BRAKE SYSTEM

SECTION BR

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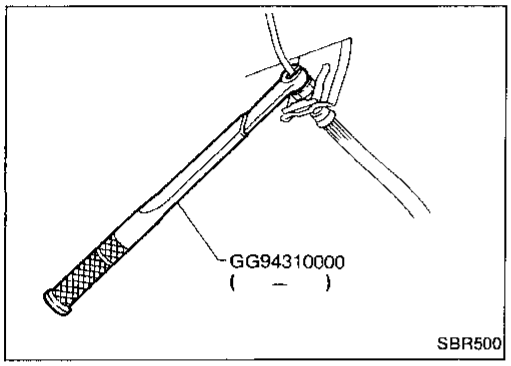
Precautions

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

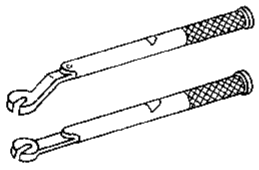
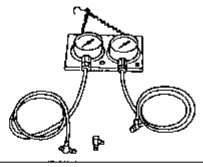
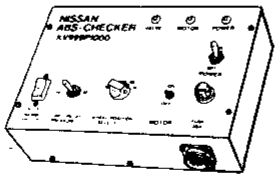
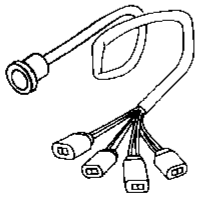


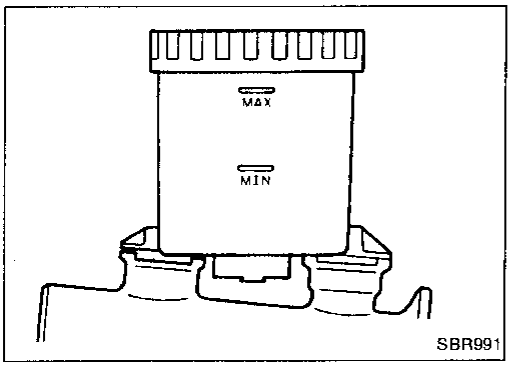
- **Use Tool when removing and installing brake tube.**

WARNING:

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

Special Service Tools

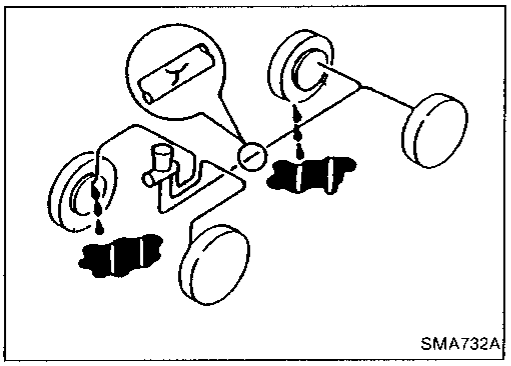
Tool number (Kent-Moore No.) Tool name	Description	
GG94310000 (—) Flare nut torque wrench		Removing and installing each brake piping
KV991V0010 (—) Brake fluid pressure gauge		Measuring brake fluid pressure
KV999P1000 (—) ABS checker		Checking brake fluid pressure of ABS actuator
KV999P1010 (—) ABS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



SBR991

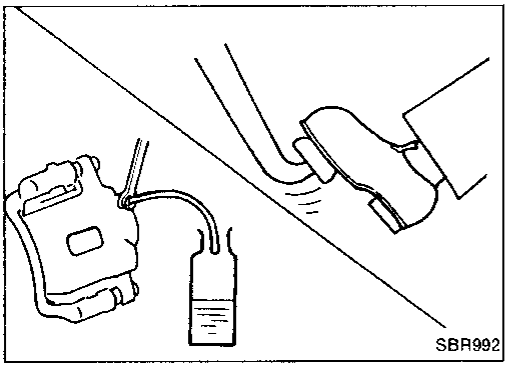
Checking Brake Fluid Level

- 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.


SMA732A

Checking Brake System

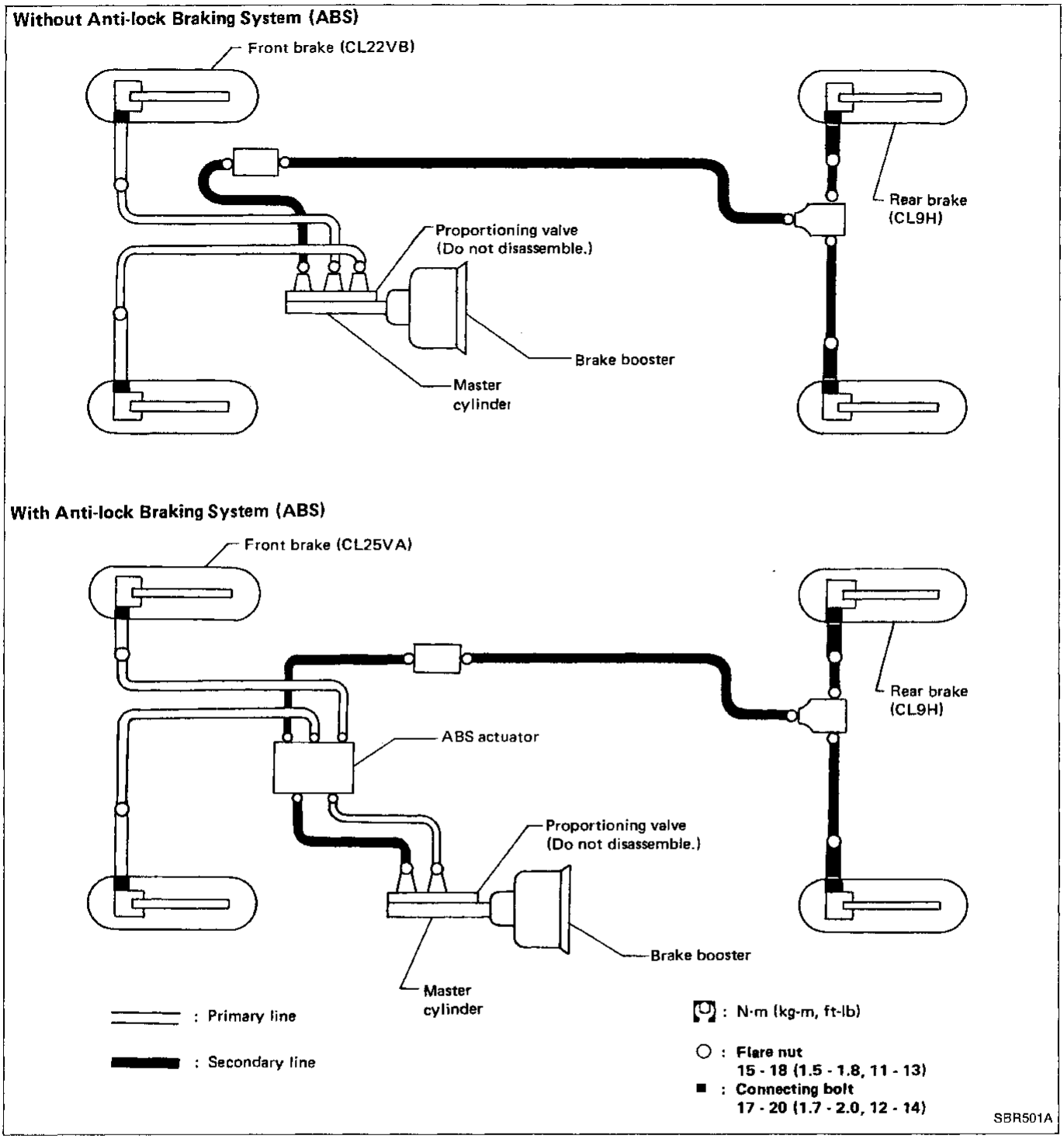
- Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
  If leakage occurs around joints, retighten or, if necessary, replace damaged parts.
- Check for oil leakage by fully depressing brake pedal.

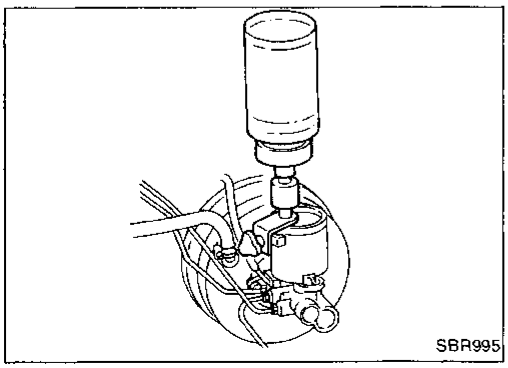

SBR992

Changing Brake Fluid

1. Drain brake fluid in each air bleeder valve.
2. Refill until new brake fluid comes out of each air bleeder valve.
   Use same procedure as in bleeding hydraulic system to refill brake fluid.
   Refer to Bleeding Procedure.

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



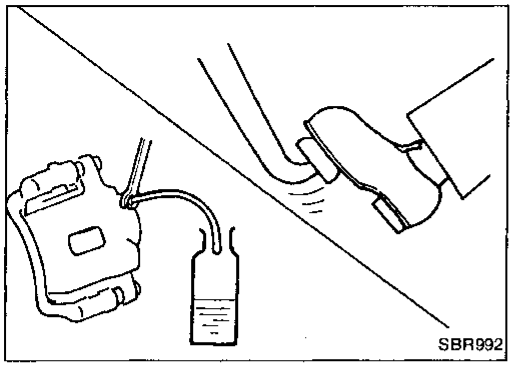


Bleeding Procedure

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.**

Bleeding Procedure (Cont'd)



- Bleed air according to the following procedure.

Without Anti-lock Braking System:

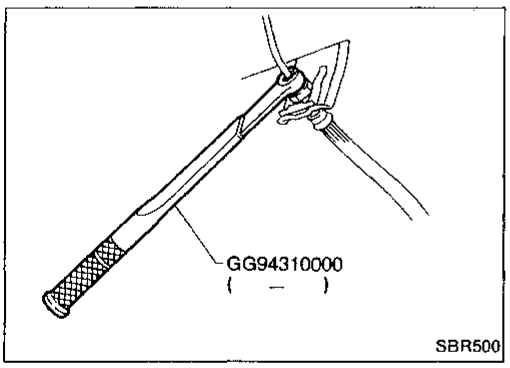
Left rear caliper
↓
Right rear caliper
↓
Left front caliper
↓
Right front caliper

With Anti-lock Braking System:

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

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

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



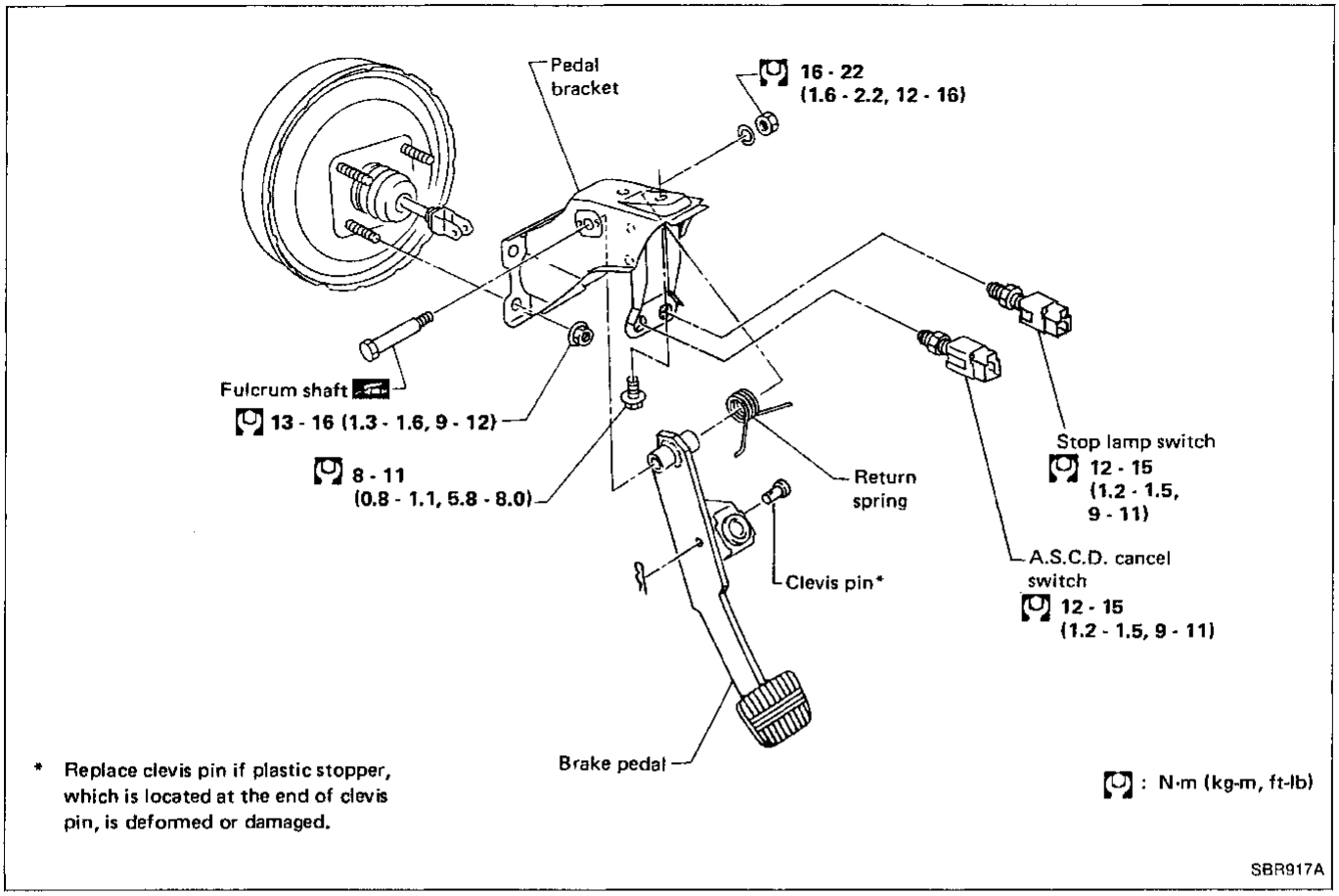
Removal and Installation

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

Inspection

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

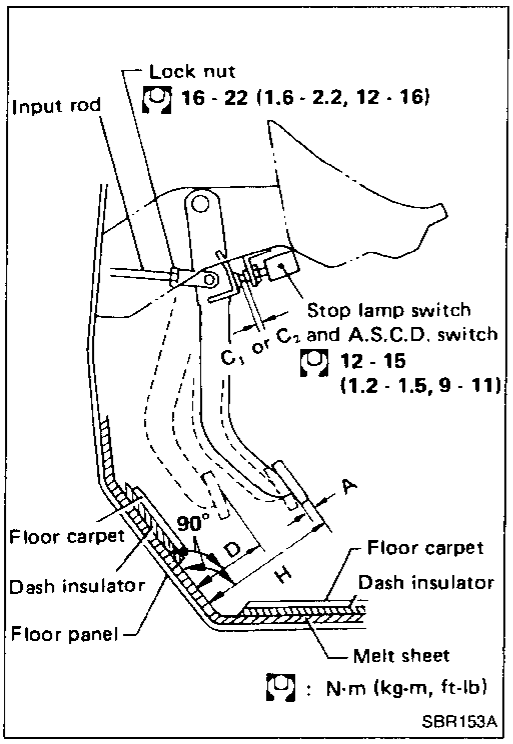
Removal and Installation

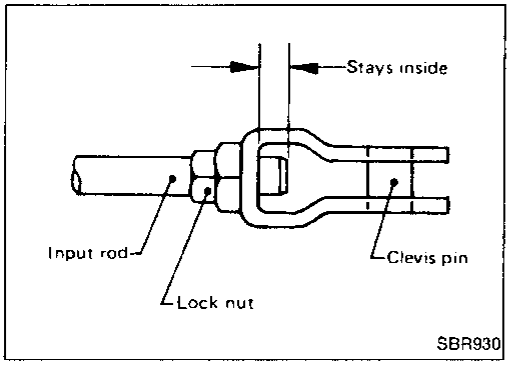


Inspection

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 S.D.S.

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

C_1: Clearance between pedal stopper and threaded end of stop lamp switch
0.3 - 1.0 mm (0.012 - 0.039 in)

C_2: Clearance between pedal stopper and threaded end of A.S.C.D. switch
0.3 - 1.0 mm (0.012 - 0.039 in)

A: Pedal free play
1 - 3 mm (0.04 - 0.12 in)

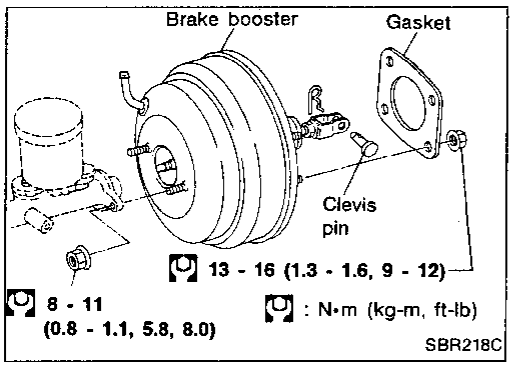
1. Adjust pedal free height with brake booster input rod. Then tighten lock nut.

Make sure that tip of input rod stays inside.

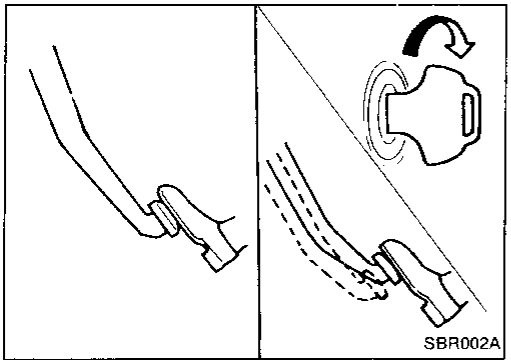
2. Adjust clearance "C_1" and "C_2" with stop lamp switch and A.S.C.D. switch respectively. Then tighten lock nuts.
3. Check pedal free play.

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

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



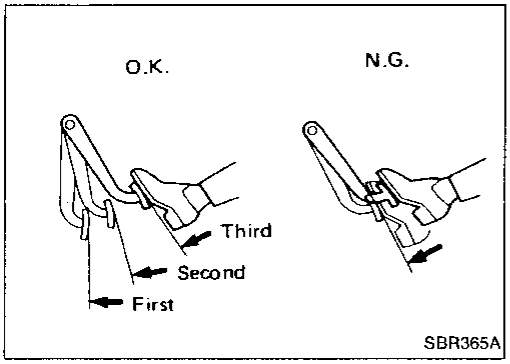
Removal and Installation



Inspection

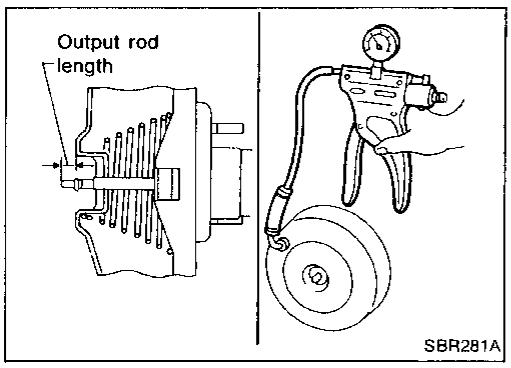
OPERATING CHECK

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



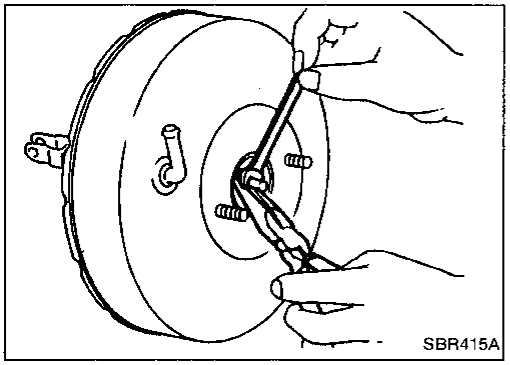
AIRTIGHT CHECK

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

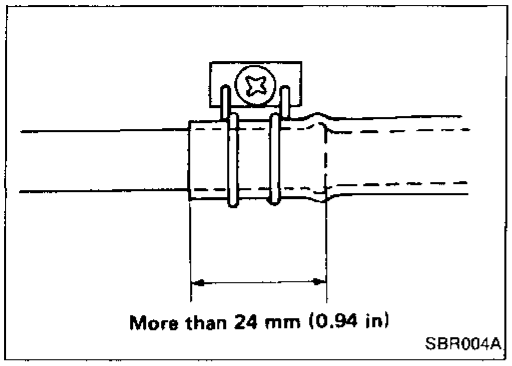


OUTPUT ROD LENGTH CHECK

1. Supply brake booster with vacuum of –66.7 kPa (–500 mmHg, –19.69 inHg) using a handy vacuum pump.
2. Check output rod length.
   Specified length:
   10.275 - 10.525 mm (0.4045 - 0.4144 in)

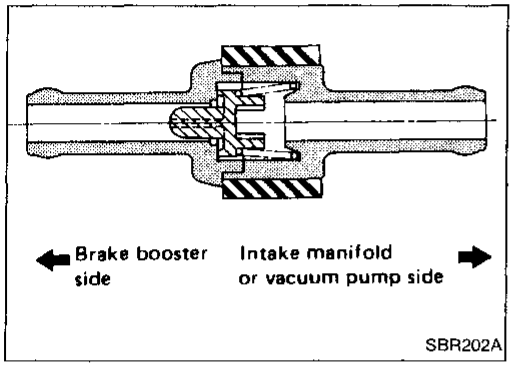


3. Adjust rod length if necessary.
4. If rod length is without specification, replace brake booster.

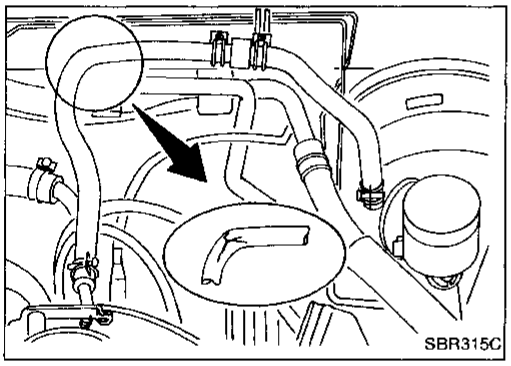


Removal and Installation

- Insert vacuum tube into vacuum hose more than 24 mm (0.94 in).
- Do not apply any oil or lubricants to vacuum hose and check valve.



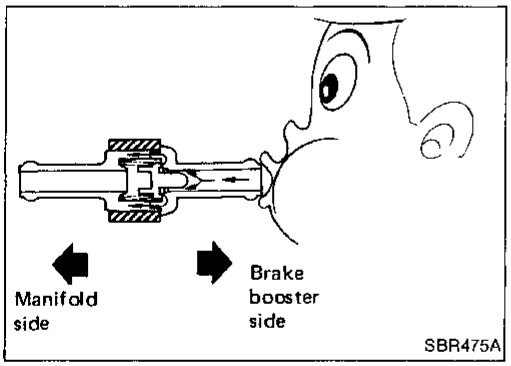
- Install check valve, paying attention to its direction.



Inspection

HOSES AND CONNECTORS

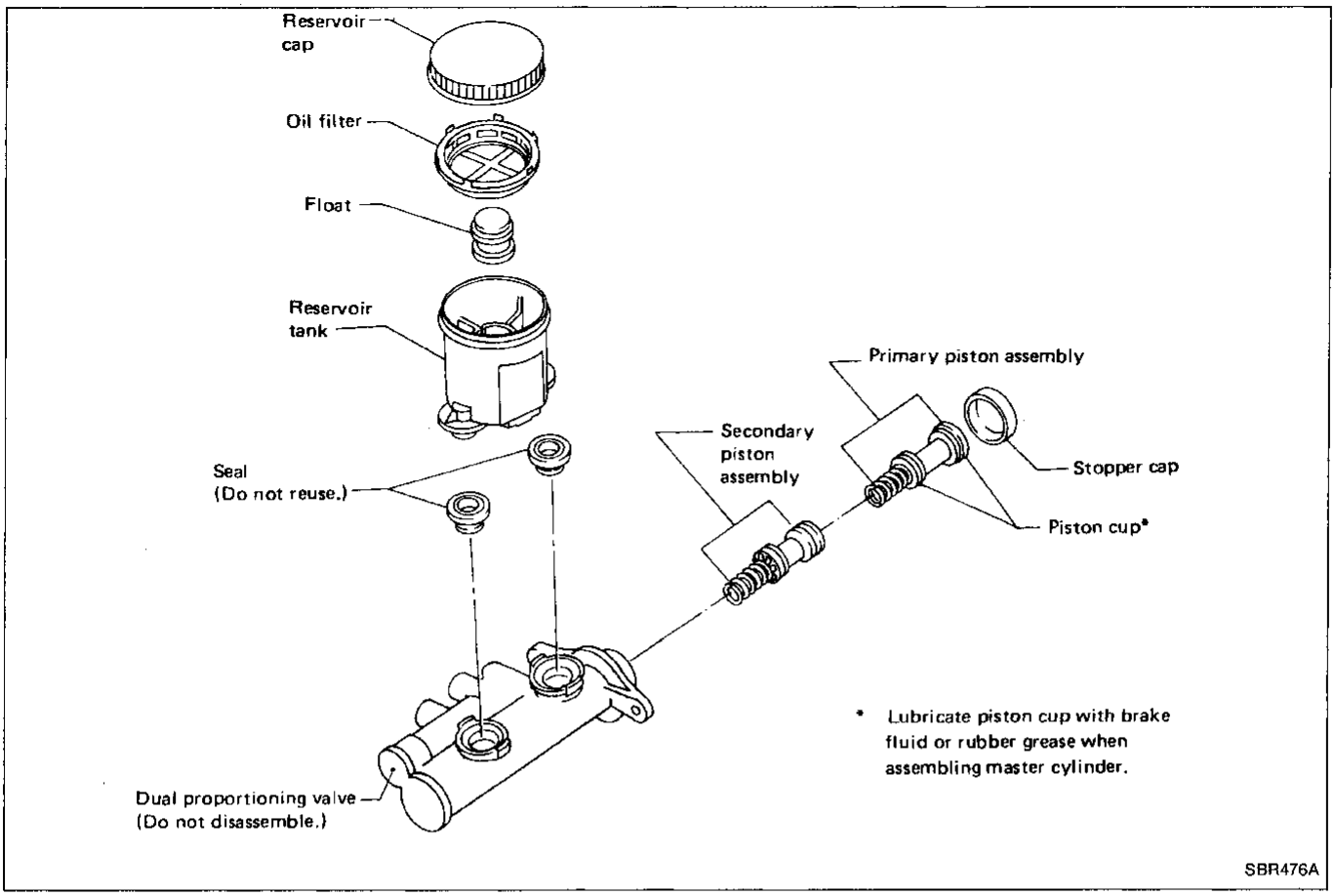
- Check vacuum lines, connections and check valve for airtightness, improper attachment chafing and deterioration.

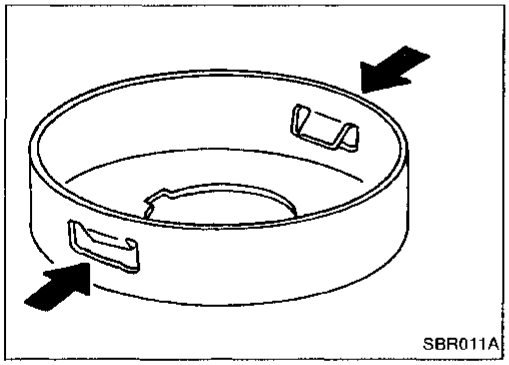


CHECK VALVE

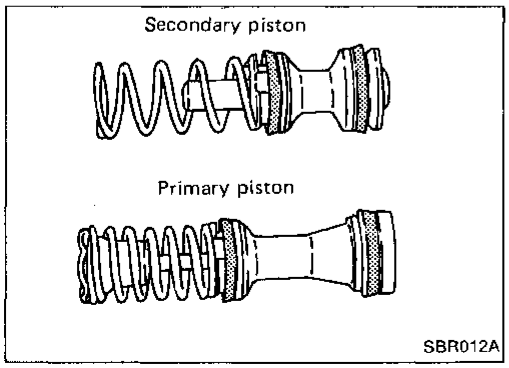
- When pressure is applied to brake booster side of check valve and valve does not open, replace check valve with a new one.

Removal and Installation

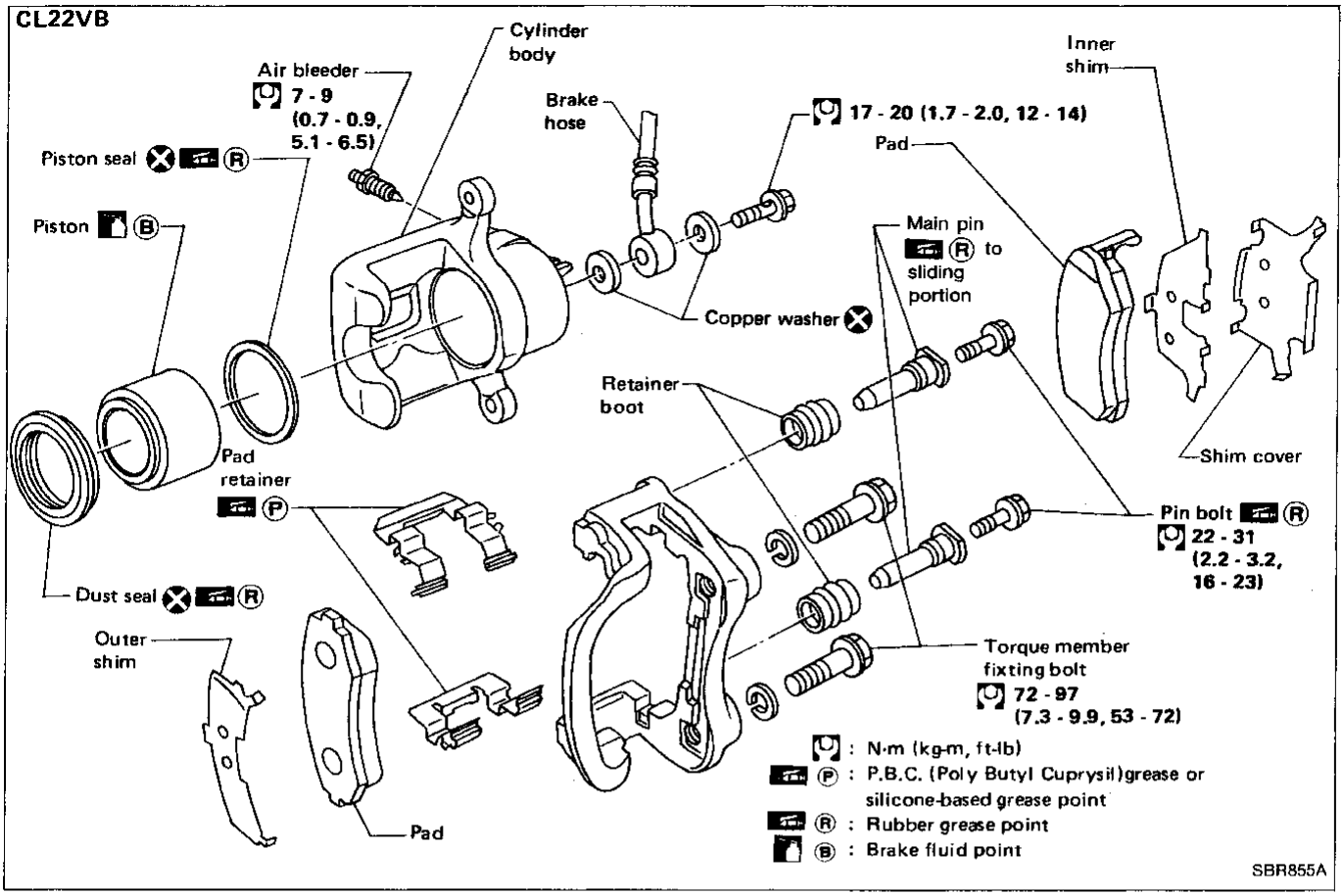


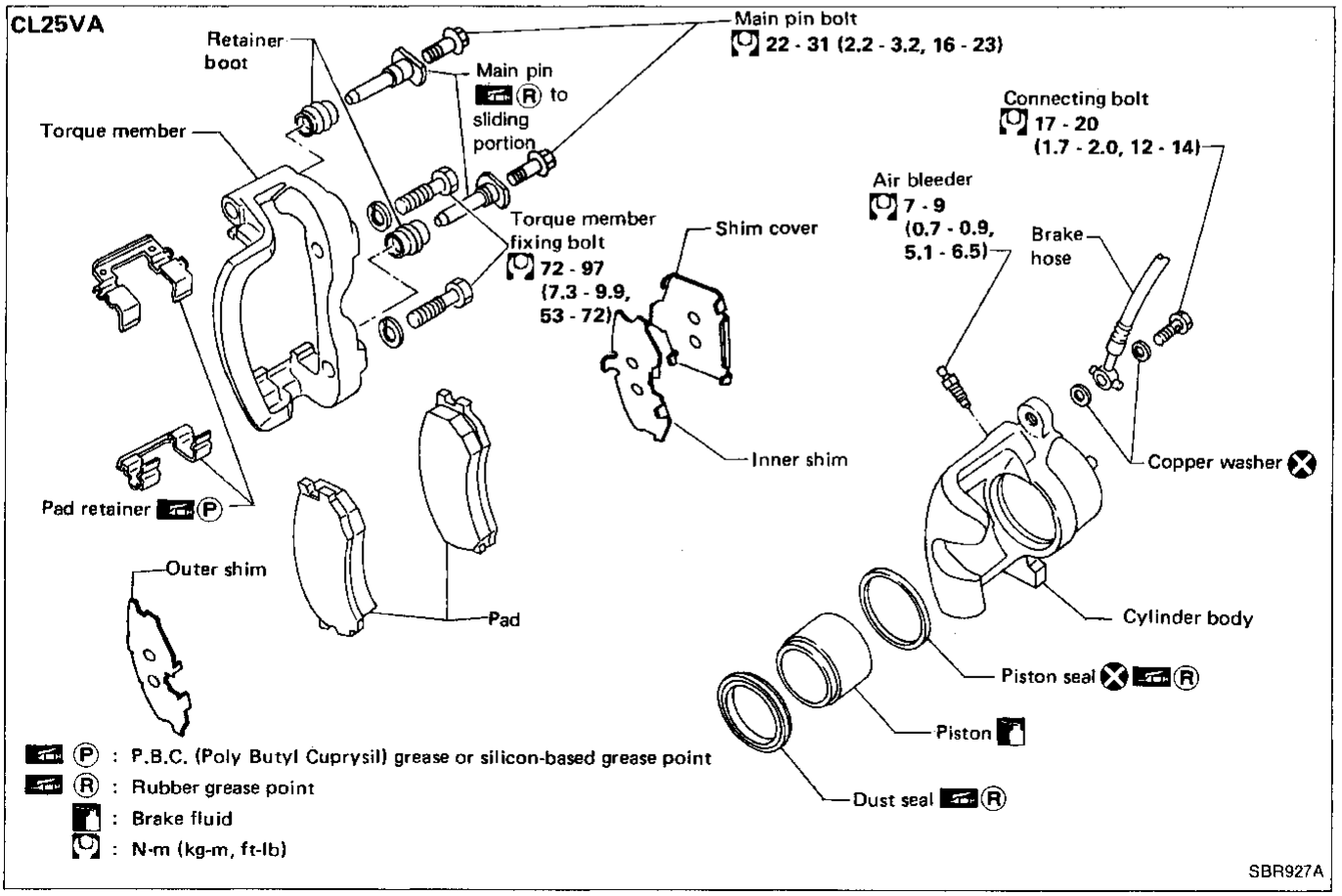


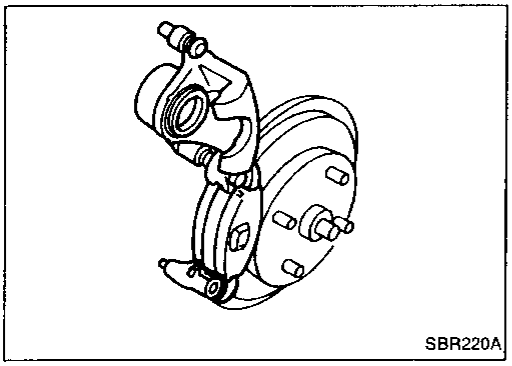
- Replace stopper cap if claw is damaged or deformed.
- Bend claws inward when installing stopper cap.



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


CL22VB
Cylinder body
Air bleeder
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Brake hose
17 - 20 (1.7 - 2.0, 12 - 14)
Inner shim
Piston seal
Pad
Piston
Main pin (R) to sliding portion
Copper washer
Retainer boot
Shim cover
Pad retainer (P)
Pin bolt (R)
22 - 31 (2.2 - 3.2, 16 - 23)
Dust seal (R)
Outer shim
Torque member fixing bolt
72 - 97 (7.3 - 9.9, 53 - 72)
Pad
: N·m (kg-m, ft-lb)
(P) : P.B.C. (Poly Butyl Cuprysil)grease or silicone-based grease point
(R) : Rubber grease point
(B) : Brake fluid point
SBR855A


CL25VA
Retainer boot
Main pin bolt
22 - 31 (2.2 - 3.2, 16 - 23)
Main pin (R) to sliding portion
Connecting bolt
17 - 20 (1.7 - 2.0, 12 - 14)
Torque member
Air bleeder
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Torque member fixing bolt
72 - 97 (7.3 - 9.9, 53 - 72)
Shim cover
Brake hose
Inner shim
Copper washer
Pad retainer (P)
Outer shim
Pad
Cylinder body
Piston seal (R)
Piston
Dust seal (R)
(P) : P.B.C. (Poly Butyl Cuprysil) grease or silicon-based grease point
(R) : Rubber grease point
: Brake fluid
: N·m (kg-m, ft-lb)
SBR927A

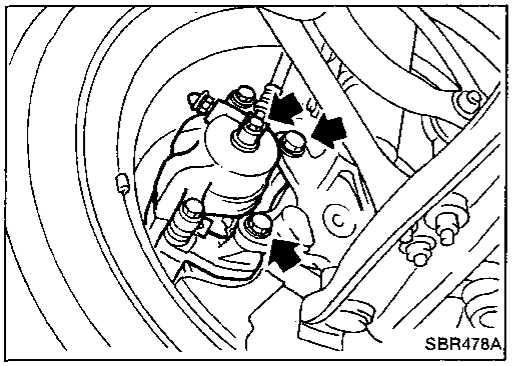

SBR220A

Pad Replacement

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

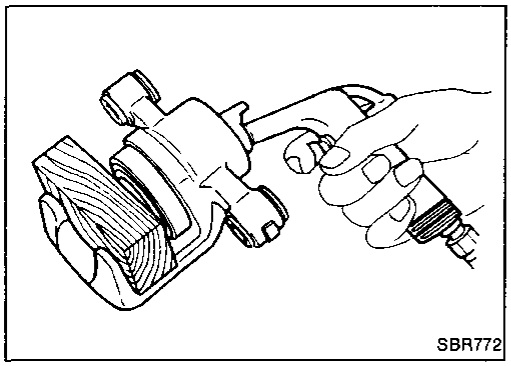
CAUTION:

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


SBR478A

Removal and Installation

- Remove torque member fixing bolts and union bolt.
- Install brake hose to caliper at protrusions securely.


SBR772

Disassembly

Push out piston with dust seal using compressed air.

Inspection

CYLINDER BODY

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

CAUTION:

Use brake fluid to clean.

PISTON

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

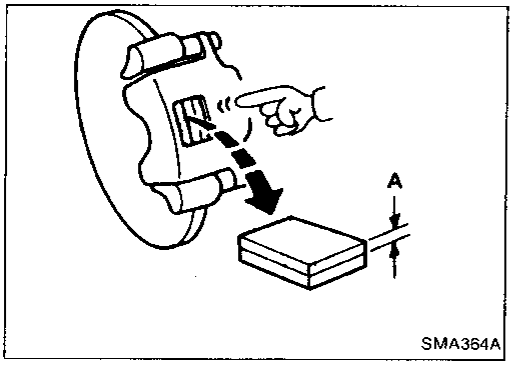
CAUTION:

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

PIN, PIN BOLT AND PIN BOOT

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

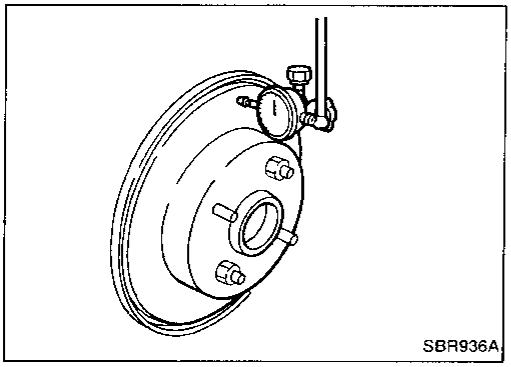
Inspection (Cont'd)



DISC PAD

Check disc pad for wear or damage.

Pad standard thickness (A):
CL22VB: 10.0 mm (0.394 in)
CL25VA: 11.0 mm (0.433 in)
Pad wear limit (A):
2.0 mm (0.079 in)



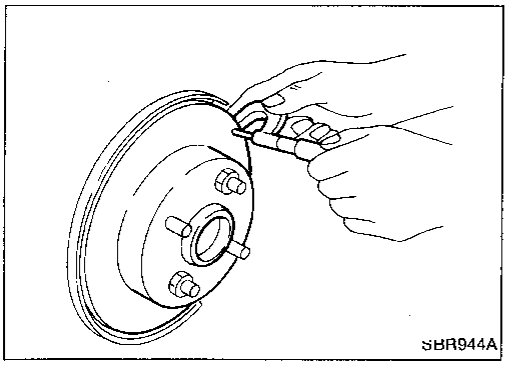
ROTOR RUNOUT

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

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

Maximum runout:
0.07 mm (0.0028 in)

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

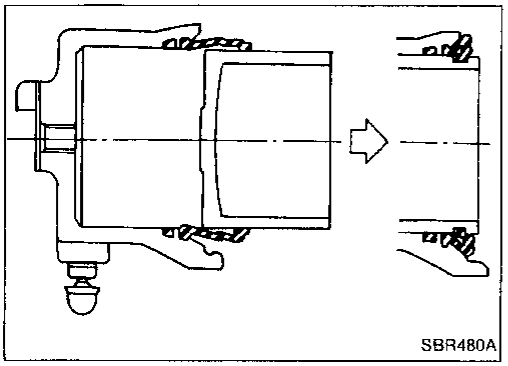


ROTOR THICKNESS

Thickness variation (At least 8 positions):
Maximum 0.01 mm (0.0004 in)

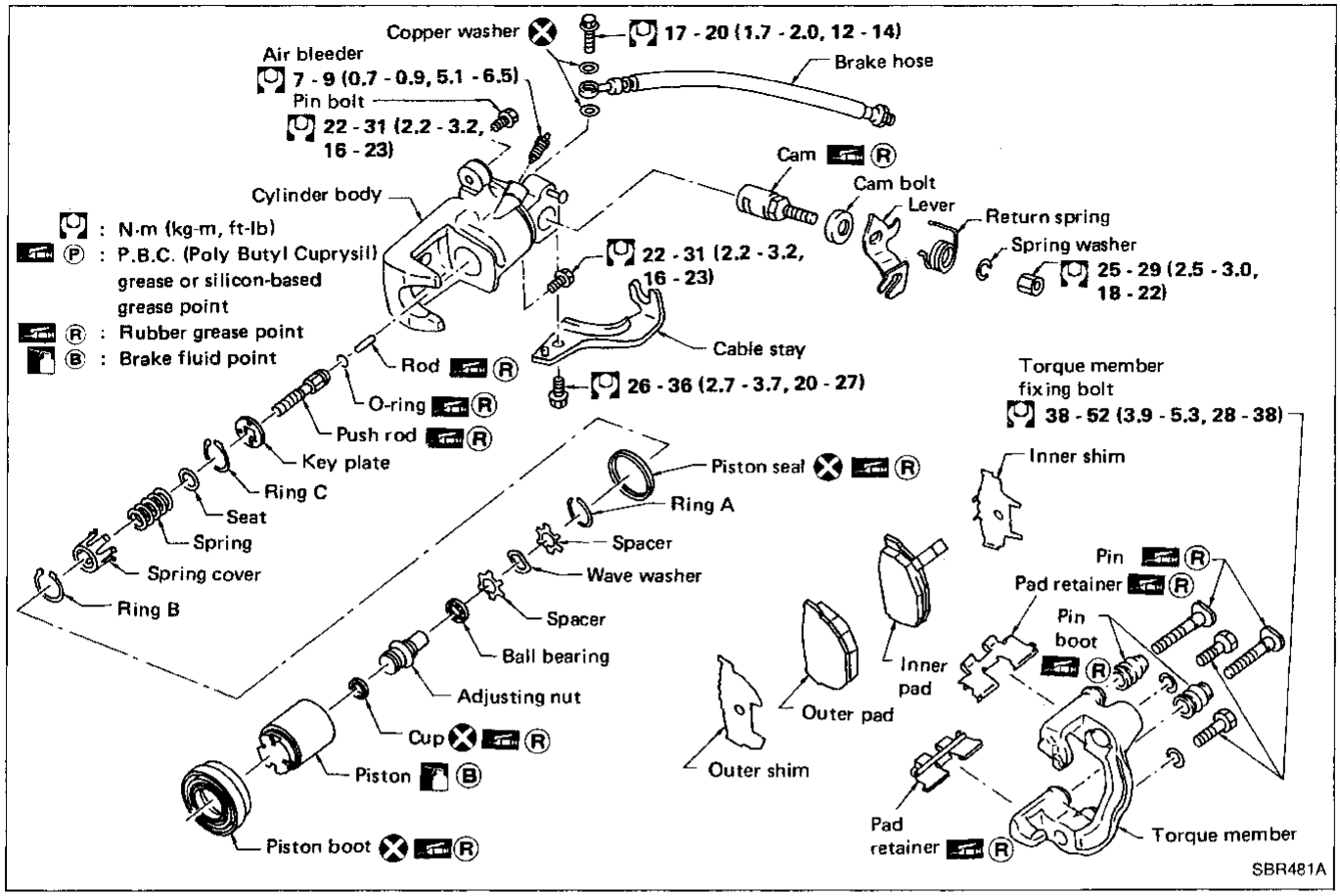
If thickness variation exceeds the specification, turn rotor with on-car brake lathe.

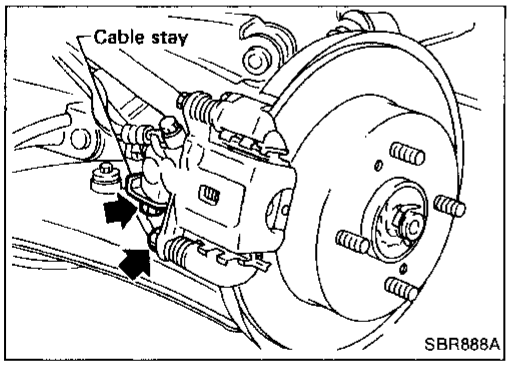
Rotor repair limit:
CL22VB 18.0 mm (0.709 in)
CL25VA 20.0 mm (0.787 in)



Assembly

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



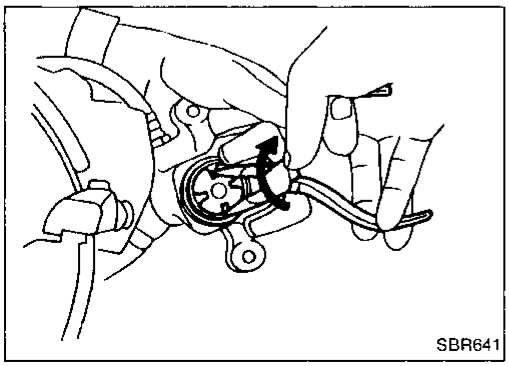


Pad Replacement

CAUTION:

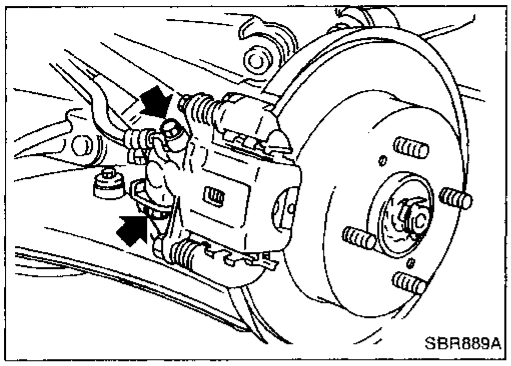
When cylinder body is swung up, do not depress brake pedal because piston will pop out.

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



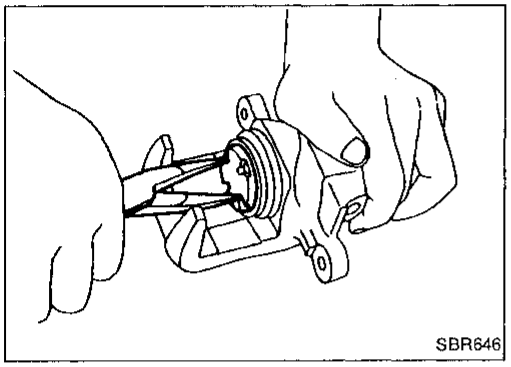
- When installing pads, retract piston into cylinder body by turning it clockwise.

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


SBR889A

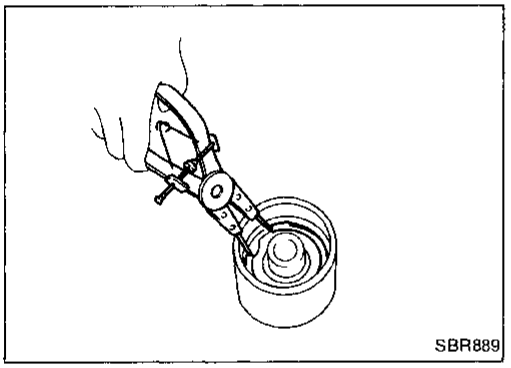
Removal and Installation

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

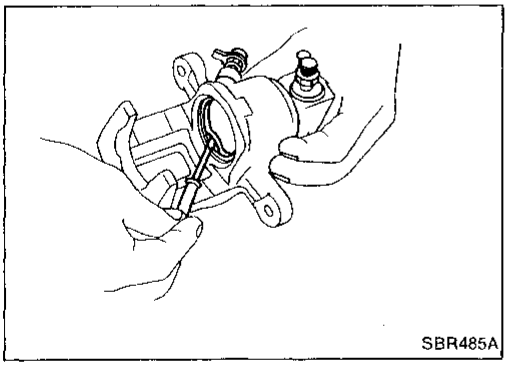

SBR646

Disassembly

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

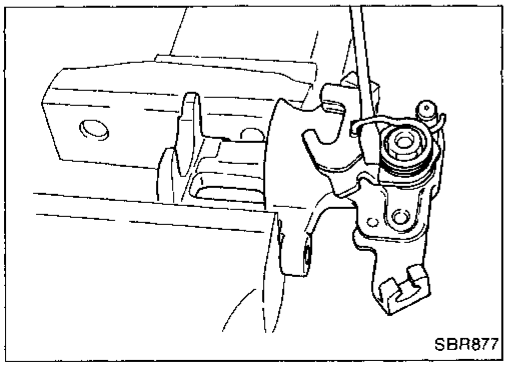

SBR889

2. Pry off ring A from piston with suitable pliers and remove adjusting nut.
3. Disassemble cylinder body.
- Pry off rings B and C with pliers, then remove spring cover, spring and seat.


SBR485A

- Remove piston seal.

Be careful not to damage cylinder body.


SBR877

4. Remove return spring and lever.

Inspection

CYLINDER BODY

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

CAUTION:
Use brake fluid to clean.

TORQUE MEMBER

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

PISTON

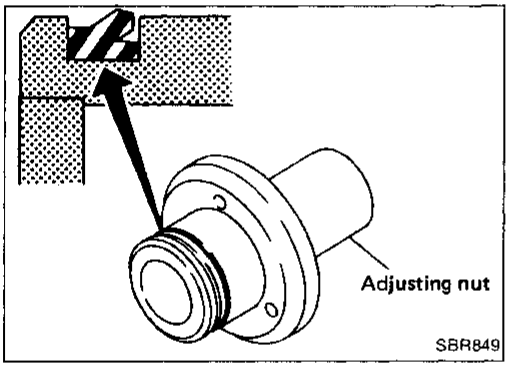
Check piston for score, rust, wear or other damage. Replace if necessary.

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

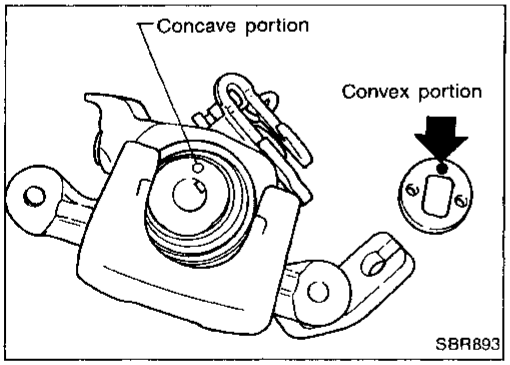
PIN AND PIN BOOT

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

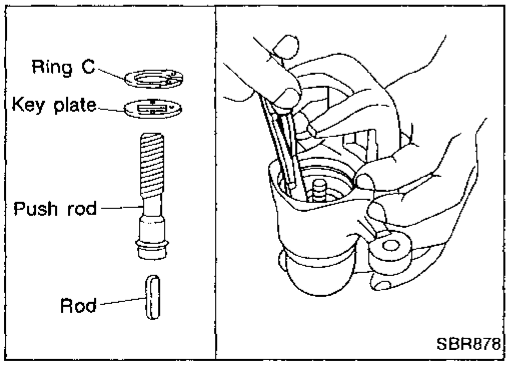
Assembly



- Install cup securely in the specified direction.

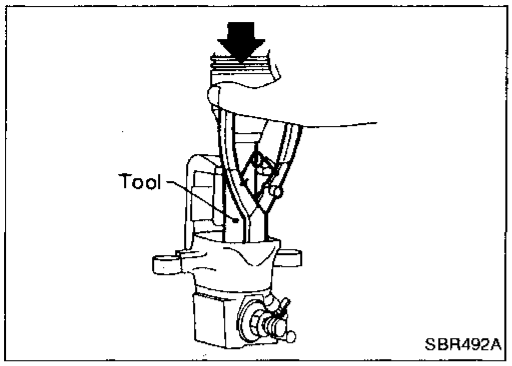


- Fit push rod into square hole in key plate. Also match convex portion of key plate with concave portion of cylinder.

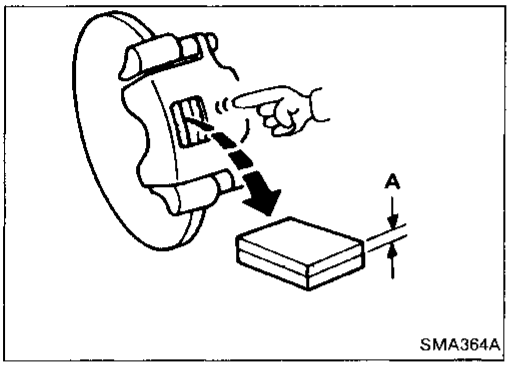


- Install ring C with suitable tool.

Assembly (Cont'd)



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

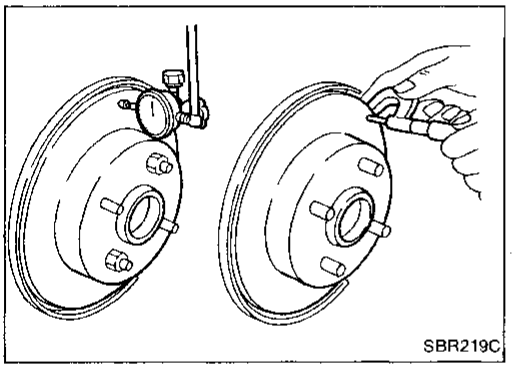


Inspection

DISC PAD

Check disc pad for wear or damage.

Standard thickness (A):
9.5 mm (0.374 in)
Pad wear limit (A):
2.0 mm (0.079 in)



ROTOR RUNOUT & THICKNESS

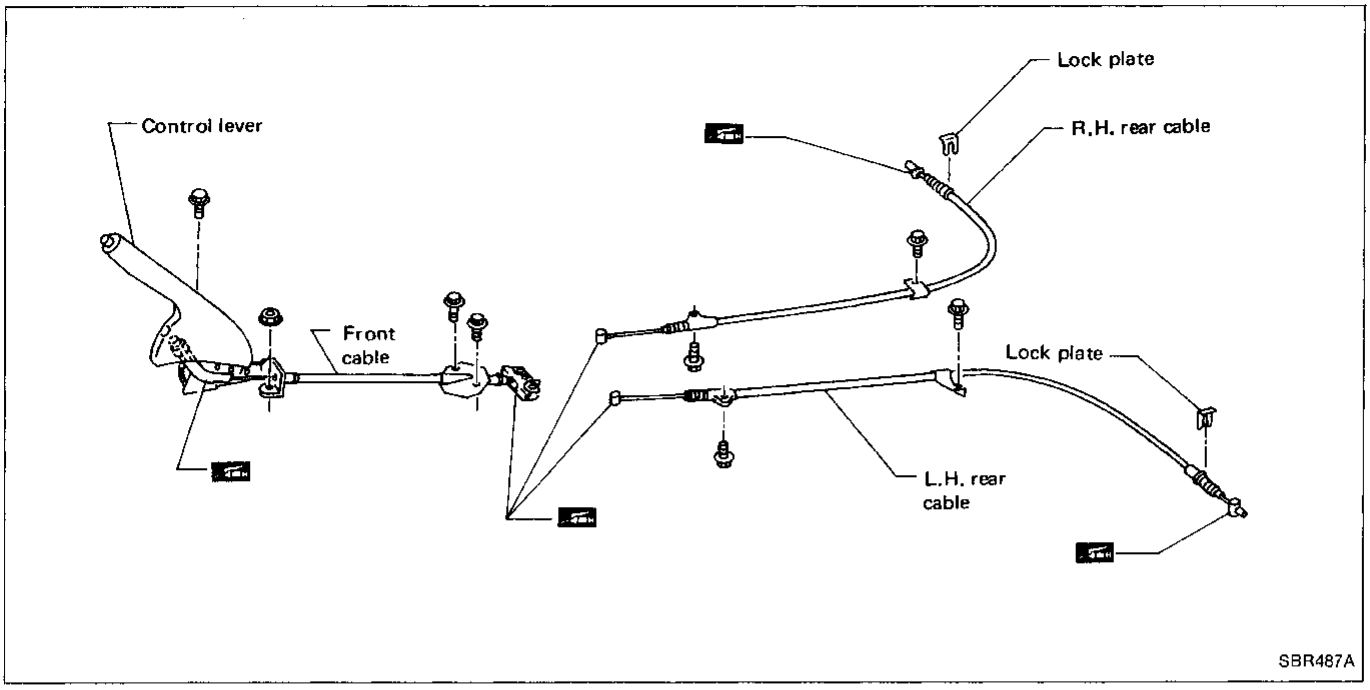
- Check runout using a dial indicator.
- Make sure that axial end play is within the specifications before measuring. Refer to section RA.

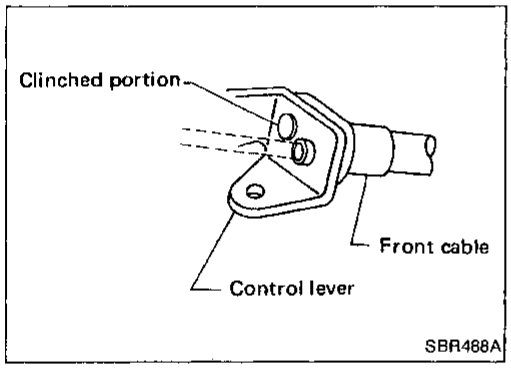
Rotor repair limit:
Maximum runout: 0.07 mm (0.0028 in)
(Total indicator reading at center of rotor pad contact surface)

- Rotor thickness

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

Removal and Installation

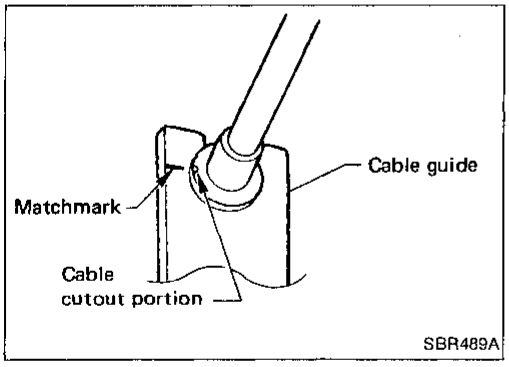




REMOVAL

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

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



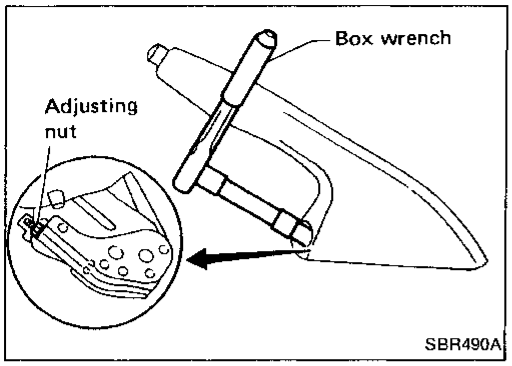
INSTALLATION

Be careful not to damage boot and inner cable.

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

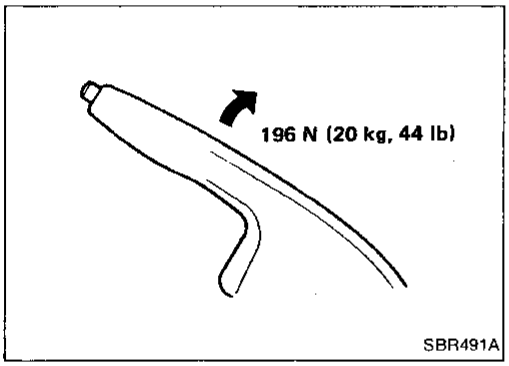
Inspection

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

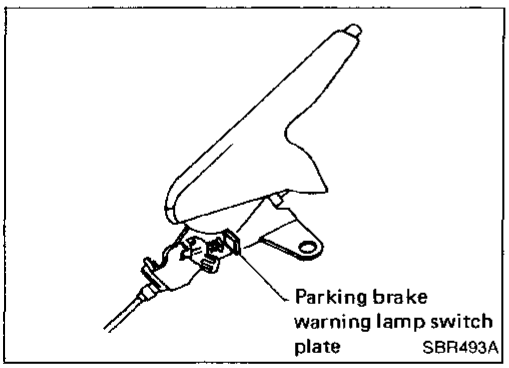


Adjustment

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

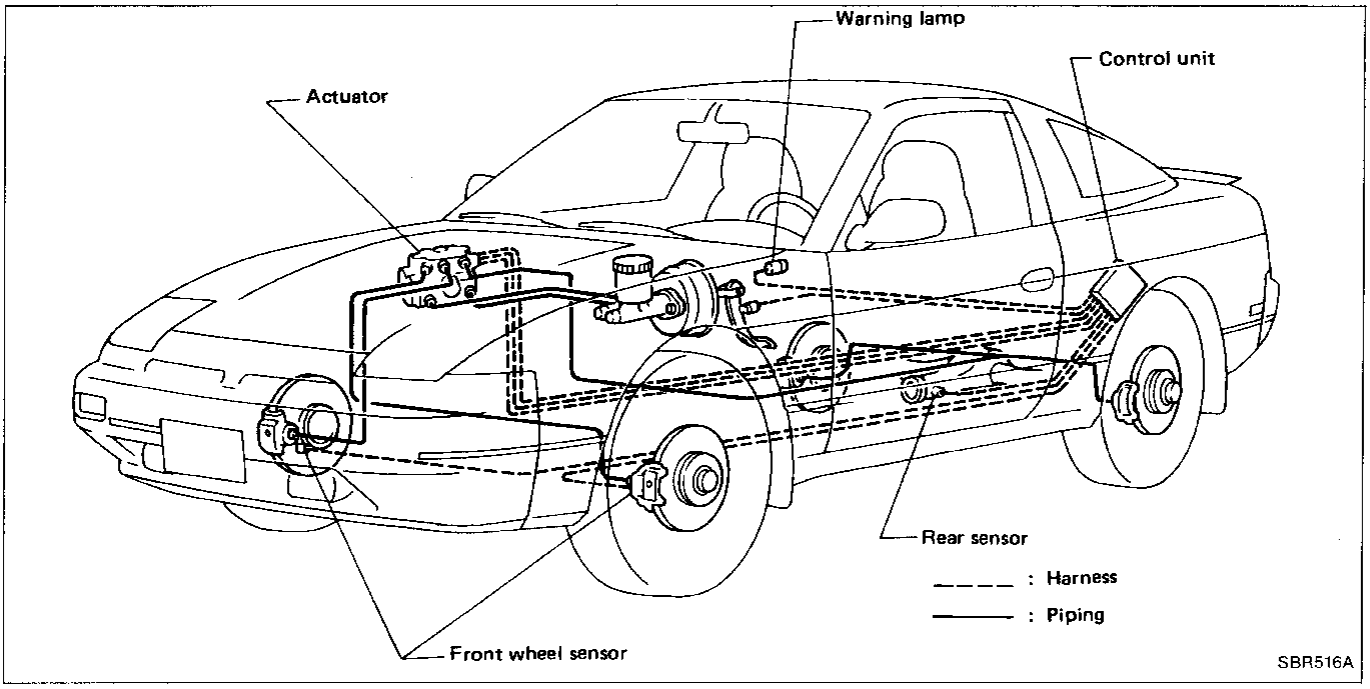


6. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.
   Number of notches:
   Center lever type 6 - 8

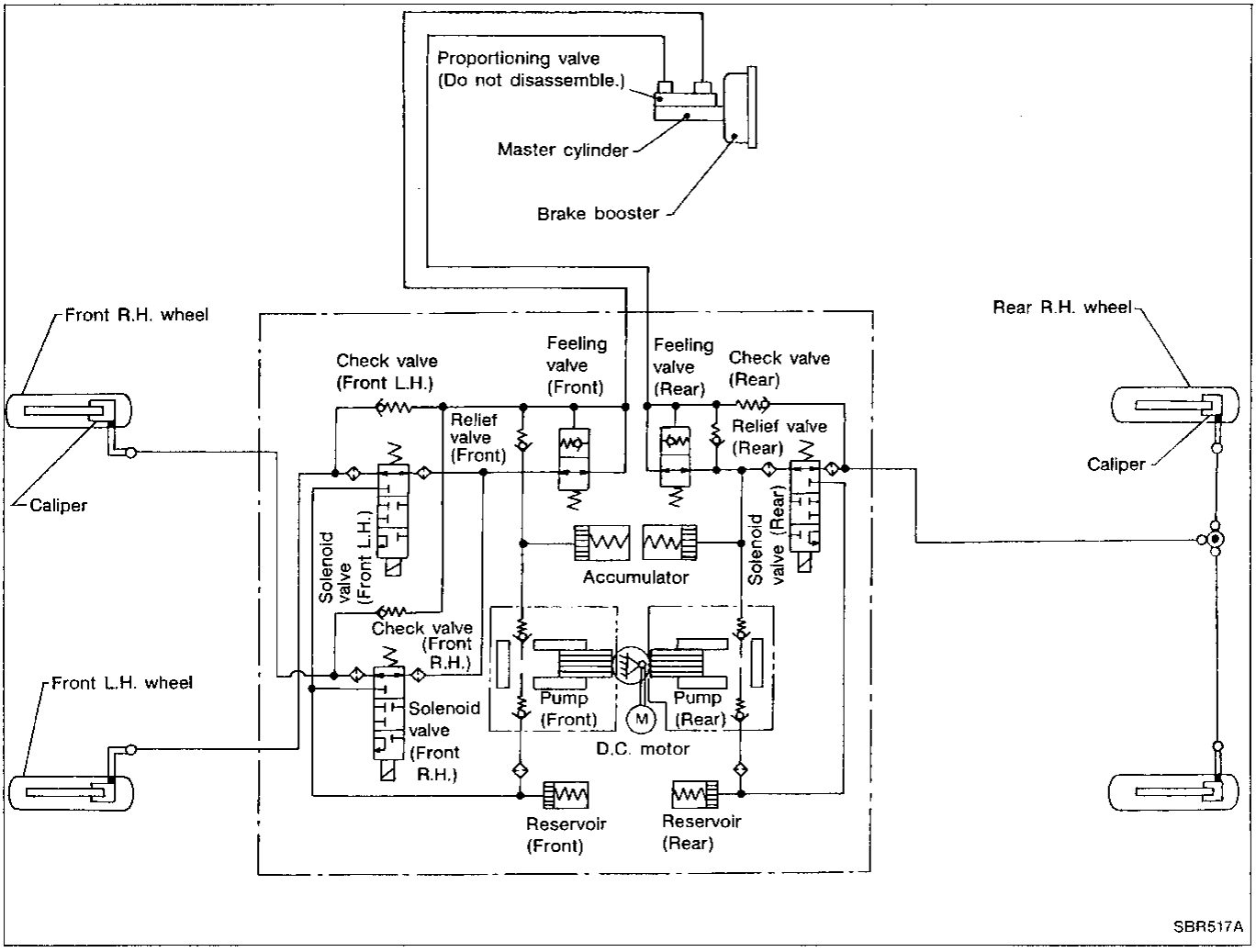


7. Bend parking brake warning lamp switch plate so that brake warning light comes on when ratchet at parking brake lever is pulled "A" notches and goes out when fully released.
   Number of "A" notches: 1

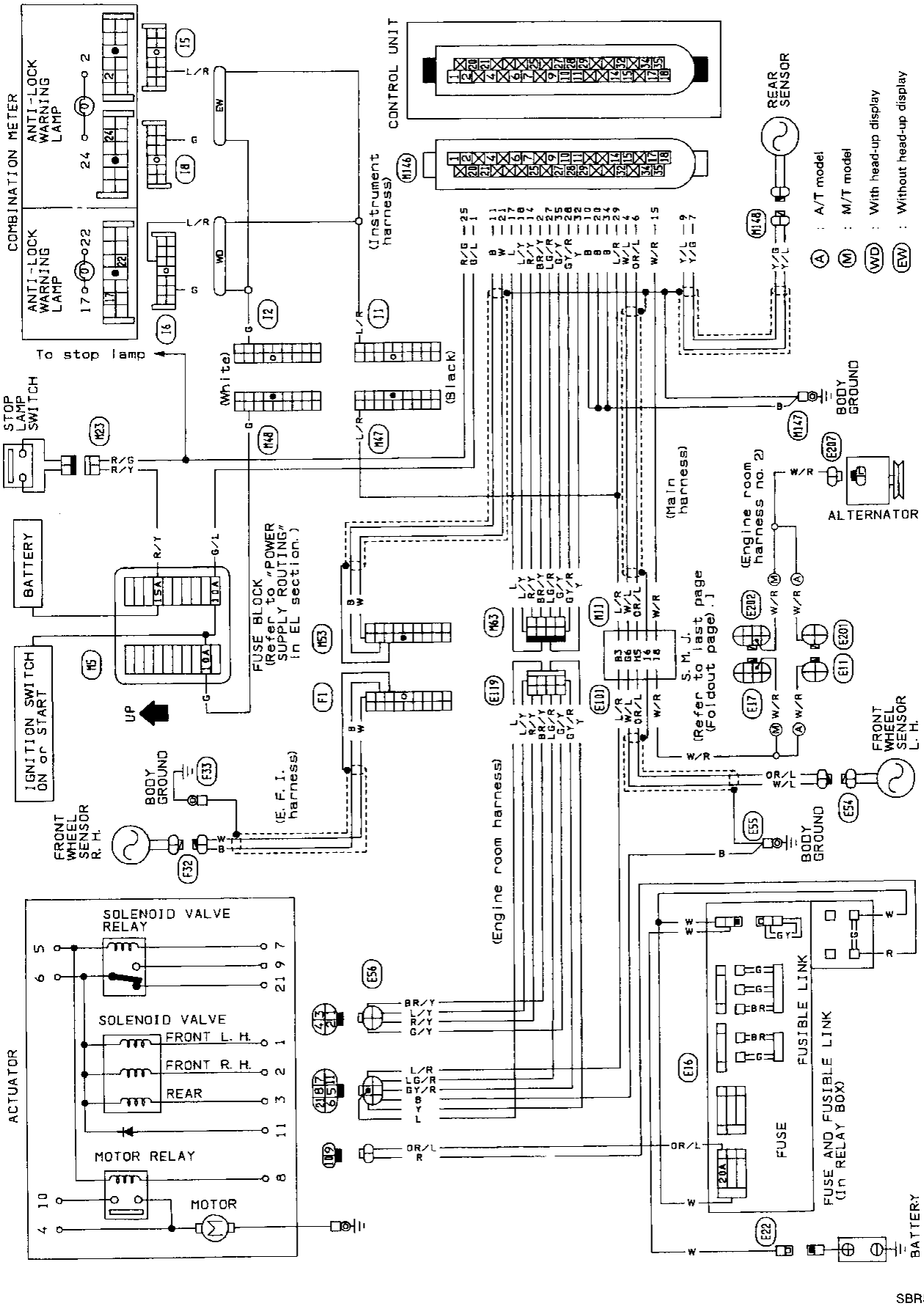
System Components



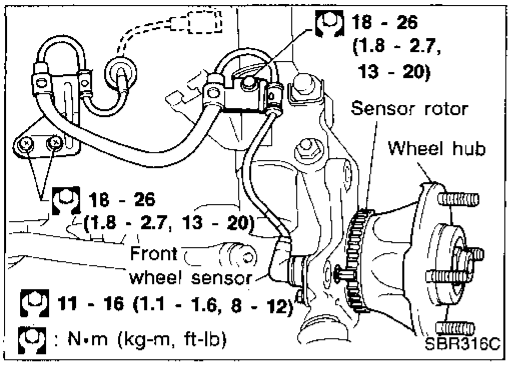
Hydraulic Circuit



Wiring Diagram



SBR552B

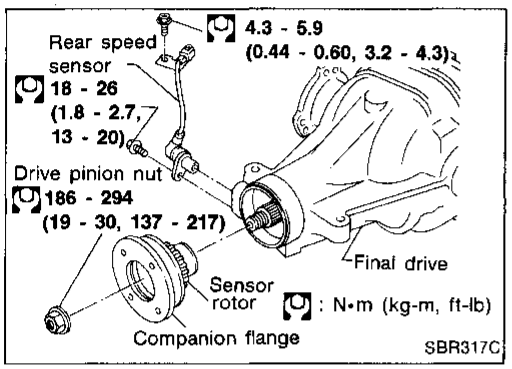


Removal and Installation

CAUTION:

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

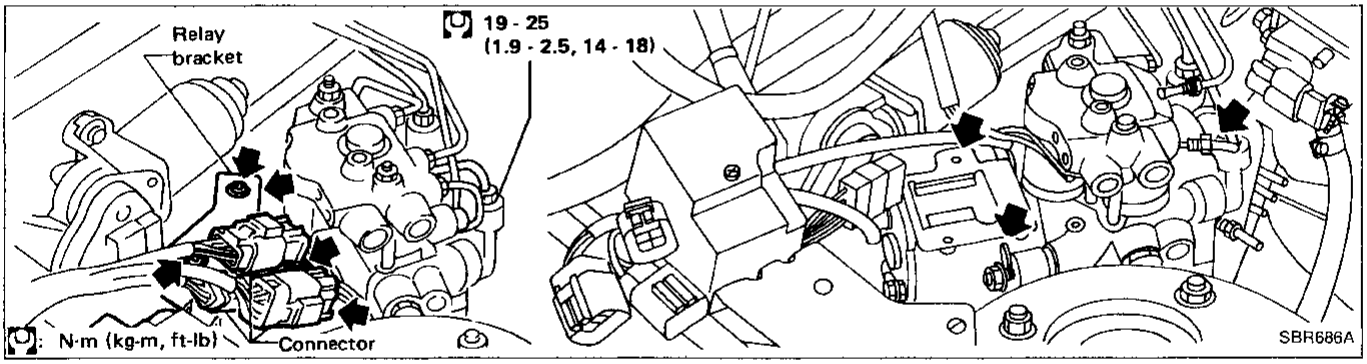
FRONT WHEEL SENSOR



REAR SENSOR

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

ACTUATOR



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

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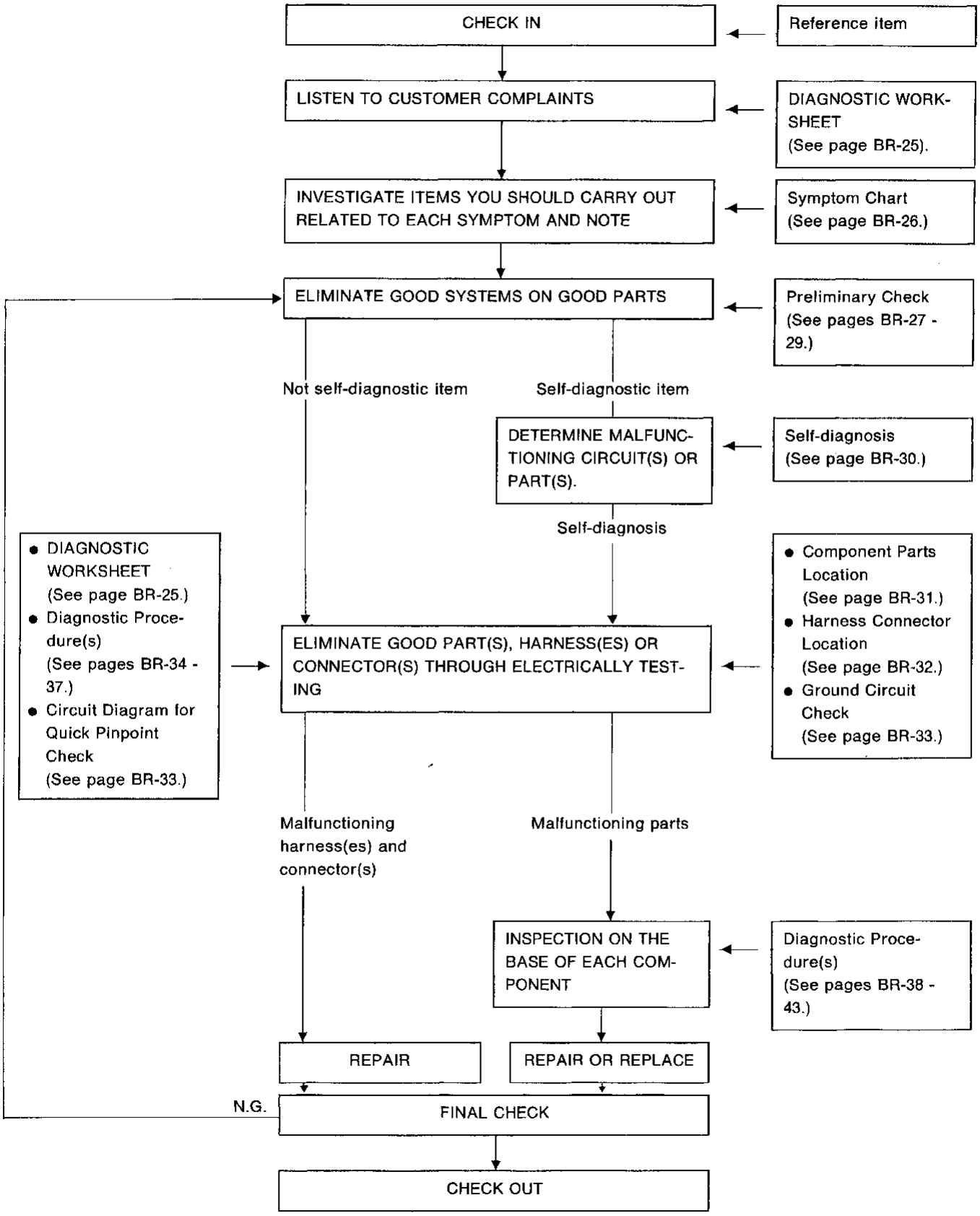
How to Perform Trouble Diagnoses for Quick and Accurate Repair

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

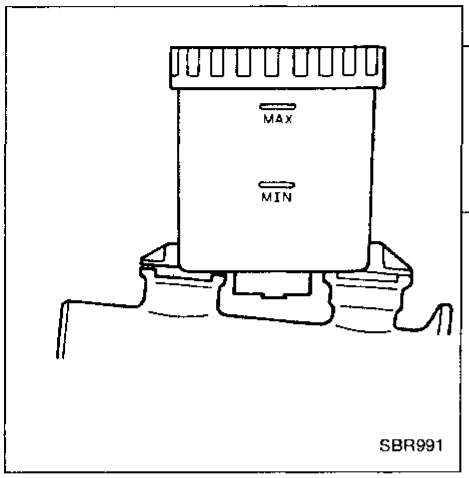
Customer name MR/MS		Model & Year			VIN		
Engine #		Trans.			Mileage		
Incident Date		Manuf. Date			In Service Date		
Symptoms	☐ Pedal vibration and noise	☐ Warning activates	☐ Long stopping distance	☐ Abnormal pedal action	☐ ABS doesn't work	☐ ABS works but warning activates	☐ ABS works frequently
Engine 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	Preliminary Check				Diagnostic Procedure						Diagnostic Procedure (Select inspection with L.E.D. flashing No.)						Ground Circuit Check	Electrical Compo-nents Inspec-tion
REFERENCE PAGE	BR-27	BR-28	BR-29	BR-29	BR-34	BR-35	BR-36	BR-36	BR-37	BR-37	BR-38	BR-39	BR-40	BR-41	BR-42	BR-43	BR-33	BR-44
SYMPTOM	Preliminary Check 1	Preliminary Check 2	Preliminary Check 3	Preliminary Check 4	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	L.E.D. flashing 1 - 4	L.E.D. flashing 5 - 8	L.E.D. flashing 9	L.E.D. flashing 10	L.E.D. flashing 16	L.E.D. comes off	Motor ground	Actuator inspection
Pedal vibration & noise			○	○	○						○	○	○	○	○	○		
Warning activates		○	○	○							○	○	○	○	○	○		
Long stopping distance	○			○		○					○	○	○	○	○	○		
Abnormal pedal action	○			○			○				○	○	○	○	○	○		
ABS doesn't work		○		○				○			○	○	○	○	○	○	○	○
ABS works but warning activates				○					○		○	○	○	○	○	○		
ABS works frequently	○	○								○								

Preliminary Check 1

CHECK

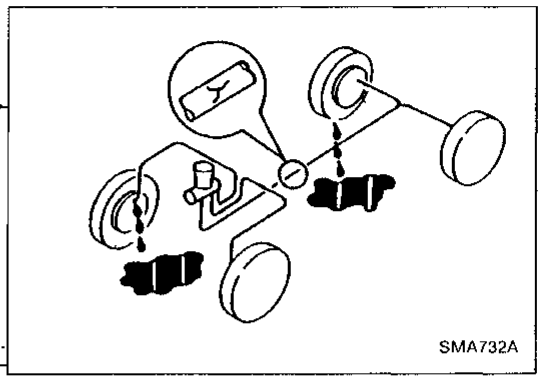


Check brake fluid level in reservoir tank.

N.G. → Fill up brake fluid.

O.K. →

CHECK

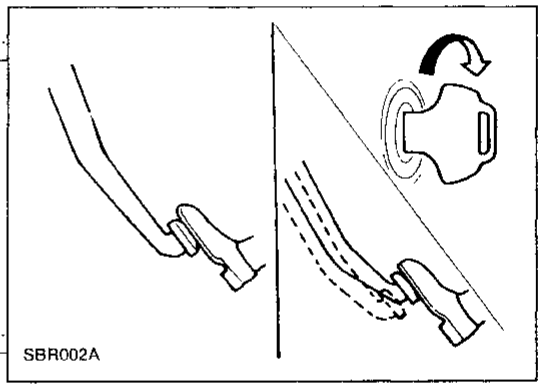


N.G. ← Repair brake system.

Check brake system.
Refer to CHECK AND ADJUSTMENT.

O.K. ↓

CHECK

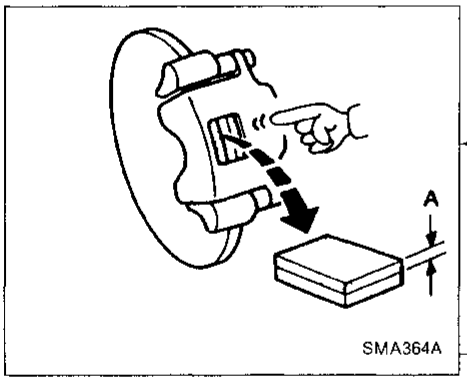


N.G. ← Repair or replace booster system.

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

O.K. ←

CHECK

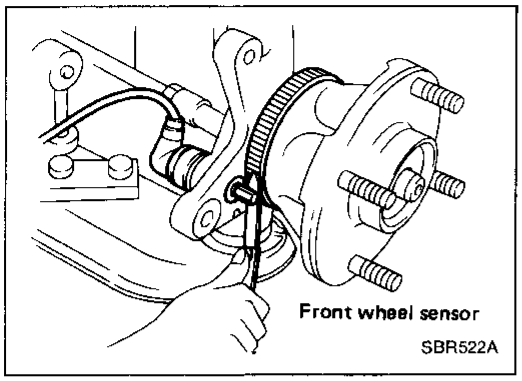


N.G. → Replace malfunctioning parts.

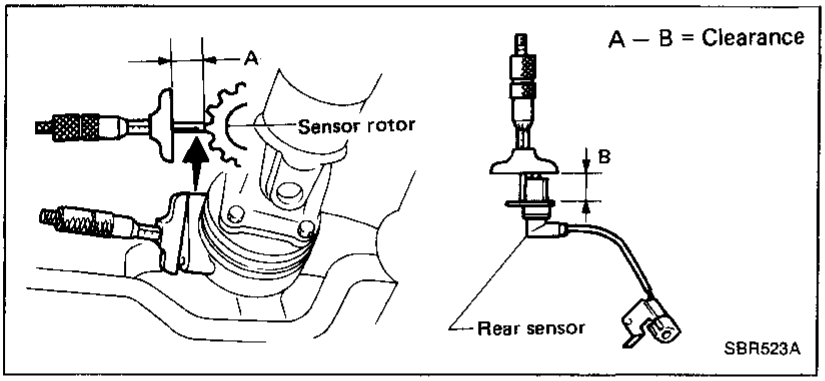
Check brake pads and rotor.
Refer to "Inspection" of FRONT and REAR DISC BRAKE.

Preliminary Check 2

CHECK



CHECK

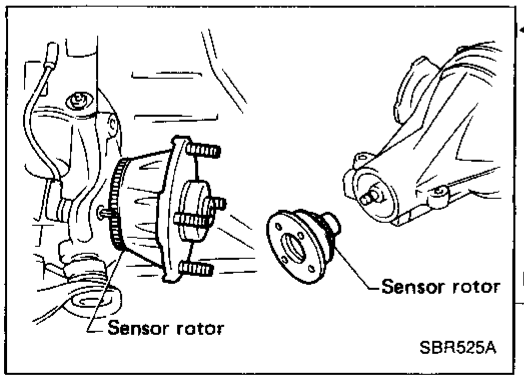


Check sensor clearance.

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

N.G. → Check sensor for the following items:
- Dust, foreign materials, etc., at fastening portion
- Improper installation
- Breakage

O.K. → CHECK



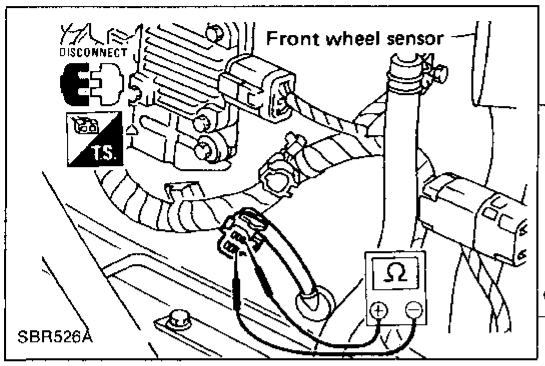
Check sensor rotor for teeth damage.

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

O.K. → N.G. → Repair or replace malfunctioning sensor.

Preliminary Check 3, 4

Preliminary Check 3
CHECK

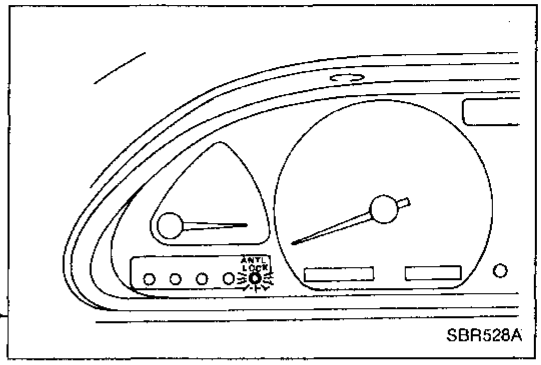


Measure each sensor resistance.
0.8 - 12 kΩ

N.G. → Replace.

O.K. →

Preliminary Check 4
CHECK

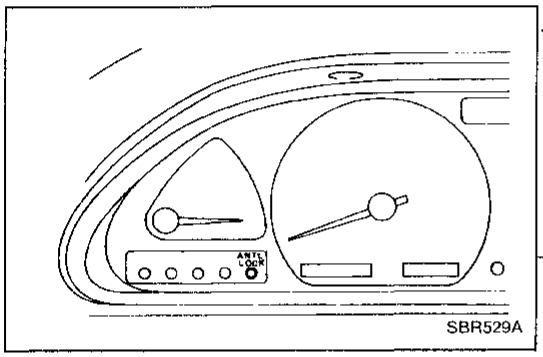


Check warning lamp activation.
When ignition switch is turned on, warning lamp turns on.

O.K. ↓

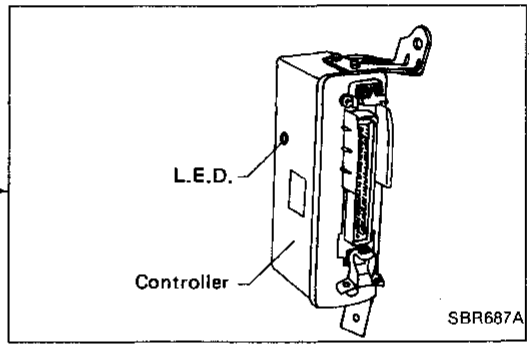
N.G. → Check fuse.
Check bulb condition and remedy.

CHECK



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

N.G. →



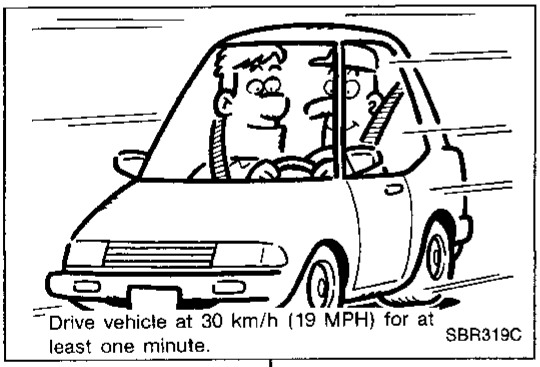
- Keep engine on and running.
- Remove rear side finisher.
- Count the number of L.E.D. flashes during 5 to 10 second "OFF" period.

↓

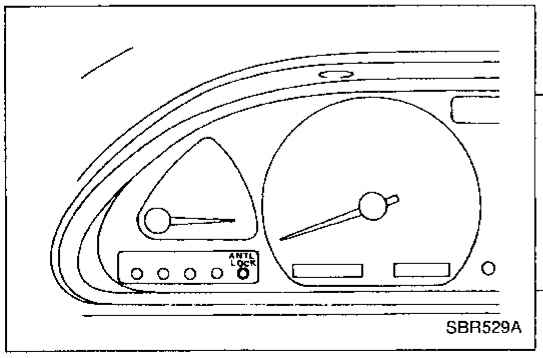
Go to Self-diagnosis.
(See next page.)

↓ O.K.

DRIVE



CHECK



Ensure warning lamp remains off while driving.

N.G. →

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

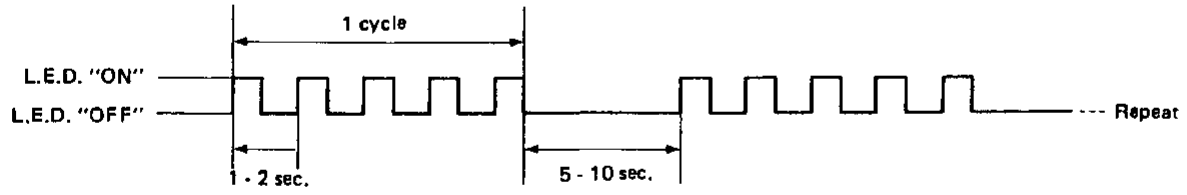
Self-diagnosis

CHECKING THE NUMBER OF L.E.D. FLASHES

When a problem occurs in the ABS, the warning light on the instrument panel comes on. As shown in the Table, the control unit performs self-diagnosis.
To obtain satisfactory self-diagnosing results, the vehicle must be driven above 30 km/h (19 MPH) for at least one minute before the self-diagnosis is performed. After the vehicle is stopped, the number of L.E.D. flashes is counted while the engine is running.
The L.E.D. is located on the control unit, identifying a malfunctioning part or unit by the number of flashes.
Both the warning light and the L.E.D. persistently activate, even after a malfunctioning part or unit has been repaired, unless the ignition switch is turned "OFF". After repairs, turn the ignition switch "OFF". Then start the engine and drive the vehicle over 30 km/h (19 MPH) for at least one minute to ensure that the malfunctioning part or unit has been repaired properly.
If more than two circuits malfunction at the same time, the L.E.D. will flash to indicate one of the malfunctioning circuits. After the circuit has been repaired, the L.E.D. will then flash to indicate that the other circuit is malfunctioning.

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

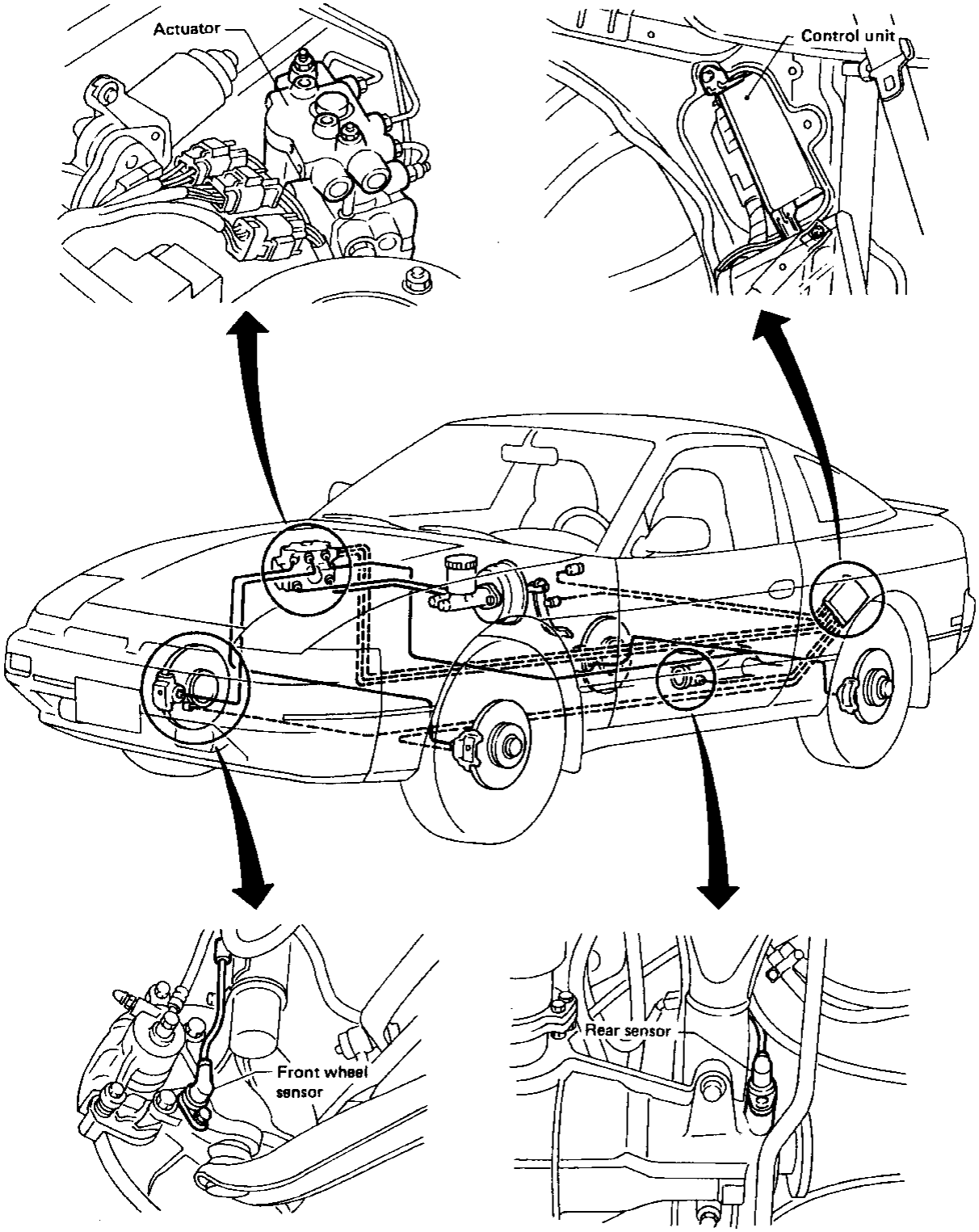
Example
Improper operation of left front rotor sensor circuit



SBR531A

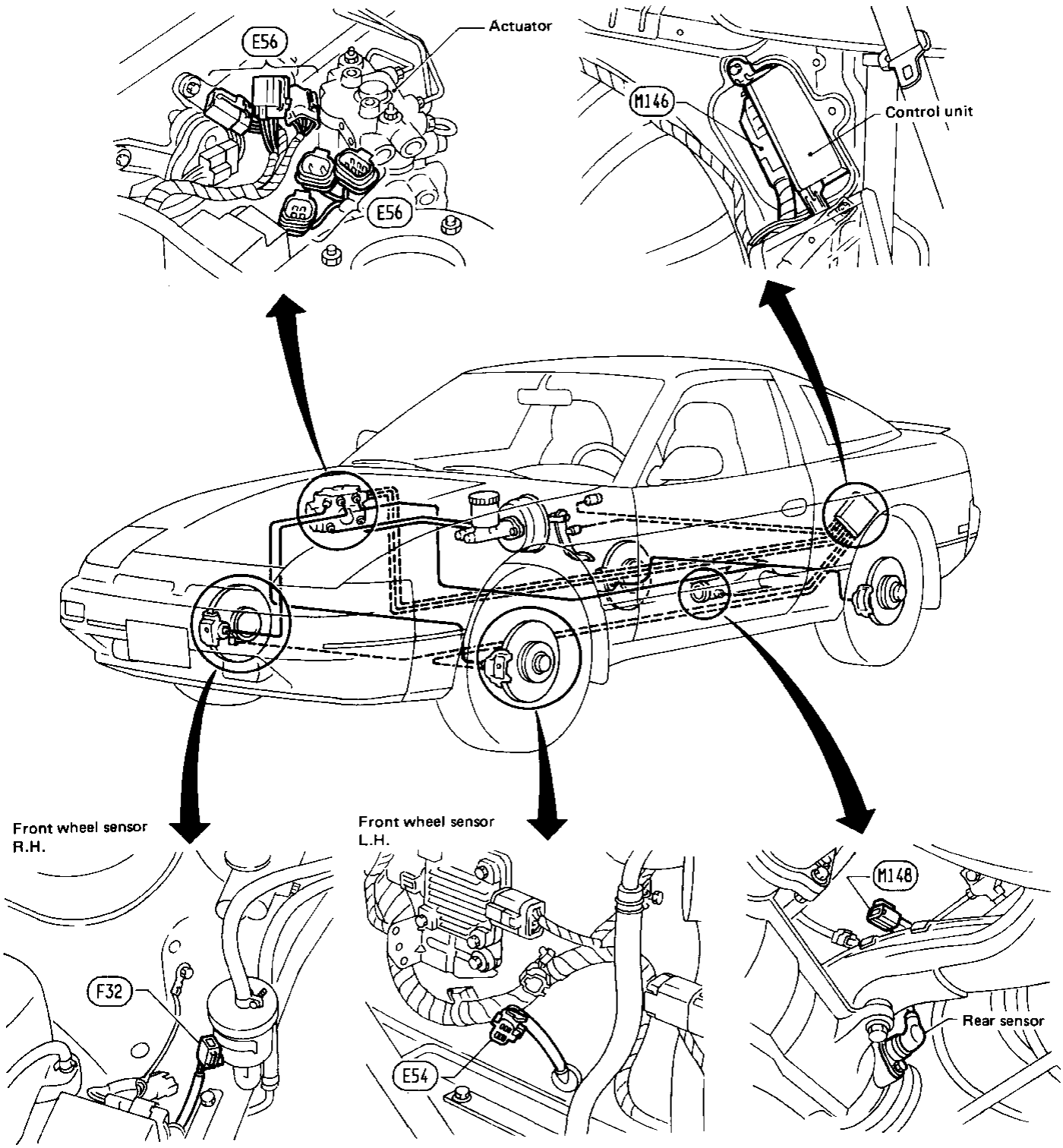
Go to Diagnostic Procedure from 7 to 10, where malfunction portion is concerned.

Component Parts Location

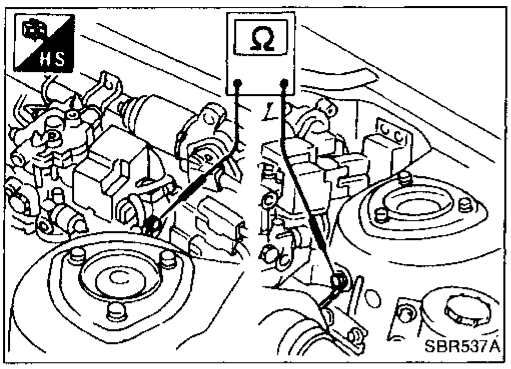


SBR532A

Harness Connector Location



SBR533A



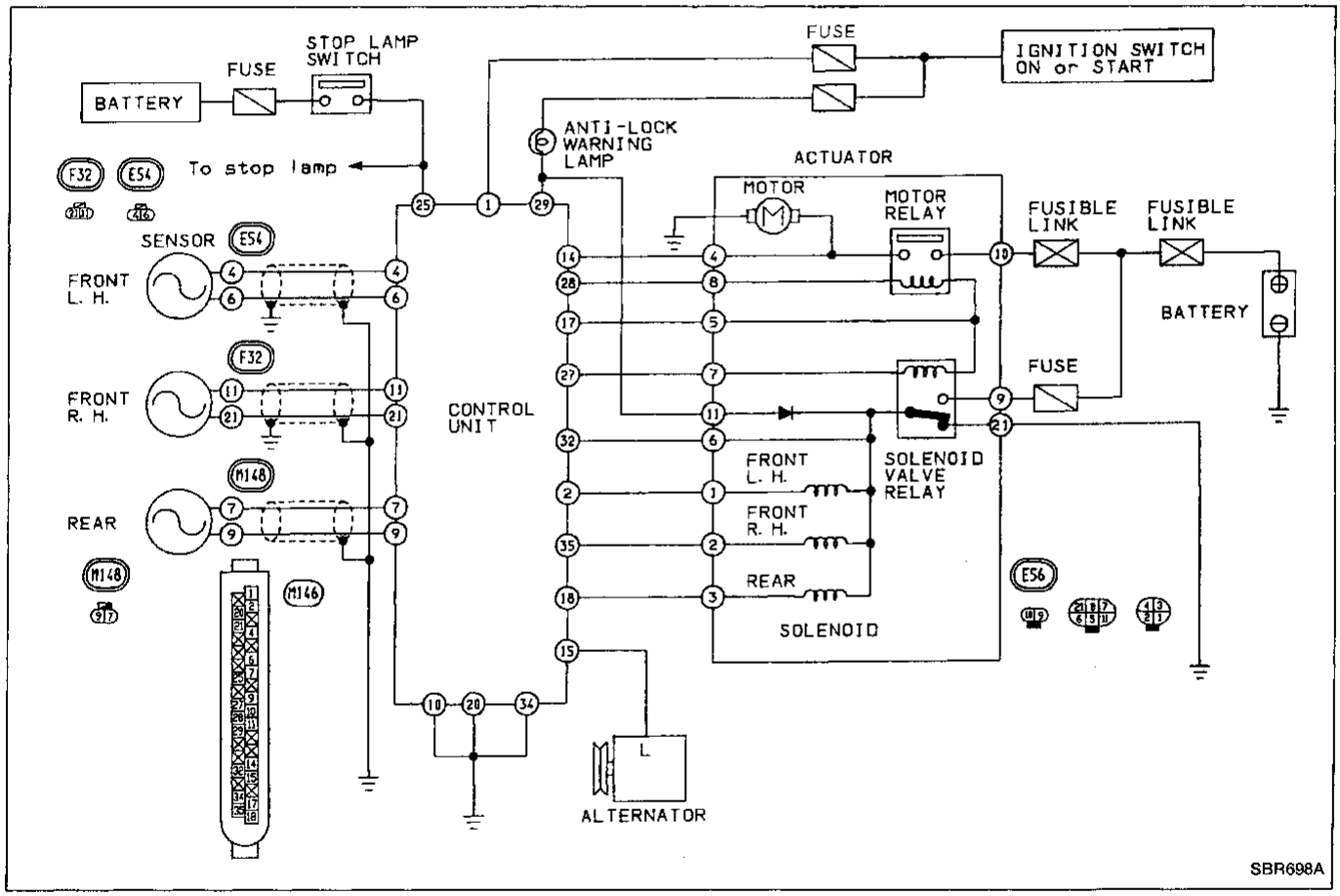
Ground Circuit Check

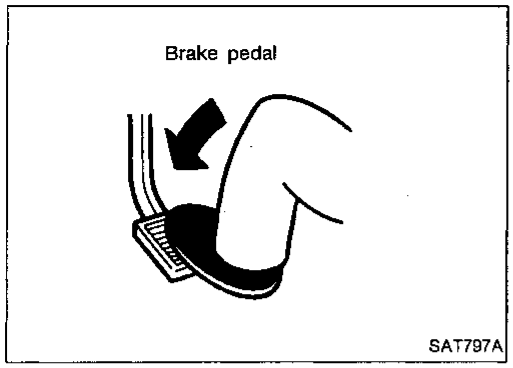
ACTUATOR MOTOR GROUND

- Check resistance between both terminals.
  Resistance: 0Ω

Circuit Diagram for Quick Pinpoint Check

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





Diagnostic Procedure 1

SYMPTOM: Pedal vibration and noise

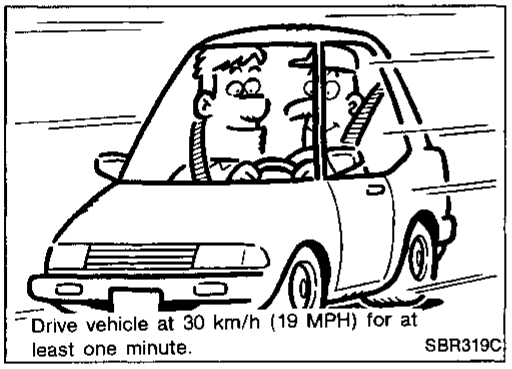
Refer to worksheet result.

Check whether the symptom appears only when brake is applied suddenly.
- Yes → When brake is normally applied, ABS works and produces pedal vibration or noise.
- No ↓

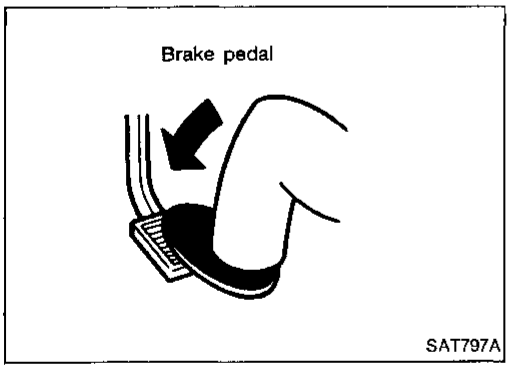
Check whether the symptom appears only when engine is started.

- Yes → Refer to Preliminary Check 4 result.
- No ↓

Check whether the symptom appears only when the vehicle speed is within 10 km/h (6 MPH) after starting engine.
- Yes → Check whether the symptom disappears within 5 seconds.
  - No → Ⓐ
  - Yes → ABS may sometimes operate when load is high and voltage is low due to insufficient alternator output.
- No ↓


Drive vehicle at 30 km/h (19 MPH) for at least one minute.
SBR319C

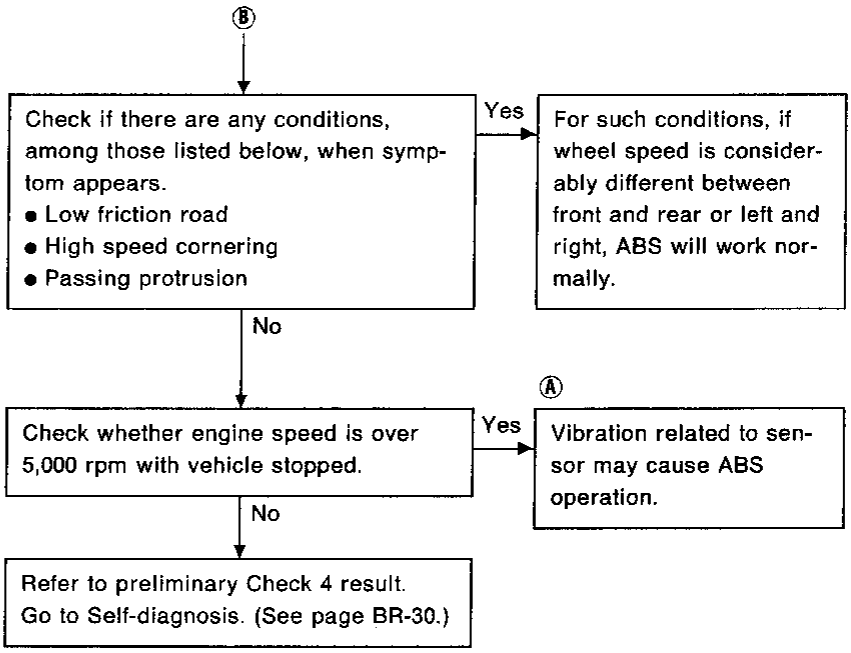
Check whether the symptom appears while the vehicle is being driven.
- No → Ⓐ
- Yes ↓

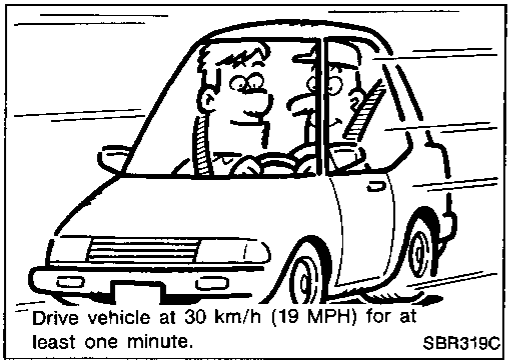


Check whether the symptom appears when brake is applied gradually.
- No (Appears when brake is not applied.) → Check if there are any conditions, among those listed below, when symptom appears.
  - Shifting
  - Operating clutch
  - Passing protrusion
  - No → Ⓑ
  - Yes → Under these conditions individual wheel speed can change suddenly. This may sometimes cause the A.B.S. to operate.
- Yes ↓

Ⓑ

Diagnostic Procedure 1 (Cont'd)

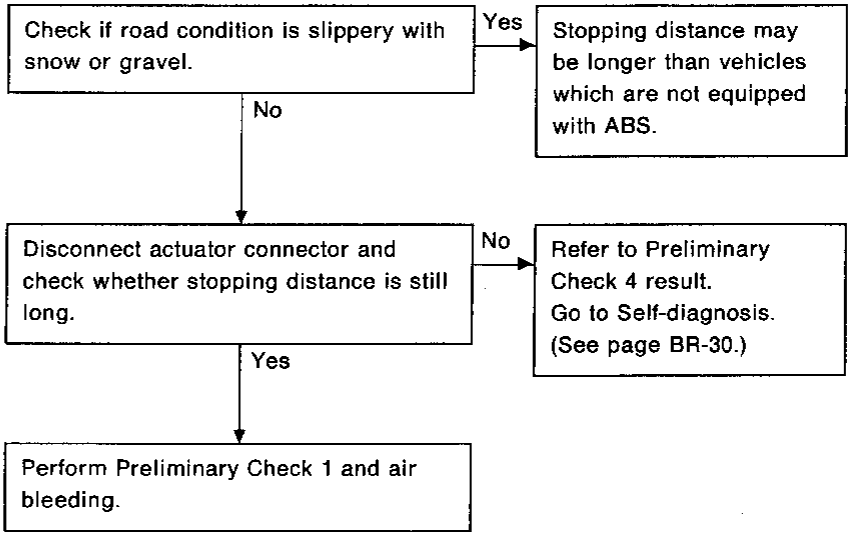


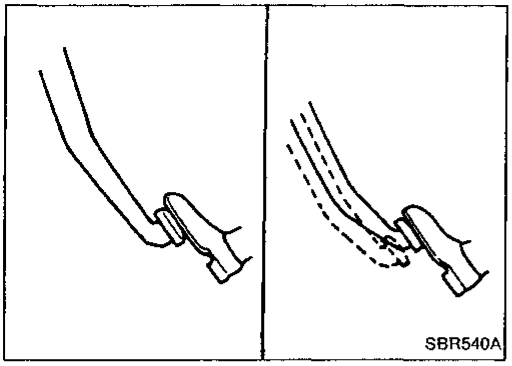


Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results.




SBR540A

Diagnostic Procedure 3

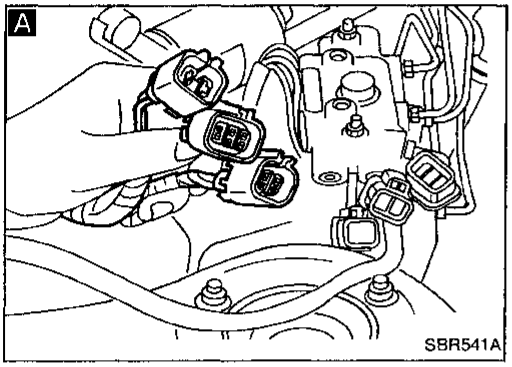
SYMPTOM: Abnormal pedal action

Refer to worksheet results.

Check whether brake pedal stroke is abnormally large.
- Yes → Vehicle equipped with ABS may have a tendency for large pedal strokes.
- No ↓

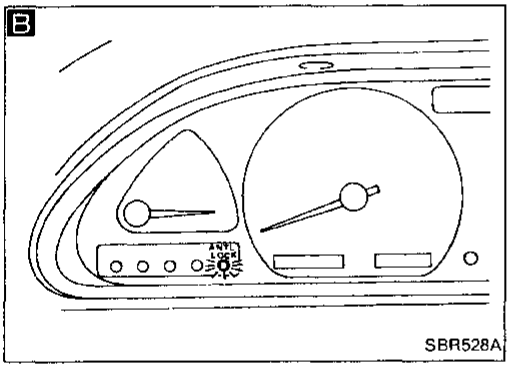
Check that brake pedal force is firm but brake is effective.
- Yes → Normal condition.
- No ↓

A


SBR541A

Disconnect actuator connector and check whether brake is effective.
- Yes → Refer to Preliminary Check 4 result. Go to Self-diagnosis. (See page BR-30.)
- No ↓

Perform Preliminary Check 1.


SBR528A

Diagnostic Procedure 4

SYMPTOM: ABS doesn't work.

Refer to worksheet results.

B

Check whether warning activates.
- Yes → Refer to Preliminary Check 4 result. Go to Self-diagnosis. (See page BR-30.)
- No ↓

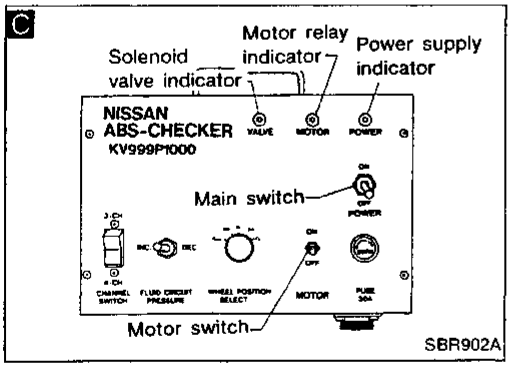
Check whether vehicle speed is under 10 km/h (6 MPH).
- Yes → ABS doesn't work in this condition.
- No ↓

Refer to Preliminary Check 2 result.

O.K. but ABS still doesn't work. ↓

C

Check actuator by referring to Electrical Components Inspection — ACTUATOR. (See page BR-44.)



SBR902A

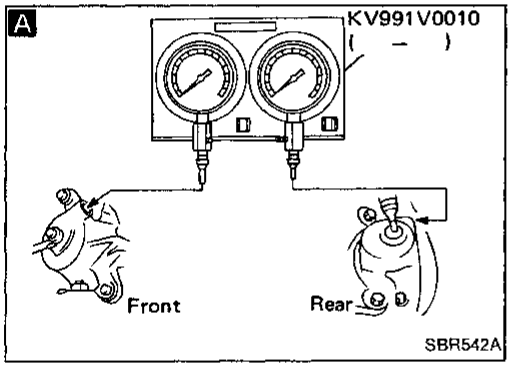
Diagnostic Procedure 5

SYMPTOM: ABS works but warning activates.

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

Check whether battery has enough voltage.
Refer to EL section.
→ No → Remedy.
↓ Yes

Refer to Preliminary Check 4 result.
Go to Self-diagnosis. (See page BR-30.)



Diagnostic Procedure 6

SYMPTOM: ABS works frequently.

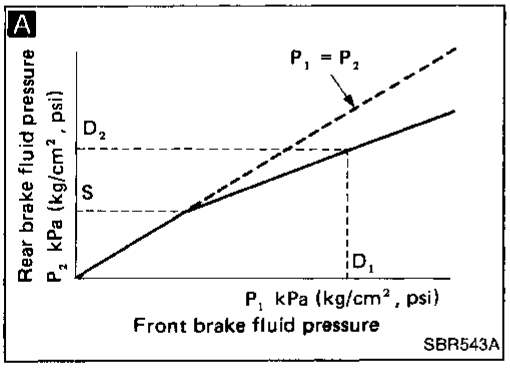
A

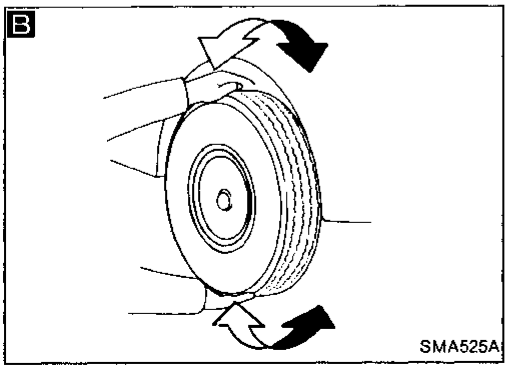
CHECK BRAKE FLUID PRESSURE.
Check whether brake fluid pressure distribution is normal.
D_2/D_1: 52 - 56/75
→ N.G. → Perform Preliminary Check 1.
↓ O.K.

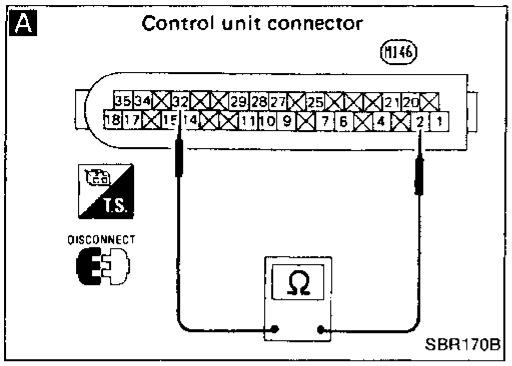
B

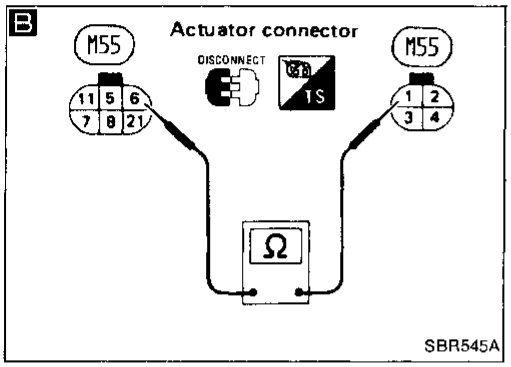
Check whether front axles have excessive looseness.
→ Yes → Remedy.
↓ No

Perform Preliminary Check 2 and Ground Circuit Check.









Diagnostic Procedure 7

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

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals.
Flashing number 1:
Terminals ㉜ and ②
Flashing number 2:
Terminals ㉜ and ㉟
Flashing number 3 or 4:
Terminals ㉜ and ⑱
Resistance: 0.7 - 1.6Ω

O.K. → Replace control unit.

N.G.

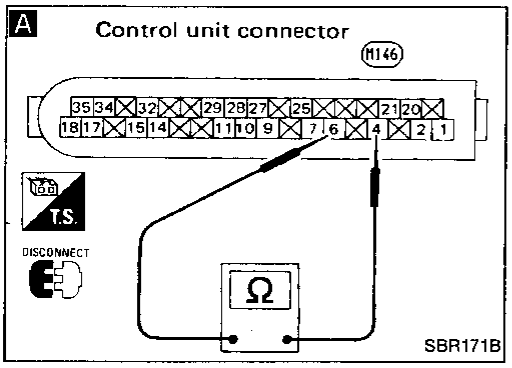
B

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

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

N.G.

Replace actuator.



Diagnostic Procedure 8

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

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SPEED SENSOR RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals.
Flashing number 5:
Terminals ④ and ⑥
Flashing number 6:
Terminals ⑪ and ㉑
Flashing number 7 or 8:
Terminals ⑦ and ⑨
Resistance: 0.8 - 1.2 kΩ

O.K. → Replace control unit.

N.G.

Refer to Preliminary Check 3 result.
Check whether sensor has 0.8 - 1.2 kΩ resistance.

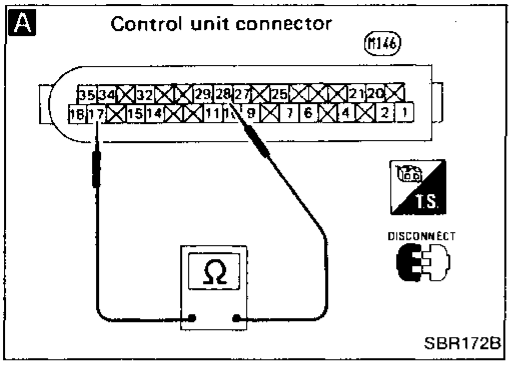
N.G. → Replace sensor.

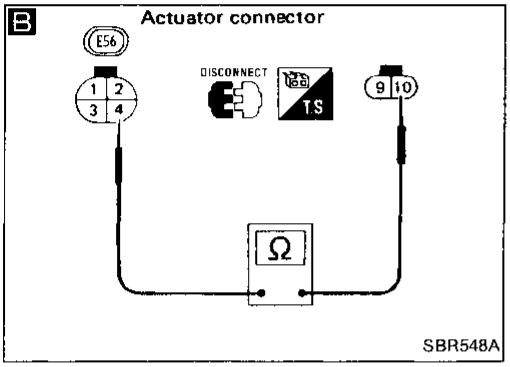
O.K.

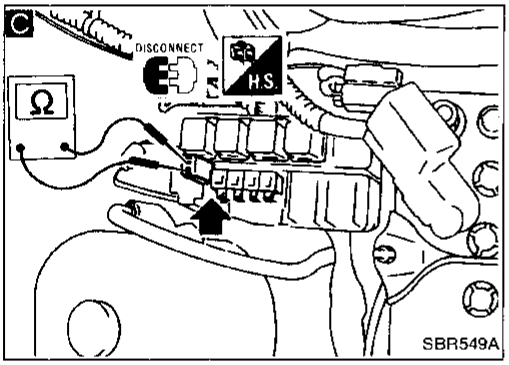
Repair harness between sensor connector and control unit connector.

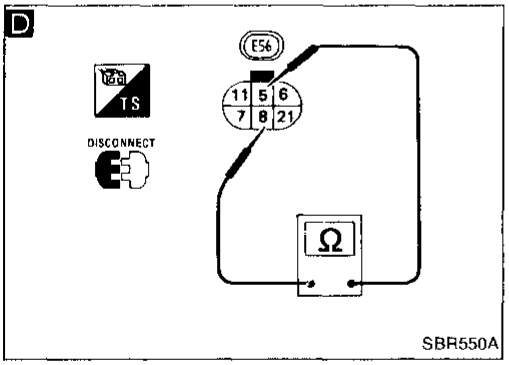
Diagnostic Procedure 9

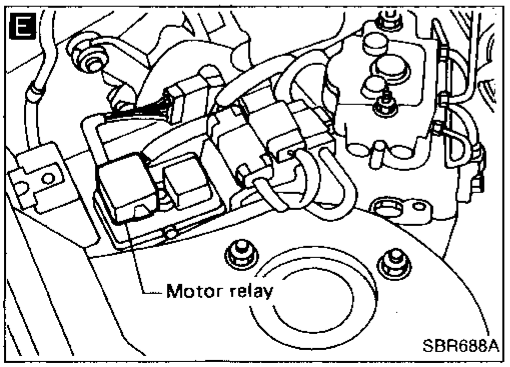
ACTUATOR MOTOR RELAY (L.E.D. flashing number 9)











INSPECTION START
Remove battery negative terminal connector.

A

CHECK MOTOR RELAY SOLENOID RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals ⑰ and ㉘.
Resistance: 45 - 55Ω

N.G. → **D**

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

O.K. → **B**

N.G. → **E**

B

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

Yes → **E**

Replace motor relay.

No → **C**

C

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

No → Perform Electrical Components Inspection — ACTUATOR.
(See page BR-44.)

Yes → Replace fusible link.

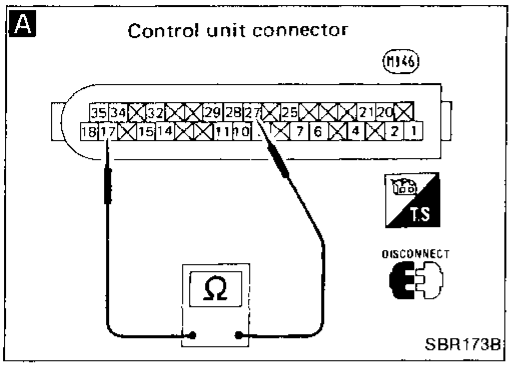
O.K. → Replace control unit.

N.G. → Replace actuator.

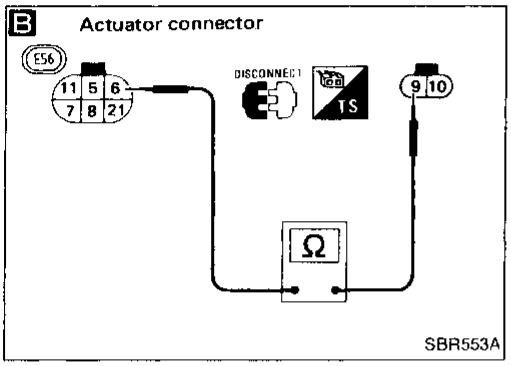
O.K. → Repair harness between actuator and control unit.

N.G. → **E** Replace motor relay.

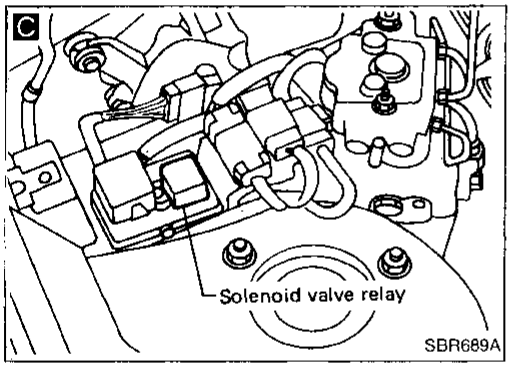
A



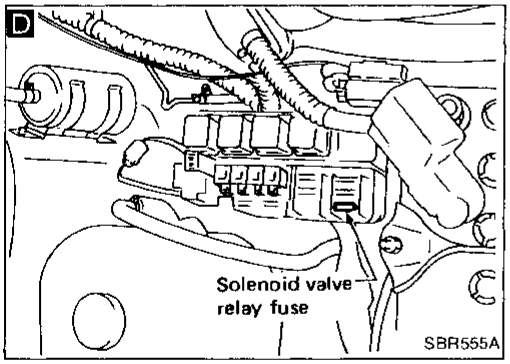
B



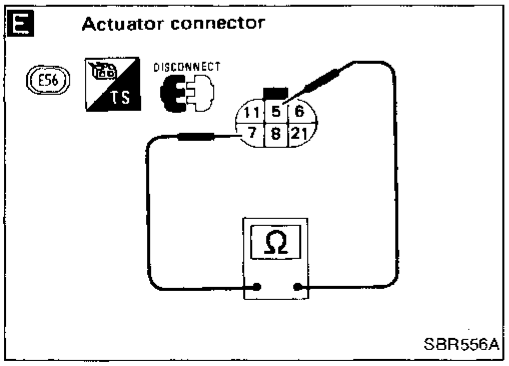
C



D



E



Diagnostic Procedure 10

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

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RELAY RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals ㉗ and ⑰.
Resistance: 80 - 90Ω

N.G. → **E**

Check resistance between actuator connector (actuator side) terminals ⑦ and ⑤.
Resistance: 80 - 90Ω

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

N.G. → **C** Replace solenoid valve relay.

O.K.

B

CHECK SOLENOID VALVE RELAY MOVEMENT.
Disconnect actuator connector.
Check continuity between actuator connector (actuator side) terminals ⑥ and ⑨.

Yes → **C** Replace solenoid valve relay.

No

D

Check if solenoid valve relay fuse is blown.

No → Perform Electrical Components Inspection — ACTUATOR.
(See page BR-44.)

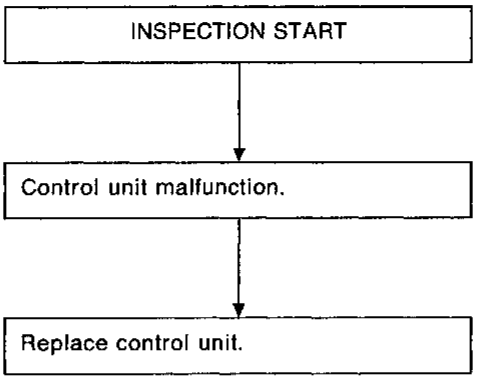
N.G. → Replace actuator.

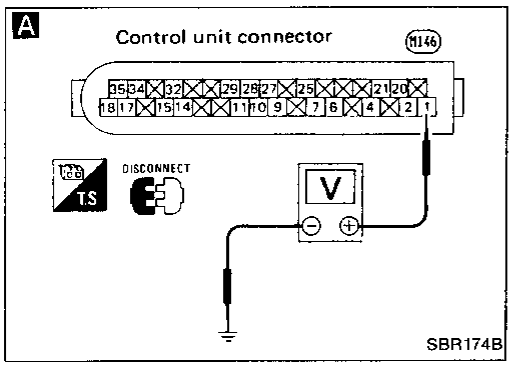
O.K. → Replace control unit.

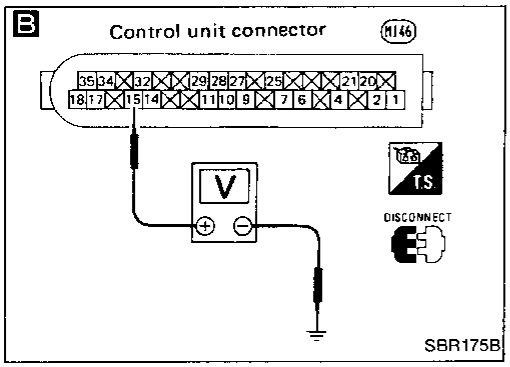
Yes → Replace fuse.

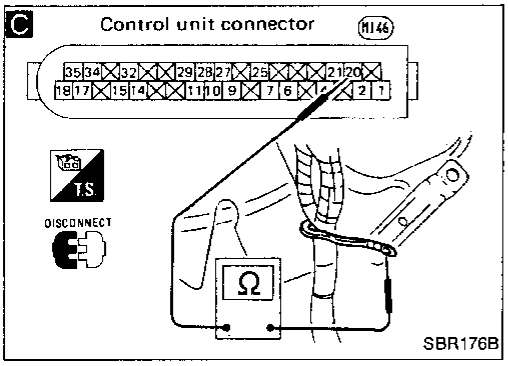
Diagnostic Procedure 11

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









Diagnostic Procedure 12

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

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.

N.G. → Check if control unit "10A" fuse is blown.

- Yes → Replace fuse.
- No → Repair power supply harness.

O.K.

B

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

N.G. → Check if other warnings activate.

- Yes → Repair harness between alternator and control unit.
- No → Malfunctioning alternator.

O.K.

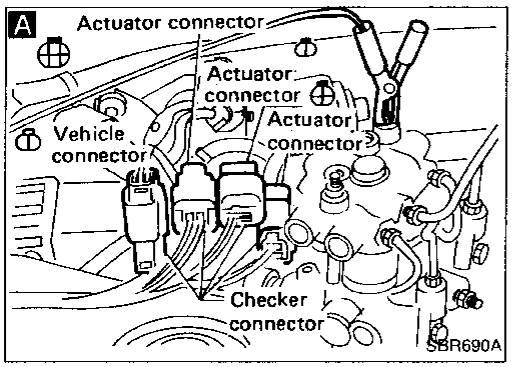
C

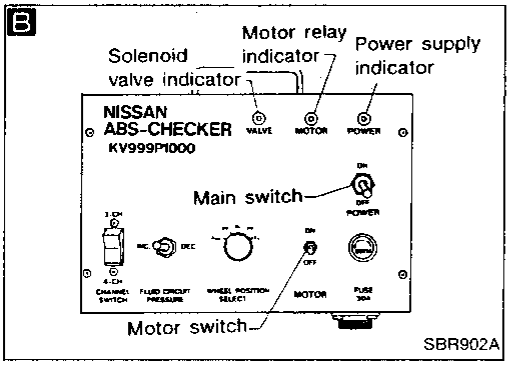
Check continuity between control unit connector (vehicle side) terminal ⑳ and body ground with ignition switch "OFF".

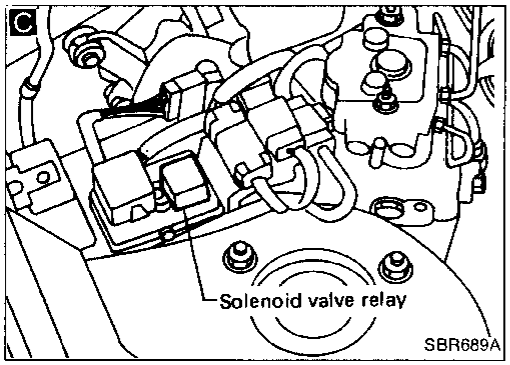
N.G. → Repair ground harness.

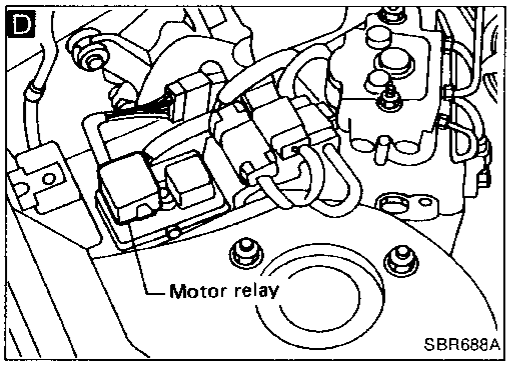
O.K.

Replace control unit









Electrical Components Inspection

ACTUATOR (Not self-diagnostic item)

INSPECTION START

A

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

B

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

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

Yes

B

Check checker valve relay indicator for coming on.

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

Yes

B step Ⓐ

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

B

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

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

Yes

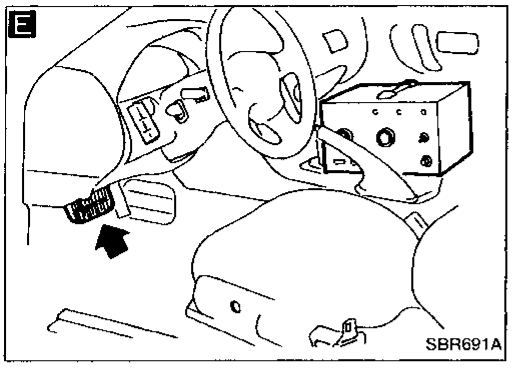
Check motor for operational sound beside the actuator in a quiet place.

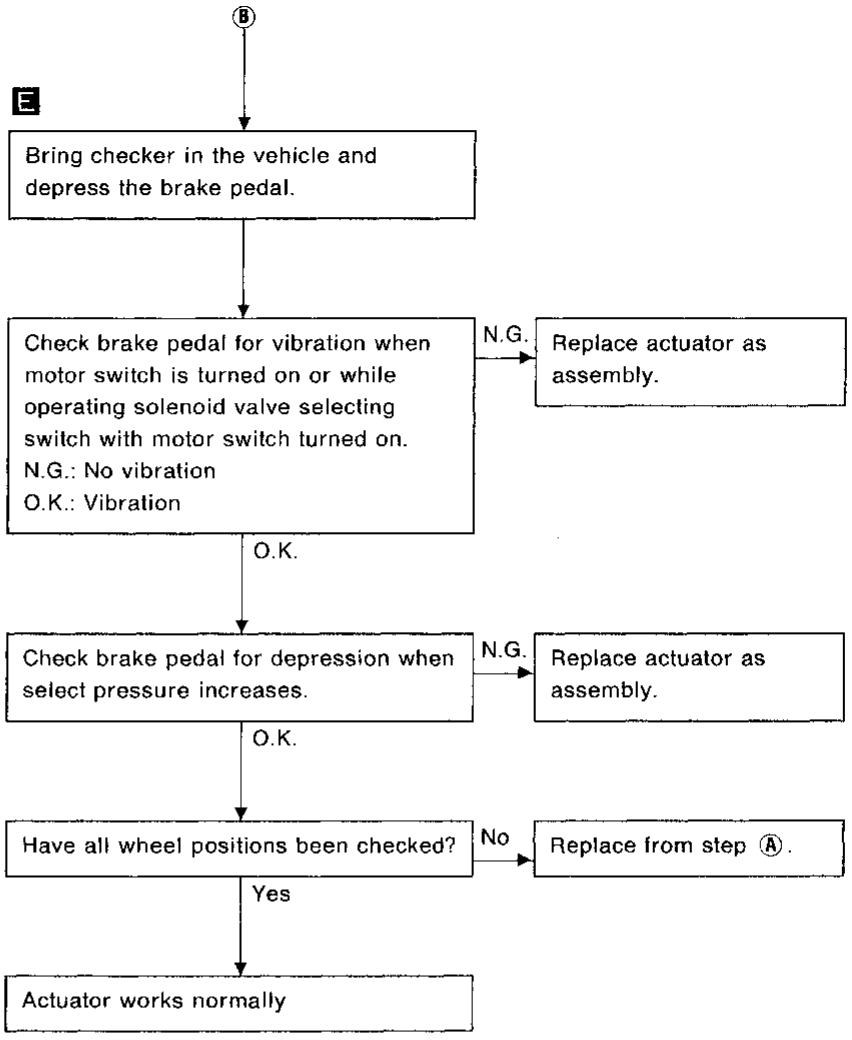
No → Replace actuator as assembly, if Diagnostic Procedures 7 - 12 are already performed and checker connection is correct.

Yes

Ⓑ

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.

General Specifications

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

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

Inspection and Adjustment

DISC BRAKE

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

BRAKE PEDAL

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

PARKING BRAKE

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