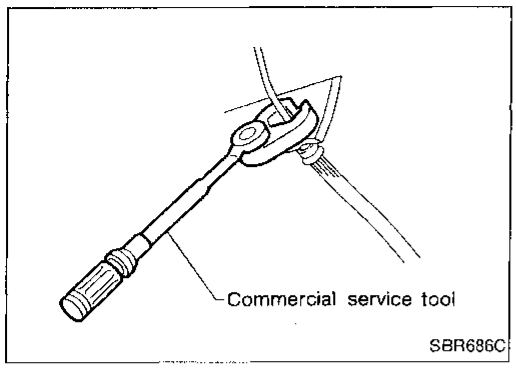
BRAKE SYSTEM

SECTION BR

GI
MA
EM
LC
EF & EC
FE
CL
MT
AT
FA
RA
BR
ST
BF
HA
EL
IDX

CONTENTS



Precautions

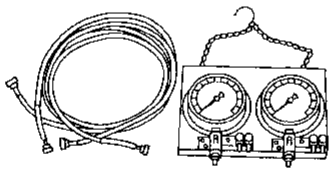
- **Use brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**
- **To clean or wash all parts of master cylinder, disc brake 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 flare nut wrench when removing and installing brake tube.**
- **Always torque brake lines when installing.**

WARNING:

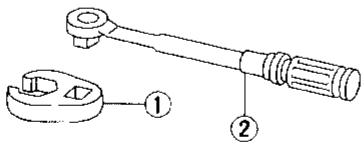
- **Clean brake pads and shoes with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.**

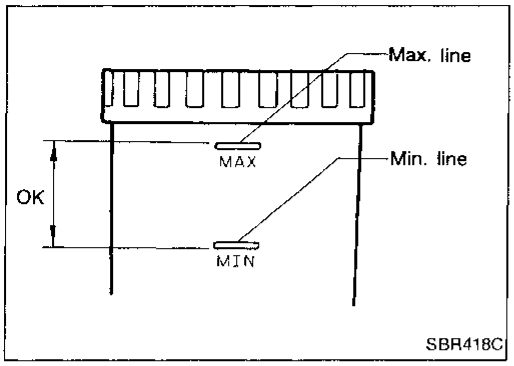
Preparation

SPECIAL SERVICE TOOL

Tool number (Kent-Moore No.) Tool name	Description
KV991V0010 (—) Brake fluid pressure gauge	Measuring brake fluid pressure  NT151

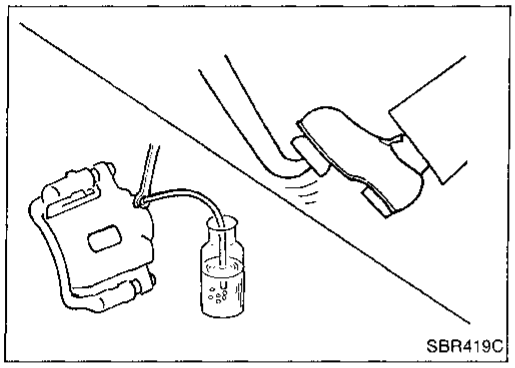
Commercial Service Tools

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



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.

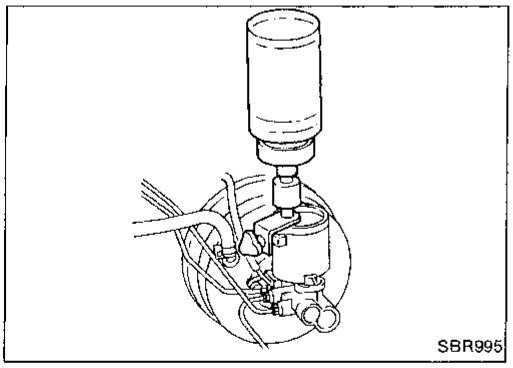
1. Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
2. Check for oil leakage by fully depressing brake pedal while engine is running.

Changing Brake Fluid

CAUTION:

- **Refill with new brake fluid "DOT 3".**
- **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. Connect a vinyl tube to each air bleeder valve.
2. Drain brake fluid from each air bleeder valve by depressing brake pedal.
3. 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 Brake System" shown below.

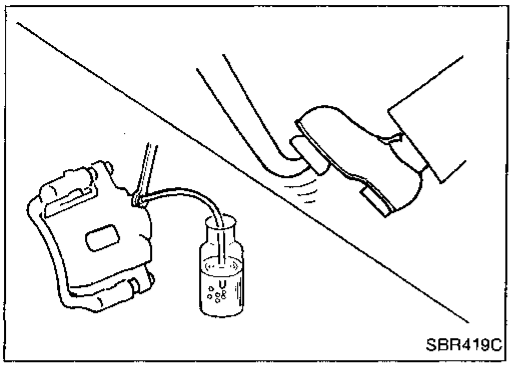


Bleeding Brake System

CAUTION:

- **Carefully monitor brake fluid level at master cylinder during bleeding operation.**
- **If master cylinder is suspected to have air inside, bleed air from master cylinder first. Refer to "Installation" in "MASTER CYLINDER". (See page BR-10.)**
- **Fill reservoir with new brake fluid "DOT 3". Make sure it is full at all times while bleeding air out of system.**
- **Place a container under master cylinder to avoid spillage of brake fluid.**

Bleeding Brake System (Cont'd)



Models without ABS

1. Connect vinyl tube to air bleeder valve.
2. Fully depress brake pedal several times. While holding brake pedal in depressed position, loosen air bleeder valve of right rear wheel to bleed air, then quickly tighten air bleeder valve.
3. Tighten air bleeder valve to specified torque.
   Specified torque:
   7 - 9 N·m (0.7 - 0.9 kg-m, 5.1 - 6.5 ft-lb)
4. Bleed each wheel in the following sequence by repeating steps 1 to 3:
   Left front caliper
   ↓
   Left rear wheel cylinder or caliper
   ↓
   Right front caliper

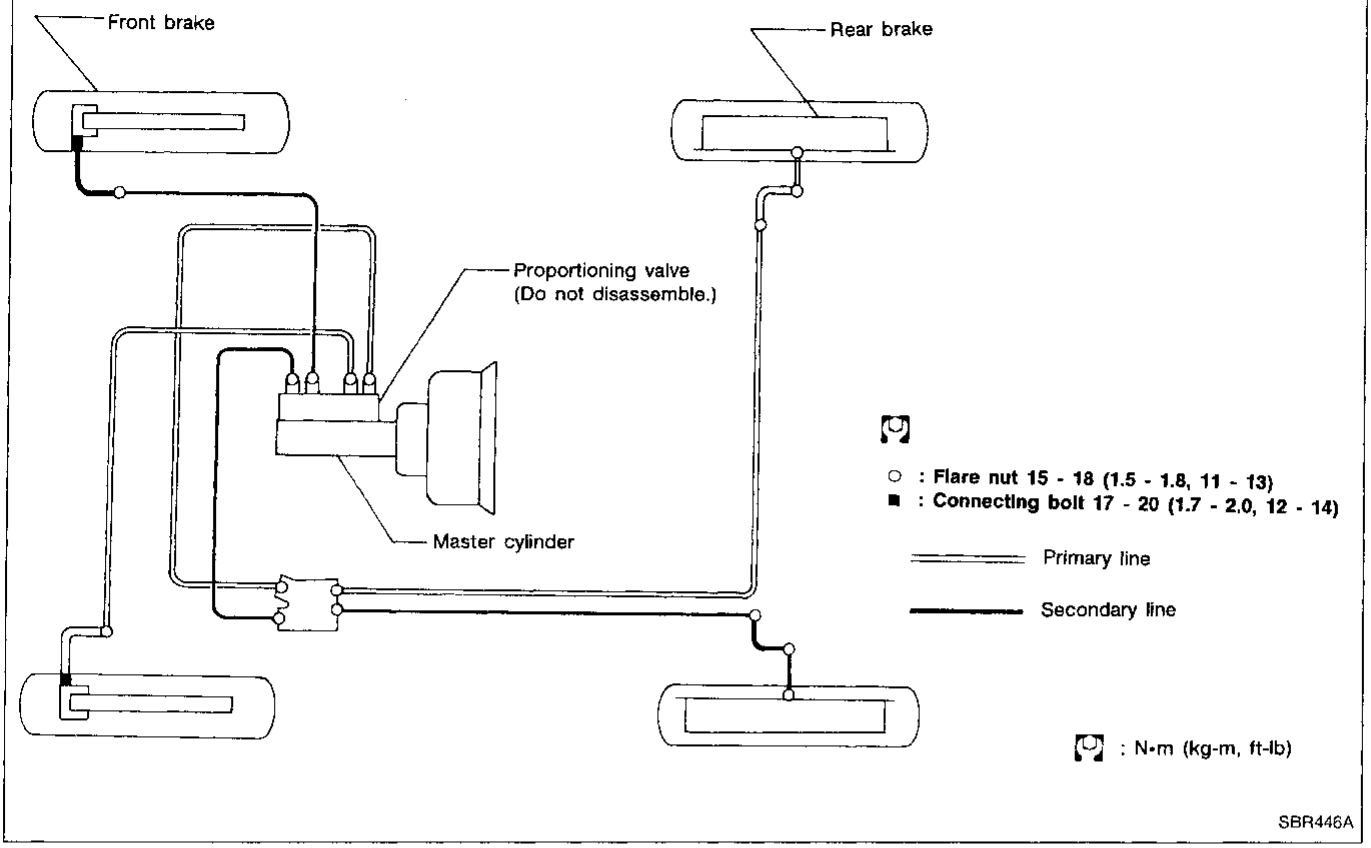
Models with ABS

1. Turn ignition switch OFF and disconnect ABS actuator connector.
2. Fill master cylinder reservoir tank with brake fluid.
   While replenishing brake fluid so that fluid level is always higher than middle of reservoir tank, bleed air using the same method as for models without ABS.

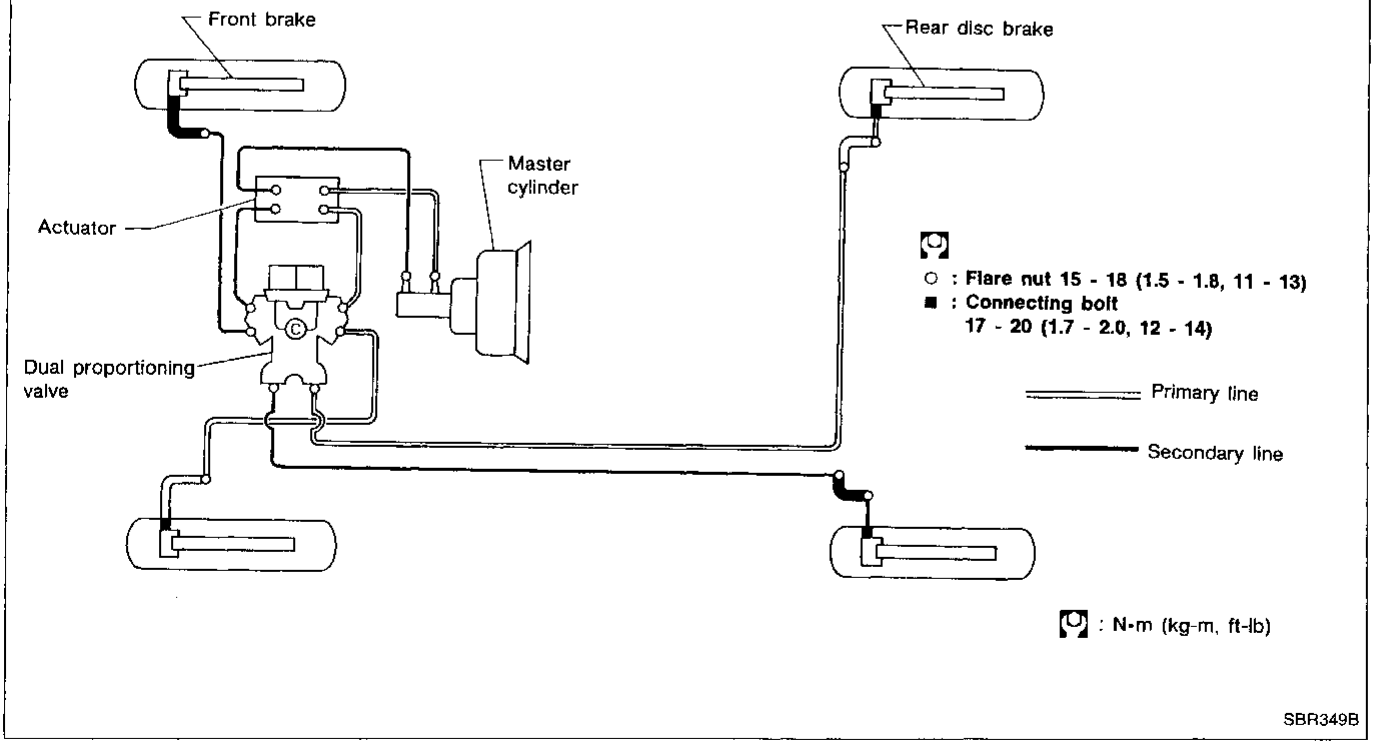
CAUTION:

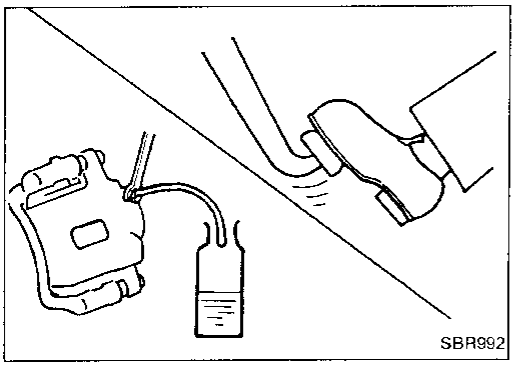
- **No air bleeder is provided on actuator.**
- **Do not loosen actuator connection during air bleeding.**

Without anti-lock braking system



With anti-lock braking system




SBR992

REMOVAL

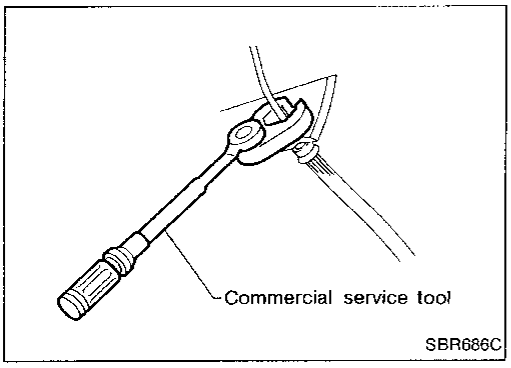
CAUTION:

- **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 a vinyl tube to air bleeder valve.
2. Drain brake fluid from each air bleeder valve by depressing brake pedal.
3. Remove flare nut securing brake tube to hose, then withdraw lock spring.
4. Cover openings to prevent entrance of dirt whenever disconnecting hydraulic line.

INSPECTION

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



SBR686C

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 Brake System". (See page BR-3.)

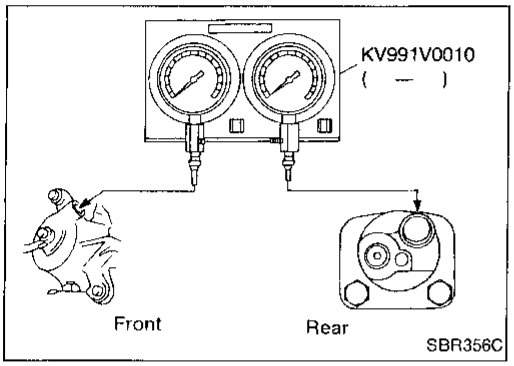
Proportioning Valve

INSPECTION

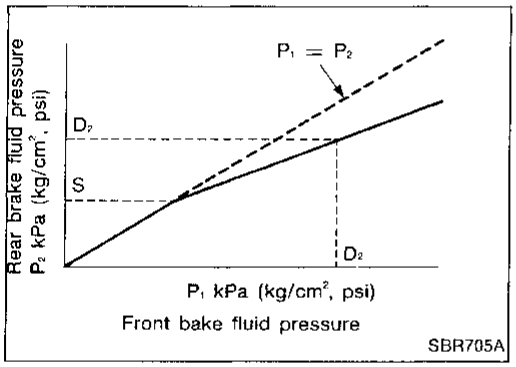
CAUTION:

- **Carefully monitor brake fluid level at master cylinder.**
- **Use new brake fluid "DOT 3".**
- **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.**

1. Connect Tool to air bleeders of front and rear brakes on either LH and RH side.
2. Bleed air from the Tool.
3. Check fluid pressure by depressing brake pedal.

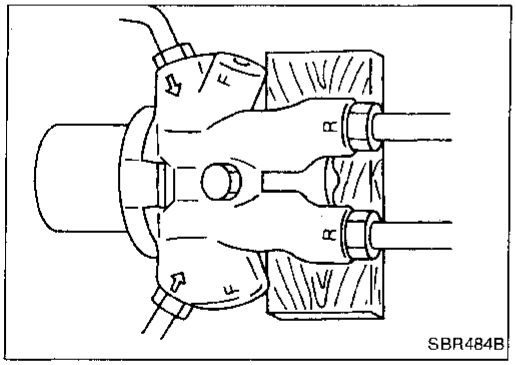


Applied model	Without ABS			With ABS	
	GA16DE	SR20DE		Except SE model	SE model
		SR	SE		
Applied pressure (Front brake) kPa (kg/cm², psi)	7,355 (75, 1,067)	5,394 (55, 782)	6,865 (70, 995)	4,904 (50, 711)	6,375 (65, 924)
Output pressure (Rear brake) kPa (kg/cm², psi)	4,413 - 4,805 (45 - 49, 640 - 697)	2,452 - 2,844 (25 -29, 356 - 412)	3,923 - 4,315 (40 - 44, 569 - 626)	1,961 - 2,354 (20 - 24, 284 - 341)	3,432 - 3,825 (35 - 39, 498 - 555)



If output pressure is out of specifications, replace dual proportioning valve (separated type) or master cylinder assembly (built into master cylinder type).

4. Bleed air after disconnecting the Tool. Refer to "Bleeding Brake System". (See page BR-3.)



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 painted areas, wash it away with water immediately.**
- **All hoses must be free from excessive bending, twisting and pulling.**

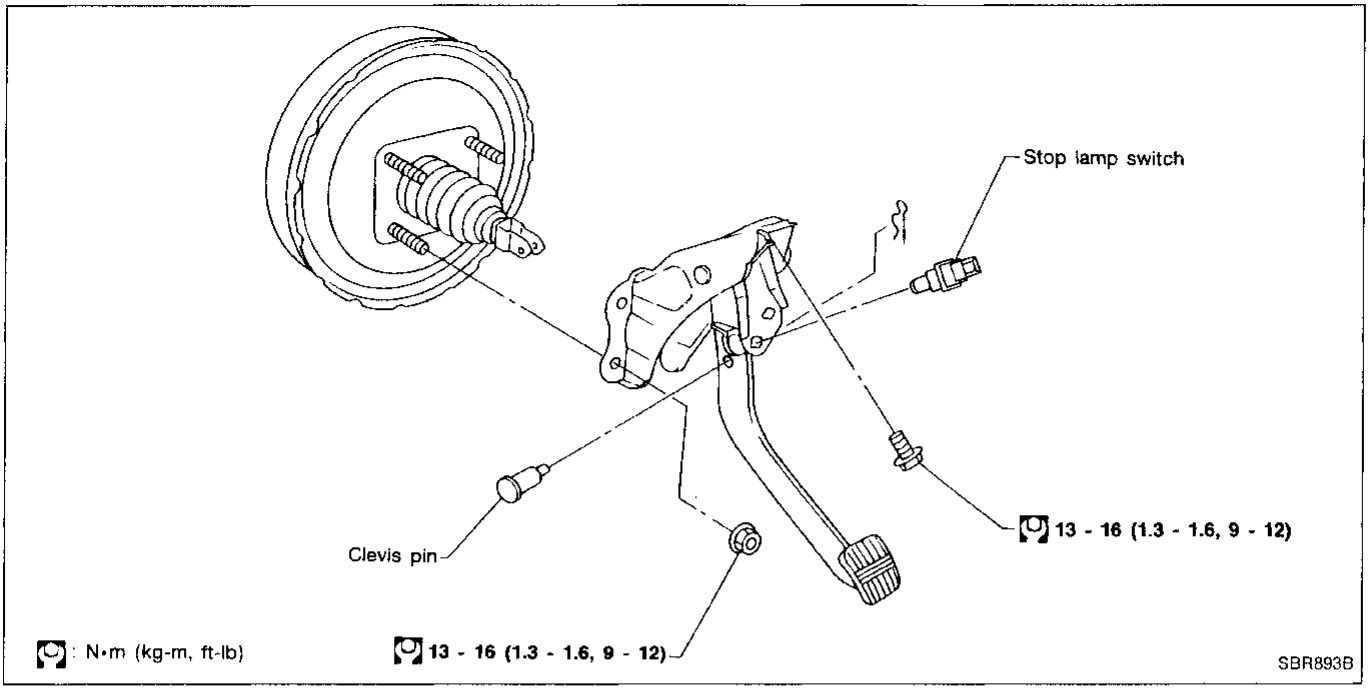
1. Remove proportioning valve mounting bolt.
2. Remove flare nut with wooden block placed between proportioning valve and dash panel.

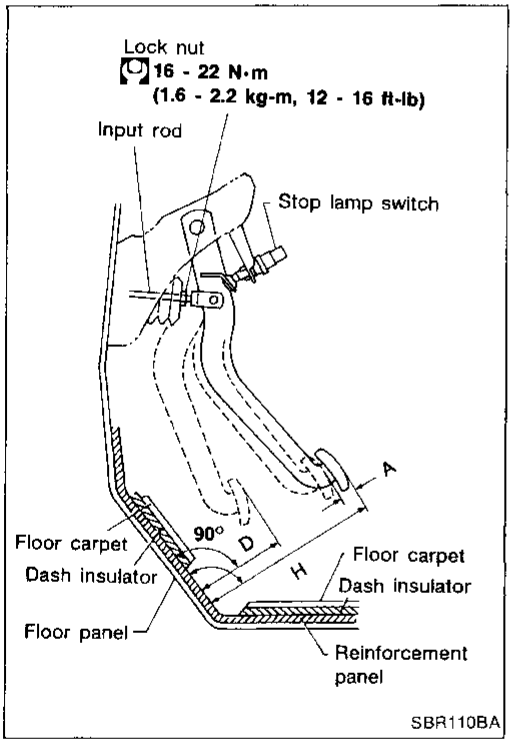
Specification:

Flare nut

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

Removal and Installation





Inspection

Check brake pedal for following items.

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

Adjustment

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

H: Free height
Refer to SDS. (See page BR-61.)

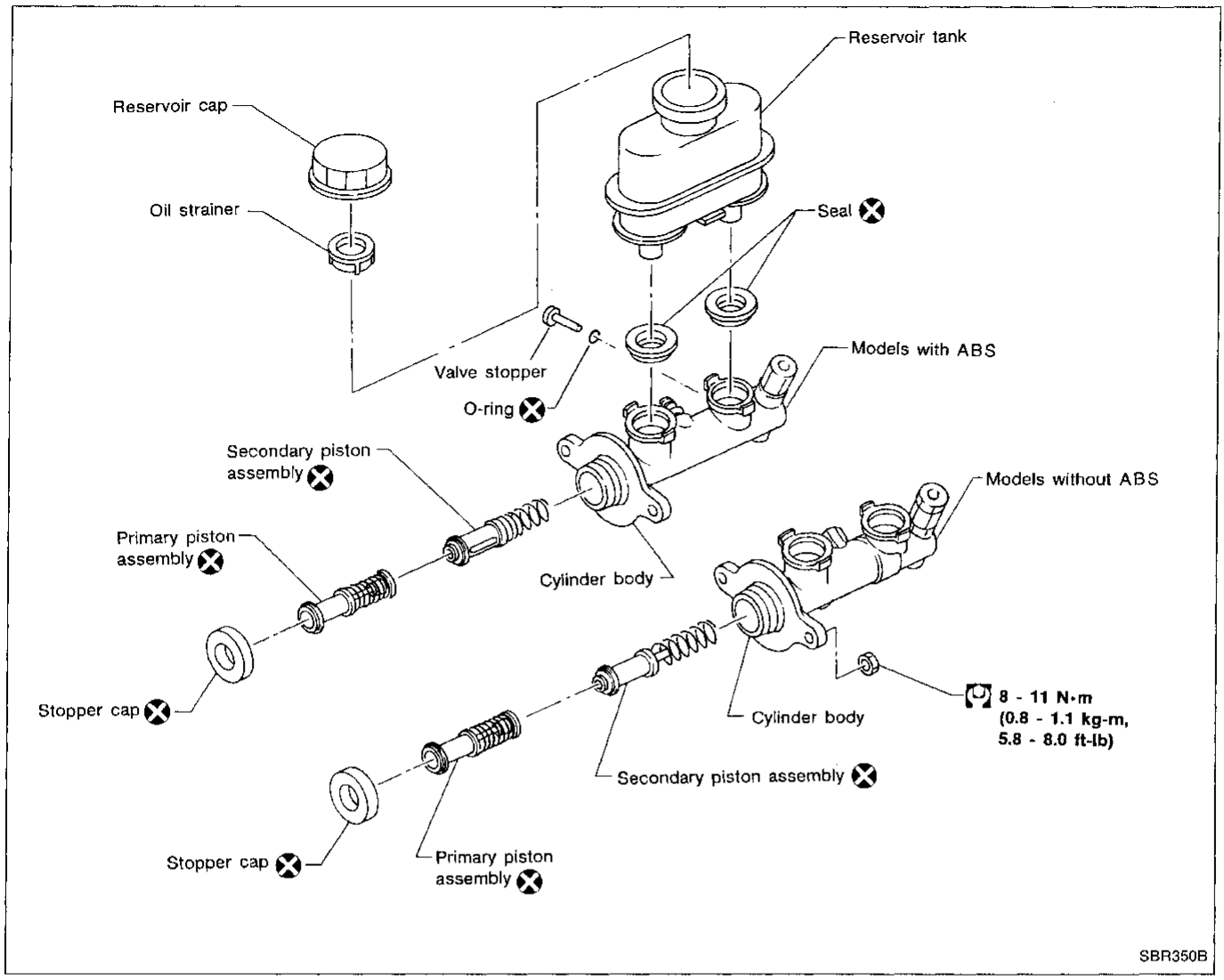
D: Depressed height
Refer to SDS.
Under force of 490 N (50 kg, 110 lb) with engine running

A: Pedal free play
Refer to SDS.

1. Loosen lock nut and adjust pedal free height by turning brake booster input rod. Then tighten lock nut.
2. Check pedal free play.

Make sure that stop lamps go off when pedal is released.

3. 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.

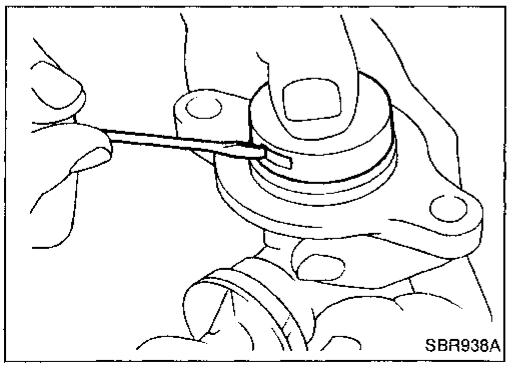


Removal

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.

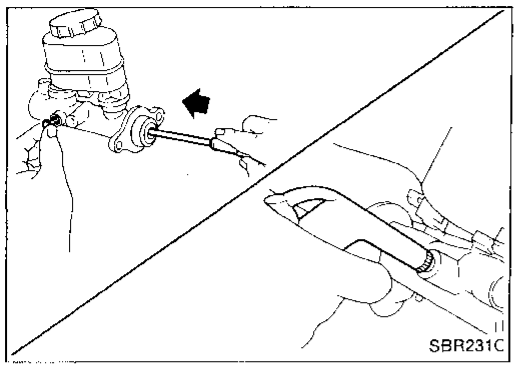
1. Connect a vinyl tube to air bleeder valve.
2. Drain brake fluid from each air bleeder valve, depressing brake pedal to empty fluid from master cylinder.
3. Remove brake pipe flare nuts.
4. Remove master cylinder mounting nuts.



Disassembly

1. Bend claws of stopper cap outward.

Disassembly (Cont'd)


SBR231C

2. Remove valve stopper while piston is pushed into cylinder. (Models with ABS only)
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.

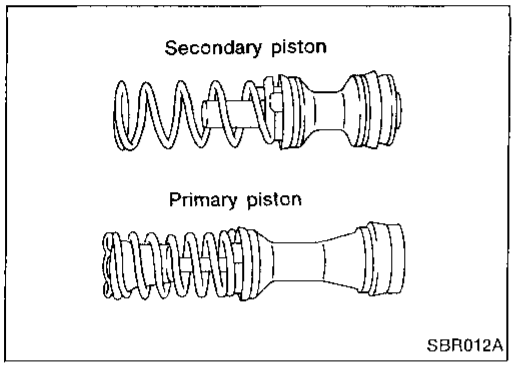
Replace any part if damaged.

Master cylinder:

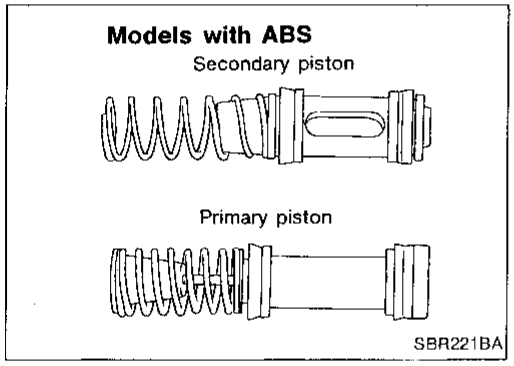
- Pin holes or scratches on inner wall.

Piston:

- Deformation of or scratches on piston cups.



SBR012A

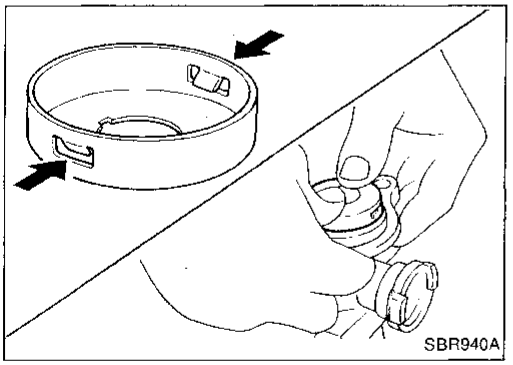


SBR221BA

Assembly

1. Insert secondary piston assembly. Then insert primary piston assembly.

- **Pay attention to direction of piston cups in figure at left. Also, insert pistons squarely to avoid scratches on cylinder bore.**
- **Pay attention to alignment of secondary piston slit with valve stopper mounting hole of cylinder body (For models with ABS only).**


SBR940A

2. Install stopper cap.

Before installing stopper cap, ensure that claws are bent inward.

3. Push reservoir tank seals.
4. Push reservoir tank into master cylinder.
5. Install valve stopper while piston is pushed into cylinder. (Models with ABS only)

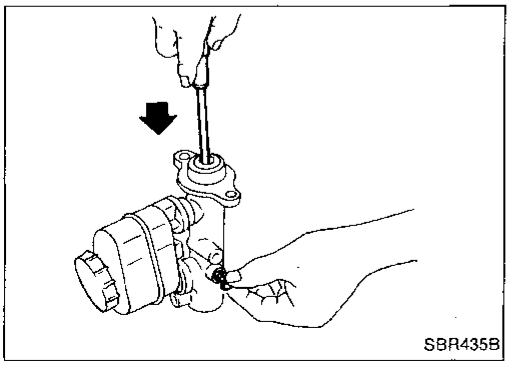
Installation

CAUTION:

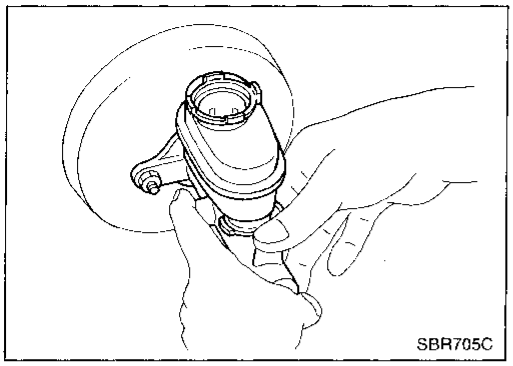
- **Refill with new brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**

1. Place master cylinder onto brake booster and secure mounting nuts lightly.
2. Fit flare nuts to master cylinder.
3. Tighten mounting nuts.

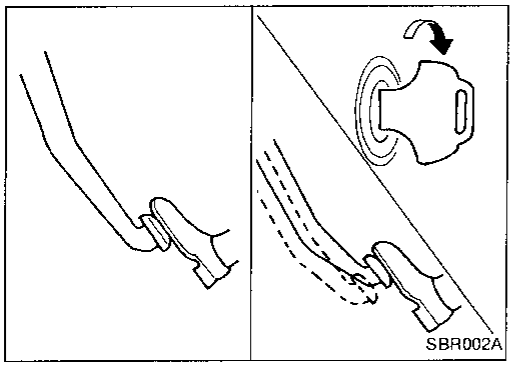
: 8 - 11 N·m (0.8 - 1.1 kg-m, 5.8 - 8.0 ft-lb)

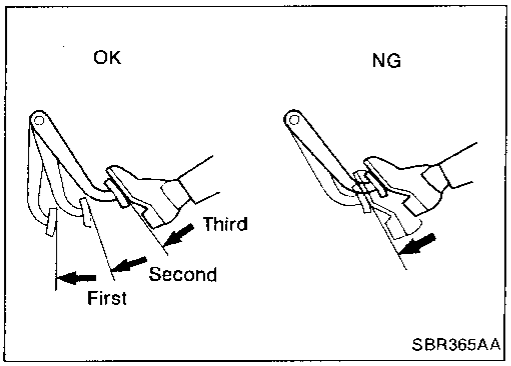

SBR435B

Installation (Cont'd)

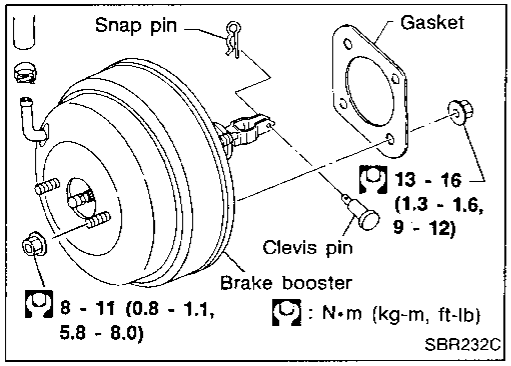


4. Fill up reservoir tank with new brake fluid.
5. Plug all ports on master cylinder with fingers in order not to have air sucked while releasing brake pedal.
6. Have driver depress brake pedal slowly several times until no air comes out of master cylinder.
7. Fit brake lines to master cylinder.
8. Tighten flare nuts.
   : 15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
9. Bleed air. Refer to "Bleeding Brake System". (See page BR-3.)

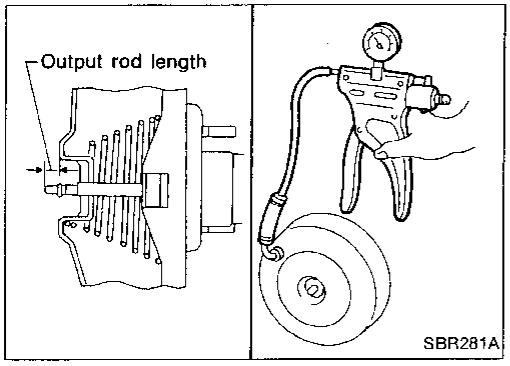

SBR002A



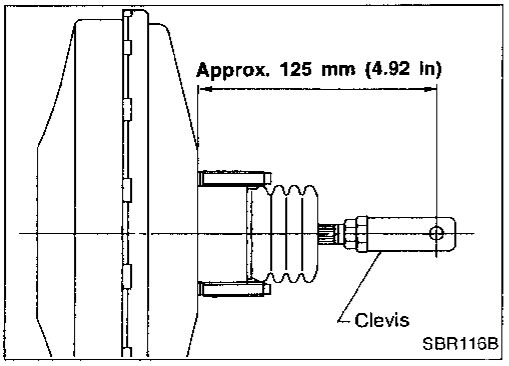
SBR365AA



SBR232C



SBR281A



SBR116B

Brake Booster

ON-VEHICLE SERVICE

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.

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.**
- **Be careful not to deform or bend brake pipes, during removal of booster.**

INSPECTION

Output rod length check

1. Apply vacuum of –66.7 kPa (–500 mmHg, –19.69 inHg) to brake booster with a handy vacuum pump.
2. Check output rod length.

Specified length:

M20

4.875 - 5.125 mm (0.1919 - 0.2018 in)

M165T, M195T

10.275 - 10.525 mm (0.4045 - 0.4144 in)

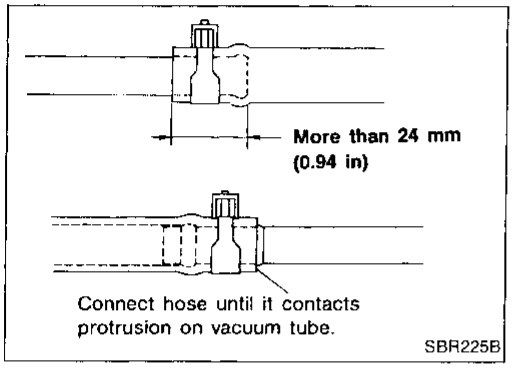
INSTALLATION

CAUTION:

- **Be careful not to deform or bend brake pipes, during installation of booster.**
- **Replace clevis pin if damaged.**
- **Refill with new brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Take care not to damage brake booster mounting bolt thread when installing. Due to the acute angle of installation, the threads can be damaged on the metal surrounding the dash panel holes.**

Brake Booster (Cont'd)

1. Before fitting booster, temporarily adjust clevis to dimension shown.
2. Fit booster, then secure mounting nuts (brake pedal bracket to master cylinder) lightly.
3. Connect brake pedal and booster input rod with clevis pin.
4. Secure mounting nuts.
   Specification: 13 - 16 N·m (1.3 - 1.6 kg-m, 9 - 12 ft-lb)
5. Install master cylinder. Refer to "Installation" in "MASTER CYLINDER". (See page BR-10.)
6. Bleed air. Refer to "Bleeding Brake System". (See page BR-3.)

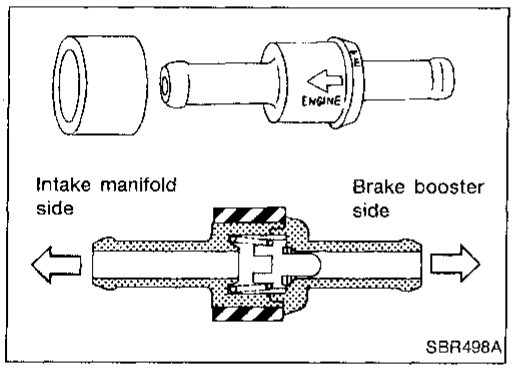


Vacuum Hose

REMOVAL AND INSTALLATION

CAUTION:
When installing vacuum hoses, pay attention to the following points.

- **Do not apply any oil or lubricants to vacuum hose and check valve.**
- **Insert vacuum tube into vacuum hose as shown.**

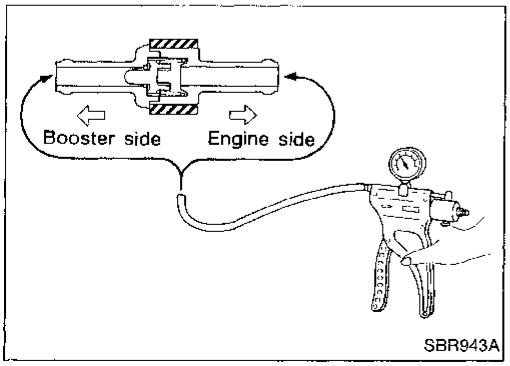


- **Install check valve, paying attention to its direction.**

INSPECTION

Hoses and connectors

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



Check valve

Check vacuum with a vacuum pump.

Connect to booster side	Vacuum should exist.
Connect to engine side	Vacuum should not exist.

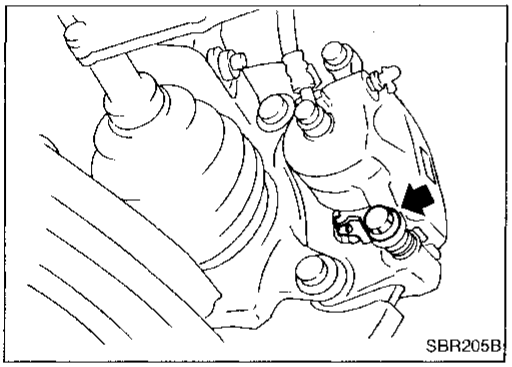
Pad Replacement

WARNING:

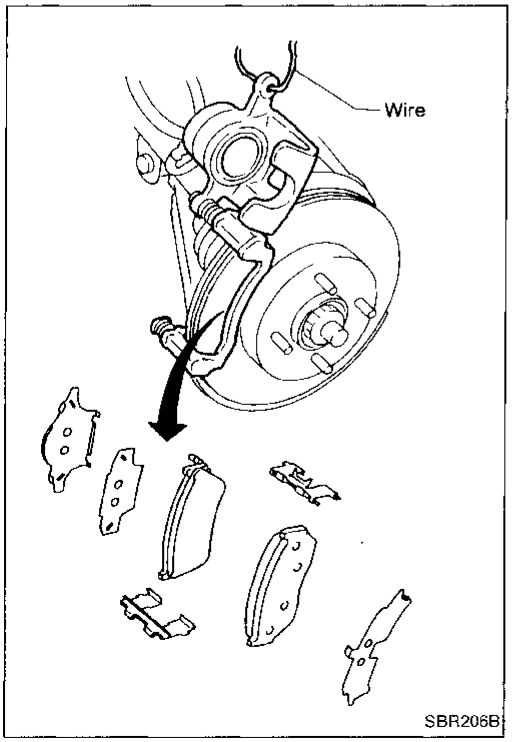
Clean brake pads with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.

CAUTION:

- **When cylinder body is open, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage piston boot or get oil on rotor. Always replace shims when replacing pads.**
- **If shims are rusted or show peeling of the rubber coat, replace them with new shims.**
- **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 master cylinder reservoir cap.
2. Remove pin bolt.



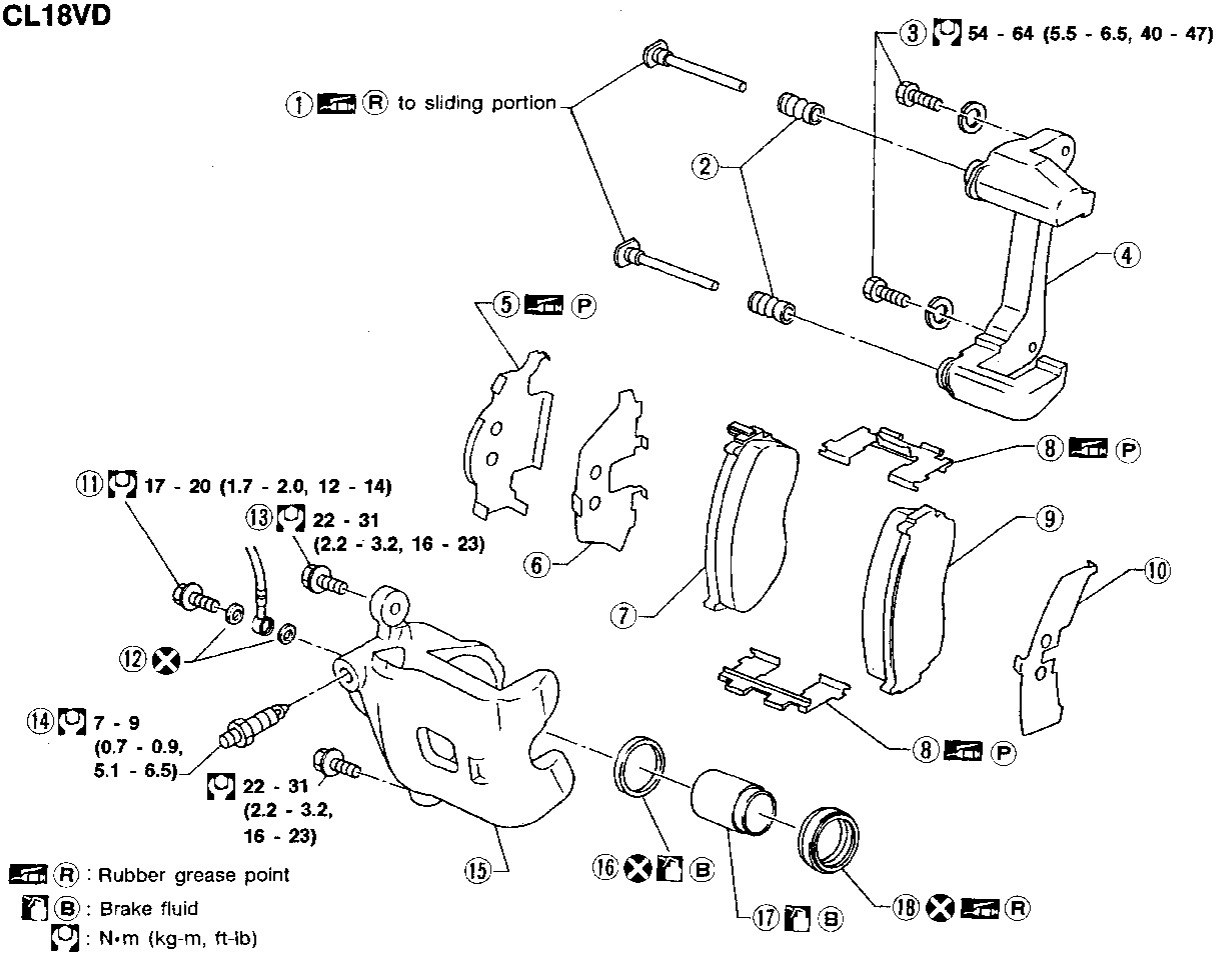
3. Open cylinder body upward. Then remove pad retainers, and inner and outer shims.

   Standard pad thickness: 10 mm (0.39 in)

   Pad wear limit: 2.0 mm (0.079 in)

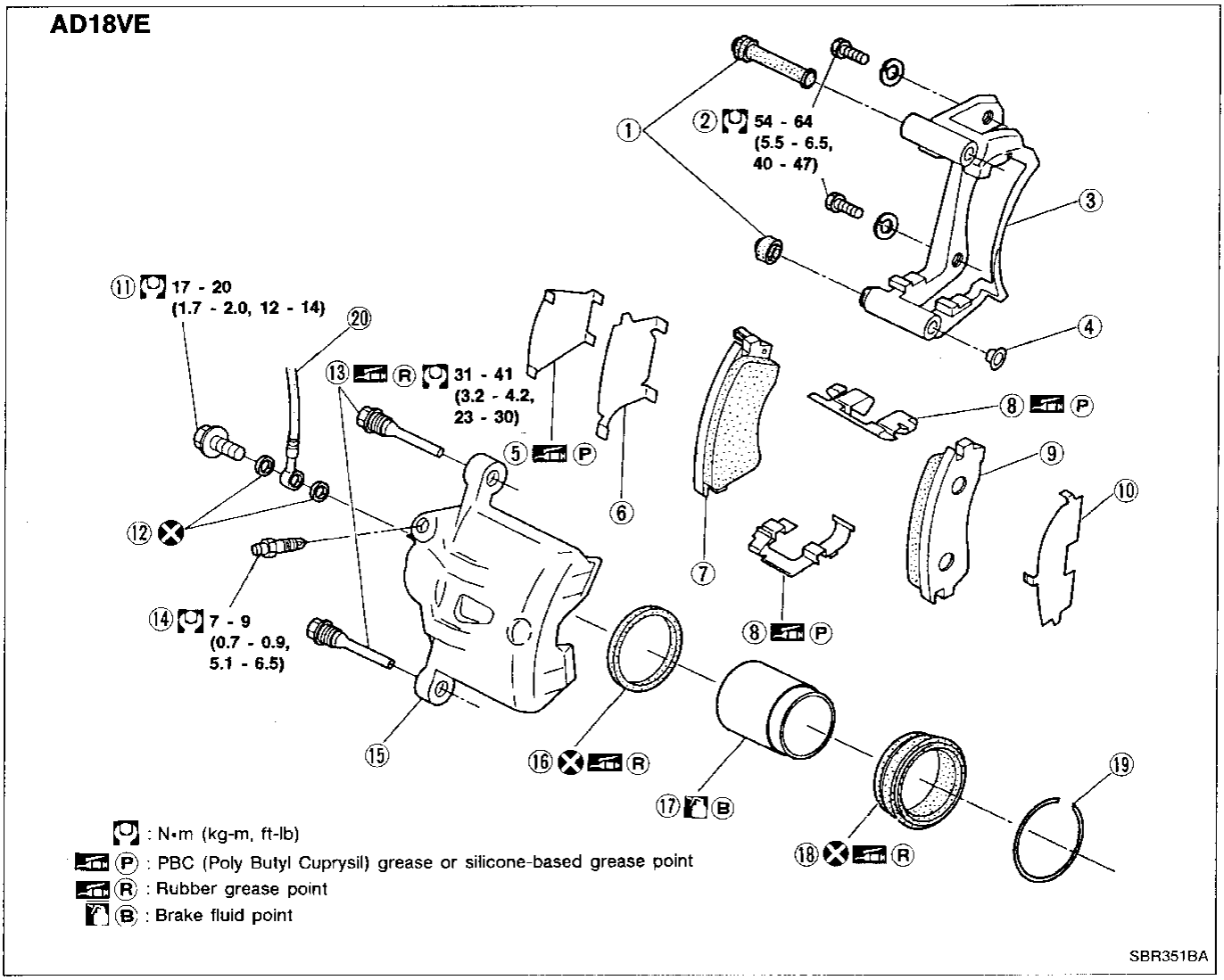
Carefully monitor brake fluid level because brake fluid will return to reservoir when pushing back piston.

CL18VD

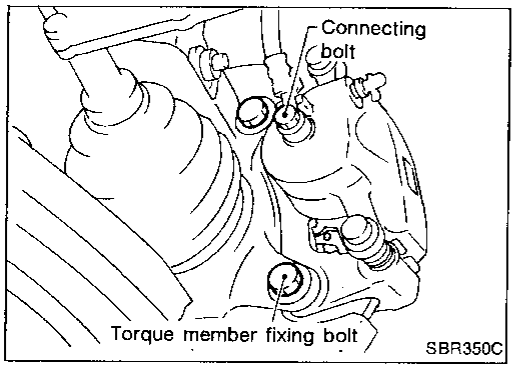


① Main pin
② Pin boot
③ Torque member fixing bolt
④ Torque member
⑤ Shim cover
⑥ Inner shim
⑦ Inner pad
⑧ Pad retainer
⑨ Outer pad
⑩ Outer shim
⑪ Connecting bolt
⑫ Copper washer
⑬ Main pin bolt
⑭ Bleed valve
⑮ Cylinder body
⑯ Piston seal
⑰ Piston
⑱ Piston boot

AD18VE



① Pin boot
② Torque member fixing bolt
③ Torque member
④ Plug
⑤ Shim cover
⑥ Inner shim
⑦ Inner pad
⑧ Pad retainer
⑨ Outer pad
⑩ Outer shim
⑪ Connecting bolt
⑫ Copper washer
⑬ Sliding pin
⑭ Air bleeder
⑮ Cylinder body
⑯ Piston seal
⑰ Piston
⑱ Piston boot
⑲ Piston boot retainer
⑳ Brake hose



Removal

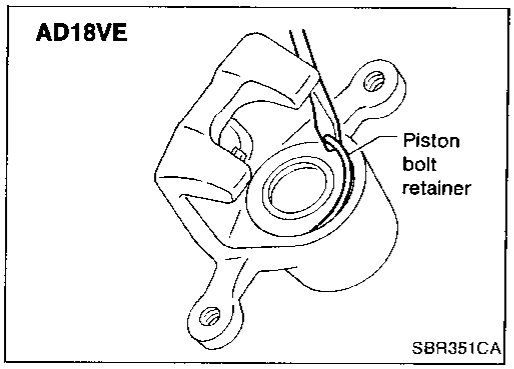
WARNING:
Clean brake pads with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.

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.

Disassembly

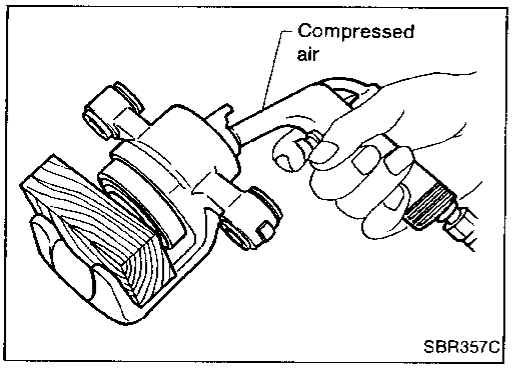
1. Remove piston boot retainer with a screwdriver. (AD18VE model only)



WARNING:
Do not place your fingers in front of piston.

CAUTION:
Do not scratch or score cylinder wall.

2. Push out piston with dust seal with compressed air.
3. Remove piston seal with a suitable tool.



Inspection — Caliper

CYLINDER BODY

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

CAUTION:
Use brake fluid to clean. Never use mineral oil.

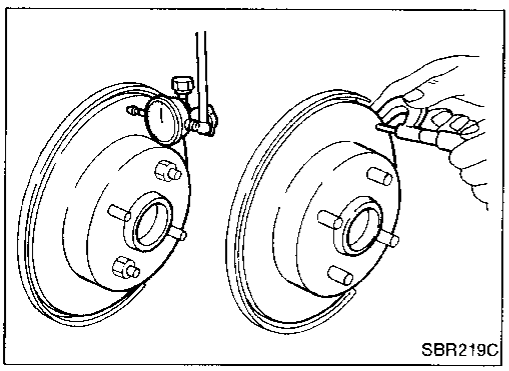
PISTON

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 materials are stuck to sliding surface.

SLIDE PIN, PIN BOLT AND PIN BOOT

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



Inspection — 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 "Front Wheel Bearing" in FA section.

Maximum runout:
0.07 mm (0.0028 in)

Inspection — Rotor (Cont'd)

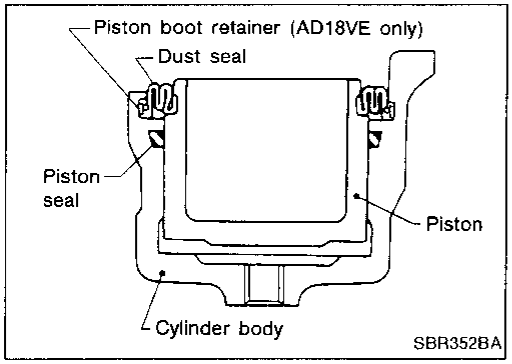
3. If the runout is out of specification, find minimum runout position as follows:
   a. Remove nuts and rotor from wheel hub.
   b. Shift the rotor one hole and secure rotor to wheel hub with nuts.
   c. Measure runout.
   d. Repeat steps a. to c. so that minimum runout position can be found.
4. If 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)

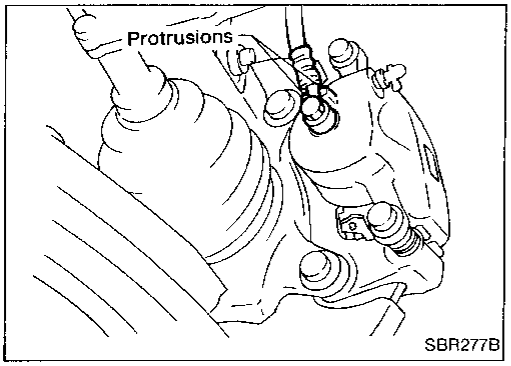
If thickness variation exceeds the specification, turn rotor with on-car brake lathe.

Rotor repair limit:
Minimum thickness
CL18VD, AD18VE 16.0 mm (0.630 in)



Assembly

1. With piston boot fitted to piston, insert piston boot into groove on cylinder body and install piston.
2. Properly secure piston boot
3. Secure piston boot with retainer. (AD18VE model only)

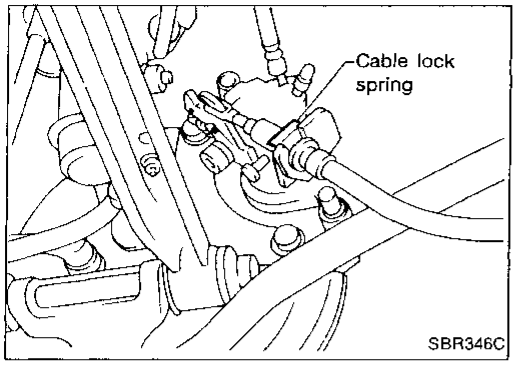


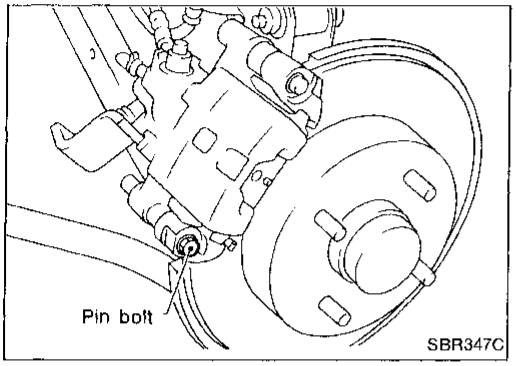
Installation

CAUTION:

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

1. Install brake hose to caliper securely.
2. Install all parts and secure all bolts.
3. Bleed air. Refer to "Bleeding Brake System" in "CHECK AND ADJUSTMENT". (See page BR-3.)





Pad Replacement

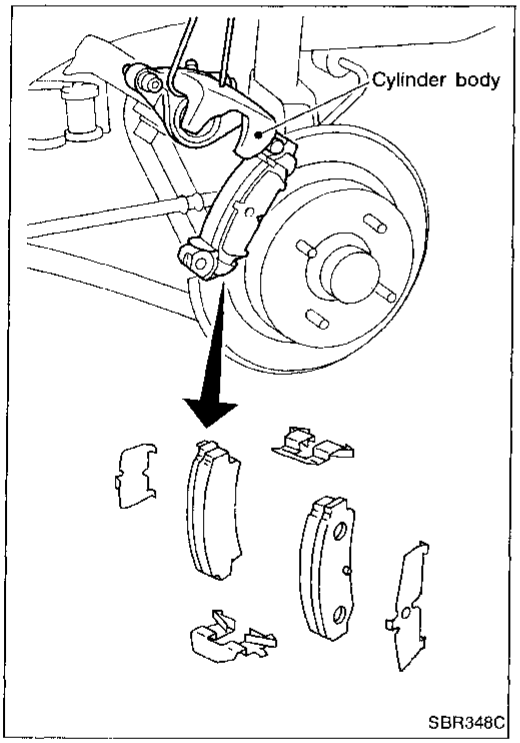
WARNING:

Clean brake pads with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.

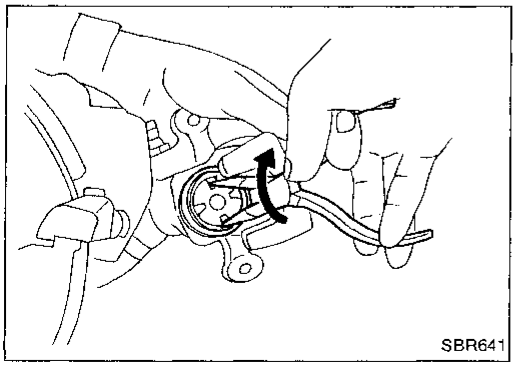
CAUTION:

- **When cylinder body is open, do not depress brake pedal, otherwise piston will pop out.**
- **Be careful not to damage piston boot or let oil get on rotor. Always replace shims in replacing pads.**
- **If shims are rusted or show peeling of rubber coat, replace them with new shims.**
- **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 master cylinder reservoir cap.
2. Remove brake cable lock spring.
3. Disconnect cable.
4. Remove pin bolt.

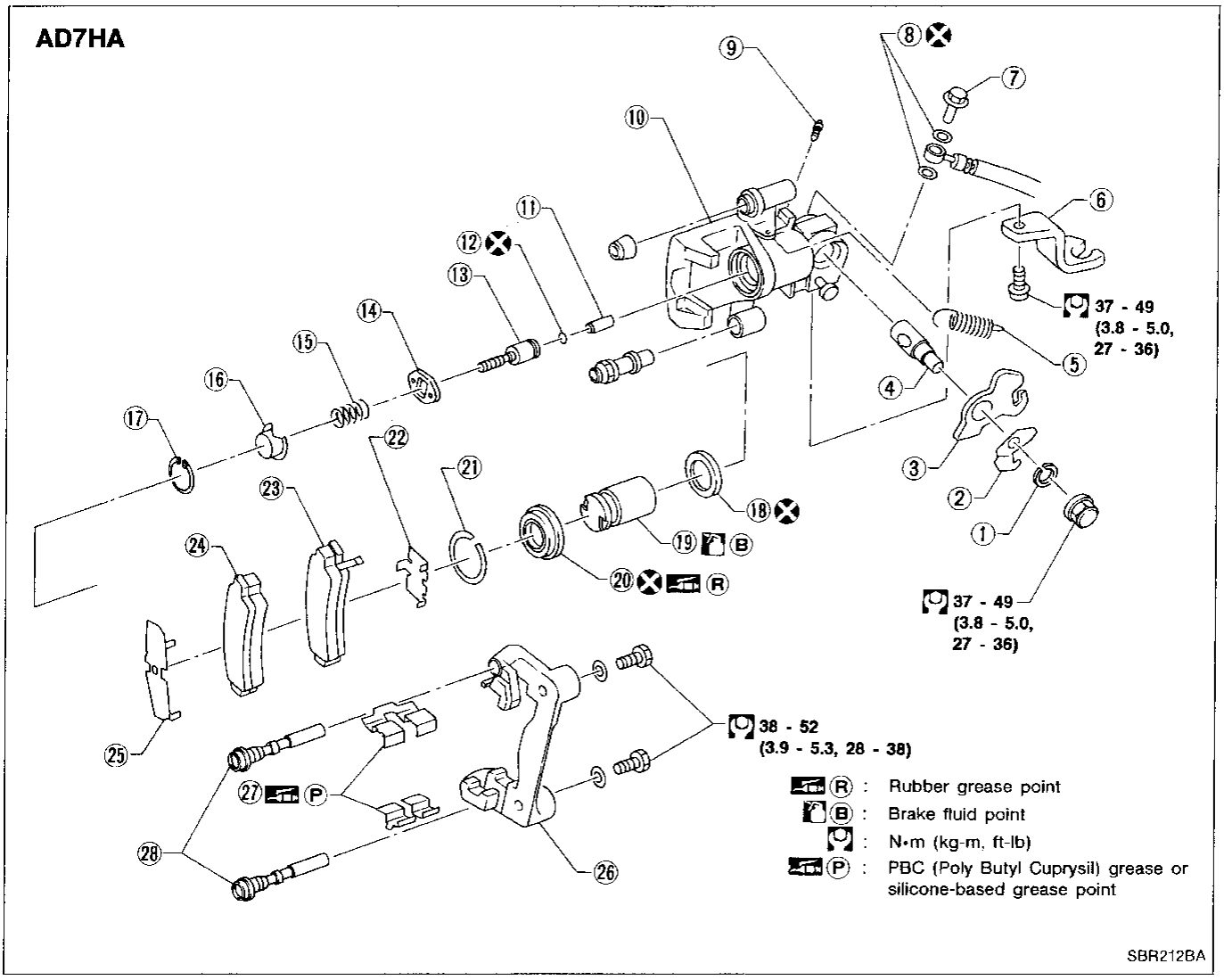


5. Open cylinder body upward. Then remove pad retainers, and inner and outer shims.
   Standard pad thickness:
   10 mm (0.39 in)
   Pad wear limit:
   2.0 mm (0.079 in)

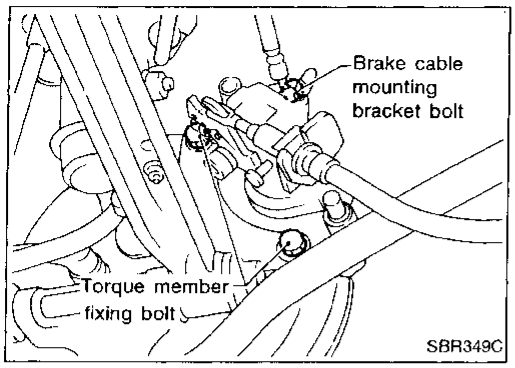


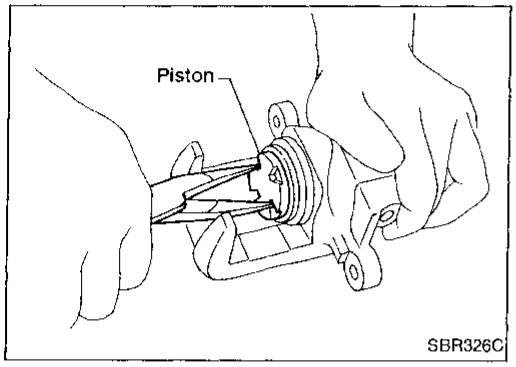
6. When installing new pads, push piston into cylinder body by turning piston clockwise.

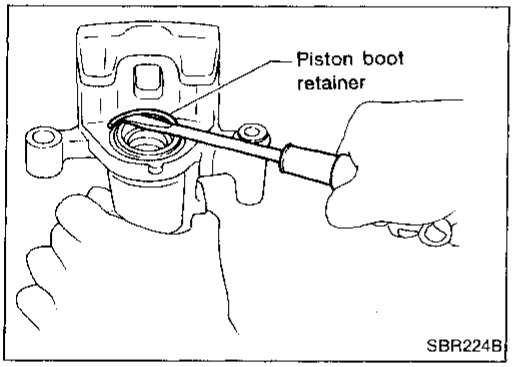
Carefully monitor brake fluid level because brake fluid will return to reservoir when pushing back piston.

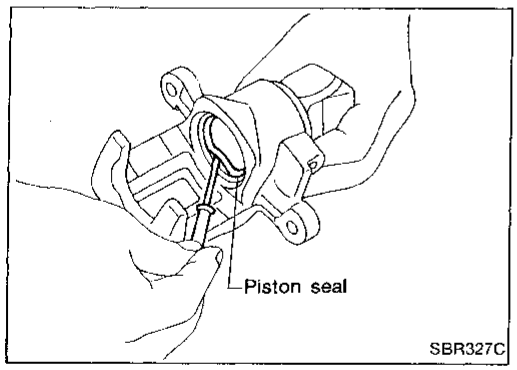


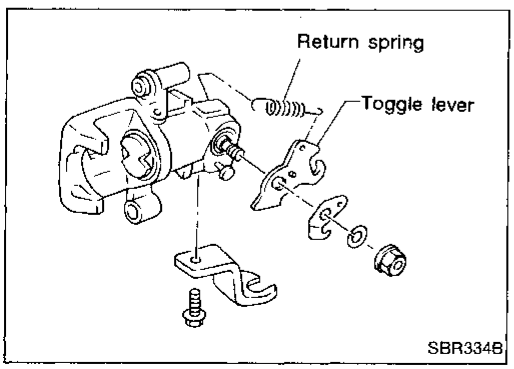
① Washer
② Spring
③ Toggle lever
④ Cam
⑤ Return spring
⑥ Cable guide
⑦ Connecting bolt
⑧ Copper washer
⑨ Bleed screw
⑩ Cylinder
⑪ Strut
⑫ O-ring
⑬ Push rod
⑭ Key plate
⑮ Spring
⑯ Spring cover
⑰ Snap ring
⑱ Piston seal
⑲ Piston
⑳ Piston boot
㉑ Piston boot retainer
㉒ Inner shim
㉓ Inner pad
㉔ Outer pad
㉕ Outer shim
㉖ Torque member
㉗ Retainer spring
㉘ Side pin











Removal

WARNING:

Clean brake pads with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.

1. Remove brake cable mounting bracket bolt and lock spring.
2. 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.

Disassembly

1. Remove piston by turning it counterclockwise with suitable long nose pliers.
2. Remove piston boot retainer with a suitable tool and remove piston boot.
3. Disassemble cylinder body.

a. Pry off snap ring with suitable pliers, then remove spring cover, spring, key plate, push rod and strut.

b. Remove piston seal.

Be careful not to damage cylinder body.

4. Remove return spring and toggle lever.

Inspection — Caliper

CAUTION:

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

CYLINDER BODY

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

PISTON

Check piston for score, rust, wear, damage or presence of foreign materials.

Replace if any of the above conditions are observed.

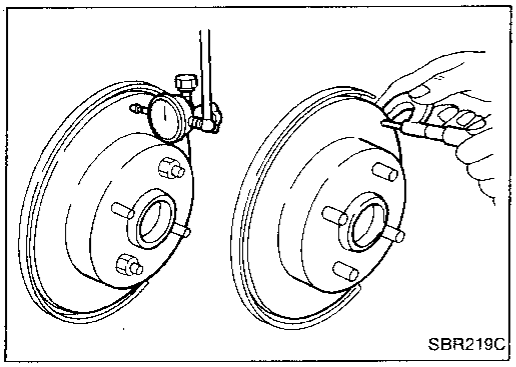
CAUTION:

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.


SBR219C

Inspection — Rotor

RUBBING SURFACE

Check rotor for roughness, cracks or chips.

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 "Wheel Bearing" in RA section.

3. Change relative positions of rotor and wheel hub so that runout is minimized.

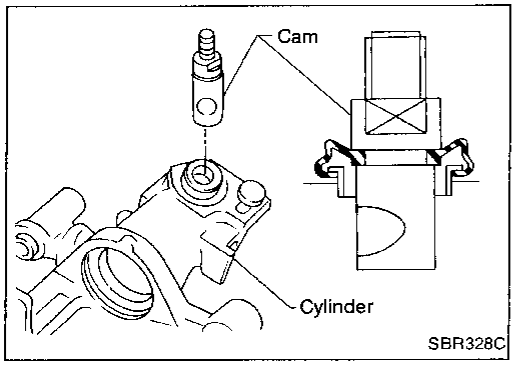
Maximum runout: 0.07 mm (0.0028 in)

THICKNESS

Rotor repair limit:

Minimum thickness 6.0 mm (0.236 in)

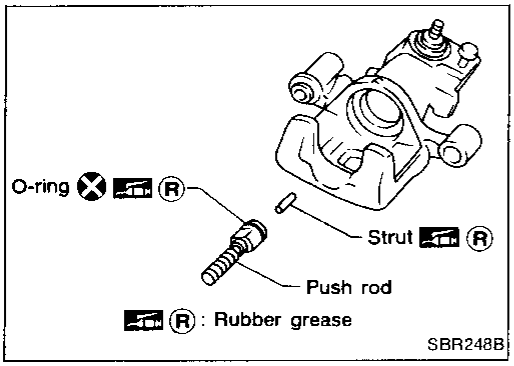
Replace rotor if any of the above did not meet the specifications.



SBR328C

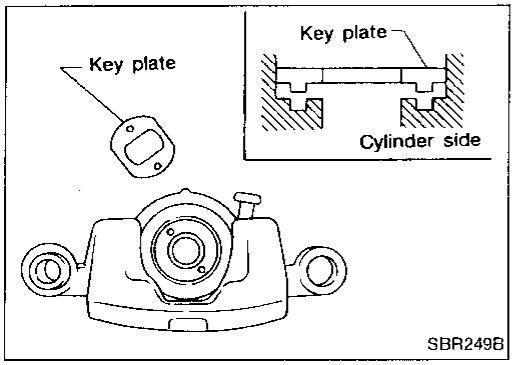
Assembly

1. Insert cam with depression facing towards open end of cylinder.



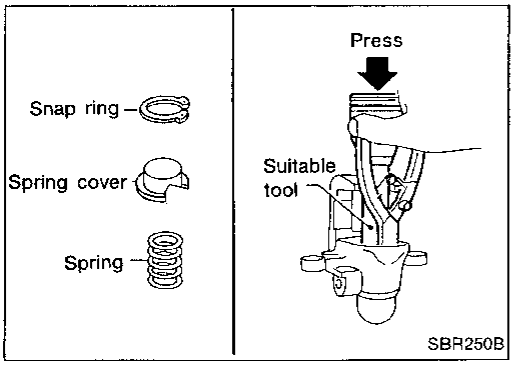
SBR248B

2. Generously apply rubber grease to strut and push rod to make insertion easy.



SBR249B

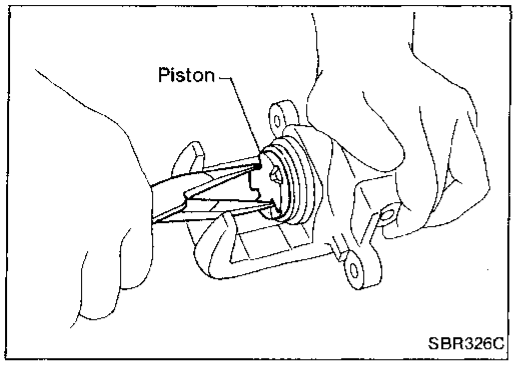
3. Match depressions in cylinder bottom with key plate protrusions.



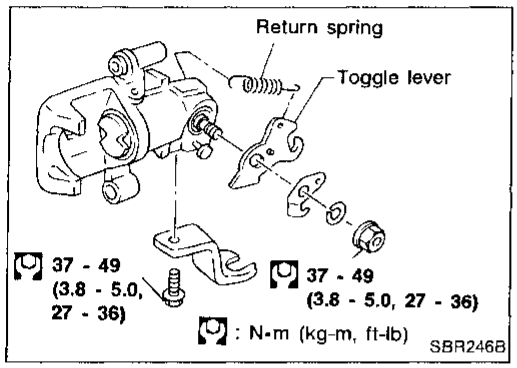
SBR250B

4. Install spring, spring cover and snap ring with a suitable tool.

Assembly (Cont'd)



5. Fit piston by turning it clockwise with suitable long nose pliers.



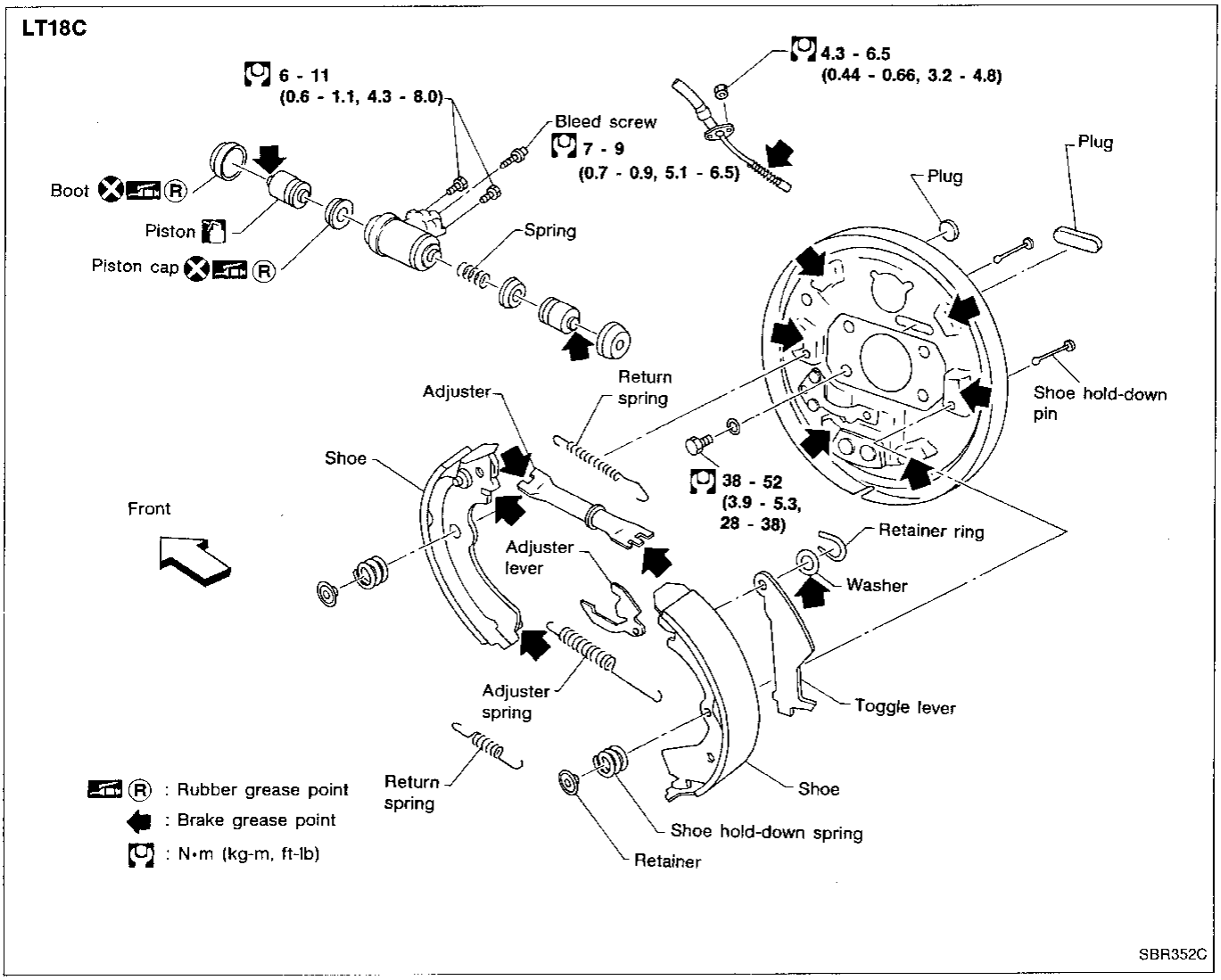
6. Fit toggle lever and return spring.

Installation

CAUTION:

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

1. Install brake hose to caliper securely.
2. Install all parts and secure all bolts.
3. Bleed air. Refer to "Bleeding Brake System" in "CHECK AND ADJUSTMENT". (See page BR-3.)



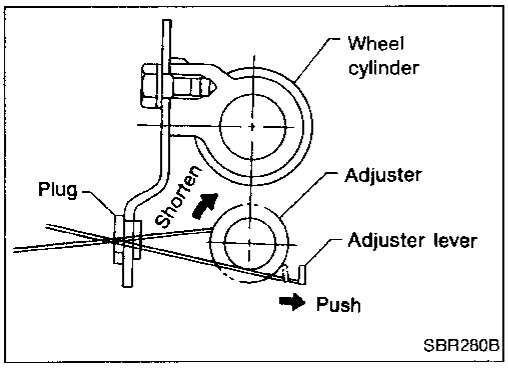
Removal

WARNING:

Clean brake lining with a vacuum dust collector to minimize the hazard of airborne asbestos or other materials.

CAUTION:

Make sure parking brake lever is released completely.

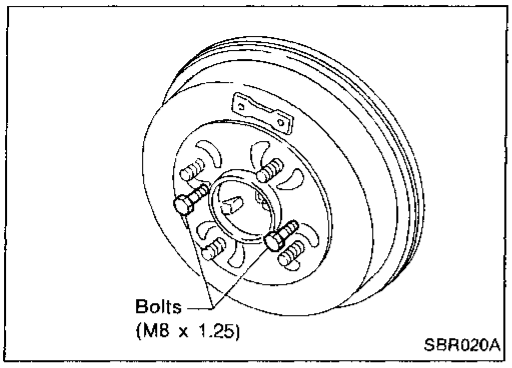


1. Release parking brake lever fully, then remove drum.

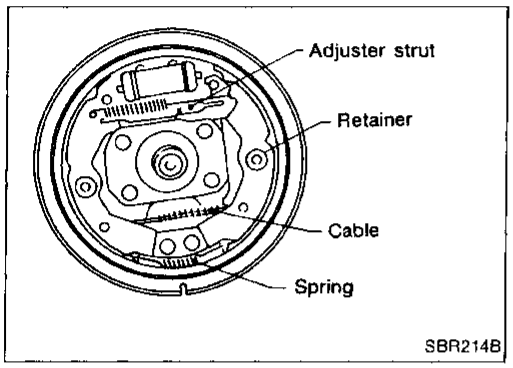
If drum is hard to remove, the following procedures should be carried out.

a. Remove plug. Then shorten adjuster to make clearance between brake shoe and drum as shown.

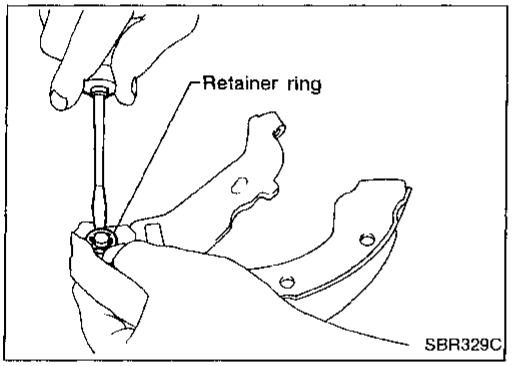
Removal (Cont'd)



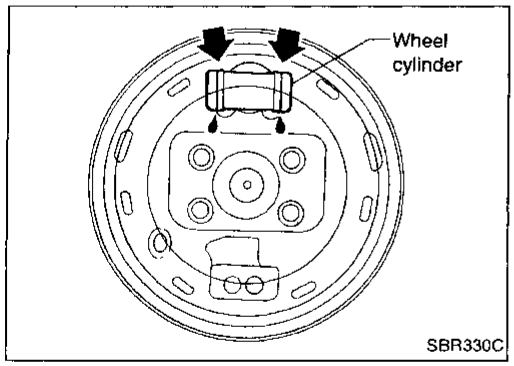
b. Tighten the two bolts gradually.



2. After removing retainer, remove spring by rotating shoes.
Be careful not to damage parking brake cable when separating it.
3. Remove adjuster.
4. Disconnect parking brake cable from toggle lever.

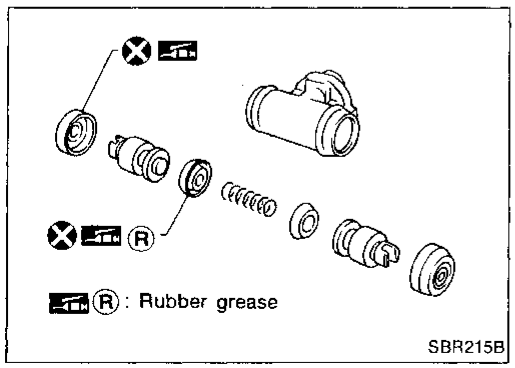


5. Remove retainer ring with a suitable tool. Then separate toggle lever and brake shoe.



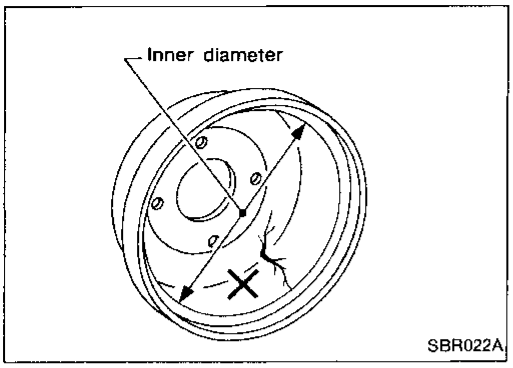
Inspection — Wheel Cylinder

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



Wheel Cylinder Overhaul

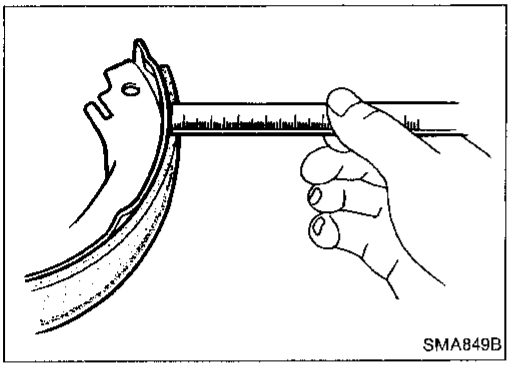
Pay attention so as not to scratch cylinder when installing pistons.



Inspection — Drum

Standard inner diameter: 180 mm (7.09 in)
Maximum inner diameter: 181 mm (7.13 in)
Out-of-roundness: 0.03 mm (0.0012 in) or less

- Contact surface should be fine finished 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.



Inspection — Lining

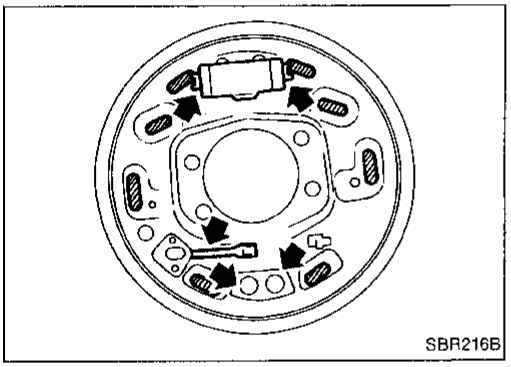
Check lining thickness.

Standard lining thickness: 4 mm (0.16 in)
Lining wear limit: 1.5 mm (0.059 in)

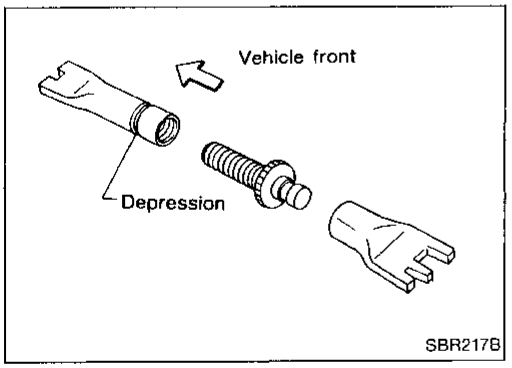
Installation

Always perform shoe clearance adjustment. Refer to "Adjustment" in "PARKING BRAKE CONTROL" (BR-27).

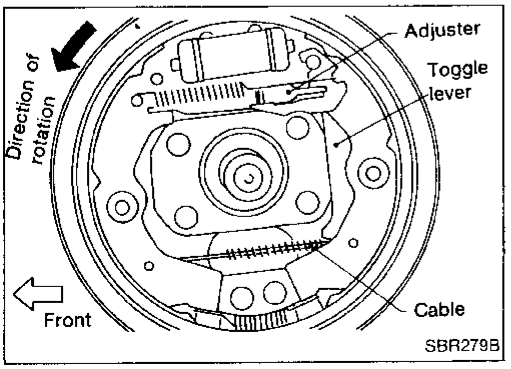
1. Fit operating lever to brake trailing shoe with retainer ring.



2. Apply brake grease to the contact areas shown at left.



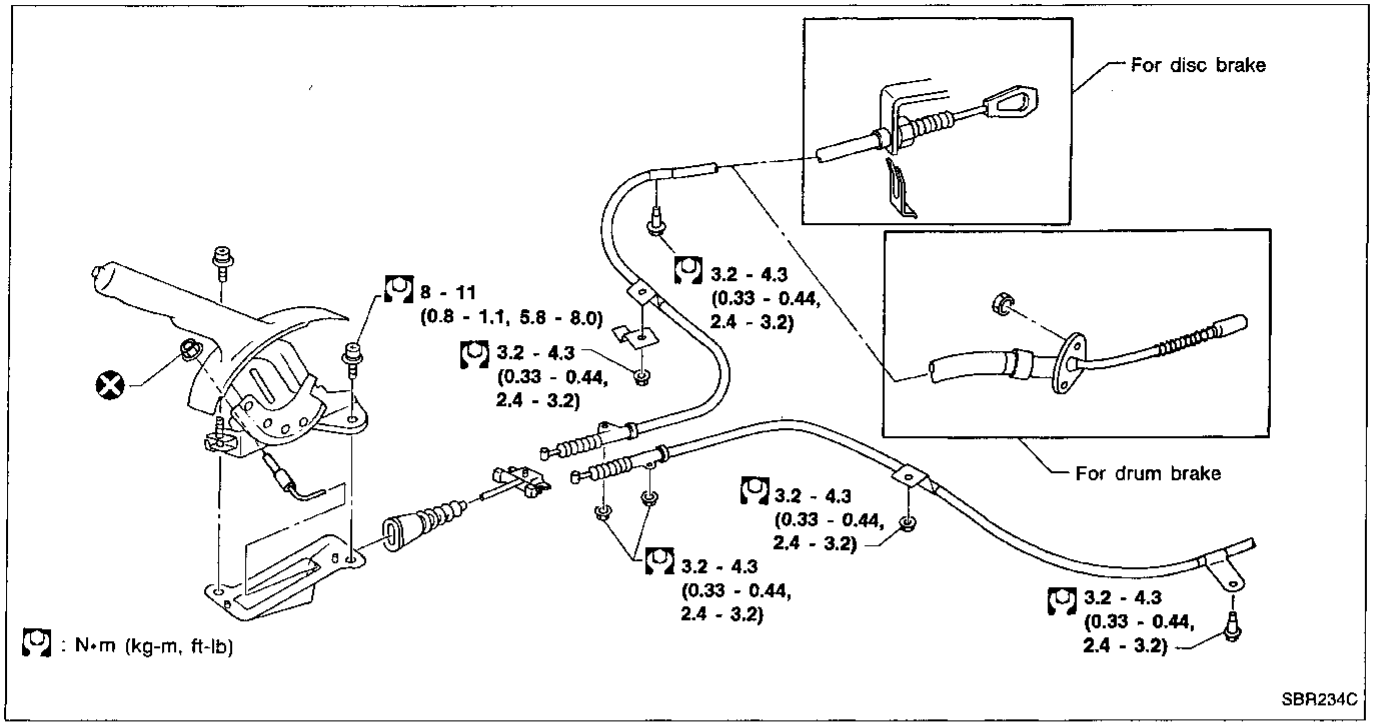
3. Shorten adjuster by rotating it.
- **Pay attention to direction of adjuster.**
- **Adjuster for left-hand brake has a depression. Adjuster for right-hand brake does not have a depression.**
4. Connect parking brake cable to toggle lever.
5. Install all parts.

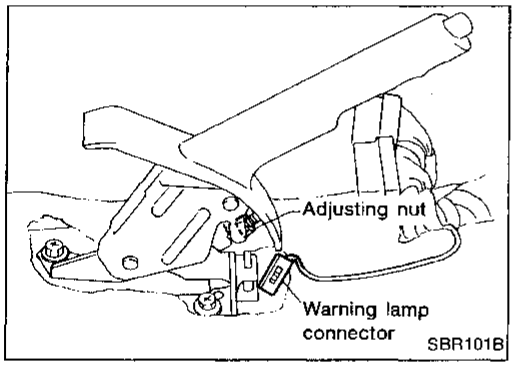


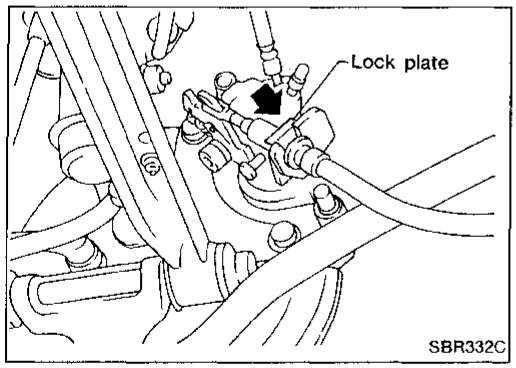
6. Check all parts are installed properly.

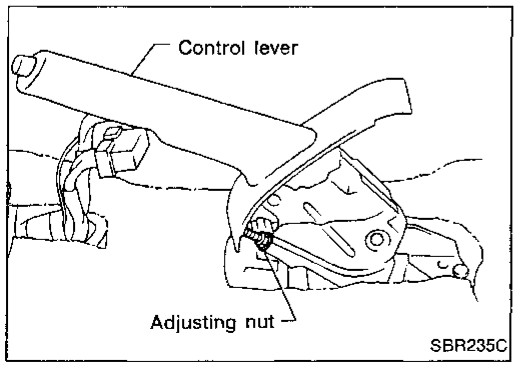
Pay attention to direction of adjuster.

7. Install brake drum.
8. When installing new wheel cylinder or overhauling wheel cylinder, bleed air. Refer to "Bleeding Brake System" in "CHECK AND ADJUSTMENT". (See page BR-3.)









Removal and Installation

1. To remove parking brake cable, first remove center console.
2. Disconnect warning lamp connector.
3. Remove bolts, slacken off and remove adjusting nut.
4. Remove lock plate and disconnect cable (disc brake only). For drum brake models, refer to "Removal" in "REAR DRUM BRAKE". (See page BR-24.)

Inspection

1. Check control lever for wear or other damage. Replace if necessary.
2. Check wires for discontinuity or deterioration. Replace if necessary.
3. Check warning lamp and switch. Replace if necessary.
4. Check parts at each connecting portion and, if found deformed or damaged, replace.

Adjustment

Before adjustment, pay attention to the following points.

1. Loosen parking brake cable.
2. Depress brake pedal fully more than 5 times to adjust clearance between brake pad and rotor/brake shoes and drum automatically.
3. Pull control lever 4 - 5 notches. Then adjust control lever by turning adjusting nut.
4. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.
   Number of notches: Drum brake 5 - 6
   Disc brake 7 - 8
5. Bend parking brake warning lamp switch plate so that brake warning lamp comes on when ratchet at parking brake control lever is pulled "A" notches and goes out when fully released.
   Number of "A" notches : 1

Purpose

- Excessive braking in any condition (Dry or wet) will adversely affect the normal turning of the vehicle's wheels and they may lock up.
- When the front wheels are locked, a vehicle cannot be controlled by the steering system.
- When the rear wheels are locked, the vehicle will enter a flat spin.

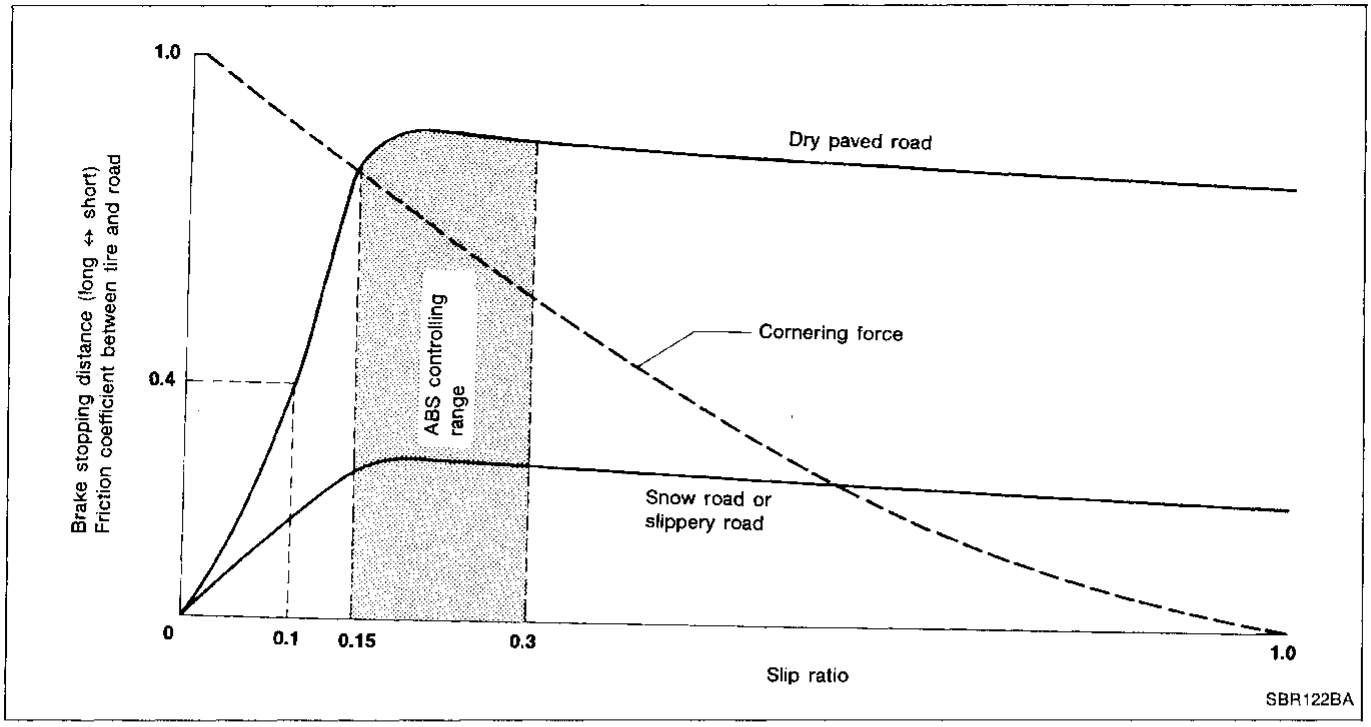
The ABS, by the use of electronic and hydraulic components, allows for control of braking force so that locking of the wheels can be avoided in the circumstances described above.
The ABS:

1) Ensures proper tracking performance through steering wheel operation.
2) Enables obstacles to be avoided through steering wheel operation.
3) Ensures vehicle stability by preventing flat spins.

Operation

The ABS is controlled by control unit (CU), which receives signals from various sensors relating to vehicle condition, speed, etc.
The hydraulic circuit is controlled by an actuator containing an electric motor, pump and 2 solenoids. The control unit directs the actuator to increase, hold or decrease hydraulic pressure to all or individual wheels.
The control unit receives information regarding wheel speed from sensors, mounted one per wheel.
When excessive braking force causes a wheel to lock, the control unit sends a 5 amp current to the actuator to release the locked wheel.
As the wheel unlocks, it can be steered. The control unit senses wheel speed is increasing and re-applies hydraulic pressure. The wheel locks again, is released, steered, braked, and so on. This continuous locking and unlocking of the wheels allows for rapid speed reduction and the vehicle to be steered in the correct manner.
The hydraulic pressure can also be "held" constant by a 2 amp current sent from the control unit to the actuator.
The rear wheels utilize a load-sensing valve to further prevent wheel locking, especially under minimum vehicle load conditions.
However, when the vehicle speed is less than 10 km/h (6MPH), this system does not work.

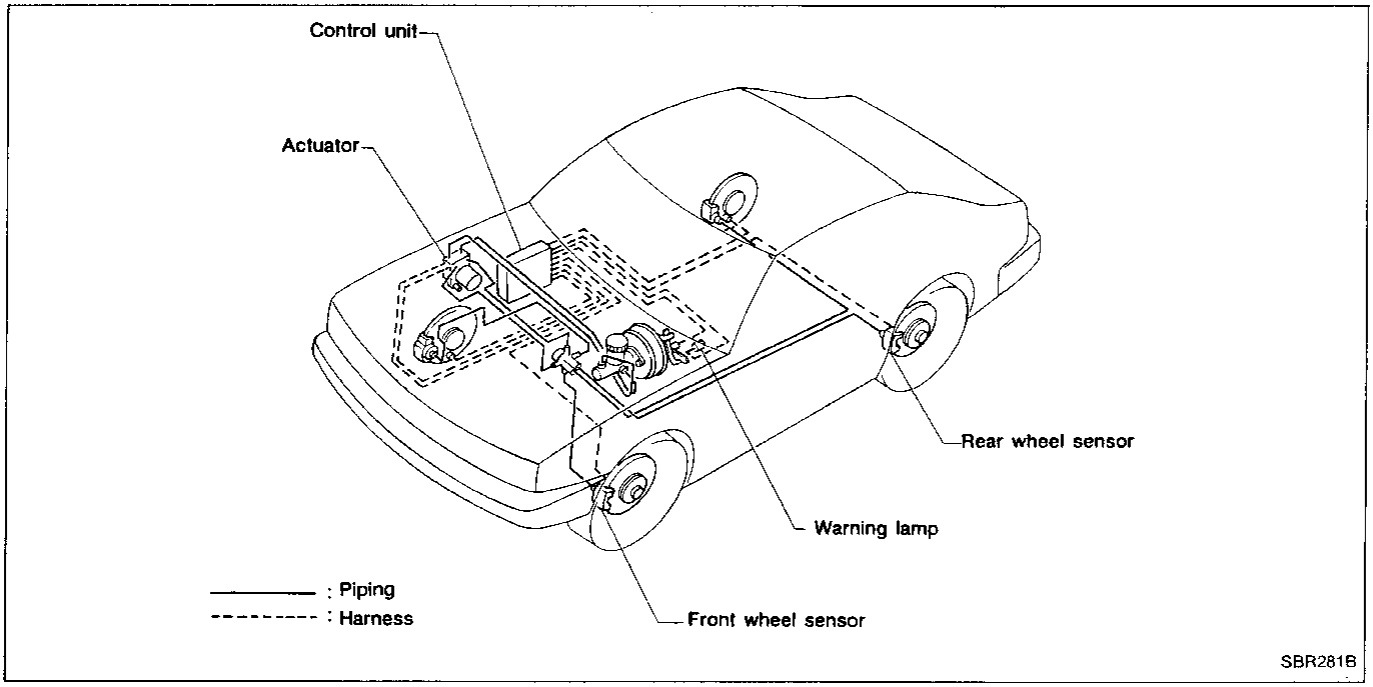
Operation (Cont'd)

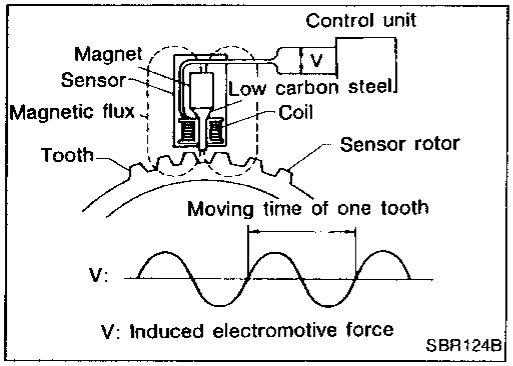


$$\text{SLIP RATIO} = \frac{\text{VEHICLE SPEED} - \text{WHEEL SPEED}}{\text{VEHICLE SPEED}}$$

- The applied brake condition is expressed by a slip ratio, as shown above. If the slip ratio is in the range from 0.15 to 0.3, the wheel has adequate cornering performance, and also minimum stopping distance can be achieved.
- The slip ratio formula indicates the control of wheel speed by the brakes.
  The Anti-lock Brake System (ABS) controls brake fluid pressure using the slip ratios and locking condition calculation contained in the ABS control unit.
- To adjust wheel speed so that the optimum slip ratio can be obtained, the ABS must sense wheel speed and vehicle speed through a wheel speed sensor.
  If the brake is applied, especially in the locked wheel condition, the vehicle speed differs from the wheel speed.
- After the wheel speed changes from the vehicle speed due to excessive brake force, the ABS calculates vehicle speed when the reduced wheel speed reaches the minimum.

System Components

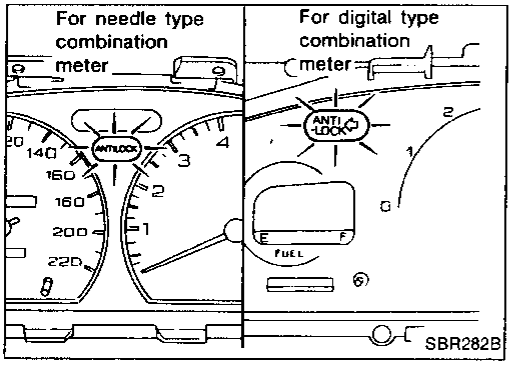




System Description

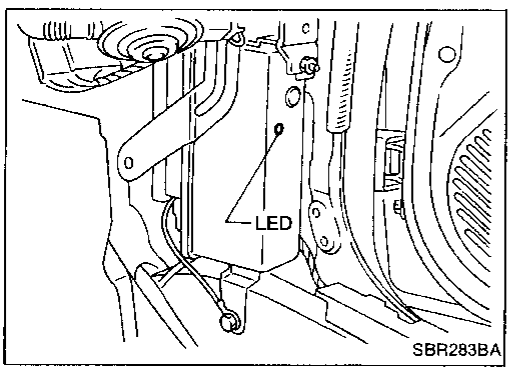
SENSOR

The sensor unit consists of a gear-shaped rotor and a sensor element which contains a bar magnet around which a coil is wound. The sensor is installed on the back side of the brake rotor. Sine-wave current is generated by the sensor as the wheel rotates. The frequency and voltage increase(s) as the rotating speed increases.



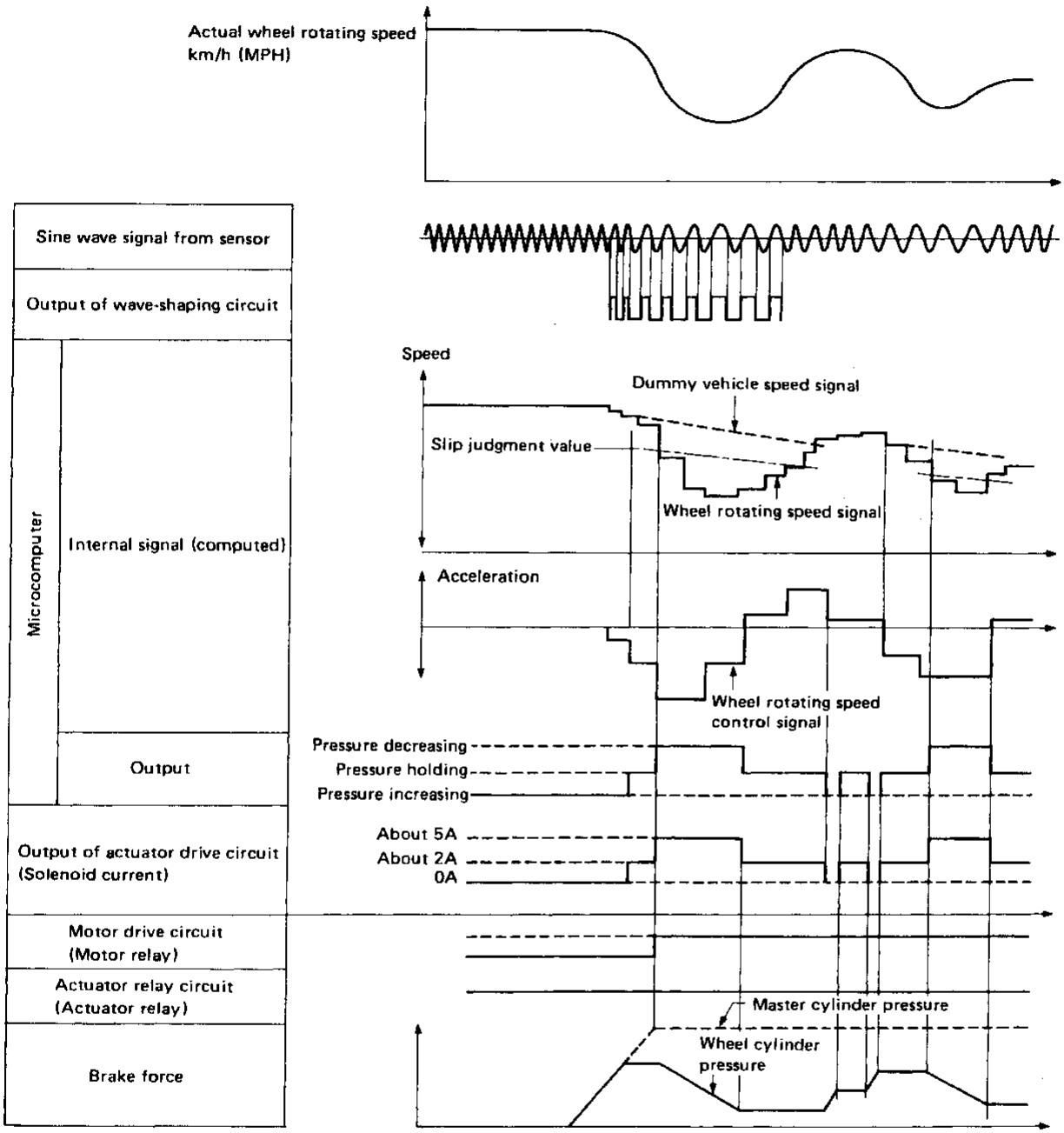
CONTROL UNIT

The control unit computes the rotating speed of the wheel by the signal current sent from the sensor, and supplies a DC current of about 5 amperes, about 2 amperes, or 0 amperes to the actuator solenoid valve provided for each wheel by changing its internal resistance. It also controls ON-OFF operation of the valve relay and pump relay. If any electrically detectable malfunction should occur in the system, the control unit causes the warning light to light up, and the LED indicator to flash the number of times which corresponds to the malfunction location. In this condition, the ABS will be deactivated by the control unit, and the vehicle's braking system reverts to normal operation.



System Description (Cont'd)

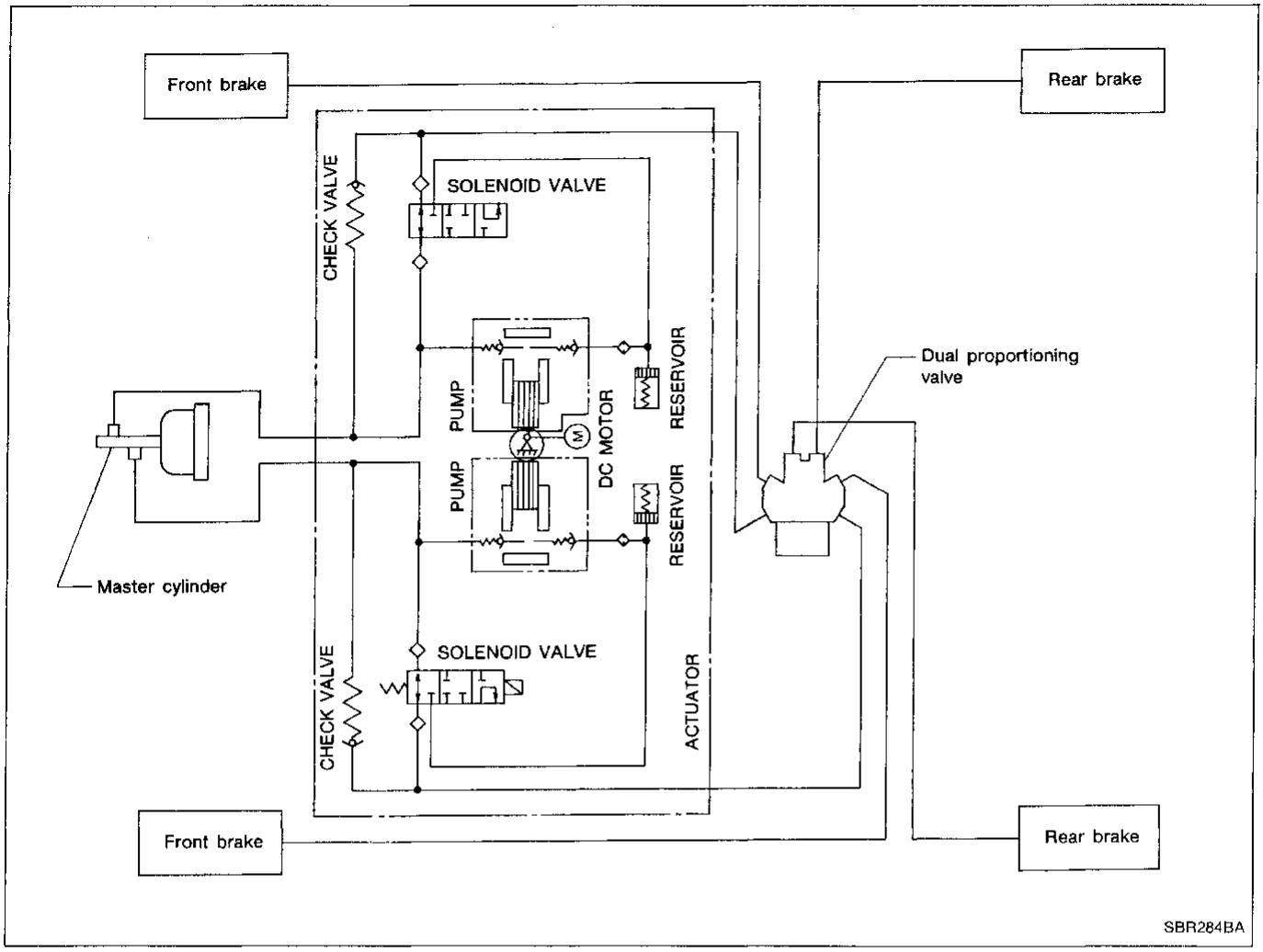
CONTROL UNIT CONTROL CHART



SBR127B

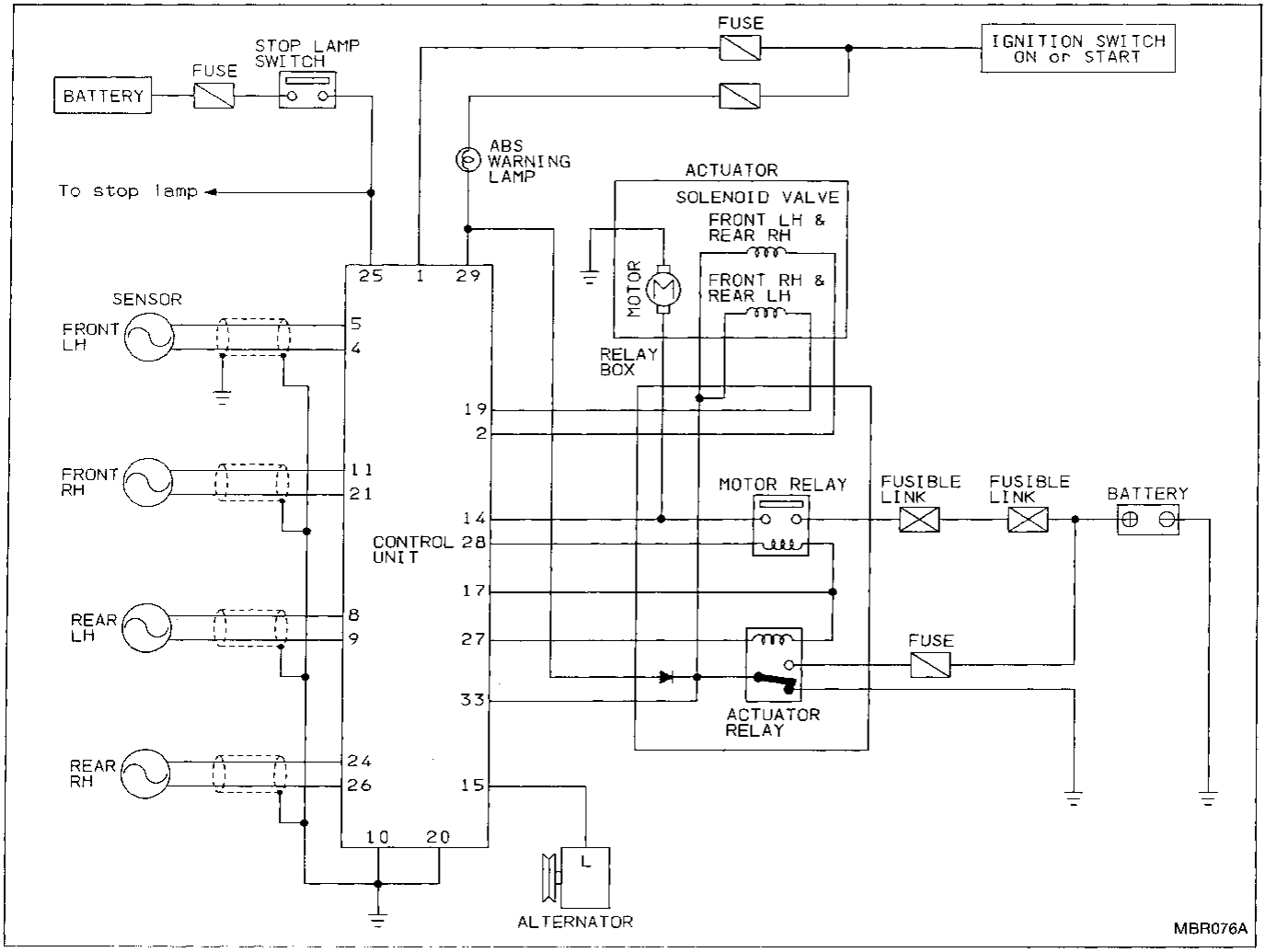
System Description (Cont'd)

ACTUATOR

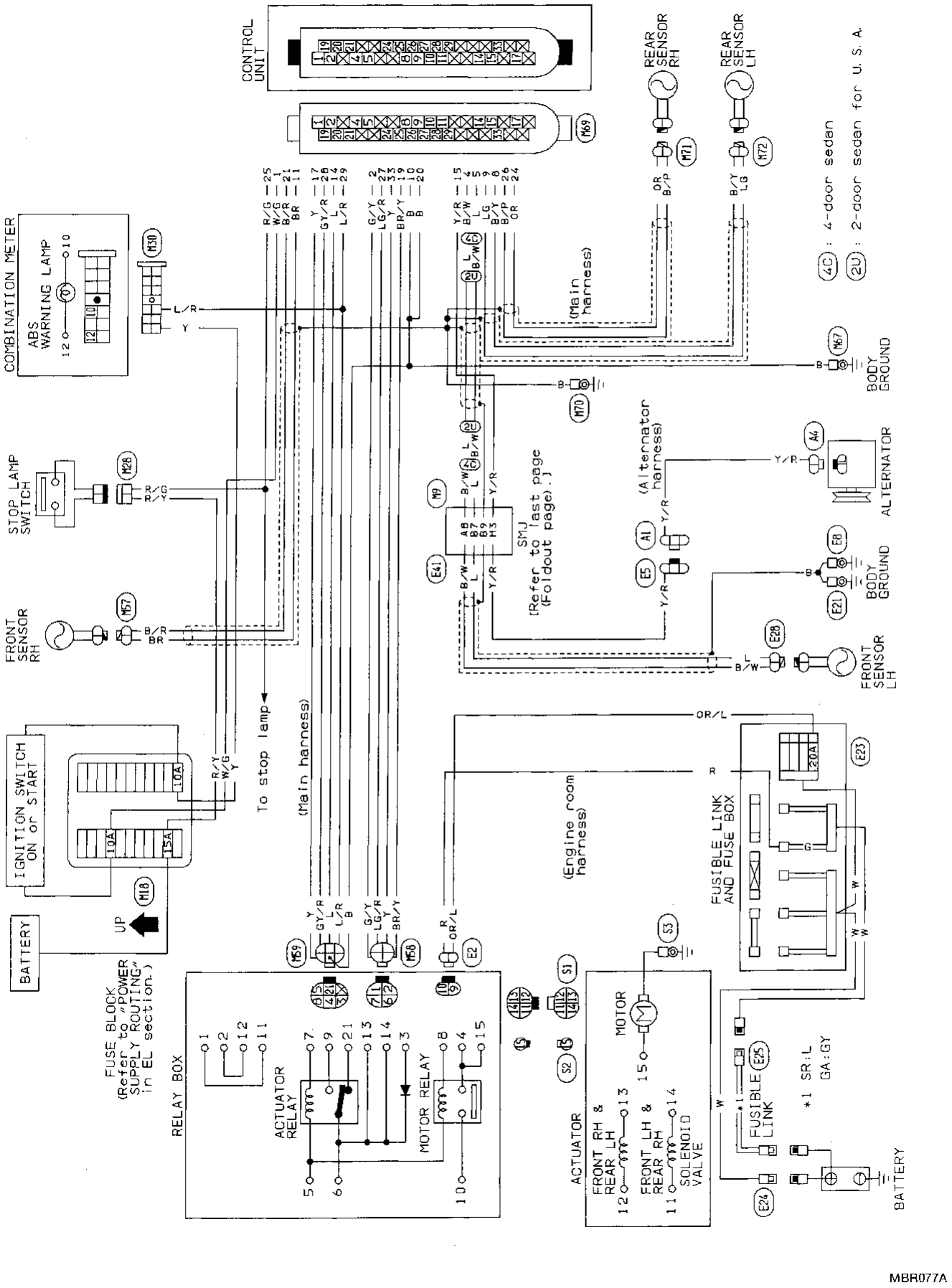


The actuator consists of solenoid valves, a pump, reservoir (for pressure decreasing). The solenoid valve changes its spool position corresponding to the control unit output amperage: it forms a pressure decreasing circuit at about 5 amperes, a pressure holding circuit at about 2 amperes, and a pressure increasing circuit at 0 amperes. When the pressure decreasing circuit is formed, the brake fluid in the caliper flows into the reservoir and the pressure drops. The pump delivers the fluid to the master cylinder. When the pressure holding circuit is formed, the caliper line is cut off, and the fluid pressure in the caliper is held constant.

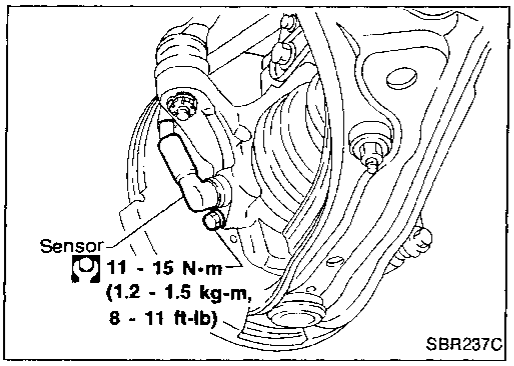
Circuit Diagram



Wiring Diagram



MBR077A



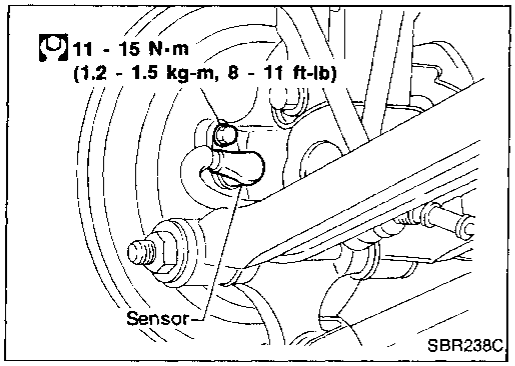
Removal and Installation

CAUTION:

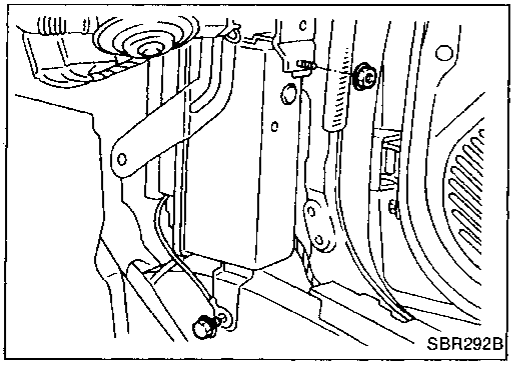
Be careful not to damage sensor edge and sensor rotor teeth.

In case the front or rear wheel hub assembly needs to be removed, disconnect the ABS wheel sensor from the assembly and move it away. Failure to do so may result in damage to the sensor wires making the sensor inoperative.

FRONT WHEEL SENSOR



REAR WHEEL SENSOR

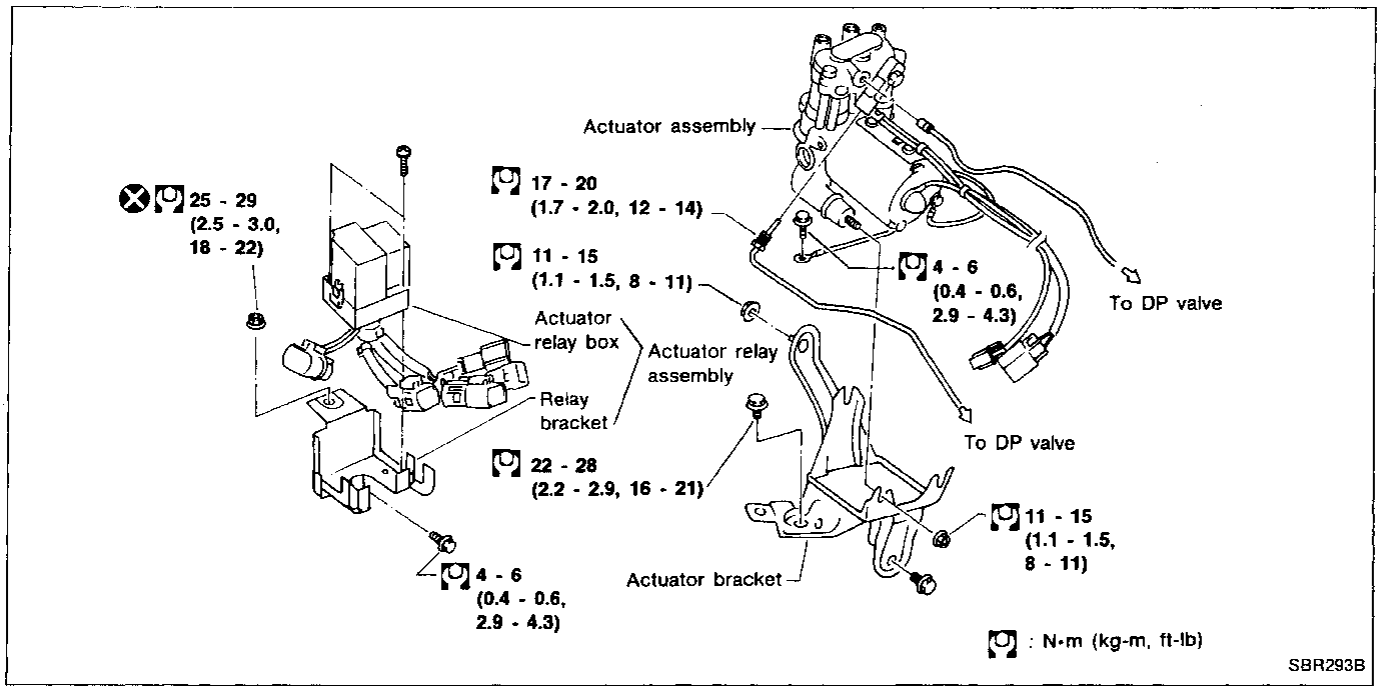


CONTROL UNIT

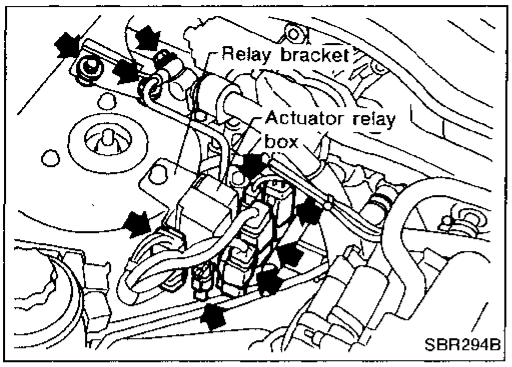
Location: Front passenger side dash side lower.

Removal

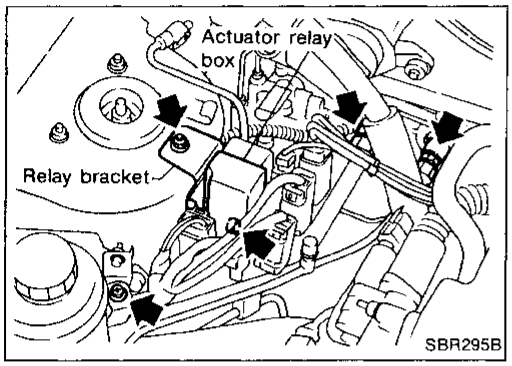
ACTUATOR



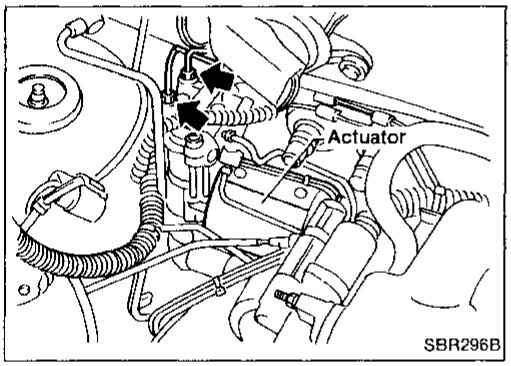
Removal (Cont'd)



1. Disconnect battery cable.
2. Drain brake fluid. Refer to "Changing Brake Fluid" in "CHECK AND ADJUSTMENT". (See page BR-3.)
3. Drain power steering fluid. Refer to section ST.
4. Discharge air conditioner refrigerant. Refer to section HA.
5. Disconnect power steering fluid pipe and hose.
6. Disconnect all connectors from actuator relay bracket.

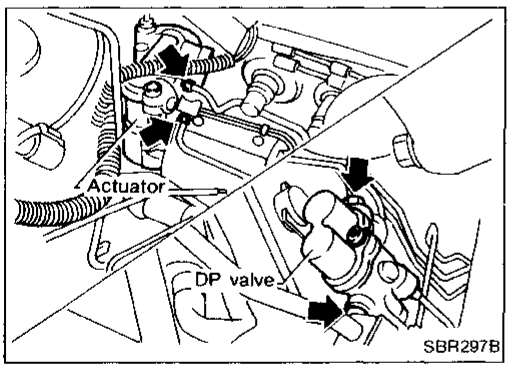


7. Remove mounting nut for relay bracket.
8. Remove mounting bolt for relay bracket. (This bolt is located just under the relay.)
9. Remove actuator relay box with bracket.
10. Remove air conditioner tubes.



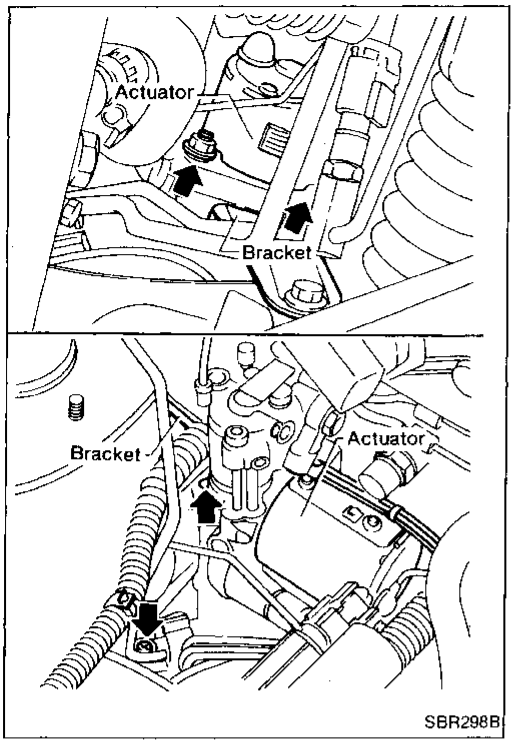
11. Disconnect top two brake pipes from actuator. (Pipes from master cylinder to actuator)

It is not necessary to remove these pipes.

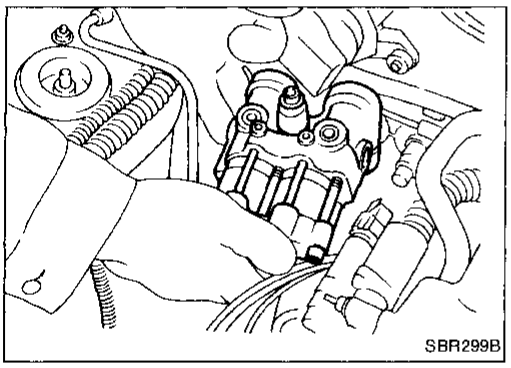


12. Remove the other two brake pipes. (Pipes from actuator to DP valve)

Removal (Cont'd)



13. Remove/loosen mounting nuts between actuator and bracket.
14. Remove actuator grounding bolt.

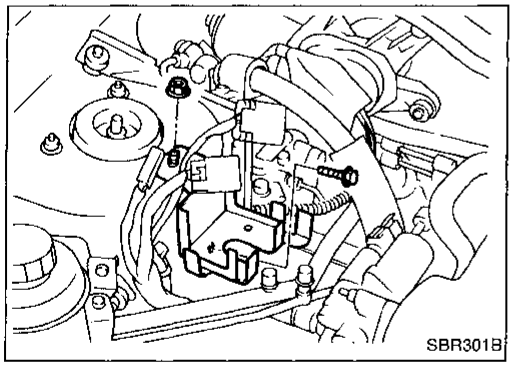


15. Draw out actuator as shown.

Installation

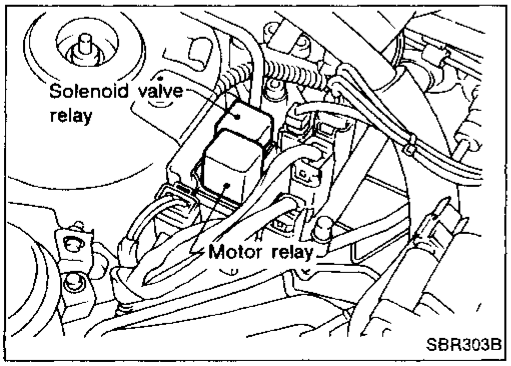
CAUTION:
After installation, pay attention to the following points.

- **Refill brake fluid and bleed air. Refer to "CHECK AND ADJUSTMENT". (See page BR-3.)**
- **Charge air conditioner refrigerant. Refer to "Charging Refrigerant" in HA section.**
- **Refill power steering fluid and bleed air. Refer to "Bleeding Hydraulic System" in ST section.**
- Installation procedure is basically the reverse order of removal.
- It is recommended to install relay bracket first. Then install actuator relay box.



Removal and Installation

ACTUATOR RELAYS

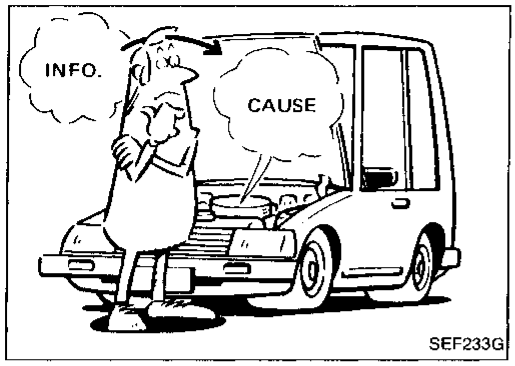


METAL BODY: MOTOR RELAY
LIGHT BLUE: SOLENOID VALVE RELAY

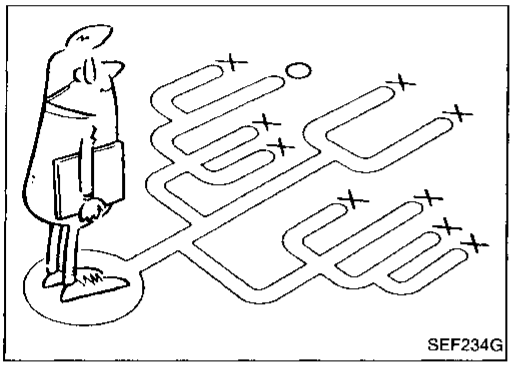
1. Disconnect battery cable.
2. Remove actuator relay cover.

It is not necessary to remove the two screws for relay box.

Contents



SEF233G


SEF234G

How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

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

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

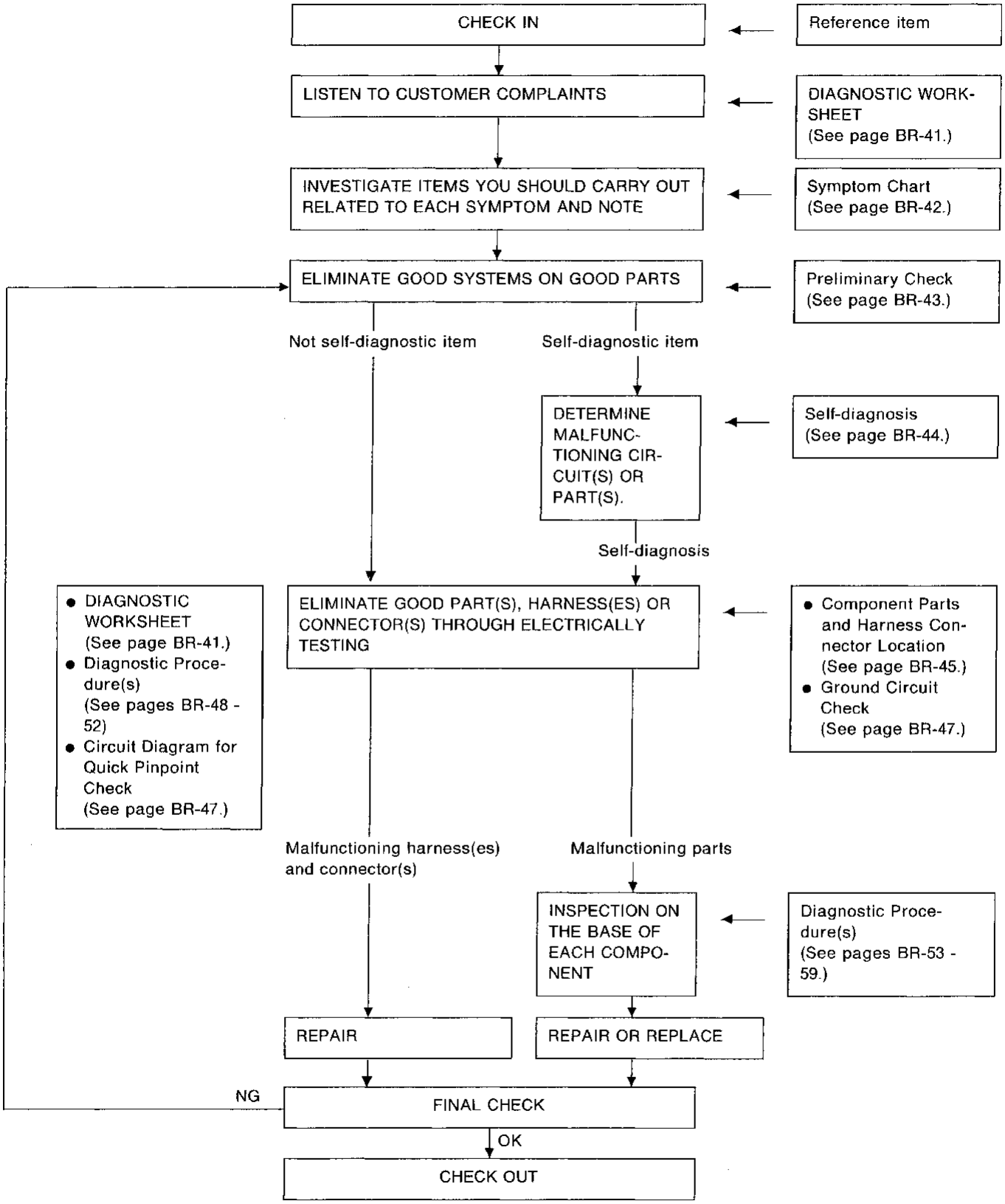
A visual check only may not find the cause of the problems, so a road test should be carried out.

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

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

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

WORK FLOW



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.

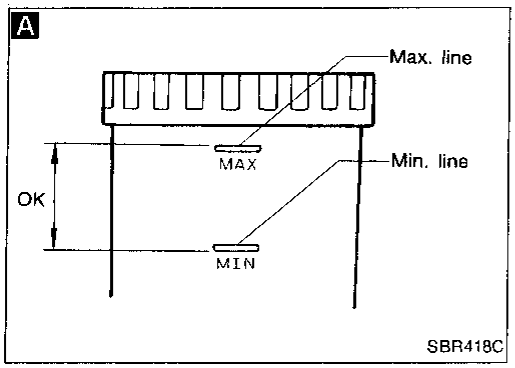
Worksheet sample

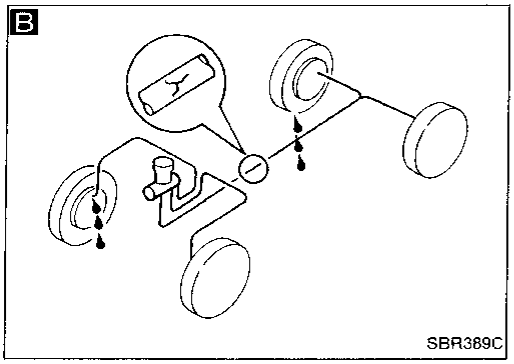
Customer name MR/MS		Model & Year			VIN		
Engine #		Trans.			Mileage		
Incident Date		Manuf. Date			In Service Date		
Symptoms	☐ Pedal vibration and noise	☐ Warning activates	☐ Long stopping distance	☐ Unexpected pedal action	☐ ABS doesn't work	☐ ABS works but warning activates	☐ ABS works frequently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

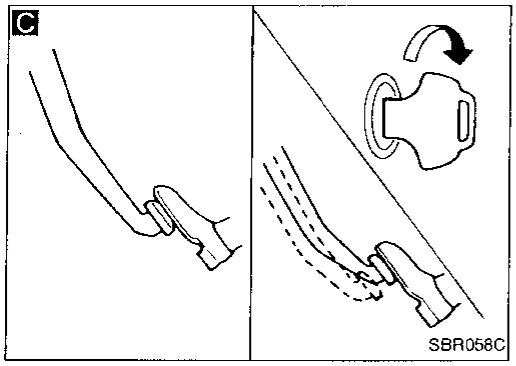
Symptom Chart

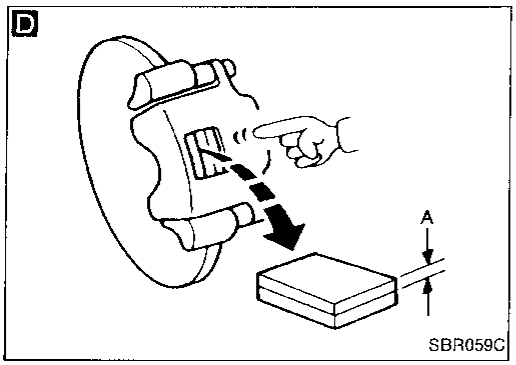
PROCEDURE	—	—	Diagnostic Procedure							Diagnostic Procedure (Select inspection with LED flashing No.)							—	Electrical Components Inspection	
REFERENCE PAGE	BR-43	BR-44	BR-48	BR-50	BR-50	BR-51	BR-51	BR-51	BR-52	BR-53	BR-54	BR-55	BR-57	BR-58	BR-58	BR-59	BR-47	BR-60	BR-60
SYMPTOM	Preliminary Check	Self-diagnosis	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	Diagnostic Procedure 7	Diagnostic Procedure 8 (LED flashing No. 1 - 3)	Diagnostic Procedure 9 (LED flashing No. 5 - 8)	Diagnostic Procedure 10 (LED flashing No. 9)	Diagnostic Procedure 11 (LED flashing No. 10)	Diagnostic Procedure 12 (LED flashing No. 15)	Diagnostic Procedure 13 (LED flashing No. 16)	Diagnostic Procedure 14 (LED comes off)	Ground Circuit Check	Actuator Motor Relay	Solenoid Valve Relay
Pedal vibration & noise		○	○							○	○	○	○	○	○	○	○		
Warning activates		○								○	○	○	○	○	○	○			
Long stopping distance	○	○		○						○	○	○	○	○	○	○			
Unexpected pedal action	○	○			○					○	○	○	○	○	○	○			
ABS doesn't work		○				○				○	○	○	○	○	○	○	○	○	○
ABS works but warning activates		○					○			○	○	○	○	○	○	○			○
ABS works frequently	○	○						○						○			○		
Warning never activates		○				○			○								○		○

Preliminary Check









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.

OK

C

Check brake booster for operation and air tightness.
Refer to "On-vehicle Service" of BRAKE BOOSTER (BR-12). — NG → Replace.

OK

D

Check brake pads and rotor.
Refer to "Inspection" of FRONT and REAR DISC BRAKES (BR-14, 17, 19, 22). — NG → Replace.

OK

A

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

OK

END

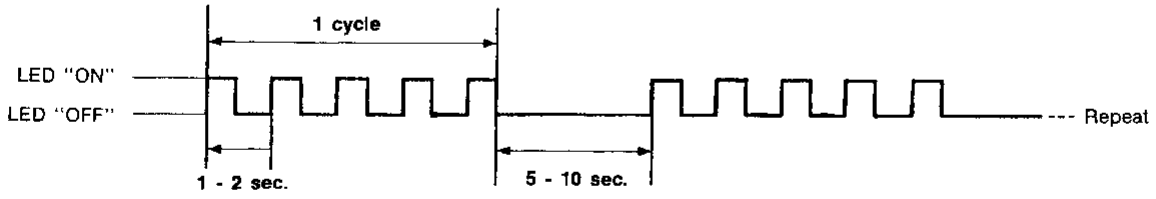
Self-diagnosis

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	Diagnostic Procedure
1	Left front actuator solenoid circuit	8
2	Right front actuator solenoid circuit	8
3	Both actuator solenoid circuits	8
5	Left front wheel sensor circuit	9
6	Right front wheel sensor circuit	9
7	Right rear wheel sensor circuit	9
8	Left rear wheel sensor circuit	9
9	Motor and motor relay	10
10	Solenoid valve relay	11
15	Sensor rotor	12
*16	Solenoid valve relay or control unit	13
Warning activates and LED "OFF"	Power supply and ground circuit	14

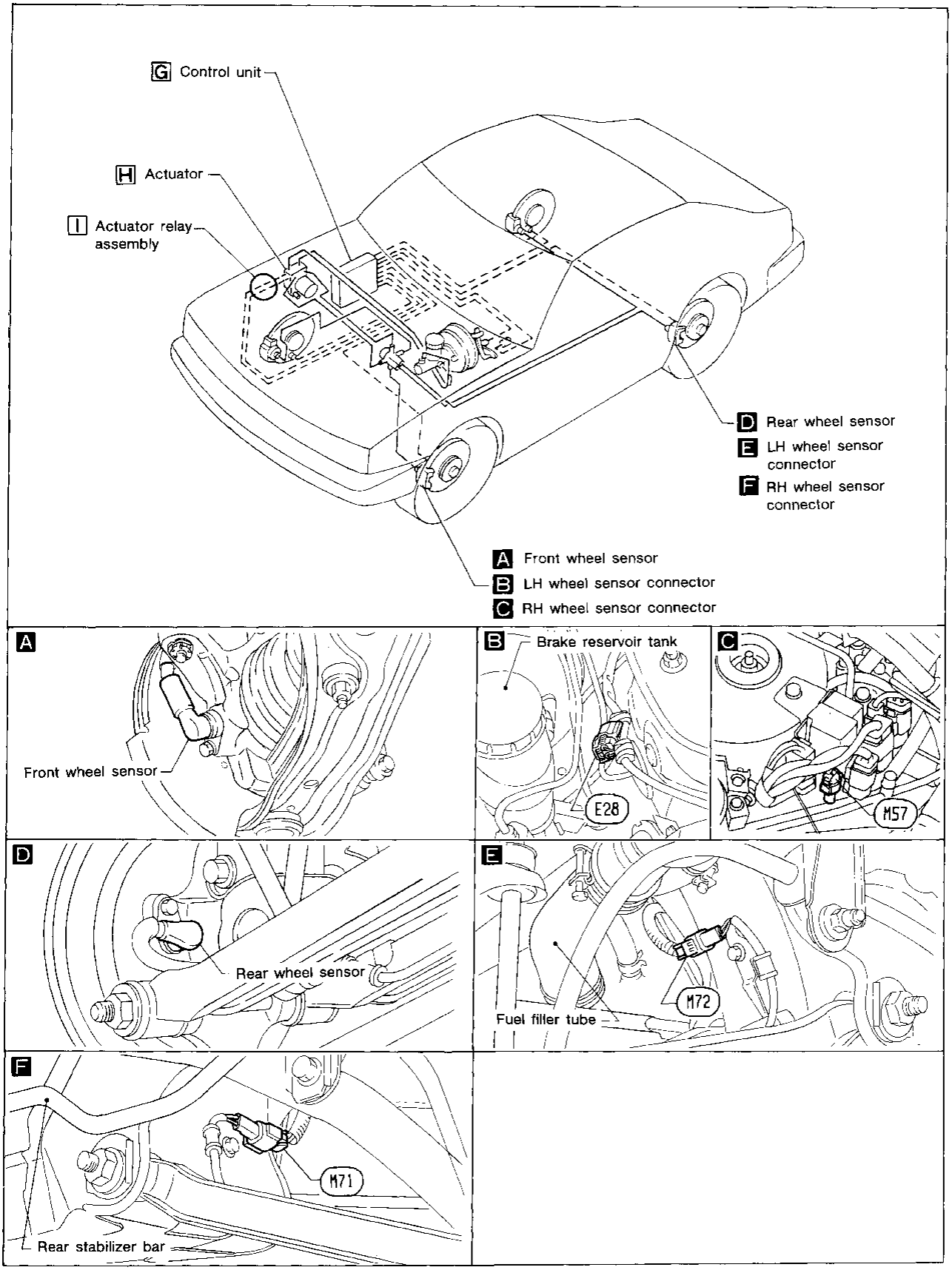
Example
Improper operation of left front rotor sensor circuit



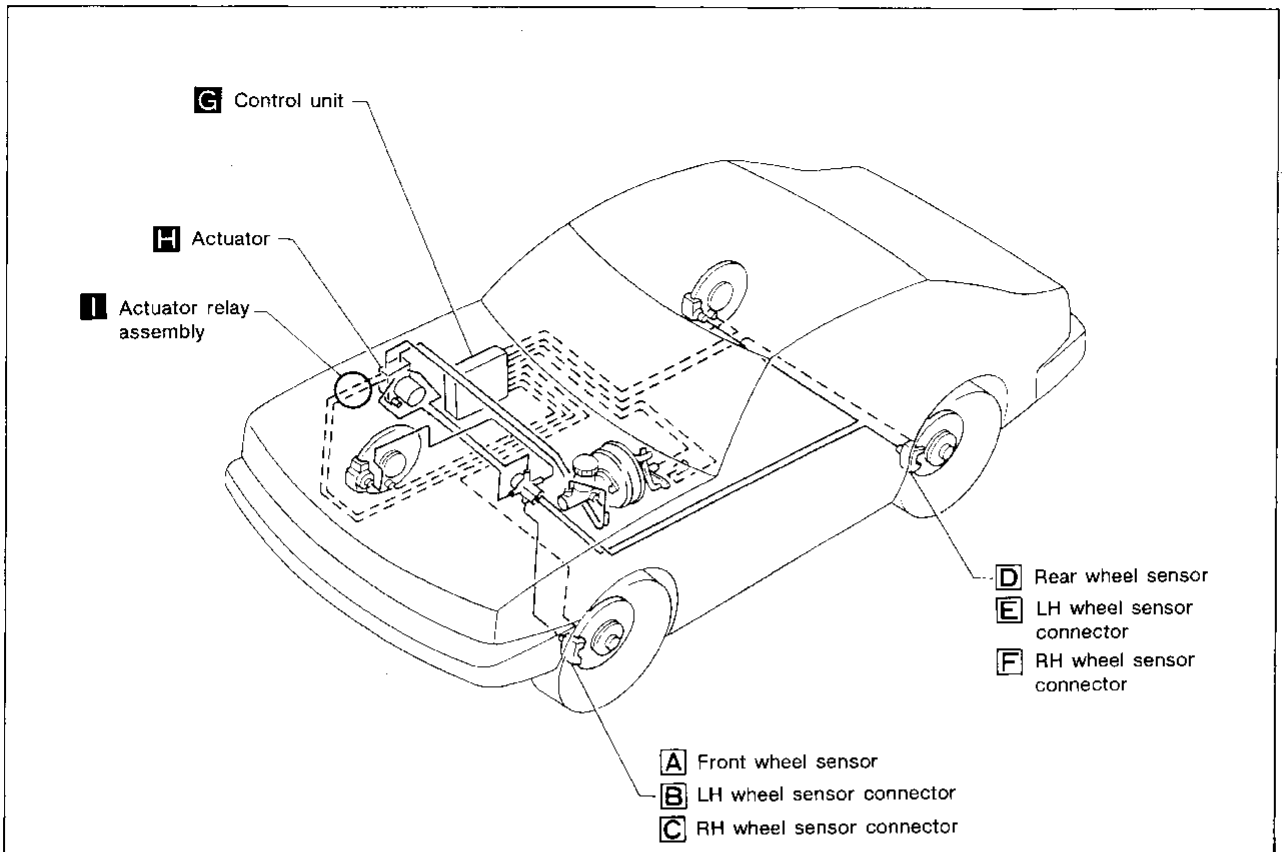
SBR531AA

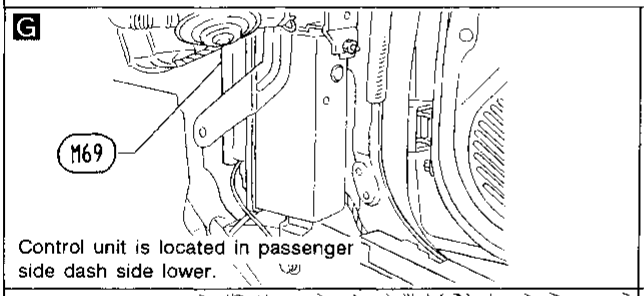
* Turn off the engine, and start it again by slowly turning the ignition key (quickly doing so may cause the ABS warning light to stay on when there is nothing wrong). If the light stays on, carry out the diagnostic procedure.

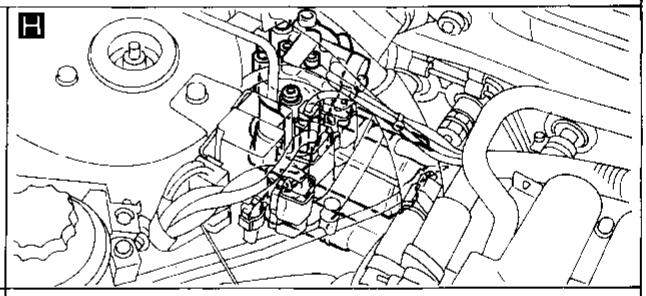
Component Parts and Harness Connector Location

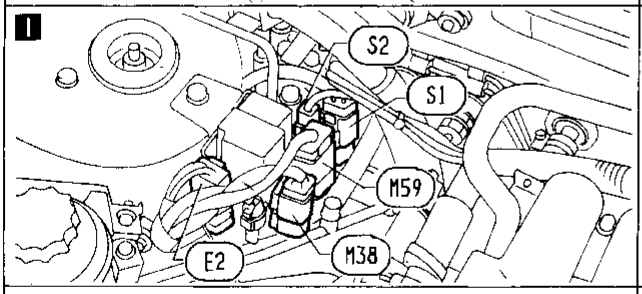


Component Parts and Harness Connector Location (Cont'd)

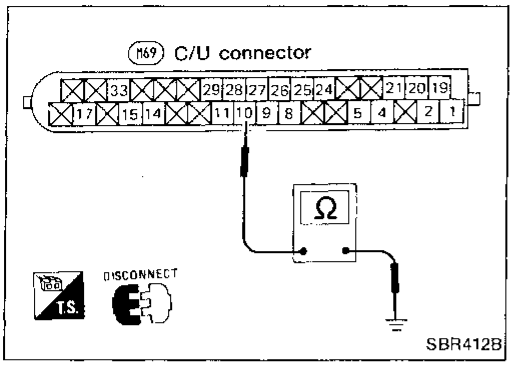








SBR702C



Ground Circuit Check

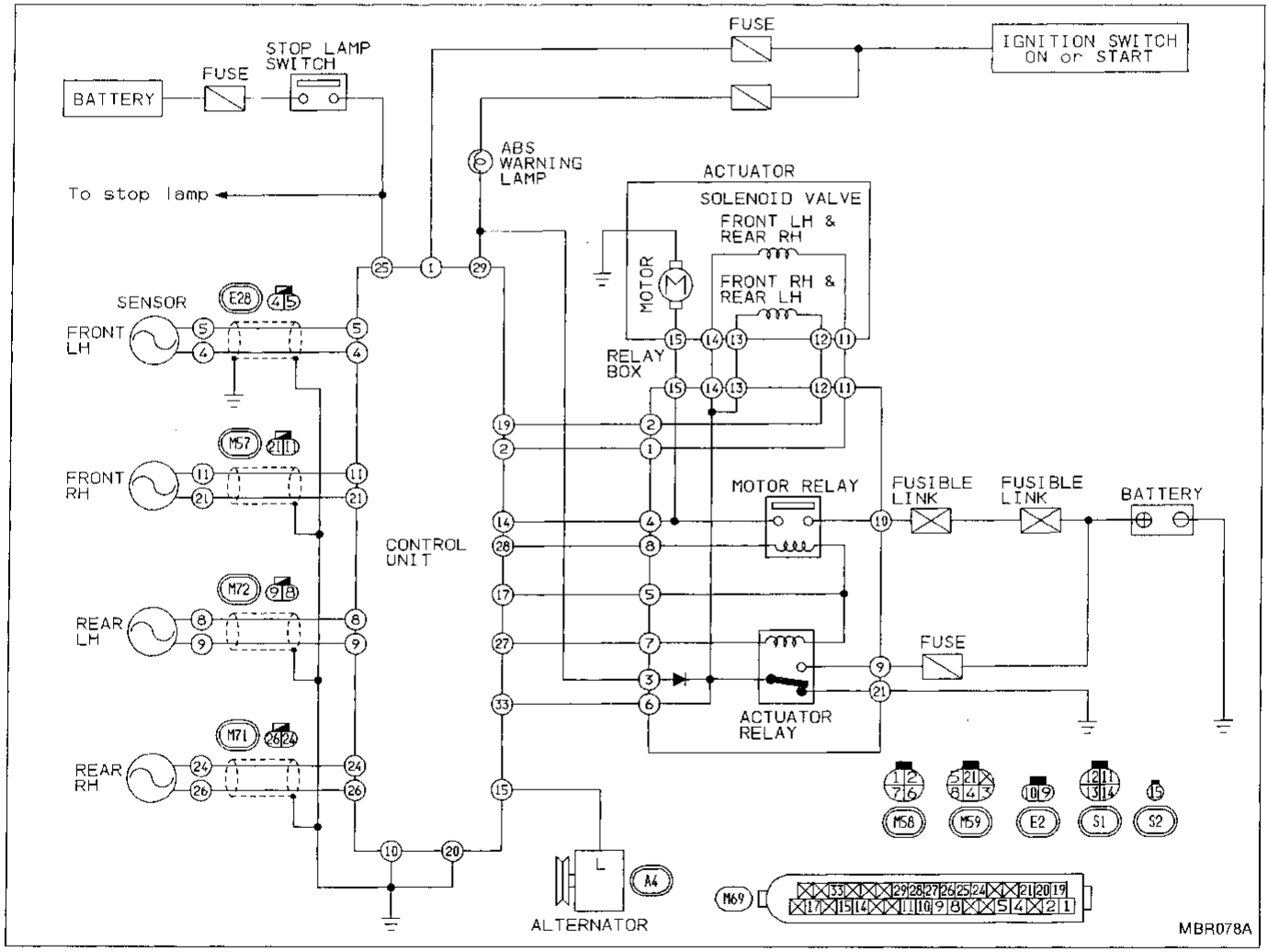
CONTROL UNIT GROUND CIRCUIT

- Check continuity between control unit connector terminal ⑩ and ground.

Continuity should exist.

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-45.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle " ○ ".

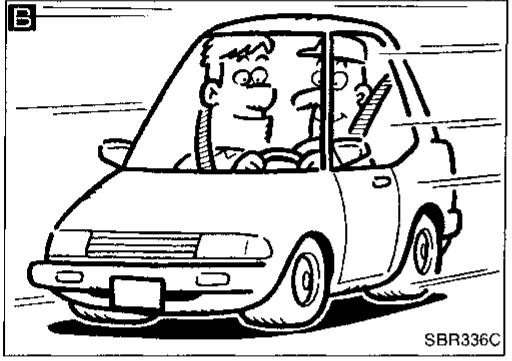


A

Brake pedal

SAT797A

B



SBR336C

B

Brake pedal

SAT797A

Diagnostic Procedure 1

SYMPTOM: Pedal vibration and noise

Refer to worksheet result. (See page BR-41.)

A

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

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

No ↓

Check whether the symptom appears only when engine is started.

Yes → Carry out self-diagnosis (See page BR-44.)

No ↓

B

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 → 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 → Ⓐ

Yes ↓

Check whether the symptom appears when brake is applied gradually.

No (Appears when brake is not applied.) → Check if there are any conditions, among those listed below, when symptom appears.

- Shifting
- Operating clutch
- Passing over bumps/potholes

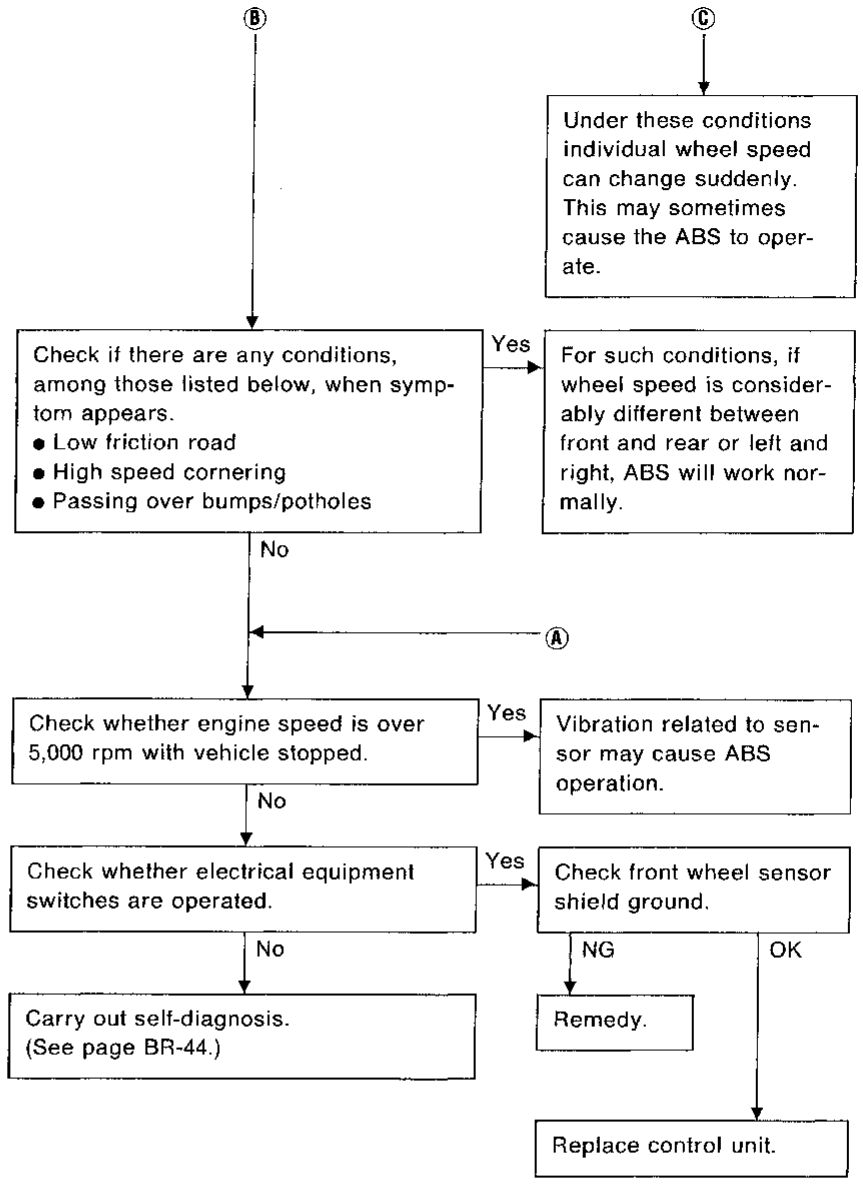
No → Ⓐ

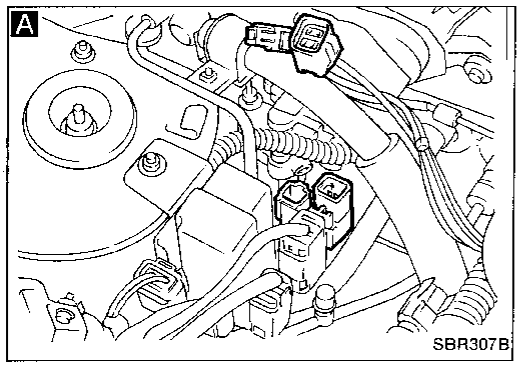
Yes → Ⓒ

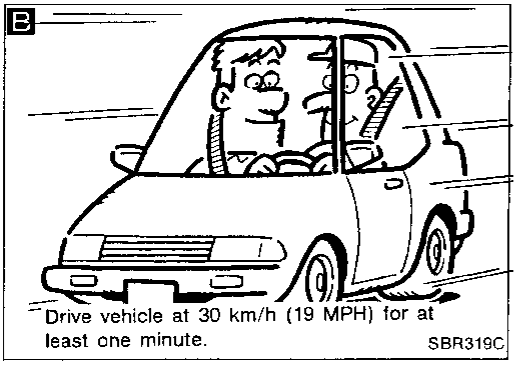
Yes ↓

Ⓑ

Diagnostic Procedure 1 (Cont'd)







Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results. (See page BR-41.)

Check if road condition is slippery with snow or gravel.

Yes → Stopping distance may be longer than vehicles which are not equipped with ABS.

No

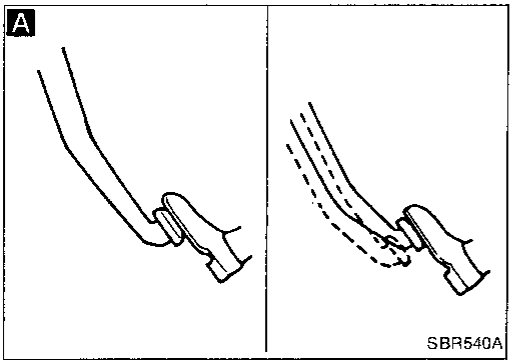
A

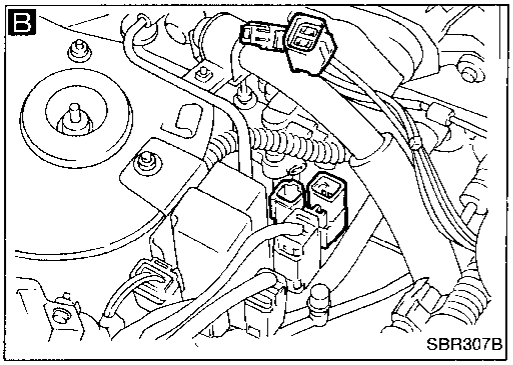
Disconnect actuator connector and check whether stopping distance is still long.

No → B Carry out self-diagnosis. (See page BR-44.)

Yes

Perform Preliminary Check and air bleeding.





Diagnostic Procedure 3

SYMPTOM: Unexpected pedal action

Refer to worksheet results.

A

Check whether brake pedal stroke is excessively large.

Yes → Vehicle equipped with ABS may have a tendency for excessive pedal strokes.

No

Check that brake pedal force is firm but brake is effective.

Yes → Normal condition.

No

B

Disconnect actuator connector and check whether brake is effective.

Yes → Carry out self-diagnosis. (See page BR-44.)

No

Perform Preliminary Check.

Diagnostic Procedure 4

SYMPTOM: ABS does not work.

Refer to worksheet results. (See page BR-41.)

Check whether warning activates.
→ Yes → Carry out self-diagnosis. (See page BR-44.)
↓ No

Check symptom condition whether vehicle speed is under 10 km/h (6 MPH).
→ Yes → ABS does not work in this condition.
↓ No

Check whether warning activates before starting the engine.
→ No → Perform Diagnostic Procedure 7. (See page BR-52.)
↓ Yes

Carry out self-diagnosis. (See page BR-44.)

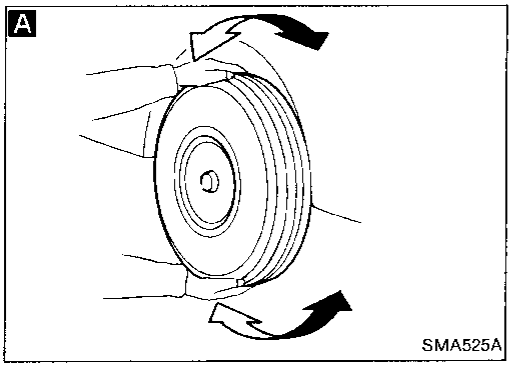
Diagnostic Procedure 5

SYMPTOM: ABS works but warning activates.

Check whether alternator produces proper output. Refer to "CHARGING SYSTEM" in EL section.
→ No → Remedy.
↓ Yes

Check whether battery has enough voltage. Refer to "How to Handle Battery" in EL section.
→ No → Remedy.
↓ Yes

Carry out self-diagnosis. (See page BR-44.)



Diagnostic Procedure 6

SYMPTOM: ABS works frequently.

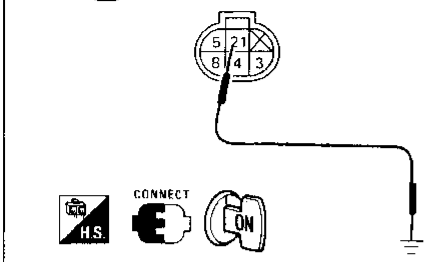
CHECK BRAKE FLUID PRESSURE.
Check whether brake fluid pressure distribution is normal.
For details, refer to DP valve inspection in "CONTROL VALVE". (See page BR-7.)
→ No → Perform Preliminary Check.
↓ Yes

A
Check whether front axles have excessive looseness.
→ Yes → Remedy.
↓ No

Perform Diagnostic Procedure 12 and Ground Circuit Check.
(See pages BR-58 and 47.)

A

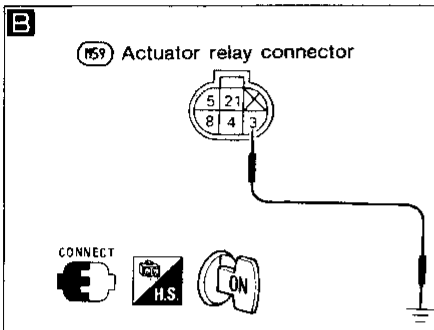
(M59) Actuator relay connector



SBR414B

B

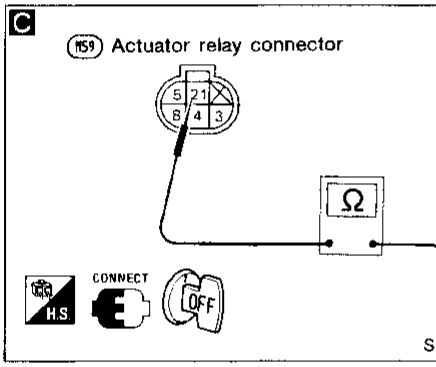
(M59) Actuator relay connector



SBR415B

C

(M59) Actuator relay connector



SBR416B

Diagnostic Procedure 7

SYMPTOM: Warning never activates.

INSPECTION START

A

Check warning by grounding actuator relay connector terminal (21).
Warning should activate.

OK → (A) (See below.)

NG

B

Check warning by grounding actuator relay connector terminal (3).
Warning should activate.

NG → Check bulb or repair harness.

OK

Check solenoid valve relay.
Refer to "SOLENOID VALVE RELAY" in "Electrical Components Inspection".
(See page BR-60.)

OK → Replace actuator relay box.

NG

Replace solenoid valve relay.

(A)

C

Check continuity between actuator relay connector terminal (21) and ground.
Continuity should exist.

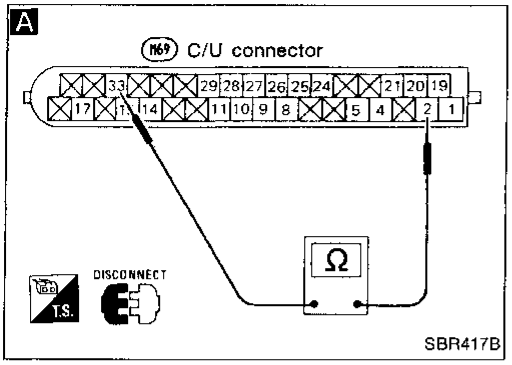
NG → Repair harness.

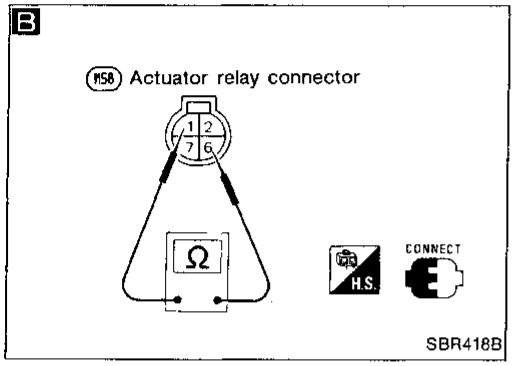
OK

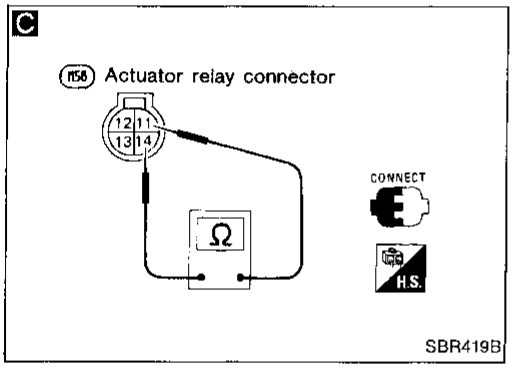
Repair harness between control unit connector terminal (29) and actuator relay connector terminal (3).

Diagnostic Procedure 8

ACTUATOR SOLENOID (LED flashing number 1 - 3)







INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RESISTANCE.
Check resistance between control unit connector (vehicle side) terminals shown below.
Flashing number 1: ㉝ and ②
Flashing number 2: ㉝ and ⑲
Flashing number 3: ㉝ and ②, ㉝ and ⑲
Resistance: Approx. 3Ω

OK → Replace control unit.

NG

B

Check resistance between actuator relay connector terminals shown below.
Flashing number 1: ⑥ and ①
Flashing number 2: ⑥ and ②
Flashing number 3: ⑥ and ①, ⑥ and ②
Resistance: Approx. 3Ω

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

NG

C

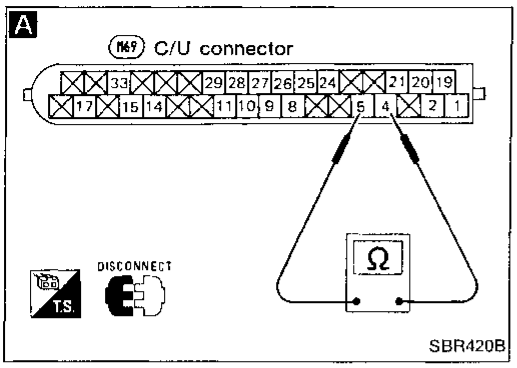
Check resistance between actuator relay connector terminals shown below.
Flashing number 1: ⑪ and ⑭
Flashing number 2: ⑫ and ⑬
Flashing number 3: ⑪ and ⑭, ⑫ and ⑬
Resistance: Approx. 3Ω

OK → Replace actuator relay assembly.

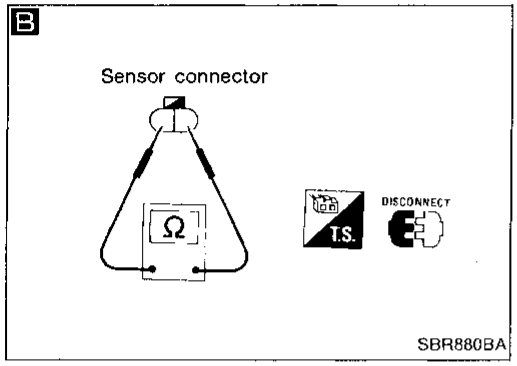
NG

Replace actuator.

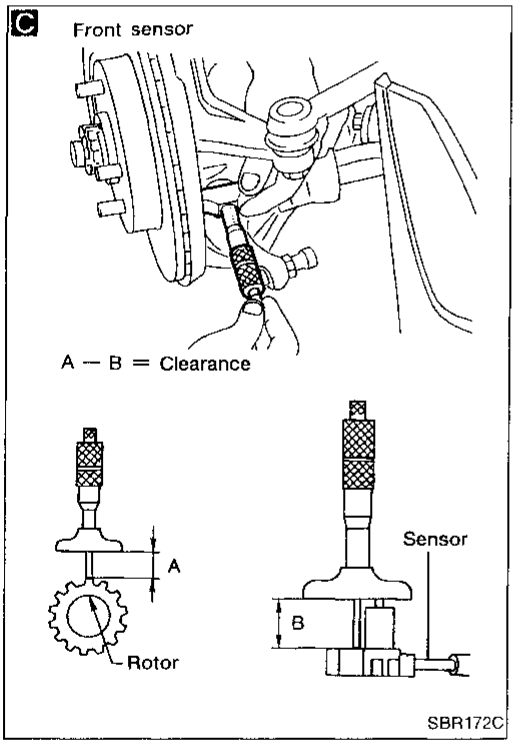
A



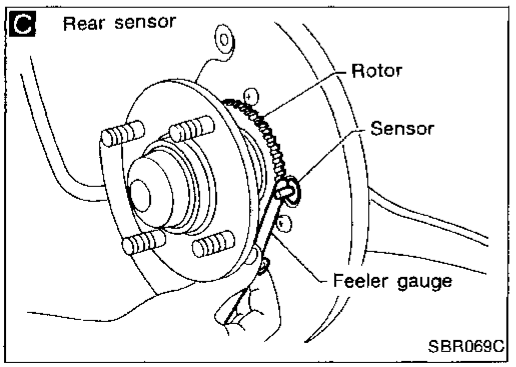
B



C Front sensor



C Rear sensor



Diagnostic Procedure 9

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 as shown.
Flashing number 5 (Fr. LH): ④ and ⑤
Flashing number 6 (Fr. RH): ⑪ and ㉑
Flashing number 7 (Rr. RH): ㉔ and ㉖
Flashing number 8 (Rr. LH): ⑧ and ⑨
Resistance: 0.8 - 1.3 kΩ

OK → Ⓐ (See below.)

NG

B

Check resistance for sensor.
Resistance: 0.8 - 1.3 kΩ
(For location of sensor connector, refer to BR-45.)

NG → Replace sensor.

OK

Repair harness between sensor connector and control unit connector.

Ⓐ

Note

WHEEL SENSOR MECHANICAL CHECK

Check for inflation pressure, wear and size of each tire.

NG → Note: Adjust tire pressure or replace tire(s).

OK

Note

Check wheel bearing axial end play.
Refer to FA or RA section ("Front/Rear Wheel Bearing", "ON-VEHICLE SERVICE").

NG → Note: Follow the direction in FA or RA section ("Front/Rear Wheel Bearing", "ON-VEHICLE SERVICE").

OK

C Note

Check clearance between sensor and rotor.
Clearance: 0.1 - 1.1 mm (0.004 - 0.043 in)

NG → Note: Clean sensor fixing portion, or replace sensor.

OK

Note

Check sensor rotor for teeth damage.

NG → Note: Replace sensor rotor (with drive shaft, wheel hub).

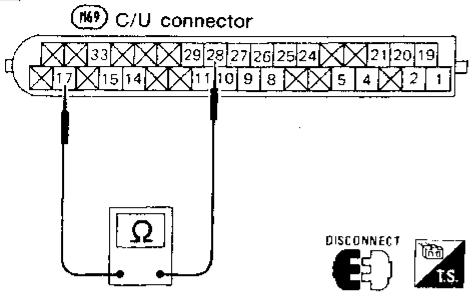
OK

Replace control module.

Note: Wheel position should be distinguished by code No.

A

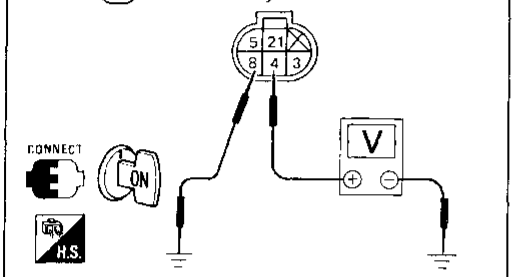
(M69) C/U connector



SBR421B

B

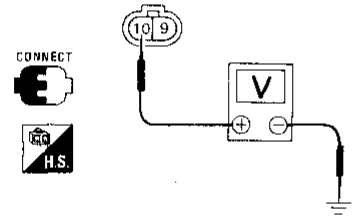
(M59) Actuator relay connector



SBR422B

C

Actuator relay connector (E2)



SBR423B

Diagnostic Procedure 10

ACTUATOR MOTOR RELAY (LED flashing number 9)

INSPECTION START

A

CHECK MOTOR RELAY SOLENOID RESISTANCE.
Check resistance between control unit connector (vehicle side) terminals (17) and (28).
Resistance: 33 - 60Ω

NG → (A) (See next page.)

OK ↓

B

- Connect harness connector to control unit.
- Check voltage between actuator relay connector terminal (4) and ground by grounding actuator relay connector terminal (8).
  Voltage: Battery voltage
- At same time, check actuator motor operation.
  Actuator motor should be operated.

OK → Repair harness between actuator relay connector terminal (4) and control unit connector terminal (14) or replace control unit.

NG ↓

Did battery voltage exist between actuator relay connector terminal (4) and ground?

Yes → (B) (See next page.)

No ↓

C

Check voltage between actuator relay connector terminal (10) and ground.
Voltage: Battery voltage

NG → Repair harness between actuator relay connector terminal (10) and battery. For details, refer to "Power Supply Routing" in EL section.

OK ↓

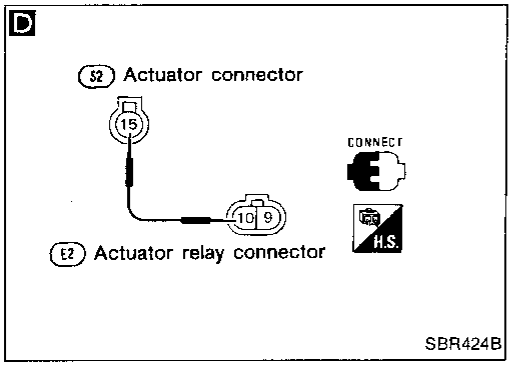
Check motor relay. Refer to "ACTUATOR MOTOR RELAY" in "Electrical Components Inspection".
(See page BR-60.)

NG → Replace motor relay.

OK ↓

Replace actuator relay assembly.

Diagnostic Procedure 10 (Cont'd)



Ⓑ

D

Does actuator motor operate with jumper cable between actuator relay connector terminal ⑩ and actuator connector terminal ⑮.

Yes → Replace actuator relay assembly.

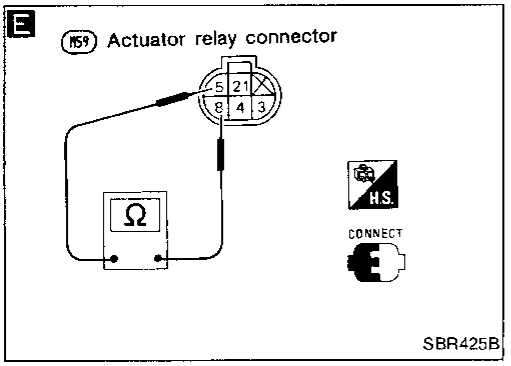
No

Check actuator motor ground cable.

OK → Replace actuator.

NG

Repair ground cable or tighten grounding portion.



Ⓐ

E

Check resistance between actuator relay connector terminals ⑤ and ⑧.
Resistance: 33 - 60Ω

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

NG

Check motor relay. Refer to "ACTUATOR MOTOR RELAY" in "Electrical Components Inspection" (See page BR-60).

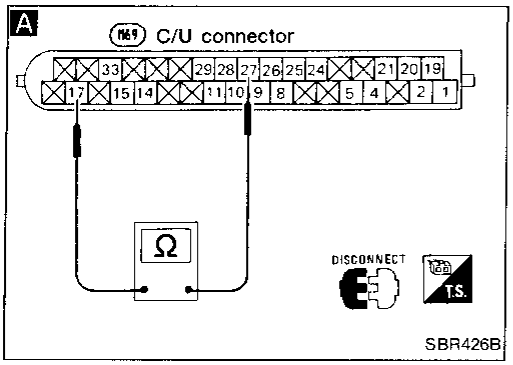
NG → Replace motor relay.

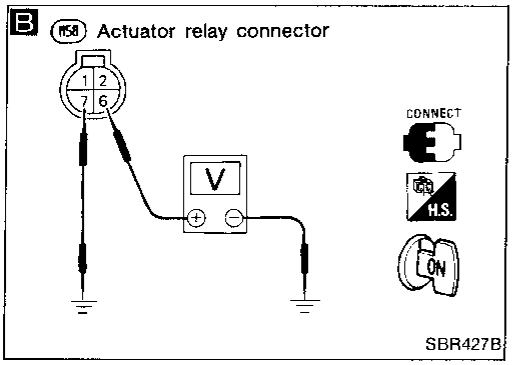
OK

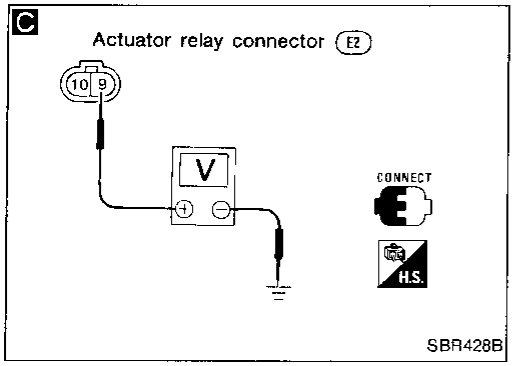
Replace actuator relay assembly.

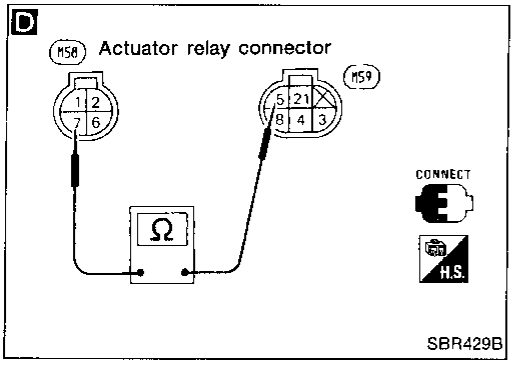
Diagnostic Procedure 11

ACTUATOR SOLENOID VALVE RELAY (LED flashing number 10)









INSPECTION START

A

CHECK SOLENOID VALVE RELAY RESISTANCE.
Check resistance between control unit connector terminals ㉗ and ⑰.
Resistance: 75 - 90Ω

NG → Ⓐ (See below.)

OK

B

- Connect harness connector to control unit.
- Check voltage between actuator relay connector terminal ⑥ and ground by grounding actuator relay connector terminal ⑦.
  Voltage: Battery voltage

OK → Repair harness between actuator relay connector terminal ⑥ and control unit connector terminal ㉝ or replace control unit.

NG

C

Check voltage between actuator relay connector terminal ⑨ and ground.
Voltage: Battery voltage

NG → Repair harness between actuator connector terminal ⑨ and battery. For details, refer to "Power Supply Routing" in EL section.

OK

Check solenoid valve relay. Refer to "SOLENOID VALVE RELAY" in "Electrical Components Inspection" (See page BR-60).

NG → Replace solenoid valve relay.

OK

Replace actuator relay assembly.

Ⓐ

D

Check resistance between actuator relay connector terminals ⑤ and ⑦.
Resistance: 75 - 90Ω

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

NG

Check solenoid valve relay. Refer to "SOLENOID VALVE RELAY" in "Electrical Components Inspection" (See page BR-60).

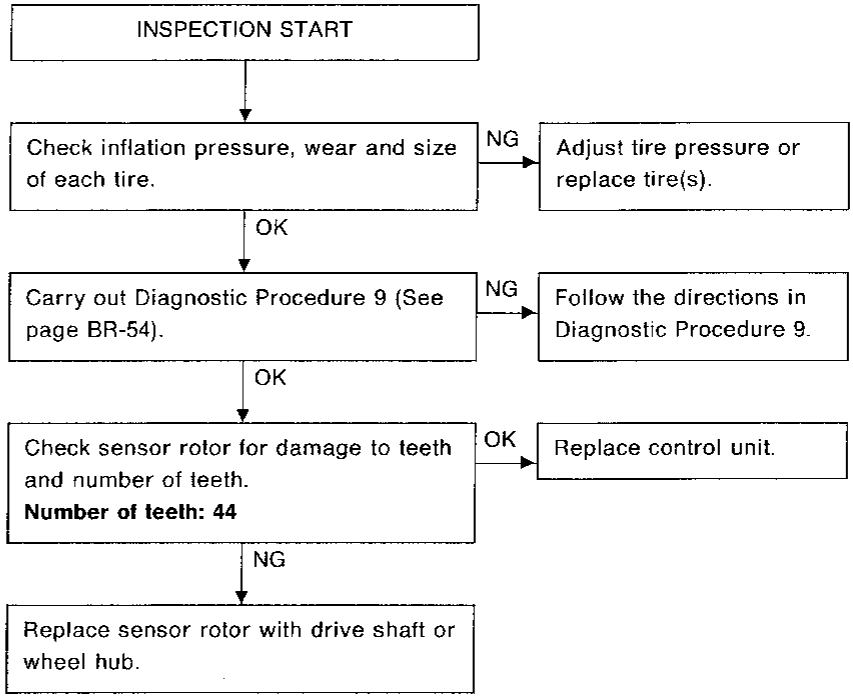
OK → Replace actuator relay assembly.

NG

Replace solenoid valve relay.

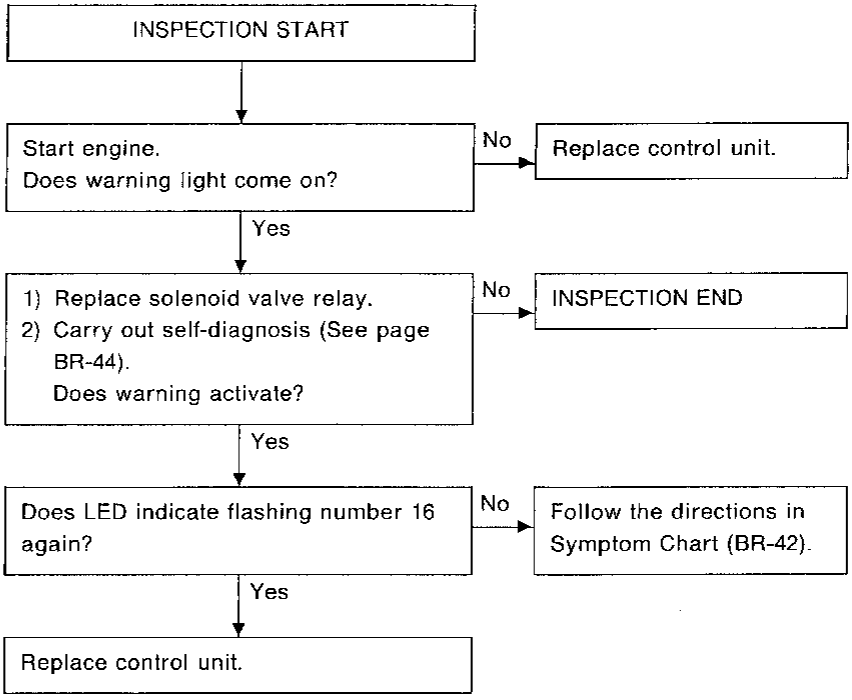
Diagnostic Procedure 12

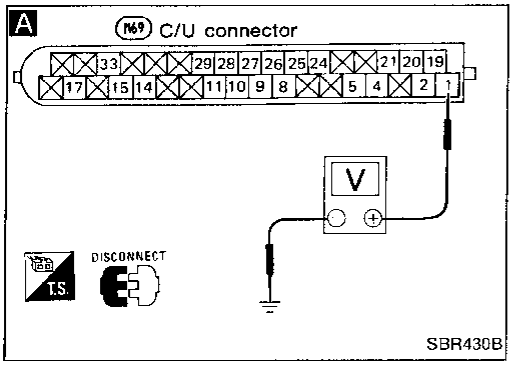
SENSOR AND SENSOR ROTOR (LED flashing number 15)

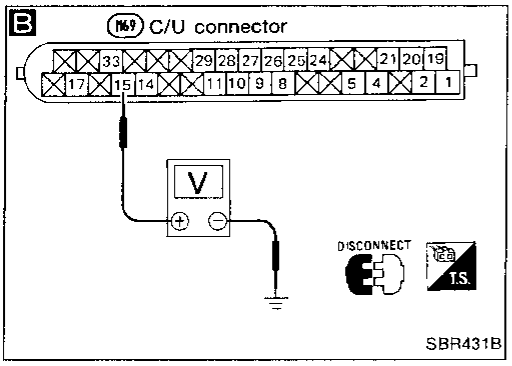


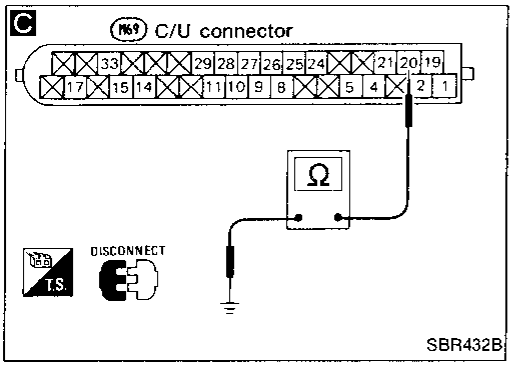
Diagnostic Procedure 13

SOLENOID VALVE RELAY OR CONTROL UNIT (LED flashing number 16)









Diagnostic Procedure 14

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

INSPECTION START

A

CHECK CONTROL UNIT POWER SUPPLY.
Disconnect control unit connector.
Check voltage between control unit connector (vehicle side) terminal ① and body ground with ignition switch turned on.
Battery voltage should exist.

NG → Repair harness between control unit connector terminal ① and battery. For details, refer to "Power Supply Routing" in EL section.

OK ↓

B

CHECK ALTERNATOR L TERMINAL VOLTAGE.
Check voltage between control unit connector (vehicle side) terminal ⑮ and body ground after engine starting.
Voltage: 6V or more

NG → Check if other warning activate.

- OK → Repair harness between alternator and control unit.
- NG → Malfunctioning alternator.

OK ↓

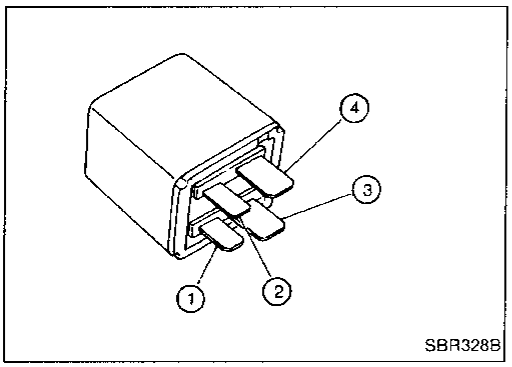
C

Check continuity between control unit connector (vehicle side) terminal ⑳ and body ground with ignition switch "OFF".

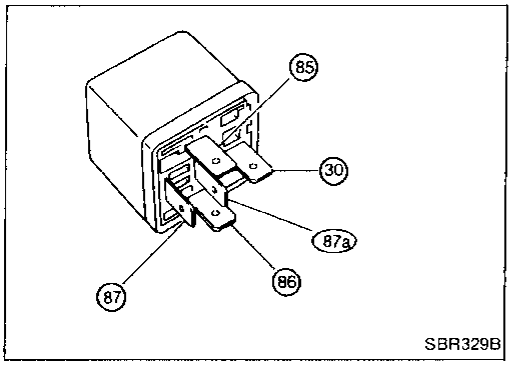
NG → Repair ground harness.

OK ↓

Replace control unit



SBR328B



SBR329B

Electrical Components Inspection

ACTUATOR MOTOR RELAY

Condition	Continuity existence between terminals ③ and ④
Battery voltage not applied between terminals ① and ②.	No
Battery voltage applied between terminals ① and ②.	Yes

SOLENOID VALVE RELAY

Condition	Continuity existence between terminals ㉚ and ㊼	Continuity existence between terminals ㉚ and ㊼
Battery voltage not applied between terminals ㊺ and ㊻.	Yes	No
Battery voltage applied between terminals ㊺ and ㊻.	No	Yes

General Specifications

BRAKE UNIT

Applied model	Without ABS				With ABS	
	GA16DE		SR20DE		GA16DE	SR20DE
	STD	GXE, XE	SR	SE		
Front brake						
Brake model	CL18VD		AD18VE		CL18VD	AD18VE
Cylinder bore diameter mm (in)	48.1 (1.894)				48.1 (1.894)	
Lining mm (in) length x width x thickness	106 x 43 x 10 (4.17 x 1.69 x 0.39)		97.5 x 42.5 x 10 (3.839 x 1.673 x 0.39)		106 x 43 x 10 (4.17 x 1.69 x 0.39)	97.5 x 42.5 x 10 (3.839 x 1.673 x 0.39)
Rotor outer diameter x thickness mm (in)	240 x 18 (9.45 x 0.71)		250 x 18 (9.84 x 0.71)		240 x 18 (9.45 x 0.71)	250 x 18 (9.84 x 0.71)
Rear brake						
Brake model	LT18C		AD7HA			
Cylinder bore diameter mm (in)	15.87 (5/8)		30.16 (1-3/16)			
Lining mm (in) length x width x thickness	172.8 x 30 x 4 (6.80 x 1.18 x 0.16)		94 x 29 x 10 (3.70 x 1.14 x 0.39)			
Drum inner diameter or rotor outer diameter x thickness mm (in)	180 (7.09)		234 x 7 (9.21 x 0.28)			
Master cylinder						
Cylinder bore diameter mm (in)	19.05 (3/4)	20.64 (13/16)	22.22 (7/8)		22.22 (7/8)	
Control valve						
Valve model	Dual proportioning valve built into master cylinder				Dual proportioning valve separated from master cylinder	
Split point [kPa (kg/cm^2, psi)] x reducing ratio	3,923 (40, 569) x 0.2		1,961 (20, 284) x 0.2		1,471 (15, 213) x 0.2	
Brake booster						
Booster model	S205 or C205	M195T				
Diaphragm diameter mm (in)	205 (8.07)	Primary: 205 (8.07) Secondary: 180 (7.09)				
Recommended brake fluid	DOT 3					

Inspection and Adjustment

DISC BRAKE

Unit: mm (in)

Brake model	Front		Rear
	CL18VD	AD18VE	AD7HA
Lining wear limit			
Minimum thickness	2.0 (0.079)		
Rotor repair limit			
Minimum thickness	16.0 (0.630)		6.0 (0.236)

DRUM BRAKE

Unit: mm (in)

Brake model	Rear LT18C
Lining wear limit	
Minimum thickness	1.5 (0.059)
Drum repair limit	
Maximum inner diameter	181 (7.13)
Out-of-roundness	0.03 (0.0012)

BRAKE PEDAL

Unit: mm (in)

Applied model	GA16DE	SR20DE
Free height		
M/T	148 - 158 (5.83 - 6.22)	
A/T	157 - 167 (6.18 - 6.57)	
Depressed height [under force of 490 N (50 kg, 110 lb) with engine running] (Minimum)		
M/T	85 (3.35)	90 (3.54)
A/T	90 (3.54)	95 (3.74)
Clearance between switches and pedal stopper bracket	0.1 - 0.3 (0.004 - 0.012)	
Pedal free play	1 - 3 (0.04 - 0.12)	

PARKING BRAKE CONTROL

Rear brake type	Drum	Disc
Number of notches [under force of 196 N (20 kg, 44 lb)]	5 - 6	7 - 8
Number of notches when warning switch comes on	1	