

# BRAKE SYSTEM

## SECTION **BR**

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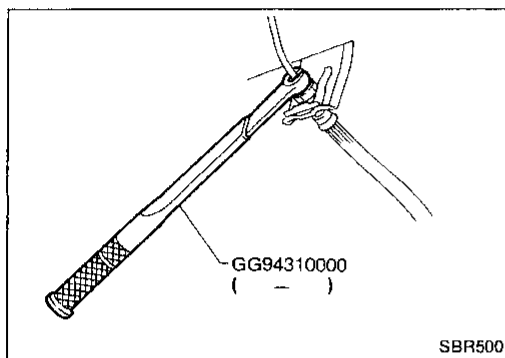
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# PRECAUTIONS AND PREPARATION

## 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.

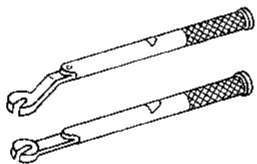
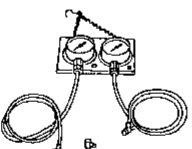
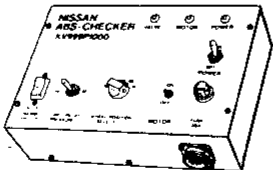
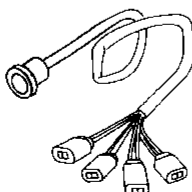


- Use Tool when removing and installing brake tube.

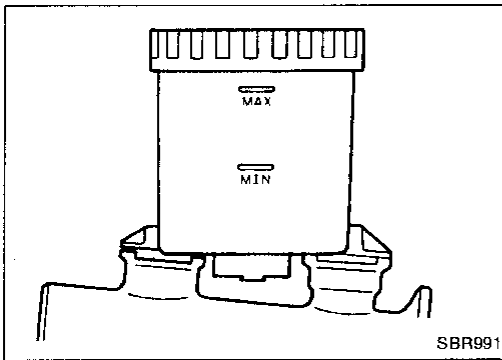
### WARNING:

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

## Special Service Tools

Tool number (Kent-Moore No.) Tool name	Description
GG94310000 ( — ) Flare nut torque wrench	 <p>Removing and installing each brake piping</p>
KV991V0010 ( — ) Brake fluid pressure gauge	 <p>Measuring brake fluid pressure</p>
KV999P1000 ( — ) ABS checker	 <p>Checking brake fluid pressure of ABS actuator</p>
KV999P1010 ( — ) ABS checker adapter harness	 <p>Checking brake fluid pressure of ABS actuator</p>

## CHECK AND ADJUSTMENT



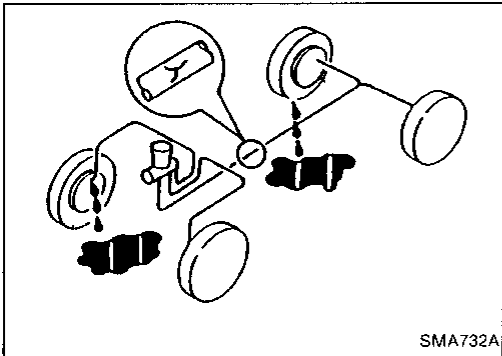
### Checking Brake Fluid Level

- 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.

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### 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.

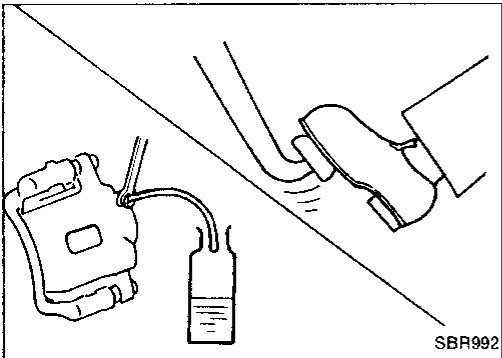
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### Changing Brake Fluid

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.

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- Refill with recommended brake fluid "DOT 3".
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.

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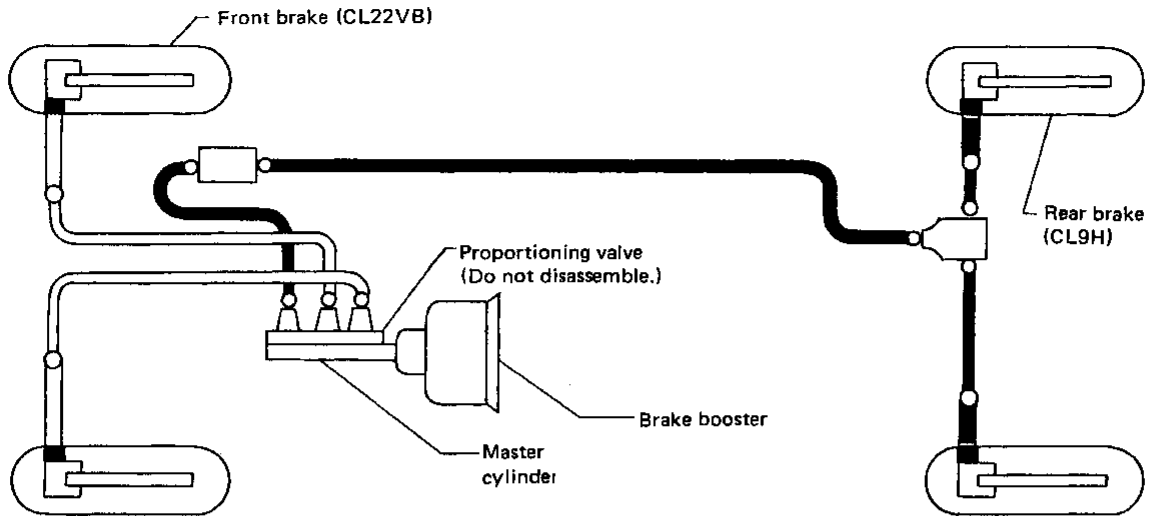
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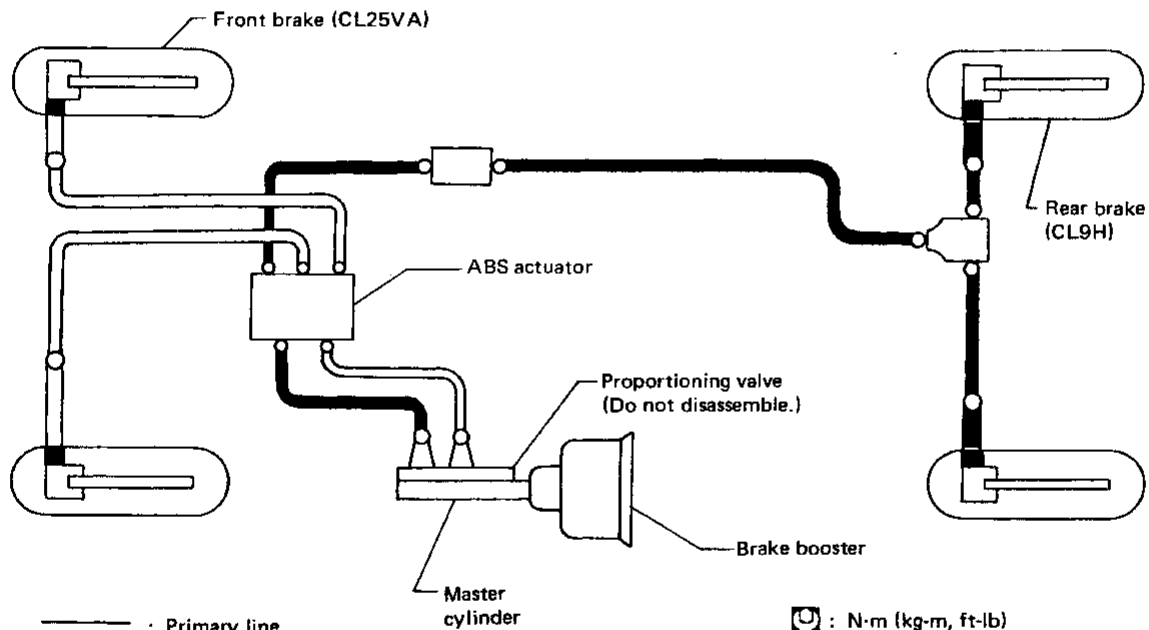
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# BRAKE HYDRAULIC LINE

## Without Anti-lock Braking System (ABS)



## With Anti-lock Braking System (ABS)



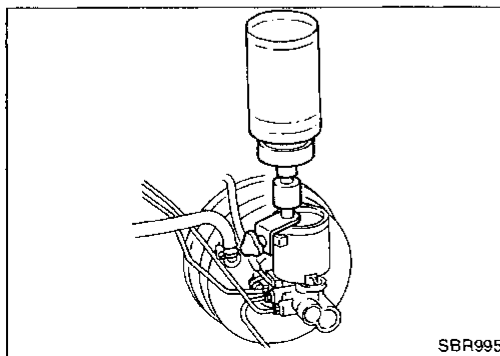
— : Primary line  
 — : Secondary line

⊗ : 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)

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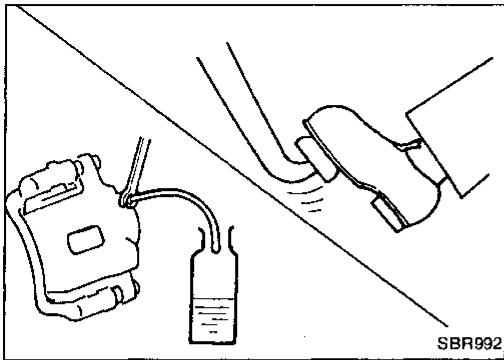
## Bleeding Procedure

### 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

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### With Anti-lock Braking System:

Left rear caliper  
↓  
Right rear caliper  
↓  
Left front caliper  
↓  
Right front caliper  
↓  
Front side air bleeder on ABS actuator  
↓  
Rear side air bleeder on ABS actuator

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

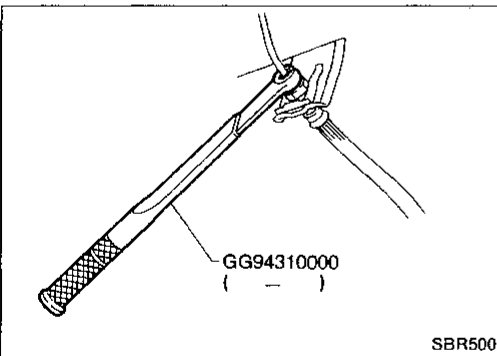
- 1) Connect a transparent vinyl tube to air bleeder valve.
- 2) Fully depress brake pedal several times.
- 3) With brake pedal depressed, open air bleeder valve to release air.
- 4) Close air bleeder valve.
- 5) Release brake pedal slowly.
- 6) Repeat steps 2) through 5) until clear brake fluid comes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

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## 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.

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## Inspection

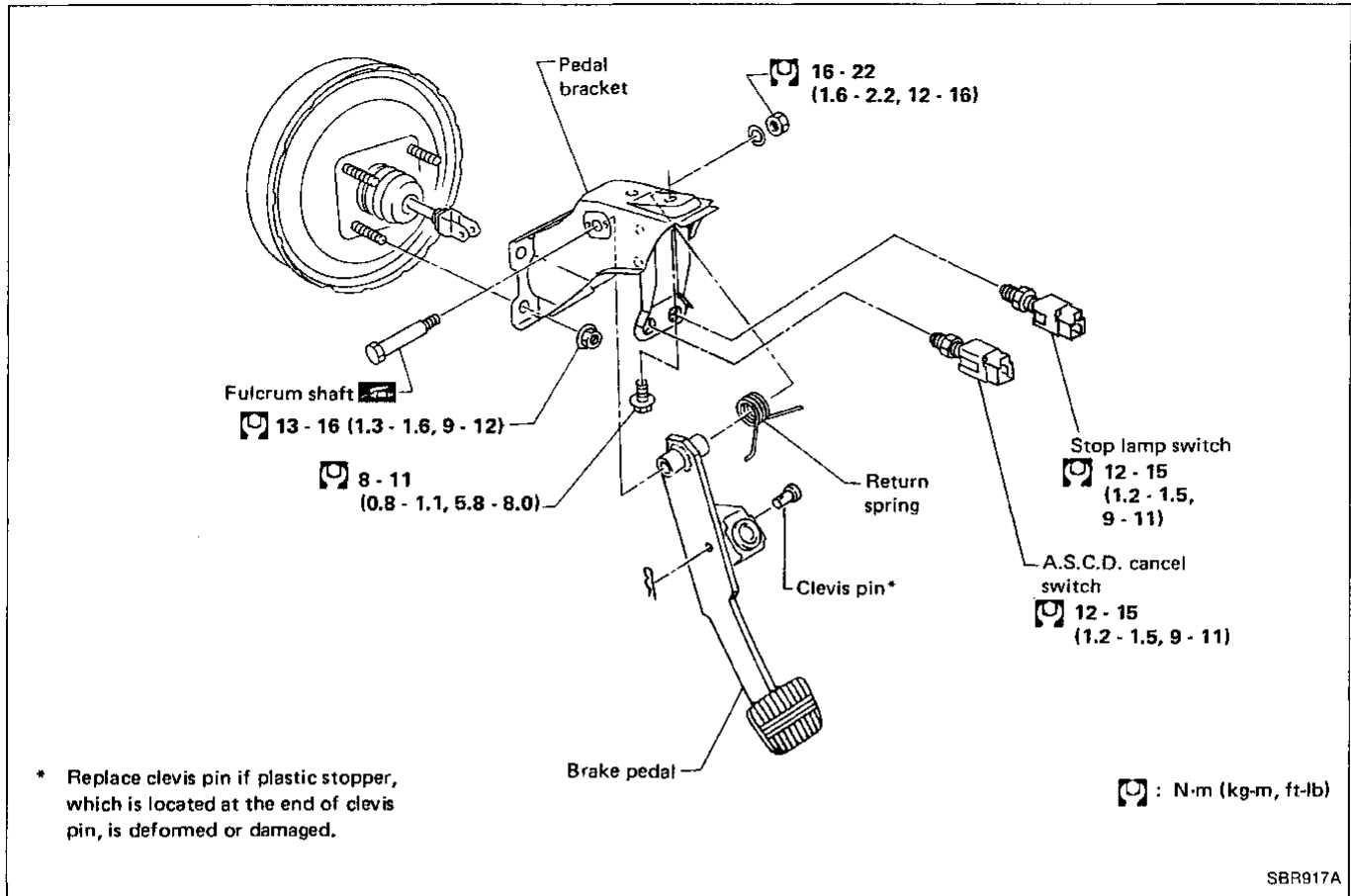
Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts. If leakage occurs around joints, retighten or, if necessary, replace damaged parts.

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# BRAKE PEDAL AND BRACKET

## Removal and Installation

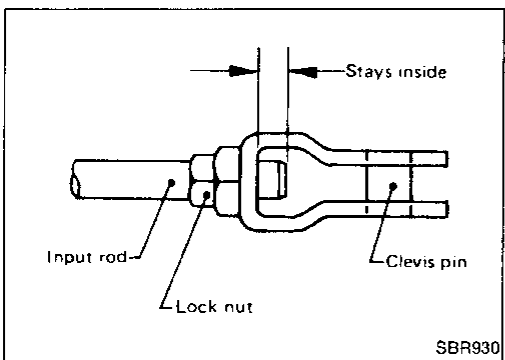
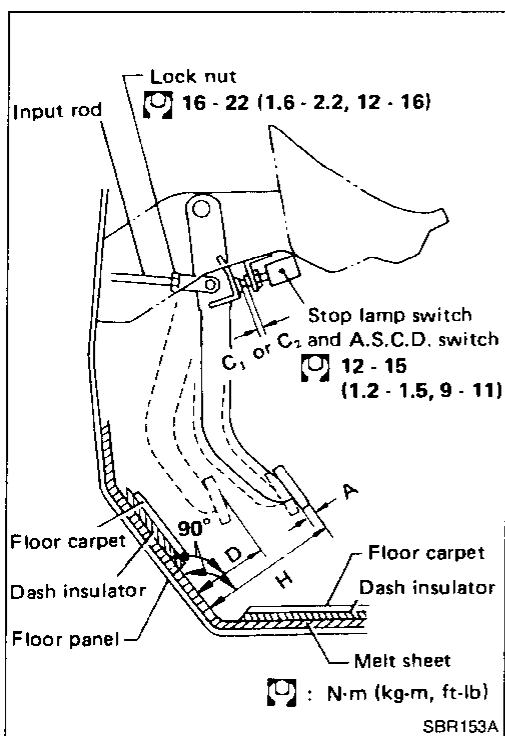


## Inspection

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
- C<sub>1</sub>:** Clearance between pedal stopper and threaded end of stop lamp switch  
0.3 - 1.0 mm (0.012 - 0.039 in)
- C<sub>2</sub>:** 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.**

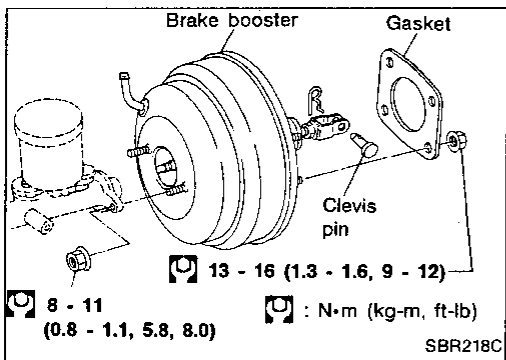
2. Adjust clearance "C<sub>1</sub>" and "C<sub>2</sub>" with stop lamp switch and A.S.C.D. switch respectively. Then tighten lock nuts.
3. Check pedal free play.

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

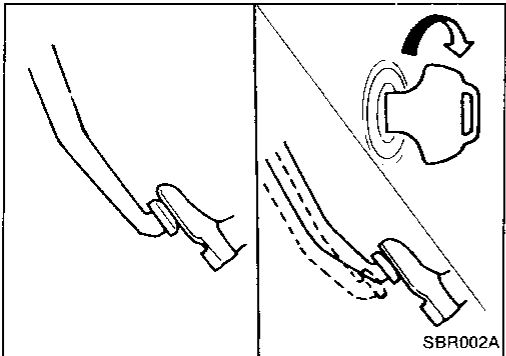
4. Check brake pedal's depressed height while engine is running.

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



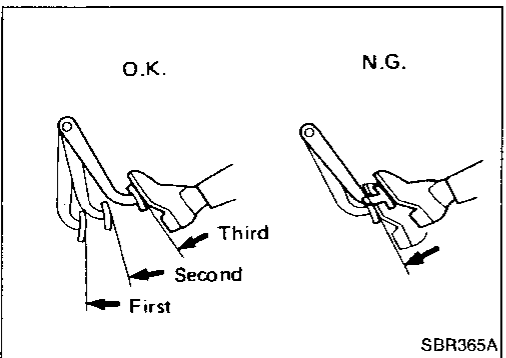
## Removal and Installation



## Inspection

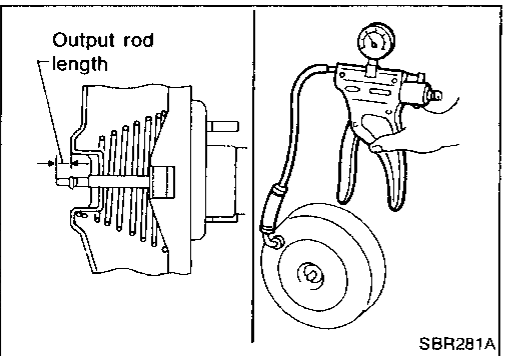
### OPERATING CHECK

- 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.

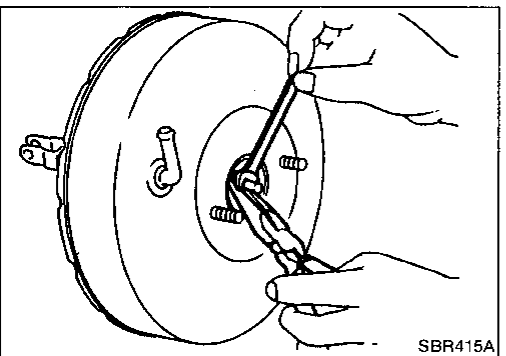


### OUTPUT ROD LENGTH CHECK

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

#### Specified length:

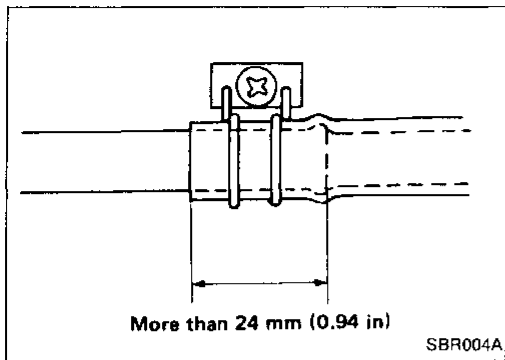
10.275 - 10.525 mm (0.4045 - 0.4144 in)



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).
- Do not apply any oil or lubricants to vacuum hose and check valve.

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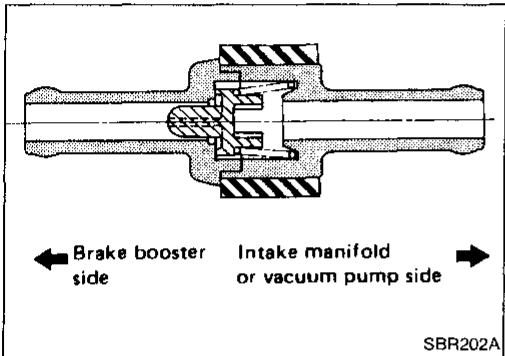
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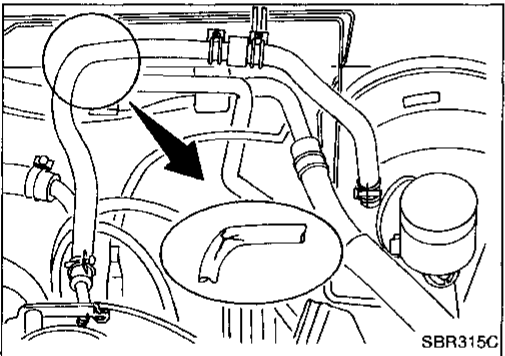
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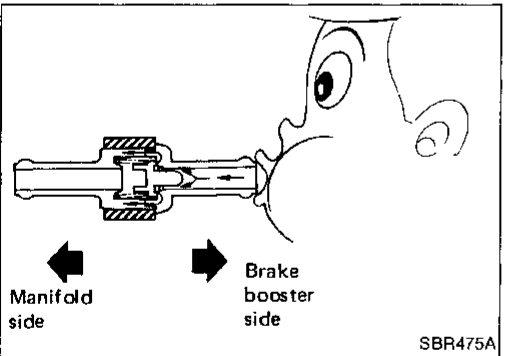
- Install check valve, paying attention to its direction.



## Inspection

### HOSES AND CONNECTORS

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

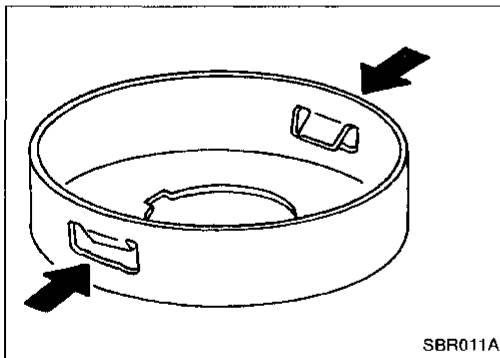
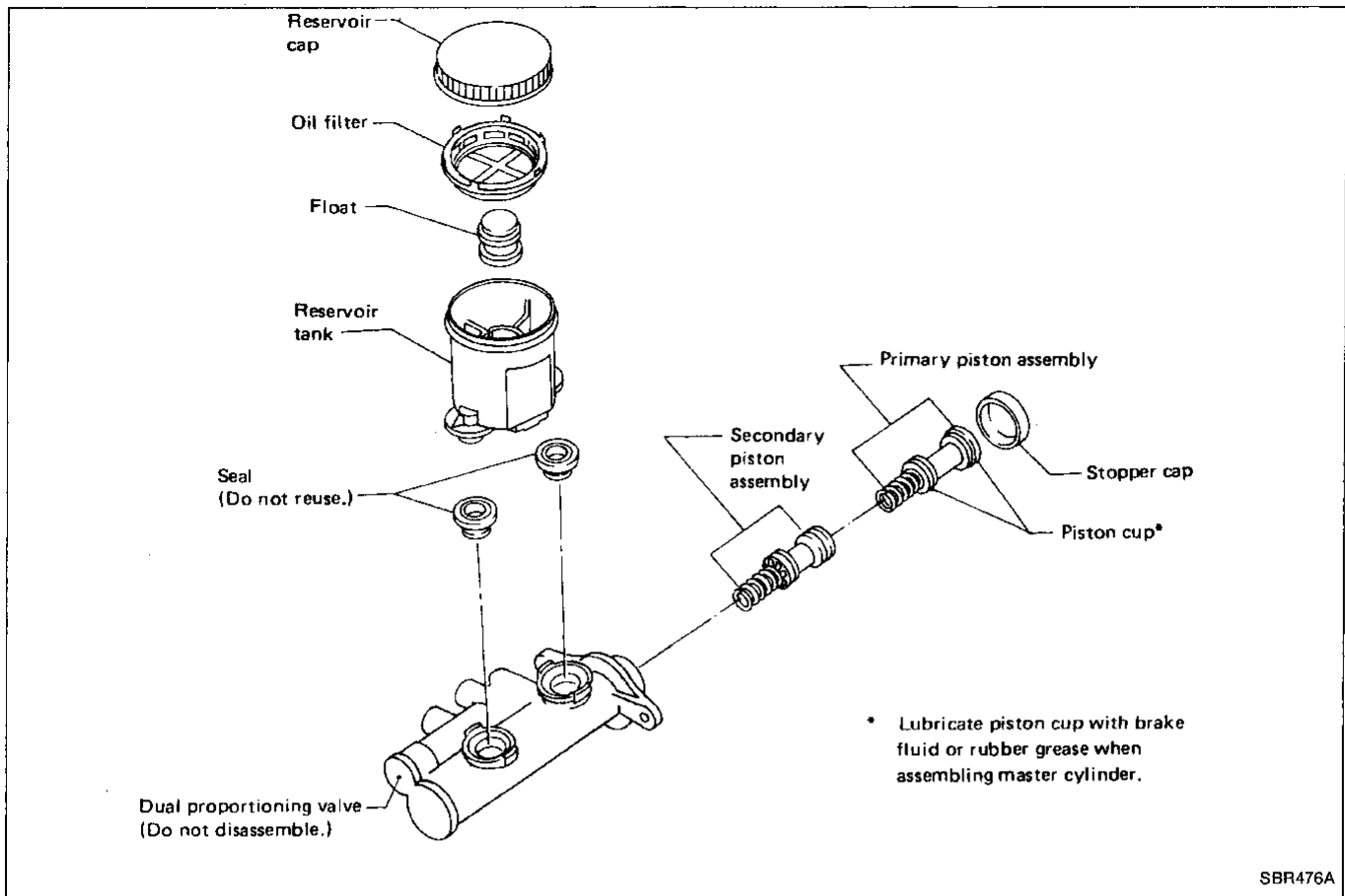


### CHECK VALVE

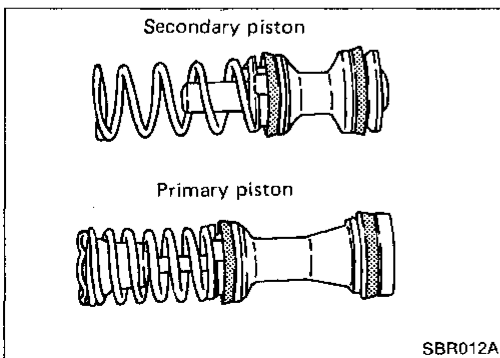
- When pressure is applied to brake booster side of check valve and valve does not open, replace check valve with a new one.

# MASTER CYLINDER

## Removal and Installation

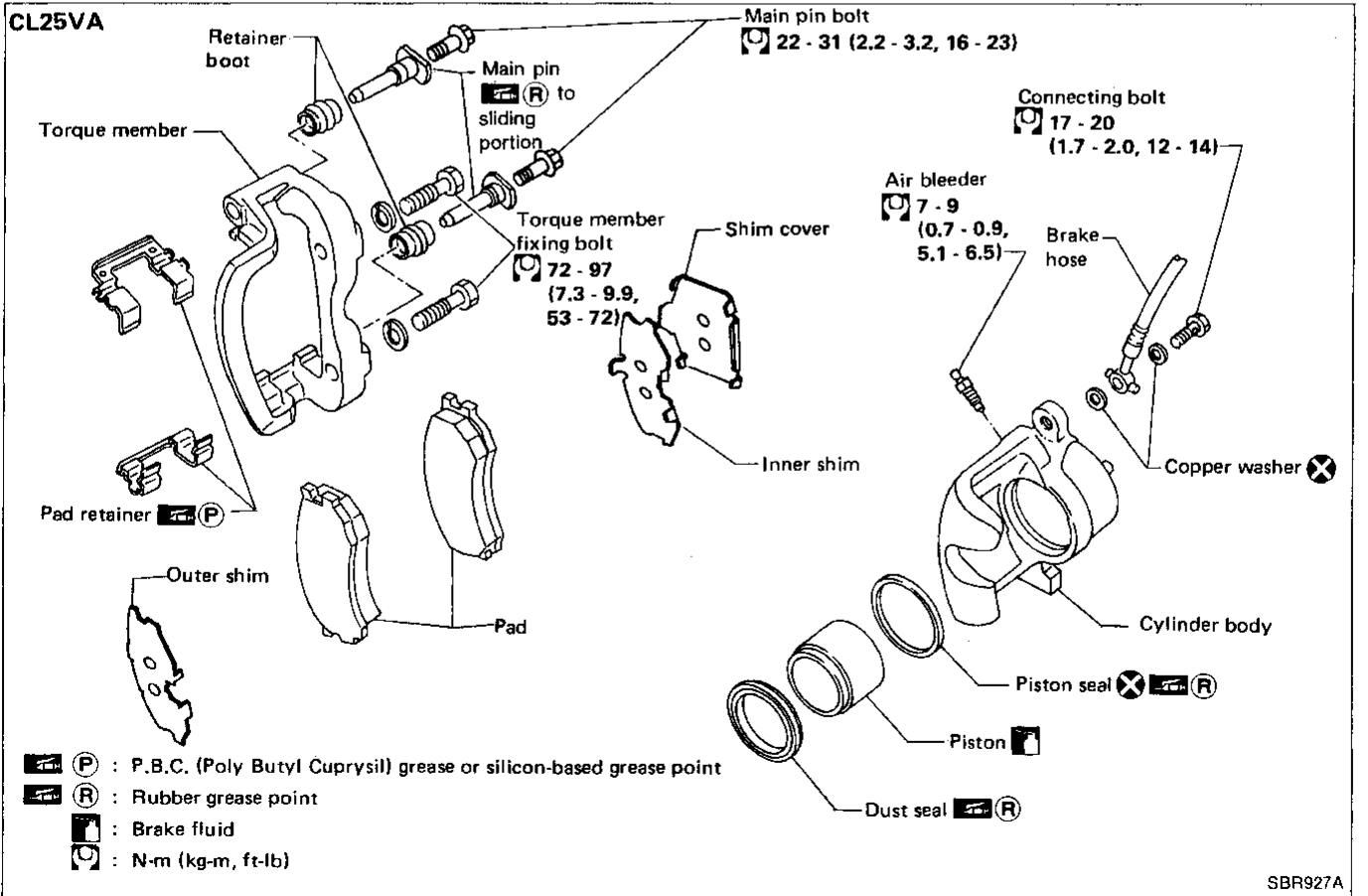
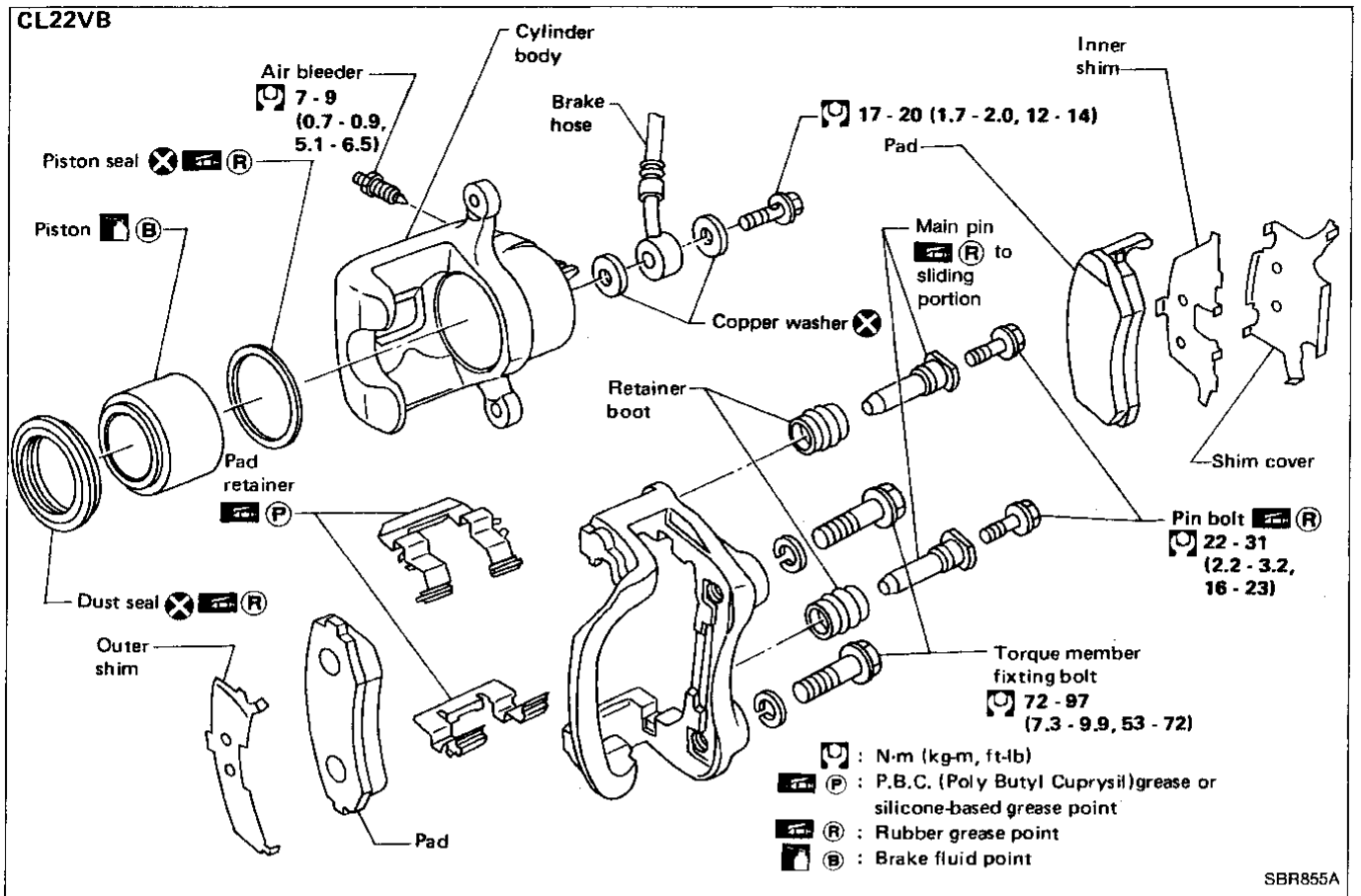


- Replace stopper cap if claw is damaged or deformed.
- Bend claws inward when installing stopper cap.



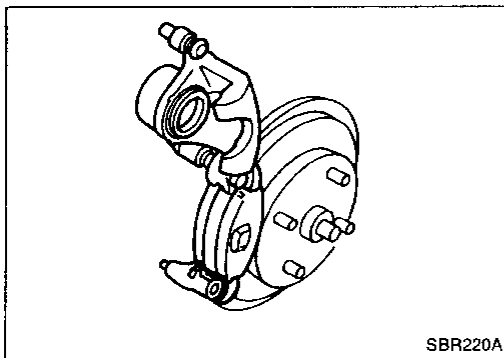
- Pay attention to direction of piston cups in figure at left.
- Check parts for wear or damage. Replace if necessary.

# FRONT DISC BRAKE (CL22VB, CL25VA)



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## FRONT DISC BRAKE (CL22VB, CL25VA)

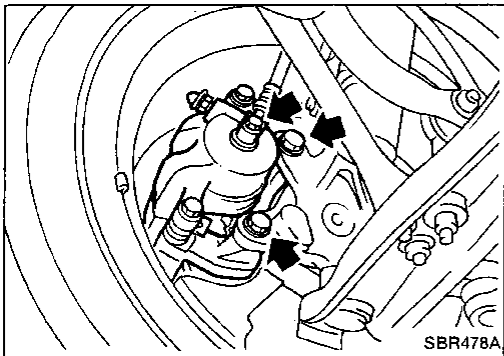


### Pad Replacement

1. Remove pin bolt.
2. Swing cylinder body upward. Then remove pad retainer, and inner and outer shims.

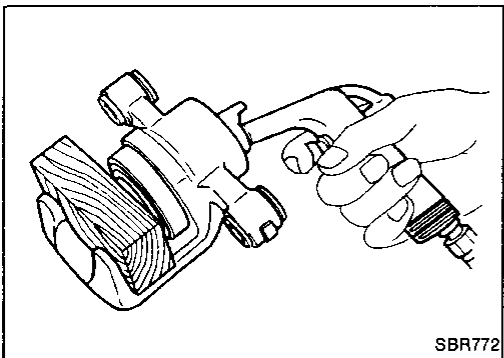
#### CAUTION:

- 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.

# FRONT DISC BRAKE (CL22VB, CL25VA)

## Inspection (Cont'd)

### DISC PAD

Check disc pad for wear or damage.

**Pad standard thickness (A):**

**CL22VB: 10.0 mm (0.394 in)**

**CL25VA: 11.0 mm (0.433 in)**

**Pad wear limit (A):**

**2.0 mm (0.079 in)**

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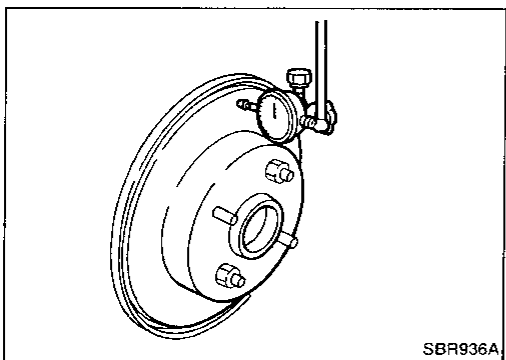
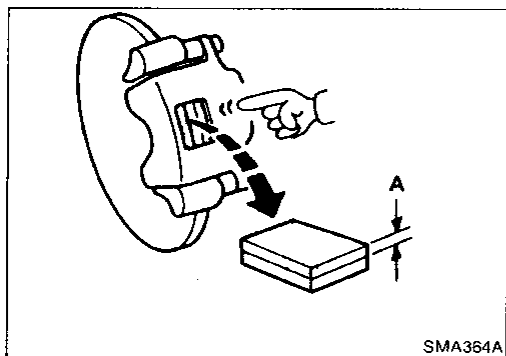
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### ROTOR RUNOUT

1. Secure rotor to wheel hub with at least two nuts (M12 x 1.25).
2. Check runout using a dial indicator.

**Make sure that wheel bearing axial end play is within the specifications before measuring. Refer to section FA.**

**Maximum runout:**

**0.07 mm (0.0028 in)**

3. If the runout is out of specification, find minimum runout position as follows:
  - a. Remove nuts and rotor from wheel hub.
  - b. Shift the rotor one hole and secure rotor to wheel hub with nuts.
  - c. Measure runout.
  - d. Repeat steps a. to c. so that minimum runout position can be found.
4. If the runout is still out of specification, turn rotor with on-car brake lathe ("MAD, DL-8700", "AMMCO 700 and 705" or equivalent).

### ROTOR THICKNESS

**Thickness variation (At least 8 positions):**

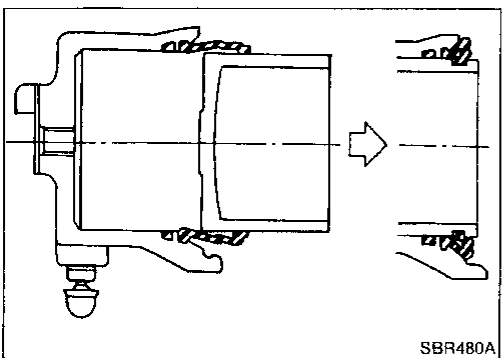
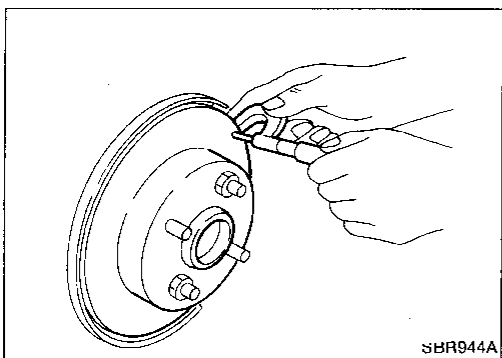
**Maximum 0.01 mm (0.0004 in)**

If thickness variation exceeds the specification, turn rotor with on-car brake lathe.

**Rotor repair limit:**

**CL22VB 18.0 mm (0.709 in)**

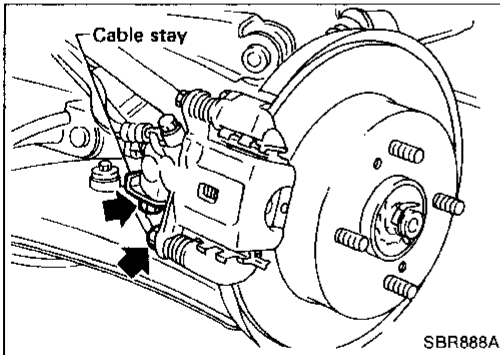
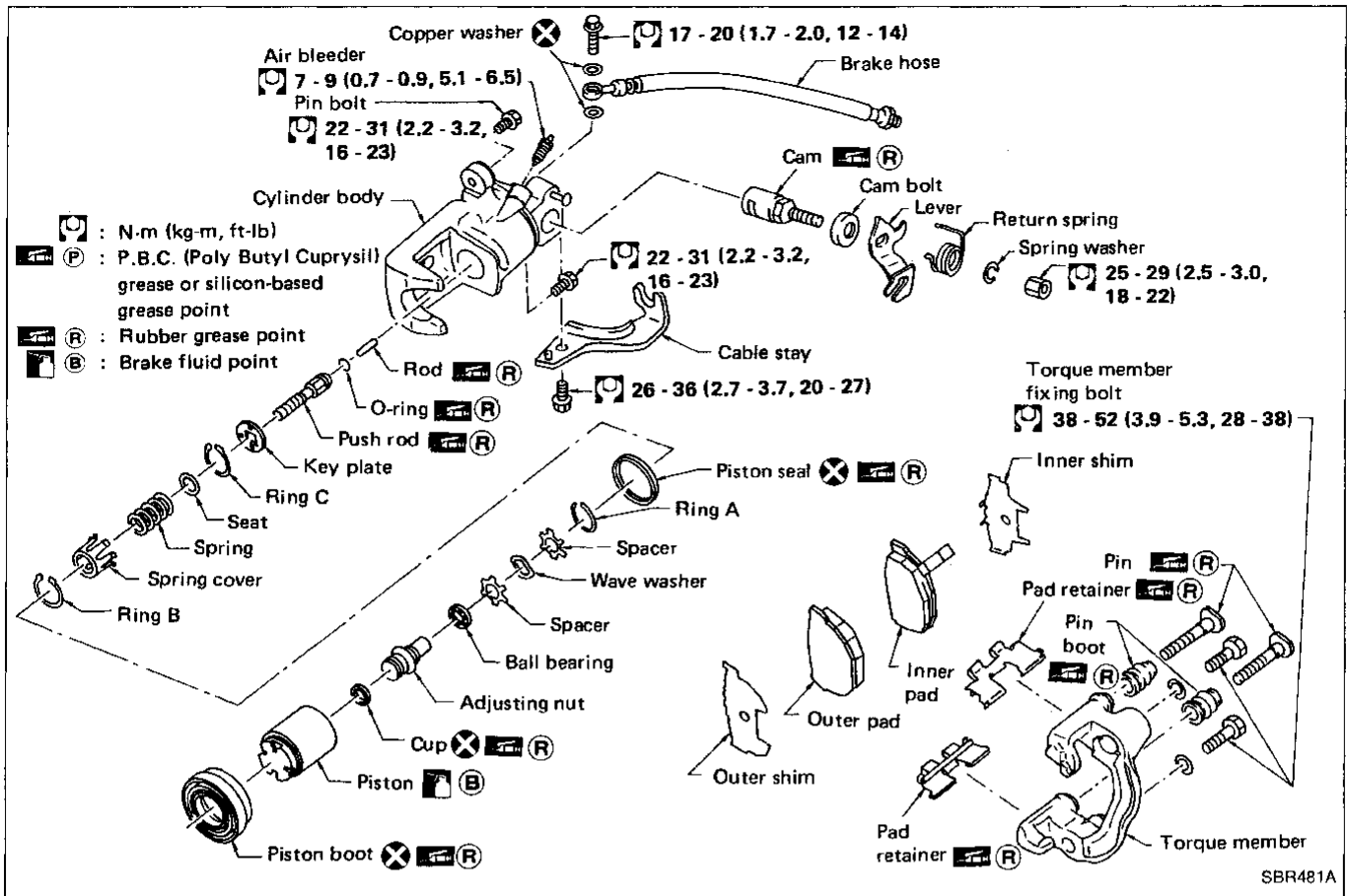
**CL25VA 20.0 mm (0.787 in)**



### 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.

# REAR DISC BRAKE (CL9H)

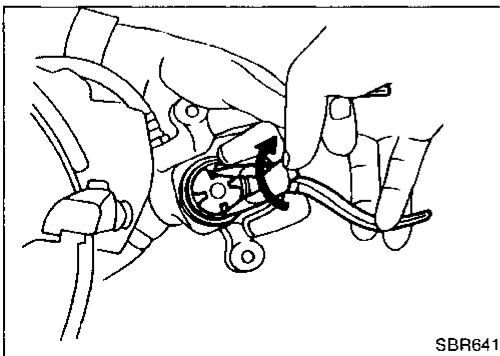


## Pad Replacement

### CAUTION:

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

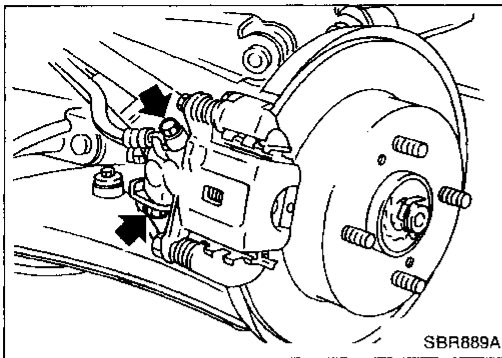
- Release parking brake.
- Remove parking cable stay fixing bolt, pin bolts and lock spring. Then remove pad retainers, pads and shims.



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

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

# REAR DISC BRAKE (CL9H)



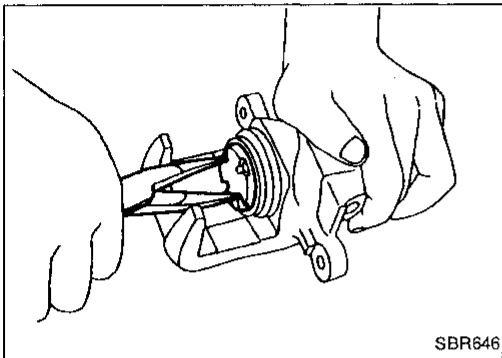
## Removal and Installation

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

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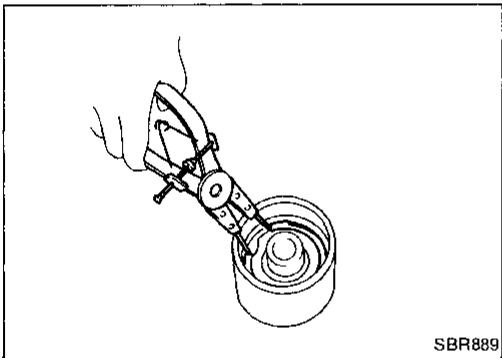
## Disassembly

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

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

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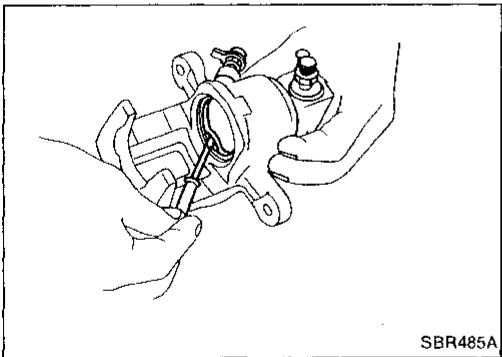
3. Disassemble cylinder body.

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

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- Remove piston seal.

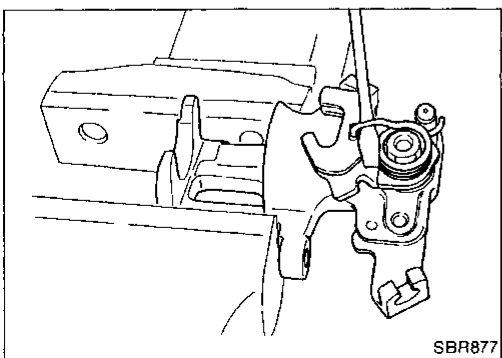
**Be careful not to damage cylinder body.**

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4. Remove return spring and lever.

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## 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:

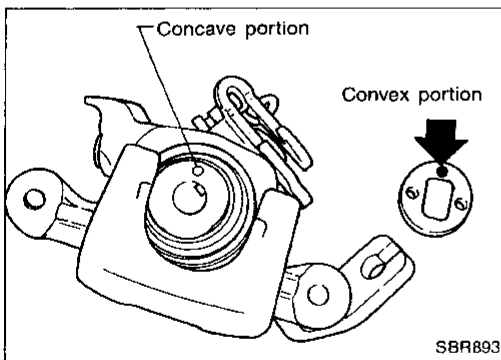
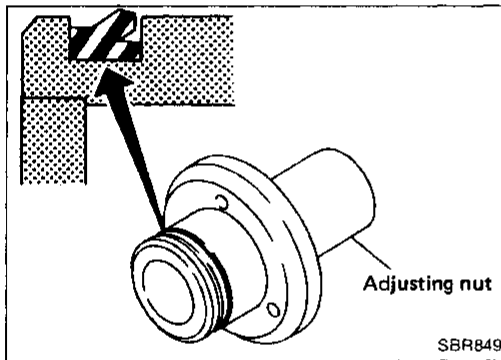
Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is stuck to sliding surface.

### PIN AND PIN BOOT

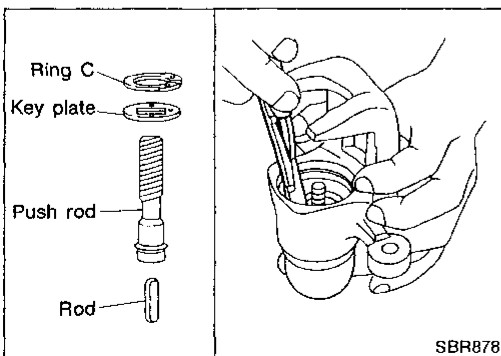
Check for wear, cracks or other damage. Replace if necessary.

### Assembly

- Install cup securely in the specified direction.



- Fit push rod into square hole in key plate. Also match convex portion of key plate with concave portion of cylinder.



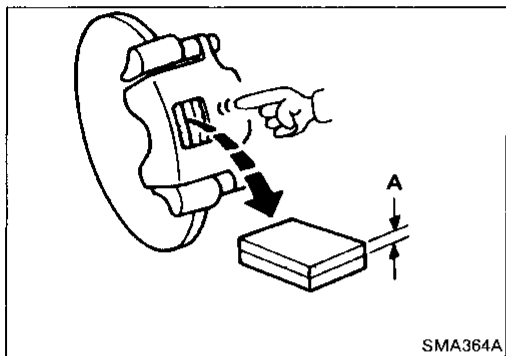
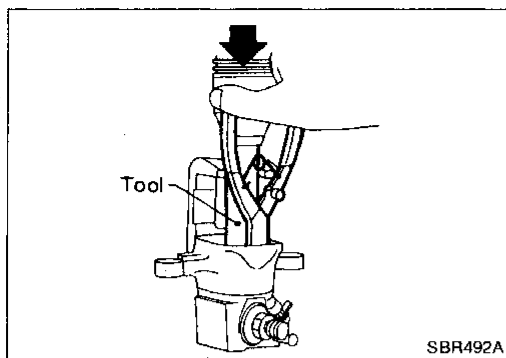
- Install ring C with suitable tool.



## REAR DISC BRAKE (CL9H)

### Assembly (Cont'd)

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



### Inspection

#### DISC PAD

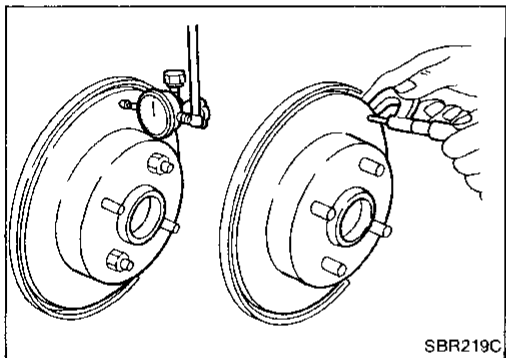
Check disc pad for wear or damage.

**Standard thickness (A):**

9.5 mm (0.374 in)

**Pad wear limit (A):**

2.0 mm (0.079 in)



#### ROTOR RUNOUT & THICKNESS

- 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: 0.07 mm (0.0028 in)**

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

- Rotor thickness

**Rotor repair limit:**

**Minimum thickness: 8.0 mm (0.315 in)**

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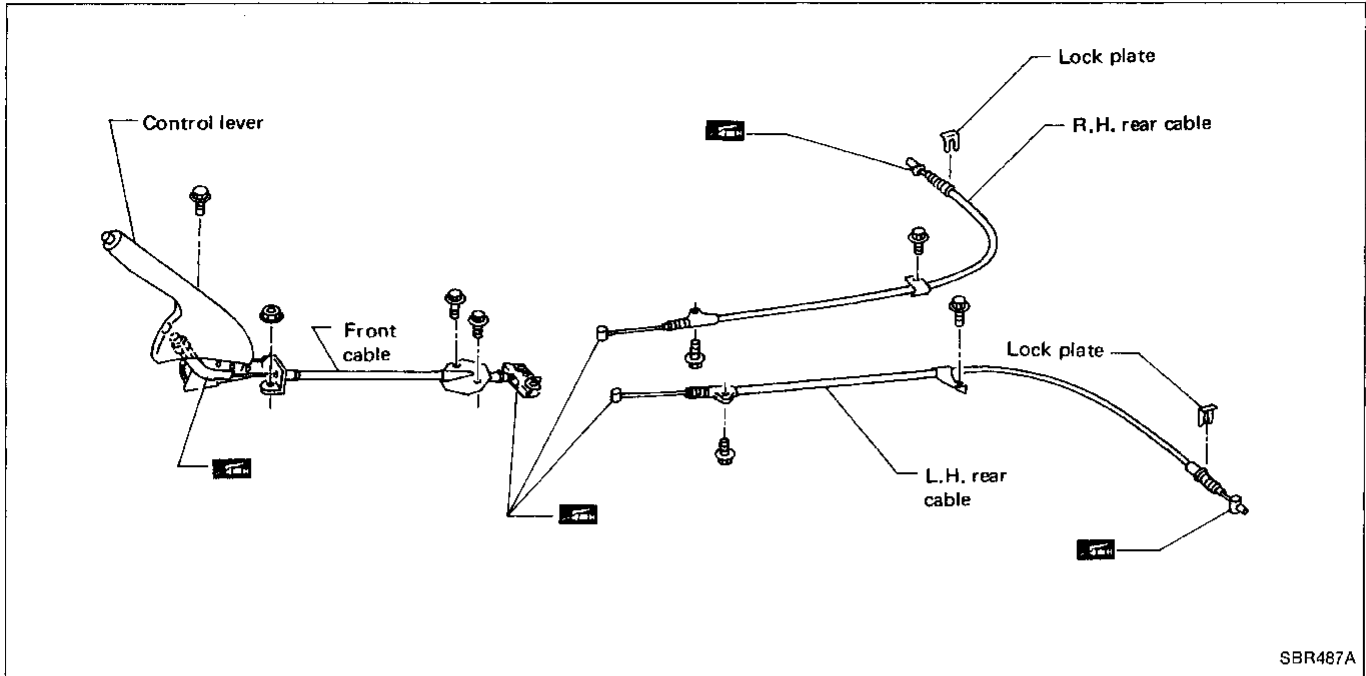
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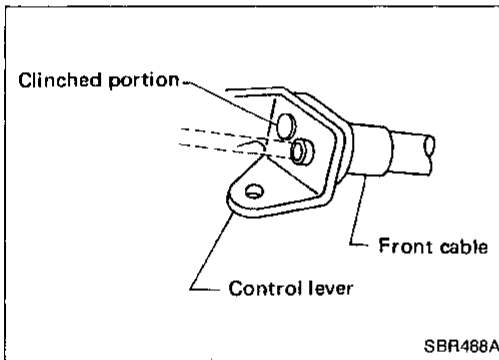
EL

# PARKING BRAKE CONTROL

## Removal and Installation



SBR487A

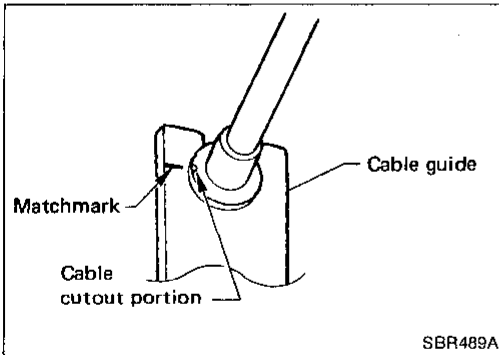


SBR488A

### 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.**



SBR489A

### INSTALLATION

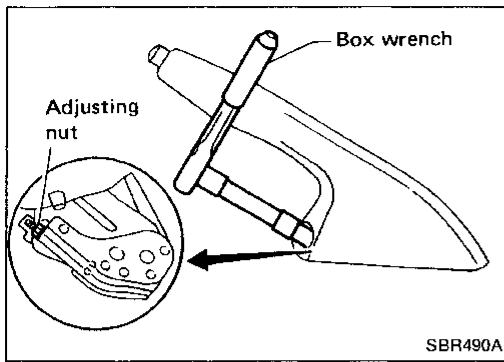
**Be careful not to damage boot and inner cable.**

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

### Inspection

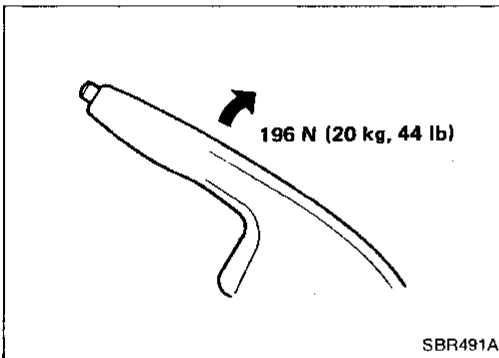
1. Check control lever for wear or other damage. Replace if necessary.
2. Check parking brake cables, lamp and switch. Replace if necessary.
3. Check parts at each connecting portion for deformation or damage. If found, replace.

# PARKING BRAKE CONTROL



## Adjustment

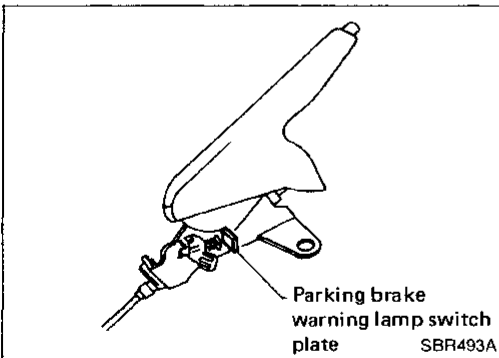
1. Ensure that parking brake releases when control lever is pulled down completely. If control lever does not release parking brake, proceed as follows:
  - Pull control lever up by 4 or 5 notches.
  - Insert a box wrench into opening in control lever and loosen self-lock adjusting nut to slacken cables. 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:**

**Center lever type 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 "A" notches: 1**

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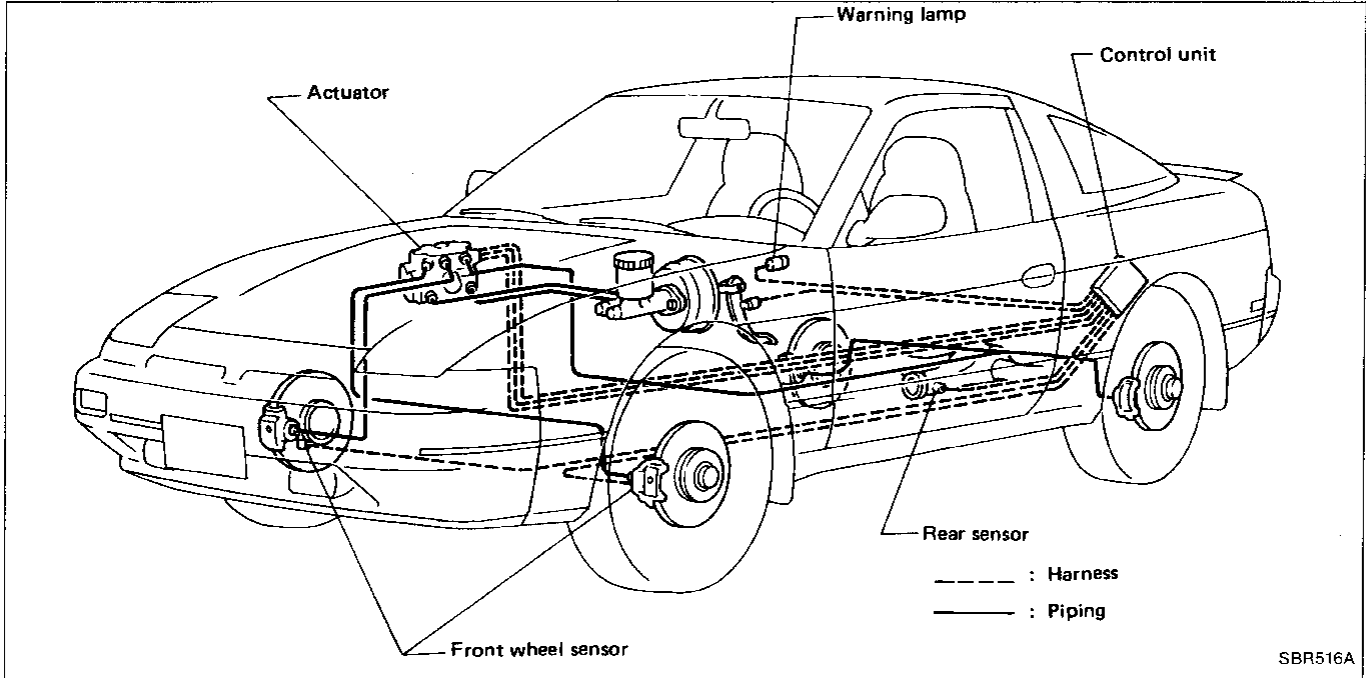
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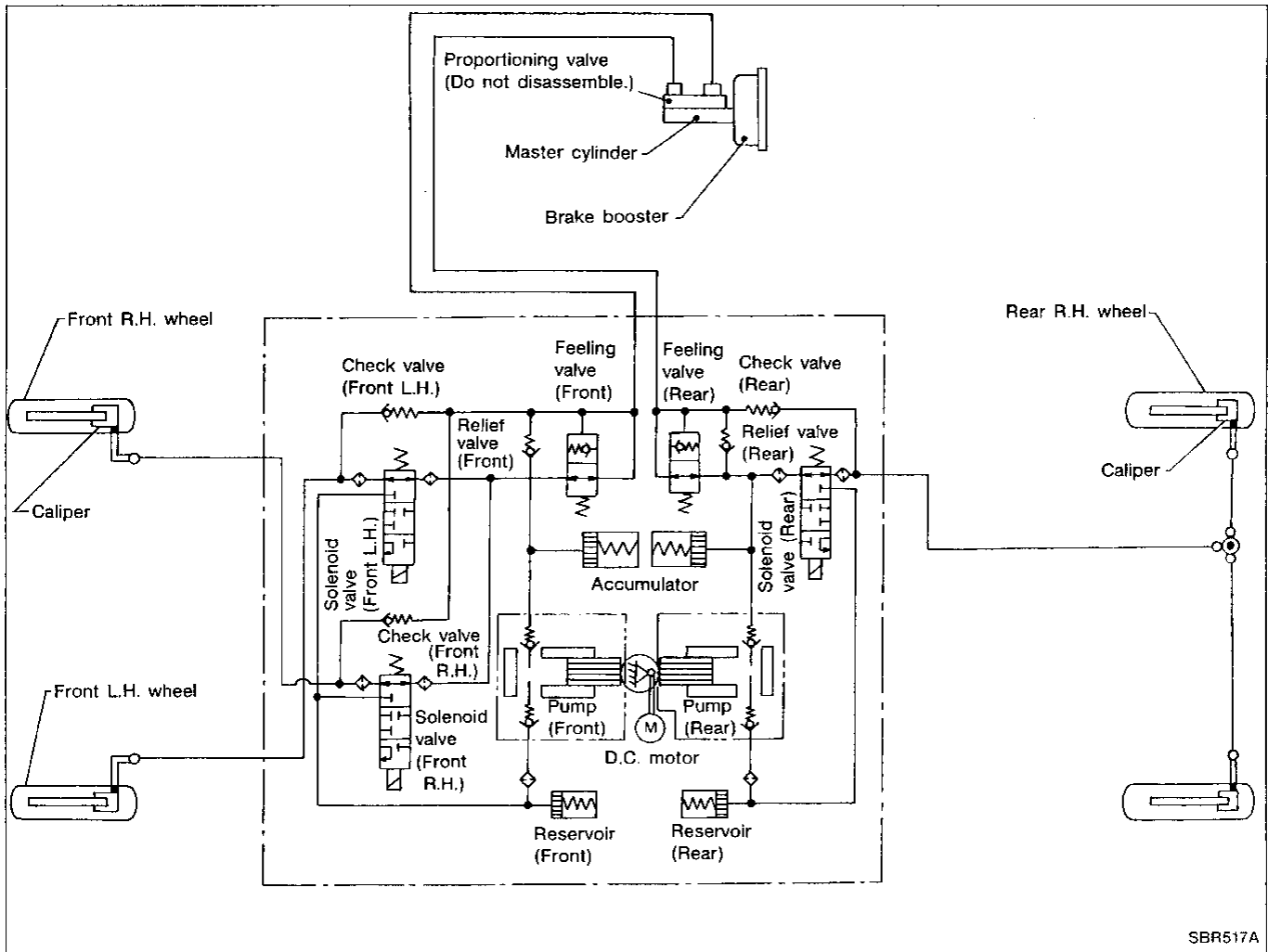
EL

# ANTI-LOCK BRAKING SYSTEM

## System Components

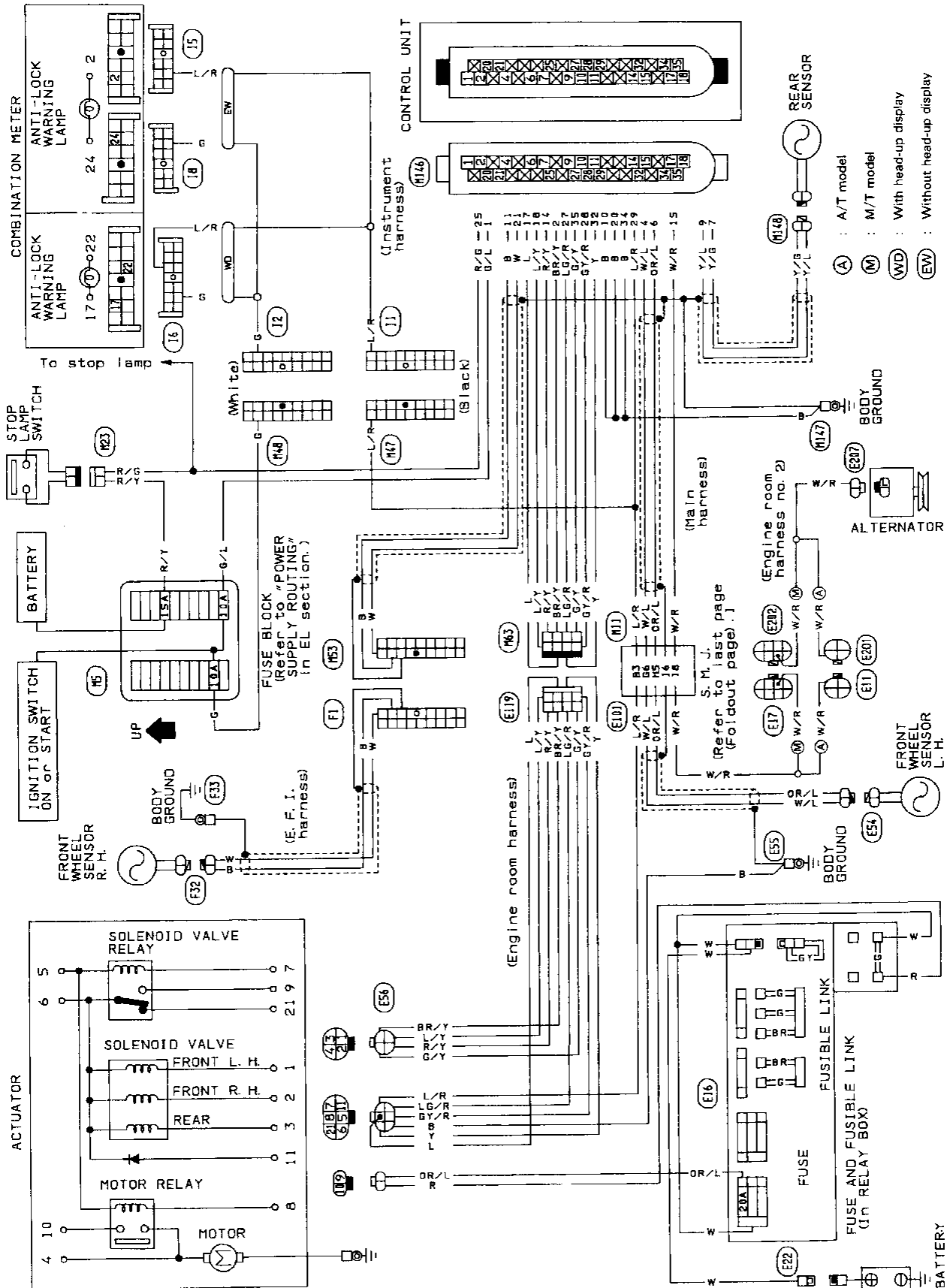


## Hydraulic Circuit



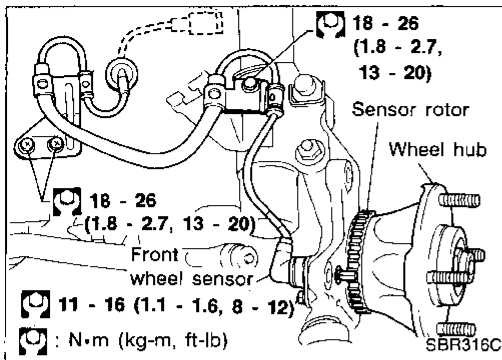
# ANTI-LOCK BRAKING SYSTEM

## Wiring Diagram



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# ANTI-LOCK BRAKING SYSTEM

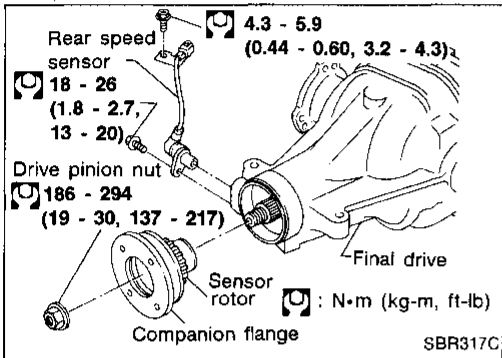


## Removal and Installation

### CAUTION:

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

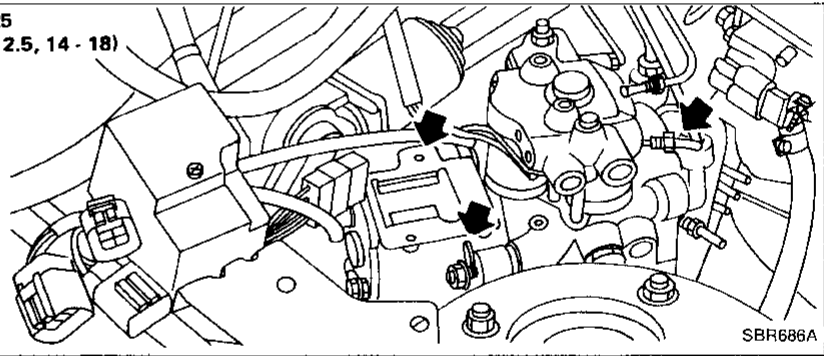
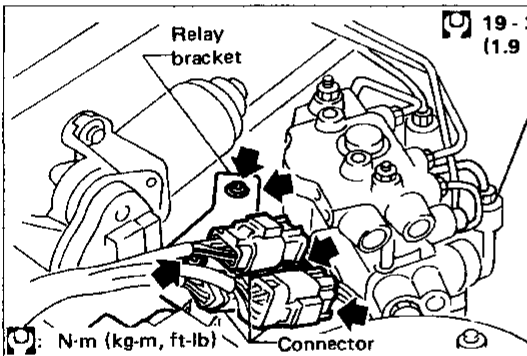
### FRONT WHEEL SENSOR



### REAR SENSOR

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

## ACTUATOR



- Disconnect 3 connectors and brake tubes.
- Remove relay bracket.
- Remove actuator by removing 3 nuts fixing actuator to bracket.

# TROUBLE DIAGNOSES

## Contents

How to Perform Trouble Diagnoses for Quick and Accurate Repair .....	BR-24	
Symptom Chart .....	BR-26	
Preliminary Check 1 .....	BR-27	
Preliminary Check 2 .....	BR-28	GI
Preliminary Check 3, 4 .....	BR-29	
Self-diagnosis .....	BR-30	
Component Parts Location .....	BR-31	MA
Harness Connector Location .....	BR-32	
Ground Circuit Check .....	BR-33	
Circuit Diagram for Quick Pinpoint Check .....	BR-33	EM
Diagnostic Procedure 1 — Pedal vibration and noise .....	BR-34	
Diagnostic Procedure 2 — Long stopping distance .....	BR-35	
Diagnostic Procedure 3 — Abnormal pedal action .....	BR-36	LC
Diagnostic Procedure 4 — ABS doesn't work .....	BR-36	
Diagnostic Procedure 5 — ABS works but warning activates .....	BR-37	EF & EC
Diagnostic Procedure 6 — ABS works frequently .....	BR-37	
Diagnostic Procedure 7 — ACTUATOR SOLENOID VALVE (L.E.D. flashing number 1 - 4) .....	BR-38	
Diagnostic Procedure 8 — WHEEL SPEED SENSOR (L.E.D. flashing number 5 - 8) .....	BR-39	
Diagnostic Procedure 9 — ACTUATOR MOTOR RELAY (L.E.D. flashing number 9) .....	BR-40	FE
Diagnostic Procedure 10 — ACTUATOR SOLENOID VALVE RELAY (L.E.D. flashing number 10) .....	BR-41	
Diagnostic Procedure 11 — CONTROL UNIT (L.E.D. flashing number 16) .....	BR-42	CL
Diagnostic Procedure 12 — CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but L.E.D. comes off.) .....	BR-43	
Electrical Components Inspection — ACTUATOR (Not self-diagnostic item) .....	BR-44	MT

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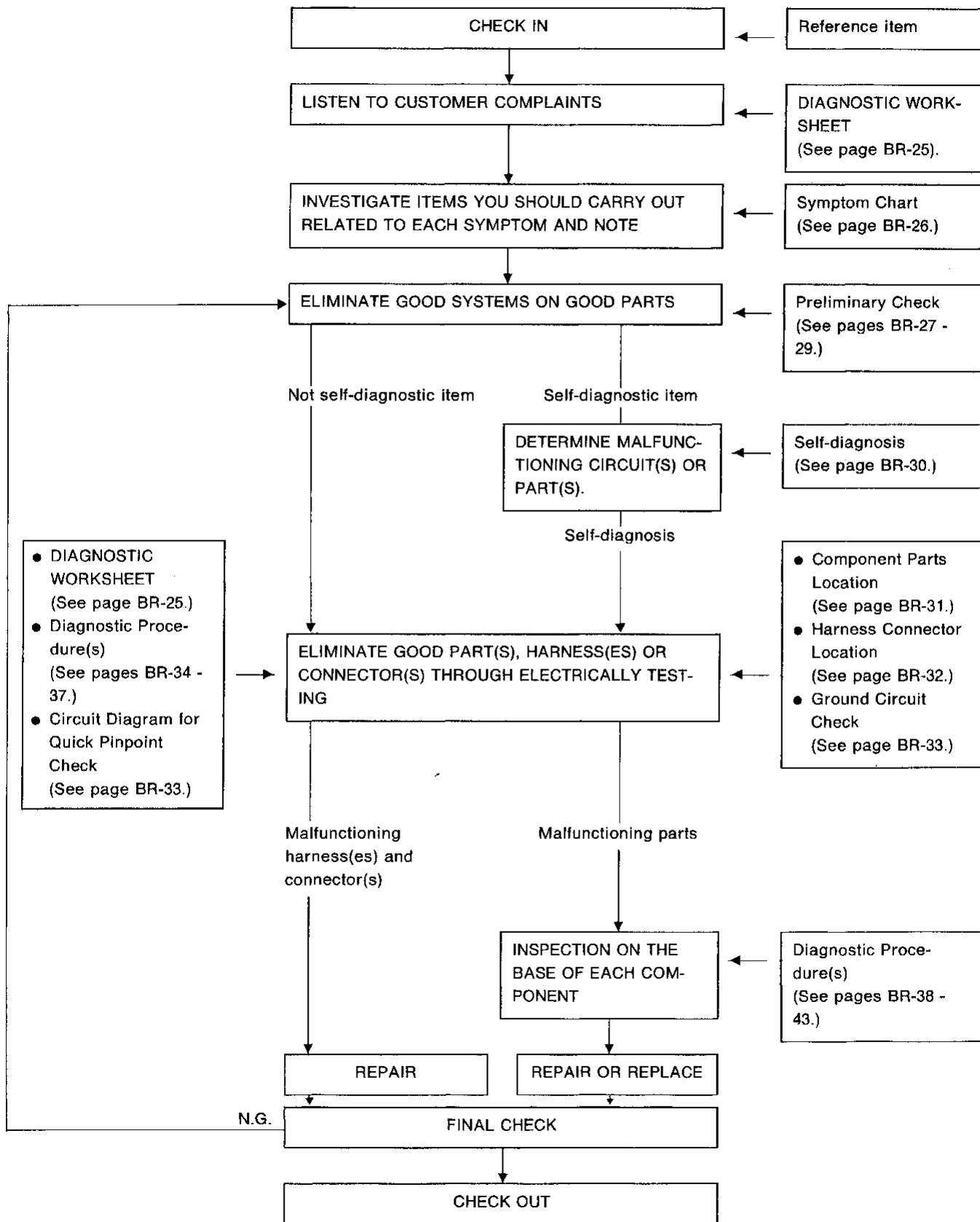
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# TROUBLE DIAGNOSES

## How to Perform Trouble Diagnoses for Quick and Accurate Repair

### WORK FLOW





# TROUBLE DIAGNOSES

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

### KEY POINTS

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

SBR339B

### 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	<input type="checkbox"/> Pedal vibration and noise	<input type="checkbox"/> Warning activates	<input type="checkbox"/> Long stopping distance	<input type="checkbox"/> Abnormal pedal action	<input type="checkbox"/> ABS doesn't work	<input type="checkbox"/> ABS works but warning activates	<input type="checkbox"/> ABS works frequently
Engine conditions		<input type="checkbox"/> When starting <input type="checkbox"/> After starting <input type="checkbox"/> Engine speed: 5,000 rpm or more					
Road conditions		<input type="checkbox"/> Low friction road ( <input type="checkbox"/> Snow <input type="checkbox"/> Gravel <input type="checkbox"/> Other) <input type="checkbox"/> Protrusion					
Driving conditions		<input type="checkbox"/> High speed cornering <input type="checkbox"/> Vehicle speed: Greater than 10 km/h (6 MPH) <input type="checkbox"/> Vehicle speed: 10 km/h (6 MPH) or less <input type="checkbox"/> Vehicle is stopped					
Applying brake conditions		<input type="checkbox"/> Suddenly <input type="checkbox"/> Gradually					
Other conditions		<input type="checkbox"/> Operation of electrical equipment <input type="checkbox"/> Large pedal stroke <input type="checkbox"/> Operation of clutch					

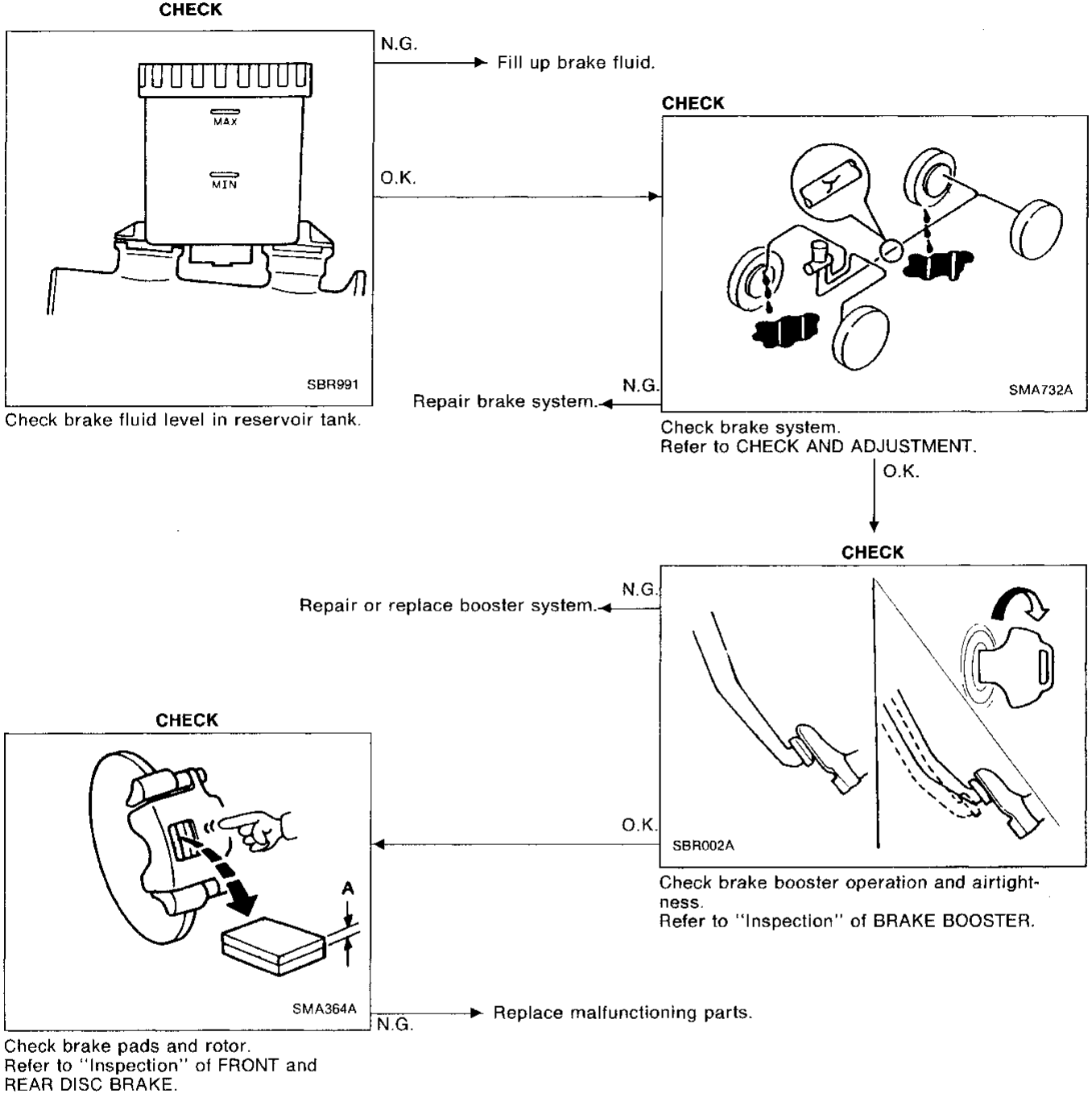
GI  
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 EL

# TROUBLE DIAGNOSES

## Symptom Chart

PROCEDURE	Preliminary Check				Diagnostic Procedure						Diagnostic Procedure (Select inspection with L.E.D. flashing No.)					Ground Circuit Check	Electrical Compo- nents Inspection	
	BR-27	BR-28	BR-29	BR-29	BR-34	BR-35	BR-36	BR-36	BR-37	BR-37	BR-38	BR-39	BR-40	BR-41	BR-42	BR-43	BR-33	BR-44
REFERENCE PAGE	BR-27	BR-28	BR-29	BR-29	BR-34	BR-35	BR-36	BR-36	BR-37	BR-37	BR-38	BR-39	BR-40	BR-41	BR-42	BR-43	BR-33	BR-44
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. comes off	Motor ground	Actuator inspection
Pedal vibration & noise			○	○	○						○	○	○	○	○	○		
Warning activates		○	○	○							○	○	○	○	○	○		
Long stopping distance	○			○		○					○	○	○	○	○	○		
Abnormal pedal action	○			○			○				○	○	○	○	○	○		
ABS doesn't work		○		○				○			○	○	○	○	○	○	○	○
ABS works but warning activates				○					○		○	○	○	○	○	○		
ABS works frequently	○	○								○								

Preliminary Check 1

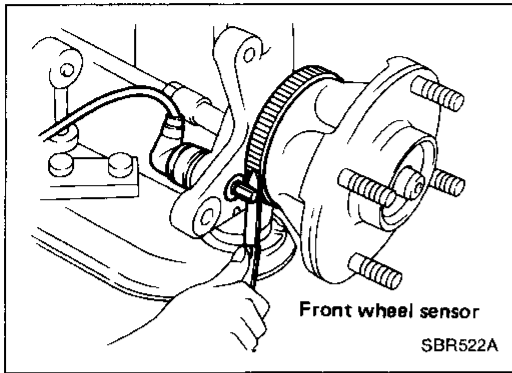


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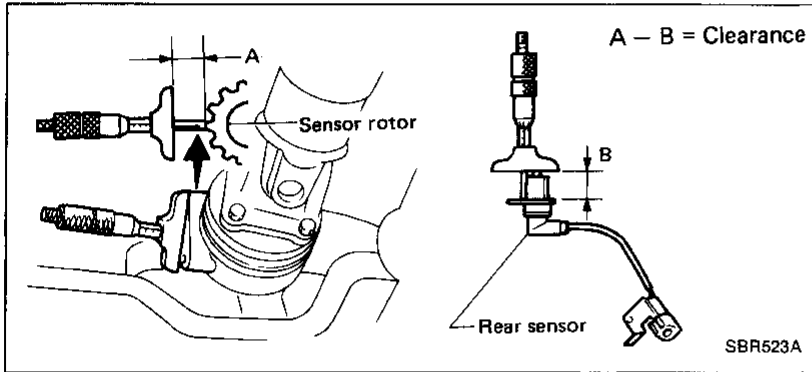
# TROUBLE DIAGNOSES

## Preliminary Check 2

CHECK



CHECK



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:

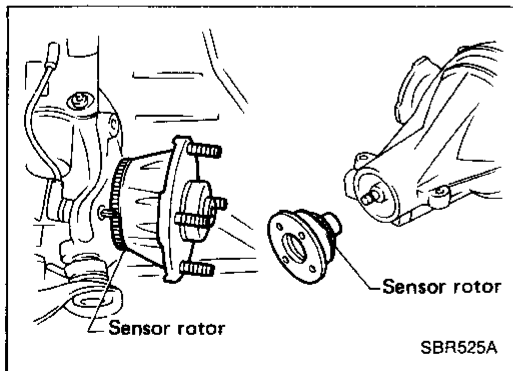
- Dust, foreign materials, etc., at fastening portion
- Improper installation
- Breakage

O.K.

O.K.

N.G.

CHECK



N.G.

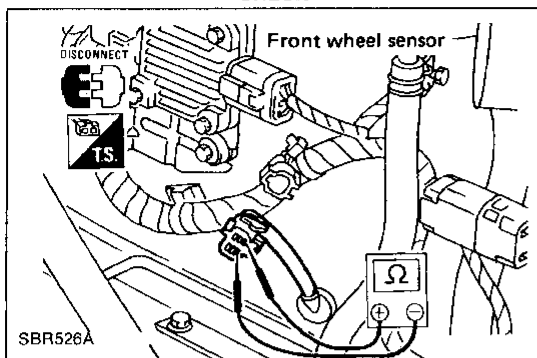
Replace sensor rotor with wheel hub or companion flange as a set.

Repair or replace malfunctioning sensor.

Check sensor rotor for teeth damage.

## Preliminary Check 3, 4

### Preliminary Check 3 CHECK

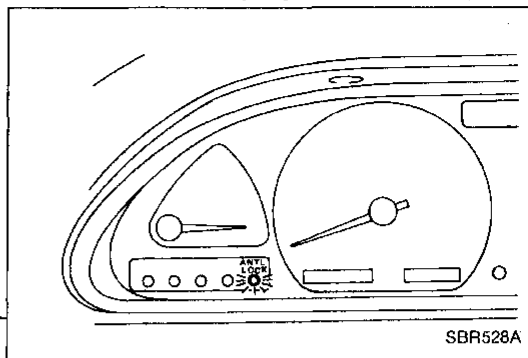


Measure each sensor resistance.  
0.8 - 12 kΩ

N.G. → Replace.

O.K. →

### Preliminary Check 4 CHECK



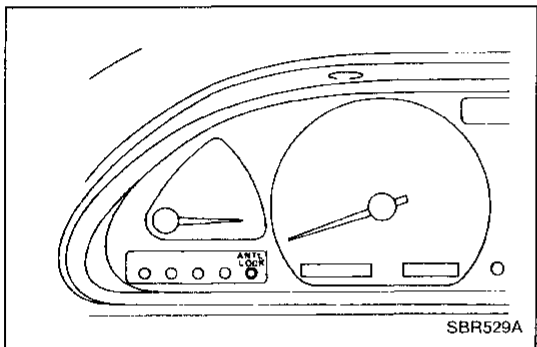
Check warning lamp activation.  
When ignition switch is turned on, warning lamp turns on.

O.K. →

N.G. ↓

Check fuse.  
Check bulb condition and remedy.  
**CHECK**

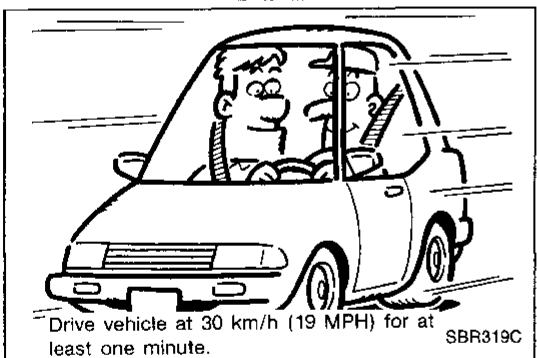
### CHECK



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

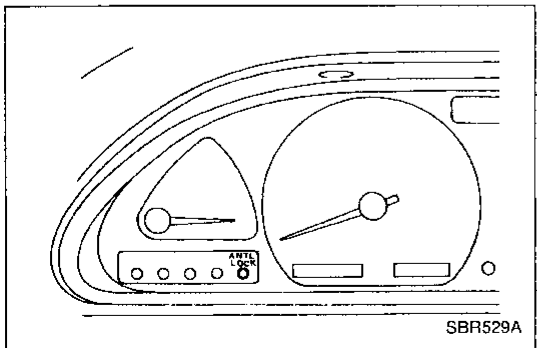
↓ O.K.

### DRIVE



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

### CHECK

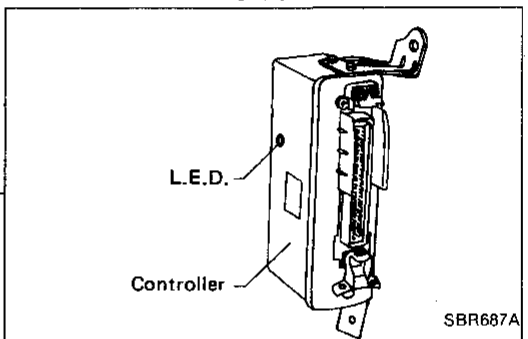


Ensure warning lamp remains off while driving.

N.G. →

O.K. →

If Preliminary Check 2 is not performed and there is abnormal ABS operation, perform Preliminary Check 2.



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

Go to Self-diagnosis.  
(See next page.)

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# TROUBLE DIAGNOSES

## Self-diagnosis

### CHECKING THE NUMBER OF L.E.D. FLASHES

When a problem occurs in the ABS, 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.

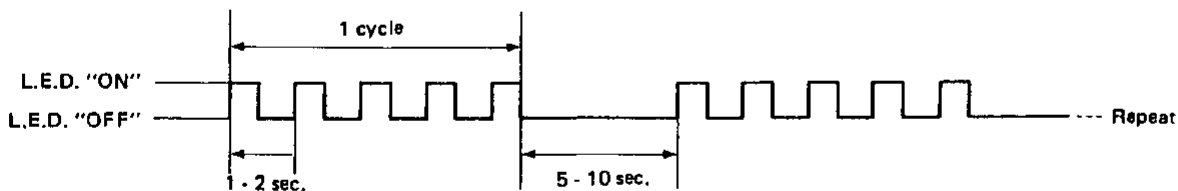
Both the warning light and the L.E.D. persistently activate, even after a malfunctioning part or unit has been repaired, unless the ignition switch is turned "OFF". After repairs, turn the ignition switch "OFF". Then start the engine and drive the vehicle over 30 km/h (19 MPH) for at least one minute 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 parts or circuit
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

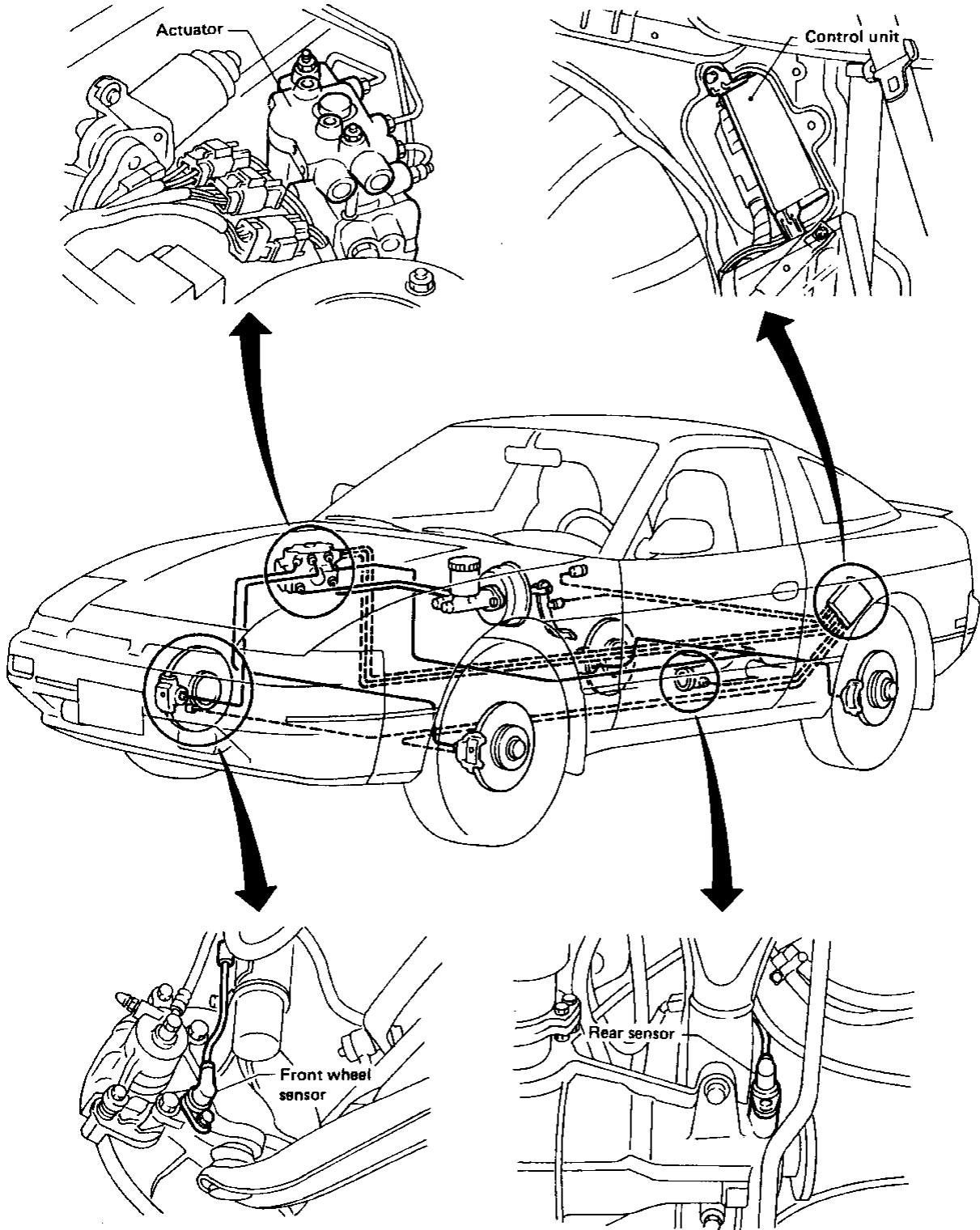
Improper operation of left front rotor sensor circuit



SBR531A

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

Component Parts Location



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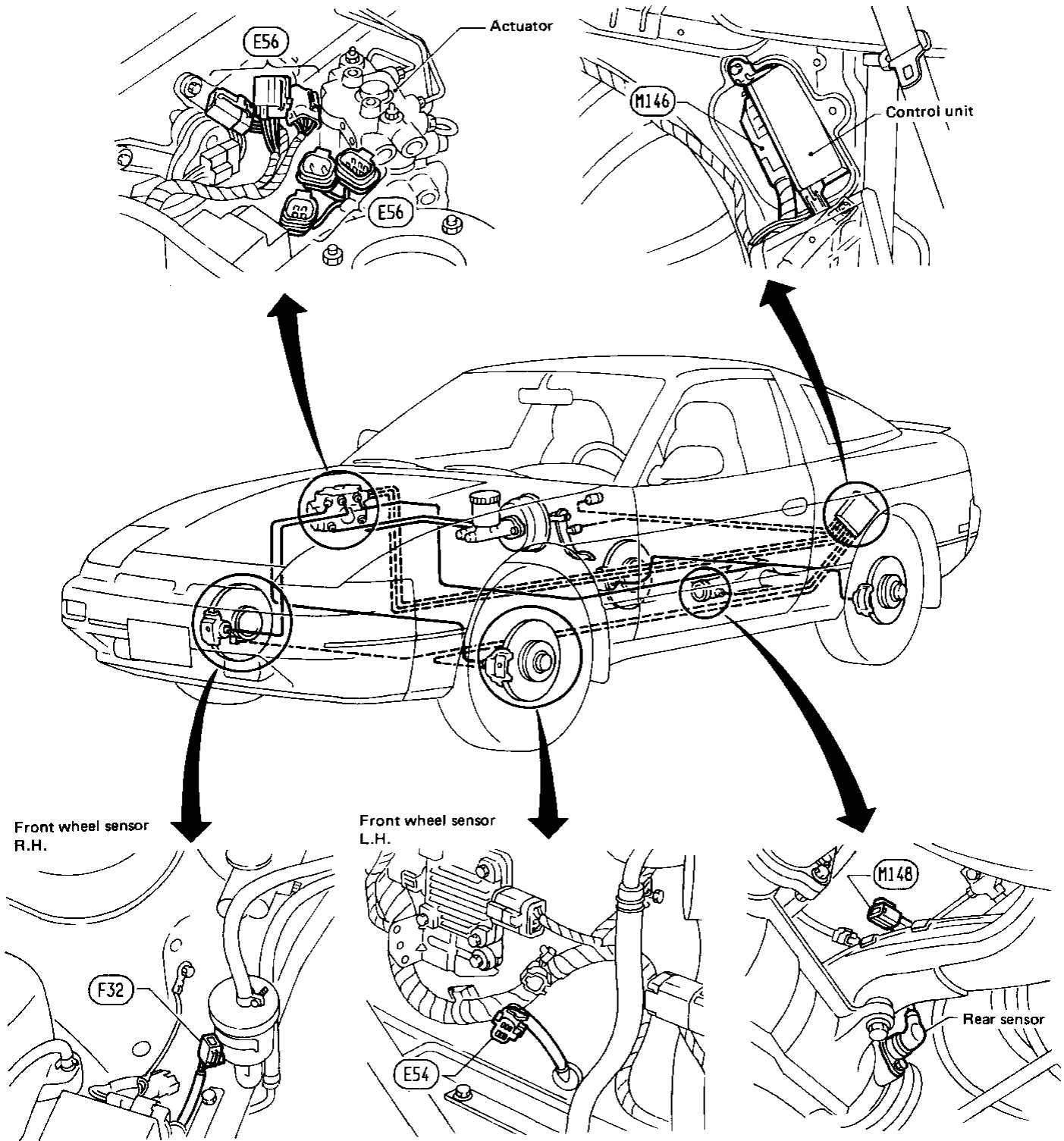
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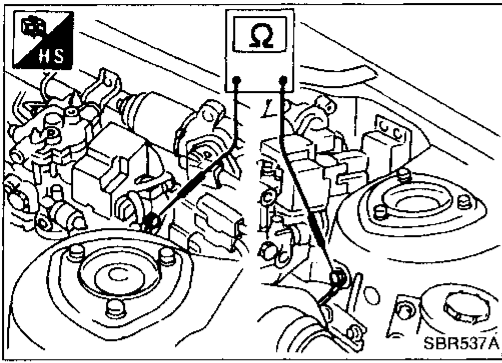
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# TROUBLE DIAGNOSES

## Harness Connector Location







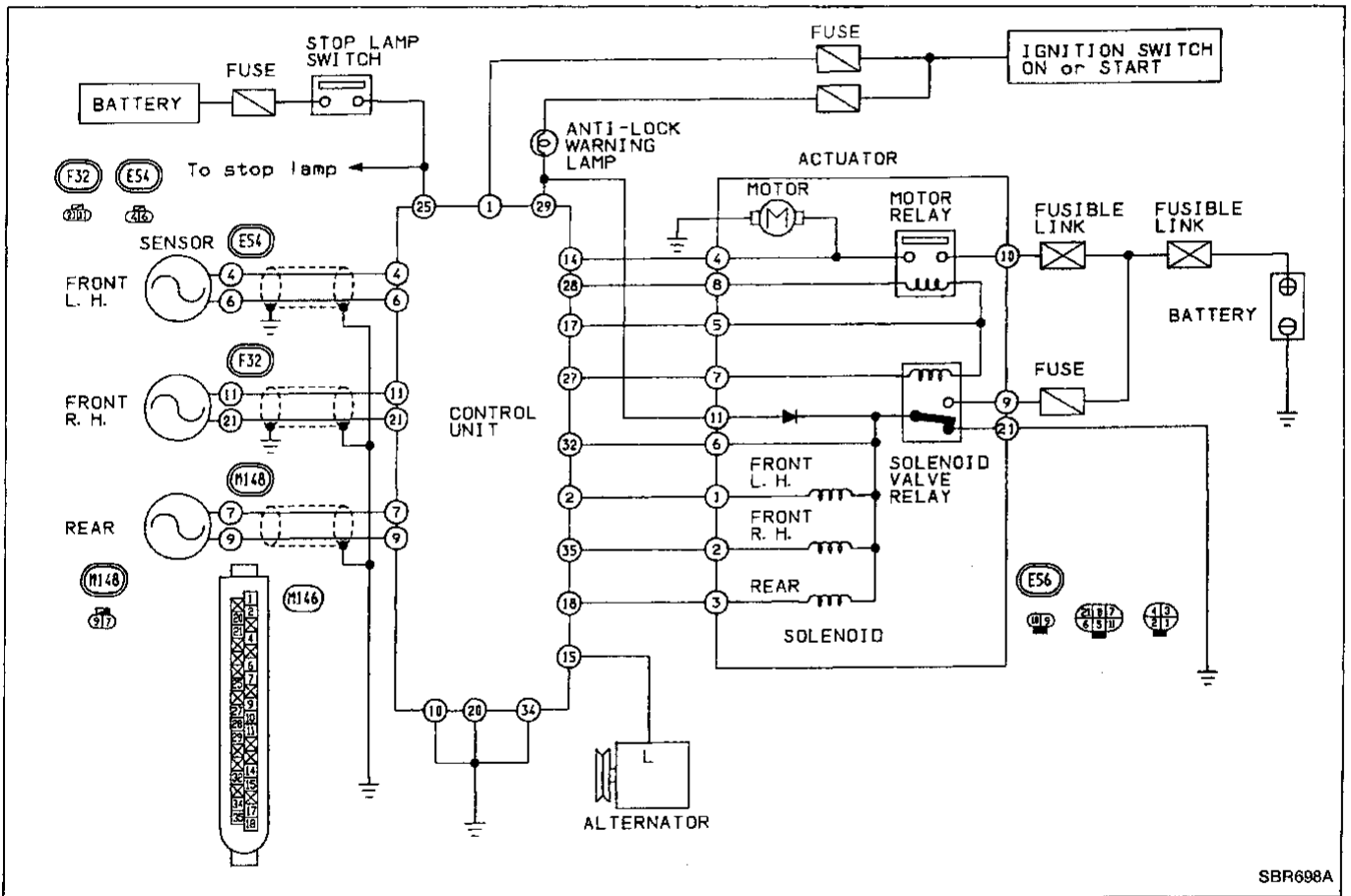
## Ground Circuit Check

### ACTUATOR MOTOR GROUND

- Check resistance between both terminals.  
**Resistance: 0Ω**

## Circuit Diagram for Quick Pinpoint Check

- The unit side connectors with a double circle "○" are connected to the harness side connectors shown in the "Harness Connector Location". (See page BR-32.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".



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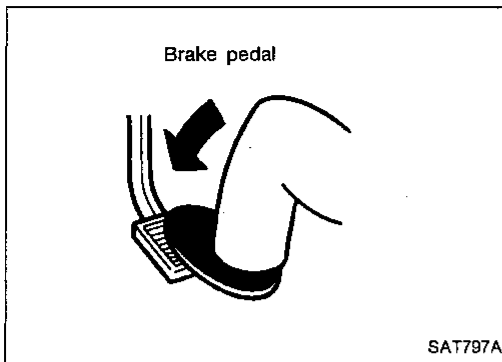
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# TROUBLE DIAGNOSES

## Diagnostic Procedure 1

### SYMPTOM: Pedal vibration and noise

Refer to worksheet result.



Check whether the symptom appears only when brake is applied suddenly.

Yes → When brake is normally applied, ABS works and produces pedal vibration or noise.

No ↓

Check whether the symptom appears only when engine is started.

Yes → Refer to Preliminary Check 4 result.

No ↓



Check whether the symptom appears only when the vehicle speed is within 10 km/h (6 MPH) after starting engine.

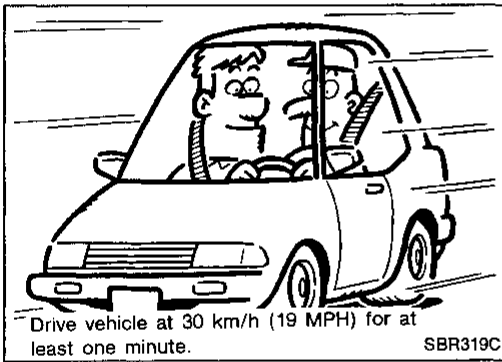
Yes → Check whether the symptom disappears within 5 seconds.

No ↓

No → (A)

Yes ↓

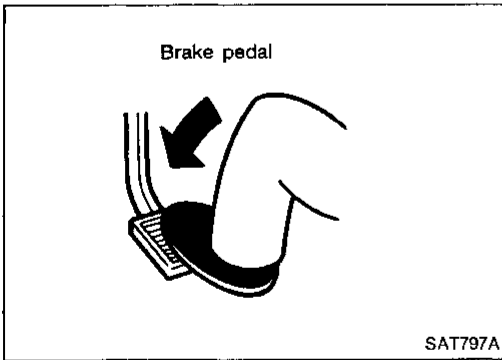
ABS may sometimes operate when load is high and voltage is low due to insufficient alternator output.



Check whether the symptom appears while the vehicle is being driven.

No → (A)

Yes ↓



Check whether the symptom appears when brake is applied gradually.

No (Appears when brake is not applied.)

Yes ↓

Check if there are any conditions, among those listed below, when symptom appears.

- Shifting
- Operating clutch
- Passing protrusion

No → (B)

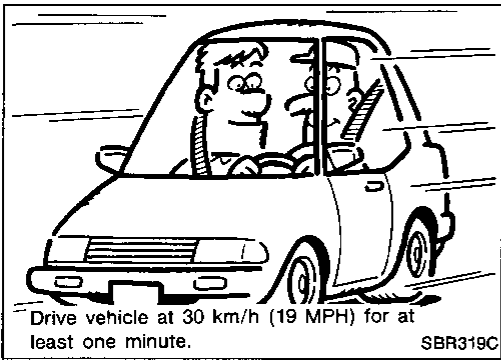
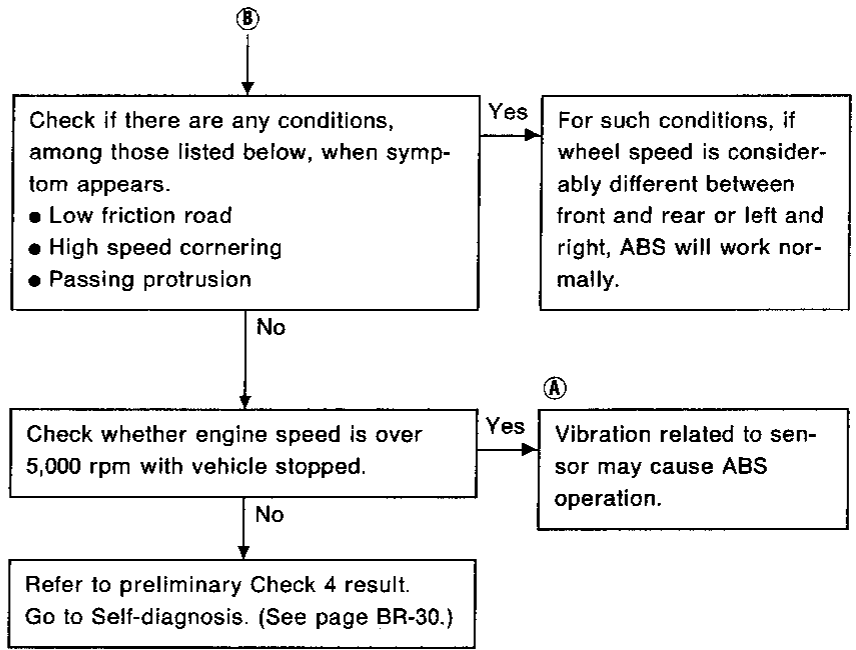
Yes ↓

Under these conditions individual wheel speed can change suddenly. This may sometimes cause the A.B.S. to operate.

(B)

# TROUBLE DIAGNOSES

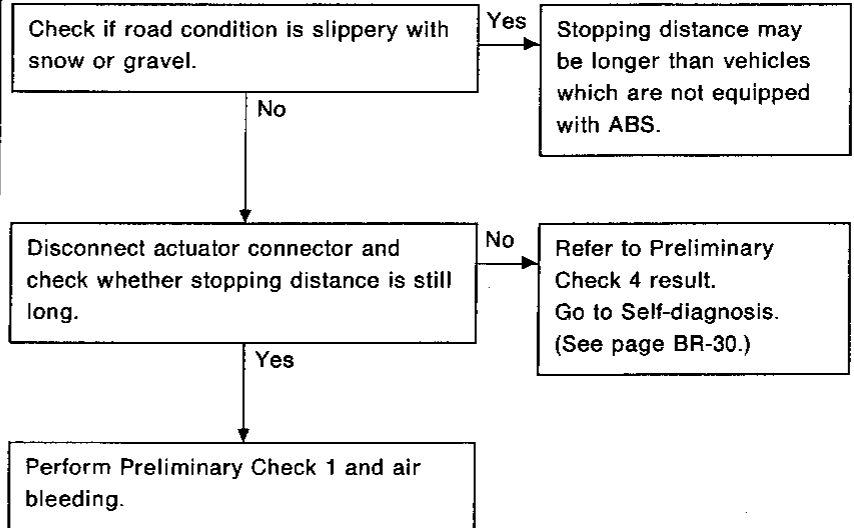
## Diagnostic Procedure 1 (Cont'd)



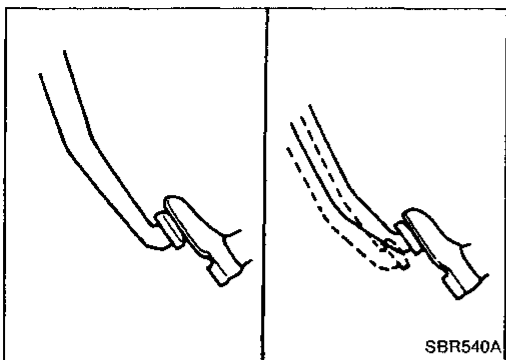
## Diagnostic Procedure 2

**SYMPTOM: Long stopping distance**

Refer to worksheet results.



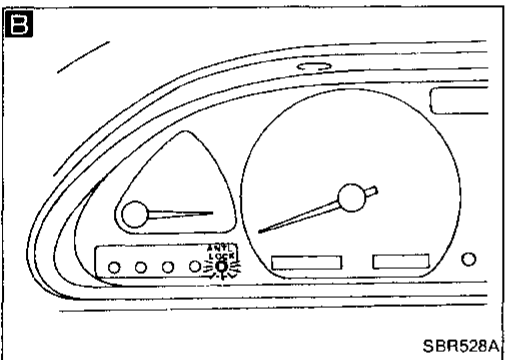
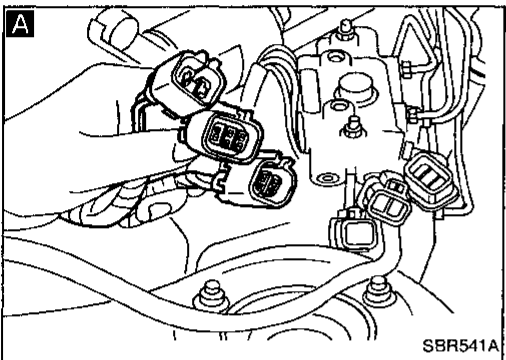
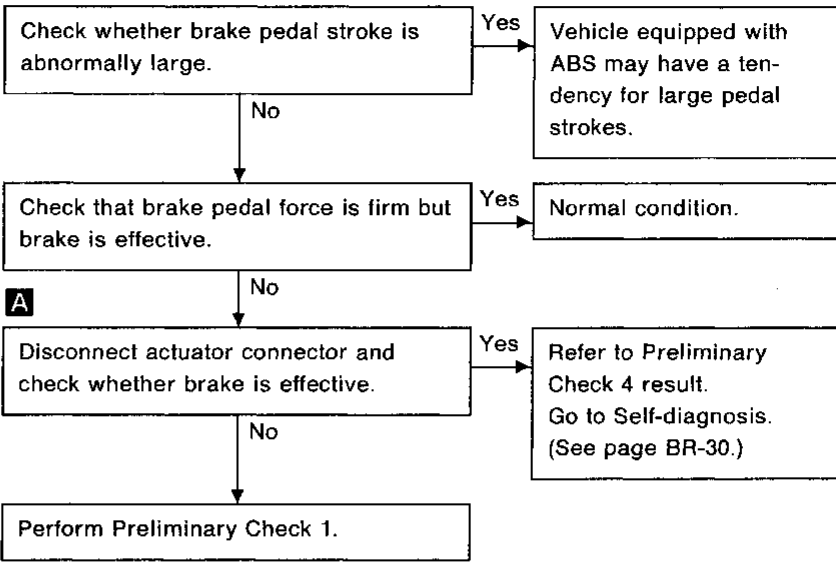
GI  
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## Diagnostic Procedure 3

**SYMPTOM: Abnormal pedal action**

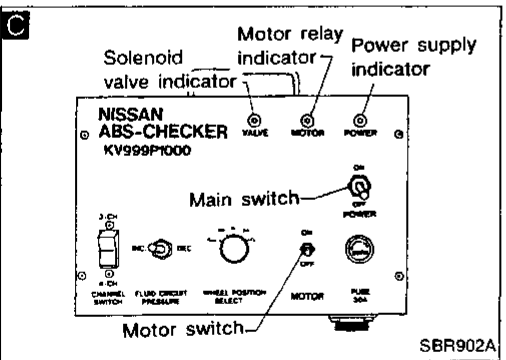
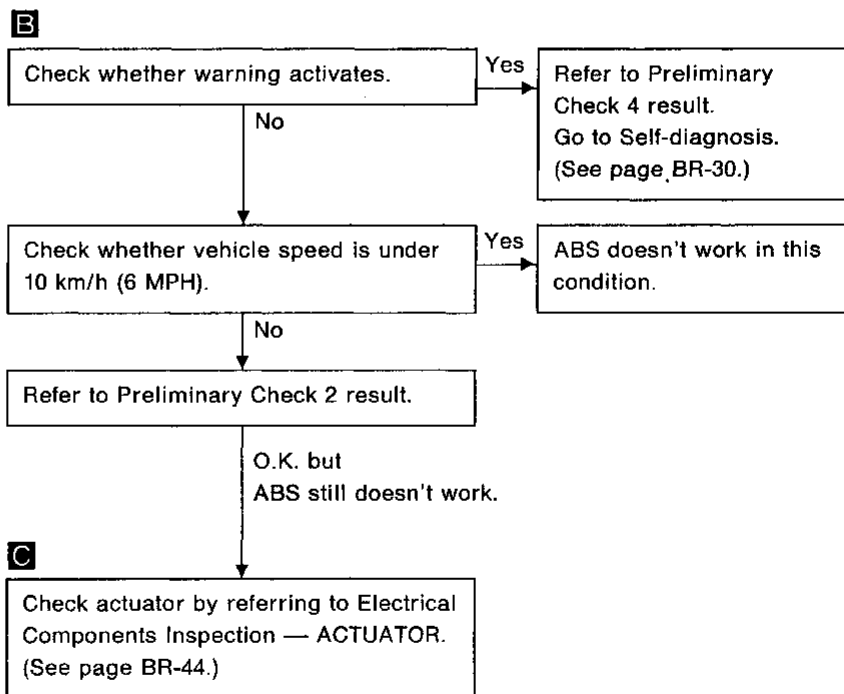
Refer to worksheet results.



## Diagnostic Procedure 4

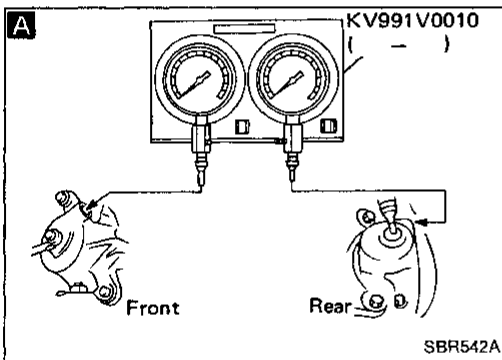
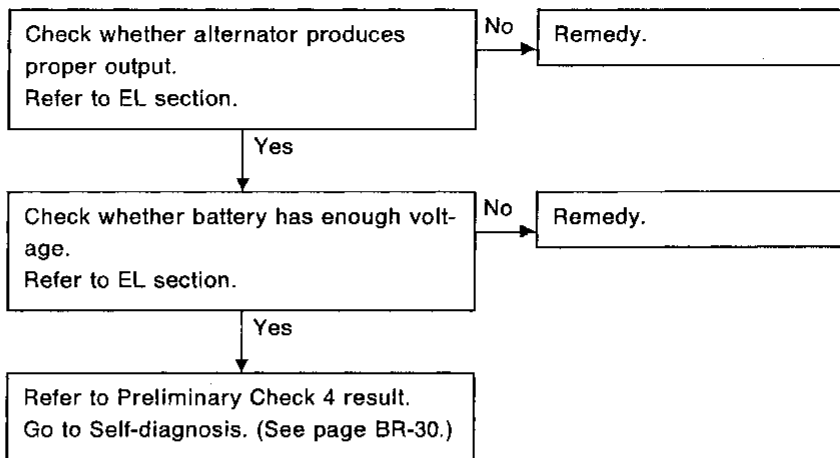
**SYMPTOM: ABS doesn't work.**

Refer to worksheet results.



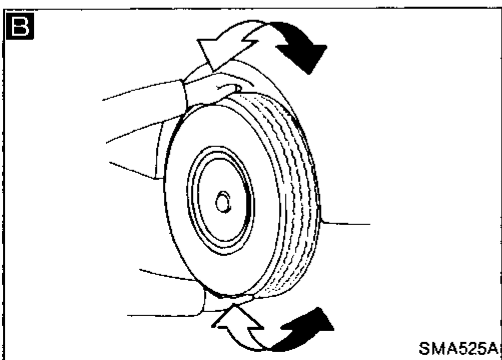
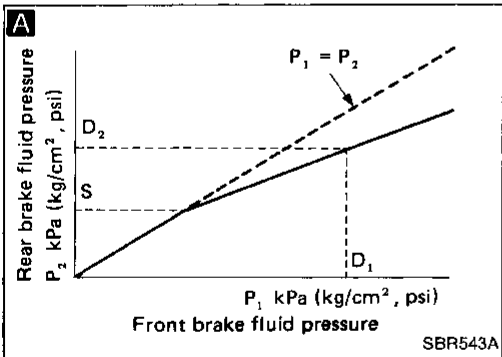
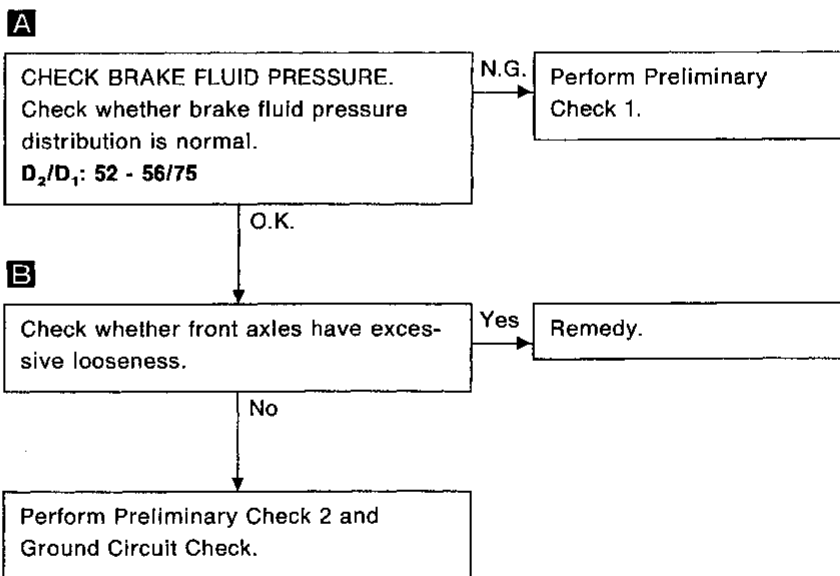
**Diagnostic Procedure 5**

**SYMPTOM: ABS works but warning activates.**



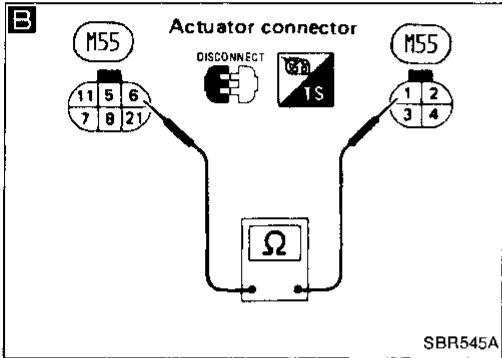
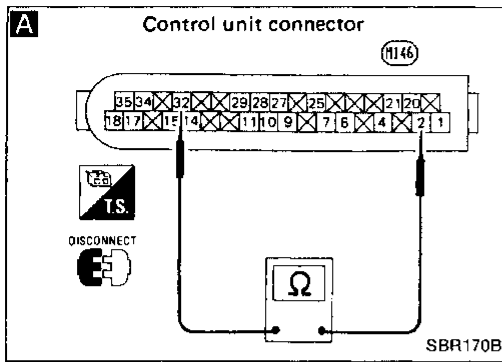
**Diagnostic Procedure 6**

**SYMPTOM: ABS works frequently.**



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# TROUBLE DIAGNOSES



## Diagnostic Procedure 7

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

**INSPECTION START**  
Remove battery negative terminal connector.

**A**

**CHECK SOLENOID VALVE RESISTANCE.**  
Disconnect control unit connector.  
Check resistance between control unit connector (vehicle side) terminals.  
Flashing number 1:  
Terminals ⑫ and ②  
Flashing number 2:  
Terminals ⑫ and ⑩  
Flashing number 3 or 4:  
Terminals ⑫ and ⑱  
**Resistance: 0.7 - 1.6Ω**

O.K. → Replace control unit.

N.G.

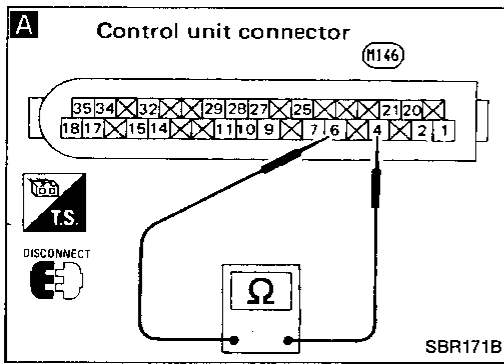
**B**

Disconnect actuator connector.  
Check resistance between actuator connector (actuator side) terminals.  
Flashing number 1:  
Terminals ⑥ and ①  
Flashing number 2:  
Terminals ⑥ and ②  
Flashing number 3 or 4:  
Terminals ⑥ and ③  
**Resistance: 0.7 - 1.6Ω**

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

N.G.

Replace actuator.



**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 ⑰  
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.

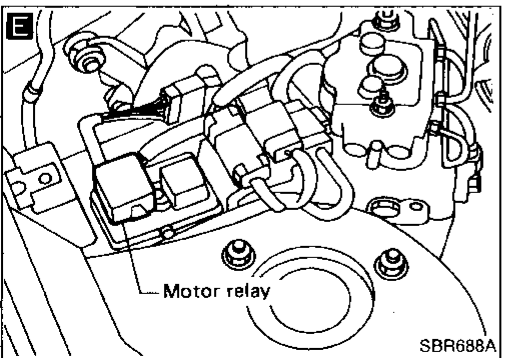
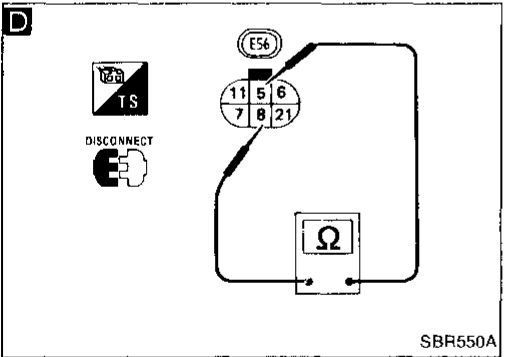
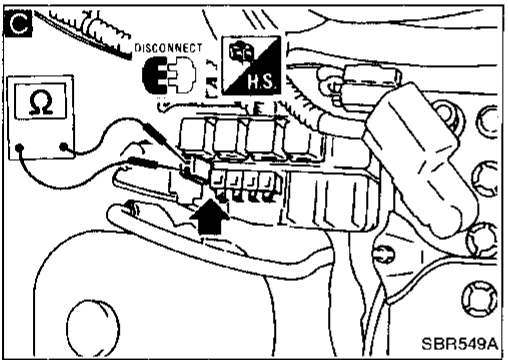
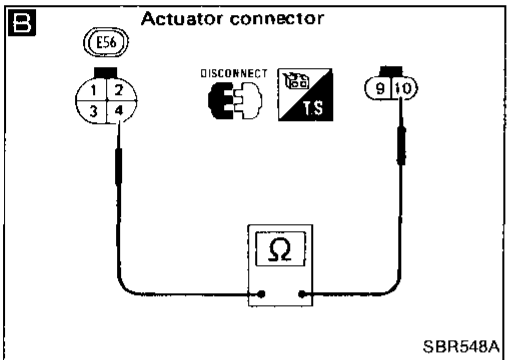
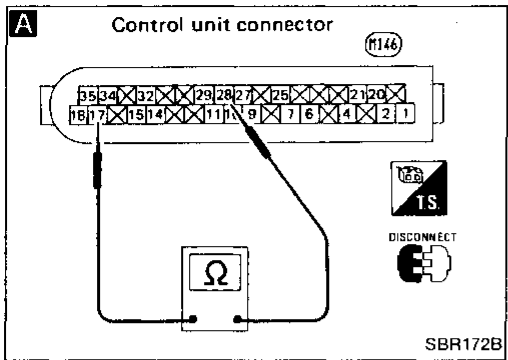
N.G. → Replace sensor.

O.K. → Repair harness between sensor connector and control unit connector.

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## 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 ⑳.  
**Resistance: 45 - 55Ω**

**D**  
Disconnect actuator connector.  
Check resistance between actuator connector (actuator side) terminals ⑧ and ⑤.  
**Resistance: 45 - 55Ω**

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

**E**  
Repair harness between actuator and control unit.

**E**  
Replace motor relay.

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

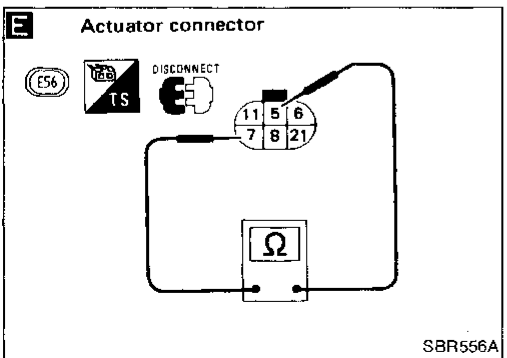
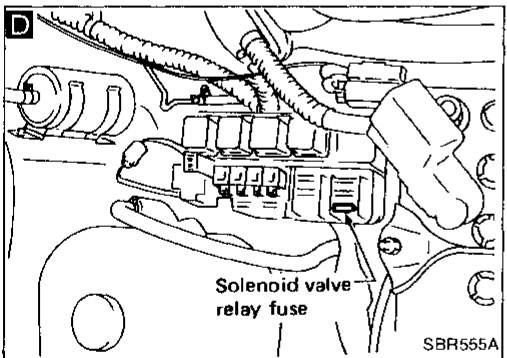
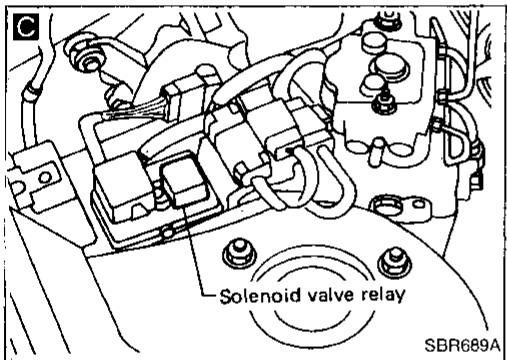
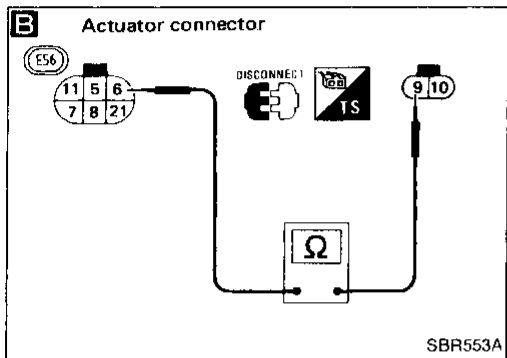
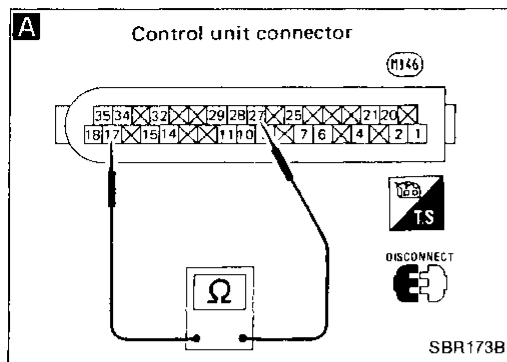
**Replace fusible link.**

**Perform Electrical Components Inspection — ACTUATOR.** (See page BR-44.)

**Replace control unit.**

**Replace actuator.**

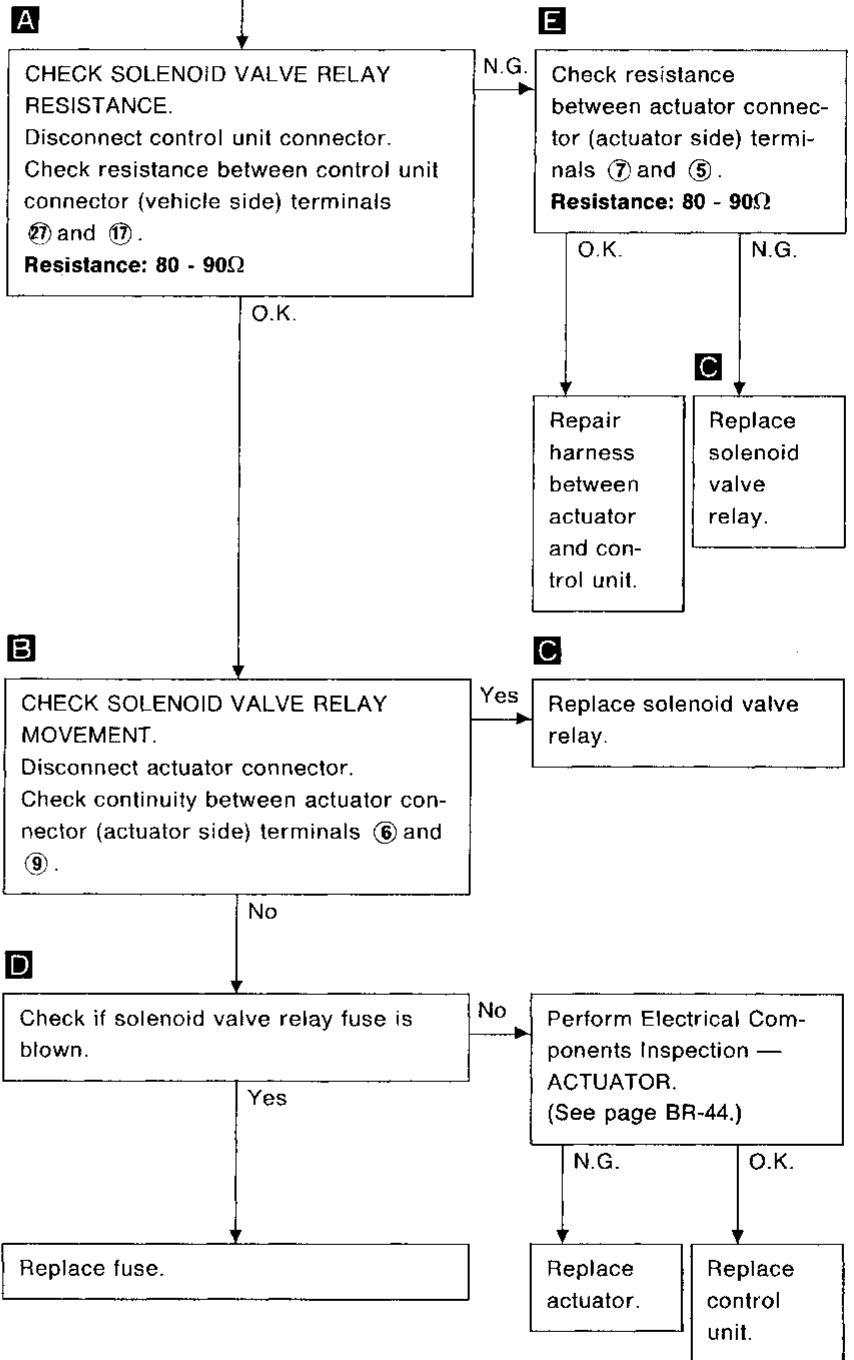




## Diagnostic Procedure 10

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

**INSPECTION START**  
Remove battery negative terminal connector.



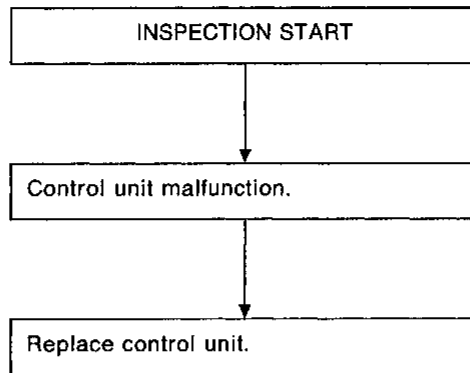
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# TROUBLE DIAGNOSES

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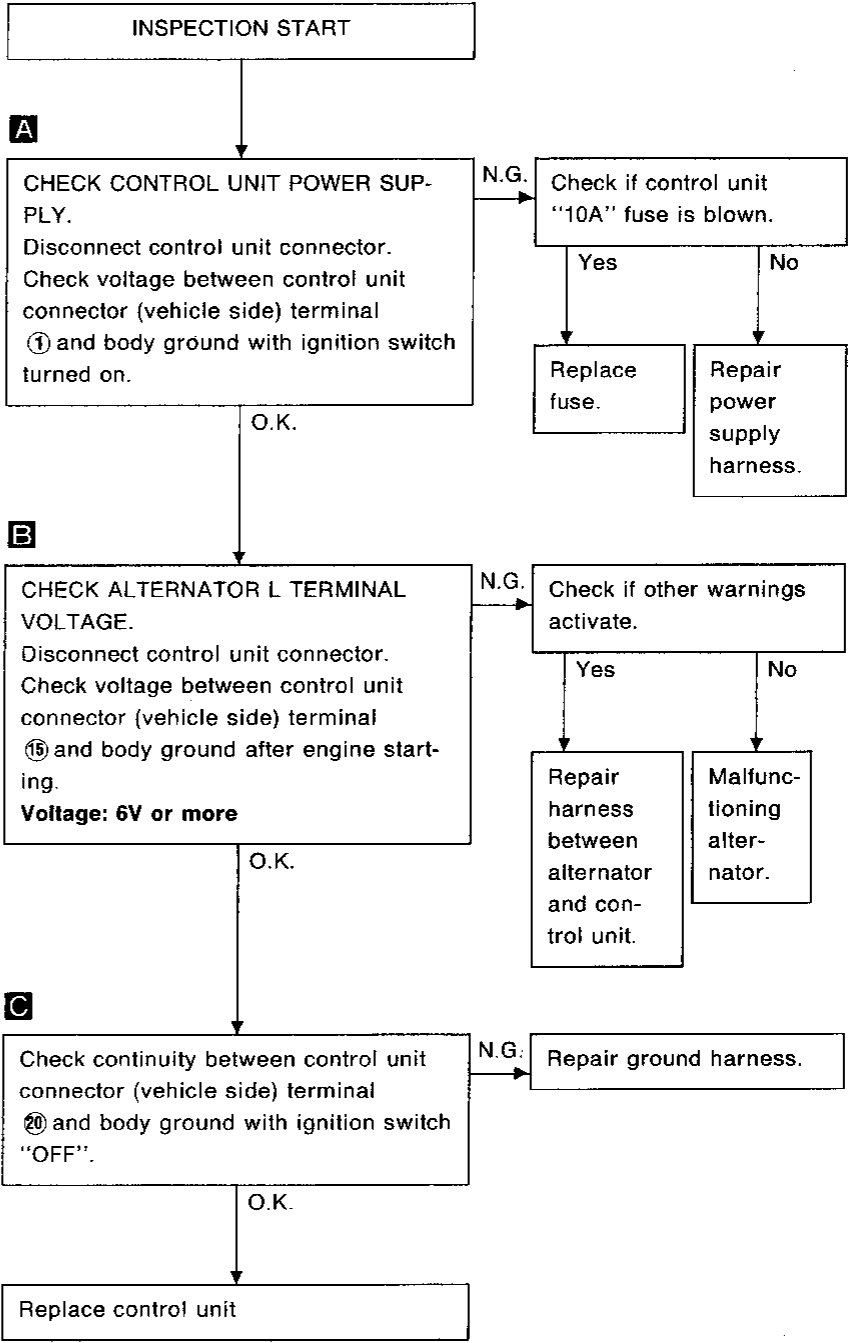
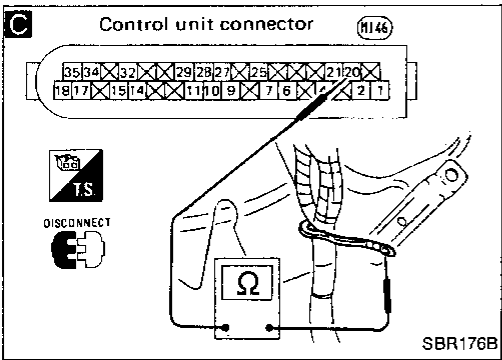
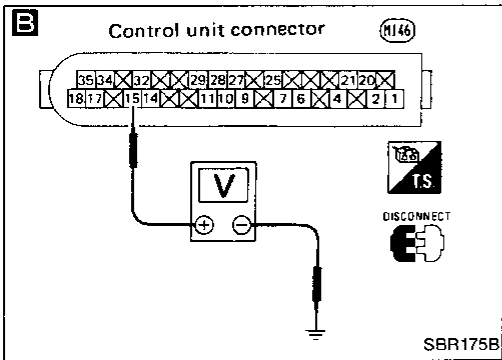
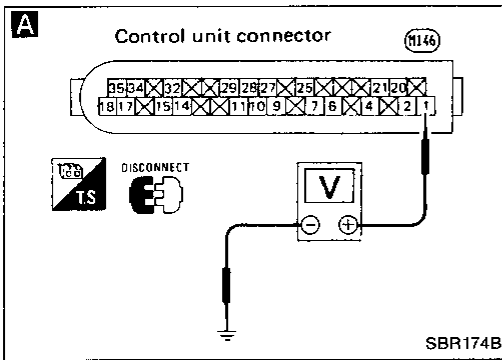
## Diagnostic Procedure 11

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



**Diagnostic Procedure 12**

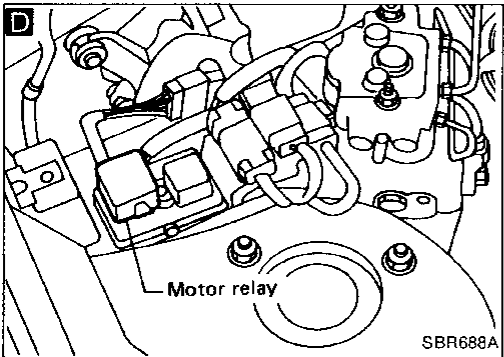
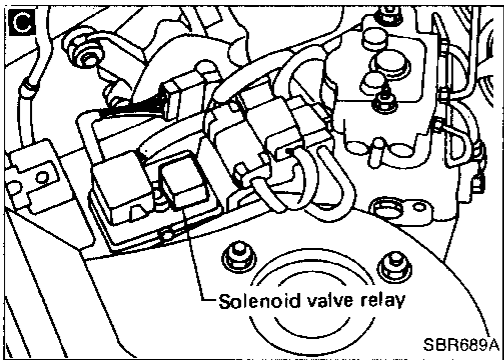
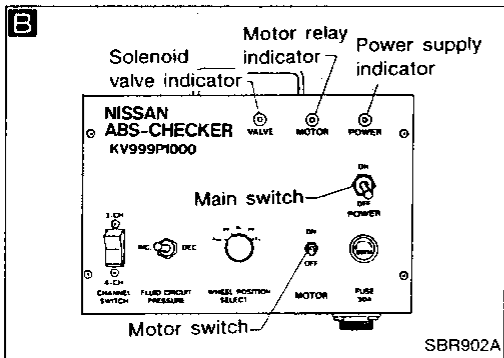
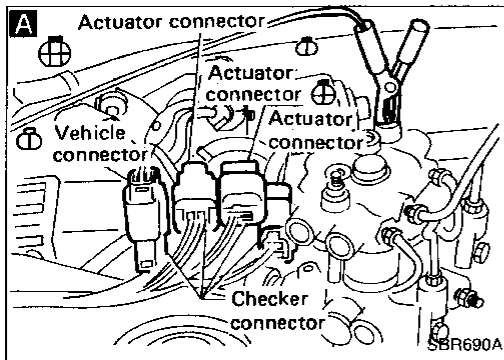
**CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but L.E.D. comes off.)**



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## Electrical Components Inspection

### ACTUATOR (Not self-diagnostic item)



INSPECTION START

**A**  
Connect ABS checker to actuator connector and vehicle harness with battery terminal connected and all checker switches turned off.  
Use harness for 3 channel.  
Set channel select switch to 3 channel.

**B**  
Turn checker main switch on.  
Check power supply indicator for coming on.

No → Replace battery with fully charged new one, if checker connection is correct.

**B**  
Check checker valve relay indicator for coming on.

No → Replace solenoid valve relay, if checker connection is correct.

**B** step **A**  
Select one valve — FL, FR or RR (valves corresponding to each wheel position).  
Select brake circuit pressure decreasing position by switch then turn motor switch on.  
Select pressure increasing position.

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

No → Replace motor relay, if checker connection is correct.

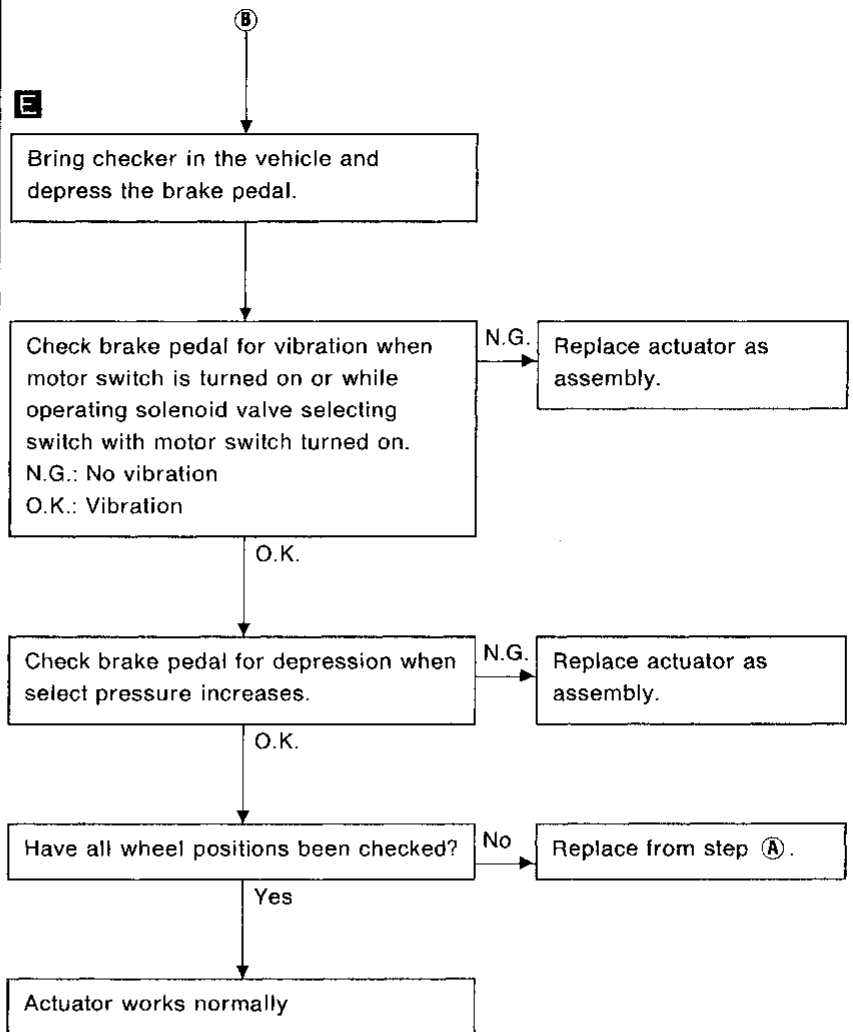
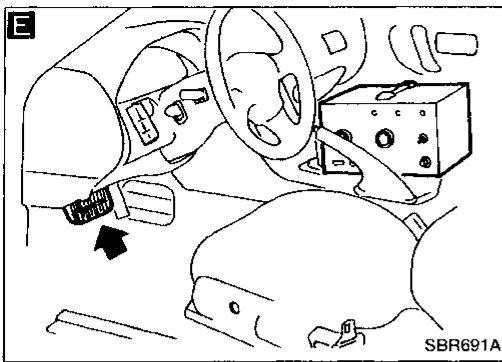
Check motor for operational sound beside the actuator in a quiet place.

No → Replace actuator as assembly, if Diagnostic Procedures 7 - 12 are already performed and checker connection is correct.

⑧

# TROUBLE DIAGNOSES

## Electrical Components Inspection (Cont'd)



### CAUTION:

Do not set checker at pressure decrease position for more than 5 seconds at a time. Actuator solenoid valve may be damaged.

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

## General Specifications

	Without ABS	With ABS
<b>Front brake</b>		
Brake model	CL22VB	CL25VA
Cylinder bore diameter mm (in)	54.0 (2.126)	57.2 (2.252)
Pad length x width x thickness mm (in)	112.8 x 44.8 x 10.0 (4.44 x 1.764 x 0.394)	125.6 x 45.3 x 11.0 (4.94 x 1.783 x 0.433)
Rotor outer diameter x thickness mm (in)	252 x 20 (9.92 x 0.79)	257 x 22 (10.12 x 0.87)
<b>Rear brake</b>		
Brake model	CL9H	
Cylinder bore diameter mm (in)	33.96 (1.3370)	
Pad length x width x thickness mm (in)	75.0 x 40.0 x 9.5 (2.953 x 1.575 x 0.374)	
Rotor outer diameter x thickness mm (in)	258 x 9 (10.16 x 0.35)	

	Without ABS	With ABS
<b>Master cylinder</b>		
Cylinder bore diameter mm (in)	22.22 (7/8)	23.81 (15/16)
<b>Control valve</b>		
Valve model	Proportioning valve (within master cylinder)	
Split point x reducing ratio kPa (kg/cm <sup>2</sup> , psi)	3,923 (40, 569) x 0.4	
<b>Brake booster</b>		
Booster model	M23	M195T
Diaphragm diameter mm (in)	230 (9.06)	Primary 205 (8.07) Secondary 180 (7.09)
<b>Brake fluid</b>		
Recommended brake fluid	DOT 3	

## Inspection and Adjustment

### DISC BRAKE

Brake model	CL22VB	CL25VA	CL9H
<b>Pad wear limit</b>			
Minimum thickness mm (in)	2.0 (0.079)		
<b>Rotor repair limit</b>			
Minimum thickness mm (in)	18.0 (0.709)	20.0 (0.787)	8.0 (0.315)
Maximum runout mm (in)	0.07 (0.0028)		

### BRAKE PEDAL

Free height mm (in)	
M/T	177 - 187 (6.97 - 7.36)
A/T	186 - 196 (7.32 - 7.72)
<b>Depressed height</b>	
[under force of 490 N (50 kg, 110 lb) with engine running]	
mm (in)	100 (3.94) or more
<b>Clearance between pedal stopper and threaded end of stop lamp and A.S.C.D. switches</b>	
mm (in)	0.3 - 1.0 (0.012 - 0.039)
<b>Pedal free play at clevis</b>	
mm (in)	1 - 3 (0.04 - 0.12)

### PARKING BRAKE

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