

SERVICE BRAKES

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ANTI-SKID BRAKING SYSTEM (ABS)	35B



BASIC BRAKE SYSTEM

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GENERAL INFORMATION

The brake system has high reliability and durability which maintains excellent braking performance.

The main features are as follows.

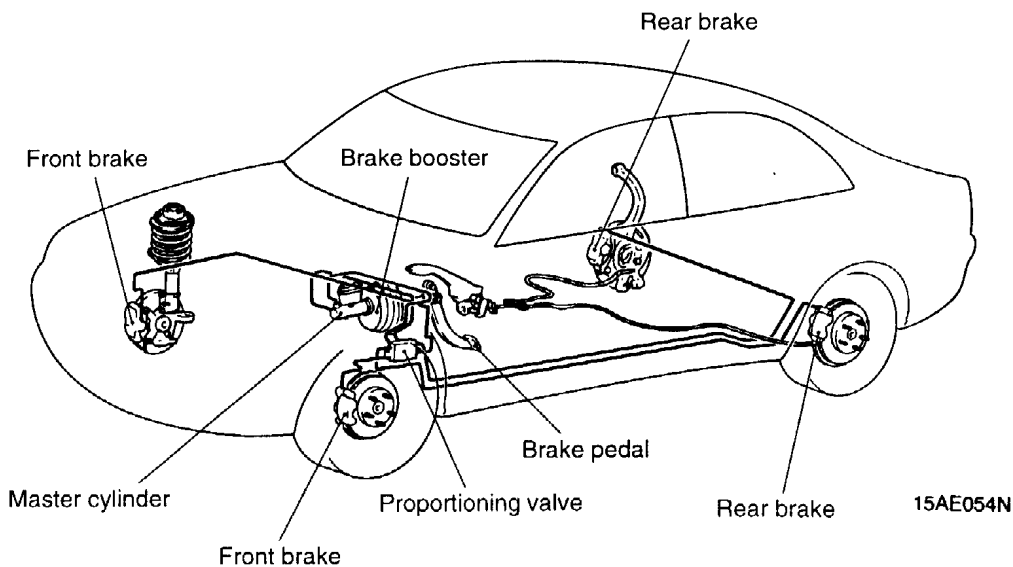
- A dual type master cylinder is equipped on all models.
- A tandem type brake booster has been

adopted.

- Floating calliper, single piston, ventilated disc brakes have been adopted as the front brakes.
- Each rear disc brake is equipped with floating calliper, single piston and solid disc.

Items		Specifications
Master cylinder	I.D. mm (in.)	25.4
Brake booster	Effective dia. of power cylinder mm	205+230
	Boosting ratio	6.5
Proportioning valve	Decompression ratio	0.25
Front brakes	Disc effective dia. mm	276
	Wheel cylinder I.D. mm	60.52
Rear disc brakes	Disc effective dia. mm	258
	Wheel cylinder I.D. mm	38.2

CONSTRUCTION DIAGRAM



SERVICE SPECIFICATIONS

Items	Standard value	Limit
Brake pedal height mm	175–180	–
Brake pedal free play mm	3–8	–
Brake pedal to floorboard clearance mm	85 or more	–
Output pressure of proportioning valve MPa	Split point	2.2–2.7
	Output fluid pressure	3.4–3.9
Left/right proportioning valve output pressure difference MPa (psi)	–	0.4
Front disc brake pad thickness mm	10	2.0
Front disc brake drag force (tangential force of wheel mounting bolts) N	69 or less	–
Front brake disc thickness mm	24	22.4
Front brake disc run-out mm	–	0.06
Front hub end play mm	–	0.05
Rear disc brake pad thickness mm	8.8	1.0
Rear disc brake drag force (tangential force of wheel mounting bolts) N	69 or less	–
Rear brake disc thickness mm	10.4	8.4
Rear brake disc run-out mm	–	0.05
Booster push rod to master cylinder piston clearance mm	0.40–0.60	–

LUBRICANTS

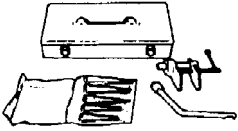
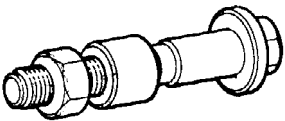
Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal	Repair kit grease (orange)
Slide pin boot and slide pin bush inner surfaces	
Brake piston boot inner surfaces	
Lock pin boot inner surfaces	
Guide pin boot inner surfaces	
Pad assembly and shim contact surface	
Piston boot mounting grooves	
Piston cup surface	

35A-4 BASIC BRAKE SYSTEM – Sealant/Special Tools

SEALANT

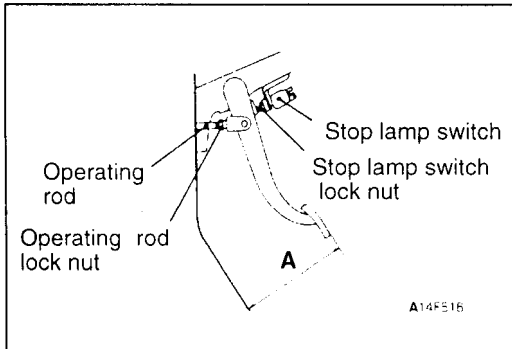
Items	Specified sealant	Remarks
Thread part fitting	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Vacuum switch		

SPECIAL TOOLS

Tool	Number	Name	Use
	MB990964 MB990520 MB990619	Brake tool set	Compressing front disc brake piston Installation of drum brake wheel cylinder piston cup
	MB990998	Front hub remover and installer	Removal and installation of front hub

ON-VEHICLE SERVICE

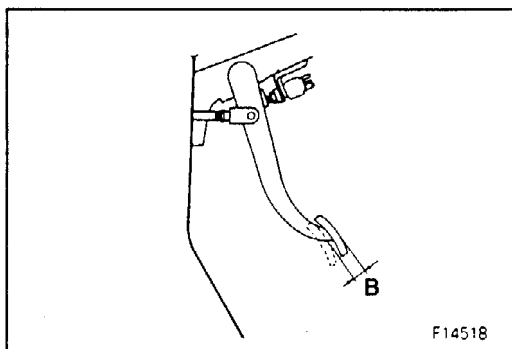
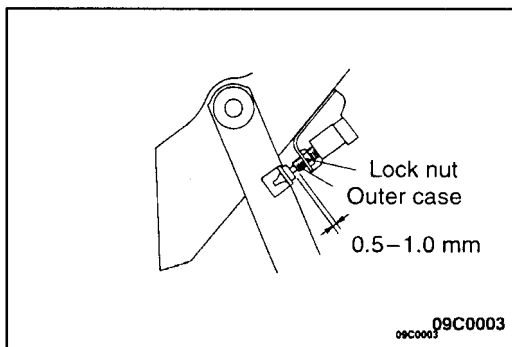
BRAKE PEDAL CHECK AND ADJUSTMENT



1. Turn up the carpet, etc. under the brake pedal.
2. Measure the brake pedal height as illustrated. If the brake pedal height is not within the standard value, adjust as follows.

Standard value (A): 175–180 mm

- (1) Disconnect the stop lamp switch connector, loosen the lock nut, and move the stop lamp switch to a position where it does not contact the brake pedal arm.
- (2) Screw in the stop lamp switch until it contacts the brake pedal stopper (just before the brake pedal is caused to move). Back off the stop lamp switch 1/2 to 1 turn and secure by tightening the lock nut.
- (3) Connect the connector of the stop lamp switch.
- (4) Check to be sure that the stop lamp is not illuminated with the brake pedal released.



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

Standard value (B): 3–8 mm

If the free play exceeds the standard value, it is probably due to excessive play between the clevis pin and brake pedal arm.

Check for excessive clearance and replace faulty parts as required.

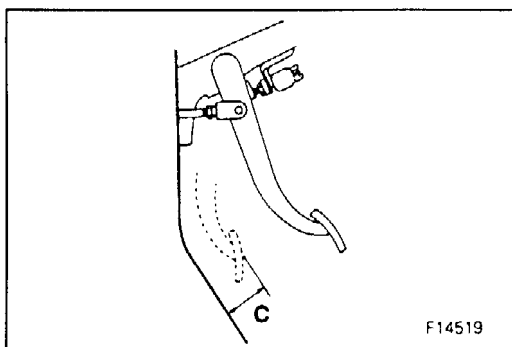
4. Start the engine, depress the brake pedal with approximately 490 N of force, and measure the clearance between the brake pedal and the floorboard.

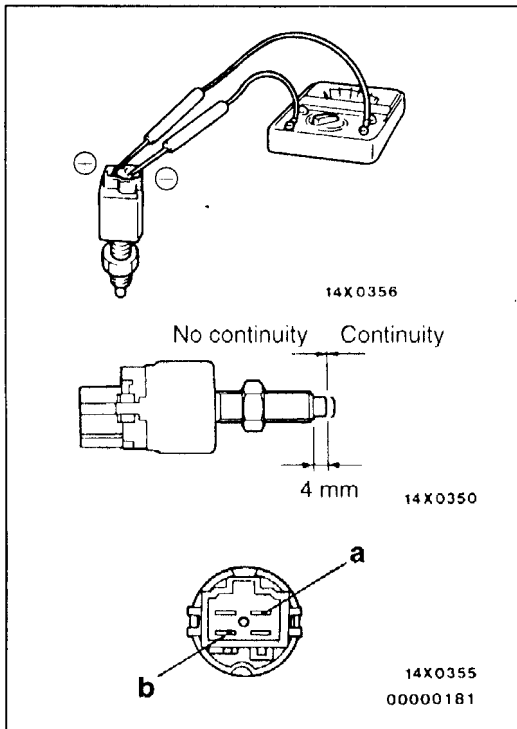
Standard value (C): 85 mm or more

If the clearance is less than the standard value, check for air trapped in the brake line.

Adjust and replace defective parts as required.

5. Turn back the carpet, etc.

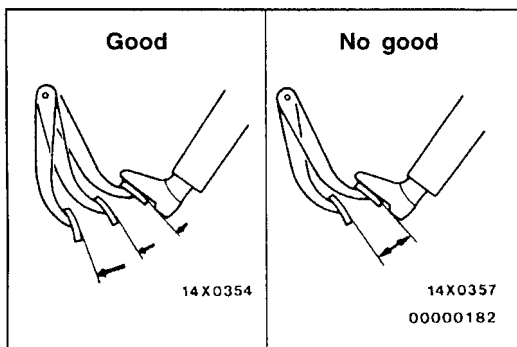




STOP LAMP SWITCH CHECK

Connect a circuit tester to stop lamp switch terminals “a” and “b” and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.

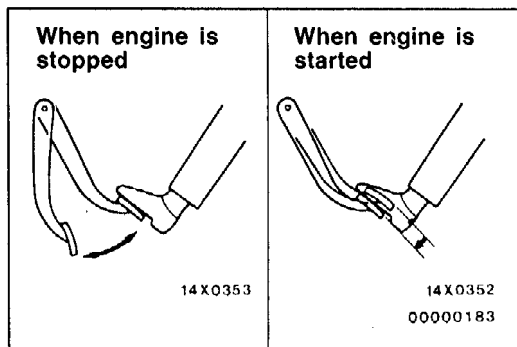
The stop lamp switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm from the outer case edge surface, and if there is continuity when it is released.



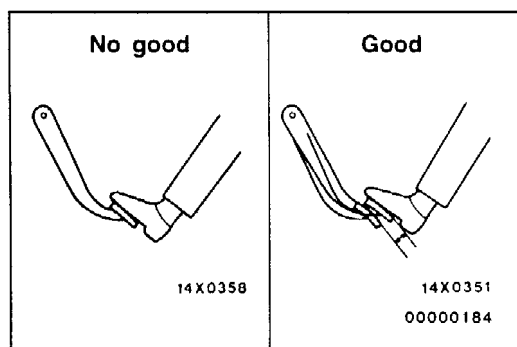
BRAKE BOOSTER OPERATING TEST

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

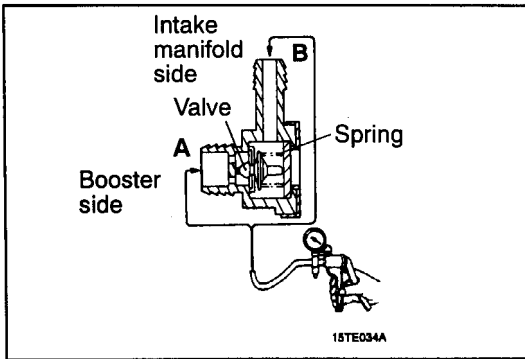
1. Run the engine for one or two minutes, and then turn the engine off.
If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly. If the pedal height remains unchanged, the booster is defective.



2. With the engine stopped, step on the brake pedal several times.
Then step on the brake pedal and start the engine.
If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition. If the pedal rises, the booster is defective.
Brake booster performance is satisfactory if it passes all three operating tests.
If the brake booster does not pass all three tests, there may be a fault in the check valve, vacuum hose or in the booster itself.



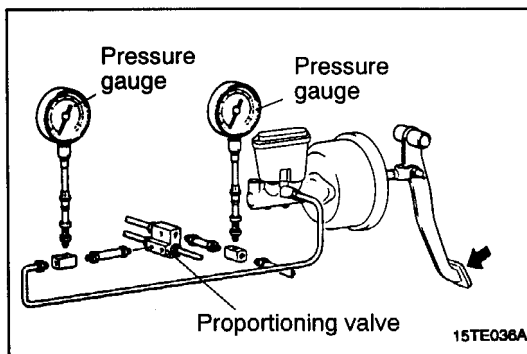
CHECK VALVE OPERATION CHECK

1. Remove the vacuum hose.
2. Remove the check valve.
3. Check the operation of the check valve by using a vacuum pump.

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

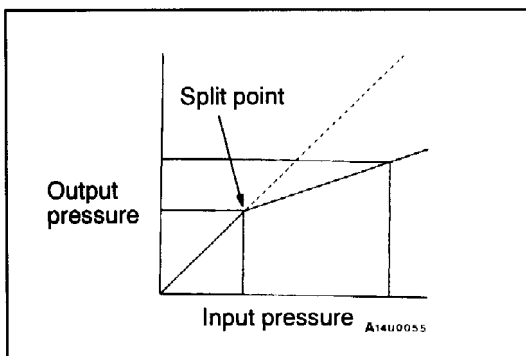
Caution

If the check valve is defective, replace it as an assembly, never attempt to disassemble it.



PROPORTIONING VALVE FUNCTION TEST

1. Connect two pressure gauges, one each to the input side and output side of the proportioning valve, as shown.
2. Air bleed the brake line and the pressure gauge.
3. While gradually depressing the brake pedal, make the following measurements and check to be sure that the measured values are within the allowable range.



- (1) Output pressure begins to drop relative to input pressure (split point).

Standard value: 2.2–2.7 MPa

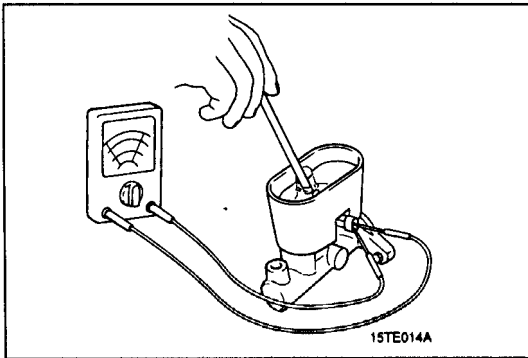
- (2) Output fluid pressure when input fluid pressure is 6.1–6.6 MPa.

Standard value: 3.4–3.9 MPa

- (3) Output pressure difference between left and right brake lines

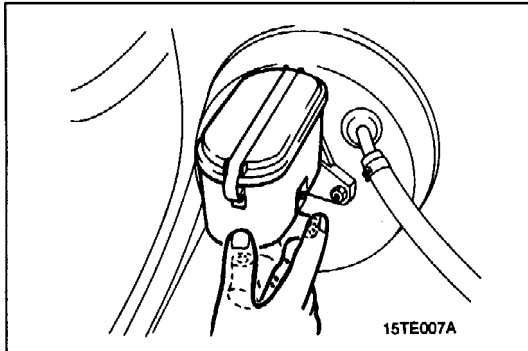
Limit: 0.4 MPa

4. If the measured pressures are not within allowable ranges, replace the proportioning valve.



BRAKE FLUID LEVEL SENSOR CHECK

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



BLEEDING

Caution

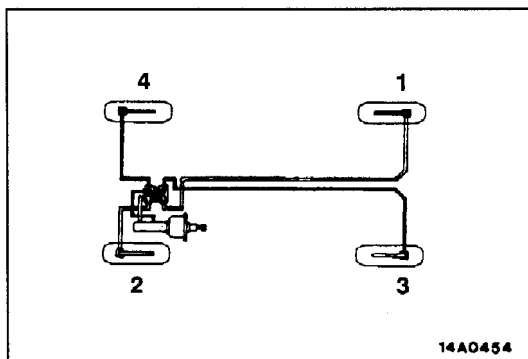
Use the specified brake fluid. Don't use a mixture of the specified brake fluid and another non-specified fluid.

Specified brake fluid: DOT3 or DOT4

MASTER CYLINDER BLEEDING

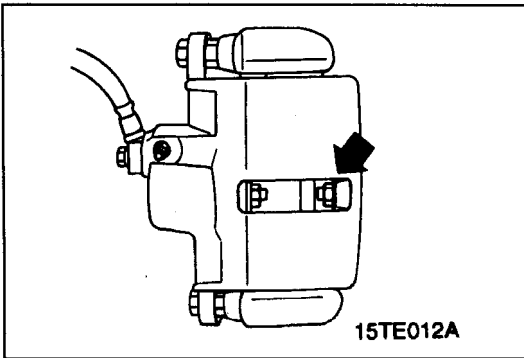
The master cylinder has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake line will become easier.

- (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 LINE BLEEDING

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



FRONT DISC BRAKE PAD CHECK AND REPLACEMENT

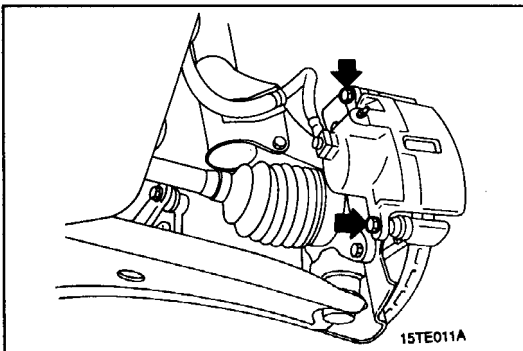
1. Check brake pad thickness through calliper body check port.

Standard value: 10 mm

Limit: 2.0 mm

Caution

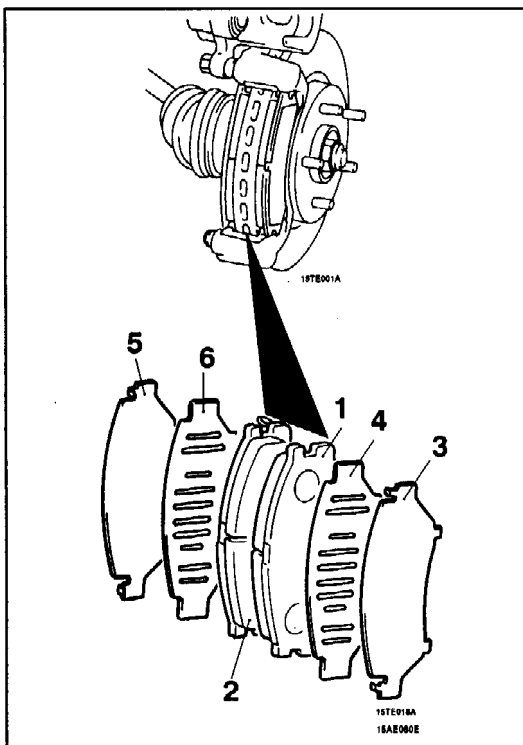
1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.



2. Remove guide pin. Lift calliper assembly upwards and support it with wires.

Caution

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

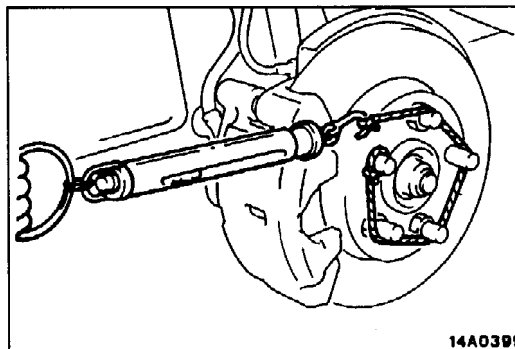
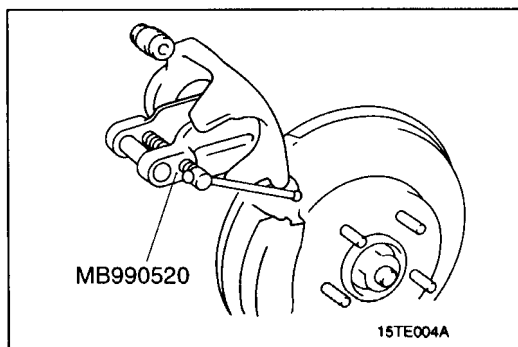
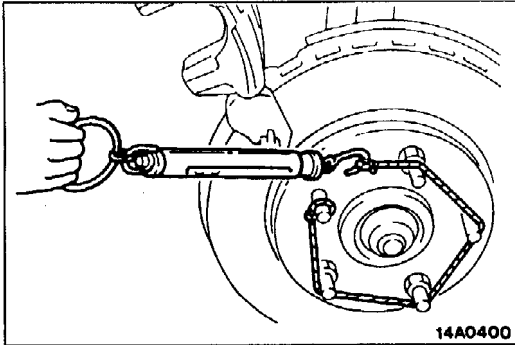
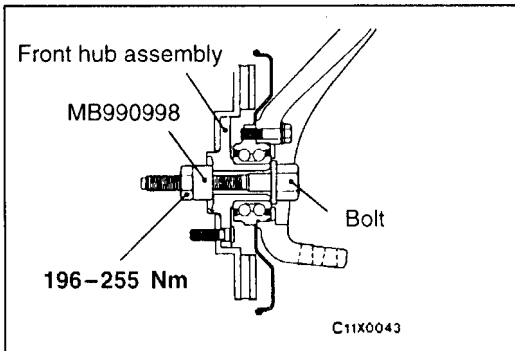


3. Remove the following parts from calliper support.

1. Pad assembly
2. Pad assembly
3. Outer shim (stainless)
4. Inner shim (coated with rubber)
5. Outer shim (stainless)
6. Inner shim (coated with rubber)

NOTE

Shims must be cleaned and inspected for serviceability, if found to be unserviceable new shims must be fitted.



4. Take out the drive shaft.
(Refer to GROUP 26 – Drive Shaft.)
5. Set the special tool to the front hub assembly as shown in the illustration.

6. Measure hub torque (A) with pads removed to measure brake drag torque. Torque value will be used later to calculate brake drag force with the pads installed.

NOTE

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

7. Fit the pad clip and pads to the calliper support.
8. Clean piston and push into cylinder (calliper) with special tool.
9. Be careful that the piston boot does not catch and tear as the calliper assembly and lock pin are installed.
10. 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 [4 Nm] or less

11. 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.
12. Reinstall the drive shaft.
(Refer to GROUP 26 – Drive Shaft.)

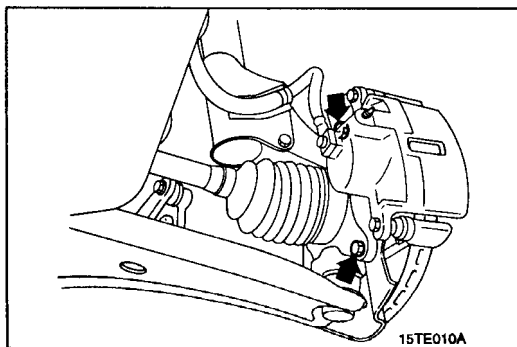
FRONT DISC BRAKE ROTOR CHECK

Caution

To maintain safe braking performance, the disc brake rotors must be kept within allowable service specifications.

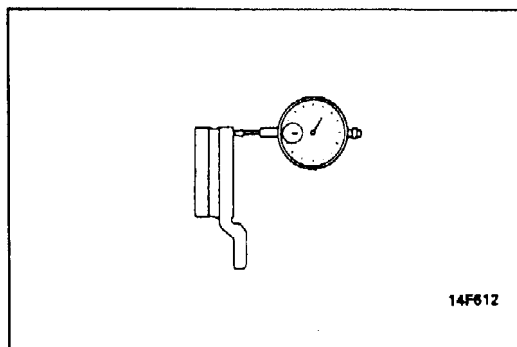
Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

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



FRONT BRAKE DISC RUN-OUT CHECK

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

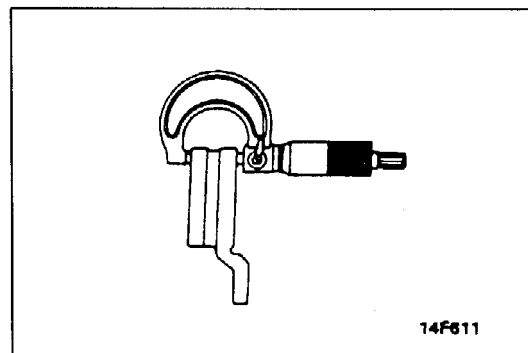
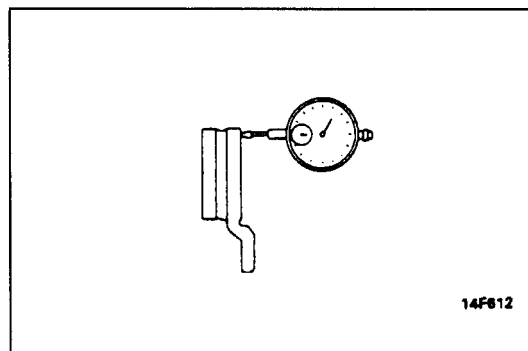
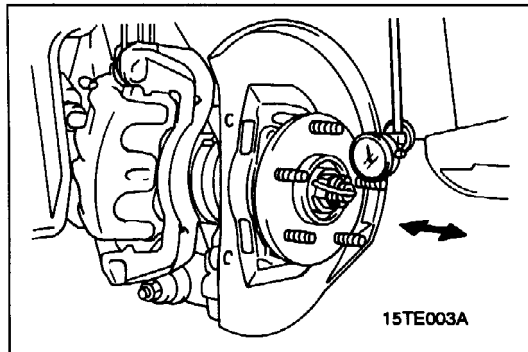
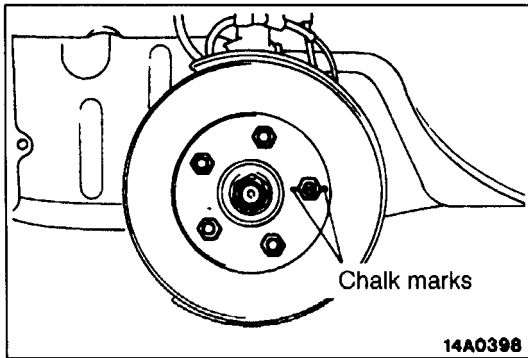


3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the runout of the disc.

Limit: 0.06 mm

NOTE

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



FRONT BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

(1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.

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

Limit: 0.05 mm

If the play is equivalent to or exceeds the limit, disassemble the hub knuckle and check each part.

(3) If the play does not exceed the limit specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc once again.

2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the brake disc or turn rotor with an on the car type brake lathe ("MAD, DL-8700PF" or equivalent). Be sure to follow the exact brake lathe manufacturer instructions. Rotors turned on the vehicle will often have a lower run-out than a new brake disc.

FRONT BRAKE DISC THICKNESS CHECK

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

Brake disc thickness

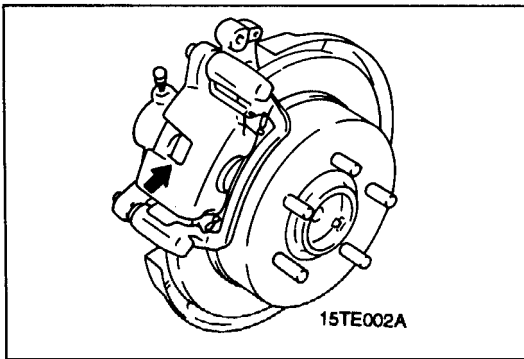
Standard value: 24 mm

Limit: 22.4 mm

Thickness variation (at least 8 positions)

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

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



REAR DISC BRAKE PAD CHECK AND REPLACEMENT

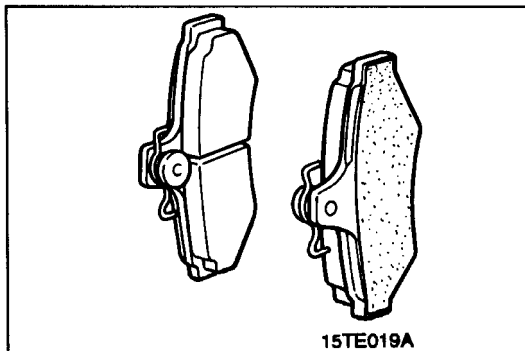
1. Check brake pad thickness through calliper body check port.

Standard value: 10 mm

Limit: 2.0 mm

Caution

1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
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 sleeve and guide pin sleeve.

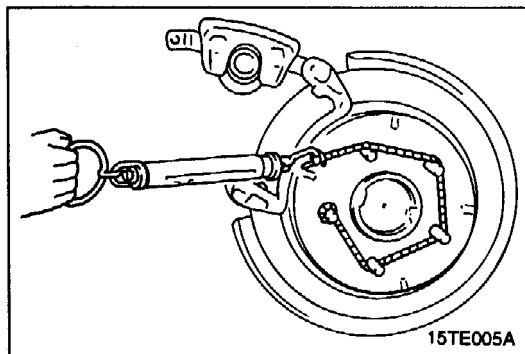


2. Remove the lower guide pin calliper bolt. Lift calliper assembly and retain with wire.

Caution

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

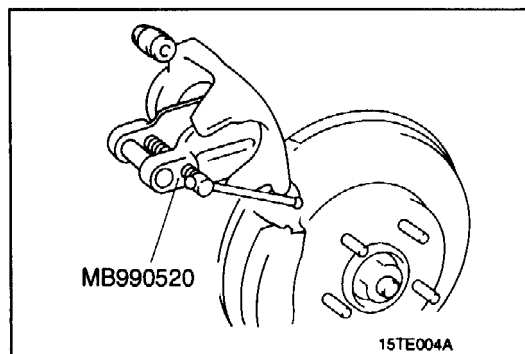
3. Remove the brake pads parts from the calliper support.



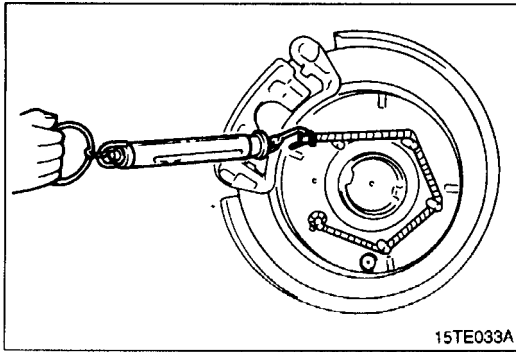
4. Measure hub torque (A) with pads removed to measure brake drag torque. Torque value (A) will be used later to calculate brake drag force with the pads installed.

NOTE

To secure the disc to the hub, tighten the nuts.



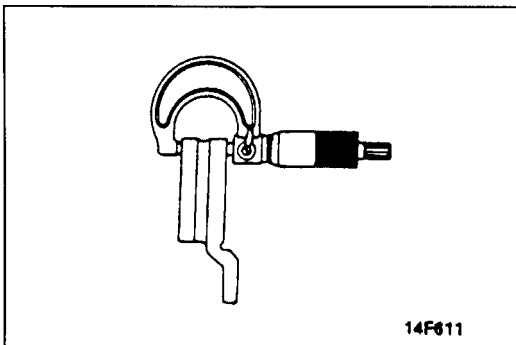
5. Clean the piston; then use the special tool to thread the piston into the cylinder (calliper).
6. Be careful that the piston boot does not catch and tear as the calliper assembly and guide pin locking bolts are installed.



7. 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 brake 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 [4 Nm] or less

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



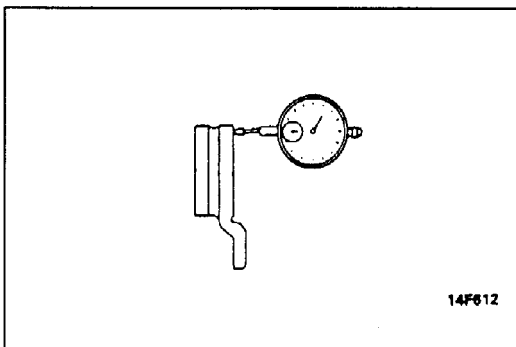
REAR BRAKE DISC THICKNESS CHECK

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 locations or more.

Standard value: 10.4 mm

Limit: 8.4 mm

Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.



REAR BRAKE DISC RUN-OUT CHECK

1. Remove the calliper support, raise the calliper assembly, and secure it by using a wire, etc.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit: 0.05 mm

NOTE

To secure the disc to the hub, tighten the nuts.

REAR BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

NOTE

The procedures for checking and changing the rear disc phase are the same as those for the front brake discs.

2. If the problem cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor using an on the car type brake lathe. Be sure to follow the exact brake lathe manufacturer instructions. Rotors turned on the vehicle will often have a lower run-out than a new brake disc.

MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

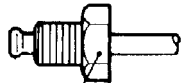
Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

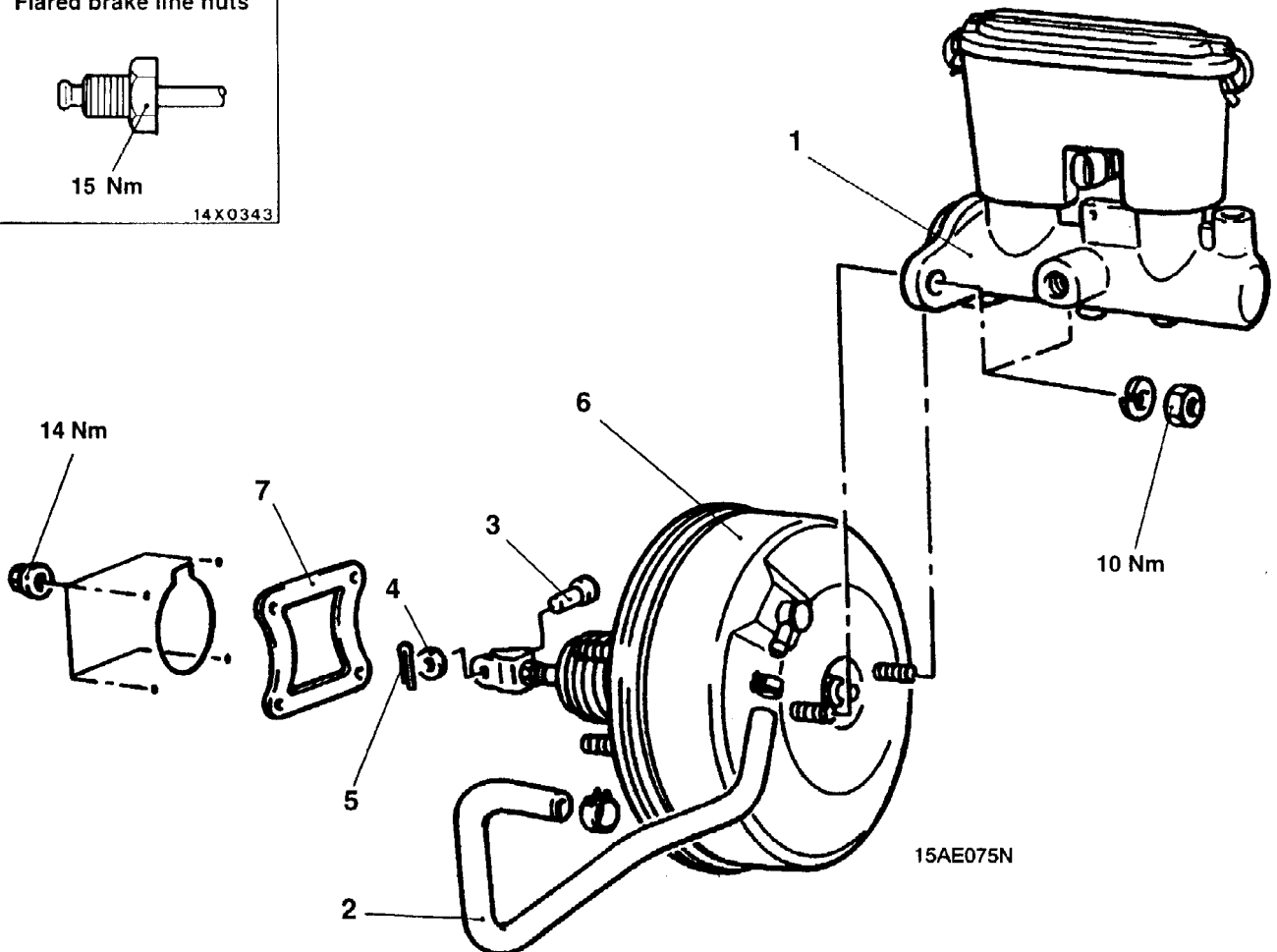
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-8.)
- Brake Pedal Adjustment (Refer to P.35A-5.)

Flared brake line nuts



15 Nm

14X0343



Master cylinder removal steps

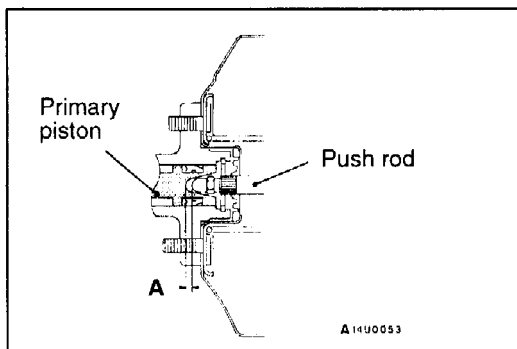
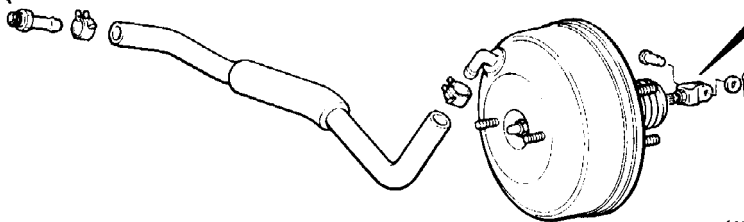
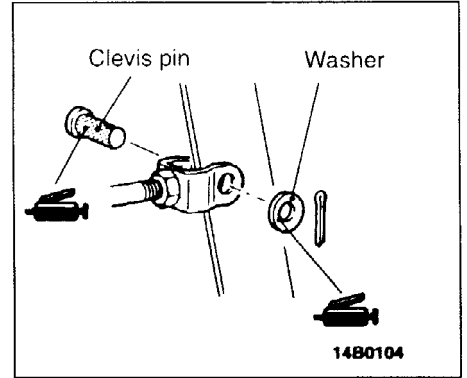
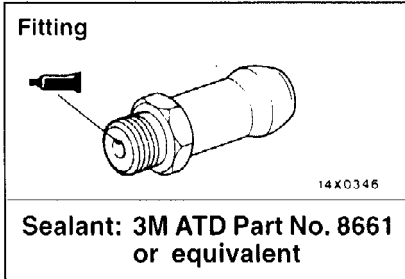
- ▶◀
1. Master cylinder
 - Adjustment of clearance between brake booster push rod and primary piston

Brake booster removal steps

- ▶◀
1. Master cylinder
 - Adjustment of clearance between brake booster push rod and primary piston
 2. Vacuum hose (With built-in check valve)
 3. Cotter pin
 4. Washer
 5. R-clip
 6. Brake booster
 7. Sealer

35A-18 BASIC BRAKE SYSTEM – Master Cylinder and Brake Booster

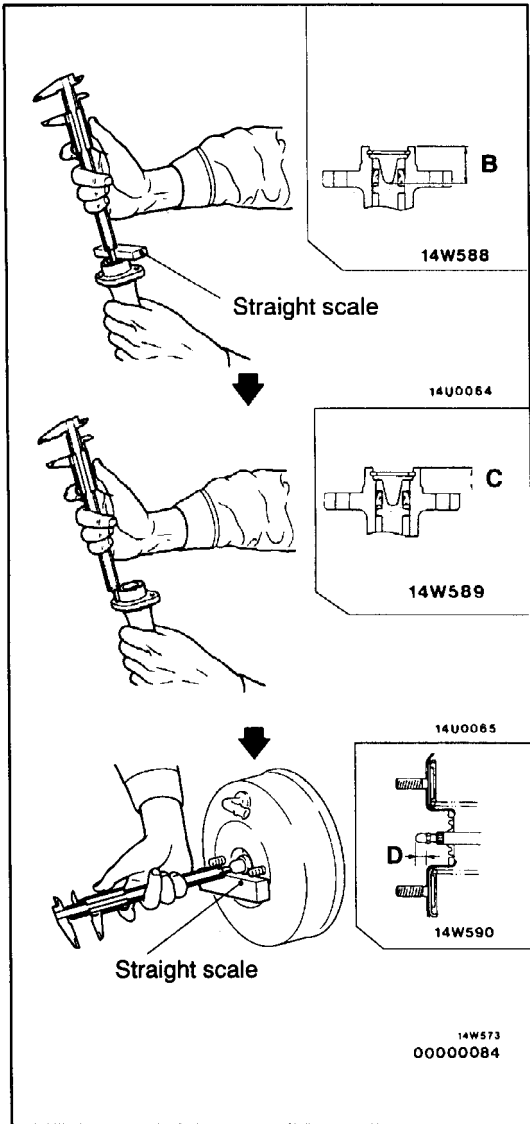
Grease points



INSTALLATION SERVICE POINT

►A◄ CLEARANCE ADJUSTMENT BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON

Adjust the clearance (A) between the brake booster push rod and primary piston as follows:



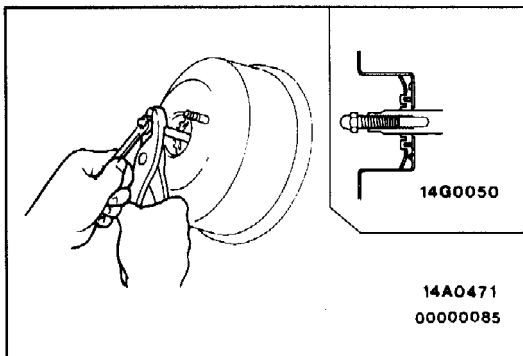
Calculate clearance A from the B, C and D measurements.

$$A = B - C - D$$

Standard value:0.40–0.60mm

NOTE

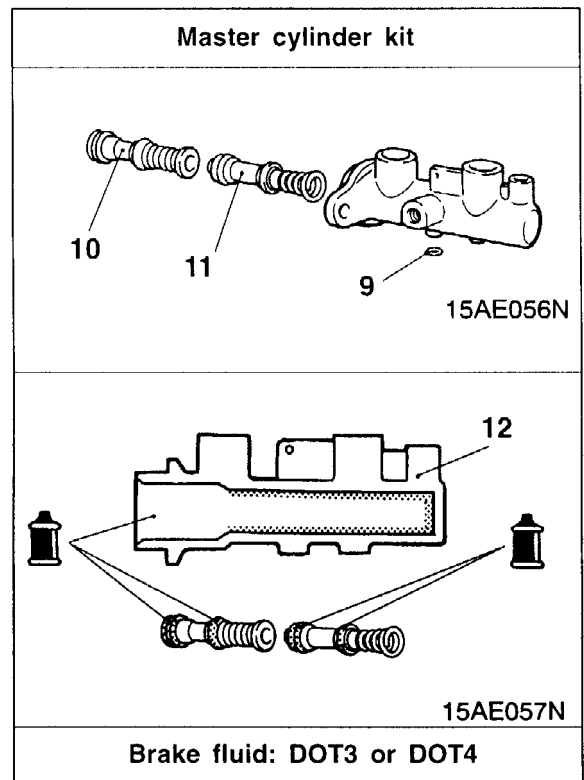
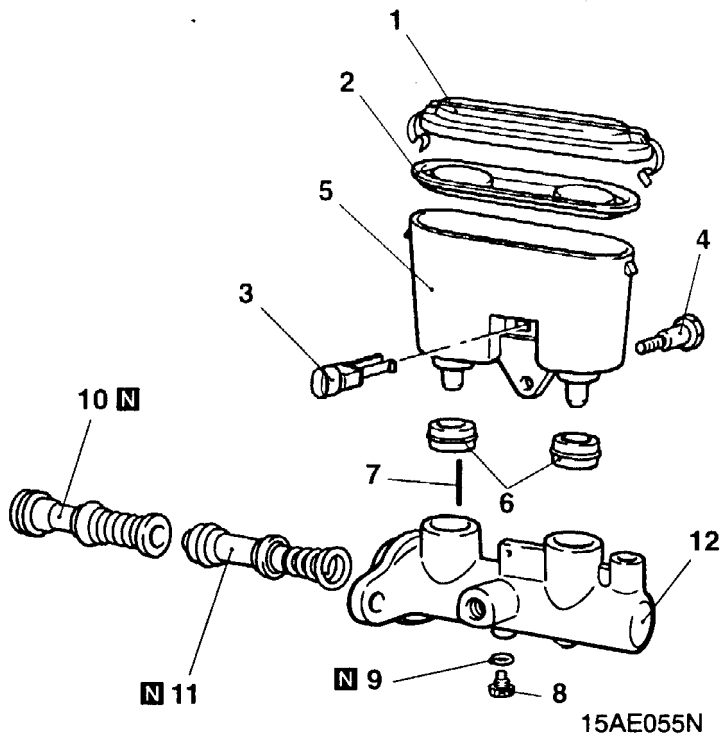
When brake booster negative pressure -93.3 kPa is applied, clearance value will become $0.05-0.30$ mm.



NOTE

If the clearance is not within the standard value range, turn the push rod screw to achieve desired length.

**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**



15AE058N

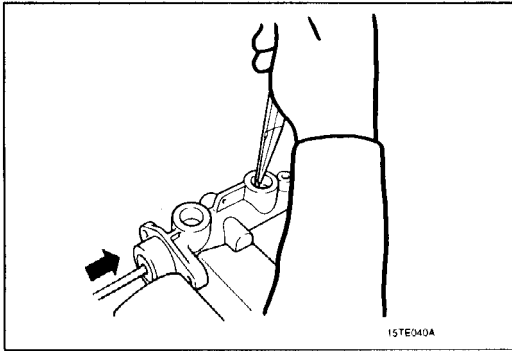
Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Brake fluid level sensor
4. Reservoir bolt
5. Reservoir
6. Reservoir seals
7. Piston stopper pin (Vehicles with ABS)



8. Piston stopper bolt (Vehicles without ABS)
9. Gasket (Vehicles without ABS)
10. Primary piston assembly
11. Secondary piston assembly
12. Master cylinder body

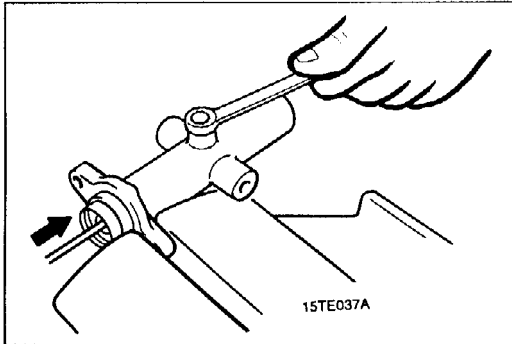
Caution
Do not disassemble the primary and secondary piston assemblies.



DISASSEMBLY SERVICE POINTS

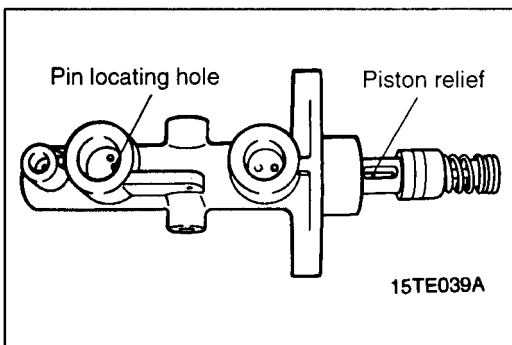
◀A▶ PISTON STOPPER PIN REMOVAL <VEHICLES WITH ABS>

Remove the piston stopper pin, while depressing the piston.



◀B▶ PISTON STOPPER BOLT REMOVAL <VEHICLES WITHOUT ABS>

Remove the piston stopper bolt while depressing the piston.



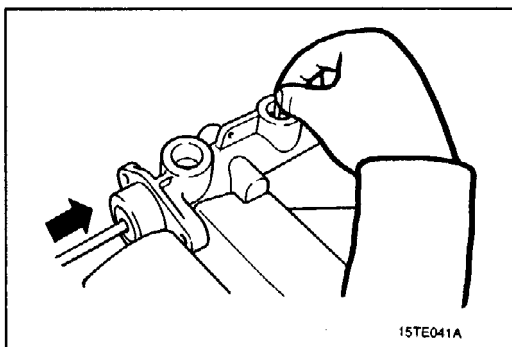
REASSEMBLY SERVICE POINT

▶A◀ PISTON STOPPER PIN <VEHICLES WITH ABS>

1. Align the relief in the secondary piston with the piston stopper pin locating hole and push the piston into the bore.
2. Push the primary piston into the bore and then while depressing the primary piston drop the piston stopper pin through the locating hole into the secondary piston relief.

NOTE

Ensure the pin goes all the way through the secondary piston and locates in the bottom of the master cylinder bore.



INSPECTION

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

FRONT DISC BRAKE

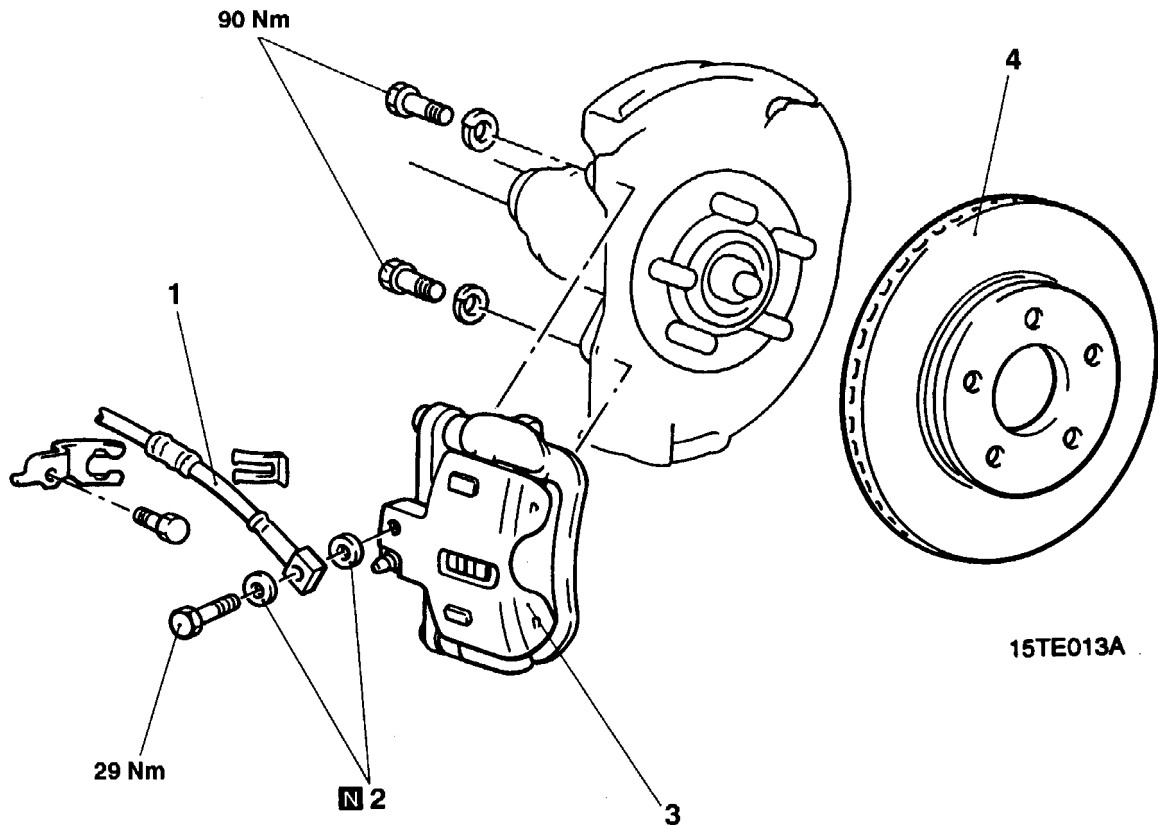
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-8.)

**Removal steps**

1. Connection for the brake hose
2. Gasket
3. Front brake assembly
4. Brake disc

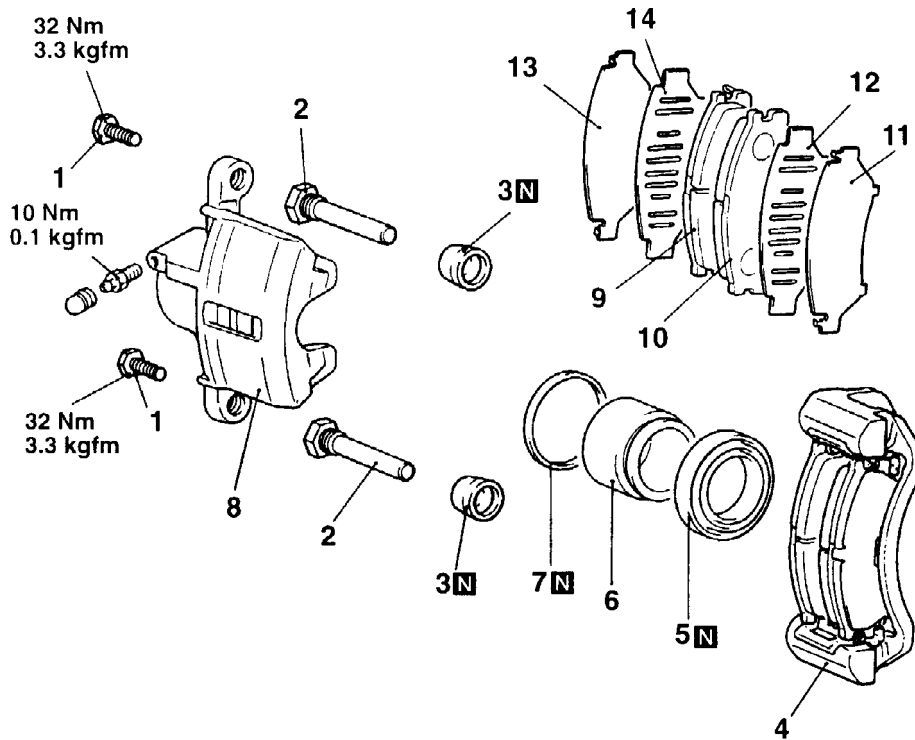
**INSTALLATION SERVICE POINTS****▶A◀ FRONT BRAKE ASSEMBLY INSTALLATION**

Install the front brake assembly and measure the disc brake drag torque. (Refer to P.35A-10.)

INSPECTION

Check the brake disc for damage.

DISASSEMBLY AND REASSEMBLY



15TE026E
15AE082E

<p>15AE081E</p>	<p>15TE026A</p>	<p>15TE028A</p>
<p>Brake calliper kit</p>	<p>Pad kit</p>	<p>Seal and boot kit</p>

Calliper Disassembly steps

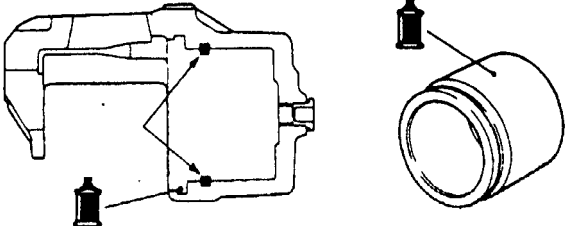
1. Guide pin locking bolts
2. Guide pins
3. Boot
4. Calliper support (pad, shims)
5. Piston boot
6. Piston
7. Piston seal
8. Calliper body

Pad Disassembly steps

1. Guide pin locking bolts
2. Guide pins
3. Boot
4. Calliper support (pad, shims)
9. Pad assembly
10. Pad assembly
11. Outer shim (stainless)
12. Inner shim (coated with rubber)
13. Outer shim (stainless)
14. Inner shim (coated with rubber)



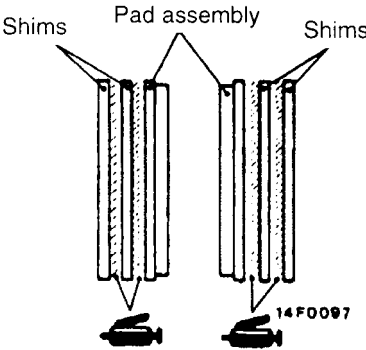
Lubrication Points



14X0302 14X0301

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

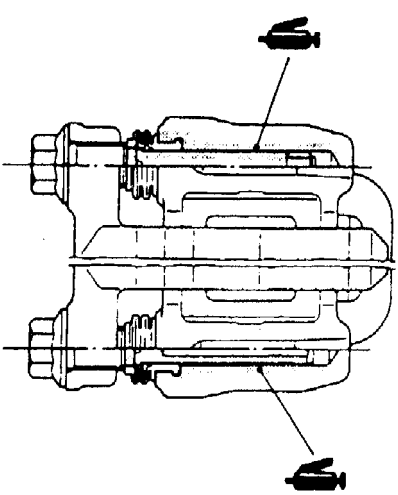
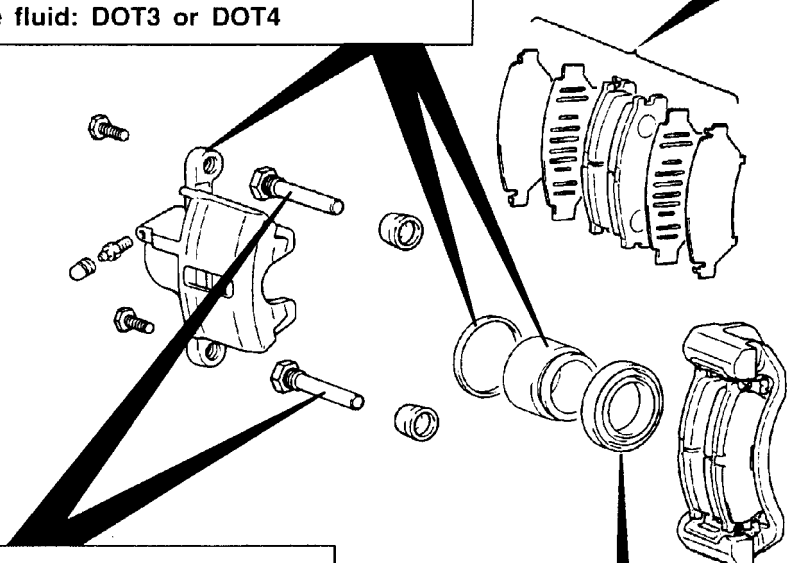
Brake fluid: DOT3 or DOT4



Shims Pad assembly Shims

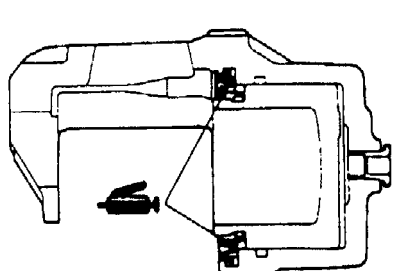
14F0097

Grease: Repair kit grease (orange)



14A0541

Grease: Repair kit grease (orange)



00000386

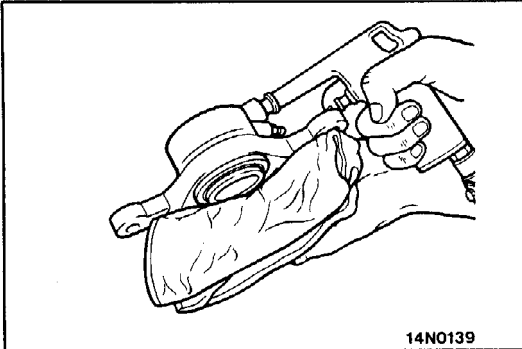
14X0303

Grease: Repair kit grease (orange)

15TE026A
15AE083E

DISASSEMBLY SERVICE POINTS

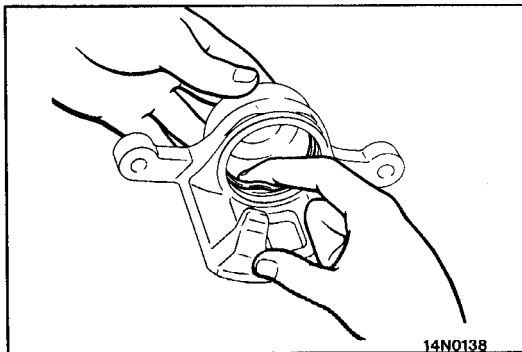
When disassembling the disc brakes, disassemble both sides (left and right) as a set.

**◀A▶ PISTON BOOT/PISTON REMOVAL**

Protect calliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution

Blow compressed air gently.

**◀B▶ PISTON SEAL REMOVAL**

1. Remove piston seal with finger tip.

Caution

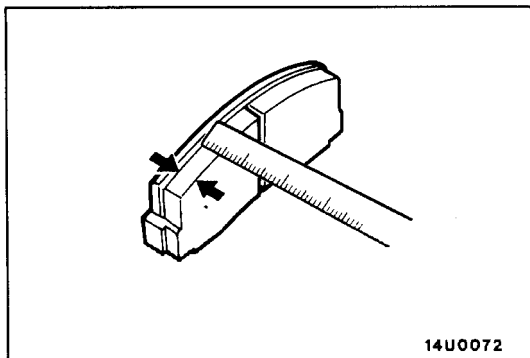
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

Specified brake fluid: DOT3 or DOT4

INSPECTION

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check calliper 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 when pad thickness is less than the limit value.

Standard value: 10 mm

Limit value: 2.0 mm

Caution

1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
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.

REAR DISC BRAKE

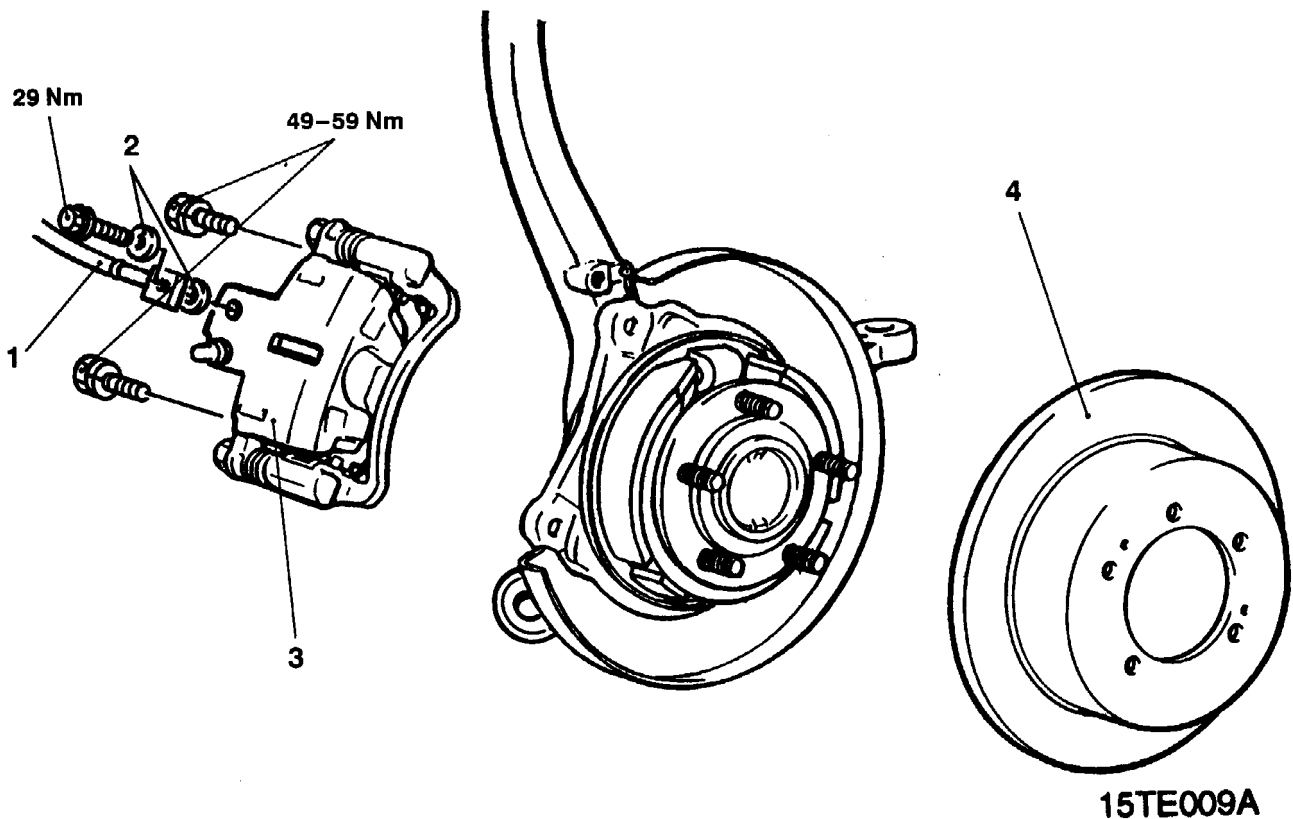
REMOVAL AND INSTALLATION

Pre-removal Operation

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

Post-installation Operation

- Brake Fluid Filling and Air Bleeding (Refer to P.35A-8.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)



Removal steps

1. Connection for the brake hose
2. Gasket
- ▶A◀ 3. Rear brake assembly
4. Brake disc

INSTALLATION SERVICE POINT

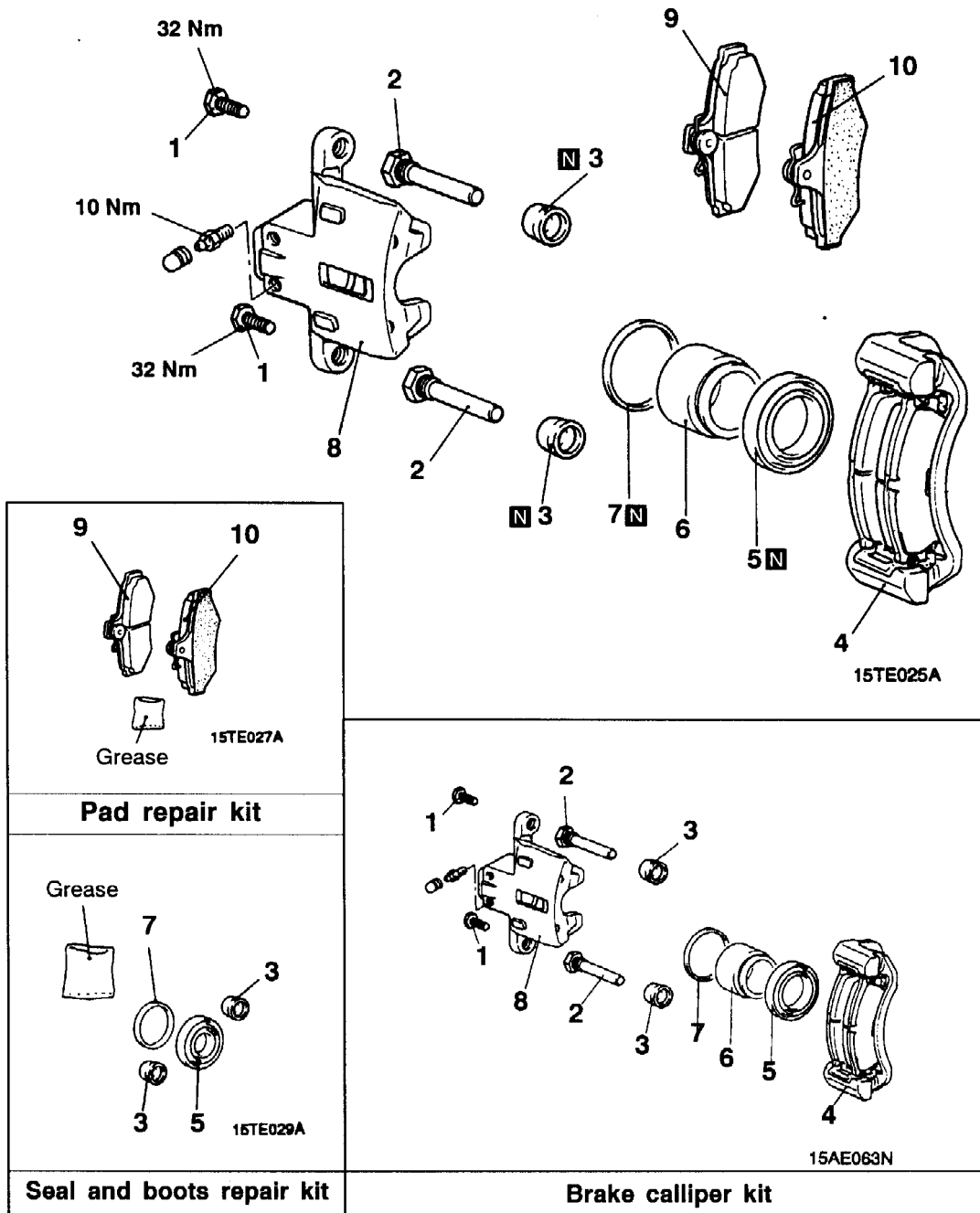
▶A◀ REAR BRAKE ASSEMBLY INSTALLATION

Install the rear brake assembly and measure the disc brake drag torque. (Refer P.35A-14.)

INSPECTION

- Check the brake disc for damage.
- Check the brake disc for thickness.
- Check the brake disc for run-out.

DISASSEMBLY AND REASSEMBLY



15AE062N

Calliper assembly disassembly steps

1. Guide pin locking bolts
2. Guide pin
3. Boot
4. Calliper support (pads)
5. Piston boot
6. Piston
7. Piston seal

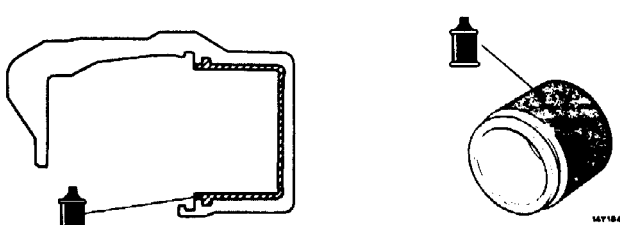
8. Calliper body

Pad assembly disassembly steps

1. Locking bolts
2. Guide pin
3. Boot
4. Calliper support (pads)
9. Pad and wear indicator assembly
10. Pad assembly



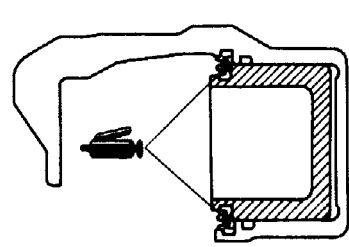
Lubrication Points



14L0127

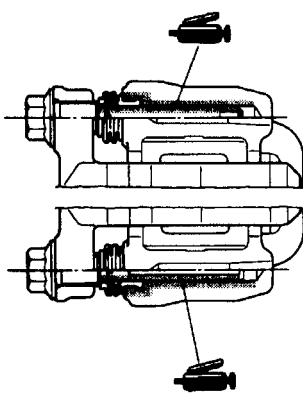
Caution
The piston seal inside the seal and boot kit is coated with special grease. Do not wipe this grease off.

Brake fluid: DOT3 or DOT4



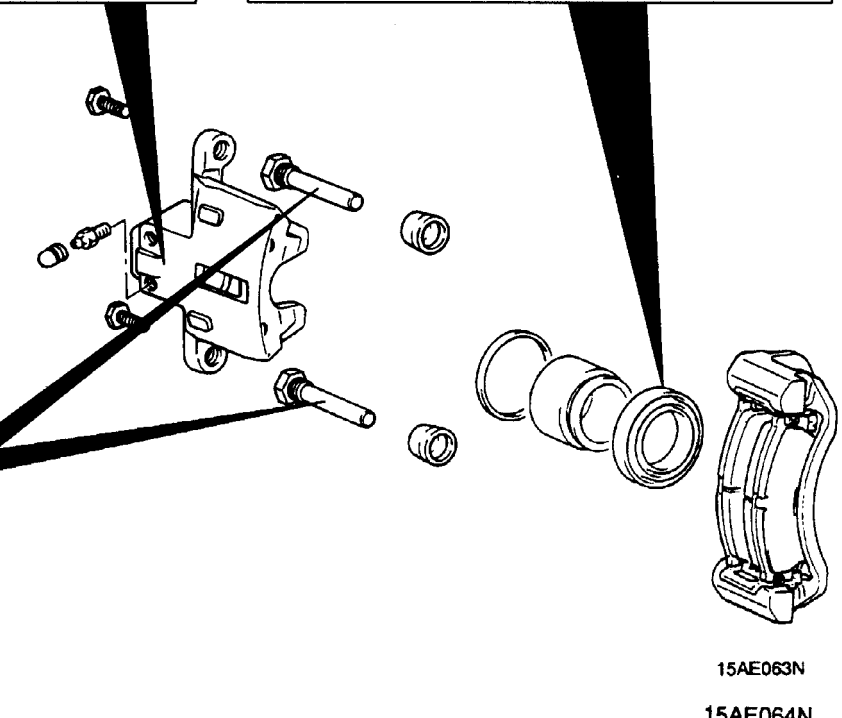
14L0128

Grease: Repair kit grease (orange)

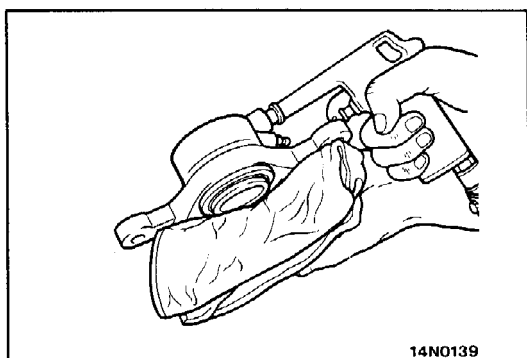


14A0541

Grease: Repair kit grease



15AE063N
15AE064N



DISASSEMBLY SERVICE POINTS

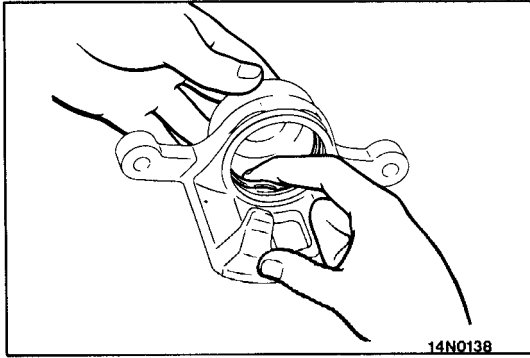
When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀▶ PISTON BOOT/PISTON REMOVAL

Protect calliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution

Blow compressed air gently.



◀B▶ PISTON SEAL REMOVAL

1. Remove piston seal with finger tip.

Caution

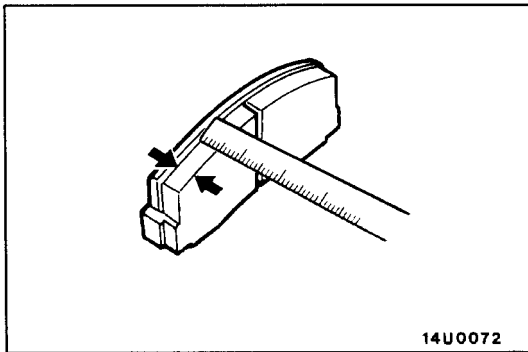
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

Specified brake fluid: DOT3 or DOT4

INSPECTION

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check calliper 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 when pad thickness is less than the limit value.

Standard value: 8.8 mm

Limit value: 1.0 mm

Caution

1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
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.

PROPORTIONING VALVE

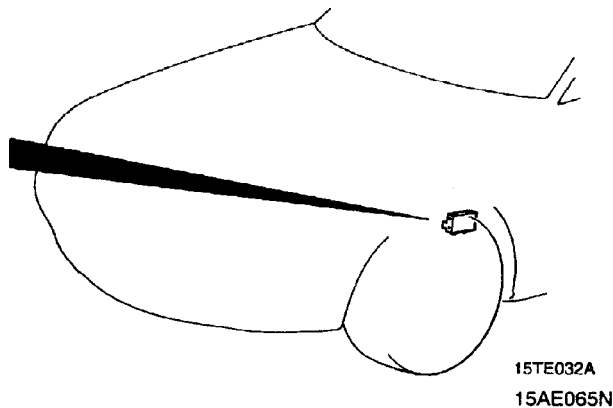
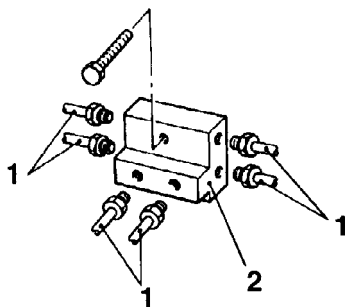
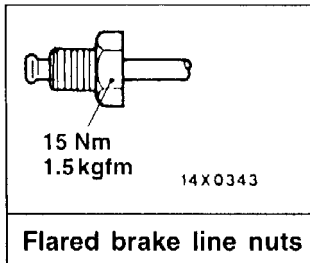
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining
- Air Intake Hose Removal

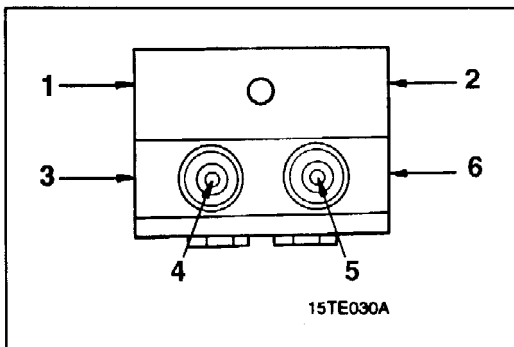
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-8.)
- Air Intake Hose Installation



Removal steps

- ▶A◀ 1. Connection for the brake pipe
2. Proportioning valve



INSTALLATION SERVICE POINT

▶A◀ **BRAKE PIPE CONNECTION**

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

Vehicles without ABS

1. Proportioning valve – Rear brake (L.H.)
2. Proportioning valve – Rear brake (R.H.)
3. Proportioning valve – Front brake (R.H.)
4. Proportioning valve – Master cylinder
5. Proportioning valve – Master cylinder
6. Proportioning valve – Front brake (L.H.)

Refer to P.35B-32.

ANTI-SKID BRAKING SYSTEM (ABS)

CONTENTS

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SEALANT	3	Motor Relay Check	27
SPECIAL TOOLS	3	Valve Relay Check	27
TROUBLESHOOTING	4	Remedy for a Flat Battery	27
ON-VEHICLE SERVICE	23	PROPORTIONING VALVE	28
Bleeding	23	HYDRAULIC UNIT	29
Wheel Speed Sensor Output Voltage Check ..	23	WHEEL SPEED SENSOR	31
Hydraulic Unit Inspection	24	ELECTRONIC CONTROL UNIT	33

Refer to GROUP 35A for the following items.

BRAKE PEDAL

FRONT DISC BRAKE

LUBRICANTS

ON-VEHICLE SERVICE

Brake Booster Operating Test

Brake Fluid Level Sensor Check

Check Valve Operation Check

Front Brake Disc Run-out Check

Front Brake Disc Run-out Correction

Front Brake Disc Thickness Check

Front Disc Brake Pad Check and Replacement

Front Disc Brake Rotor Inspection

Proportioning Valve Function Test

Rear Brake Disc Run-out Check

Rear Brake Disc Run-out Correction

Rear Brake Disc Thickness Check

Rear Disc Brake Pad Check and Replacement

MASTER CYLINDER AND BRAKE BOOSTER

REAR DISC BRAKE

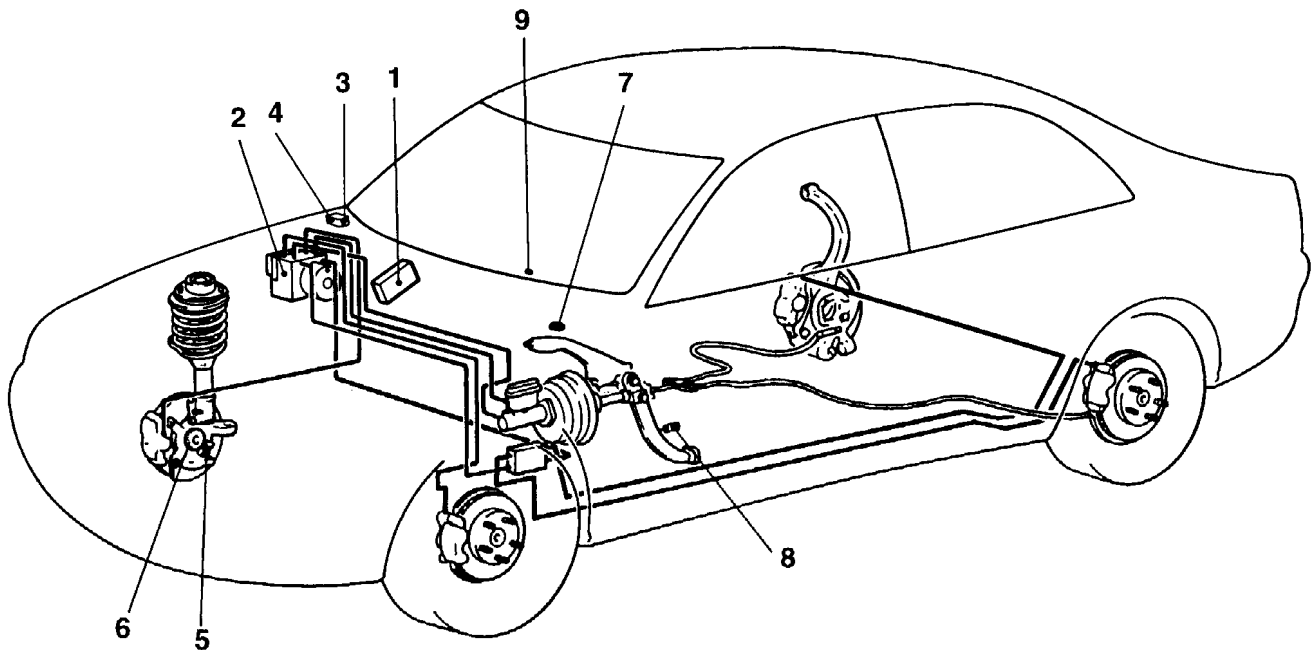
GENERAL INFORMATION

The ABS consists of wheel speed sensors, brake pedal switch, hydraulic unit and the ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnostic function. The diagnosis code will not be erased even if the ignition switch is turned to OFF.

In addition, reading of diagnosis codes, service data and actuator testing are possible using the MUT-II.

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	48
Rear rotor teeth	48

CONSTRUCTION DIAGRAM



15AE047N

1. ABS-ECU
2. Hydraulic unit
3. ABS valve relay
4. ABS motor relay
5. Wheel speed sensor

6. Rotor
7. Diagnosis connector
8. Stop lamp switch
9. ABS warning lamp

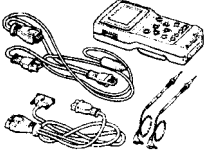

SERVICE SPECIFICATIONS

Items	Standard value
Hydraulic unit inlet solenoid valve internal resistance Ω	8.0–9.0
Hydraulic unit outlet solenoid valve internal resistance Ω	3.8–4.8
Speed sensor's internal resistance $k\Omega$	1.4–1.8
Clearance between the wheel speed sensor mounting surface and the toothed rotor mm	28.2–28.5

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II	For checking ABS
		ROM pack	

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTES WITH REGARD TO DIAGNOSIS

The conditions listed in the following table are considered normal.

Condition	Explanation of condition
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. This is considered normal.
ABS operation sound	<ol style="list-style-type: none"> 1. Sound of the motor inside the ABS hydraulic unit operating (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 overconfident.

Diagnosis detection condition depends on the diagnosis code.

When checking to see if the trouble symptom reoccurs after the diagnosis code has been erased, check the detection conditions column in the inspection chart for diagnosis codes (refer to P.35B-6) and the memorise conditions recorded in the “Comments” column of the inspection procedure chart for diagnosis codes in order to carry out testing under driving conditions which satisfy each of the given conditions.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

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

ERASING DIAGNOSIS CODES

WITH MUT-II

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

WITHOUT MUT-II

1. Press on the brake pedal so that the brake pedal switch is on.
2. Switch the ignition ON.
3. Wait until the ABS warning lamp goes out, then release the brake pedal.
4. “Toggle” the brake pedal so that the ABS-ECU receives a brake pedal switch on signal 9 times in 20 seconds.
5. The warning lamp will illuminate for 1 second to confirm code erasure.

INSPECTION CHART FOR DIAGNOSIS CODES

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

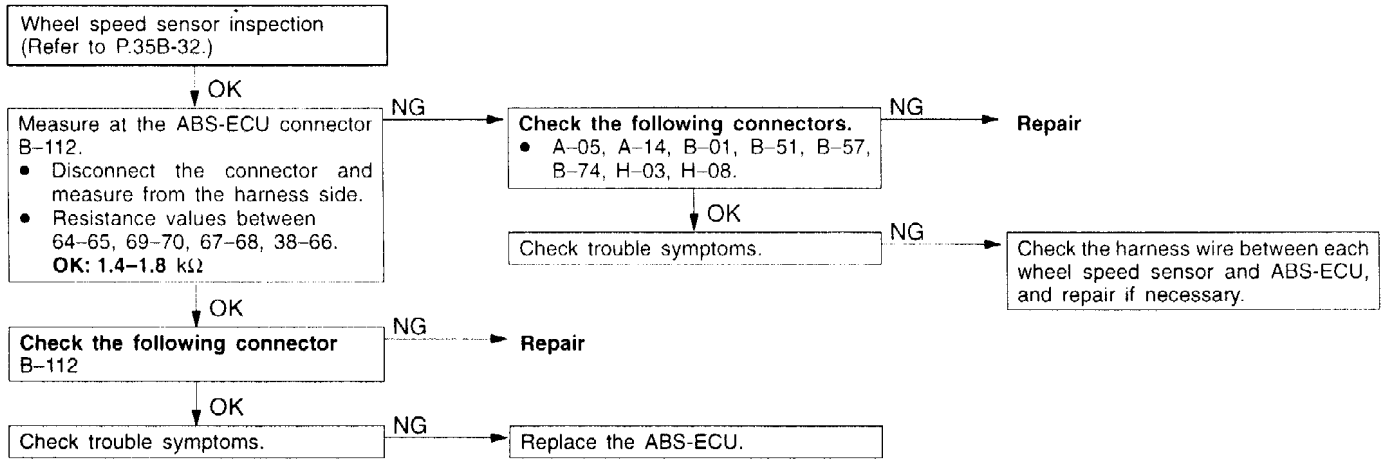
Diagnosis code no.	Inspection item	Detection conditions	Reference page
11	Front right wheel speed sensor	Open circuit	B, C 35B-6
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor output signal abnormal	A, B	35B-6
16	Power supply system	A, B, C	35B-7
21	Front right wheel speed sensor	Short circuit	
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
38	Stop light switch system	B, C	35B-8
41	Front right solenoid valve (inlet)	B, C	35B-9
42	Front left solenoid valve (inlet)		
43	Rear right solenoid valve (inlet)		
44	Rear left solenoid valve (inlet)		
45	Front right solenoid valve (outlet)	B, C	35B-10
46	Front left solenoid valve (outlet)		
47	Rear right solenoid valve (outlet)		
48	Rear left solenoid valve (outlet)		
51	Valve relay	A, B, C	35B-11
53	Motor relay	B	35B-12
63	ABS-ECU	A, B, C	Replace ABS-ECU

Detection conditions

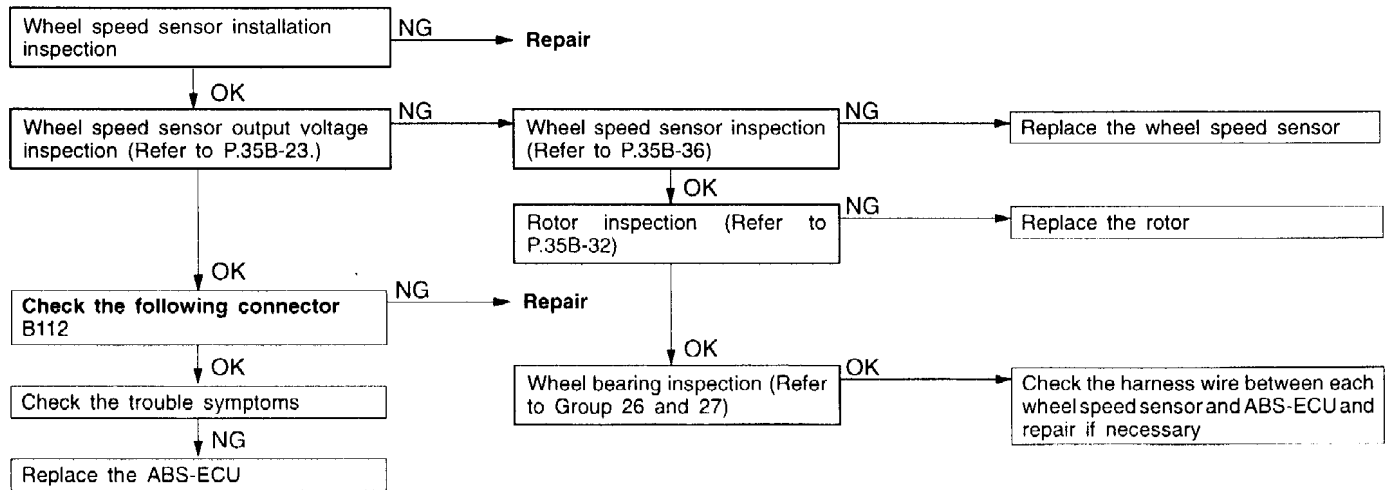
- A: During system check immediately after starting
 B: While ABS control is not operating while driving
 C: While ABS control is operating

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
These codes are displayed when the sensor with the open circuit can be distinguished.	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor (Open circuit) • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



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

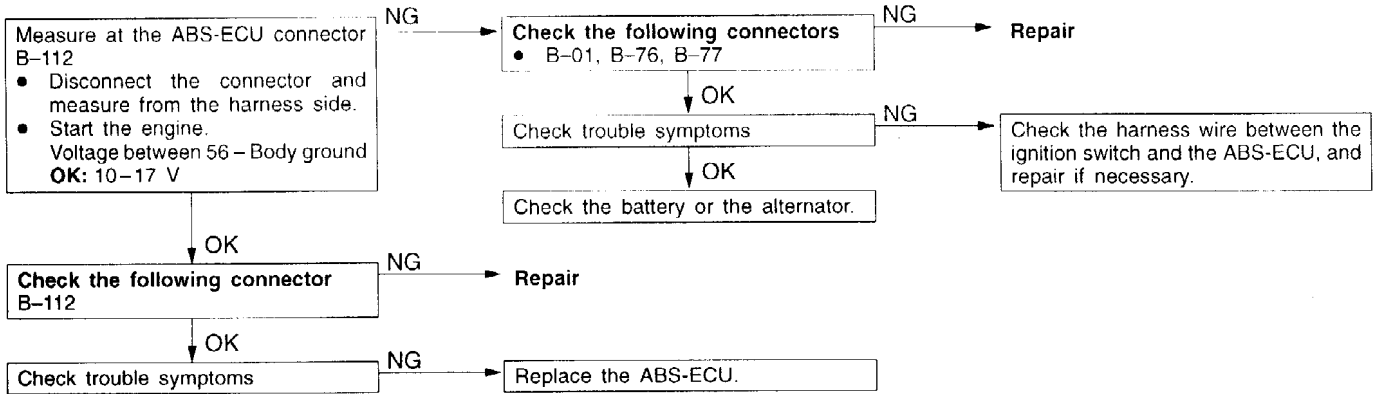


Code No. 16 Power supply system	Probable cause
This diagnosis code is output when the ABS-ECU power voltage is outside the standard value. Furthermore, if the voltage returns to normal, this diagnosis code will not be output.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector. ● Malfunction of battery or alternator ● Malfunction of ABS-ECU

Caution

If the battery voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made.

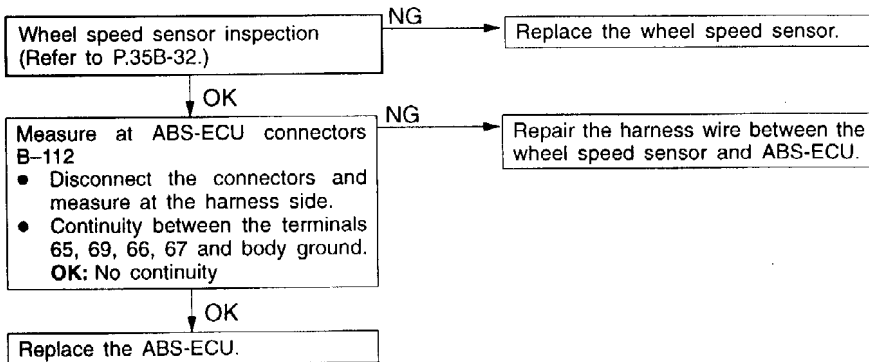
Before carrying out the following inspection, check the battery condition, and recharge it if necessary.



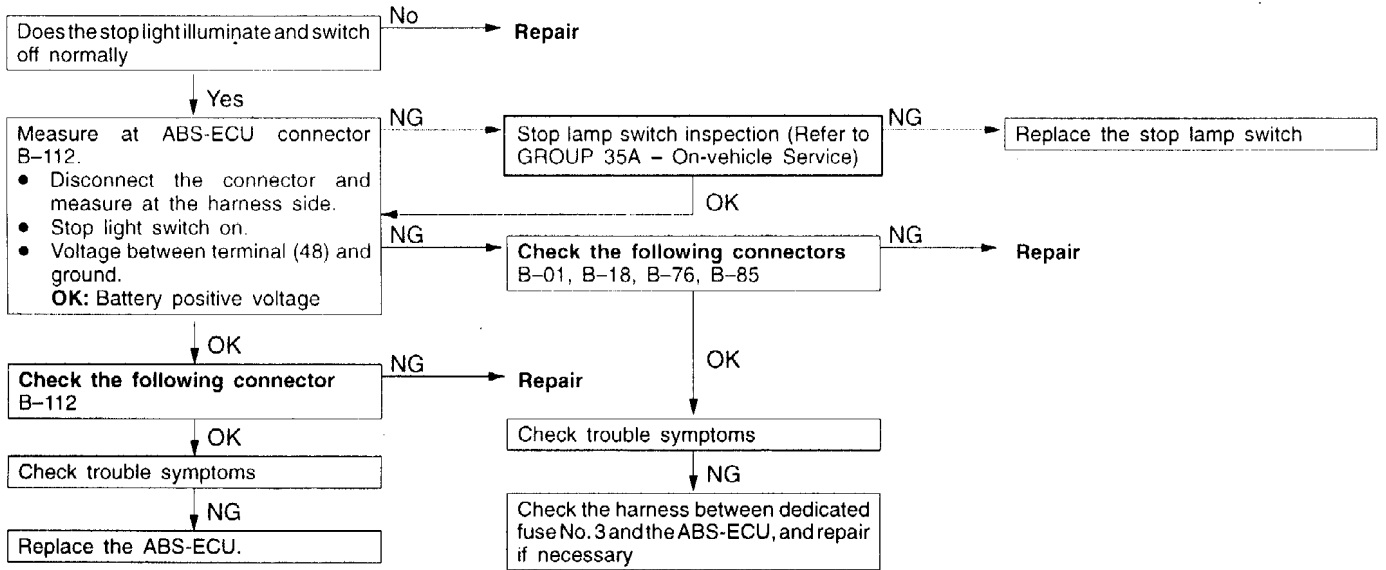
Code No. 21, 22, 23, 24 Wheel speed sensor short circuit	Probable cause
These codes are displayed when the sensor with the short circuited can be distinguished.	<ul style="list-style-type: none"> ● Malfunction of wheel speed sensor ● Malfunction of wiring harness ● Malfunction of ABS-ECU

NOTE

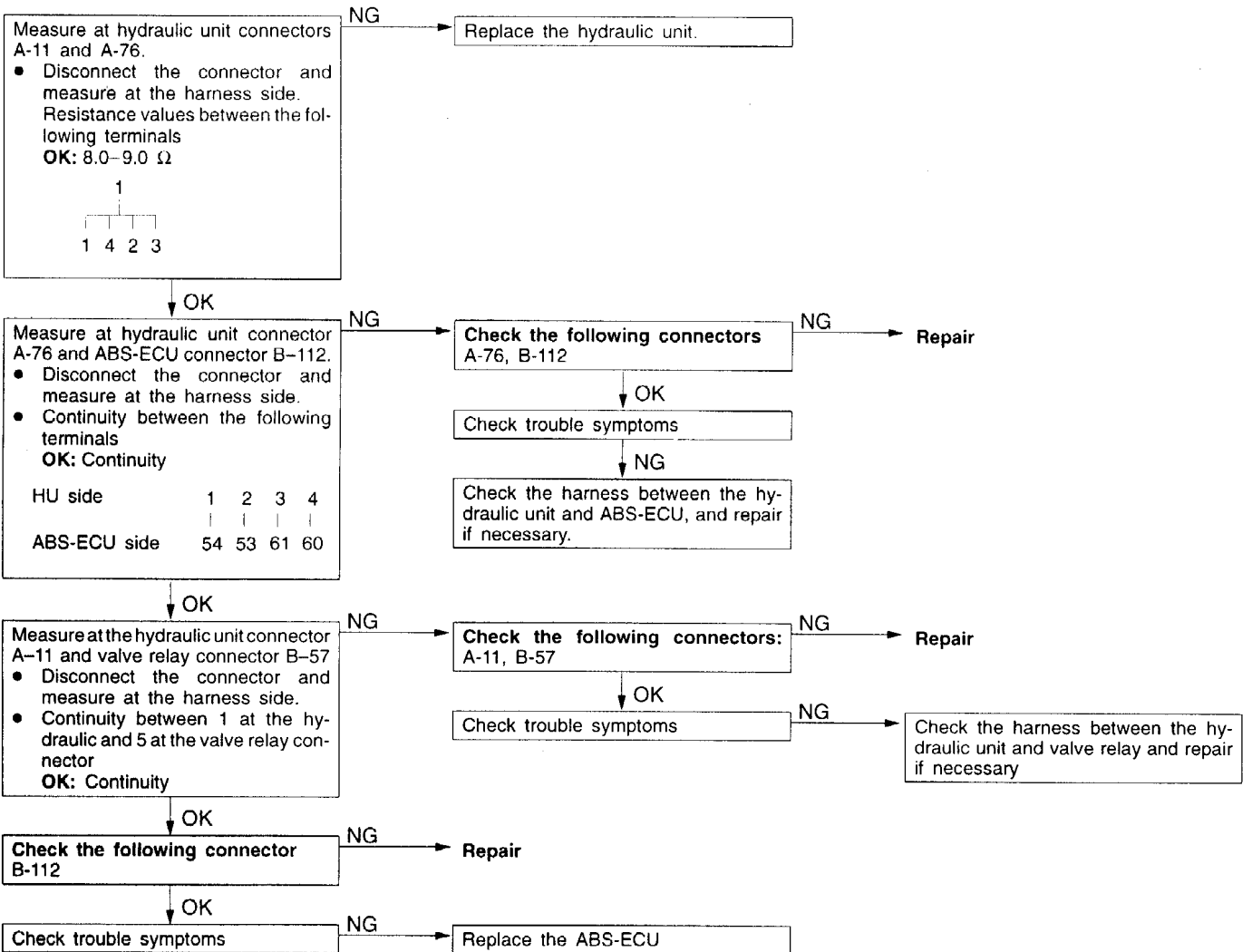
Short circuit is not detected when IG power voltage drops.



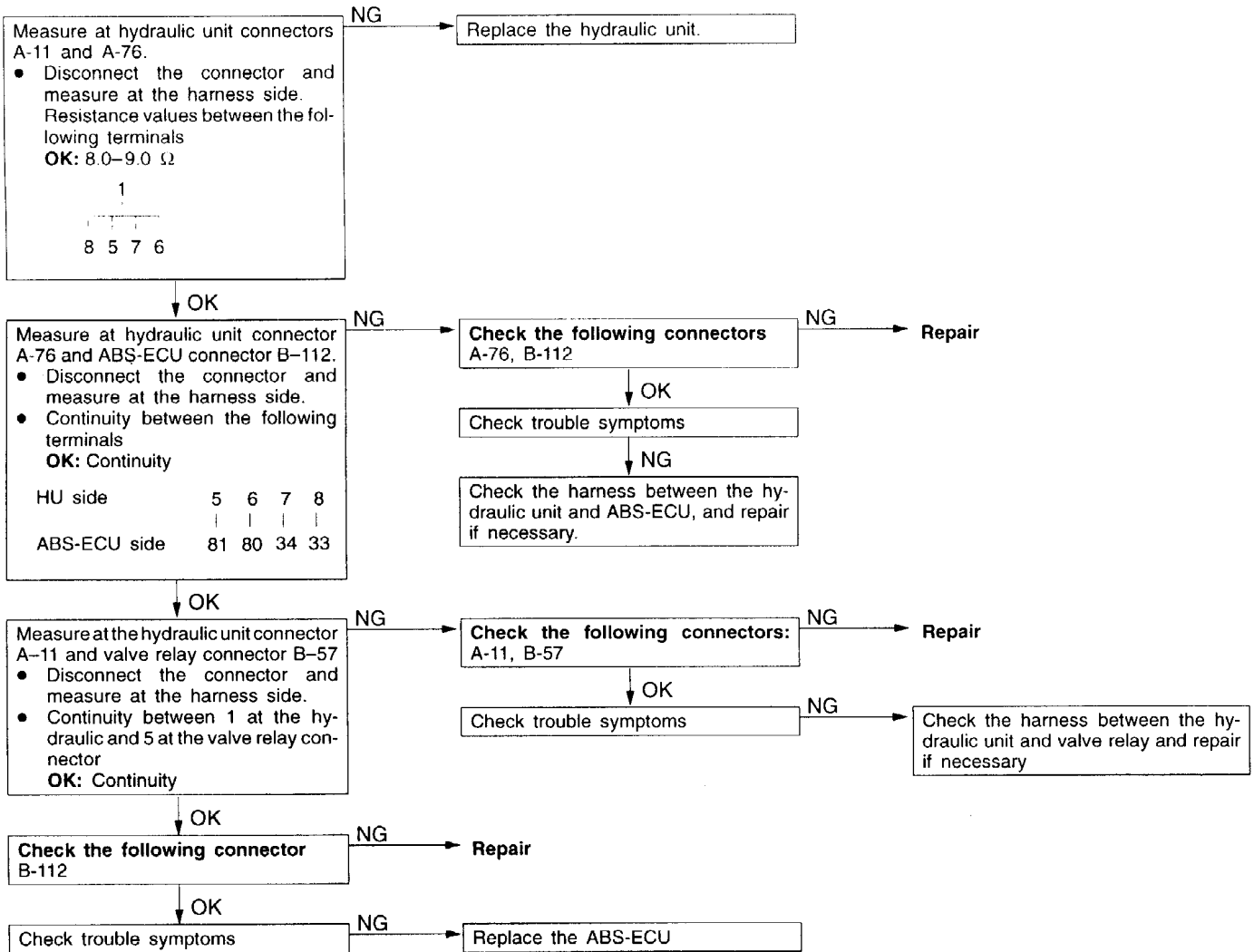
Code No. 38 Stop light switch system	Probable cause
This diagnosis code is output if it is judged to be a short circuit when the stop light switch is ON for a continuous period of 15 minutes or more.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector ● Malfunction of stop light switch ● Malfunction of ABS-ECU



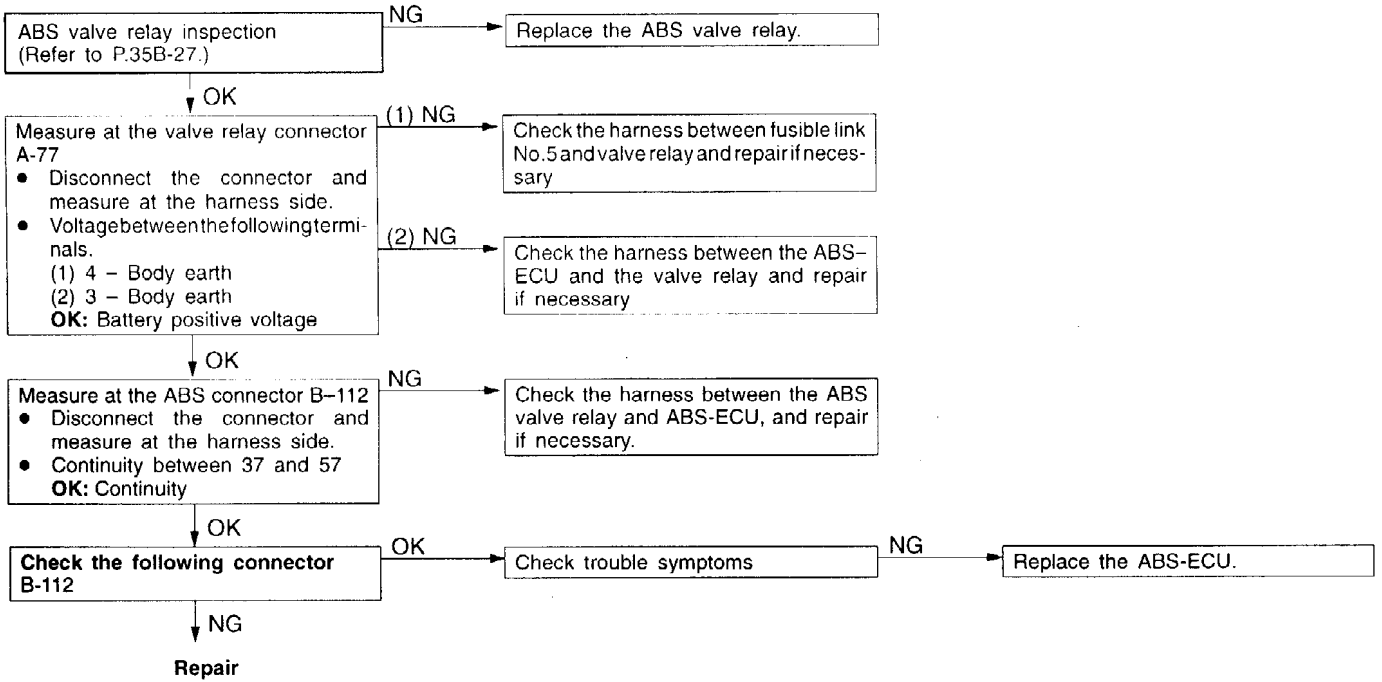
Code No. 41, 42, 43, 44 Solenoid valve (inlet)	Probable cause
The ABS-ECU normally monitors the solenoid valve drive circuit, and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS-ECU turns it on,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



Code No. 45, 46, 47, 48 Solenoid valve (outlet)	Probable cause
The ABS-ECU normally monitors the solenoid valve drive circuit, and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS-ECU turns it on, and vice versa.	<ul style="list-style-type: none"> • Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU



Code No. 51 Valve relay	Probable cause
When the ignition switch is turned to ON, the ABS-ECU switches the valve relay off and on during the initial check to check if the valve relay is operating normally.	<ul style="list-style-type: none"> ● Malfunction of ABS valve relay ● Malfunction of wiring harness or connector ● Malfunction of ABS-ECU ● Malfunction of hydraulic unit

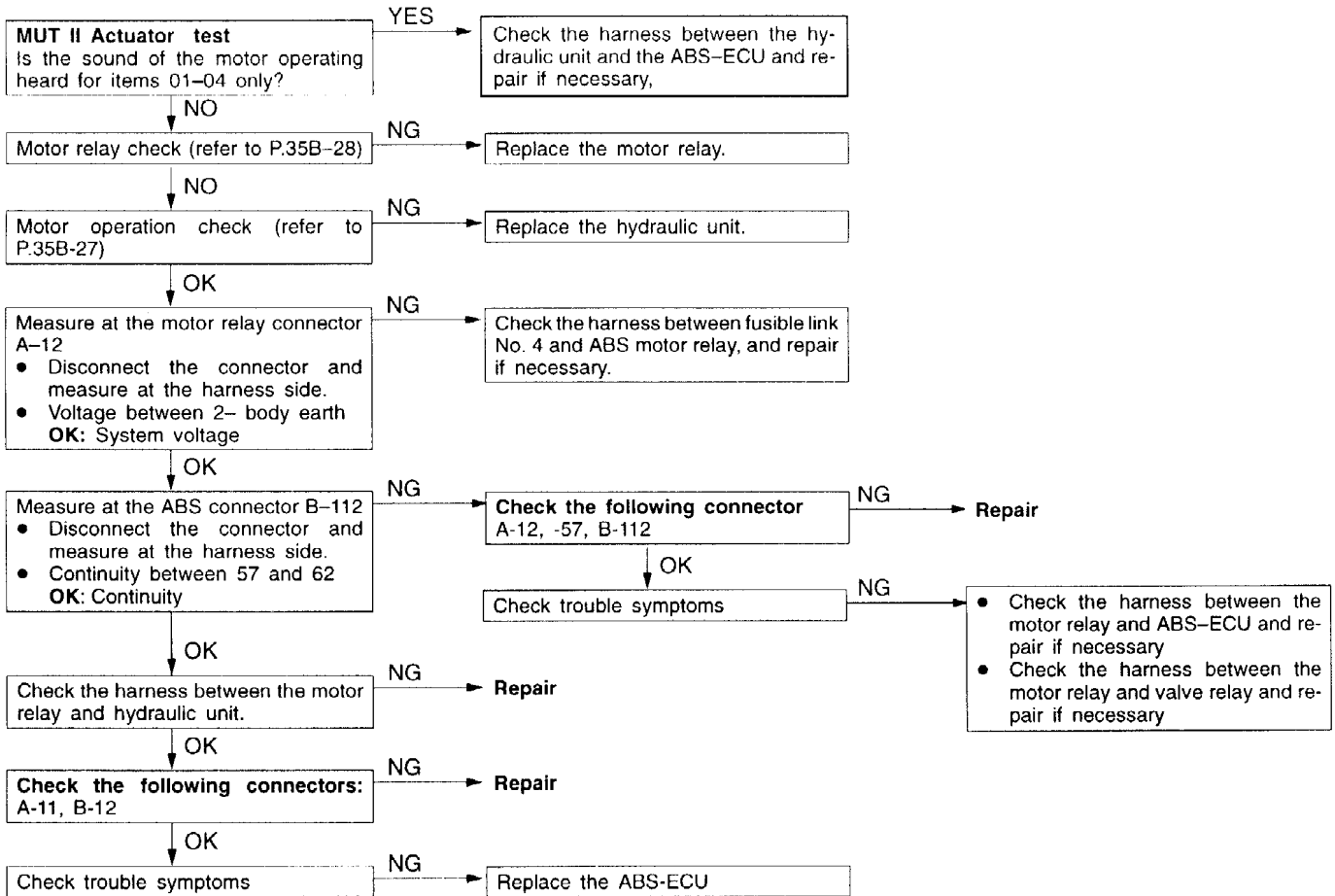


Code No. 53 Motor relay, motor	Probable cause
The code is output at the following times: • When the motor relay is on but no signal is input to the motor monitor line (motor is not operating etc.). • When the motor relay is off but a signal is input to the motor monitor line (motor continues operating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

WHEN THE MOTOR DOES NOT RUN

Caution

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

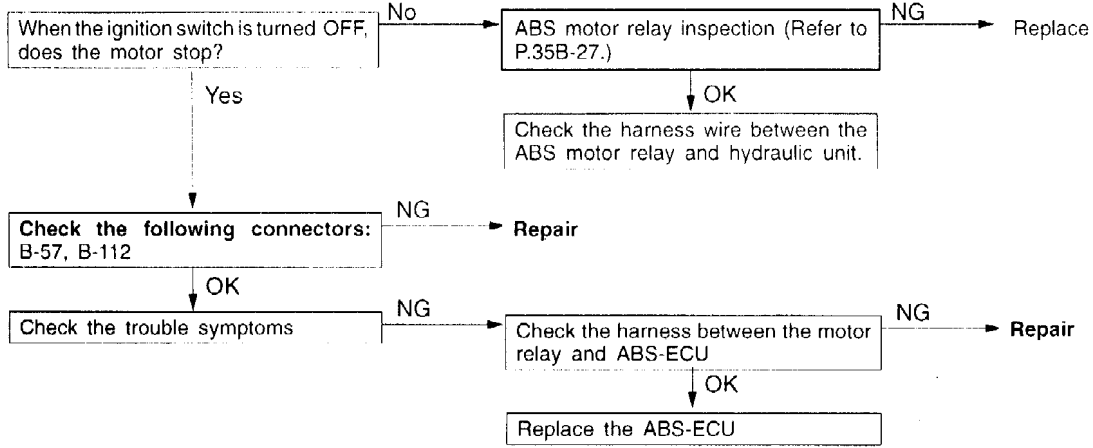


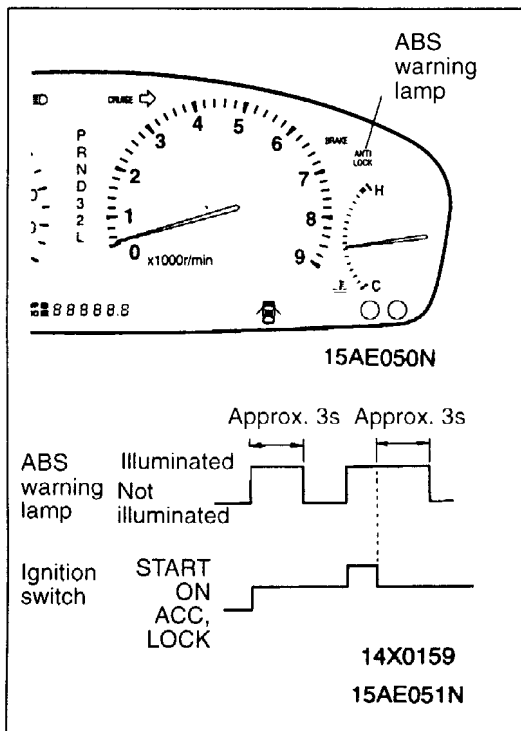
Continued next page

WHEN THE MOTOR KEEPS RUNNING

Caution

If there is a melted contact in the motor relay, the motor will keep turning, even if the ignition switch is turned to OFF. In such a case, immediately remove the fusible link No. 5 or disconnect the hydraulic unit connector A-11 or motor relay connector A-12. Excessive running of the motor will drain the battery.





ABS WARNING LAMP INSPECTION

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the ABS warning lamp remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
4. If the illumination is other than the above, check the diagnostic trouble codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

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

Trouble symptom		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 lamp remains illuminated.		4	35B-17
Faulty ABS operation	Unequal braking power on both sides	5	35B-18
	Insufficient braking power		
	ABS operates under normal braking conditions		
	ABS operates before vehicle stops under normal braking conditions		
	Large brake pedal vibration when ABS operates	-	-
	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, changes in the feeling of the brake pedal (vibration may occur or pedal may not be able to be depressed). Such changes are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking, and is considered normal.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

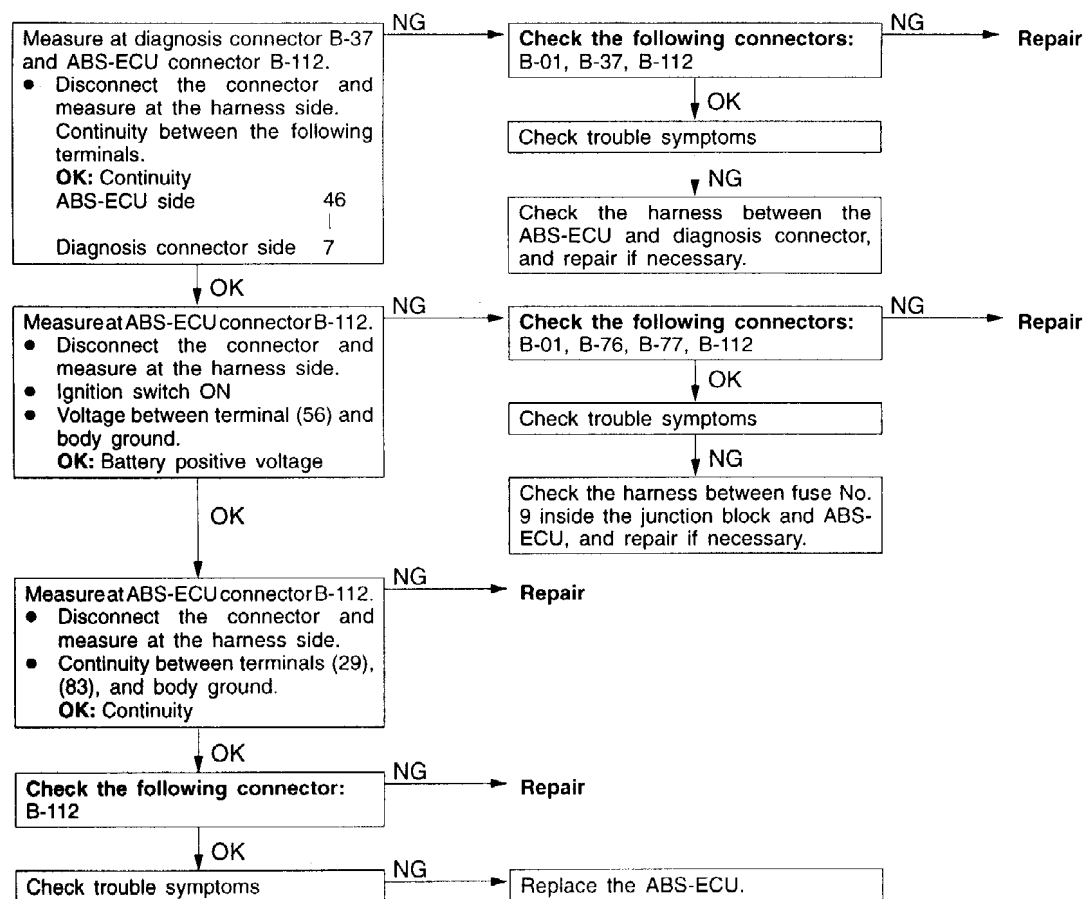
INSPECTION PROCEDURE 1

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 ground) for the diagnostic line.	<ul style="list-style-type: none"> • Malfunction of connector • Malfunction of harness

Refer to GROUP 13A – Troubleshooting

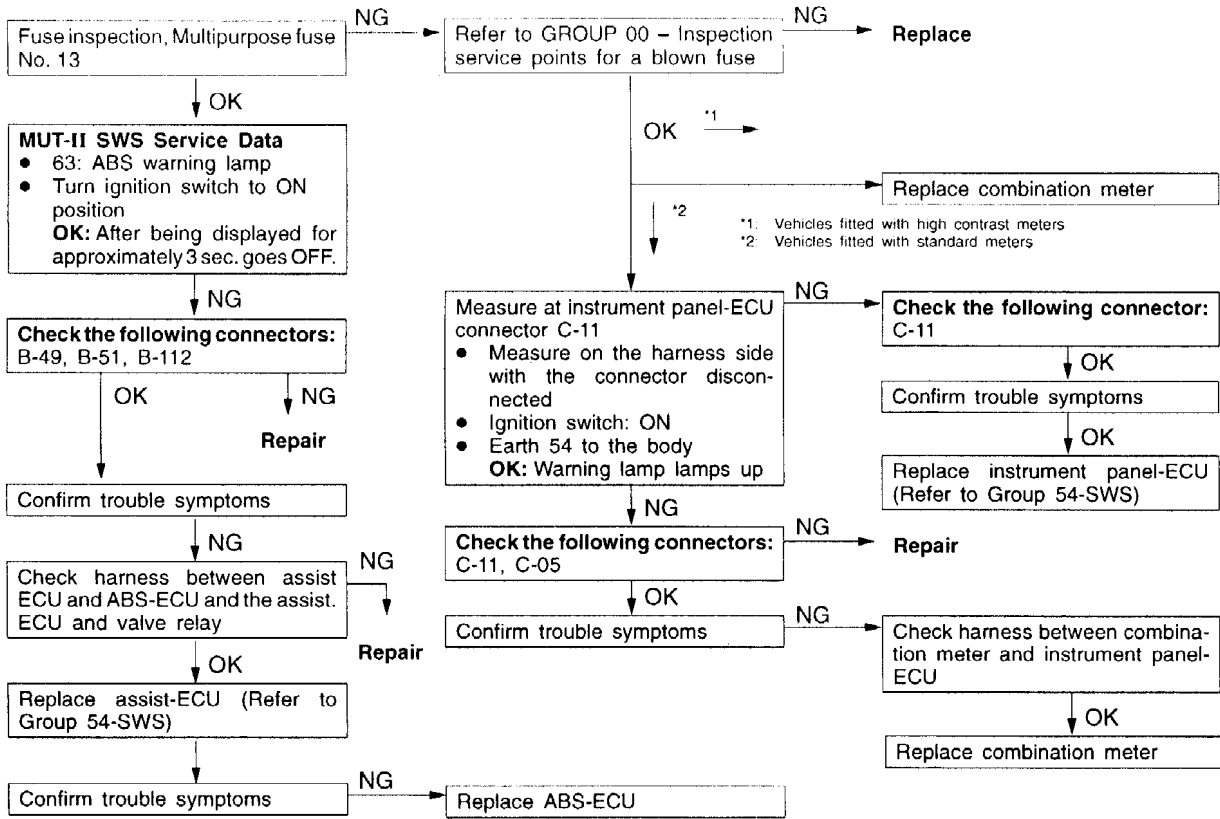
INSPECTION PROCEDURE 2

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



INSPECTION PROCEDURE 3

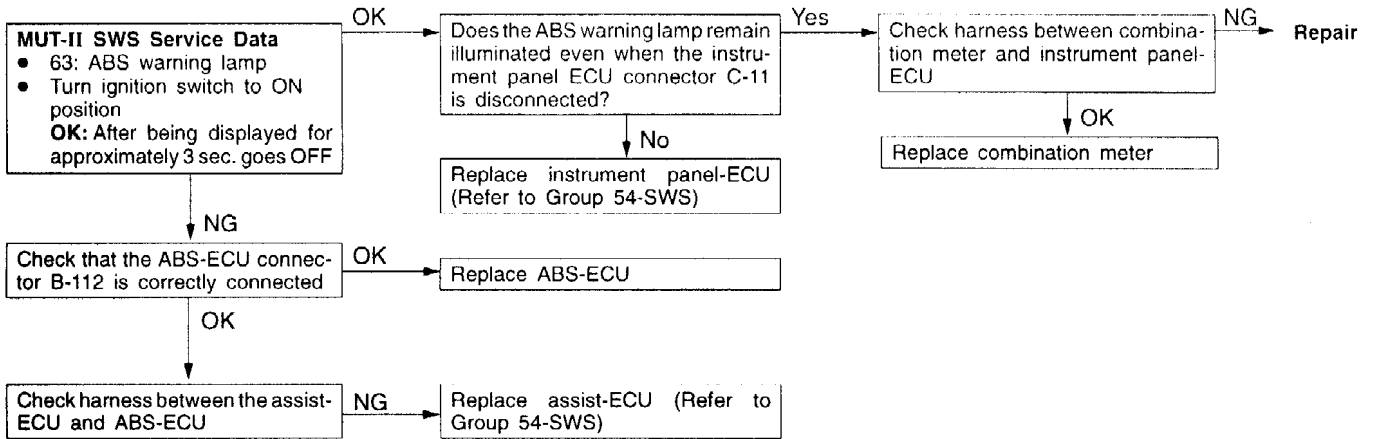
When ignition key is turned to “ON” (engine stopped), ABS warning lamp does not illuminate	Probable cause
The cause may be an open circuit in the lamp power supply circuit, a blown lamp bulb, an open circuit in both the circuit between the ABS warning lamp and the ABS-ECU.	<ul style="list-style-type: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



INSPECTION PROCEDURE 4

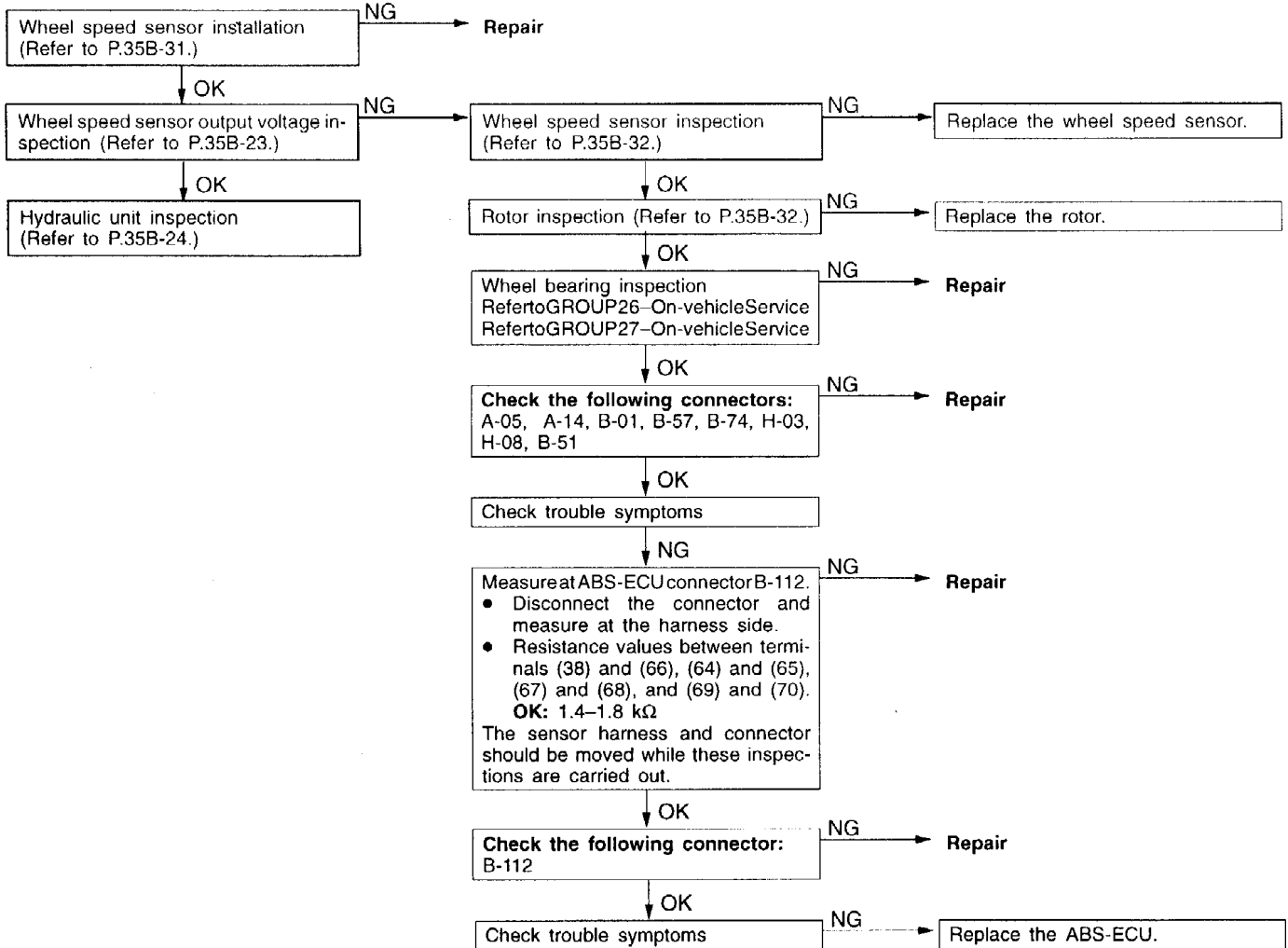
Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
The cause may be a short circuit in the ABS warning lamp illumination circuit or an incorrectly secured connector at the ABS-ECU.	<ul style="list-style-type: none"> ● Combination meter fault ● ABS-ECU fault ● Harness fault (short) ● Assist-ECU fault ● Instrument panel-ECU fault

This breakdown phenomenon is restricted to circumstances where communication with the MUT-II is possible (ABS-ECU power supply normal), and when the diagnosis code is normal.



INSPECTION PROCEDURE 5

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



DATA LIST REFERENCE TABLE

With the MUT-II, check the data list for the items listed.

Item No.	Check point	Check condition	Normal condition
11	Front right wheel speed sensor	Check by actually operating vehicle.	Speedometer indication and MUT-II indication are the same.
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
16	Battery positive voltage	IG power voltage and valve monitor voltage	9–16 V
33	Stop lamp switch	Depress brake pedal.	ON
		Release brake pedal.	OFF

ACTUATOR TEST REFERENCE TABLE

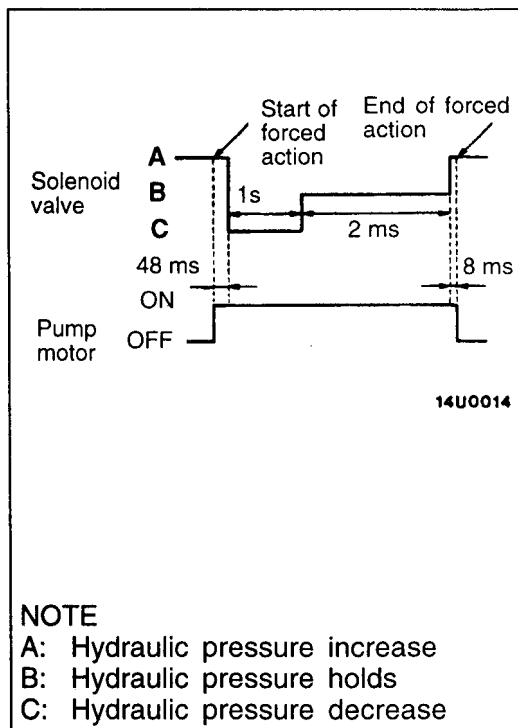
The MUT-II activates the following actuators for testing.

NOTE

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

ACTUATOR TEST SPECIFICATIONS

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



NOTE

- A: Hydraulic pressure increase
- B: Hydraulic pressure holds
- C: Hydraulic pressure decrease

CHECK AT THE ABS-ECU**TERMINAL VOLTAGE CHECK CHART**

1. Turn the ignition switch to OFF.
2. Disconnect the ABS-ECU connector.
3. Measure the voltage at the terminals of the ABS-ECU harness-side connector while referring to the check chart.

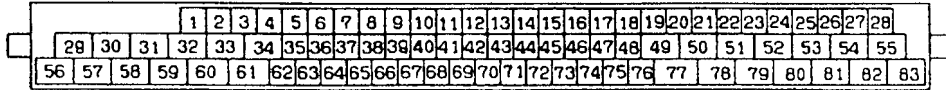
NOTE

1. When measuring voltage, a harness for checking contact pin pressure should be used instead of inserting a test probe.
2. Checks do not have to be carried out in the order given in this chart.

Caution

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, ABS-ECU, or all three. Use care to prevent this!

4. If voltmeter shows any deviation from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.



15AE052N

Item No.	Check point	Check condition	Normal condition	
81	F.R. solenoid valve <Outlet> (Output) of hydraulic unit	Ignition switch: ON (when solenoid valve turns OFF approximately 1 second after the engine is started)	Battery positive voltage	
54	F.R. solenoid valve <Inlet> (Output) of hydraulic unit			
53	R.L. solenoid valve <Inlet> (Output) of hydraulic unit			
48	Stop lamp switch (Input)	Ignition switch: ON (Stop lamp switch ON)	Battery positive voltage	
		Ignition switch: ON (Stop lamp switch OFF)	1.0 V or less	
57	Memory power supply	At all times	Battery positive voltage	
56	ECU power supply	Ignition switch: ON	Battery positive voltage	
80	R.L. solenoid valve <Outside> (Output) of hydraulic unit	Ignition switch: ON (when solenoid valve turns OFF approximately 1 second after the engine is started)	Battery positive voltage	
30	ABS warning lamp (Output)	Ignition switch: ON	When lamp is switched off	Battery positive voltage
			When lamp is illuminated	0–2 V
33	F.L. solenoid valve <Outlet> (Output) of hydraulic unit	Ignition switch: ON (when solenoid valve turns OFF approximately 1 second after the engine is started)	Battery positive voltage	
60	F.L. solenoid valve <Inlet> (Output) of hydraulic unit			
34	R.R. solenoid valve <Outlet> (Output) of hydraulic unit	Ignition switch: ON (when solenoid valve turns OFF approximately 1 second after the engine is started)	Battery positive voltage	
61	R.R. solenoid valve <Inlet> (Output) of hydraulic unit			

TERMINAL RESISTANCE AND CONTINUITY CHECKS

1. Turn the ignition switch to OFF.
2. Disconnect the ABS-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the ABS-ECU harness-side connector while referring to the check chart.

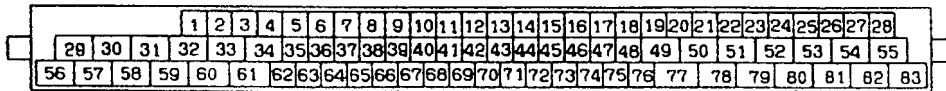
NOTE

1. When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
2. Checks do not have to be carried out in the order given in this chart.

Caution

If resistance or continuity checks are performed on the wrong terminals, damage to the vehicle wiring, sensors, ABS-ECU, and/or ohmmeter may occur. Use care to prevent this!

4. If ohmmeter shows any deviation from the normal condition, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.



15AE052N

Terminal No.	Name of circuit	Check requirements	Terminal voltage
38–66	Rear right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
62–57	Motor relay coil	Ignition switch: OFF	Continuity
64–65	Front left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
83–earth	ABS-ECU earth	—	Continuity
29–earth	ABS-ECU earth	—	Continuity
37–57	Valve relay coil	Ignition switch: OFF	Continuity
67–68	Rear left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
69–70	Front right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ

ON-VEHICLE SERVICE

BLEEDING

Caution

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

Specified brake fluid: DOT3 or DOT4

MASTER CYLINDER BLEEDING

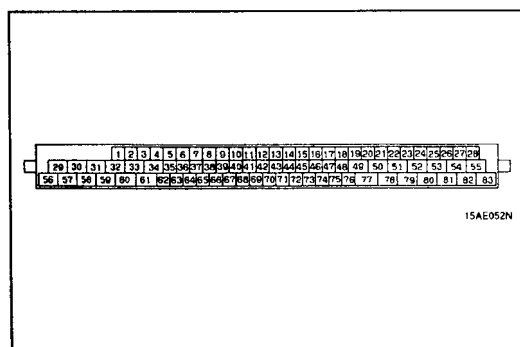
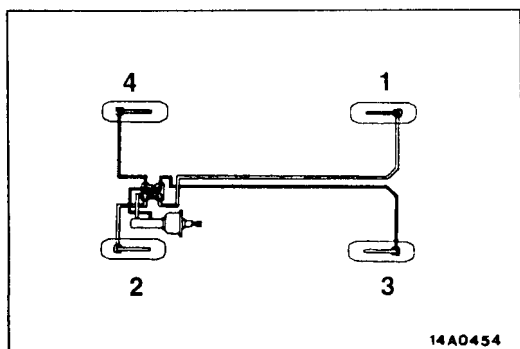
Refer to GROUP 35A – On-vehicle Service.

BRAKE LINE BLEEDING

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

Caution

For vehicles with ABS, be sure to filter/strain the brake fluid being added to the master cylinder reservoir tank. Debris may damage the HU.



ABS OPERATION CHECK

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ECU harness connector and measure from the harness side connector.

Caution

Use a special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness side connector to prevent damaging the connector terminals.

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.	64 65	69 70	67 68	38 66

Output voltage

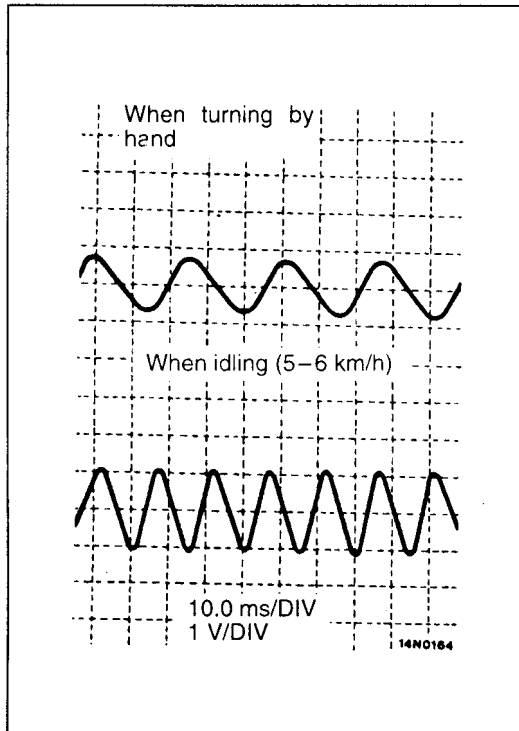
When measuring with a circuit tester:

50 mV or more

When measuring with an oscilloscope:

20 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 Wave Forms With An Oscilloscope

Use the following method to observe the output voltage wave form from each wheel sensor with an oscilloscope

- Start the engine, and rotate the front wheels by engaging D range. Turn the rear wheels manually so that they rotate at a constant speed.

NOTE

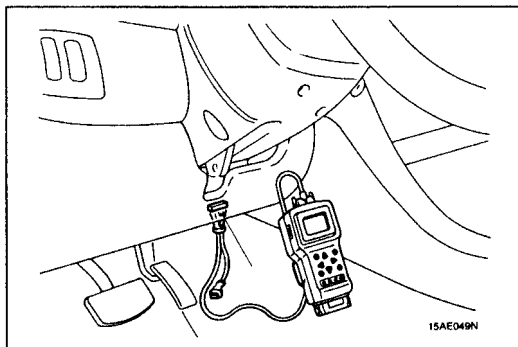
1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The wave form measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be low when the wheel speed is low, and similarly it will be higher as the wheel speed increases.

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 INSPECTION

Caution

Connection and disconnection of the MUT-II should always be made with the ignition switch in the OFF position.

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.

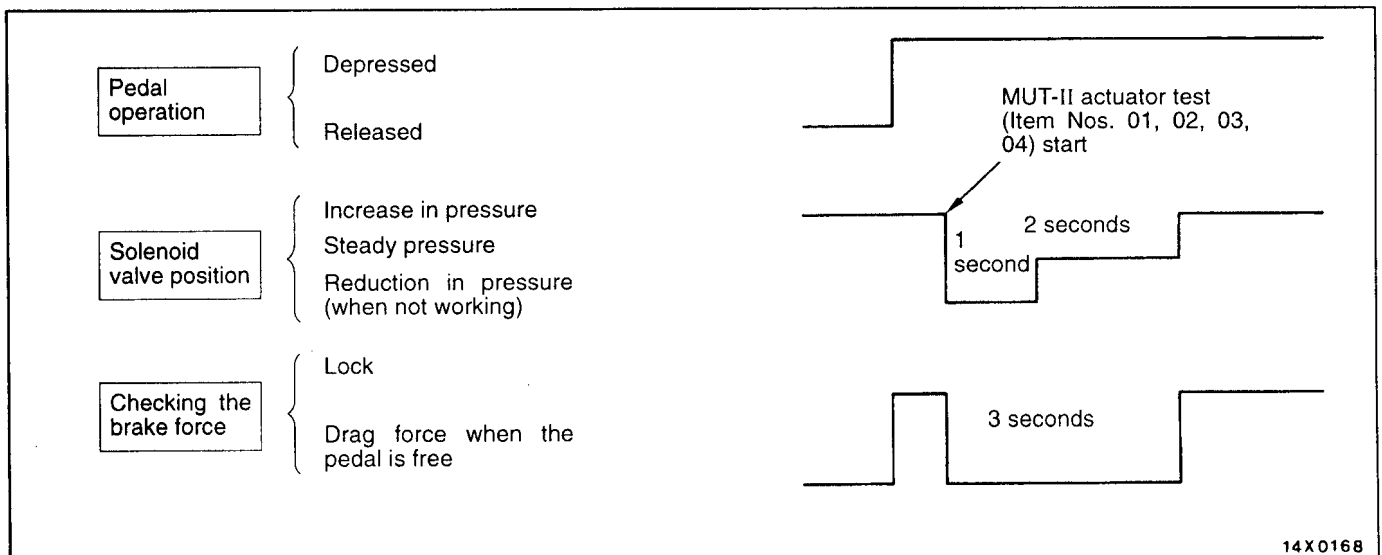
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel.
When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II as shown in the diagram.
4. After checking that the selector lever is in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

NOTE

- (1) At this time, the ABS system will switch to the MUT-II mode and the ABS warning lamp will illuminate.
 - (2) When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.
5. Use the MUT-II to force-drive the actuator.
 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 to be sure that the braking force changes to the brake drag force inspected in step 2 when the actuator is force-driven.

Front wheel	785–981 N (80 – 100 kgf)
Rear wheel	294–490 N (30 – 50 kgf)

The result should be as shown in the following diagram.

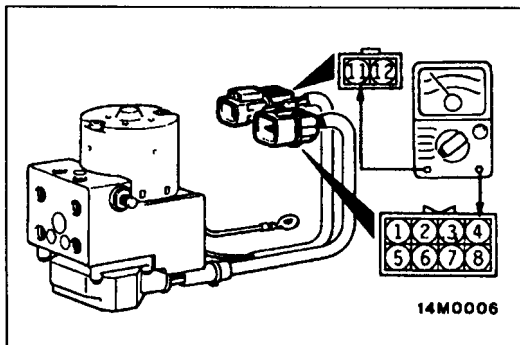


7. If the result of inspection is abnormal, correct according to the "Diagnosis Table."

Diagnosis Table

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

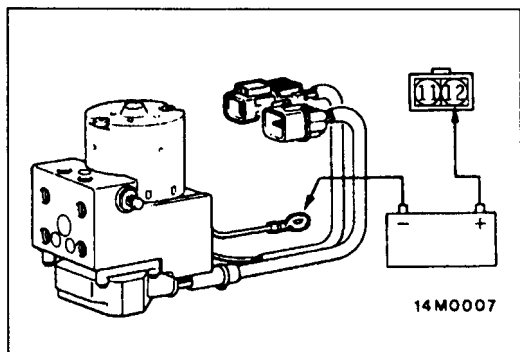
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.



SOLENOID VALVE CHECK

Measure the resistance between terminals.

Solenoid valve	Measurement terminals	Resistance between terminals
Front IN (right side)	1-11	8.0-9.0Ω
Front IN (left side)	4-11	
Rear IN (right side)	3-11	
Rear IN (left side)	2-11	3.8-4.8Ω
Front OUT (right side)	5-11	
Front OUT (left side)	8-11	
Rear OUT (right side)	7-11	
Rear OUT (left side)	6-11	

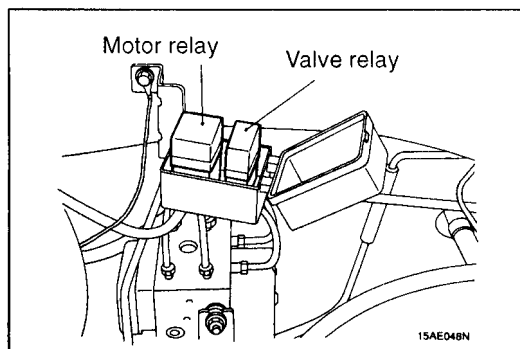


MOTOR OPERATION CHECK

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

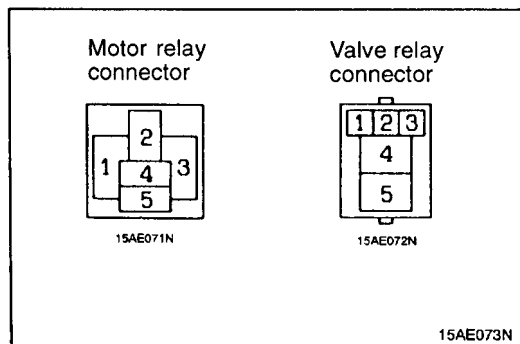
Caution

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



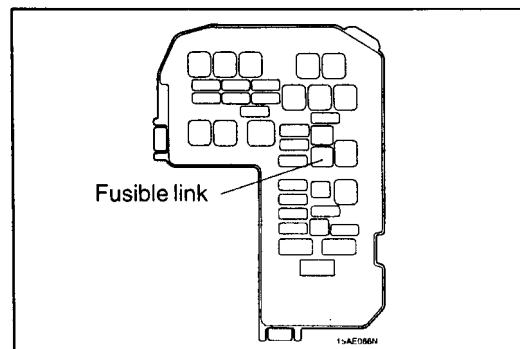
MOTOR RELAY CHECK

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



VALVE RELAY CHECK

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



REMEDY FOR A FLAT BATTERY

When booster cables are used to start the engine when the battery is completely discharged and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire or stall, making driving difficult.

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

PROPORTIONING VALVE

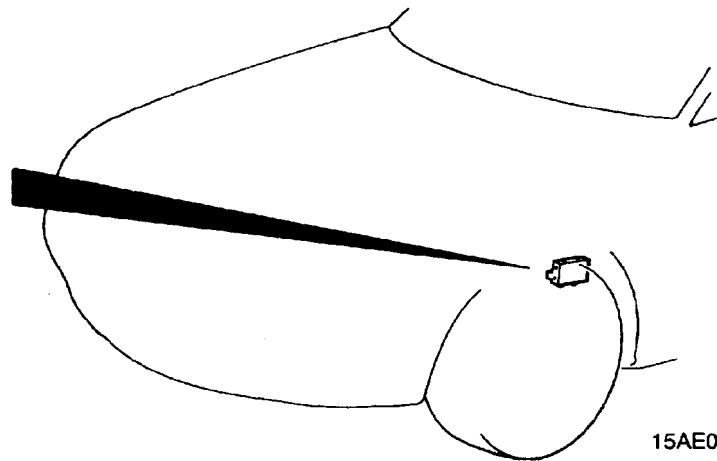
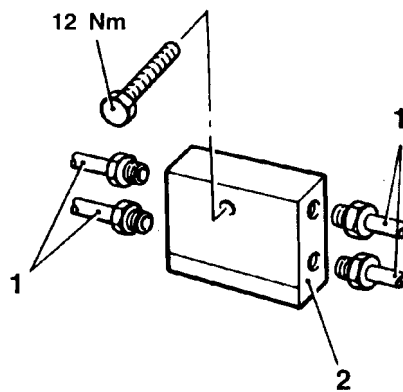
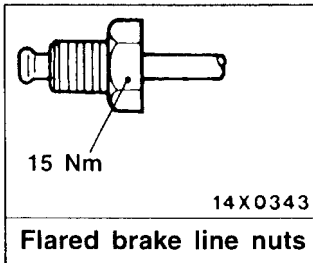
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

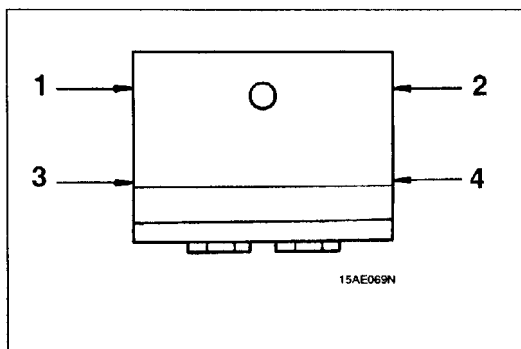
Post-installation Operation

- Brake Fluid Supplying
- Brake Lines Bleeding (Refer to P.35B-23.)



Removal steps

- ▶A◀
1. Brake pipe
 2. Proportioning valve



INSTALLATION SERVICE POINT

▶A◀ **BRAKE PIPE CONNECTION**

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

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

HYDRAULIC UNIT

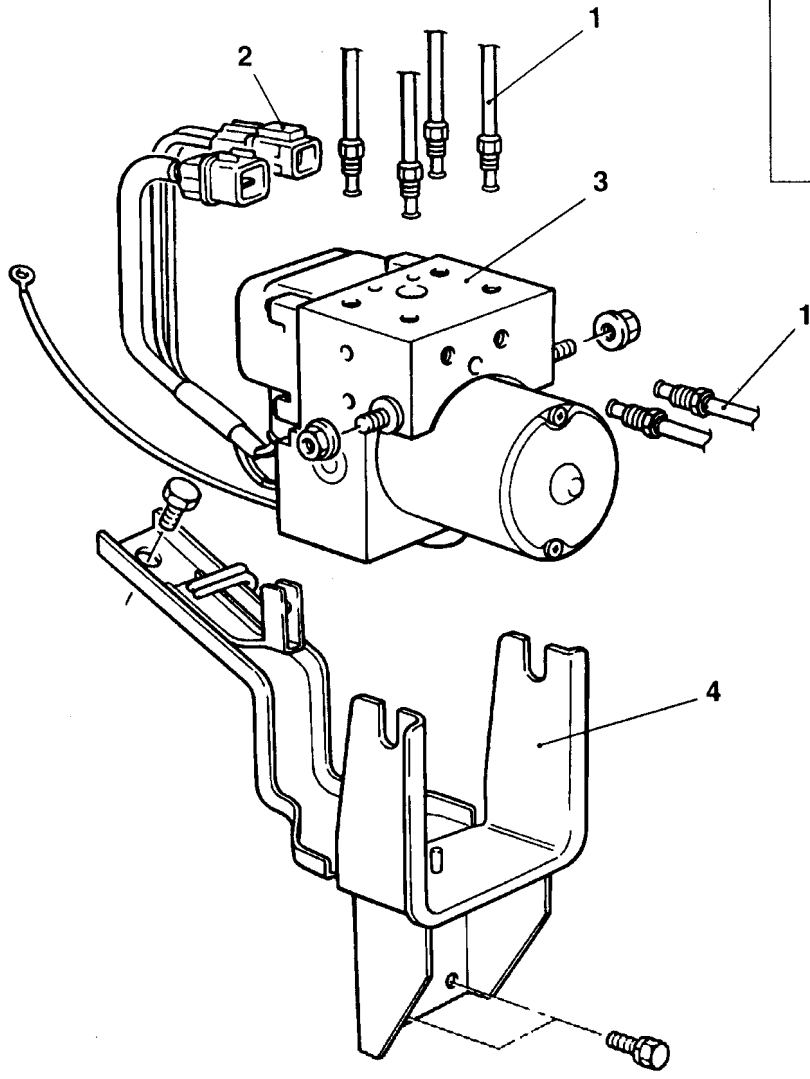
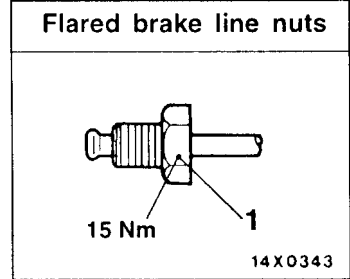
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining
- Air Intake Hose Removal

Post-installation Operation

- Installation of the Air Intake Hose Removal
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35B-23.)
- Hydraulic Unit Checking (Refer to P.35B-24.)



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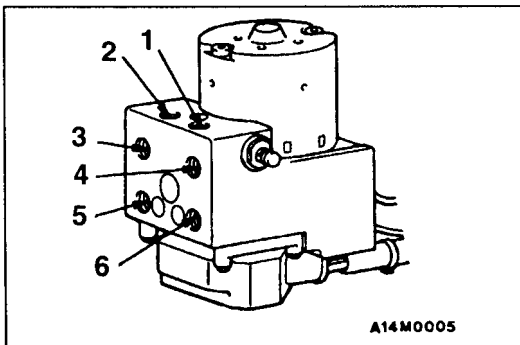
Removal steps

- ▶A◀ 1. Connection for brake pipe
2. Connection for harness connector

- ◀A▶ 3. 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 taken when removing it.
2. The hydraulic unit is not to be disassembled; its nuts and bolts must 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 PIPE CONNECTION**

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

1. To the proportioning valve (R.H. Rear)
2. To the proportioning valve (L.H. Rear)
3. From the master cylinder (primary)
4. From the master cylinder (secondary)
5. To the front brake (R.H.)
6. To the front brake (L.H.)

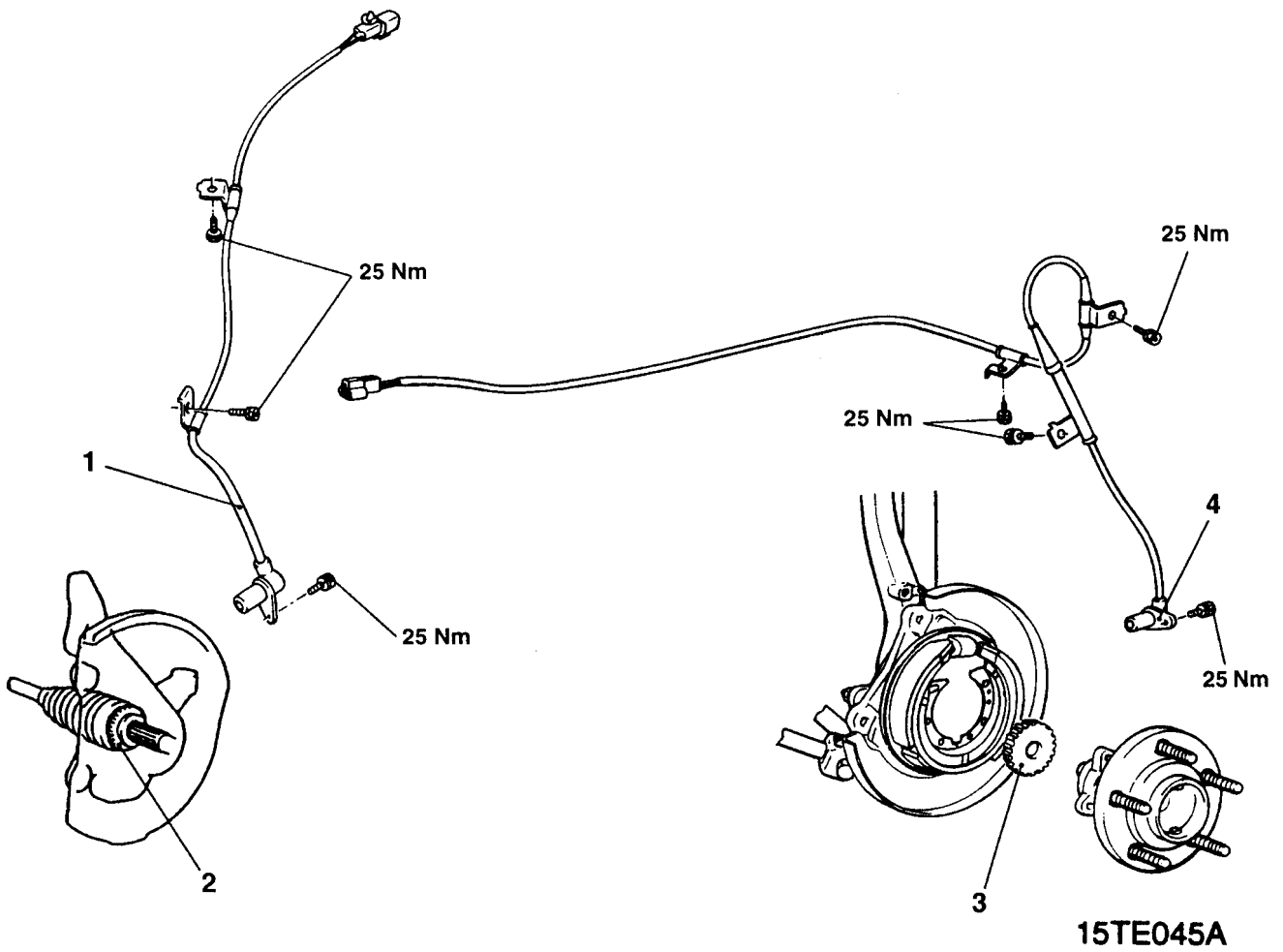
WHEEL SPEED SENSOR REMOVAL AND INSTALLATION

Post-installation Operation

- Wheel Speed Sensor Output Voltage Checking (Refer to P.35B-23.)

Front

Rear



Front speed sensor removal steps

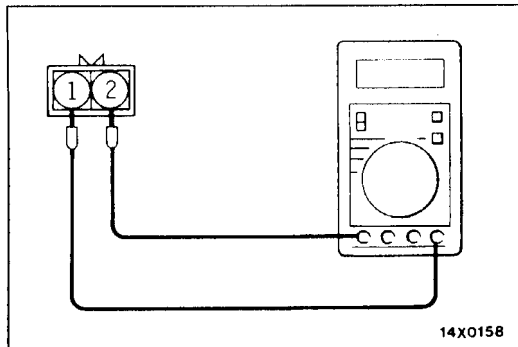
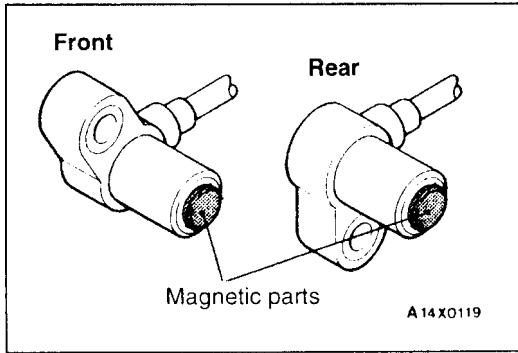
1. Front speed sensor
2. Front rotor (Refer to GROUP 26 – Drive Shaft)

Rear speed sensor removal

3. Rear rotor (Refer to GROUP 27 – Rear Axle Hub)
4. Rear speed sensor

NOTE

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



INSPECTION 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 magnetised because of the magnet built into the speed sensor, with the result that foreign metallic material is attached to it.

2. Measure the resistance between the speed sensor terminals.

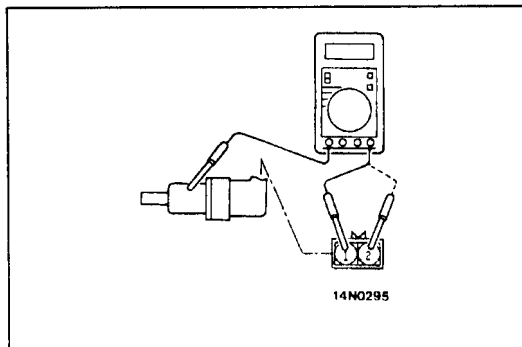
Standard value: 1.4–1.8 k Ω

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 an intermittent contact results. Check the connector connection and the terminal insertion.



SPEED SENSOR INSULATION INSPECTION

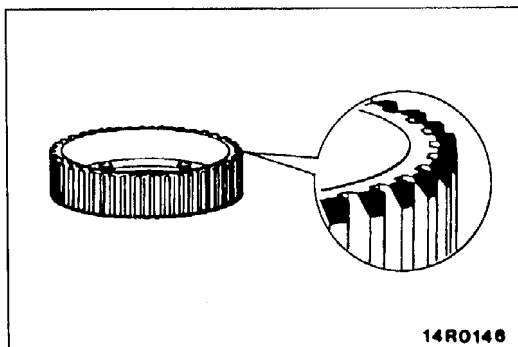
1. Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

Standard value: 100 k Ω or more

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

TOOTHED ROTOR

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

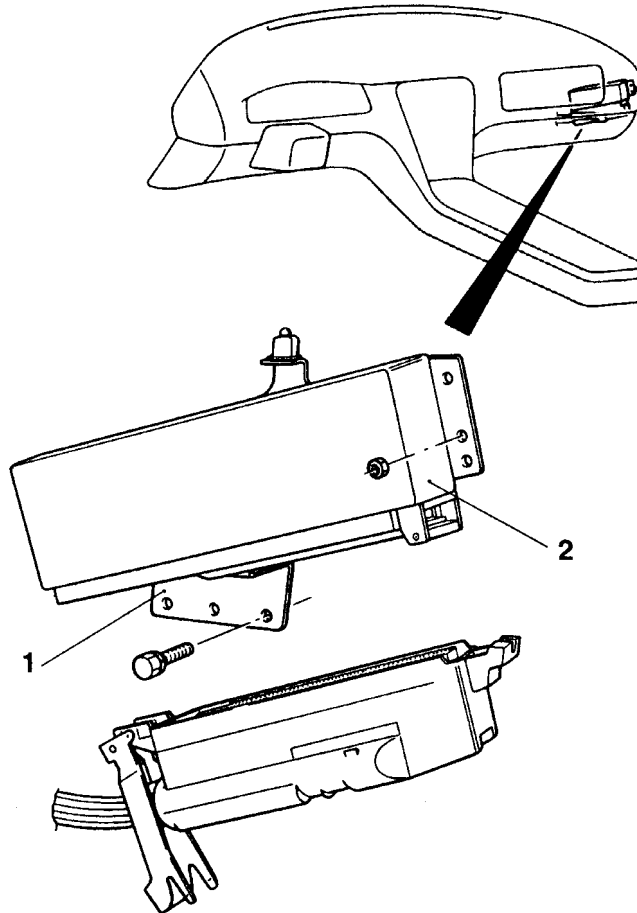


ELECTRONIC CONTROL UNIT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover and Glovebox Removal and Installation
(Refer to GROUP 52A – Instrument Panel.)



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Removal steps

1. ABS-ECU bracket
2. ABS-ECU

INSPECTION

Refer to P.35B-20.