

BRAKE SYSTEM

SECTION **BR**

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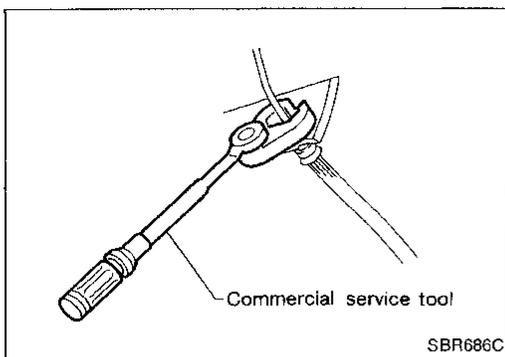
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When you read wiring diagrams:

- Read GI section, "HOW TO READ WIRING DIAGRAMS".
- See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

PRECAUTIONS AND PREPARATION



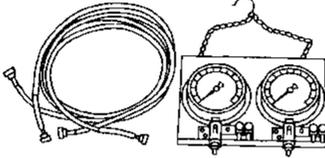
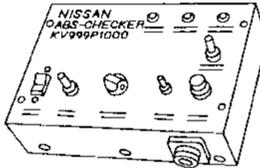
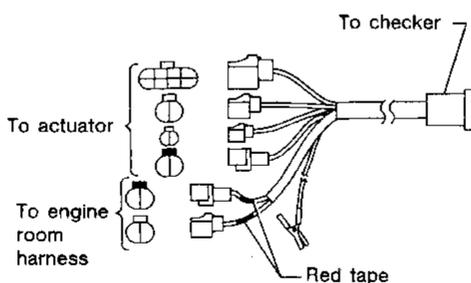
Precautions

- 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 the hydraulic system.
- Use flare nut wrench when removing and installing brake tube.
- Always torque brake lines when installing.

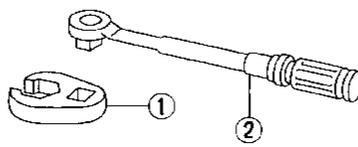
WARNING:

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

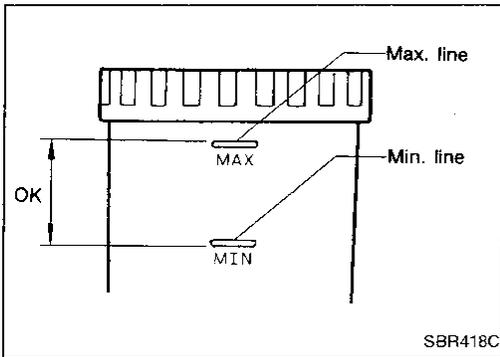
Special Service Tools

Tool number (Kent-Moore No.) Tool name	Description
KV991V0010 (—) Brake fluid pressure gauge	 Measuring brake fluid pressure NT151
KV999P1000 (—) ABS checker	 Checking ABS actuator operation NT165
KV999P1010 (—) ABS checker adapter harness	 Connecting ABS checker with actuator NT167

Commercial Service Tools

Tool name	Description
① Flare nut crows foot ② Torque wrench	 NT223

CHECK AND ADJUSTMENT



Checking Brake Fluid Level

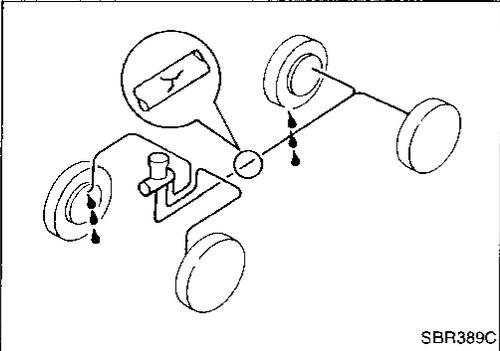
- Check fluid level in reservoir tank. It should be between Max. and Min. lines on reservoir tank.
- If fluid level is extremely low, check brake system for leaks.
- When brake warning lamp comes on even when parking brake lever is released, check brake system for leaks.

Checking Brake Line

CAUTION:

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

1. Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
2. Check for oil leakage by fully depressing brake pedal while engine is running.

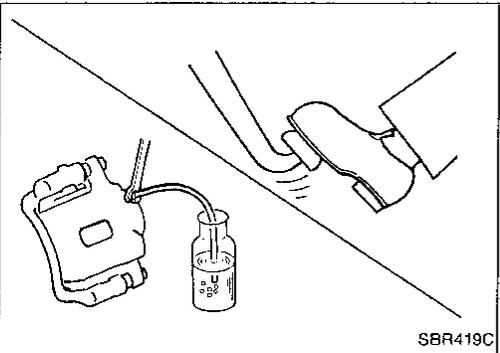


Changing Brake Fluid

CAUTION:

- Refill with new brake fluid "DOT 3".
- Always keep fluid level higher than minimum line on reservoir tank.
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.

1. Clean inside of reservoir tank, and refill with new brake fluid.
2. Connect a vinyl tube to each air bleeder valve.
3. Drain brake fluid from each air bleeder valve by depressing brake pedal.
4. Refill until brake fluid comes out of each air bleeder valve. Use same procedure as in bleeding hydraulic system to refill brake fluid. Refer to "Bleeding Brake System" (BR-5).



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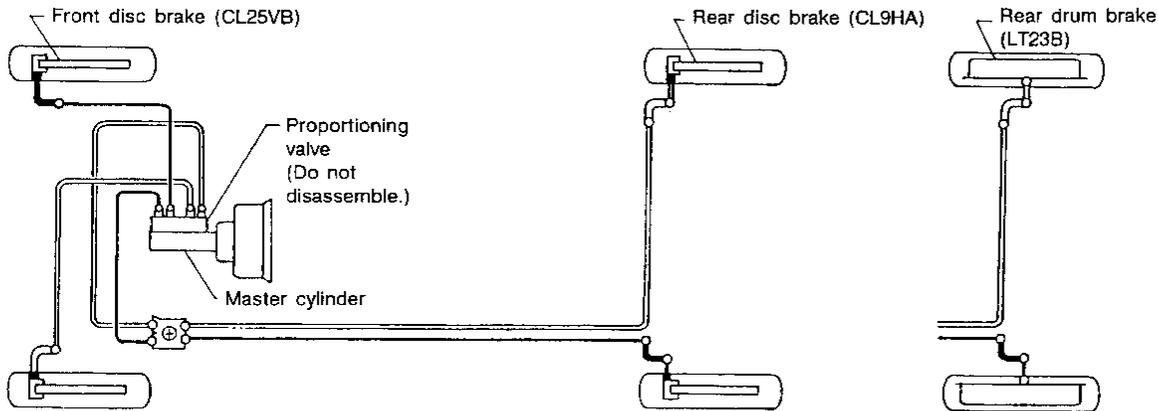
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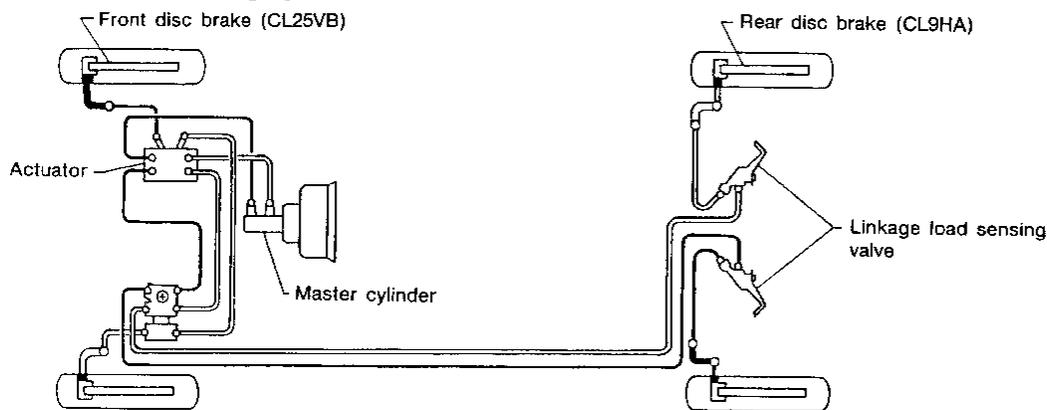
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BRAKE HYDRAULIC LINE

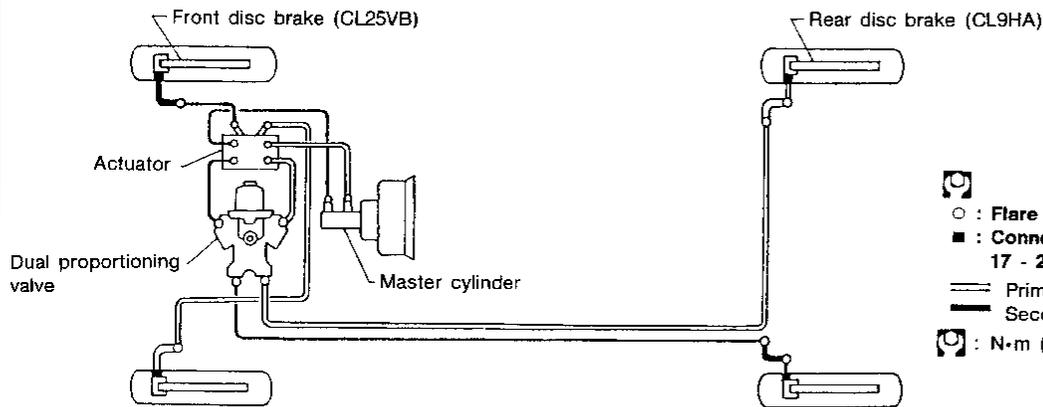
Without anti-lock braking system



With LSV anti-lock braking system

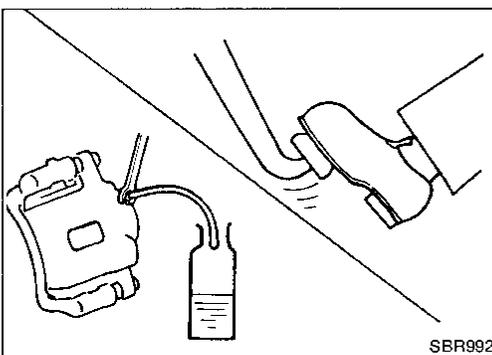


With DPV anti-lock braking system



-  : Flare nut 15 - 18 (1.5 - 1.8, 11 - 13)
-  : Connecting bolt 17 - 20 (1.7 - 2.0, 12 - 14)
-  : Primary line
-  : Secondary line
-  : N·m (kg·m, ft·lb)

SBR932AA



Removal

CAUTION:

- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.
 - All hoses must be free from excessive bending, twisting and pulling.
1. Connect vinyl tube to air bleeder valve.
 2. Drain brake fluid from each air bleeder valve by depressing brake pedal.

BRAKE HYDRAULIC LINE

Removal (Cont'd)

3. Remove flare nut connecting brake tube and hose, then withdraw lock spring.
4. Cover openings to prevent entrance of dirt whenever disconnecting brake lines.

Inspection

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

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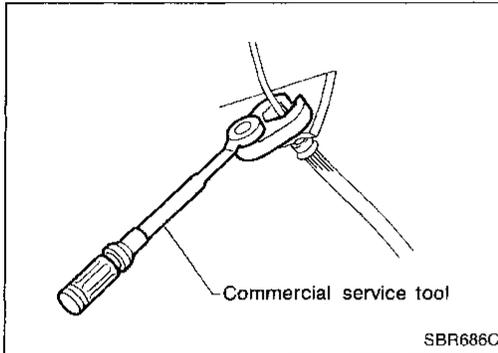
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Installation

CAUTION:

- Refill with new brake fluid "DOT 3".
 - Never reuse drained brake fluid.
1. Tighten all flare nuts and connecting bolts.

Specification:

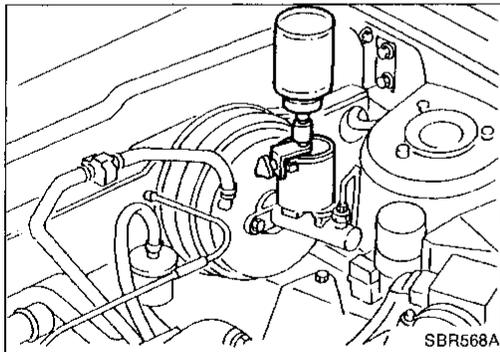
Flare nut

15 - 18 N·m (1.5 - 1.8 kg·m, 11 - 13 ft·lb)

Connecting bolt

17 - 20 N·m (1.7 - 2.0 kg·m, 12 - 14 ft·lb)

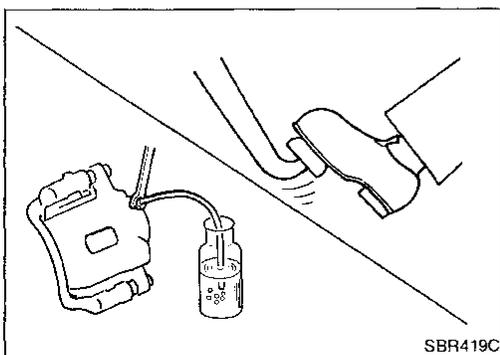
2. Refill until new brake fluid comes out of each air bleeder valve.
3. Bleed air. Refer to "Bleeding Procedure" (BR-5).



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.



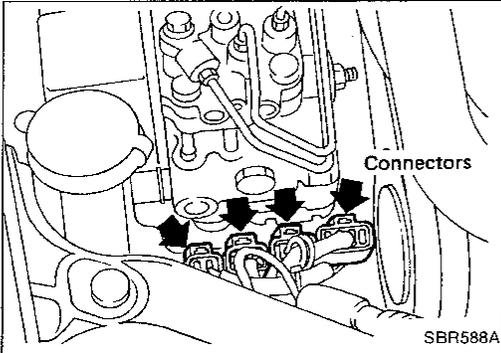
- Bleed air according to the following procedure.
Left rear wheel cylinder (or caliper) → Right front caliper → Right rear wheel cylinder (or caliper) → Left front caliper
- To bleed air out of lines, wheel cylinders and calipers, use the following procedure.

BRAKE HYDRAULIC LINE

Bleeding Procedure (Cont'd)

WITHOUT ANTI-LOCK BRAKING SYSTEM

- 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.

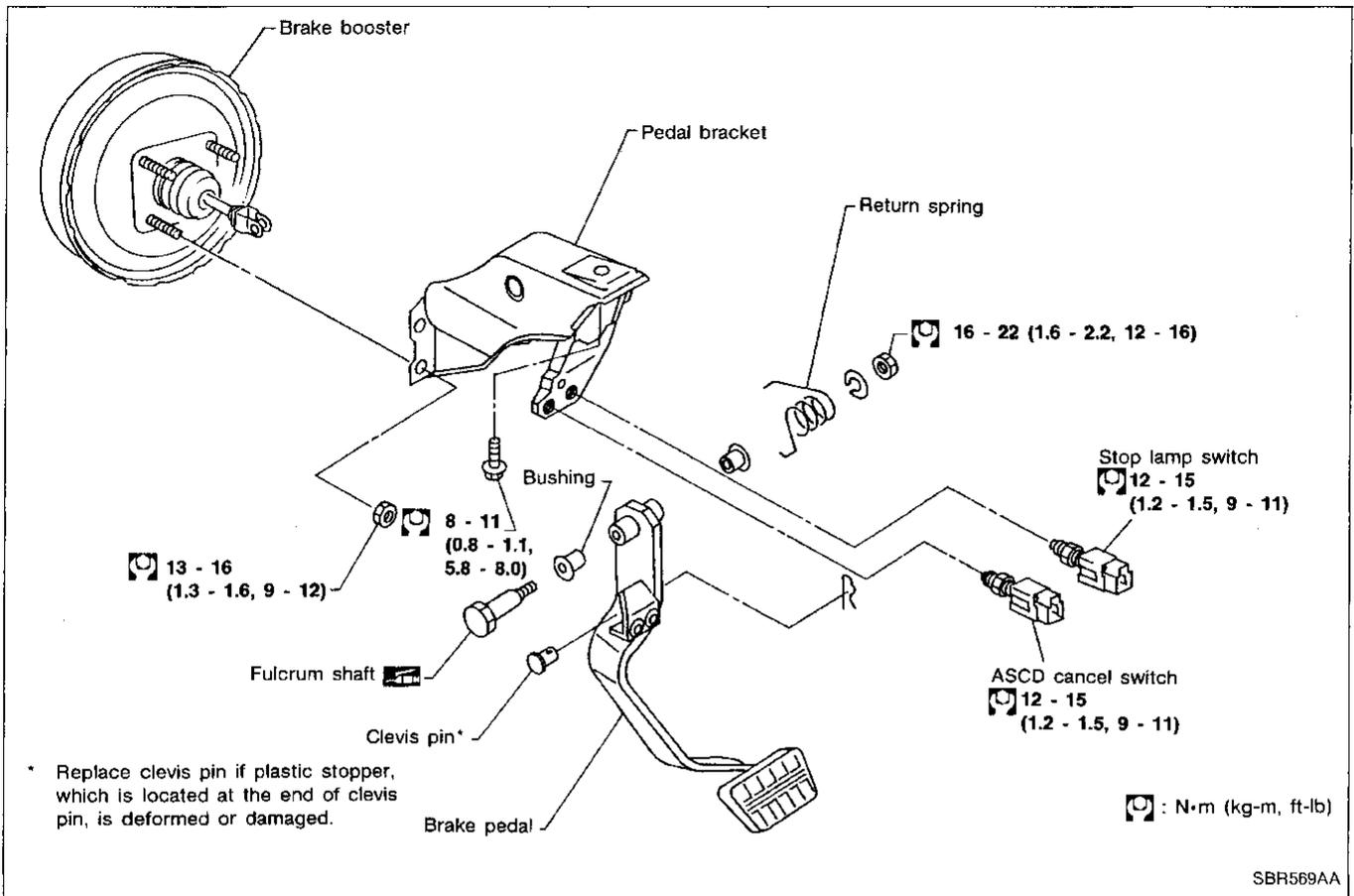


WITH ANTI-LOCK BRAKING SYSTEM

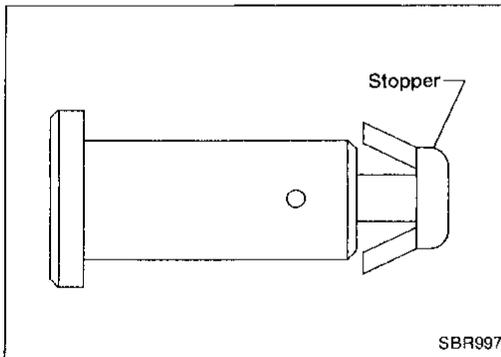
- 1) Turn ignition switch to "OFF" position, and then disconnect ABS actuator connectors.
- 2) Connect a transparent vinyl tube to air bleeder valve.
- 3) Fully depress brake pedal several times.
- 4) With brake pedal depressed, open air bleeder valve to release air.
- 5) Close air bleeder valve.
- 6) Release brake pedal slowly.
- 7) Repeat steps 3) through 6) until clear brake fluid comes out of air bleeder valve.

BRAKE PEDAL AND BRACKET

Removal and Installation



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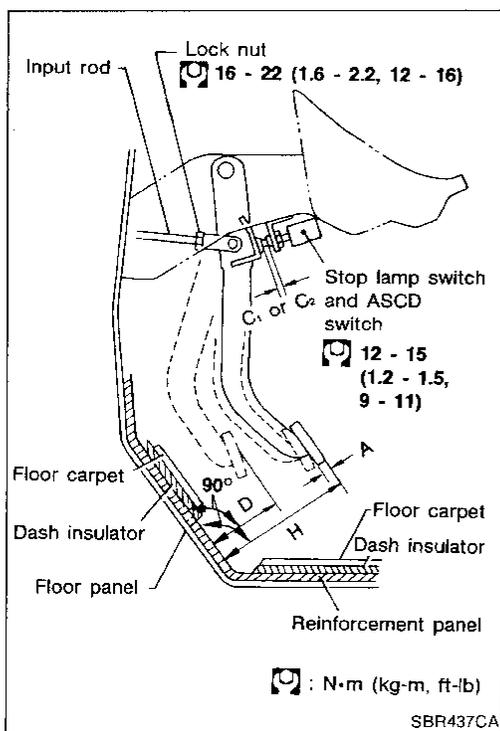


Inspection

Check brake pedal for following items.

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

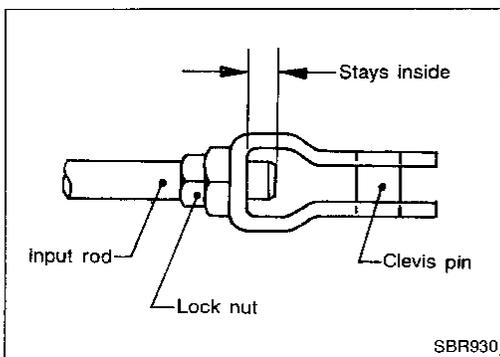
BRAKE PEDAL AND BRACKET



Pedal Adjustment

Check brake pedal free height from melt sheet. Adjust if necessary.

- H:** Free height
Refer to SDS (BR-54).
- D:** Depressed height
Refer to SDS (BR-54).
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 ASCD cancel switch
0.3 - 1.0 mm (0.012 - 0.039 in)
- A:** Pedal free play
1 - 3 mm (0.04 - 0.12 in)



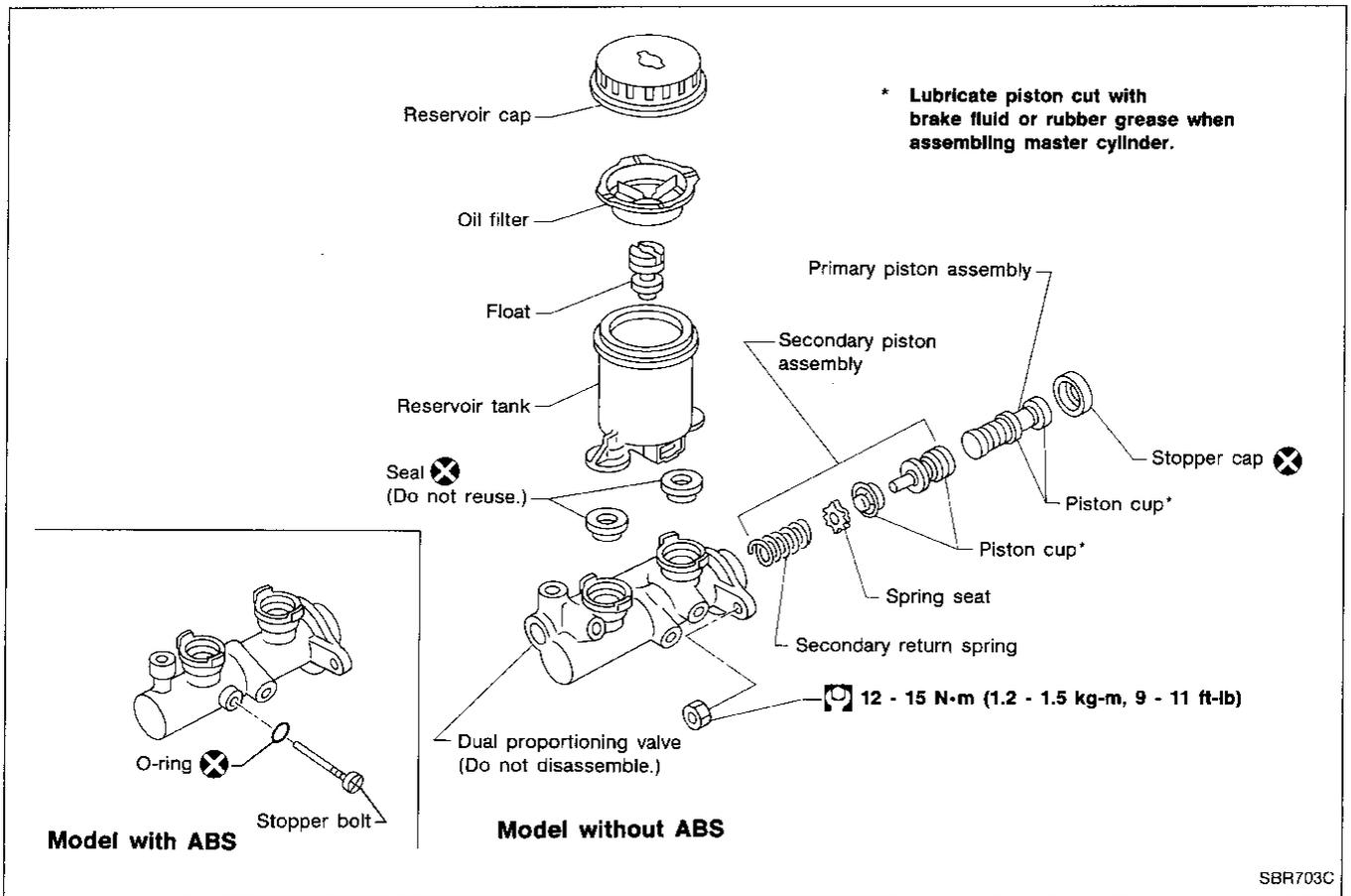
1. Adjust pedal free height with brake booster input rod. Then tighten lock nut.

Make sure that the tip of input rod stays inside.

2. Adjust clearance "C₁" and "C₂" with stop lamp switch and ASCD cancel 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 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 such as master cylinder, wheel cylinder, etc. Make the necessary repairs, if necessary.

MASTER CYLINDER



Removal

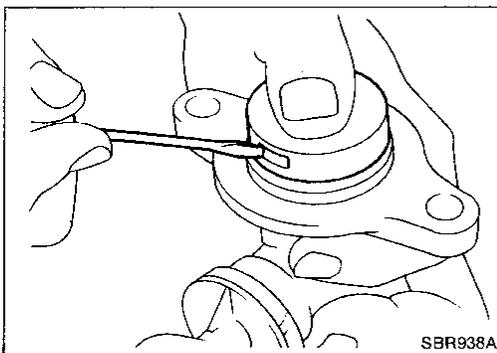
CAUTION:

- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.

1. Connect a vinyl tube to air bleeder valve.
2. Drain brake fluid from each air bleeder valve, depressing brake pedal to empty fluid from master cylinder.
3. Remove brake pipe flare nuts.
4. Remove master cylinder mounting nuts.

Disassembly

1. Bend claws of stopper cap outward.

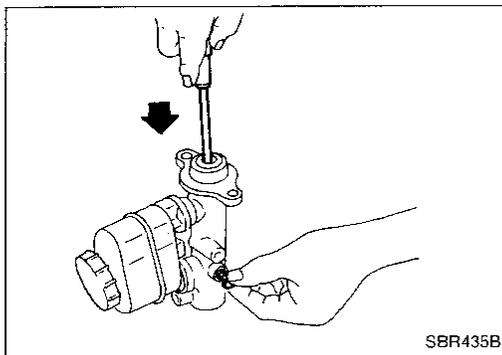


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MASTER CYLINDER

Disassembly (Cont'd)

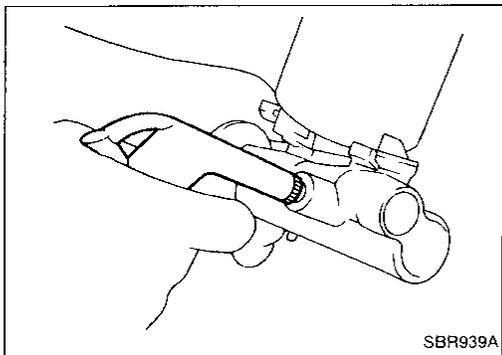
2. Remove stopper bolt while pushing piston into cylinder.



3. Remove piston assemblies.

If it is difficult to remove secondary piston assembly, gradually apply compressed air through fluid outlet.

4. Draw out reservoir tank.



Inspection

Check for the following items.

Replace any part if damaged.

Master cylinder:

- Pin holes or scratches on inner wall.

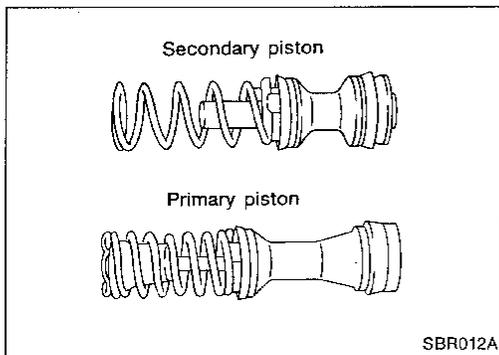
Piston:

- Deformation of or scratches on piston cups.

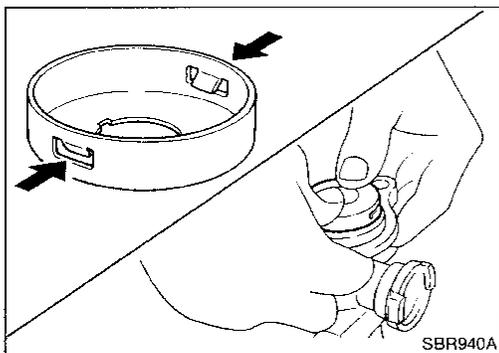
Assembly

Pay attention to direction of piston cups in figure at left. Also, insert pistons squarely to avoid scratches on cylinder bore.

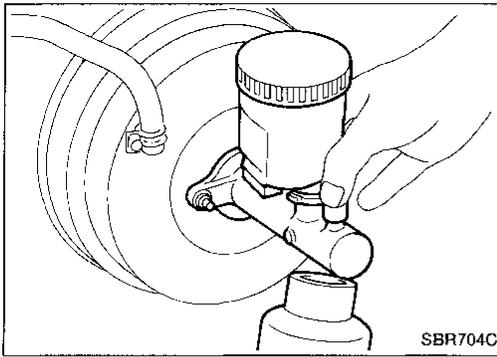
1. Lightly push pistons in and assemble valve stopper.



2. Bend claws inward.
3. Install stopper cap.
4. Install reservoir tank oil seals.
5. Push reservoir tank into master cylinder.



MASTER CYLINDER



Installation

CAUTION:

- Refill with new brake fluid "DOT 3".
- Never reuse drained brake fluid.

1. Place master cylinder onto brake booster and secure mounting nuts lightly. GI
2. Torque mounting nuts.
12 - 15 N·m (1.2 - 1.5 kg-m, 9 - 11 ft-lb) MA
3. Fill up reservoir tank with new brake fluid.
4. Plug all ports on master cylinder with fingers in order not to have air sucked while releasing brake pedal. EM
5. Have driver depress brake pedal slowly several times until no air comes out of master cylinder. LC
6. Fit brake lines to master cylinder.
7. Tighten flare nuts.
15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb) EF & EC
8. Bleed air from brake system. Refer to "Bleeding Procedure" (BR-5).

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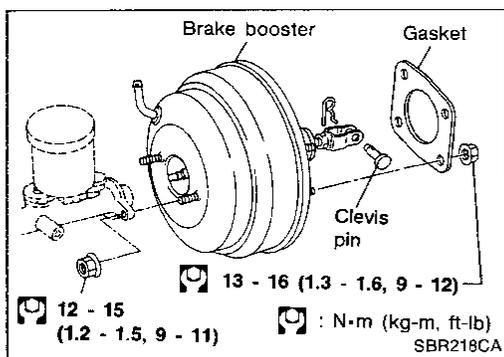
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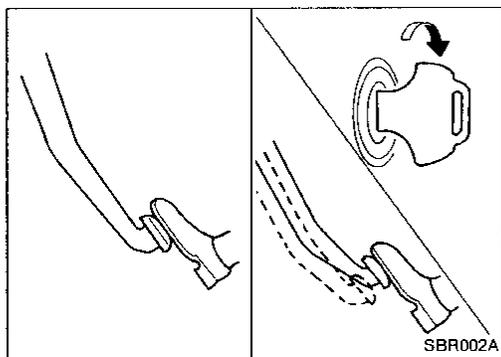
BRAKE BOOSTER



Removal and Installation

CAUTION:

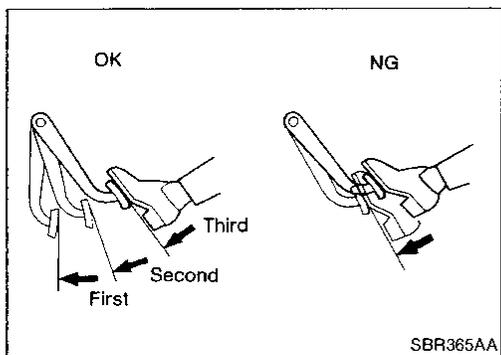
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on paint areas, wash it away with water immediately.
 - Be careful not to deform or bend brake lines, during removal of booster.
1. Remove master cylinder. Refer to "Removal and Installation" in "MASTER CYLINDER" (BR-9).
 2. Remove clevis pin (brake pedal to booster input rod).
 3. Remove mounting nuts (brake pedal bracket to booster).
 4. Draw out booster assembly.



Inspection

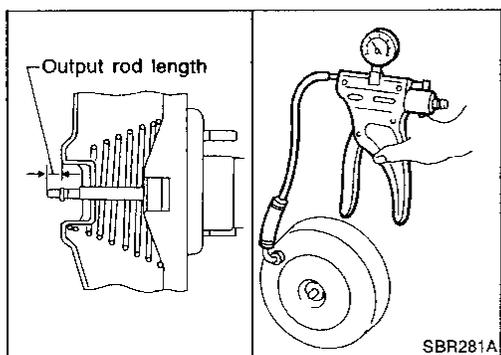
OPERATING CHECK

- 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.

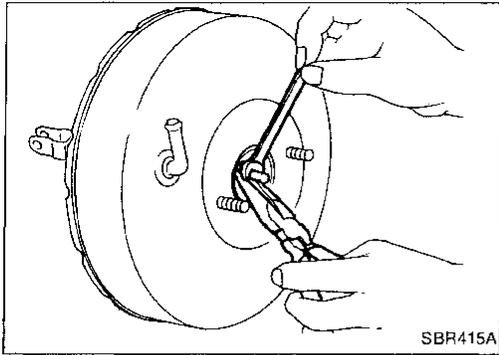


OUTPUT ROD LENGTH CHECK

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)

BRAKE BOOSTER

Inspection (Cont'd)



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

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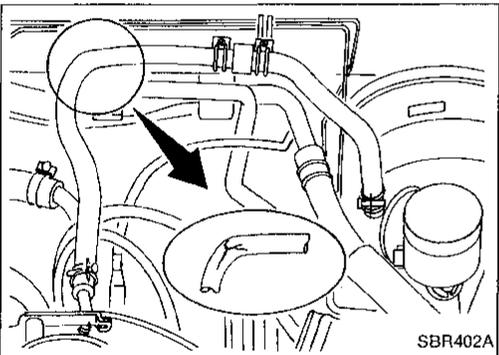
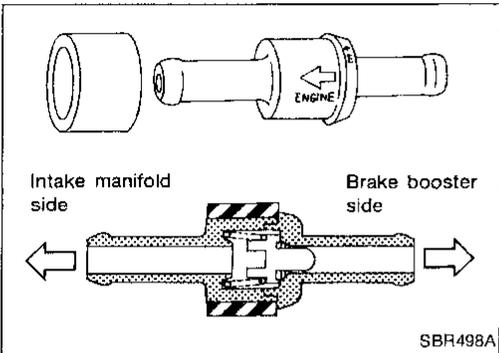
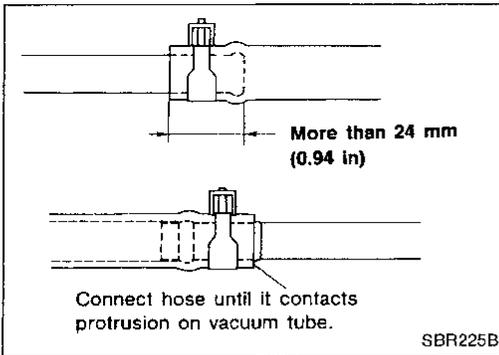
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VACUUM PIPING



Removal and Installation

CAUTION:

Do not apply any oil or lubricants to vacuum hoses and check valve.

- Insert vacuum tube into vacuum hose more than 24 mm (0.94 in).
- Install check valve, paying attention to its direction.

Inspection

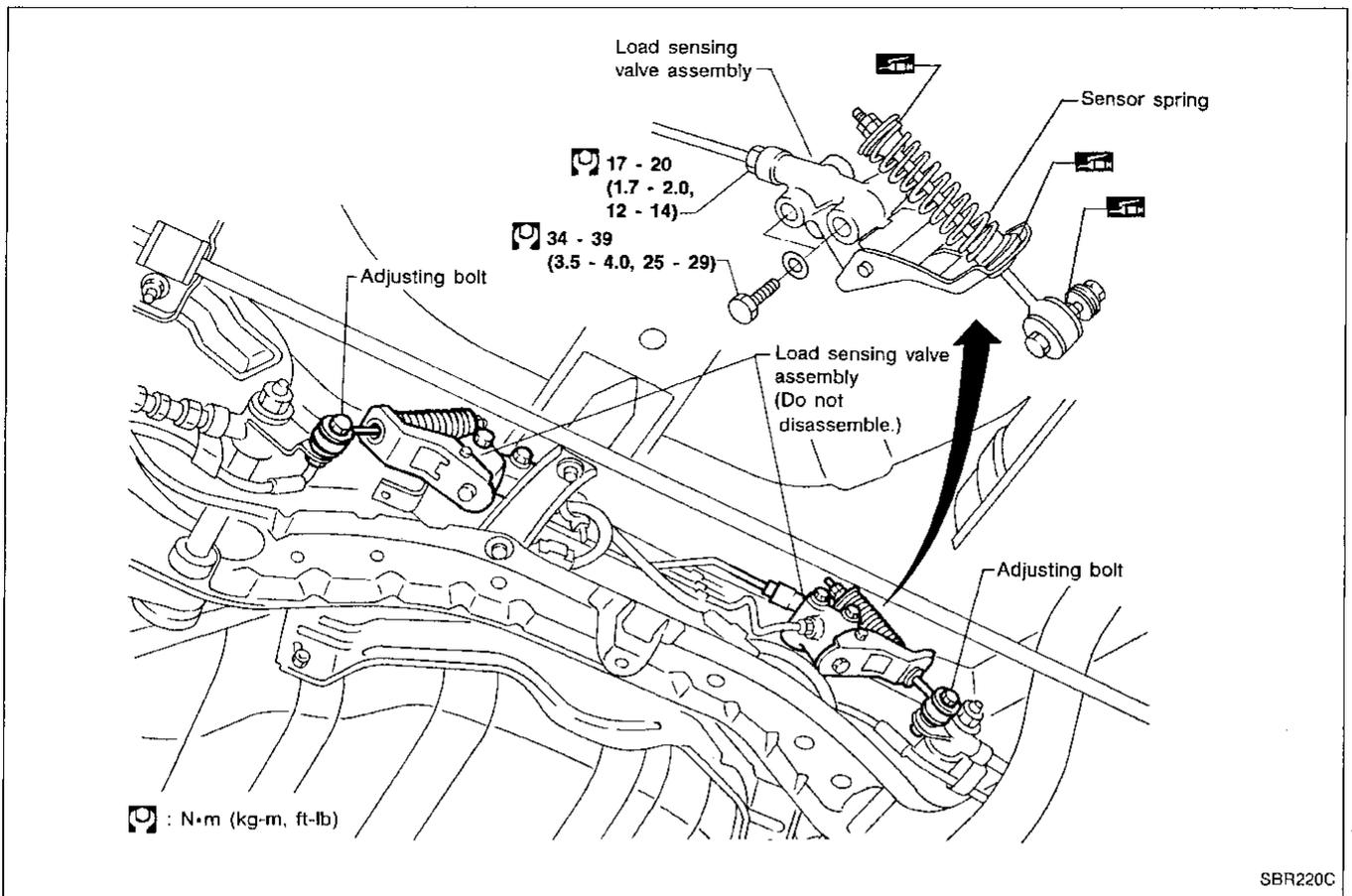
HOSES AND CONNECTORS

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

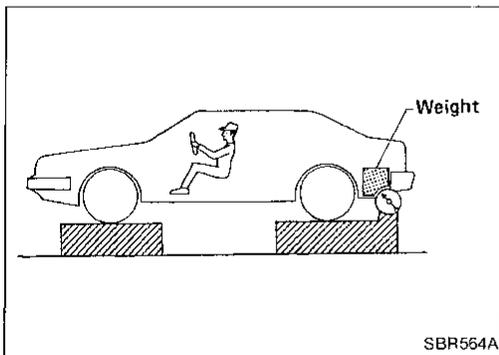
CHECK VALVE

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

TWIN LOAD SENSING VALVE

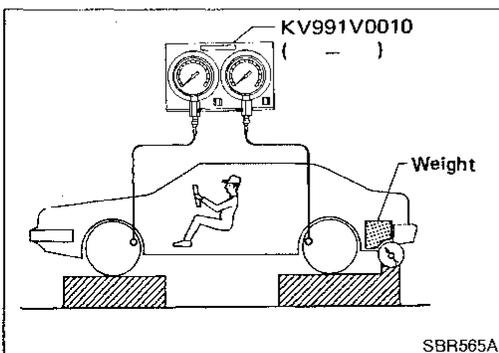


- Replace damaged Twin Load Sensing Valve as an assembly.
- When disassembling, apply multi-purpose grease to all rubbing areas.



Inspection

1. With one person aboard, set rear axle load to 5,884 N (600 kg, 1,323 lb) by using weight in trunk room.

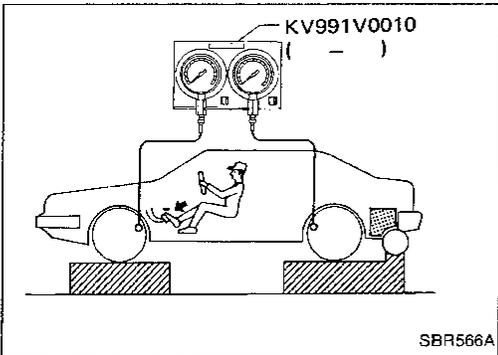
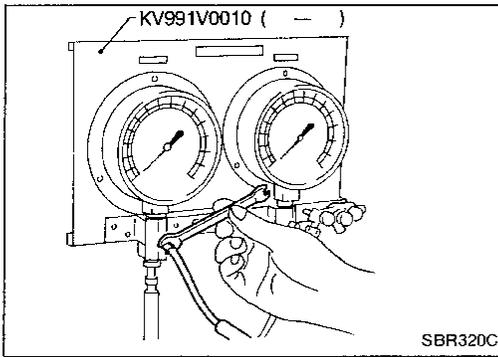


2. Install pressure gauge on front and rear brake air bleeders.

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TWIN LOAD SENSING VALVE

Inspection (Cont'd)



3. Bleed air from front and rear brake lines.

4. Raise front brake pressure to 4,904 kPa (50 kg/cm², 711 psi) and check rear brake pressure.

Rear brake pressure:

3,825 - 4,805 kPa

(39 - 49 kg/cm², 555 - 697 psi)

5. Raise front brake pressure to 9,807 kPa (100 kg/cm², 1,422 psi) and check rear brake pressure.

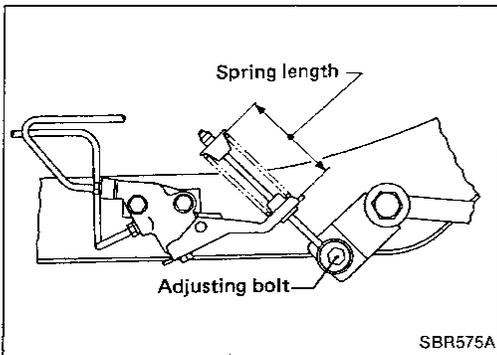
Rear brake pressure:

5,100 - 6,473 kPa

(52 - 66 kg/cm², 739 - 939 psi)

CAUTION:

- Depress pedal slowly when raising front brake pressure.
- Check rear brake pressure 2 seconds after front brake pressure reaches specified value.

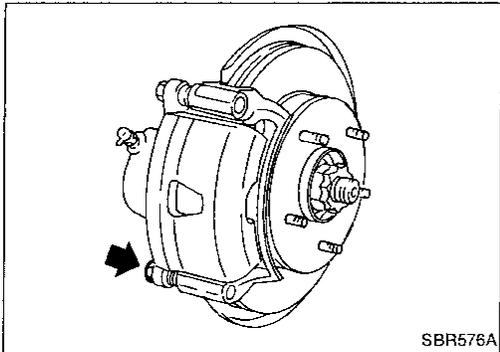
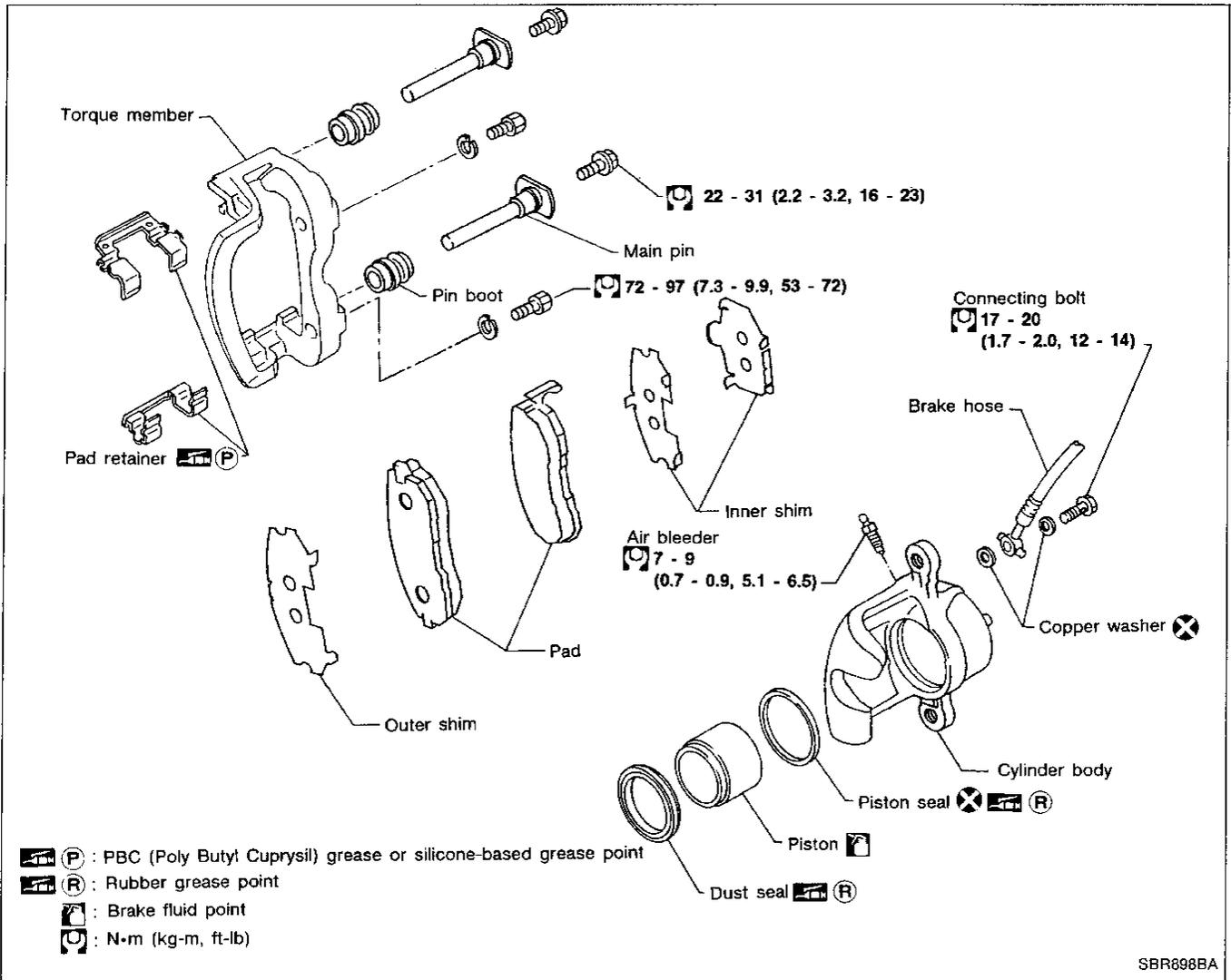


6. If rear brake pressure is not within specification, adjust sensor spring length by adjusting bolt.

7. Repeat steps 4. through 6.

8. If pressure is outside specified range after spring length is adjusted, replace Twin Load Sensing Valve assembly.

FRONT DISC BRAKE (CL25VB)



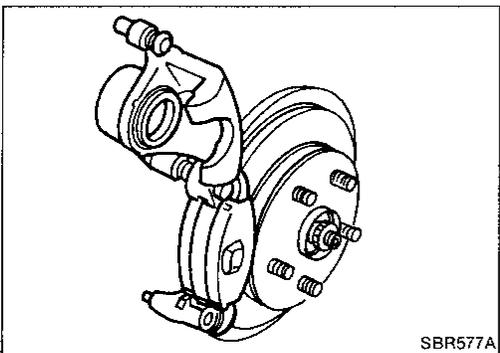
Pad Replacement

WARNING:

Clean brakes with a vacuum dust collector to minimize the hazard of airborne particles.

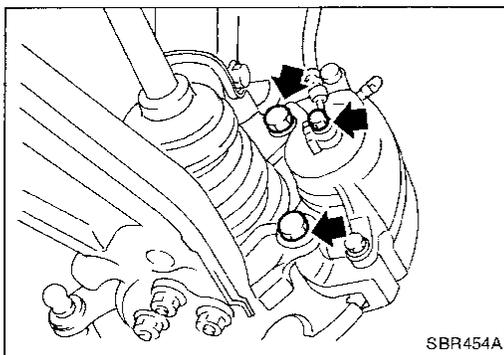
CAUTION:

- When cylinder body is open, do not depress brake pedal, or piston will pop out.
- Be careful not to damage piston boot or get oil on rotor. Always replace shims in replacing pads.
- If shims are rusted or show peeling of the rubber coat, replace them with new shims.
- It is not necessary to remove brake hose connecting bolt except for disassembly or replacement of caliper assembly. In this case, suspend cylinder body with wire so as not to stretch brake hose.
- Carefully monitor brake fluid level because brake fluid will return to reservoir when pushing back piston.



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

FRONT DISC BRAKE (CL25VB)



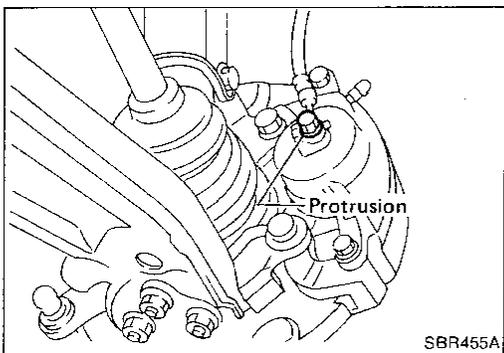
Removal

WARNING:

Clean brakes with a vacuum dust collector to minimize the hazard of airborne particles.

Remove torque member fixing bolts and connecting bolt.

It is not necessary to remove connecting bolt except for disassembly or replacement of caliper assembly. In this case, suspend caliper assembly with wire so as not to stretch brake hose.



Installation

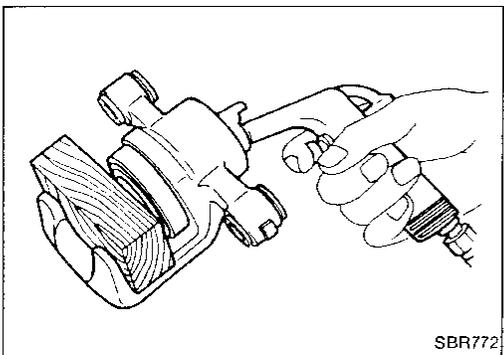
CAUTION:

- Refill with new brake fluid "DOT 3".
- Never reuse drained brake fluid.

1. Install caliper assembly.

Do not forget to install washers.

2. Install brake hose to caliper securely.
3. Install all parts and secure all bolts.
4. Bleed air. Refer to "Bleeding Procedure" (BR-5).



Disassembly

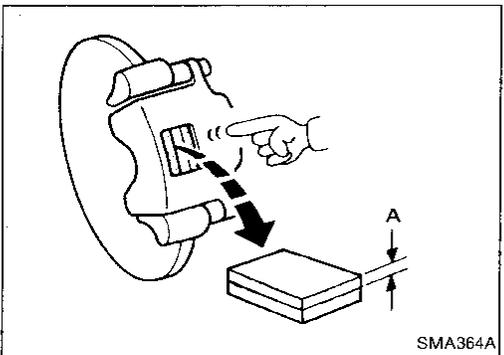
WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

1. Push out piston and piston boot with compressed air.
2. Remove piston seal with a suitable tool.



Inspection

DISC PAD

Check disc pad for wear or damage.

Pad standard thickness (A):

11.0 mm (0.433 in)

Pad wear limit (A):

2.0 mm (0.079 in)

CYLINDER BODY

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

CAUTION:

Use brake fluid to clean. Never use mineral oil.

FRONT DISC BRAKE (CL25VB)

Inspection (Cont'd)

PISTON

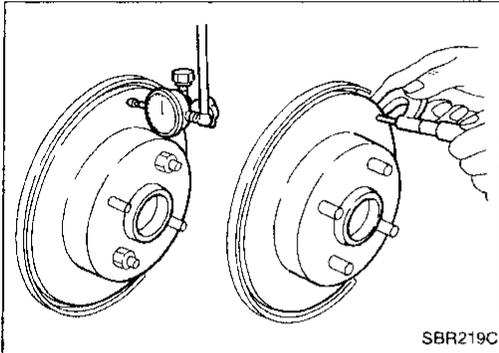
Check piston for scoring, rust, wear, damage or foreign materials. Replace if any condition exists.

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.



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 "Front Wheel Bearing" in FA section.

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).

THICKNESS

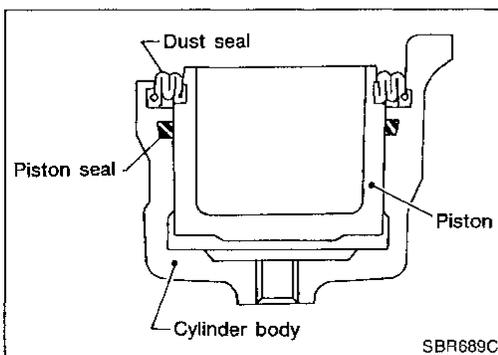
Thickness variation (At least 8 positions):

Maximum 0.01 mm (0.0004 in)

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

Rotor repair limit:

20.0 mm (0.787 in)



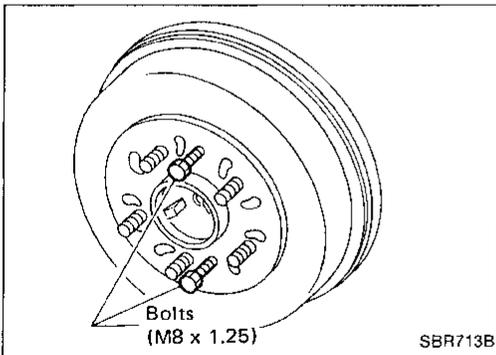
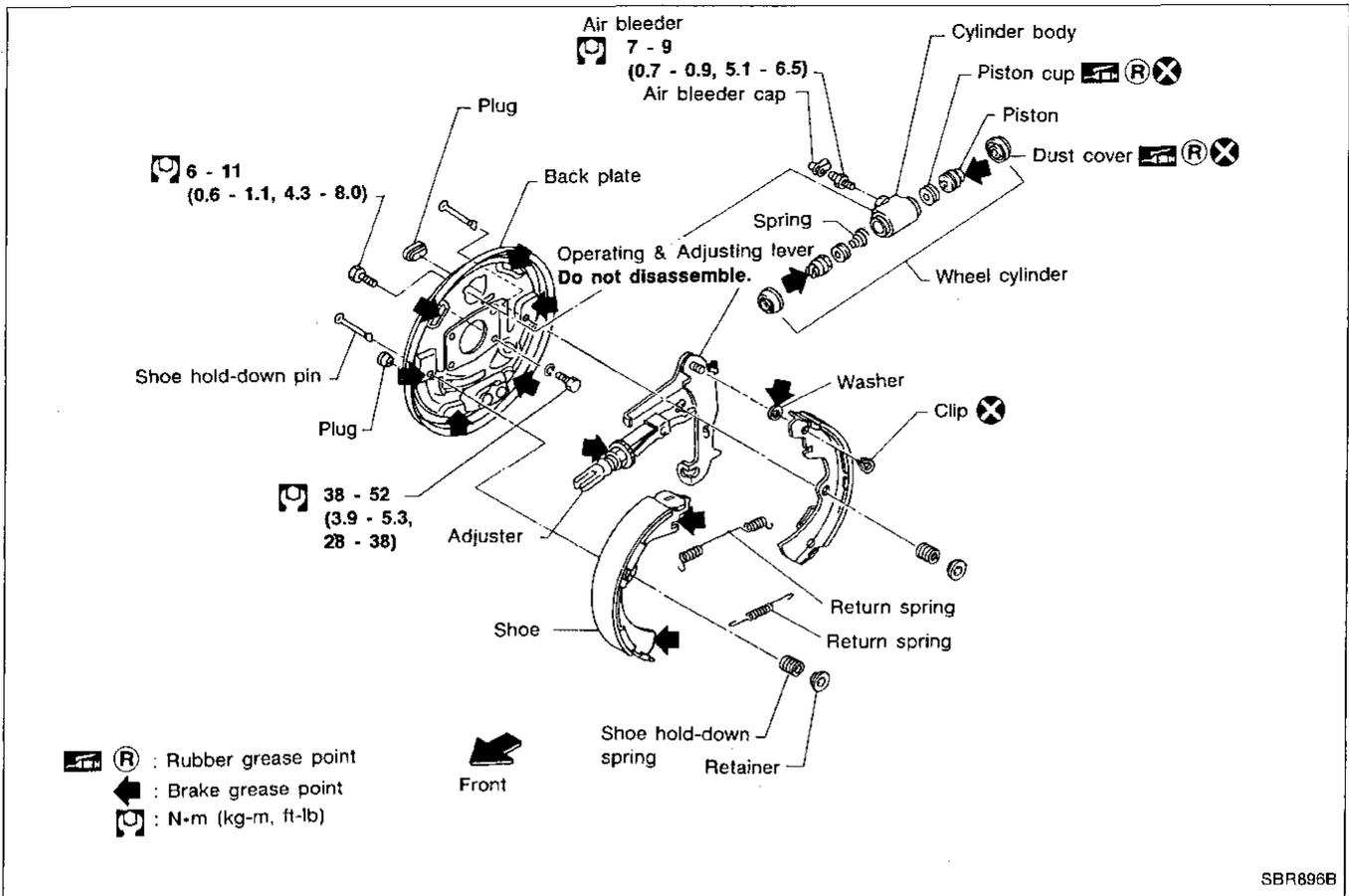
Assembly

- Insert piston seal into groove on cylinder body.
- With dust seal fitted to piston, install piston into cylinder body.

CAUTION:

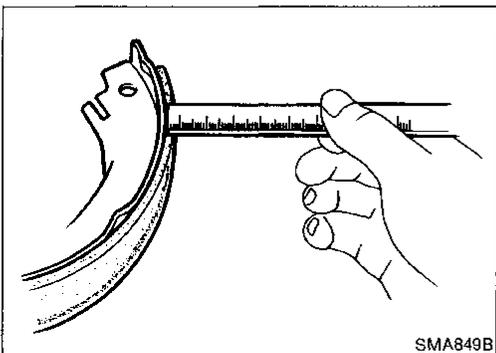
- **Secure dust seal properly.**

REAR DRUM BRAKE (LT23B)



Brake Drum Removal

- Release parking brake control lever fully.
- Tighten two bolts gradually if brake drum is hard to remove.



Shoe Replacement

- Measure lining thickness.

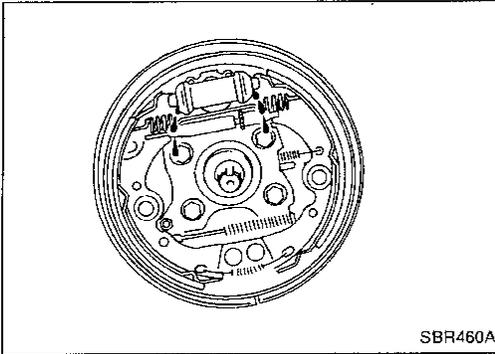
Standard thickness:
 4.5 mm (0.177 in)

Lining wear limit:
 1.5 mm (0.059 in)

Before installing new shoes, rotate nut until adjuster rod is at its shortest point.

After installation, adjust shoe-to-drum clearance. Refer to "Removal and Installation" (BR-21).

REAR DRUM BRAKE (LT23B)



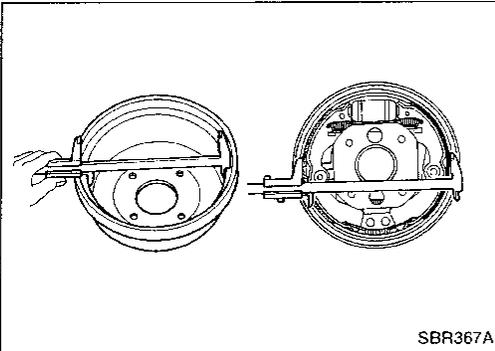
Wheel Cylinder Inspection

- Check wheel cylinder for leakage.
- Check for wear, damage and loose conditions. Replace if any condition exists.

GI

MA

EM



Removal and Installation

When installing, measure brake drum inside diameter and diameter of brake shoes. Check that difference between diameters is correct shoe clearance.

Shoe clearance:

0.35 - 0.55 mm (0.0138 - 0.0217 in)

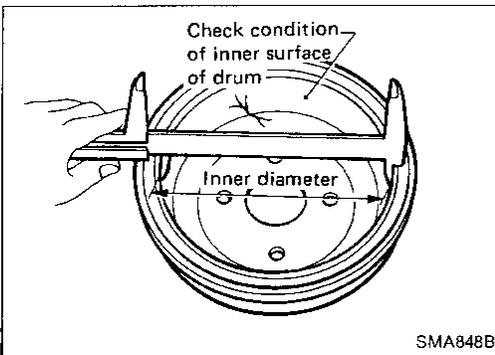
If necessary, adjust by rotating adjuster.

LC

EF &
EC

FE

CL



Drum Inspection

Standard inner diameter:

228.6 mm (9 in)

Maximum inner diameter:

230 mm (9.06 in)

Out-of-roundness (Ellipticity):

0.03 mm (0.0012 in) or less

MT

AT

FA

RA

- Contact surface should be finefinished with No. 120 to 150 emery paper.
- Using a drum lathe, lathe brake drum if it shows scoring, partial wear or stepped wear.
- After brake drum has been completely reconditioned or replaced, check drum and shoes for proper contact pattern.

BR

ST

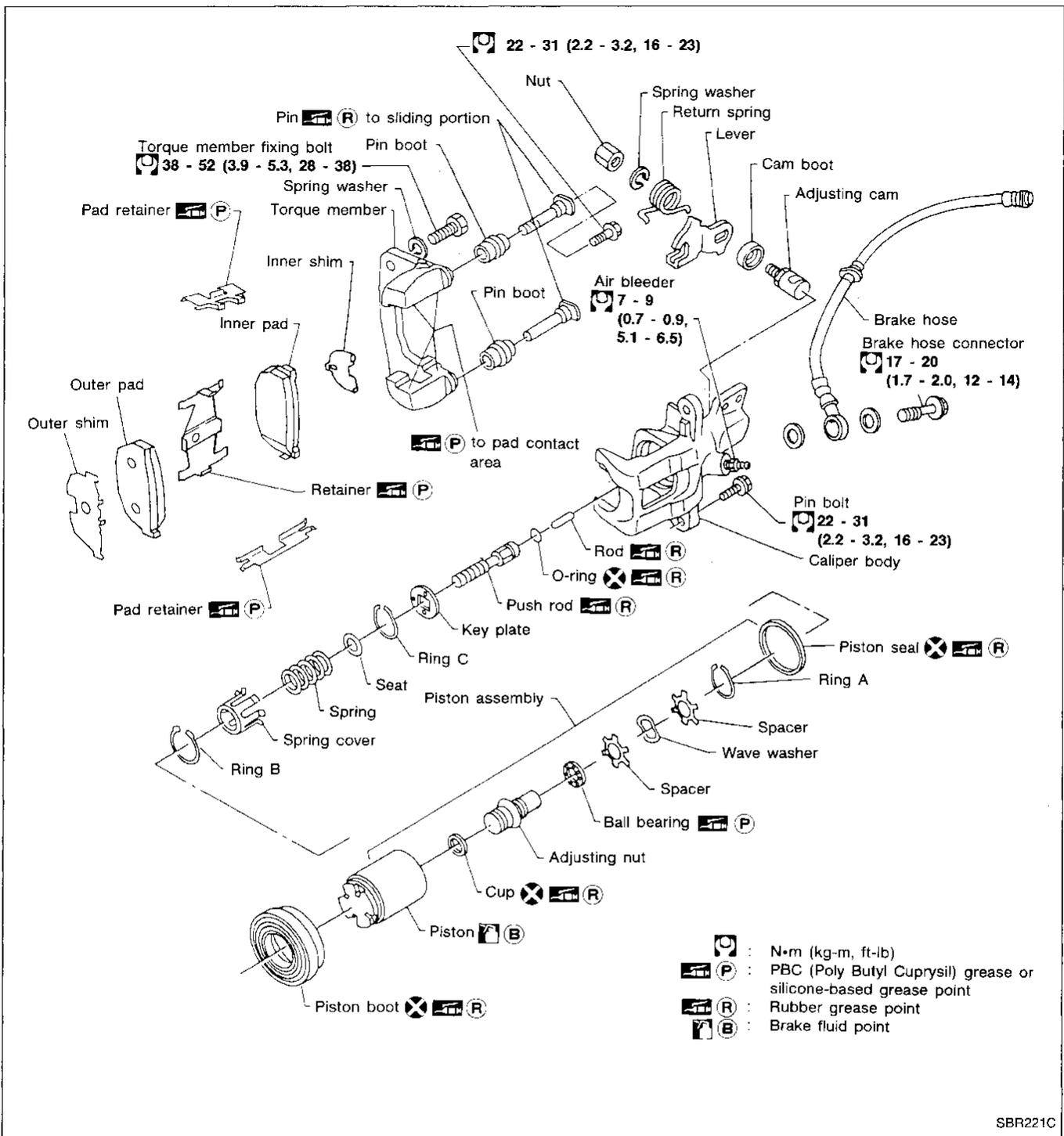
BF

HA

EL

IDX

REAR DISC BRAKE (CL9HA)



SBR221C

Pad Replacement

WARNING:

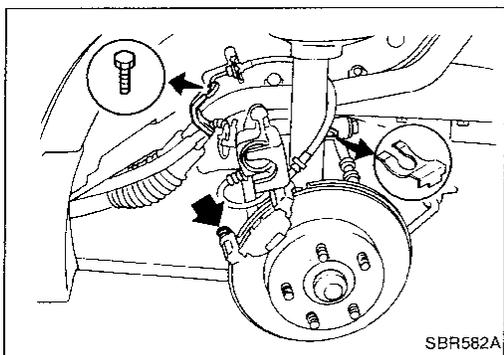
Clean brakes with a vacuum dust collector to minimize the hazard of airborne particles.

CAUTION:

- When cylinder body is open, do not depress brake pedal, or piston will pop out.
- Be careful not to damage piston boot or get oil on rotor. Always replace shims in replacing pads.
- If shims are rusted or show peeling of rubber coat, replace them with new shims.

REAR DISC BRAKE (CL9HA)

Pad Replacement (Cont'd)



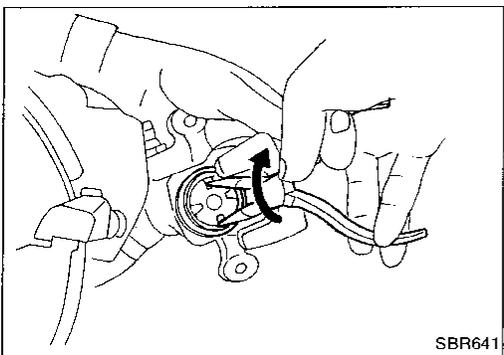
- It is not necessary to remove connecting bolt except for disassembly or replacement of caliper assembly. In this case, suspend cylinder body with wire so as not to stretch brake hose.

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

GI

MA

EM



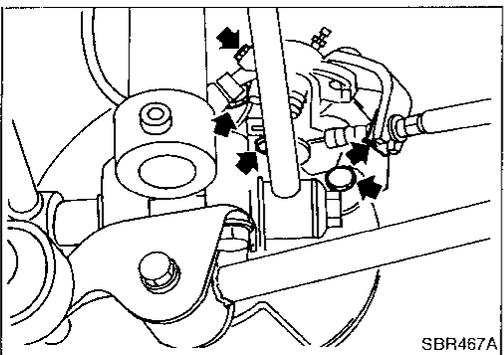
2. When installing pads, retract piston into cylinder body by turning piston clockwise.

LC

EF &
EC

FE

CL



Removal and Installation

WARNING:

Clean brakes with a vacuum dust collector to minimize the hazard of airborne particles.

CAUTION:

- Refill with new brake fluid "DOT 3".
- Never reuse drained brake fluid.

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

MT

AT

FA

RA

Disassembly

WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

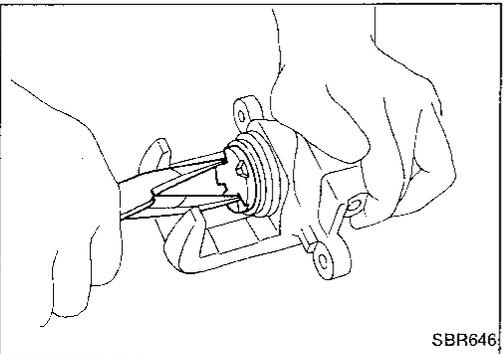
1. Remove piston by turning it counterclockwise with suitable long nose pliers.

BR

ST

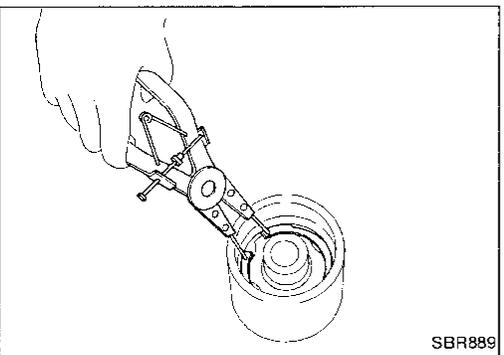
BF

HA



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

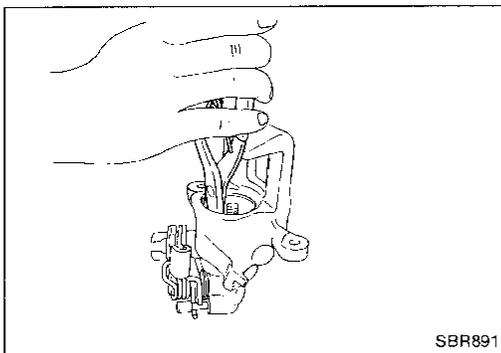
EL



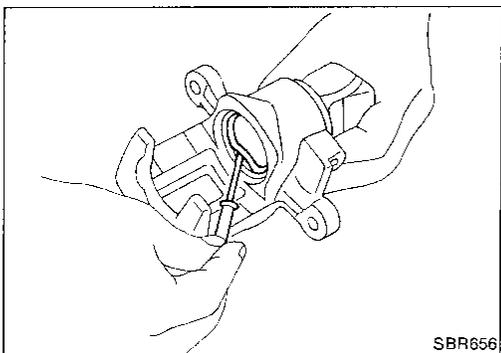
IDX

REAR DISC BRAKE (CL9HA)

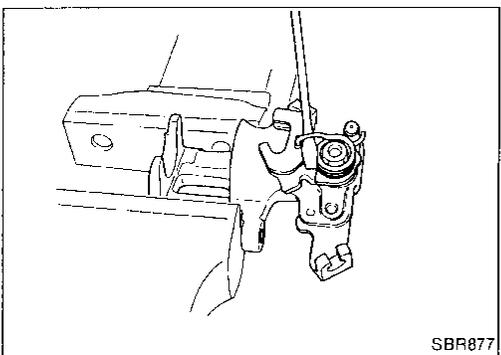
Disassembly (Cont'd)



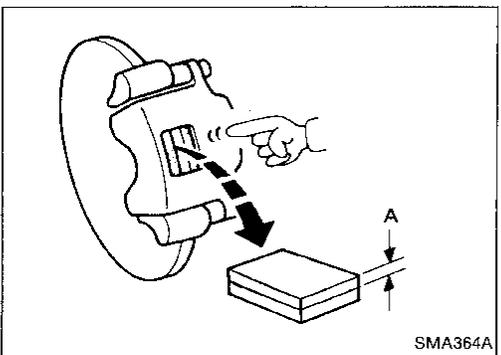
3. Disassemble cylinder body.
- (1) Pry off ring B with suitable pliers, then remove spring cover, spring and seat.
- (2) Pry off ring C, then remove key plate, push rod and rod.



- (3) Remove piston seal.
Be careful not to damage cylinder body.



4. Remove return spring and lever.



Inspection

DISC PAD

Check disc pad for wear or damage.

Pad standard thickness (A):

10 mm (0.39 in)

Pad wear limit (A):

2.0 mm (0.079 in)

CAUTION:

Use brake fluid to clean cylinder. Never use mineral oil.

REAR DISC BRAKE (CL9HA)

Inspection (Cont'd)

CYLINDER BODY

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

TORQUE MEMBER

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

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 AND PIN BOOT

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

RUNOUT

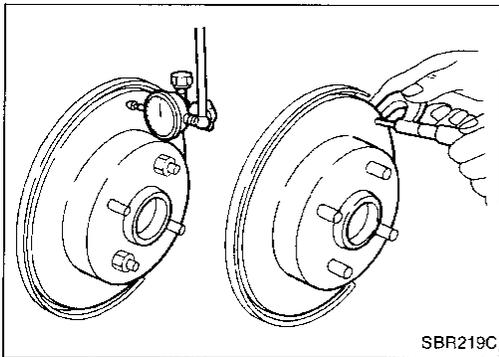
Make sure that axial end play is within the specifications before measuring. Refer to "Rear Wheel Bearing" in RA section. Then check runout with a dial indicator.

**Rotor repair limit: Maximum runout
0.07 mm (0.0028 in)**

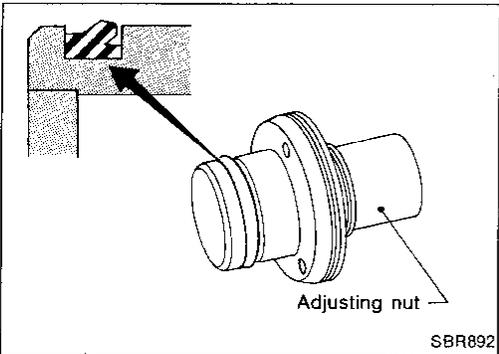
(Total indicator reading at center of rotor pad contact surface)

THICKNESS

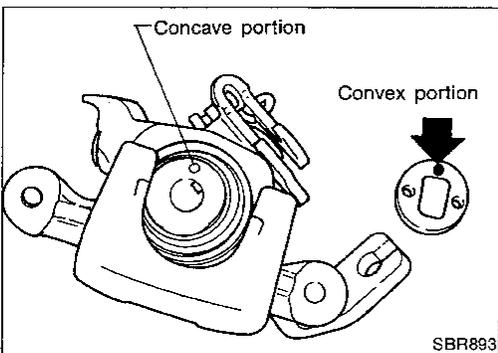
**Rotor repair limit: Minimum thickness
8.0 mm (0.315 in)**



SBR219C



SBR892



SBR893

Assembly

1. Install cup in the specified direction.
2. Fit push rod into square hole in key plate. Also match convex portion of key plate with concave portion of cylinder.

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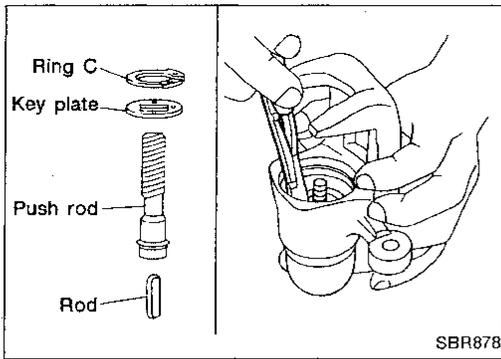
HA

EL

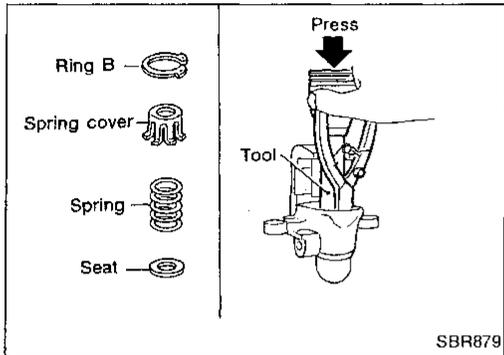
IDX

REAR DISC BRAKE (CL9HA)

Assembly (Cont'd)



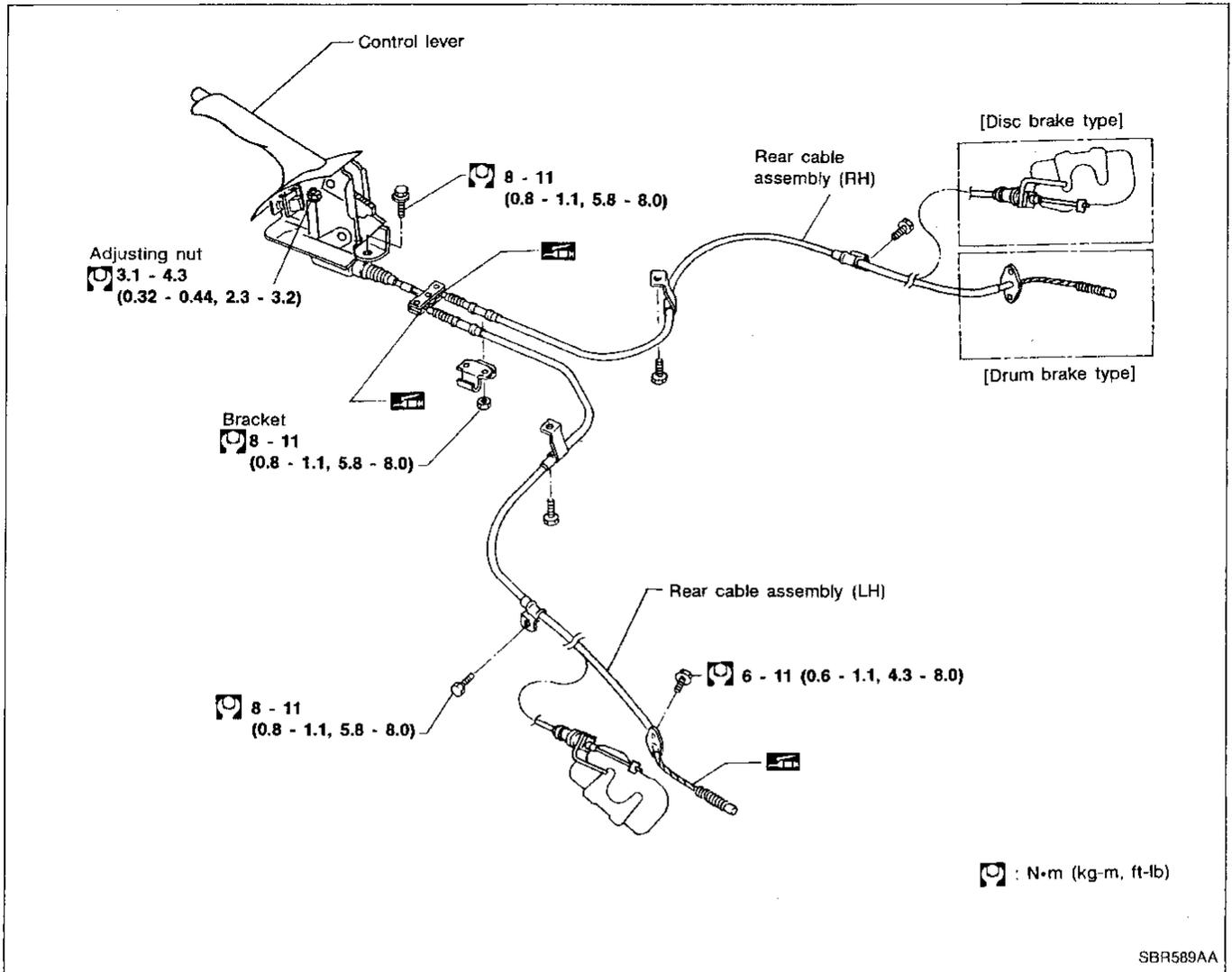
3. Install ring C with suitable tool.



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

PARKING BRAKE CONTROL

Removal and Installation



- Before removing parking brake control, remove console box.
- Make sure there is no free play after installing.

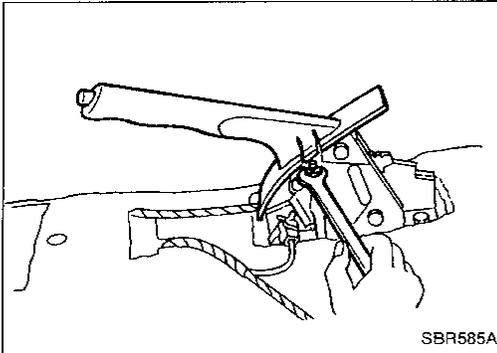
Inspection

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

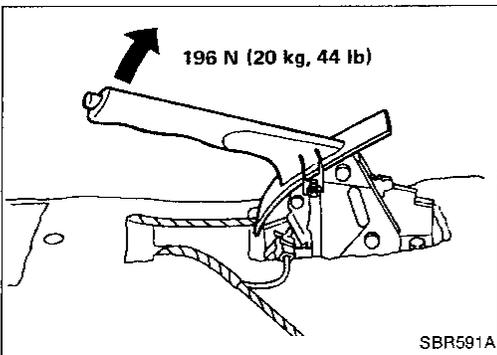
PARKING BRAKE CONTROL

Adjustment

Adjust control lever stroke as follows:

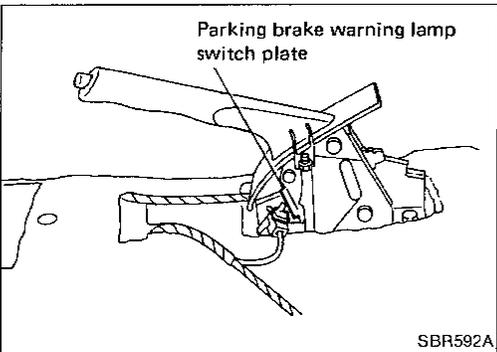


1. Adjust control lever by turning adjusting nut.



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

Number of notches: 8 - 10

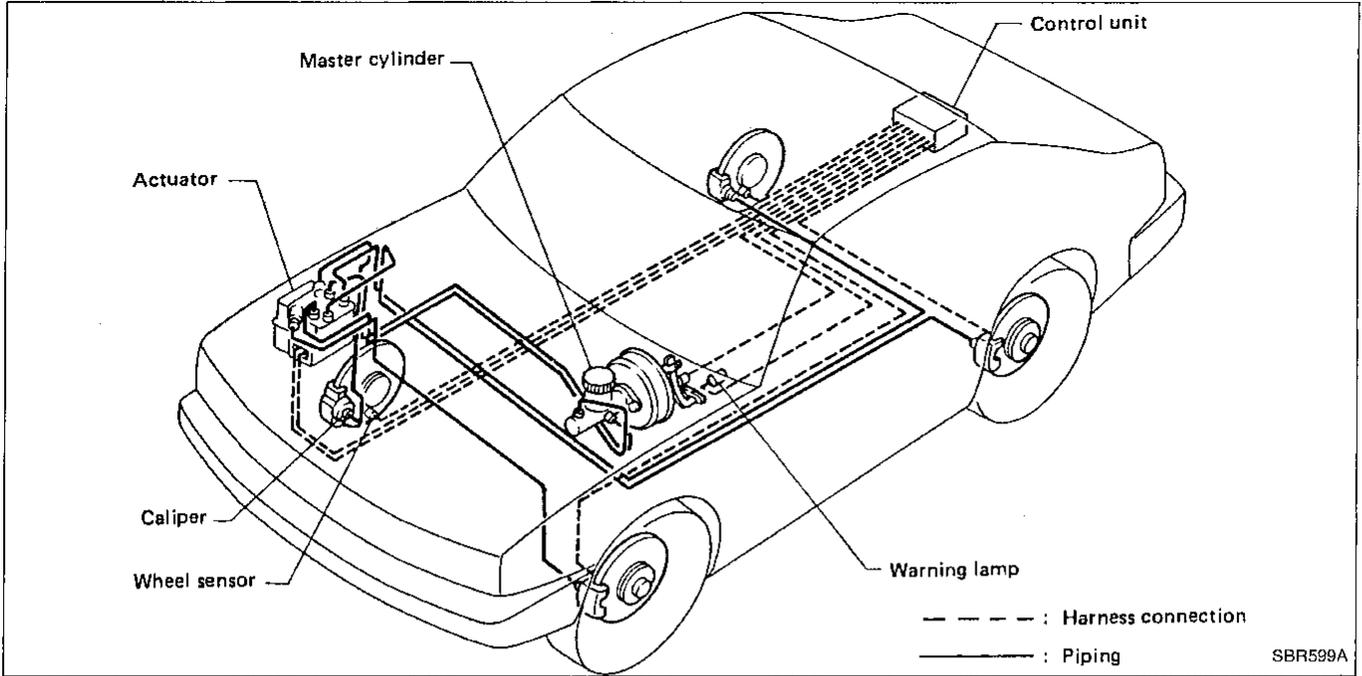


3. Bend parking brake warning lamp switchplate so that brake warning lamp comes on when ratchet at parking brake lever is pulled "A" notches and goes out when fully released.

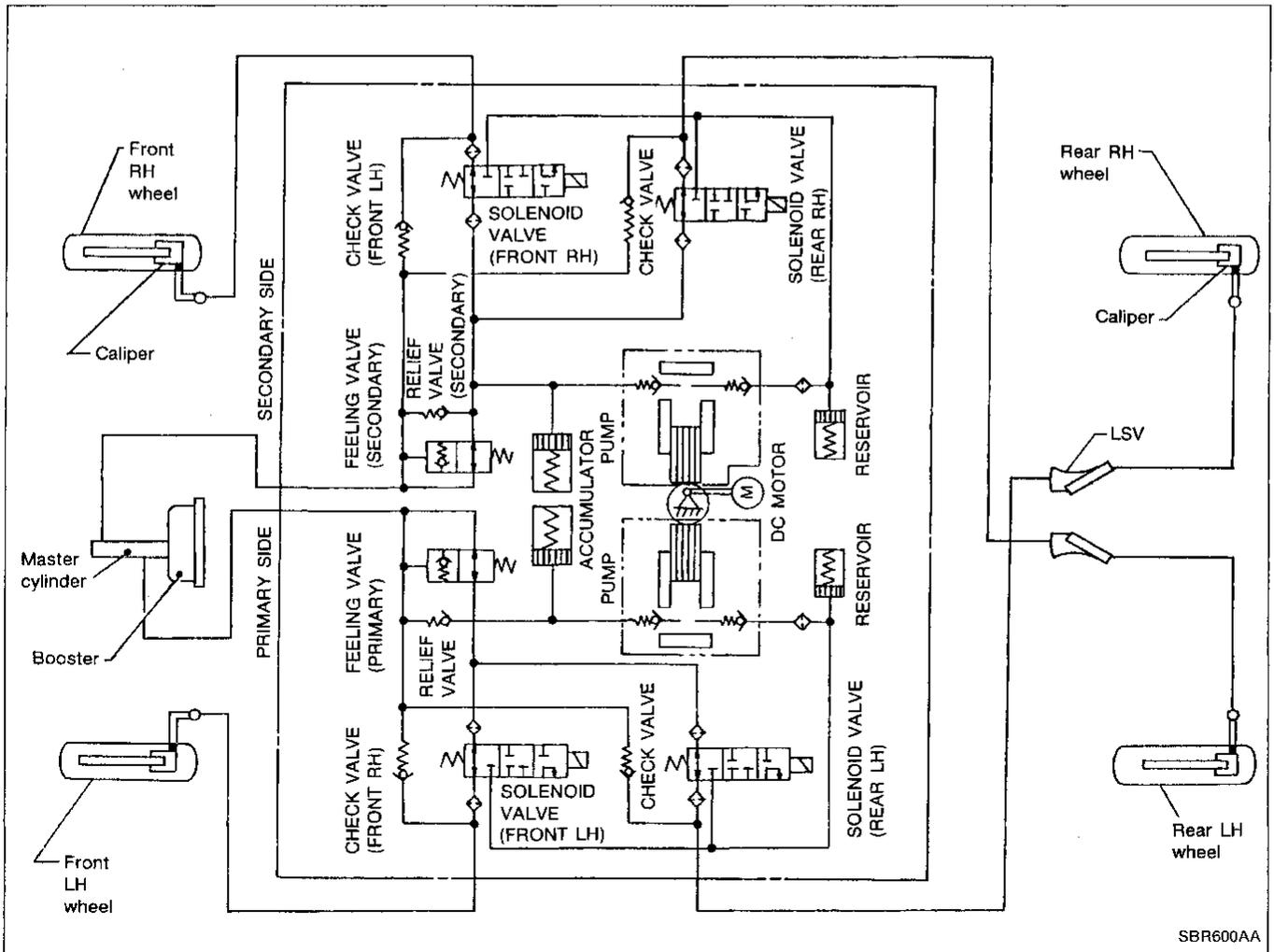
Number of notches "A": 1

ANTI-LOCK BRAKING SYSTEM

System Components

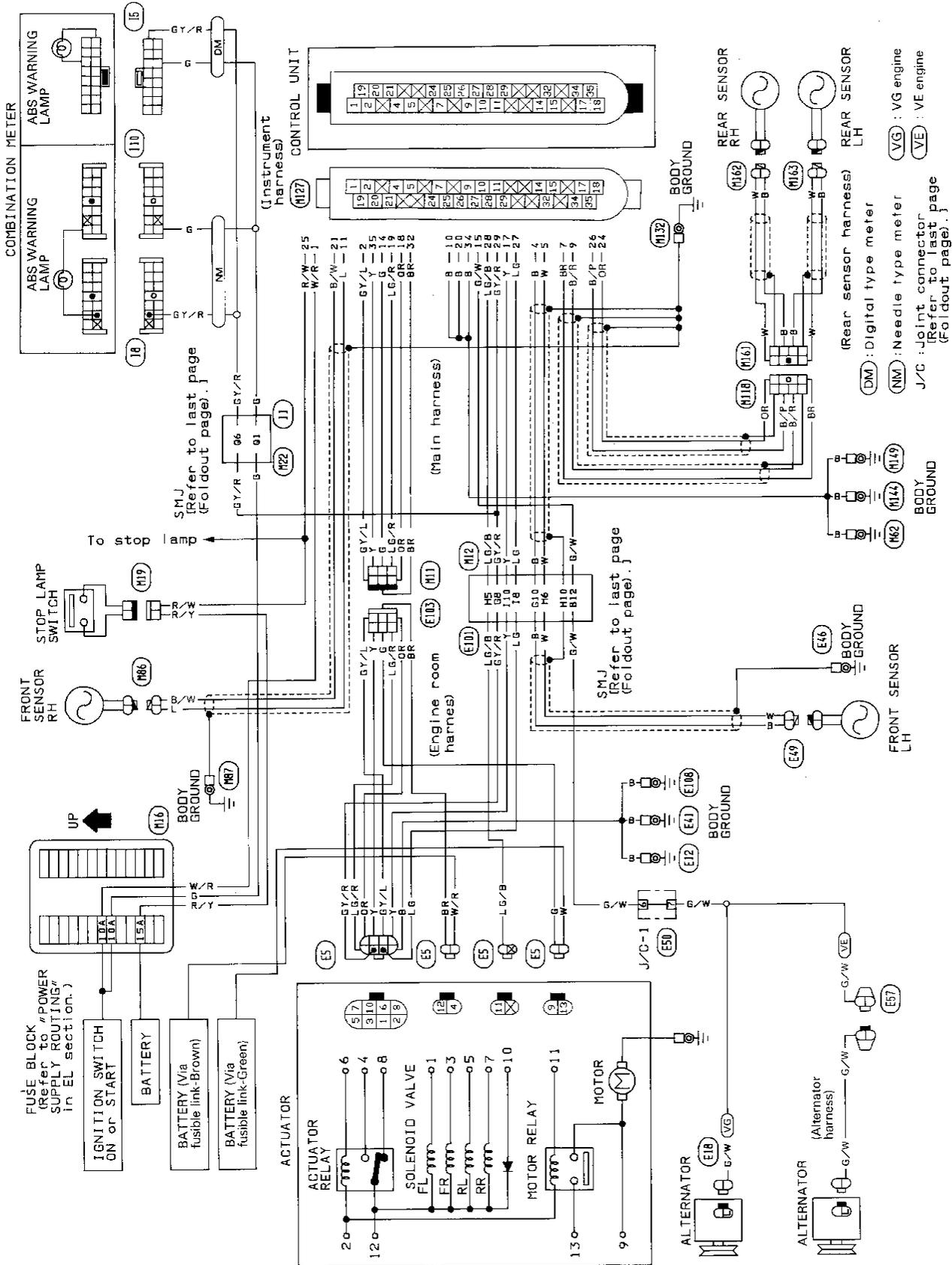


Hydraulic Circuit



ANTI-LOCK BRAKING SYSTEM

Wiring Diagram



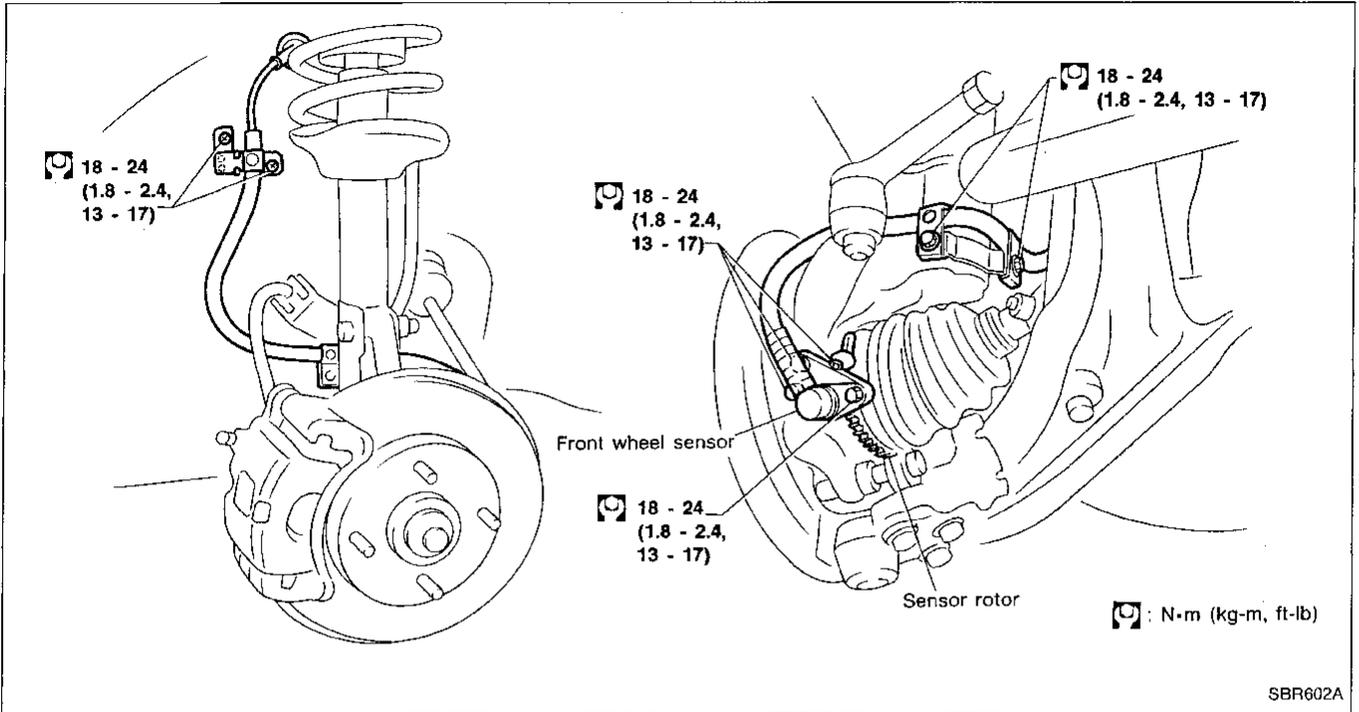
ANTI-LOCK BRAKING SYSTEM

Removal and Installation

CAUTION:

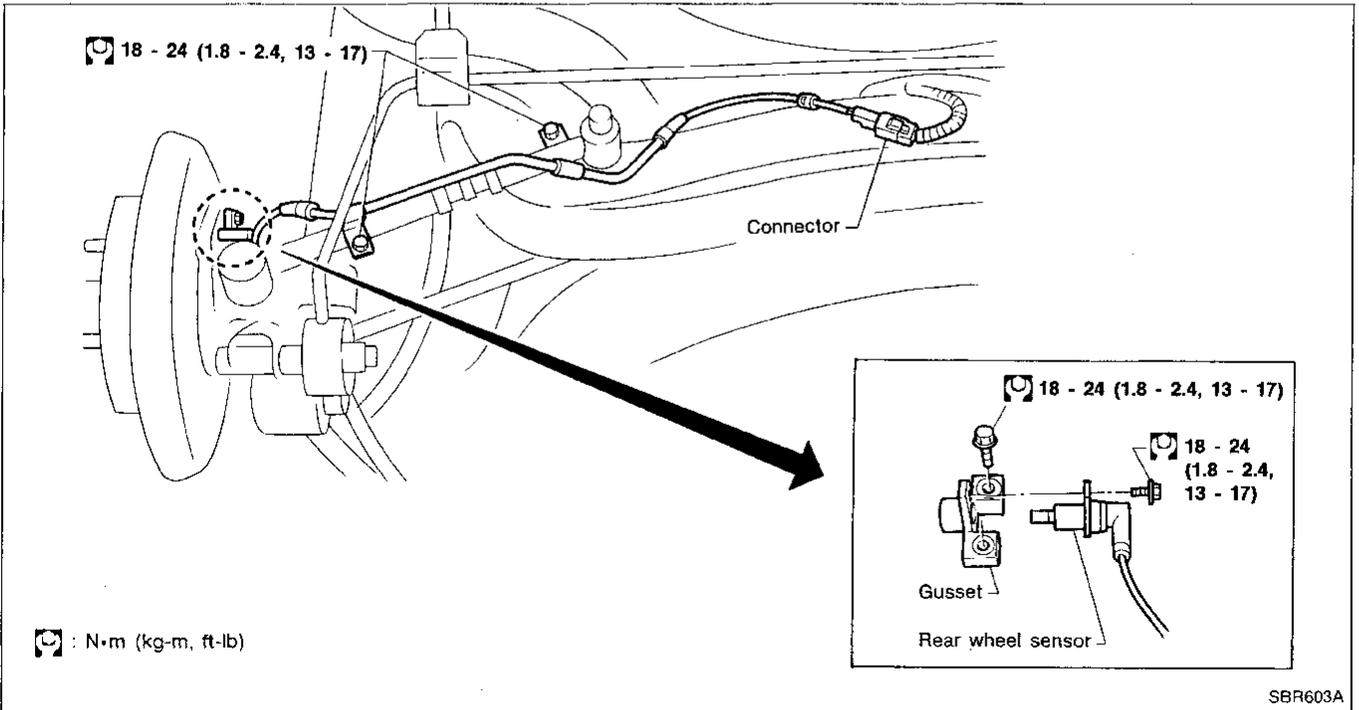
Be careful not to damage sensor edge and sensor rotor teeth. In case the wheel hub assembly needs to be removed, disconnect the ABS wheel sensor from the assembly.

FRONT WHEEL SENSOR



- Remove sensor rotor with front wheel hub, referring to "Wheel Hub and Knuckle" in FA section.

REAR WHEEL SENSOR



ACTUATOR

- Disconnect 4 connectors and brake tubes.
- Remove 3 nuts fixing actuator to bracket.

TROUBLE DIAGNOSES

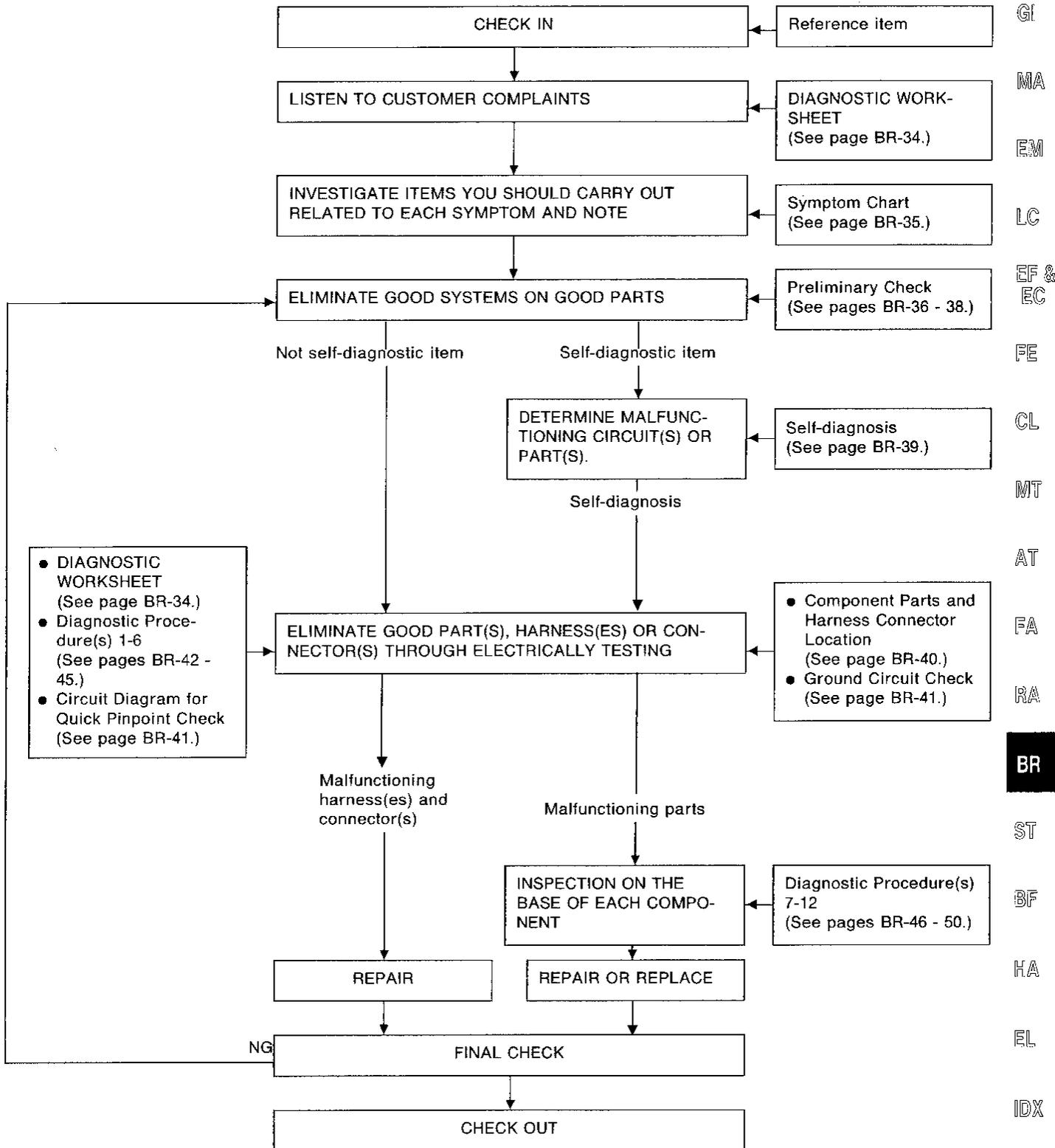
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TROUBLE DIAGNOSES

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					

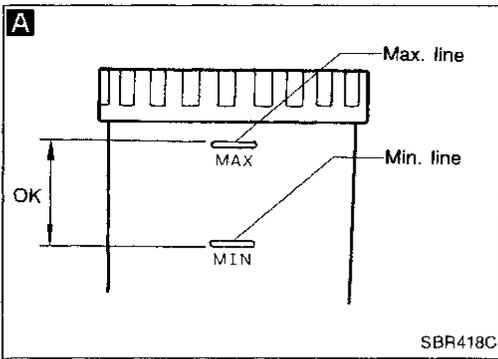
TROUBLE DIAGNOSES

Symptom Chart

PROCEDURE	Preliminary Check			Diagnostic Procedure						Diagnostic Procedure (Select inspection with LED flashing No.)					Ground Circuit Check	Electrical Components Inspection	
	BR-36	BR-37	BR-38	BR-42	BR-43	BR-44	BR-44	BR-45	BR-45	BR-46	BR-47	BR-48	BR-49	BR-49			BR-50
REFERENCE PAGE	BR-36	BR-37	BR-38	BR-42	BR-43	BR-44	BR-44	BR-45	BR-45	BR-46	BR-47	BR-48	BR-49	BR-49	BR-50	BR-41	BR-51
SYMPTOM	Preliminary Check 1	Preliminary Check 2	Preliminary Check 3	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	LED flashing 1 - 4	LED flashing 5 - 8	LED flashing 9	LED flashing 10	LED flashing 16	LED comes on continuously	Motor ground	Actuator inspection
Pedal vibration & noise			<input type="radio"/>	<input type="radio"/>						<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
Warning activates		<input type="radio"/>	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
Long stopping distance	<input type="radio"/>		<input type="radio"/>		<input type="radio"/>					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
Abnormal pedal action	<input type="radio"/>		<input type="radio"/>			<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
ABS doesn't work		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ABS works but warning activates			<input type="radio"/>					<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
ABS works frequently	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>									

CI
 WA
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 LC
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TROUBLE DIAGNOSES



Preliminary Check 1

A
Check brake fluid level in reservoir tank.
Low fluid level may indicate brake pad wear or leakage from brake line.

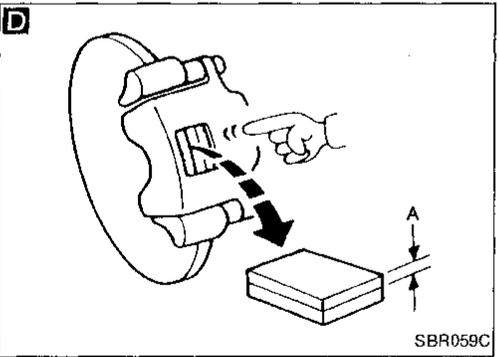
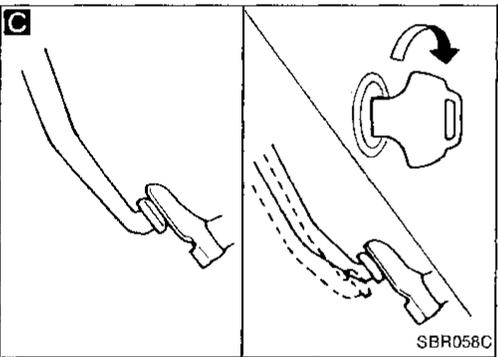
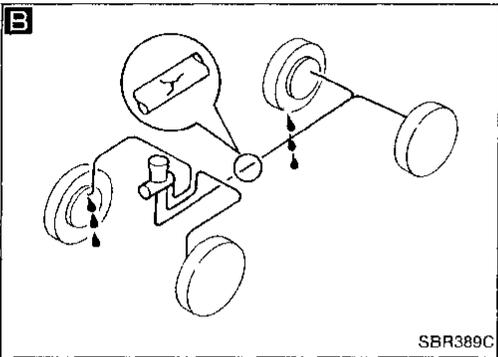
B
Check brake line for leakage. NG → Repair.

C
Check brake booster for operation and air tightness. Refer to "Inspection" of BRAKE BOOSTER (BR-12). NG → Replace.

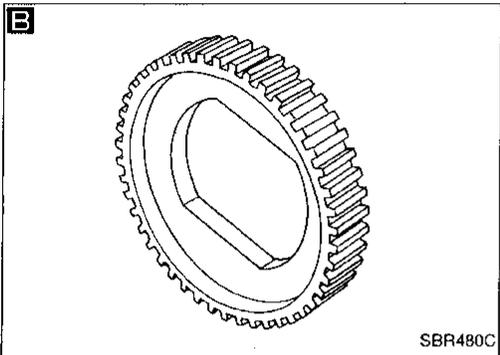
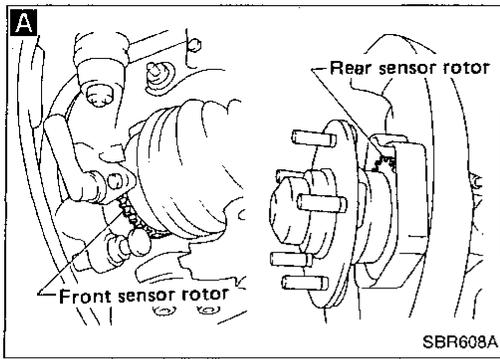
D
Check brake pads and rotor. Refer to "Inspection" of FRONT and REAR DISC BRAKES (BR-18, 24). NG → Replace.

A
Check brake fluid level in reservoir tank. NG → Fill up brake fluid.

END



TROUBLE DIAGNOSES



Preliminary Check 2

A

Check sensor clearance.
Clearance = A - B

	Clearance mm (in)
Front wheel sensor	0.2 - 1.0 (0.008 - 0.039)
Rear sensor	0.2 - 1.0 (0.008 - 0.039)

OK

NG

Check sensor for the following items:

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

NG

Repair or replace malfunctioning sensor.

OK

B

Check sensor rotor for teeth damage.

NG

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

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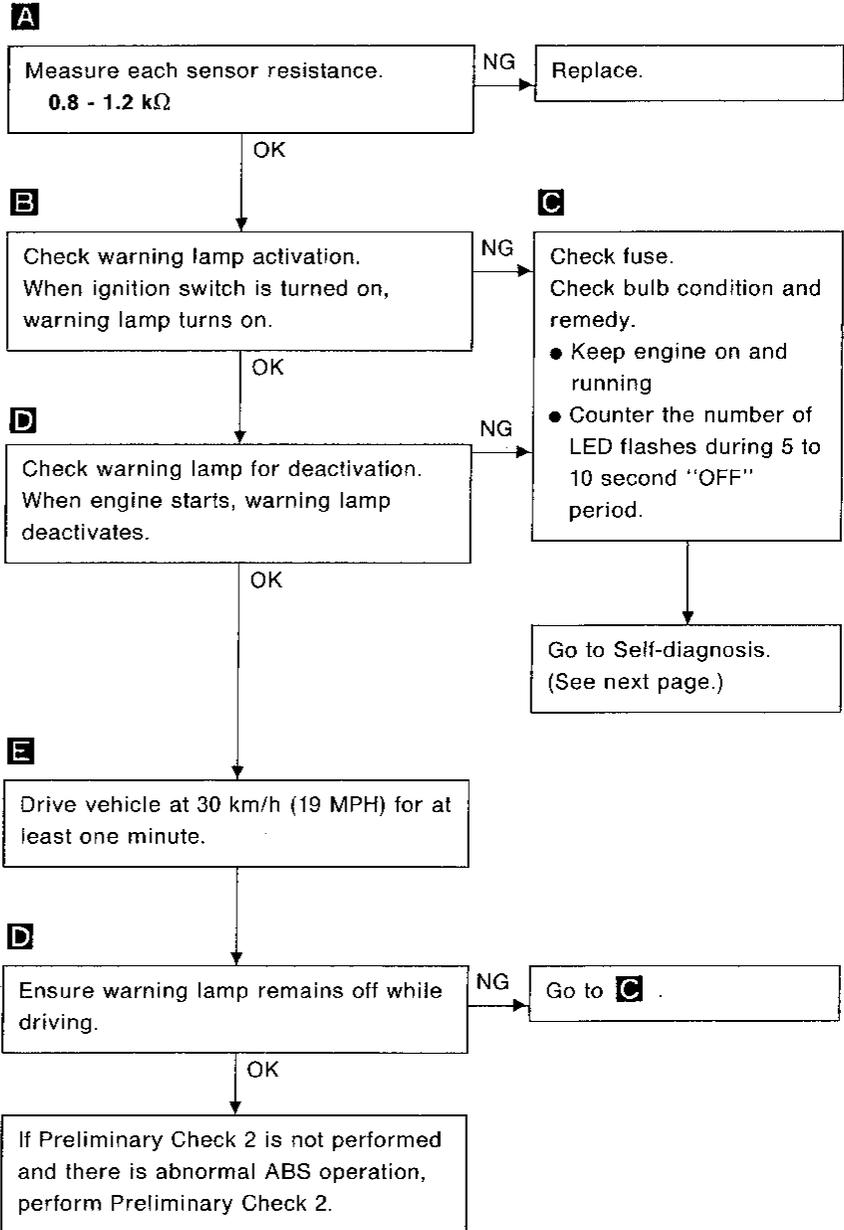
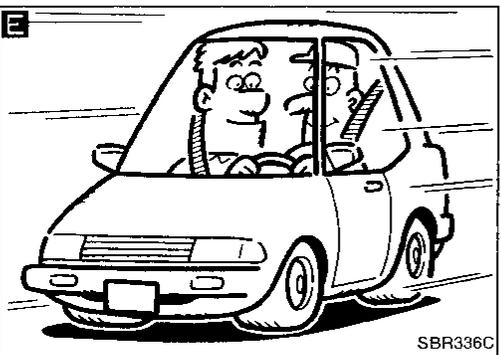
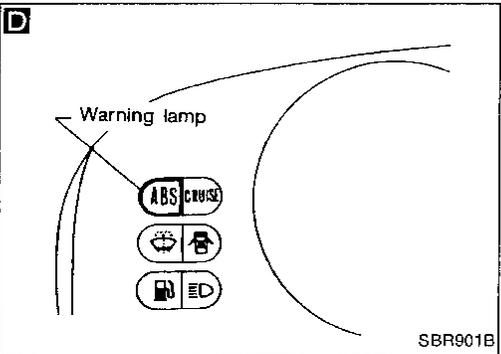
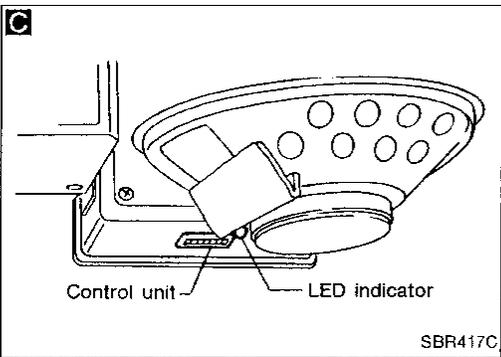
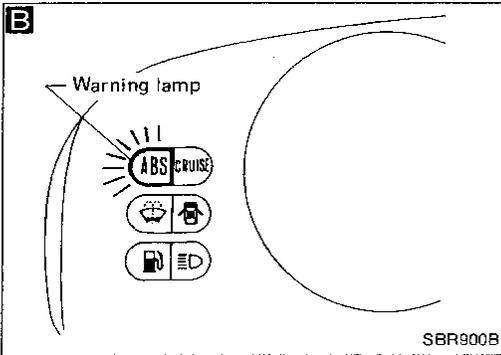
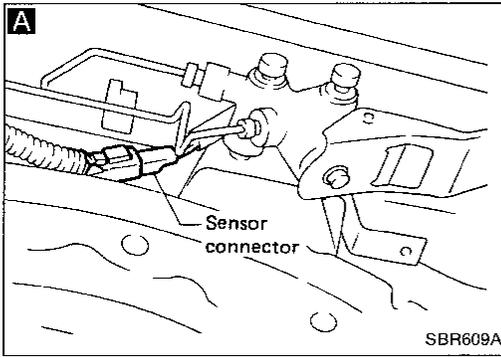
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Preliminary Check 3



Self-diagnosis

CHECKING THE NUMBER OF LED 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 LED flashes is counted while the engine is running.

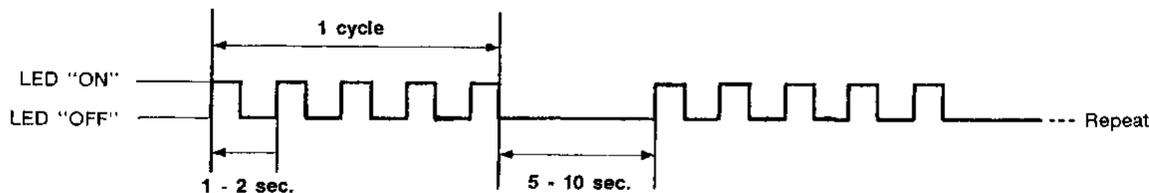
The LED is located on the control unit, identifying a malfunctioning part or unit by the number of flashes. Both the warning light and the LED persistently activate, even after a malfunctioning part or unit has been repaired, unless the ignition switch is turned "OFF". After repairs, turn the ignition 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 LED will flash to indicate one of the malfunctioning circuits. After the circuit has been repaired, the LED will then flash to indicate that the other circuit is malfunctioning.

No. of LED flashes	Malfunctioning parts or circuit
1	Left front actuator solenoid circuit
2	Right front actuator solenoid circuit
3	Right rear actuator solenoid circuit
4	Left rear actuator solenoid circuit
5	Left front wheel sensor circuit
6	Right front wheel sensor circuit
7	Right rear wheel sensor circuit
8	Left rear wheel sensor circuit
9	Motor and motor relay
10	Solenoid valve relay
16 or continuous	Control unit
Warning activates and LED "OFF"	Power supply or ground circuit for control unit

Example

Improper operation of left front rotor sensor circuit

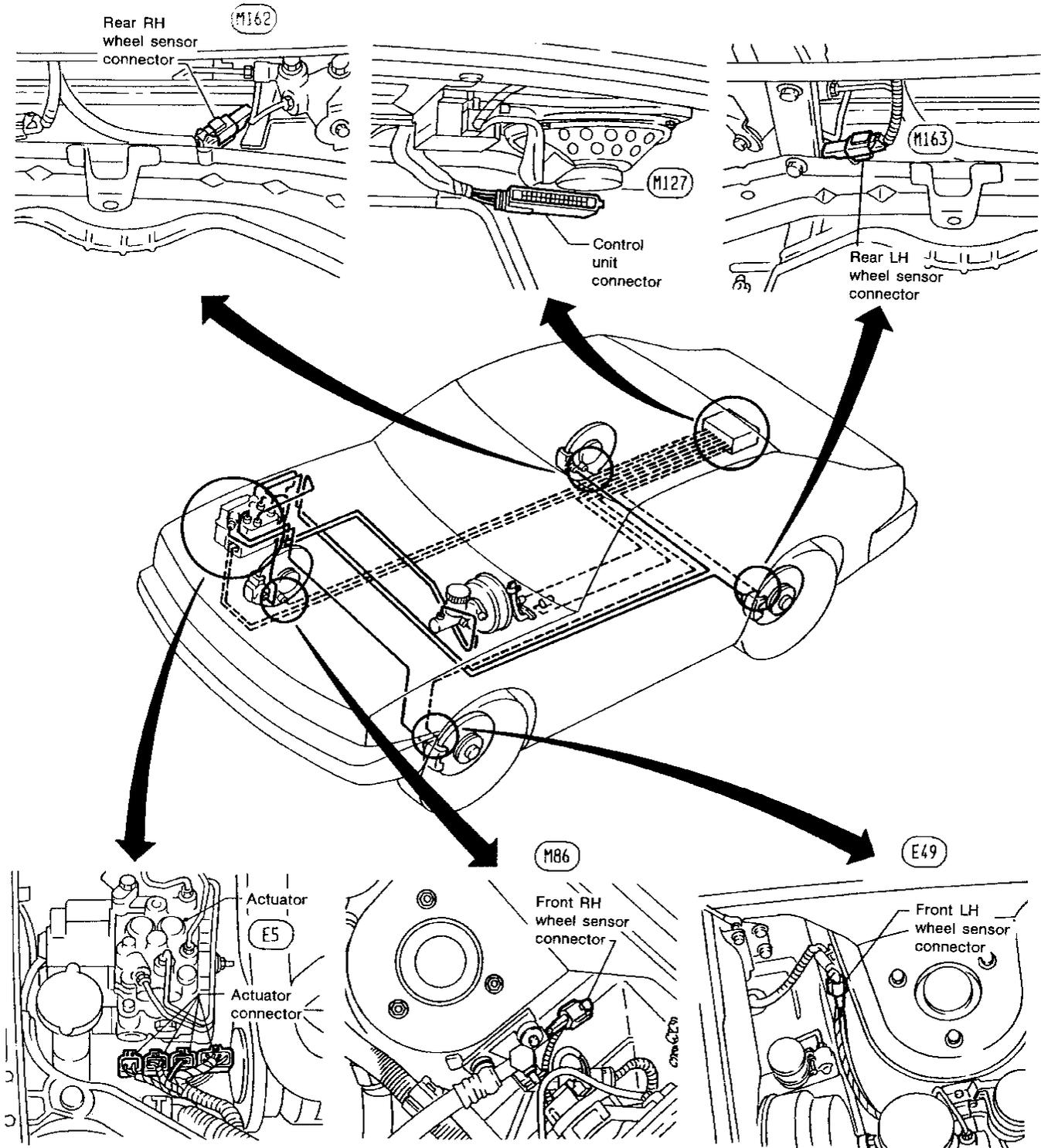


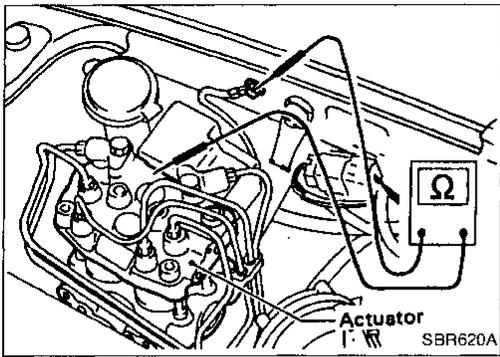
SBR531AA

Go to Diagnostic Procedures 7-12 (BR-46 - 50), where malfunction portion is concerned.

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Component Parts and Harness Connector Location





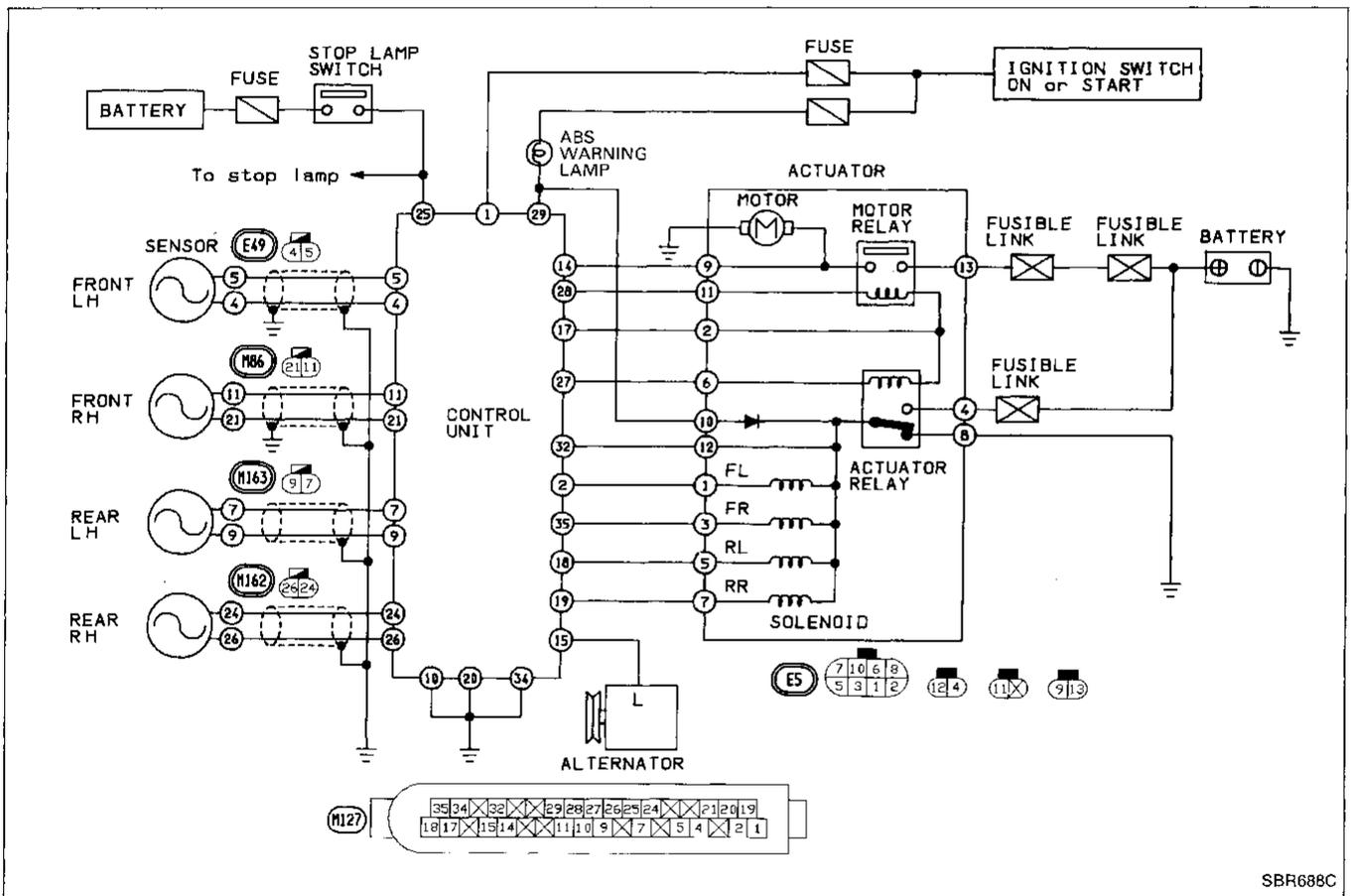
Ground Circuit Check

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 "Component Parts and Harness Connector Location". (See page BR-40.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".

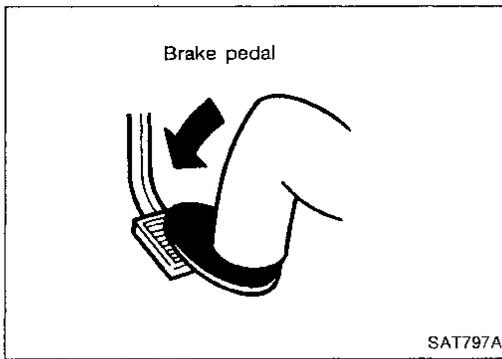


SBR688C

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 3 result (BR-38).



No

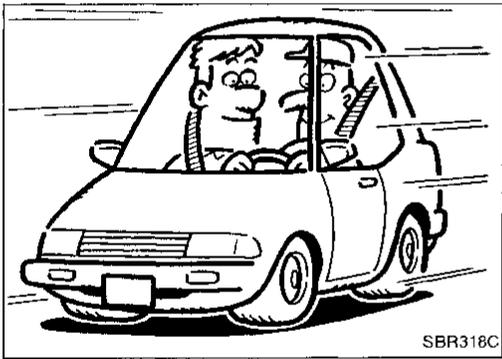
Check whether the symptom appears only when the vehicle speed is within 10 km/h (6 MPH) after starting engine. Yes → Check whether the symptom disappears within 5 seconds.

No

Yes

(A)

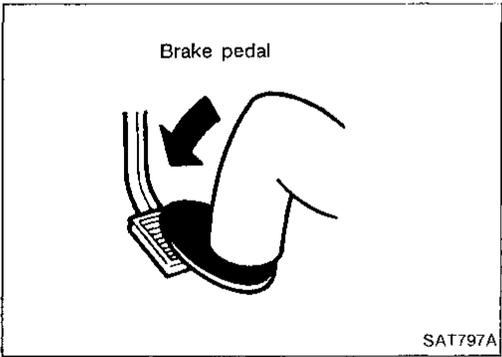
ABS may sometimes operate when load is high and voltage is low due to insufficient alternator output.



No

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 → (A)

Yes

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

- Shifting
- Operating clutch
- Passing protrusion

No

Yes

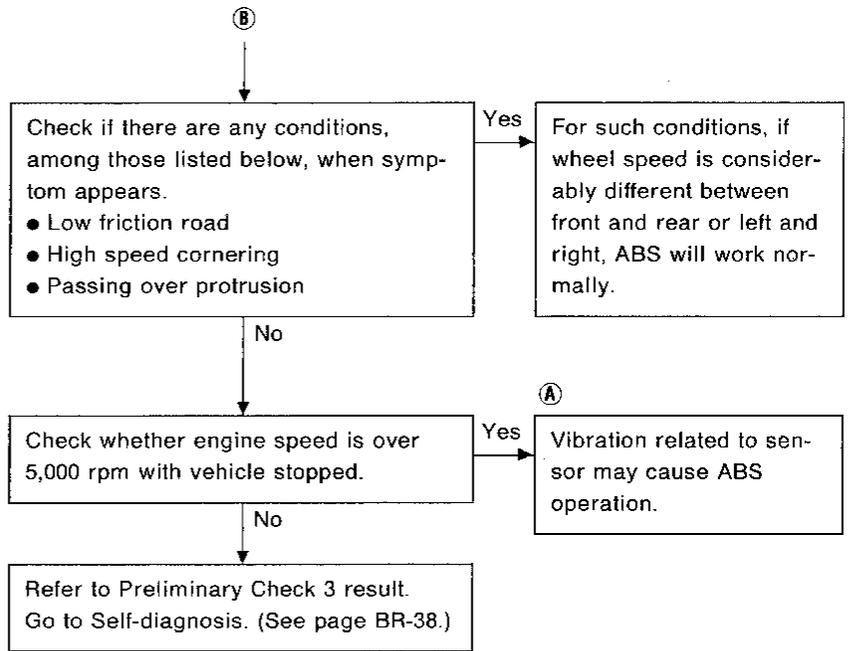
(B)

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

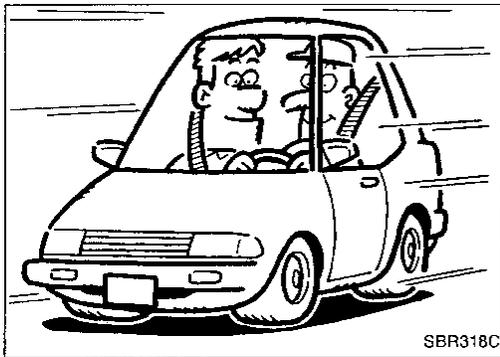
(B)

TROUBLE DIAGNOSES

Diagnostic Procedure 1 (Cont'd)



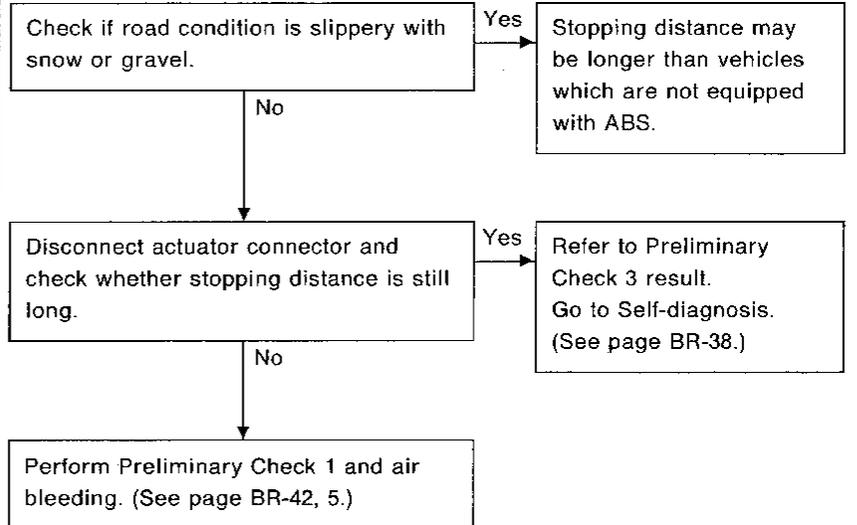
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Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results.

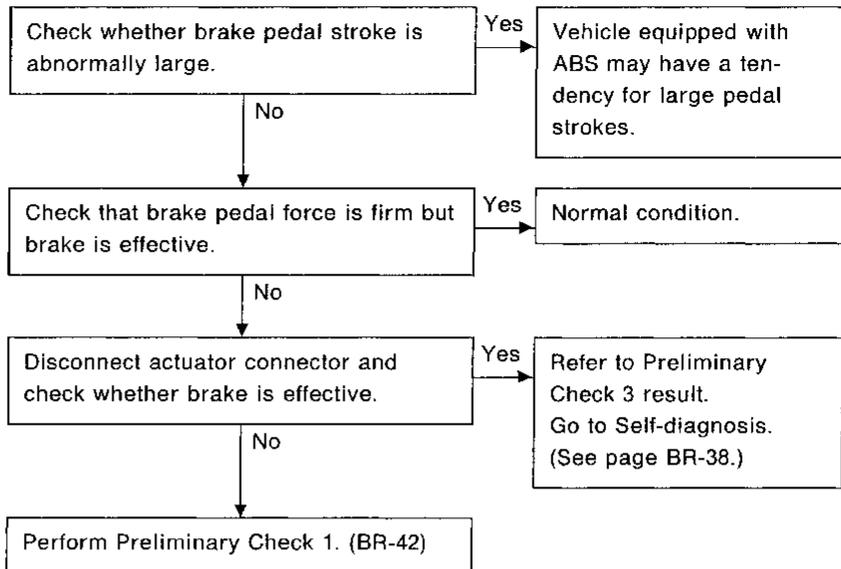


TROUBLE DIAGNOSES

Diagnostic Procedure 3

SYMPTOM: Abnormal pedal action

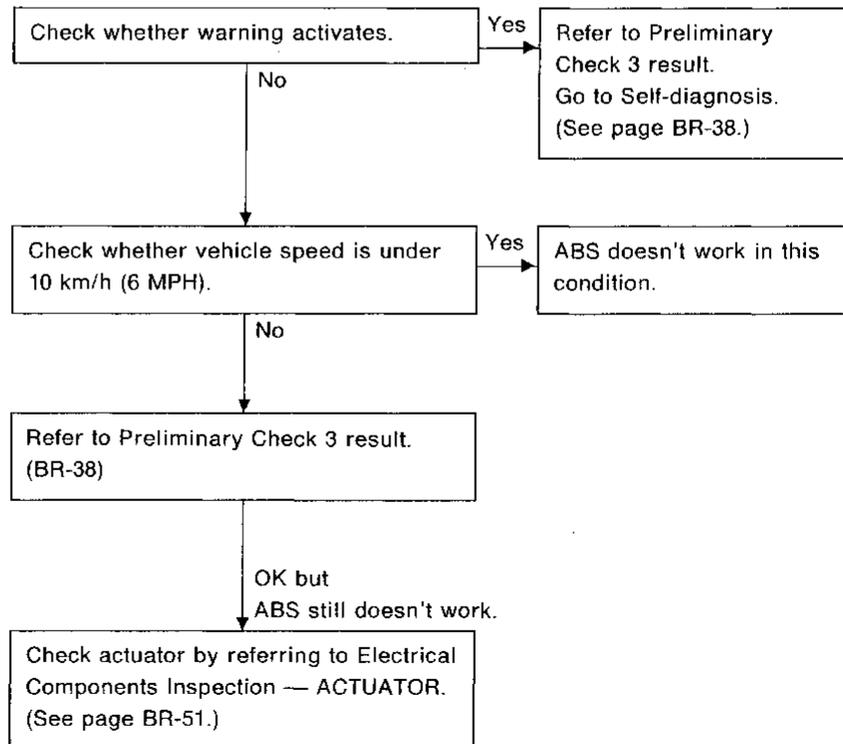
Refer to worksheet results.



Diagnostic Procedure 4

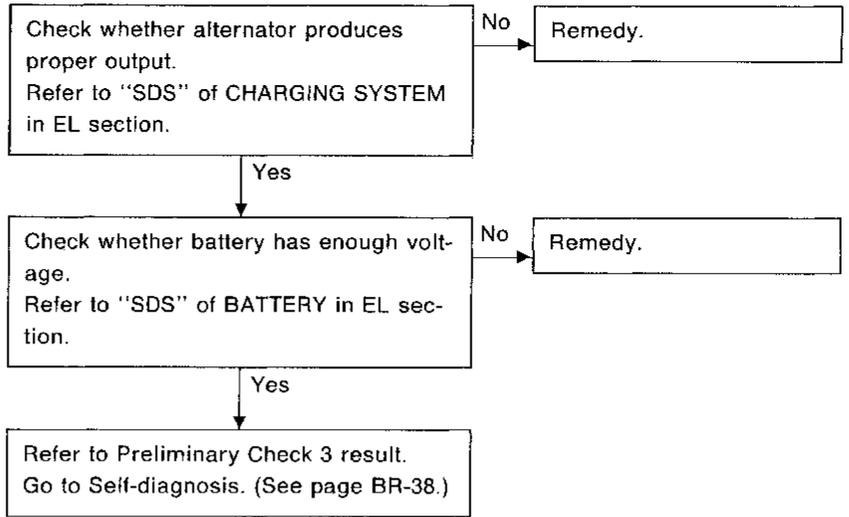
SYMPTOM: ABS doesn't work.

Refer to worksheet results.

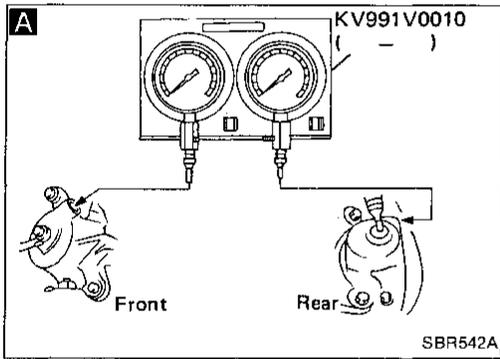


Diagnostic Procedure 5

SYMPTOM: ABS works but warning activates.

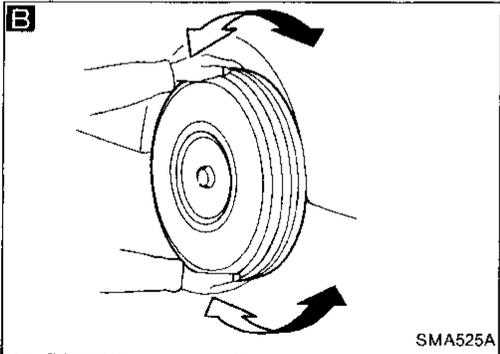
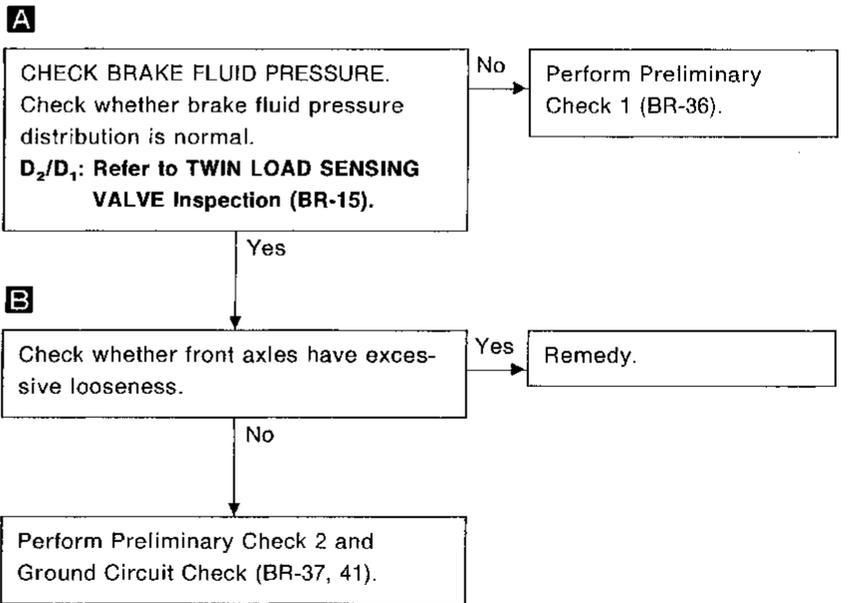


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Diagnostic Procedure 6

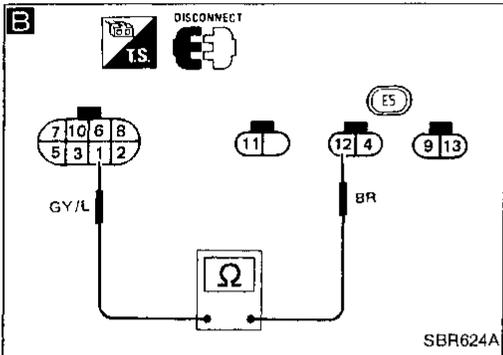
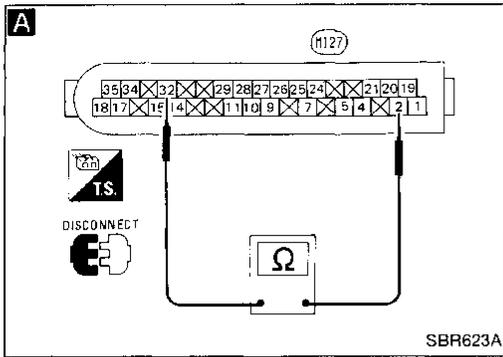
SYMPTOM: ABS works frequently.



TROUBLE DIAGNOSES

Diagnostic Procedure 7

ACTUATOR SOLENOID (LED flashing number 1 - 4)



INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RESISTANCE.
Check resistance between control unit connector (vehicle side) terminals.

Flashing number 1:
Terminals ③② and ②

Flashing number 2:
Terminals ③② and ③⑤

Flashing number 3:
Terminals ③② and ①⑨

Flashing number 4:
Terminals ③② and ①⑩

Resistance: 0.7 - 1.6Ω

OK → Replace control unit.

B

Check resistance between actuator connector (actuator side) terminals.

Flashing number 1:
Terminals ⑫ and ①

Flashing number 2:
Terminals ⑫ and ③

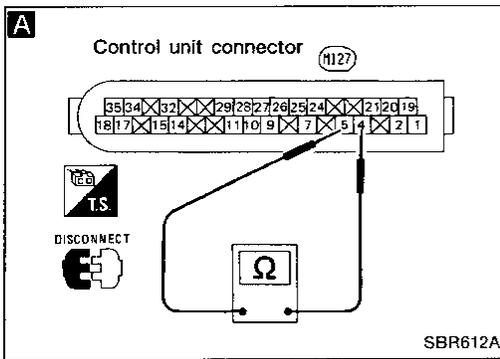
Flashing number 3:
Terminals ⑫ and ⑦

Flashing number 4:
Terminals ⑫ and ⑤

Resistance: 0.7 - 1.6Ω

OK → Repair harness between actuator connector and control unit connector.

NG → Replace actuator.



Diagnostic Procedure 8

WHEEL SPEED SENSOR (LED flashing number 5 - 8)

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SPEED SENSOR RESISTANCE.
Check resistance between control unit connector (vehicle side) terminals.

Flashing number 5 (Fr. LH):
Terminals ④ and ⑤

Flashing number 6 (Fr. RH):
Terminals ⑪ and ⑫

Flashing number 7 (Rr. RH):
Terminals ⑳ and ㉑

Flashing number 8 (Rr. LH):
Terminals ㉗ and ㉘

Resistance: 0.8 - 1.2 kΩ

OK → Perform preliminary check 2 (BR-37).

OK → Replace control unit.

NG → Refer to Preliminary Check 3 result (BR-36).
Check whether sensor has 0.8 to 1.2 kΩ resistance.

NG → Replace sensor.

OK → Repair harness between sensor connector and control unit connector.

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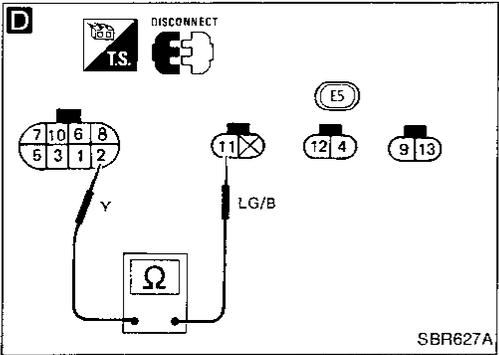
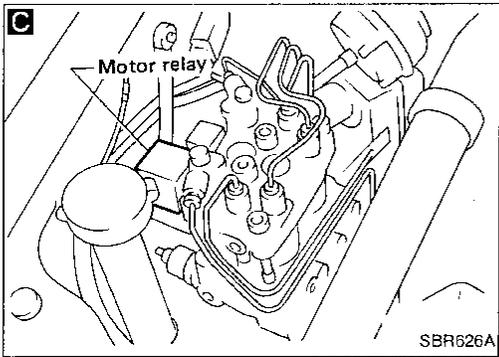
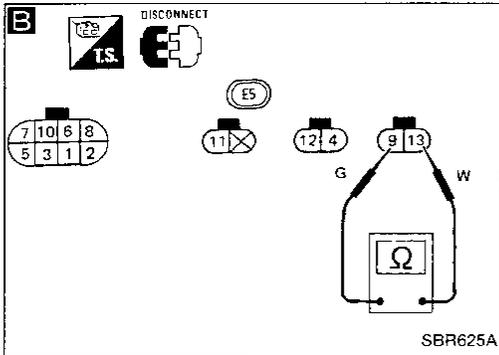
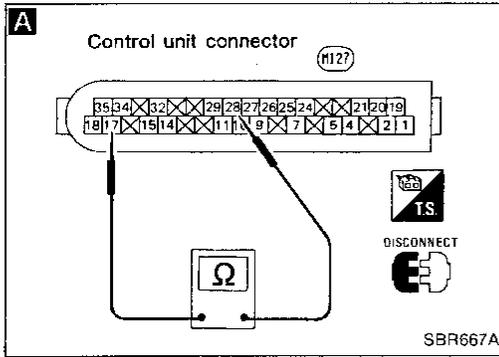
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Diagnostic Procedure 9

ACTUATOR MOTOR RELAY (LED flashing number 9)



INSPECTION START
Remove battery negative terminal connector.

A

CHECK MOTOR RELAY SOLENOID RESISTANCE.
Check resistance between control unit connector (vehicle side) terminals ⑰ and ⑱.
Resistance: 45 - 55Ω

D

Check resistance between actuator connector (actuator side) terminals ② and ⑪.
Resistance: 45 - 55Ω

OK → Repair harness between actuator and control unit.
NG → **C** → Replace motor relay.

B

CHECK MOTOR RELAY DEACTIVATION.
Check continuity between actuator connector (actuator side) terminals ⑬ and ⑨.

Yes → Replace motor relay.
No → Check if motor fusible link is blown.

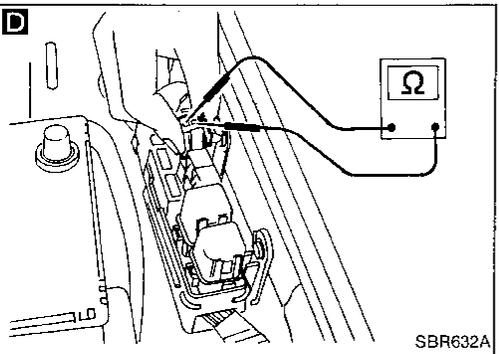
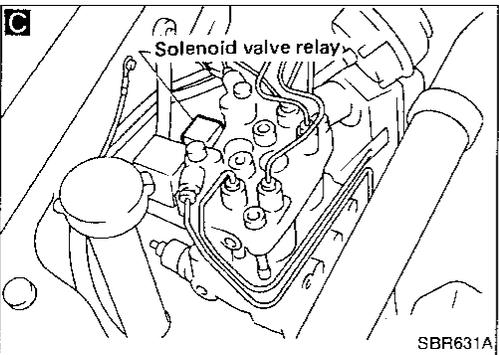
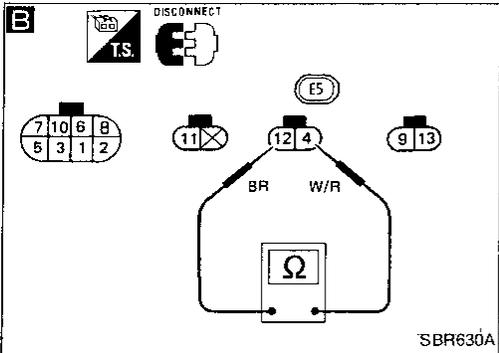
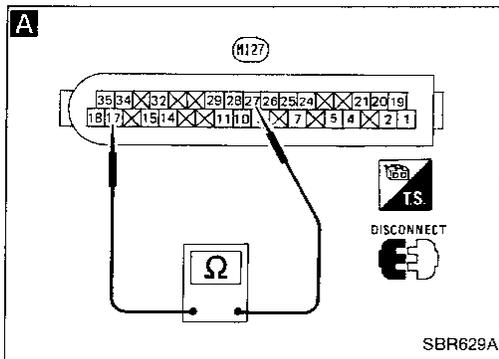
Check if motor fusible link is blown.

Yes → Replace fusible link.
No → Perform Electrical Components Inspection — ACTUATOR.

Perform Electrical Components Inspection — ACTUATOR.
(See page BR-51.)

NG → Replace actuator.
OK → Replace control unit.

Replace control unit.



Diagnostic Procedure 10

ACTUATOR SOLENOID VALVE RELAY (LED flashing number 10)

INSPECTION START
Remove battery negative terminal connector.

```

    graph TD
      Start[INSPECTION START  
Remove battery negative terminal connector.] --> A1[A CHECK SOLENOID VALVE RELAY RESISTANCE.  
Check resistance between control unit connector (vehicle side) terminals ⑭ and ⑮.  
Resistance: 80 - 90Ω]
      A1 -- NG --> A2[Check resistance between actuator connector (actuator side) terminals ⑥ and ②.  
Resistance: 80 - 90Ω]
      A1 -- OK --> B1[B CHECK SOLENOID VALVE RELAY MOVEMENT.  
Disconnect actuator connector.  
Check continuity between actuator connector (actuator side) terminals ④ and ⑫.]
      A2 -- OK --> B1
      A2 -- NG --> C1[C Replace solenoid valve relay.]
      B1 -- Yes --> C1
      B1 -- No --> D1[D Check if solenoid valve relay 20A fuse is blown.]
      D1 -- Yes --> D2[Replace fuse.]
      D1 -- No --> E1[Perform Electrical Components Inspection — ACTUATOR.  
(See page BR-51.)]
      E1 -- NG --> E2[Replace actuator.]
      E1 -- OK --> E3[Replace control unit.]
  
```

Diagnostic Procedure 11

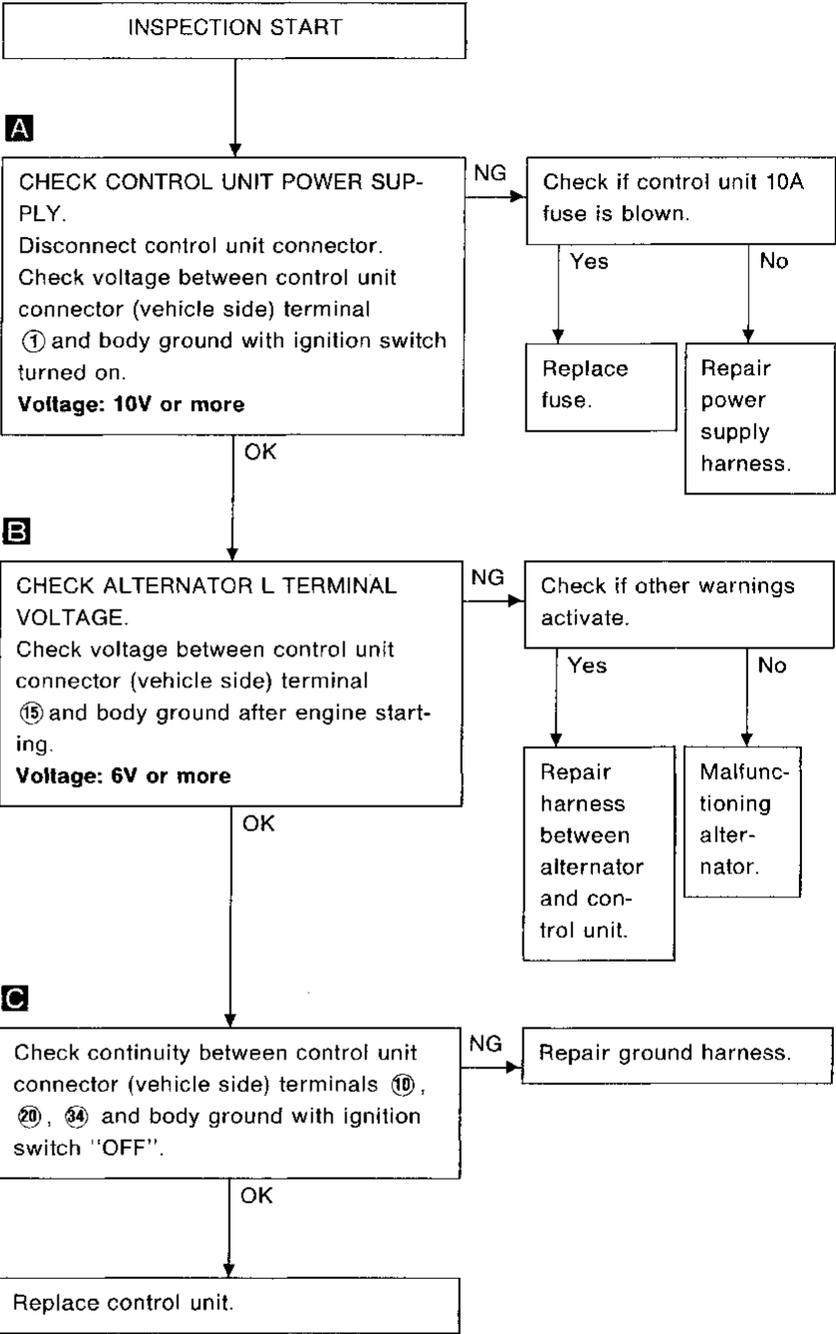
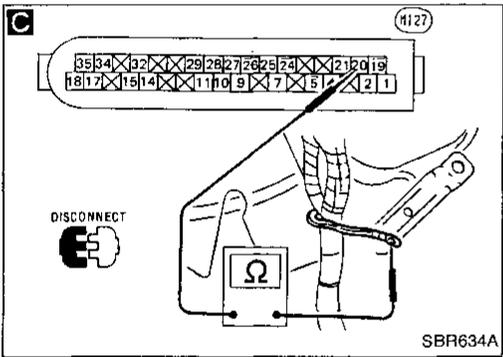
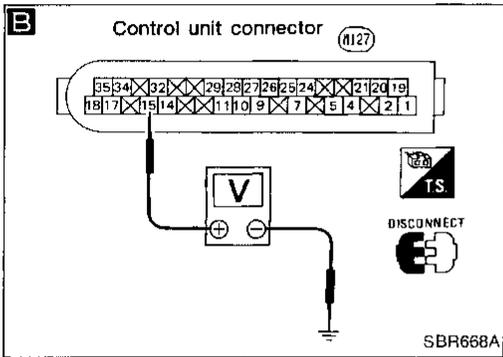
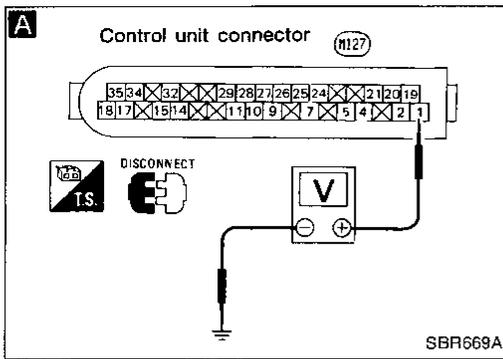
CONTROL UNIT (LED flashing number 16 or continuous)

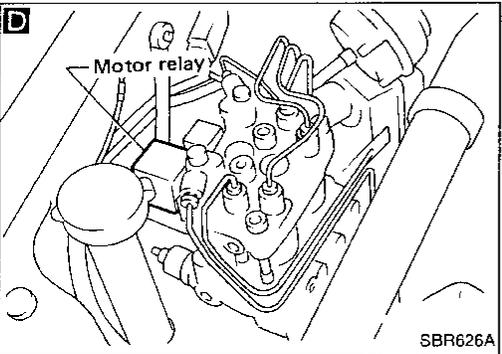
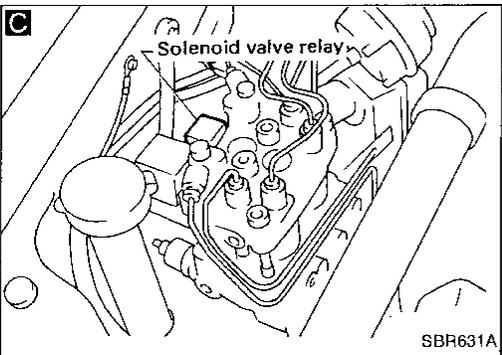
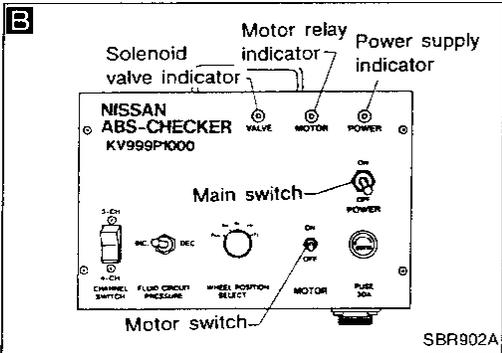
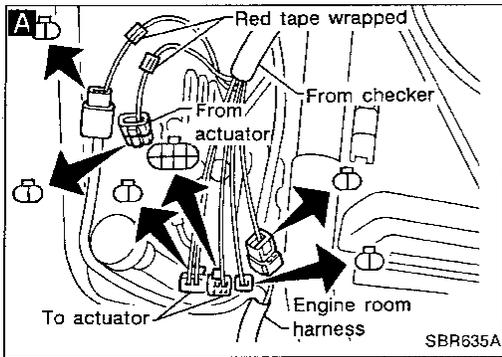
```

    graph TD
      Start[INSPECTION START] --> Step1[Control unit malfunction.]
      Step1 --> Step2[Replace control unit.]
  
```

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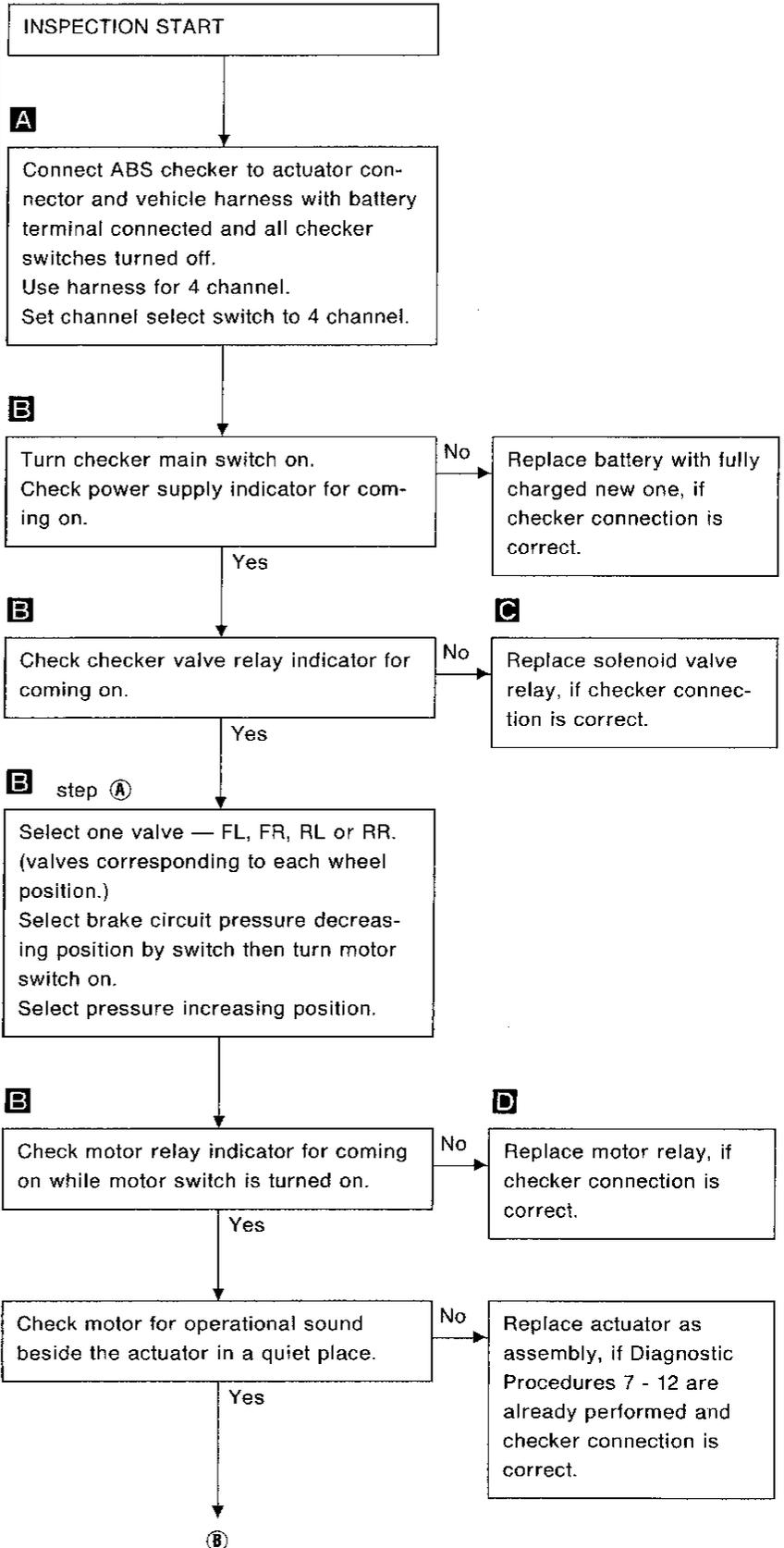
Diagnostic Procedure 12 CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but LED comes off.)





Electrical Components Inspection

ACTUATOR (Not self-diagnostic item)



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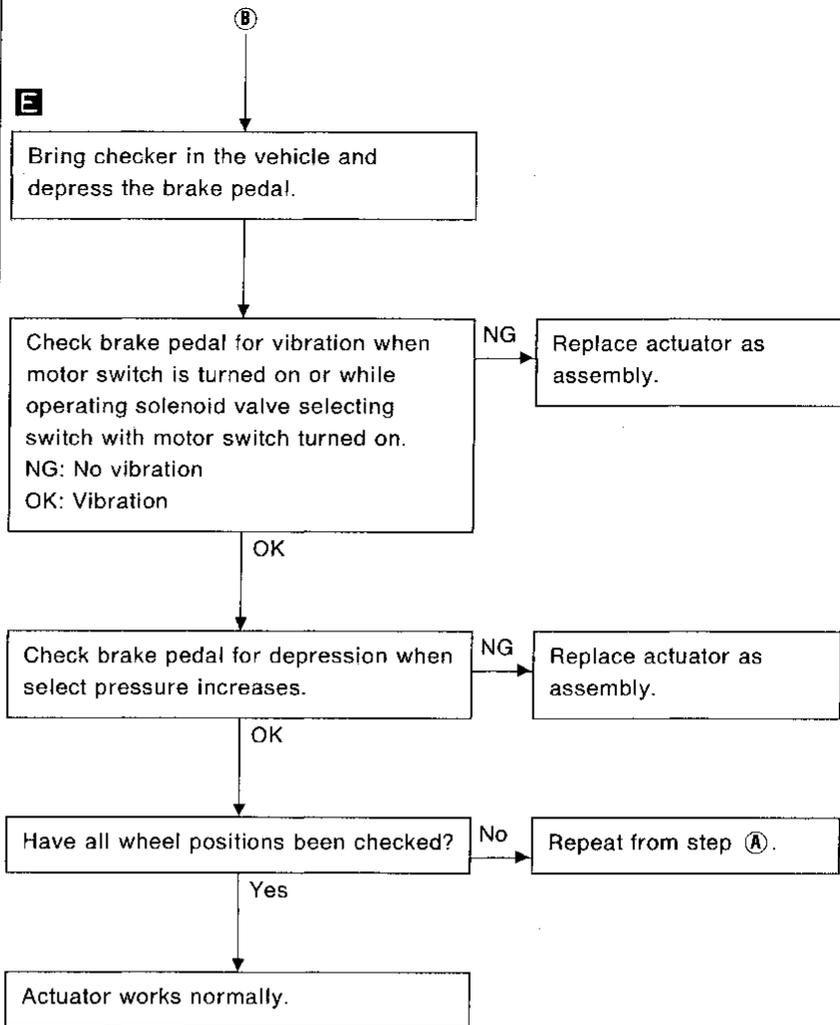
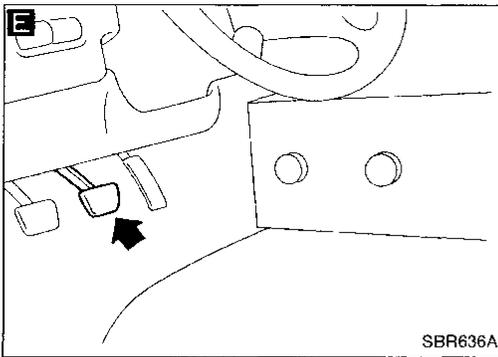
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TROUBLE DIAGNOSES

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.

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

Applied model	Without ABS		With ABS	
	VG30E for U.S.A.	Others	VG30E	VE30DE
Front brake				
Brake model	CL25VB			
Cylinder bore diameter	mm (in)	57.2 (2.252)		
Pad Length x width x thickness	mm (in)	125.6 x 45.3 x 11 (4.94 x 1.783 x 0.43)		
Rotor Outer diameter x thickness	mm (in)	280 x 22 (11.02 x 0.87)		
Rear brake				
Brake model	LT23B		CL9HA	
Cylinder bore diameter	mm (in)	19.05 (3/4)	33.96 (1.3370)	
Lining Length x width x thickness	mm (in)	219.4 x 40 x 4.5 (8.64 x 1.57 x 0.177)	—	
Drum inner diameter	mm (in)	228.6 (9)	—	
Pad Length x width x thickness	mm (in)	—	89.1 x 39.5 x 10 (3.508 x 1.555 x 0.39)	
Rotor Outer diameter x thickness	mm (in)	—	258 x 9 (10.16 x 0.35)	
Master cylinder				
Cylinder bore diameter	mm (in)	23.81 (15/16)		25.40 (1)
Control valve				
Valve model	Dual proportioning valve (within master cylinder)		Dual proportioning valve	Linkage LSV
Split point [kPa (kg/cm ² , psi)] x reducing ratio	2,942 (30, 427) x 0.2	2,942 (30, 427) x 0.4		Variable x 0.3
Brake booster				
Booster model	M195T		M215T	
Diaphragm diameter	mm (in)	205 (8.07)		230 (9.06)
Primary	205 (8.07)		230 (9.06)	
Secondary	180 (7.09)		205 (8.07)	
Recommended brake fluid	DOT 3			

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SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment

DISC BRAKE

Brake model		CL25VB	CL9HA
Pad wear limit	mm (in)	2.0 (0.079)	
Minimum thickness			
Rotor repair limit	mm (in)	20.0 (0.787) 8.0 (0.315)	
Minimum thickness			

DRUM BRAKE

Brake model		LT23B
Lining wear limit	mm (in)	1.5 (0.059)
Minimum thickness		
Drum repair limit	mm (in)	230.0 (9.06)
Maximum inner diameter		
Out-of-roundness		

BRAKE PEDAL

Free height "H"	mm (in)	159 - 169 (6.26 - 6.65)
M/T		
A/T		169 - 179 (6.65 - 7.05)
Depressed height "D"	mm (in)	90 (3.54)
[under force of 490 N (50 kg, 110 lb) with engine running]		
Clearance between switches and pedal stopper bracket "C"	mm (in)	0.3 - 1.0 (0.012 - 0.039)
Pedal free play "A"	mm (in)	1 - 3 (0.04 - 0.12)

PARKING BRAKE

Number of notches		8 - 10
[under force of 196 N (20 kg, 44 lb)]		
Number of notches		1
when warning lamp switch comes on		