

GENERAL INFORMATION

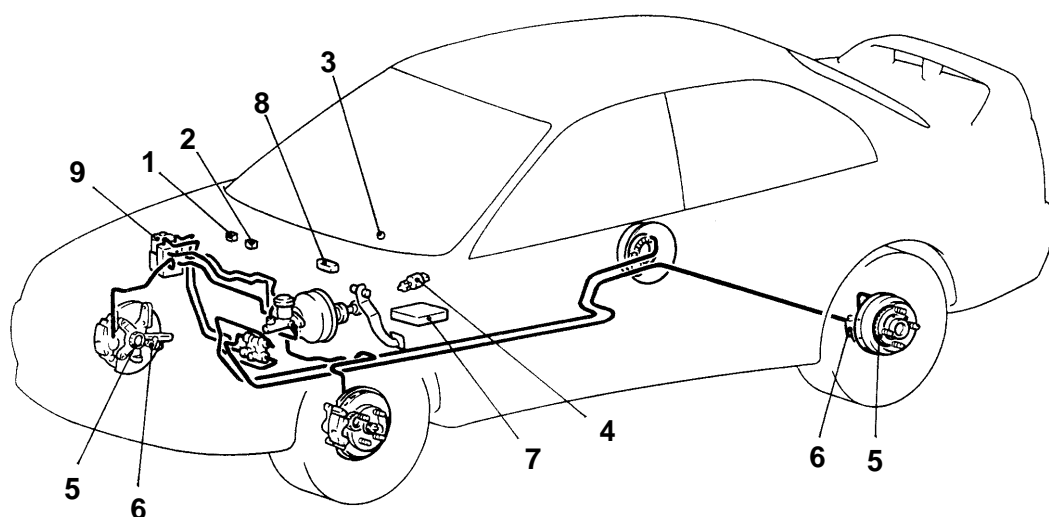
The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly, ABS control unit (ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be

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.

Items		Specifications
Master cylinder	Type	Tandem type (with level sensor)
	I.D. mm	22.2
Brake booster	Type	Vacuum type, single
	Effective dia. of power cylinder mm	230
	Boosting ratio	5.0
Proportioning valve	Type	Dual type
	Decompression ratio	0.25
Front brakes	Type	Floating caliper, 1-piston, ventilated disc
	Disc effective dia. × thickness mm	184 × 18
	Wheel cylinder I.D. mm	54.0
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Rear drum brakes	Type	Leading trailing
	Drum I.D. mm	203
	Wheel cylinder I.D. mm	17.4
	Lining thickness mm	4.4
	Clearance adjustment	Automatic
Brake fluid		DOT3 or DOT4
ABS type		4-sensor, 4-channel method
Speed sensor		Magnet coil type on 4 wheels
Front rotor teeth		43
Rear rotor teeth		43

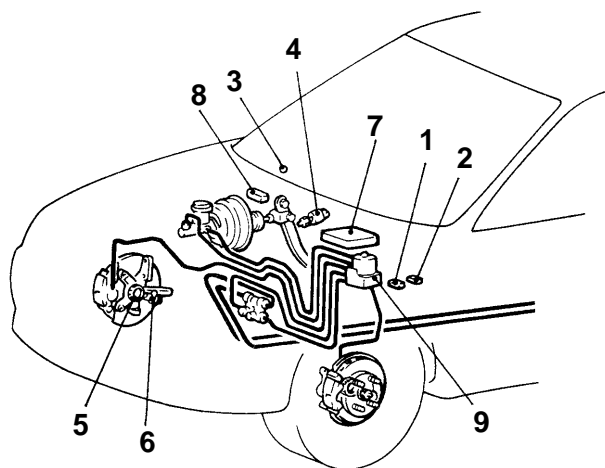
CONSTRUCTION DIAGRAM

<L.H. drive vehicles>



14M0060

<R.H. drive vehicles>

14M0039
00004484

1. ABS valve relay
2. ABS motor relay
3. ABS warning lamp
4. Stop lamp switch
5. Rotor

6. Wheel-speed sensor
7. ABS-ECU
8. Diagnosis connector
9. Hydraulic unit


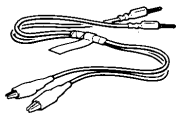

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Rear drum brake	Lining thickness mm	4.4	1.0
	Drum inside diameter mm	203	205
Resistance between solenoid valve terminals Ω	IN	8.04 – 9.04	–
	OUT	4.04 – 4.54	–
Wheel speed sensor's internal resistance $k\Omega$		1.4 – 1.8	–
Wheel speed sensor insulation resistance $k\Omega$		100 or more	–

LUBRICANTS

Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Wheel cylinder body inner surfaces	Repair kit grease
Rear brake shoe and backing plate contact surfaces	Brake grease SAE J310, NLGI No.1
Shoe assembly and auto adjuster assembly contact surfaces	
Shoe and lever assembly and auto adjuster assembly contact surfaces	

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
	MB991529	Diagnosis code check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)
	MB991008	Piston cup installer	Installation of drum brake wheel cylinder piston cup

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer – [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

DIAGNOSIS CODES CHECK

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

ERASING DIAGNOSIS CODES

Refer – [How to Use Troubleshooting/Inspection Service Points](#).

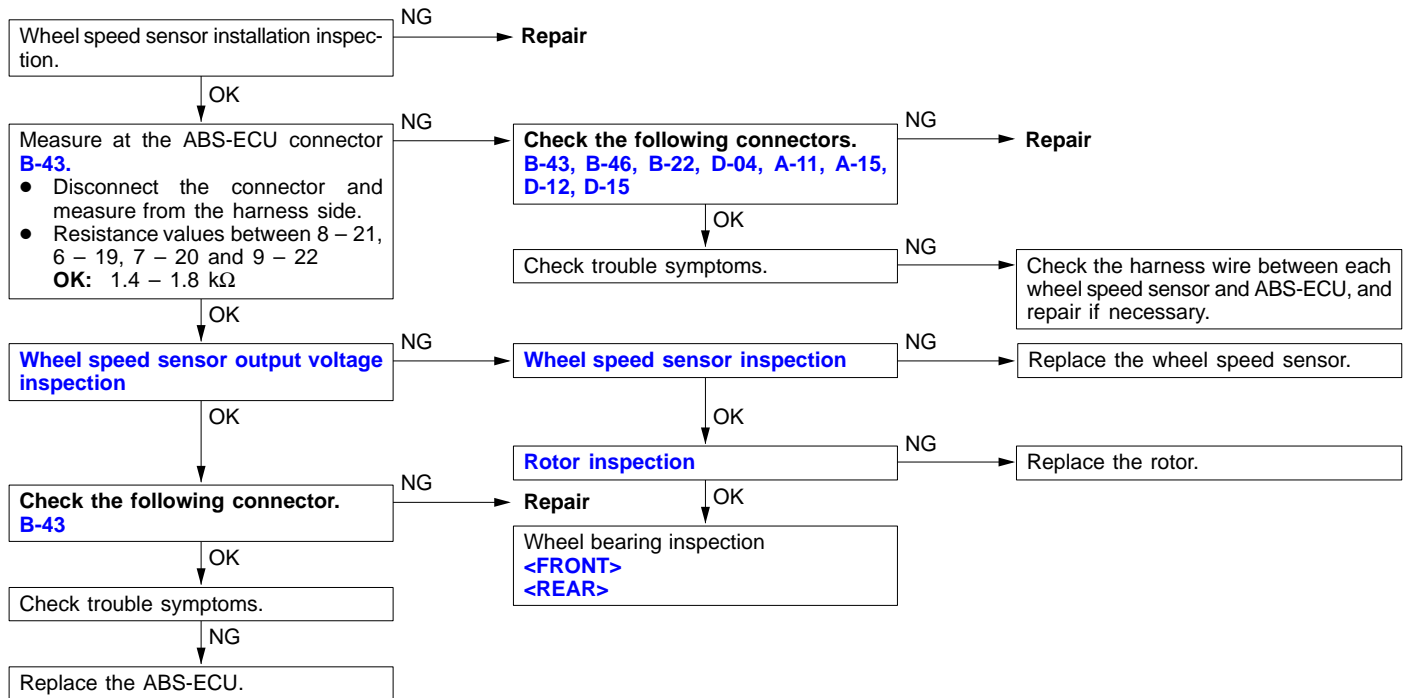
INSPECTION CHART FOR DIAGNOSIS CODES

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

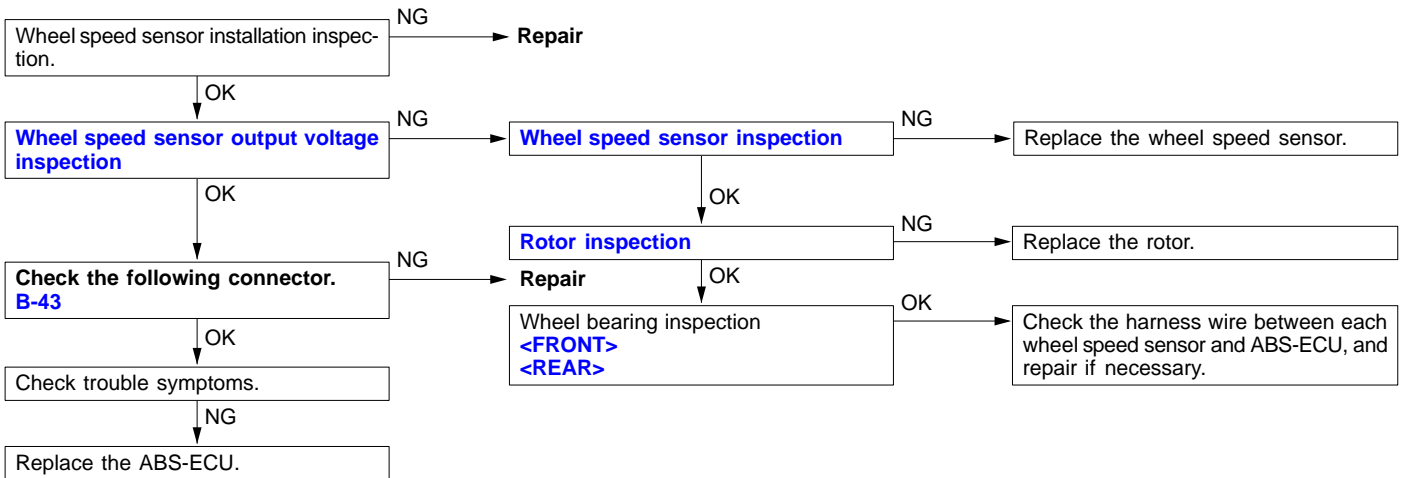
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open circuit	35B-8
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	35B-9
16	Power supply system		35B-9
21	Front right wheel speed sensor	Short circuit	35B-8
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
33	Stop lamp switch system		35B-10
41	Front right solenoid valve		35B-11
42	Front left solenoid valve		
43	Rear right solenoid valve		
44	Rear left solenoid valve		
51	Valve relay		35B-12
53	Motor relay, motor		35B-12
63	ABS-ECU		Replace the ABS-ECU

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code Nos. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
Code Nos.21, 22, 23, 24 Wheel speed sensor short circuit	
Code Nos.11, 12, 13, 14 are output when the ABS-ECU detects an open circuit in at least 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 ABS-ECU
Code Nos.21, 22, 23, 24 are output under the following cases: <ul style="list-style-type: none"> • When an open circuit cannot be found, but more than one wheel-speed sensor does not output any signal during driving at 8 km/h or higher. • When a chipped or plugged-up rotor tooth, etc. is detected during driving at 40 km/h or more. 	<ul style="list-style-type: none"> • Malfunction of wheel-speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	<ul style="list-style-type: none"> Improper installation of wheel speed sensor Malfunction of wheel speed sensor Malfunction of rotor Malfunction of wheel bearing Malfunction of wiring harness or connector Malfunction of ABS-ECU

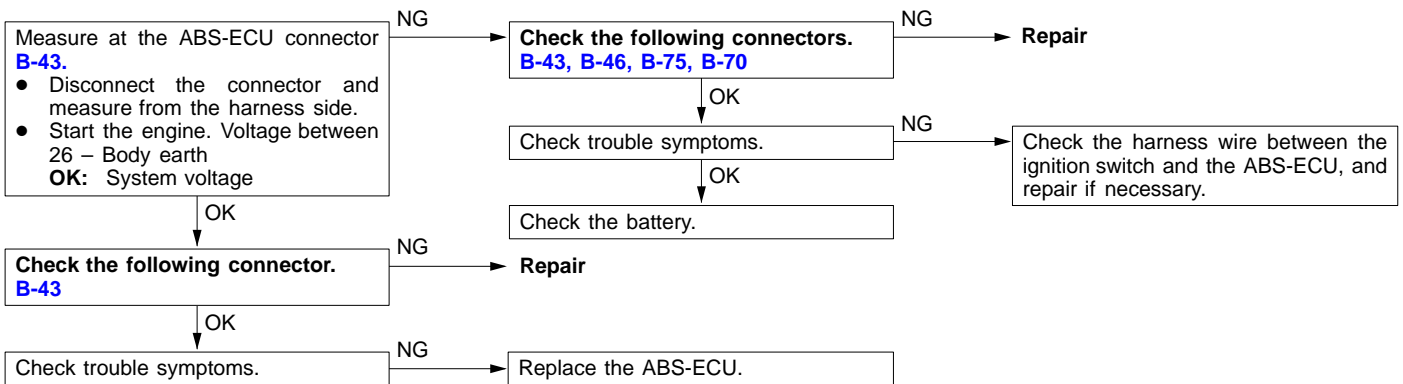


Code No. 16 Power supply system	Probable cause
The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	<ul style="list-style-type: none"> Malfunction of wiring harness or connector. Malfunction of ABS-ECU

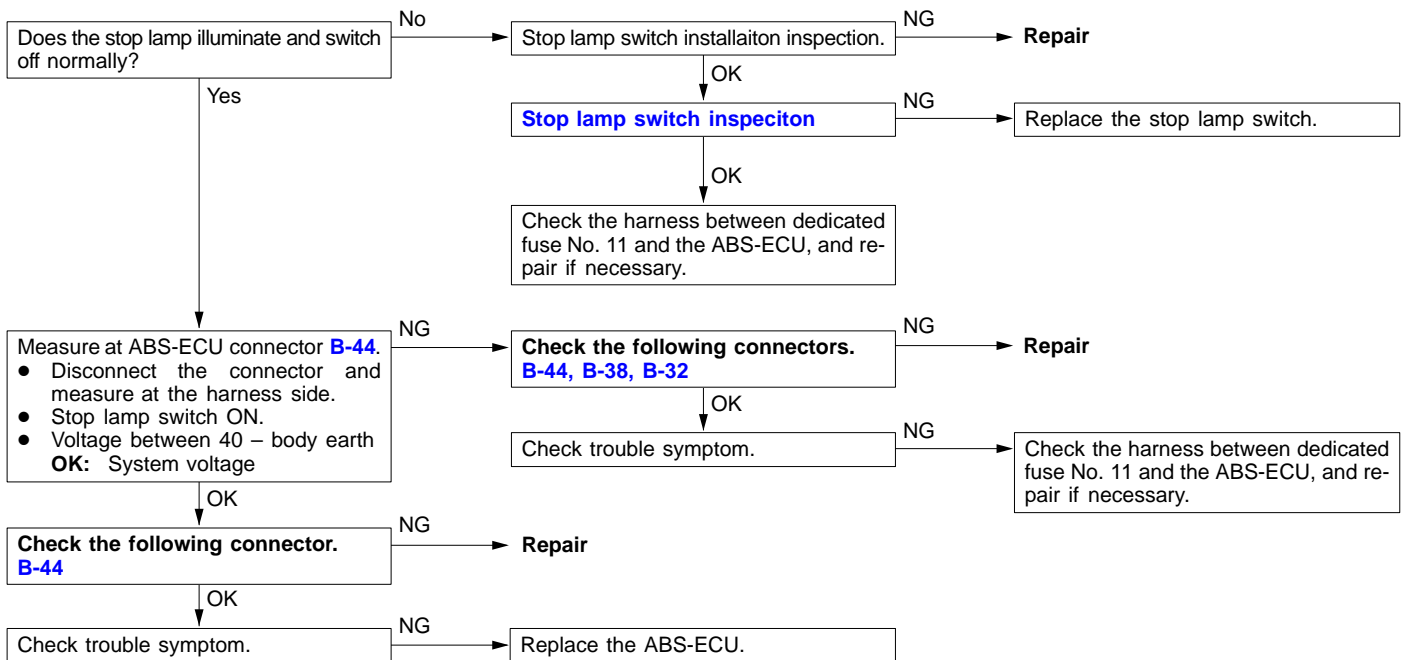
Caution

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.

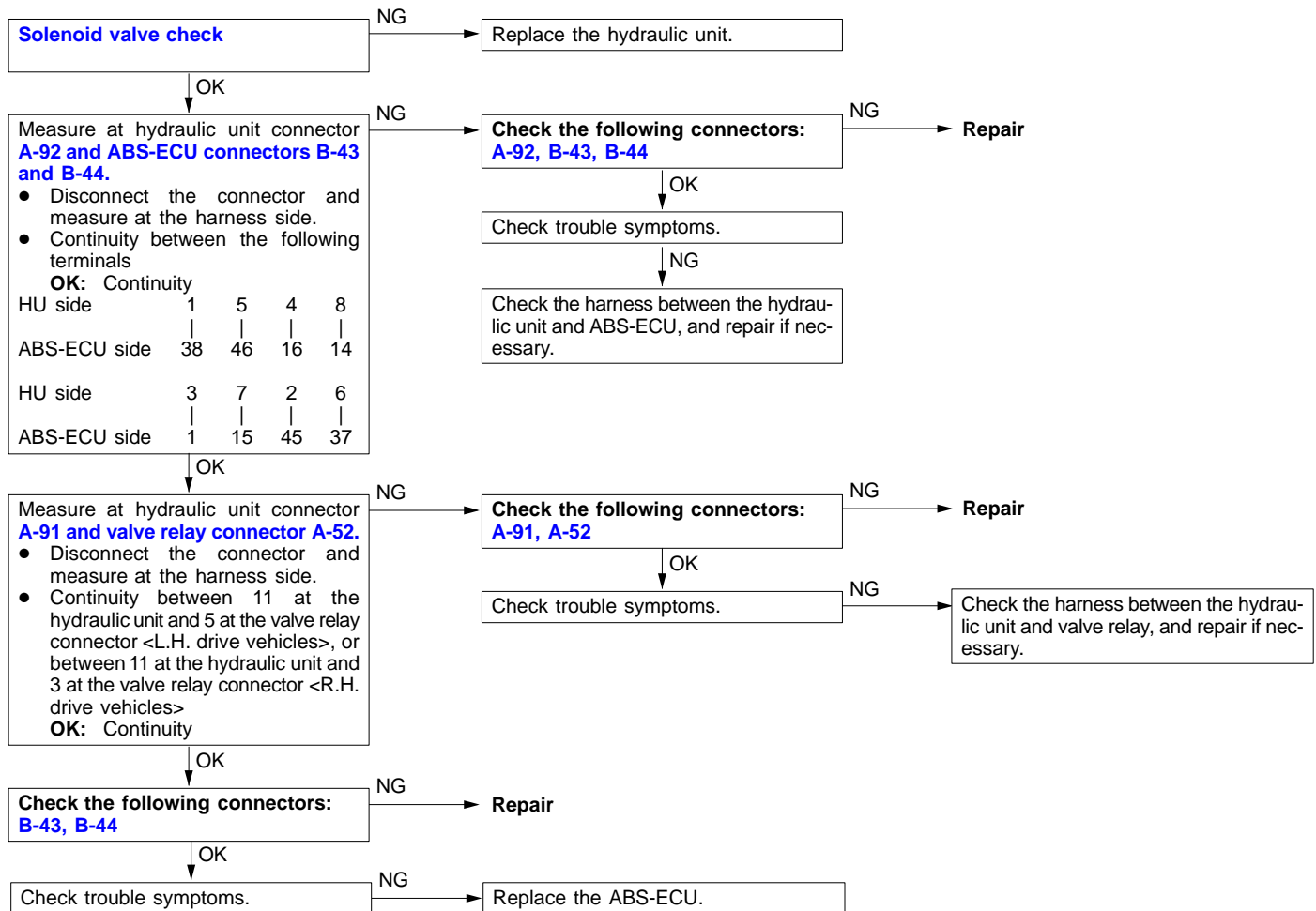
Before carrying out the following inspection, check the battery level, and refill it if necessary.



Code No. 33 Stop lamp switch system	Probable cause
This code is output 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).	<ul style="list-style-type: none"> • Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of ABS-ECU



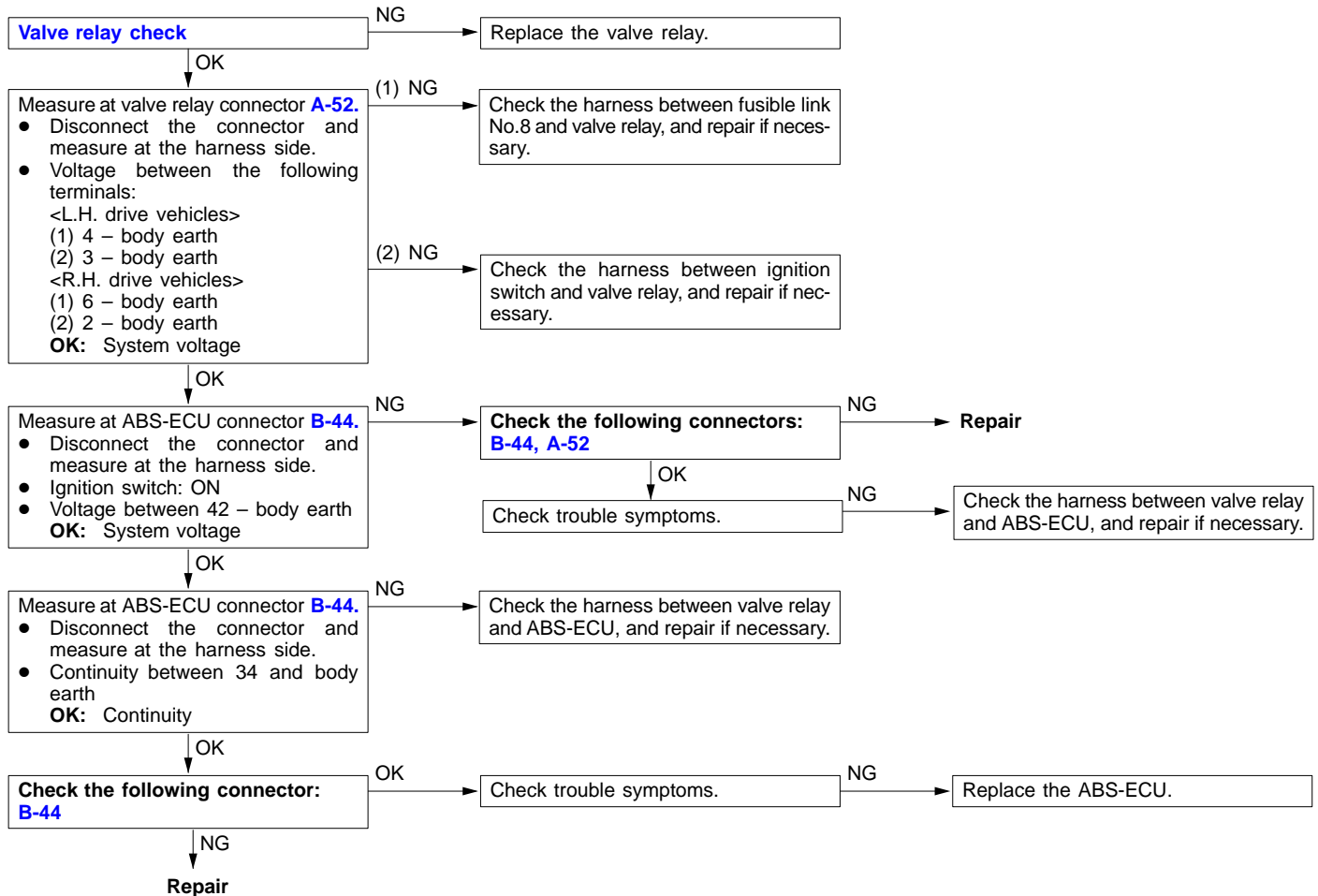
Code Nos.41, 42, 43, 44 Solenoid valve	Probable cause
The ABS-ECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness. When no current flows in the solenoid even though the ABS-ECU turns on it, and vice versa.	<ul style="list-style-type: none"> • Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU



Code No.51 Valve relay	Probable cause
When the ignition switch is turned to ON, the ABS-ECU switches the valve relay off and on during the initial check. In that way, the ABS-ECU compares the signals sent to the valve relay with the voltage in the valve relay monitor line. That is how to check if the valve relay is operating normally. The ABS-ECU always checks if current flows in the valve relay monitor line, too. It determines that there is an open circuit when no current flows. If no current flows in the valve relay monitor line, this diagnosis code is output.	<ul style="list-style-type: none"> • Malfunction of valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

NOTE

Whenever reading the diagnosis codes using the ABS warning lamp (refer – [How to Use Troubleshooting/Inspection Service Points](#)), this diagnosis code will be output. That is not a malfunction but because the valve relay connector is disconnected. After repairing all other malfunctions, connect the valve relay connector again to check the valve relay. Then check that the ABS warning lamp does not illuminate. If it illuminates, the valve relay may be defective. So carry out the following procedure.

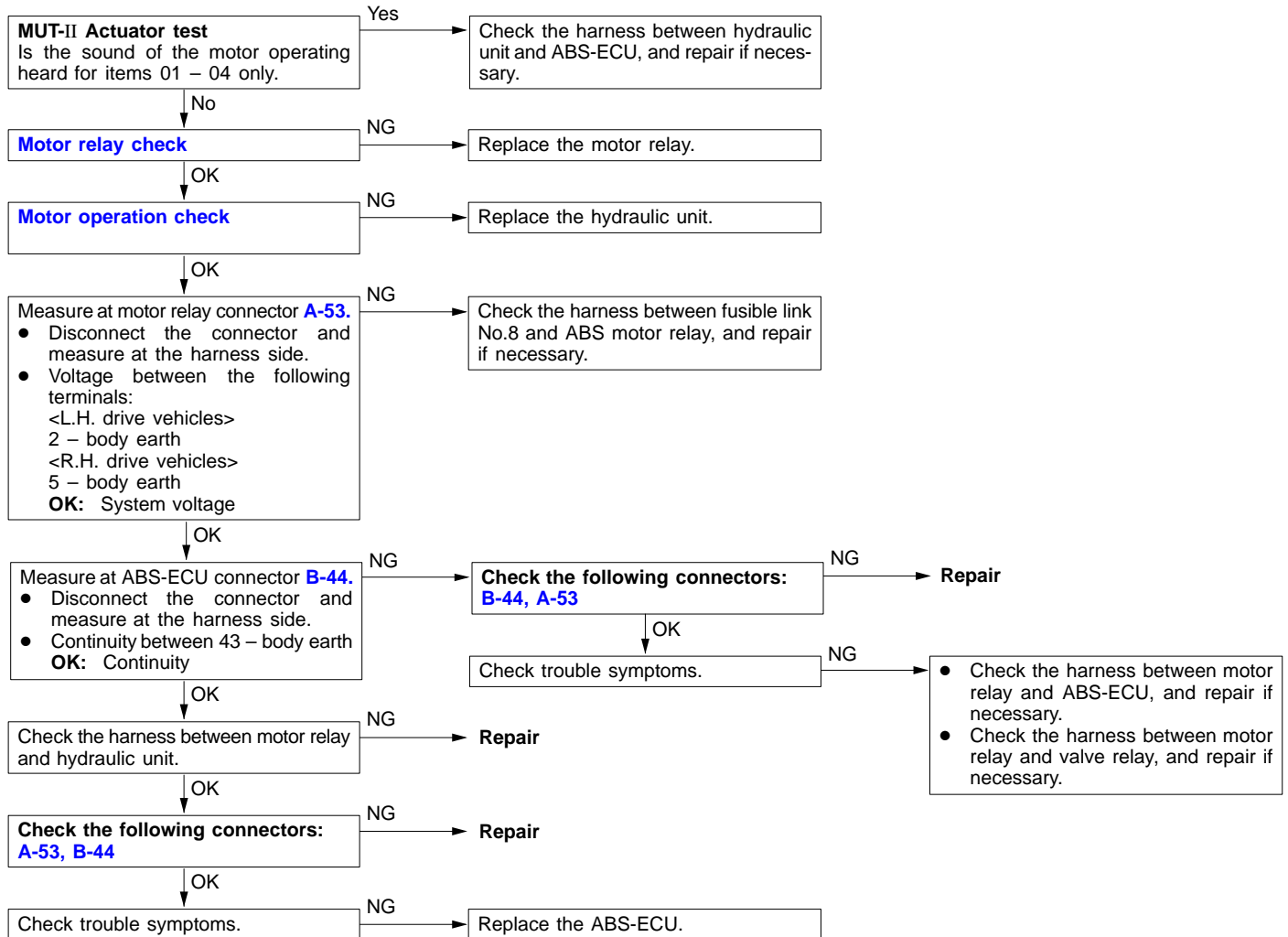


Code No.53 Motor relay, motor	Probable cause
<p>This code is output at the following times:</p> <ul style="list-style-type: none"> When the motor relay is on but no signal is input to the motor monitor line (motor is not operating, etc.) When the motor relay is off but a signal is input to the motor monitor line (motor continues operating, etc.) 	<ul style="list-style-type: none"> Malfunction of motor relay Malfunction of wiring harness or connector Malfunction of hydraulic unit Malfunction of ABS-ECU

<When the motor does not run>

Caution

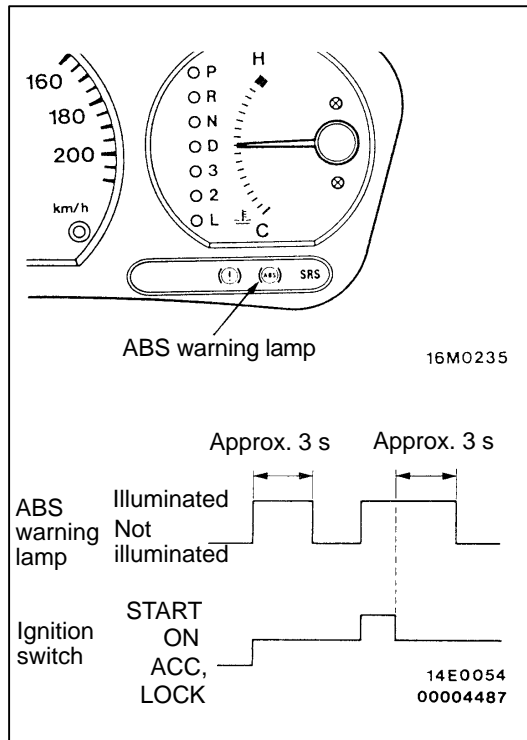
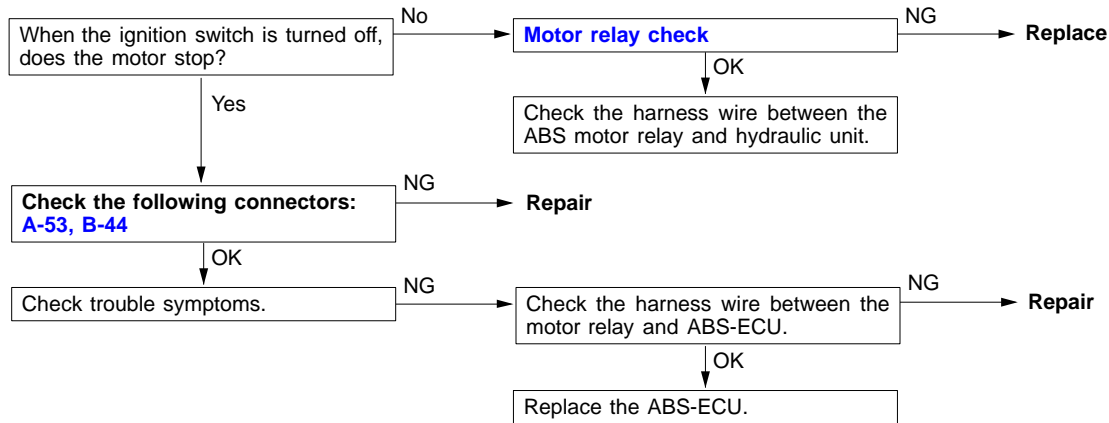
Because force-driving of the motor by means of the actuator test will drain the battery, the engine should be started and left to run for a while after testing is completed.



<When the motor keep running>

Caution

If there is a melted contact in the motor relay, the motor will keep running, even if the ignition switch is turned off. In this case, immediately remove the fusible link No.8, or disconnect the hydraulic unit connector A-91 or motor relay connector A-53. Excessive running of the motor will waste battery.



ABS WARNING LAMP INSPECTION

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

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.
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.		3
After the engine starts, the ABS warning lamp remains illuminated.		4
When the ignition key is turned to "START", the ABS warning lamp does not illuminate.		5
After the ignition key is turned to "ON", the ABS warning lamp blinks twice, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off.		6
Faulty ABS operation	Unequal braking power on both sides	7
	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

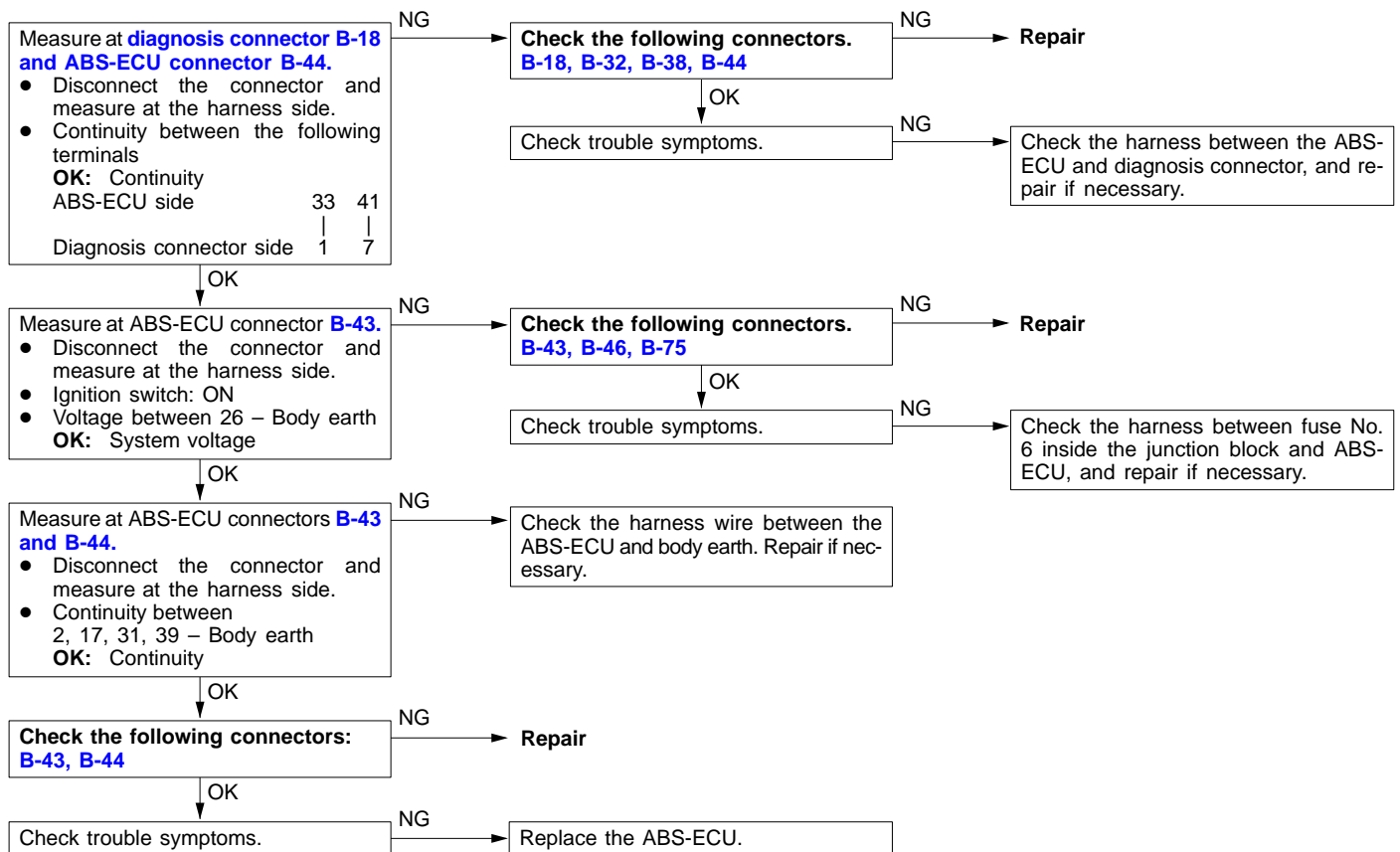
Inspection Procedure 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The reason is probably defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> Malfunction of wiring harness or connector

Refer – [Troubleshooting](#).

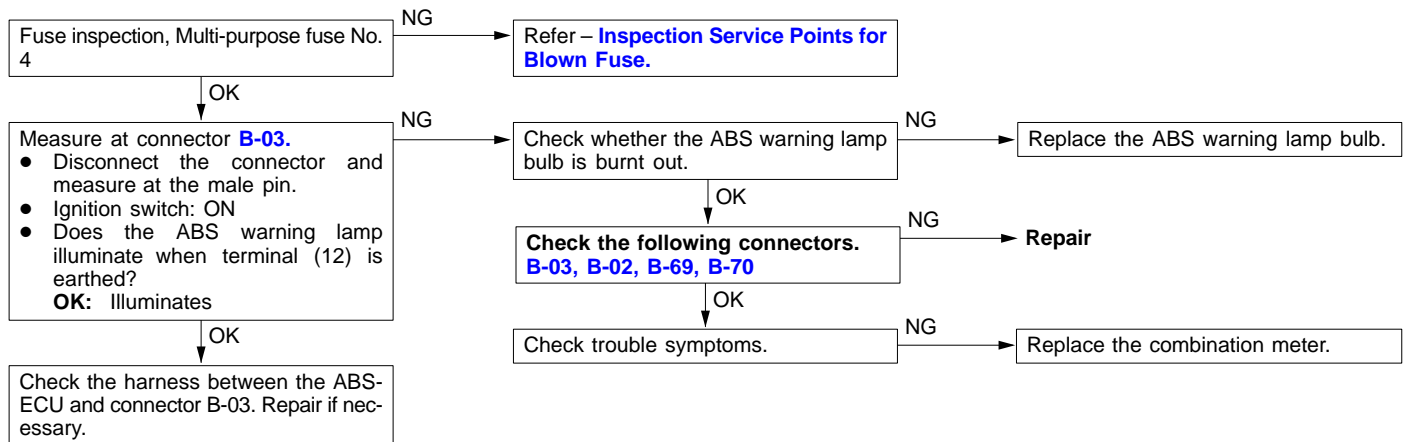
Inspection Procedure 2

Communication with MUT-II is not possible. (Communication with ABS only is not possible.)	Probable cause
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"> Blown fuse Malfunction of wiring harness or connector Malfunction of ABS-ECU



Inspection Procedure 3

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

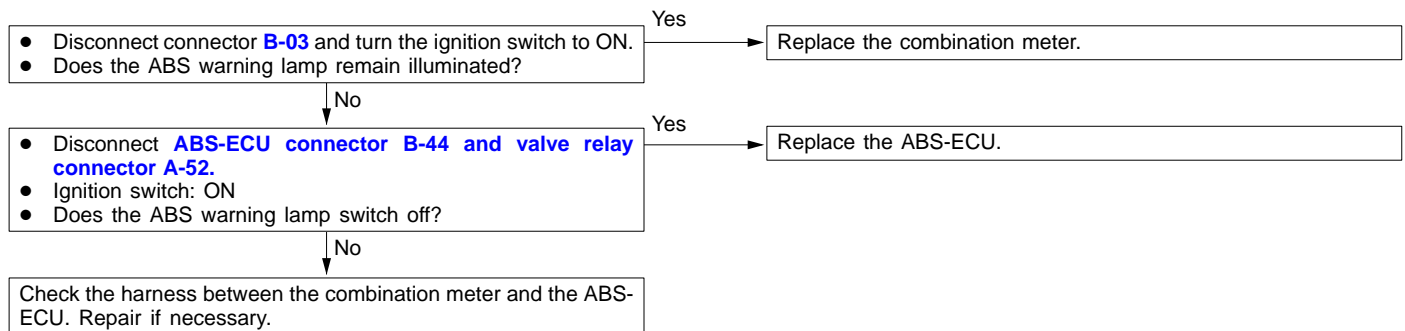


Inspection Procedure 4

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-ECU Malfunction of wiring harness

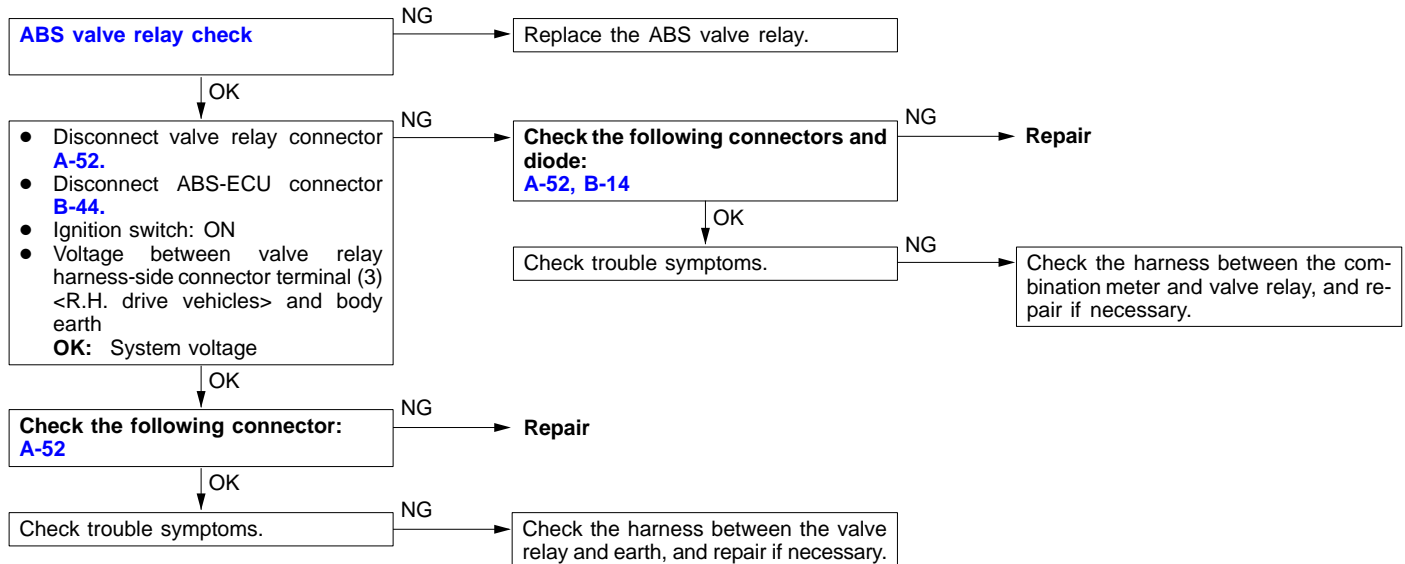
NOTE

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.



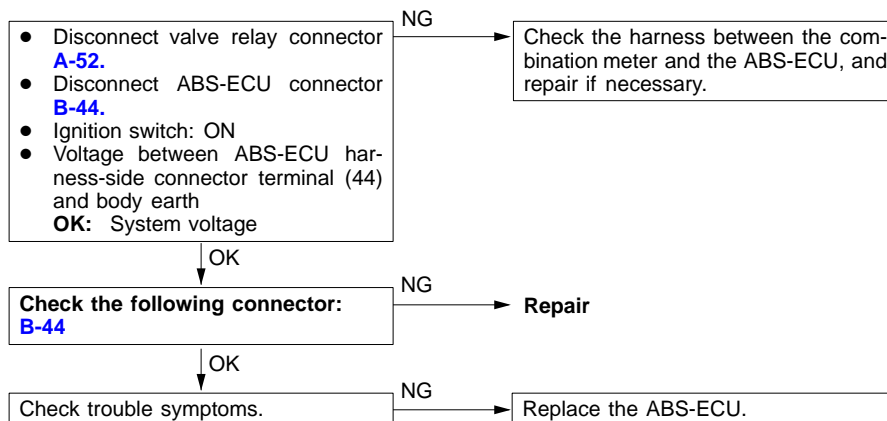
Inspection Procedure 5

When the ignition key is turned to “START”, the ABS warning lamp does not illuminate.	Probable cause
Current does not flow in the ABS-ECU when the ignition switch is turned to “START”. Current flows in the ABS warning lamp even when the ignition switch is turned to “START”. Therefore, the valve relay, which current is supplied through the ABS-ECU, turns off when the ignition switch is at “START”. However, the warning lamp circuit of the valve relay must turn on in turn. So the cause must be a defective circuit on valve relay side.	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



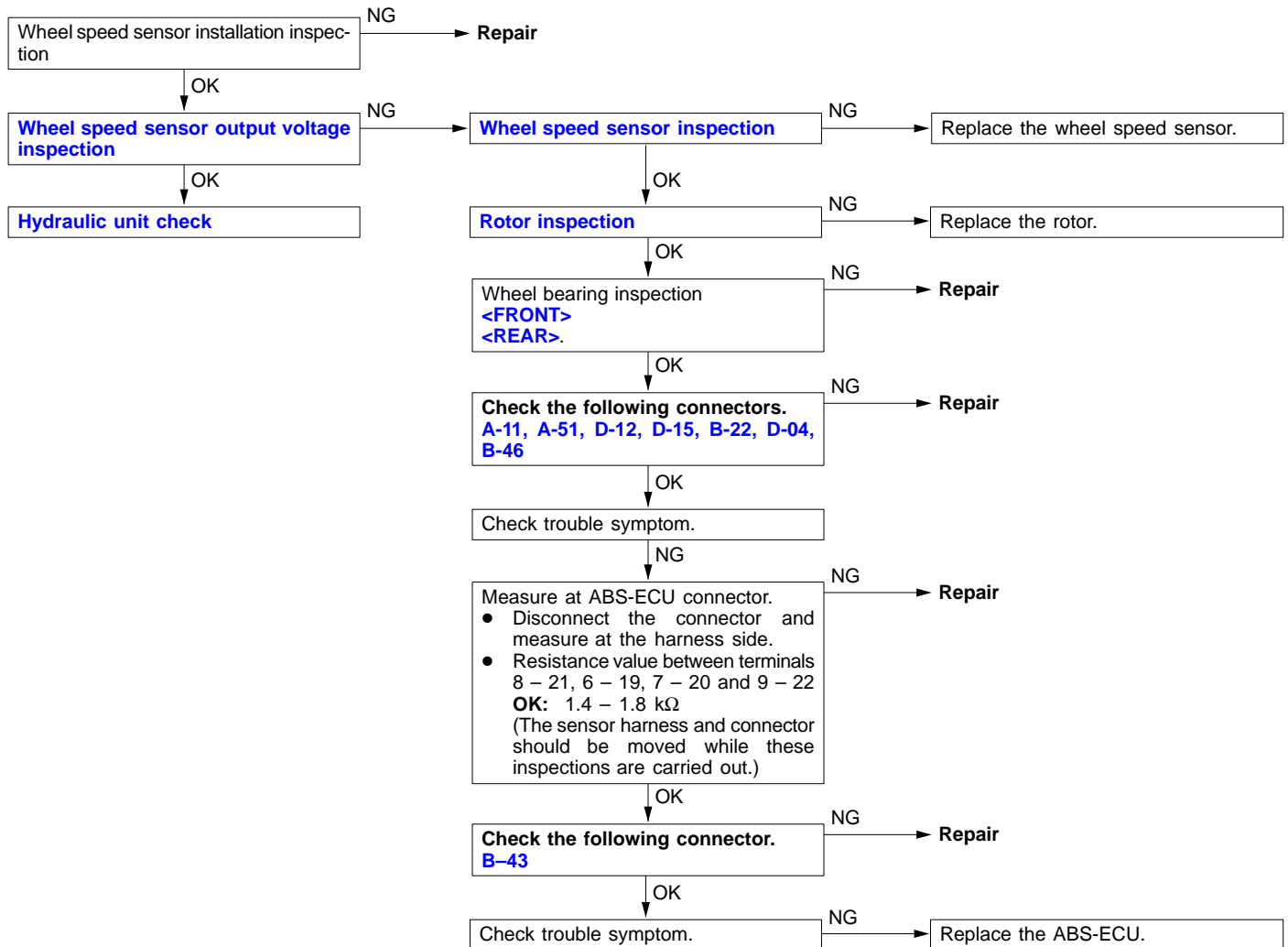
Inspection Procedure 6

After the ignition key is turned to “ON”, the ABS warning lamp blinks twice, and when turned to “START”, it illuminates. When returned to “ON”, the lamp flashes once, and then switches off.	Probable cause
The ABS-ECU causes the ABS warning lamp to illuminate during the initial check (approx. 3 seconds). During the initial check, the valve relay turns from off to on, off and back to on again. If there is an open circuit in the harness between the ABS-ECU and the ABS warning lamp, the lamp will illuminate only when the valve relay is OFF during valve relay test, etc.	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Inspection Procedure 7

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"> Improper installation of wheel speed sensor Incorrect sensor harness contact Foreign material adhering to wheel speed sensor Malfunction of wheel speed sensor Malfunction of rotor Malfunction of wheel bearing Malfunction of hydraulic unit Malfunction of ABS-ECU



DATA LIST REFERENCE TABLE

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	9–16 V
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

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

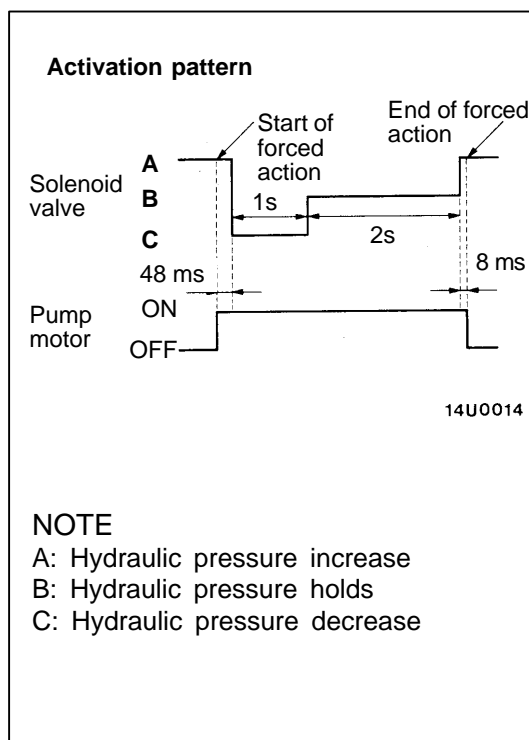
When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

NOTE

- If the ABS-ECU runs down, actuator testing cannot be carried out.
- 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.
- 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

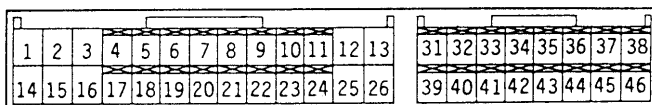
TERMINAL VOLTAGE CHECK CHART

- Measure the voltages between terminals (15), (25) and (42) (earth terminals) and each respective terminal.

NOTE

Do not measure terminal voltage for approx. 3 seconds after the ignition switch is turned on. The ABS-ECU performs the initial check for that period.

- The terminal layouts are shown in the illustrations below.



14Y0076

Con- nector termi- nal No.	Signal	Checking requirements		Normal condition
1	Output to rear-right sole- noid valve (IN)	Ignition switch: ON (When solenoid valve is off)		System voltage
14	Output to front-left sole- noid valve (OUT)			
15	Output to rear-right sole- noid valve (OUT)			
16	Output to front-left sole- noid valve (IN)			
25	Memory power supply	Always		System voltage
26	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
33	Input from diagnosis in- dication selection	Connect the MUT-II.		0 V
		Do not connect the MUT-II.		Approx. 12 V
34	Valve relay monitor	Ignition switch: ON		System voltage
35	Motor monitor	Ignition switch: ON	Motor is on.	System voltage
			Motor is off.	0.5V or less
37	Output to rear-left sole- noid valve (OUT)	Ignition switch: ON (When solenoid valve is off)		System voltage
38	Output to front-right sole- noid valve (IN)			
40	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch ON	System voltage
			Stop lamp switch OFF	1 V or less

35B ANTI-SKID BRAKING SYSTEM 1996 – Troubleshooting

MAIN

Group
35

35B
1996

Con- nector termi- nal No.	Signal	Checking requirements		Normal condition
41	MUT-II	Connect the MUT-II.		Serial com- munication with MUT-II
		Do not connect the MUT-II.		1 V or less
42	Output to valve relay	Ignition switch; ON	The relay is on.	2 V or less
			The relay is off. The system runs down.	System voltage
43	Output to motor relay	Ignition switch: ON	Motor is on.	2 V or less
			Motor is off.	System voltage
44	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off.	System voltage
			The lamp is illuminated.	3 V or less
45	Output to rear-left sole- noid valve (IN)	Ignition switch: ON (When solenoid valve is off)		System volt- age
46	Output to front-right sole- noid valve (OUT)			

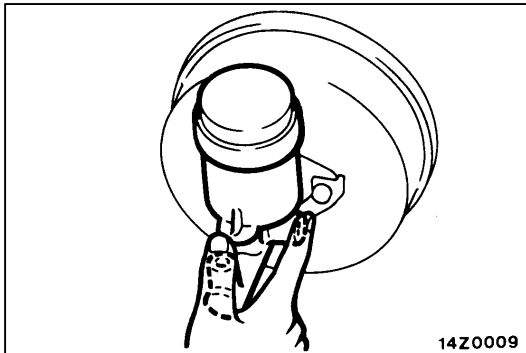
RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

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.



14Y0077

Connector terminal No.	Signal	Normal condition
2 – Body earth	ABS-ECU earth	Continuity
6-19	Front-left wheel speed sensor	1.4 – 1.8 kΩ
7-20	Rear-right wheel speed sensor	1.4 – 1.8 kΩ
8-21	Front-right wheel speed sensor	1.4 – 1.8 kΩ
9-22	Rear-left wheel speed sensor	1.4 – 1.8 kΩ
17 – Body earth	ABS-ECU earth	Continuity
31 – Body earth		
39 – Body earth		



14Z0009

ON-VEHICLE SERVICE

BLEEDING

Caution

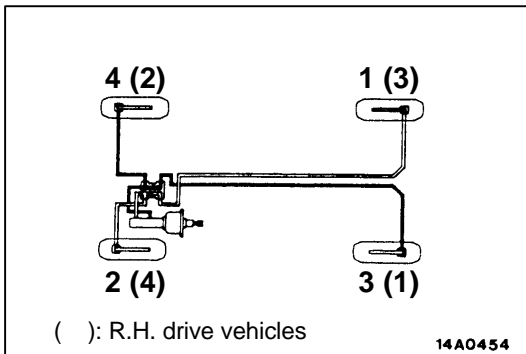
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

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.



(): R.H. drive vehicles

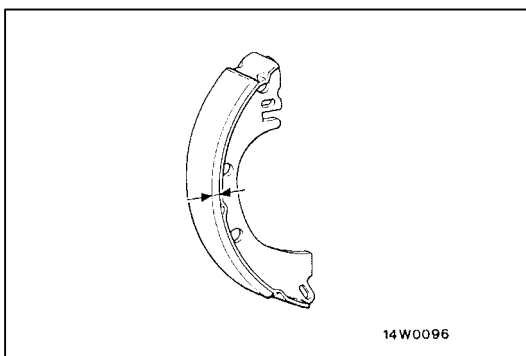
14A0454

BRAKE PIPE LINE BLEEDING

Start the engine and bleed the air in the sequence shown in the figure.

Caution

Be sure to install a filter to the master cylinder reservoir tank when supplying brake fluid.



14W0096

BRAKE LINING THICKNESS CHECK

1. Remove the brake drum.
2. Measure the wear of the brake lining at the place worn the most.

Standard value: 4.4 mm

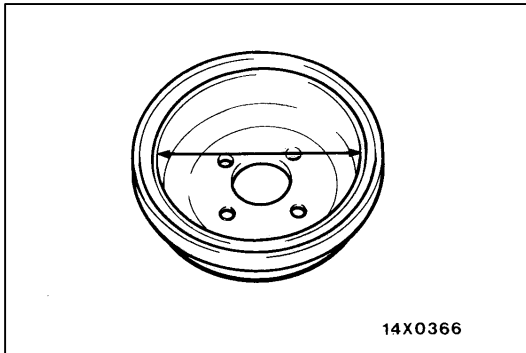
Limit: 1.0 mm

Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly.

For information concerning the procedures for installation of the shoe and lining assembly

Caution

1. Whenever the shoe and lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.
2. If there is a significant difference in the thickness of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.



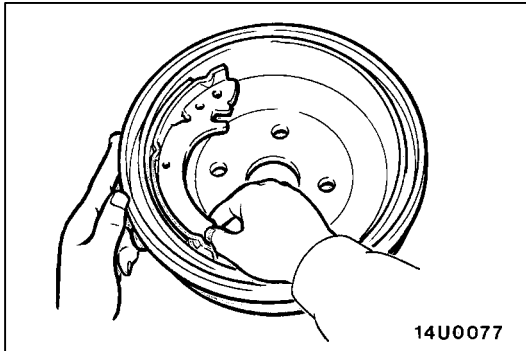
BRAKE DRUM INSIDE DIAMETER CHECK

1. Remove the brake drum.
2. Measure the inside diameter of the brake drum at two or more locations.

Standard value: 203 mm

Limit: 205 mm

3. Replace brake drums, shoe and lining assembly when wear exceeds the limit value or is badly imbalanced.

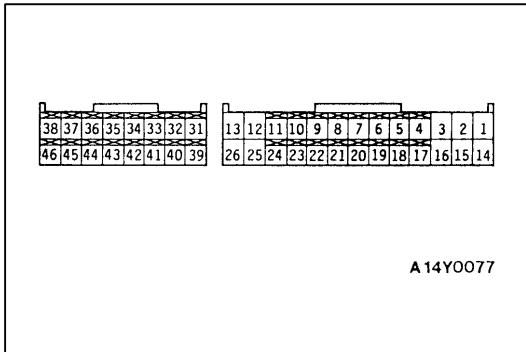


BRAKE LINING AND BRAKE DRUM CONNECTION CHECK

1. Remove the brake drum.
2. **Remove the shoe and lining assembly.**
3. Chalk inner surface of brake drum and rub with shoe and lining assembly.
4. Replace shoe and lining assembly or brake drums if there are any irregular contact area.

NOTE

Clean off chalk after check.



WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU connector, and then use the special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness-side connector.

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.	6	8	9	7
	19	21	22	20

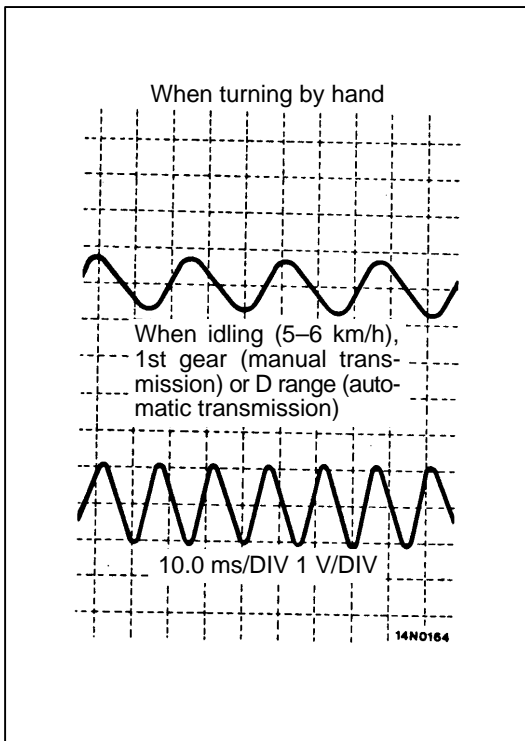
Output voltage

When measuring with a circuit tester:
50 mV or more

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

4. If the output voltage is lower than the above values, the reason could be as follow:
 - Faulty wheel speed sensor.

So replace the 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

- Check the connection of the sensor harness and connector before using the oscilloscope.
- The waveform measurements can also be taken while the vehicle is actually moving.
- 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

NOTE

The wheel speed sensor cable moves following motion of the front or rear suspension. Therefore, it is likely that it has an open circuit only when driving on rough roads and it functions normally on ordinary roads. It is, therefore, recommended to observe sensor output voltage waveform also under special conditions, such as rough road driving.

HYDRAULIC UNIT (HU) CHECK

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.

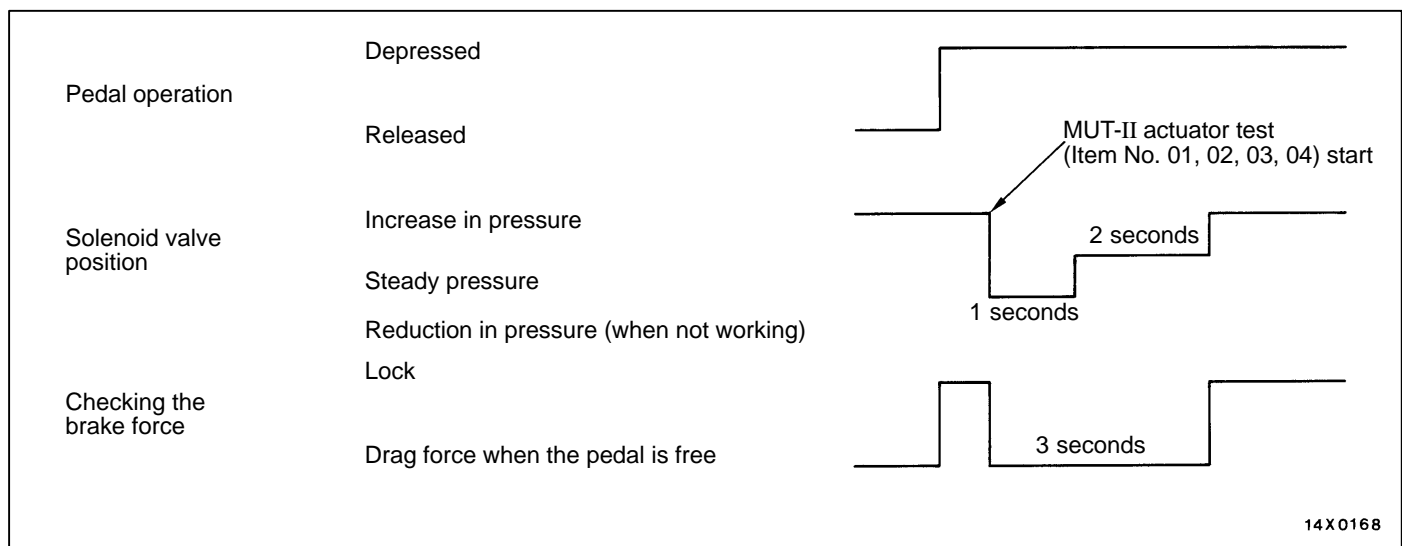
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever <M/T> or the selector lever <A/T> 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	294–490 N

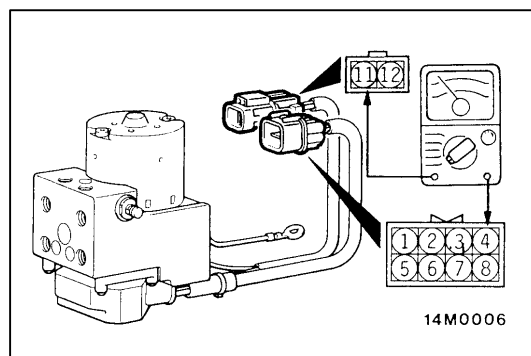
The result should be as shown in the following diagram.



7. If the result of inspection is abnormal, correct according to the **“Diagnosis Table”**
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

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 HU	Check and clean brake line
02				Clogged hydraulic circuit in HU	Replace HU assembly
03			Brake force is not released	Incorrect HU brake tube connection	Connect correctly
04				HU solenoid valve not functioning correctly	Replace HU assembly

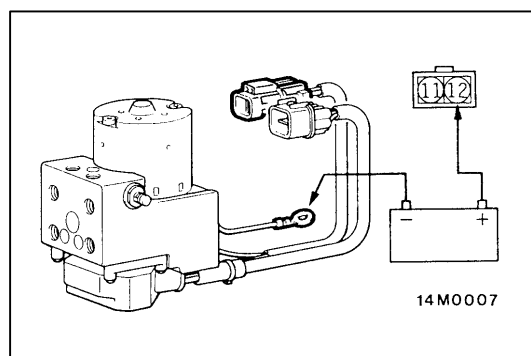


SOLENOID VALVE CHECK

Measure the resistance between terminals.

Standard value:

Solenoid valve	Measurement terminals	Resistance between terminals.
Front IN (right side)	1–11	8.04 – 9.04 Ω
Front IN (left side)	4–11	
Rear IN (right side)	3–11	
Rear IN (left side)	2–11	
Front OUT (right side)	5–11	4.04 – 4.54 Ω
Front OUT (left side)	8–11	
Rear OUT (right side)	7–11	
Rear OUT (left side)	6–11	



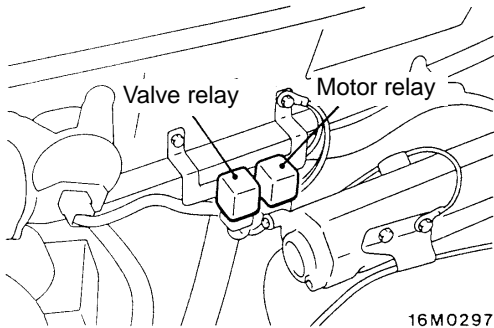
MOTOR OPERATION CHECK

Connect the battery and check to be sure that the sound of the hydraulic unit motor operating can be heard.

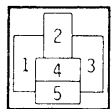
Caution

The battery power should not be applied for more than 1 second.

<L.H. drive vehicles>

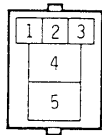


Motor relay connector



20Z0004

Valve relay connector


20Z0003
00004684

MOTOR RELAY AND VALVE RELAY CONTINUITY CHECK

<L.H. drive vehicles>

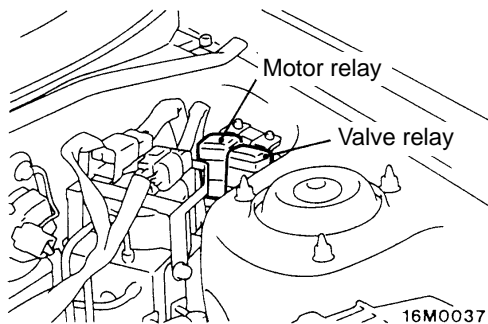
Motor relay

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

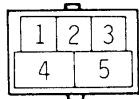
Valve relay

Battery voltage	Terminal No.				
	1	2	3	4	5
Power is not supplied	○		○		○
Power is supplied	⊕		⊖	○	○

<R.H. drive vehicles>

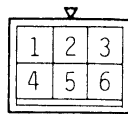


Motor relay connector



14 X0104

Valve relay connector


14W0039
00004683

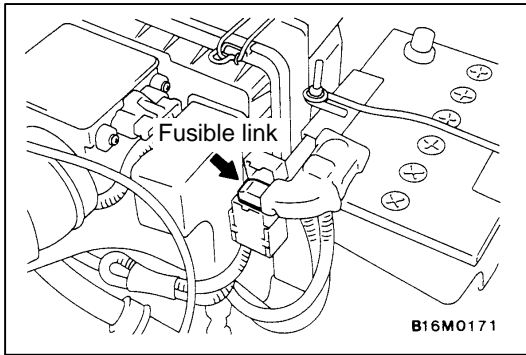
<R.H. drive vehicles>

Motor relay

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

Valve relay

Battery voltage	Terminal No.				
	1	2	3	5	6
Power is not supplied	○	○	○	○	
Power is supplied		⊕	○	⊖	○



REMEDY FOR A FLAT BATTERY

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.

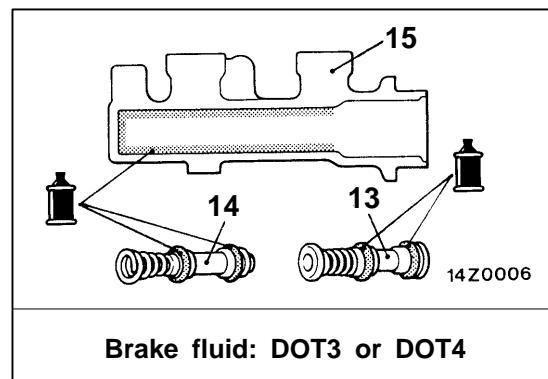
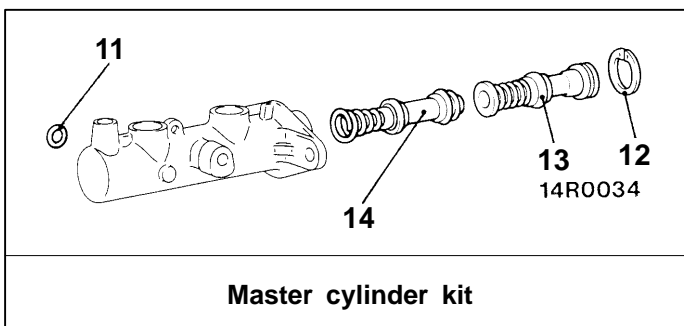
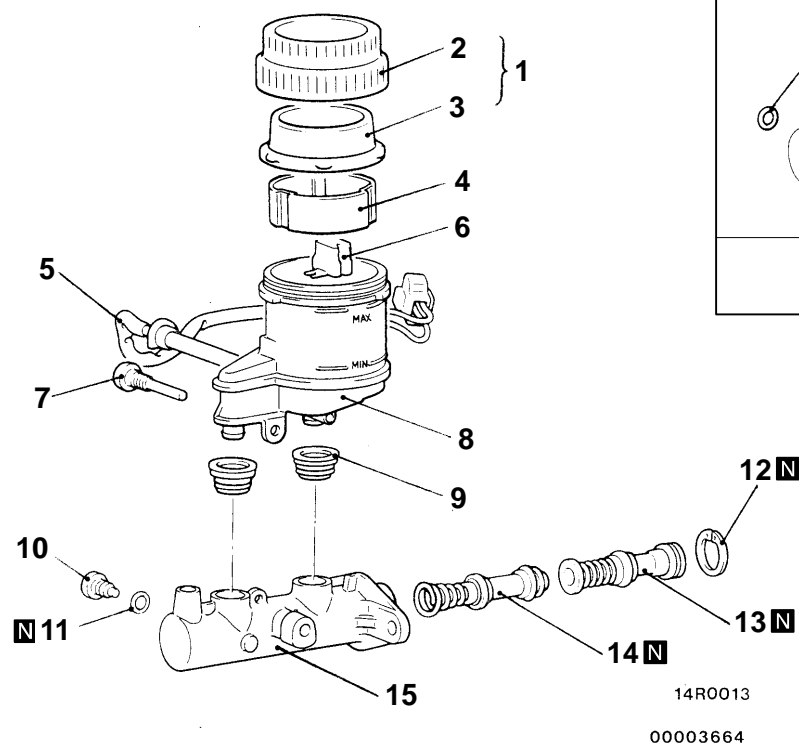
MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

Refer to **GROUP 35A**

MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY

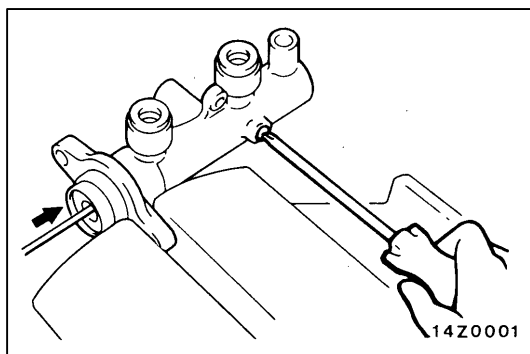


Disassembly steps

1. Reservoir cap assembly
2. Reservoir cap
3. Diaphragm
4. Filter
5. Brake fluid level sensor
6. Float
7. Reservoir stopper bolt



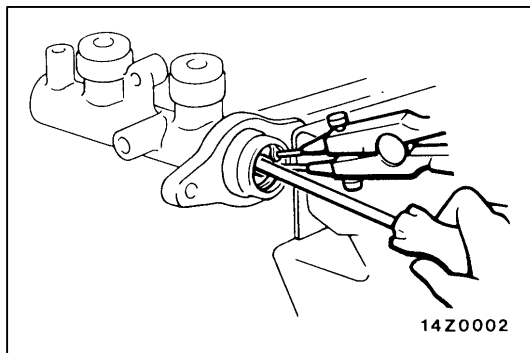
8. Reservoir tank
9. Reservoir seal
10. Piston stopper bolt
11. Gasket
12. Piston stopper ring
13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body



DISASSEMBLY SERVICE POINTS

◀A▶ PISTON STOPPER BOLT DISASSEMBLY

Remove the piston stopper bolt, while depressing the piston.



◀B▶ PISTON STOPPER RING DISASSEMBLY

Remove the piston stopper ring, while depressing the piston.

INSPECTION

- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, wear, damage or wear.
- Check the diaphragm for cracks and wear.

REAR DRUM BRAKE

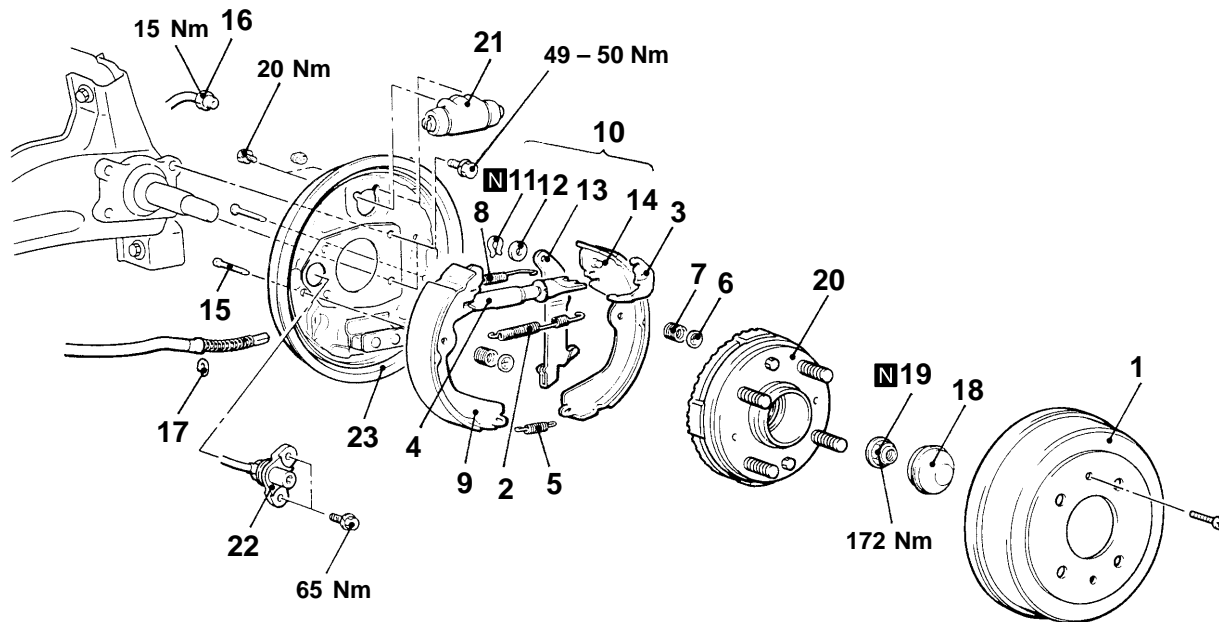
REMOVAL AND INSTALLATION

Pre-removal Operation

- Loosening the Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation

- **Brake Line Bleeding**
- **Parking Brake Lever Stroke Adjustment**



A14M0055

Rear drum brake removal steps

1. Brake drum
2. Shoe-to-lever spring
3. Adjuster lever
4. Auto adjuster assembly
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe-to-shoe spring
9. Shoe and lining assembly
10. Shoe, lining and lever assembly
11. Retainer
12. Wave washer
13. Parking lever
14. Shoe and lining assembly
15. Shoe hold-down pin
16. Brake pipe connection
17. Snap ring
18. Hub cap
19. Flange nut
20. Rear hub and rotor assembly
21. Wheel cylinder
22. Speed sensor
23. Backing plate

Wheel cylinder removal steps

1. Brake drum
2. Shoe-to-lever spring
8. Shoe-to-shoe spring
16. Brake pipe connection
21. Wheel cylinder

Caution

1. Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.
2. When removing the rear hub assembly, the wheel bearing inner race may be left at the spindle side. In this case, always replace the rear hub assembly, otherwise the hub will damage the oil seal, causing oil leaks or excessive play.

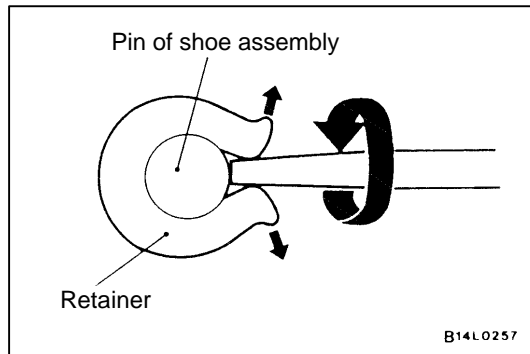
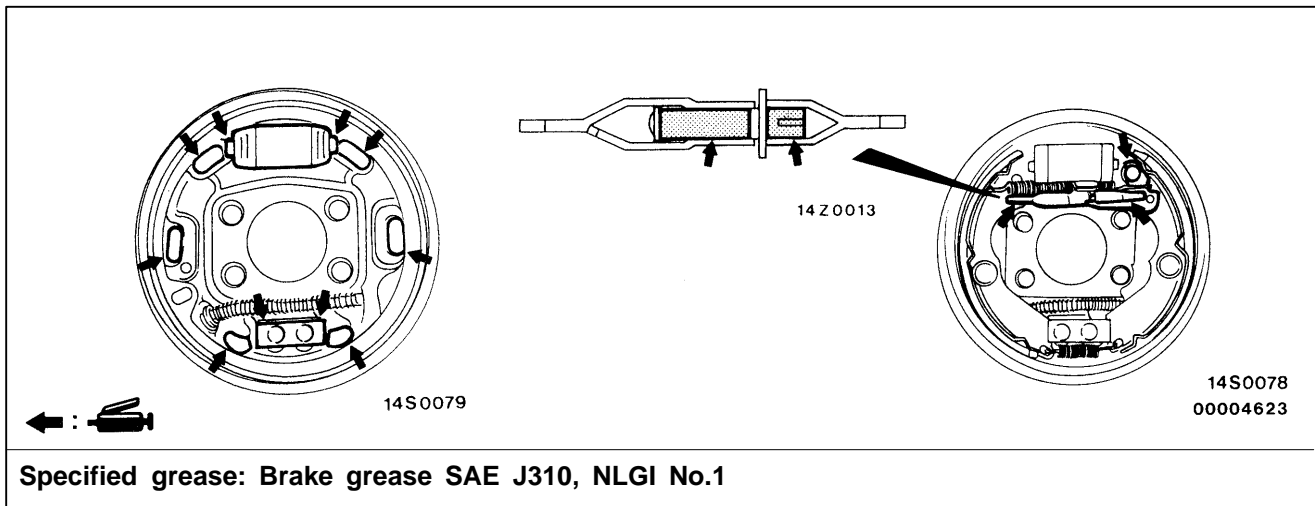


LUBRICATION POINTS

MAIN

Group
35

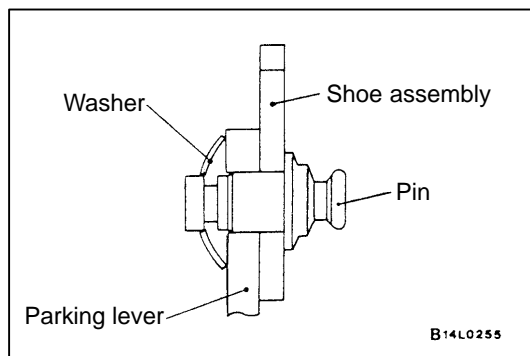
35B
1996



REMOVAL SERVICE POINT

◀A▶ RETAINER REMOVAL

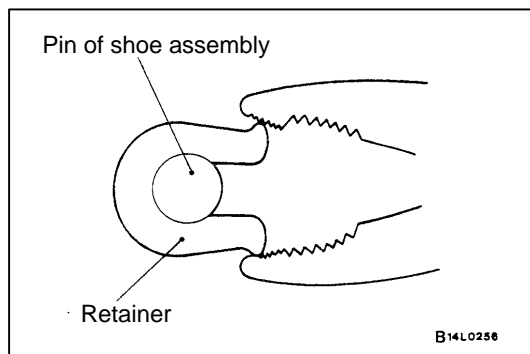
Use a flat-tipped screwdriver or the like to open up the retainer joint, and remove retainer.



INSTALLATION SERVICE POINTS

▶A◀ WAVE WASHER INSTALLATION

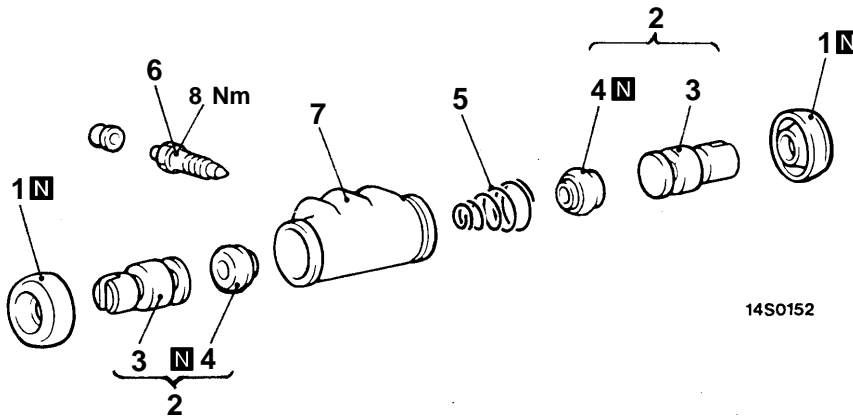
Install the washer in the direction shown in the illustration.



▶B◀ RETAINER INSTALLATION

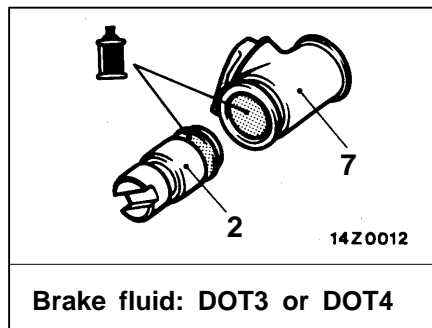
Use pliers or the like to install the retainer or the pin positively.

WHEEL CYLINDER DISASSEMBLY AND REASSEMBLY

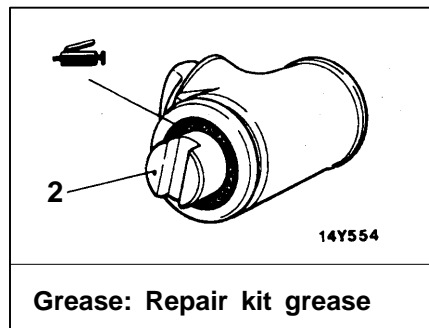


14S0152

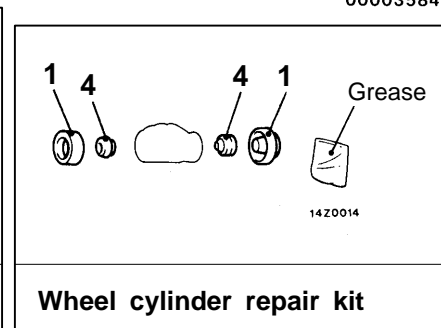
00003584



Brake fluid: DOT3 or DOT4



Grease: Repair kit grease



Wheel cylinder repair kit

Disassembly steps



1. Boots
2. Piston assembly
3. Pistons
4. Piston cups

5. Spring
6. Bleeder
7. Wheel cylinder body

REASSEMBLY SERVICE POINT

►A◄ PISTON CUP/PISTON REASSEMBLY

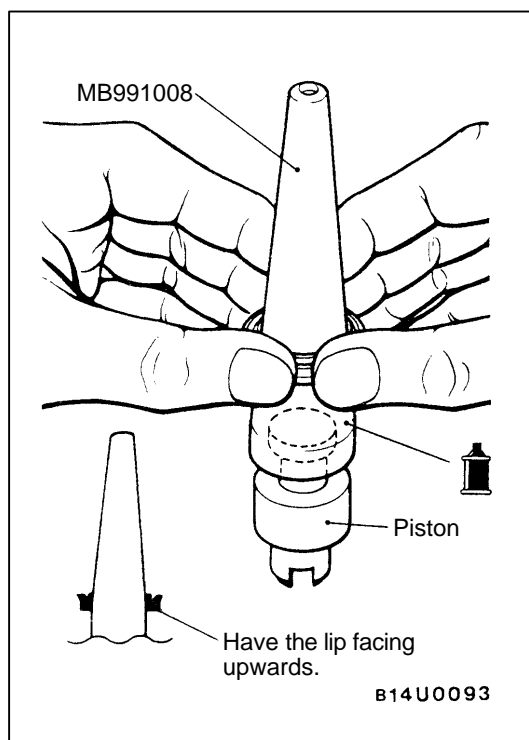
- (1) Use alcohol or specified brake fluid to clean the wheel cylinder and the piston.
- (2) Apply the specified brake fluid to the piston cups and the special tool.

Specified brake fluid: DOT3 or DOT4

- (3) Set the piston cup on the special tool with the lip of the cup facing up, fit the cup onto the special tool, and then slide it down the outside of the tool into the piston groove.

Caution

In order to keep the piston cup from becoming twisted or slanted, slide the piston cup down the tool slowly and carefully, without stopping.



INSPECTION

Check the piston and wheel cylinder walls for rust or damage, and if there is any abnormality, replace the entire wheel cylinder assembly.

PROPORTIONING VALVE**REMOVAL AND INSTALLATION****Pre-removal Operation**

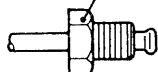
- Brake Fluid Draining
- Air Intake Hose Removal

Post-installation Operation

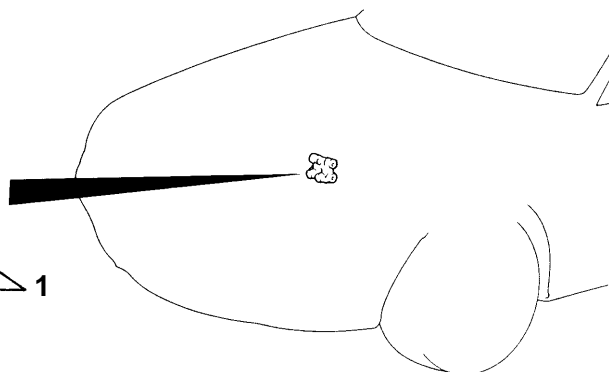
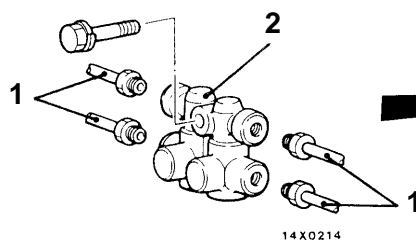
- Brake Fluid Supplying
- **Brake Line Bleeding**
- Air Intake Hose Installation

Flared brake line nuts

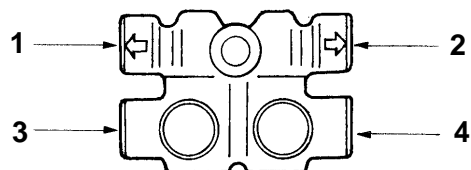
15 Nm



14X0343

14X0146
00004486**Removal steps**

1. Brake pipe
2. Proportioning valve
3. Bracket



A14L0340

INSTALLATION SERVICE POINT**►A◄ BRAKE PIPE CONNECTION**

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

1. Proportioning valve – Rear brake (L.H.)
2. Proportioning valve – Rear brake (R.H.)
3. Proportioning valve – Hydraulic unit
4. Proportioning valve – Hydraulic unit

HYDRAULIC UNIT

REMOVAL AND INSTALLATION

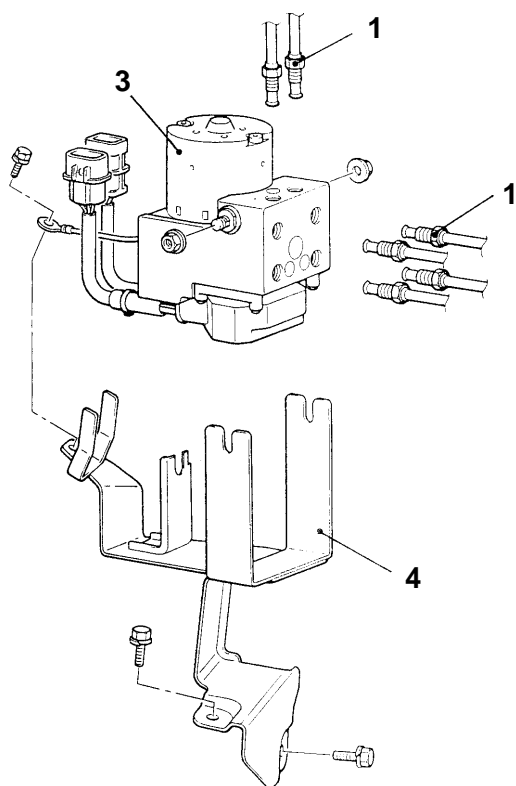
Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

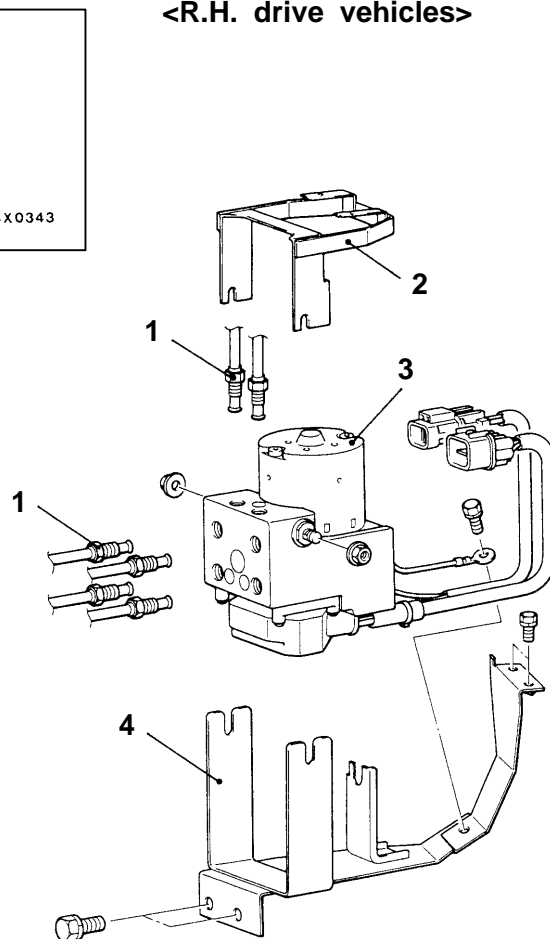
- Brake Fluid Supplying
- **Brake Line Bleeding**
- **Brake Pedal Adjustment**

<L.H. drive vehicles>



14M0049

<R.H. drive vehicles>


14M0003
00004485

Removal steps

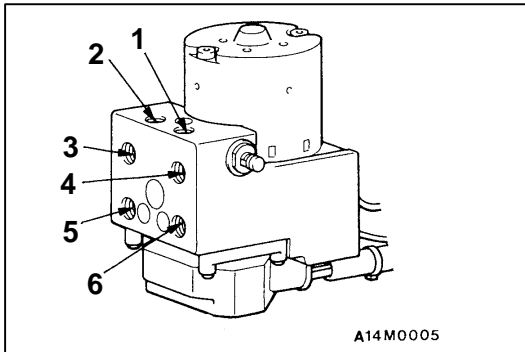
1. Brake pipe connection
2. Connector bracket <R.H. drive vehicles>
3. Hydraulic unit assembly
4. Hydraulic unit bracket

REMOVAL SERVICE POINT

◀A▶ HYDRAULIC UNIT ASSEMBLY 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.

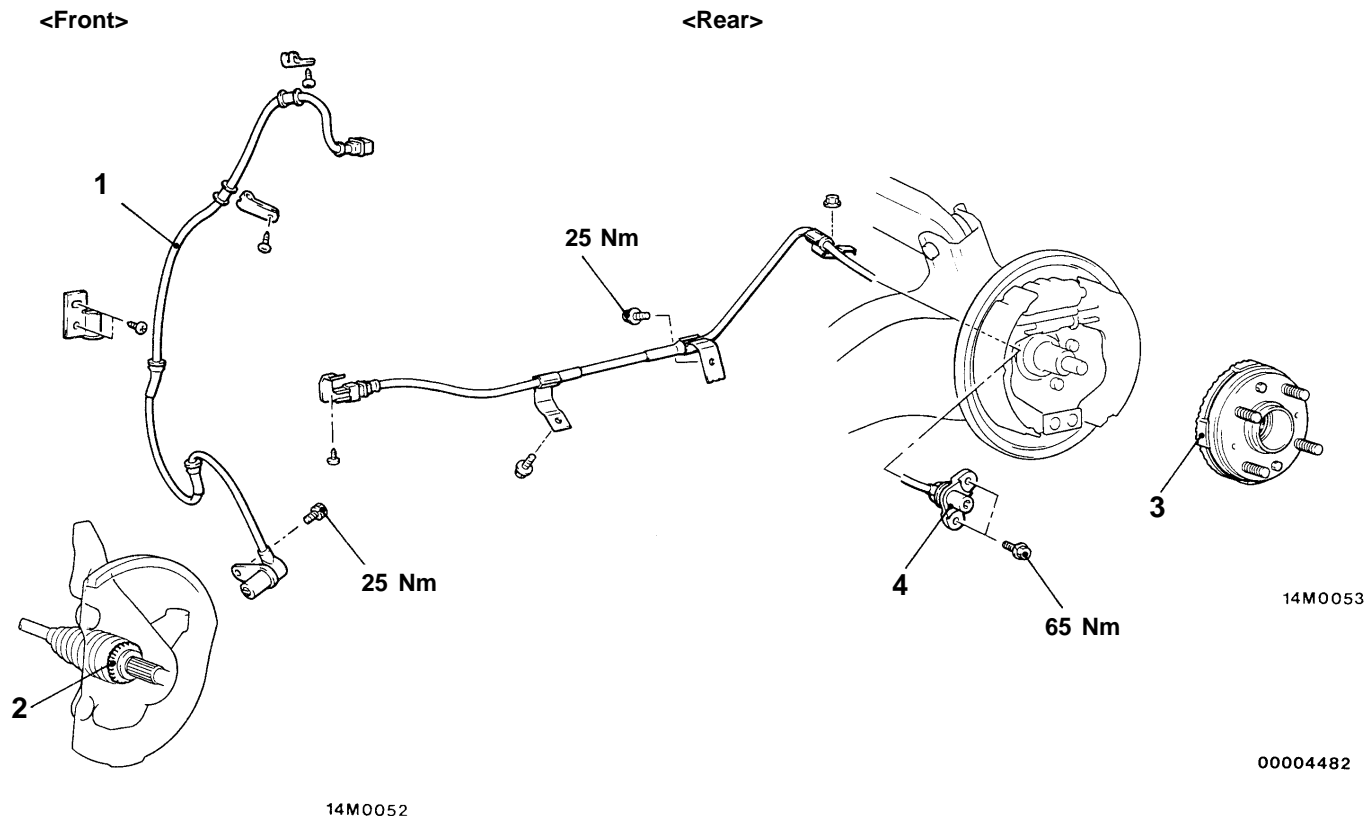
1. To the proportioning valve (RH)
2. To the proportioning valve (LH)
3. From the master cylinder (Primary)
4. From the master cylinder (Secondary)
5. To the front brake (RH)
6. To the front brake (LH)

WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation

- [Wheel Speed Sensor Output Voltage Check](#)



Front speed sensor removal steps



1. Front speed sensor
2. [Front rotor](#)

NOTE

The front rotor is integrated with the drive shaft and is not disassembled.

Rear speed sensor removal steps



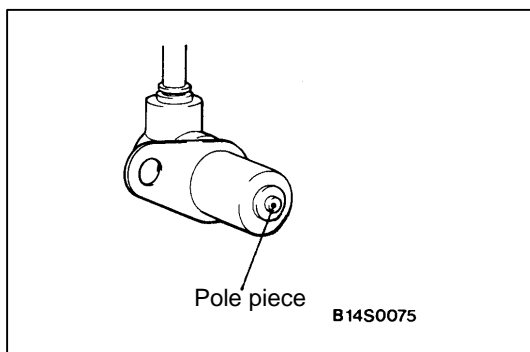
3. [Rear rotor](#)
4. Rear speed sensor

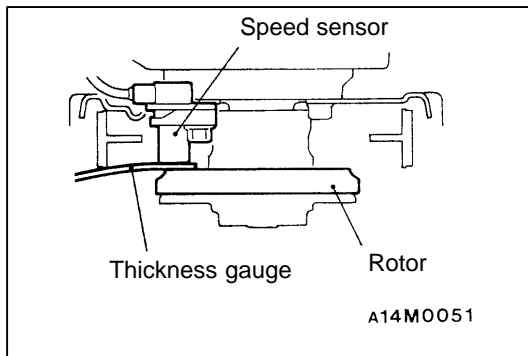
REMOVAL SERVICE POINT

 FRONT SPEED SENSOR/REAR SPEED SENSOR
REMOVAL

Caution

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





INSTALLATION SERVICE POINT

►A◄ REAR SPEED SENSOR INSTALLATION

Caution

Be careful that the pole piece at the end of the speed sensor and the rotor teeth do not become damaged by striking them against the metal parts.

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface, and then tighten the speed sensor bracket at the position where the clearance is the standard value all around.

Standard value: 0.1 – 2.0 mm

INSPECTION

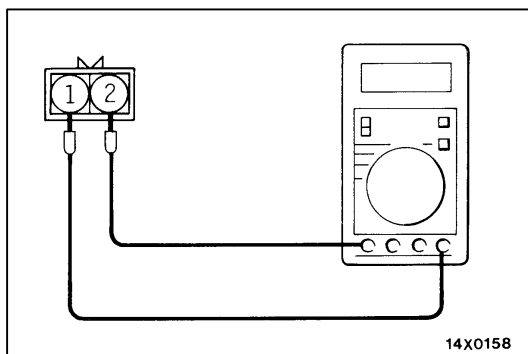
SPEED SENSOR

- (1) Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip, and if so, remove it.

Also check whether the pole piece is damaged, and if so, replace it with a new one.

NOTE

The pole piece can become magnetized because of the magnet built into the 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.



- (2) Measure the resistance between the speed sensor terminals.

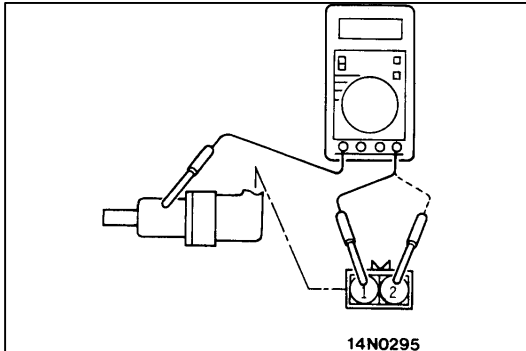
Standard value: 1.4 – 1.8 kΩ

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

- (3) Check the 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.



SPEED SENSOR INSULATION INSPECTION

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

TOOTHED ROTOR

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

ABS-ECU

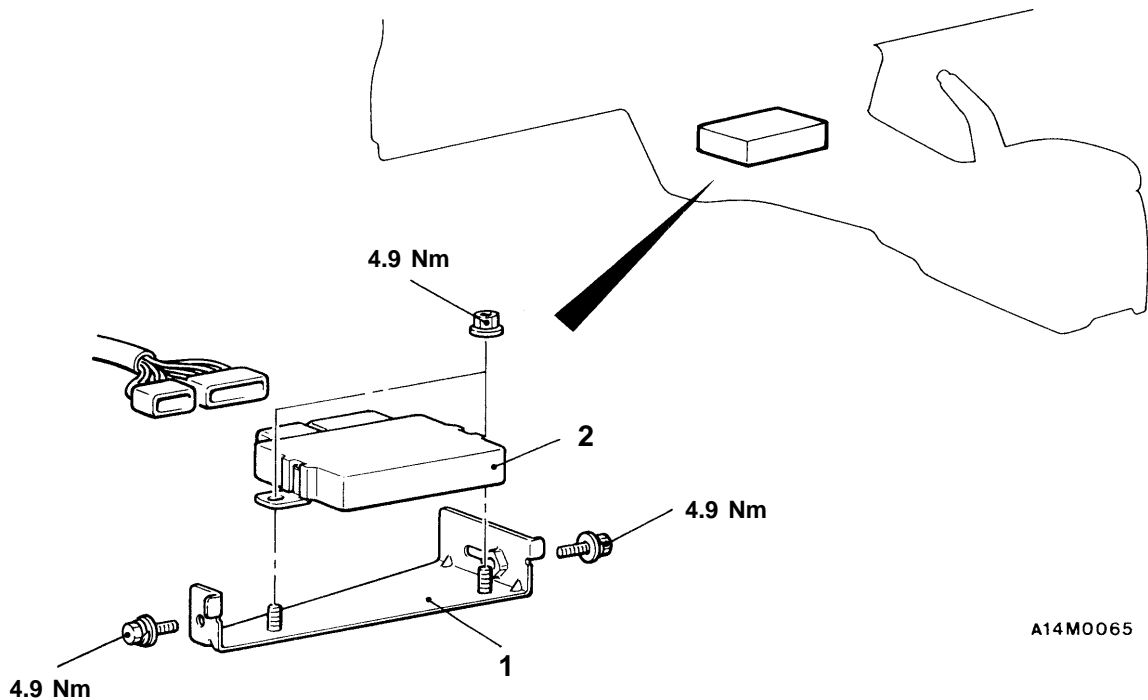
REMOVAL AND INSTALLATION

CAUTION: SRS

When removing and installing the ABS-ECU from vehicles equipped with SRS, do not let it bump against the SRS diagnosis unit or other components.

Pre-removal and Post-installation Operation

- [Floor Console Removal and Installation](#)

**Removal steps**

1. ABS-ECU bracket
2. ABS-ECU

INSPECTION

[Refer inspection](#)