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

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

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35209000282

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GENERAL INFORMATION

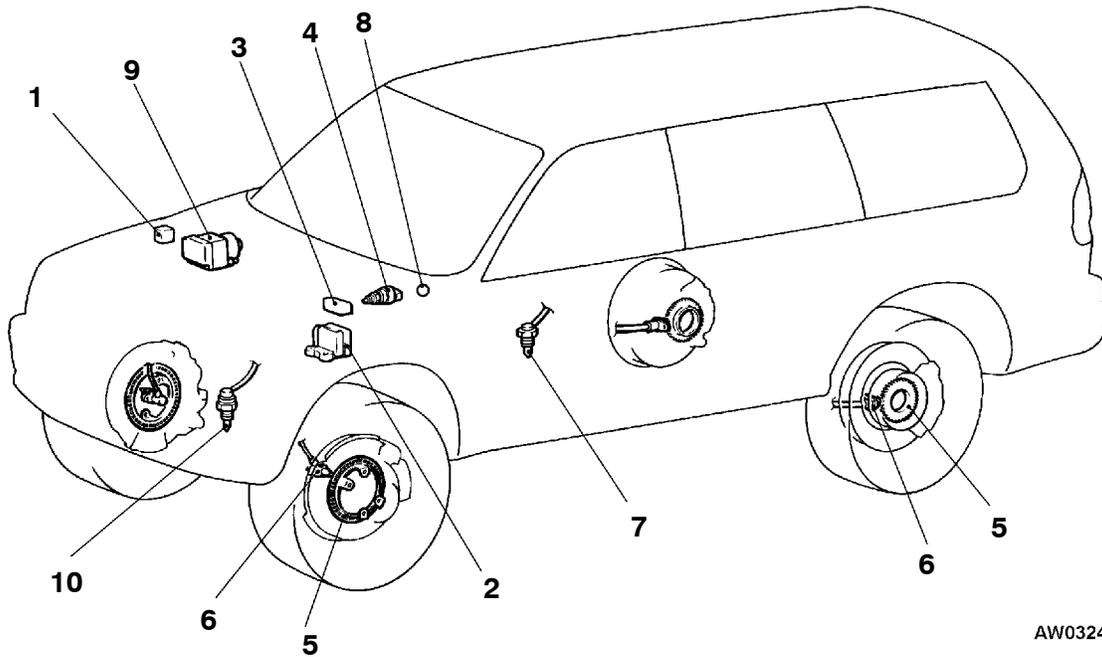
35200010307

The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly (integrated in 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
ABS type	4-sensor, 3-channel type
Speed sensor	Magnet coil type on 4-wheels
Front ABS rotor teeth	47
Rear ABS rotor teeth	47

CONSTRUCTION DIAGRAM



AW0324AA

- 1. ABS Warning lamp relay
- 2. Hydraulic unit assembly (integrated in ABS-ECU)
- 3. Diagnosis connector
- 4. Stop lamp switch
- 5. ABS rotor
- 6. Wheel speed sensor
- 7. 4WD detection switch
- 8. ABS warning lamp
- 9. G-Sensor
- 10. Freewheel engage switch

SERVICE SPECIFICATIONS

35200030327

Items		Standard value
Wheel speed sensor internal resistance k Ω		1.3 – 1.5
Wheel speed sensor insulation resistance k Ω		100 or more
G-sensor output voltage V	Stationary vehicle	2.4 – 2.6
	Arrow facing downward	3.4 – 3.6

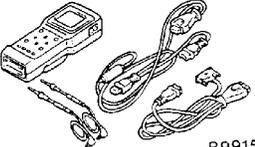
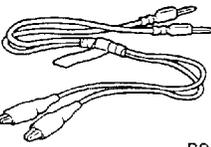
LUBRICANT

35200040061

Item	Specified lubricant
Brake fluid	DOT3 or DOT4

SPECIAL TOOLS

35200060296

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

35201110501

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 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

35201120351

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**With the MUT-II**

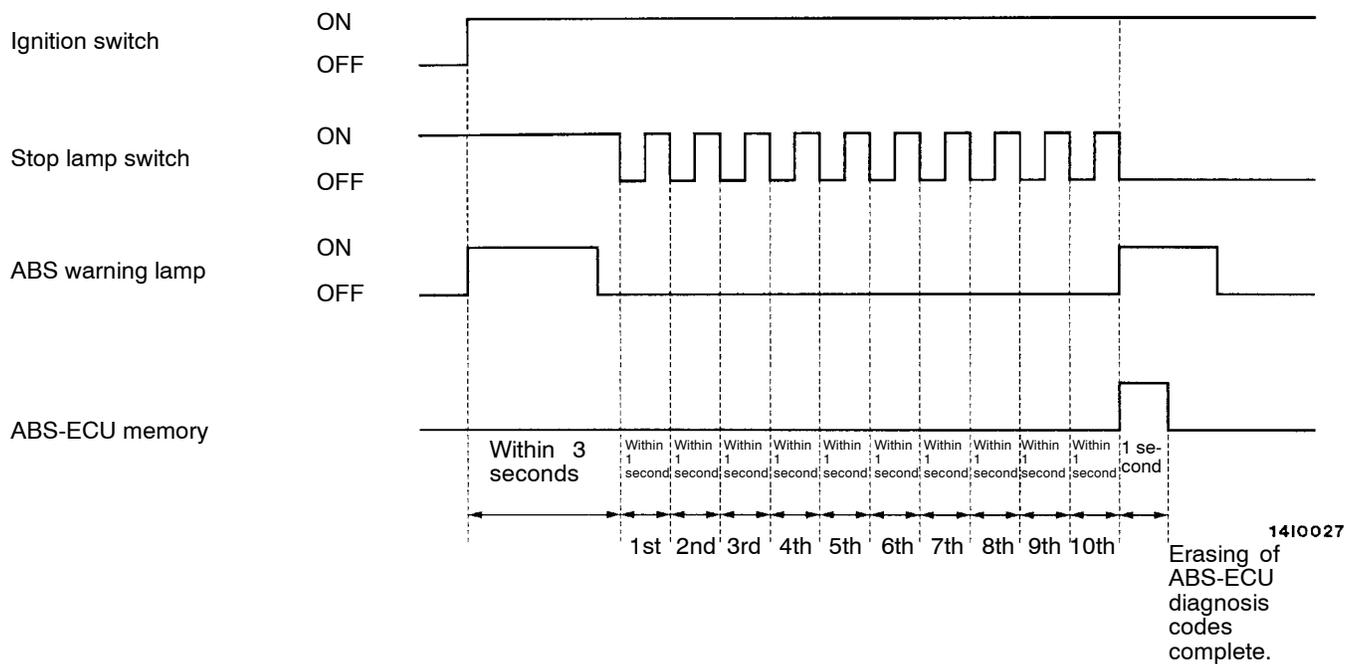
Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

Without the MUT-II

1. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)
2. Stop the engine.
3. Turn on the stop lamp switch. (Depress the brake.)
4. After carrying out steps 1. to 3., turn the ignition switch to ON. Within 3 seconds after turning the ignition switch to ON, turn off the stop lamp switch (release the brake). Then, turn the stop lamp switch on and off a total of 10 times.

NOTE

If the ABS-ECU function has been stopped because of fail-safe operation, it will not be possible to erase the diagnosis codes.



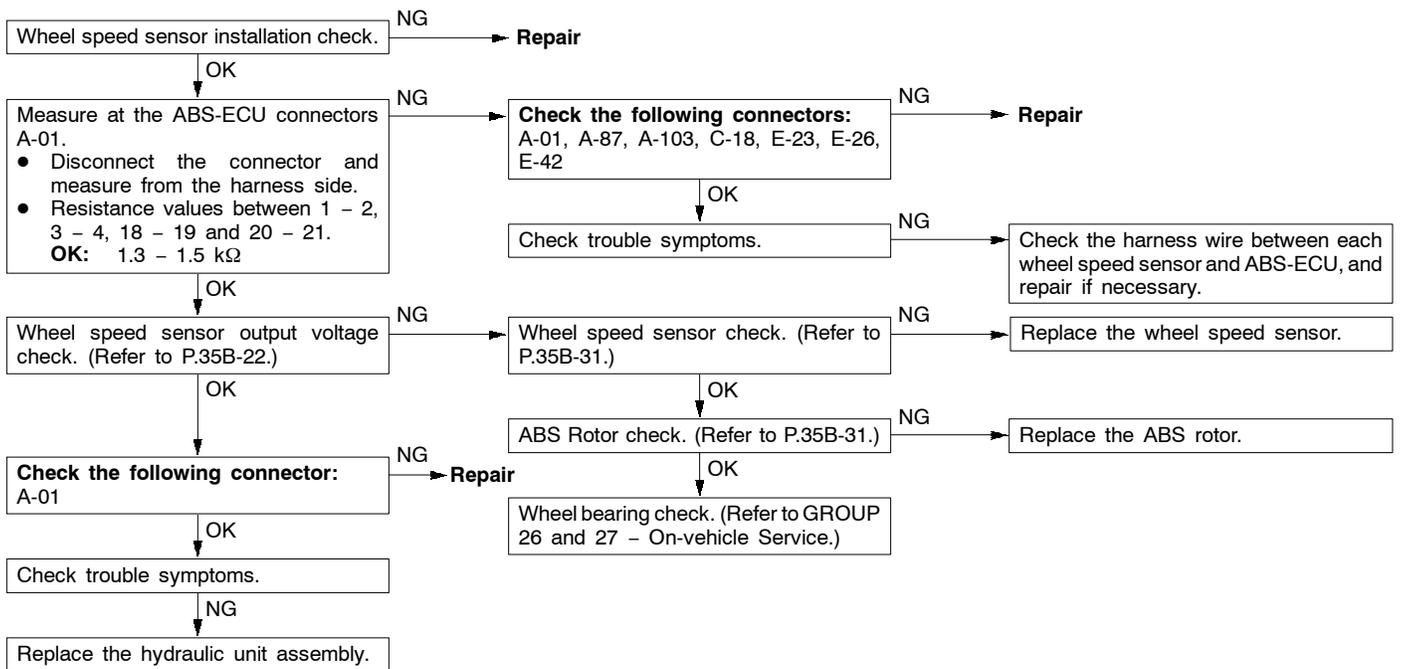
INSPECTION CHART FOR DIAGNOSIS CODES

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

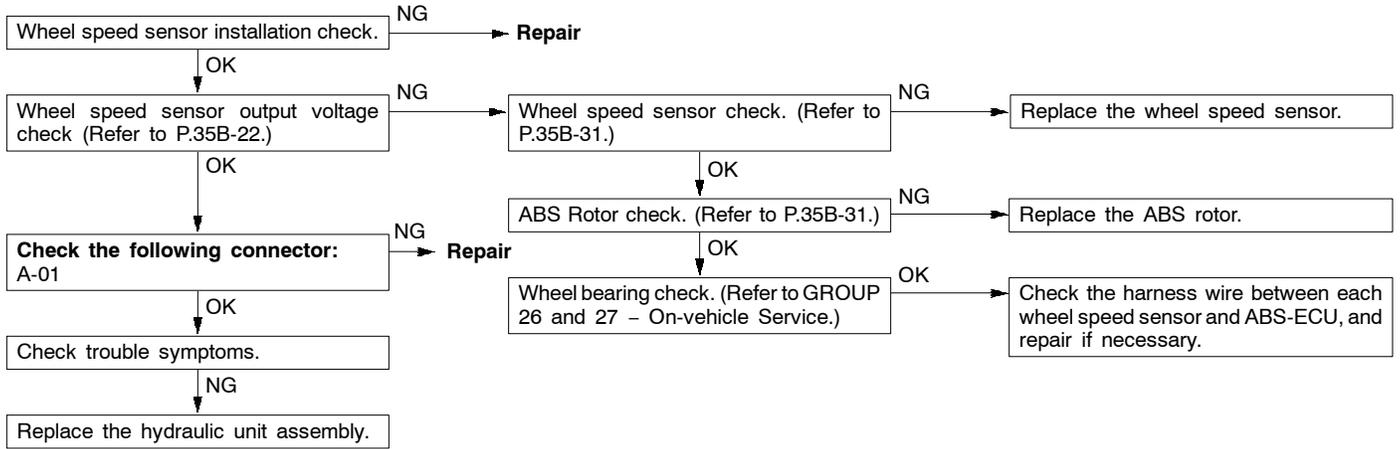
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open or short circuit	35B-7
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	35B-8
16	Power supply system		35B-8
21	Front right wheel speed sensor	Abnormal	35B-7
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
25	4WD position detection switch		35B-9
26	Freewheel engage switch		35B-10
32	G-sensor system		35B-11
33	Stop lamp switch system		35B-11
41	Front right solenoid valve		35B-12
42	Front left solenoid valve		
43	Rear solenoid valve		
51	Valve relay		
53	Motor relay, motor		
63	ABS-ECU		Refer to P. 35B-28 (Replace the hydraulic unit assembly)

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit or short circuit	Probable cause
Code No. 21, 22, 23, 24 Wheel speed sensor abnormal	
The ABS-ECU determines that an open circuit or short circuit occurs in more than one line of wheel speed sensors.	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of hydraulic unit assembly
These codes are output at the following times: <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. • When the sensor output drops and anti-lock control is continuously carried out due to a defective sensor or a warped rotor. 	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor • Malfunction of ABS rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of hydraulic unit assembly



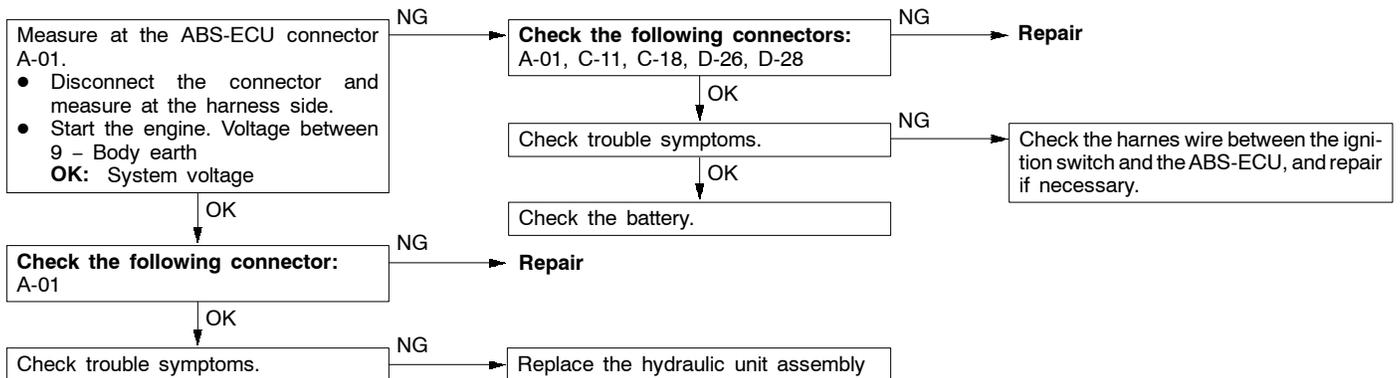
Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	<ul style="list-style-type: none"> ● Improper installation of wheel speed sensor ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor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



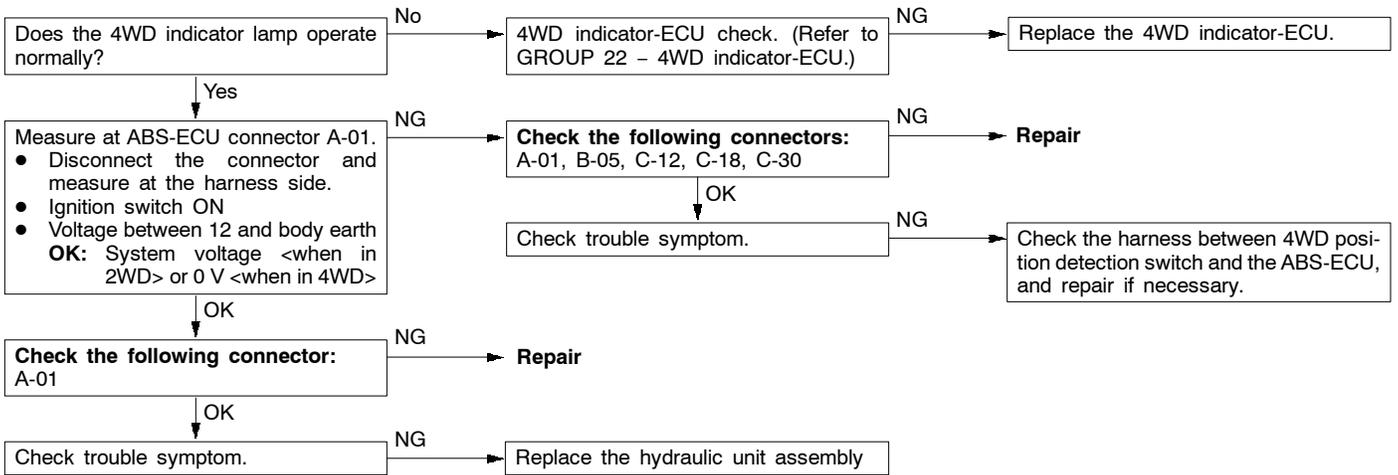
Code No. 16 Power supply system	Probable cause
The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector. ●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

Caution

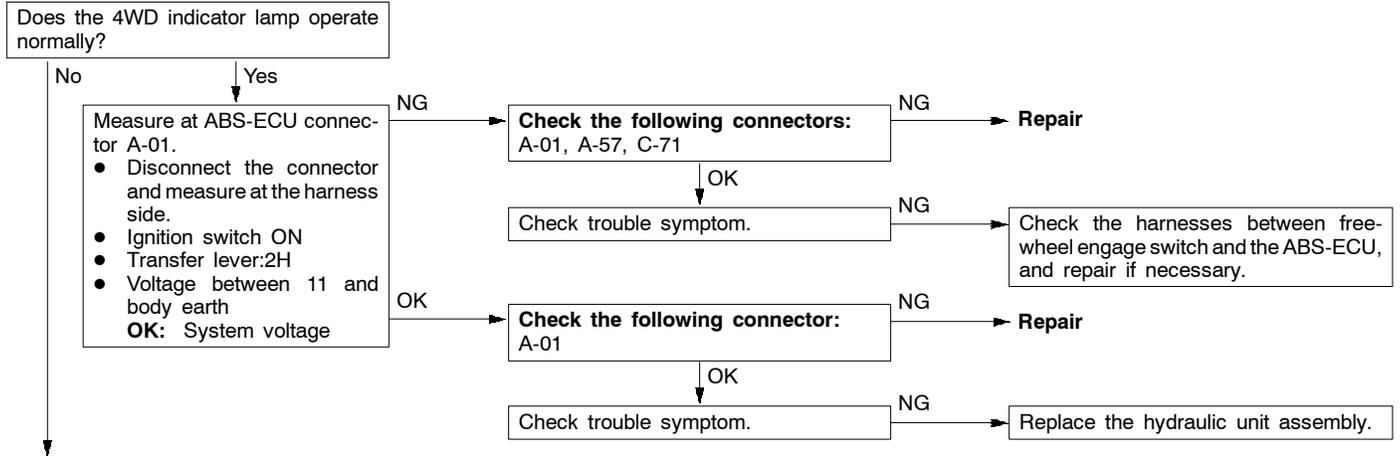
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output. Before carrying out the following inspection, check the battery level, and refill distilled water if necessary.



Code No. 25 4WD position detection switch	Probable cause
ABS-ECU determines that an open circuit exists in the 4WD position detection switch system.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector ● Malfunction of 4WD indicator-ECU ● Malfunction of 4WD position detection switch ● Malfunction of hydraulic unit assembly



Code No. 26 Freewheel engage switch	Probable cause
<p>This code is output at the following times:</p> <ul style="list-style-type: none"> • ABS-ECU determines that an open circuit exists in the freewheel engage switch system. • When the 4WD detection switch is off and the freewheel engage switch is on, the vehicle will continue running at 20 km/h or more for approximately 5 min. or more and then will continue running until a speed of 0 km/h is reached. (Code Nos. 25 and 26 are output.) 	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of freewheel engage switch • Malfunction of 4WD indicator-ECU • Malfunction of 4WD position detection switch • Malfunction of hydraulic unit assembly

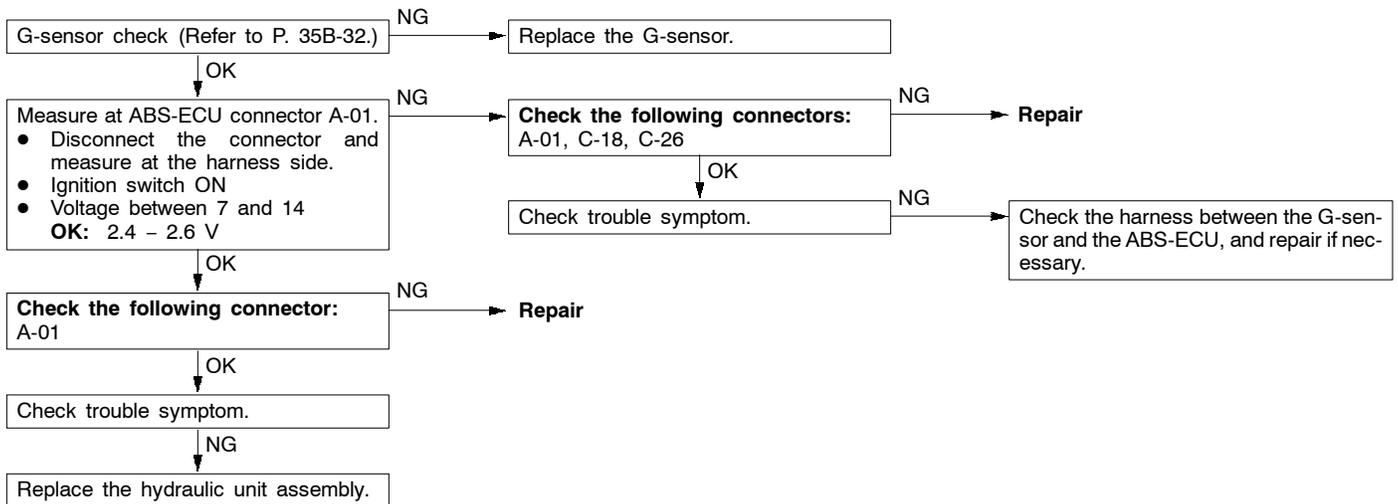


Trouble symptom	Main cause	Remedy
Even when the transfer shift lever is in the "4H" position, the 4WD indicator lamp does not illuminate.	Broken harness wire between the 4WD indicator-ECU and the freewheel engage switch, or broken earth wire from the freewheel engage switch	Repair the harness.
	Freewheel engage switch or 4WD position detection switch is defective.	Replace the switch.
	Broken harness wire between the 4WD indicator-ECU and the 4WD position detection switch	Repair the harness.
	Broken wire in the 4WD indicator-ECU circuit	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)
4WD indicator lamp illuminates regardless of the position of the transfer shift lever.	Short in the harness wire in the 4WD position detection switch circuit	Repair the harness.
	4WD position detection switch is defective.	Replace the switch.
	Short in the ABS-ECU circuit	Replace the ABS-ECU.
	Short in the 4WD indicator-ECU circuit	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)
No indicator is illuminated	Power circuit in the 4WD indicator-ECU is defective.	Repair the harness.
	4WD indicator-ECU is defective.	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)

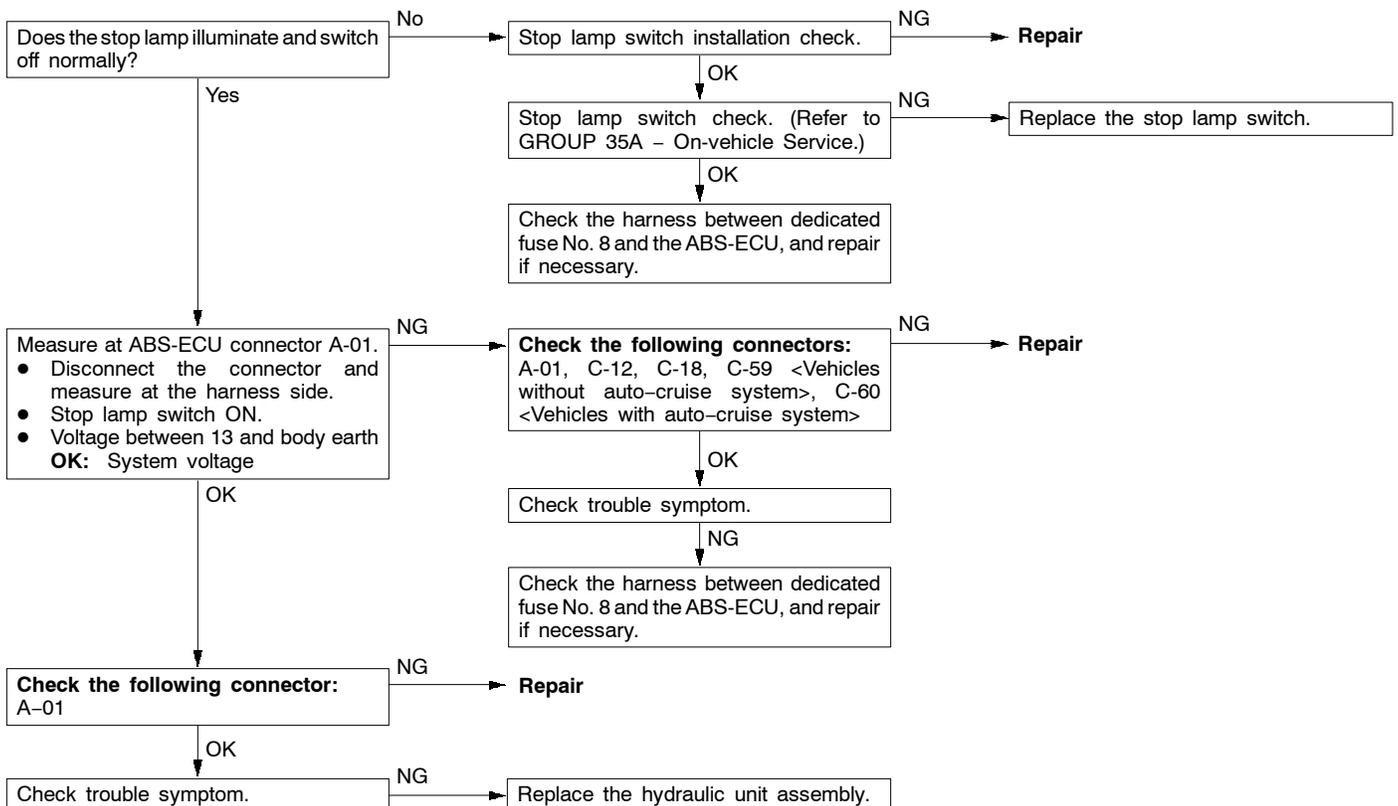
NOTE

When checking a short in the ABS-ECU circuit, remove the ABS-ECU connector and check if the 4WD indicator returns to normal. If it returns to normal, the ABS-ECU is defective. Furthermore, if the ABS-ECU is normal, then the 4WD indicator-ECU will be defective.

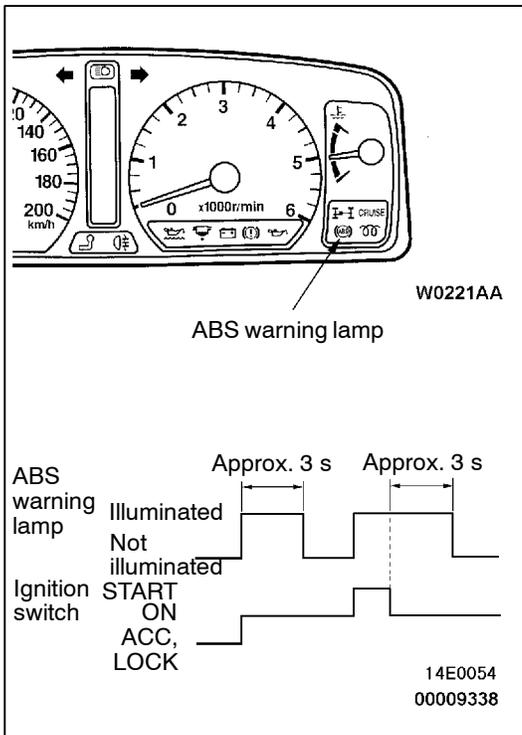
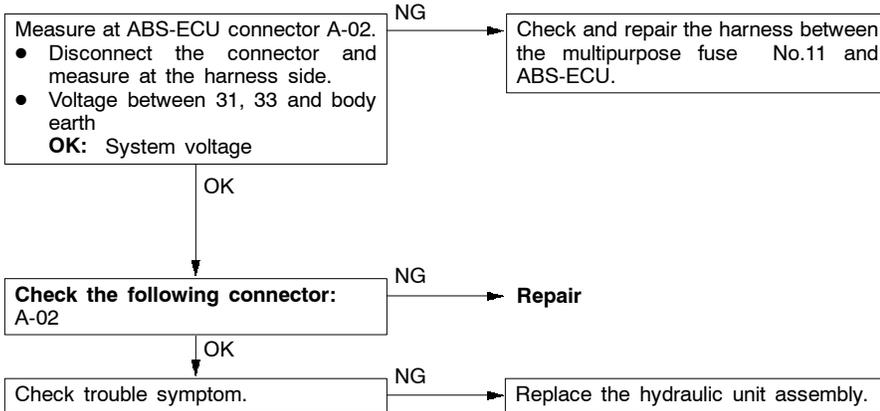
Code No. 32 G-sensor system	Probable cause
This code is output at the following times: ● The G-sensor output is less than 0.5 V or more than 4.5 V. ● An open or short circuit is present in the G-sensor system.	● Malfunction of G-sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly



Code No. 33 Stop lamp switch system	Probable cause
These codes are output at the following times: ● 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) ● When the ABS-ECU determines that there is an open circuit in harness of the stop lamp switch system.	● Malfunction of stop lamp switch ● Malfunction of harness or connector ● Malfunction of hydraulic unit assembly



Code No. 41, 42, 43 Solenoid valve system	Probable cause
Code No. 51 Valve relay system	
Code No. 53 Motor relay, Motor system	
These codes are output in the following cases: • If there is an open or short circuit in the ABS-ECU power circuit (solenoid valve, motor). • If there is a malfunction in the hydraulic unit inner circuit.	• Malfunction of harness or connector • Malfunction of hydraulic unit assembly



ABS WARNING LAMP INSPECTION

35201200161

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

35201140555

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

Trouble symptoms		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	35B-14
	Communication with ABS only is not possible.	2	35B-14
When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.		3	35B-15
The ABS warning lamp remains illuminated after the engine is started.		4	35B-16
Faulty ABS operation	Unequal braking power on both sides	5	35B-17
	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

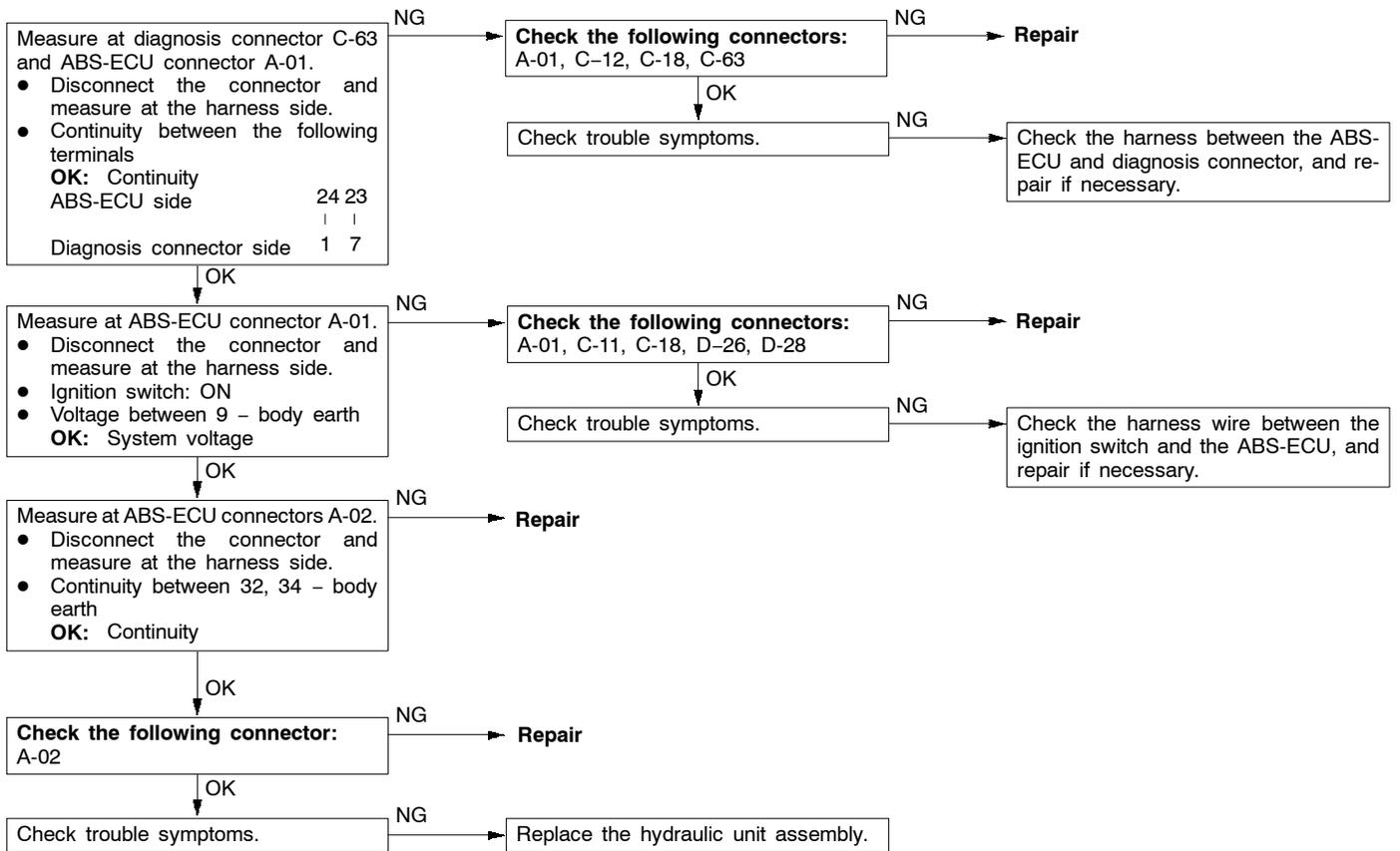
Inspection Procedure 1

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

Refer to GROUP 13A – Troubleshooting.

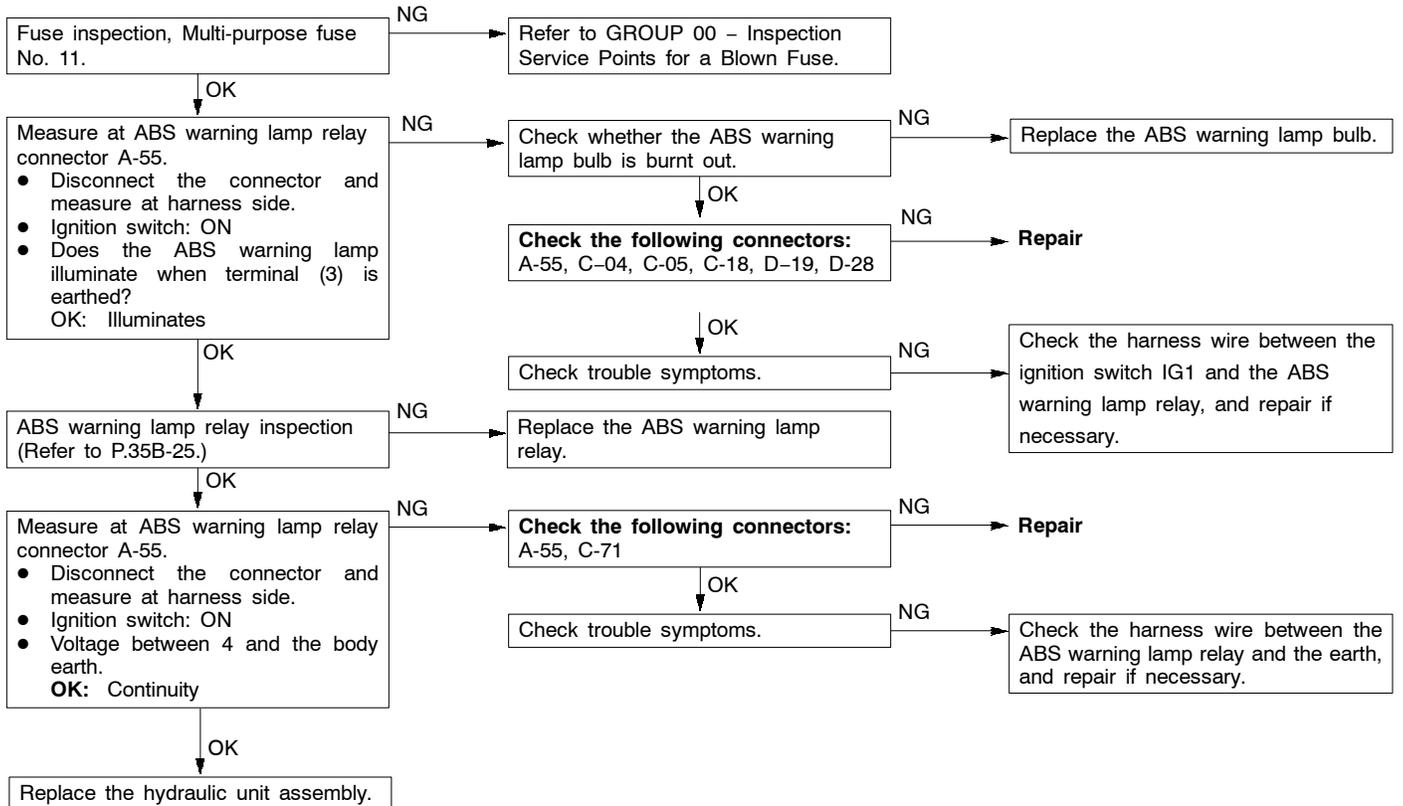
Inspection Procedure 2

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 hydraulic unit assembly



Inspection Procedure 3

When ignition key is turned to “ON” (engine stopped), ABS warning lamp does not illuminate.	Probable cause
Lamp power supply circuit disconnections, lamp bulb burnouts, ABS warning lamp relay faults, or circuit breaks between the ABS warning lamp and the ground are possible causes.	<ul style="list-style-type: none"> ● Blown fuse ● Burnt out ABS warning lamp bulb ● Malfunction of the ABS warning lamp relay ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly

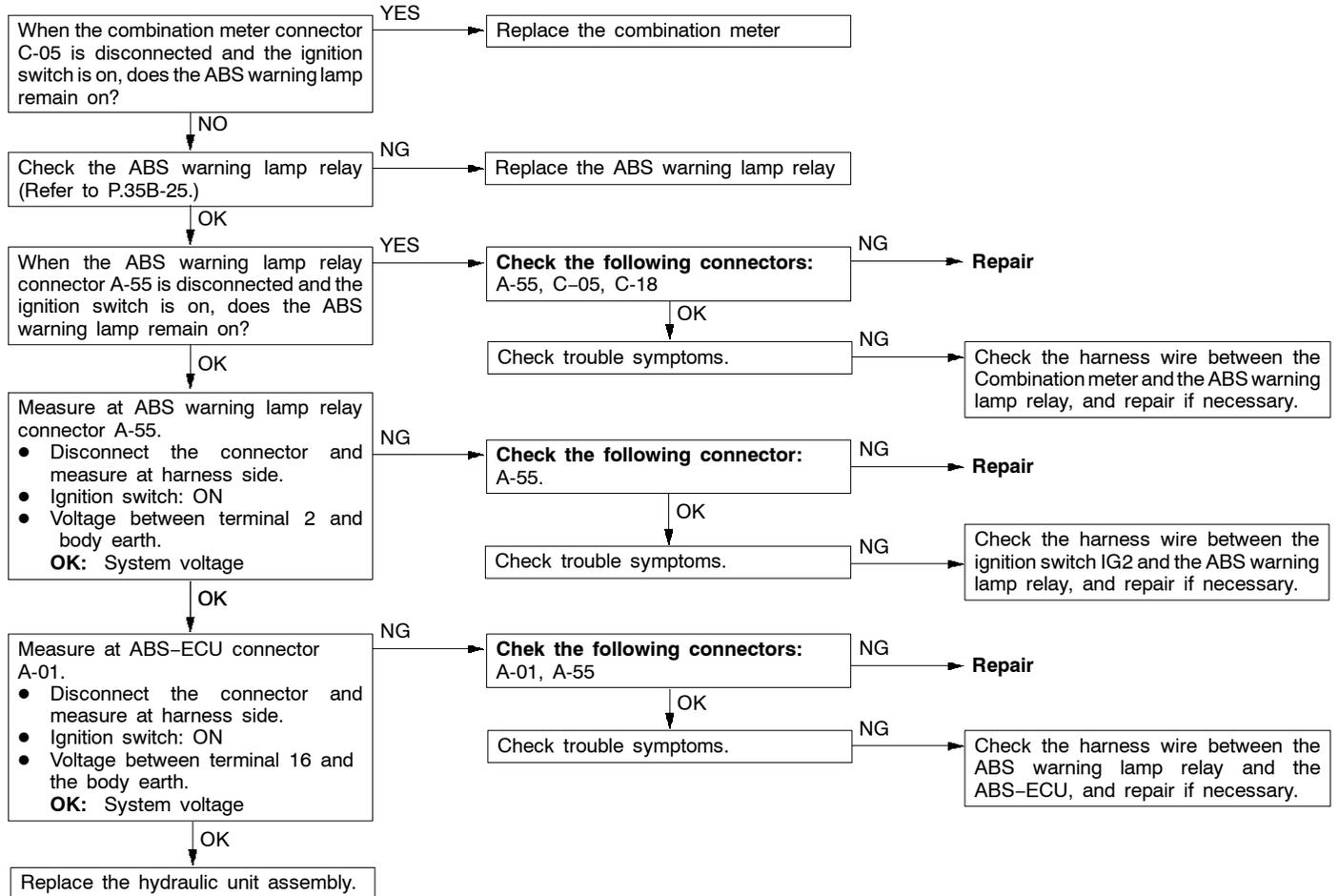


Inspection Procedure 4

The ABS warning lamp remains illuminated after the engine is started.	Probable cause
It is probably a short circuit in the ABS warning lamp circuit.	<ul style="list-style-type: none"> ● Defective combination meter ● Defective ABS warning lamp relay ● Malfunction of wiring or connector ● Defective hydraulic unit assembly

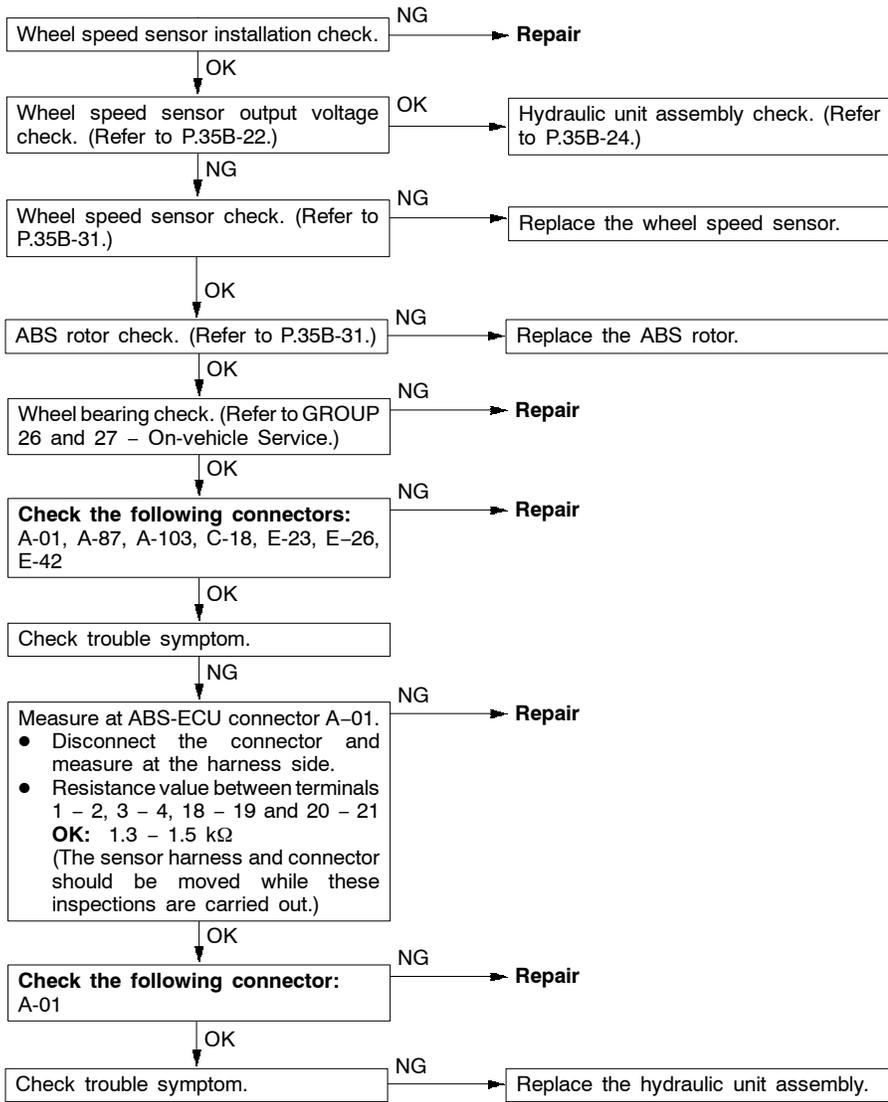
NOTE

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

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 ABS rotor ● Malfunction of wheel bearing ● Malfunction of hydraulic unit assembly



DATA LIST REFERENCE TABLE

35201150299

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
25	4WD position detection switch	Place the transfer lever at 4H.	ON
		Place the transfer lever at 2H.	OFF
26	Free wheel engage switch	Engage 4WD	ON
		Engage 2WD	OFF
32	G-sensor output voltage	Stop the vehicle.	2.4 – 2.6 V
		Perform a test run.	Display value fluctuates with a mean value of 2.5 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.

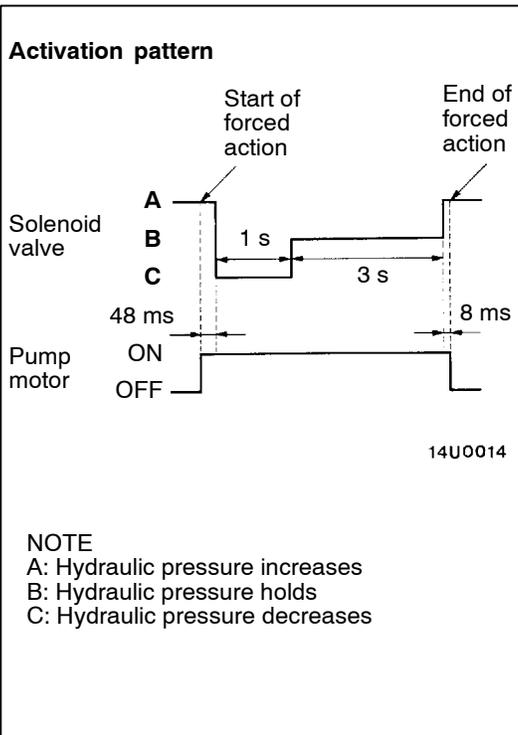
ACTUATOR TEST REFERENCE TABLE

35201160209

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 cancelled.
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 wheel	

CHECK AT ABS-ECU

35201180359

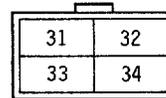
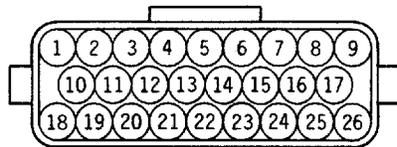
TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (32) and (34) (ground terminals) and each respective terminal.

NOTE

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

2. The terminal layouts are shown in the illustrations below.



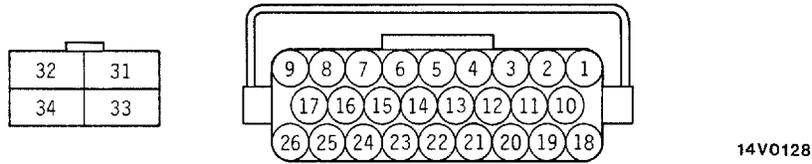
14V0127

Connector terminal No.	Signal	Checking requirement	Normal condition	
6	Engine control module	Ignition switch: "ON" (The motor is on approx.1 second after engine is started)	2 V or less	
7	G-sensor signal	Ignition switch: "ON"	2.38 – 2.62 V	
9	ABS-ECU power supply	Ignition switch: "ON"	System voltage	
		Ignition switch: "START"	0 V	
11	Input from freewheel engage switch	Ignition switch: "ON"	Transfer lever position: "2H"	System voltage
			Transfer lever position: "4H"	0 V

Connector terminal No.	Signal	Checking requirement		Normal condition
12	Input from 4WD detection switch	Ignition switch: ON	Transfer lever position: "2H"	System voltage
			Transfer lever position: "4H"	0 V
13	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: "ON"	System voltage
			Stop lamp switch: "OFF"	0 V
14	G-sensor	Always		0V
16	Control output to ABS warning lamp relay.	Ignition switch: ON	The lamp is switch off.	2 V or less
			The lamp is illuminated.	System voltage
23	MUT-II	Connect the MUT-II		Serial communication with MUT-II
		Do not connect the MUT-II		1 V or less
24	Input from diagnosis indication selection	Connect the MUT-II		0 V
		Do not connect the MUT-II		Approximately 12 V
31	Solenoid valve power supply	Always		System voltage
33	Motor power supply			

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

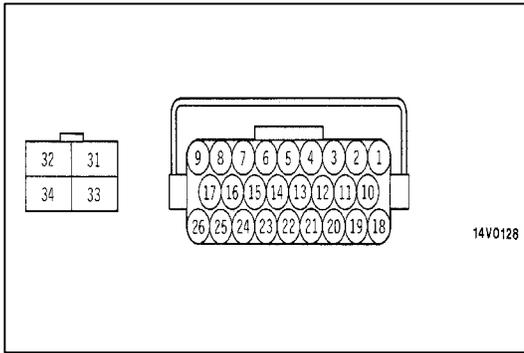
1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustration below.



Connector terminal No.	Signal	Normal condition
20 – 21	Front-left wheel speed sensor	1.3 – 1.5 kΩ
1 – 2	Rear-right wheel speed sensor	1.3 – 1.5 kΩ
18 – 19	Front-right wheel speed sensor	1.3 – 1.5 kΩ
3 – 4	Rear-left wheel speed sensor	1.3 – 1.5 kΩ
32 – body earth	Solenoid valve earth	Continuity
34 – body earth	Motor earth	Continuity

ON-VEHICLE SERVICE

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.	20	18	3	1
	21	19	4	2

Output voltage

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

**When measuring with an oscilloscope:
200 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.

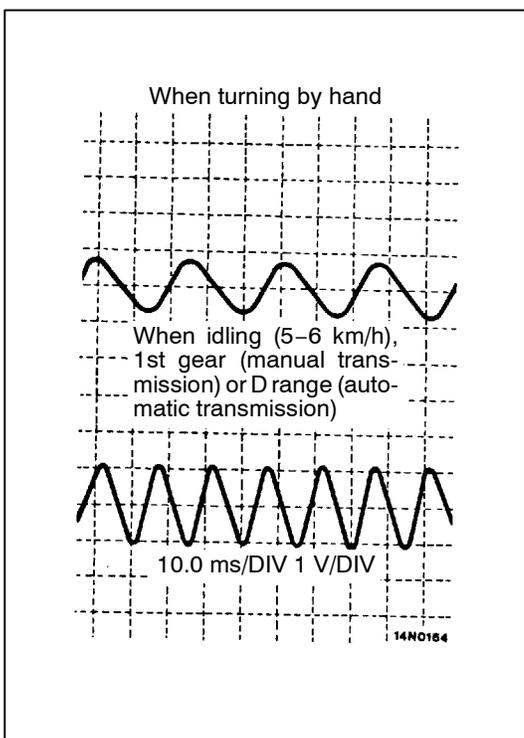
Inspecting Waveforms With An Oscilloscope

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

- Start the engine, and rotate the rear wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the front 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
	ABS rotor with missing or damaged teeth	Replace ABS 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 CHECK

35200170302

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.

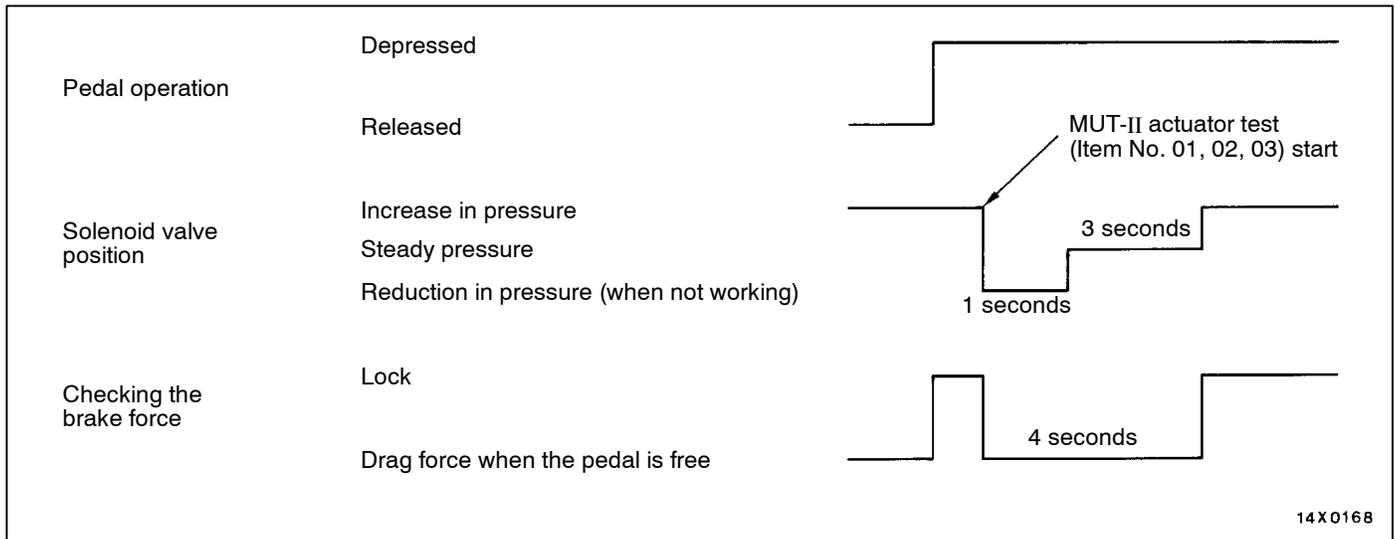
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever is in neutral, start the engine.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

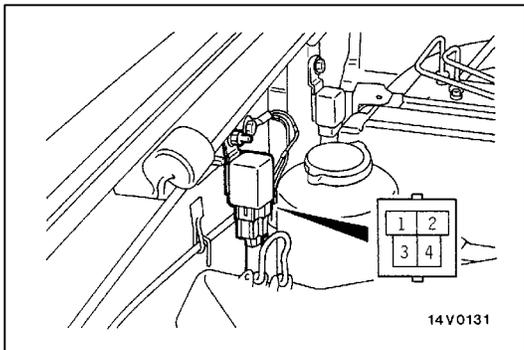
The result should be as shown in the following diagram.



7. If the result of inspection is abnormal, correct according to the “Diagnosis Table” (Refer to P.35B-25).
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

Diagnosis Table

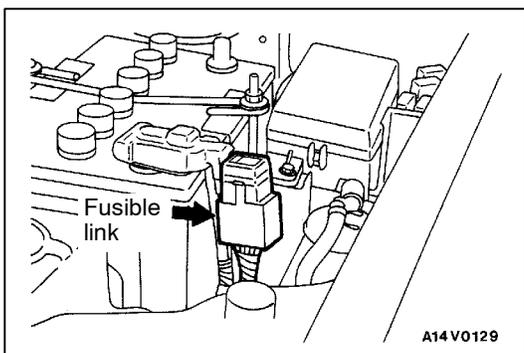
No.	Operation	Judgement – Normal	Judgement – Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 4 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
				Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly



ABS WARNING LAMP RELAY CONTINUITY CHECK

35201090263

Battery voltage	Terminal No.			
	1	2	3	4
Not applied			○	○
Applied	⊖	⊕		



REMEDY FOR A FLAT BATTERY

35200350232

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

Caution

Do not remove the check valve from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

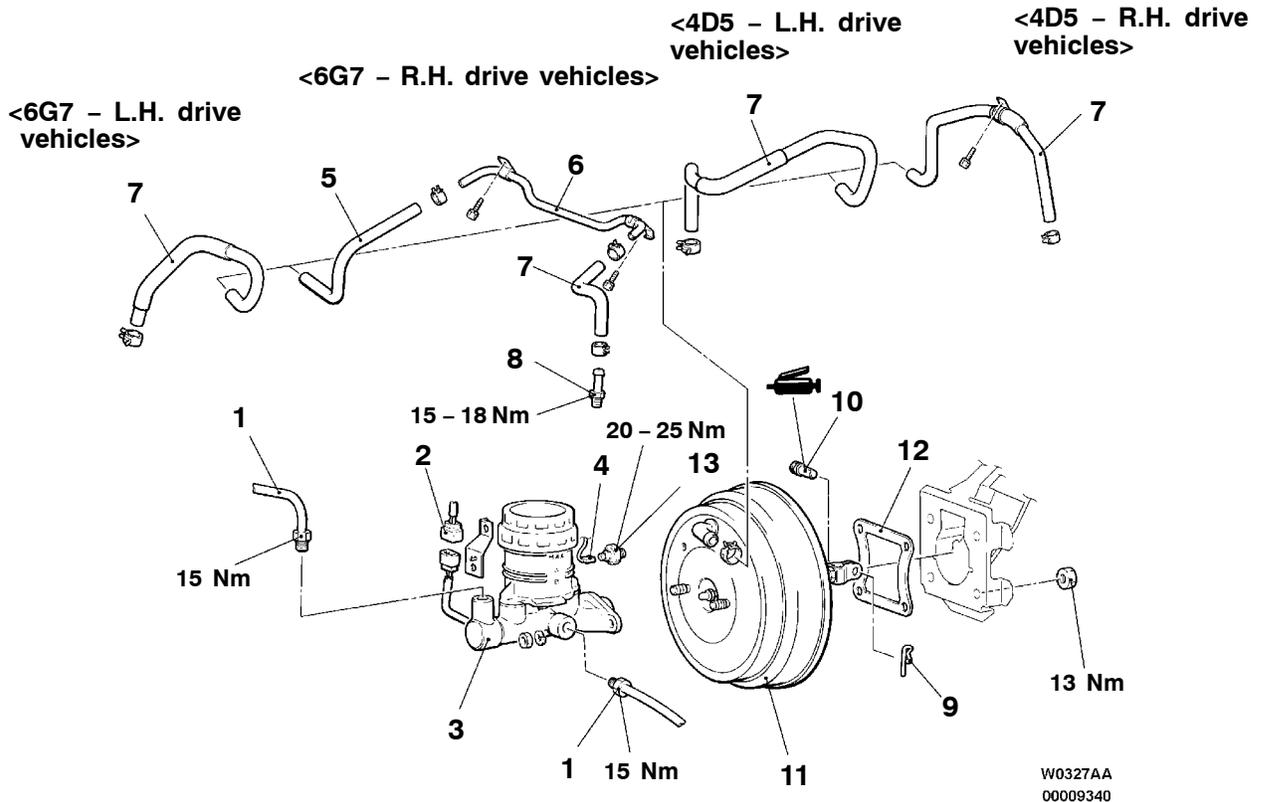
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Brake Pedal Adjustment (Refer to GROUP 35A – On-vehicle Service.)



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00009340

Sealant: 3M ATD Part No. 8661 or equivalent

Removal steps

- | | |
|--|--|
| <p>1. Brake tube connection</p> <p>2. Brake fluid level sensor connector</p> <p>3. Master cylinder assembly</p> <p>►B◀ • Adjustment of clearance between brake booster push rod and primary piston</p> <p>4. Vacuum switch connector <4D5></p> <p>5. Vacuum hose</p> <p>6. Vacuum pipe</p> | <p>►A◀ 7. Vacuum hose (with built-in check valve)</p> <p>8. Fitting</p> <p>9. Snap pin</p> <p>10. Pin assembly</p> <p>11. Brake booster</p> <p>12. Sealer</p> <p>13. Vacuum switch <4D5></p> |
|--|--|

INSTALLATION SERVICE POINTS

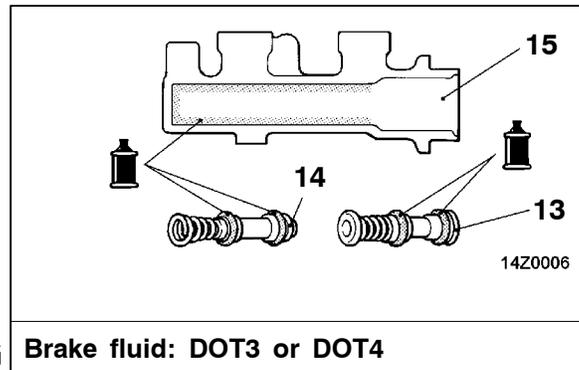
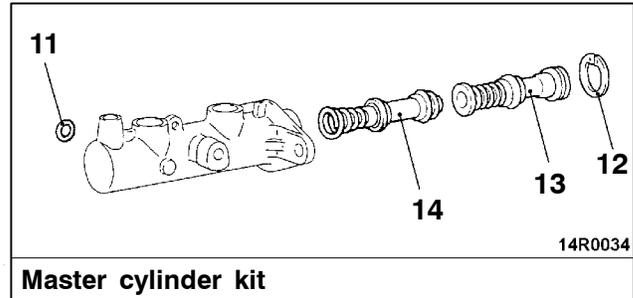
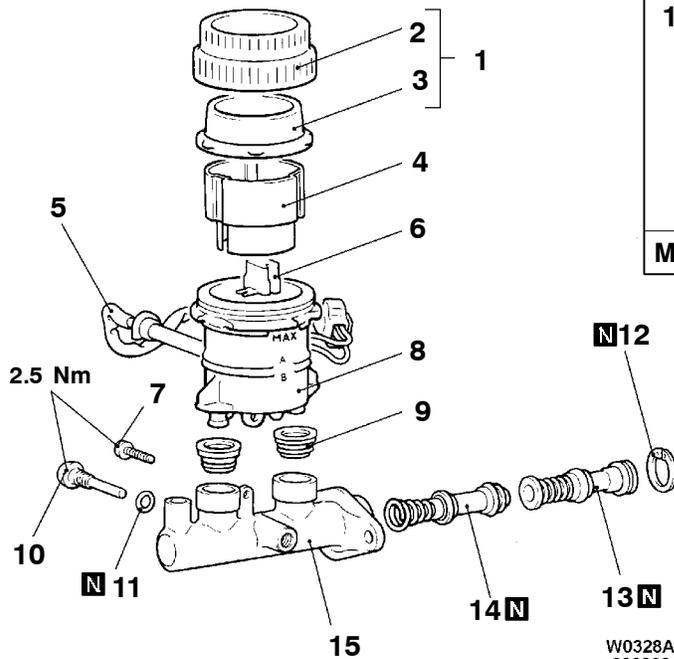
Refer to GROUP 35A – Master Cylinder and Brake Booster.

**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**

35200450178

Caution

Do not disassemble the primary piston and secondary piston assembly.



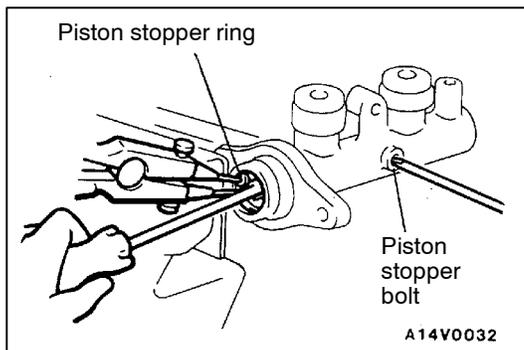
W0328AA
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Disassembly steps

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 POINT

◀▶ PISTON STOPPER BOLT/PISTON STOPPER RING DISASSEMBLY

Remove the piston stopper bolt and piston stopper ring while depressing the piston.

INSPECTION

35200460027

- 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.

HYDRAULIC UNIT

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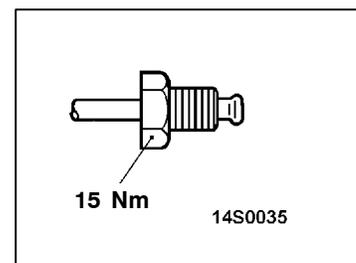
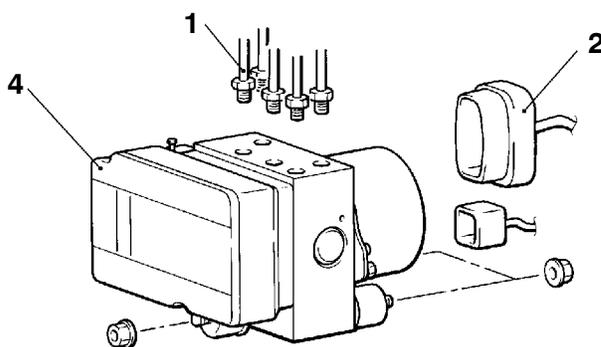
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

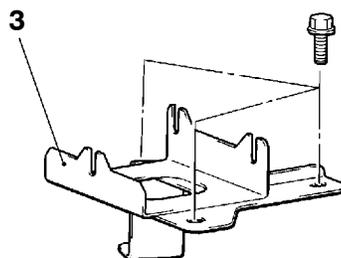
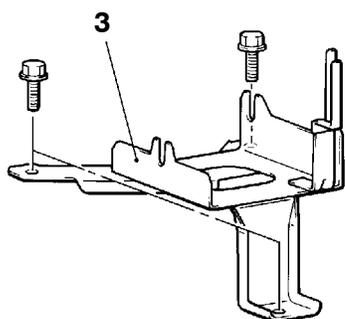
Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)



<6G7, 4D5 – R.H. drive vehicles>

<4D5 – L.H. drive vehicles>

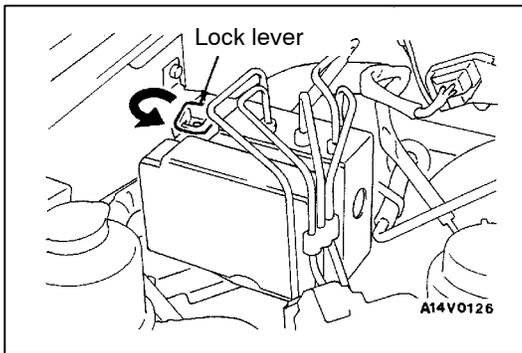


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Removal steps

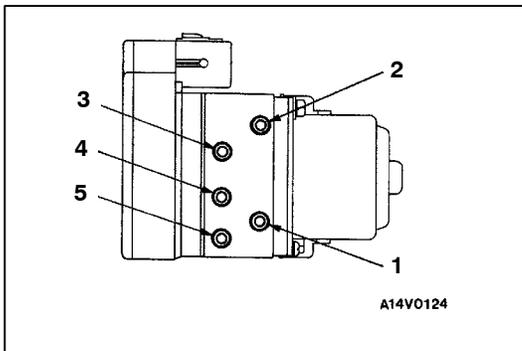
- ▶A◀
 ◀A▶ 1. Brake tube
 ◀B▶ 2. Harness connector
 3. Bracket assembly
 4. Hydraulic unit assembly

**REMOVAL SERVICE POINTS****◀A▶ HARNESS CONNECTOR REMOVAL**

Turn the lock lever in the direction shown in the illustration, and remove the harness.

◀B▶ HYDRAULIC UNIT REMOVAL**Caution**

1. The hydraulic unit assembly is heavy. Use care when removing it.
2. The hydraulic unit assembly cannot be disassembled. Never loosen its nuts or bolts.
3. Do not drop or shock the hydraulic unit assembly.
4. Do not turn the hydraulic unit assembly upside down or lay it on its side.

**INSTALLATION SERVICE POINT****▶A◀ BRAKE TUBE INSTALLATION**

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

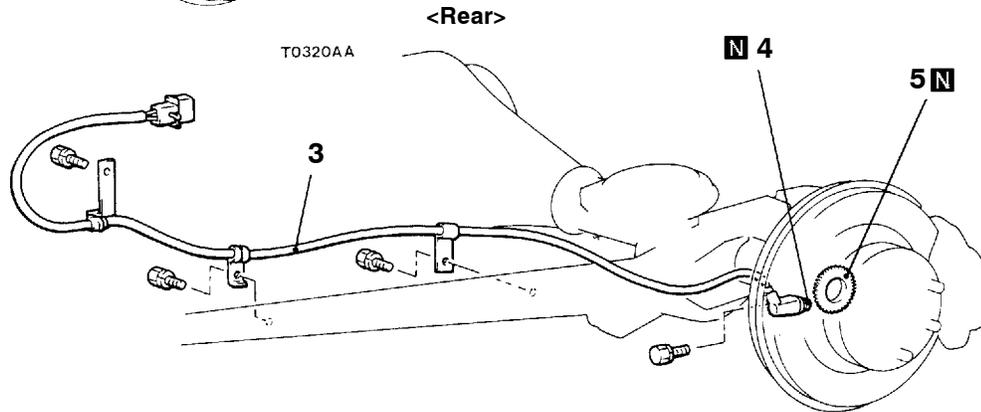
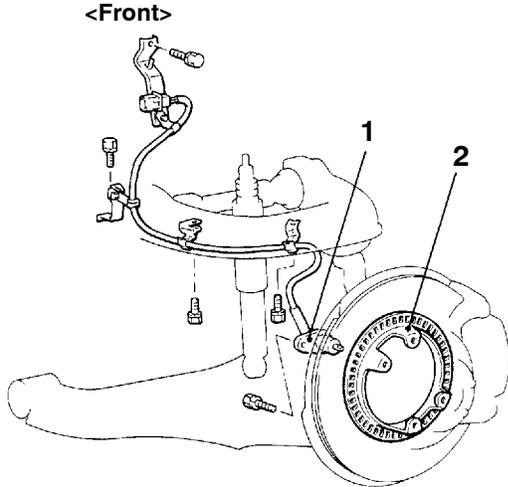
1. Master cylinder and load sensing proportioning valve <Front system>
2. Master cylinder <Rear system>
3. Load sensing proportioning valve <Rear system>
4. Front brake <R.H.>
5. Front brake <L.H.>

WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation

- Wheel Speed Sensor Output Voltage Measurement (Refer to P.35B-22.)



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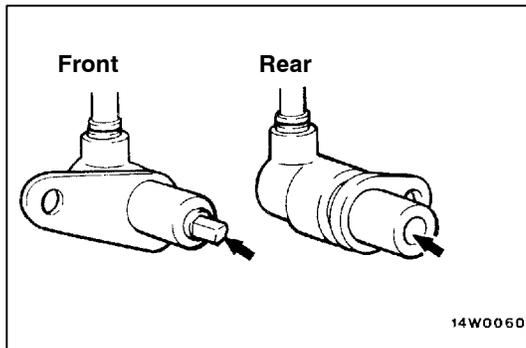
Rear speed sensor removal steps



1. Front speed sensor
2. Front ABS rotor (Refer to Group 26 - Front Hub Assembly.)
5. Rear ABS rotor (Refer to Group 27 - Axle Shaft.)



3. Rear speed sensor
4. O-ring



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 contacting other parts.

35200840289

INSPECTION**SPEED SENSOR CHECK**

1. Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip. Remove any foreign material.
Also check whether the pole piece is damaged. Replace it with a new one if it is damaged.

NOTE

The pole piece can become magnetized due to the magnet inside the speed sensor, causing foreign material to easily adhere to it. The pole piece may not be able to correctly sense the wheel rotation speed if foreign matter is on it or if it is damaged.

2. Measure the resistance between the speed sensor terminals.

Standard value: 1.3 – 1.5 k Ω

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

3. 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

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

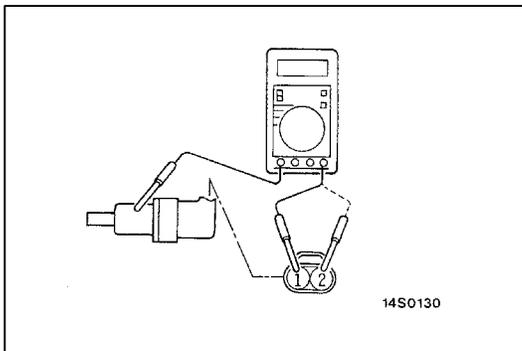
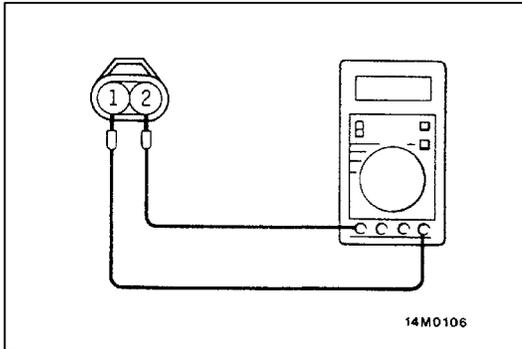
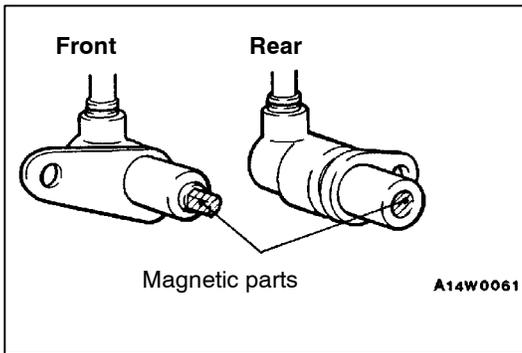
4. Check the speed sensor cable for breakage, damage or disconnection. Replace with a new one if a problem is found.

NOTE

When checking for cable damage, remove the cable clamp part from the body and then gently bend and pull the cable near the clamp.

TOOTHED ABS ROTOR CHECK

Inspect to see if the ABS rotor is deformed or broken, and if faulty replace it with a new one.



G-SENSOR

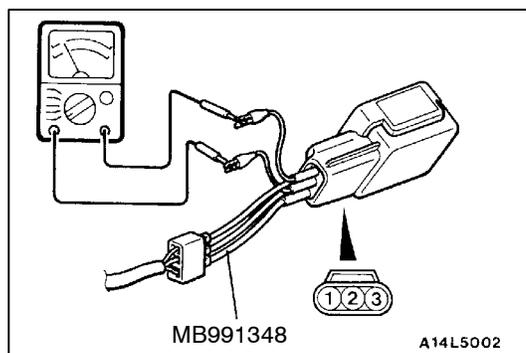
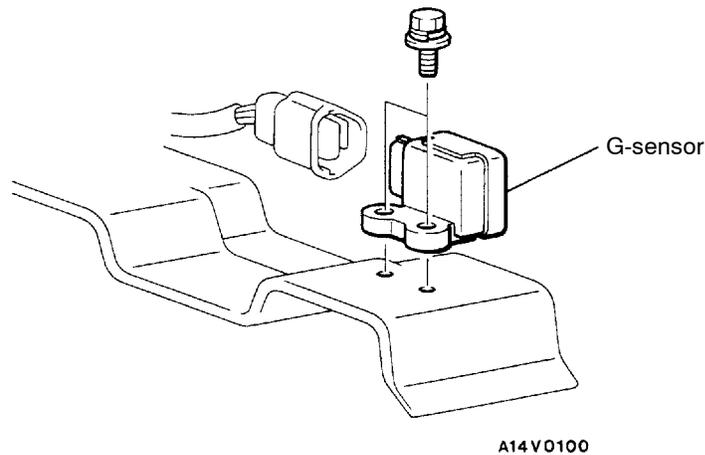
REMOVAL AND INSTALLATION

Caution

Do not drop or apply a shock on the G-sensor.

Pre-removal and Post-installation Operation

- Front and Rear Console Assembly Removal and Installation (Refer to GROUP 52A – Floor Console.)



INSPECTION

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G-SENSOR CHECK

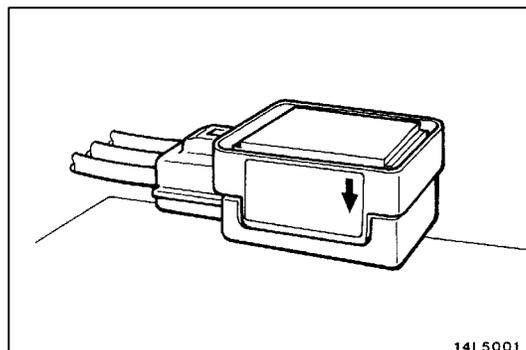
1. Disconnect the G-sensor connector and connect special tool, between terminals of the disconnected connector.
2. With the ignition switch turned ON, read the voltage between terminals No. 2 and 3.

Standard value: 2.4 – 2.6 V

3. With special tool connected, rotate the sensor so that the arrow faces straight down. Read output voltage between terminals No. 2 and 3.

Standard value: 3.4 – 3.6 V

4. If the voltage deviates from the standard value, make sure that nothing is wrong with the power supply wire and ground wire and then replace the G-sensor.



GROUP 35B

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

GENERAL

OUTLINE OF CHANGE

The following service procedure has been added due to the addition of an Electronic Brake force Distribution (EBD).

EBD CONTROL

In ABS, electronic control method is used whereby the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration and the front and rear wheel slippage which are calculated from the signals received from the various wheel sensors. EBD control is a control system which provides a high level of control for both vehicle braking force and vehicle stability. The system has the following features:

- Because the system provides the optimum rear wheel braking force regardless of the vehicle

laden condition and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily laden or driving on road surfaces with high frictional coefficients.

- Because the duty placed on the front brakes has been reduced, the increases in pad temperature can be controlled during front brakes applying to improve the wear resistance characteristics of the pad.
- Control valves such as the proportioning valve are no longer required.

ON-VEHICLE SERVICE

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. If this happens, recharge the battery fully.

Caution

The vehicle posture will be unstable during braking, so do not drive the vehicle with the ABS-ECU connector disconnected or with the ABS not operating for any other reason.