When a chipped or blocked-up ABS rotor is detected and if the anti-lock system operates continuously because a malfunctioning sensor or a warped ABS rotor is causing sensor output to drop. 	<ul style="list-style-type: none"> ● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of ABS rotor ● Too much gap between the sensor and the rotor ● Malfunction of hydraulic unit ● Malfunction of wheel bearing



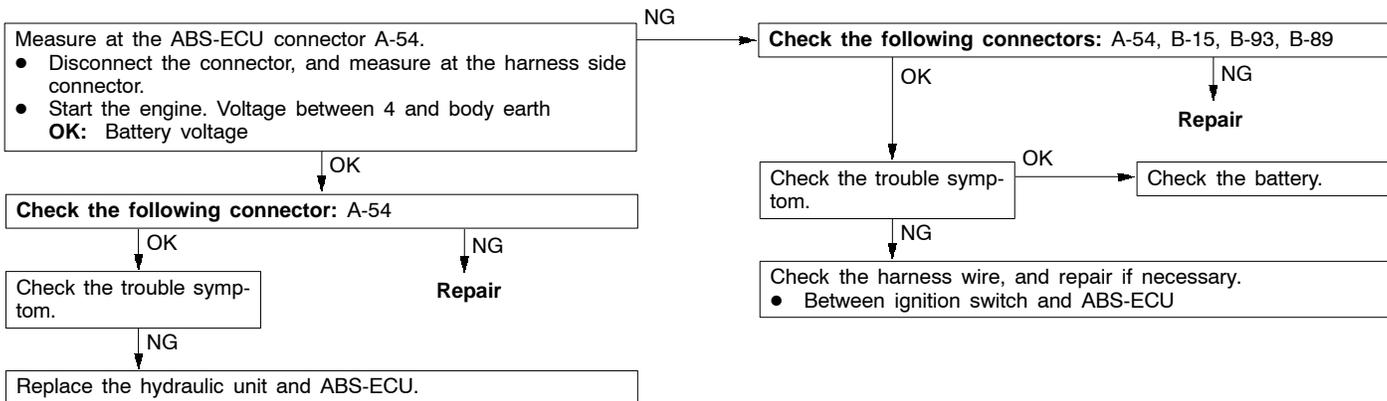
NOTE
 *1: L.H. drive vehicles
 *2: R.H. drive vehicles

Code No.16 ABS-ECU power supply system (abnormal voltage drop or rise)	Probable cause
This code is output if the ABS-ECU power supply voltage drops below or rises above the rated values. Furthermore, if the voltage returns to normal, this code is no longer output.	<ul style="list-style-type: none"> ● Malfunction of battery ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit

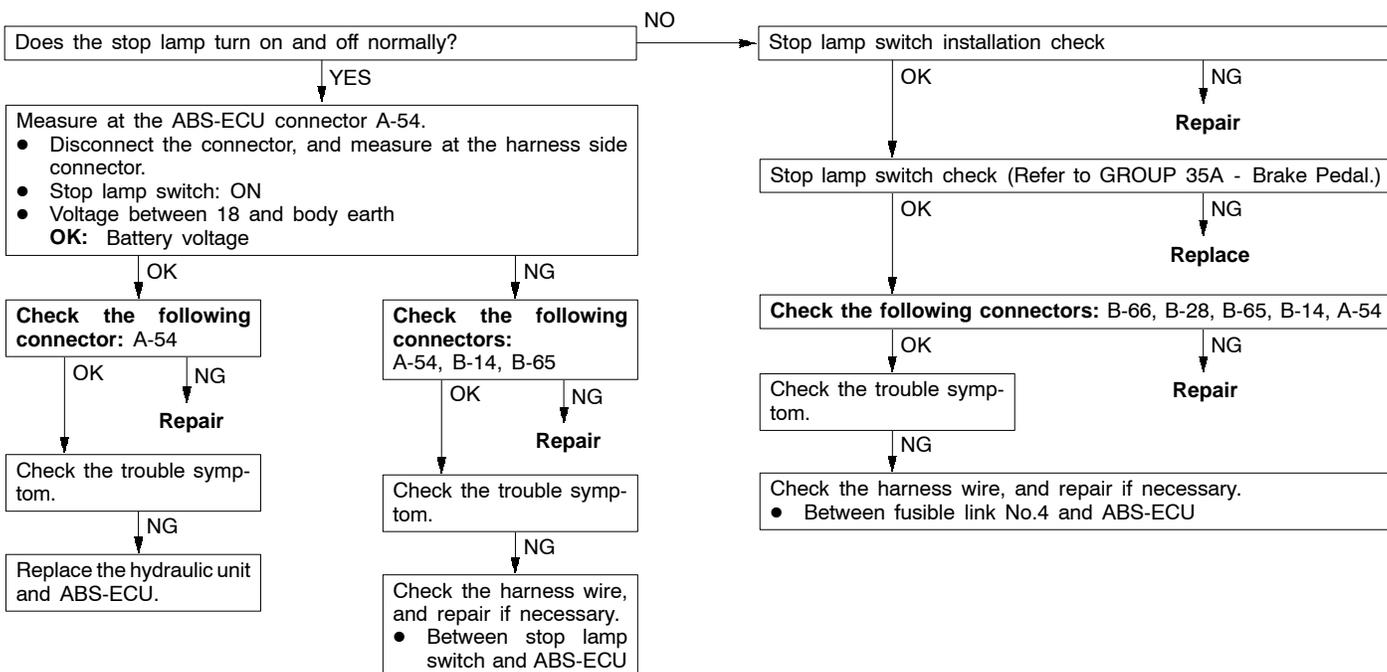
Caution

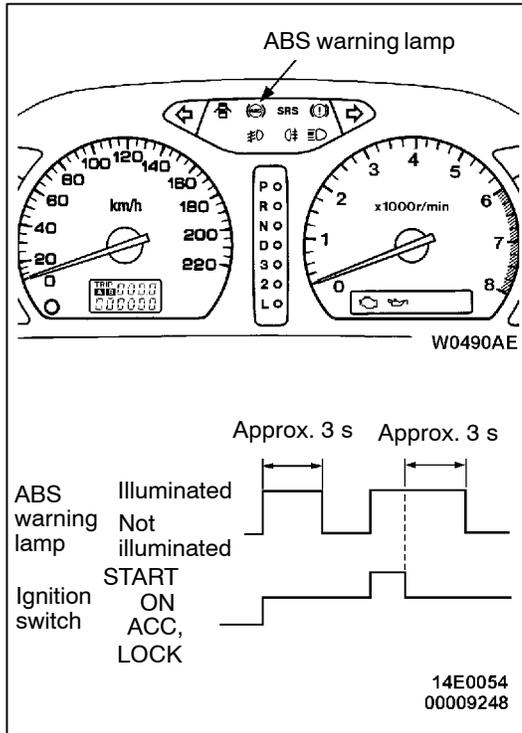
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.

Before carrying out the following inspection, check the battery level, and refill it if necessary.



Code No.33 Stop lamp switch system (open circuit or stop lamp stays ON)	Probable cause
This code is output in the following cases. <ul style="list-style-type: none"> ● If the stop lamp switch is continuously on for 15 minutes or more even though the ABS system is not operating. ● If there is an open circuit in the stop lamp switch input circuit harness. 	<ul style="list-style-type: none"> ● Malfunction of stop lamp switch ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit





ABS WARNING LAMP INSPECTION

35201200178

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to "START", the ABS warning lamp remains illuminated.
3. When the ignition key is turned from "START" back to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then switches off.

NOTE

The ABS warning lamp may remain on until the vehicle reaches a speed of several km/h. This is limited to cases where diagnosis code Nos.21 - 24 and 55 have been recorded because of a previous problem occurring. In this case, the ABS-ECU keeps the warning lamp illuminated until the problem corresponding to that diagnosis code can be detected.

4. If the illumination is other than the above, check the diagnosis codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

35201140562

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

Trouble symptoms	Inspection procedure No.	Reference page
Communication between the MUT-II and the whole system is not possible.	1	35B-9
Communication between the MUT-II and the ABS-ECU is not possible.	2	35B-10
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.	3	35B-11
Even after the engine is started, the ABS warning lamp remains illuminated.	4	35B-12
Faulty ABS operation	5	35B-13

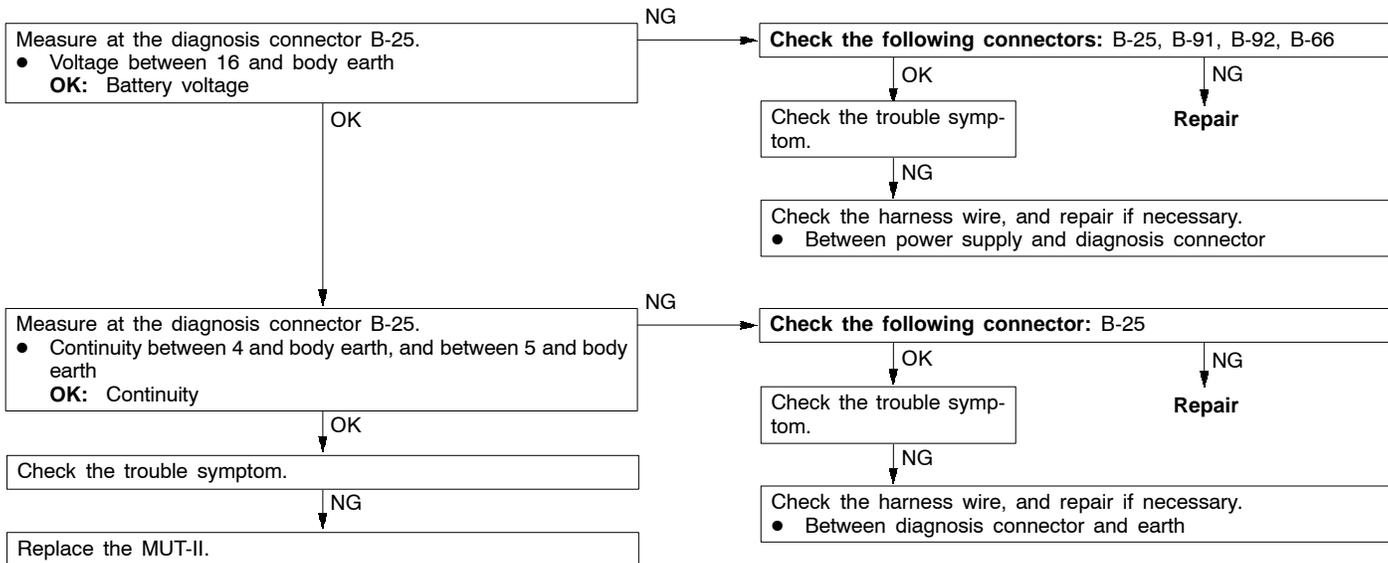
Caution

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

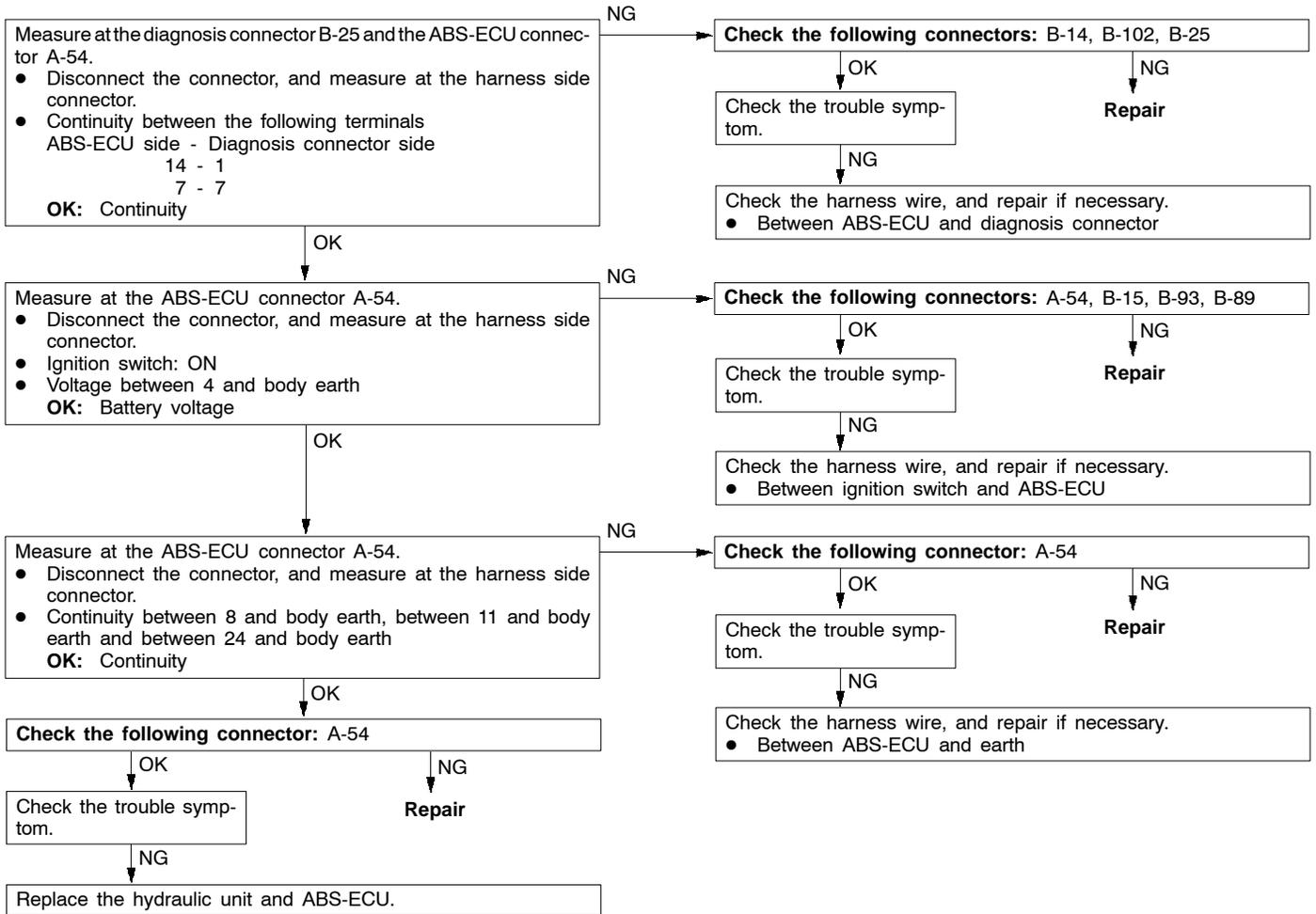
Inspection Procedure 1

Communication between the MUT-II and the whole system is not possible.	Probable cause
The cause may be a malfunction of the power supply circuit or the earth circuit of the diagnosis connector.	<ul style="list-style-type: none"> ● Malfunction of diagnosis connector ● Malfunction of wiring harness or connector



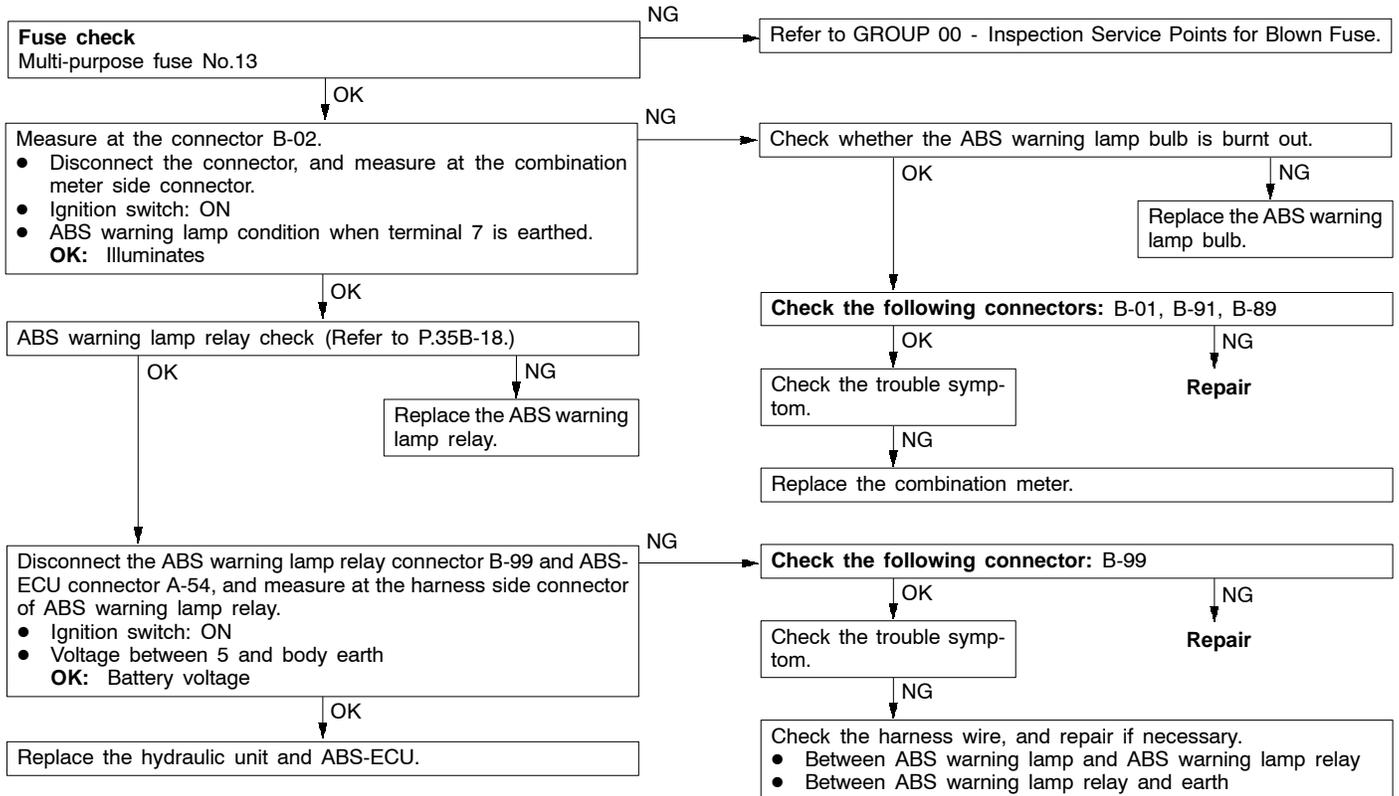
Inspection Procedure 2

Communication between MUT-II and the ABS-ECU is not possible.	Probable cause
The cause may be an open circuit in the ABS-ECU power supply circuit or an open circuit in the diagnosis output circuit.	<ul style="list-style-type: none"> ● Blown fuse ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit



Inspection Procedure 3

When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.	Probable cause
The cause may be an open circuit in the lamp power supply circuit, a blown lamp, a malfunction of the ABS warning lamp relay or an open circuit between the ABS warning lamp and the earth.	<ul style="list-style-type: none"> ● Blown fuse ● Burn out ABS warning lamp bulb ● Malfunction of ABS warning lamp relay ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit

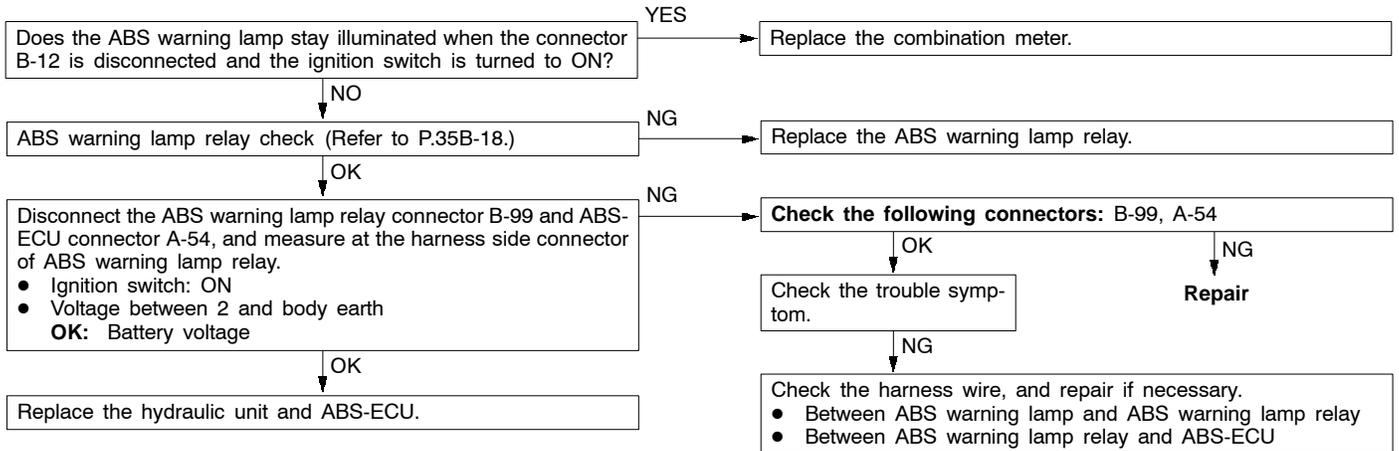


Inspection Procedure 4

Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	<ul style="list-style-type: none"> ● Malfunction of combination meter ● Malfunction of ABS warning lamp relay ● Malfunction of wiring harness (short circuit) ● Malfunction of hydraulic unit

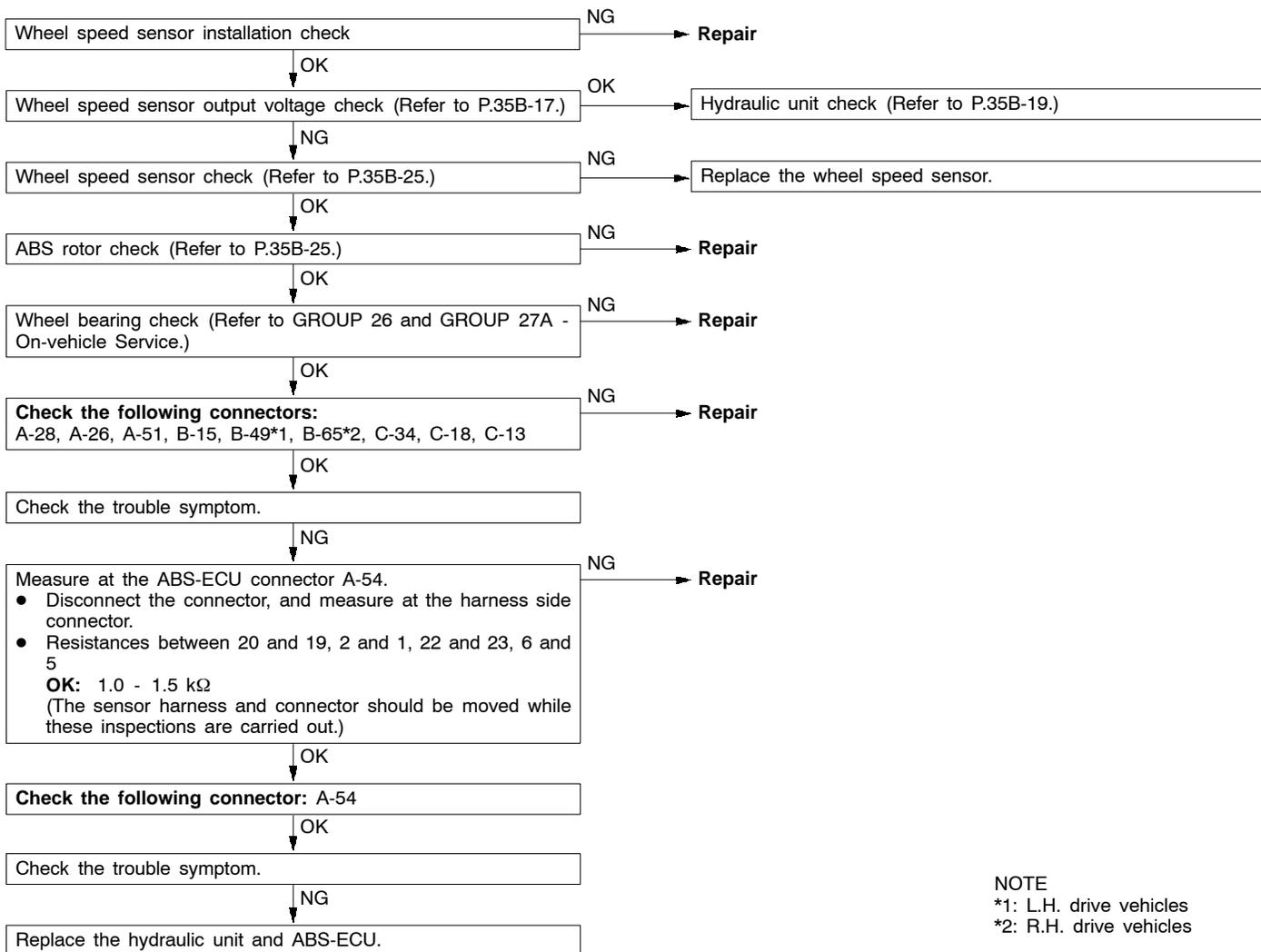
NOTE

This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



Inspection Procedure 5

Faulty ABS operation	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"> ● Improper installation of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor ● Foreign material adhering to wheel speed sensor ● Malfunction of wheel bearing ● Malfunction of hydraulic unit



NOTE
 *1: L.H. drive vehicles
 *2: R.H. drive vehicles

DATA LIST REFERENCE TABLE

35201150206

The following items can be read by the MUT-II from the ABS-ECU input data.

1. When the system is normal

Item No.	Check item	Checking requirements	Normal value
11	Front-right wheel speed sensor	Perform a test run	Vehicle speeds displayed on the speedometer and MUT-II are identical.
12	Front-left wheel speed sensor		
13	Rear-right wheel speed sensor		
14	Rear-left wheel speed sensor		
16	ABS-ECU power supply voltage	Ignition switch power supply voltage and valve monitor voltage	9.2 - 17.5 V
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

2. When the ABS-ECU shut off ABS operation.

When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

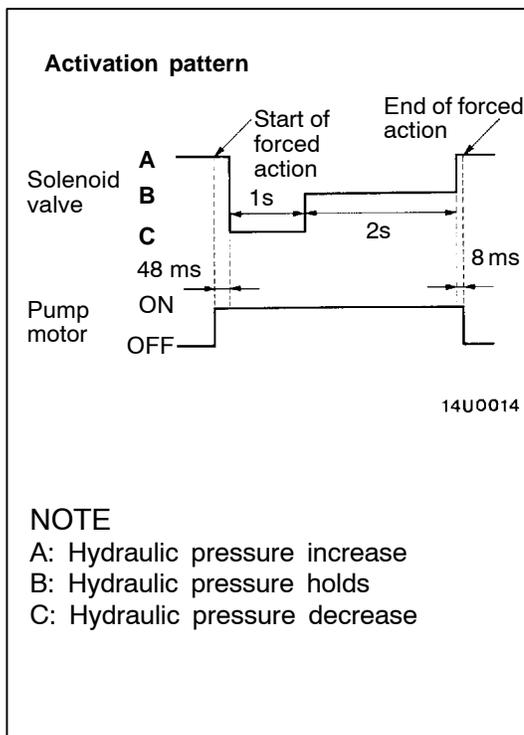
ACTUATOR TEST REFERENCE TABLE

35201160025

The MUT-II activates the following actuators for testing.

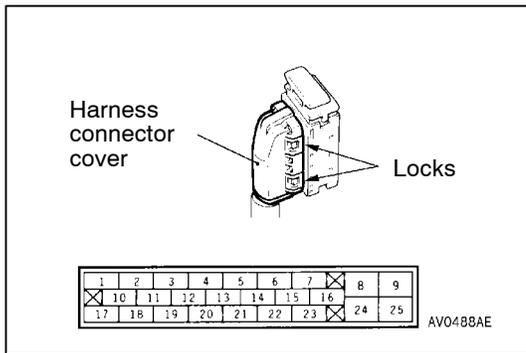
NOTE

1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will be canceled.
3. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.



ACTUATOR TEST SPECIFICATIONS

No.	Item	
01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-right wheel	
03	Solenoid valve for rear-left wheel	
04	Solenoid valve for rear-right wheel	



CHECK AT ABS-ECU

35201180366

Remove the harness connector cover and measure the terminal voltage of the ABS-ECU.

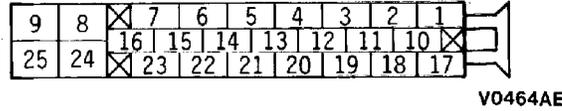
TERMINAL VOLTAGE CHECK CHART

1. Measure the voltage between each terminal and earth.
2. The terminal layout is shown in the illustration below.

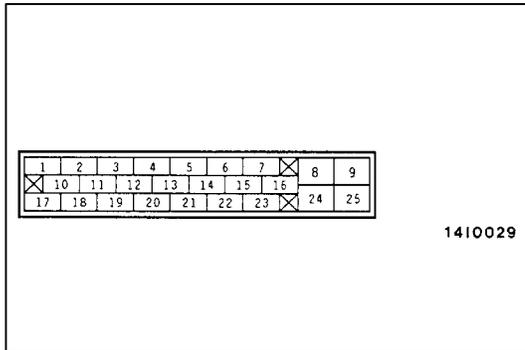
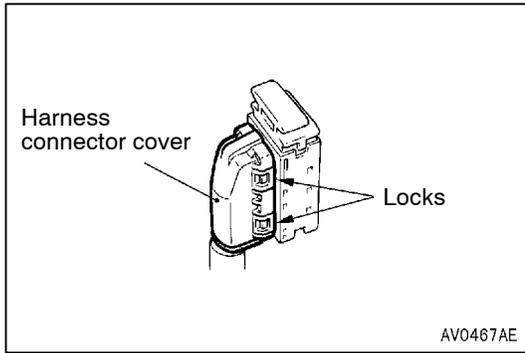
Terminal No.	Check item	Checking requirements		Normal condition
4	ABS-ECU power supply	Ignition switch: ON		Battery voltage
		Ignition switch: START		0 V
7	MUT-II	When the MUT-II is connected		Serial communication with MUT-II
		When the MUT-II is not connected		1 V or less
9	Solenoid valve power supply	Always		Battery voltage
14	Diagnosis changeover input	When the MUT-II is connected		0 V
		When the MUT-II is not connected		Approx. 12 V
16	ABS valve transistor output	Ignition switch: ON	When the lamp is switched off	2 V or less
			When the lamp is illuminated	Battery voltage
18	Stop lamp switch input	Ignition switch: ON	Stop lamp switch: ON	Battery voltage
			Stop lamp switch: OFF	1 V or less
25	Motor power supply	Always		Battery voltage

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.



Terminal No.	Signal	Normal condition
1 - 2	Wheel speed sensor (front left)	1.0 - 1.5 kΩ
5 - 6	Wheel speed sensor (rear left)	1.0 - 1.5 kΩ
19 - 20	Wheel speed sensor (front right)	1.0 - 1.5 kΩ
23 - 22	Wheel speed sensor (rear right)	1.0 - 1.5 kΩ
8 - Body earth	Solenoid valve earth	Continuity
24 - Body earth	Motor earth	



ON-VEHICLE SERVICE

35200160323

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Remove the harness connector cover of the ABS-ECU and measure.
3. Rotate the wheel to be measured at approximately 1/2 - 1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

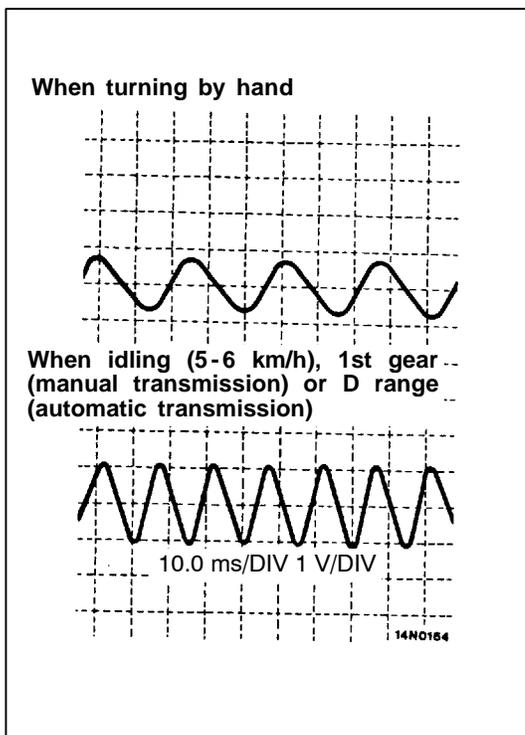
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	1	19	5	23
	2	20	6	22

Output voltage

**When measuring with a circuit tester:
42 mV or more**

**When measuring with an oscilloscope:
120 mV p-p or more**

4. The followings are suspected if the output voltage is lower than the value described above. Check the speed sensor, and replace if necessary.
 - Too large clearance between the pole piece of the speed sensor and ABS rotor
 - Faulty wheel speed sensor



Inspecting Waveforms With An Oscilloscope

Use the following method to observe the output voltage waveform from each wheel sensor with an oscilloscope.

- Start the engine, and rotate the front wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the rear wheels manually so that they rotate at a constant speed.

NOTE

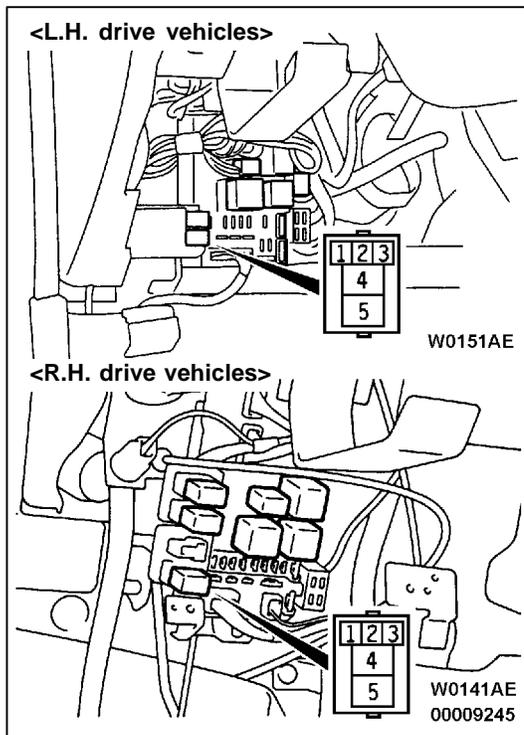
1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The waveform measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

Points In Waveform Measurement

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	Rotor with missing or damaged teeth	Replace rotor

Caution

Because the wheel speed sensor cables move together with the front and rear suspension, they vibrate greatly when driving over poor road surfaces. As a result, the sensor harnesses should also be shaken when monitoring of output waveforms of the wheel speed sensors in order to simulate conditions such as driving over poor road surfaces.



ABS WARNING LAMP RELAY CONTINUITY CHECK

35200930047

Battery voltage	Terminal No.			
	1	2	3	5
Power is not supplied	○	○	○	○
Power is supplied	⊕		⊖	

HYDRAULIC UNIT CHECK

35200170227

Caution

Turn the ignition switch off before connecting or disconnecting the MUT-II.

1. Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points or place the wheels which are checked on the rollers of the braking force tester.

Caution

(1) The roller of the braking force tester and the tyre should be dry during testing.

(2) When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.

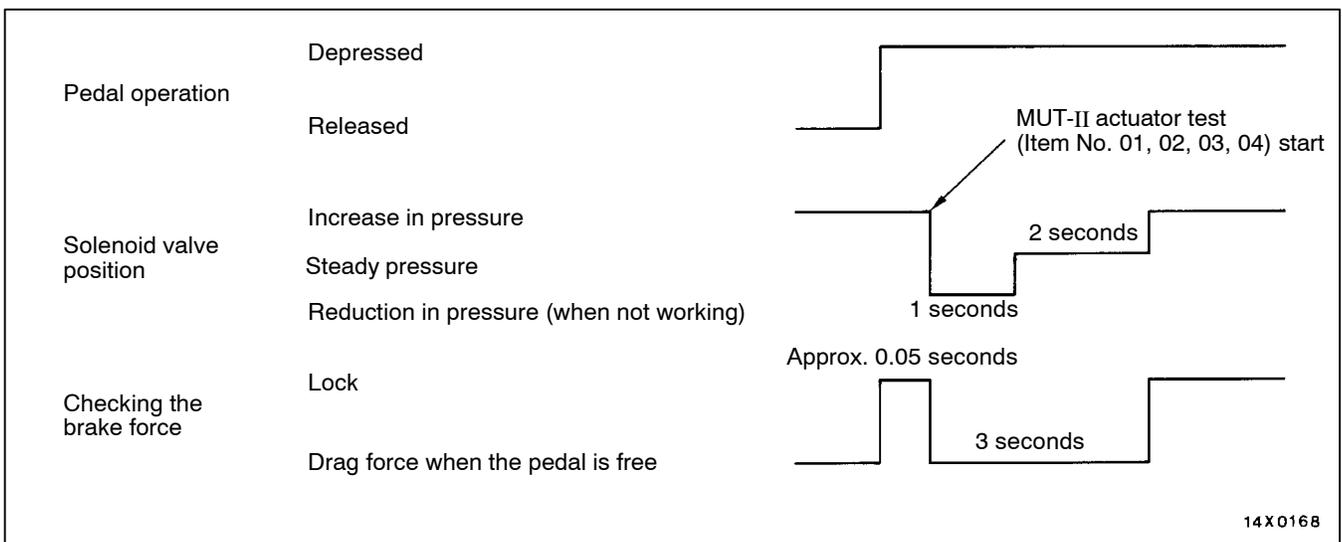
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.
5. Use the MUT-II to force-drive the actuator.

NOTE

- (1) During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.
 - (2) When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.
6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed. When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check that the braking force decreases when the actuator is force-driven.

Front wheel	785 - 981 N
Rear wheel	588 - 784 N

The result should be as shown in the following diagram.

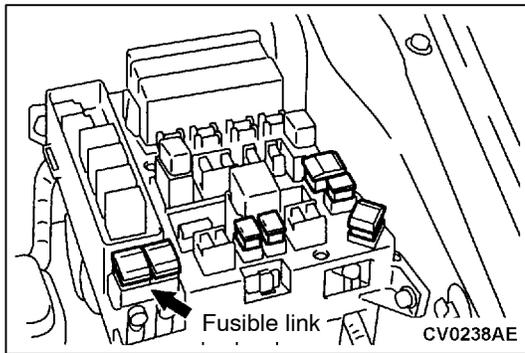


7. If the result of inspection is abnormal, correct according to the "Diagnosis Table".

Diagnosis Table

No.	Operation	Judgement - Normal	Judgement - Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 3 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than hydraulic unit	Check and clean brake line
02				Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly
03			Brake force is not released	Incorrect hydraulic unit brake tube connection	Connect correctly
04			Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly	

8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.



REMEDY FOR A FLAT BATTERY

35200350249

When booster cables are used to start the engine when the battery is completely flat and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire, and driving might not be possible.

This happens because ABS consumes a great amount of current for its self-check function; the remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit, thus disabling the anti-skid brake system. The ABS warning lamp will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently recharged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning lamp is not illuminated.

HYDRAULIC UNIT AND ABS-ECU

REMOVAL AND INSTALLATION

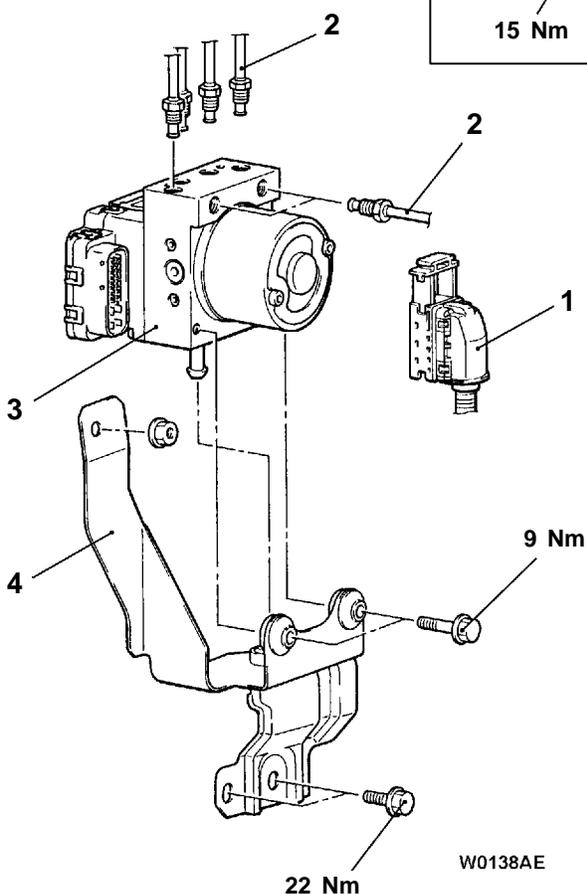
Pre-removal Operation

- Brake Fluid Draining
- Air Cleaner Removal <R.H. drive vehicles>
- Wiper Motor Removal <L.H. drive vehicles>

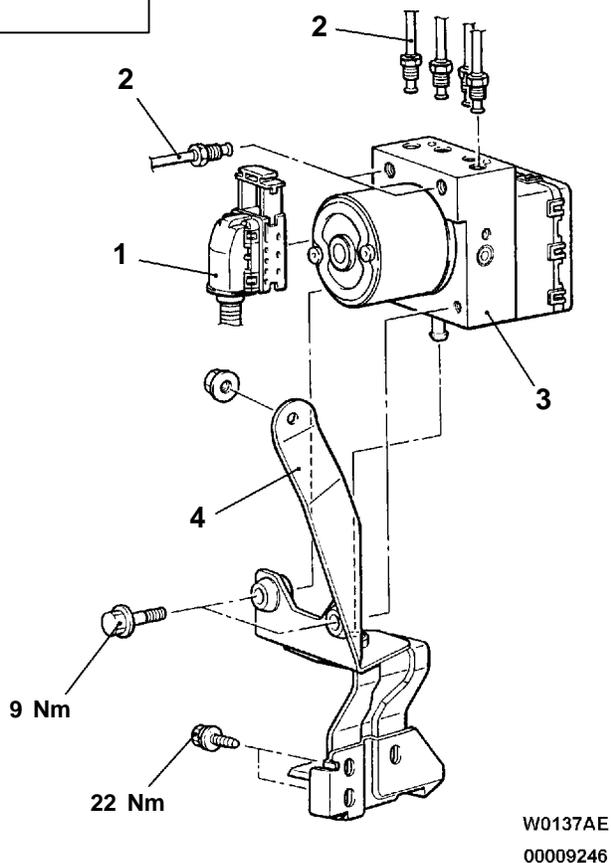
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding
(Refer to GROUP 35A - On-vehicle Service.)
- Hydraulic Unit Inspection
(Refer to P.35B-19.)
- Wiper Motor Installation <L.H. drive vehicles>
- Air Cleaner Installation <R.H. drive vehicles>

<L.H. drive vehicles>



<R.H. drive vehicles>



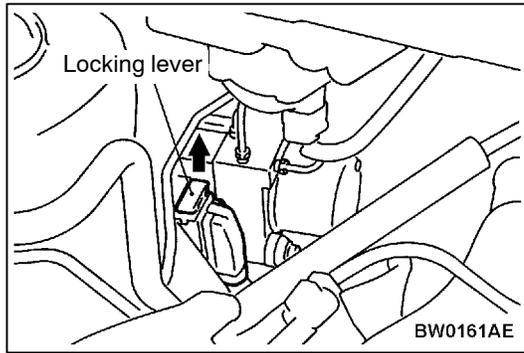
Removal steps



1. Harness connector
2. Brake pipe connection



3. Hydraulic unit and ABS-ECU
4. Hydraulic unit bracket assembly



REMOVAL SERVICE POINTS

◀A▶ HARNESS CONNECTOR REMOVAL

Raise the locking lever as shown in the illustration, and then disconnect the harness connector.

◀B▶ HYDRAULIC UNIT AND ABS-ECU REMOVAL

Caution

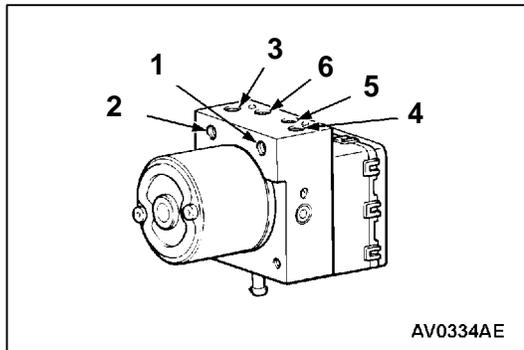
1. The hydraulic unit assembly is heavy, and so care should be taken when removing it.
2. The hydraulic unit assembly is not to be disassembled; its nuts and bolts should absolutely not be loosened.
3. The hydraulic unit assembly must not be dropped or otherwise subjected to impact shocks.
4. The hydraulic unit assembly must not be turned upside down or laid on its side.

INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit assembly as shown in the illustration.

1. To the proportioning valve (Rear brake, LH)
2. To the proportioning valve (Rear brake, RH)
3. From the master cylinder (Primary)
4. From the master cylinder (Secondary)
5. To the front brake (RH)
6. To the front brake (LH)



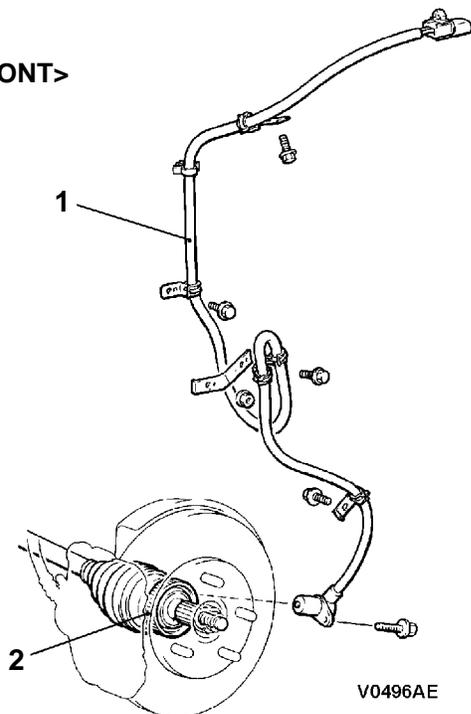
WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

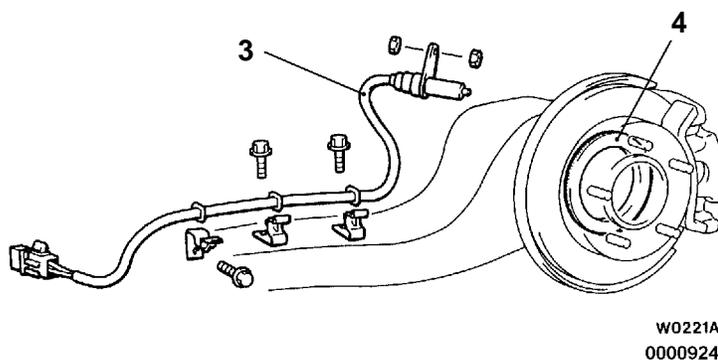
Post-installation Operation

Wheel Speed Sensor Output Voltage Check
(Refer to P.35B-17.)

<FRONT>



<REAR>



Front wheel speed sensor removal steps

- Splash Shield Removal
(Refer to GROUP 42 - Fender.)
- 1. Front wheel speed sensor
- 2. Front ABS rotor (Refer to GROUP 26 - Drive Shaft.)



Rear wheel speed sensor removal steps

- 3. Rear wheel speed sensor
- 4. Rear ABS rotor (Refer to GROUP 27A - Rear Hub Assembly.)



NOTE

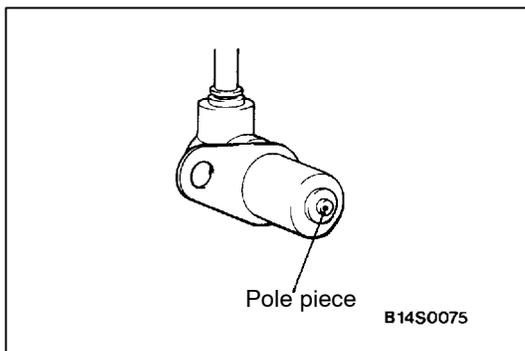
The front ABS rotor is integrated with the drive shaft, and the rear ABS rotor with the hub assembly. Do not disassemble them.

REMOVAL SERVICE POINT

◀▶ FRONT WHEEL SPEED SENSOR/REAR WHEEL SPEED SENSOR REMOVAL

Caution

Be sure not to damage the pole piece at the tip of the wheel speed sensor and the ABS rotor tooth surface by striking against other parts.

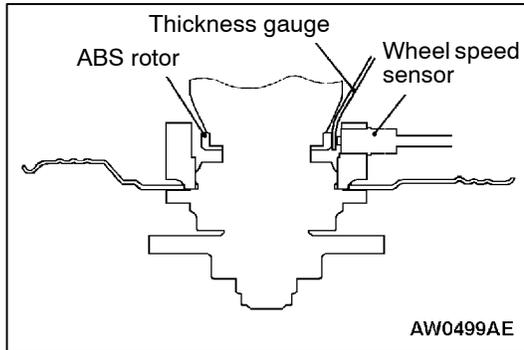


INSTALLATION SERVICE POINT

▶A◀ FRONT WHEEL SPEED SENSOR/REAR WHEEL SPEED SENSOR INSTALLATION

Caution

Be sure not to damage the pole piece at the tip of the wheel speed sensor and the ABS rotor tooth surface by striking them against other parts.

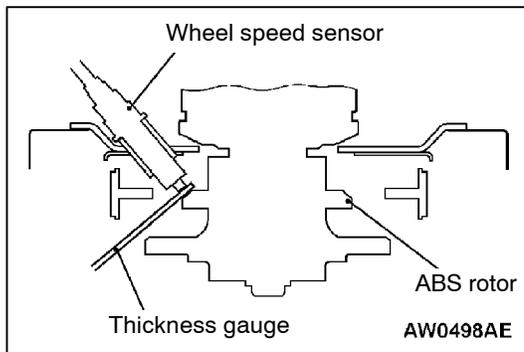


<FRONT>

1. Insert a thickness gauge between the wheel speed sensor and the tooth surface of the ABS rotor. Check that clearance meets the limit all around them.

Limit: 0.85 mm or less

2. If the clearance exceeds the limit, replace the wheel speed sensor. The clearance between the wheel speed sensor and the ABS rotor tooth surface is unadjustable.

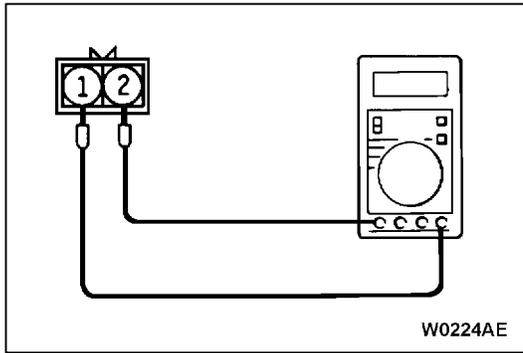


<REAR>

1. Insert a thickness gauge between the wheel speed sensor and the tooth surface of the ABS rotor. Check that clearance meets the standard value all around them.

Standard value: 0.2 - 0.7 mm

2. If the clearance exceeds the standard value, re-tighten the wheel speed sensor installation nut to adjust the clearance, and then remeasure the clearance.
3. If the clearance exceeds the standard value, replace the wheel speed sensor.



INSPECTION

35200840296

CHECK OF RESISTANCE BETWEEN WHEEL SPEED SENSOR TERMINALS

Caution

The pole piece can become magnetized because of the magnet but into the wheel speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

1. Measure the resistance between the wheel speed sensor terminals.

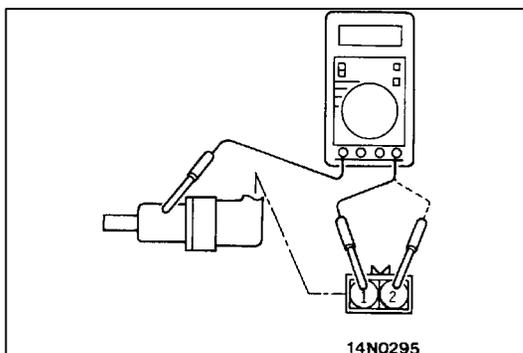
Standard value: 1.0 - 1.5 k Ω

If the internal resistance of the wheel speed sensor is not within the standard value, replace with a new wheel speed sensor.

2. Check the wheel speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

NOTE

When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.



WHEEL SPEED SENSOR INSULATION INSPECTION

1. Remove all connections from the wheel speed sensor, and then measure the resistance between terminals 1 and 2 and the body of the wheel speed sensor.

Standard value: 100 k Ω or more

2. If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

ABS TOOTHED ROTOR CHECK

Check whether ABS rotor teeth are broken or deformed, and, if so, replace the ABS rotor.

NOTES

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

CONTENTS

35209000305

GENERAL INFORMATION	3	Bleeding	Refer to GROUP 35A
SERVICE SPECIFICATIONS	3	Disc Brake Pad Check and Replacement	Refer to GROUP 35A
LUBRICANTS	Refer to GROUP 35A	Disc Brake Rotor Check	Refer to GROUP 35A
SPECIAL TOOL	3	Brake Disc Thickness Check	Refer to GROUP 35A
TROUBLESHOOTING	4	Brake Disc Run-out Check	Refer to GROUP 35A
ON-VEHICLE SERVICE		Brake Disc Run-out Correction	Refer to GROUP 35A
Brake Pedal Check and Adjustment	Refer to GROUP 35A	Wheel Speed Sensor Output Voltage Check	Refer to GROUP 35B
Brake Booster Operating Test	Refer to GROUP 35A	ABS Warning Lamp Relay Continuity Check	Refer to GROUP 35B
Check Valve Operation Check	Refer to GROUP 35A	Hydraulic Unit Check	Refer to GROUP 35B
Load Sensing Spring Length Check and Adjustment	Refer to GROUP 35A	Remedy for a Flat Battery	Refer to GROUP 35B
Load Sensing Proportioning Valve Function Test	Refer to GROUP 35A		
Brake Fluid Level Sensor Check	Refer to GROUP 35A		

CONTINUED ON NEXT PAGE

35C-2

BRAKE PEDAL Refer to GROUP 35A

MASTER CYLINDER AND BRAKE
BOOSTER Refer to GROUP 35A

DISC BRAKE Refer to GROUP 35A

LOAD SENSING PROPORTIONING VALVE
..... Refer to GROUP 35A

HYDRAULIC UNIT AND ABS-ECU
..... Refer to GROUP 35B

WHEEL SPEED SENSOR 5

G SENSOR 7



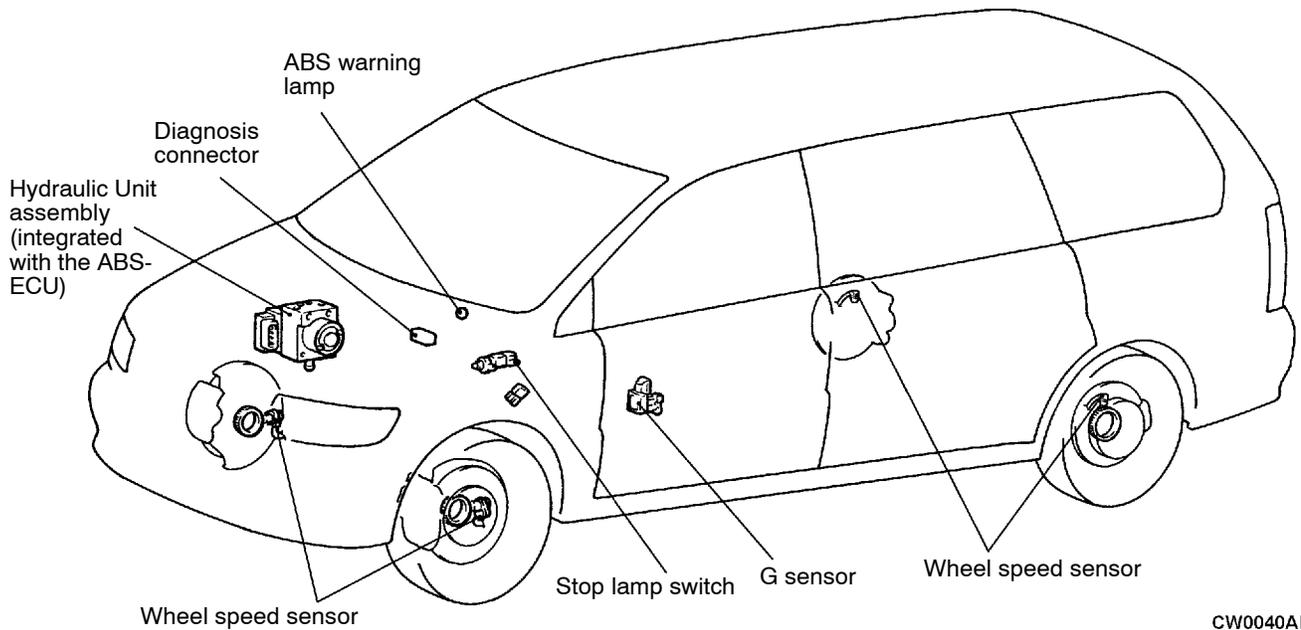
GENERAL INFORMATION

35200010321

The ABS consists of components such as the wheel speed sensors, G sensor, stop lamp switch, hydraulic unit assembly (integrated with the ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be identified and the trouble

symptoms will be memorized by the diagnosis function. In addition, reading of diagnosis codes and service data and actuator testing are possible by using the MUT-II.

CONSTRUCTION DIAGRAM



CW0040AE

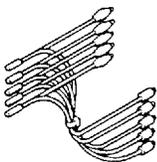
SERVICE SPECIFICATIONS

35200030341

Items		Standard value
G sensor output voltage V	When labeled surface is faced to horizontal direction	2.4 - 2.6
	When labeled surface is faced straight down	3.3 - 3.7

SPECIAL TOOL

35200060302

Tool	Number	Name	Use
 B991348	MB991348	Test harness set	For checking of G sensor

TROUBLESHOOTING

35201130590

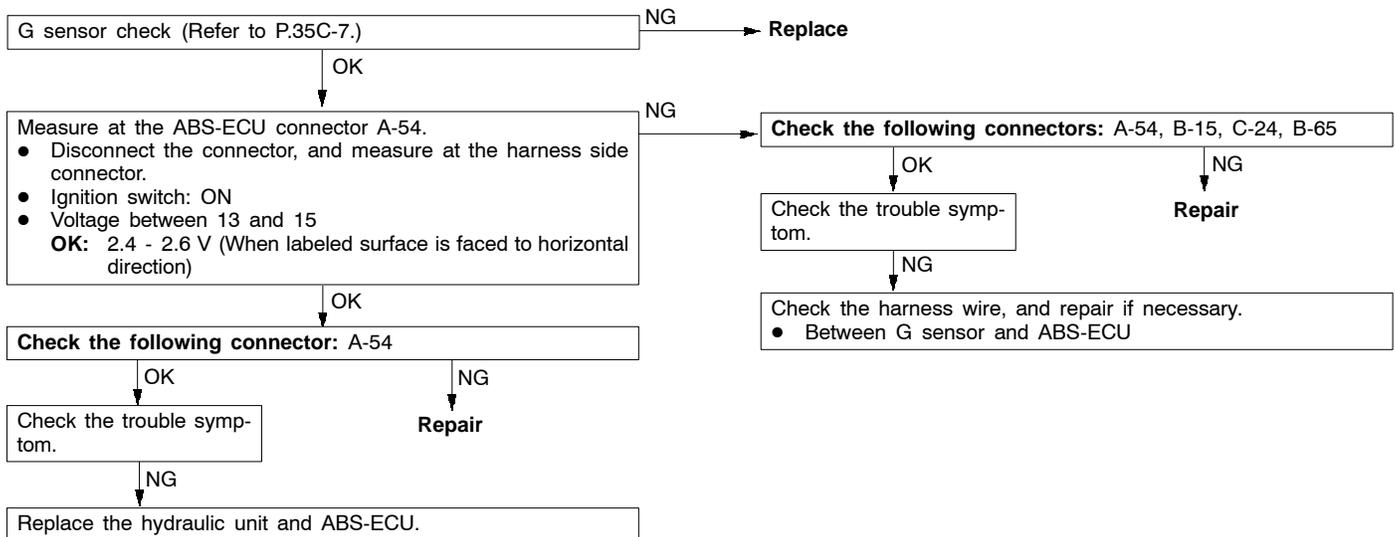
For troubleshooting other than those listed below, refer to GROUP 35B - Troubleshooting.

INSPECTION CHART FOR DIAGNOSIS CODE

Diagnosis code No.	Inspection item	Reference page
32	G sensor system	35C-4

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No.32 G sensor system	Probable cause
This code is output in the following cases. <ul style="list-style-type: none"> • G sensor output voltage is less than 0.5 V or more than 4.5 V. • An open or short circuit is present in the G sensor system. 	<ul style="list-style-type: none"> • Malfunction of G sensor • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



DATA LIST REFERENCE TABLE

35201150305

Item No.	Check item	Checking requirements	Normal value
32	G sensor	Vehicle is stopped.	2.4 - 2.6 V
		Vehicle is running.	0.5 - 4.5 V

CHECK AT ABS-ECU

35201180373

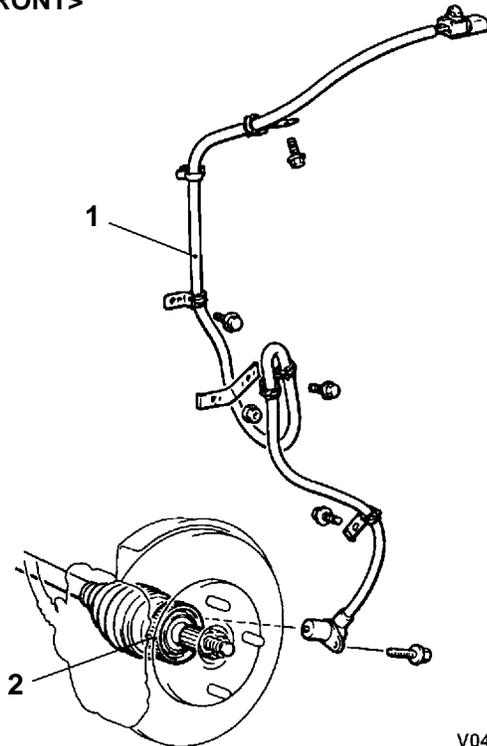
TERMINAL VOLTAGE CHECK CHART

Terminal No.	Check item	Checking requirements	Normal condition
13	Input from G sensor	Ignition switch: ON Labeled surface is faced to horizontal direction (Refer to P.35C-7.)	2.4 - 2.6 V
15	Earth for G sensor	At all times	0 V

WHEEL SPEED SENSOR**REMOVAL AND INSTALLATION****Post-installation Operation**

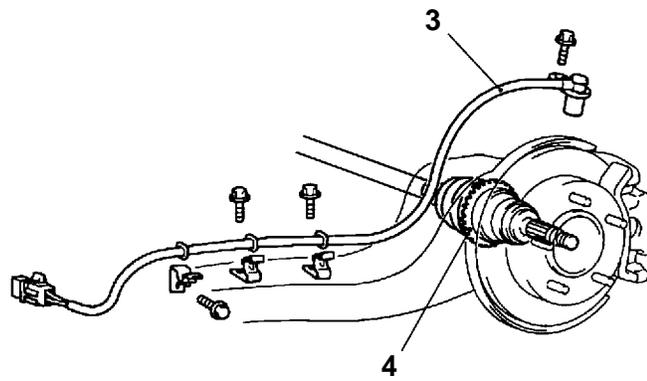
Wheel Speed Sensor Output Voltage Check
(Refer to GROUP 35B - On-vehicle Service.)

<FRONT>



V0496AE

<REAR>



V1133AE
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Front wheel speed sensor removal steps

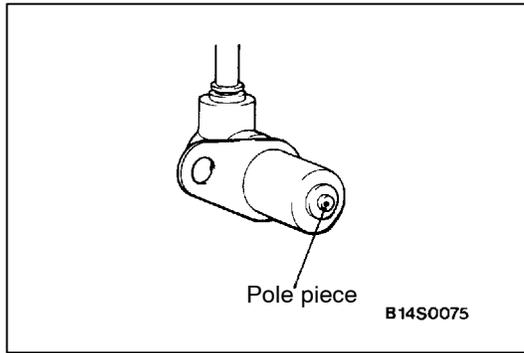
- Splash Shield Removal
(Refer to GROUP 42 - Fender.)
1. Front wheel speed sensor
 2. Front ABS rotor (Refer to GROUP 26 - Drive Shaft.)

**Rear wheel speed sensor removal steps**

3. Rear wheel speed sensor
4. Rear ABS rotor (Refer to GROUP 27B - Drive Shaft.)

**NOTE**

The front ABS rotor is integrated with the front drive shaft, and the rear ABS rotor with the rear drive shaft. Do not disassemble them.

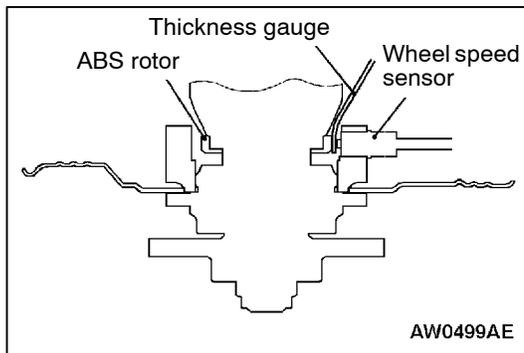


REMOVAL SERVICE POINT

◀A▶ FRONT WHEEL SPEED SENSOR/REAR WHEEL SPEED SENSOR REMOVAL

Caution

Be careful when handling the pole piece at the tip of the wheel speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.



INSTALLATION SERVICE POINT

▶A◀ FRONT WHEEL SPEED SENSOR INSTALLATION

Caution

Be sure not to damage the pole piece at the tip of the wheel speed sensor and the ABS rotor tooth surface by striking them against other parts.

1. Insert a thickness gauge between the wheel speed sensor and the tooth surface of the ABS rotor. Check that clearance meets the limit all around them.

Limit: 0.85 mm or less

2. If the clearance exceeds the limit, replace the wheel speed sensor. The clearance between the wheel speed sensor and the ABS rotor tooth surface is unadjustable.

INSPECTION

Refer to GROUP 35B.

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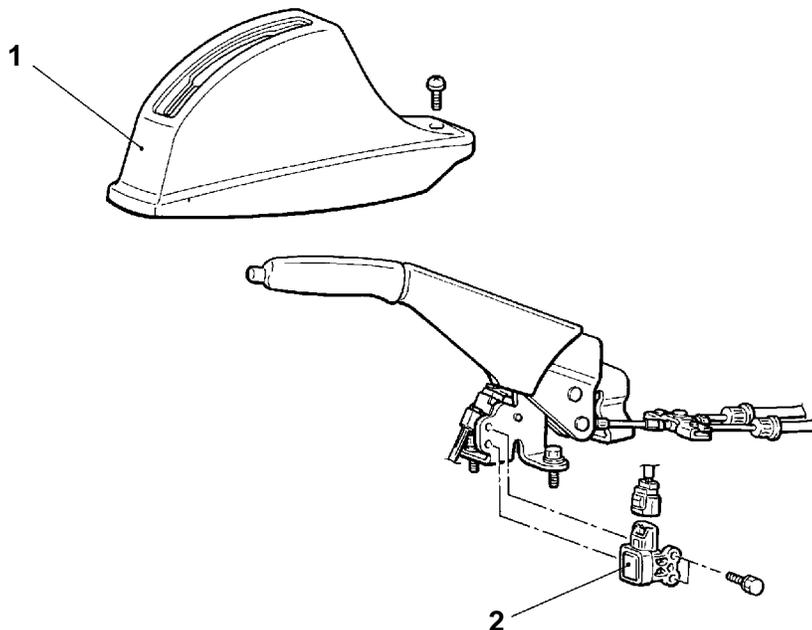
G SENSOR

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REMOVAL AND INSTALLATION

Caution

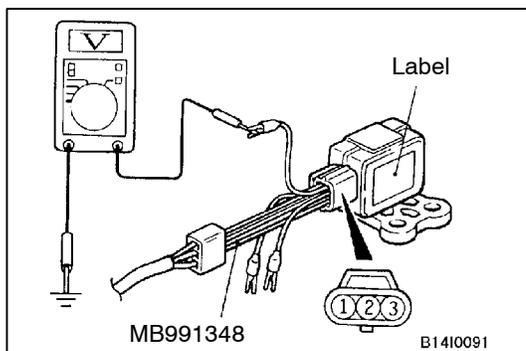
Do not drop the G sensor or subject it to any shocks.



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Removal steps

1. Parking cover
2. G sensor

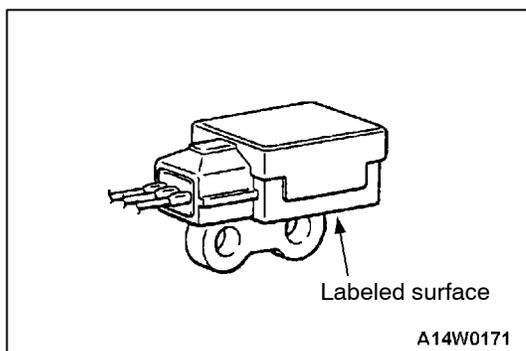


INSPECTION

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1. Remove the G sensor.
2. Connect the special tool between the disconnected connectors, and then place the G sensor horizontally as shown in the illustration.
3. Turn on the ignition switch, and then measure the voltage between terminal No.2 and body earth.

Standard value: 2.4 - 2.6 V



4. Face the labeled surface straight down with the special tool still connected. Measure the voltage between terminal No.2 and body earth with the labeled surface faced straight down.

Standard value: 3.3 - 3.7 V

5. If not within the standard value, check the power supply line and earth condition, and then replace the G sensor.

NOTES