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

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

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35209000121

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must throughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before begining any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

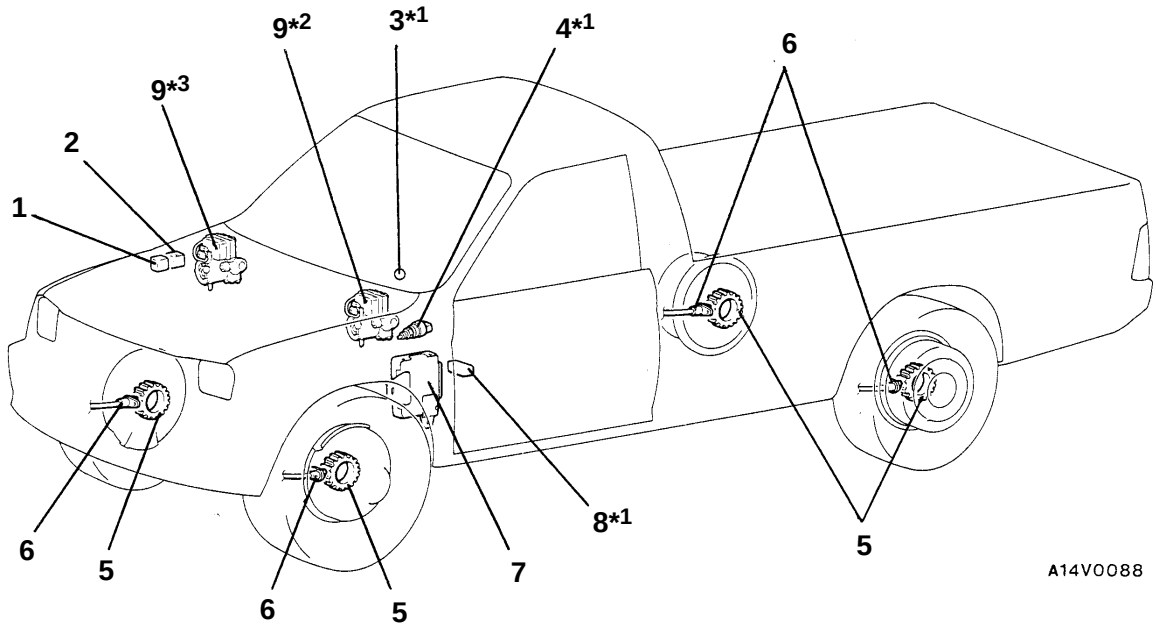
GENERAL INFORMATION

35200010123

The ABS consists of wheel speed sensors, stop lamp switch hydraulic unit and the ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnosis function, and the trouble symptom memory will not be erased even if the ignition switch is turned to OFF. (However, it will be erased if the battery is disconnected.)
In addition, reading of diagnosis codes and data list and actuator testing are possible using the MUT-II.

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	47
Rear rotor teeth	47

CONSTRUCTION DIAGRAM



NOTE
*1: For R.H. drive vehicles, those parts are installed at the right side.
*2: Diesel-powered vehicles-L.H. drive vehicles.
*3: Except diesel-powered vehicles-L.H. drive vehicles.

1. ABS motor relay
2. ABS valve 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

35200030136

Items		Standard value	Limit
Booster push rod to master cylinder piston clearance mm	Diesel-powered vehicles	0.70 – 1.10	–
	Petrol-powered vehicles	0.90 – 1.30	–
Front disc brake pad thickness mm		10	2.0
Hydraulic unit solenoid valve internal resistance Ω	OUT	2.2	–
	IN	5.0	–
Speed sensor's internal resistance kΩ		1.2 – 1.4	–
Speed sensor insulation resistance kΩ		100 or more	–

LUBRICANTS

35200040023

Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal	Repair kit grease
Guide pin boot inner surfaces	
Lock pin boot inner surfaces	
Piston boot mounting grooves	
Brake piston boot inner surfaces	
Lock pin bush inner surfaces	
Piston cup surface	

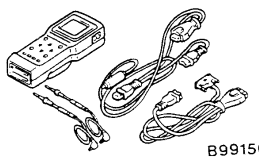
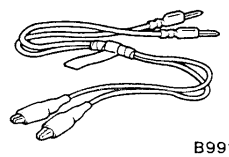
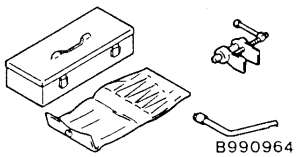
SEALANTS

35200050057

Items	Specified sealant	Remarks
Vacuum switch	3M ATD Part No. 8661 or equivalent	Semi-drying sealant

SPECIAL TOOLS

35200060135

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)
 B990964	MB990964 MB990520	Brake tool set	Pushing-in of the disc brake piston

TROUBLESHOOTING

35201110143

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	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.
Shock during system operation check	Shock may be felt when the brake pedal is depressed slightly at a low driving speed. This occurs due to ABS operation check (initial check at a vehicle speed of 8 km/h), and does not indicate any malfunction.

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

35201120108

DIAGNOSIS CODES CHECK

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

ERASING DIAGNOSIS CODES

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

INSPECTION CHART FOR DIAGNOSIS CODES

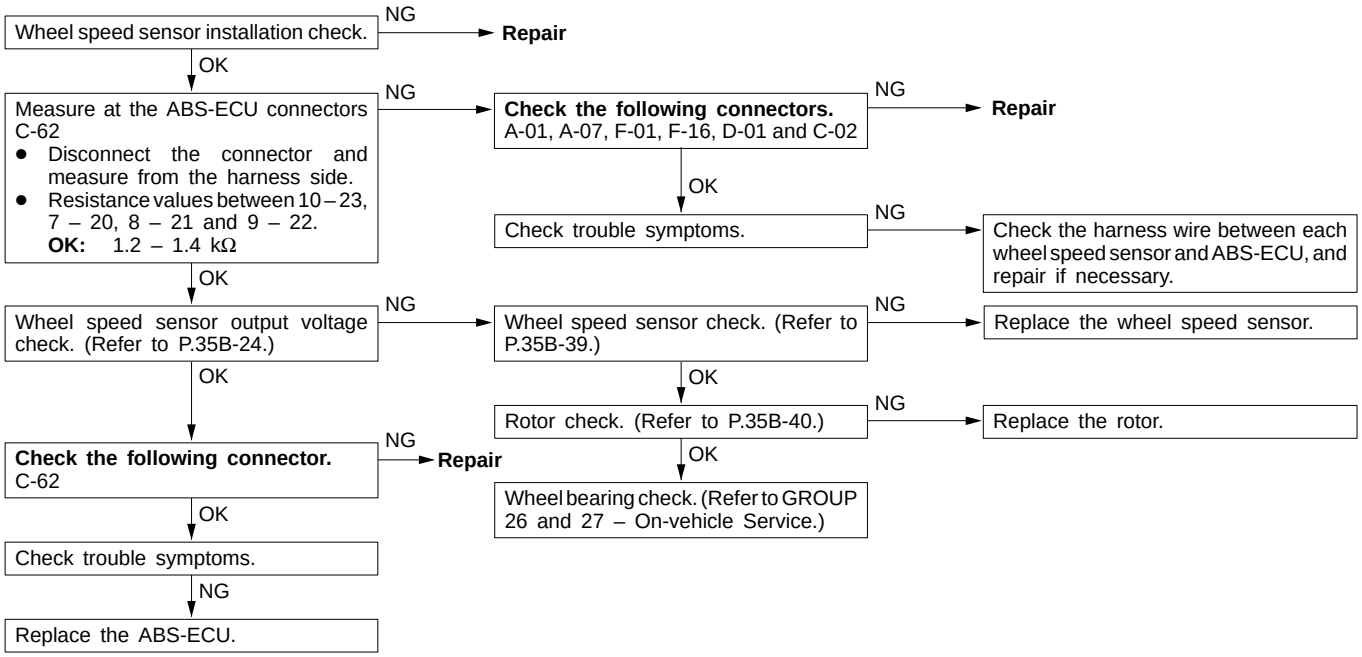
35201130156

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

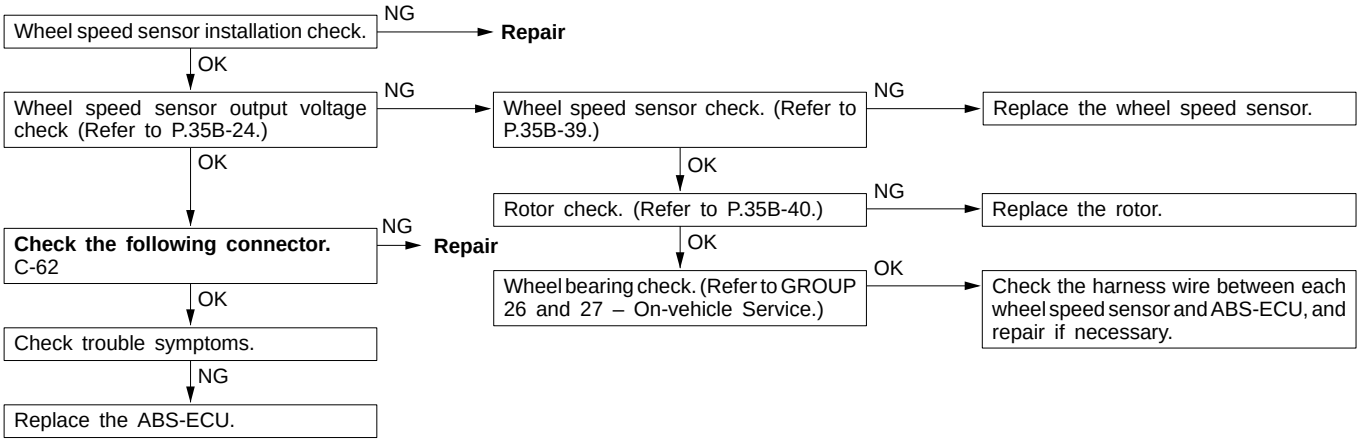
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open or short circuit	35B-7
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	35B-8
16	Power supply 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		
33	Stop lamp switch system		35B-9
41	Front right solenoid valve		35B-10
42	Front left solenoid valve		
43	Rear solenoid valve		
51	Valve relay		35B-11
53	Motor relay, motor		35B-12
63	ABS-ECU		35B-41 (Replace the ABS-ECU)
64			

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit or short circuit **Code No. 21, 22, 23, 24 Wheel speed sensor abnormal**	**Probable cause**
The ABS-ECU determines that an open circuit or short circuit occurs in more than one line of wheel speed sensors.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of ABS-ECU
These codes are output at the following times: • 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.	• Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU

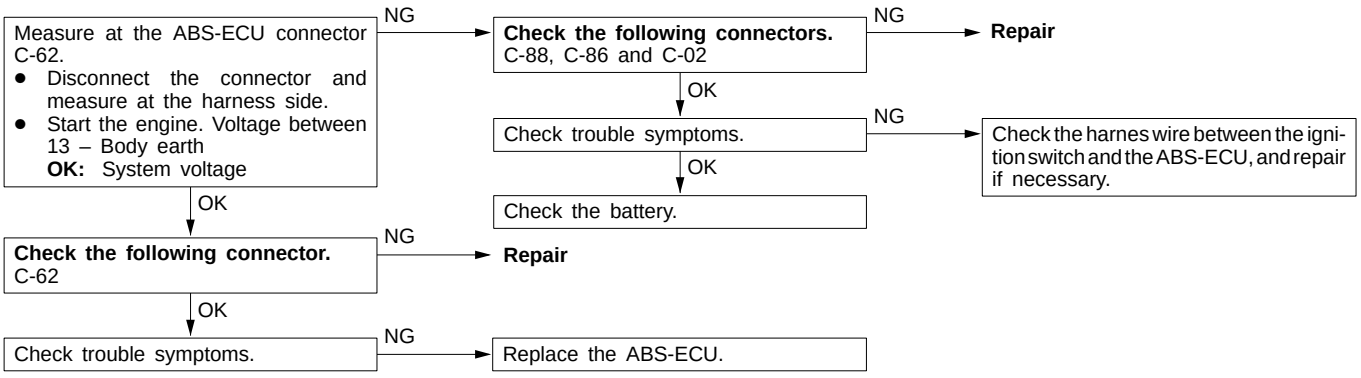


Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU

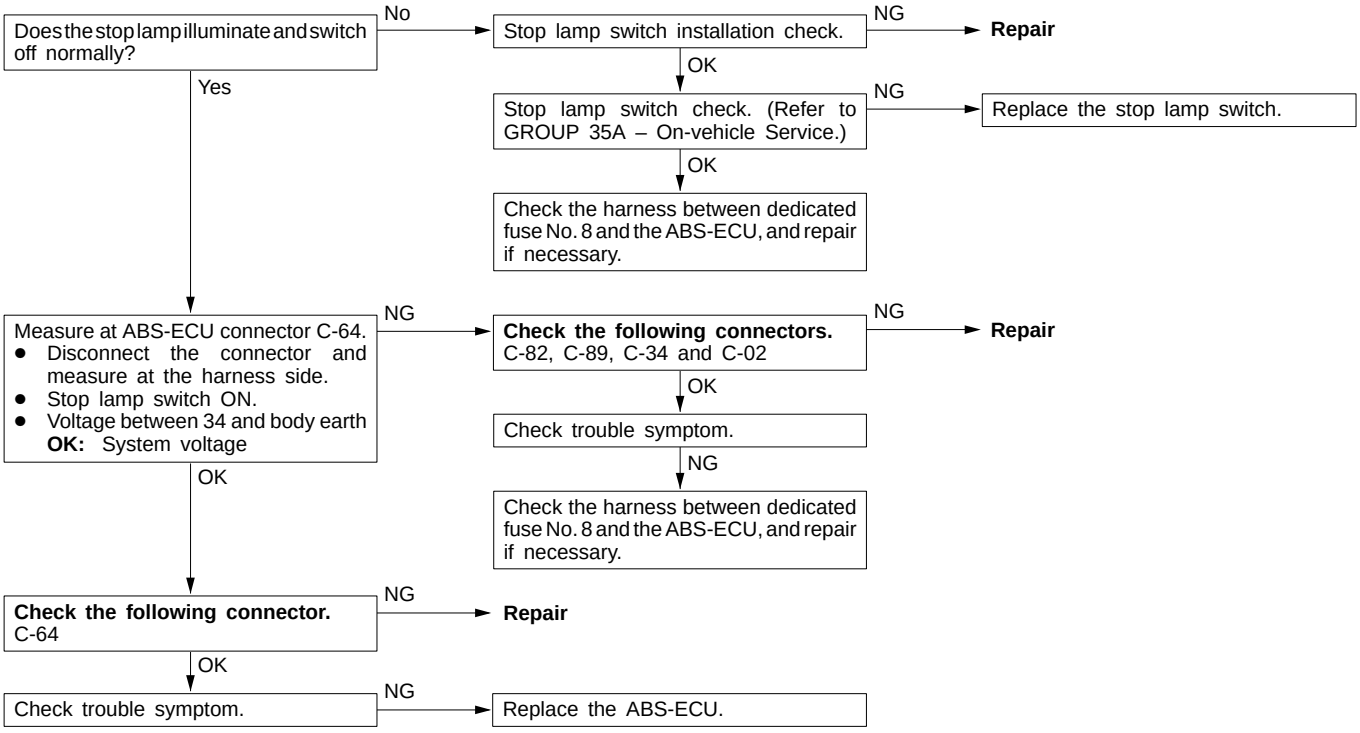


Code No. 16 Power supply system	Probable cause
The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	• Malfunction of wiring harness or connector. • Malfunction of ABS-ECU

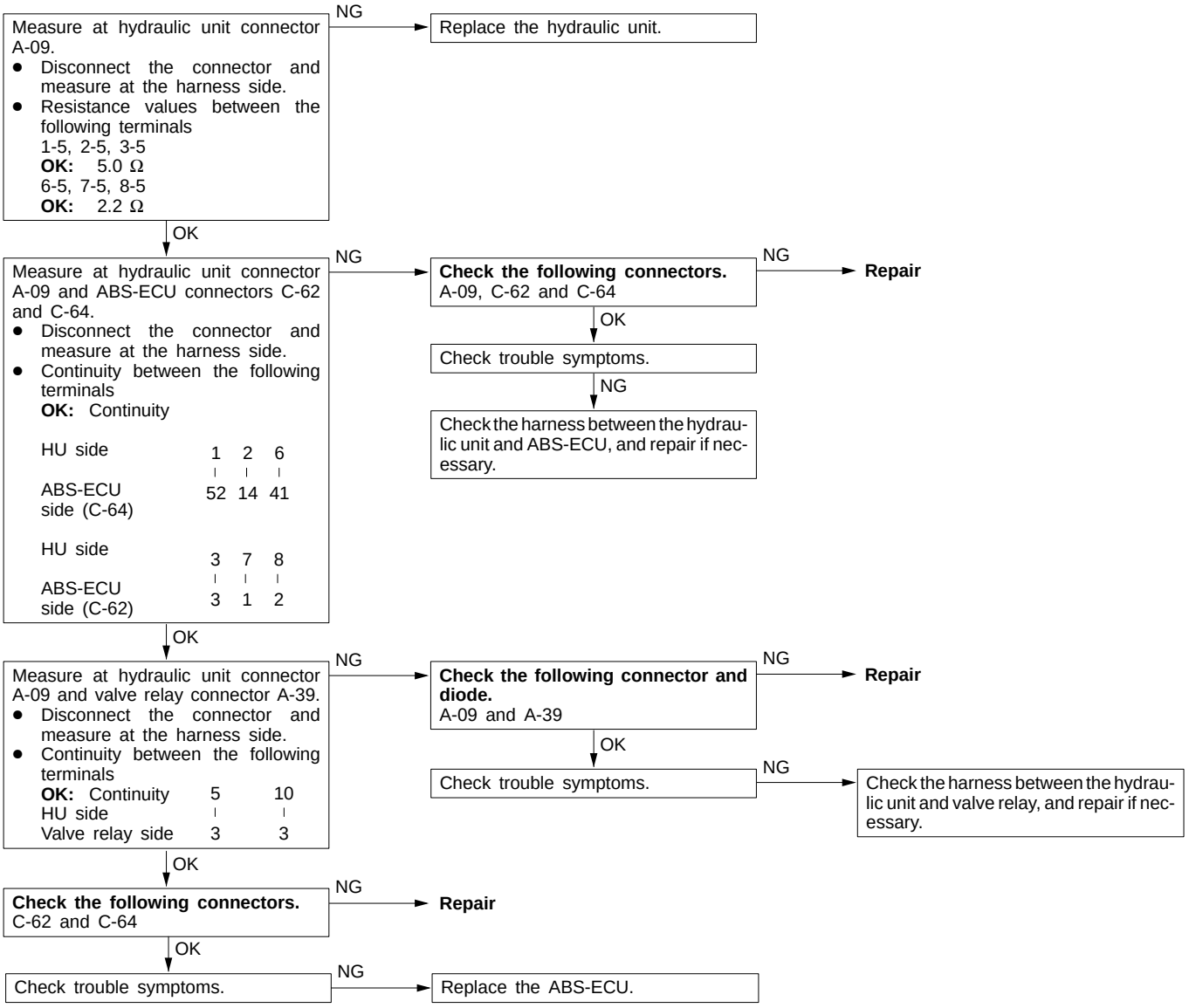
Caution
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.
Before carrying out the following inspection, check the battery level, and refill distilled water if necessary.



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 ABS-ECU

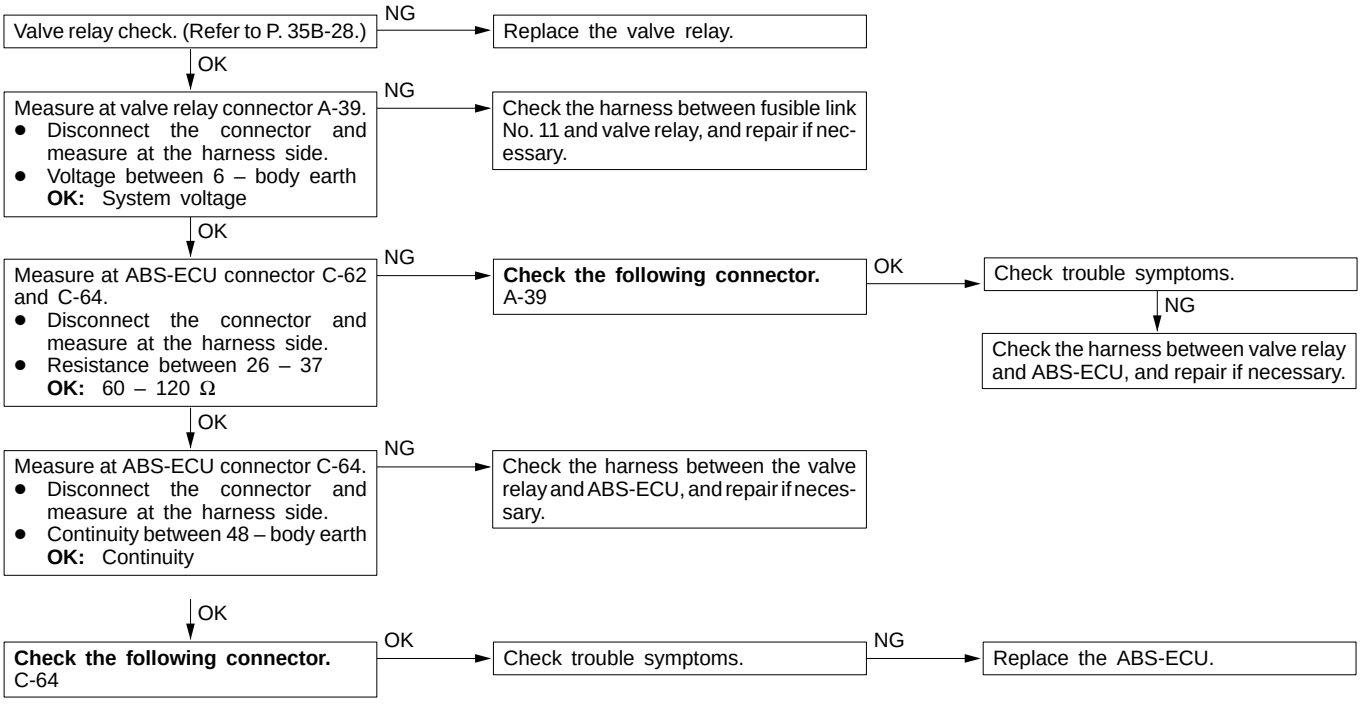


Code No. 41, 42, 43 Solenoid valve	Probable cause
The ABS-ECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness: When no current flows in the solenoid even though the ABS-ECU turns on it, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU



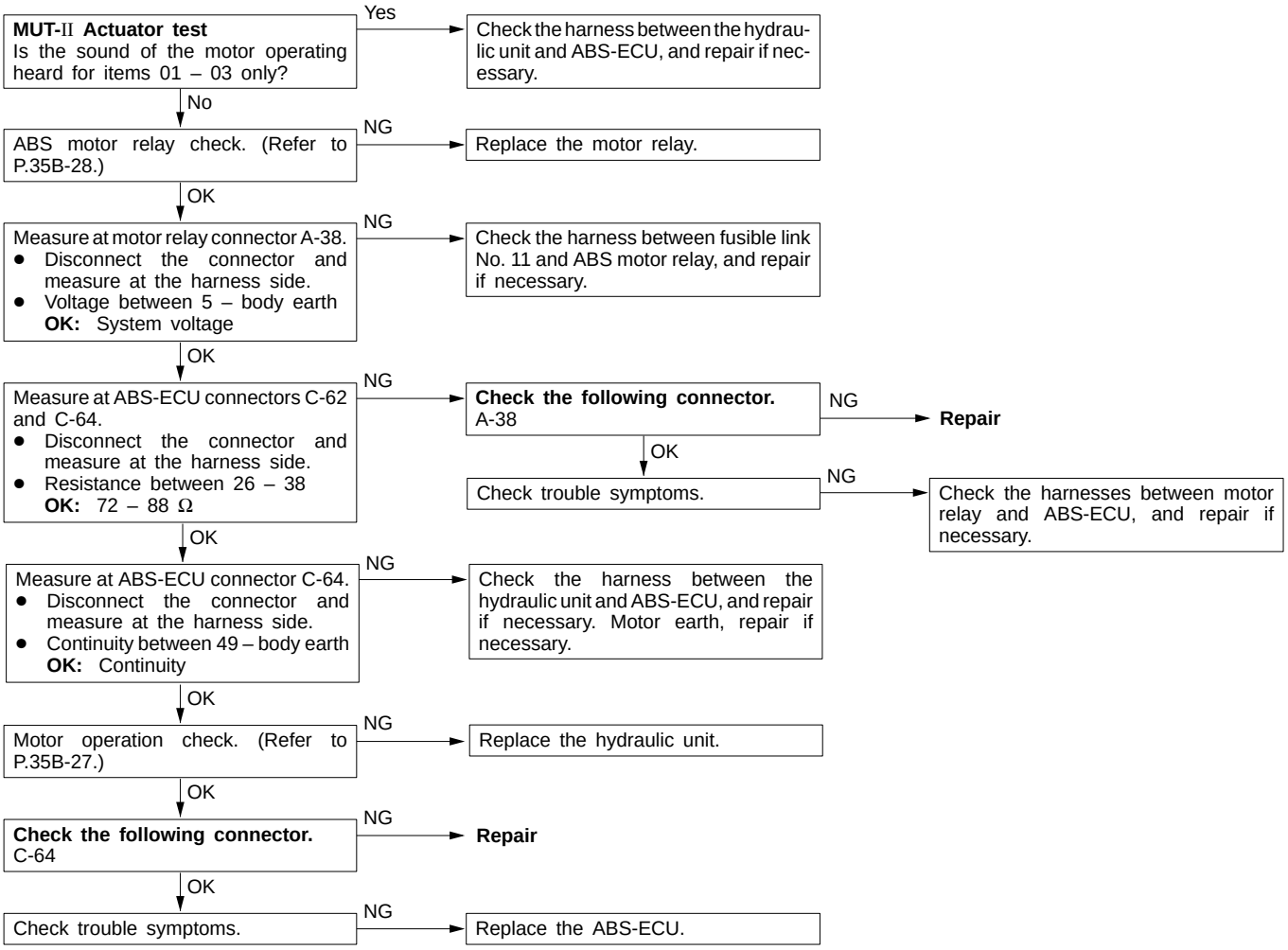
Code No. 51 Valve relay	Probable cause
When the ignition switch is turned to ON, the ABS-ECU switches the valve relay off and on during the initial check. In that way, the ABS-ECU compares the signals sent to the valve relay with the voltage in the valve power monitor line. That is how to check if the valve relay is operating normally. The ABS-ECU always checks if current flows in the valve power monitor line, too. It determines that there is an open circuit when no current flows. If no current flows in the valve power monitor line, this diagnosis code is output.	• Malfunction of valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

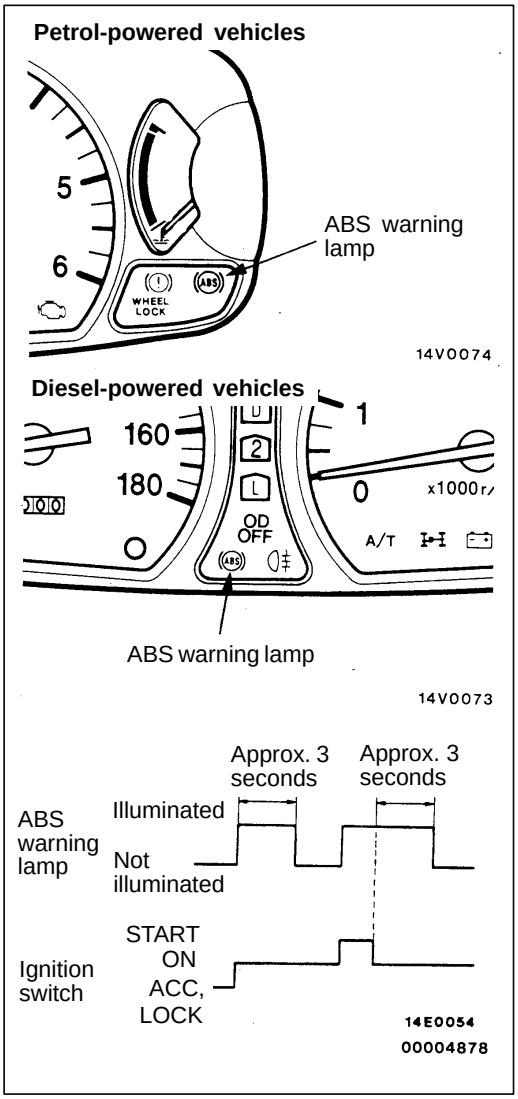
NOTE
Whenever reading the diagnosis codes using the ABS warning lamp (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points), this diagnosis code will be output. That is not a malfunction but because the valve relay connector is disconnected. After repairing all other malfunctions, 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
These codes are output at the following times: 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 for 5 seconds or more (motor continues operating, etc.) When the motor relay does not operate	• Malfunction of motor relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit • Malfunction of ABS-ECU

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.





ABS WARNING LAMP INSPECTION 35201200079

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.

NOTE

*: The warning lamp may continue to illuminate until the vehicle speed reaches 8 km/h after the ignition switch is turned on. If the ABS-ECU has stored one of the diagnosis codes Nos.21 to 24 or No.53 as a former malfunction, the ECU attempts to detect the malfunction at 8 km/h. Until the speed reaches 8 km/h, the ABS-ECU illuminates the warning lamp.

INSPECTION CHART FOR TROUBLE SYMPTOMS

35201140142

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-15
	Communication with ABS only is not possible.	2	35B-15
When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.		3	35B-16
After the engine starts, the ABS warning lamp remains illuminated.		4	35B-16
When the ignition key is turned to “START”, the ABS warning lamp does not illuminate.		5	35B-17
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	35B-17
Faulty ABS operation	Unequal braking power on both sides	7	35B-18
	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

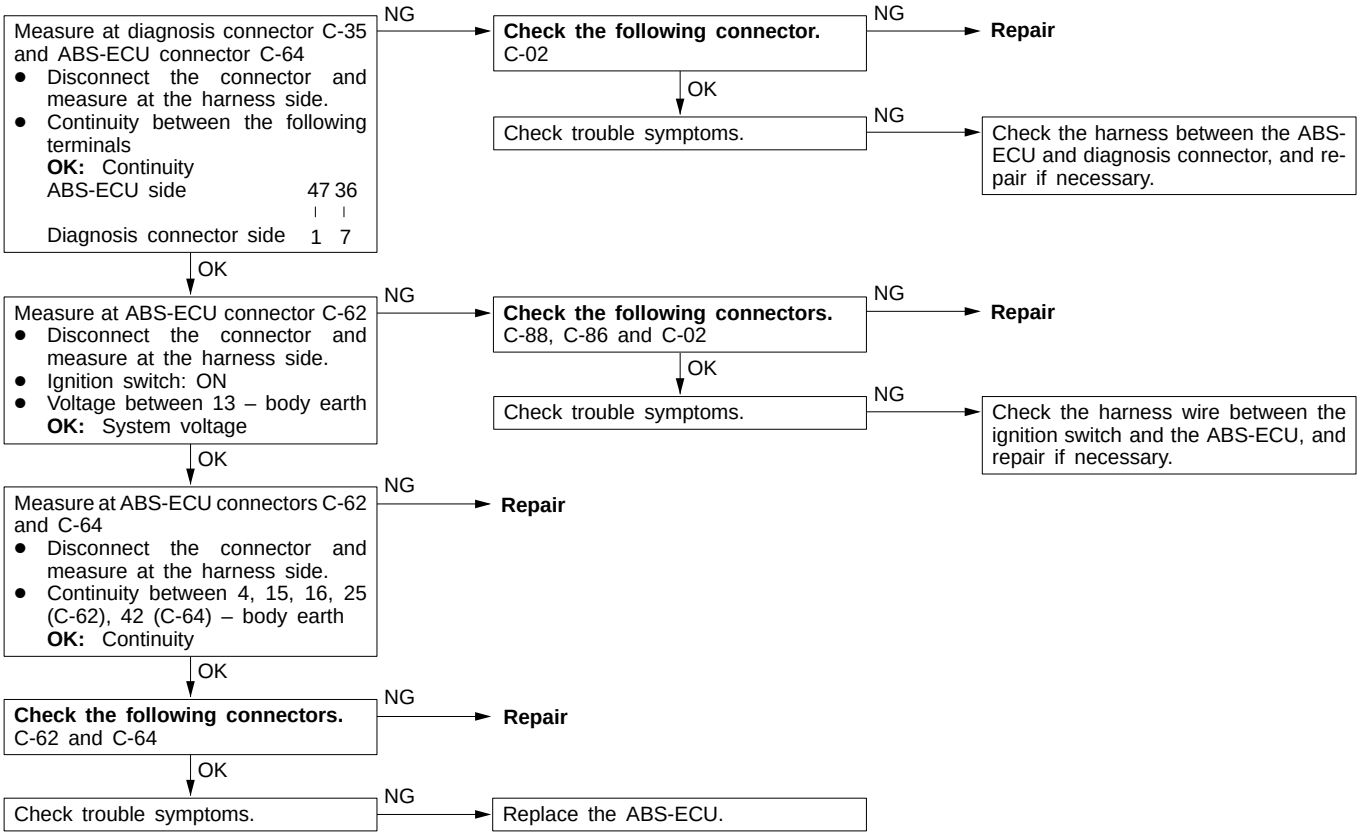
Inspection Procedure 1

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.	• Malfunction of connector • Malfunction of harness

Refer to GROUP 13A – Troubleshooting.

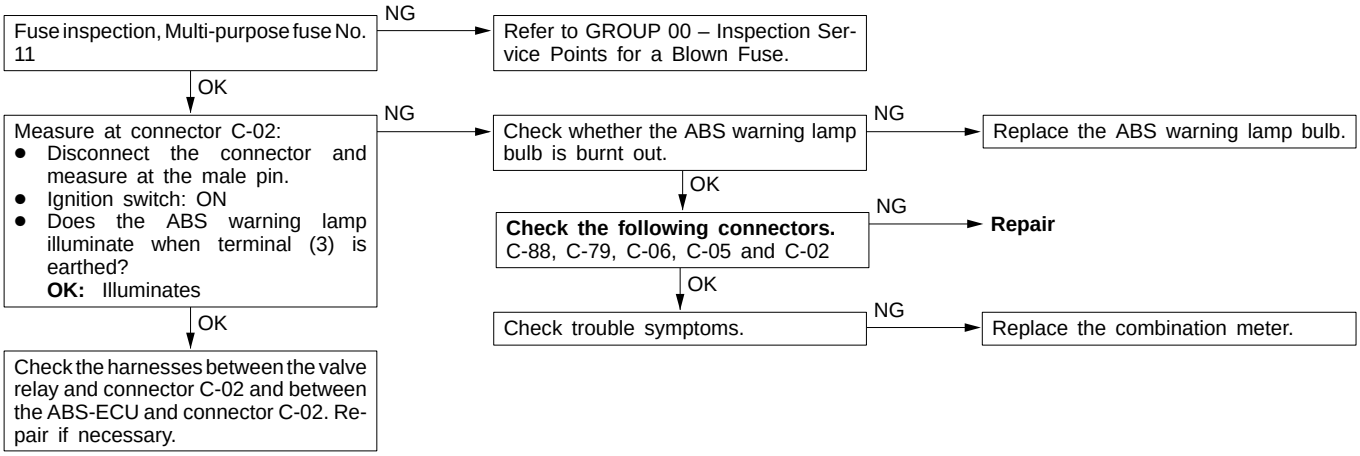
Inspection Procedure 2

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.	• Blown fuse • Malfunction of wiring harness or connecter • Malfunction of ABS-ECU



Inspection Procedure 3

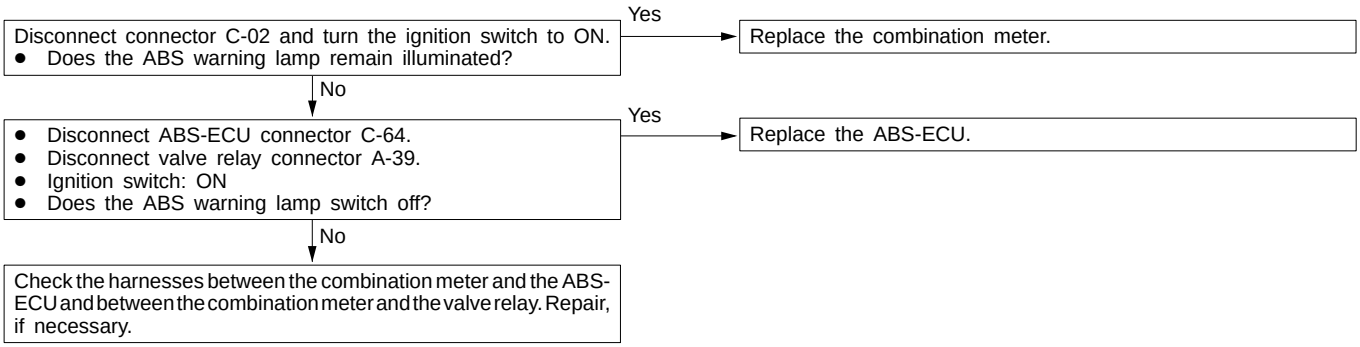
When ignition key is turned to "ON" (engine stopped), ABS warning lamp does not illuminate.	Probable cause
When current flows in the ABS-ECU, the valve relay turns from off to on, off and back to on again as the initial check. So the ABS warning lamp will illuminate twice when the valve relay is off even if there is a problem with the circuit between the ABS warning lamp and the ABS-ECU. Therefore, if the lamp does not illuminate, 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 and in the circuit between the ABS warning lamp and the valve relay.	• Blown fuse • Burnt out ABS warning lamp bulb • Malfunction of wiring harness or connector



Inspection Procedure 4

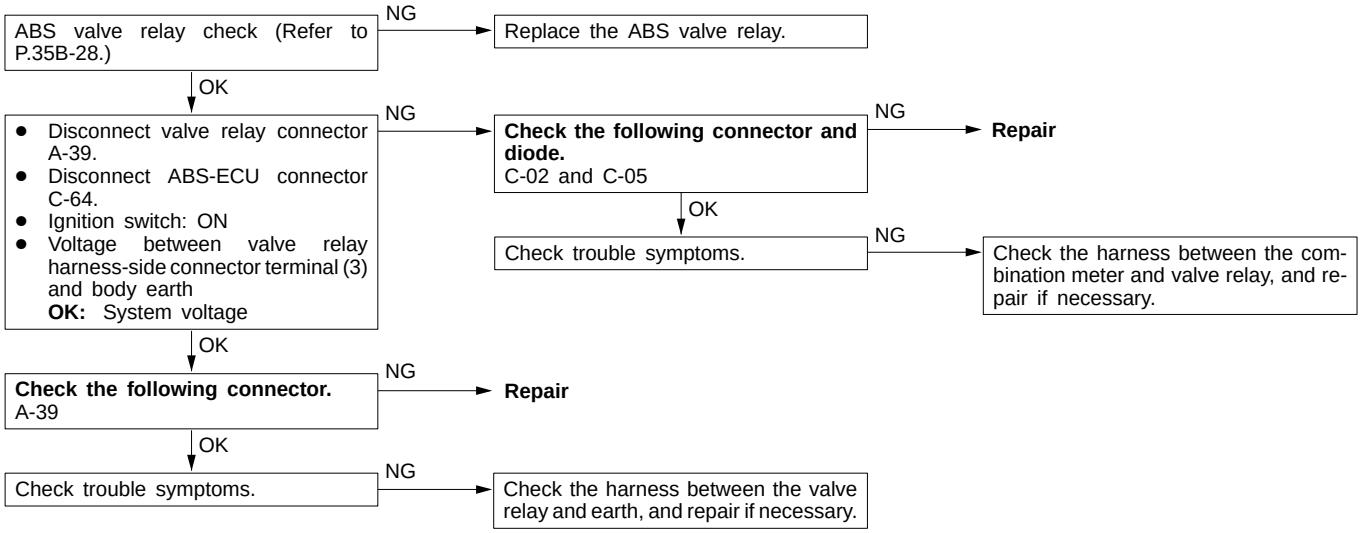
Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	• Malfunction of combination meter • Malfunction of ABS-ECU • Malfunction of wiring harness

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.



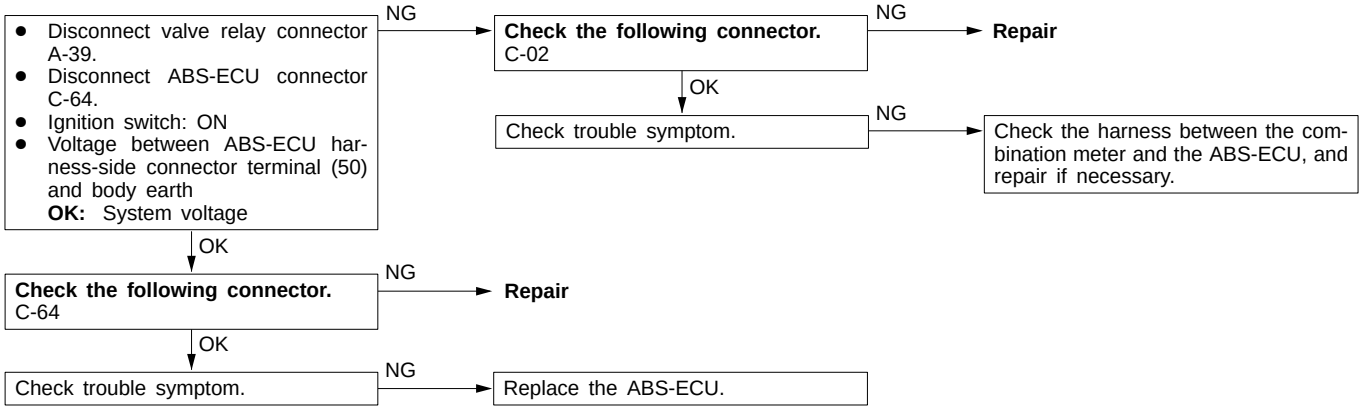
Inspection Procedure 5

When ignition key is turned to "START", 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.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU



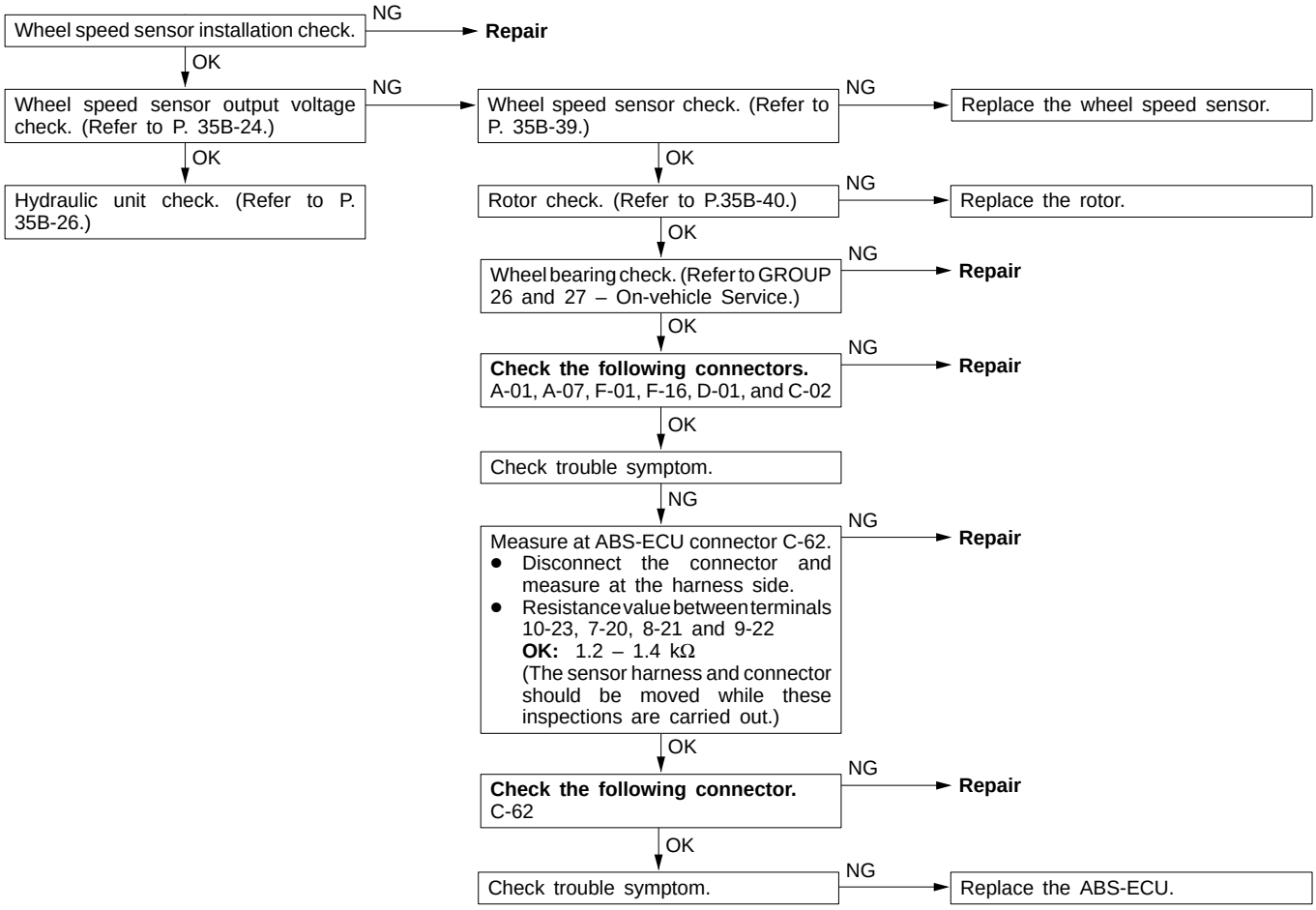
Inspection Procedure 6

The ABS warning lamp flashes twice after the ignition key is turned to "ON". The lamp illuminates when the ignition key is turned to "START", and when the key is returned to "ON", it flashes once.	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.	• 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.	• 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

35201150091

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.

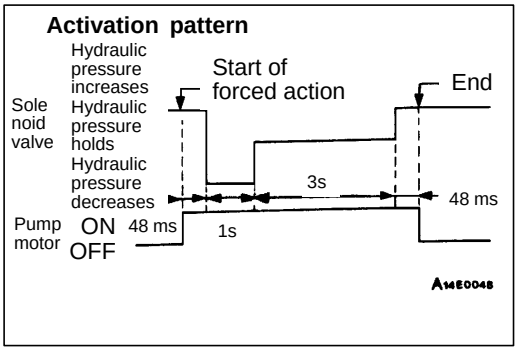
When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

35201160049

The MUT-II activates the following actuators for testing.

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



ACTUATOR TEST SPECIFICATIONS

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

CHECK AT ABS-ECU

35201180120

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (15), (16), (25) and (42) (earth terminals) and each respective terminal.
2. The terminal layouts are shown in the illustrations below.

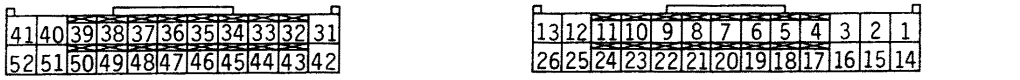
14W0043

Connector terminal No.	Signal	Checking requirements		Normal condition
1	Output to front-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
2	Output to rear hydraulic unit solenoid valve (OUT side)			
3	Output to rear hydraulic unit solenoid valve (IN side)			
13	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
14	Output to front-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
26	Output to relay power supply	Ignition switch: ON		System voltage
32	Memory power supply	Always		System voltage
34	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less
36	MUT-II	Connect the MUT-II.		Serial communication with MUT-II.
		Do not connect the MUT-II.		1 V or less
37	Output to valve relay	Ignition switch: ON	Approximately 1 second after engine is started, the relay is on.	2 V or less
			The system runs down. The relay is off.	System voltage
38	Output to motor relay	Ignition switch: ON Approximately 1 second after engine is started	Motor is on.	2 V or less
			Motor is off.	System voltage
39	Idle-up solenoid valve (+)	Ignition switch: ON (The motor is on approximately 1 second after engine is started.)		System voltage
41	Output to front-right hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started.)		System voltage

Connector terminal No.	Signal	Checking requirements		Normal condition
43	Idle-up solenoid valve (–)	Ignition switch: ON (The motor is on approximately 1 second after engine is started.)		2 V or less
46	Ignition switch	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
47	Input from diagnosis indication selection	Connect the MUT-II.		0 V
		Do not connect the MUT-II.		Approx. 12 V
48	Input from valve relay monitor	Ignition switch: ON		System voltage
49	Motor monitor	Ignition switch: ON Approximately 1 second after engine is started	Motor is on.	System voltage
			Motor is off.	0.5 V or less
50	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off.	System voltage
			The lamp is illuminated.	0 – 2 V
52	Output to front-right hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started.)		System voltage

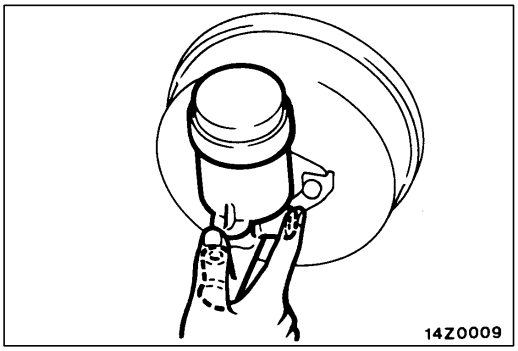
RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

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



14W0042

Connector terminal No.	Signal	Normal condition
1 – Body earth	Front-left solenoid valve (OUT side)	2.2 Ω
2 – Body earth	Rear solenoid valve (OUT side)	2.2 Ω
3 – Body earth	Rear solenoid valve (IN side)	5.0 Ω
7 – 20	Front-left wheel speed sensor (+ wire)	1.2 – 1.4 kΩ
8 – 21	Rear-right wheel speed sensor (+ wire)	1.2 – 1.4 kΩ
9 – 22	Rear-left wheel speed sensor (+ wire)	1.2 – 1.4 kΩ
10 – 23	Front-right wheel speed sensor (+ wire)	1.2 – 1.4 kΩ
14 – Body earth	Front-left solenoid valve (IN side)	5.0 Ω
15 – Body earth	ABS-ECU earth	Continuity
16 – Body earth		
25 – Body earth		
39 – 43	Idle-up solenoid valve	37 – 44 Ω
41 – Body earth	Front-right solenoid valve (OUT side)	2.2 Ω
42 – Body earth	ABS-ECU earth	Continuity
48 – Body earth	Valve relay monitor input	Continuity
49 – Body earth	Motor monitor	Continuity
52 – Body earth	Front-right solenoid valve (IN side)	5.0 Ω



ON-VEHICLE SERVICE

35200150108

BLEEDING

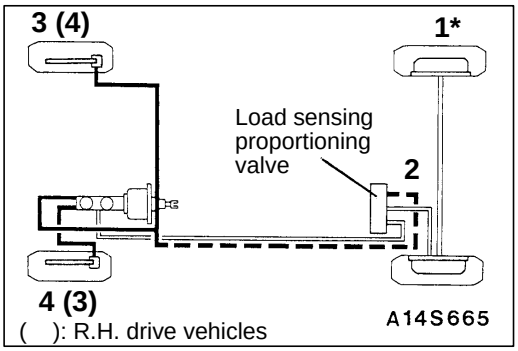
Caution
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

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.)

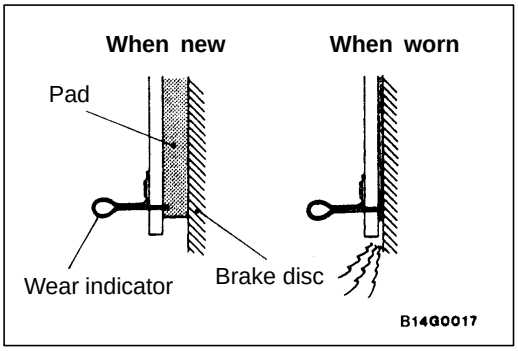
(1) Fill the reserve tank with brake fluid.
(2) Keep the brake pedal depressed.
(3) Have another person cover the master cylinder outlet with a finger.
(4) With the outlet still closed, release the brake pedal.
(5) Repeat steps (2) –(4) three or four times to fill the inside of the master cylinder with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



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.



DISC BRAKE PAD CHECK AND REPLACEMENT

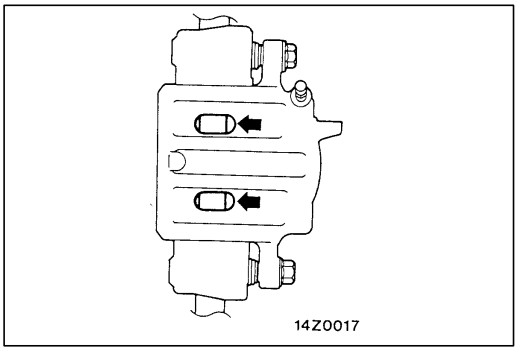
35200280012

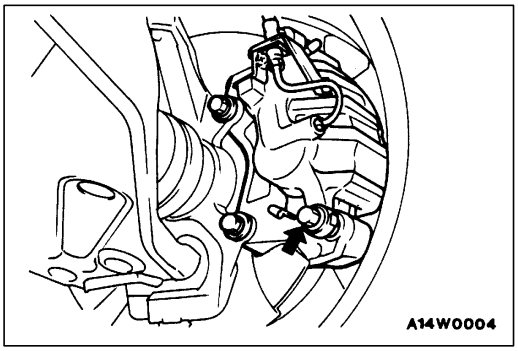
NOTE
The brake pads have wear indicators that contact the brake disc when the brake pad thickness becomes 2 mm, and emit a squealing sound to warn the driver.

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

   Standard value: 10 mm
   Limit: 2.0 mm

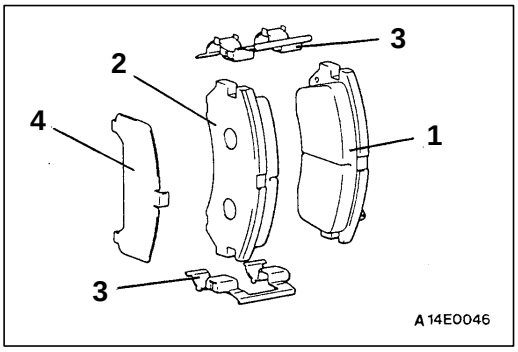
   Caution
   1. When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.
   2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock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



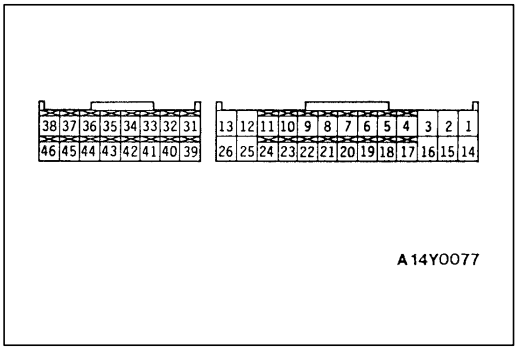


2. Remove guide pin. Lift caliper assembly and retain with wires.

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



3. Remove the following parts from caliper support.
   (1) Pad and wear indicator assembly
   (2) Pad assembly
   (3) Clip
   (4) Outer shim
4. Measure hub torque with pad removed to measure brake drag torque after pad installation. (Refer to P. 35B-33.)
5. Install the pad and caliper assembly, and check the brake drag force. (Refer to P. 35B-33.)



WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

35200160156

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.	7	10	9	8
	20	23	22	21

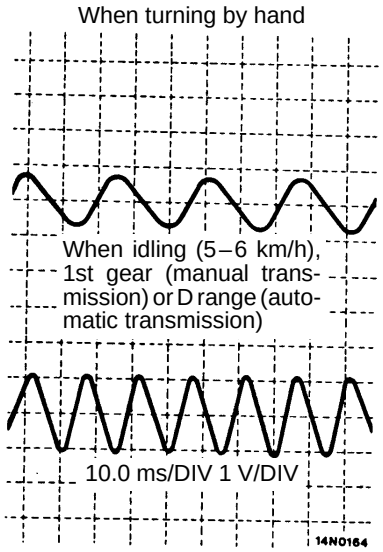
Output voltage

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 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
	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 CHECK

35200170166

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.

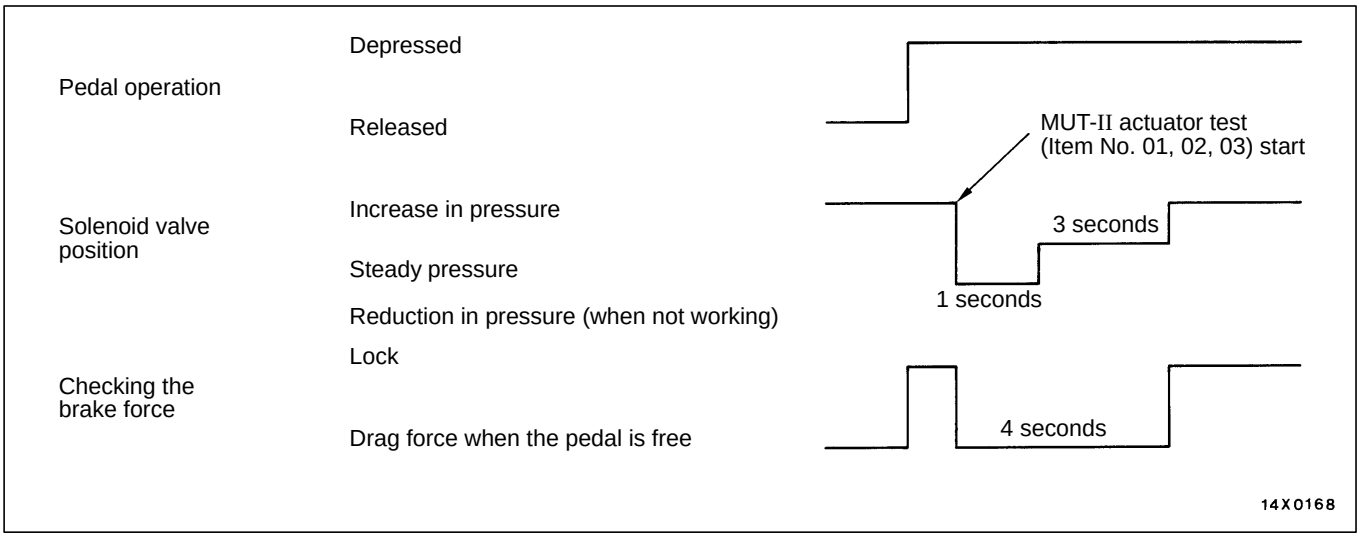
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel.
   When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever <M/T> or the selector lever 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

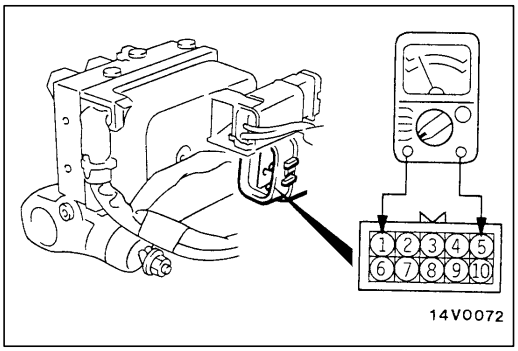
The result should be as shown in the following diagram.



7. If the result of inspection is abnormal, correct according to the “Diagnosis Table” (Refer to P.35B-27).
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



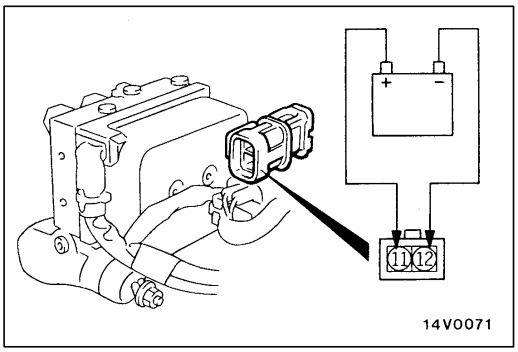
SOLENOID VALVE CHECK

35201070120

Measure the resistance between terminals.

Standard value:

Solenoid valve	Measurement terminals	Resistance between terminals.
Front IN (right side)	1 – 5 or 10	5.0 Ω
Front IN (left side)	2 – 5 or 10	
Rear IN	3 – 5 or 10	
Front OUT (right side)	6 – 5 or 10	2.2 Ω
Front OUT (left side)	7 – 5 or 10	
Rear OUT	8 – 5 or 10	



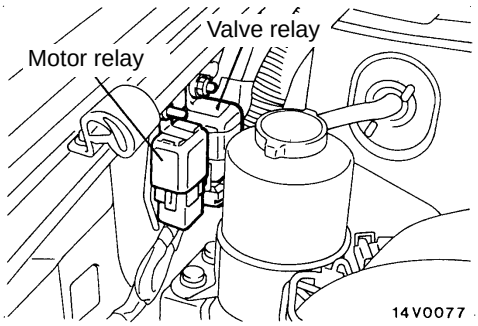
MOTOR OPERATION CHECK

35200180121

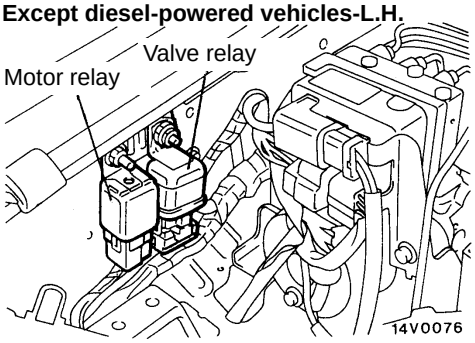
Connect the battery and check to be sure that the sound of the hydraulic unit motor operating can be heard.

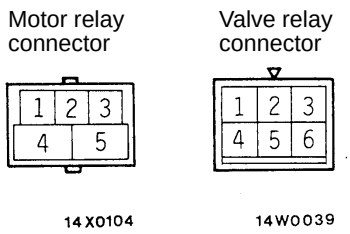
Caution
The battery power should not be applied for more than 1 second.

Diesel-powered vehicles-L.H.



Except diesel-powered vehicles-L.H.





00004879

MOTOR RELAY AND VALVE RELAY CONTINUITY CHECK

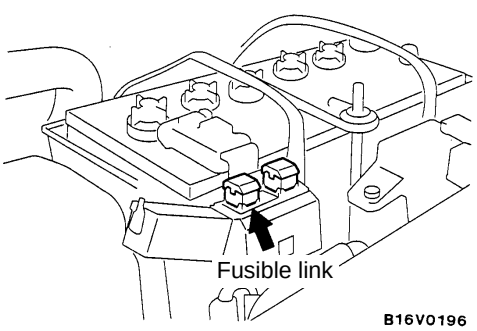
35201090133

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

35200350126

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.

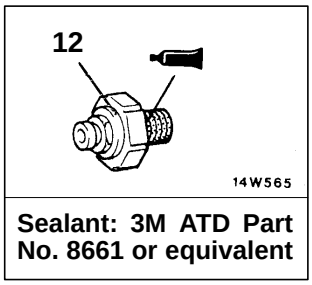
MASTER CYLINDER AND BRAKE BOOSTER

35200400159

REMOVAL AND INSTALLATION

Pre-removal Operation
- Battery Removal
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35B-23.)
- Brake Pedal Adjustment (Refer to GROUP 35A – On-vehicle Service.)



Sealant: 3M ATD Part No. 8661 or equivalent

Removal steps

1. Brake tube connection
2. Brake fluid level sensor connector
3. Master cylinder assembly

▶B◀ • Adjustment of clearance between brake booster push rod and primary piston

4. Vacuum switch connector <4D56>

▶A◀ 5. Vacuum hose (With built-in check valve)

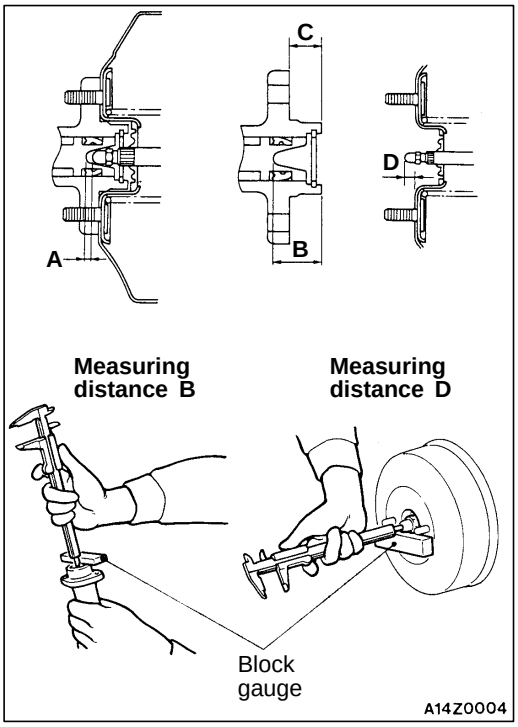
6. Split pin
7. Washer
8. Clevis pin
9. Brake booster
10. Sealer
11. Vacuum switch <4D56>

Caution
The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

INSTALLATION SERVICE POINTS

▶A◀ VACUUM HOSE CONNECTION

Insert securely and completely until the vacuum hose at the engine side contacts the edge of the hexagonal part of the fitting, and then secure by using the hose clip.



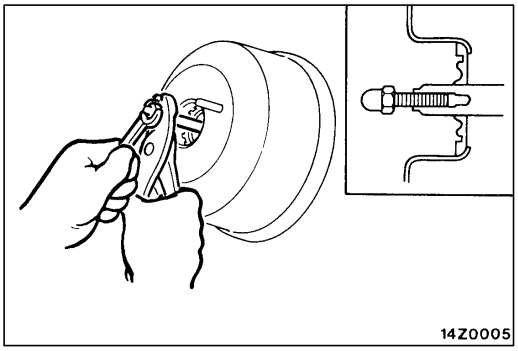
▶B◀ CLEARANCE ADJUSTMENT BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON

Calculate clearance A from the B, C and D measurements.
A = B – C – D

Standard value:

Brake booster size	Clearance A standard value mm
Petrol-powered vehicles	0.90 – 1.30
Diesel-powered vehicles	0.70 – 1.10

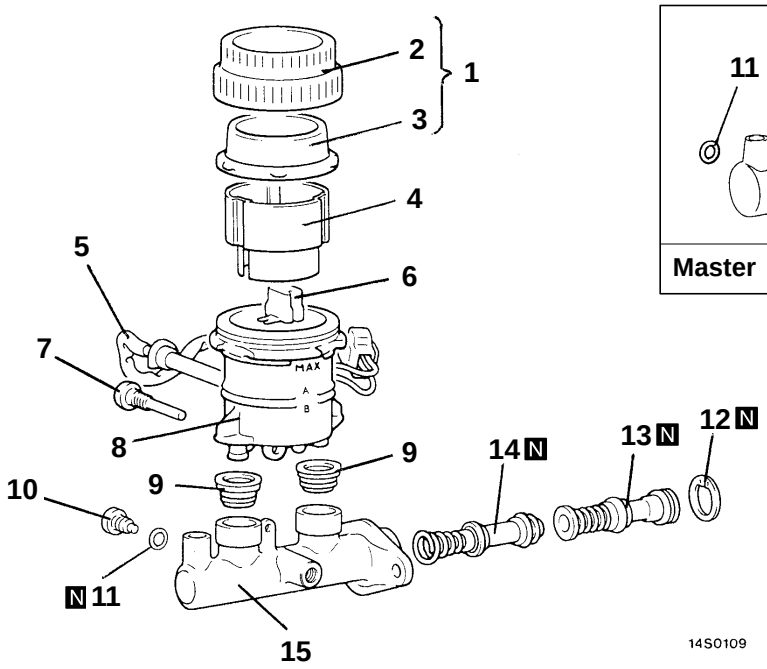
NOTE
When brake booster negative pressure (petrol-powered vehicles: –66.7 kPa, diesel-powered vehicles: –93.3 kPa) is applied, clearance value will become 0.10 – 0.50 mm.

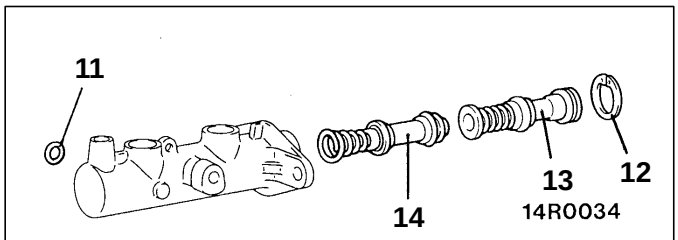


If the clearance is not within the standard value range, adjust by changing the push rod length by turning the screw of the push rod.

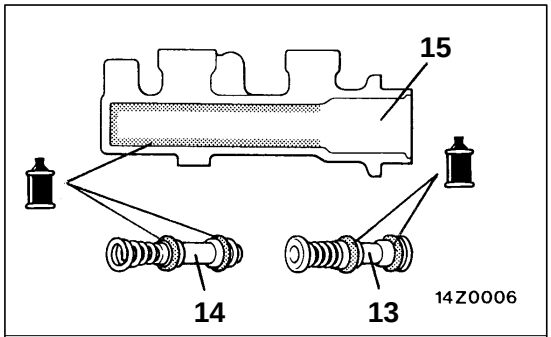
MASTER CYLINDER
35200450109

DISASSEMBLY AND REASSEMBLY





Master cylinder kit



Brake fluid: DOT3 or DOT4

00004883

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

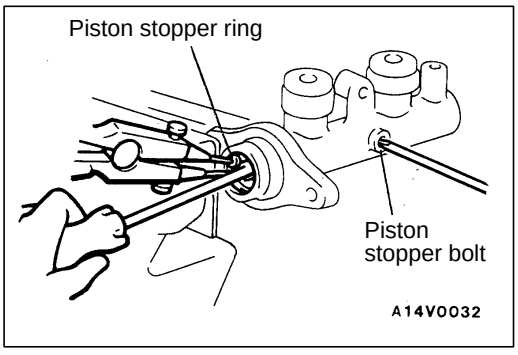
◀A▶ 10. Piston stopper bolt

11. Gasket

◀A▶ 12. Piston stopper ring

13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body

Caution
Do not disassemble the primary and secondary piston assembly.



DISASSEMBLY SERVICE POINTS

◀A▶ 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.

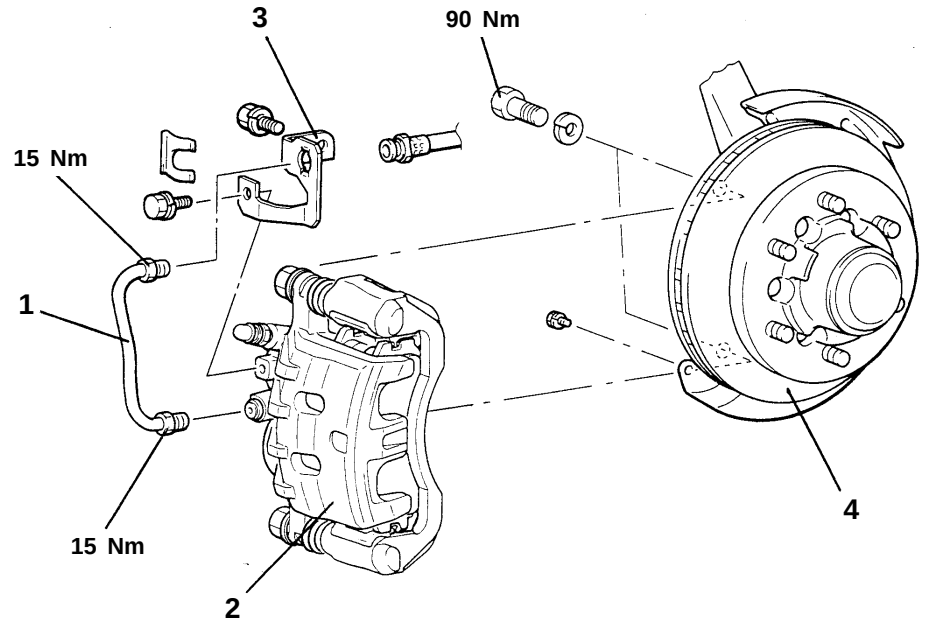
FRONT DISC BRAKE

35200600016

REMOVAL AND INSTALLATION

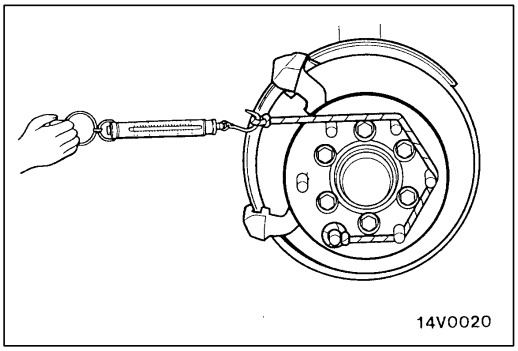
Pre-removal Operation
- Brake Fluid draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35B-23.)



Removal steps

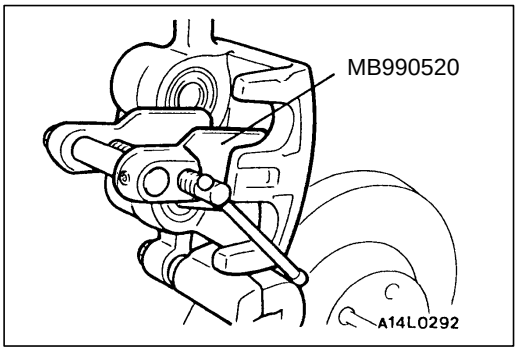
1. Brake tube
▶A◀ 2. Front brake assembly
3. Brake hose bracket
4. Brake disc (Refer to GROUP 26 – Front Hub Assembly.)



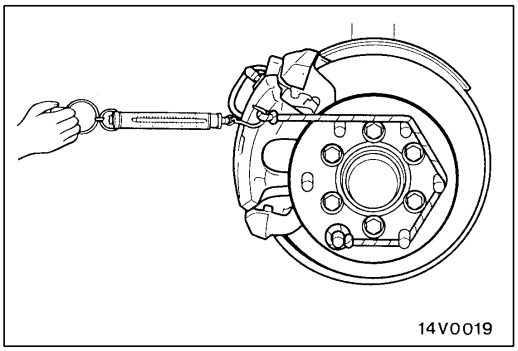
INSTALLATION SERVICE POINT

▶A◀ FRONT BRAKE ASSEMBLY INSTALLATION

1. Measure hub torque (A) with pad removed to measure brake drag torque after pad installation.
2. Securely attach the pad clip to the caliper support.



3. Clean piston and insert into cylinder with special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the lock pin.
5. Check brake drag torque as follows.
   (1) Start engine and hold brake pedal down for 5 seconds. (Pedal depression force approx. 196 N.)
   (2) Stop engine.
   (3) Turn brake disc forward 10 times.



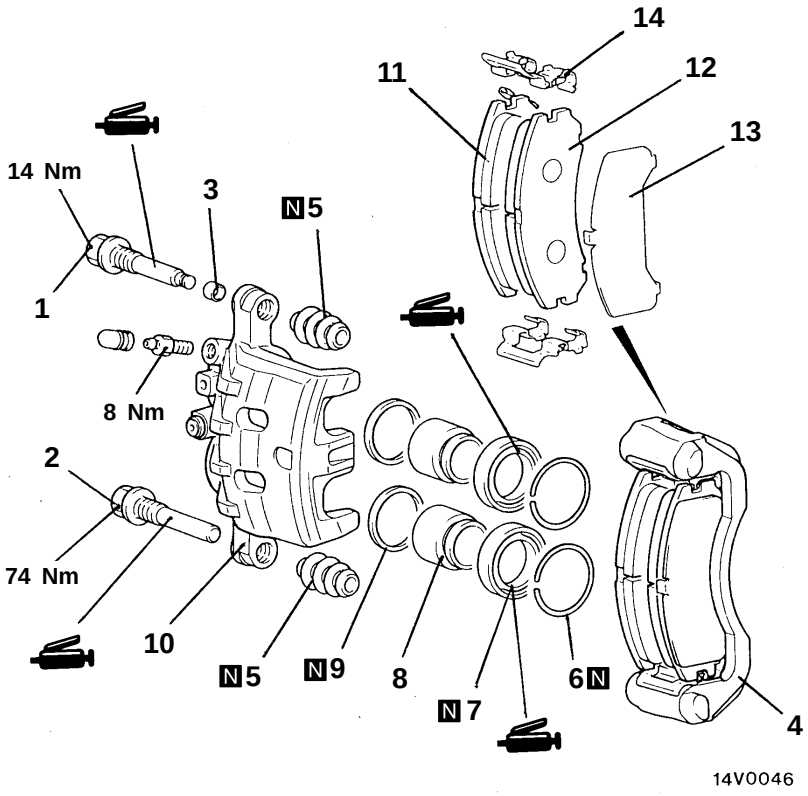
   (4) Check hub torque (B) with spring balance.
   (5) Calculate the drag torque of the disc brake [difference between hub torque (B) and hub torque (A)].

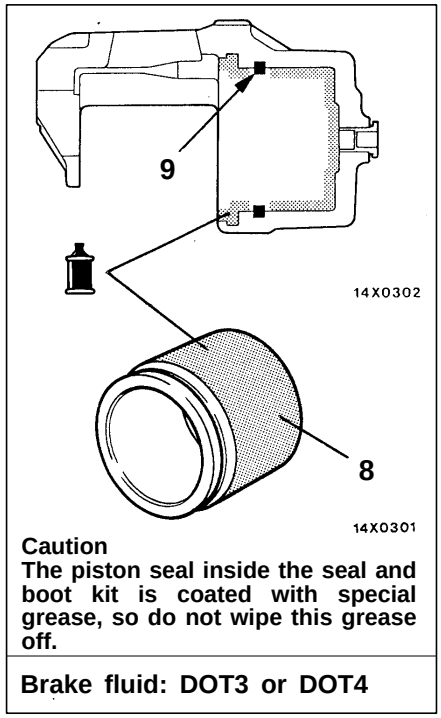
   Standard value: 69 N or less

6. If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

DISASSEMBLY AND REASSEMBLY

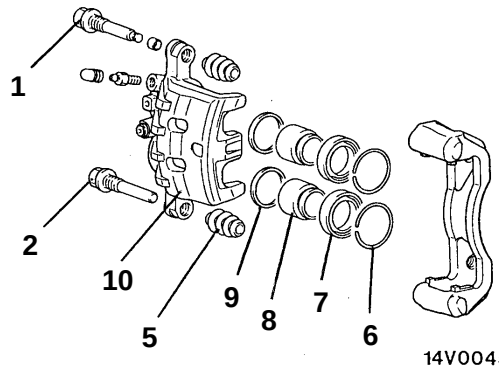
35200620012



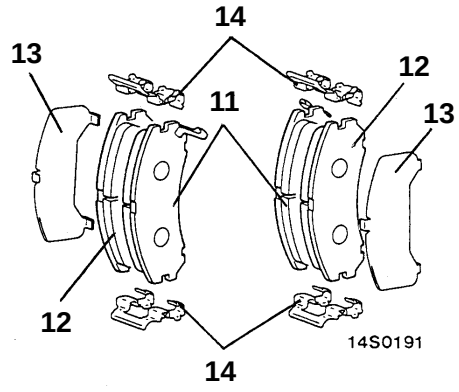


Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

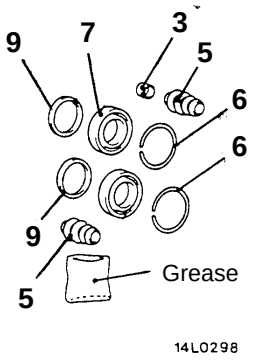
Brake fluid: DOT3 or DOT4



Brake caliper kit



Pad kit



Seal and boot kit

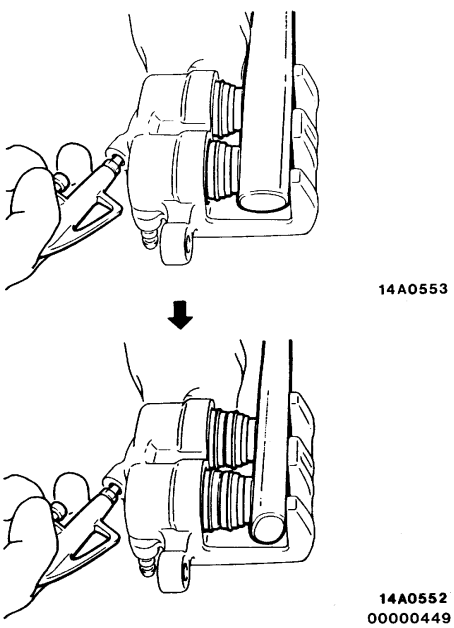
00004884

Caliper assembly disassembly steps

- ▶A◀ 1. Lock pin
- ▶A◀ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 5. Pin boot
- 6. Boot ring
- ◀A▶ 7. Piston boot
- ◀A▶ 8. Piston
- ◀B▶ 9. Piston seal
- 10. Caliper body

Pad assembly disassembly steps

- ▶A◀ 1. Lock pin
- ▶A◀ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 11. Pad and wear indicator assembly
- 12. Pad assembly
- 13. Outer shim
- 14. Clip



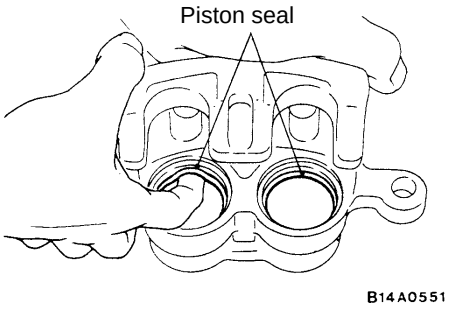
DISASSEMBLY SERVICE POINTS

When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀A▶ PISTON BOOT/PISTON REMOVAL

Pump in compressed air through the brake hose installation hole and remove the piston and piston boot.

Caution
When removing the pistons, be sure to use the handle of a plastic hammer and adjust the height of the two pistons while pumping air slowly in so that the pistons protrude evenly.
Do not remove one piston completely before trying to remove the other piston because it will become impossible to remove the second piston.



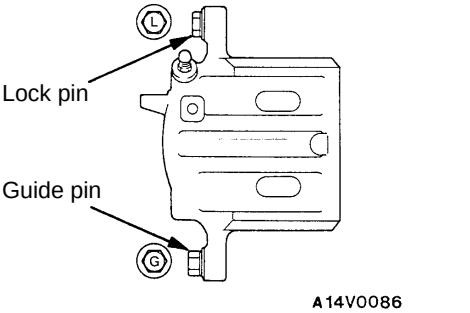
◀B▶ PISTON SEAL REMOVAL

(1) Remove piston seal with finger tip.

Caution
Do not use a screwdriver or other tool to prevent damage to inner cylinder.

(2) Clean piston surface and inner cylinder with trichloro-ethylene, alcohol or specified brake fluid.

Specified brake fluid: DOT3 or DOT4



REASSEMBLY SERVICE POINT

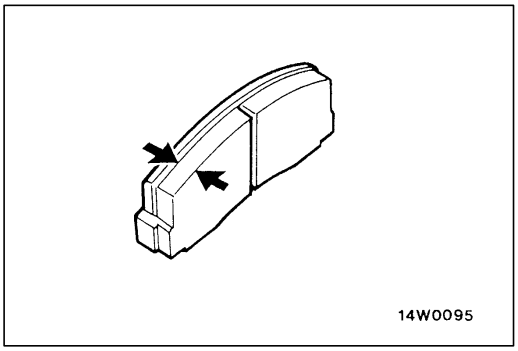
▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the lock pin and the guide pin to the caliper body as shown in the illustration..

INSPECTION

35200630015

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



PAD WEAR CHECK

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

Standard value: 10 mm

Limit value: 2.0 mm

Caution

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

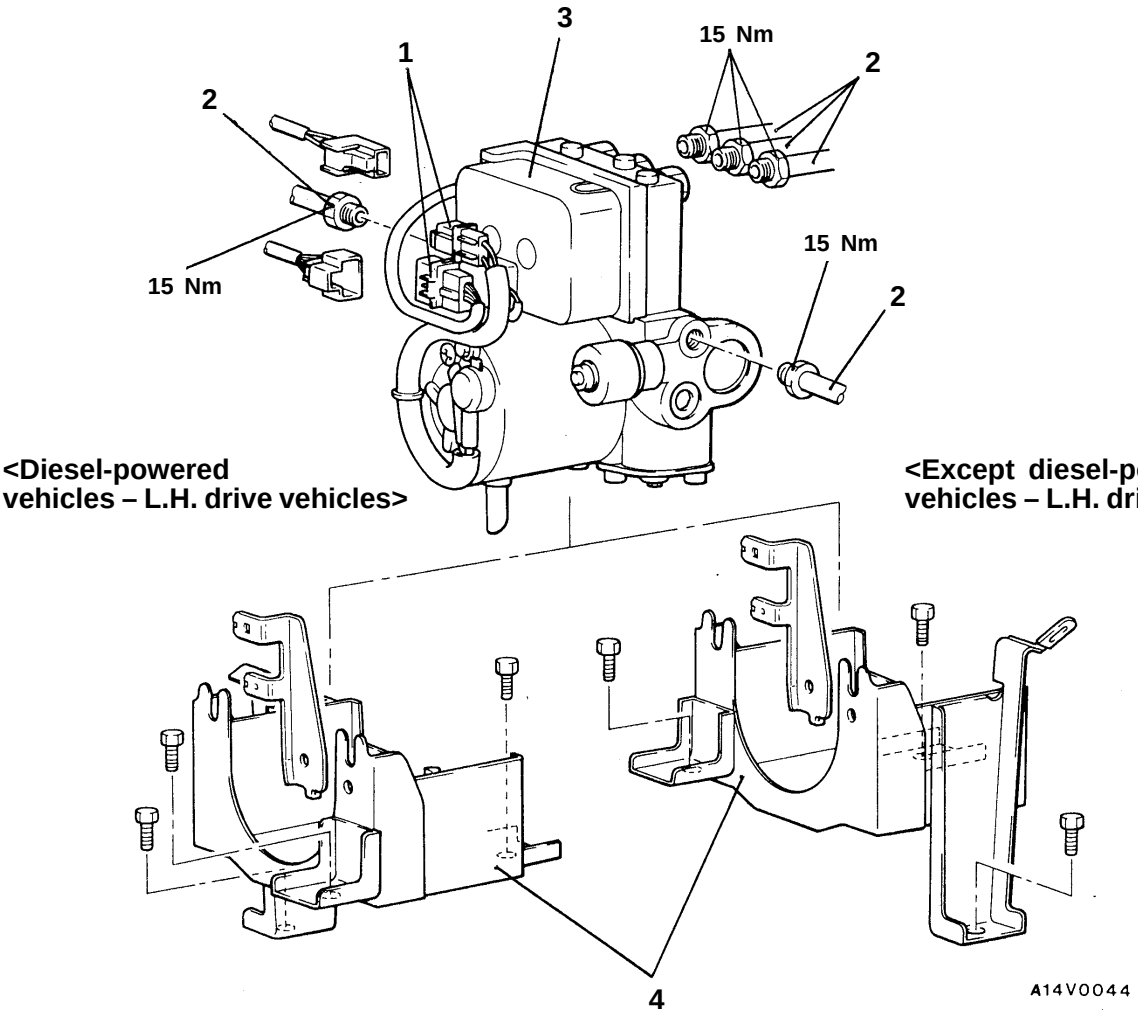
HYDRAULIC UNIT

35200860179

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Lines Bleeding (Refer to P. 35B-23.)
- Hydraulic Unit Checking (Refer to P. 35B-26.)



Removal steps

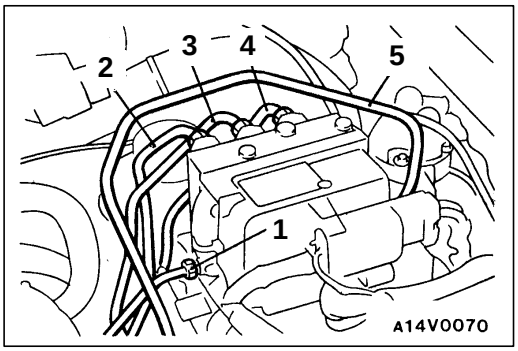
1. Harness connector
2. ▶A◀ Brake tube connection
3. ◀A▶ Hydraulic unit
4. Hydraulic unit bracket

REMOVAL SERVICE POINT

◀A▶ HYDRAULIC UNIT REMOVAL

Caution

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



INSTALLATION SERVICE POINT

◀A▶ BRAKE TUBE CONNECTION

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

1. Master cylinder (for front)
2. Front brake (R.H.)
3. Front brake (L.H.)
4. Rear brake
5. Master cylinder (for rear)

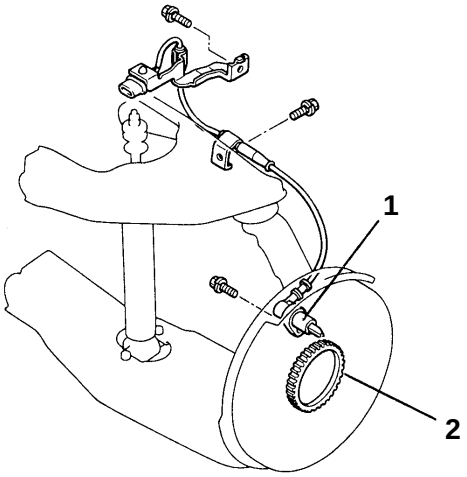
WHEEL SPEED SENSOR

35200830163

REMOVAL AND INSTALLATION

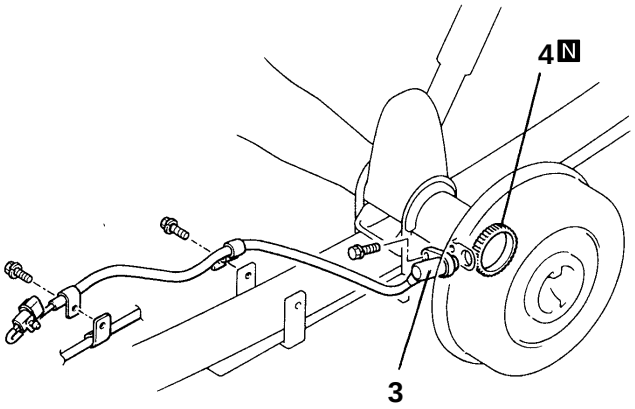
Post-installation Operation
- Wheel Speed Sensor Output Voltage Checking (Refer to P. 35B-24.)

Front



14V0055

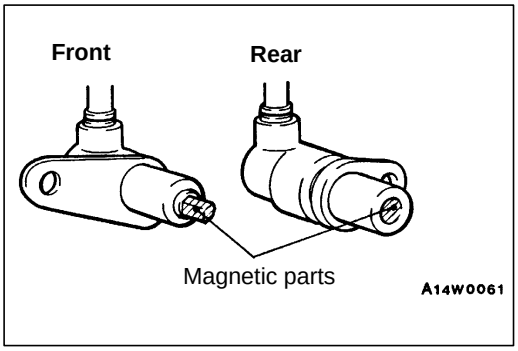
Rear



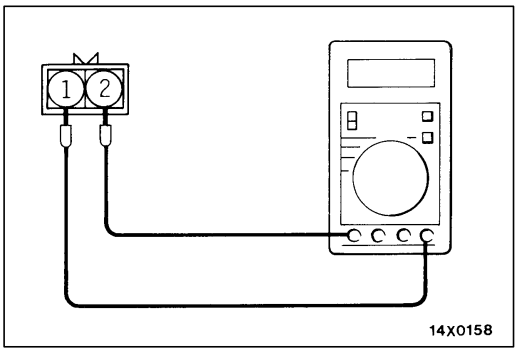
14V0057

00004902

1. Front speed sensor
2. Front rotor (Refer to GROUP 26 – Front Hub.)
3. Rear speed sensor
4. Rear rotor (Refer to GROUP 27 – Rear Axle Shaft.)



A14W0061



14X0158

INSPECTION

35200840128

SPEED SENSOR

(1) Check whether any metallic foreign material has adhered to the parts shown in the illustration at the speed sensor tip, and if so, remove it.

NOTE
The section shown in the illustration can become magnetized because of the magnet built into the speed sensor, with the result that foreign metallic material easily adheres to it.

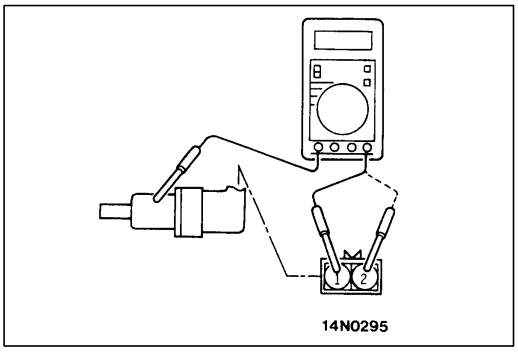
(2) Measure the resistance between the speed sensor terminals.

Standard value: 1.2 – 1.4 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. Check the connector connection and the terminal insertion.



SPEED SENSOR INSULATION CHECK

(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 kΩ or more

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

TOOTHED ROTOR

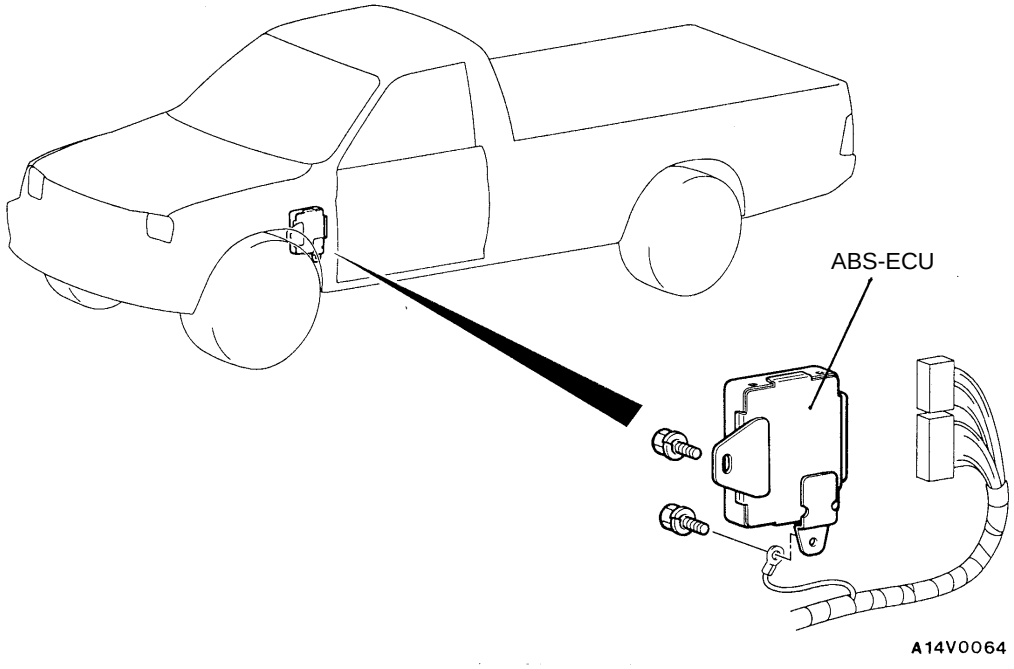
Check whether rotor teeth are broken or deformed, and if so, replace the rotor.

ABS-ECU

35200980141

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Driver's Side Under Cover Removal and Installation (Refer to GROUP 52A – Instrument Panel.)
- Junction Block Installation Nut Removal and Installation.



INSPECTION

35200990106

Refer to P. 35B-20.

NOTES

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

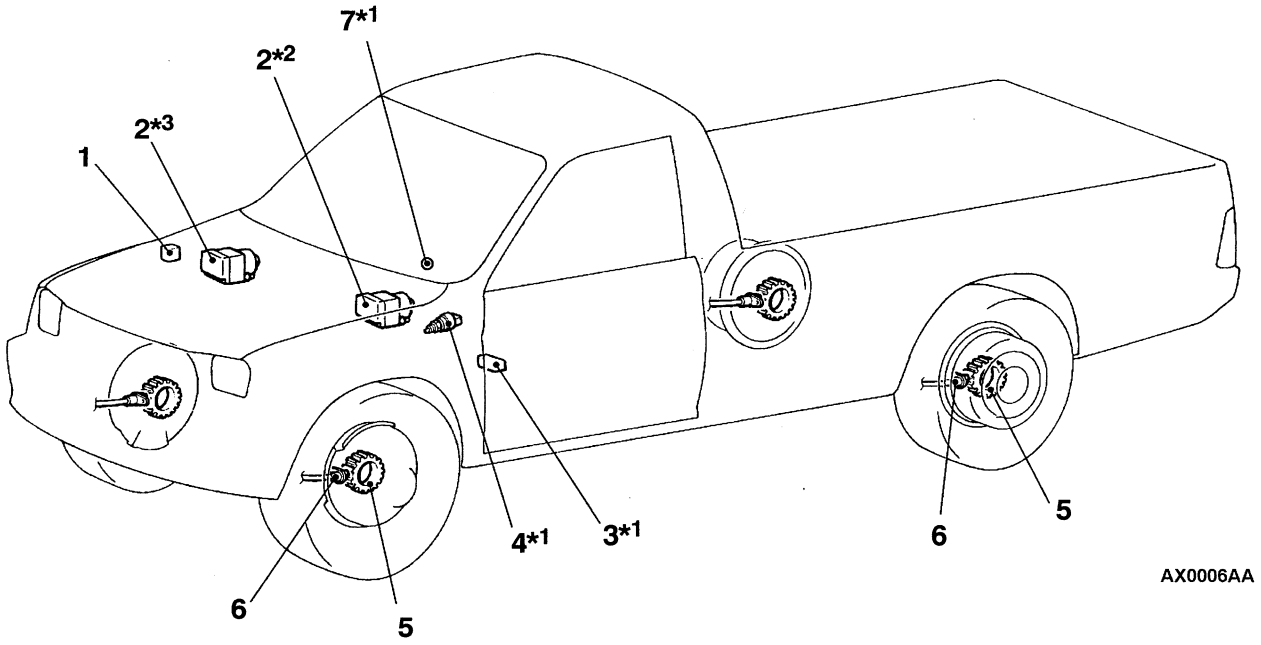
CONTENTS

GENERAL

OUTLINE OF CHANGE

- The ABS system has been revised as follows:
  (1) The ABS control unit (ABS-ECU) and the hydraulic unit have been unified.
  (2) The motor relay and the valve relay have been discontinued.
  (3) The ABS warning lamp relay has been added.

CONSTRUCTION DIAGRAM



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. ABS warning lamp

NOTE
For R.H. drive vehicles, *1 indicates installation at the right aide.
*2: LHD diesel-powered vehicles
*3: Except LHD diesel-powered vehicles

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to Basic Manual 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	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.
Shock during system operation check	Shock may be felt when the brake pedal is depressed slightly at a low driving speed. This occurs due to ABS operation check (check at a vehicle speed of 8 km/h after starting), and does not indicate any malfunction.

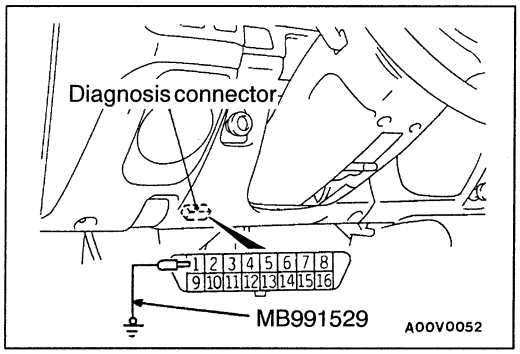
Diagnosis detection condition can vary depending on the diagnosis code.
Make sure that checking requirements listed in the "Comment" are satisfied when checking the trouble symptom again.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

With the MUT-II

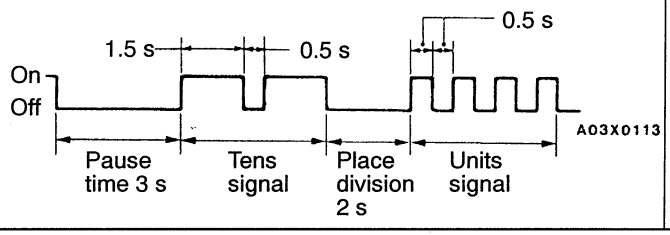
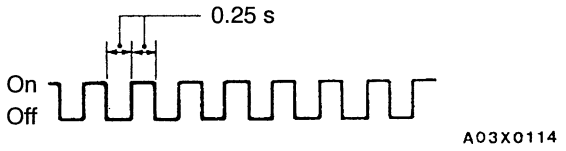
Refer to Basic Manual GROUP 00 – How to Use Troubleshooting/Inspection Service Points.



WHEN USING THE ABS WARNING LAMP

1. Use the special tool to earth No.1 terminal (diagnosis control terminal) of the diagnosis connector.
2. Turn on the ignition switch.
3. Read out a diagnosis code by observing how the ABS warning lamp flashes.

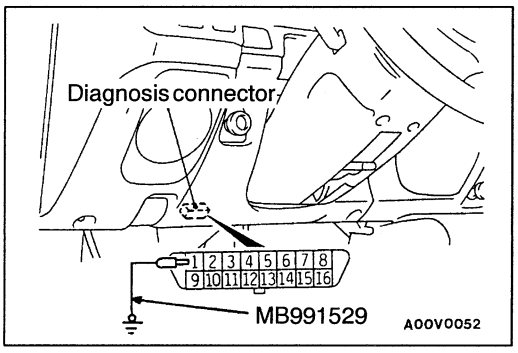
Indication of diagnosis code by ABS warning lamp

When the diagnosis code No.24 is output	When no diagnosis code is output
	

ERASING DIAGNOSIS CODES

With the MUT-II

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

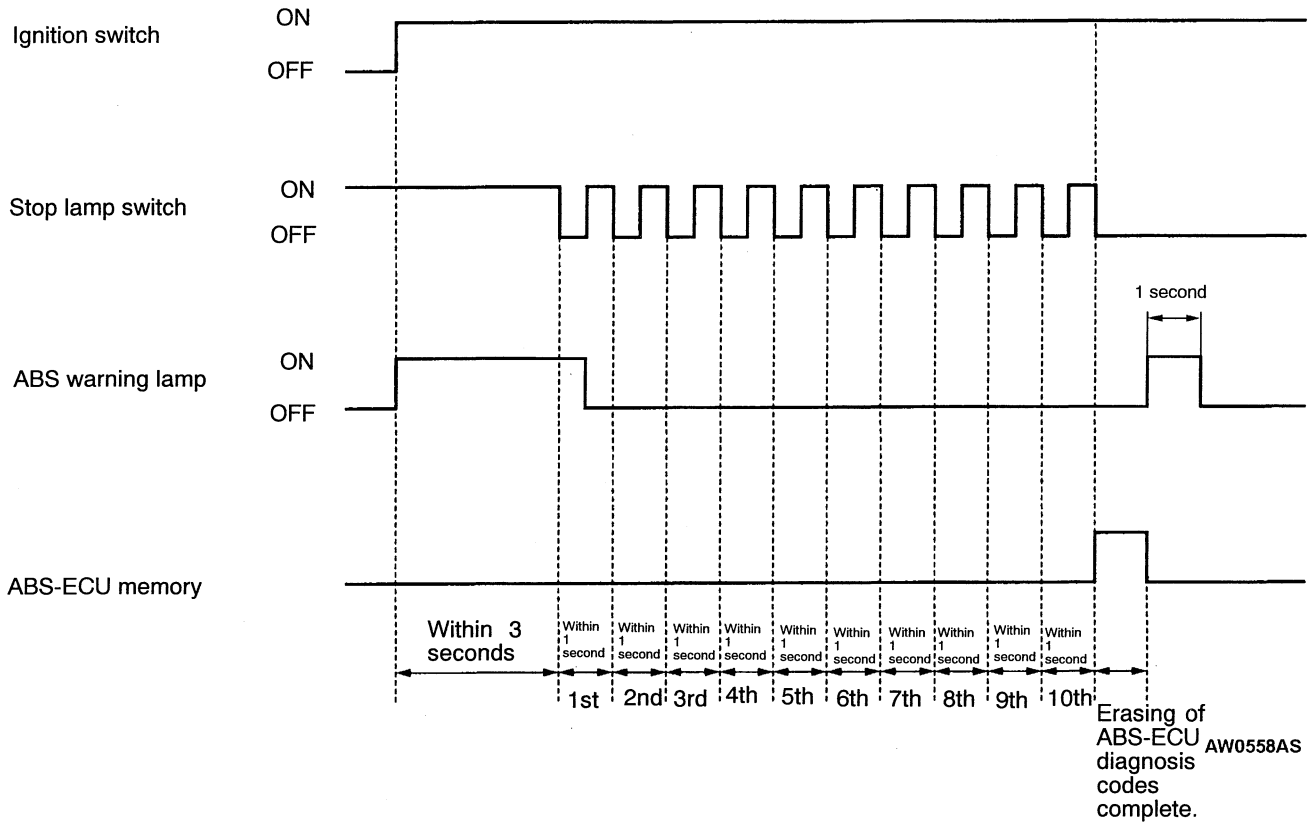


Without the MUT-II

1. Stop the engine.
2. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector.
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.



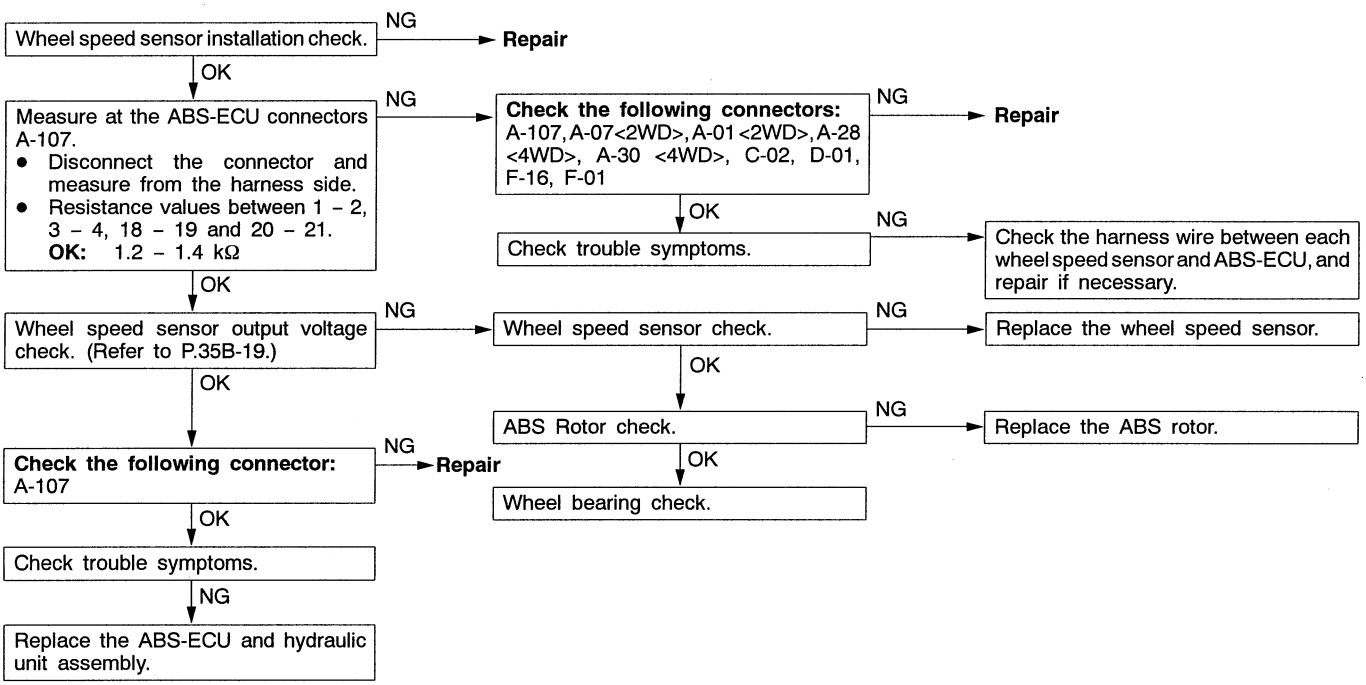
INSPECTION CHART FOR DIAGNOSIS CODES

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

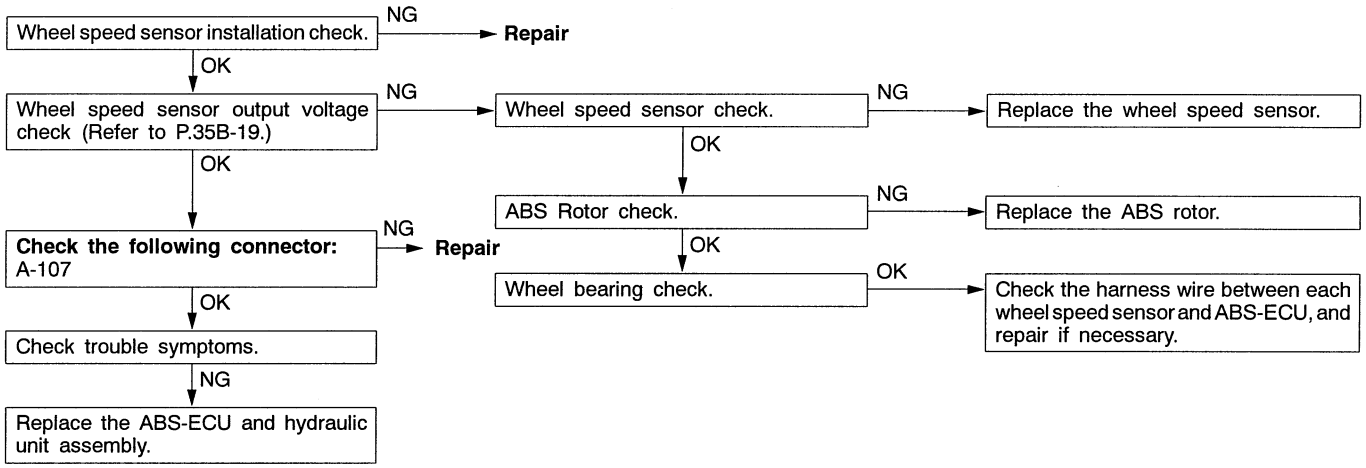
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open or short circuit	35B-7
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	35B-8
16	Power supply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

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit or short circuit **Code No. 21, 22, 23, 24 Wheel speed sensor abnormal**	**Probable cause**
The ABS-ECU determines that an open circuit or short circuit occurs in more than one line of wheel speed sensors.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly
These codes are output at the following times: • 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.	• Malfunction of wheel speed sensor • Malfunction of ABS rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly

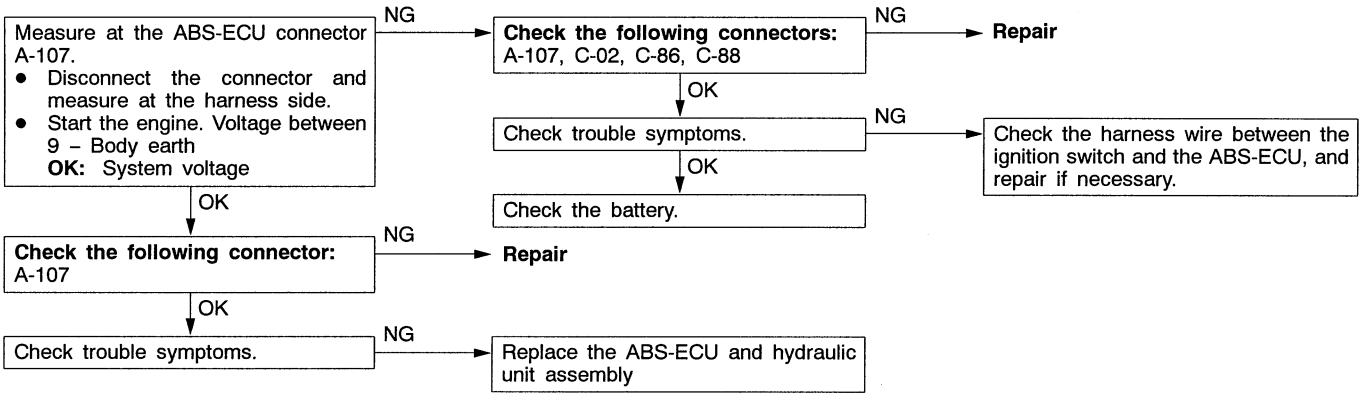


Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of ABS rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly

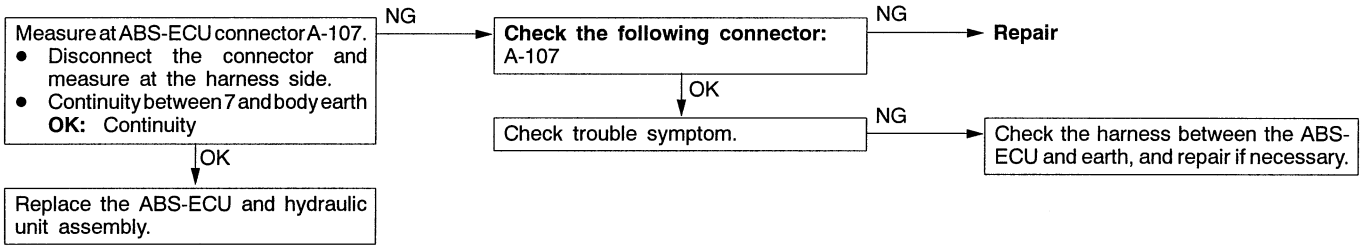


Code No. 16 Power supply system	Probable cause
The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	• Malfunction of wiring harness or connector. • Malfunction of ABS-ECU and hydraulic unit assembly

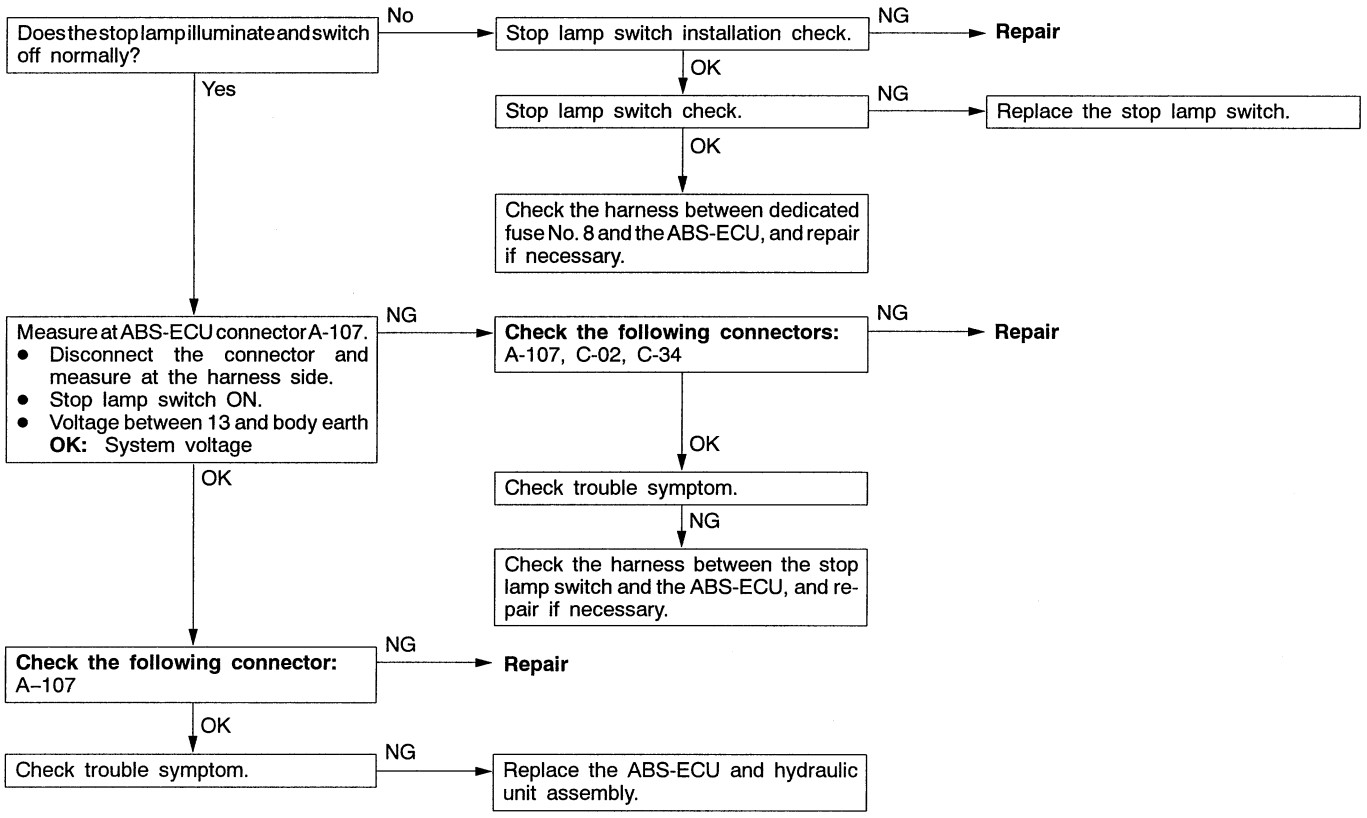
Caution
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.
Before carrying out the following inspection, check the battery level, and refill distilled water if necessary.



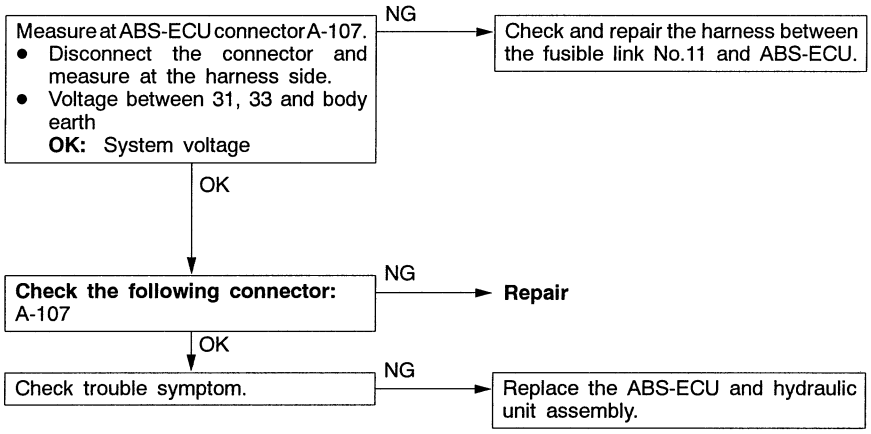
Code No. 25 Freewheel engage switch system Code No. 26 4WD position detection switch system Code No. 27 Rear differential lock detection switch Code No. 32 G-sensor system	Probable cause
The ABS-ECU is shared by 2WD and 4WD vehicles. To identify 2WD from 4WD, on 2WD vehicles, the ABS-ECU G-sensor signal input terminal (terminal No.7) is earthed. Code Nos. 25, 26, 27 and 32 are output when the earth line to that terminal is open circuit.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly

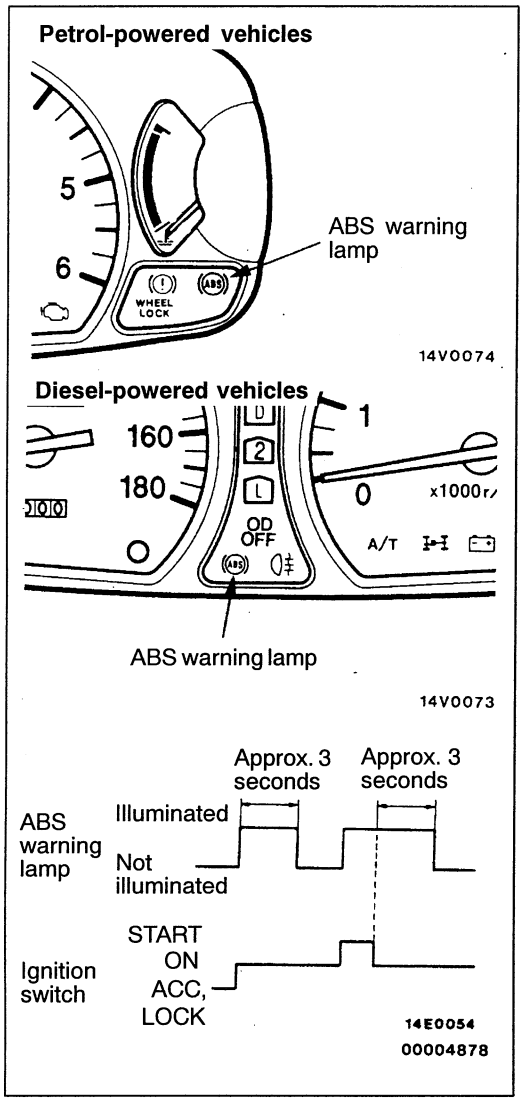


Code No. 33 Stop lamp switch system	Probable cause
This code is output when the stop lamp switch stays on for 15 minutes or more at a vehicle speed of 15 km/h or more due to a ON-failure in the stop lamp switch or open circuit in the stop lamp switch circuit.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly



Code No. 41, 42, 43 Solenoid valve system Code No. 51 Valve driver system Code No. 53 Motor driver system	Probable cause
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 ABS-ECU and hydraulic unit inner circuit.	• Malfunction of harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly





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.

   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 53 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 PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

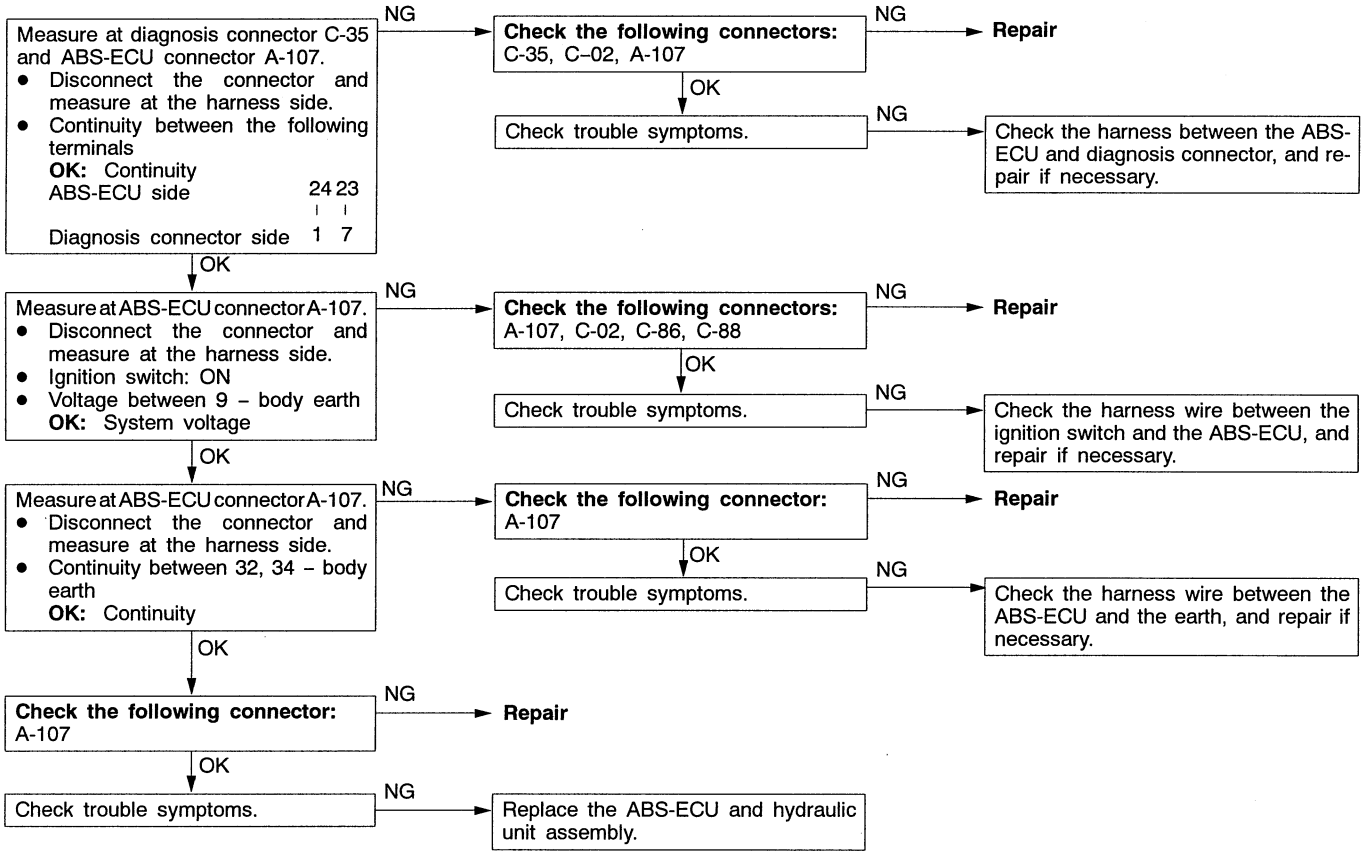
Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The reason is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of connector • Malfunction of harness

Refer to GROUP 13A – Troubleshooting*.

NOTE
*: Refer to '98 L200 Workshop Manual (Pub.No. PWTE96E1-B).

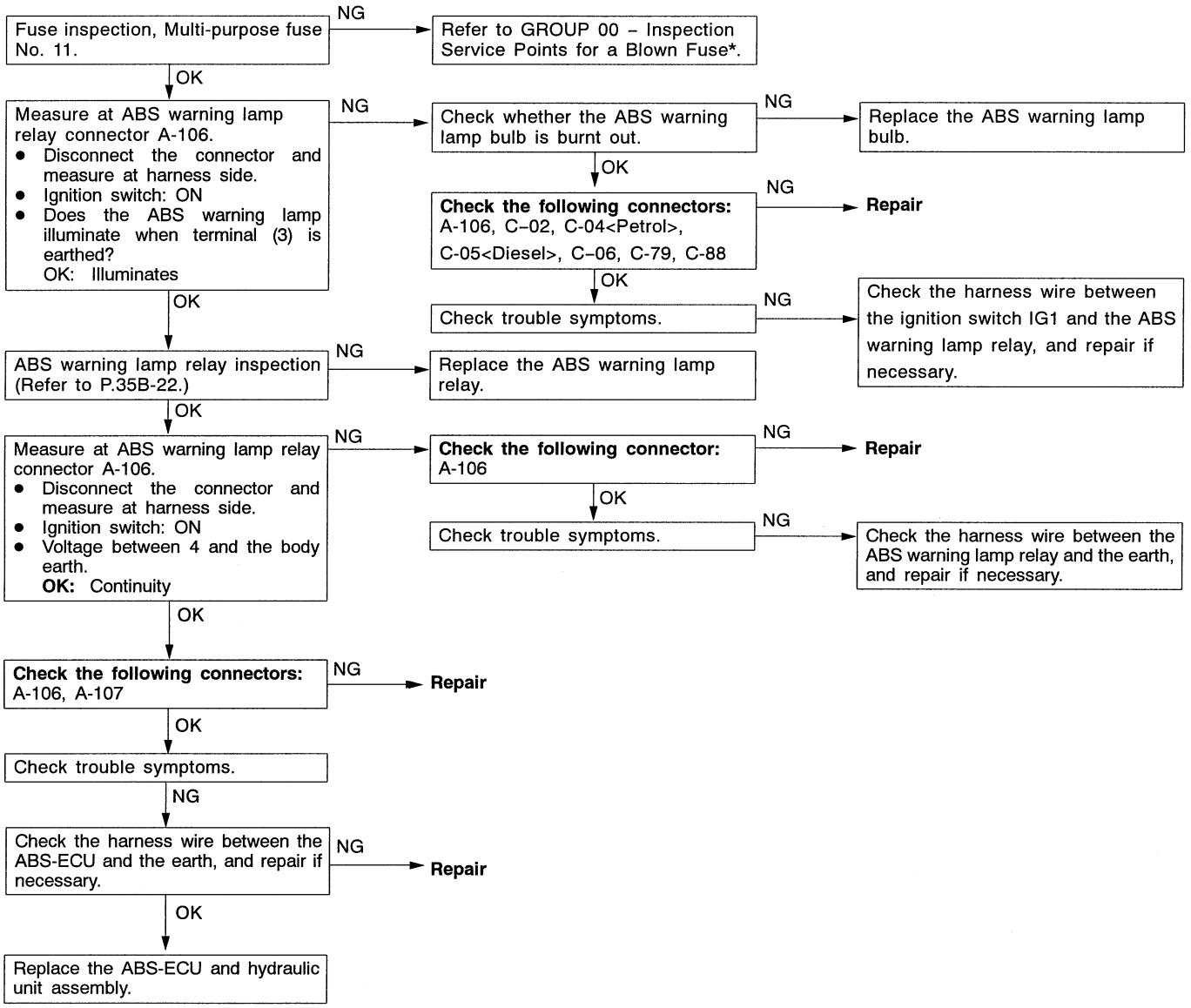
Inspection Procedure 2

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.	• Blown fuse • Malfunction of wiring harness or connecter • Malfunction of ABS-ECU and 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 earth are possible causes.	• Blown fuse • Burnt out ABS warning lamp bulb • Malfunction of the ABS warning lamp relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU and hydraulic unit assembly



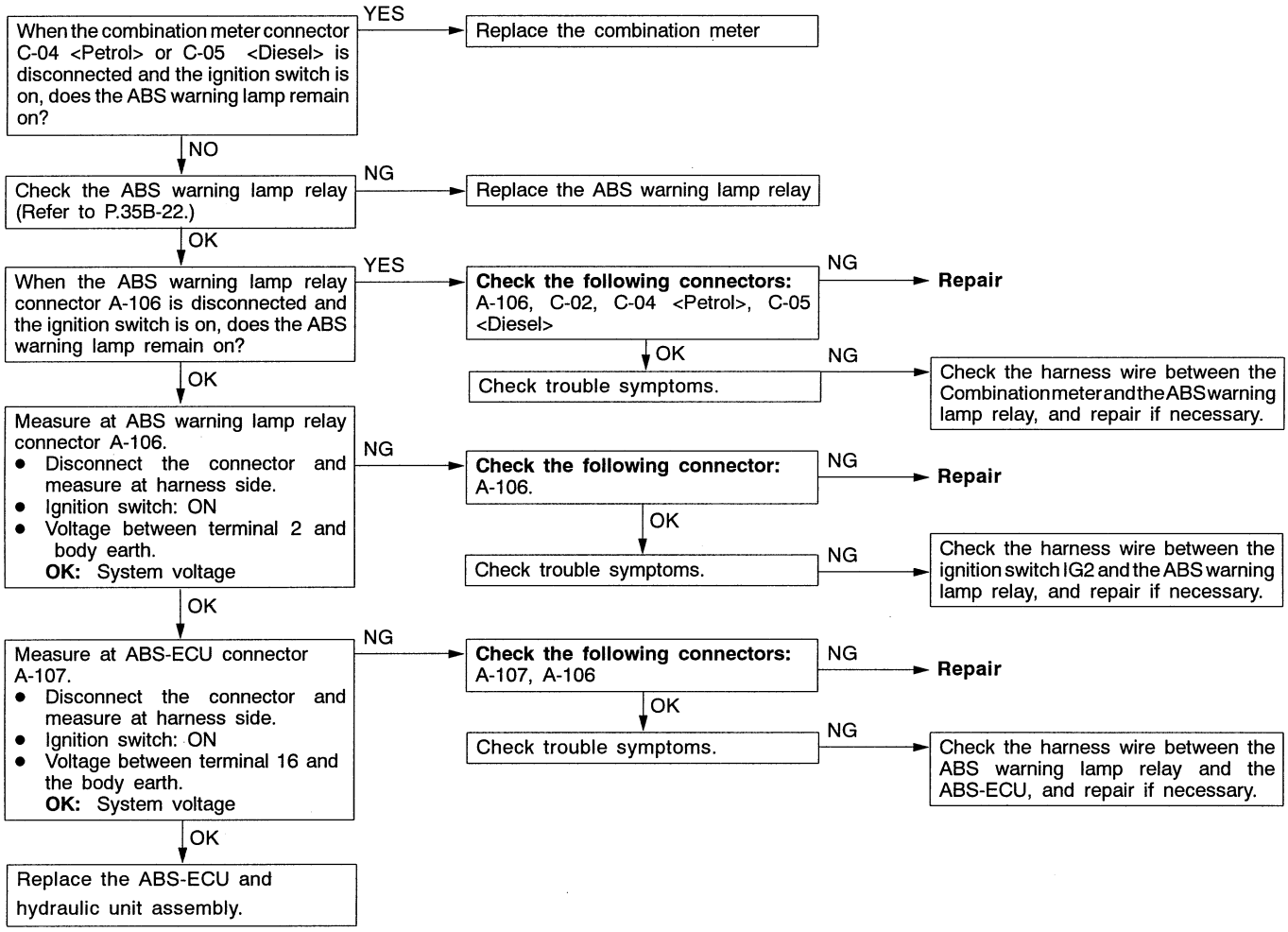
NOTE
*: Refer to '97 L200 Workshop Manual (Pub.No. PWTE96E1).

Inspection Procedure 4

The ABS warning lamp remains illuminated after the engine is started.	Probable cause
The following causes are suspected: • Short circuit in the harness between the ABS warning lamp and the ABS waring lamp relay • Defective ABS waring lamp relay • Open circuit in the ABS warning lamp relay power supply circuit • Open circuit in the harness between the ABS-ECU and the ABS waring lamp relay	• Defective combination meter • Defective ABS warning lamp relay • Malfunction of wiring or connector • Defective ABS-ECU and hydraulic unit assembly

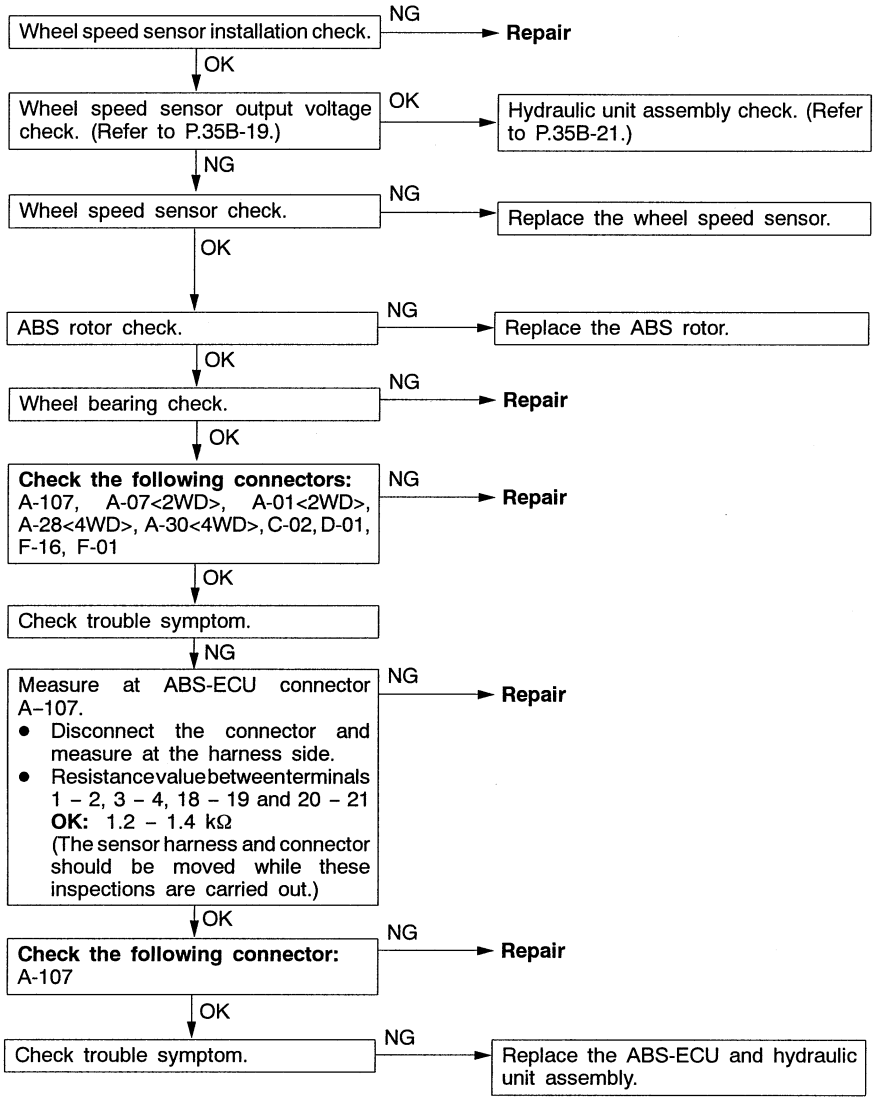
NOTE

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.	• 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 ABS-ECU and hydraulic unit assembly



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
25	Freewheel engage switch	Always	OFF
26	4WD position detection switch	Always	OFF
27	Rear differential lock detection switch	Always	OFF
32	G-sensor system	Always	0V
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.

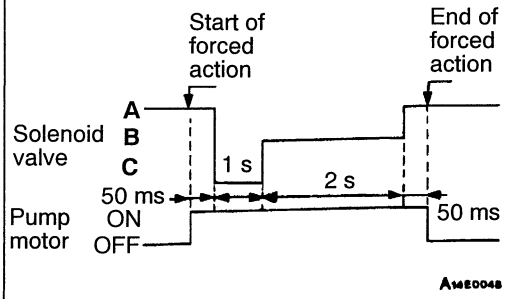
ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

NOTE

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.

Activation pattern



NOTE
A: Hydraulic pressure increases
B: Hydraulic pressure holds
C: Hydraulic pressure decreases

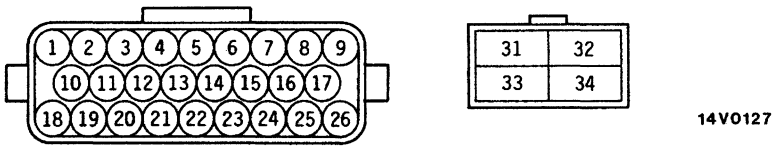
ACTUATOR TEST SPECIFICATIONS

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

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (32) and (34) (earth 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.

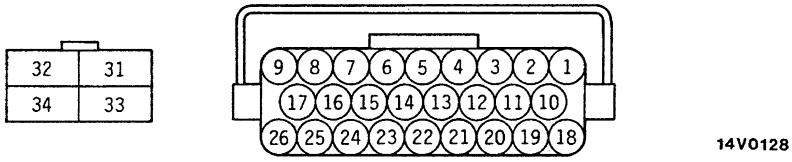


Connector terminal No.	Signal	Checking requirement		Normal condition
7	G-sensor signal	Ignition switch: "ON"		0 V
9	ABS-ECU power supply	Ignition switch: "ON"		System voltage
		Ignition switch: "START"		0 V
13	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: "ON"	System voltage
			Stop lamp switch: "OFF"	1 V or less
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

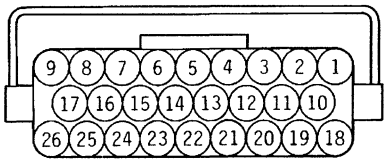
Connector terminal No.	Signal	Checking requirement	Normal condition
23	MUT-II	Connect the MUT-II	Serial communication with MUT-II
		Do not connect the MUT-II	1 V or less
24	Input from diagnosis indication selection	Connect the MUT-II	0 V
		Do not connect the MUT-II	Approximately 12 V
31	Solenoid valve 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	1.2 – 1.4 kΩ
1 – 2	Rear-right wheel speed sensor	1.2 – 1.4 kΩ
18 – 19	Front-right wheel speed sensor	1.2 – 1.4 kΩ
3 – 4	Rear-left wheel speed sensor	1.2 – 1.4 kΩ
32 – body earth	Solenoid valve earth	Continuity
34 – body earth	Motor earth	Continuity



B14V0128

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

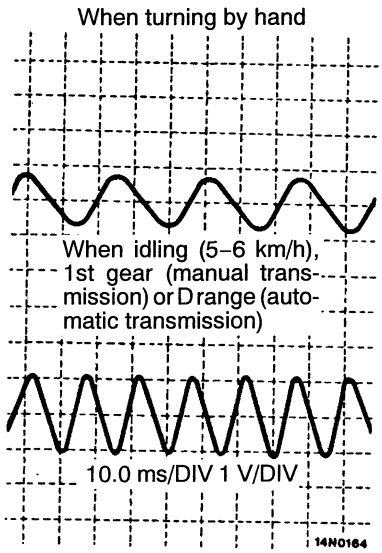
Output voltage

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

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.

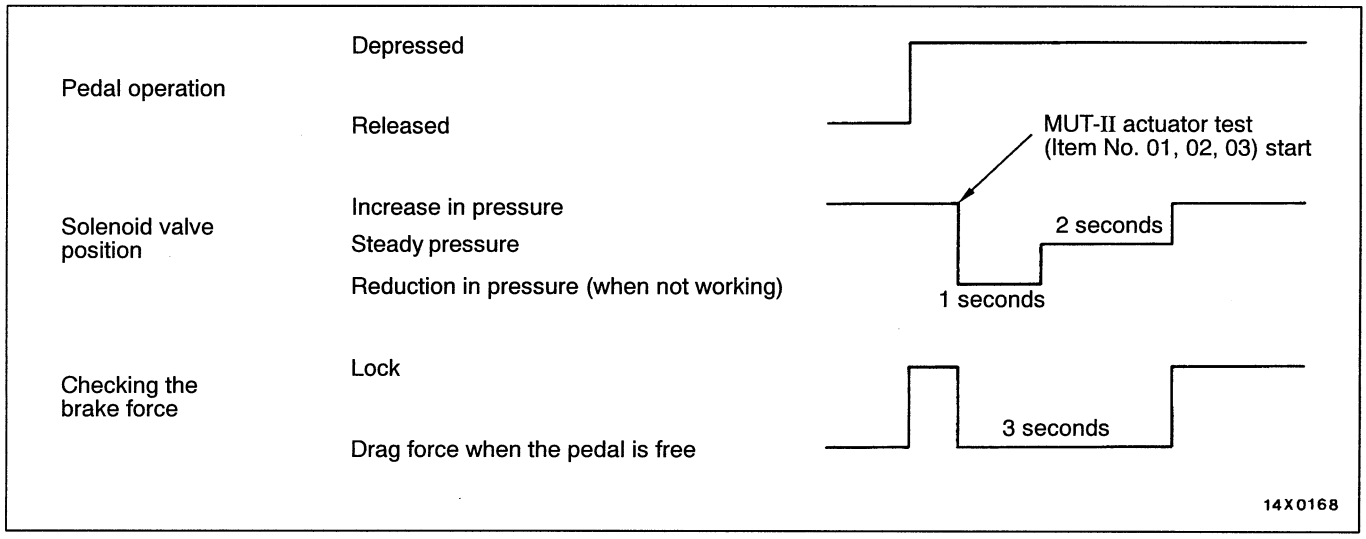
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever is in neutral, start the engine.
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	2942 – 3334 N
Rear wheel	1275 – 1471 N

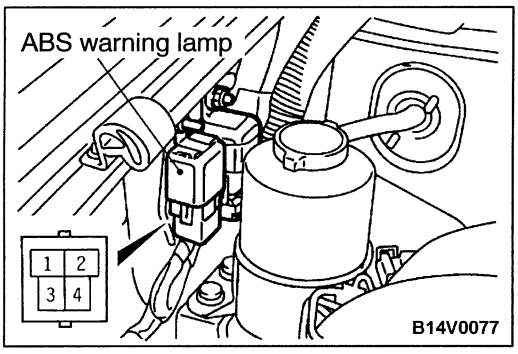
The result should be as shown in the following diagram.



7. If the result of inspection is abnormal, correct according to the "Diagnosis Table" (Refer to P.35B-22).
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

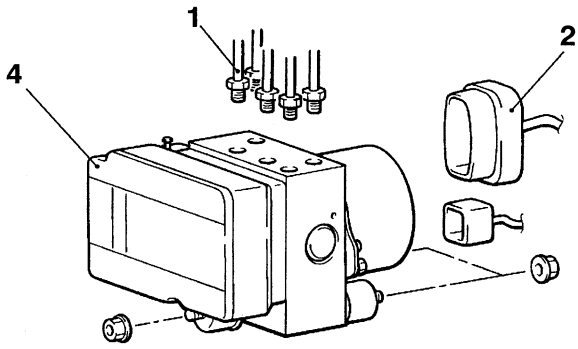
Battery voltage	Terminal No.			
	1	2	3	4
Not applied		○—○	○—○	
Applied	⊖	⊕		

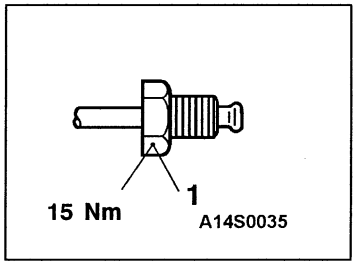
ABS-ECU AND HYDRAULIC UNIT

REMOVAL AND INSTALLATION

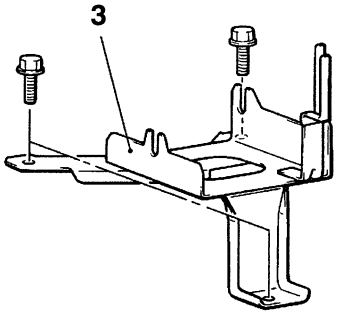
Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Filling
- Bake Line Bleeding

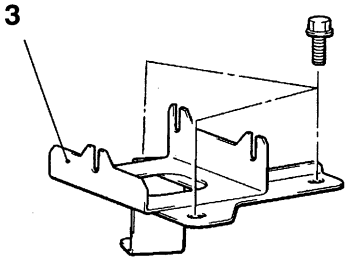




<4G6, 4D5 – R.H. drive vehicles>

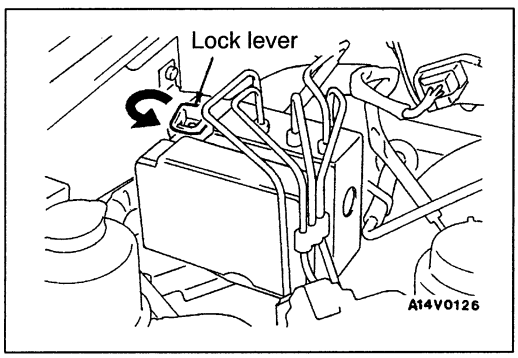


<4D5 – L.H. drive vehicles>



Removal steps

▶A◀ 1. Brake tube
◀A▶ 2. Harness connector
3. Bracket assembly
◀B▶ 4. ABS-ECU and hydraulic unit assembly



REMOVAL SERVICE POINTS

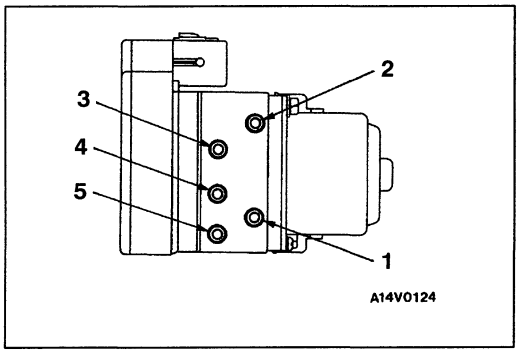
◀A▶ HARNESS CONNECTOR REMOVAL

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

◀B▶ ABS-ECU AND HYDRAULIC UNIT REMOVAL

Caution

1. **The ABS-ECU and hydraulic unit assembly is heavy. Use care when removing it.**
2. **The ABS-ECU and hydraulic unit assembly cannot be disassembled. Never loosen its nuts or bolts.**
3. **Do not drop or shock the ABS-ECU and hydraulic unit assembly.**
4. **Do not turn the ABS-ECU and 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.>

SERVICE BULLETIN

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E35-001	
	Date: 2000-05-30	

Subject:	CHANGE TO ERASING OF ABS DIAGNOSTIC CODES
Group:	SERVICE BRAKE
Draft No.:	99AL122308

INFORMATION/ CORRECTION	**INTERNATIONAL CAR ADMINISTRATIO OFFICE**	Tomoaki Nitta T.NITTA - PROJECT LEADER AFTER SALES SERVICE & CS PROMOTION

<Model>	**<M/Y>**
(EC)COLT/LANCER (CKOA,CJOA)	96-10
(EC)PAJERO (V10, 20, 30,40)	95-10
(EC)L400 (PA0 to PD0)	95-10
(EC)PAJERO SPORT/MONTERO SPORT (K80W, K90W)	99-10
(EC)L200 (K60, k70)	97-10

1. Description:

This Service Bulletin informs you of erasing of the diagnostic codes for the cars mentioned below that are equipped with the ABS-ECU

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'96 COLT/LANCER Workshop Manual Chassis	PWME9511	(English)	35-6
	PWMS9512	(Spanish)	
	PWMF9513	(French)	
	PWMG9514	(German)	
	PWMD9515	(Dutch)	
	PWMW9516	(Swedish)	
'95 PAJERO Workshop Manual Chassis Supplement	PWJE9086-F	(English)	35-36-4
	PWJF9088-F	(French)	
	PWJG9089-F	(German)	
	PWJD9090-F	(Dutch)	
	PWJW9091-F	(Swedish)	
'95 MONTERO Workshop Manual Chassis Supplement	PWJS9087-F	(Spanish)	35-36
'95 L400 Workshop Manual Chassis	PWWE9410	(English)	35B-7
	PWWS9411	(Spanish)	
	PWWF9412	(French)	
	PWWG9413	(German)	
	PWWD9414	(Dutch)	
	PWWW9415	(Swedish)	
'99 PAJERO SPORT Workshop Manual Chassis	PWJE9812	(English)	35B-4,5
	PWJF9814	(French)	
	PWJG9815	(German)	
'99 MONTERO SPORT Workshop Manual Chassis	PWJS9813	(Spanish)	35B-4,5

Manual	Pub. No.	Language	Page(s)
'97 L200 Workshop Manual Chassis	PWTE96E1	(English)	35b-5
	PWTS96E1	(Spanish)	
	PWTF96E1	(French)	
	PWTG96E1	(German)	
2000 L200 Workshop Manual Chassis	PWTE96E2	(English)	35b-5
	PWTS96E2	(Spanish)	
	PWTF96E2	(French)	
	PWTG96E2	(German)	

3. Effective date:

Model	Effective Date	ABS-ECU part No.
COLT/LANCER	From March 1998	MR445910
PAJERO/MONTERO	From September 1998	MR400413
L400	From September 1998	MR400415
PAJERO SPORT/ MONTERO SPORT	From the first production car	MR235362*, MR307755*, MR334886*
L200	From September 1998	MR400416, MR400417, MR4469642*

* Integral Hydraulic unit. These part numbers are for the hydraulic unit.

4. Details:

TROUBLESHOOTING

35201110129

STANDARD FOW 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	Sound of the motor inside the ABS hydraulic unit operation. (whine) Sound is the generated along with vibration of the brak pedal. (Scraping). 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 suc 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

35201120106

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

<Old> ~~Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.~~

<New> **See next page.**

With the MUT-II

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

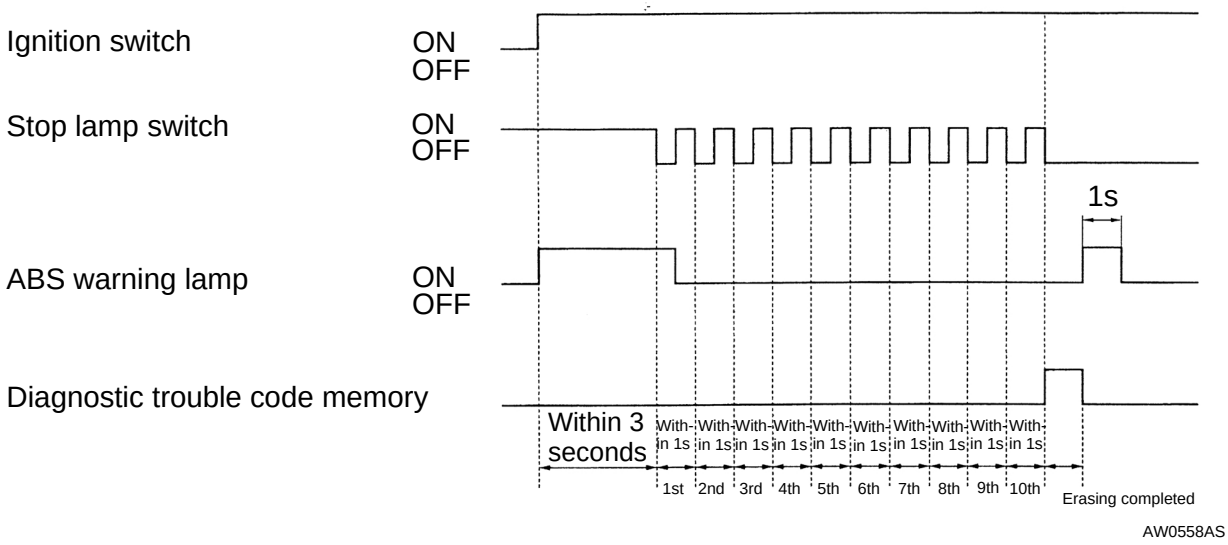
When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.

1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.)
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II.

Without the MUT-II

1. Stop the car.
2. Place the stop lamp switch to ON (with brake pedal depressed).
3. Under the condition of 1 and 2 above, turn the ignition switch ON. After that, place the stop lamp switch to OFF (with brake pedal released) within 3 seconds and cycle the stop lamp switch to ON an OFF ten times consecutively.

   NOTE:
   When ABS-ECU stops functioning through the fail-safe mechanism, erasing of the diagnostic troubl codes cannot be performed.



AW0558AS

4. Ensure that the diagnostic trouble codes have been erased.
   When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, the above procedures may not erase those codes. In that case, turn the ignition switch OFF, and then repeat steps 1 to 3 above.

4. Remedy the malfunctions indicated by th diagnosis codes, disconnect the diagnosis code check harness, and then install the valve relay. Then turn the ignition switch to ON again t check the ABS warning lamp. (Refer to P.35-36-16.) If the lamp indicates a malfunction, th valve relay system may be detective. (Refer to P.35-36-14.)

ERASING DIAGNOSIS CODES

<Old>

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), and then erase the diagnosis codes.

Without the MUT-II

Remove the battery cable from the battery (-) terminal for 10 seconds or more, and the reconnect the cable.

<New> **See next page.**

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), then erase the diagnosis codes.

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

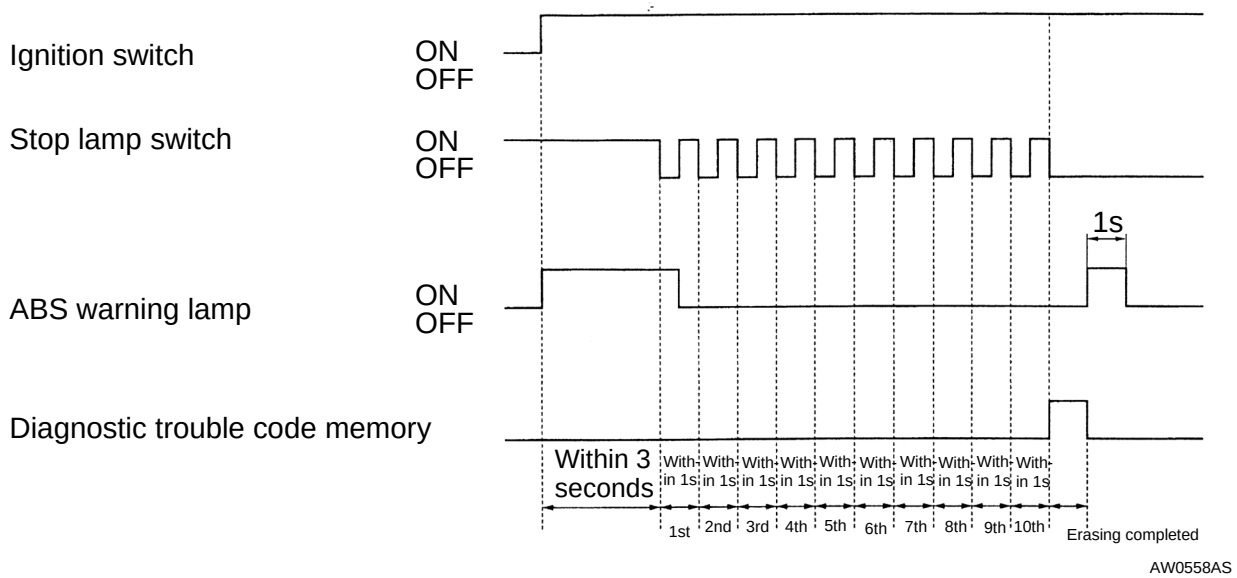
When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.

1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.)
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II.

Without the MUT-II

1. Stop the car.
2. Place the stop lamp switch to ON (with brake pedal depressed).
3. Under the condition of 1 and 2 above, turn the ignition switch ON. After that, place the stop lamp switch to OFF (with brake pedal released) within 3 seconds, and cycle the stop lamp switch ON and OFF ten times consecutively.

   NOTE:
   When ABS-ECU stops functioning through the fail-safe mechanism, erasing of the diagnostic troubl codes cannot be performed.



AW0558AS

4. Ensure that the diagnostic trouble codes have been erased. When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, the above procedures may not eras those codes. In that case, turn the ignition switch OFF, then repeat steps 1 to 3 above.

4. Remedy the malfunctions indicated by th diagnosis codes, disconnect the diagnosis code check harness, and then reconnect the valve relay harness. Then turn the ignition switch to ON again to check the ABS warning lamp. (Refer to P.35B-19.) If the lamp indicates a malfunction, the valve relay system may be defective. (Refer to P.35B-17)

ERASING DIAGNOSTIC CODES

<Old>

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), then erase the diagnostic codes.

Without the MUT-II

Removing the battery cable from the battery (-) terminal for 10 seconds or more, then reconnect the cable.

<New> **See next page.**

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), then erase the diagnosis codes.

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

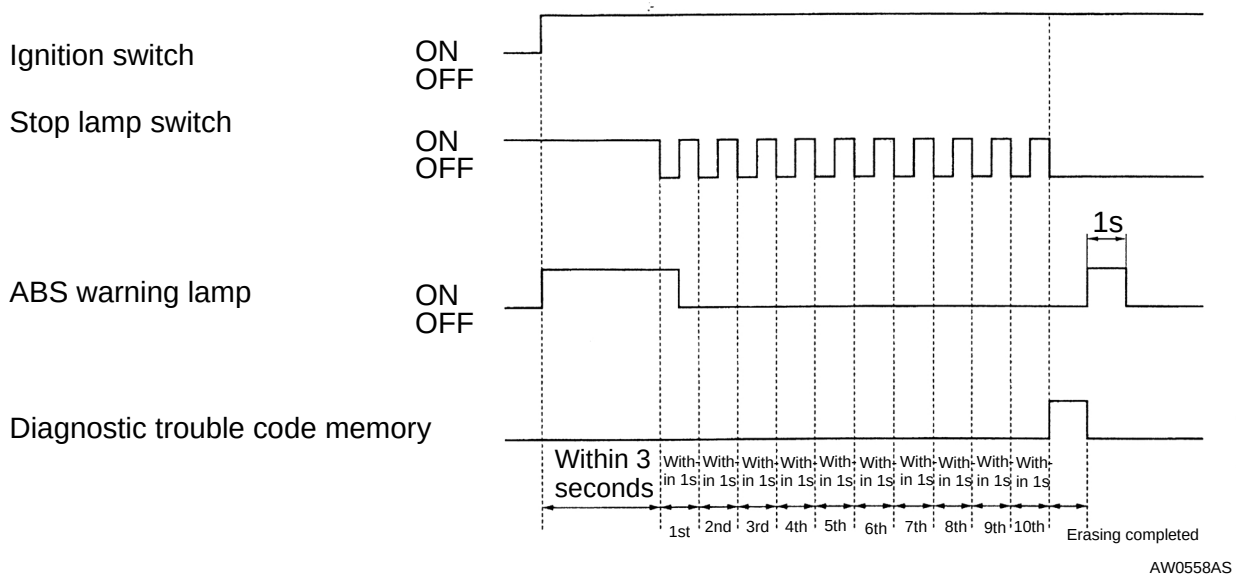
When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.

1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.)
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II.

Without the MUT-II

1. Stop the car.
2. Place the stop lamp switch to ON (with brake pedal depressed).
3. Under the condition of 1 and 2 above, turn the ignition switch ON. After that, place the stop lamp switch to OFF (with brake pedal released) within 3 seconds, and cycle the stop lamp switch ON and OFF ten times consecutively.

   NOTE:
   When ABS-ECU stops functioning through the fail-safe mechanism, erasing of the diagnostic troubl codes cannot be performed.



4. Ensure that the diagnostic trouble codes have been erased. When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, the above procedures may not eras those codes. In that case, turn the ignition switch OFF, then repeat steps 1 to 3 above.

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 hear 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	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 suck as snow-covered roads a 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 suck roads by lowering the vehicle speed and not being to 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 Trouble-shooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES

With the MUT-II

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

<Added>

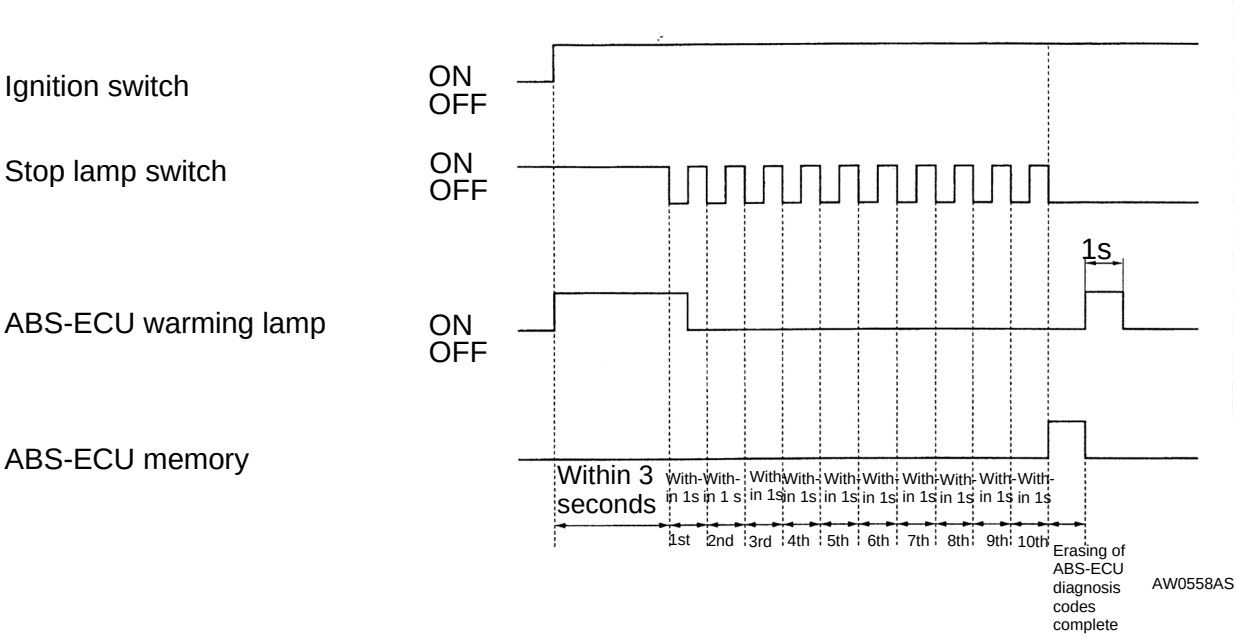
When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.

1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.)
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II.

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.
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-sage operation, it will not be possible t erase the diagnosis codes.



<Added>

5. Ensure that the diagnostic trouble codes have been erased.
   When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur,the above procedures may not erase those codes. In that case, turn the ignition switch OFF, then repeat steps 1 to 4 above.

TROUBLESHOOTING

35201110143

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 hear 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	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 suck as snow-covered roads an 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 suck roads by lowering the vehicle speed and not being to overconfident.
Shock during system operation check	Shock may be felt when the brake pedal is depressed slightly at a low driving speed. This occurs due to ABS operation check (initial check at a vehicle speed of 8 km/h), and does not indicate any malfunction.

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

35201120108

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

<Old> ~~Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.~~

<New> **See next page**

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), then erase the diagnosis codes.

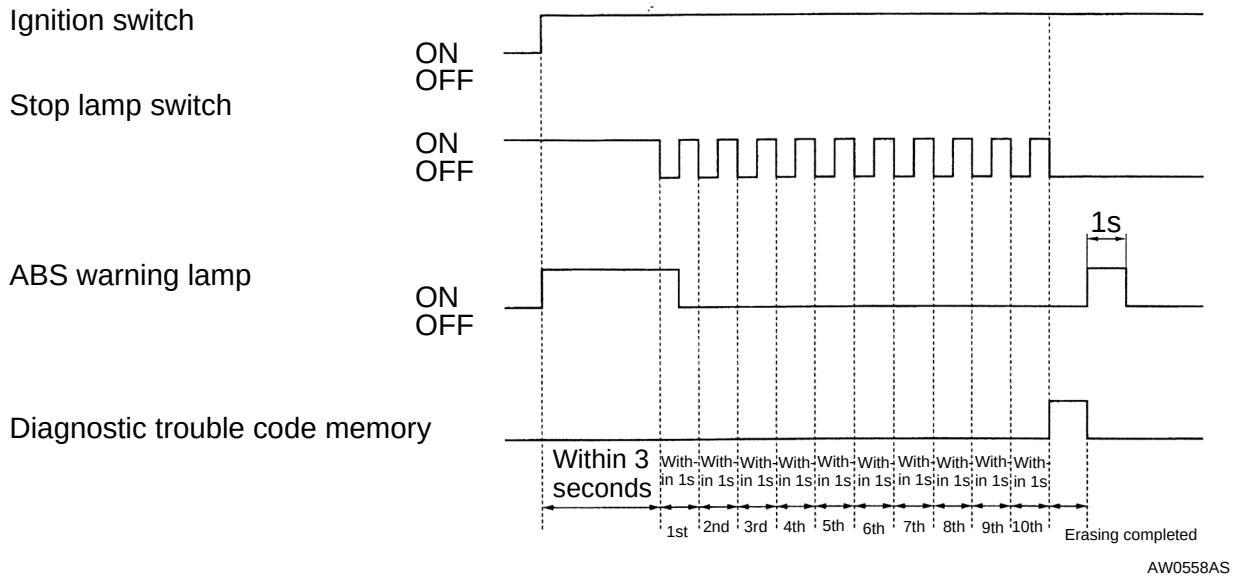
Caution
Turn the ignition switch off before connecting or disconnecting the MUT-II.

When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.
1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.)
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II.

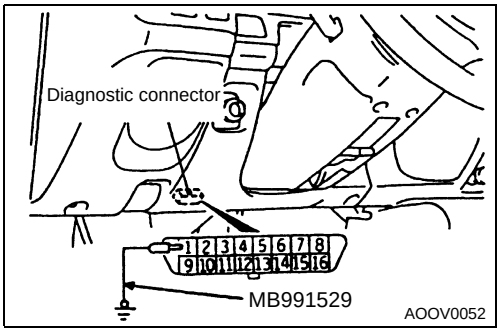
Without the MUT-II

1. Stop the car.
2. Place the stop lamp switch to ON (with brake pedal depressed).
3. Under the condition of 1 and 2 above, turn the ignition switch ON. After that, place the stop lamp switch to OFF (with brake pedal released) within 3 seconds, and cycle the stop lamp switch ON and OFF ten times consecutively.

   NOTE:
   When ABS-ECU stops functioning through the fail-safe mechanism, erasing of the diagnostic troubl codes cannot be performed.



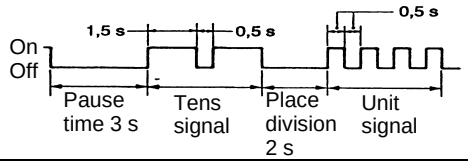
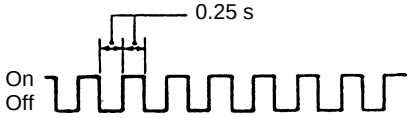
4. Ensure that the diagnostic trouble codes have been erased. When diagnostic trouble codes (Nos. 21 to 24) (for vehicle wheel speed sensor system failures) occur, the above procedures may not erase those codes. In that case, turn the ignition switch OFF, then repeat steps 1 to 3 above.



WHEN USING THE ABS WARNING LAMP

1. Use the special tool to earth No.1. terminal (diagnosis control terminal) of the diagnosis connector.
2. Turn on the ignition switch.
3. Read out a diagnosis code by observing how the ABS warning lamp flashes.

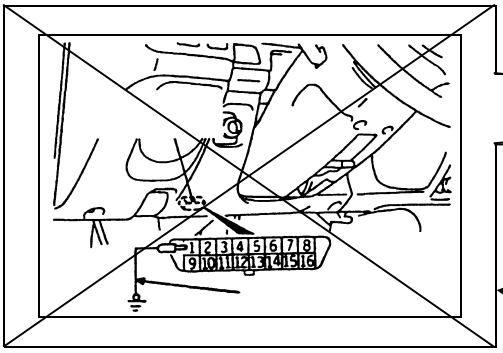
Indication of diagnosis code by ABSA warning lamp

When the diagnosis code No.24 is output	When no diagnosis is output
	

ERASING DIAGNOSIS CODES

With the MUT-II

Refer to Basic Manual GROUP 00 – How to use Troubleshooting/Inspection Service Points.



Without the MUT-II

1. Stop the engine.
2. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector.
3. Turn on the stop lamp switch. (Depress the brake)

2. **<Changed>**

<Deleted>

<Added>

When diagnostic trouble codes (Nos. 21 to 24)(for vehicle wheel speed sensor system failures) occur, normal MUT-II operation may not erase those codes. In that case, erase the diagnostic trouble codes using the following procedures.

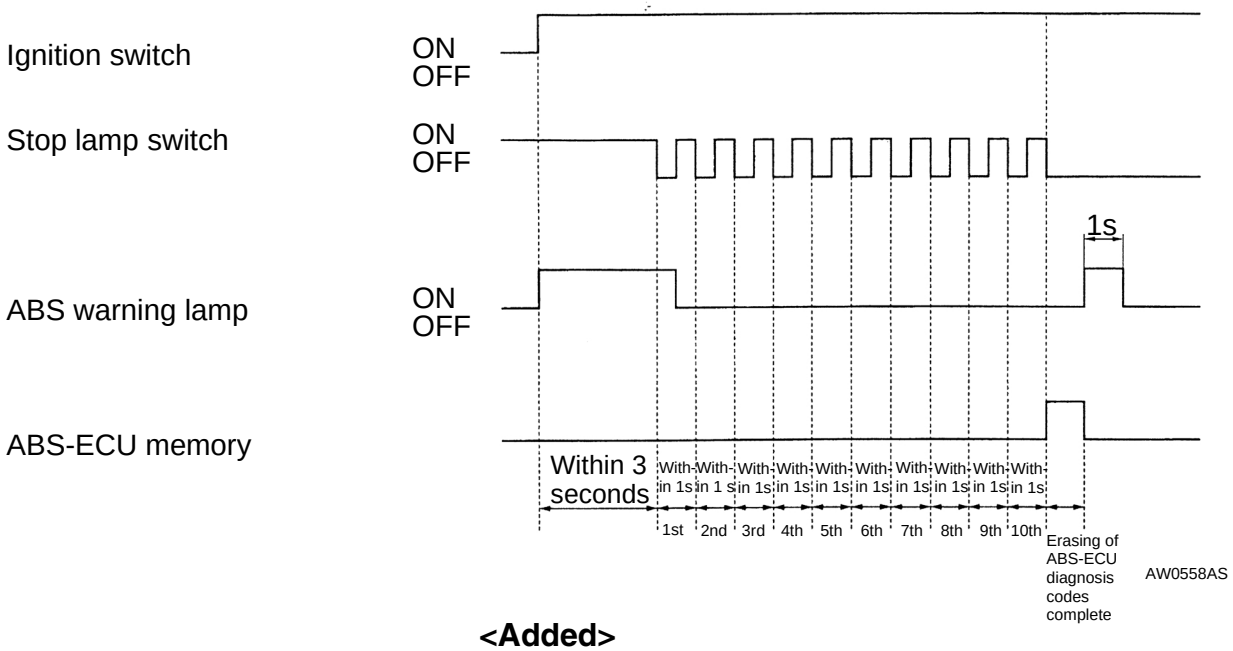
1. Perform erasing of the diagnostic trouble codes by special operation of the brake pedal. (See erasing procedure for the diagnostic trouble codes without use of the MUT-II.
2. Turn the ignition switch OFF.
3. Perform erasing of the diagnostic trouble codes by use of the MUT-II

<Changed> 3.

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 sto lamp switch on and off a total of 10 times.

NOTE

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



<Added>

4. Ensure that the diagnostic trouble codes have been erased.
   When diagnostic trouble codes (Nos.21 to 24)(for vehicle wheel speed sensor system failures) occur, the above procedures may not erase those codes. In that case, turn the ignition switch OFF, then repeat steps 1 to 3 above.