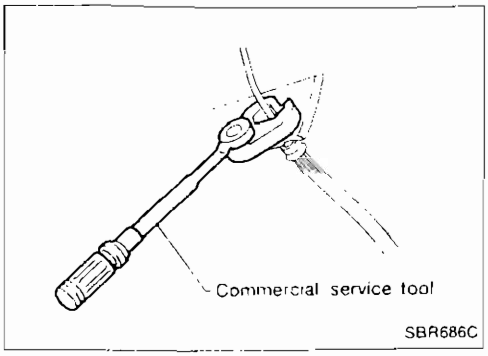
SECTION BR

CONTENTS



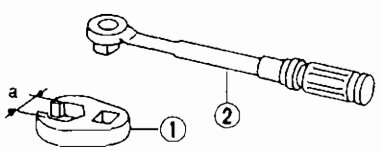
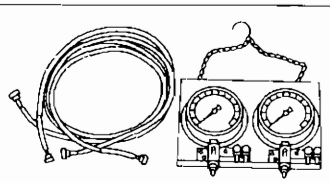
Precautions

- Recommended brake fluid.
  For Europe: DOT3 or DOT4
  Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- To clean or wash all parts of master cylinder, disc brake caliper and wheel cylinder, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene. They will ruin rubber parts of the hydraulic system.
- Use flare nut wrench when removing and installing brake tube.
- Always torque brake lines when installing.

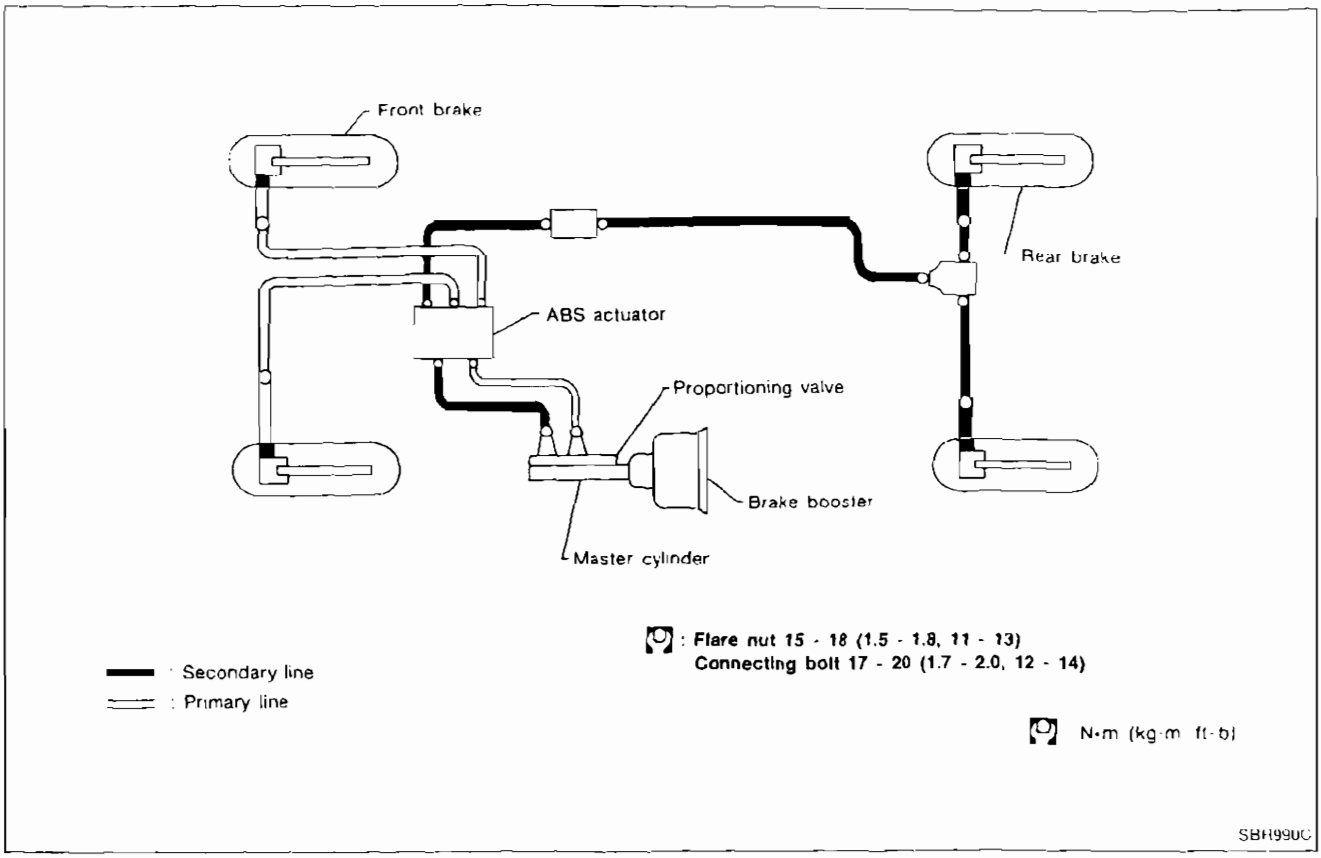
WARNING:

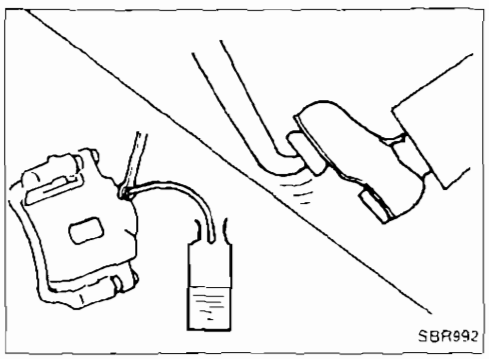
- Clean brake pads and shoes with a waste cloth, then wipe with a dust collector.

Commercial Service Tools

Tool name	Description	
① Flare nut crows foot ② Torque wrench	 NT360	Removing and installing each brake piping **a: 10 mm (0.39 in)**
Brake fluid pressure gauge	 NT151	Measuring brake fluid pressure

Brake Hydraulic Line





REMOVAL

CAUTION:

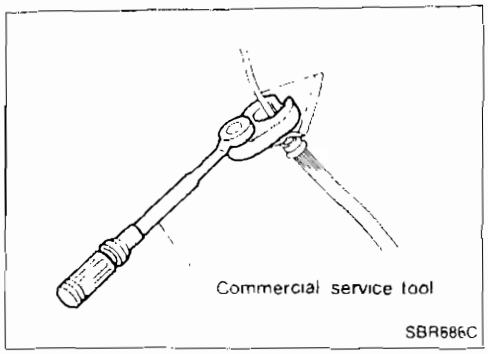
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**
- **All hoses must be free from excessive bending, twisting and pulling.**

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

INSPECTION

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

Brake Hydraulic Line (Cont'd)



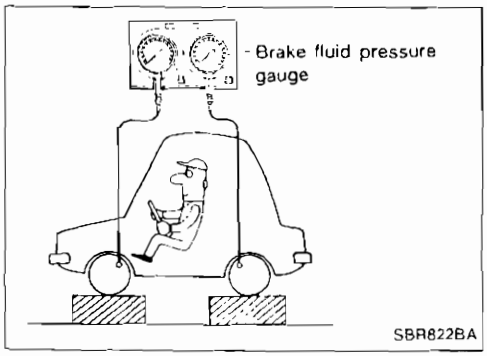
INSTALLATION

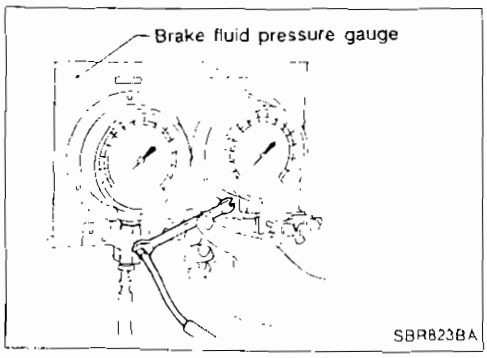
CAUTION:

- **Refill with new brake fluid.**
  For Europe: DOT3 or DOT4
  Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- **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" (BR-5).

Proportioning Valve





INSPECTION

CAUTION:

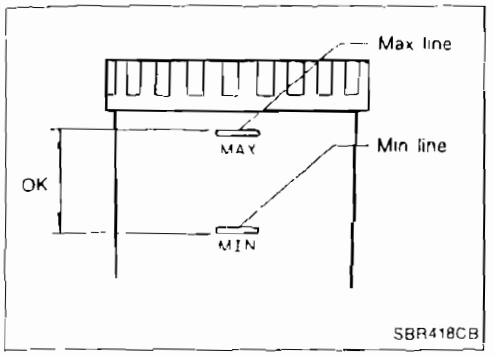
- **Carefully monitor brake fluid level at master cylinder.**
- **Use new brake fluid.**
  For Europe: DOT3 or DT4
  Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake 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.

Unit: kPa (bar, kg/cm^2, psi)

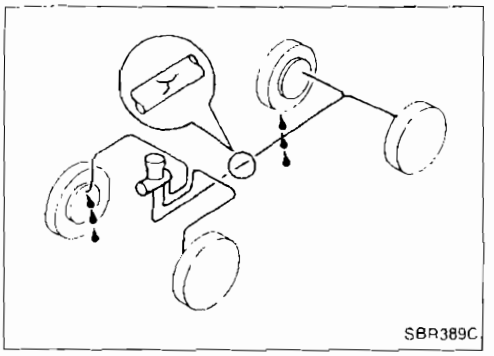
Applied pressure (Front brake)	7,355 (73.6, 75, 1,067)
Output pressure (Rear brake)	5,100 - 5,492 (51.0 - 54.9, 52 - 56, 739 - 796)

4. Bleed air after disconnecting the Tool. Refer to "Bleeding Brake System" (BR-5).



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.
- If brake warning lamp comes on, check brake fluid level switch and parking brake switch.

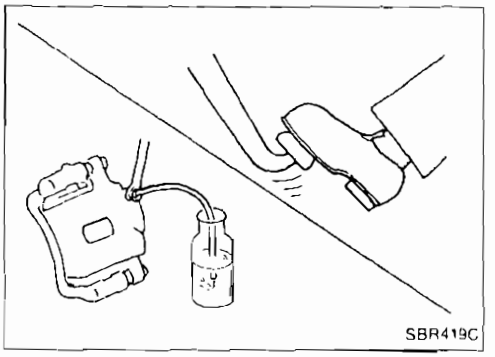


Checking Brake Line

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.

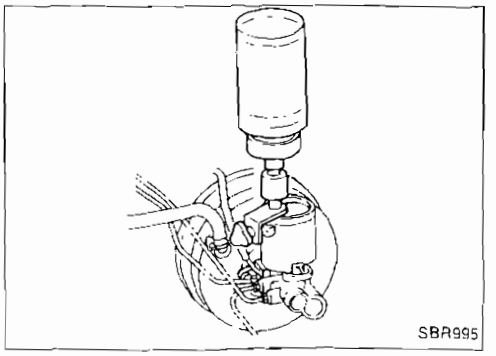


Changing Brake Fluid

CAUTION:

- **Refill with new brake fluid.**
  For Europe: DOT3 or DOT4/Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- **Always keep fluid level higher than minimum line on reservoir tank.**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**

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



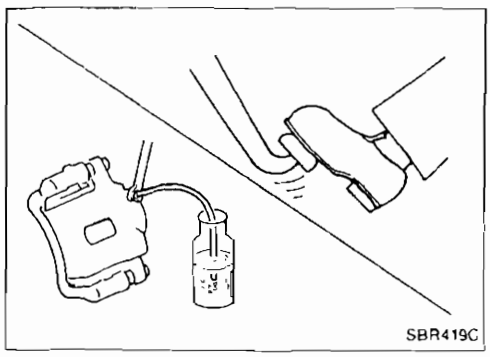
Bleeding Brake System

CAUTION:

- **Carefully monitor brake fluid level at master cylinder during bleeding operation.**
- **Fill reservoir with new brake fluid.**
  For Europe: DOT3 or DOT4/Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
  Make sure it is full at all times while bleeding air out of system.

Bleeding Brake System (Cont'd)

- **Place a container under master cylinder to avoid spillage of brake fluid.**
- **Turn ignition switch OFF and disconnect ABS actuator connectors or battery ground cable.**

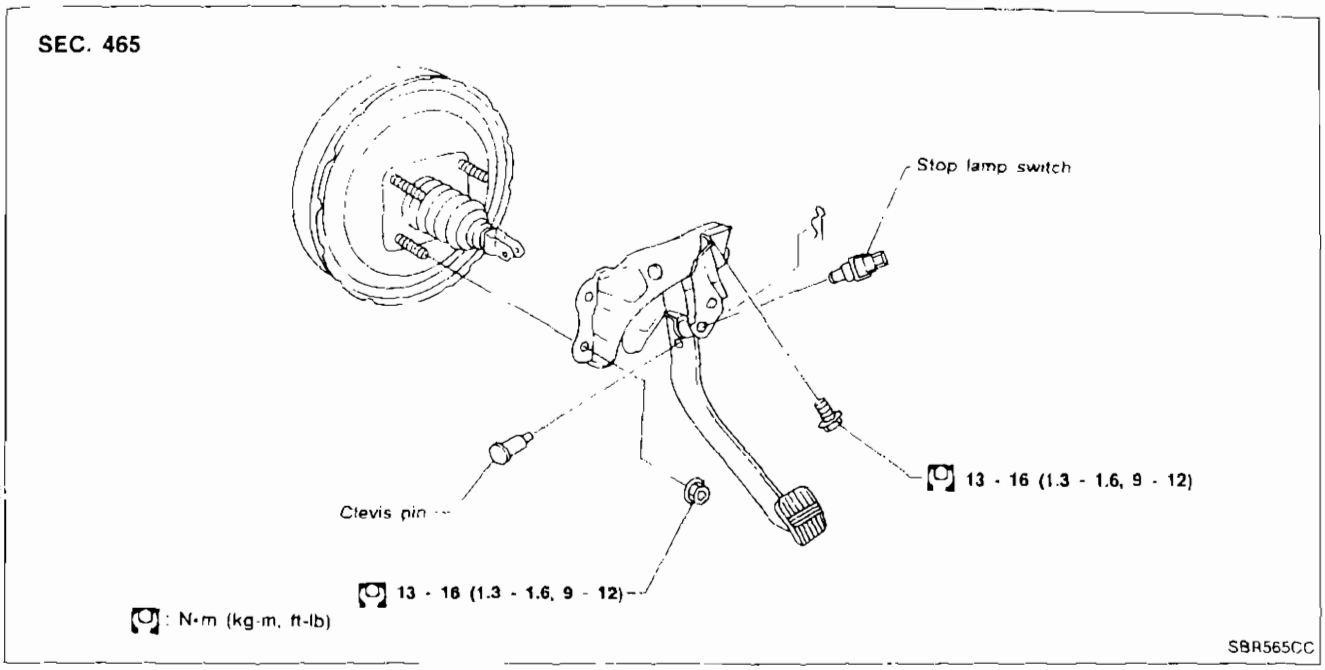


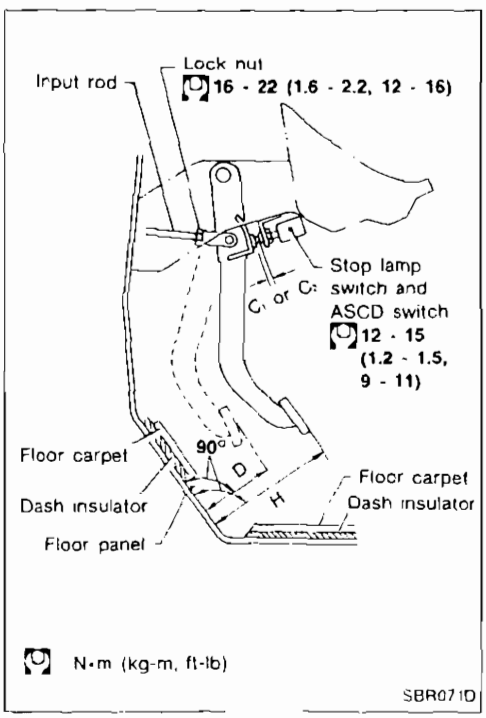
- Bleed air in the following order.
  Right rear brake → Left rear brake →
  Right front brake → Left front brake

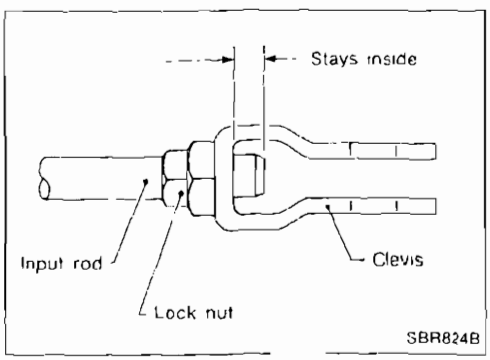
1. Connect a transparent vinyl tube to air bleeder valve.
2. Fully depress brake pedal several times.
3. With brake pedal depressed, open air bleeder valve to release air.
4. Close air bleeder valve.
5. Release brake pedal slowly.
6. Repeat steps 2. through 5. until clear brake fluid comes out of air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

Removal and Installation

SEC. 465







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 (BR-66).

D: **Depressed height**
Refer to SDS. (BR-66).
Under force of 490 N (50 kg, 110 lb) with engine running

C_1, C_2: **Clearance between pedal stopper and threaded end of stop lamp switch and ASCD switch**
0.3 - 1.0 mm (0.012 - 0.039 in)

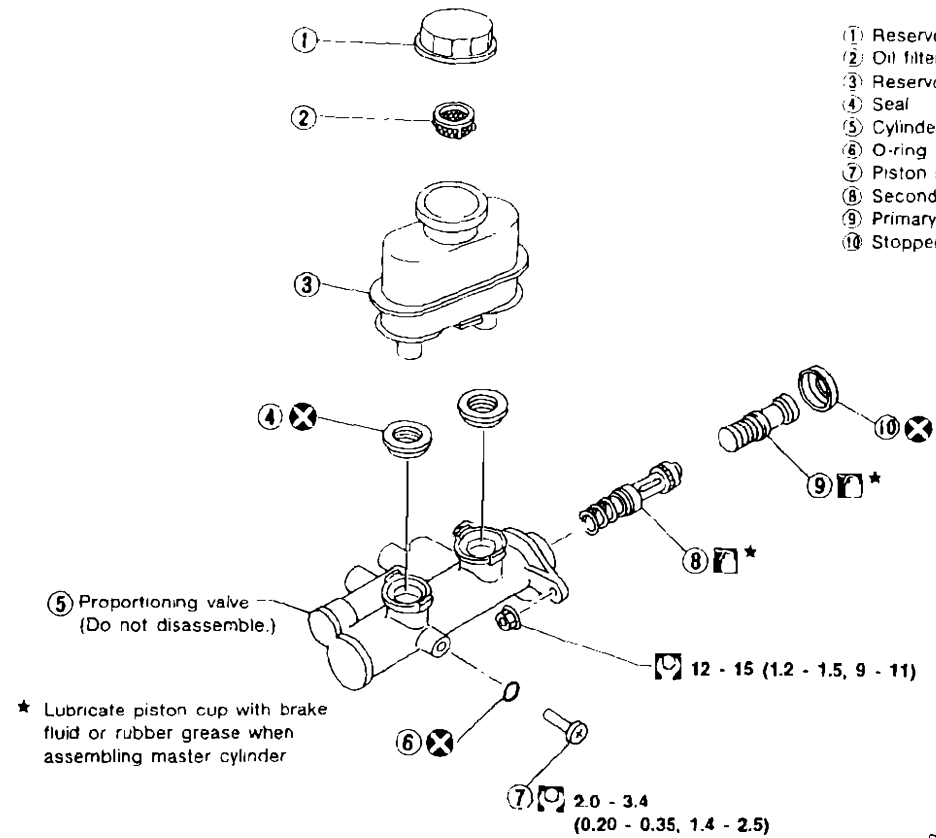
1. Loosen lock nut and adjust pedal free height by turning brake booster input rod. Then tighten lock nut.
2. Check pedal free play.

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

3. Check brake pedal's depressed height while engine is running. If lower than specification, check for leaks, air in system, or damage to components (master cylinder, wheel cylinder, etc.). Then make necessary repair.

BR

SEC. 460

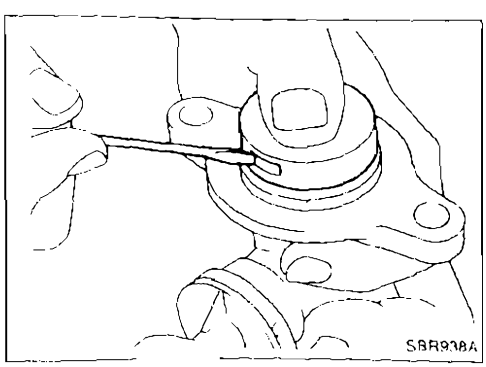


Removal

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)

2. Remove valve stopper while piston is pushed into cylinder.
3. Remove piston assemblies.

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

4. Draw out reservoir tank.

Inspection

Check for the following items.

Replace any part if damaged.

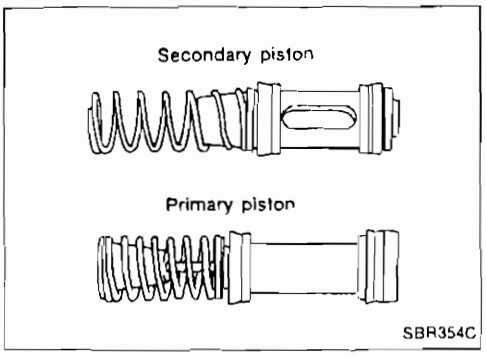
Master cylinder:

- Pin holes or scratches on inner wall.

Piston:

- Deformation of or scratches on piston cups.

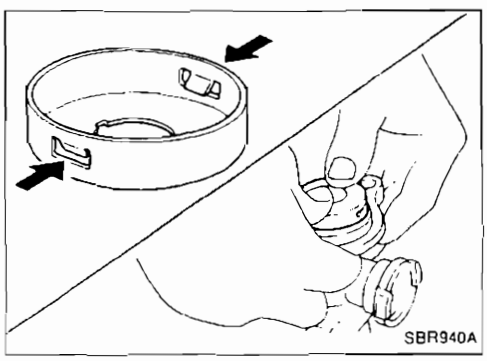
SBR231C



Assembly

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

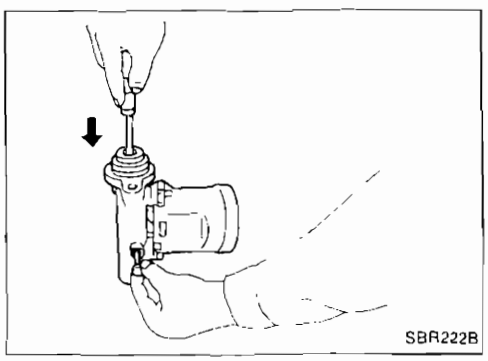
- **Pay attention to alignment of secondary piston slit with valve stopper mounting hole of cylinder body.**



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.



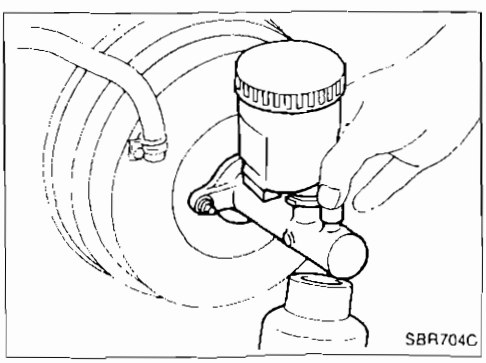
5. Install valve stopper while piston is pushed into cylinder.

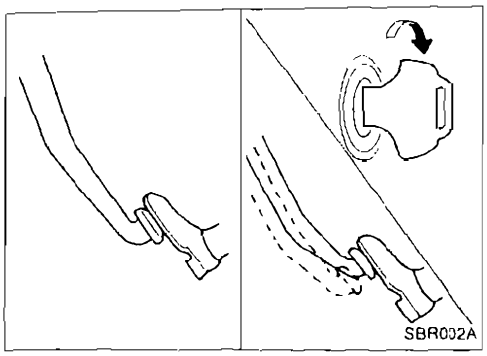
Installation

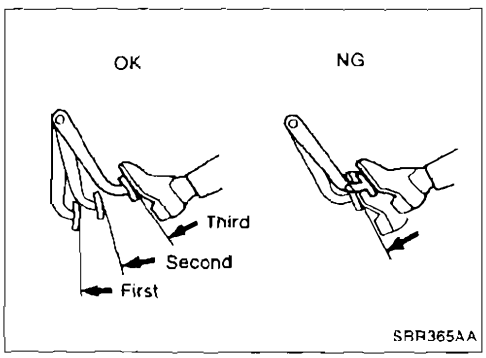
CAUTION:

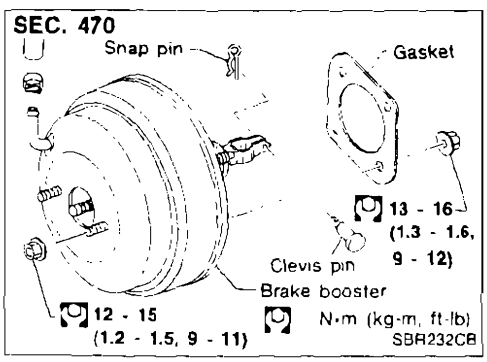
- **Refill with new brake fluid.**
  For Europe: DOT3 or DOT4/Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- **Never reuse drained brake fluid.**

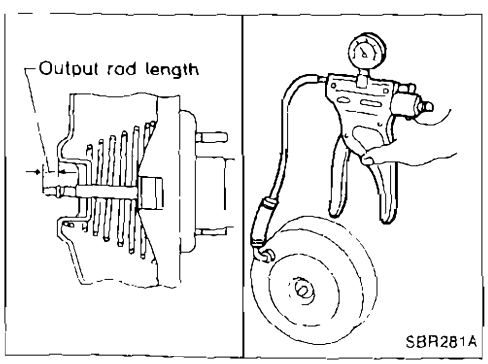
1. Place master cylinder onto brake booster and secure mounting nuts lightly.
2. Torque mounting nuts.
   12 - 15 N·m (1.2 - 1.5 kg-m, 9 - 11 ft-lb)
3. Fill up reservoir tank with new brake fluid.
4. Plug all ports on master cylinder with fingers to prevent air suction while releasing brake pedal.
5. Have driver depress brake pedal slowly several times until no air comes out of master cylinder.
6. Fit brake lines to master cylinder.
7. Tighten flare nuts.
   : 15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
8. Bleed air from brake system. Refer to "Bleeding Brake System" (BR-5)











Brake Booster

ON-VEHICLE SERVICE

Operating check

- Stop engine and depress brake pedal several times. Check that pedal stroke does not change.
- 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. The pedal should go further down the first time, and then it should gradually rise thereafter.
- Depress brake pedal while engine is running, and stop engine with pedal depressed. The pedal stroke should not change after holding pedal down for **30 seconds**.

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 (–667 mbar, –500 mmHg, –19.69 inHg) to brake booster with a handy vacuum pump.
2. Check output rod length.
   Specified length:
   10.4 mm (0.409 in)

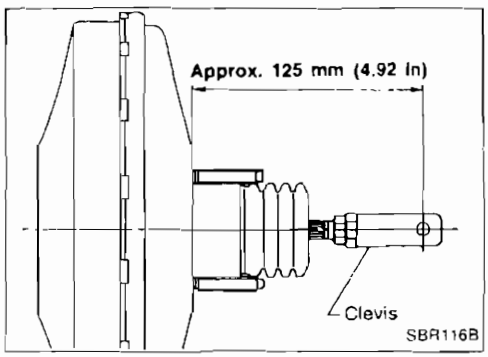
INSTALLATION

CAUTION:

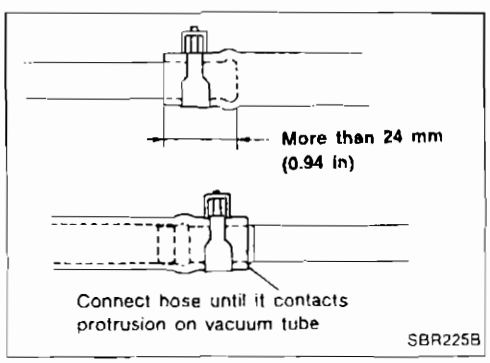
- **Be careful not to deform or bend brake pipes, during installation of booster.**
- **Replace clevis pin if damaged.**
- **Refill with new brake fluid.**
  For Europe: DOT3 or DOT4/Except for Europe: DOT3
  For Europe, never mix different type brake fluids (DOT3 and DOT4).
- **Never reuse drained brake fluid.**
- **Take care not to damage brake booster mounting bolt**

Brake Booster (Cont'd)

thread when installing. Due to the angle of installation, threads can be damaged by the dash panel.



1. Before fitting booster, temporarily adjust clevis to dimension shown.
2. Fit booster, then secure mounting nuts (brake pedal bracket to booster) 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" (BR-9).
6. Bleed air. Refer to "Bleeding Brake System" (BR-5).



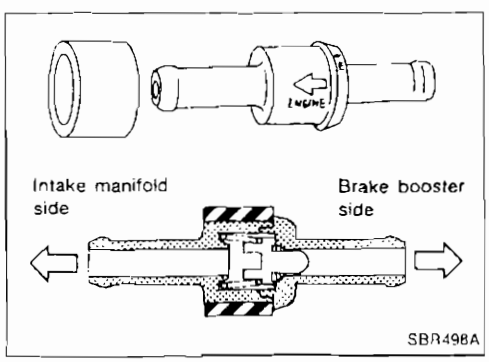
Vacuum Hose

REMOVAL AND INSTALLATION

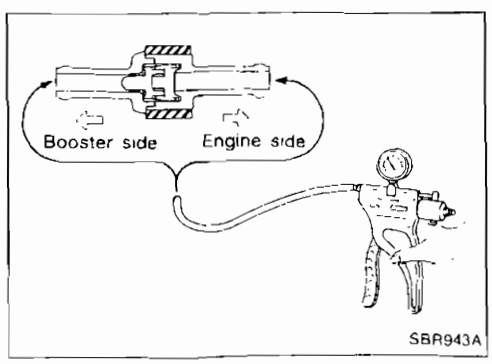
CAUTION:

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

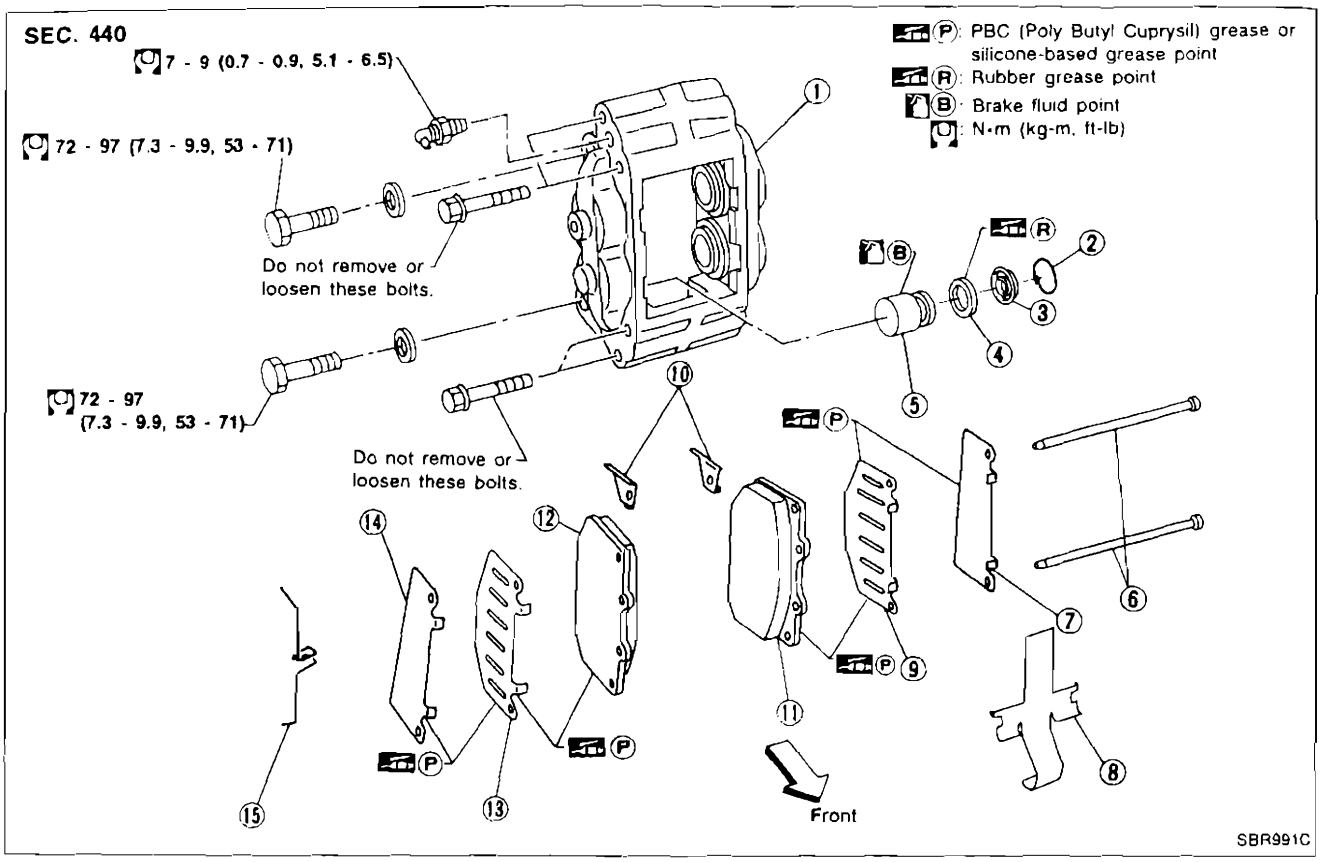
Hoses and connectors

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

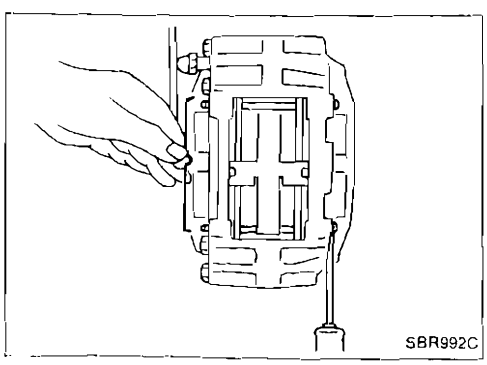
Check valve

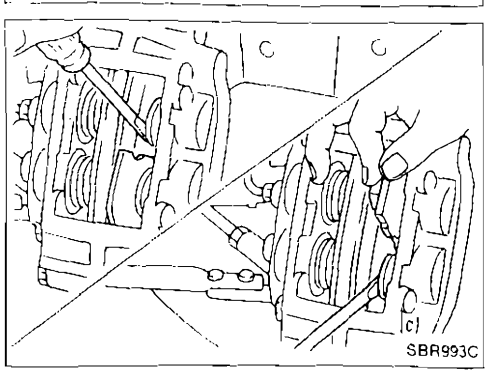
Check vacuum with a vacuum pump.

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



①	Caliper	⑥	Pad pin	⑪	Outer pad
②	Retaining ring	⑦	Outer shim A	⑫	Inner pad
③	Dust seal	⑧	Cross spring	⑬	Inner shim B
④	Piston seal	⑨	Outer shim B	⑭	Inner shim A
⑤	Piston	⑩	Pad retainer	⑮	Clip



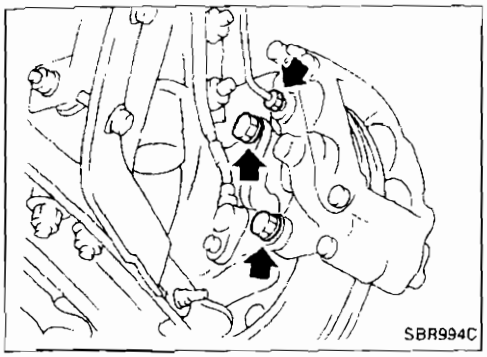


Pad Replacement

CAUTION:

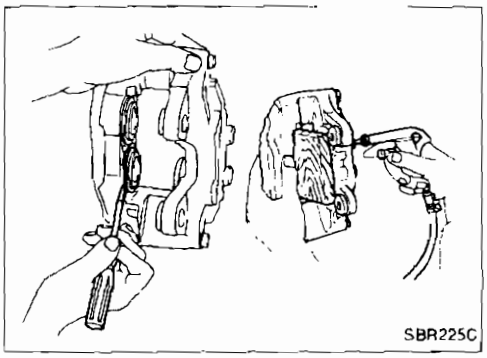
- **When pads are removed, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage dust seal or get oil on rotor. Always replace shims when replacing pads.**

1. Remove clip from pad pin and then remove pad pin.
2. Remove cross spring.
3. Pull out outer pad and insert it temporarily between lower piston and rotor as shown.
4. Push back upper piston with a suitable tool and insert new pad so it contacts upper piston as shown.
5. Pull out old pad.
6. Push back lower piston with a suitable tool.
7. Pull out new pad and reinstall it in the proper position.
8. Repeat step 3 to 7 for inner pad.
9. Install cross spring, pad pin and clip.


SBR994C

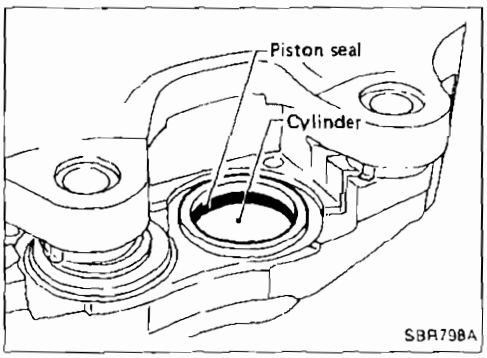
Removal and Installation

1. Disconnect brake tube.
2. Remove brake pad.
3. Remove brake caliper mounting bolts.


SBR225C

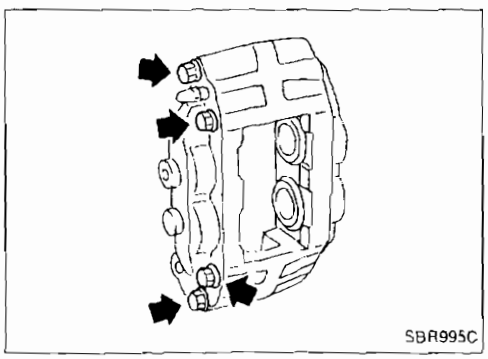
Disassembly

1. Remove retaining ring.
2. Push out piston with dust seal using compressed air.



SBR798A

3. Remove piston seal.


SBR995C

CAUTION:
Be careful not to loosen or remove bolts joining both sides of caliper.
If there is any fluid leakage, replace caliper assembly.

Inspection

CALIPER

- Check dust seals for damage.
- Check calipers for damage, rust or foreign materials.
- 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.

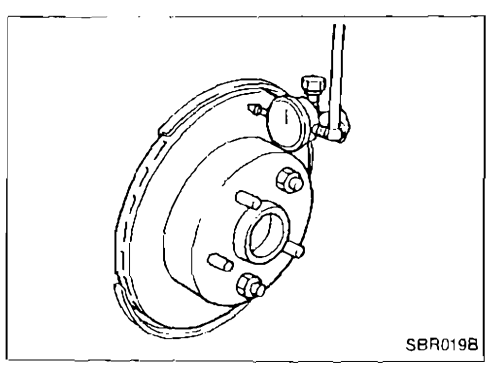
PISTON

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.

PAD PIN AND CLIPS

Check for wear, cracks deformation, deterioration, rust or other damage. Replace if any such condition exists.


SBR019B

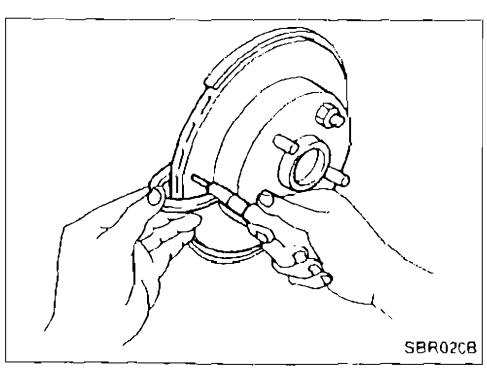
RUNOUT

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:
0.05 mm (0.0020 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).

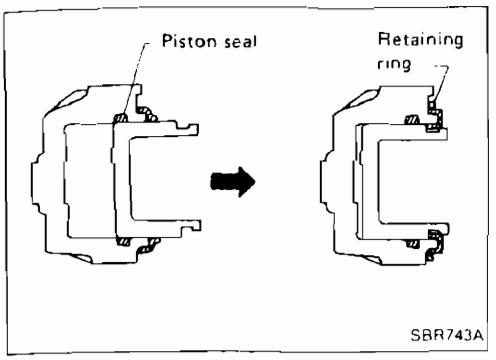

SBR020B

THICKNESS

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

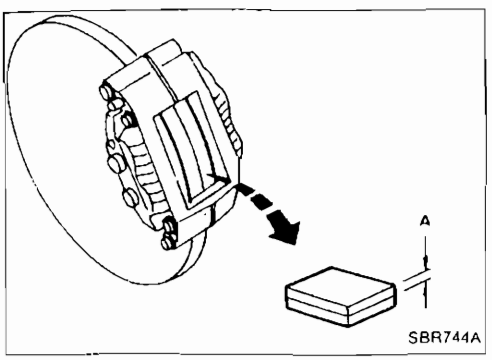
If thickness variation exceeds the specification, turn rotor with on-car brake lathe.

Rotor repair limit:
28.0 mm (1.102 in)



Assembly

1. Insert piston seal into groove on cylinder body
2. With dust seal fitted to piston, install piston into cylinder body.
3. Secure dust seal properly.
4. Install retaining ring.

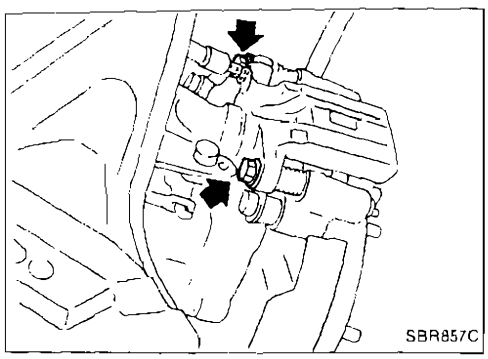


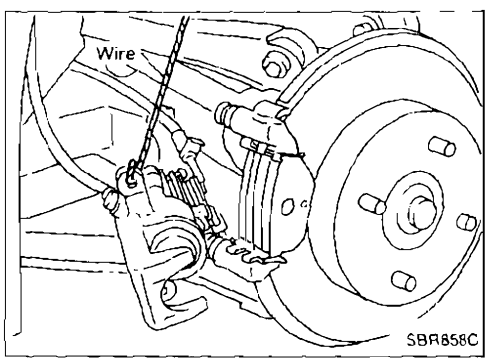
Inspection (On-vehicle)

DISC PAD

- Check pad shims for deformation or damage.
- Check disc pad for wear or damage.

Pad standard thickness (A):
10.0 mm (0.394 in)
Pad wear limit (A):
2.0 mm (0.079 in)





Pad Replacement

WARNING:

Clean brake pads with a vacuum dust collector to minimize the hazard of airborne particles 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 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.**

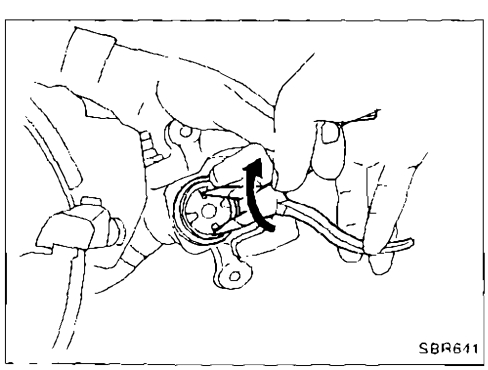
1. Remove master cylinder reservoir cap.
2. Release parking brake.
3. Remove brake cable mounting bolts from the rear suspension.
4. Remove pin bolts.
5. Remove cylinder body. Then remove pad retainers, and inner and outer shims.

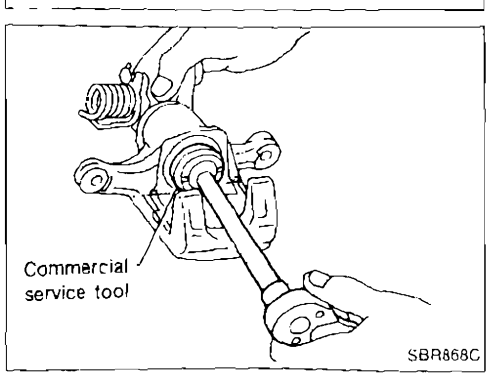
   Standard pad thickness:

   9.5 mm (0.374 in)

   Pad wear limit:

   2.0 mm (0.079 in)

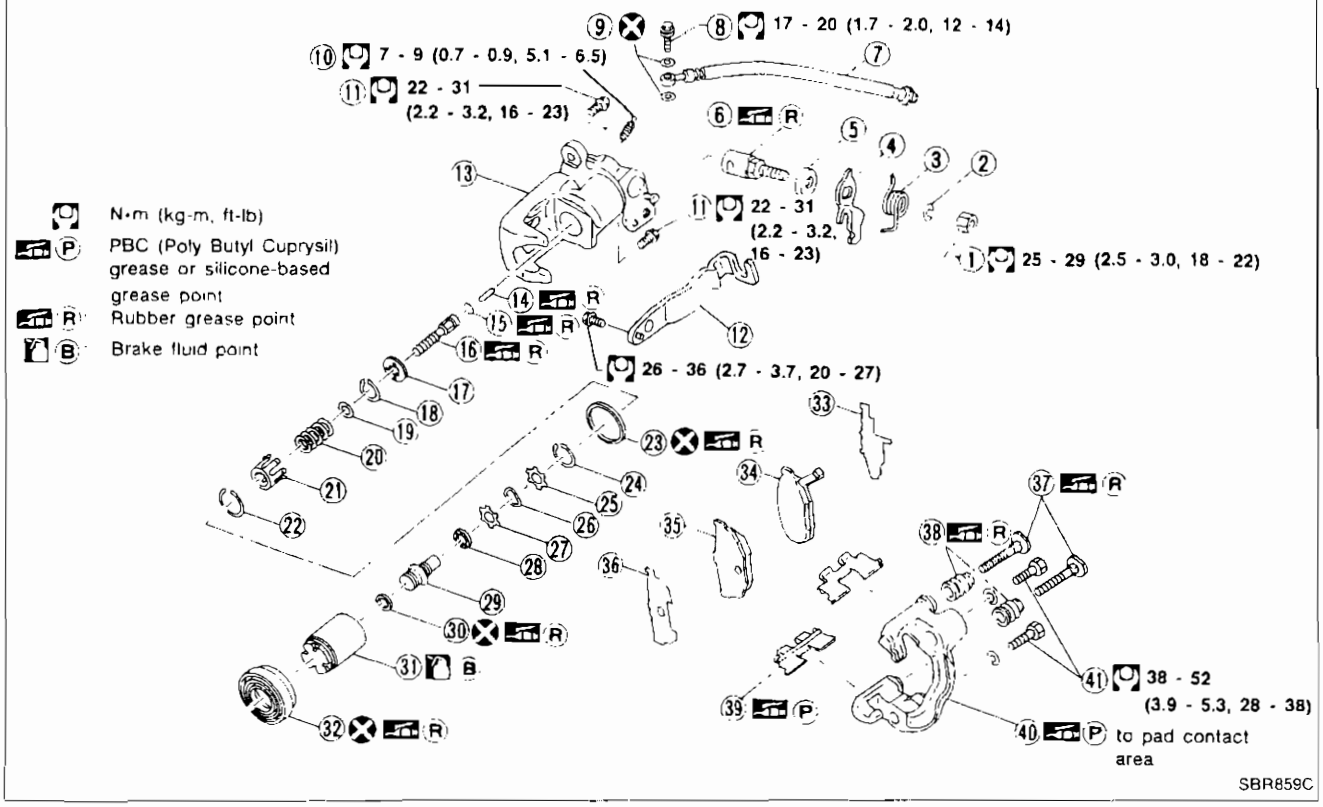




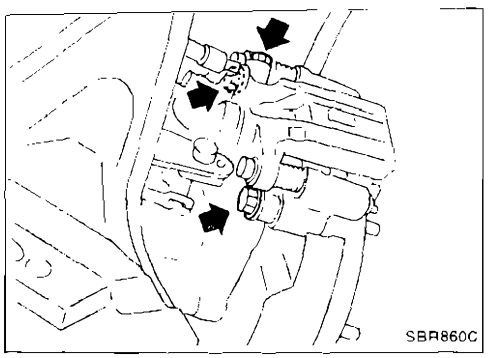
6. When installing new pads, push piston into cylinder body by gently turning piston clockwise, as shown.

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

SEC. 441



①	Nut	⑮	O-ring	㉙	Adjusting nut
②	Washer	⑯	Push rod	㉚	Cup
③	Return spring	⑰	Key plate	㉛	Piston
④	Parking brake lever	⑱	Ring C	㉜	Dust seal
⑤	Cam boot	⑲	Seat	㉝	Inner shim
⑥	Cam	⑳	Spring	㉞	Inner pad
⑦	Brake hose	㉑	Spring cover	㉟	Outer pad
⑧	Connecting bolt	㉒	Ring B	㊱	Outer shim
⑨	Copper washer	㉓	Piston seal	㊲	Pin
⑩	Bleed screw	㉔	Ring A	㊳	Pin boot
⑪	Pin bolt	㉕	Spacer	㊴	Pad retainer
⑫	Cable mounting bracket	㉖	Wave washer	㊵	Torque member
⑬	Cylinder	㉗	Spacer	㊶	Torque member fixing bolt
⑭	Strut	㉘	Ball bearing		


SBR860C

Removal

WARNING:

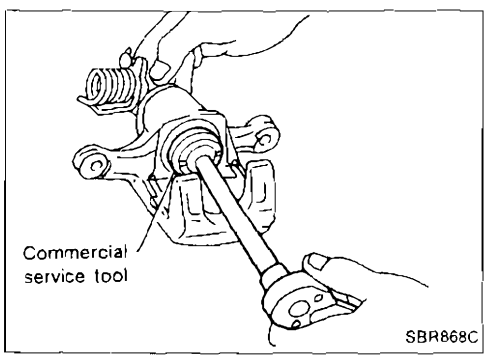
Clean brake pads with a vacuum dust collector to minimize the hazard of airborne particles or other materials.

1. Remove brake cable mounting bracket bolt and lock spring.
2. Remove torque member fixing bolts and connecting bolt.

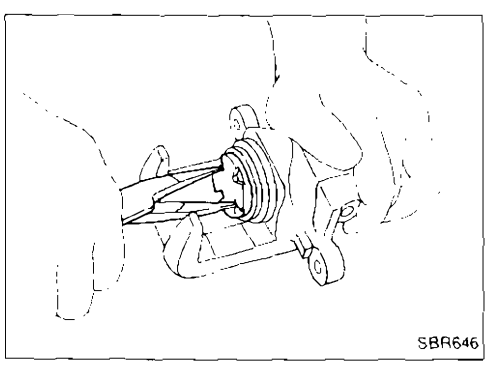
It is not necessary to remove connecting bolt except for disassembly or replacement of caliper assembly. In this case, suspend caliper assembly with wire so as not to stretch brake hose.

Disassembly

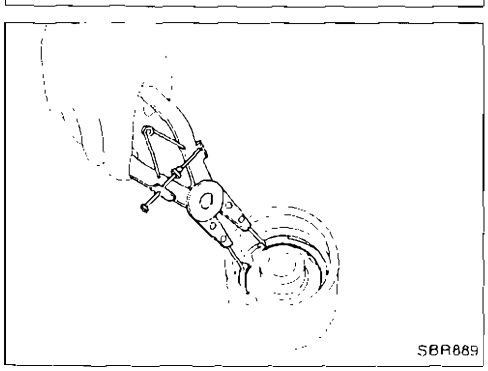
1. Remove piston by turning it counterclockwise with suitable commercial service tool or long nose pliers.



SBR868C


SBR646

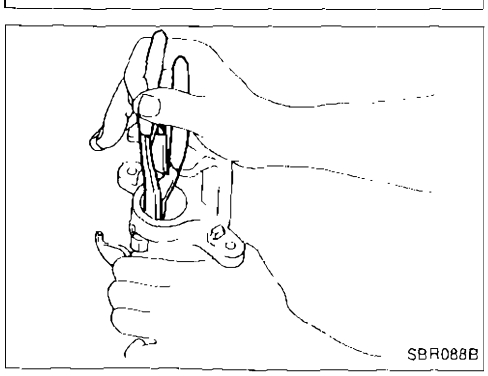
2. Pry off ring A from piston with suitable pliers and remove adjusting nut.


SBR889

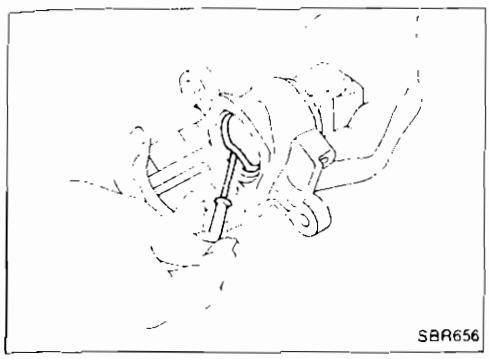
3. Disassemble cylinder body.

a. Pry off ring B with suitable pliers, then remove spring cover, spring and seat.

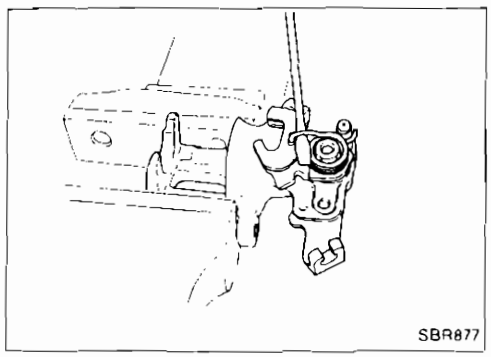
b. Pry off ring C, then remove key plate, push rod and strut.


SBR088B

Disassembly (Cont'd)


SBR656

c. Remove piston seal.
Be careful not to damage cylinder body.


SBR877

4. Remove return spring, nut and parking brake 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.

TORQUE MEMBER

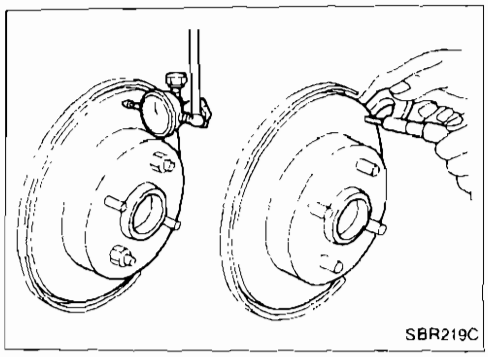
Check for wear, cracks or other damage. Replace if necessary.

PISTON

CAUTION:
Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is stuck to sliding surface.
Check piston for score, rust, wear, damage or presence of foreign materials.
Replace if any of the above conditions are observed.

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 two nuts (M12 x 1.25).
2. Check runout using a dial indicator.

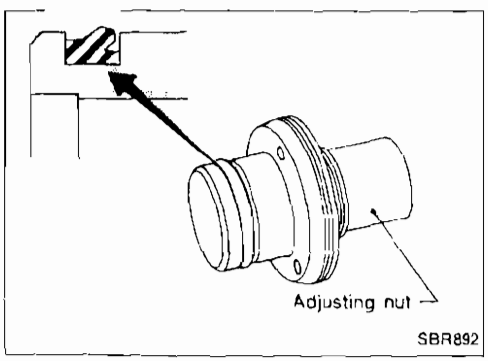
Make sure that axial end play is within the specifications before measuring. Refer to "Rear Wheel Bearing" in RA section.

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

Maximum runout:
0.07 mm (0.0028 in)

THICKNESS

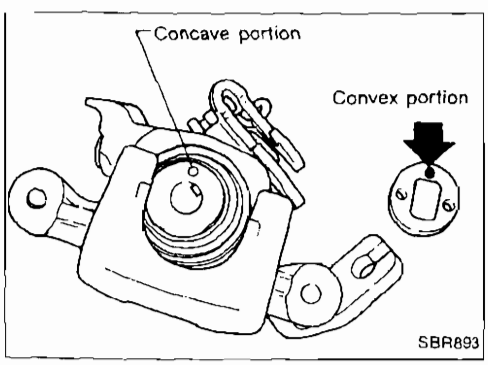
Rotor repair limit:
Standard thickness
9 mm (0.35 in)
Minimum thickness
8 mm (0.31 in)
Thickness variation (At least 8 portions)
Maximum 0.02 mm (0.0008 in)



SBR892

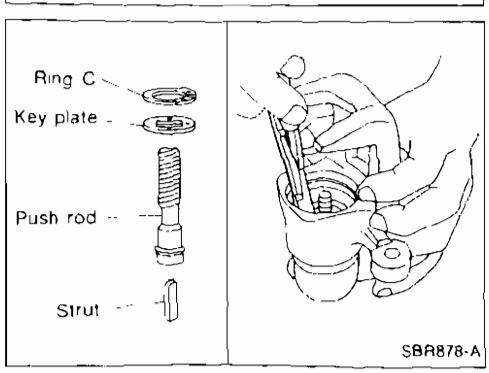
Assembly

1. Install cup in the specified direction.



SBR893

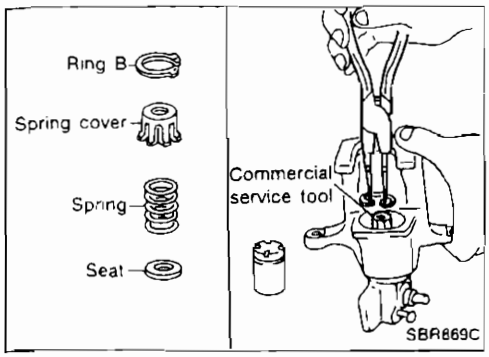
2. Fit push rod into square hole in key plate. Also match convex portion of key plate with concave portion of cylinder.



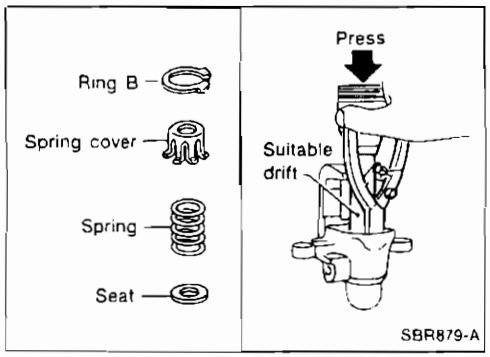
SBR878-A

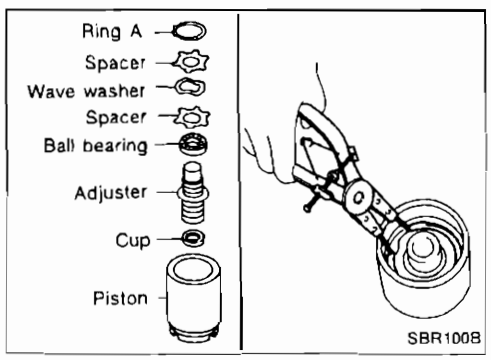
3. Install ring C with a suitable tool.

Assembly (Cont'd)

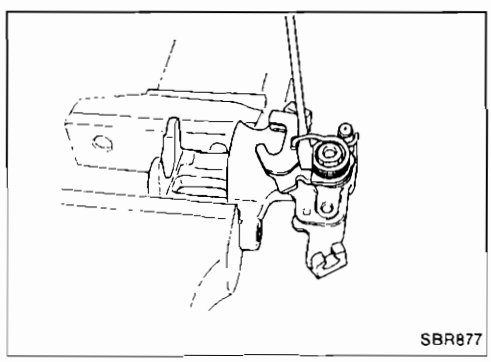


4. Install seat, spring, spring cover and ring B while depressing with suitable commercial service tool or press and drift.





5. Install cup, adjuster, bearing, spacers, washers and ring A with a suitable tool.



6. Fit parking brake lever and tighten nut.
7. Fit return spring in the order shown.

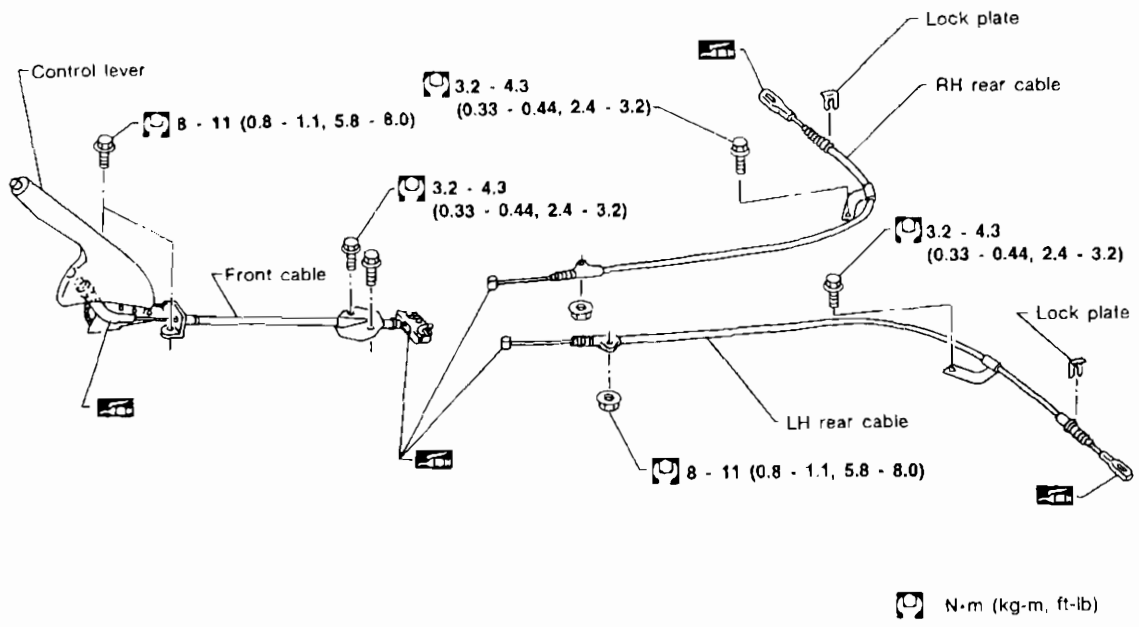
Installation

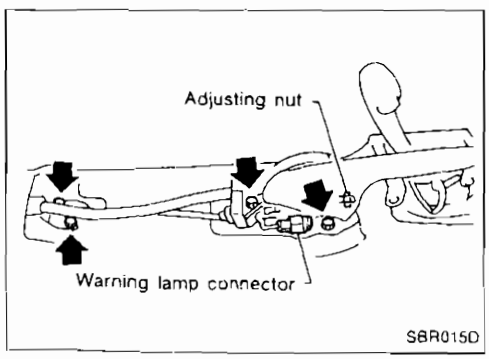
CAUTION:

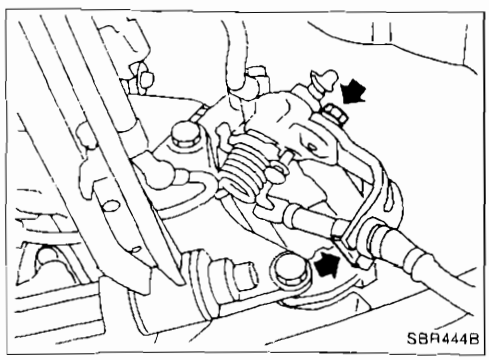
- **Refill with new brake fluid "DOT 3" (Except for Europe) and "DOT3 or DOT4" (For Europe). For Europe, never mix different type brake fluids (DOT3 and DOT4).**
- **Never reuse drained brake fluid.**

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

SEC. 443



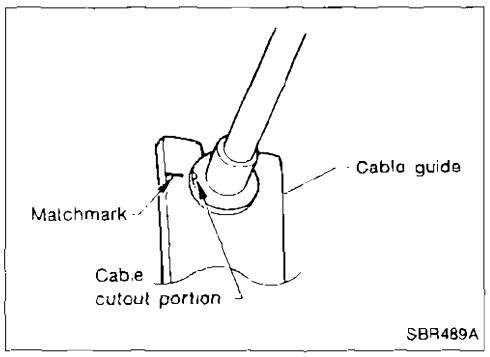




Removal and Installation

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, then disconnect cable from caliper.

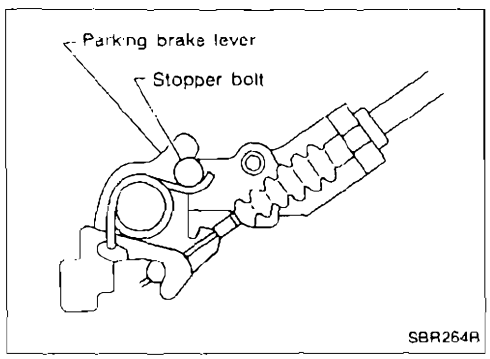
Removal and Installation (Cont'd)



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

Inspection

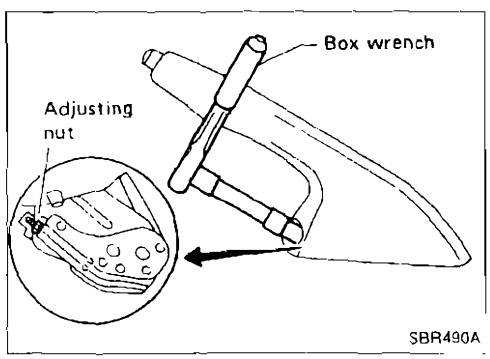
1. Check control lever for wear or other damage. Replace if necessary.
2. Check wires for discontinuity or deterioration. Replace if necessary.
3. Check warning lamp and switch. Replace if necessary.
4. Check parts at each connecting portion and, if found deformed or damaged, replace.



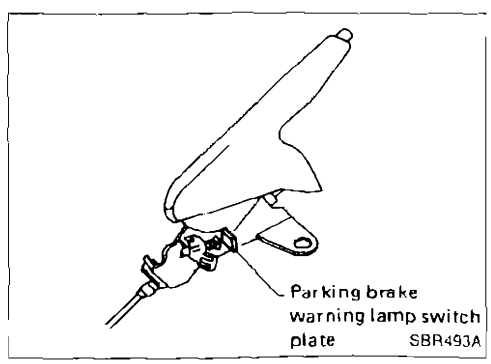
Adjustment

Pay attention to the following points after adjustment.

- There is no drag when control lever is being released.
- Parking brake lever returns to stopper bolt when control lever for rear disc brake is released.



1. Pull control lever up by 4 or 5 notches.
2. Insert a box wrench into opening in control lever and loosen self-lock adjusting nut to slacken cables.
3. Completely push control lever down.
4. Forcefully depress brake pedal about five times (so that caliper is automatically set in position.).
5. Pull lever up by 4 or 5 notches.
6. Turn adjusting nut as shown in figure and adjust lever stroke to specified value.
7. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.
   Number of notches : 7 - 9 [196 N (20 kg, 44 lb)]
8. Bend warning lamp switch plate to ensure the following. Warning lamp comes on when lever is lifted "A" notches, and goes out when fully released.
   Number of "A" notches : 1



Purpose

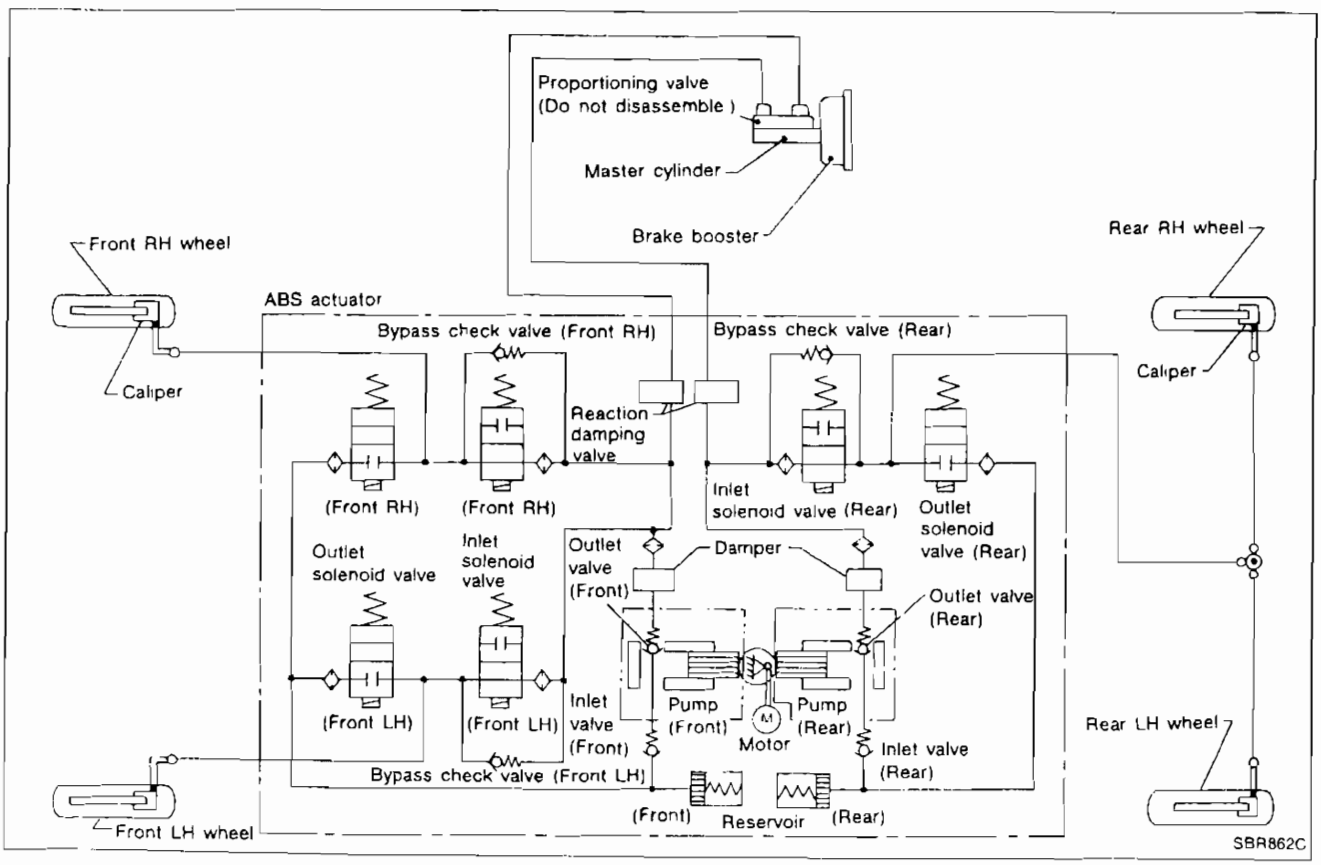
The Anti-Lock Brake System (ABS) consists of electronic and hydraulic components. It allows for control of braking force so that locking of the wheels can be avoided.
The ABS.

1) Improves proper tracking performance through steering wheel operation.
2) Eases obstacle avoidance through steering wheel operation.
3) Improves vehicle stability.

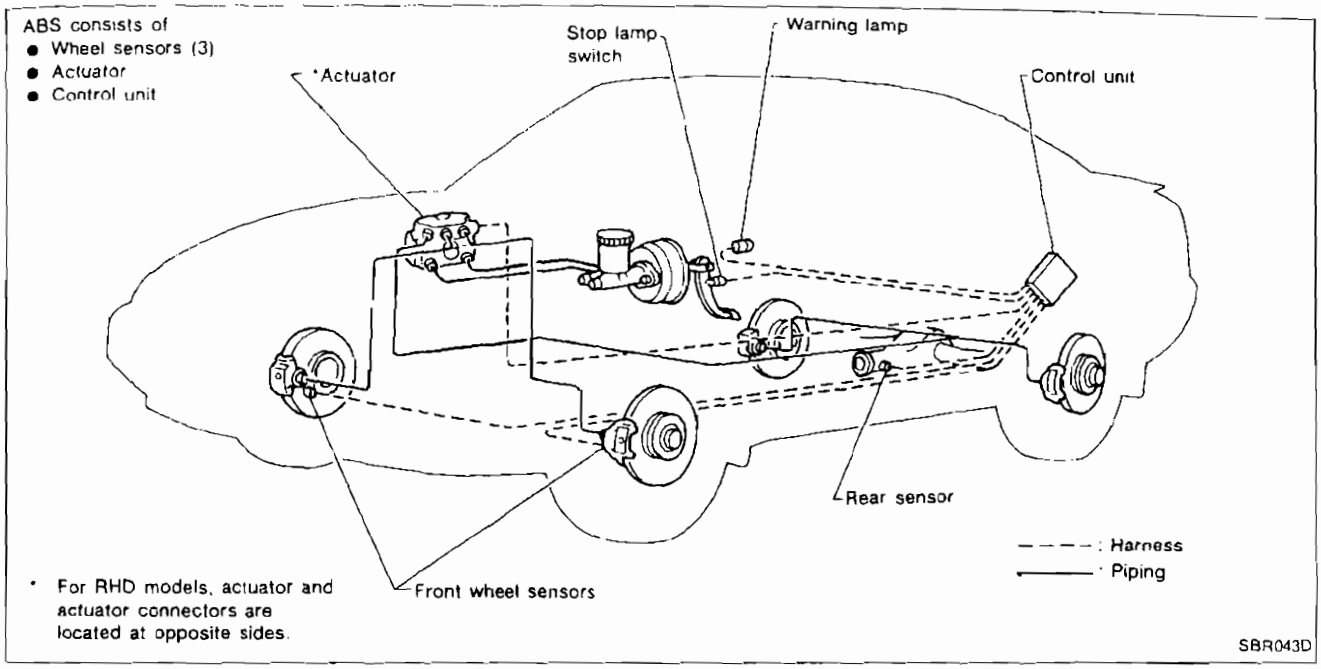
Operation

- The ABS will not operate at speeds below 5 to 10 km/h (3 to 6 MPH) to completely stop the vehicle. (The speeds will vary according to road conditions.)
- The ABS has self-test capabilities. A mechanical noise may be heard as the ABS performs a self-test the first time the vehicle reaches 10 km/h (6 MPH). This is a normal part of the self-test feature. If a malfunction is found during this check, the anti-lock warning lamp will come on.
- During ABS operation, a mechanical noise may be heard. This is a normal condition.

ABS Hydraulic Circuit



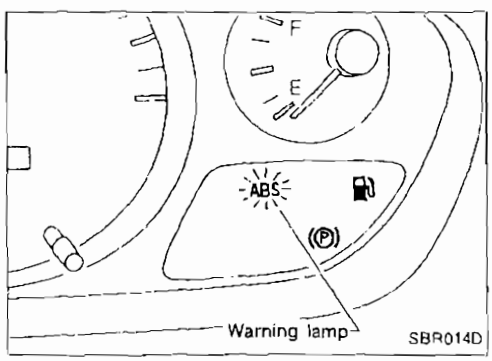
System Components



System Description

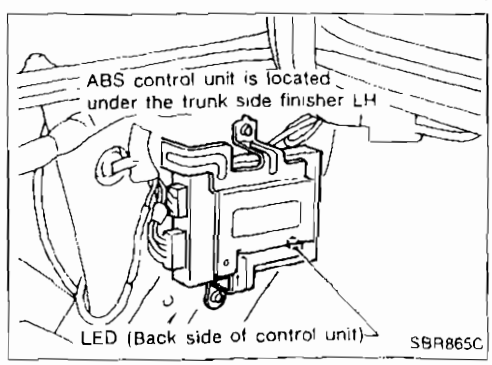
SENSOR

The sensor unit consists of a gear-shaped sensor rotor and a sensor element. The element contains a bar magnet wound with a coil. The sensor is installed on the back side of the brake rotor or the final drive. As the wheel rotates, the sensor generates a sine-wave pattern. The frequency and voltage increase(s) as the rotating speed increases.

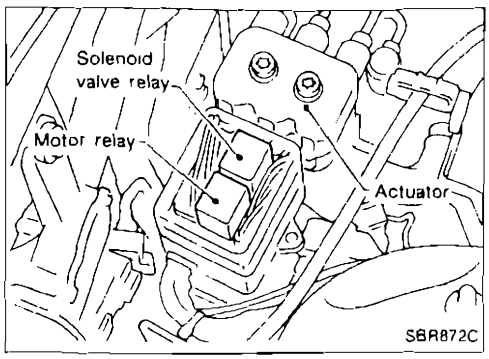


CONTROL UNIT

The control unit computes the wheel rotating speed by the signal current sent from the sensor. Then it supplies a DC current to the actuator solenoid valve. It also controls ON-OFF operation of the solenoid valve relay and motor relay. If any electrical malfunction should be detected in the system, the warning lamp is turned on. In this condition, the ABS will be deactivated, and the vehicle's brake system reverts to normal operation



System Description (Cont'd)



ACTUATOR

The actuator contains:

- An electric motor and pump
- Two relays
- Six solenoid valves, each inlet and outlet for
  - — LH front
  - — RH front
  - — LH and RH rear

These components control the hydraulic circuit. The ABS control unit directs the actuator to increase, hold or decrease hydraulic pressure to all or individual wheels.

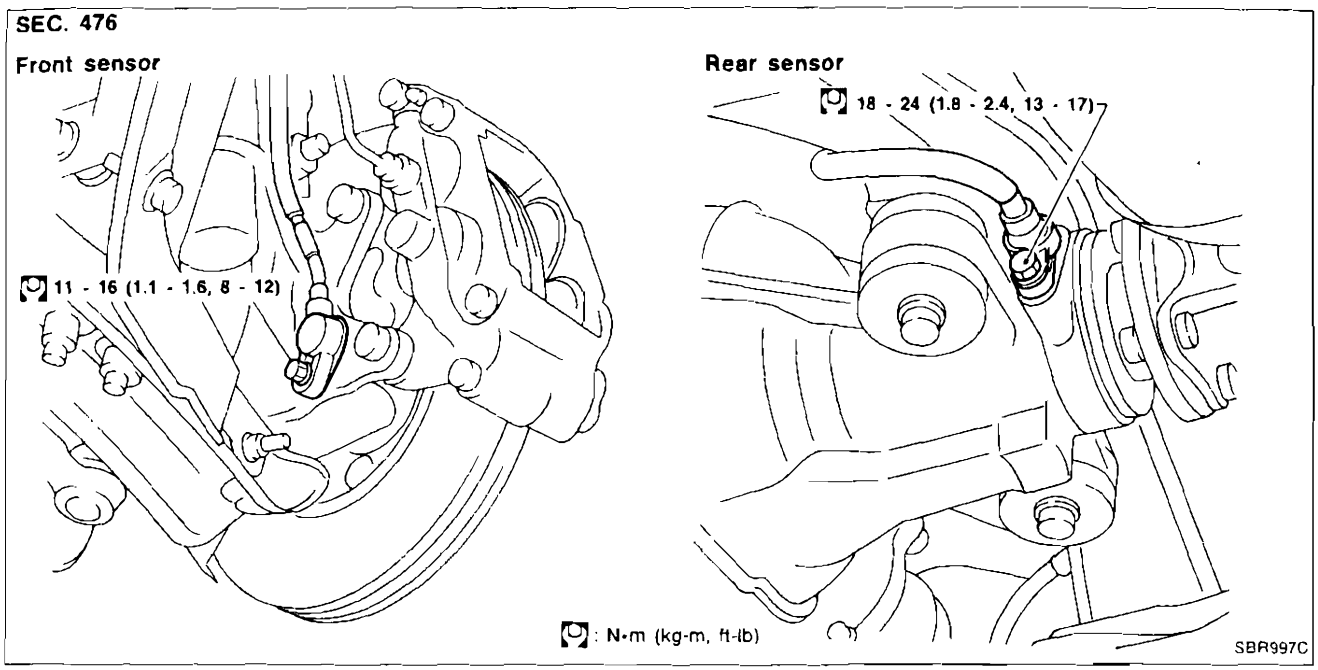
ABS actuator operation

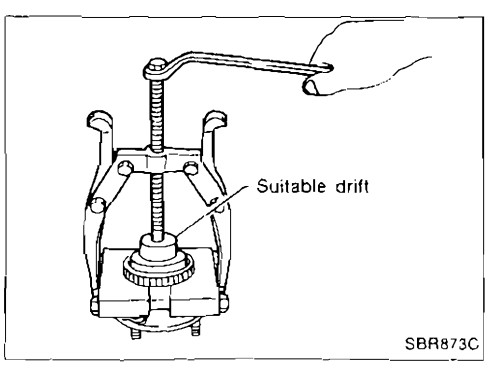
		Inlet solenoid valve	Outlet solenoid valve	
Normal brake operation		OFF (Open)	OFF (Closed)	Master cylinder brake fluid pressure is directly transmitted to caliper via the inlet solenoid valve.
ABS operation	Pressure hold	ON (Closed)	OFF (Closed)	Hydraulic circuit is shut off to hold the caliper brake fluid pressure.
	Pressure decrease	ON (Closed)	ON (Open)	Caliper brake fluid is sent to reservoir via the outlet solenoid valve. Then it is pushed up to the master cylinder by pump.
	Pressure increase	OFF (Open)	OFF (Closed)	Master cylinder brake fluid pressure is transmitted to caliper.

Removal and Installation

CAUTION:
Be careful not to damage sensor edge and sensor rotor teeth. When removing the front wheel hub or final drive assemblies, first remove the ABS wheel sensor from the assembly. Failure to do so may result in damage to the sensor wires making the sensor inoperative.

WHEEL SENSORS

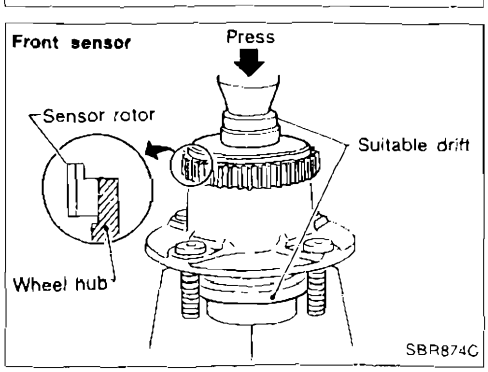




SENSOR ROTOR

Removal

1. Remove the front wheel hub or final drive companion flange. Refer to FA and PD sections.
2. Remove the sensor rotor using suitable puller, drift and bearing replacer.

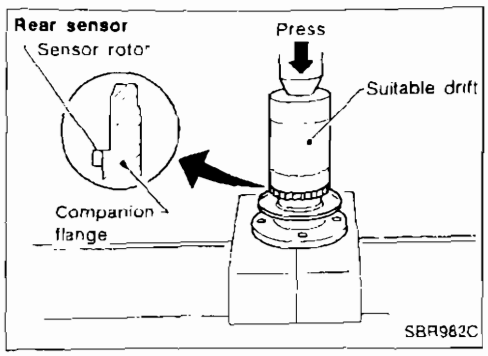


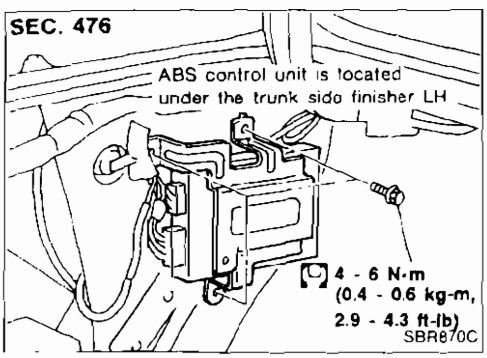
Installation

Install the sensor rotor using suitable drift and press.

- Always replace sensor rotor with new one.
- Pay attention to the direction of front sensor rotor as show in figure.

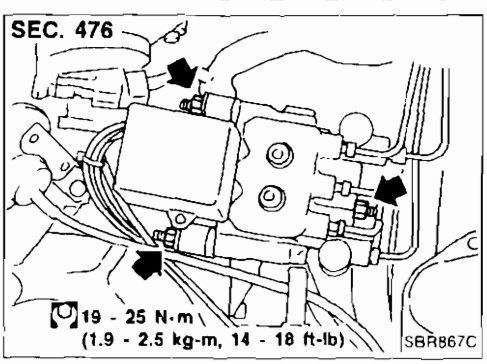
Removal and Installation (Cont'd)





CONTROL UNIT

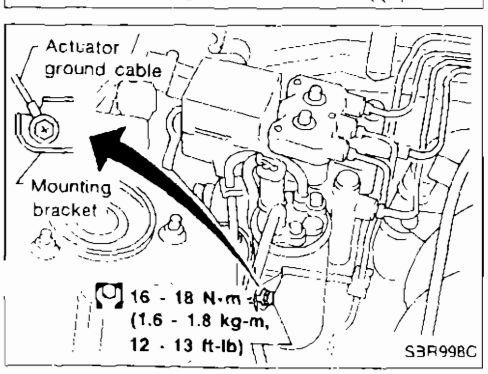
Location: Under trunk side finisher LH.



ACTUATOR

Removal

1. Disconnect battery cable.
2. Drain brake fluid. Refer to "Changing Brake Fluid" (BR-5).
3. Apply different colored paint to each pipe connector and actuator to prevent incorrect connection.
4. Disconnect connector, brake pipes and remove fixing nuts and actuator ground cable.



Installation

CAUTION:

After installation, refill brake fluid. Then bleed air. Refer to "Bleeding Brake System" (BR-5).

1. Tighten actuator ground cable.

Place ground cable at a notch of mounting bracket.

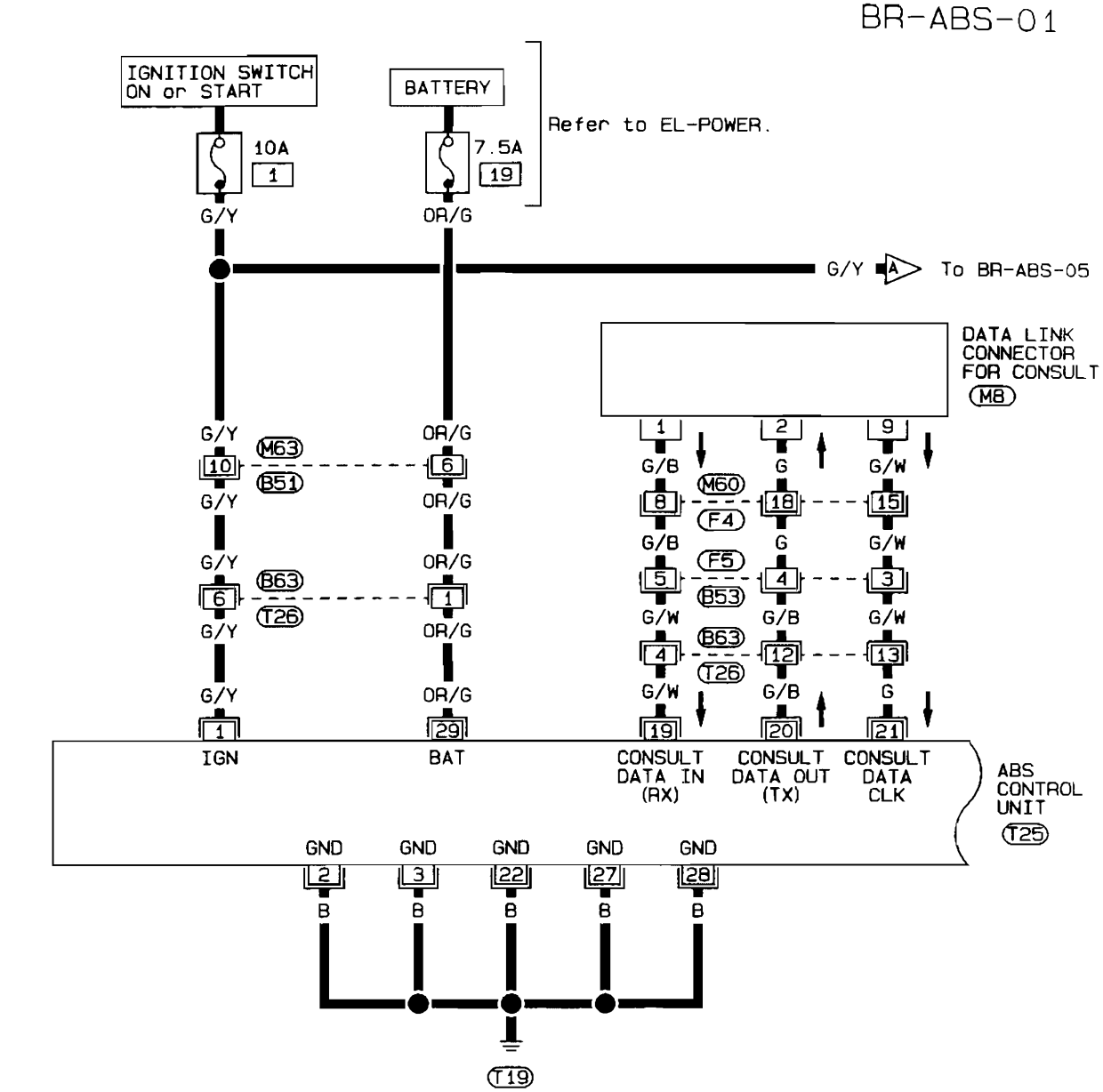
2. Connect brake pipes temporarily.
3. Tighten fixing nuts.
4. Tighten brake pipes.
5. Fix actuator harness clip on the mounting bracket.
6. Connect connector and battery cable.

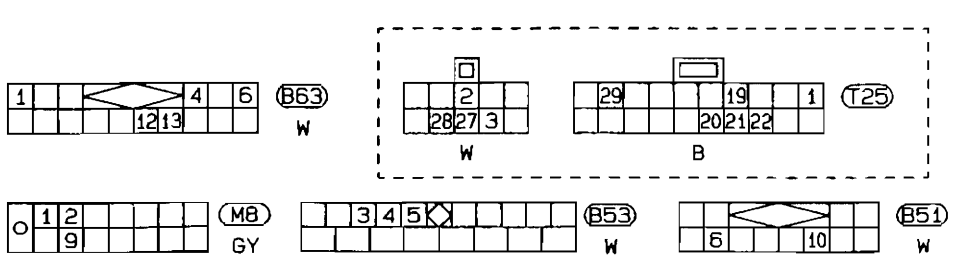
ACTUATOR RELAYS

1. Disconnect battery cable.
2. Remove actuator relay cover.
3. Pull out relays.

Wiring Diagram — ABS —

LHD MODELS





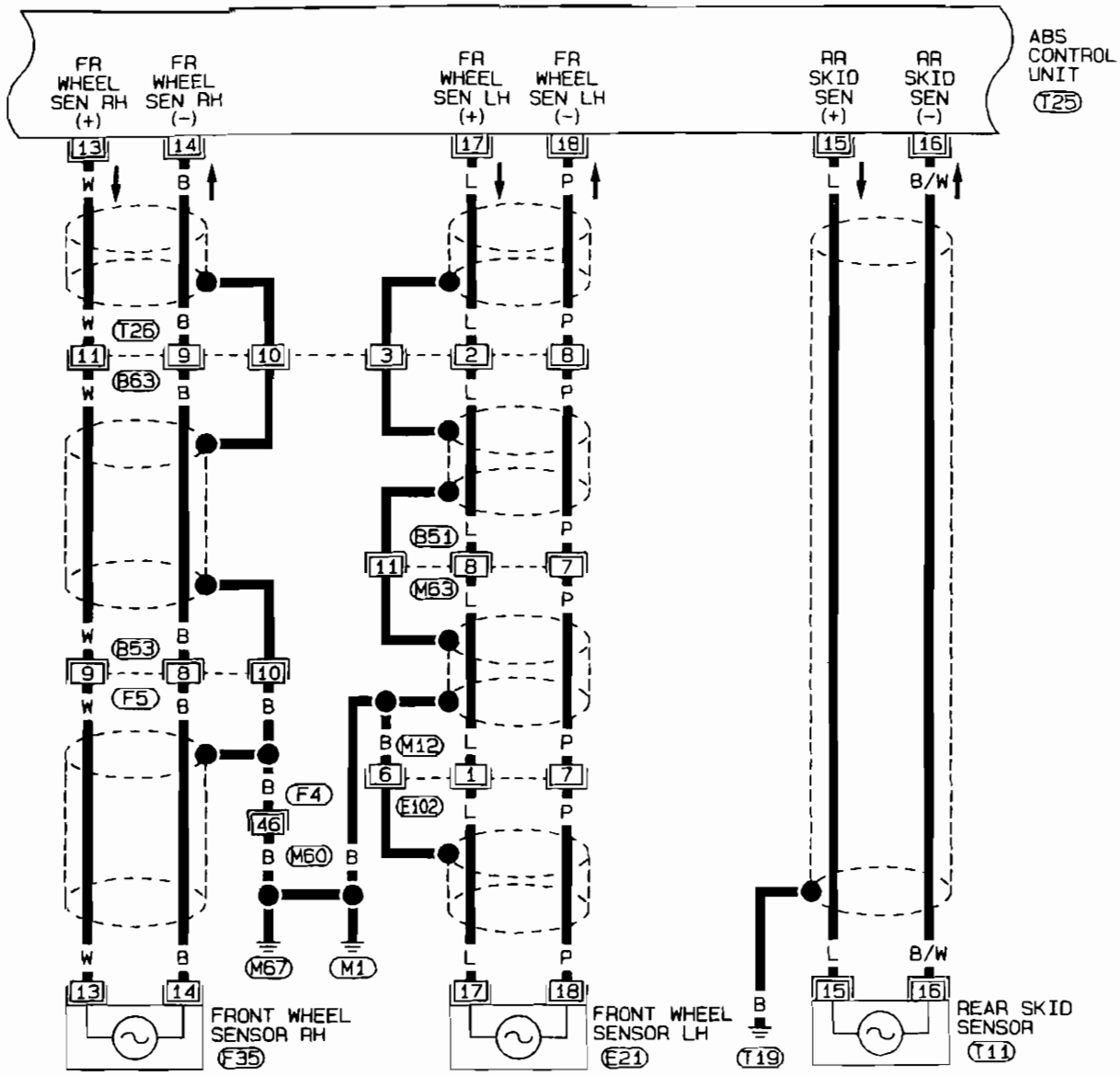
Refer to last page (Foldout page).
M60, F4

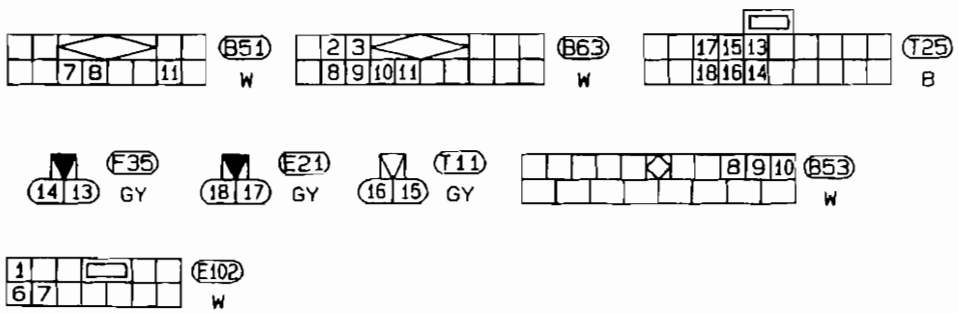
SBR001D

BR

Wiring Diagram — ABS — (Cont'd)

BR-ABS-02





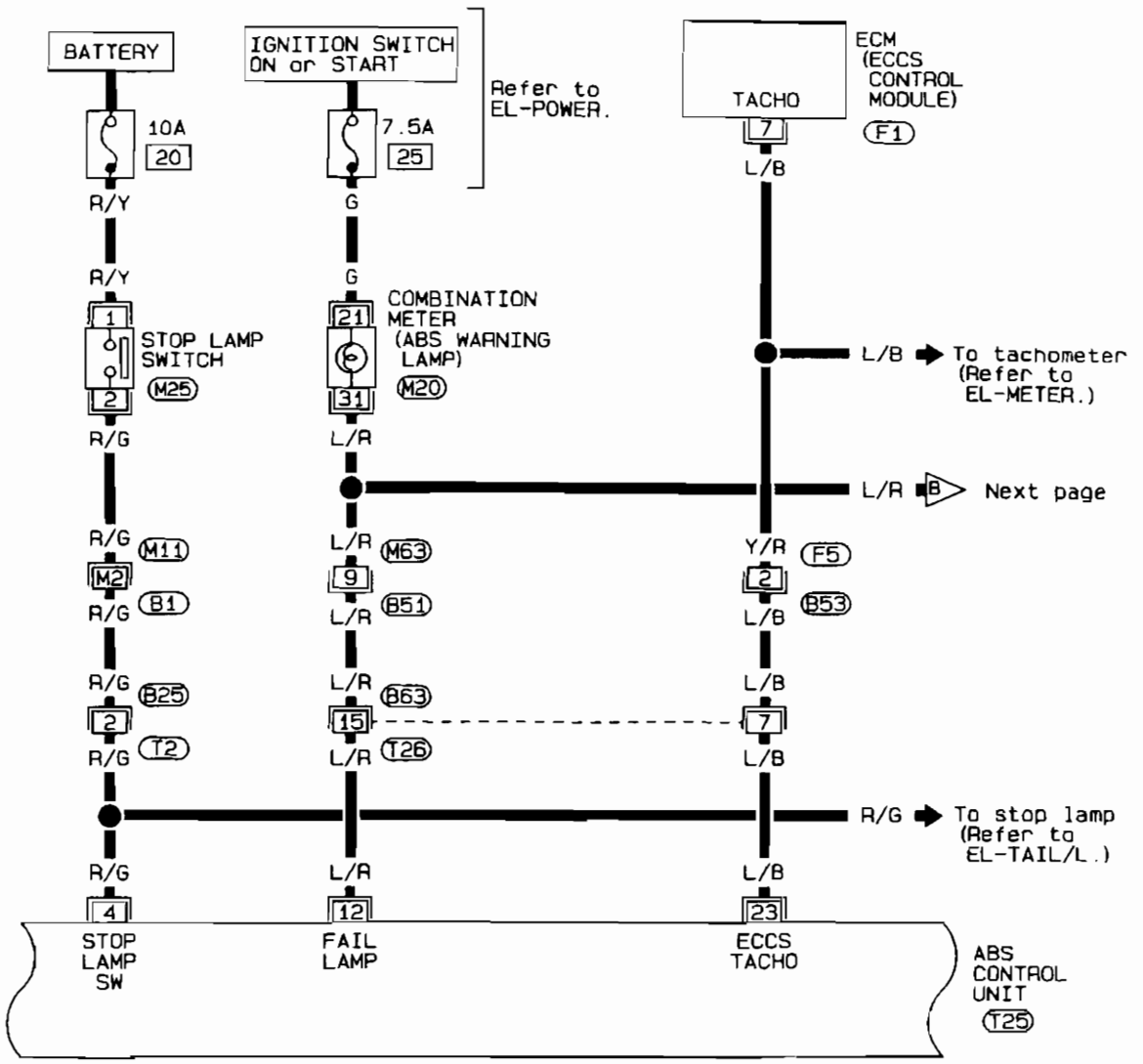
Refer to last page (Foldout page).

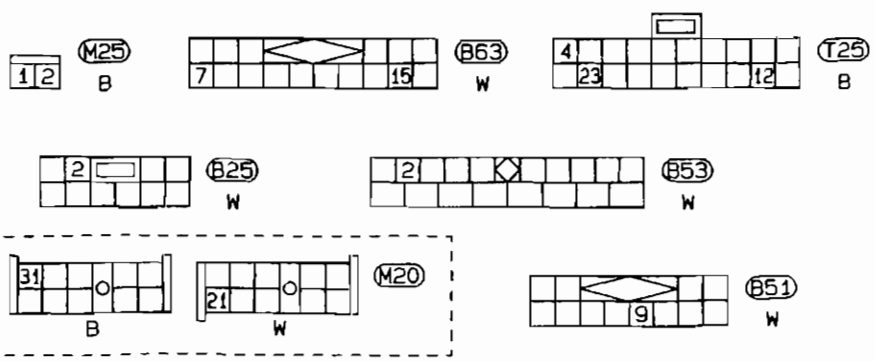
M60, F4

SBR002D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-03





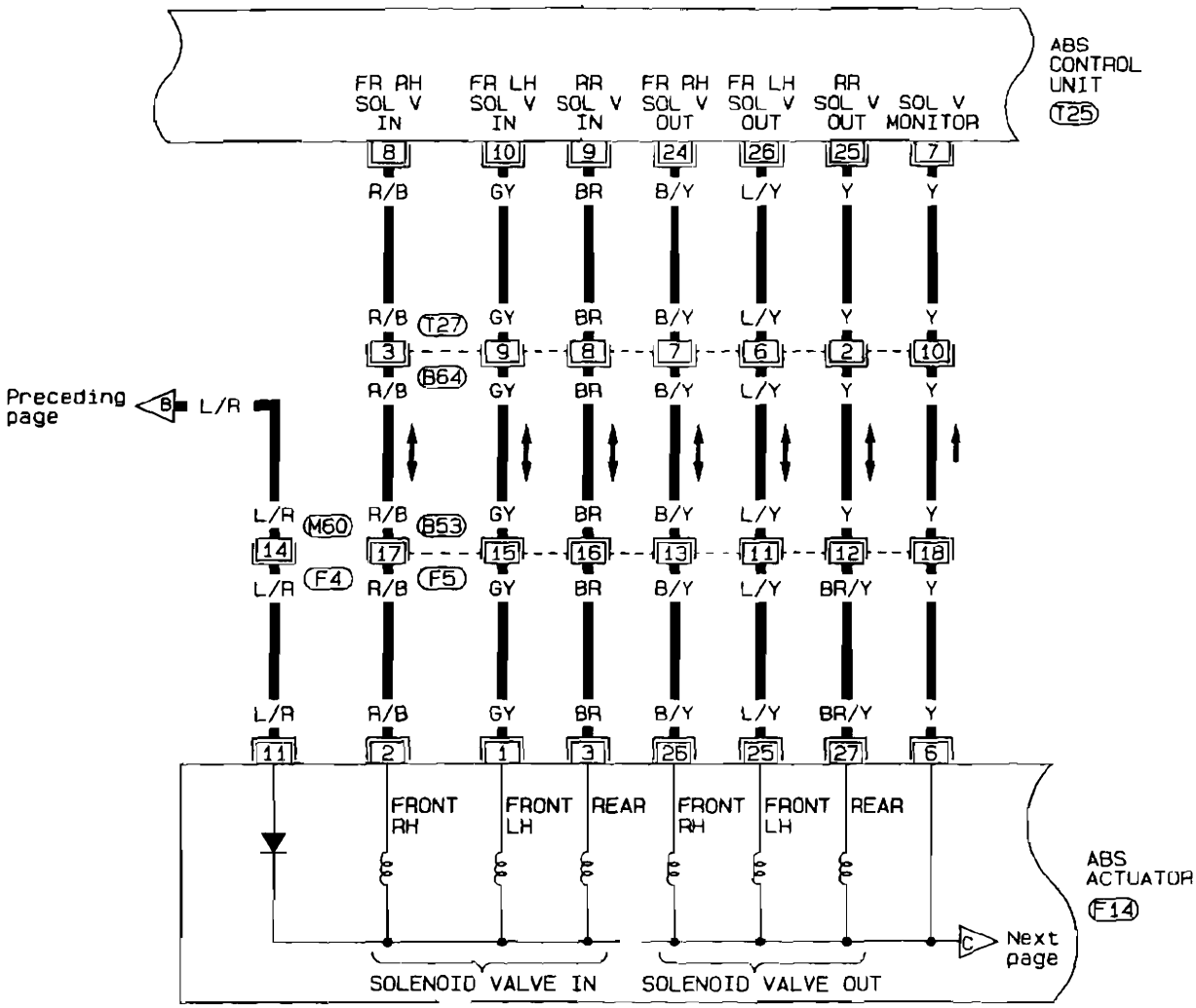
Refer to last page (Foldout page).

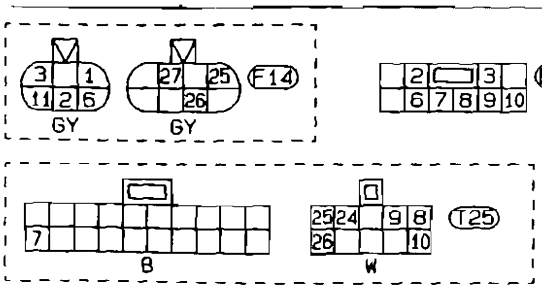
M11, B1, F1

SBR003D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-04



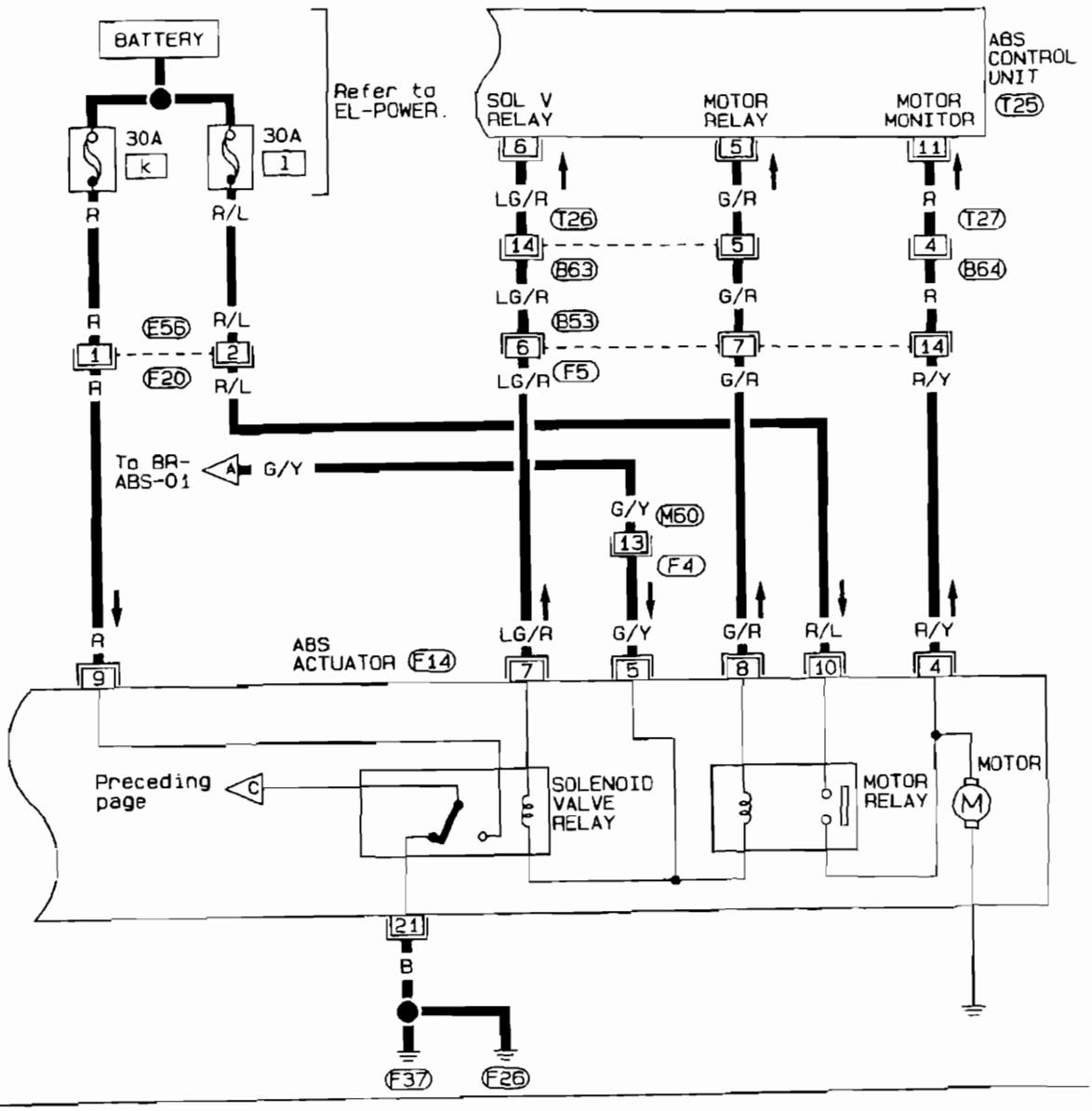


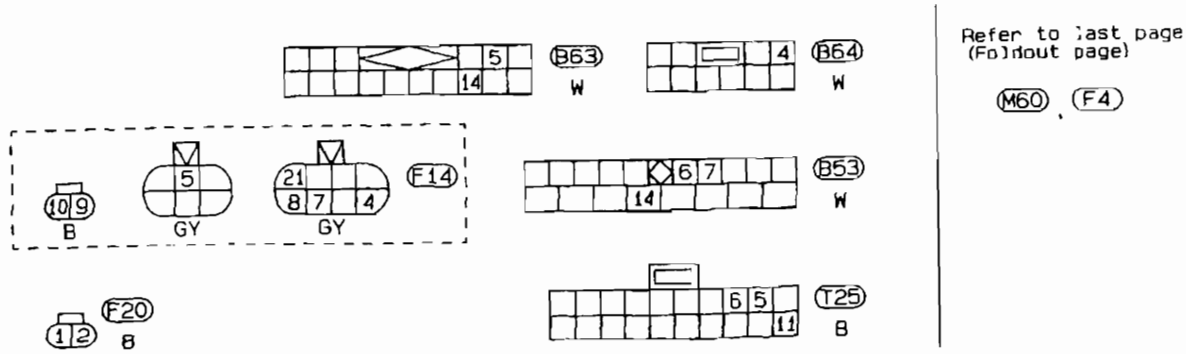
Refer to last page (Foldout page).
M60, F4

SBR004D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-05





Refer to last page (Foldout page)
M60, F4

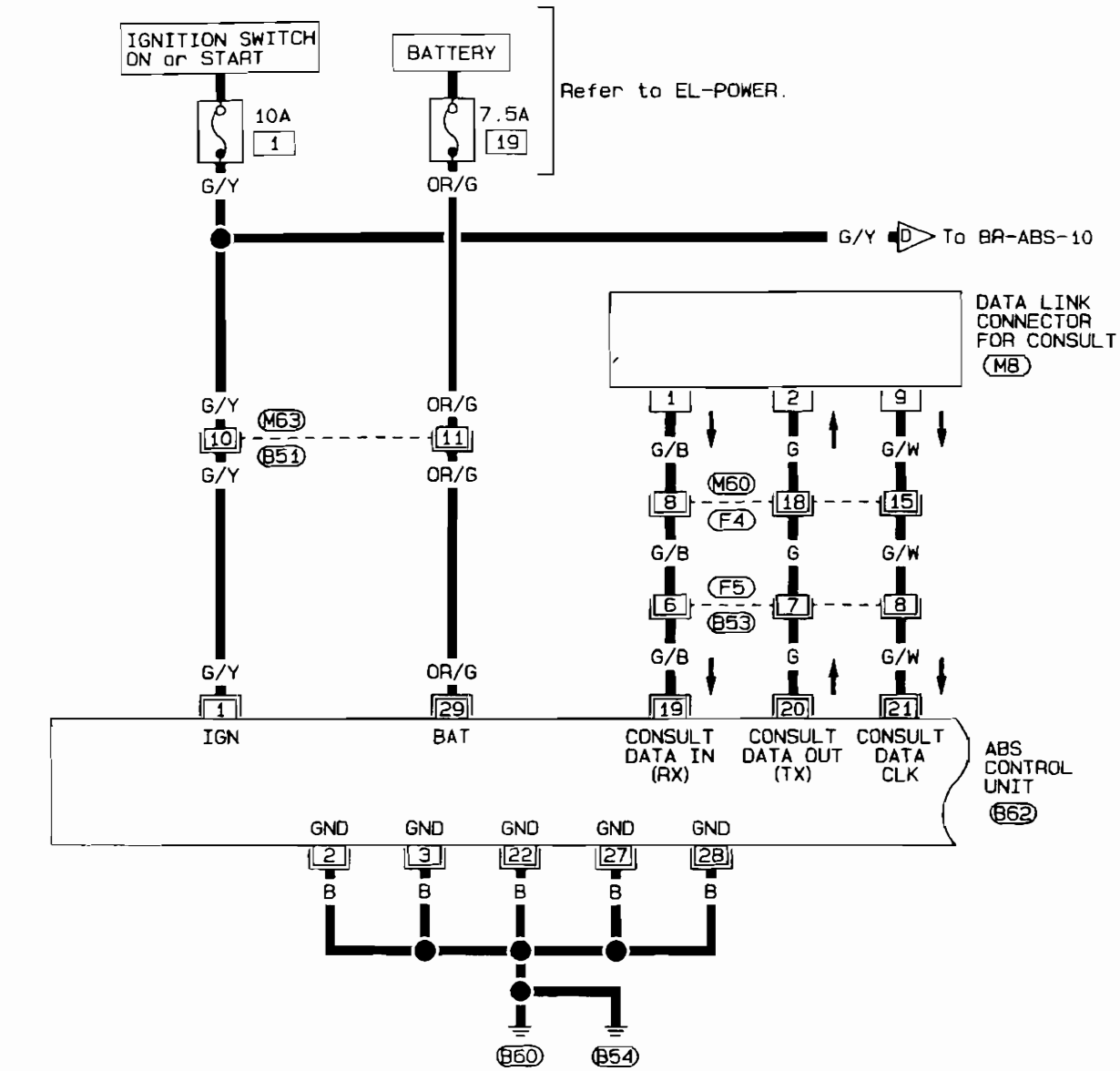
SBR005D

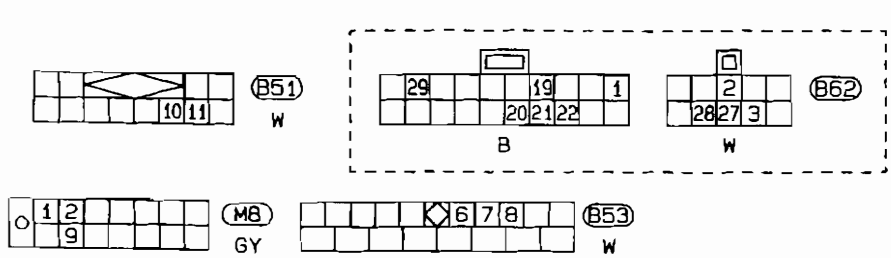
BR

Wiring Diagram — ABS — (Cont'd)

RHD MODELS

BR-ABS-06



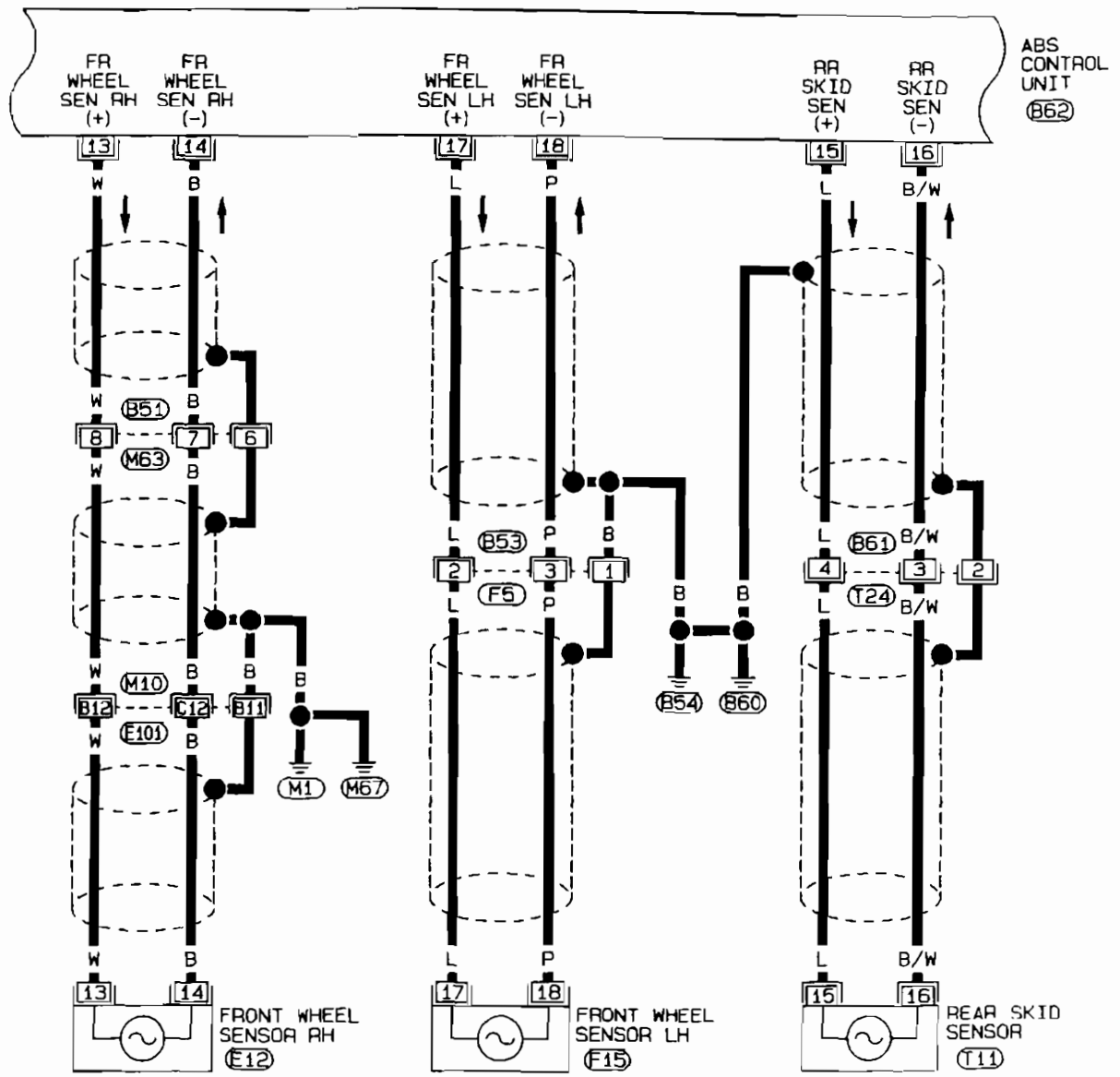


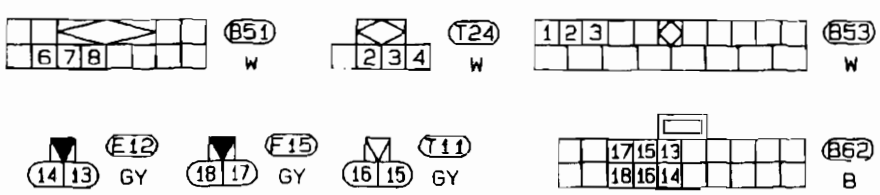
Refer to last page (Foldout page).
M60, F4

SBR006D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-07





Refer to last page (Foldout page).

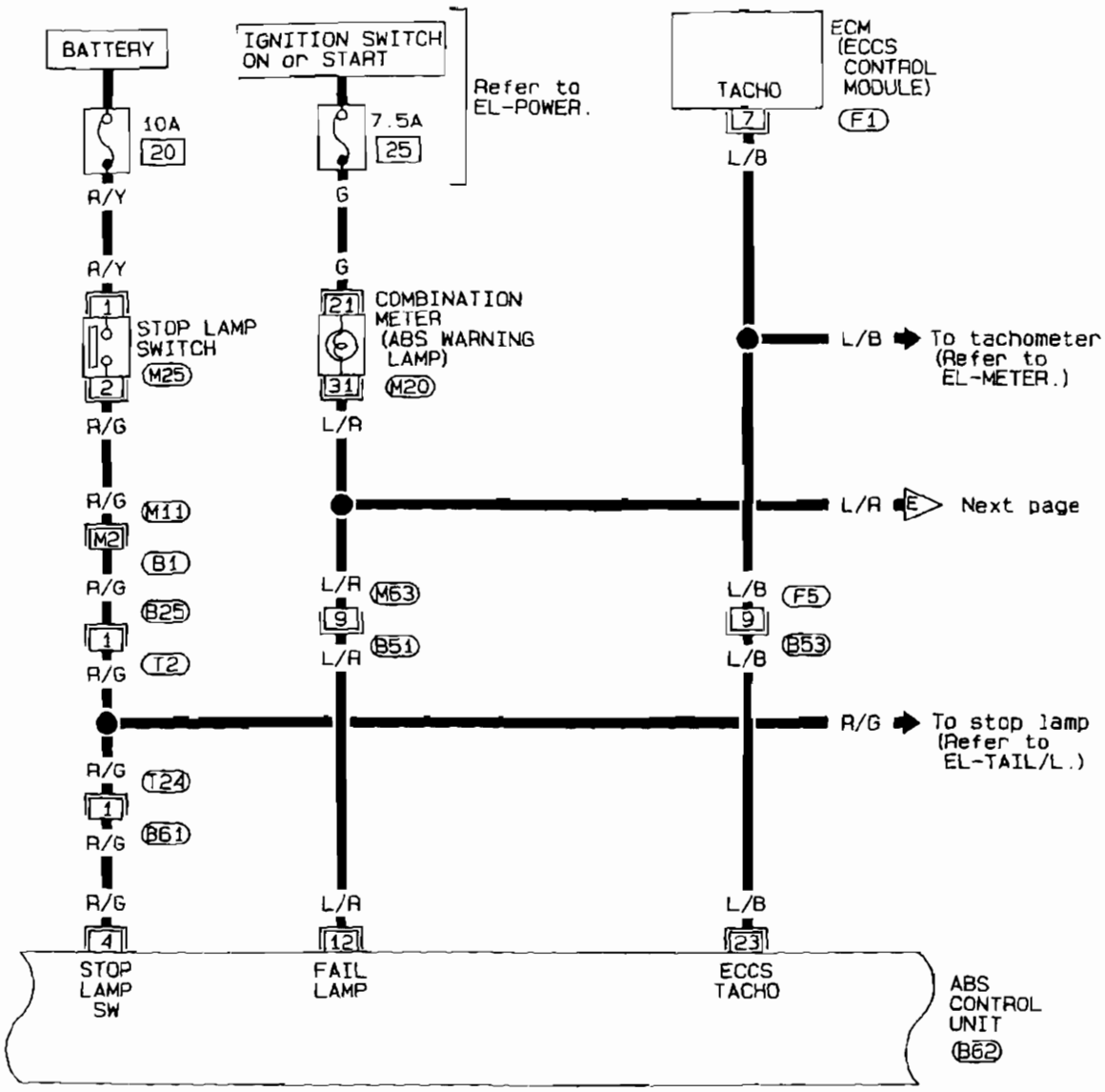
M10, E101

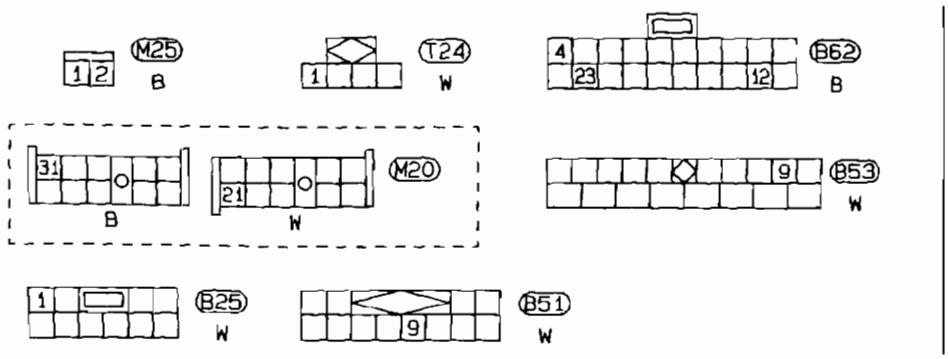
SBR007D

BR

Wiring Diagram — ABS — (Cont'd)

BR-ABS-08





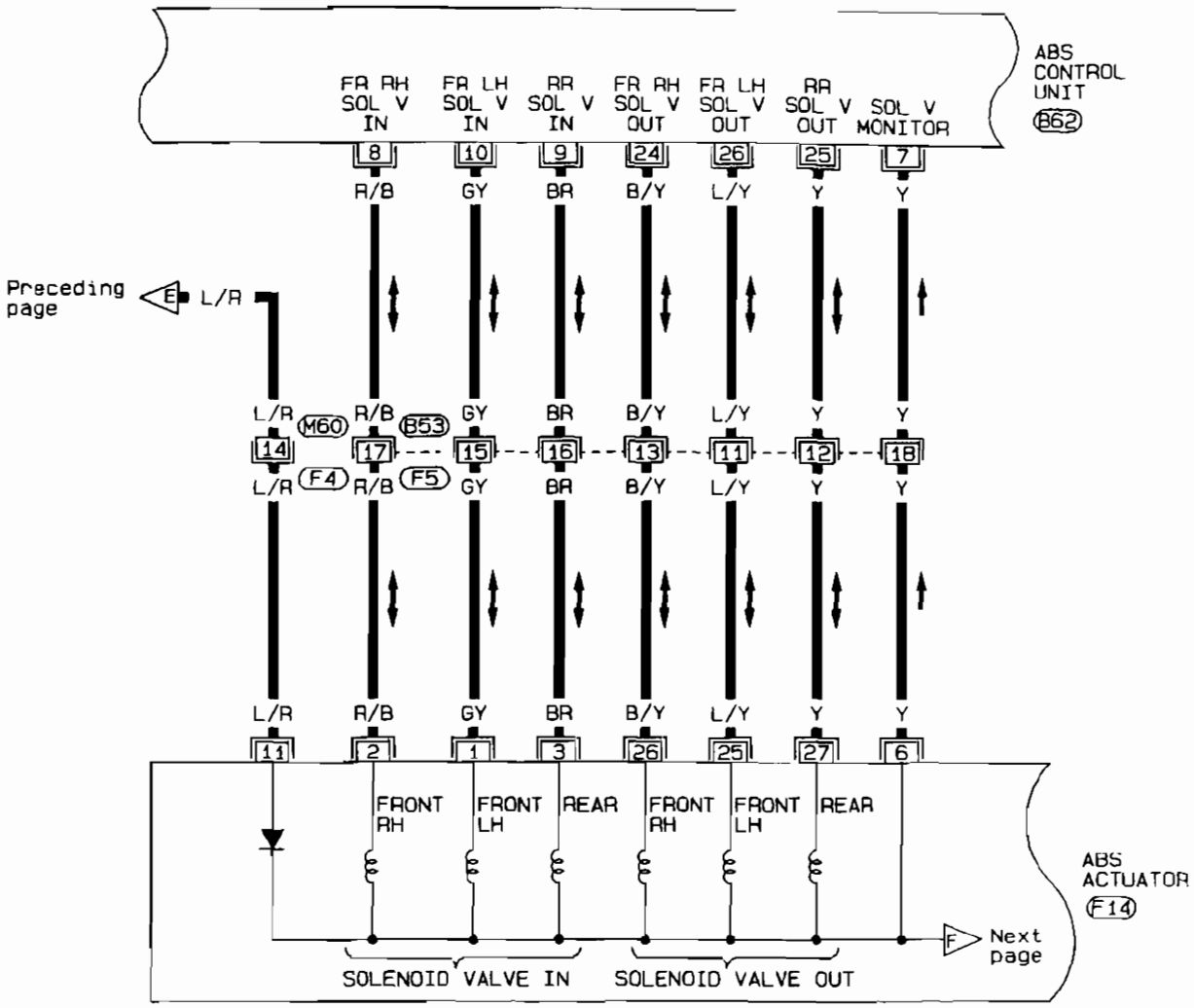
Refer to last page (Foldout page).

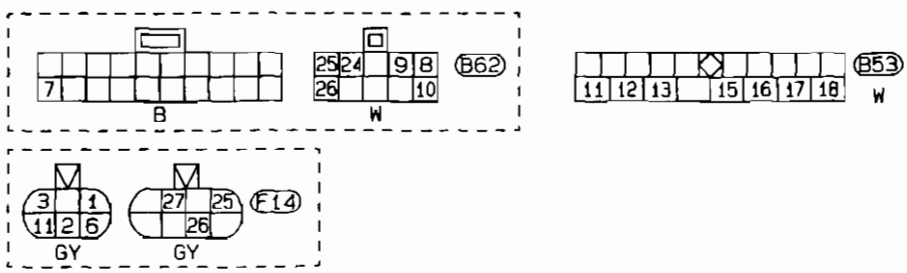
M11 B1 F1

SBR008D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-09





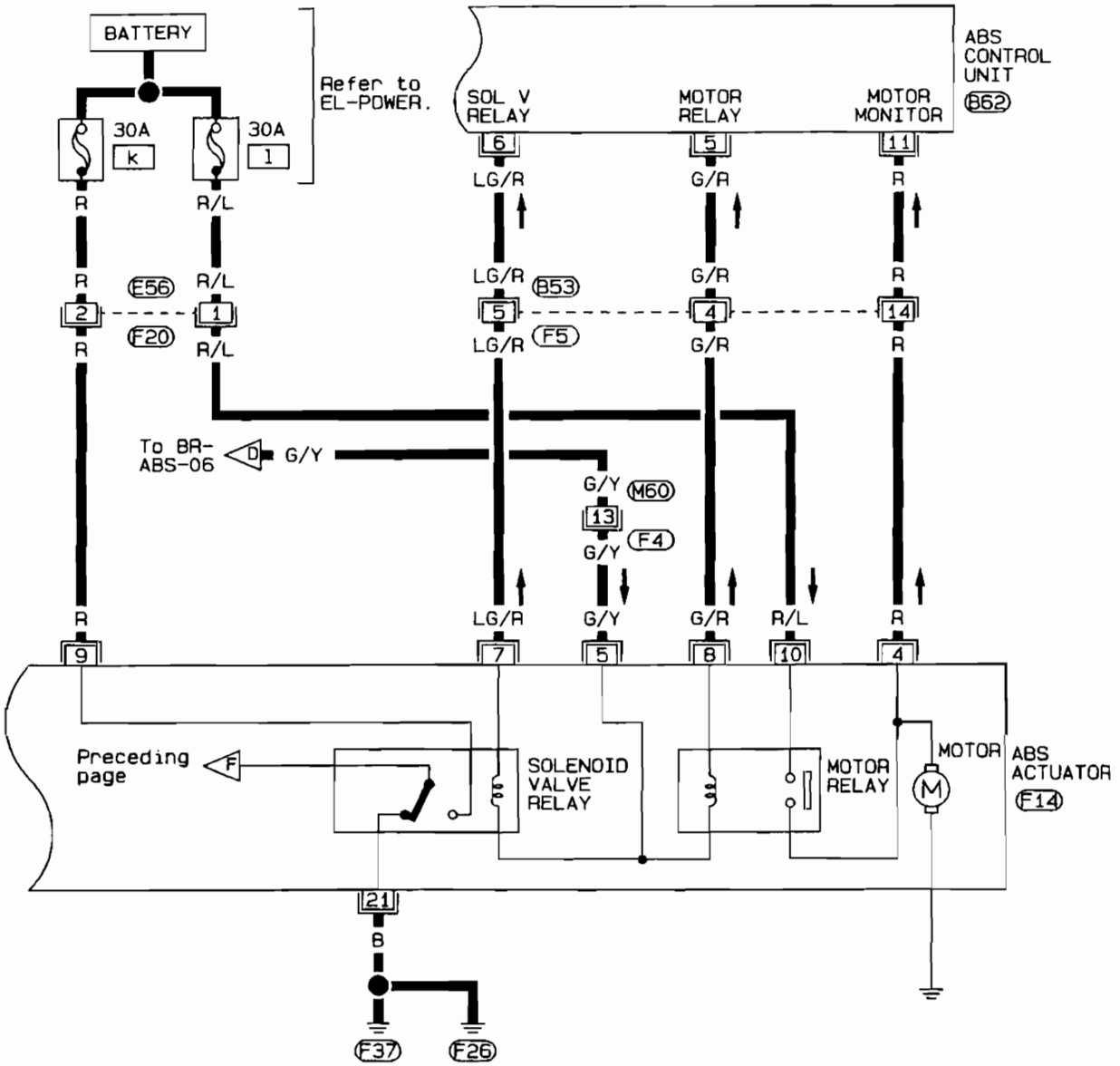
Refer to last page (Foldout page).

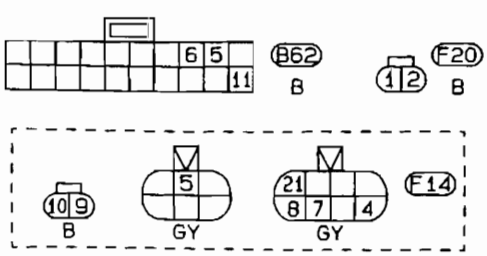
M60, F4

SBR009D

Wiring Diagram — ABS — (Cont'd)

BR-ABS-10



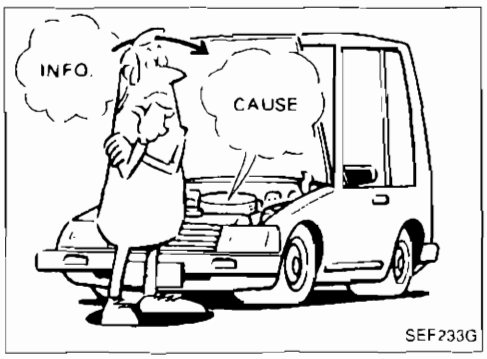


Refer to last page (Foldout page).

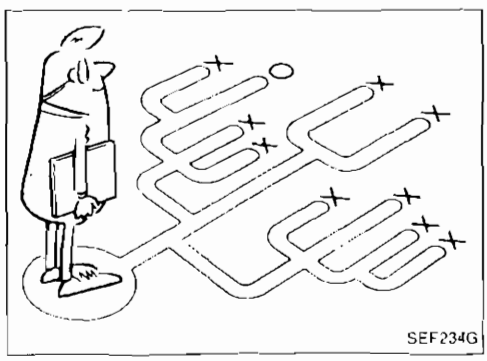
M60, F4

SBR010D

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. It is also important to check for conventional problems: such as air leaks in the booster or lines, lack of brake fluid, or other problems with the brake system.

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

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

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a 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.

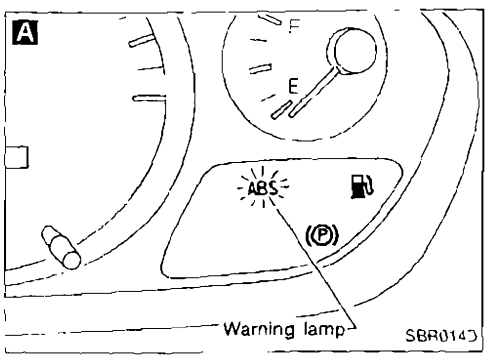
Self-diagnosis

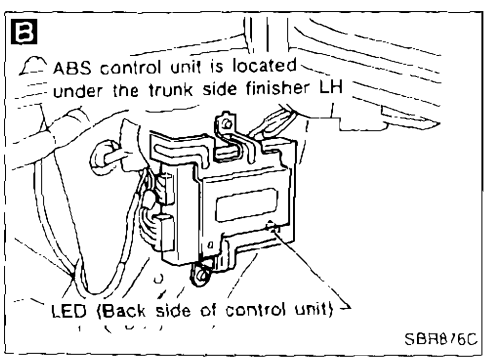
FUNCTION

- When a problem occurs in the ABS, the warning lamp on the instrument panel comes on.
- A maximum of three malfunctions are stored in the memory of the ABS control unit.

Erase the self-diagnosis results stored in the control unit after malfunctions are repaired (See next page).

- The self-diagnosis results are identified by Consult or LED on the control unit





SELF-DIAGNOSIS PROCEDURE

Start engine.
Drive vehicle over 15 km/h (9 MPH) for at least one minute.

↓

A

Stop vehicle with engine running.
Make sure that the ABS warning lamp activates.

↓

B

The LED on the ABS control unit flashes to indicate the malfunction code No

↓

Verify the location of the malfunction with the malfunction code chart
Then make necessary repairs following the diagnostic procedures

↓

After the malfunctions are repaired, erase the self-diagnostic results stored in the control unit
Disconnect connectors for ABS control unit or the battery negative terminal for at least one minute.

↓

Check warning lamp for deactivation after driving vehicle over 15 km/h (9 MPH) for at least one minute

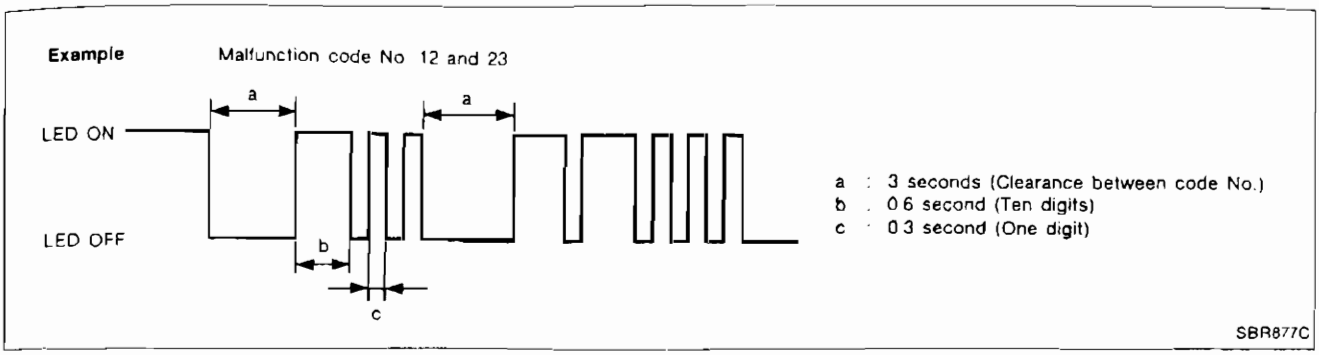
↓

Test the ABS in a safe area to verify that it functions properly

Self-diagnosis (Cont'd)

HOW TO READ SELF-DIAGNOSTIC RESULTS (Malfunction codes)

- Determine the code No. by counting the number of times the LED flashes on and off
- The malfunction code chart is given on the next page.



HOW TO ERASE SELF-DIAGNOSTIC RESULTS (Malfunction codes)

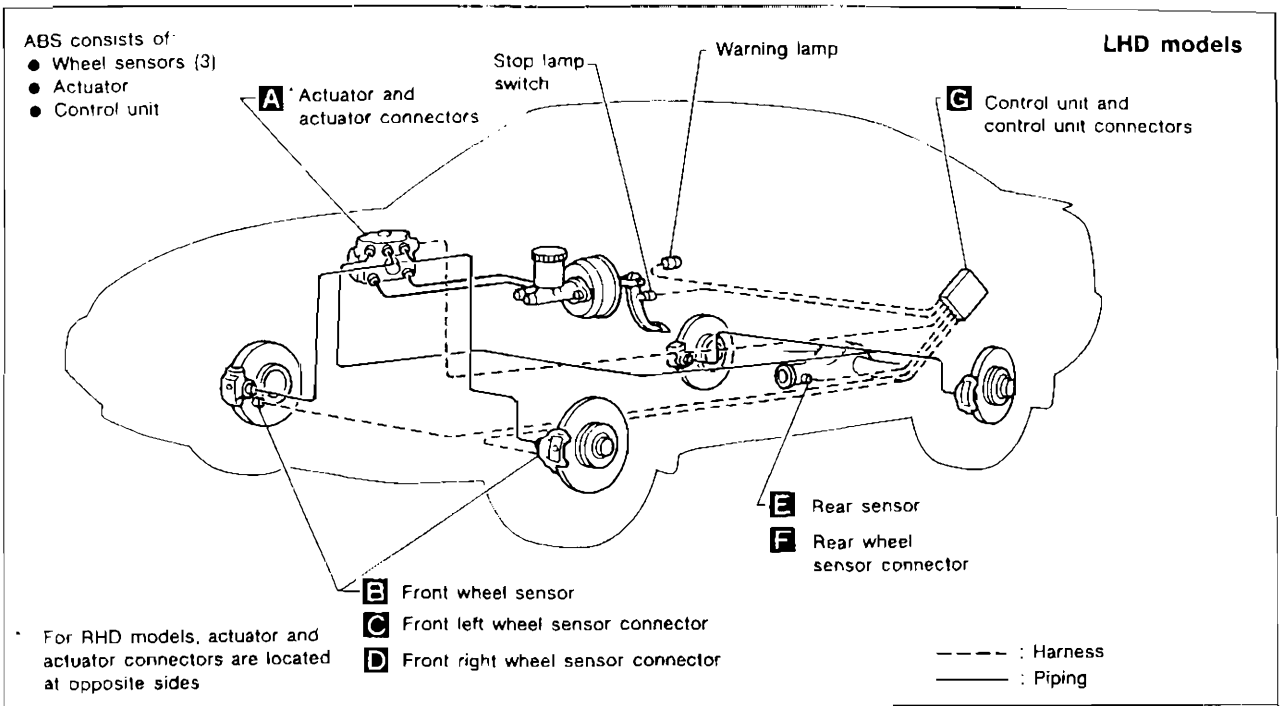
- Disconnect ABS control unit connectors or battery negative terminal for at least one minute.

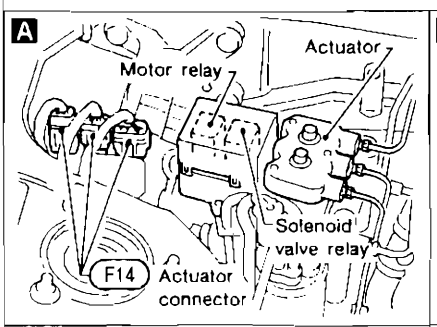
Self-diagnosis (Cont'd)

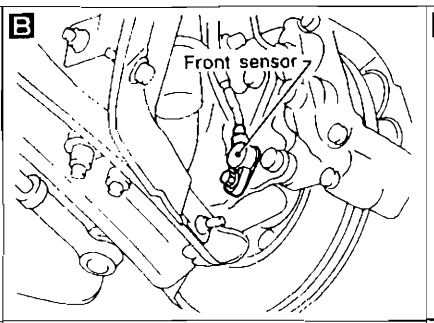
MALFUNCTION CODE/SYMPTOM CHART

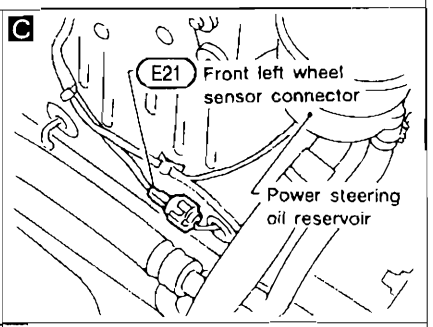
Code No. (No. of LED flashes)	Malfunctioning part and circuit	Diagnostic procedure
01	Front right sensor (open-circuit)	4
02	Front left sensor (open-circuit)	4
03	Rear sensor (open-circuit)	4
05	Front right sensor (short-circuit)	4
06	Front left sensor (short-circuit)	4
07	Rear sensor (short-circuit)	4
11	Actuator front right inlet solenoid valve (open-circuit)	3
12	Actuator front left inlet solenoid valve (open-circuit)	3
13	Actuator rear inlet solenoid valve (open-circuit)	3
15	Actuator front right outlet solenoid valve (open-circuit)	3
16	Actuator front left outlet solenoid valve (open-circuit)	3
17	Actuator rear outlet solenoid valve (open-circuit)	3
21	Actuator front right inlet solenoid valve (short-circuit)	3
22	Actuator front left inlet solenoid valve (short-circuit)	3
23	Actuator rear inlet solenoid valve (short-circuit)	3
25	Actuator front right outlet solenoid valve (short-circuit)	3
26	Actuator front left outlet solenoid valve (short-circuit)	3
27	Actuator rear outlet solenoid valve (short-circuit)	3
41	Solenoid valve relay circuit (unable to turn off)	6
42	Solenoid valve relay circuit (unable to turn on)	6
43	Actuator motor or motor relay (unable to turn off)	5
44	Actuator motor or motor relay (unable to turn on)	5
47	Power supply (High voltage)	7
48	Power supply (Low voltage)	7
45, 46, 77 LED deactivation or continuous activation	Control unit Ground circuit	2
Warning lamp does not come on when ignition switch is turned on.	Fuse, warning lamp bulb or warning lamp circuit Control unit power supply circuit	1
Pedal vibration and noise	—	9
Long stopping distance	—	10
Unexpected pedal action	—	11
ABS does not work	—	12
ABS works frequently.	—	13

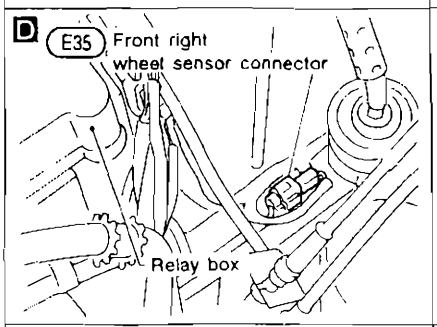
Component Parts and Harness Connector Location

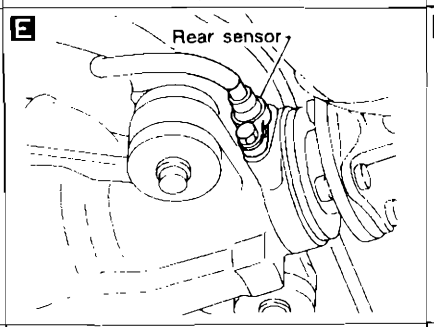


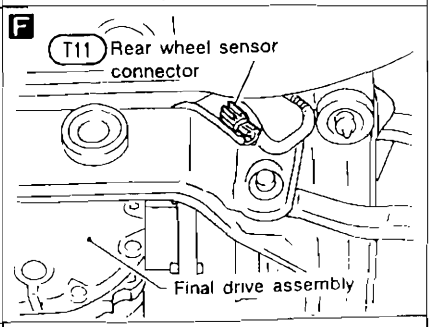


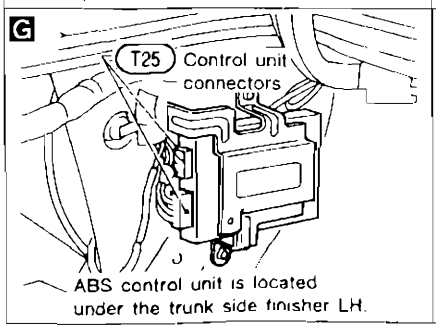








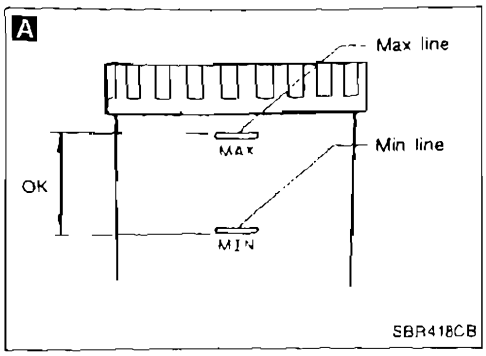




SBR011D

Preliminary Check

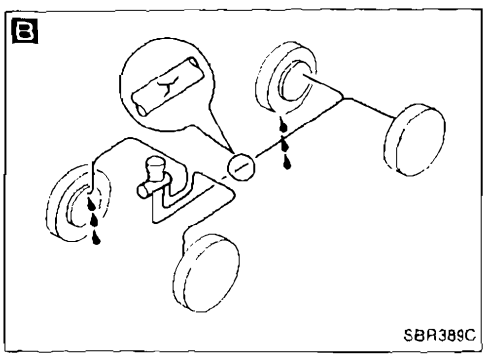
A



Check brake fluid level in reservoir tank

Low fluid level may indicate brake pad wear or leakage from brake line

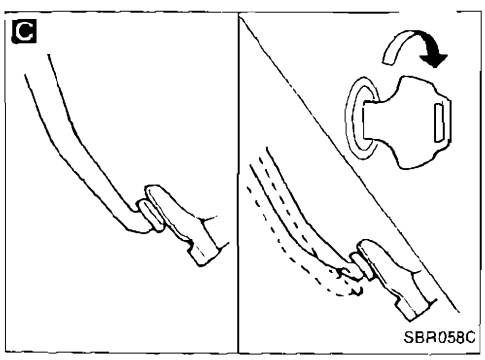
B



Check brake line for leakage. — NG → Repair

OK

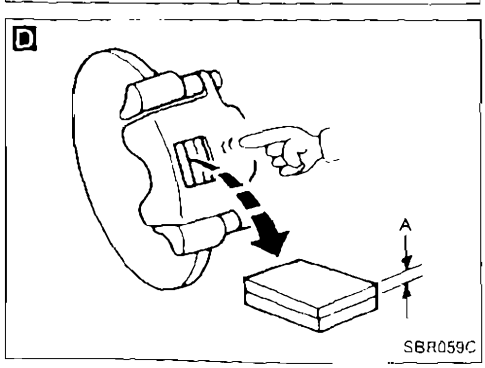
C



Check brake booster for operation and air tightness. Refer to (BR-10). — NG → Replace.

OK

D



Check brake pads and rotor. Refer to (BR-12, 16) — NG → Replace

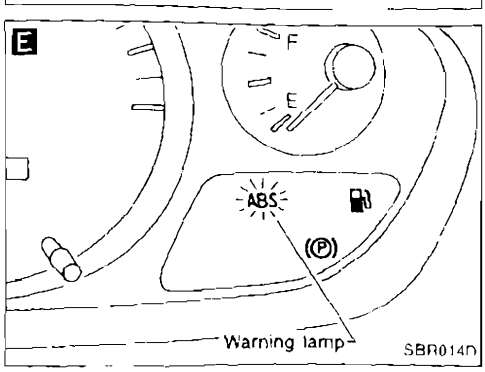
OK

A

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

OK

E



Check warning lamp activation. When ignition switch is turned on, warning lamp turns on. — NG → Check fuse, warning lamp bulb and warning lamp circuit

OK

Check warning lamp for deactivation after engine is started. — NG → Go to Self-diagnosis (BR-40)

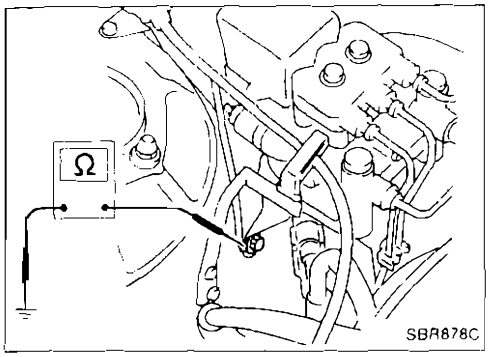
OK

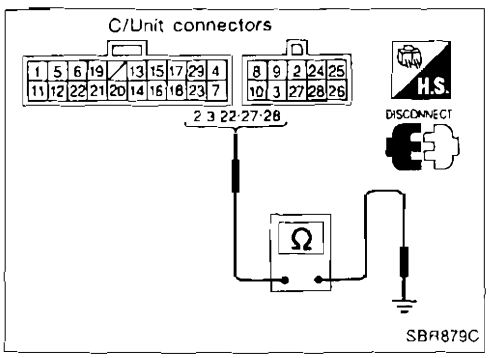
Drive vehicle at speeds over 15 km/h (9 MPH) for at least one minute.

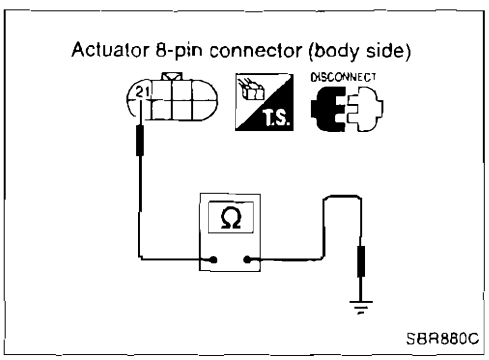
Ensure warning lamp remains off while driving. — NG → Go to Self-diagnosis (BR-40)

OK

END







Ground Circuit Check

ACTUATOR MOTOR GROUND

Actuator motor ground is secured with actuator mounting bracket bolt.

- Check resistance between actuator motor ground terminal and body ground.
  Resistance: approximately 0Ω

CONTROL UNIT GROUND

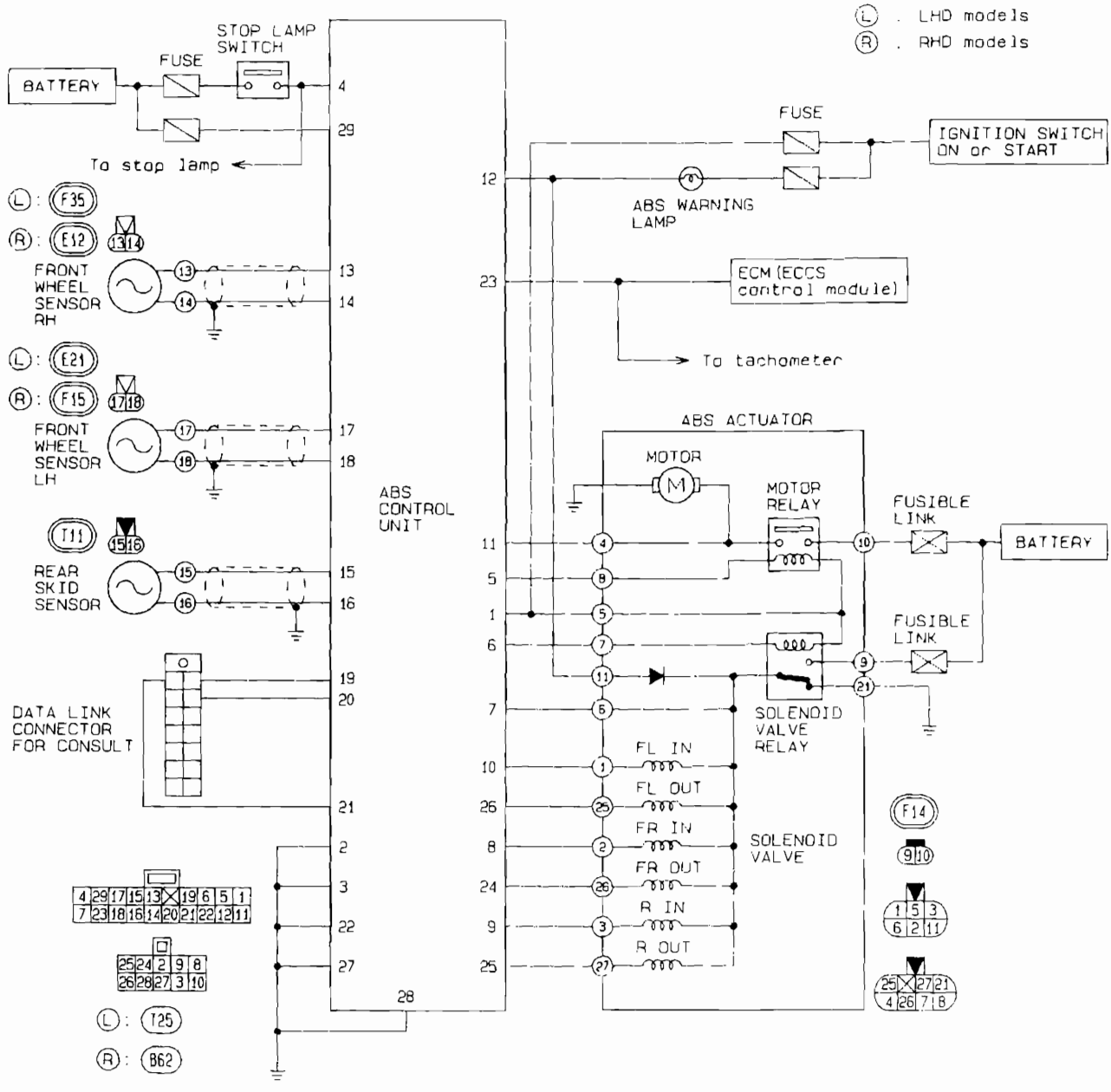
- Check resistance between control unit connector terminals and ground.
  Resistance: approximately 0Ω

ACTUATOR GROUND

- Check resistance between actuator harness 8-pin connector (body side) terminal (21) and ground.
  Resistance: approximately 0Ω

BR

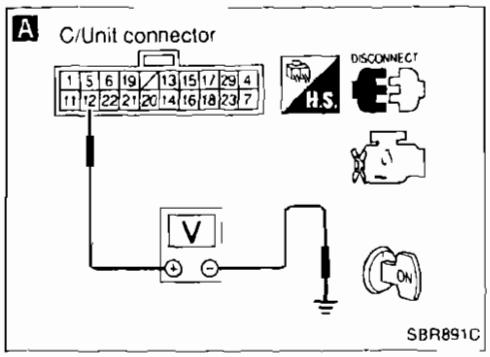
Circuit Diagram for Quick Pinpoint Check

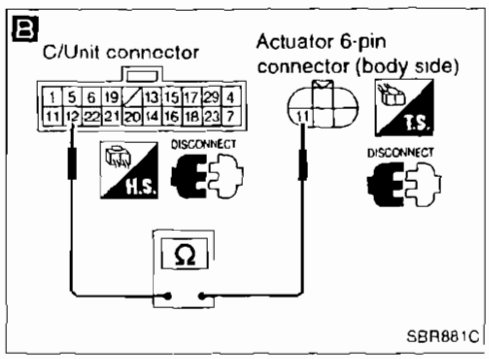


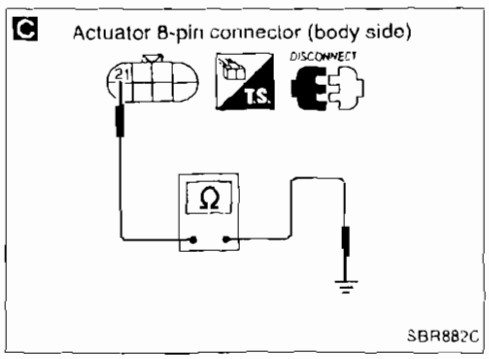
SBR999C

Diagnostic Procedure 1 (Not self-diagnostic item)

Warning lamp does not work when ignition switch is turned ON.







WARNING LAMP CIRCUIT CHECK

Check 7.5A fuse [25] for warning lamp. For fuse layout, refer to POWER SUPPLY ROUTING in EL section.

NG → Replace fuse

OK ↓

A

- Install 7.5A fuse
- Disconnect connectors from control unit and actuator.
- Check voltage between control unit connector terminal ⑫ and ground after turning ignition switch "ON".

Battery voltage should exist after turning ignition switch "ON".

NG → Check warning lamp bulb

NG → Replace bulb.

OK → Repair harness and connectors between battery and control unit connector terminal ⑫ (including combination meter)

OK ↓

B

- Turn ignition switch "OFF"
- Disconnect actuator 6-pin connector.
- Check continuity between control unit connector terminal ⑫ and actuator 6-pin connector (body side) terminal ⑪.

Continuity should exist.

NG → Repair harness and connectors between warning lamp (combination meter) and actuator 6-pin connector (body side) terminal ⑪.

OK ↓

C

- Disconnect actuator 8-pin connector.
- Check continuity between actuator harness 8-pin connector (body side) terminal ㉑ and body ground

Continuity should exist.

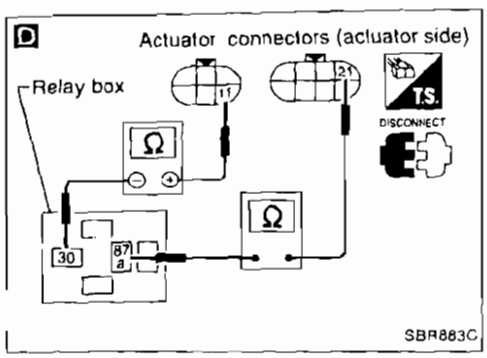
NG → Repair harness and connectors.

OK ↓

Ⓐ

(Go to next page)

Diagnostic Procedure 1 (Not self-diagnostic item) (Cont'd)



Ⓐ

D

- Disconnect solenoid valve relay
- Check continuity between actuator connector (actuator side) terminals and solenoid valve relay box terminals.

NG → Replace actuator assembly

Actuator	Relay box
11 ⊕	30 ⊖
21	87a

Continuity should exist.
Note: Pay attention to tester polarity*.

OK ↓

CHECK SOLENOID VALVE RELAY.

Refer to SOLENOID VALVE RELAY in Electrical Components Inspection (BR-65).

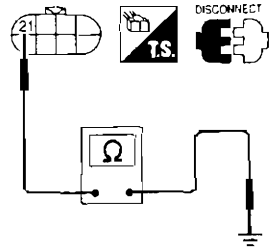
NG → Replace solenoid valve relay.

OK ↓

Go to D in Diagnostic Procedure 2.

*: **Specifications may vary depending on the type of tester. Before performing this inspection, refer to the instruction manual of the tester.**

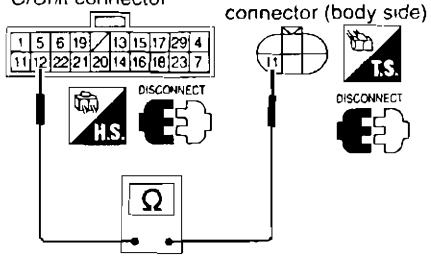
A Actuator 8-pin connector (body side)



SBR882C

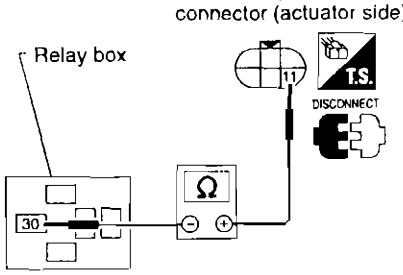
B C/Unit connector

Actuator 6-pin connector (body side)



SBR881C

C Actuator 6-pin connector (actuator side)



SBR884C

Diagnostic Procedure 2

CONTROL UNIT OR GROUND CIRCUIT

(Malfunction code No. 45, 46, 77, LED deactivation or continuous activation)

- Disconnect connectors from control unit and actuator. Check terminals for damage or connection. Then reconnect connectors.
- Carry out self-diagnosis again.

Does warning lamp activate again?

No → Inspection end

Yes ↓

SOLENOID VALVE RELAY CHECK

Refer to SOLENOID VALVE RELAY in Electrical Components Inspection (BR-65).

NG → Replace solenoid valve relay

OK ↓

A

SOLENOID VALVE RELAY GROUND CIRCUIT

- Disconnect actuator 8-pin connector.
- Check continuity between actuator 8-pin connector (body side) terminal ㉑ and body ground.

Continuity should exist.

NG → Repair harness and connectors

OK ↓

B

- Disconnect control unit connectors and actuator 6-pin connector.
- Check continuity between control unit connector terminal ⑫ and actuator 6-pin connector (body side) terminal ⑪.

Continuity should exist.

NG → Repair harness and connectors.

OK ↓

C

- Check continuity between actuator 6-pin connector (actuator side) terminal ⑪ and solenoid valve relay box terminal ㉚

Actuator	Relay box	Continuity
11 ⊕	30 ⊖	Yes
11 ⊖	30 ⊕	No

Note: Pay attention to tester polarity*.

NG → Replace actuator assembly.

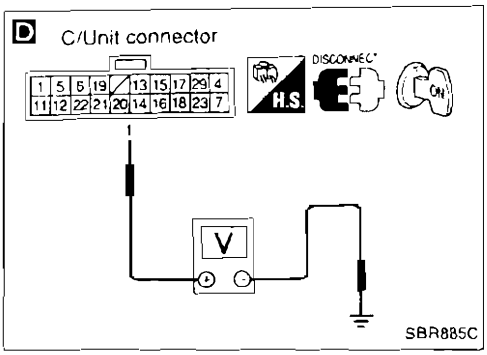
OK ↓

Ⓐ

(Go to next page.)

*: **Specifications may vary depending on the type of tester. Before performing this inspection, refer to the instruction manual of the tester.**

Diagnostic Procedure 2 (Cont'd)



Ⓐ

D

CONTROL UNIT POWER SUPPLY CIRCUIT

- Check voltage between control unit connector terminal ① and body ground after turning ignition switch "ON".
  Battery voltage should exist after turning ignition switch "ON".

NG → Check 10A fuse [1] for control unit. For fuse layout, refer to POWER SUPPLY ROUTING in EL section

NG → Replace fuse

OK → Repair harness and connectors.

OK

CONTROL UNIT GROUND CIRCUIT

Refer to CONTROL UNIT GROUND in Ground Circuit Check (BR-45).

NG → Repair harness and connectors.

OK

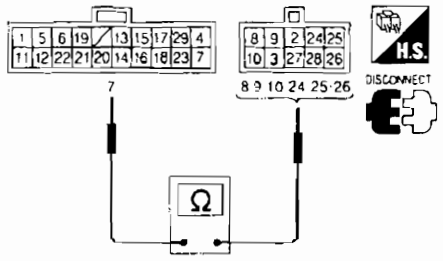
Go to Diagnostic Procedure 4 (BR-52).

OK

Replace ABS control unit

A

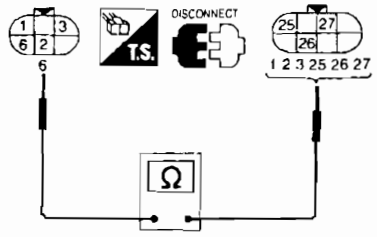
C/Unit connectors



SBR886C

B

Actuator connectors (actuator side)

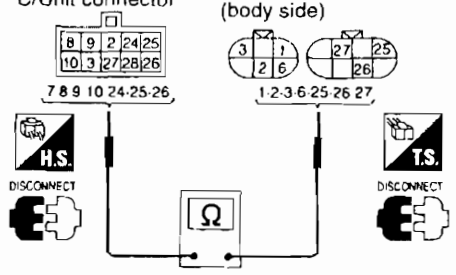


SBR887C

C

C/Unit connector

Actuator connectors (body side)



SBR888C

Diagnostic Procedure 3

ACTUATOR SOLENOID VALVE (Malfunction code No. 11 - 13, 15 - 17, 21 - 23, 25 - 27)

- Disconnect connectors from control unit and actuator. Check terminals for damage or loose connection. Then reconnect connectors.
- Carry out self-diagnosis again.

Does warning lamp activate again?

No → Inspection end

Yes ↓

A

ACTUATOR SOLENOID VALVE CHECK

OK → Replace control unit

- Disconnect control unit connectors.
- Check resistance between control unit connector terminals.

Code No. (LED flashes)	Terminals
11, 21	⑦ - ⑧
12, 22	⑦ - ⑩
13, 23	⑦ - ⑨
15, 25	⑦ - ㉔
16, 26	⑦ - ㉖
17, 27	⑦ - ㉕

Resistance: 3.7 - 8.0Ω

NG ↓

B

NG → Replace actuator

- Disconnect actuator connectors.
- Check resistance between actuator connector (actuator side) terminals.

Code No. (LED flashes)	Terminals
11, 21	⑤ - ②
12, 22	⑥ - ①
13, 23	⑤ - ③
15, 25	⑥ - ㉕
16, 26	⑤ - ㉕
17, 27	⑥ - ㉗

Resistance: 3.7 - 8.0Ω

OK ↓

C

NG → Repair harness and connector

- Check continuity between control unit connector terminals and actuator connector (body side) terminals.

Code No. (LED flashes)	Control unit	Actuator
11, 21	⑧	②
12, 22	⑩	①
13, 23	⑨	③
15, 25	㉔	㉕
16, 26	㉖	㉕
17, 27	㉕	㉗
42	⑦	⑥

Continuity should exist.

OK ↓

Ⓐ

(Go to next page)

BR

Diagnostic Procedure 3 (Cont'd)

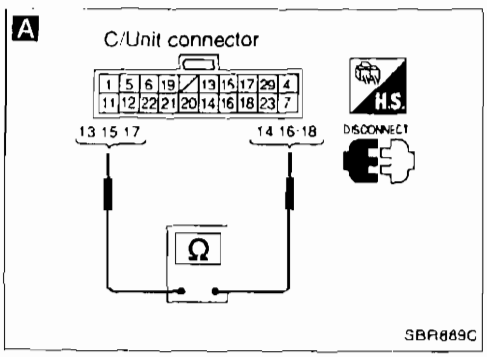
Ⓐ

- Carry out self-diagnosis again.
  Does the malfunction code No. indicate actuator solenoid valve?

Yes → Go to D in Diagnostic Procedure 2

No ↓

Go to applicable diagnostic procedure for malfunction code No



Diagnostic Procedure 4

WHEEL SENSOR OR ROTOR

(Malfunction code No. 01 - 03, 05 - 07)

- Disconnect connectors from control unit and wheel sensor of malfunction code No. Check terminals for damage or loose connection. Then reconnect connectors.
- Carry out self-diagnosis again.
  Does warning lamp activate again?

No → Inspection end

Yes ↓

A

WHEEL SENSOR ELECTRICAL CHECK → OK → Ⓐ (See next page.)

- Disconnect control unit connector.
- Check resistance between control unit connector terminals.
  Code No. 01 or 05 (Front RH wheel)
  Terminals ⑬ and ⑭
  Code No. 02 or 06 (Front LH wheel)
  Terminals ⑰ and ⑱
  Code No. 03 or 07 (Rear wheel)
  Terminals ⑮ and ⑯
  Resistance: 0.6 - 3.3 kΩ

Note: If the result is OK, check it again while moving sensor harness

NG ↓

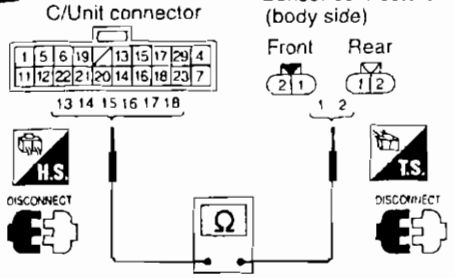
Ⓑ

(Go to next page.)

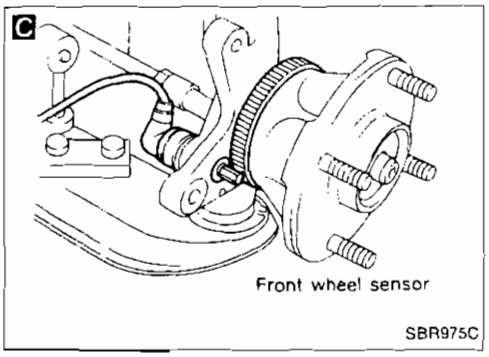
Note: Wheel position should be distinguished by code No. (LED flashes).

Diagnostic Procedure 4 (Cont'd)

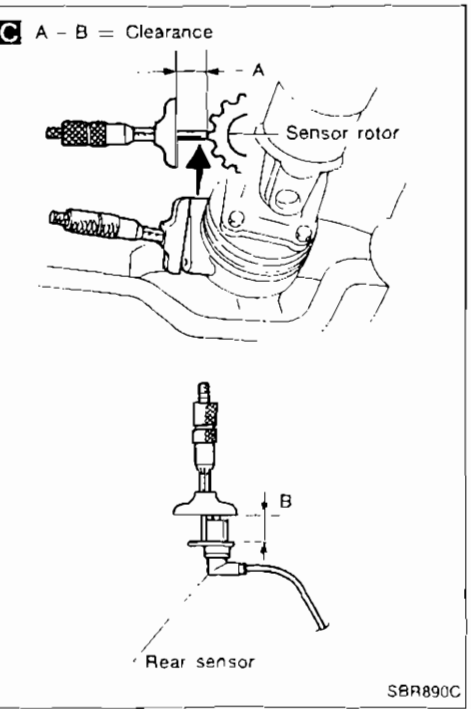
B



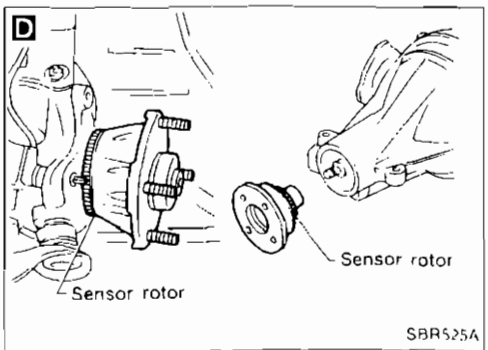
C



C A – B = Clearance



D



Ⓑ

B

- Disconnect wheel sensor connector
- Check continuity between control unit connector terminals and wheel sensor connector (body side) terminals

Code No (LED flashes)	Control unit	Wheel sensor
01, 05 (Front RH)	⑬	①
	⑭	②
02, 06 (Front LH)	⑰	①
	⑱	②
03, 07 (Rear)	⑮	②
	⑯	①

Continuity should exist.

OK → Note: CHECK WHEEL SENSOR
Refer to WHEEL SENSOR in Electrical Components Inspection (BR-65)

NG ↓

Note: Repair harness and connectors between control unit connector and wheel sensor connector.

Ⓐ

C Note: WHEEL SENSOR MECHANICAL CHECK

Check for any foreign materials and clearance between sensor and rotor.
Clearance:
Front
Make sure the sensor is installed of minimum clearance.
Rear
0.31 - 0.82 mm
(0.0122 - 0.0323 in)

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

OK ↓

D Note: Check sensor rotor for teeth damage

NG → Note: Replace sensor rotor

OK ↓

- Carry out self-diagnosis again.
Does the malfunction code No. (LED flashes) indicate wheel sensor?

Yes → Go to **D** in Diagnostic Procedure 2

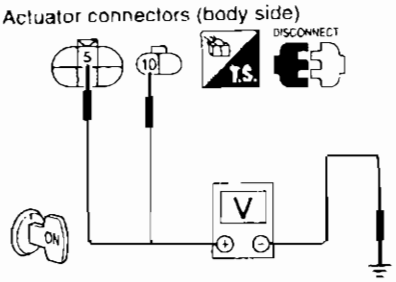
No ↓

Go to applicable diagnostic procedure for malfunction code No. (LED flashes)

Note: Wheel position should be distinguished by code No. (LED flashes).

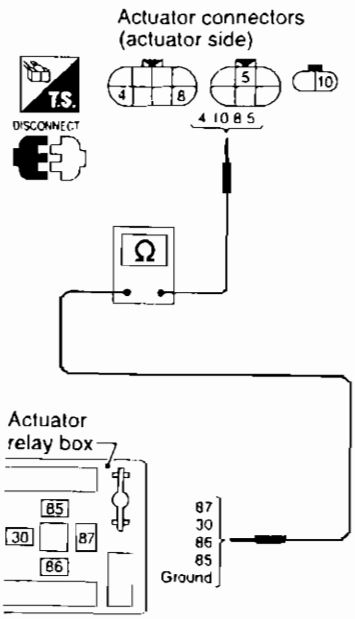
BR

A Actuator connectors (body side)



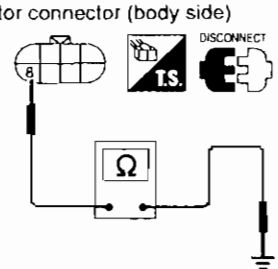
SBR892C

B



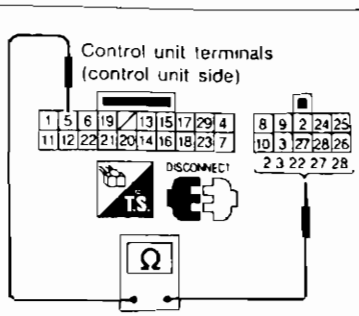
SBR893C

C Actuator connector (body side)



SBR900C

D



SBR901CA

Diagnostic Procedure 5

MOTOR RELAY OR MOTOR

(Malfunction code No. 43, 44)

MOTOR POWER SUPPLY CIRCUIT → NG → B (Skip page.)

- Check 30A fusible link [L] and 10A fuse [1] for actuator. For fusible link and fuse layout, refer to POWER SUPPLY ROUTING in EL section.

OK ↓

- Disconnect connectors from control unit and actuator. Check terminals for damage or loose connection. Then reconnect connectors.
- Carry out self-diagnosis again.

Does warning light activate again?

No → Inspection end

Yes ↓

A

- Disconnect actuator connectors.
- Check voltage between connector (body side) terminals and ground.

Terminals	Ignition switch
(5) - ground	ON position
(10) - ground	—

Battery voltage should exist.

NG → Repair harness and connectors between battery and actuator connector (body side) terminals.

OK ↓

B

MOTOR RELAY CIRCUIT → NG → Replace actuator assembly

- Remove motor relay.
- Disconnect actuator connectors.
- Check continuity between actuator connector (actuator side) terminals and relay connector terminals or body ground.

Actuator connector	Relay connector	Continuity
(4)	(87)	Yes
(10)	(30)	Yes
(8)	(86)	Yes
(5)	(85)	Yes
(4)	Ground	No

OK ↓

C

- Check continuity between actuator connector (body side) terminal (8) and ground.

Continuity should not exist.

OK → Ⓐ (Go to next page.)

NG ↓

D

- Disconnect control unit connectors.
- Check continuity between control unit terminals (control unit side) (5) and (2), (3), (22), (27), (28).

Continuity should not exist.

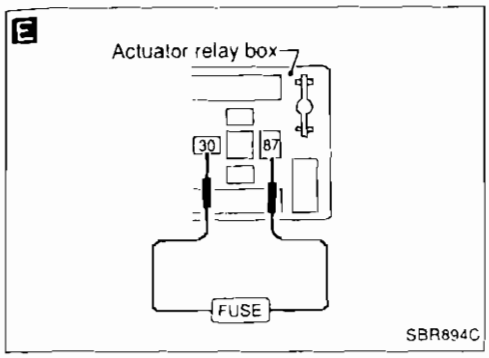
OK → Repair harness and connectors

NG ↓

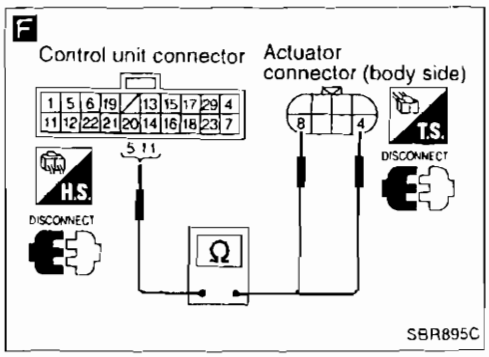
Replace control unit

Diagnostic Procedure 5 (Cont'd)

E



F



Ⓐ

E

MOTOR CHECK

- Connect actuator connectors.
- Connect suitable wire between relay connector terminals ⑧⑦ and ⑧⑥.

Motor should operate.

Do not connect wire for more than 5 seconds.

NG → Check actuator motor ground (Refer to BR-45)

NG → Repair harness and terminals.

OK → Replace actuator assembly

OK

MOTOR RELAY CHECK

Refer to MOTOR RELAY in Electrical Components Inspection (BR-65).

NG → Replace motor relay

OK

F

CIRCUIT CHECK

- Disconnect control unit connector.
- Check continuity between control unit connector terminals and actuator connector (body side) terminals.

Control unit	Actuator
⑤	⑧
⑪	④

Continuity should exist.

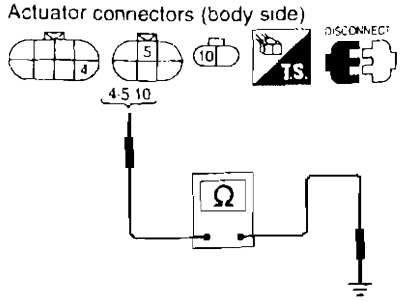
NG → Repair harness and connectors.

OK

Go to **D** in Diagnostic Procedure 2

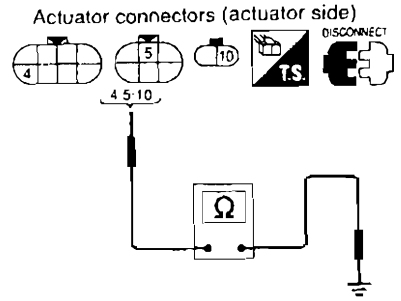
Diagnostic Procedure 5 (Cont'd)

G Actuator connectors (body side)



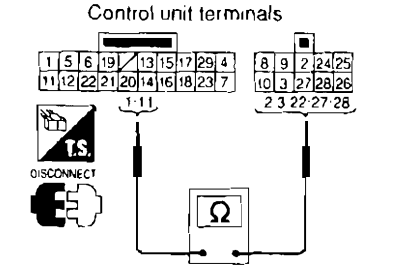
SBR896C

H Actuator connectors (actuator side)



SBR898C

I Control unit terminals



SBR899C

Ⓑ

- Replace fusible link or fuse
  Is it blown out when it is replaced or ignition switch is turned "ON"?

No → Inspection end

Yes

G

MOTOR POWER SUPPLY CIRCUIT

NG → Repair harness and connector

- Disconnect connectors from actuator and control unit.
- Check continuity between actuator connector (body side) terminals and ground

Fuse/Fusible link	Terminals
Fusible link [L]	④ - ground ⑩ - ground
Fuse [1]	⑤ - ground

Continuity should not exist.

OK

H

- Remove motor ground.
- Check continuity between actuator connector (actuator side) terminals and ground.

NG → Replace actuator assembly.

Fuse/Fusible link	Terminals
Fusible link [L]	④ - ground ⑩ - ground
Fuse [1]	⑤ - ground

Continuity should not exist.

OK

I

- Check continuity between control unit terminals.

NG → Replace control unit

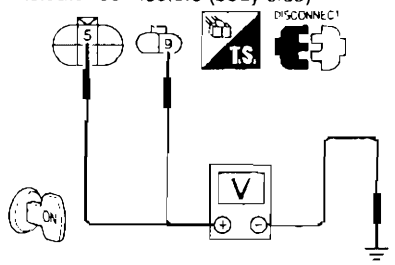
Fuse/Fusible link	Terminals
Fusible link [L]	⑪ - ②, ③, ㉒, ㉗, ㉘
Fuse [1]	① - ②, ③, ㉒, ㉗, ㉘

Continuity should not exist.

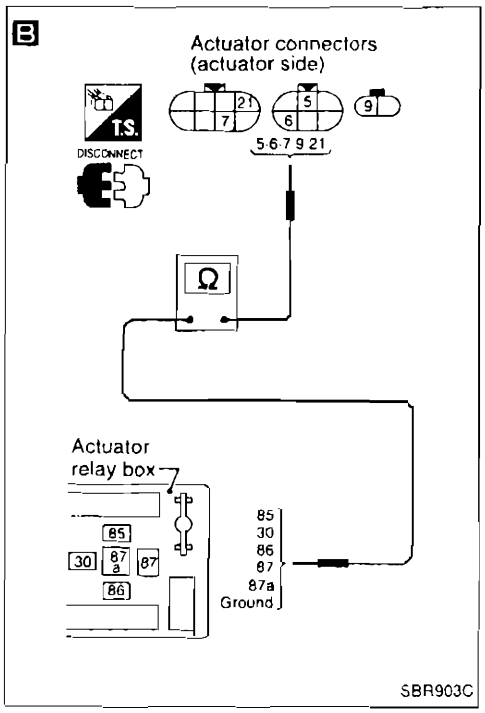
OK

Replace actuator assembly.

A Actuator connectors (body side)



B Actuator connectors (actuator side)



Diagnostic Procedure 6

SOLENOID VALVE RELAY

(Malfunction code No. 41, 42)

SOLENOID VALVE POWER SUPPLY CHECK

- Check 30A fusible link [K] and 10A fuse [1] for actuator. For fusible link and fuse layout, refer to POWER SUPPLY ROUTING in EL section.

NG → Ⓑ (See next page.)

OK ↓

- Disconnect connectors from control unit and actuator. Check terminals for damage or loose connection. Then reconnect connectors
- Carry out self-diagnosis again.

Does warning lamp activate again?

No → Inspection end

Yes ↓

A

SOLENOID VALVE POWER SUPPLY CHECK

NG → Repair harness and connector.

- Disconnect connectors from actuator.
- Check voltage between actuator 2-pin connector (body side) terminals and ground.

Terminals	Ignition switch
⑤ - ground	ON position
⑨ - ground	—

Battery voltage should exist.

OK ↓

SOLENOID VALVE RELAY CHECK

NG → Replace solenoid valve relay.

Refer to SOLENOID VALVE RELAY in Electrical Components Inspection (BR-65).

OK ↓

B

SOLENOID VALVE RELAY CIRCUIT CHECK

NG → Replace actuator.

Check continuity between relay terminals and actuator connector (actuator side) terminals

Relay terminals	Connector terminals	Continuity
㉚	⑥	Yes
㉗	⑨	Yes
(87a)	㉑	Yes
㊱	⑦	Yes
㊺	⑤	Yes
Ground	⑦	No

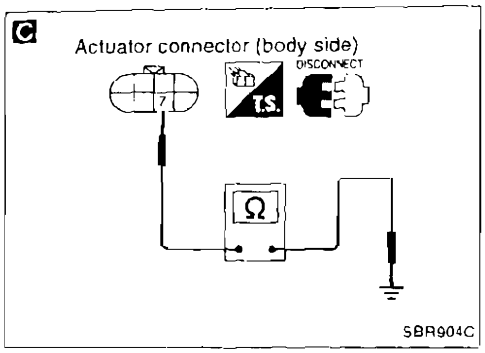
OK ↓

Ⓐ

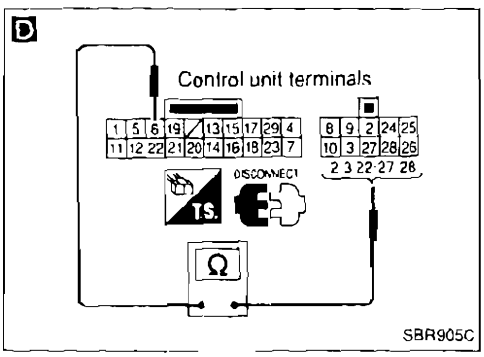
(Go to next page.)

Diagnostic Procedure 6 (Cont'd)

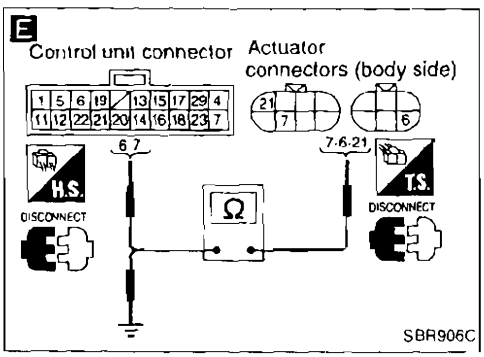
C



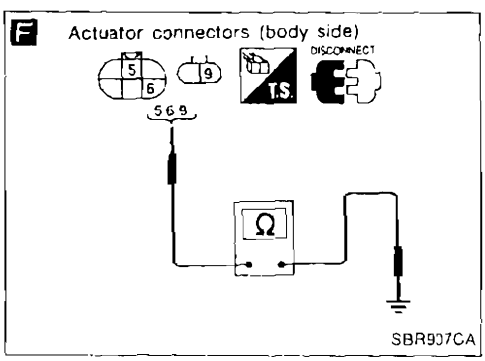
D



E



F



Ⓐ

C

- Check continuity between actuator connector (body side) terminal ⑦ and ground.
  Continuity should not exist.

OK → Ⓒ (See below.)

NG ↓

D

- Disconnect control unit connectors
- Check continuity between control unit terminals (control unit side) ⑥ and ②, ③, ㉒, ㉗, ㉘
  Continuity should not exist.

OK → Repair harness and connectors.

NG ↓

Replace control unit.

Ⓒ

E

CIRCUIT CHECK

NG → Repair harness and connectors

- Disconnect control unit connector
- Check continuity between control unit connector terminals and actuator connector (body side) terminals.

Control unit	Actuator
⑥	⑦
⑦	⑥
Ground	㉑

Continuity should exist.

OK ↓

Go to **D** in Diagnostic Procedure 2

Ⓑ

- Replace fusible link or fuse
  Is it blown out when it is replaced or ignition switch is turned "ON"?

No → Inspection end

Yes ↓

F

ACTUATOR POWER SUPPLY CIRCUIT

NG → Repair harness and connector.

- Disconnect connectors from actuator and control unit.
- Check continuity between actuator connector (body side) terminals and ground

Fuse/Fusible link	Terminals
Fusible link [K]	⑥ - ground
	⑨ - ground
Fuse [1]	⑤ - ground

Continuity should not exist.

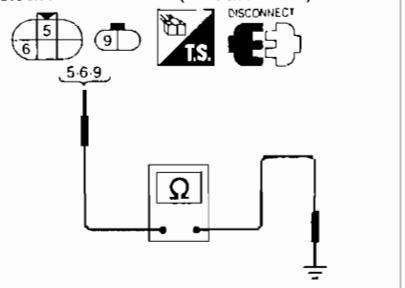
OK ↓

Ⓓ

(Go to next page.)

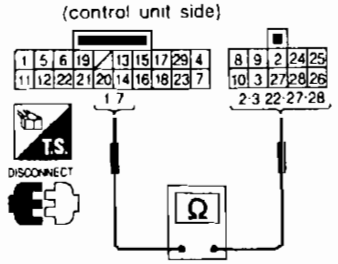
Diagnostic Procedure 6 (Cont'd)

G Actuator connectors (actuator side)



SBR908C

H Control unit terminals (control unit side)



SBR909CA

Ⓓ

G

- Check continuity between actuator connector (actuator side) terminals and ground.

Fuse/Fusible link	Terminals
Fusible link [K]	⑤ - ground ⑨ - ground
Fuse [1]	⑤ - ground

Continuity should not exist.

NG → Replace actuator assembly.

OK ↓

H

- Check continuity between control unit terminals (control unit side).

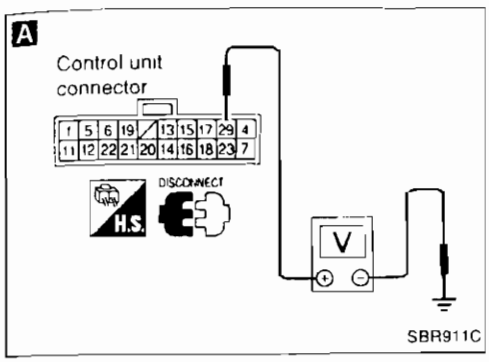
Fuse/Fusible link	Terminals
Fusible link [K]	⑦ - ②, ③, ㉒, ㉗, ㉘
Fuse [1]	① - ②, ③, ㉒, ㉗, ㉘

Continuity should not exist.

NG → Replace control unit.

OK ↓

Replace actuator assembly



Diagnostic Procedure 8

MEMORY VOLT STOP

- Disconnect control unit connectors. Check terminals for damage or loose connection. Then reconnect connectors
- Turn ignition switch ON and OFF more than two times
- Carry out self-diagnosis again

Does warning lamp activate again?

No → Inspection end

Yes ↓

A

CONTROL UNIT POWER SUPPLY

- Disconnect control unit connectors
- Check voltage between connector terminal (29) and ground

Battery voltage should exist.

NG → Check harness and connectors between battery and control unit connector terminal (29) or 7.5A fuse [19] For fuse layout, refer to POWER SUPPLY ROUTING in EL section

OK ↓

CONTROL UNIT GROUND CIRCUIT

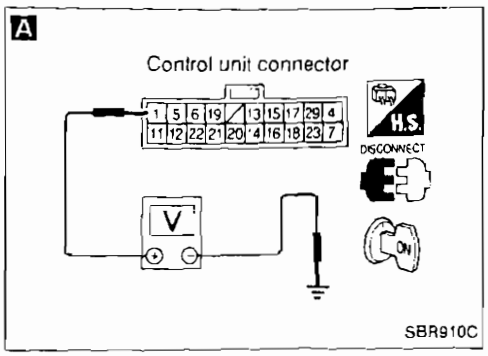
Refer to CONTROL UNIT GROUND in Ground Circuit Check (BR-45)

NG → Repair harness and connectors

OK ↓

Replace control unit.

Note: MEMORY VOLT STOP is always indicated after disconnecting control unit connector.



Diagnostic Procedure 7

POWER SUPPLY

(Malfunction code No. 47, 48)

- Disconnect control unit connectors. Check terminals for damage or connection. Then reconnect connectors.
- Carry out self-diagnosis again.

Does warning lamp activate again?

No → Inspection end

Yes ↓

A

CONTROL UNIT POWER SUPPLY

- Disconnect control unit connectors.
- Check voltage between connector terminal ① and ground when ignition switch is turned ON.

Battery voltage should exist.

NG → Check harness and connectors between battery and control unit connector terminal ①, 10A fuse [1] or battery. For fuse layout, refer to POWER SUPPLY ROUTING in EL section.

OK ↓

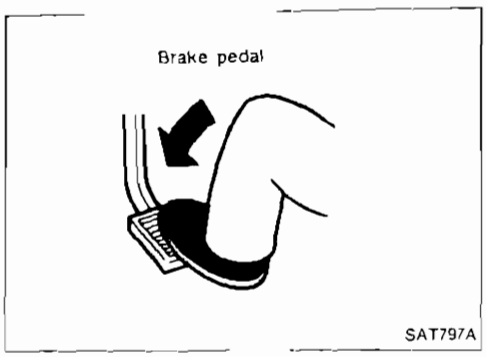
CONTROL UNIT GROUND CIRCUIT

Refer to CONTROL UNIT GROUND in Ground Circuit Check (BR-45).

NG → Repair harness and connectors

OK ↓

Replace control unit.



Diagnostic Procedure 9

SYMPTOM: Pedal vibration and noise

Check whether the symptom appears only when engine is started.
- Yes → Carry out self-diagnosis (See page BR-40.)
- No ↓

Check whether the symptom appears when brake is applied gradually under the conditions below.
- Shifting
- Operating clutch
- Passing over bumps/potholes

- Yes → For such conditions, ABS will work due to difference of wheel speeds
- No ↓

Check if there are any conditions, among those listed below, when symptom appears.
- Low friction road
- High speed cornering
- Passing over bumps/potholes

- Yes → For such conditions, ABS will work due to difference of wheel speeds
- No ↓

Check whether the symptom appears when engine speed is over 5,000 rpm with vehicle stopped
- Yes → Vibration related to sensor may cause ABS operation
- No ↓

Check whether electrical equipment switches are operated.
- No → Go to **B** in Diagnostic Procedure 11 (BR-63).
- Yes ↓

Check wheel sensor shield ground. For location of shield ground, refer to wiring diagram and "HARNESS LAYOUT" in EL section.
- NG → Remedy.
- OK → Replace control unit.

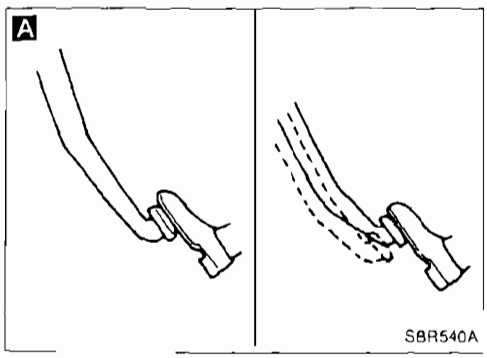
Diagnostic Procedure 10

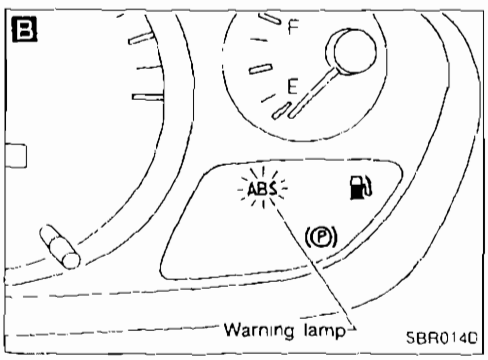
SYMPTOM: Long stopping distance

Check if road condition is slippery with snow or gravel
- Yes → Stopping distance may be longer than vehicles without ABS
- No ↓

Disconnect actuator connector and check whether stopping distance is still long.
- No → Go to **B** in Diagnostic Procedure 11 (See below.)
- Yes ↓

Perform Preliminary Check and air bleeding.





Diagnostic Procedure 11

SYMPTOM: Unexpected pedal action

A

Check whether brake pedal stroke is excessively large.
- Yes → Perform Preliminary Check (BR-44).
- No ↓

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

Disconnect actuator connector and check whether brake is effective
- No → Perform Preliminary Check (BR-44)
- Yes ↓

B

Ensure warning lamp remains off while driving
- NG → Carry out self-diagnosis (See page BR-40)
- OK ↓

CHECK WHEEL SENSOR
- NG → Remedy.

- Check wheel sensor connector for terminal damage or loose connection
- Perform wheel sensor mechanical check
  Refer to **C** and **D** in Diagnostic Procedure 4. (BR-53)

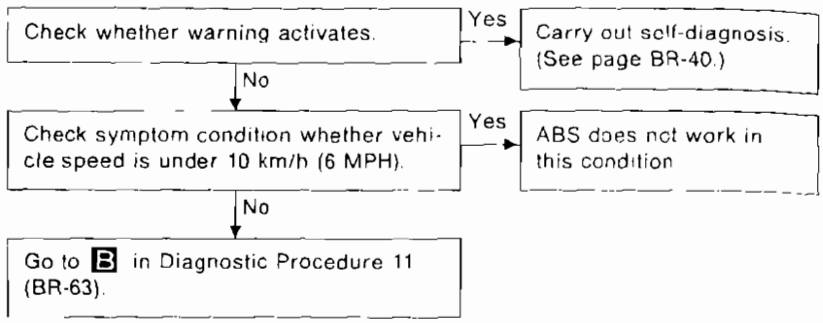
OK ↓

Replace control unit

BR

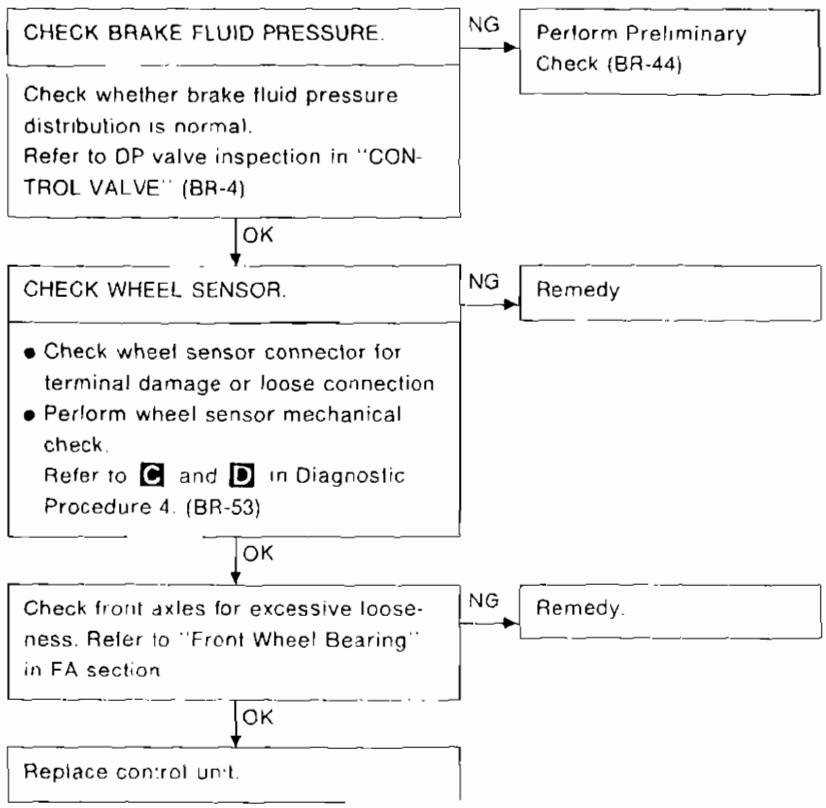
Diagnostic Procedure 12

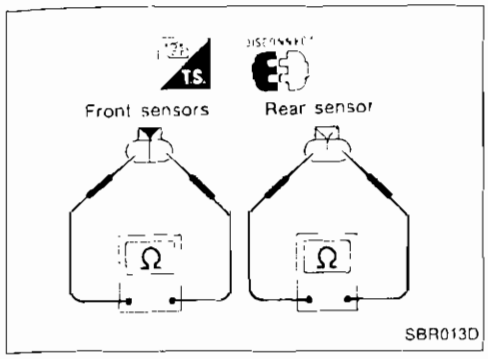
SYMPTOM: ABS does not work.

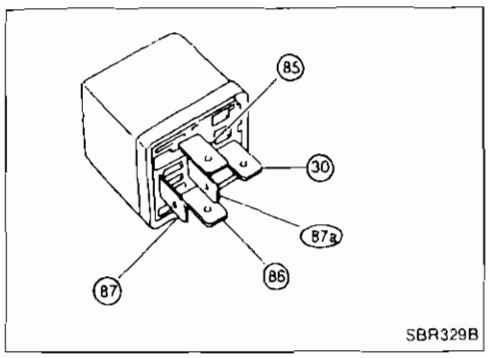


Diagnostic Procedure 13

SYMPTOM: ABS works frequently.







Electrical Components Inspection

WHEEL SENSOR

Check resistance for each sensor

Resistance: 0.6 - 3.3 kΩ

ACTUATOR MOTOR RELAY AND SOLENOID VALVE RELAY

	Solenoid valve relay	Actuator motor relay solenoid valve relay
Condition	Continuity existence between terminals 30 and 87a	Continuity existence between terminals 30 and 87
Battery voltage not applied between terminals 85 and 86.	Yes	No
Battery voltage applied between terminals 85 and 86	No	Yes

BR

General Specifications

Front brake	
Brake model	OPF25V disc brake
Cylinder bore diameter mm (in)	40.4 (1.59) x 2
Pad mm (in) Length x width x thickness	116.0 x 50.0 x 10.0 (4.57 x 1.969 x 0.394)
Rotor outer diameter x thickness mm (in)	280 x 30 (11.02 x 1.18)
Rear brake	
Brake model	CL11H disc brake
Cylinder bore diameter mm (in)	38.18 (1.5031)
Pad mm (in) Length x width x thickness	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)	23.81 (15/16)	25.40 (1)
Control valve		
Valve model	Proportioning valve (built into master cylinder)	
Split point kPa (bar, kg/cm^2, psi) x reducing ratio	3,923 (39.2, 40, 569) x 0.4	
Brake booster		
Booster model	M23 or G23	M195T
Diaphragm diameter mm (in)	230 (9.06)	Primary: 205 (8.07) Secondary: 180 (7.09)
Recommended brake fluid		
For Europe*	DOT3 or DOT4	
Except for Europe	DOT 3	

*For Europe, never mix different type brake fluids (DOT3 and DOT4)

Inspection and Adjustment

DISC BRAKE

Brake model	OPF25V	CL11H
Pad wear limit mm (in)		
Minimum thickness	2.0 (0.079)	
Rotor repair limit mm (in)		
Minimum thickness	28 (1.10)	8 (0.31)

BRAKE PEDAL

Vehicle model	LHD	RHD
Free height "H" mm (in)		
M/T	181 - 191 (7.13 - 7.52)	179 - 189 (7.05 - 7.44)
A/T	191 - 201 (7.52 - 7.91)	189 - 199 (7.44 - 7.83)
Depressed height "D" mm (in) [under force of 490 N (50 kg, 110 lb) with engine running]	110 (4.33)	
Clearance "C" between pedal stopper and threaded end of stop lamp switch or ASCD switch mm (in)	0.3 - 1.0 (0.012 - 0.039)	

PARKING BRAKE

Type	Center lever
Number of notches [under force of 196 N (20 kg, 44 lb)]	7 - 9
Number of notches when warning lamp switch comes on	1