

BRAKE SYSTEM**SECTION BR****CONTENTS**

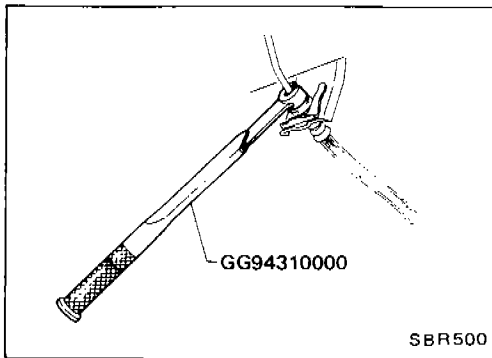
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BR

PRECAUTIONS AND PREPARATION

Precautions

- Recommended fluid is brake fluid "DOT 3".
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- To clean or wash all parts of master cylinder, disc brake caliper and wheel cylinder, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene. They will ruin rubber parts of hydraulic system.



- Use Tool when removing and installing brake tube.

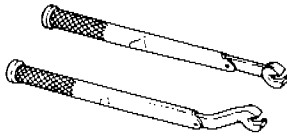
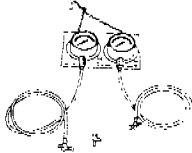
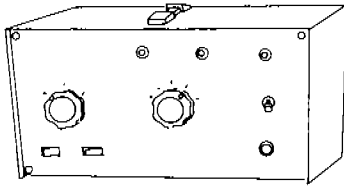
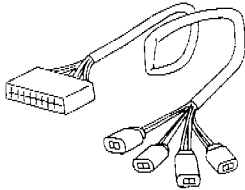
WARNING:

- Clean brake pads and shoes with a waste cloth, then collect dust with a dust collector.

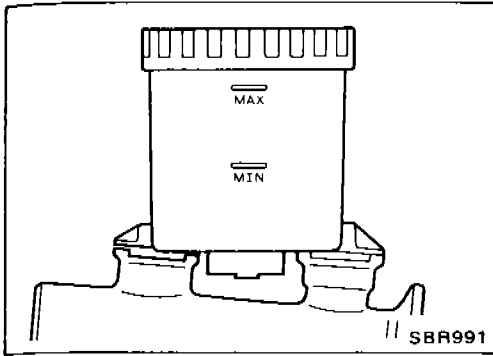
Preparation

SPECIAL SERVICE TOOL

*: Special tool or commercial equivalent

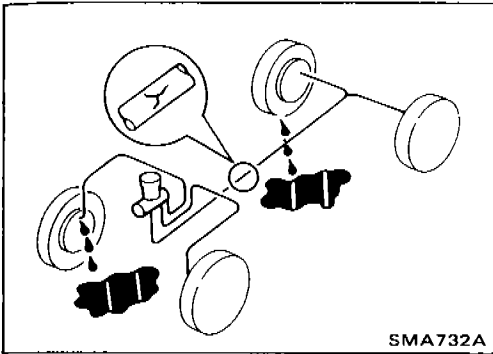
Tool number Tool name	Description
GG94310000* Flare nut torque wrench	 Removing and installing each brake piping
KV991V0010* Brake fluid pressure gauge	 Measuring brake fluid pressure
KV999P1000 A.B.S. checker	 Checking brake fluid pressure of A.B.S. actuator
KV999P1010 A.B.S. checker adapter harness	 Checking brake fluid pressure of A.B.S. actuator

CHECK AND ADJUSTMENT



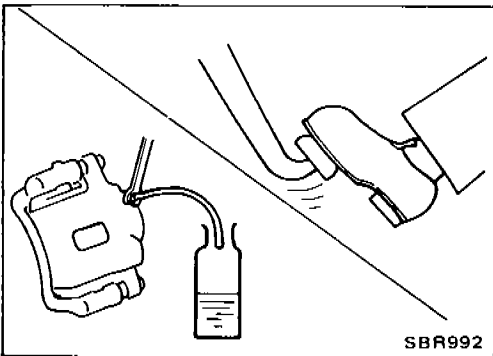
Checking Brake Fluid Level

- Check fluid level in reservoir tank. It should be between Max. and Min. lines on reservoir tank.
- If fluid level is extremely low, check brake system for leaks.



Checking Brake System

- Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts. If leakage occurs around joints, retighten or, if necessary, replace damaged parts.
- Check for oil leakage by fully depressing brake pedal.

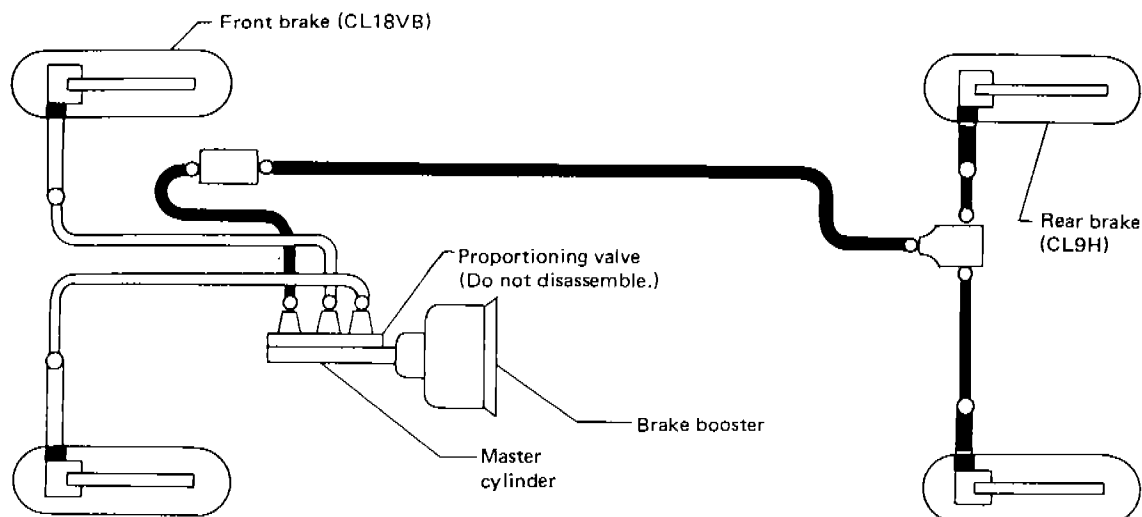


Changing Brake Fluid

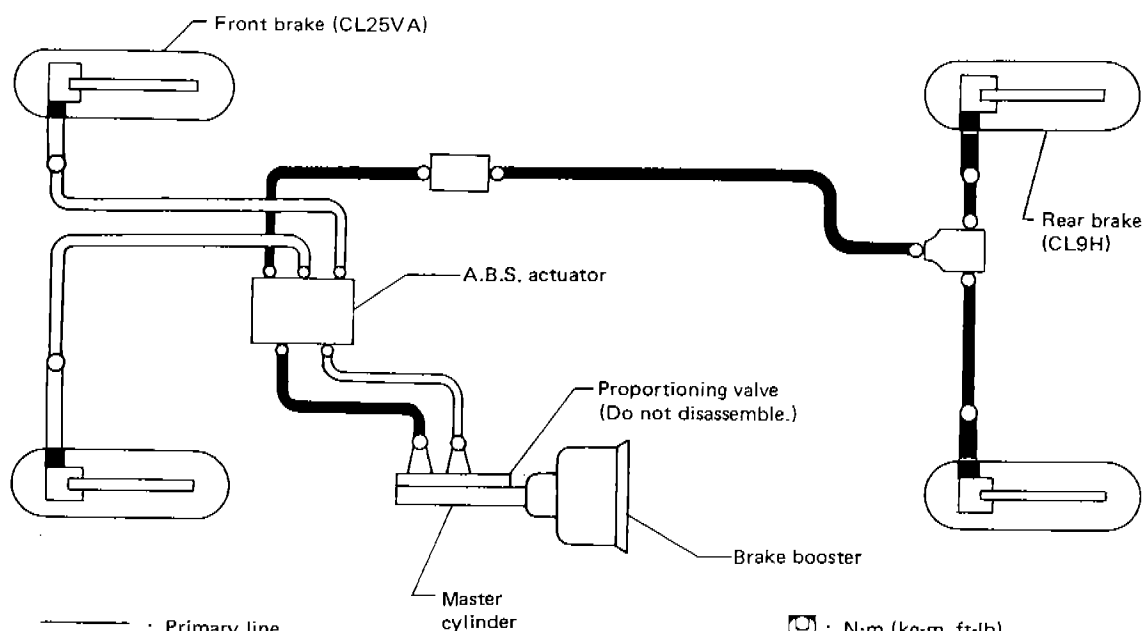
1. Drain brake fluid in each air bleeder valve.
 2. Refill until new brake fluid comes out of each air bleeder valve.
- Use same procedure as in bleeding hydraulic system to refill brake fluid.
Refer to Bleeding Procedure.
- Refill with recommended brake fluid "DOT 3".
 - Never reuse drained brake fluid.
 - Be careful not to splash brake fluid on painted areas.

BRAKE HYDRAULIC LINE

Without Anti-lock Braking System (A.B.S.)



With Anti-lock Braking System (A.B.S.)



— : Primary line

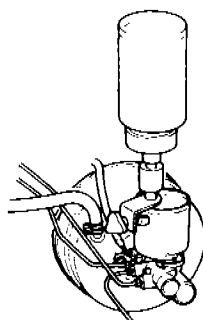
- - - : Secondary line

⊗ : N·m (kg·m, ft·lb)

○ : Flare nut
15 - 18 (1.5 - 1.8, 11 - 13)

■ : Connecting bolt
17 - 20 (1.7 - 2.0, 12 - 14)

SBR501A



SBR995

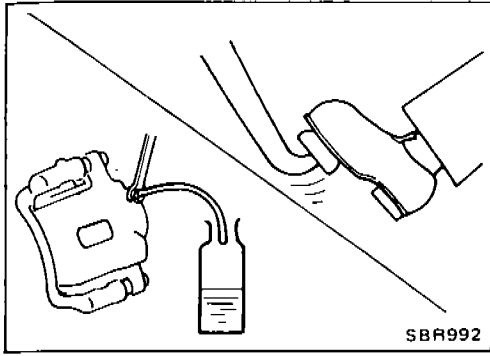
Bleeding Procedure

CAUTION:

- Carefully monitor brake fluid level at master cylinder during bleeding operation.
- Fill reservoir with recommended brake fluid. Make sure it is full at all times while bleeding air out of system.
- Place a container beneath master cylinder to avoid spillage of brake fluid.

BRAKE HYDRAULIC LINE

Bleeding Procedure (Cont'd)



- Bleed air according to the following procedure.

Without Anti-lock Braking System:

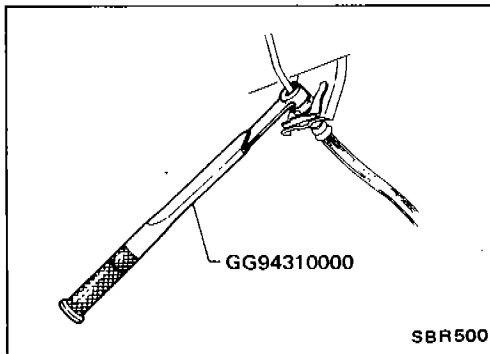
Left rear caliper
↓
Right rear caliper
↓
Left front caliper
↓
Right front caliper

With Anti-lock Braking System:

Left rear caliper
↓
Right rear caliper
↓
Left front caliper
↓
Right front caliper
↓
Front side air bleeder on A.B.S. actuator
↓
Rear side air bleeder on A.B.S. actuator

- **To bleed air out of lines, wheel cylinders and calipers, use the following procedure.**

- 1) Connect a transparent vinyl tube to air bleeder valve.
- 2) Fully depress brake pedal several times.
- 3) With brake pedal depressed, open air bleeder valve to release air.
- 4) Close air bleeder valve.
- 5) Release brake pedal slowly.
- 6) Repeat steps 2) through 5) until clear brake fluid comes out of air bleeder valve.



Removal and Installation

1. To remove brake hose, first remove flare nut securing brake tube to hose, then withdraw lock spring.
2. Cover openings to prevent entrance of dirt whenever disconnecting hydraulic line.
3. All hoses must be free from excessive bending, twisting and pulling.
4. After installing brake lines, check for oil leakage by fully depressing brake pedal.

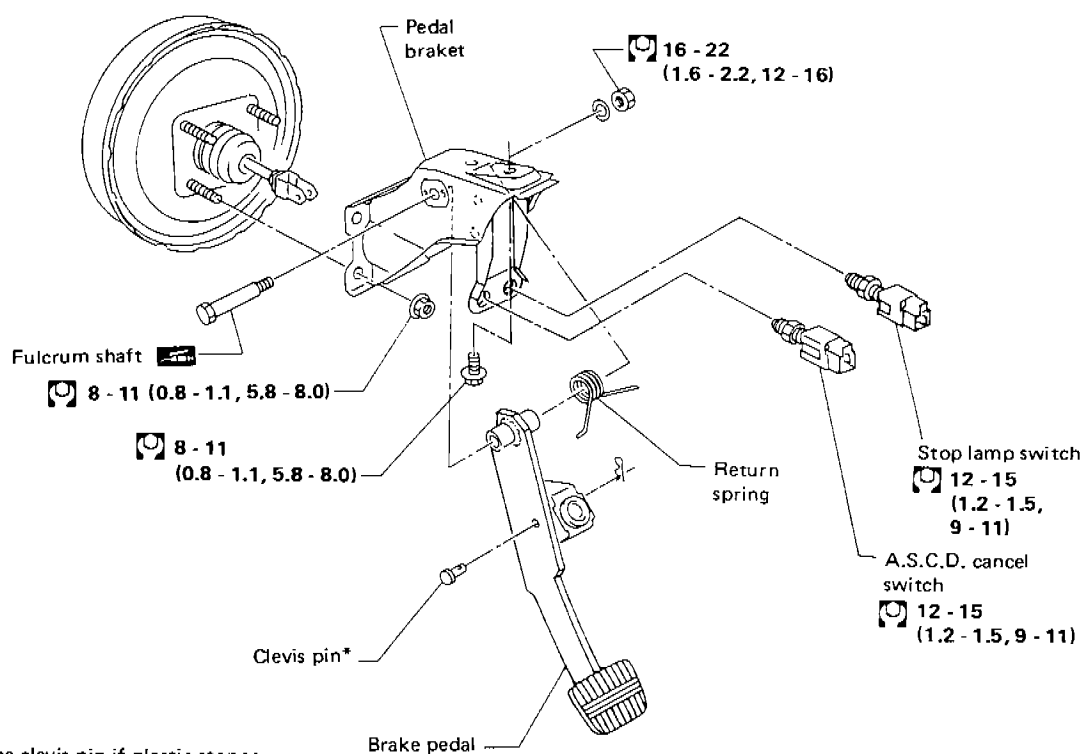
Inspection

Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.

If leakage occurs around joints, retighten or, if necessary, replace damaged parts.

BRAKE PEDAL AND BRACKET

Removal and Installation



⌚ : N·m (kg-m, ft-lb)

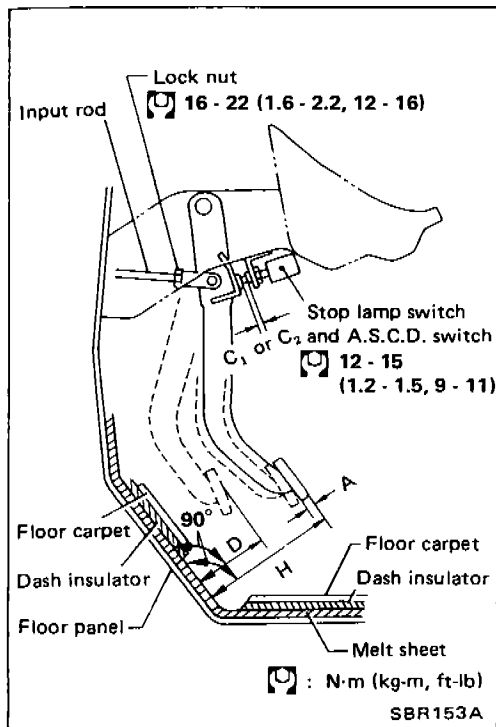
SBR472A

Inspection

Check brake pedal for following items.

- Brake pedal bend
- Clevis pin deformation
- Crack of any welded portion

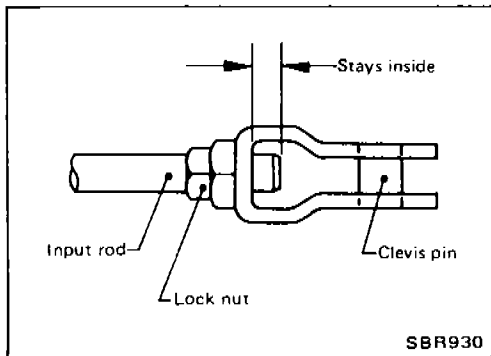
BRAKE PEDAL AND BRACKET



Adjustment

Check brake pedal free height from dash reinforcement panel. Adjust if necessary.

- H: Free height
Refer to S.D.S.
- D: Depressed height
Refer to S.D.S.
Under force of 490 N (50 kg, 110 lb)
with engine running
- C₁: Clearance between pedal stopper and threaded end of stop lamp switch
0.3 - 1.0 mm (0.012 - 0.039 in)
- C₂: Clearance between pedal stopper and threaded end of A.S.C.D. switch
0.3 - 1.0 mm (0.012 - 0.039 in)
- A: Pedal free play
1 - 3 mm (0.04 - 0.12 in)



1. Adjust pedal free height with brake booster input rod. Then tighten lock nut.

Make sure that tip of input rod stays inside.

2. Adjust clearance "C₁" and "C₂" with stop lamp switch and A.S.C.D. switch respectively. Then tighten lock nuts.

3. Check pedal free play.

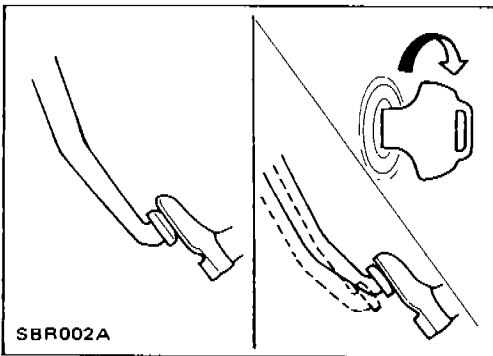
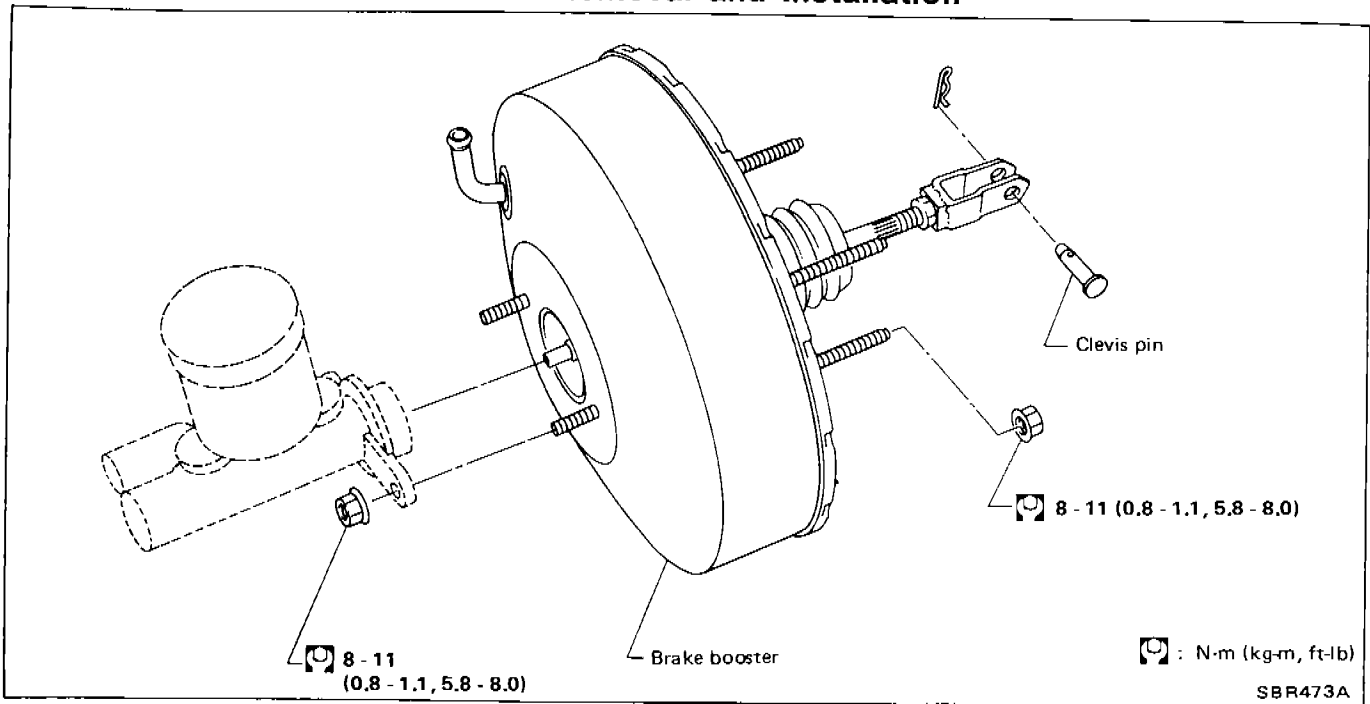
Make sure that stop lamp is off when pedal is released.

4. Check brake pedal's depressed height while engine is running.

If depressed height is below specified value, check brake system for leaks, accumulation of air or any damage to components (master cylinder, wheel cylinder, etc.); then make necessary repairs.

BRAKE BOOSTER

Removal and Installation



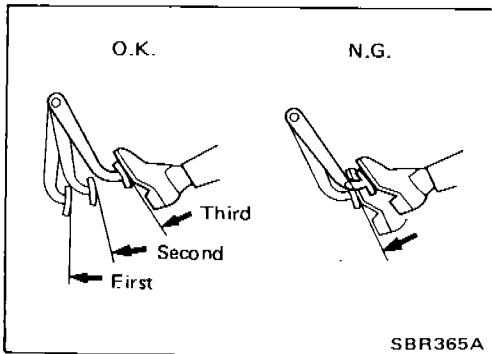
Inspection

OPERATING CHECK

- Depress brake pedal several times with engine off, and check that there is no change in pedal stroke.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.

AIRTIGHT CHECK

- Start engine, and stop it after one or two minutes. Depress brake pedal several times slowly. If pedal goes further down the first time and gradually rises after second or third time, booster is airtight.
- Depress brake pedal while engine is running, and stop engine with pedal depressed. If there is no change in pedal stroke after holding pedal down **30 seconds**, brake booster is airtight.

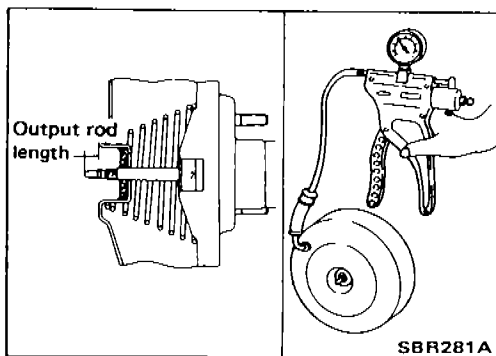


OUTPUT ROD LENGTH CHECK

1. Supply brake booster with vacuum of -66.7 kPa (-667 mbar, -500 mmHg, -19.69 inHg) using a handy vacuum pump.
2. Check output rod length.

Specified length:

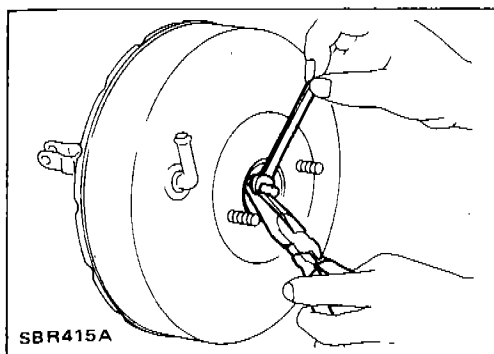
10.275 - 10.525 mm (0.4045 - 0.4144 in)



BRAKE BOOSTER

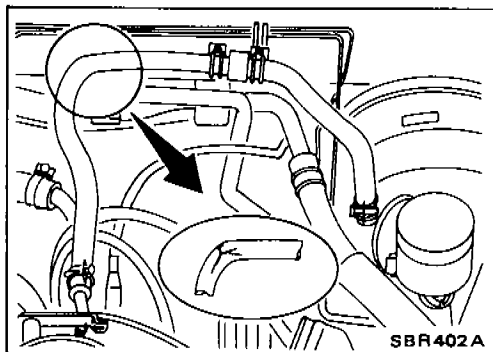
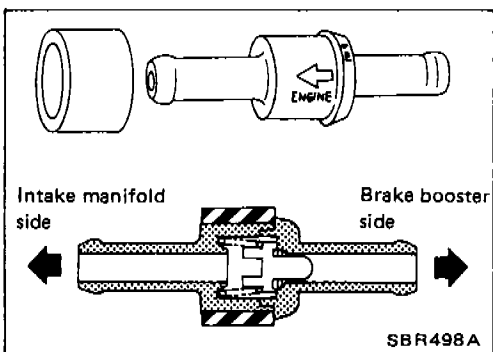
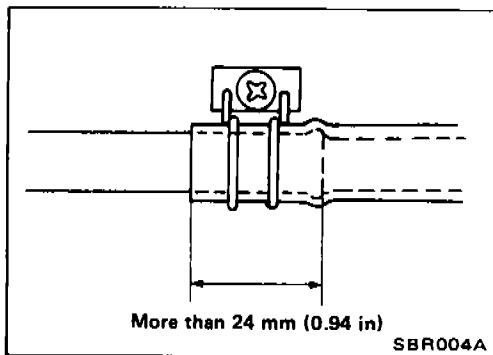
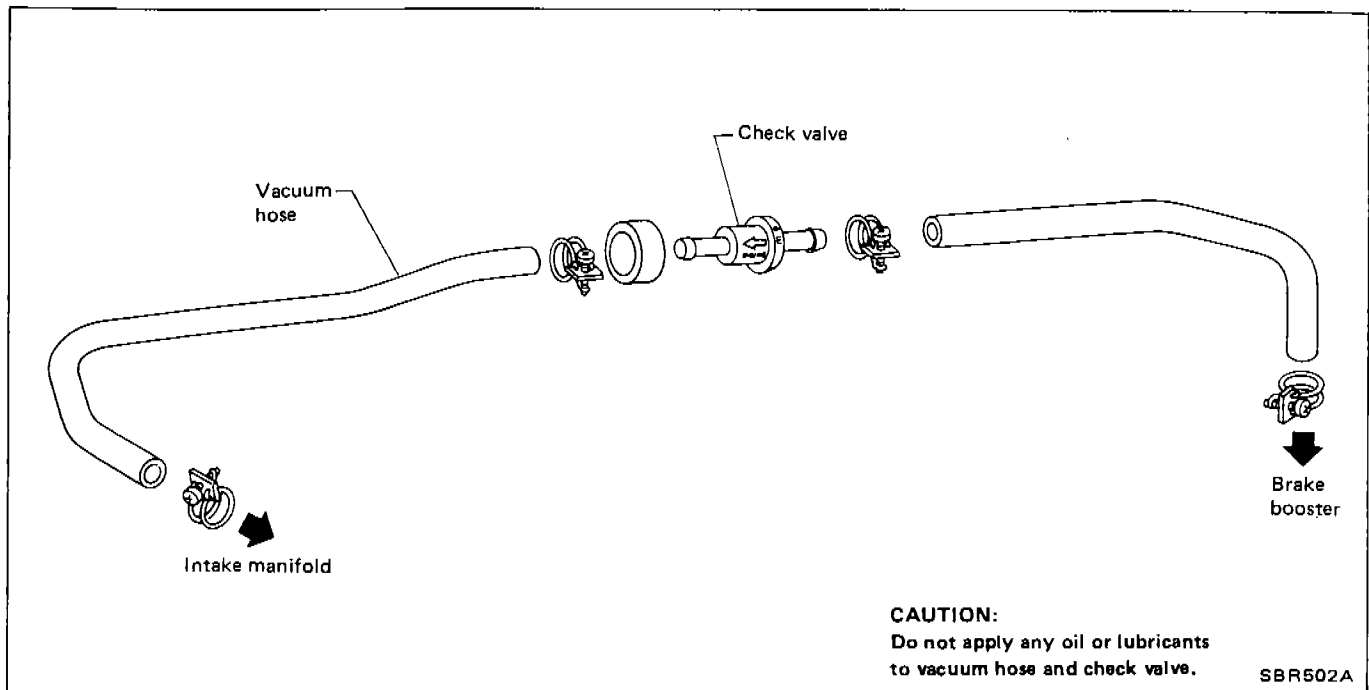
Inspection (Cont'd)

3. Adjust rod length if necessary.
4. If rod length is without specification, replace brake booster.



VACUUM PIPING

Removal and Installation



- Insert vacuum tube into vacuum hose more than 24 mm (0.94 in).

- Install check valve, paying attention to its direction.

Inspection

HOSES AND CONNECTORS

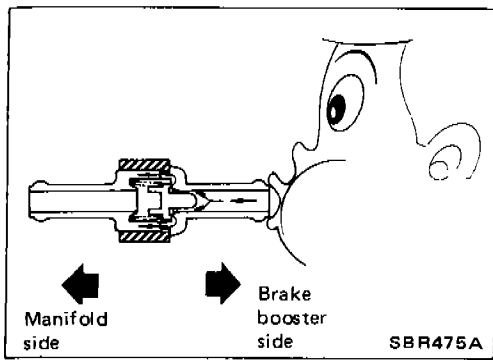
- Check vacuum lines, connections and check valve for airtightness, improper attachment chafing and deterioration.

VACUUM PIPING

Inspection (Cont'd)

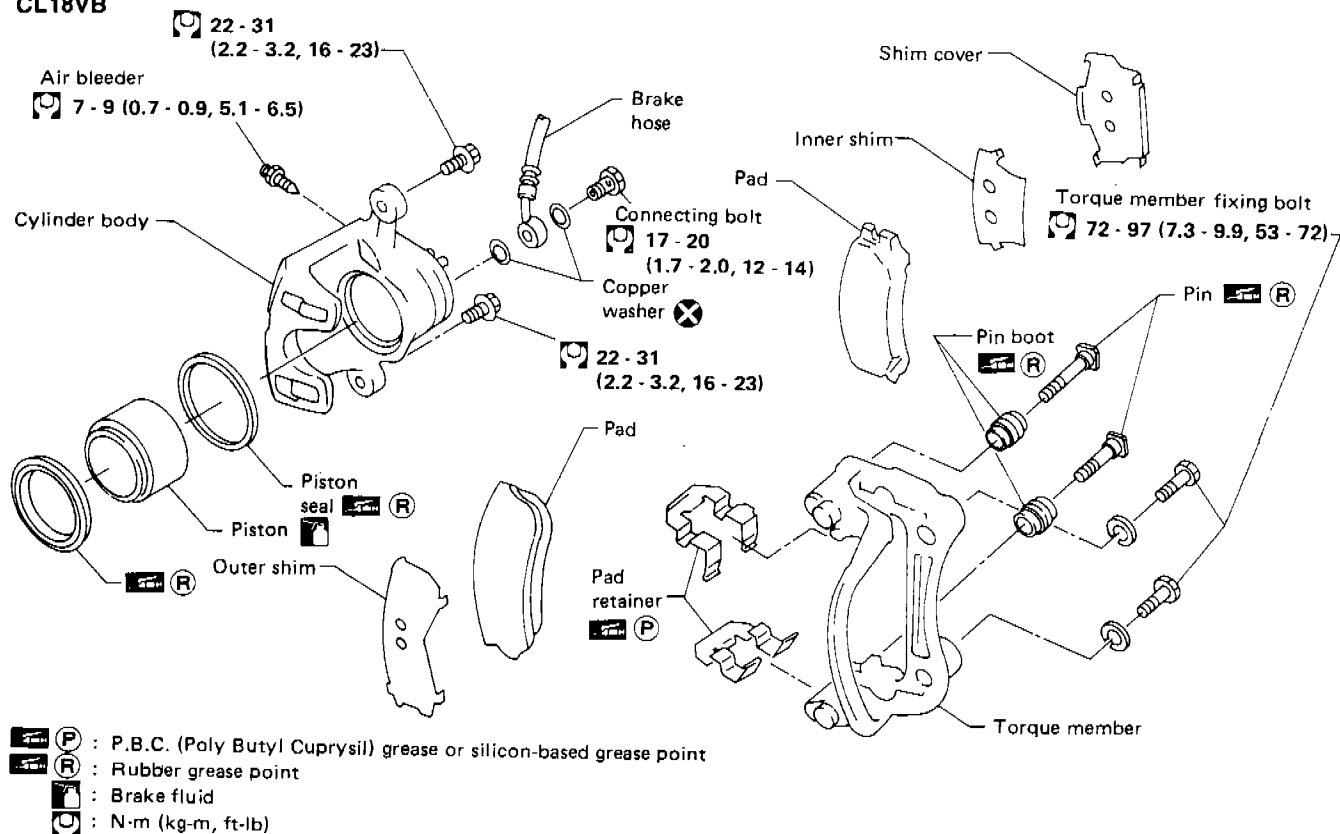
CHECK VALVE

- When pressure is applied to brake booster side of check valve and valve does not open, replace check valve with a new one.



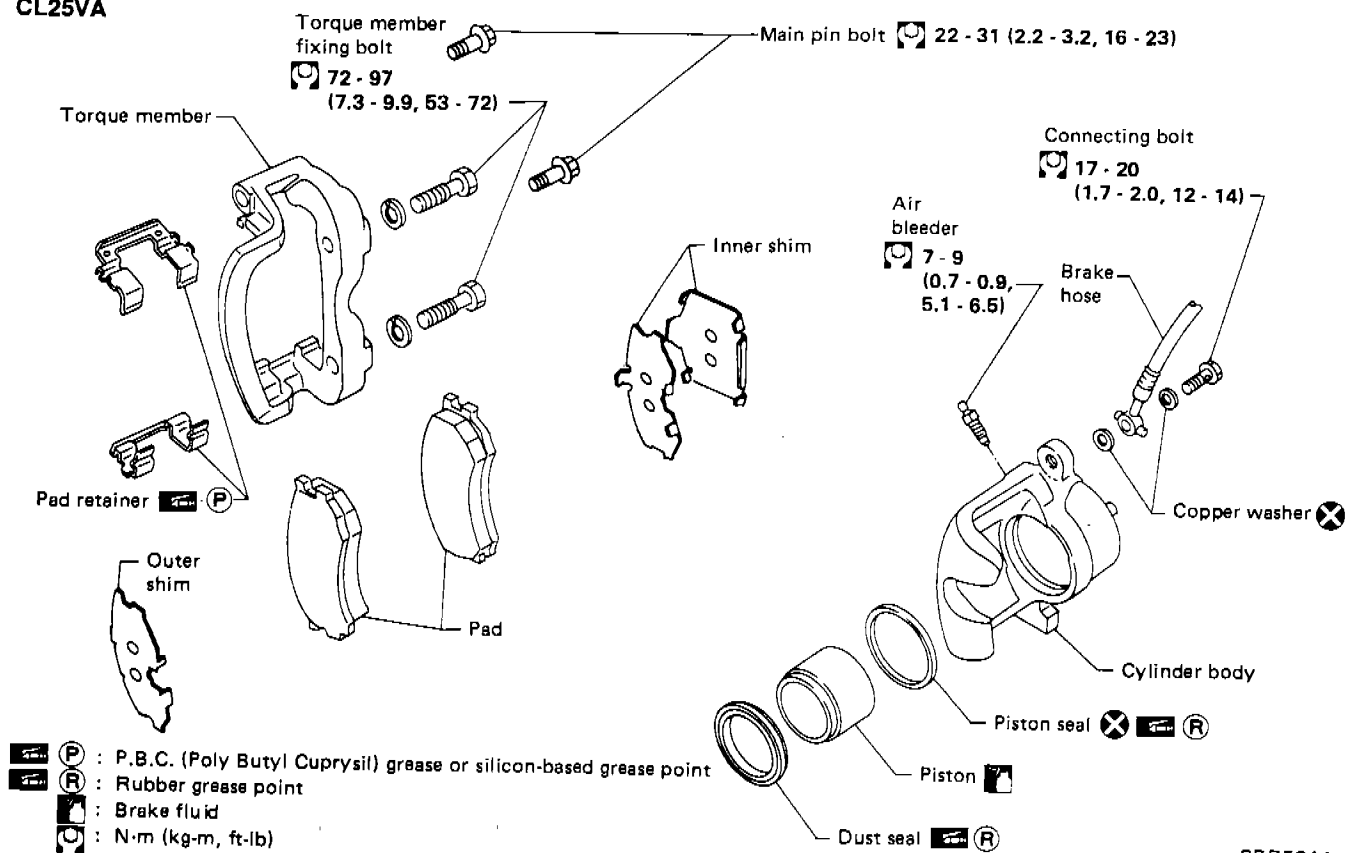
FRONT DISC BRAKE (CL18VB, CL25VA) — Caliper

CL18VB



SBR503A

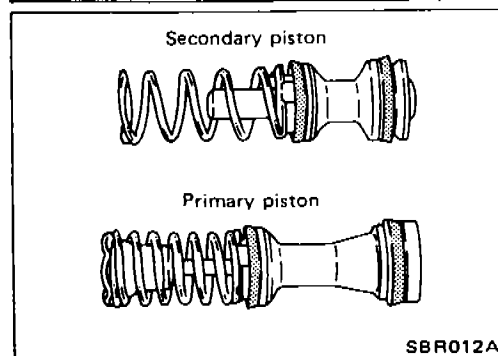
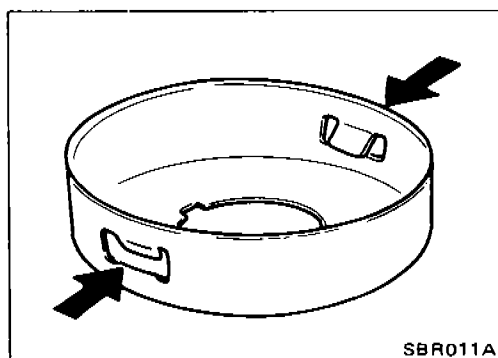
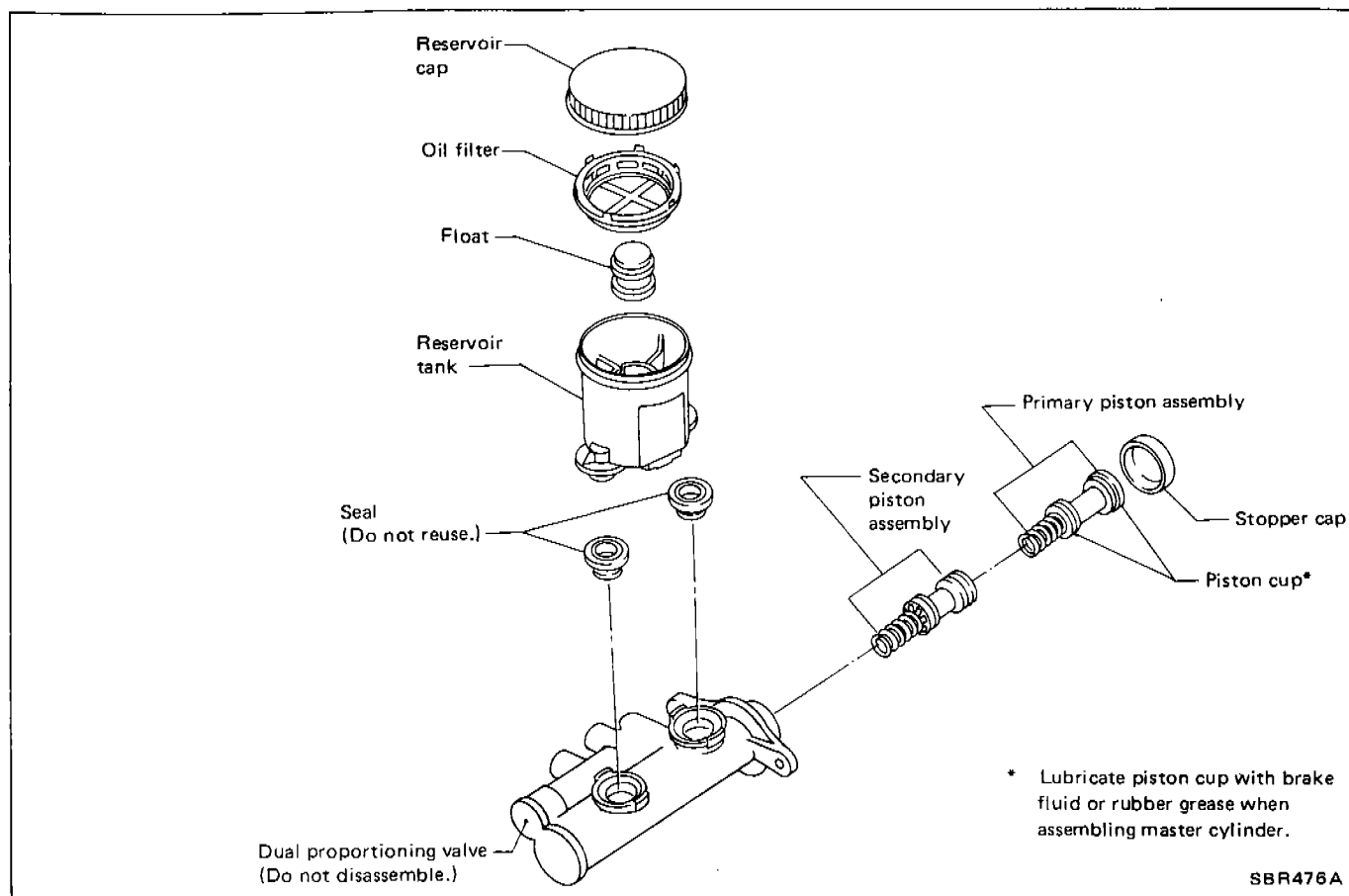
CL25VA



SBR504A

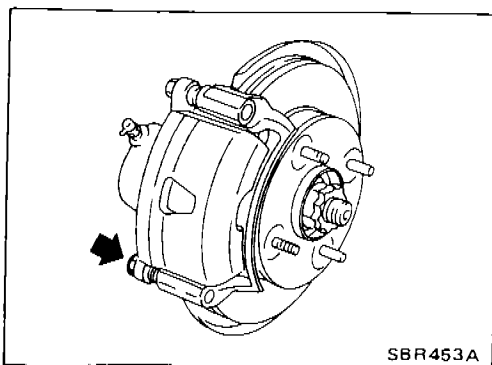
MASTER CYLINDER

Removal and Installation



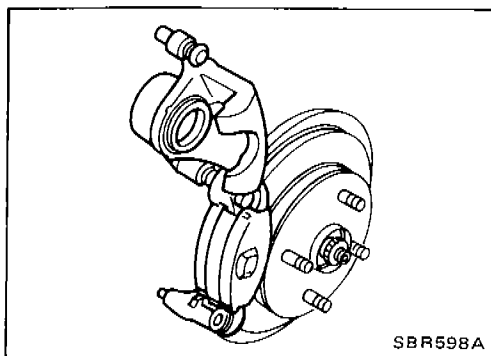
- Replace stopper cap if claw is damaged or deformed.
- Bend claws inward when installing stopper cap.

- Pay attention to direction of piston cups in figure at left.
- Check parts for wear or damage. Replace if necessary.



Pad Replacement

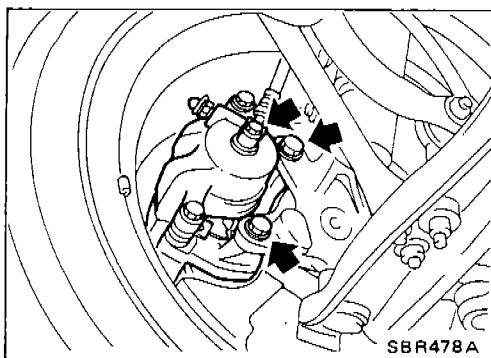
1. Remove pin bolt.



2. Swing cylinder body upward. Then remove pad retainer, and inner and outer shims.

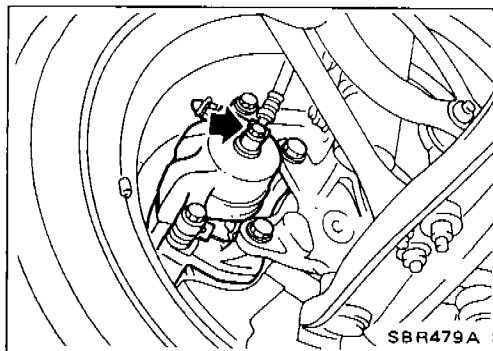
CAUTION:

- When cylinder body is swung up, do not depress brake pedal because piston will pop out.
- Be careful not to damage dust seal or get oil on rotor. Always replace shims when replacing pads.

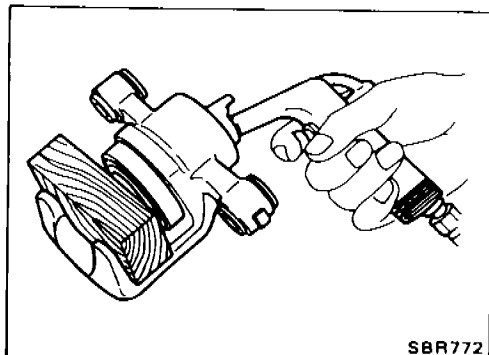


Removal and Installation

- Remove torque member fixing bolts and union bolt.



- Install brake hose to caliper at protrusions securely.



Disassembly

Push out piston with dust seal using compressed air.

Inspection

CYLINDER BODY

- Check inside surface of cylinder for scoring, rust, wear, damage or foreign materials. Replace if any such condition exists.
- Eliminate minor damage from rust or foreign materials by polishing surface with fine emery paper.

CAUTION:

Use brake fluid to clean.

PISTON

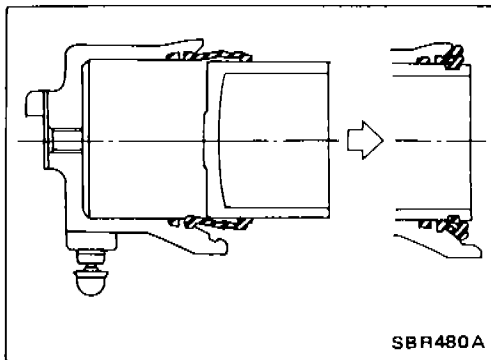
Check piston for scoring, rust, wear, damage or foreign materials. Replace if any condition exists.

CAUTION:

Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign materials are stuck to sliding surface.

PIN, PIN BOLT AND PIN BOOT

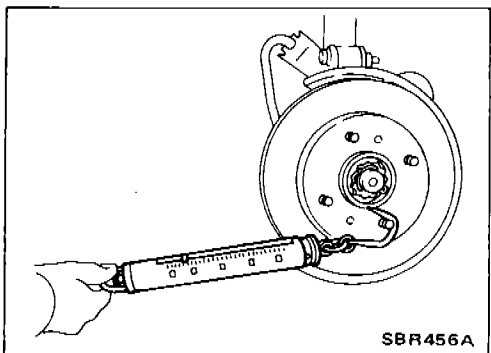
Check for wear, cracks or other damage. Replace if any condition exists.



SBR480A

Assembly

- Place piston boot over rear of piston. Fit piston boot's lip properly in corresponding groove on cylinder body.
- Insert piston into cylinder body and fit boot's lip properly in corresponding groove on piston.

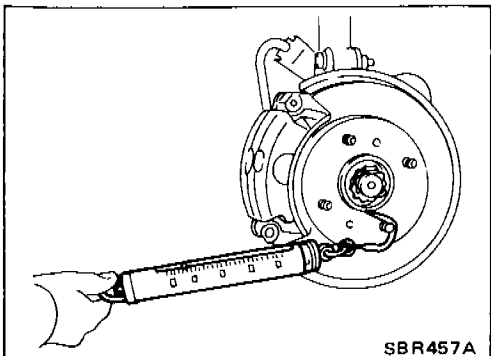


SBR456A

Inspection (On-vehicle)

INSPECTION OF BRAKE DRAG FORCE

1. Swing cylinder body upward.
2. Make sure that wheel bearing is adjusted properly. Refer to section FA.
3. Measure rotating force (F_1).



SBR457A

4. Install caliper with pads to original position.
5. Depress brake pedal for 5 seconds.
6. Release brake pedal and rotate disc rotor 10 revolutions.
7. Measure rotating force (F_2).
8. Calculate brake drag force by subtracting F_1 from F_2 .

Maximum brake drag force ($F_2 - F_1$):

59.8 N (6.1 kg, 13.5 lb)

If it is not within specification, check main pins and retainer boots in caliper.

FRONT DISC BRAKE (CL18VB, CL25VA) — Caliper

Inspection (On-vehicle) (Cont'd)

DISC PAD

Check disc pad for wear or damage.

CL18VB:

Pad standard thickness (A)

10.0 mm (0.394 in)

Pad wear limit (A)

2.0 mm (0.079 in)

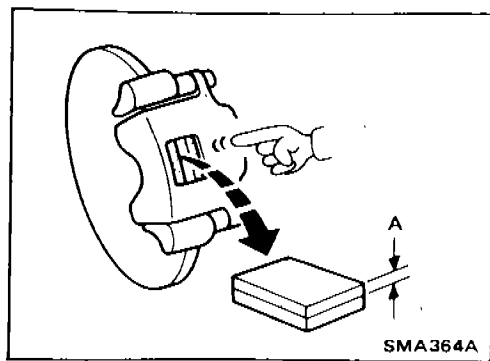
CL25VA:

Pad standard thickness (A)

11.0 mm (0.433 in)

Pad wear limit (A)

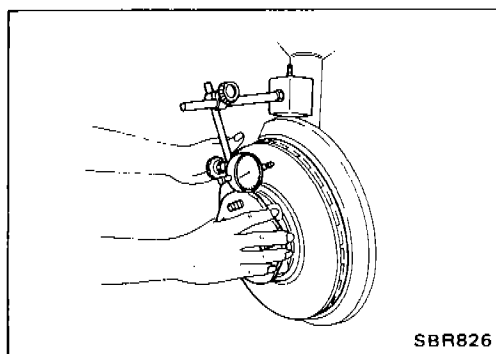
2.0 mm (0.079 in)



Inspection

RUBBING SURFACE

Check rotor for roughness, cracks or chips.



RUNOUT

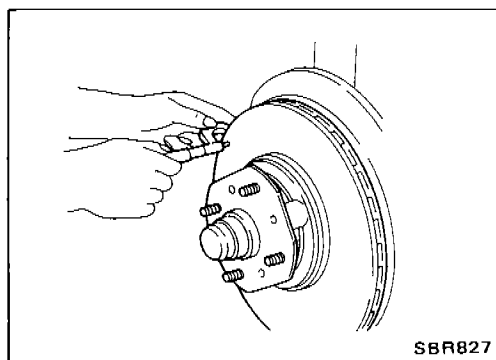
Adjust wheel bearing preload. Check runout using a dial indicator.

Rotor repair limit:

Maximum runout

(Total indicator reading at center of rotor pad contact surface)

0.07 mm (0.0028 in)



THICKNESS

CL18VB:

Standard thickness

18.0 mm (0.709 in)

Minimum thickness

16.0 mm (0.630 in)

CL25VA:

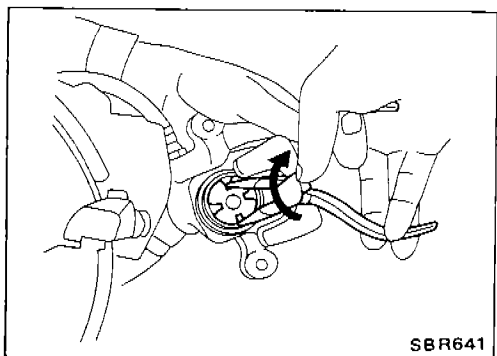
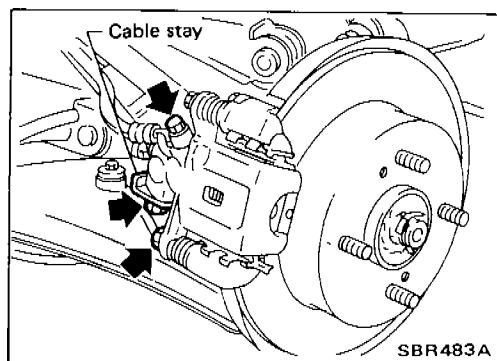
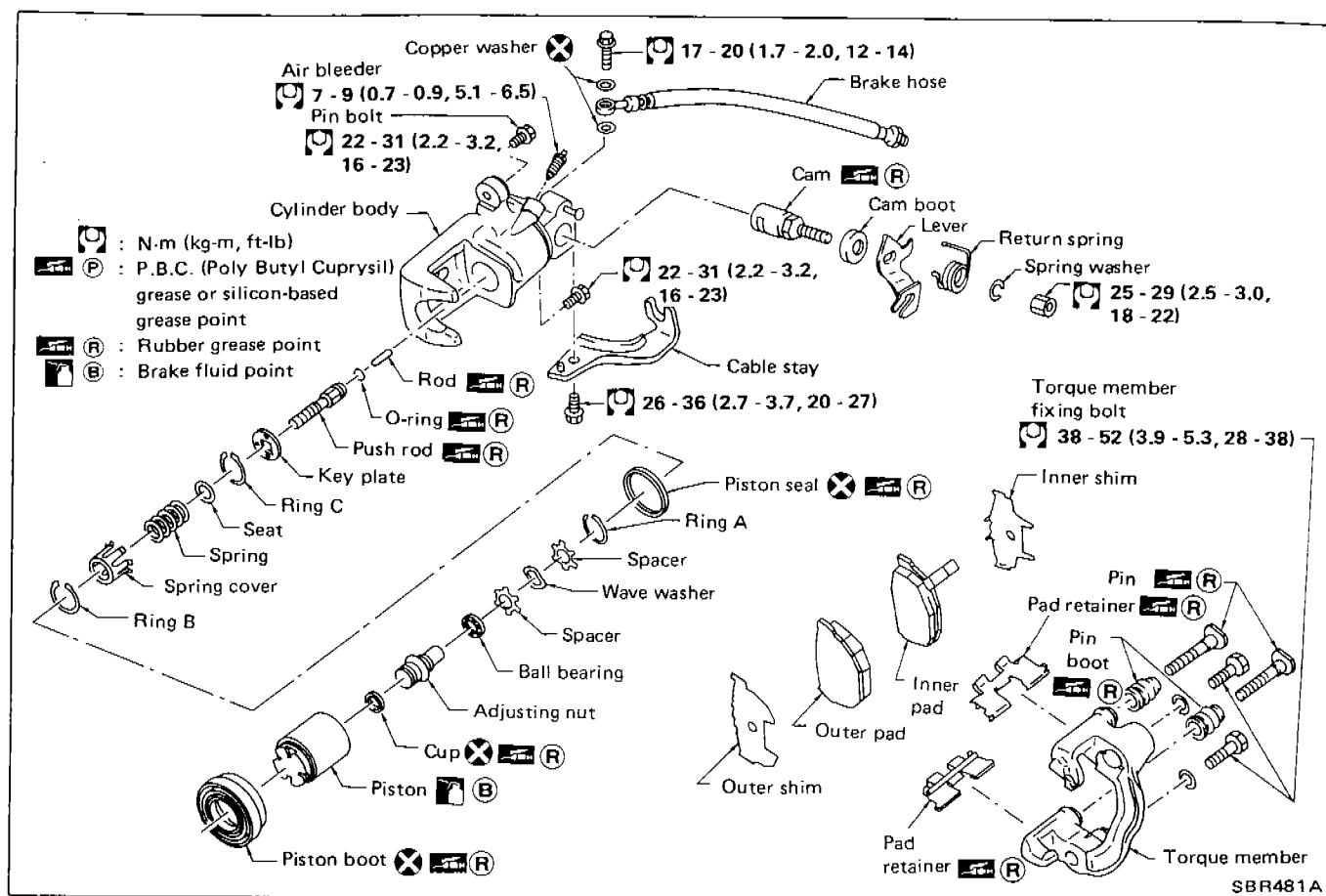
Standard thickness

22.0 mm (0.866 in)

Minimum thickness

20.0 mm (0.787 in)

REAR DISC BRAKE (CL9H) — Caliper



Pad Replacement

CAUTION:

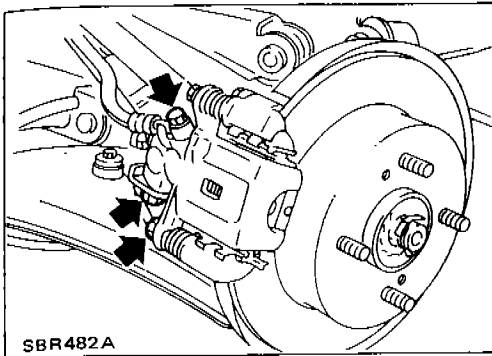
When cylinder body is swung up, do not depress brake pedal because piston will pop out.

- Remove parking cable stay fixing bolt, pin bolts and lock spring. Then remove pad retainers, pads and shims.

- When installing pads, retract piston into cylinder body by turning it clockwise.

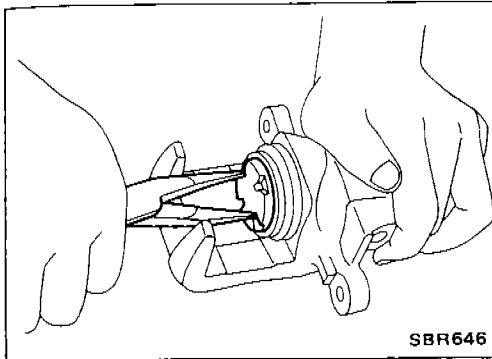
CAUTION:

Be careful not to damage piston boot or get oil on rotor. Always replace shims when replacing pads.



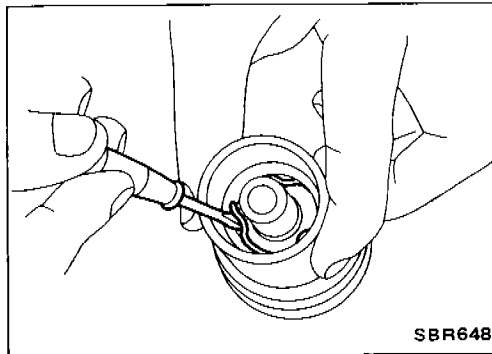
Removal and Installation

Disconnect parking brake cable and brake hose, then remove caliper assembly.

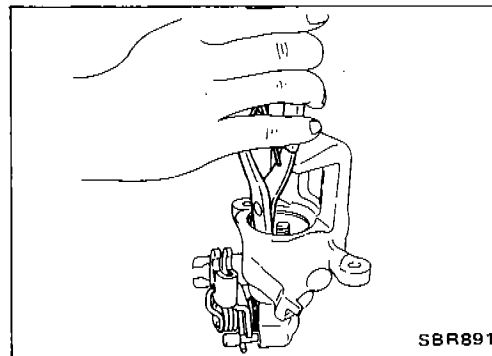


Disassembly

1. Remove piston by turning it counterclockwise with suitable longnose pliers.

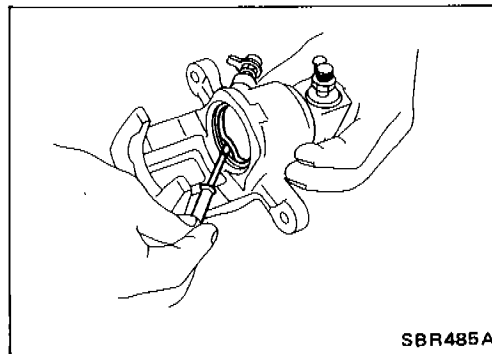


2. Pry off ring A from piston with suitable pliers and remove adjusting nut.



3. Disassemble cylinder body.

- Pry off rings B and C with pliers, then remove spring cover, spring and seat.



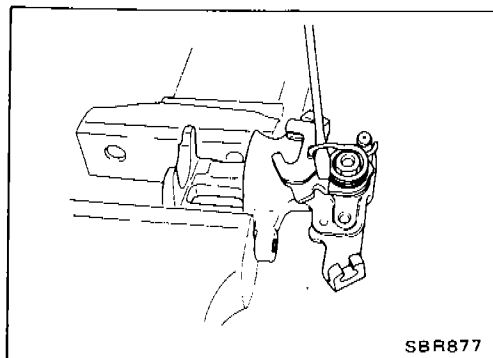
- Remove piston seal.

Be careful not to damage cylinder body.

REAR DISC BRAKE (CL9H) — Caliper

Disassembly (Cont'd)

4. Remove return spring and lever.



Inspection

CYLINDER BODY

- Check inside surface of cylinder for score, rust, wear or other damage.
- Minor damage from rust of foreign materials may be eliminated by polishing surface with a fine emery paper. Replace if necessary.

CAUTION:

Use brake fluid to clean.

TORQUE MEMBER

Check for wear, cracks or other damage. Replace if necessary.

PISTON

Check piston for score, rust, wear or other damage. Replace if necessary.

CAUTION:

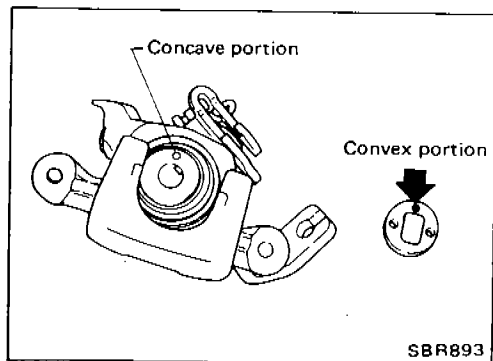
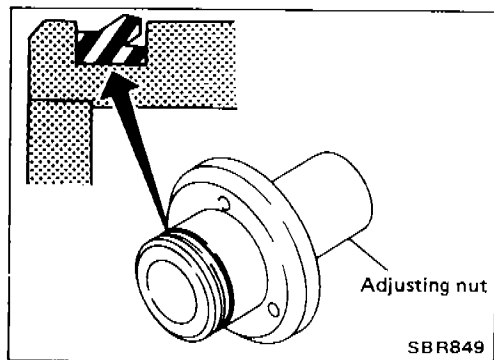
Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is stuck to sliding surface.

PIN AND PIN BOOT

Check for wear, cracks or other damage. Replace if necessary.

Assembly

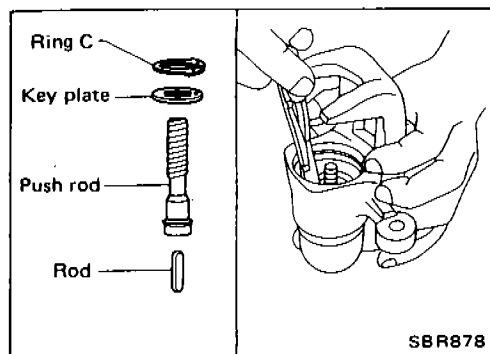
- Install cup securely in the specified direction.



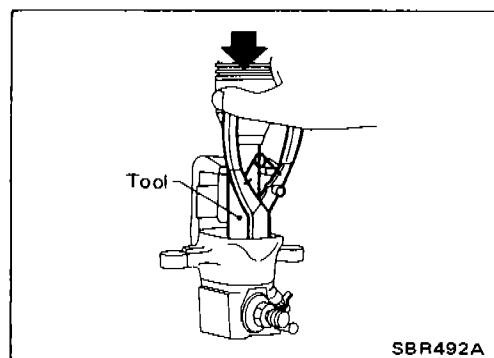
REAR DISC BRAKE (CL9H) — Caliper

Assembly (Cont'd)

- Install ring C with suitable tool.



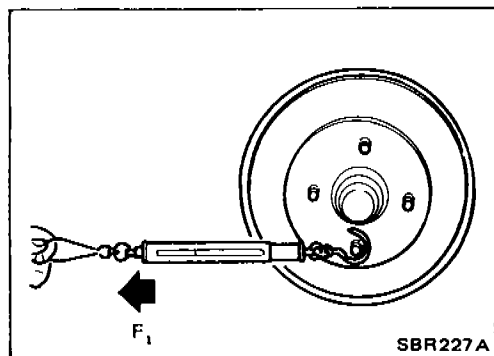
- Install seat, spring, spring cover and ring B with suitable press and drift.



Inspection (On-vehicle)

INSPECTION OF BRAKE DRAG FORCE

1. Swing cylinder body upward.
2. Make sure that wheel bearing is adjusted properly. Refer to section RA.
3. Measure rotating force (F_1).

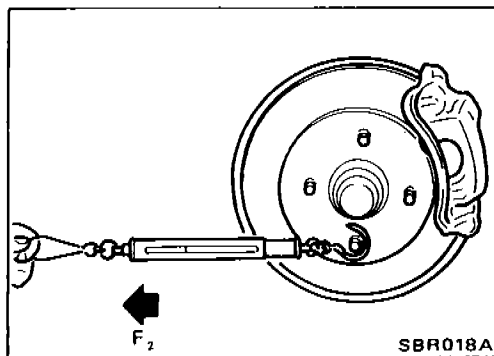


4. Install caliper with pads to original position.
5. Depress brake pedal for 5 seconds.
6. Release brake pedal, rotate disc rotor 10 revolutions.
7. Measure rotating force (F_2).
8. Calculate brake drag force by subtracting F_1 from F_2 .

Maximum brake drag force ($F_2 - F_1$):

86.3 N (8.8 kg, 19.4 lb)

If it is not within specification, check pins and pin boots in caliper.



DISC PAD

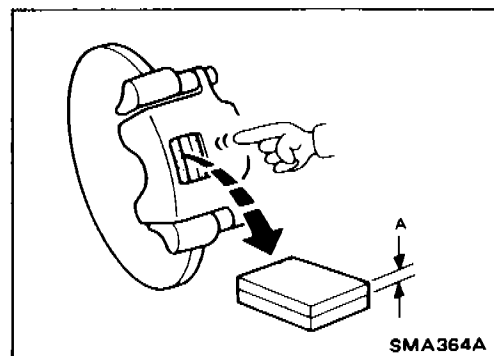
Check disc pad for wear or damage.

Standard thickness (A):

9.5 mm (0.374 in)

Pad wear limit (A):

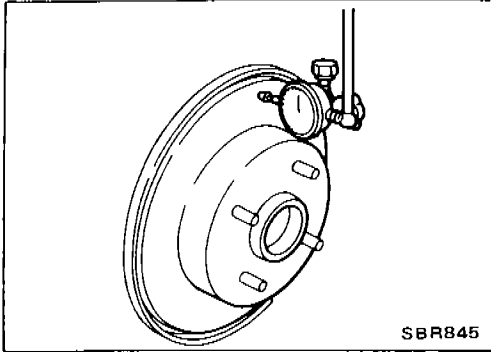
2.0 mm (0.079 in)



Inspection

RUBBING SURFACE

Check rotor for roughness, cracks or chips.



RUNOUT

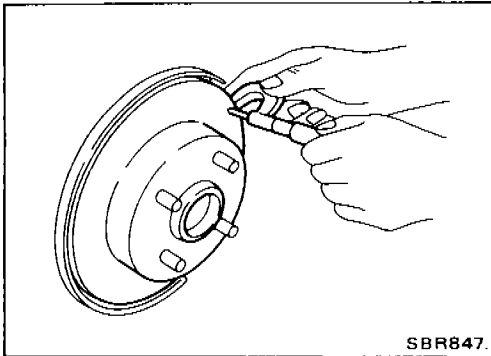
- Check runout using a dial indicator.
- Make sure that axial end play is within the specifications before measuring. Refer to section RA.

Rotor repair limit:

Maximum runout

(Total indicator reading at center of rotor pad contact surface)

0.07 mm (0.0028 in)



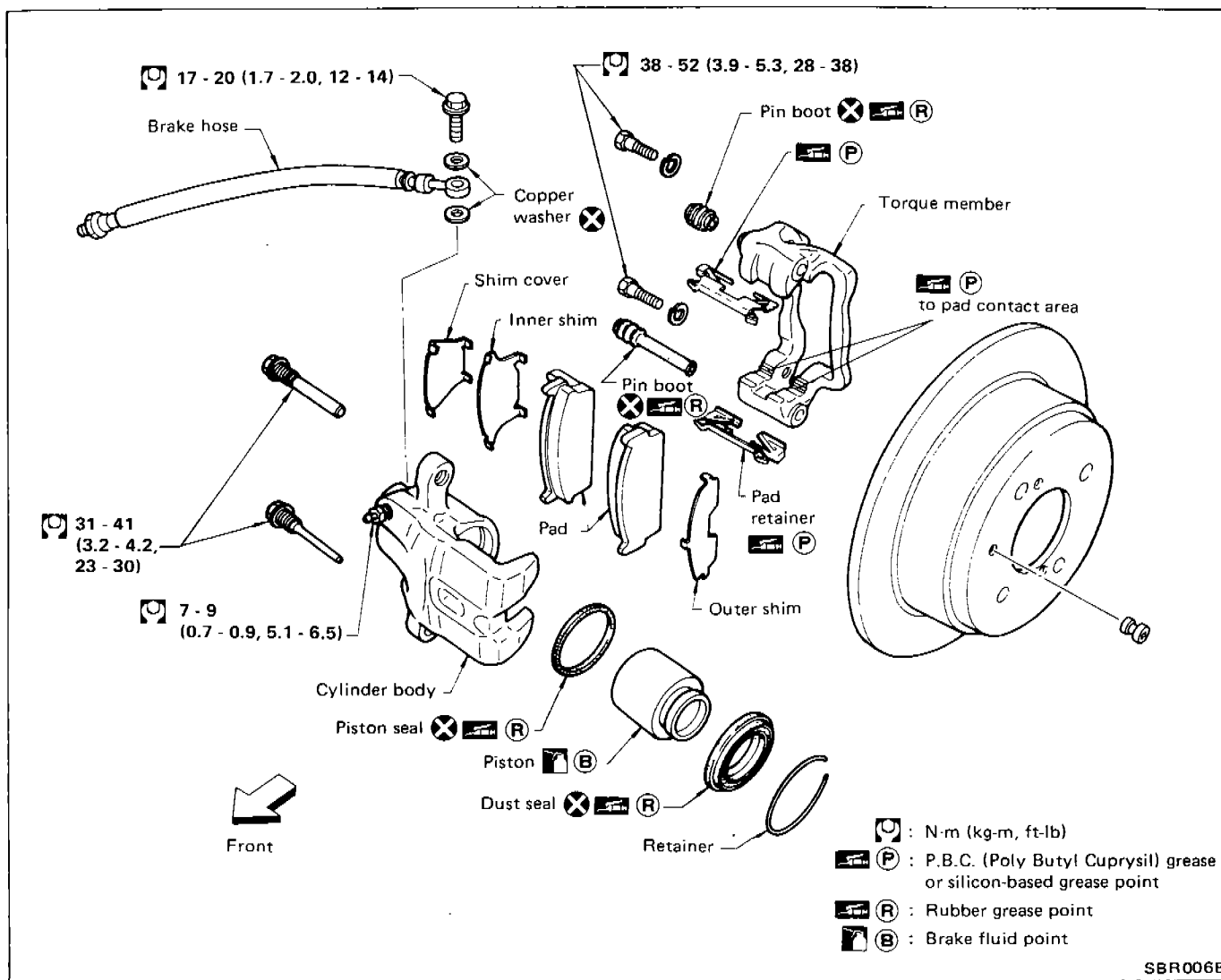
THICKNESS

Rotor repair limit:

Minimum thickness

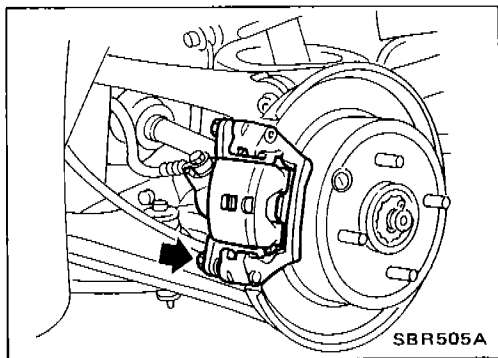
8.0 mm (0.315 in)

REAR DISC BRAKE (AD9) — Caliper



Pad Replacement

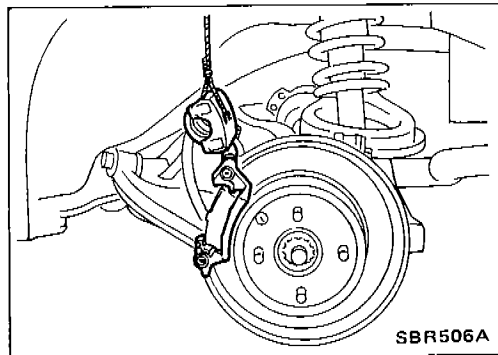
1. Remove guide pin.

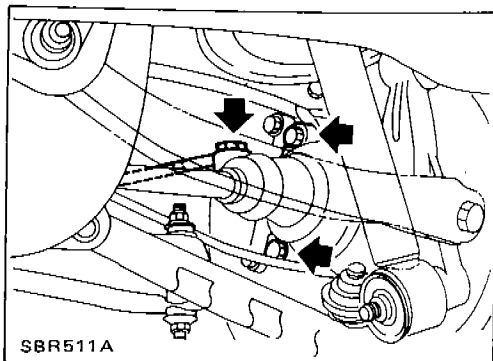


2. Swing cylinder body upward. Then remove pad retainer and inner and outer shims.

CAUTION:

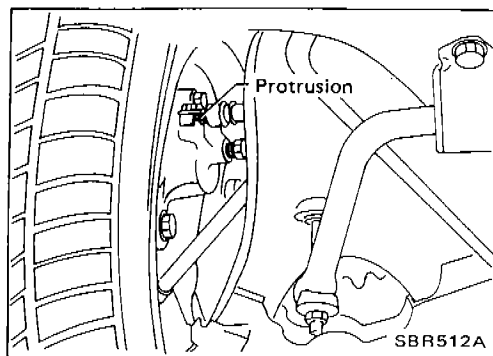
- When cylinder body is swung up, do not depress brake pedal because piston will pop out.
- Be careful not to damage dust seal or get oil on rotor. Always replace shims when replacing pads.



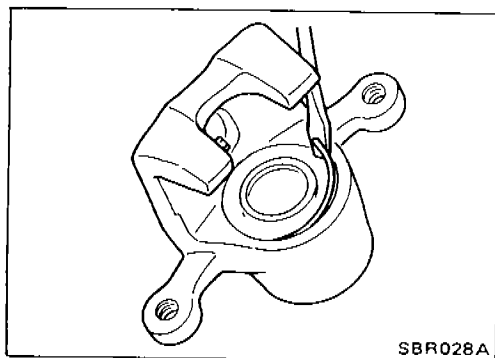


Removal and Installation

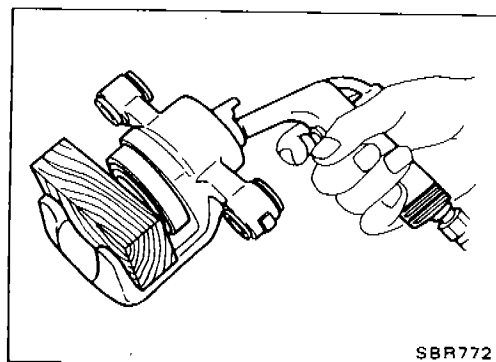
- Remove torque member fixing bolts and eye bolt.



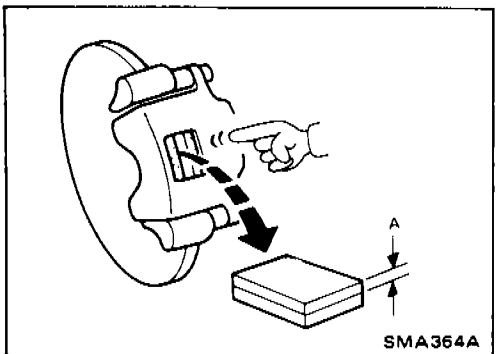
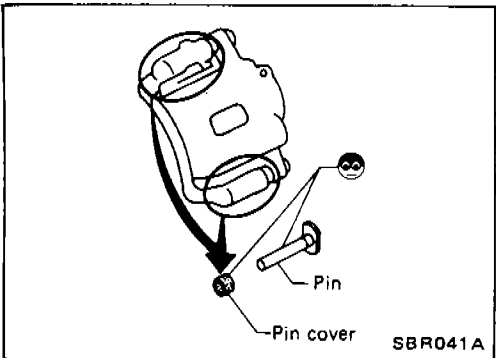
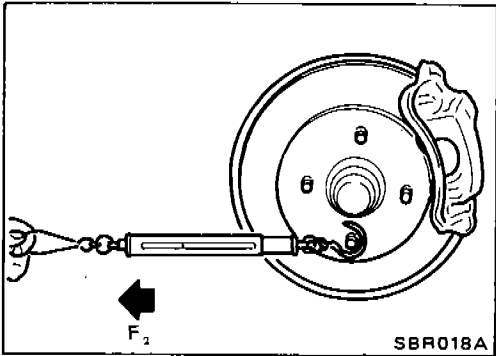
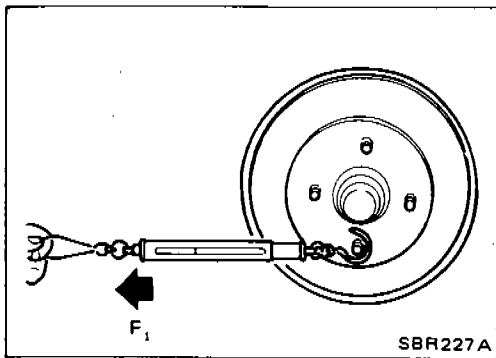
- Install brake hose to caliper securely.



- Remove retainer with a screwdriver.



- Push out piston with dust seal with compressed air.



Inspection

INSPECTION OF BRAKE DRAG FORCE

1. Swing cylinder body upward.
2. Make sure that wheel bearing is adjusted properly. Refer to section RA.
3. Measure rotating force (F_1).

4. Install caliper with pads to original position.
5. Depress brake pedal for 5 seconds.
6. Release brake pedal, rotate disc rotor 10 revolutions.
7. Measure rotating force (F_2).
8. Calculate brake drag force by subtracting F_1 from F_2 .

Maximum brake drag force ($F_2 - F_1$):
103.0 N (10.5 kg, 23.2 lb)

If it is not within specification, check pins and pin boots in caliper.

- Make sure that wheel bearing is adjusted properly.
- Disc pads and disc rotor must be dried.

DISC PAD

Check disc pad for wear or damage.

Pad wear limit (A):
2.0 mm (0.079 in)

CYLINDER BODY

- Check inside surface of cylinder body for score, rust, wear, damage or presence of foreign materials. If any of the above conditions are observed, replace cylinder body.
- Minor damage from rust or foreign materials may be eliminated by polishing surface with a fine emery paper. Replace cylinder body if necessary.

CAUTION:

Use brake fluid to clean. Never use mineral oil.

Inspection (Cont'd)

PISTON

Check piston for score, rust, wear, damage or presence of foreign materials. Replace if any of the above conditions are observed.

CAUTION:

Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is stuck to sliding surface.

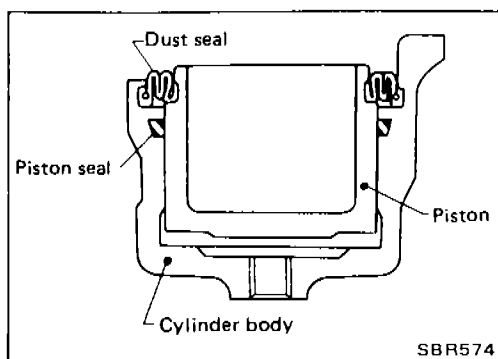
PIN, PIN BOLT, RETAINER, PISTON SEAL,

DUST SEAL AND PIN BOOT

Check for wear, cracks or other damage. Replace if any of the above conditions are observed.

Assembly

- With dust seal fitted to piston, insert dust seal into groove on cylinder body and install piston.
- Properly secure dust seal.

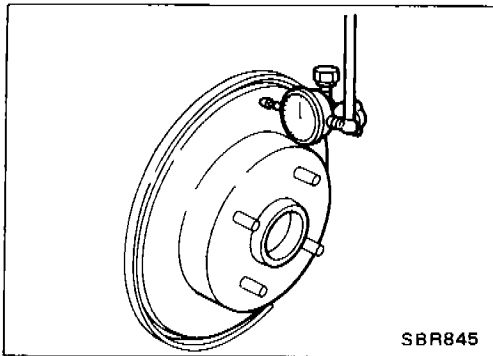


REAR DISC BRAKE (AD9) — Rotor

Inspection

RUBBING SURFACE

Check rotor for roughness, cracks or chips. Repair or replace if necessary.



RUNOUT

Make sure that axial end play is within the specifications before measuring. Refer to section RA.

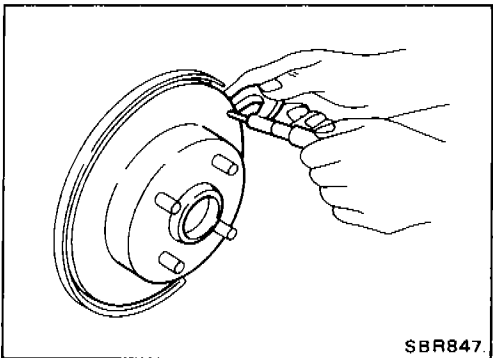
Then check runout using a dial indicator.

Rotor repair limit:

Maximum runout

(Total indicator reading at center of rotor pad contact surface)

0.07 mm (0.0028 in)



THICKNESS

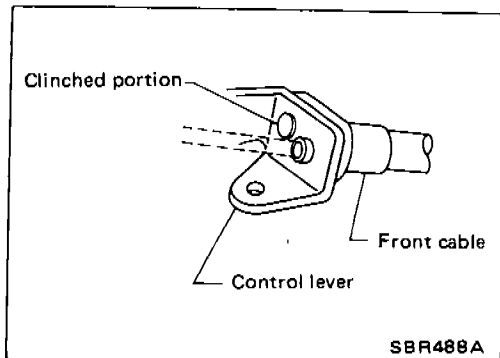
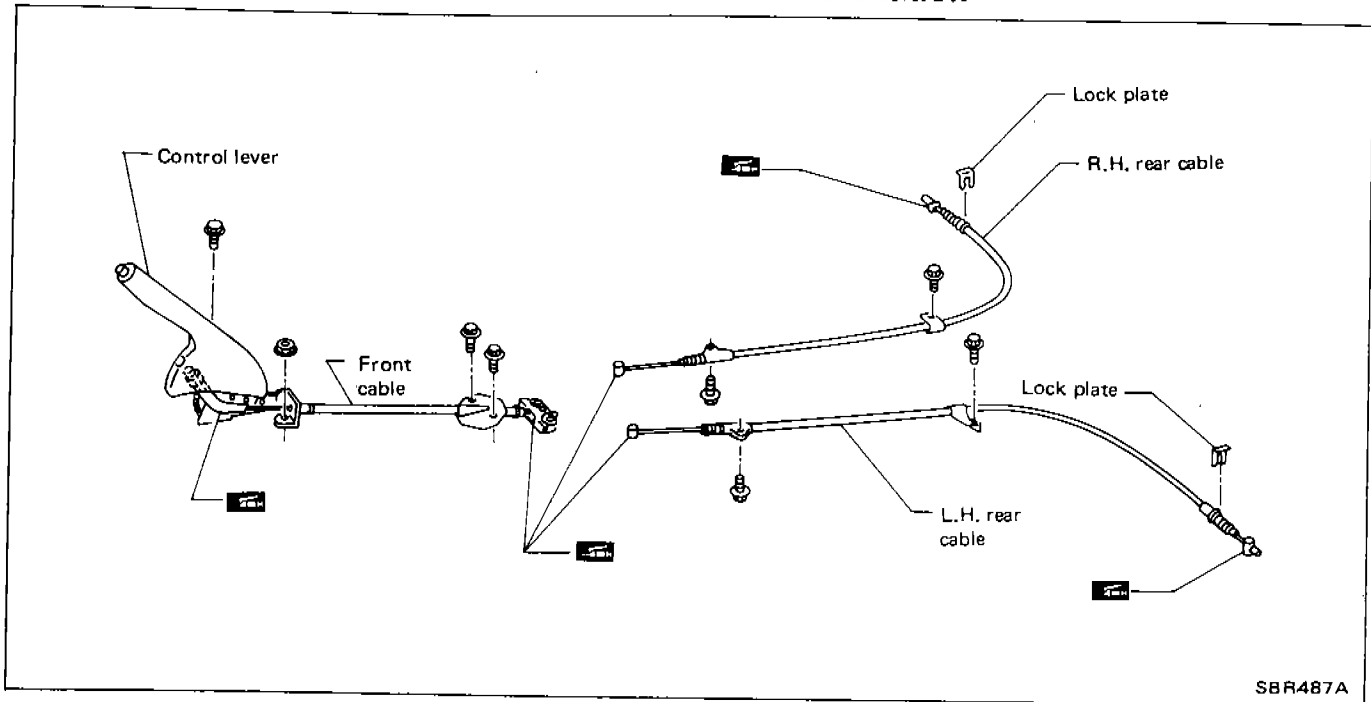
Rotor repair limit:

Minimum thickness

8.0 mm (0.315 in)

PARKING BRAKE CONTROL

Removal and Installation



REMOVAL

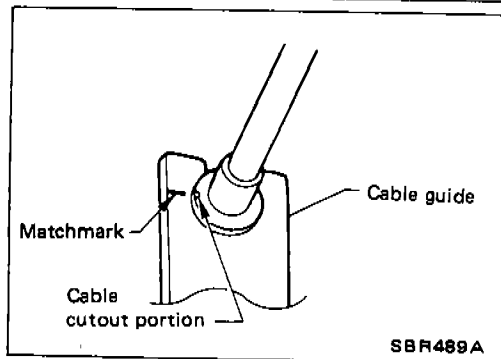
- Before removing parking brake control, remove console box.
- Loosen cable using control lever adjuster, and separate front and rear cables.
- Break clinched portion of control lever using a hammer and chisel as shown in figure at left, and replace cables with new parts.

Apply multi-purpose grease to areas between control lever drum and cables.

INSTALLATION

Be careful not to damage boot and inner cable.

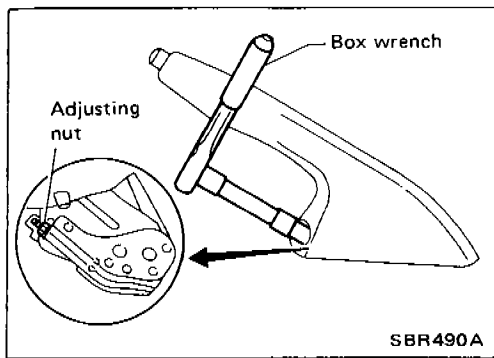
- When installing parking brake cable at rear caliper, make sure to align matchmark on parking cable stay and cable.



Inspection

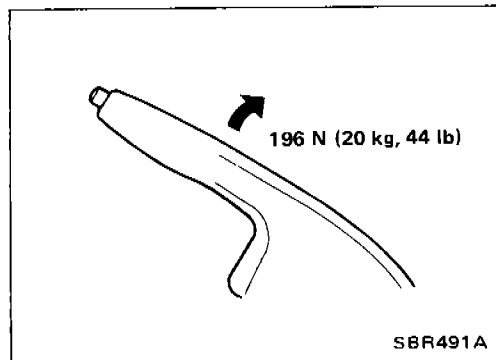
1. Check control lever for wear or other damage. Replace if necessary.
2. Check parking brake cables, lamp and switch. Replace if necessary.
3. Check parts at each connecting portion for deformation or damage. If found, replace.

PARKING BRAKE CONTROL



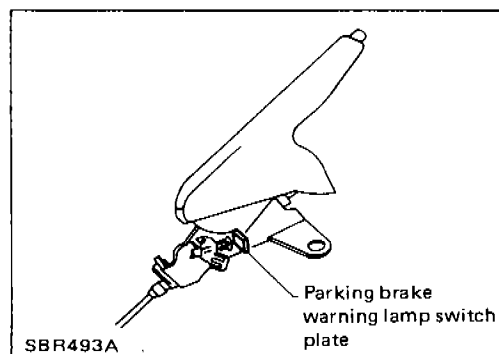
Adjustment

1. Ensure that parking brake releases when control lever is pulled down completely. If control lever does not release parking brake, proceed as follows:
 - Pull control lever up by 4 or 5 notches.
 - Insert a box wrench into opening in control lever and loosen self-lock adjusting nut to slacken cables. Completely push control lever down.
2. Forcefully depress brake pedal about five times (so that caliper is automatically set in position.).
3. Pull lever up by 4 or 5 notches.
4. Turn adjusting nut as shown in figure at left and adjust lever stroke to specified value.
5. Completely push control lever down and ensure that:
 - Parking brake is released completely.
 - Rear brakes are free from dragging.



6. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.

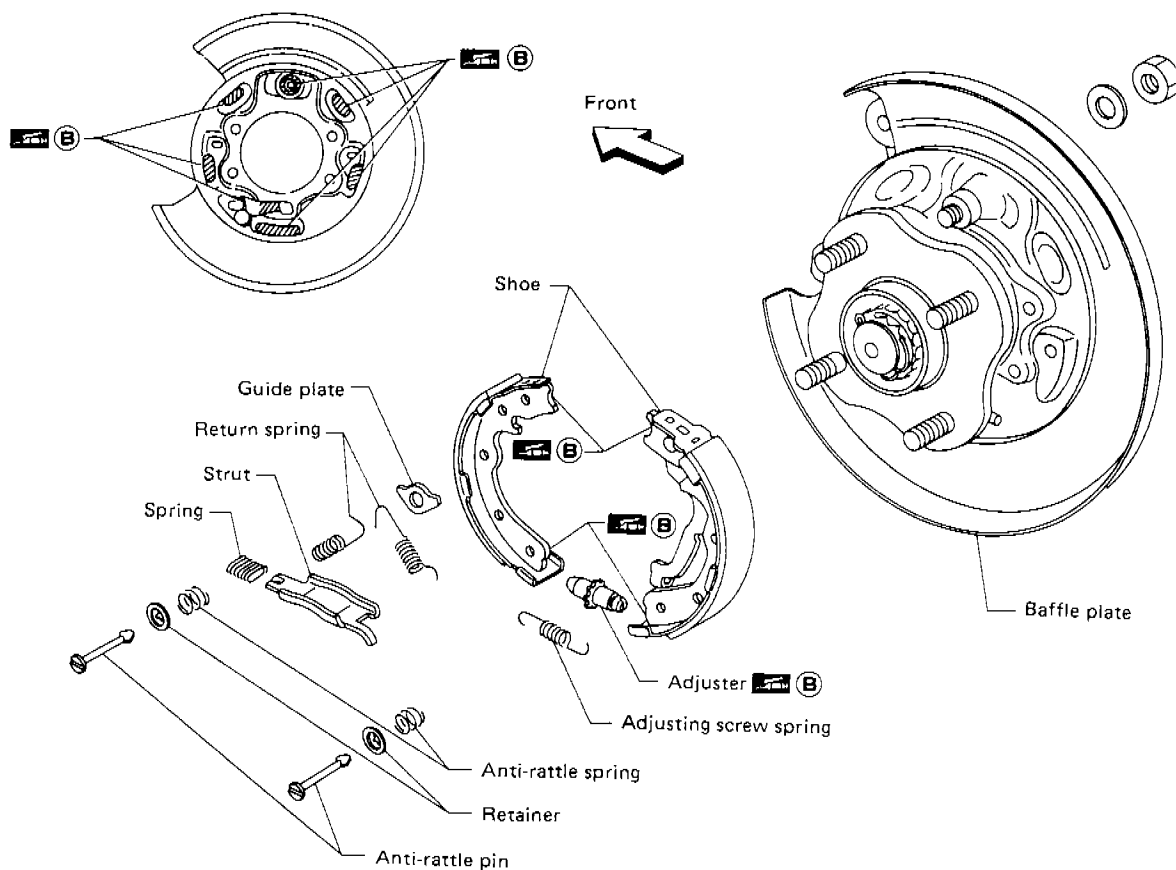
Number of notches: 6 - 8



7. Bend parking brake warning lamp switch plate so that brake warning light comes on when ratchet at parking brake lever is pulled "A" notches and goes out when fully released.

Number of notches "A": 1

PARKING DRUM BRAKE (DS17HD) — Rear Disc Brake AD9 Model

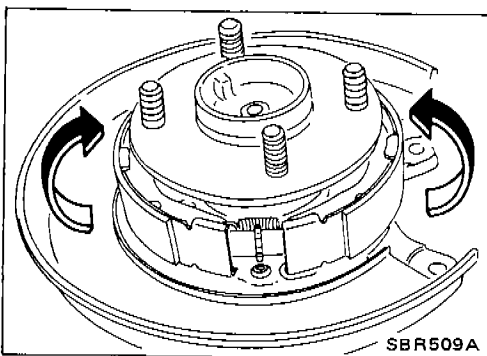
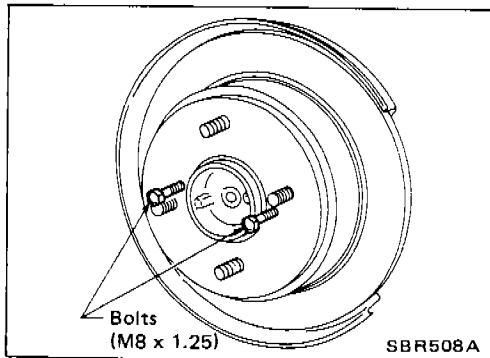


B : Brake grease point

SBR007B

Shoe Replacement

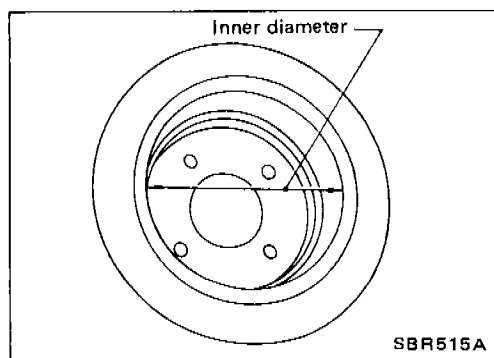
1. Remove disc rotor (With parking drum brake).
Tighten two bolts gradually if disc rotor is hard to remove.



2. After removing retainer, remove spring by rotating shoes.
Be careful not to damage parking brake cable when separating it.

Breaking in Drum and Lining

1. Using either low or 2nd transmission speed, drive the unloaded vehicle at approximately 30 km/h (19 MPH) on a safe, level and dry road.
2. Depress the release button of parking brake lever, then pull the lever with a force of 98 N (10 kg, 22 lb).
3. While holding the lever back, continue to drive the vehicle 100 m (328 ft).
4. Repeat steps 1 through 3 two or three times.



Drum Inspection

Standard inner diameter:

172.0 mm (6.77 in)

Maximum inner diameter:

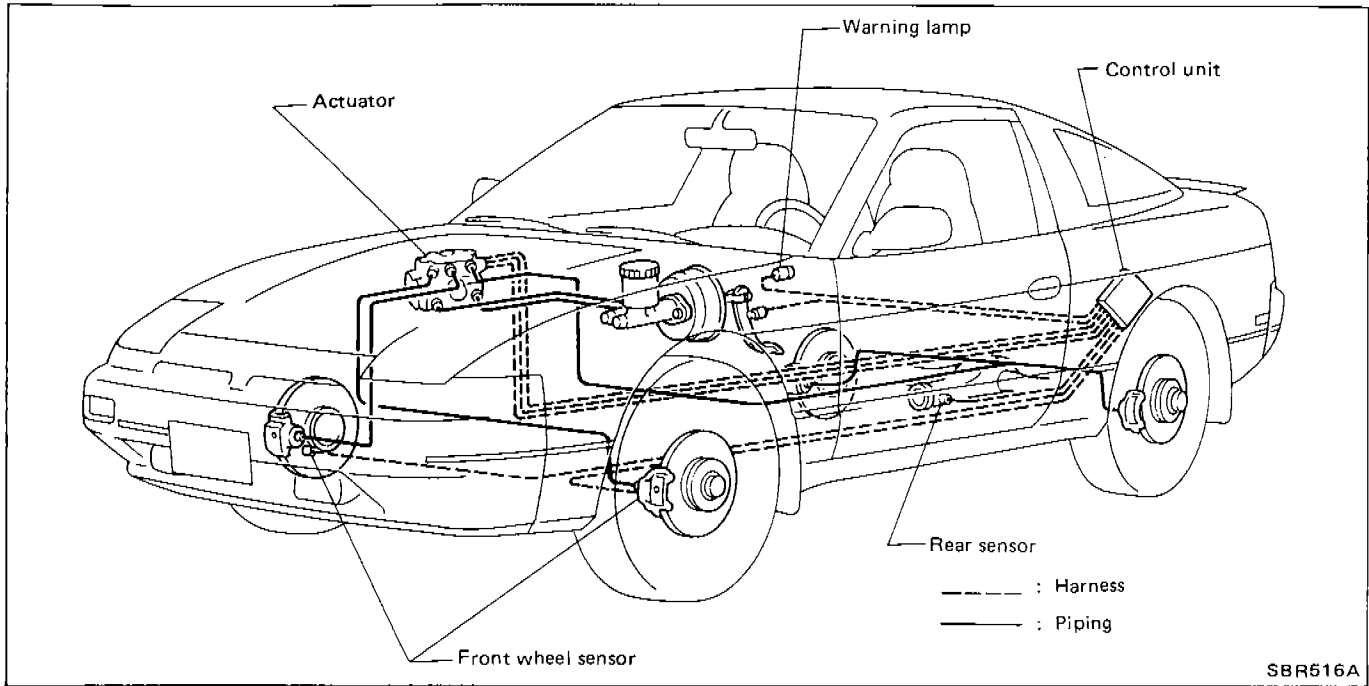
173.0 mm (6.81 in)

Radial runout (Total indicator reading):

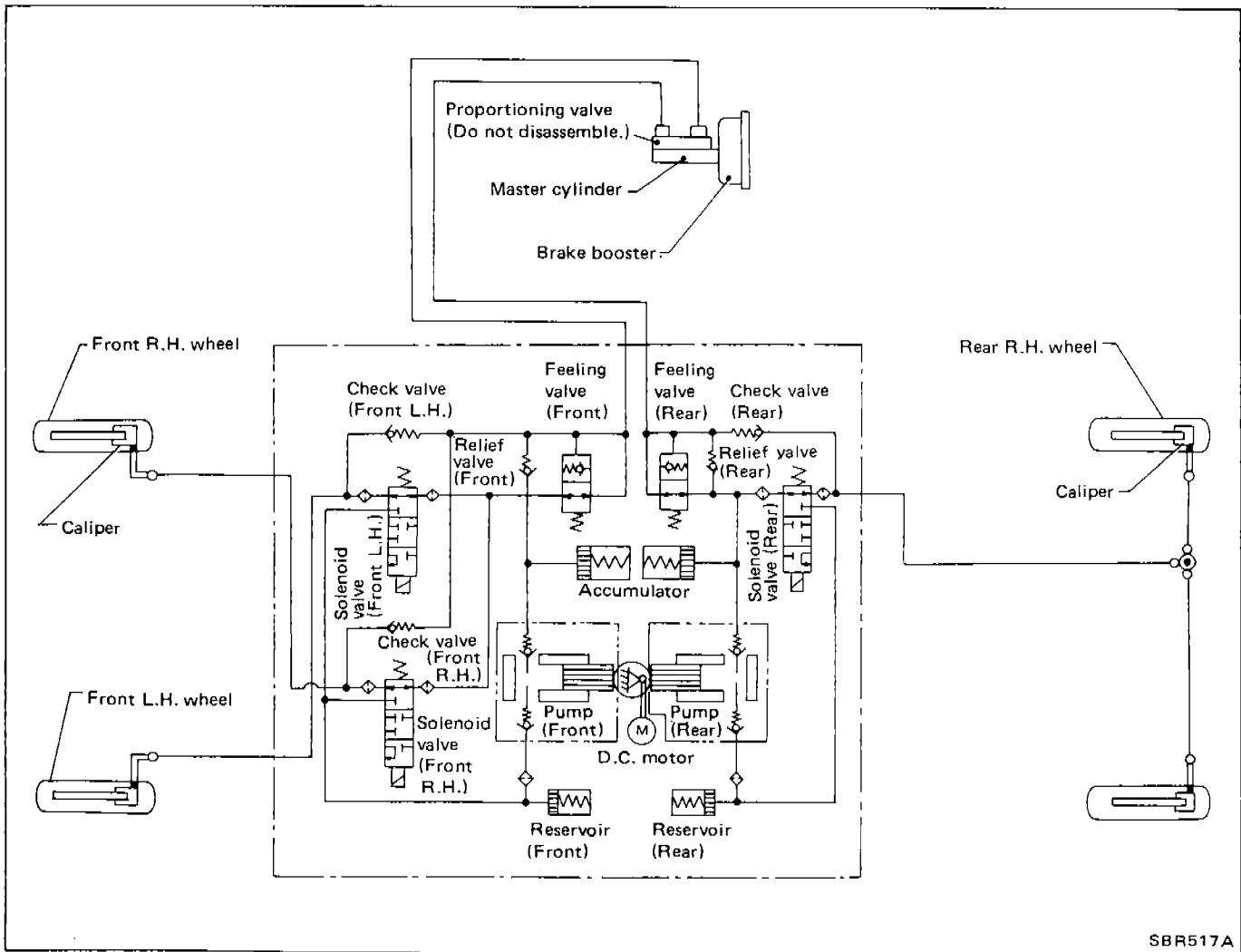
0.07 mm (0.0028 in)

ANTI-LOCK BRAKING SYSTEM

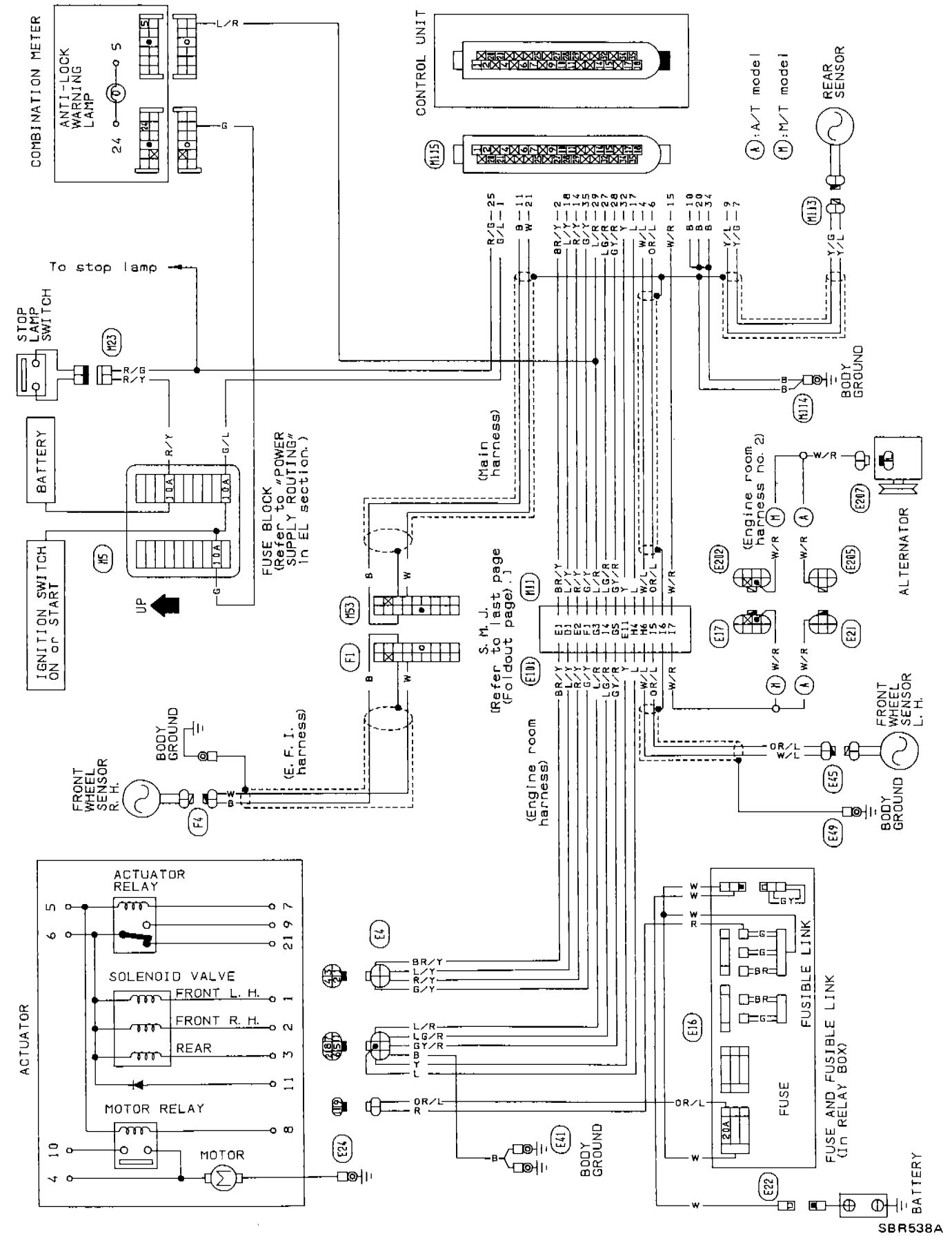
System Components



Hydraulic Circuit



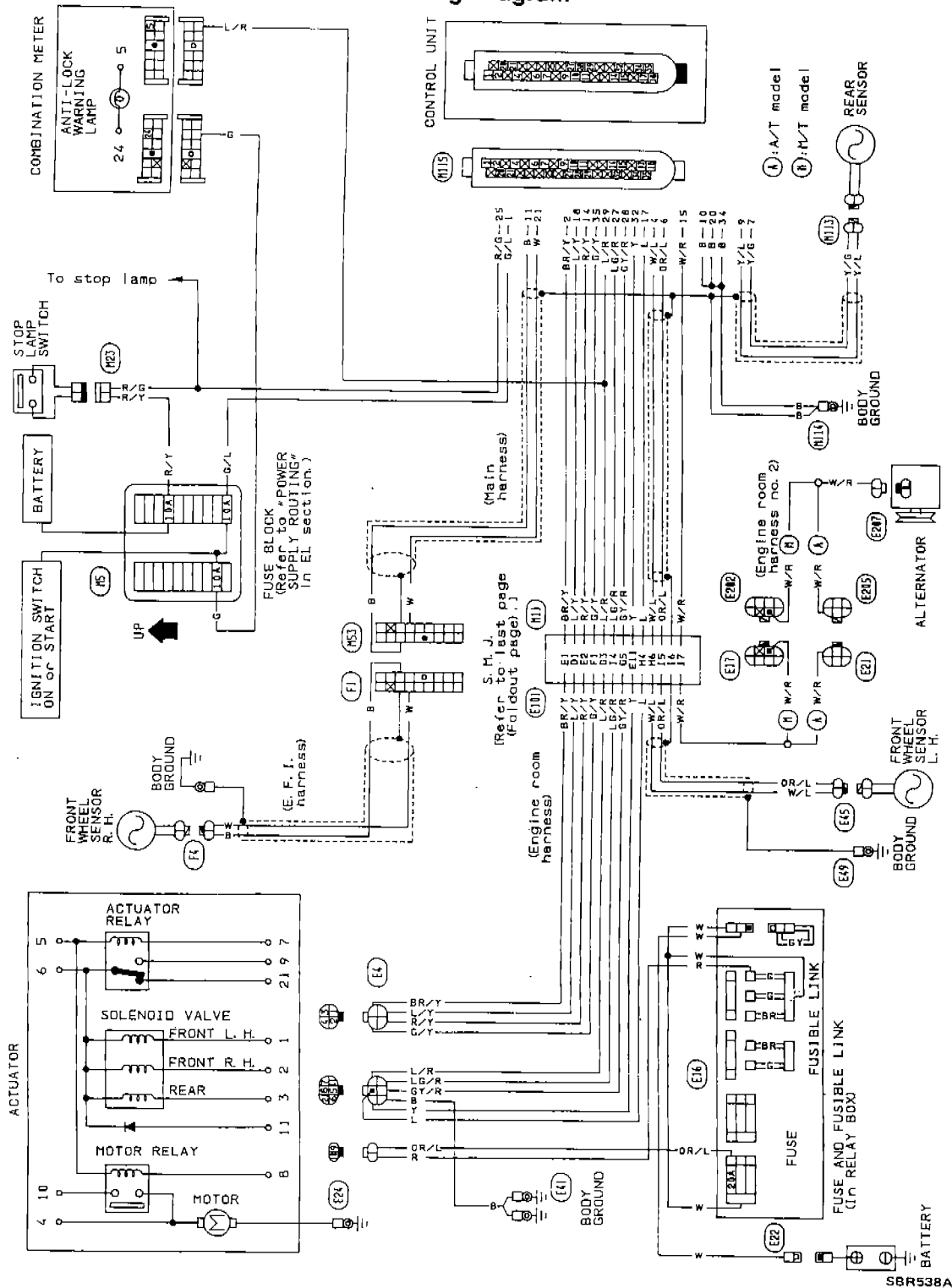
Wiring Diagram



ANTI-LOCK BRAKING SYSTEM

L.H.D. MODEL

Wiring Diagram



SBR538A

Wiring Diagram (Cont'd)

[illegible]

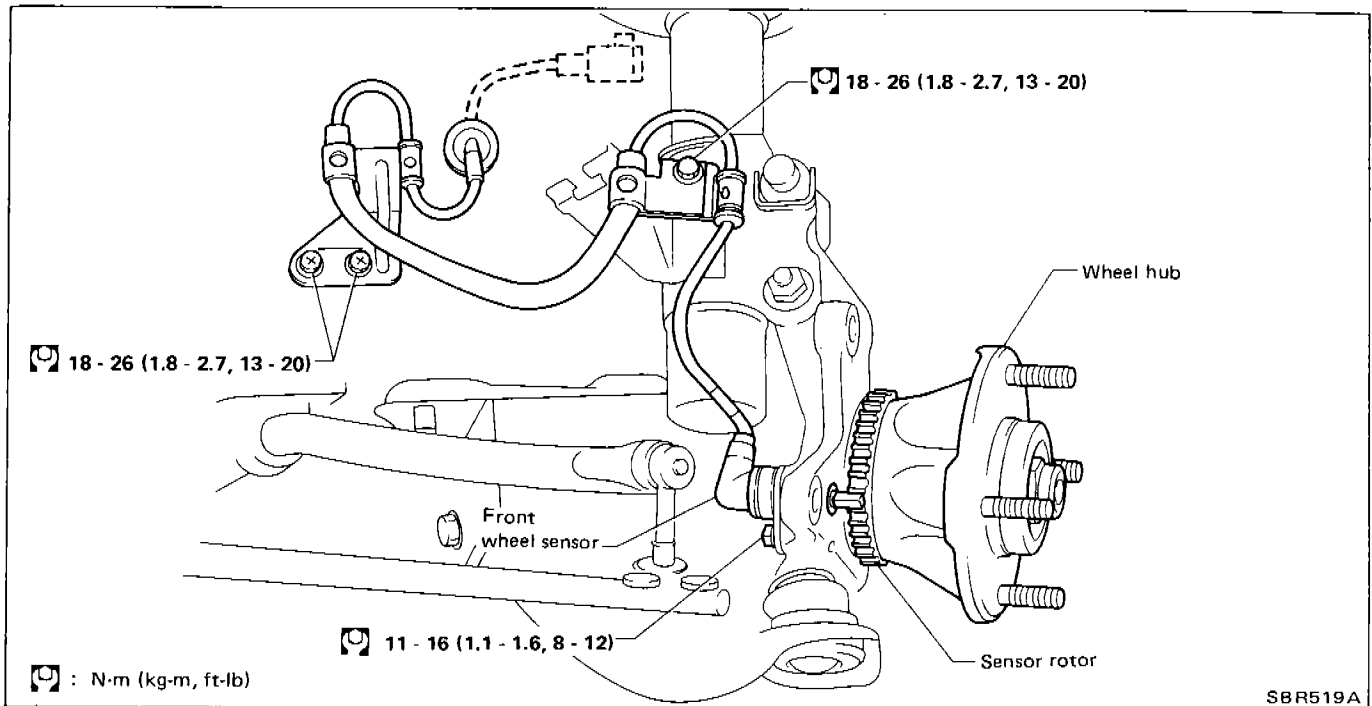
ANTI-LOCK BRAKING SYSTEM

Removal and Installation

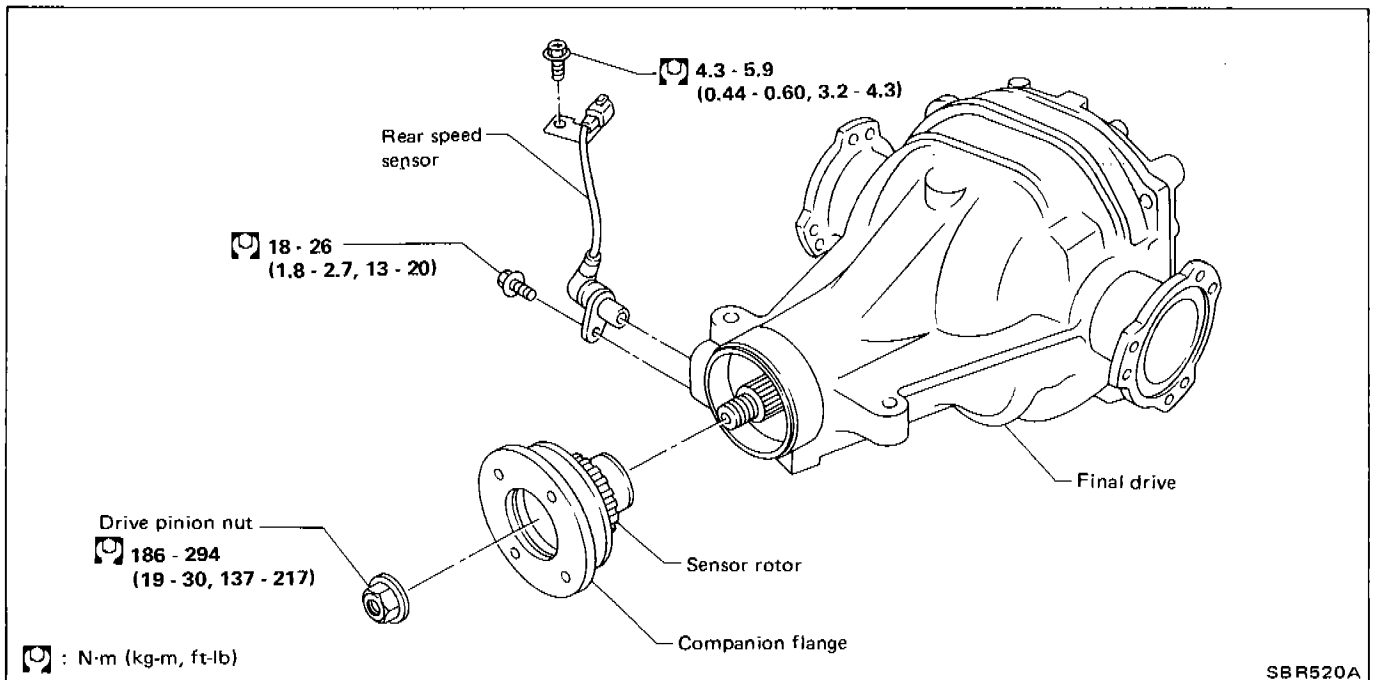
CAUTION:

Be careful not to damage sensor edge and sensor rotor teeth.

FRONT WHEEL SENSOR



REAR SENSOR

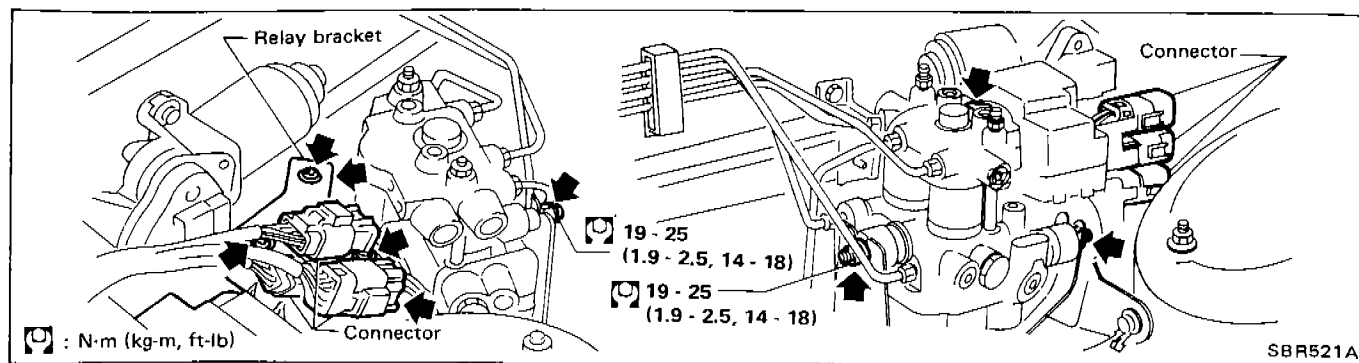


- Remove rear sensor rotor with companion flange after propeller shaft removal. Refer to PD section.

ANTI-LOCK BRAKING SYSTEM

Removal and Installation (Cont'd)

ACTUATOR

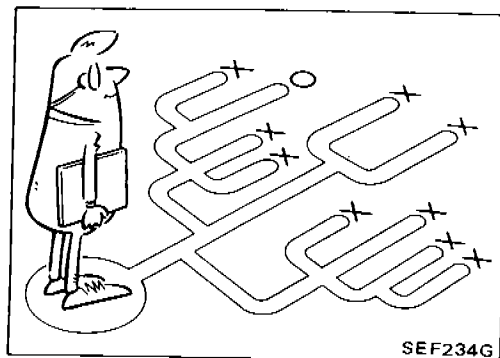
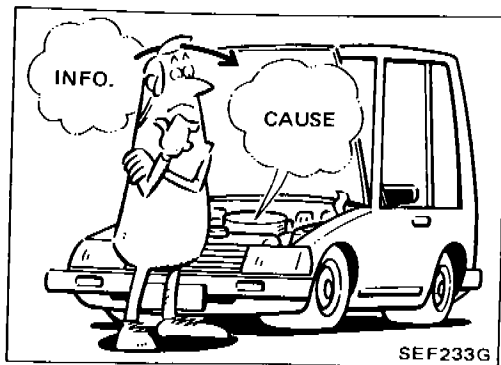


- Disconnect 3 connectors and brake tubes.
- For L.H. only, remove relay bracket 3 screws.
- Remove 3 nuts fixing actuator to bracket.

TROUBLE DIAGNOSES

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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The A.B.S. system has an electronic control unit to control major functions. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as air leaks in the booster or lines, lack of brake fluid, or other problems with brake system.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspicious circuits may help prevent the replacement of good parts.

A visual check only may not find the cause of the problems, so a road test should be performed.

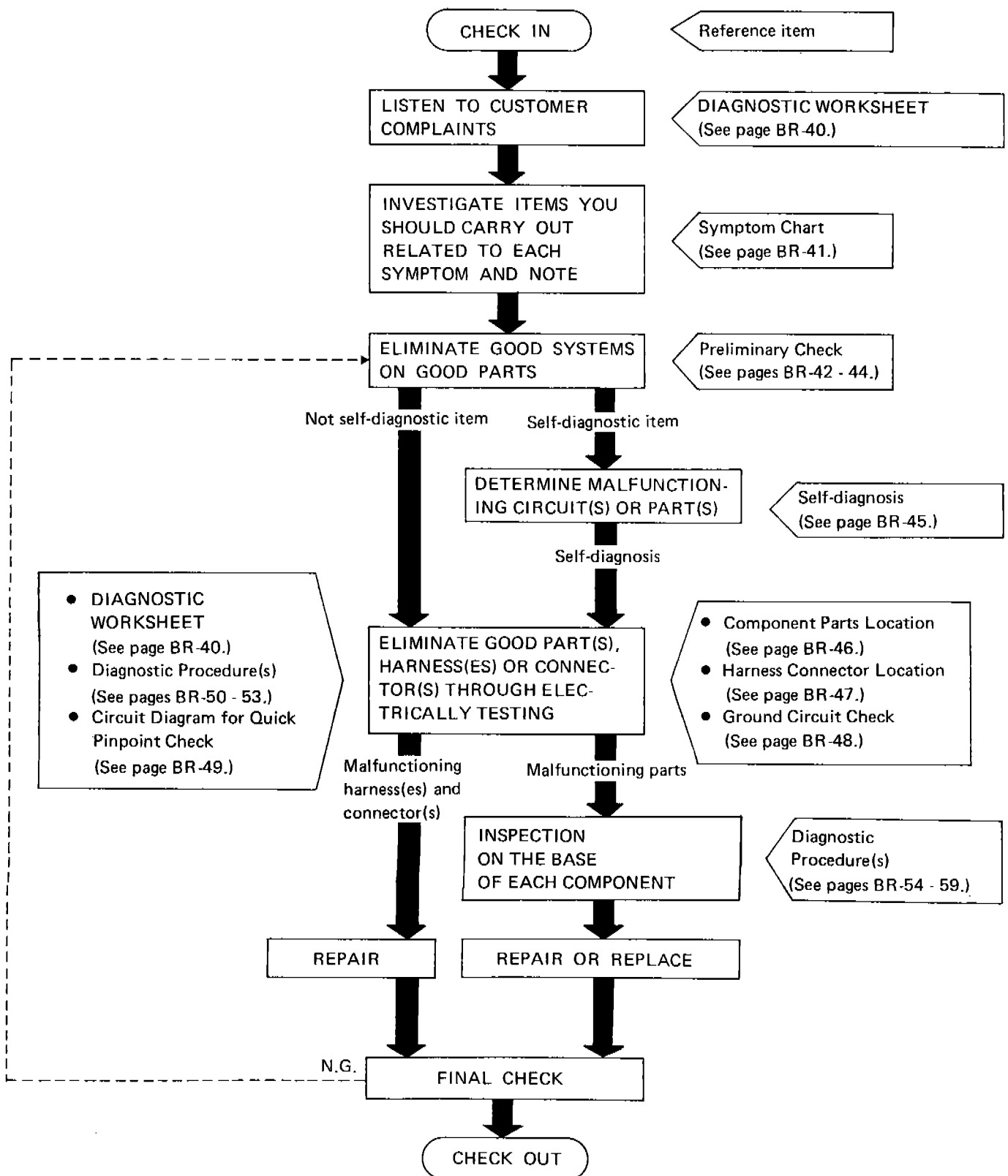
Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a A.B.S. complaint. The customer is a very good source of information on such problems; especially intermittent ones. Through the talks with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot brake problems on an A.B.S. controlled vehicle.

TROUBLE DIAGNOSES

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

WORK FLOW



TROUBLE DIAGNOSES

KEY POINTS

WHAT Vehicle model
WHEN Date, Frequencies
WHERE Road conditions
HOW Operating conditions,
 Weather conditions,
 Symptoms

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to customer complaints, even if the system is normal.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

In general, feelings for a problem depend on each customer's information. It is therefore important to fully understand the symptoms or under what conditions a customer complains.

Make good use of a diagnostic worksheet such as the one shown below in order to utilize all the complaints for trouble-shooting.

Worksheet sample

Customer name MR/MS		Model & Year			VIN		
Engine #		Trans.			Mileage		
Incident Date		Manuf. Date			In Service Date		
Symptoms	☐ Pedal vibration and noise	☐ Warning activates	☐ Long stopping distance	☐ Abnormal pedal action	☐ A.B.S. doesn't work	☐ A.B.S. works but warning activates	☐ A.B.S. works frequently
Engine conditions		☐ When starting ☐ After starting ☐ Engine speed: 5,000 rpm or more					
Road conditions		☐ Low friction road (☐ Snow ☐ Gravel ☐ Other) ☐ Protrusion					
Driving conditions		☐ High speed cornering ☐ Vehicle speed: Greater than 10 km/h (6 MPH) ☐ Vehicle speed: 10 km/h (6 MPH) or less ☐ Vehicle is stopped					
Applying brake conditions		☐ Suddenly ☐ Gradually					
Other conditions		☐ Operation of electrical equipment ☐ Large pedal stroke ☐ Operation of clutch					

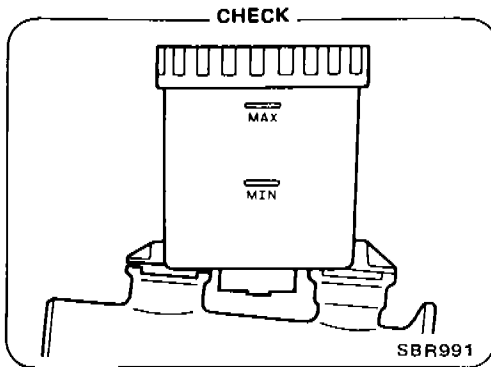
TROUBLE DIAGNOSES

Symptom Chart

PROCEDURE	Preliminary Check				Diagnostic Procedure						Diagnostic Procedure (Select inspection with L.E.D. flashing No.)						Ground Circuit Check		Electrical Com- ponents Inspec- tion
REFERENCE PAGE	BR-42	BR-43	BR-44	BR-44	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	BR-54	BR-55	BR-56	BR-57	BR-58	BR-59	BR-48	BR-48	BR-60
SYMPTOM	Preliminary Check 1	Preliminary Check 2	Preliminary Check 3	Preliminary Check 4	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	L.E.D. flashing 1 - 4	L.E.D. flashing 5 - 8	L.E.D. flashing 9	L.E.D. flashing 10	L.E.D. flashing 16	L.E.D. goes off	Sensor shield	Motor ground	Actuator inspection
					○						○	○	○	○	○	○	○		
	Pedal vibration & noise		○	○															
	Warning activates	○	○	○							○	○	○	○	○	○			
	Long stopping distance	○			○							○	○	○	○	○			
Abnormal pedal action	○			○			○				○	○	○	○	○	○			
A.B.S. doesn't work		○		○				○			○	○	○	○	○	○	○		○
A.B.S. works but warning activates											○								
A.B.S. works frequently	○	○																	

TROUBLE DIAGNOSES

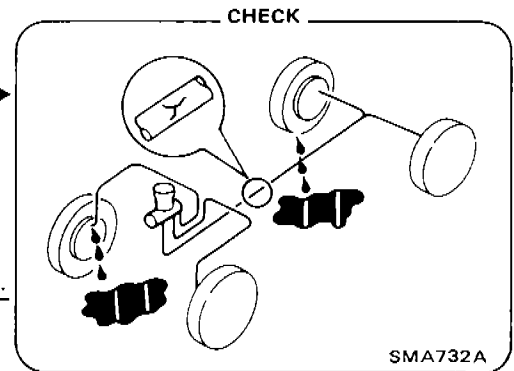
Preliminary Check 1



Check brake fluid level in reservoir tank.

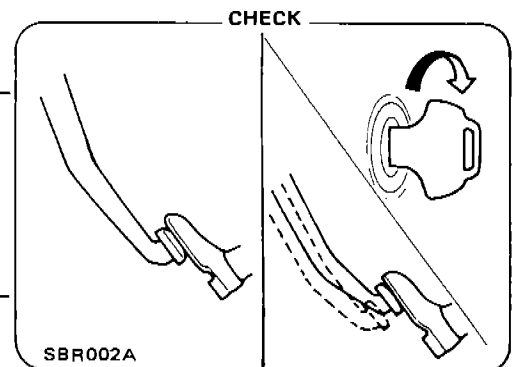
N.G. → Fill up brake fluid.

O.K. →



Check brake system.
Refer to CHECK AND ADJUSTMENT.

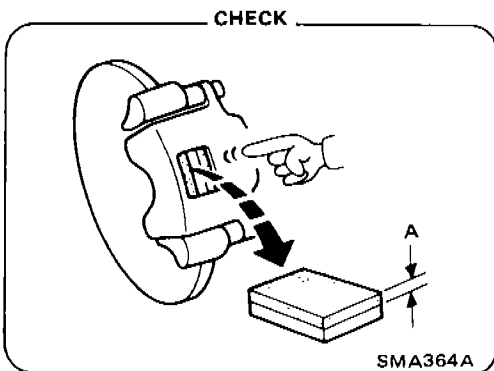
O.K. ↓



Check brake booster operation and airtightness.
Refer to "Inspection" of BRAKE BOOSTER.

N.G. → Repair or replace booster system.

O.K. →

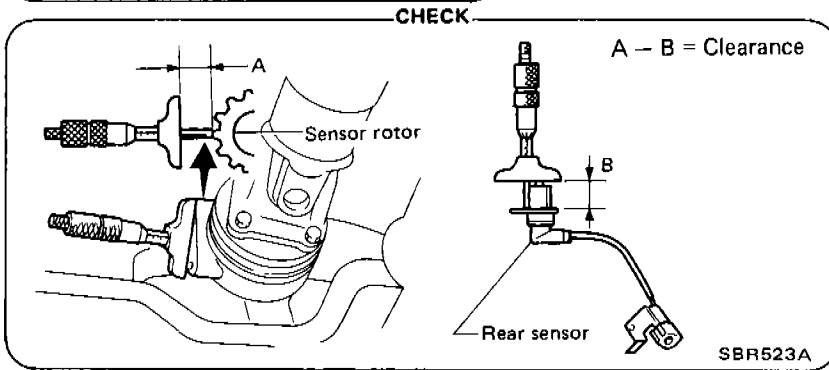
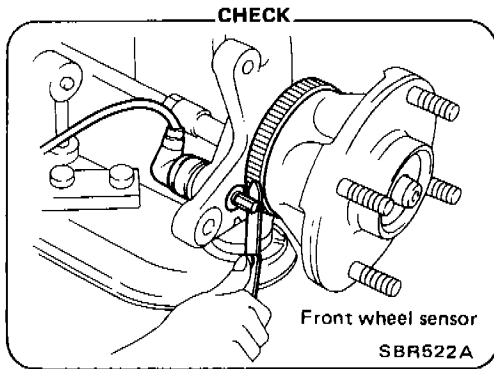


Check brake pads and rotor.
Refer to "Inspection" of FRONT and REAR DISC BRAKE.

N.G. → Replace malfunctioning parts.

TROUBLE DIAGNOSES

Preliminary Check 2



Check sensor clearance.

	Clearance mm (in)
Front wheel sensor	0.275 - 0.75 (0.0108 - 0.0295)
Rear sensor	0.35 - 0.625 (0.0138 - 0.0246)

N.G.

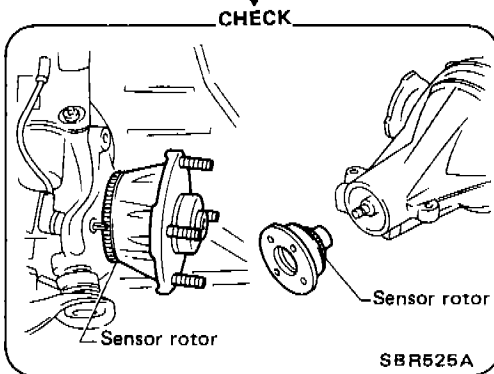
Check sensor for the following items:

- Dust, foreign materials, etc., at fastening portion
- Improper installation
- Breakage

O.K.

N.G.

Repair or replace malfunctioning sensor.



N.G.

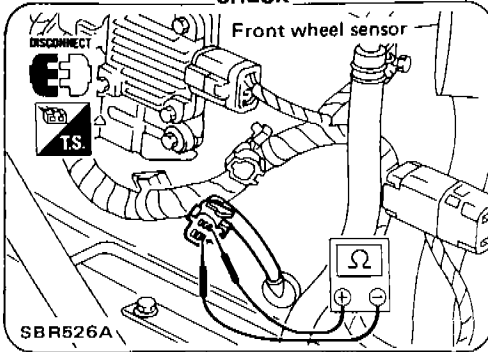
Replace sensor rotor with wheel hub or companion flange as a set.

Check sensor rotor for teeth damage.

TROUBLE DIAGNOSES

Preliminary Check 3

CHECK



Measure each sensor resistance.
0.8 - 1.2 kΩ

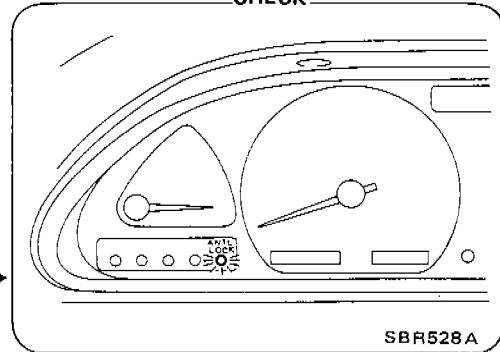
N.G. → Replace.

O.K. →

Preliminary Check 3, 4

Preliminary Check 4

CHECK



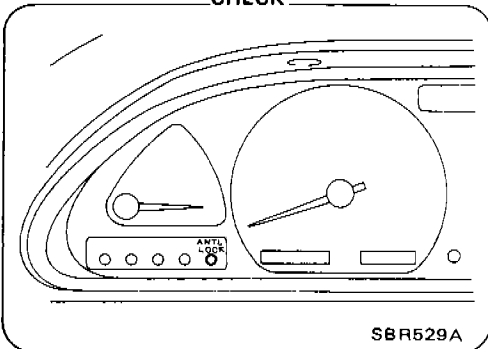
Check warning lamp activation.
When ignition switch is turned on, warning lamp turns on.

O.K. →

N.G. →

Check fuse.
Check bulb condition and remedy.

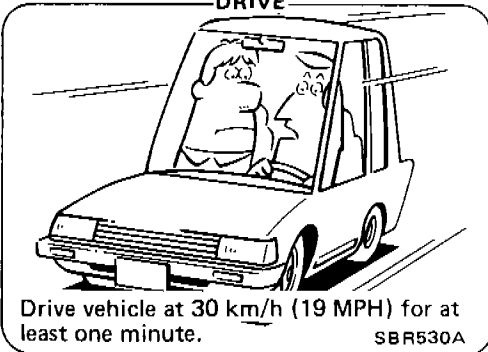
CHECK



Check warning lamp for deactivation.
When engine starts, warning lamp deactivates.

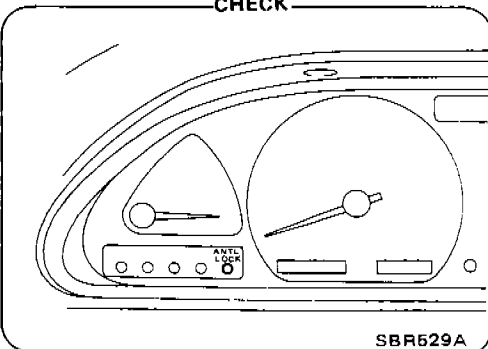
O.K. →

DRIVE



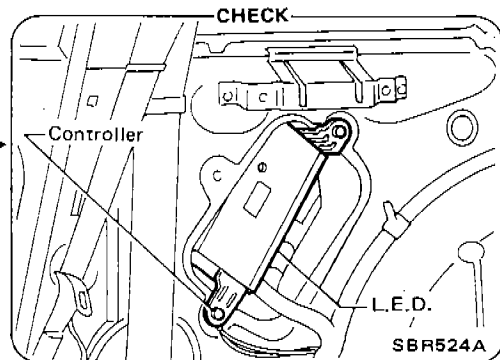
Drive vehicle at 30 km/h (19 MPH) for at least one minute.

CHECK



Ensure warning lamp remains off while driving.

N.G. →



- Keep engine on and running.
- Remove rear side finisher.
R.H. model: R.H. side
L.H. model: L.H. side
- Count the number of L.E.D. flashes during 5 to 10 second "OFF" period.

Go to Self-diagnosis.
(See page BR-45.)

N.G. →

O.K. →

If Preliminary Check 2 is not performed
and there is abnormal A.B.S. operation,
perform Preliminary Check 2.

TROUBLE DIAGNOSES

Self-diagnosis

CHECKING THE NUMBER OF L.E.D. FLASHES

When a problem occurs in the A.B.S., the warning light on the instrument panel comes on. As shown in the Table, the control unit performs self-diagnosis.

To obtain satisfactory self-diagnosing results, the vehicle must be driven above 30 km/h (19 MPH) for at least one minute before the self-diagnosis is performed. After the vehicle is stopped, the number of L.E.D. flashes is counted while the engine is running.

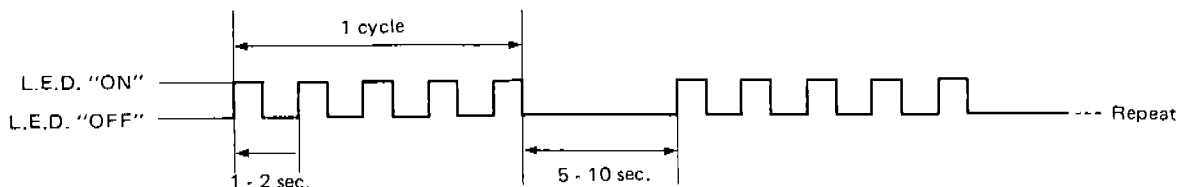
The L.E.D. is located on the control unit, identifying a malfunctioning part or unit by the number of flashes. Both the warning light and the L.E.D. persistently activate, even after a malfunctioning part or unit has been repaired, unless the ignition switch is turned "OFF". After repairs, turn the ignition switch "OFF". Then start the engine and drive the vehicle over 30 km/h (19 MPH) for at least one minute to ensure that the malfunctioning part or unit has been repaired properly.

If more than two circuits malfunction at the same time, the L.E.D. will flash to indicate one of the malfunctioning circuits. After the circuit has been repaired, the L.E.D. will then flash to indicate that the other circuit is malfunctioning.

No. of L.E.D. flashes	Malfunctioning part or unit
1	Left front actuator solenoid circuit
2	Right front actuator solenoid circuit
3 or 4	Rear actuator solenoid circuit
5	Left front rotor sensor circuit
6	Right front rotor sensor circuit
7 or 8	Rear rotor sensor circuit
9	Actuator motor, motor relay circuit
10	Actuator solenoid valve relay
16	Control unit
Warning activates and L.E.D. "OFF"	Power supply or ground circuit for control unit

Example

Improper operation of left front rotor sensor circuit

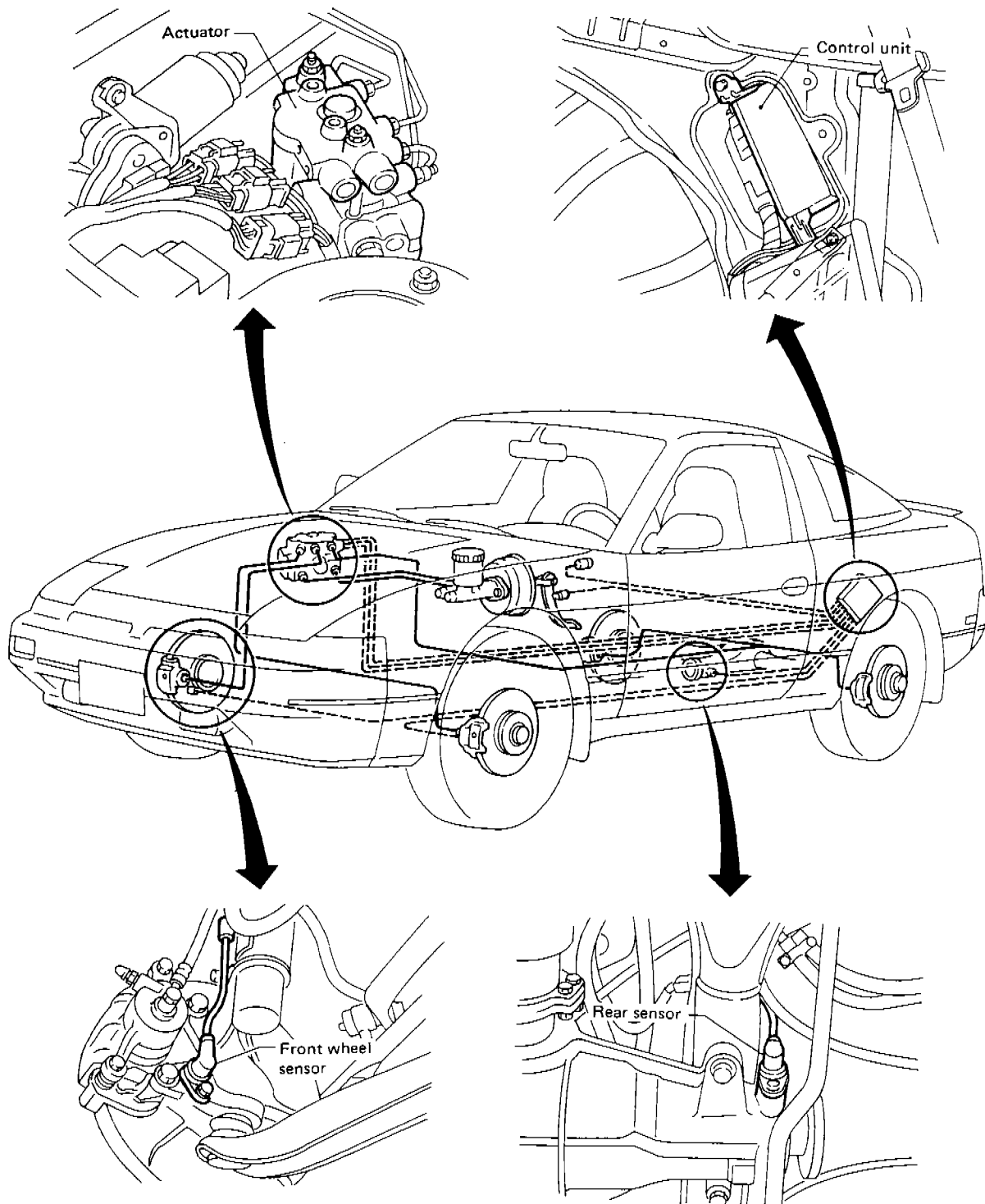


SBR531A

Go to Diagnostic Procedure from 7 to 10, where malfunction portion is concerned.

TROUBLE DIAGNOSES

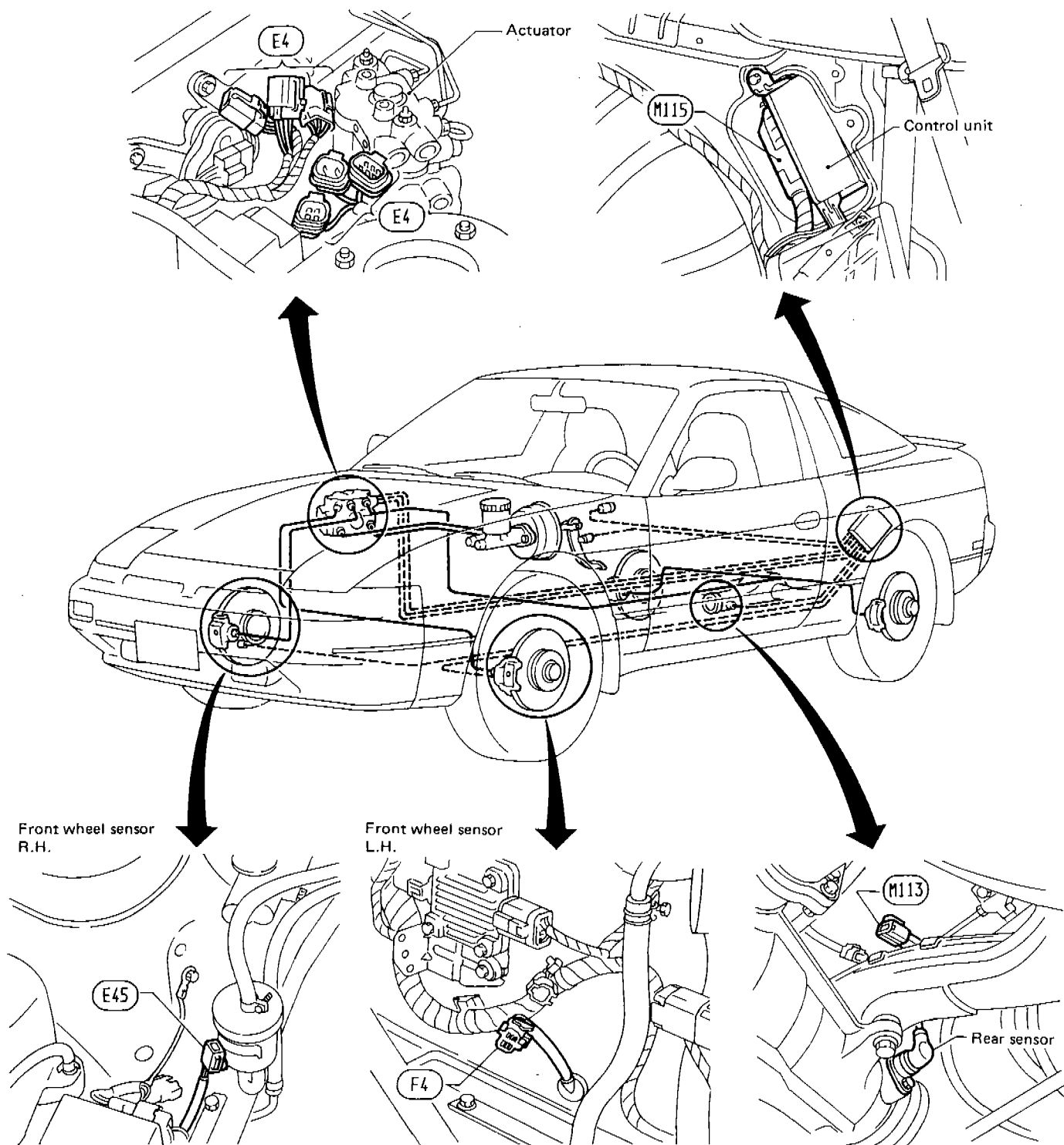
Component Parts Location



SBR532A

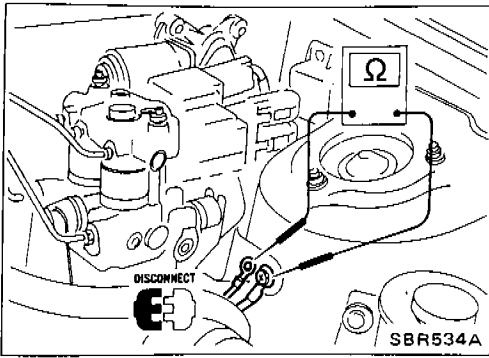
TROUBLE DIAGNOSES

Harness Connector Location



SBR533A

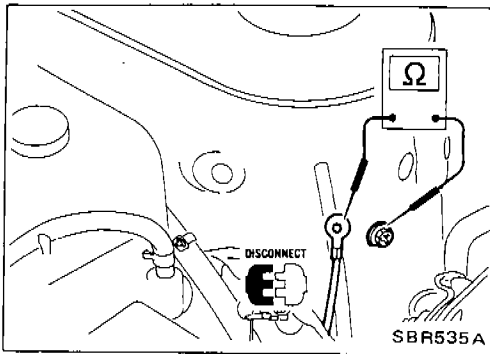
TROUBLE DIAGNOSES



Ground Circuit Check

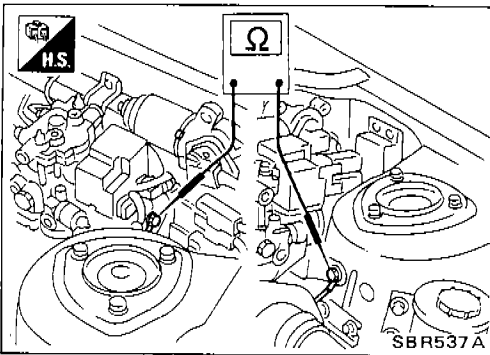
FRONT WHEEL SENSOR L.H. SHIELDED WIRE GROUND

- Check resistance between both terminals.
Resistance: 0Ω



FRONT WHEEL SENSOR R.H. SHIELDED WIRE GROUND

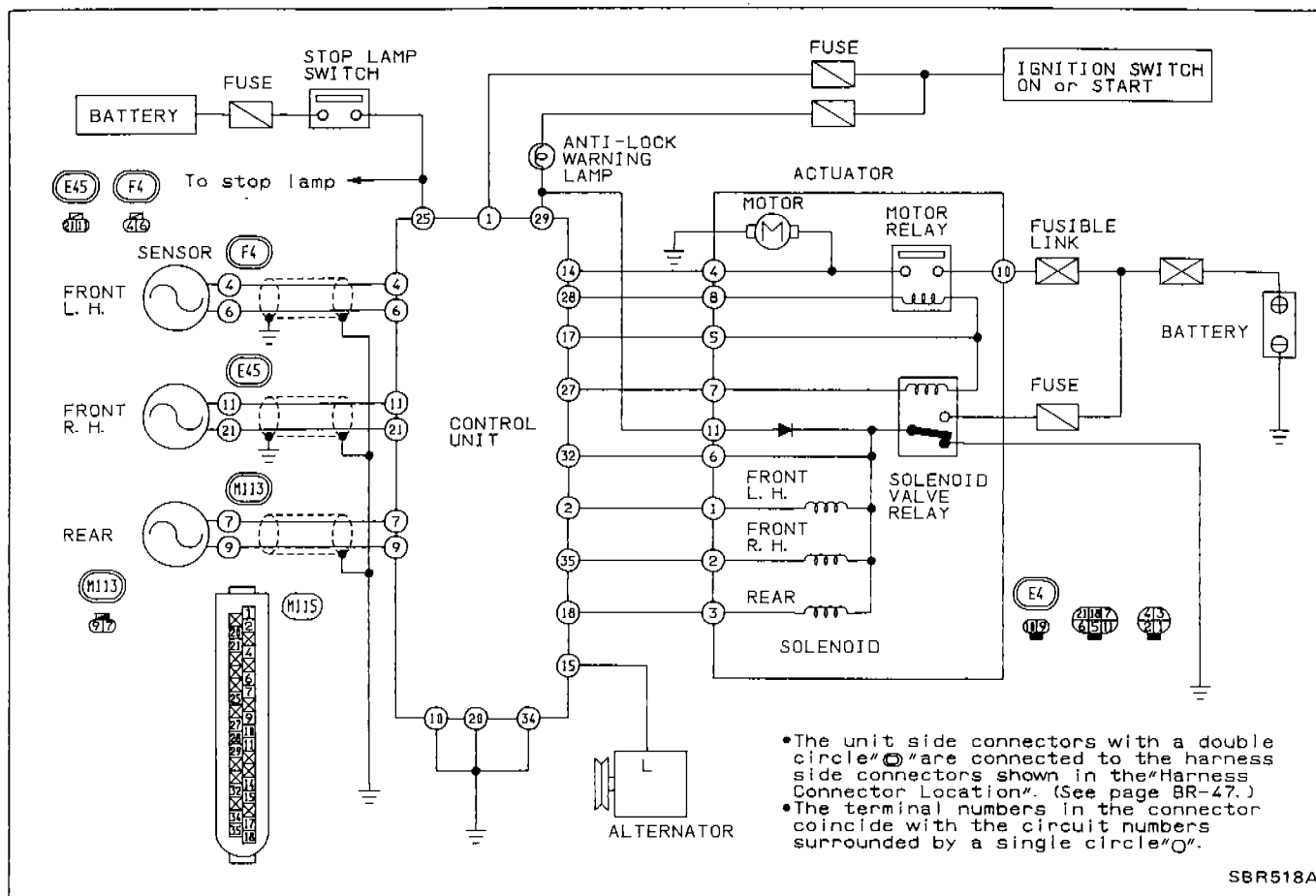
- Check resistance between both terminals.
Resistance: 0Ω



ACTUATOR MOTOR GROUND

- Check resistance between both terminals.
Resistance: 0Ω

Circuit Diagram for Quick Pinpoint Check

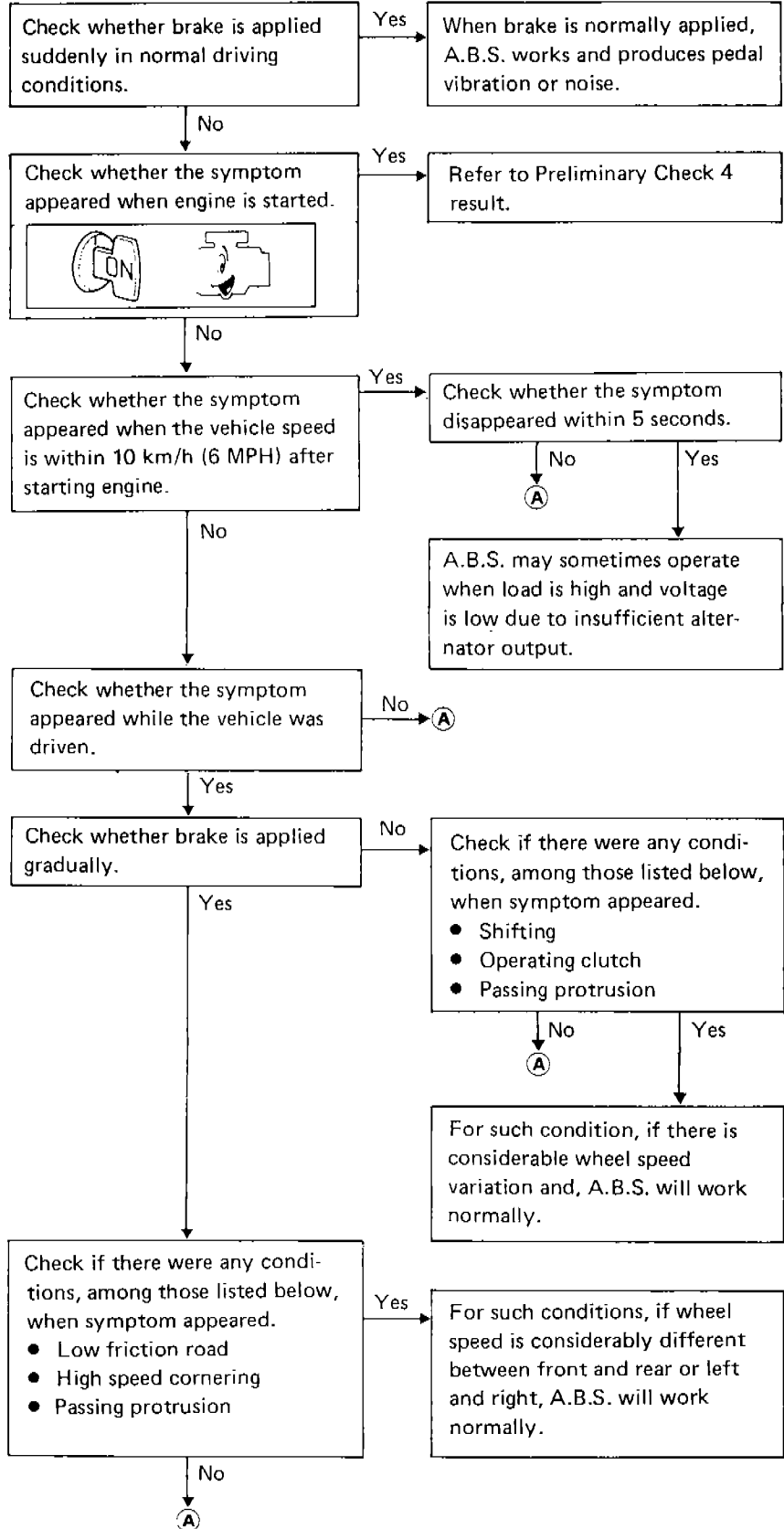
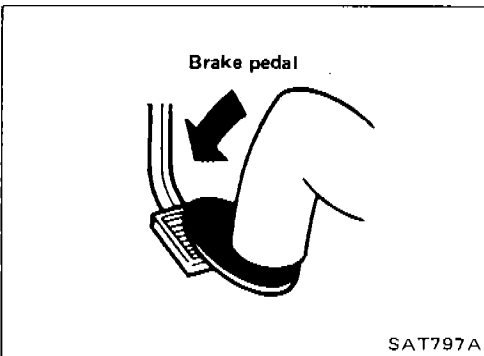
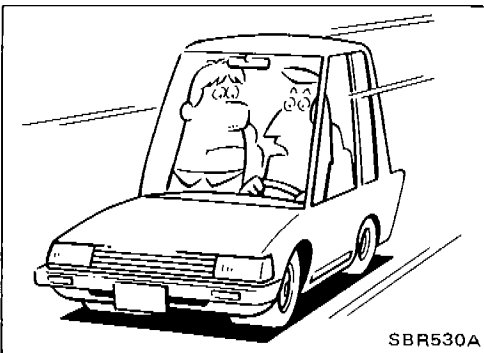
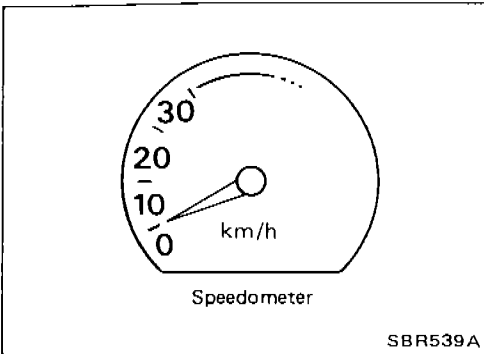
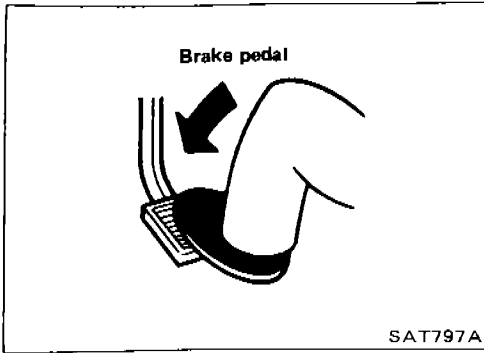


SBR518A

Diagnostic Procedure 1

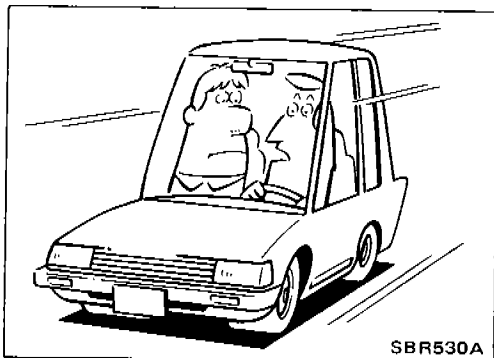
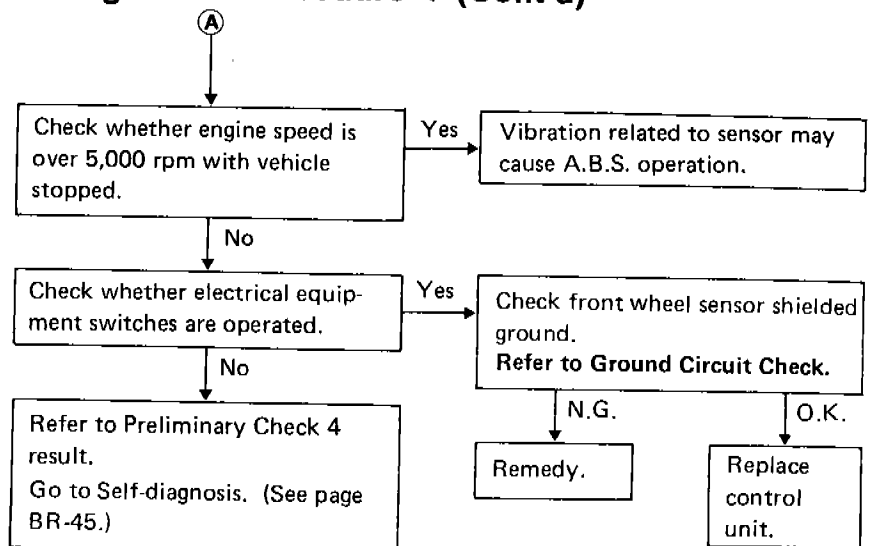
SYMPTOM: Pedal vibration and noise

Refer to worksheet results.



TROUBLE DIAGNOSES

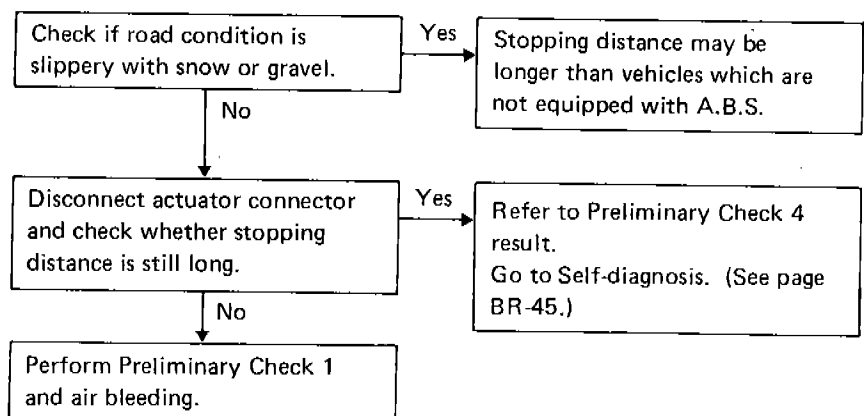
Diagnostic Procedure 1 (Cont'd)

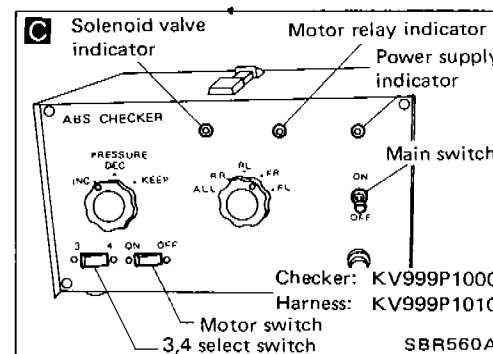
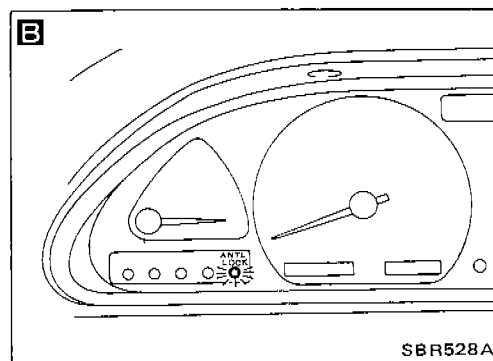
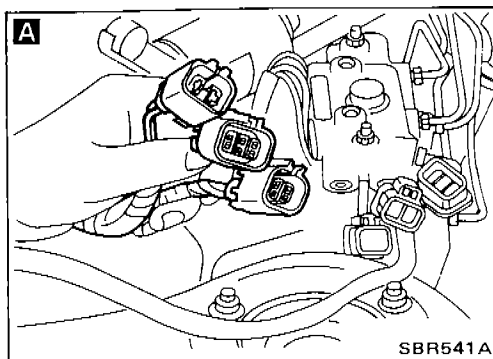
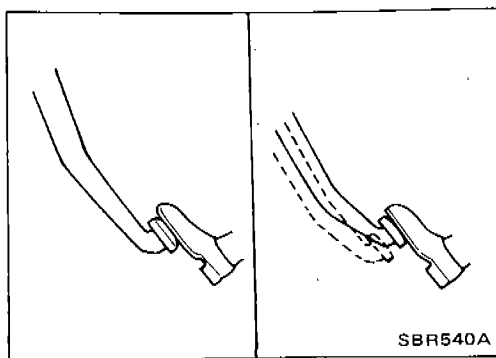


Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results.

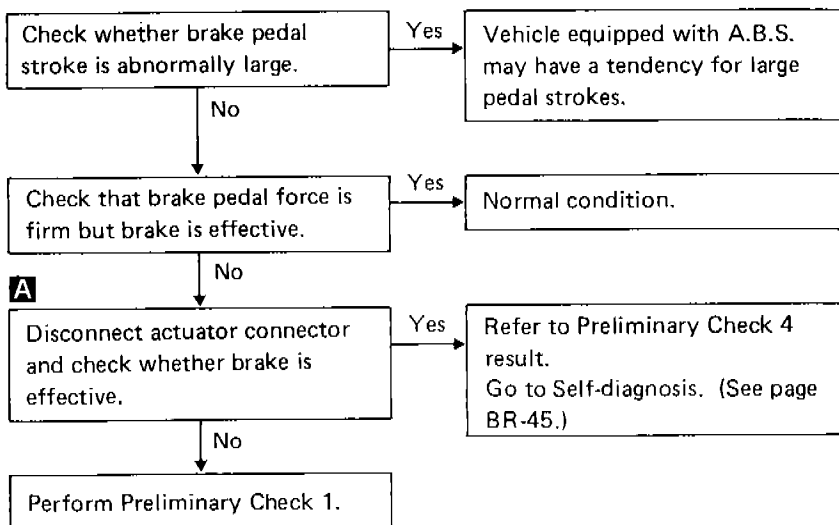




Diagnostic Procedure 3

SYMPTOM: Abnormal pedal action

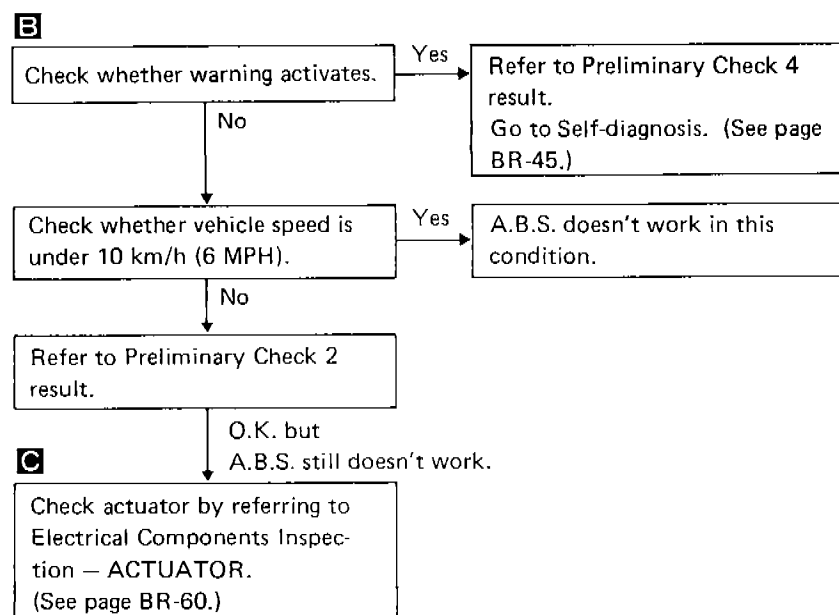
Refer to worksheet results.



Diagnostic Procedure 4

SYMPTOM: A.B.S. doesn't work.

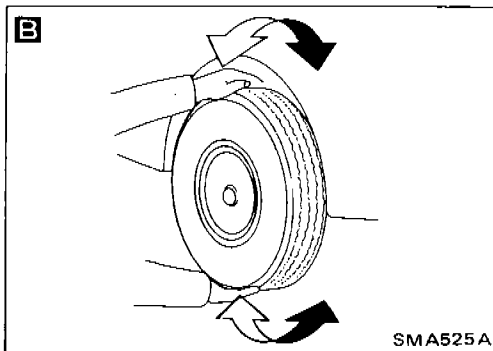
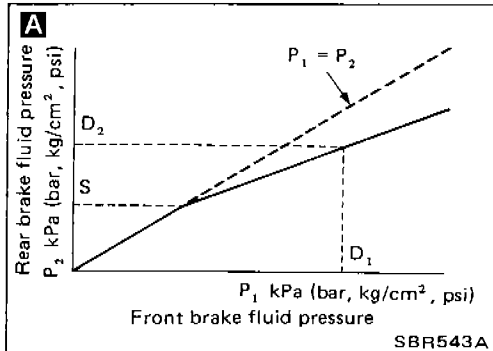
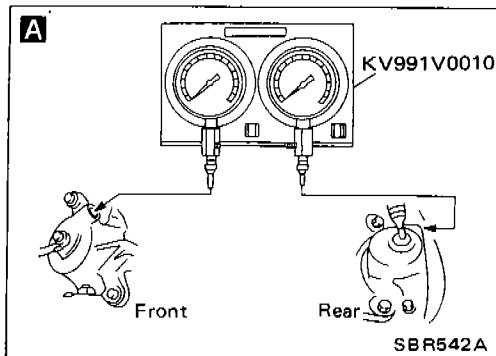
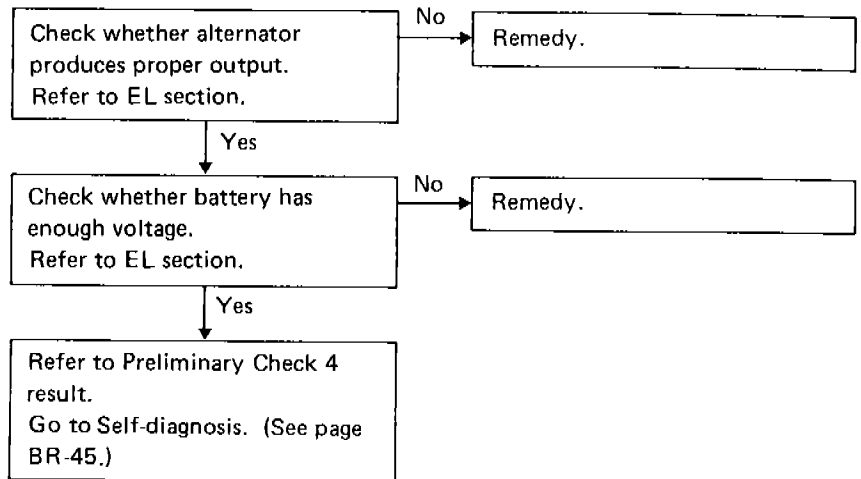
Refer to worksheet results.



TROUBLE DIAGNOSES

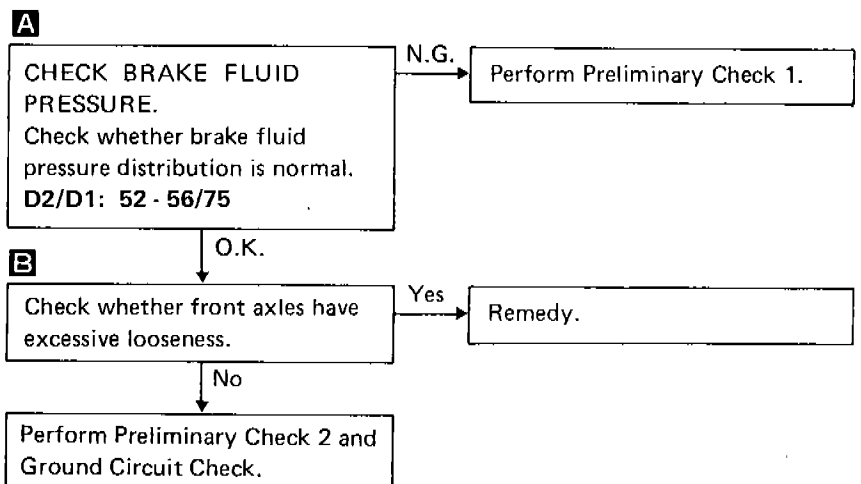
Diagnostic Procedure 5

SYMPTOM: A.B.S. works but warning activates.

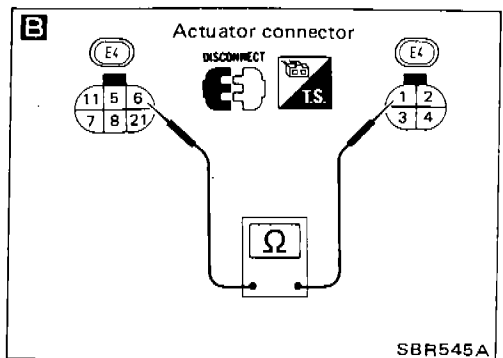
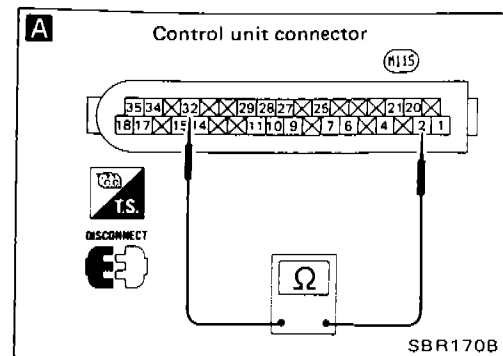


Diagnostic Procedure 6

SYMPTOM: A.B.S. works frequently.



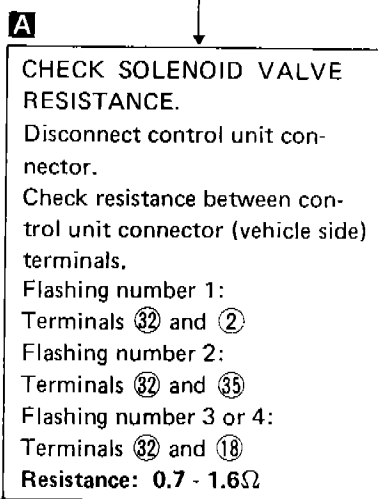
TROUBLE DIAGNOSES



Diagnostic Procedure 7

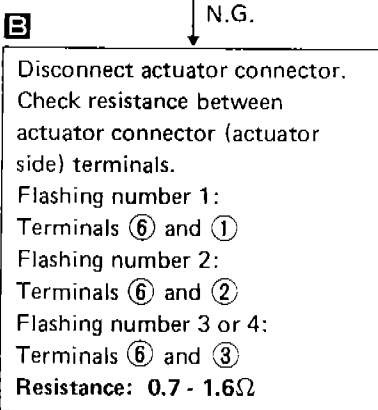
ACTUATOR SOLENOID (L.E.D. flashing number 1 - 4)

INSPECTION START
Remove battery negative terminal connector.



O.K.

Replace control unit.



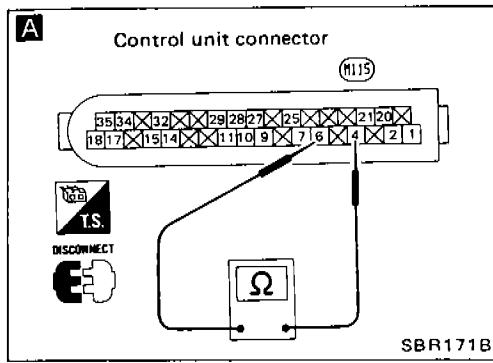
O.K.

Repair harness between actuator connector and control unit connector.

N.G.

Replace actuator.

TROUBLE DIAGNOSES



Diagnostic Procedure 8

WHEEL SPEED SENSOR (L.E.D. flashing number 5 - 8)

INSPECTION START

Remove battery negative terminal connector.

A

CHECK SPEED SENSOR RESISTANCE

Disconnect control unit connector.

Check resistance between control unit connector (vehicle side) terminals.

Flashing number 5:

Terminals ④ and ⑥

Flashing number 6:

Terminals ⑪ and ⑫

Flashing number 7 or 8:

Terminals ⑦ and ⑨

Resistance: 0.8 - 1.2 kΩ

O.K.

Replace control unit.

N.G.

Refer to Preliminary Check 3 result.

Check whether sensor has 0.8 - 1.2 kΩ resistance.

N.G.

Replace sensor.

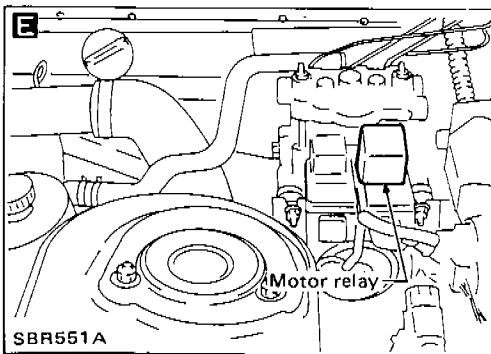
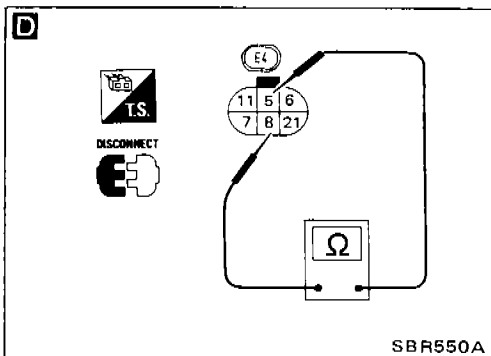
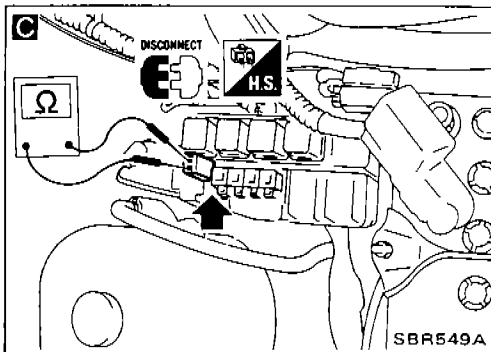
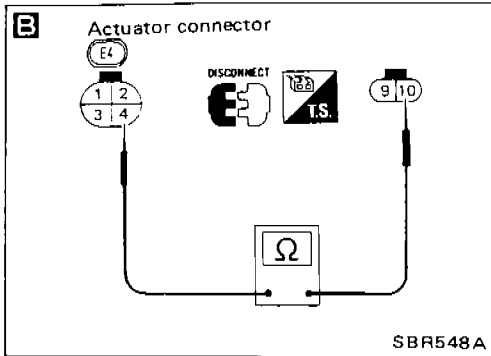
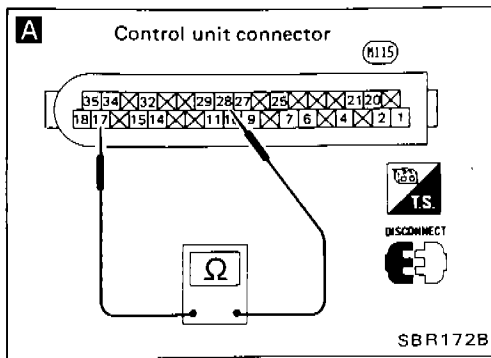
O.K.

Repair harness between sensor connector and control unit connector.

Diagnostic Procedure 9

ACTUATOR MOTOR RELAY (L.E.D. flashing number 9)

INSPECTION START
Remove battery negative
terminal connector.



A CHECK MOTOR RELAY SOLENOID RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals ①⑦ and ②⑧.
Resistance: 38 - 45Ω

B CHECK MOTOR RELAY DEACTIVATION.
Disconnect actuator connector.
Check continuity between actuator connector (actuator side) terminals ④ and ⑩.

E Yes
Replace motor relay.

C Check if motor's fusible link is blown.
Resistance:
Approximately 0Ω

Yes
Replace fusible link.

D Disconnect actuator connector.
Check resistance between actuator connector (actuator side) terminals ⑧ and ⑤.
Resistance: 38 - 45Ω

O.K.
Repair harness between actuator and control unit.

E N.G.
Replace motor relay.

No
Perform Electrical Components Inspection - ACTUATOR.
(See page BR-60.)

O.K.
Replace control unit.

N.G.
Replace actuator.

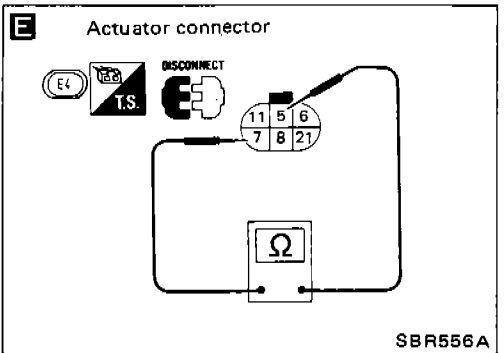
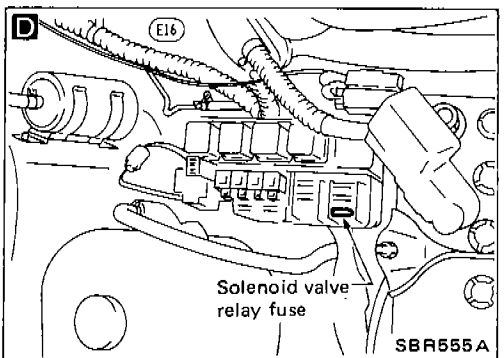
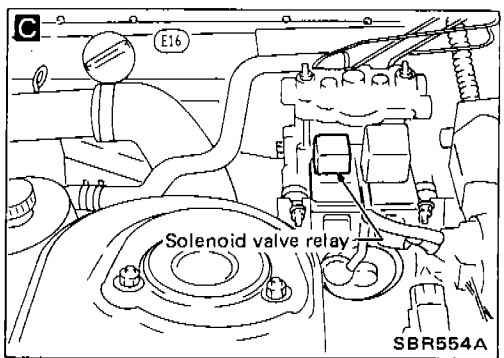
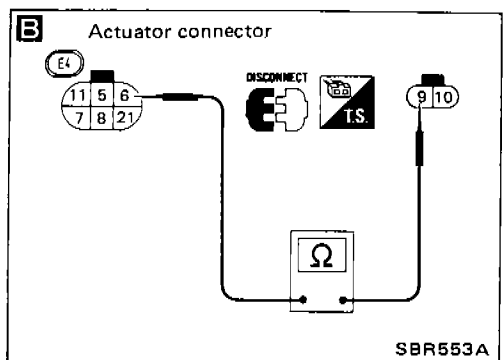
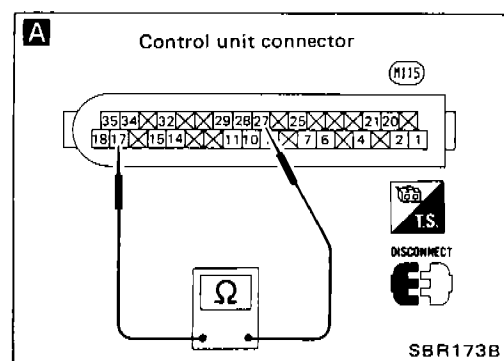
TROUBLE DIAGNOSES

Diagnostic Procedure 10

ACTUATOR SOLENOID VALVE RELAY (L.E.D. flashing number 10)

INSPECTION START

Remove battery negative terminal connector.



A

CHECK SOLENOID VALVE RELAY RESISTANCE.

Disconnect control unit connector.

Check resistance between control unit connector (vehicle side) terminals ②⑦ and ①⑦.

Resistance: 80 - 90Ω

B

CHECK SOLENOID VALVE RELAY MOVEMENT.

Disconnect actuator connector.

Check continuity between actuator connector (actuator side) terminals ⑥ and ⑨.

```

graph TD
    D[D] -- No --> E[Check if solenoid valve relay fuse is blown.]
    E -- Yes --> F[Replace fuse.]
    
```

```

graph TD
    Start([START]) --> Step1[1. Check resistance between actuator connector (actuator side) terminals ⑦ and ⑤.  
Resistance: 80 - 90Ω]
    Step1 -- "O.K." --> Step2[2. Repair harness between actuator and]
    Step1 -- "N.G." --> Step3[3. Replace solenoid valve relay.]
    Step2 --> End([END])
    Step3 --> End
  
```

C

Yes → Replace solenoid valve relay.

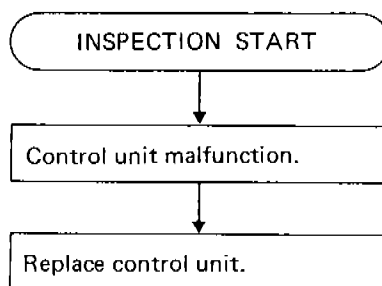
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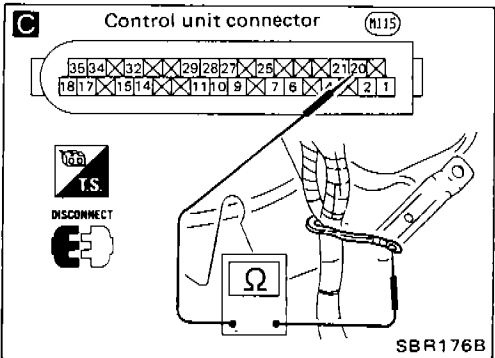
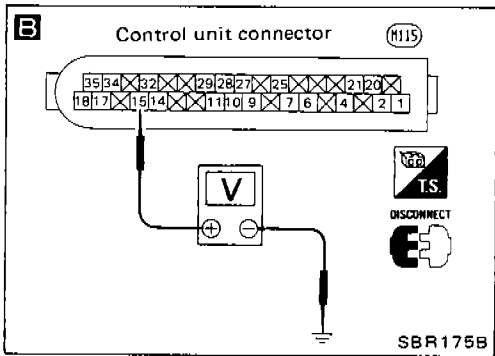
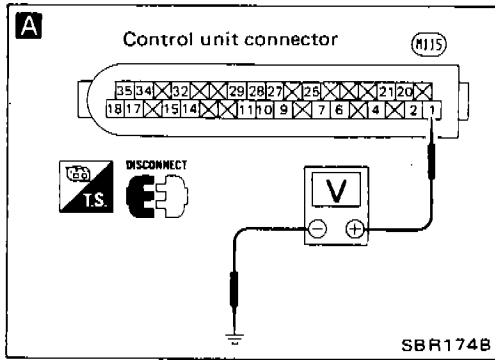
graph TD
    Start(( )) --> Step1[Perform Electrical Components Inspection – ACTUATOR.  
(See page BR-60.)]
    Step1 -- N.G. --> Step2[Replace actuator.]
    Step1 -- O.K. --> Step3[Replace control unit.]
    
```

TROUBLE DIAGNOSES

Diagnostic Procedure 11

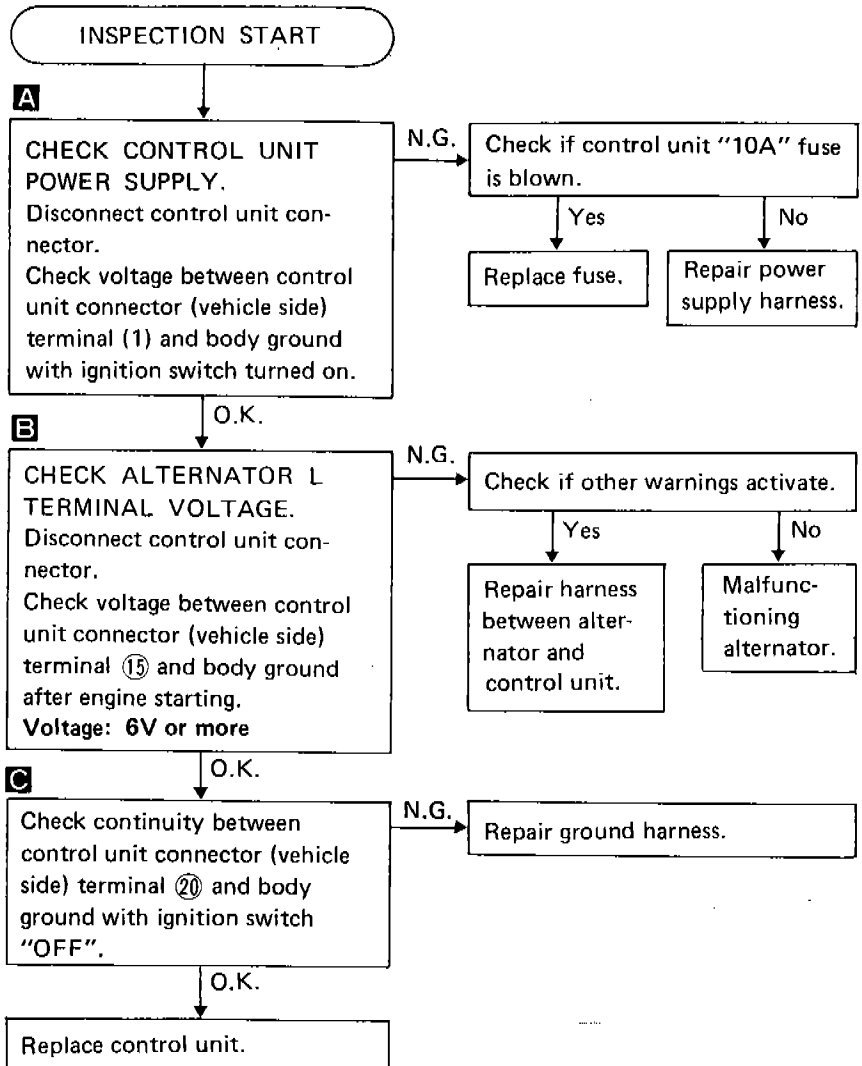
CONTROL UNIT (L.E.D. flashing number 16)



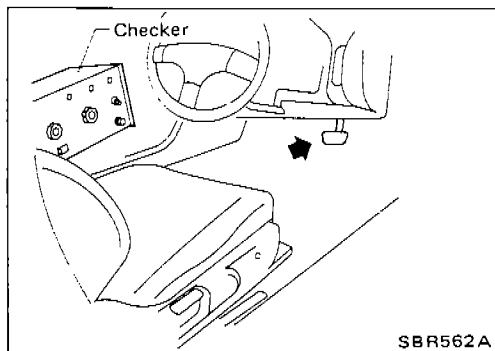
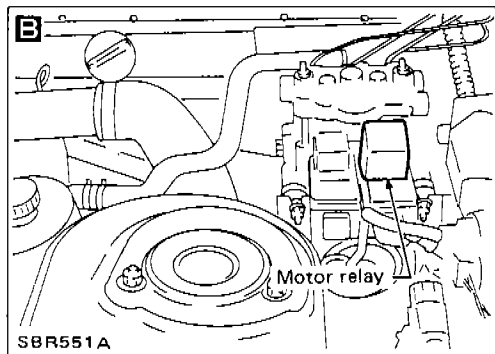
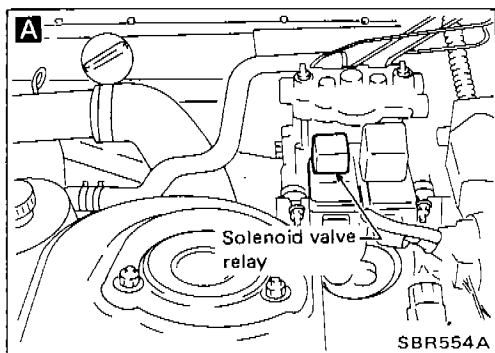
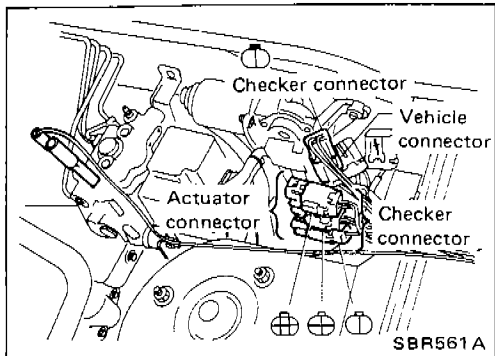
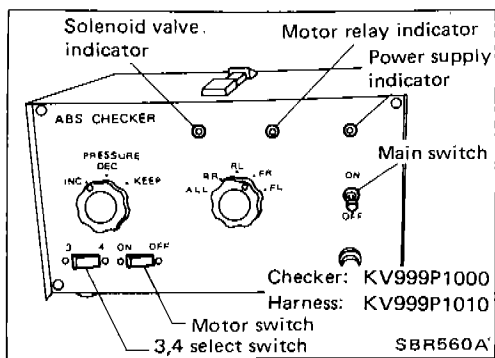


Diagnostic Procedure 12

CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but L.E.D. comes off.)



Electrical Components Inspection ACTUATOR (Not self-diagnostic item)



INSPECTION START

Connect A.B.S. checker to actuator connector and vehicle harness with battery terminal connected and all checker switch turning off.
Use harness for 3 channel.
Set select switch to 3 channel.

Turn checker power supply switch on.
Check power supply indicator for coming on.

No

Replace battery with fully charged new one, if checker connection is correct.

Yes

Check checker valve relay indicator for coming on.

No

A
Replace solenoid valve relay, if checker connection is correct.

Yes

Select one valve.
Select pressure decreasing position by switch then turn motor switch on.
Turn motor switch off.
Select pressure increasing position.

A

CAUTION:
Do not hold switch at the pressure decreasing position for more than 5 seconds. Otherwise, solenoid valve may be overheated and damaged.

Repeat so that all valve will be performed.

Check motor relay indicator for coming on while motor switch is turned on.

No

B
Replace motor relay, if checker connection is correct.

Yes

Check motor for operational sound beside the actuator in a quiet place.

No

Replace actuator as assembly, if Diagnostic Procedures 7 - 12 are already performed and checker connection is correct.

Yes

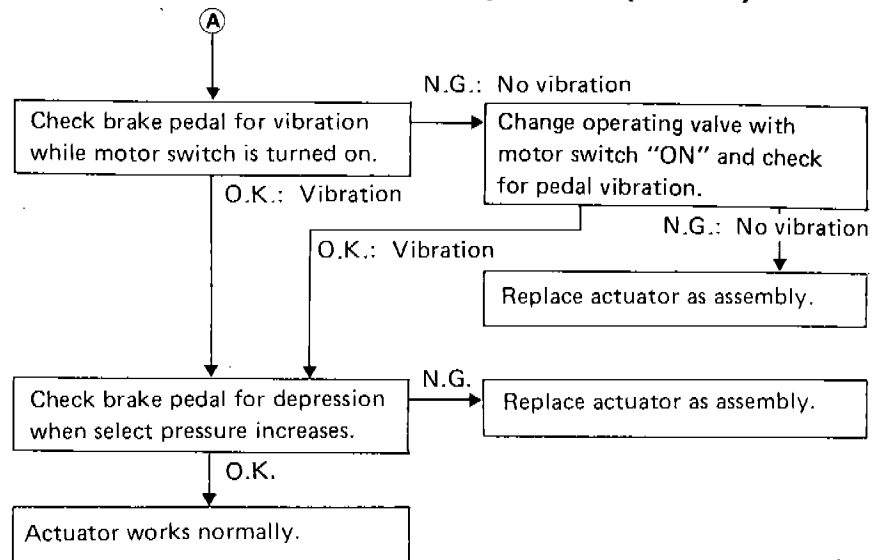
Bring checker in the vehicle and depress the brake pedal.
Repeat step **A**.

A

Valve select switch position RR is used for 4 channel checking. In the case of 3 channels, brake pedal vibration or depression will not occur in position RR. It will occur, however, in position RL.

TROUBLE DIAGNOSES

Electrical Components Inspection (Cont'd)



SERVICE DATA AND SPECIFICATIONS (S.D.S.)

General Specifications

Destination		Except Europe	Europe (Without A.B.S.*)	Europe (With A.B.S.*)
Front brake				
Brake model		CL18VB	CL25VA	
Cylinder bore diameter	mm (in)	48.1 (1.894)	57.2 (2.252)	
Pad length x width x thickness		100.8 x 44.3 x 10.0 (3.97 x 1.744 x 0.394)	134.1 x 45.3 x 11.0 (5.28 x 1.783 x 0.433)	
mm (in)				
Rotor outer diameter x thickness		250 x 18 (9.84 x 0.71)	257 x 22 (10.12 x 0.87)	
mm (in)				
Rear brake				
Brake model		CL9H	AD9	
Cylinder bore diameter	mm (in)	33.96 (1.3370)	34.93 (1.3752)	
Pad length x width x thickness		75.0 x 40.0 x 9.5 (2.953 x 1.575 x 0.374)	93.8 x 33.4 x 10.0 (3.693 x 1.315 x 0.394)	
mm (in)				
Rotor outer diameter x thickness		258 x 9 (10.16 x 0.35)	266 x 9 (10.47 x 0.35)	
mm (in)				
Master cylinder				
Cylinder bore diameter	mm (in)	20.64 (13/16)	22.22 (7/8)	23.81 (15/16)
Control valve		Proportioning valve (within master cylinder)		
Valve model				
Sprit point x reducing ratio		3,923 (39.2, 40, 569) x 0.4		
kPa (bar, kg/cm², psi)				
Brake booster				
Booster model		M23, G23	M195T	
Diaphragm diameter	mm (in)	230 (9.06)	Primary 205 (8.07) Secondary 180 (7.09)	
Brake fluid		DOT 3		
Recommended brake fluid				
Parking brake		Center lever		
Control type				
Parking drum brake				
Brake model		—	DS17HD	
Lining		—	154.1 x 25.0 x 3.0 (6.07 x 0.984 x 0.118)	
Width x thickness x length	mm (in)			
Drum inner diameter	mm (in)	—	172.0 (6.77)	

*Anti-lock Braking System

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Inspection and Adjustment

FRONT DISC BRAKE

Unit: mm (in)

Item	CL18VB	CL25VA
Pad wear limit Minimum thickness	2.0 (0.079)	
Rotor repair limit Minimum thickness	16.0 (0.630)	20.0 (0.787)
Maximum runout	0.07 (0.0028)	

REAR DISC BRAKE

Unit: mm (in)

Item	CL9H	AD9
Pad wear limit Minimum thickness	2.0 (0.079)	
Rotor repair limit Minimum thickness	8.0 (0.315)	
Maximum runout	0.07 (0.0028)	

PARKING DRUM BRAKE

Unit: mm (in)

Brake model	DS17H
Lining replacement limit Minimum thickness	1.5 (0.059)
Drum repair limit Maximum inner diameter	173.0 (6.81)

BRAKE PEDAL

Unit: mm (in)

Model	L.H.D.	R.H.D.
Free height		
M/T	177.0 - 187.0 (6.97 - 7.36)	178.0 - 188.0 (7.01 - 7.40)
A/T	186.0 - 196.0 (7.32 - 7.72)	188.0 - 198.0 (7.40 - 7.80)
Depressed height [under force of 490 N (50 kg, 110 lb) with engine running] Except Europe		
M/T	90 (3.54) or more	95 (3.74) or more
A/T	100 (3.94) or more	100 (3.94) or more
Europe		
M/T	85 (3.35) or more	90 (3.54) or more
A/T	95 (3.74) or more	95 (3.74) or more
Clearance between pedal stopper and threaded end of stop lamp switch	0.3 - 1.0 (0.012 - 0.039)	
Clearance between pedal stopper and threaded end of A.S.C.D. switch	0.3 - 1.0 (0.012 - 0.039)	
Pedal free play at clevis	1 - 3 (0.04 - 0.12)	

PARKING BRAKE

Control type	Center lever
Item	
Number of notches [under force of 196 N (20 kg, 44 lb)]	6 - 8
Number of notches (when warning switch comes on)	1