

BRAKE SYSTEM

SECTION **BR**

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When you read wiring diagrams:

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

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES" and "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".

PRECAUTIONS AND PREPARATION

Supplemental Restraint System (SRS) “AIR BAG” and “SEAT BELT PRE-TENSIONER”

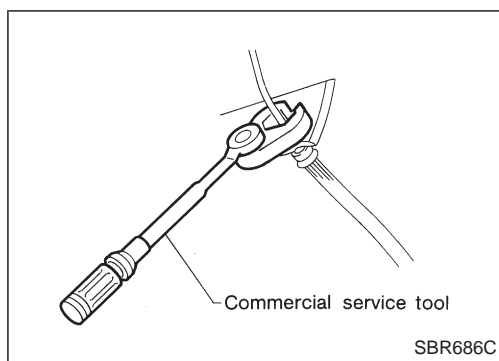
The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER” used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The SRS system composition which is available to NISSAN MODEL Y61 is as follows (The composition varies according to the destination.):

Driver air bag module (located in the center of the steering wheel), front passenger air bag module (located on the instrument panel on passenger side), seat belt pre-tensioner, a diagnosis sensor unit, warning lamp, wiring harness and spiral cable.

Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the RS section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. Spiral Cable and wiring harnesses covered with yellow insulation either just before the harness connectors or for the complete harness are related to the SRS.



Precautions for Brake System

- Use brake fluid “DOT 3”.
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.
- To clean master cylinder parts, disc brake caliper parts or wheel cylinder parts, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene. They will ruin rubber parts of hydraulic system.
- Use flare nut wrench when removing and installing brake tubes.
- Always torque brake lines when installing.

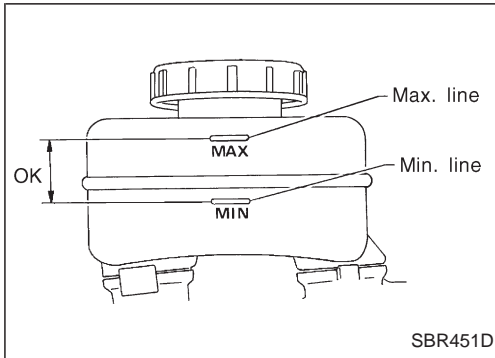
WARNING:

Clean brakes with a vacuum dust collector to minimize risk of health hazard from powder caused by friction.

Commercial Service Tools

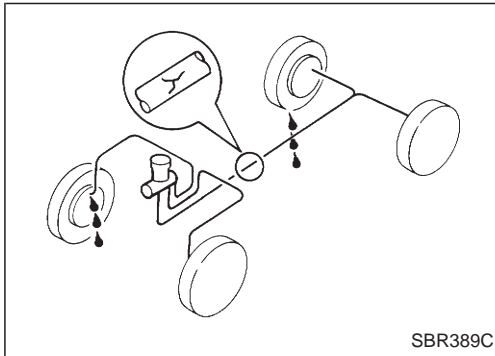
Tool name	Description
① Flare nut crowfoot ② Torque wrench	<p style="text-align: center;">NT360</p> <p style="text-align: center;">a: 10 mm (0.39 in)</p>
Brake fluid pressure gauge	<p style="text-align: center;">NT151</p>

CHECK AND ADJUSTMENT



Checking Brake Fluid Level

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

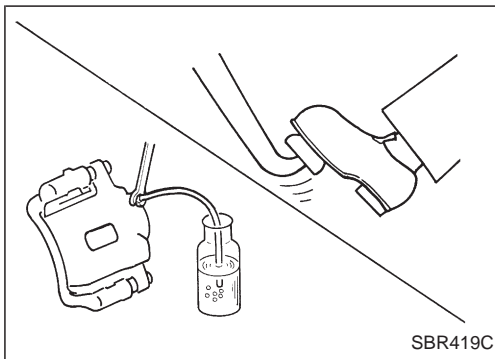


Checking Brake Line

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.



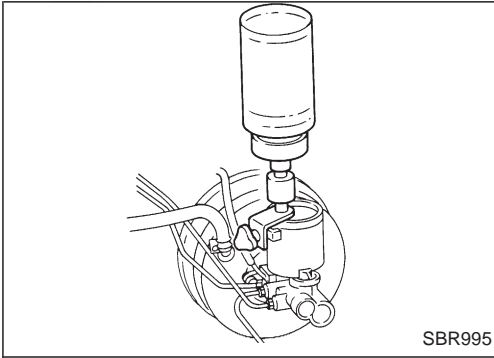
Changing Brake Fluid

CAUTION:

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

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

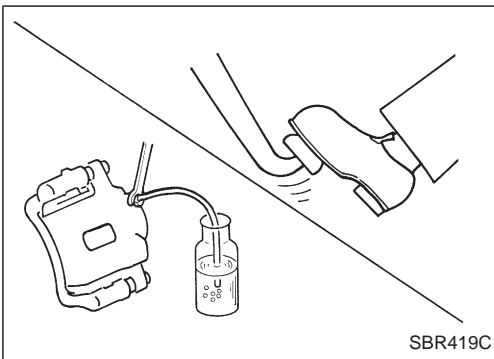
CHECK AND ADJUSTMENT



Bleeding Brake System

CAUTION:

- Carefully monitor brake fluid level at master cylinder during bleeding operation.
- If master cylinder is suspected to have air inside, bleed air from master cylinder first. Refer to "Installation", "MASTER CYLINDER", BR-14.
- Fill reservoir with new brake fluid "DOT 3". Make sure it is full at all times while bleeding air out of system.
- Place a container under master cylinder to avoid spillage of brake fluid.
- For models with ABS, turn ignition switch OFF and disconnect ABS actuator connectors or battery ground cable.
- Bleed air in the following order.
 1. LSV air bleeder
 2. Left rear brake
 3. Right rear brake
 4. Left front brake
 5. Right front brake

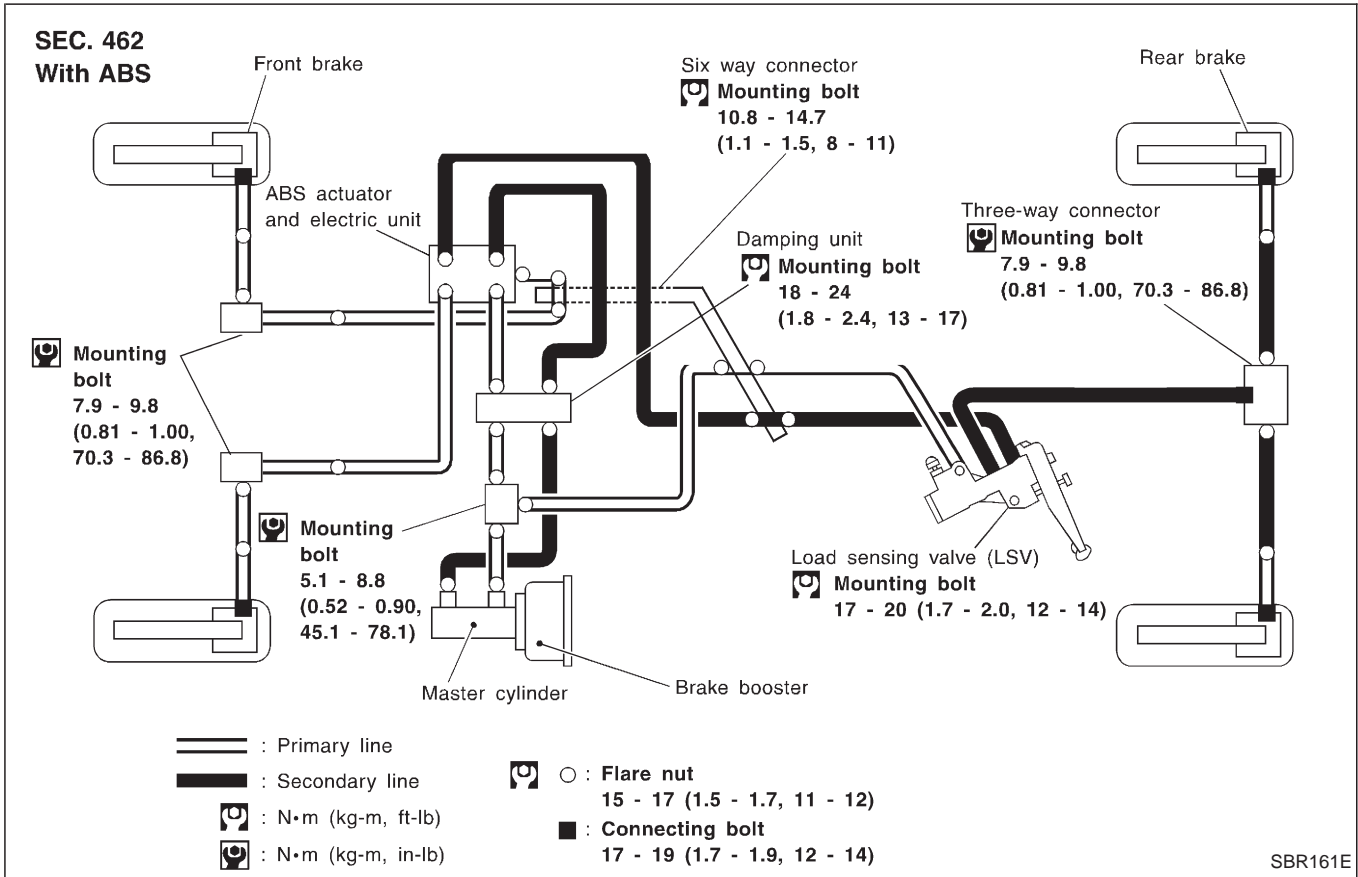
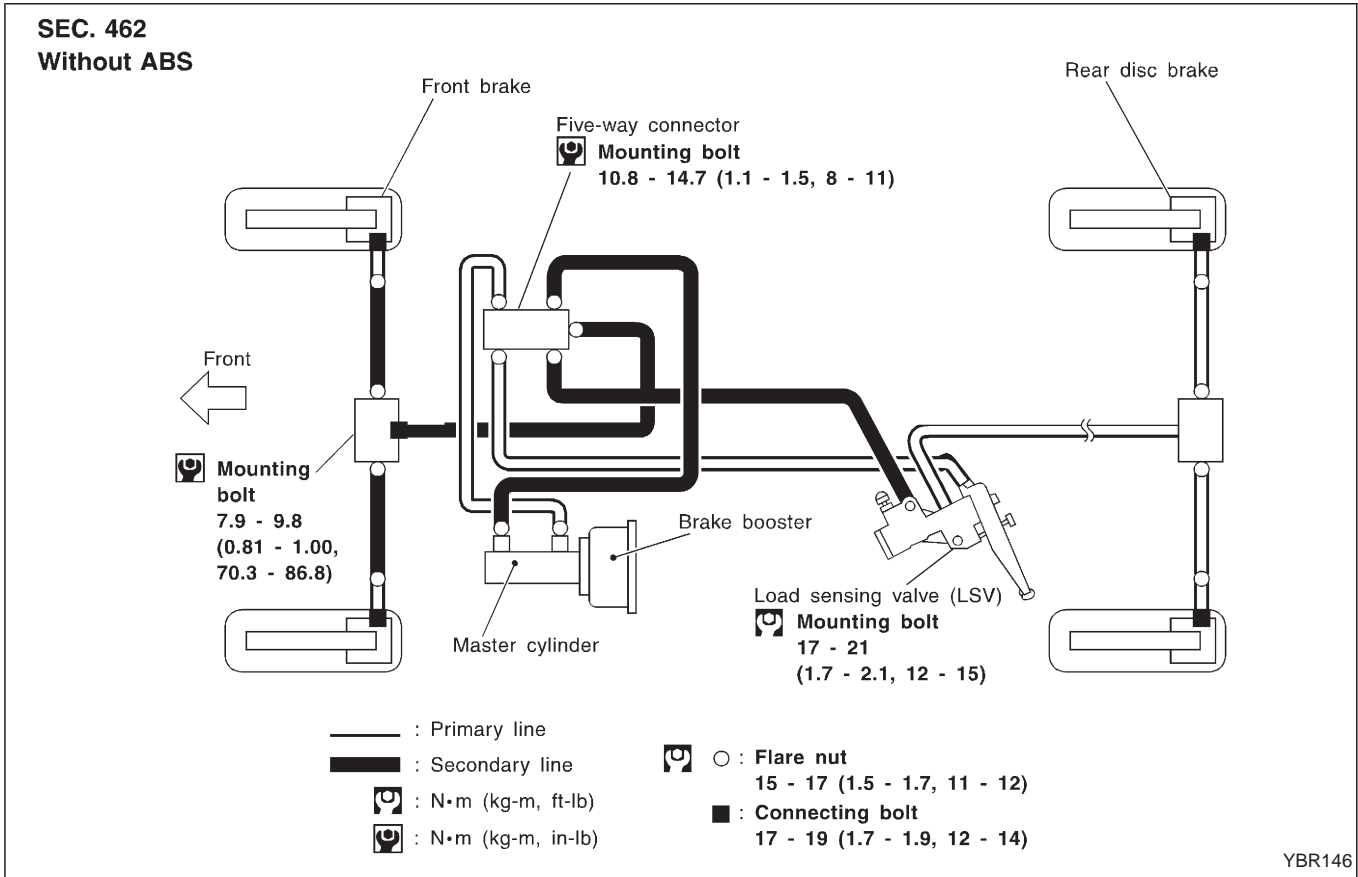


1. Connect a transparent vinyl tube to air bleeder valve.
2. Fully depress brake pedal several times.
3. With brake pedal depressed, open air bleeder valve to release air.
4. Close air bleeder valve.
5. Release brake pedal slowly.
6. Repeat steps 2. through 5. until clear brake fluid comes out of air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

 : 7 - 9 N·m (0.7 - 0.9 kg-m, 61 - 78 in-lb)

BRAKE HYDRAULIC LINE/CONTROL VALVE

Brake Hydraulic Line



BRAKE HYDRAULIC LINE/CONTROL VALVE

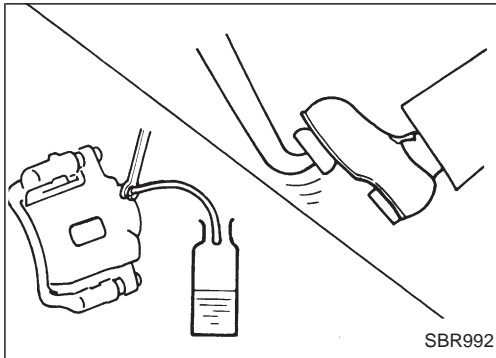
Brake Hydraulic Line (Cont'd)

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.

INSTALLATION


CAUTION:

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

Flare nut:

: 15 - 17 N·m (1.5 - 1.7 kg·m, 11 - 12 ft·lb)

Connecting bolt:

: 17 - 19 N·m (1.7 - 1.9 kg·m, 12 - 14 ft·lb)

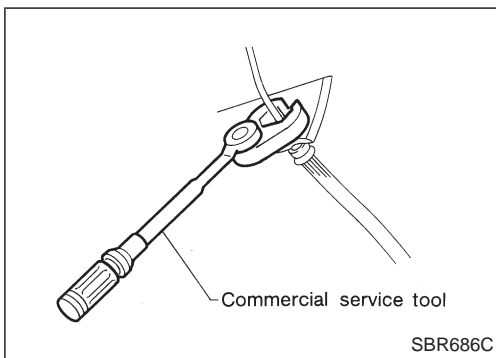
2. Refill until new brake fluid comes out of each air bleeder valve.
3. Bleed air. Refer to "Bleeding Brake System", BR-4.

Load Sensing Valve

INSPECTION

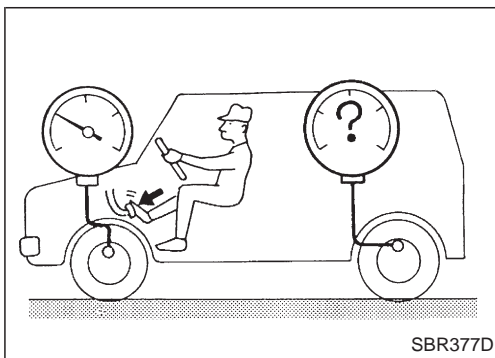
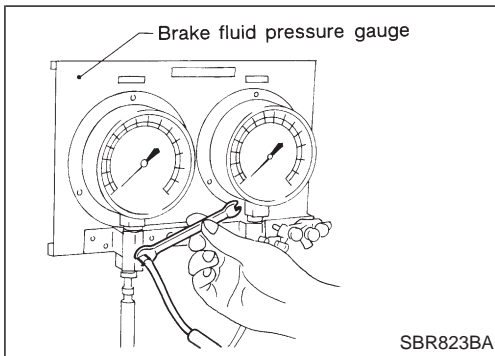
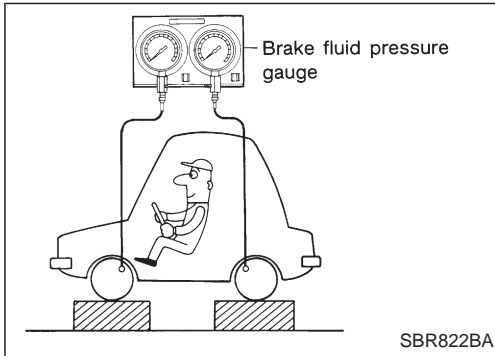
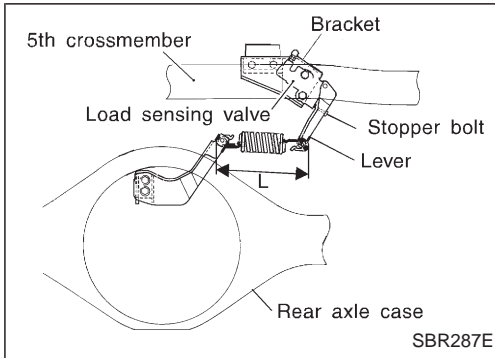
CAUTION:

- Carefully monitor brake fluid level at master cylinder.
- Use new brake fluid "DOT 3".
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on paint areas, wash it away with water immediately.
- Depress pedal slowly when raising front brake pressure.
- Check rear brake pressure 2 seconds after front brake pressure reaches specified value.
- For models with ABS disconnect harness connectors from ABS actuator relay before checking.



BRAKE HYDRAULIC LINE/CONTROL VALVE

Load Sensing Valve (Cont'd)



1. Ensure vehicle is unladen condition*.
* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
2. Have a driver sit in the driver's seat and one person sit on the rear end. Then have the person on the rear end slowly get off the vehicle. This is necessary to stabilize suspension deflection.
3. Gradually depress brake pedal and attach a lever to the stopper bolt, then adjust length "L" as follows:
Length "L": Approx. 175.2 - 178.2 mm (6.90 - 7.02 in)

4. Remove front LH tire.
5. Connect tool to air bleeders on front LH brake caliper and rear LH or RH brake wheel cylinder.

6. Install front LH tire.
Before installing front LH tire, confirm the tool is not touching the front LH wheel.

7. Bleed air from Tool.

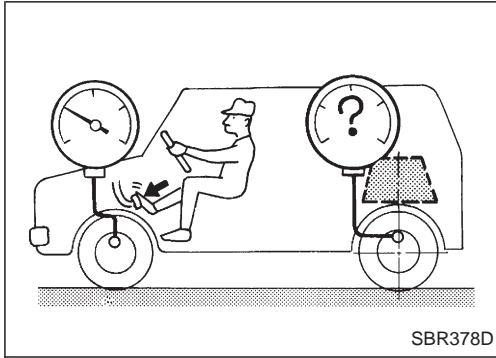
8. Raise front brake pressure to 4,904 kPa (49.0 bar, 50 kg/cm², 711 psi) and 9,807 kPa (98.1 bar, 100 kg/cm², 1,422 psi) and check rear brake pressure.

Rear brake pressure:

Refer to table on next page.

BRAKE HYDRAULIC LINE/CONTROL VALVE

Load Sensing Valve (Cont'd)



9. Set down weight slowly over axle center so that sensor spring length becomes the same as when in loaded condition (Refer to table below). Check rear brake pressure in the same way described in step 7.

4-door rear disc brake

Unit: kPa (bar, kg/cm², psi)

		Sensor spring length "L"* mm (in)	Front brake pressure 4,904 (49.0, 50, 711)	Front brake pressure 9,807 (98.1, 100, 1,422)
Rear brake pressure	Without weight	175.2 - 178.2 (6.90 - 7.02)	2,158 - 3,138 (21.58 - 31.38, 22.0 - 32.0, 313 - 455)	3,629 - 4,609 (36.29 - 46.09, 37.0 - 47.0, 526 - 668)
	With weight	193.6 - 196.6 (7.62 - 7.74)	2,746 - 4,707 (27.46 - 47.07, 28.0 - 48.0, 398 - 683)	4,217 - 6,178 (42.17 - 61.78, 43.0 - 63.0, 611 - 896)

*: Depressed brake pedal.

10. Bleed air after disconnecting the tool. Refer to "Bleeding Brake System", BR-4.
11. Install front LH tire.

REMOVAL AND INSTALLATION

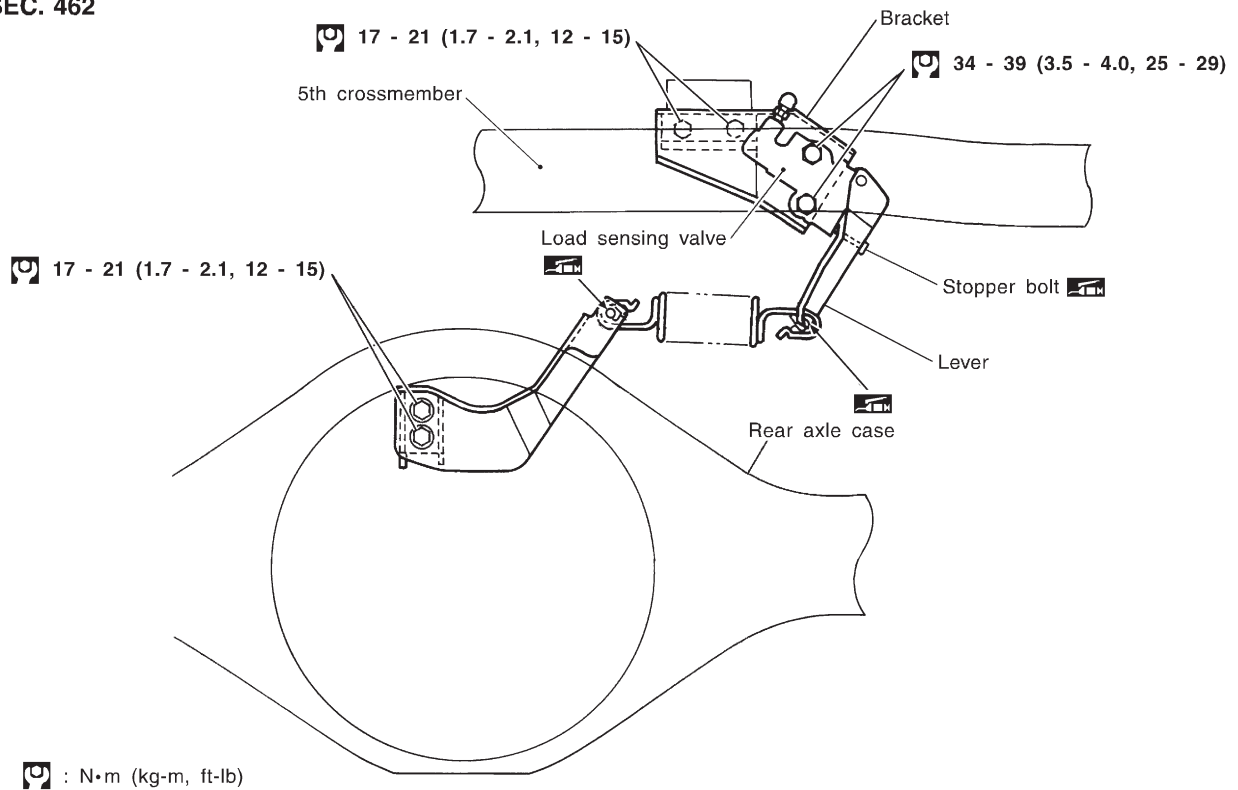
CAUTION:

- Refill with new brake fluid "DOT 3".
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.
- Do not reuse Load Sensing Valve once it is disassembled.
- Replace damaged Load Sensing Valve as an assembly.
- When disassembling, apply multi-purpose grease to all rubbing areas.

BRAKE HYDRAULIC LINE/CONTROL VALVE

Load Sensing Valve (Cont'd)

SEC. 462



SBR162E

1. Tighten all flare nuts and mounting bolts.

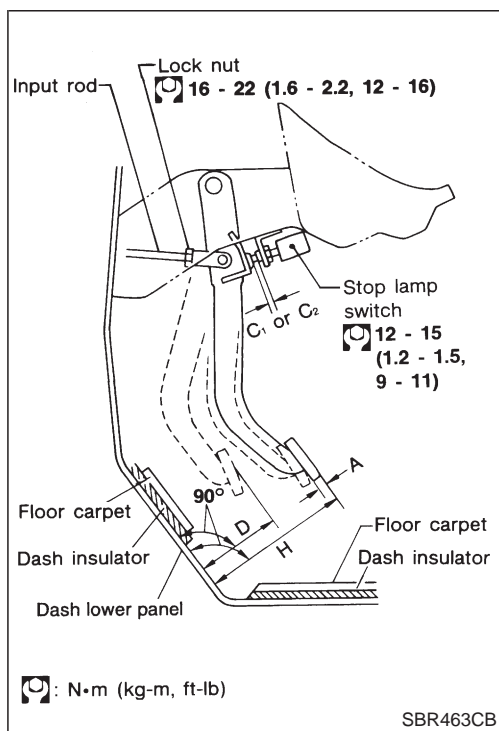
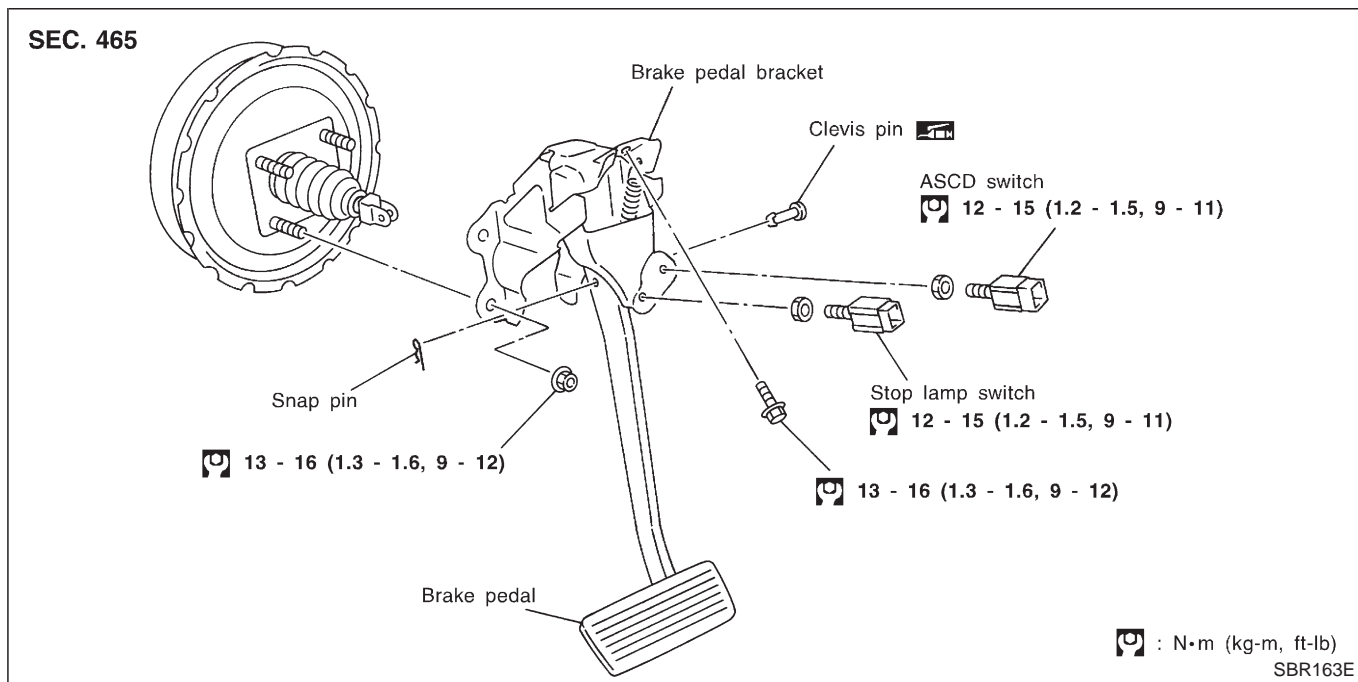
Flare nut:

☞: 15 - 17 N·m (1.5 - 1.7 kg-m, 11 - 12 ft-lb)

2. Refill until new brake fluid comes out of each air bleeder valve.
3. Bleed air. Refer to "Bleeding Brake System", BR-4.

BRAKE PEDAL AND BRACKET

Removal and Installation



Inspection

Check brake pedal for following items.

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

Adjustment

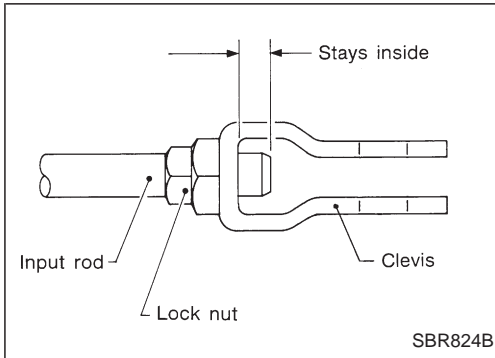
Check brake pedal free height from dash lower panel.

- H: Free height**
Refer to SDS (BR-72).
- D: Depressed height**
Refer to SDS (BR-72).
Under force of 490 N (50 kg, 110 lb) with engine running
- C₁, C₂: Clearance between pedal stopper and threaded end of stop lamp switch and ASCD switch**
0.3 - 1.0 mm (0.012 - 0.039 in)
- A: Pedal free play**
1 - 3 mm (0.04 - 0.12 in)

If necessary, adjust brake pedal free height.

BRAKE PEDAL AND BRACKET

Adjustment (Cont'd)



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

Make sure that tip of input rod stays inside.

2. Adjust clearance "C₁" and "C₂" with stop lamp switch and ASCD switch respectively. Then tighten lock nuts.
3. Check pedal free play.

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

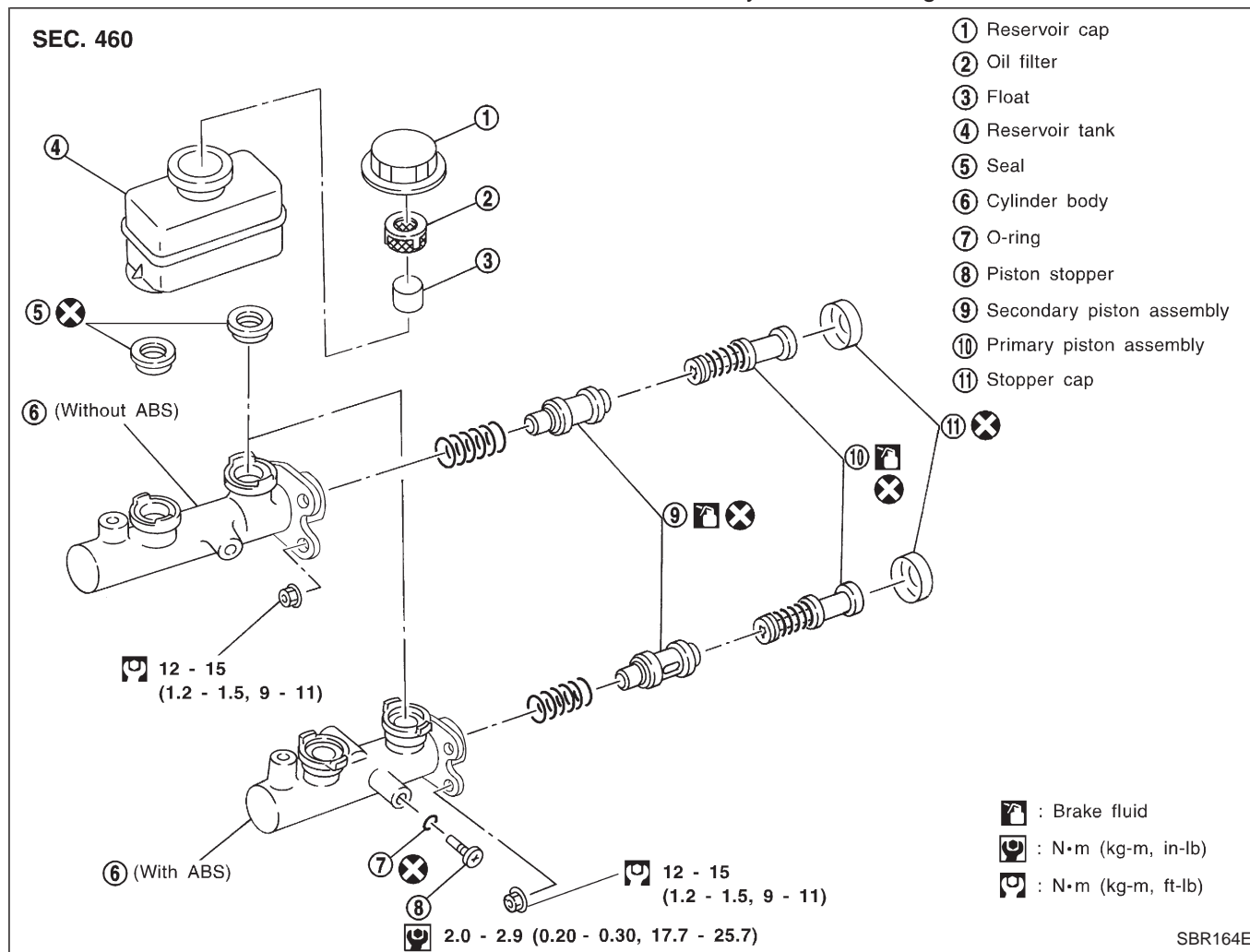
4. Check brake pedal's depressed height while engine is running. If depressed height is below specified value, check brake system for leaks, accumulation of air or any damage to components (master cylinder, wheel cylinder, etc.). Then make necessary repairs.

MASTER CYLINDER

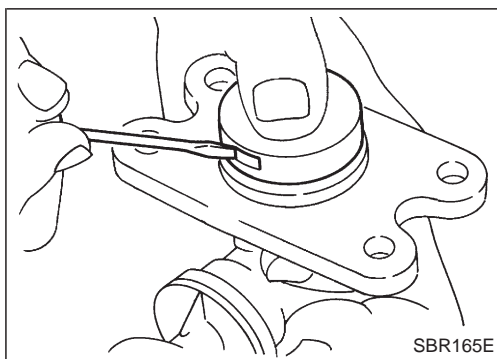
Removal

CAUTION:

- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.
 - In the case of brake fluid leakage from the master cylinder, disassemble the cylinder. Then check piston cups for deformation or scratches and replace necessary parts.
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.

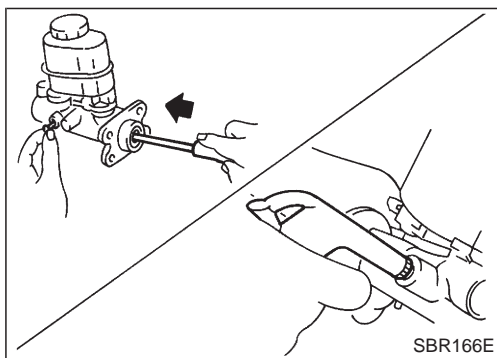


MASTER CYLINDER



Disassembly

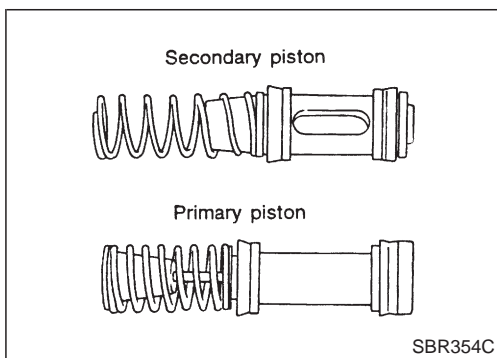
1. Bend claws of stopper cap outward.



2. Remove piston stopper while piston is pushed into cylinder (Models with ABS only).
3. Remove piston assemblies.
If it is difficult to remove secondary piston assembly, gradually apply compressed air through fluid outlet.
4. Draw out reservoir tank.

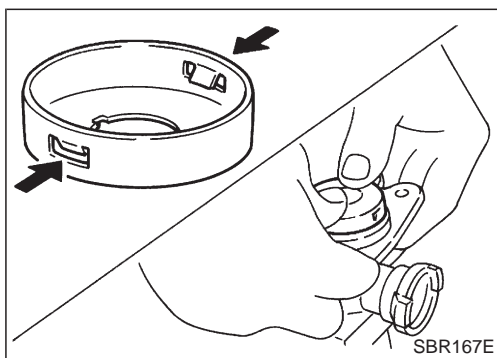
Inspection

Check master cylinder inner wall for pin holes or scratches. Replace if damaged.



Assembly

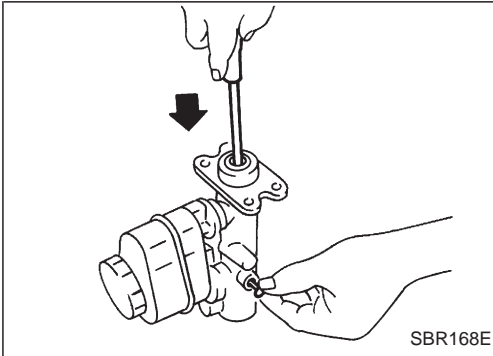
1. Insert secondary piston assembly. Then insert primary piston assembly.
 - Pay attention to direction of piston cups in figure at left. Also, insert pistons squarely to avoid scratches on cylinder bore.
 - Pay attention to alignment of secondary piston slit with valve stopper mounting hole of cylinder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



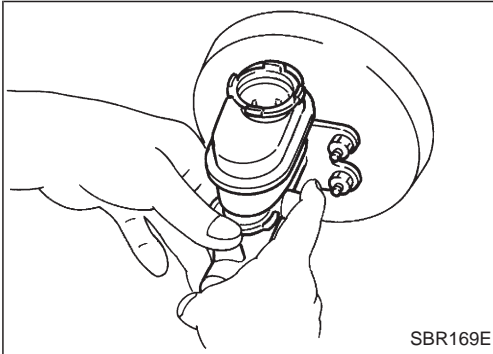
2. Install stopper cap.
Before installing stopper cap, ensure that claws are bent inward.
3. Push reservoir tank seals into cylinder body.
4. Push reservoir tank into cylinder body.

MASTER CYLINDER

Assembly (Cont'd)



5. Install valve stopper while piston is pushed into cylinder (Model with ABS only).

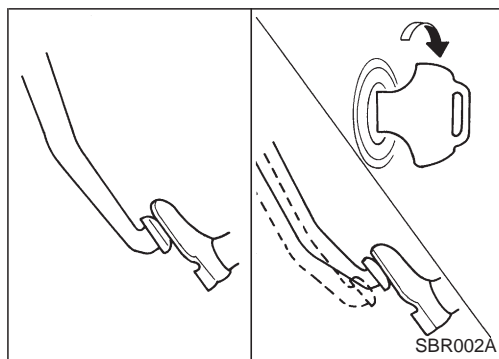


Installation

CAUTION:

- Refill with new brake fluid "DOT 3".
 - Never reuse drained brake fluid.
1. Place master cylinder onto brake booster and secure mounting nuts lightly.
 2. 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 - 17 N·m (1.5 - 1.7 kg-m, 11 - 12 ft-lb)**
 8. Bleed air. Refer to "Bleeding Brake System", BR-4.

BRAKE BOOSTER



Brake Booster

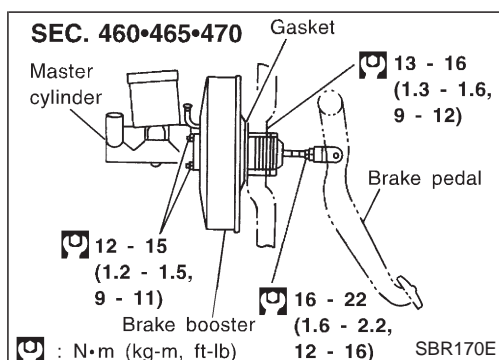
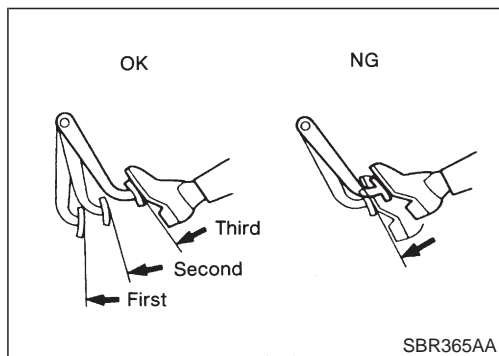
ON-VEHICLE SERVICE

Operating check

- Depress brake pedal several times with engine off. After exhausting vacuum, make sure there is no change in pedal stroke.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.

Airtight check

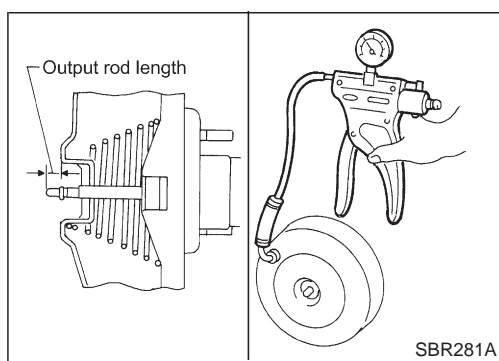
- Start engine, and stop it after one or two minutes. Depress brake pedal several times slowly. Booster is airtight if pedal stroke is less each time.
- Depress brake pedal while engine is running, and stop engine with pedal depressed. The pedal stroke should not change after holding pedal down for **30 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.



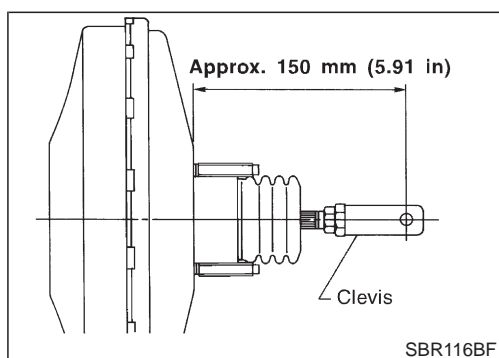
INSPECTION

Output rod length check

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

Specified length:

10.275 - 10.525 mm (0.4045 - 0.4144 in)




INSTALLATION

CAUTION:

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

BRAKE BOOSTER

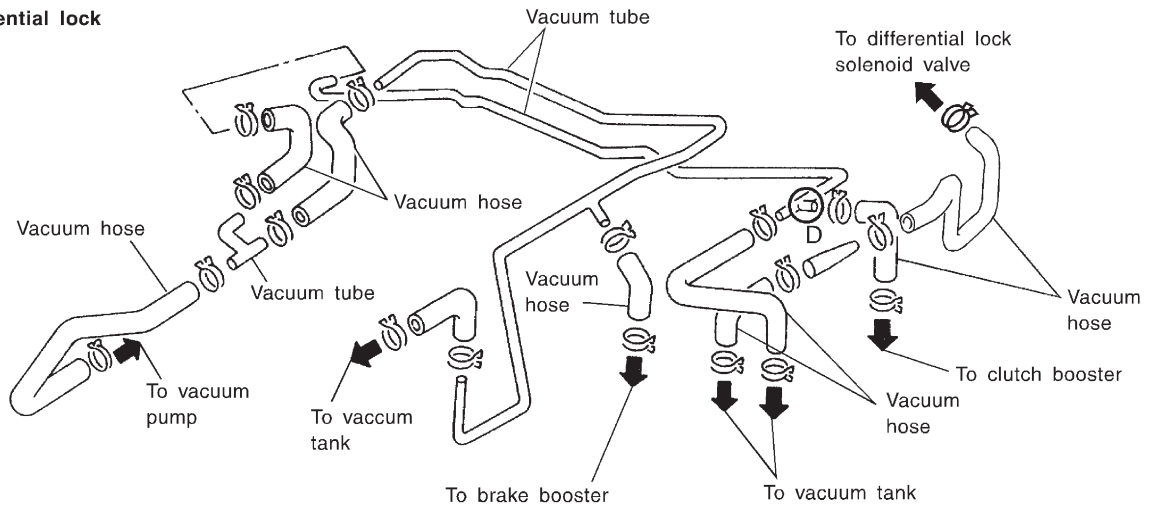
Brake Booster (Cont'd)

1. Before fitting booster, temporarily adjust clevis to dimension shown.
2. Fit booster, then secure mounting nuts (brake pedal bracket to brake 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-14.
6. Adjust brake pedal height and free play.
Refer to "Adjustment" in "BRAKE PEDAL AND BRACKET", BR-10.
7. Secure lock nut for clevis.
: **16 - 22 N·m (1.6 - 2.2 kg-m, 12 - 16 ft-lb)**
8. Bleed air. Refer to "Bleeding Brake System", BR-4.

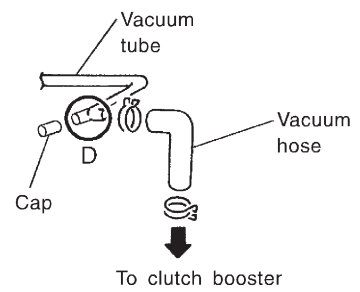
VACUUM PIPING (LHD models)

Vacuum Hose

With differential lock



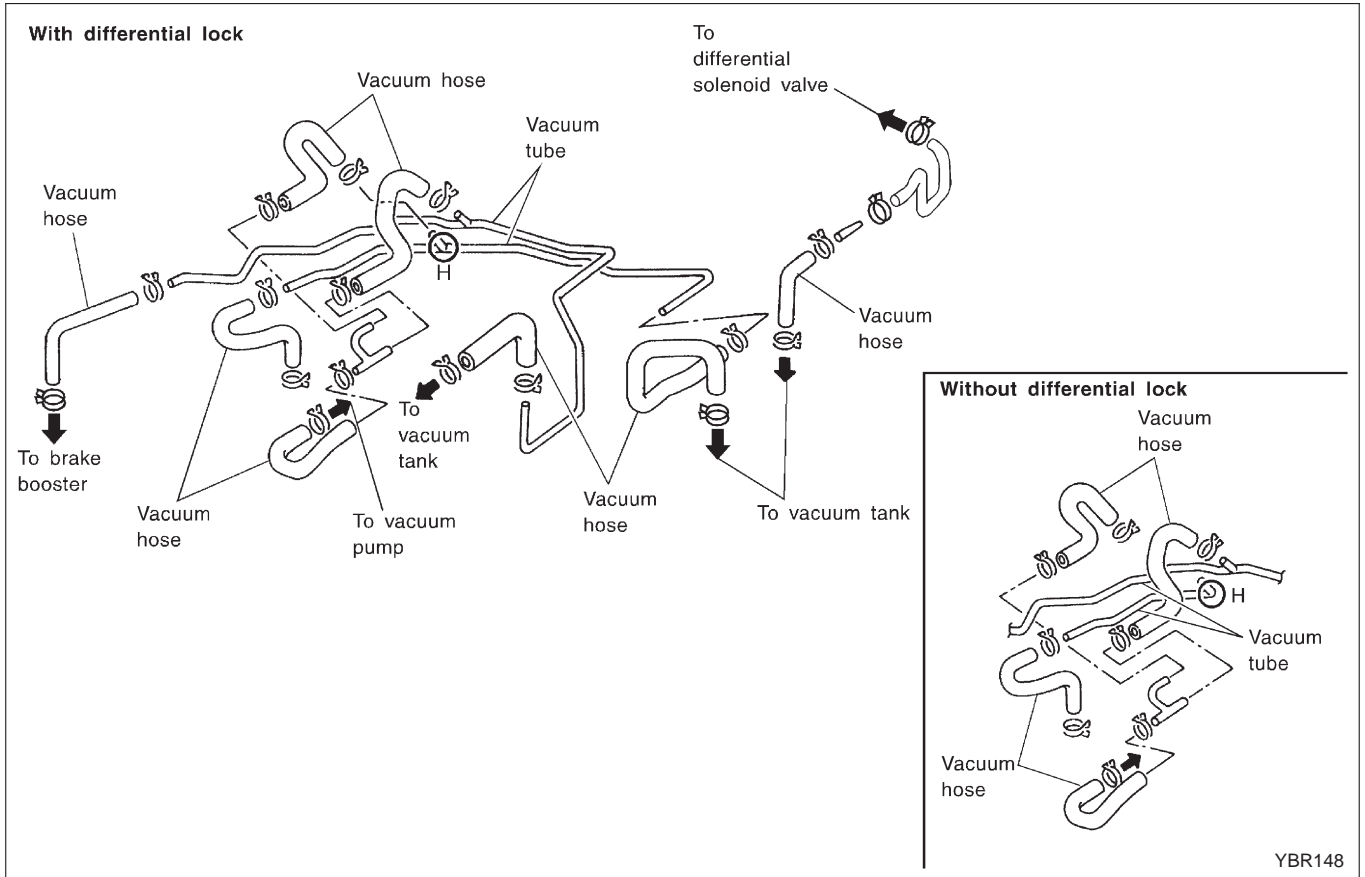
Without differential lock



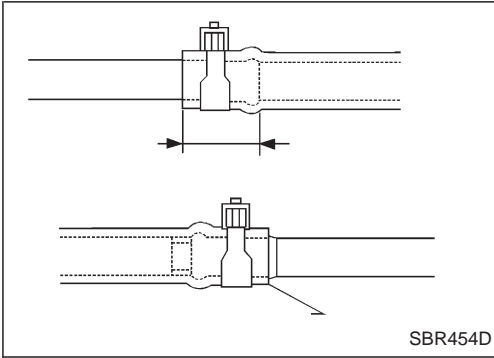
YBR147

VACUUM PIPING (RHD models)

Vacuum Hose



VACUUM PIPING



REMOVAL AND INSTALLATION

CAUTION:

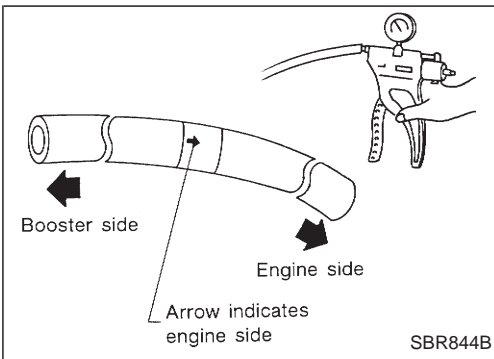
When installing vacuum hoses, pay attention to the following points.

- 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

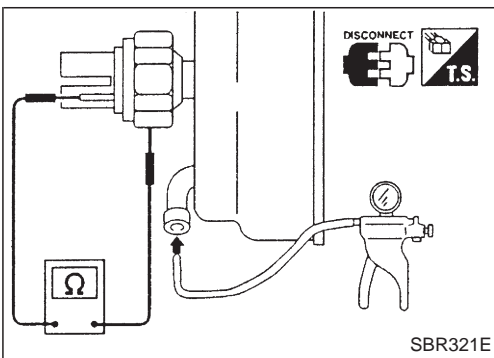
Check vacuum lines, connections and check valve for airtightness, improper attachment chafing and deterioration.



Check valve

Check vacuum with a vacuum pump.

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



Vacuum warning switch*

Test continuity through vacuum warning switch with an ohmmeter and vacuum pump.

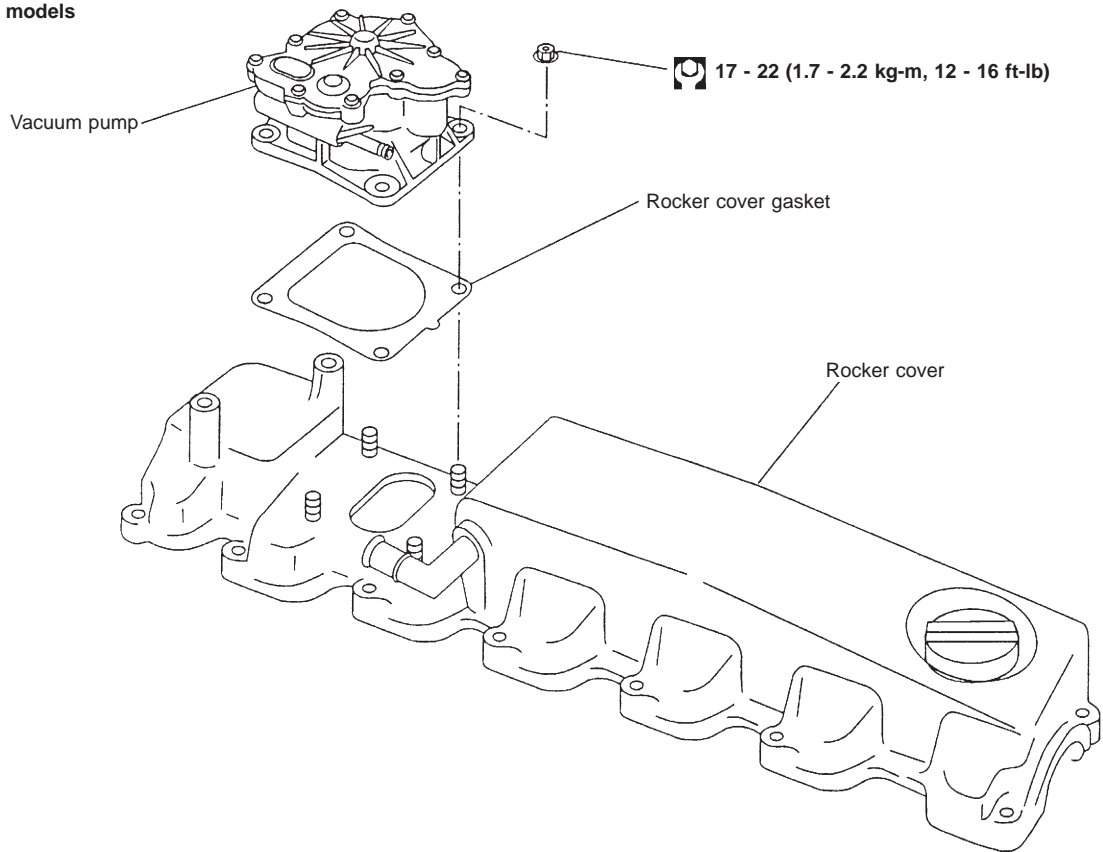
Vacuum	Less than 26.7 kPa (267 mbar, 200 mmHg, 7.87 inHg)	0 Ω
	33.3 kPa (333 mbar, 250 mmHg, 9.84 inHg) or more	∞ Ω

* Diesel engine models except Australia

VACUUM PUMP

Removal and Installation

RD28 engine models



1. Rotate crankshaft so intake cam nose for No. 1 cylinder faces straight up when viewed through oil filler cap mounting hole.
2. Rotate crankshaft approximately 240° counterclockwise.
3. Remove vacuum pump.

CAUTION:

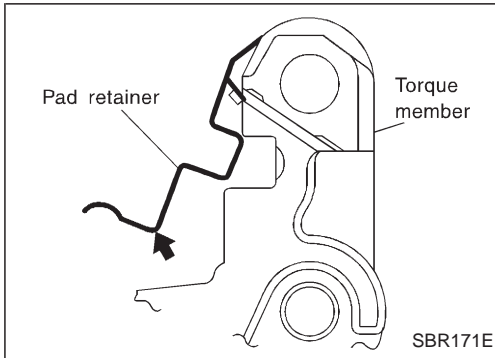
Loosen mounting nuts equally and gradually.

Always remove mounting nuts by pushing to keep the vacuum pump from jumping up.

Do not disassemble vacuum pump.

4. Install the vacuum pump in the location from which it was removed with cam nose set in position.

FRONT DISC BRAKE



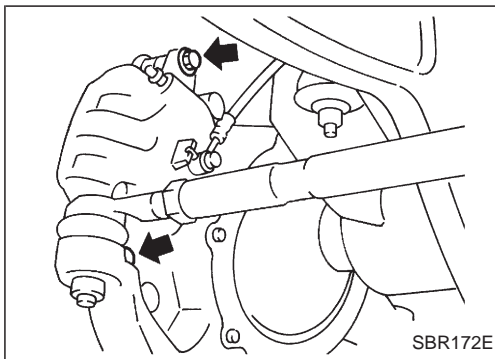
Pad Replacement

WARNING:

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

CAUTION:

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



1. Remove master cylinder reservoir cap.
2. Remove upper and lower pin bolts.
3. Remove cylinder body from torque member. Then remove pads, pad retainers, and inner and outer shims.

Standard pad thickness:

12.0 mm (0.472 in)

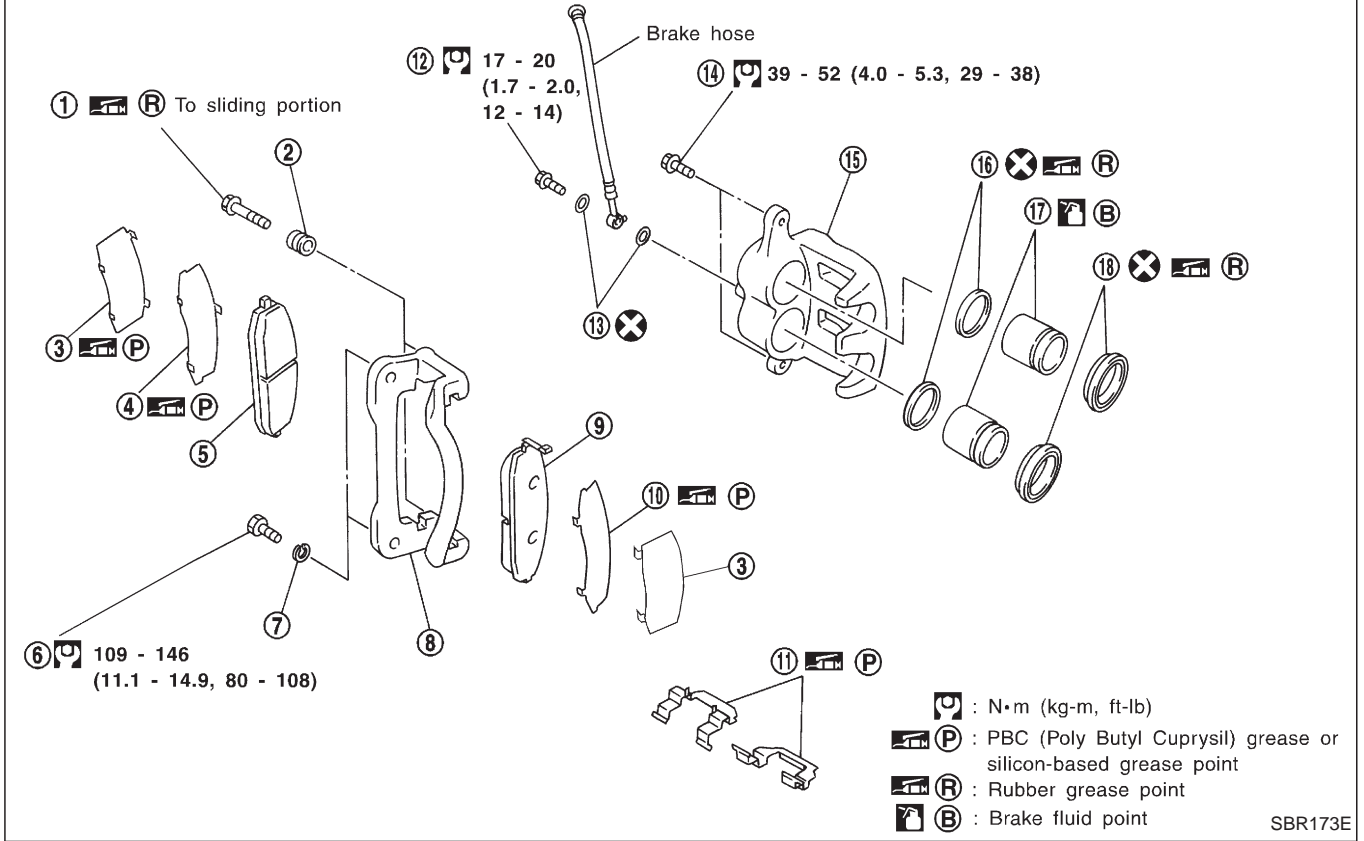
Pad wear limit:

2.0 mm (0.079 in)

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

FRONT DISC BRAKE

SEC. 440



- ① Main pin
- ② Pin boot
- ③ Shim cover
- ④ Inner shim
- ⑤ Inner pad
- ⑥ Torque member fixing bolt

- ⑦ Washer
- ⑧ Torque member
- ⑨ Outer pad
- ⑩ Outer shim
- ⑪ Pad retainer
- ⑫ Connecting bolt

- ⑬ Copper washer
- ⑭ Main pin bolt
- ⑮ Cylinder body
- ⑯ Piston seal
- ⑰ Piston
- ⑱ Piston boot

FRONT DISC BRAKE

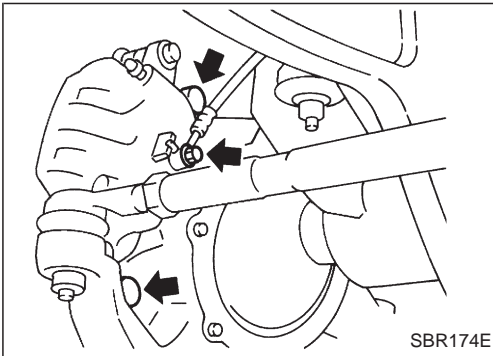
Removal

WARNING:

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

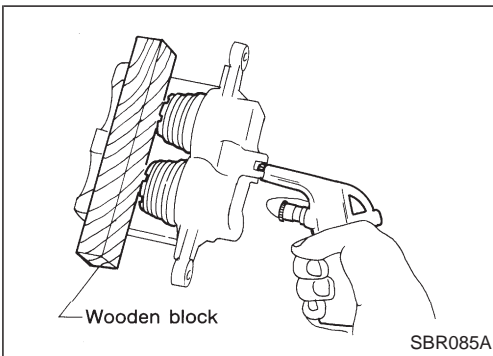
CAUTION:

Suspend caliper assembly with wire so as not to stretch brake hose.



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

WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

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

Inspection — Caliper

CYLINDER BODY

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

CAUTION:

Use brake fluid to clean. Never use mineral oil.

PISTON

Check piston for score, rust, wear, damage or presence of foreign objects. Replace if any of the above conditions are observed.

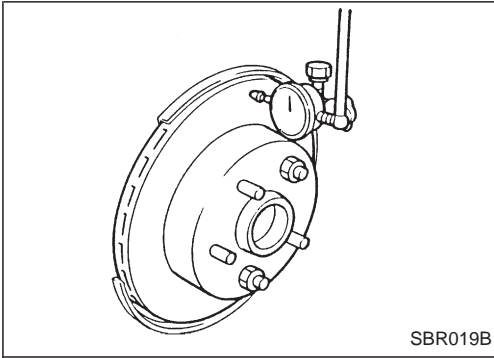
CAUTION:

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

SLIDE PIN, PIN BOLT AND PIN BOOT

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

FRONT DISC BRAKE



Inspection — Rotor

RUNOUT

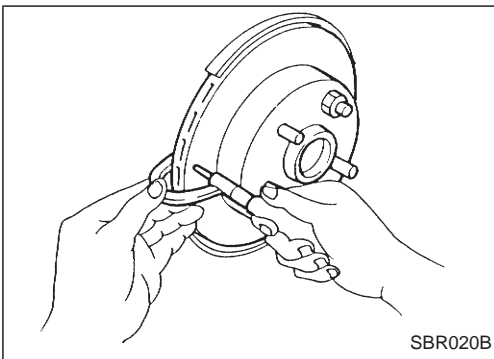
1. Secure rotor to wheel hub with at least two nuts (M12 x 1.25).
2. Check runout using a dial indicator.

Make sure that wheel bearing axial end play is within the specifications before measuring. Refer to FA section (“Front Wheel Bearing”, “ON-VEHICLE SERVICE”).

Maximum runout:

0.1 mm (0.004 in)

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



THICKNESS

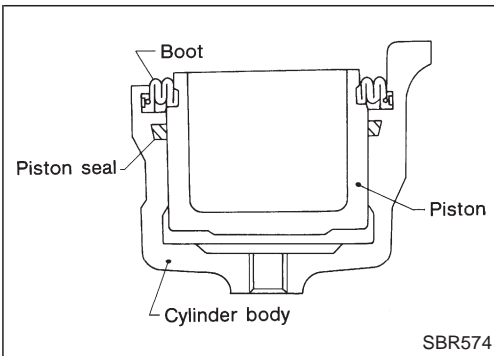
Thickness variation (At least 8 positions):

Maximum 0.015 mm (0.0006 in)

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

Rotor repair limit:

30.0 mm (1.181 in)

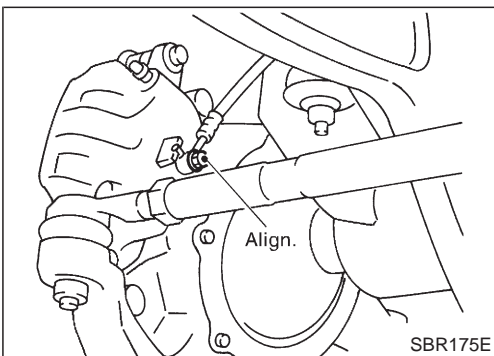


Assembly

1. Insert piston seal into groove on cylinder body.
2. With piston boot fitted to piston, insert piston boot into groove on cylinder body and install piston.
3. Properly secure piston boot

CAUTION:

Secure dust seal properly.



Installation

CAUTION:

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

1. Install caliper assembly.
2. Install brake hose to caliper securely.
3. Install all parts and secure all bolts.
4. Bleed air. Refer to “Bleeding Brake System”, BR-4.

REAR DISC BRAKE

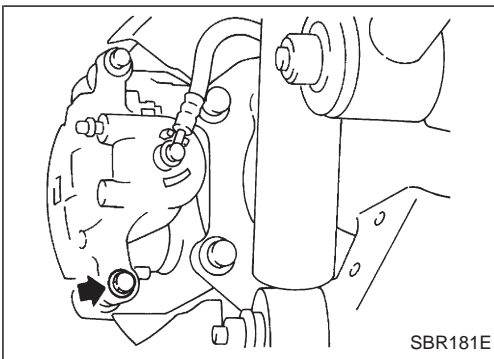
Pad Replacement

WARNING:

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



1. Remove master cylinder reservoir cap.
2. Remove lower pin bolt.
3. Open cylinder body upward. Then remove pad retainers, and inner and outer shims.

Standard pad thickness:

10.0 mm (0.394 in)

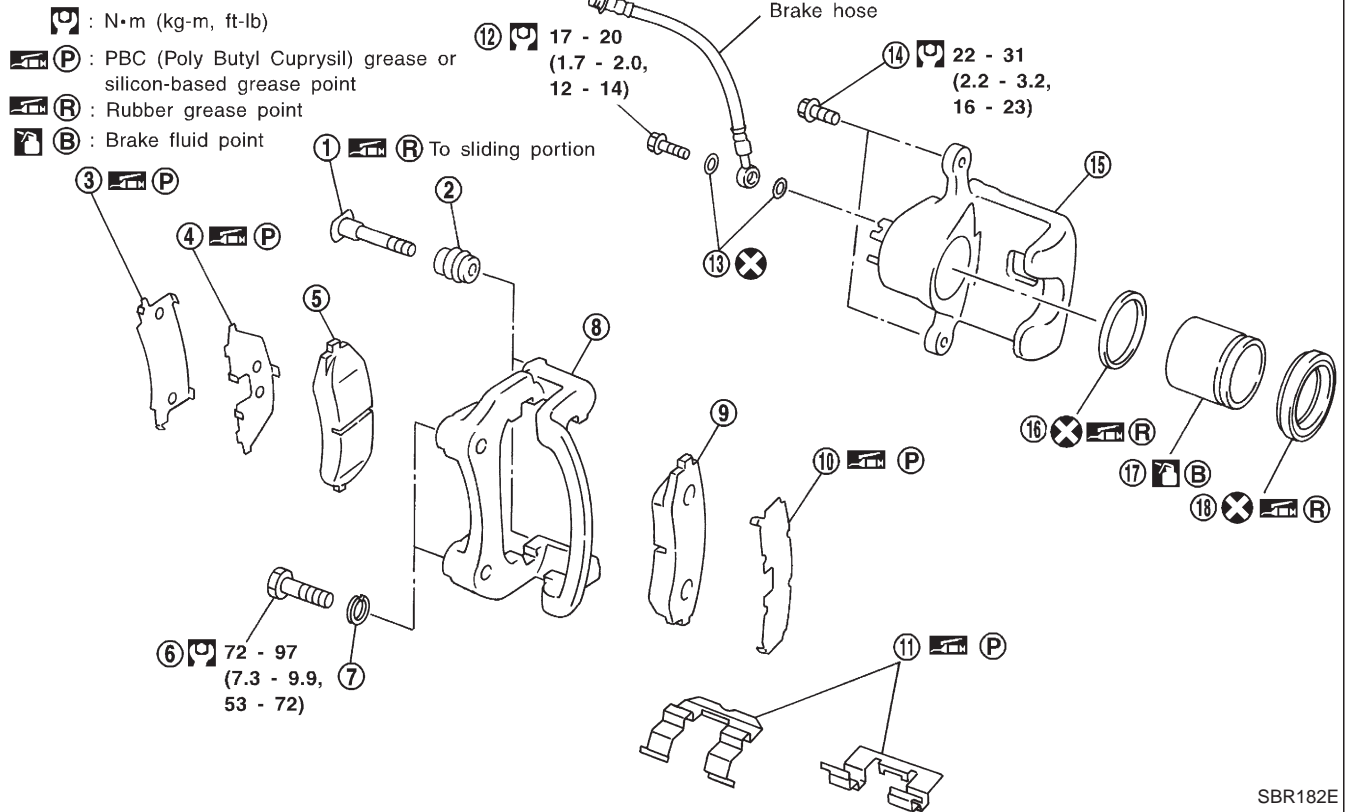
Pad wear limit:

2.0 mm (0.079 in)

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

REAR DISC BRAKE

SEC. 441



SBR182E

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

REAR DISC BRAKE

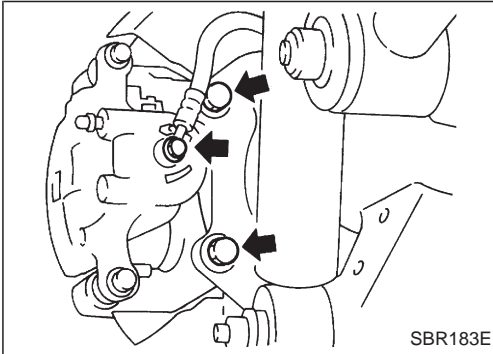
Removal

WARNING:

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

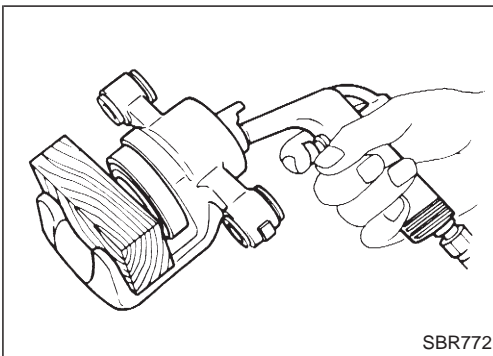
CAUTION:

Suspend caliper assembly with wire so as not to stretch brake hose.



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

WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

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

Inspection — Caliper

CYLINDER BODY

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

CAUTION:

Use brake fluid to clean. Never use mineral oil.

PISTON

Check piston for score, rust, wear, damage or presence of foreign objects. Replace if any of the above conditions are observed.

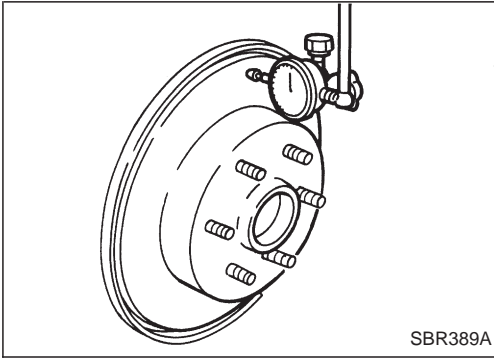
CAUTION:

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

SLIDE PIN, PIN BOLT AND PIN BOOT

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

REAR DISC BRAKE



Inspection — Rotor

RUNOUT

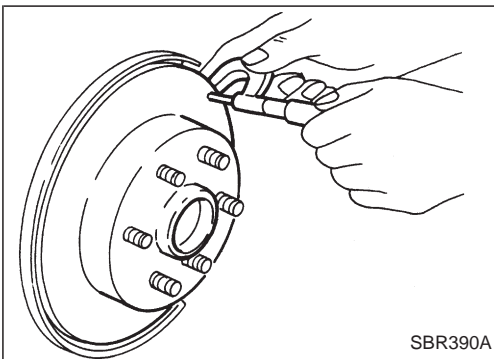
1. Secure rotor to wheel hub with at least two nuts (M12 × 1.25).
2. Check runout using a dial indicator.

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

Maximum runout:

0.1 mm (0.004 in)

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



THICKNESS

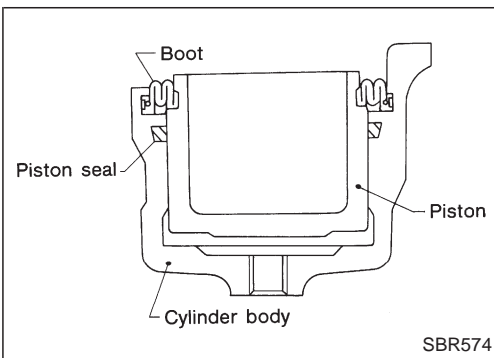
Thickness variation (At least 8 positions):

Maximum 0.015 mm (0.0006 in)

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

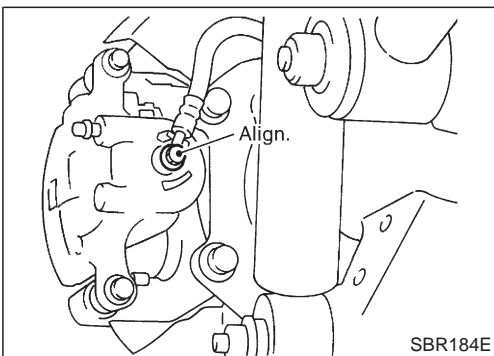
Rotor repair limit:

16.0 mm (0.630 in)



Assembly

1. Insert piston seal into groove on cylinder body.
2. With piston boot fitted to piston, insert piston boot into groove on cylinder body and install piston.
3. Properly secure piston boot



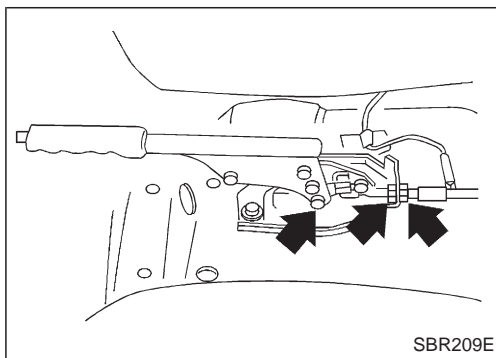
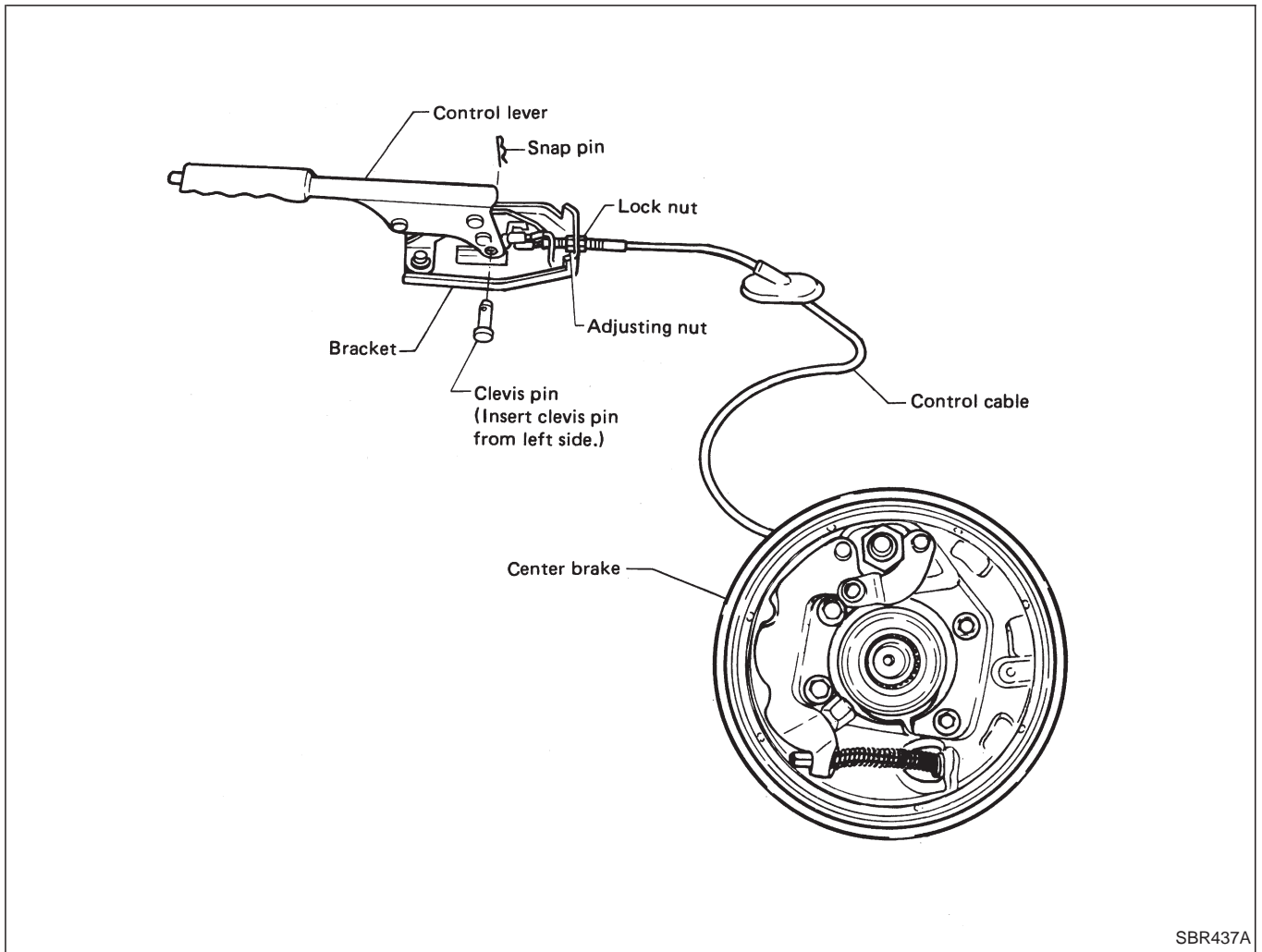
Installation

CAUTION:

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

1. Install caliper assembly.
2. Install brake hose to caliper securely.
3. Install all parts and secure all bolts.
4. Bleed air. Refer to “Bleeding Brake System”, BR-4.

PARKING CENTER BRAKE CONTROL



Removal

1. Disconnect harness connector.
2. Disconnect control cable from control lever and bracket.
3. Remove control lever and bracket.
4. Disconnect control cable from center brake and remove control cable.

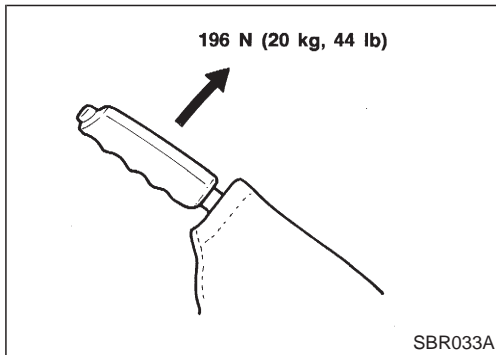
Inspection

1. Check control lever and ratchet for evidence of wear or other damage. Replace if necessary.
2. Check wires for evidence of discontinuity or other deterioration. Replace if necessary.
3. Check parts at each connection for deformation or damage. Replace if necessary.
4. Check warning lamp and switch. Replace if necessary.

PARKING CENTER BRAKE CONTROL

Installation

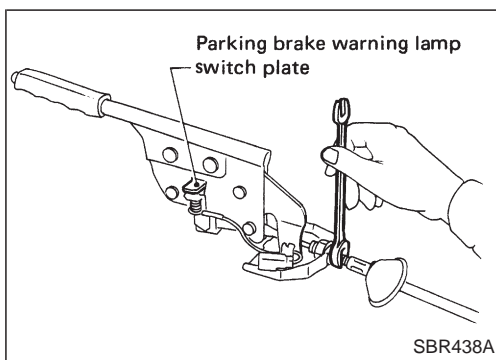
1. Apply a coating of grease to sliding contact surfaces.
2. Insert clevis pin from left side.
3. After installation is completed, adjust entire system.



Adjustment

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

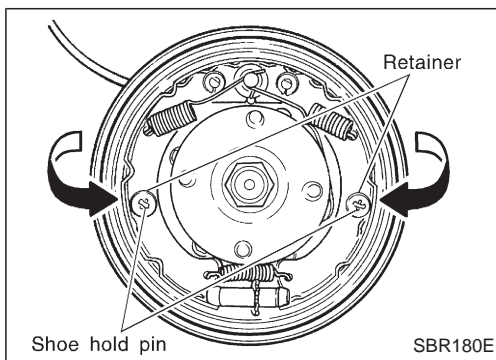
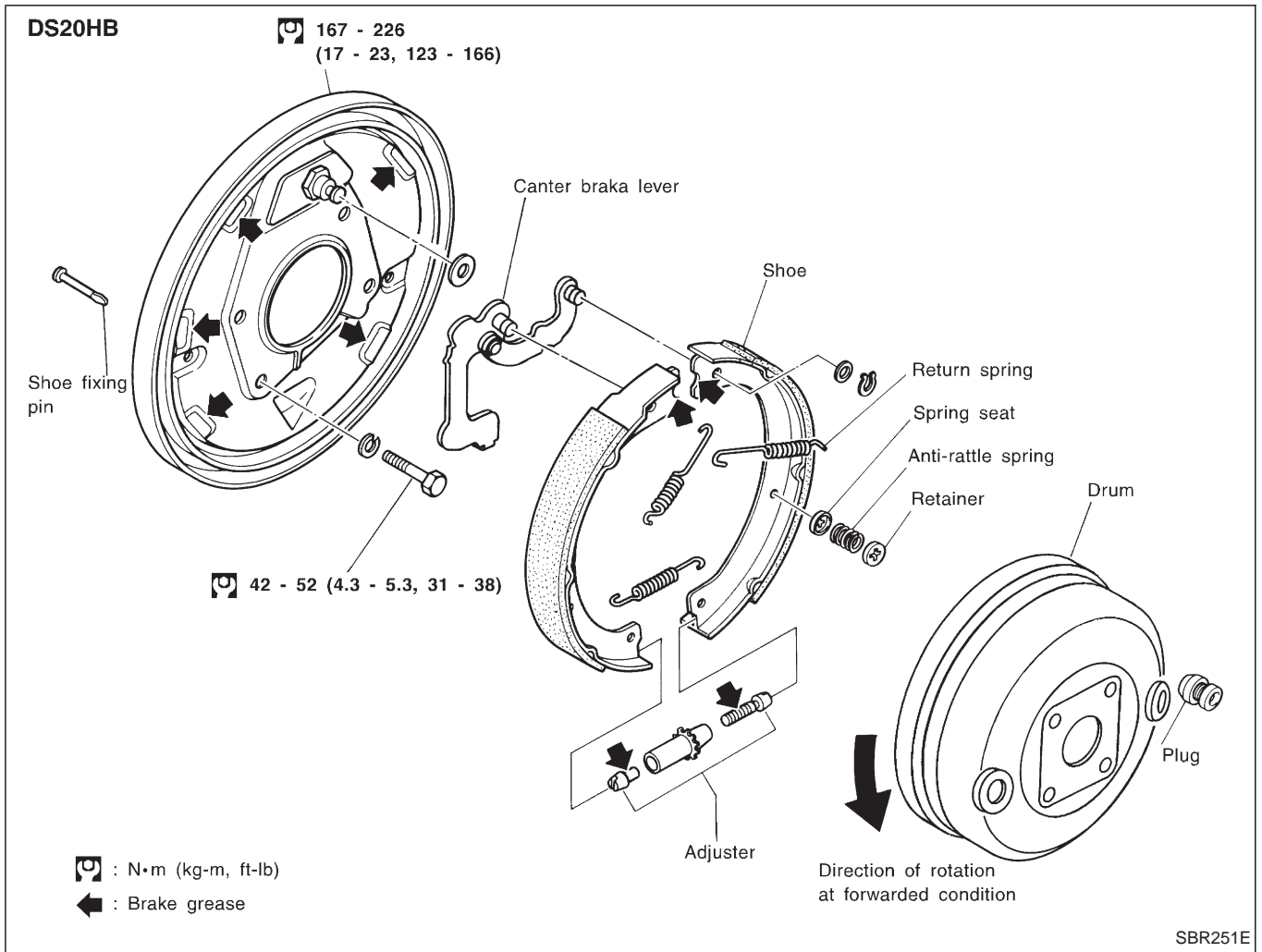
Number of notches: 7 - 9



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

Number of notches: 2

PARKING CENTER BRAKE



Removal and Installation

WARNING:

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

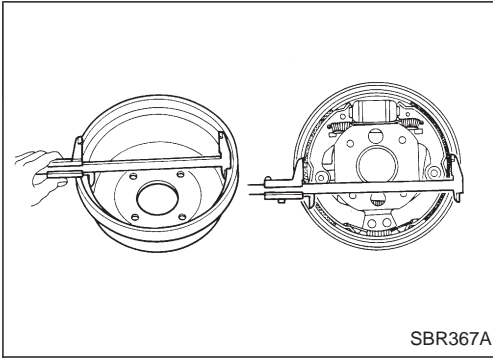
CAUTION:

Make sure parking brake lever is released completely.

1. Release parking brake lever fully.
2. Remove rear propeller shaft and drum.
3. After removing shoe hold pin by rotating push retainer, remove leading shoe then remove trailing shoe.
Remove spring by rotating shoes in direction arrow.
4. Remove adjuster and return spring.
5. Disconnect parking brake cable from center brake lever.
Be careful not to damage parking brake cable when separating it.
6. Remove retainer ring with a suitable tool. Then separate center brake lever and brake shoe.

PARKING CENTER BRAKE

Removal and Installation (Cont'd)

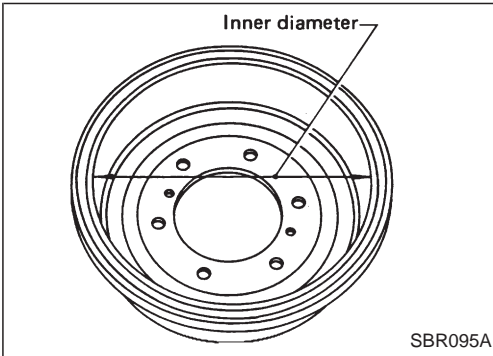


When installing, measure brake drum inside diameter and diameter of brake shoes. Check that the difference between diameters is the correct shoe clearance.

Shoe clearance:

0.25 - 0.4 mm (0.0098 - 0.0157 in)

If necessary, adjust by rotating adjuster.



Inspection — Drum

Standard inner diameter:

203.2 mm (8 in)

Maximum inner diameter:

204.5 mm (8.05 in)

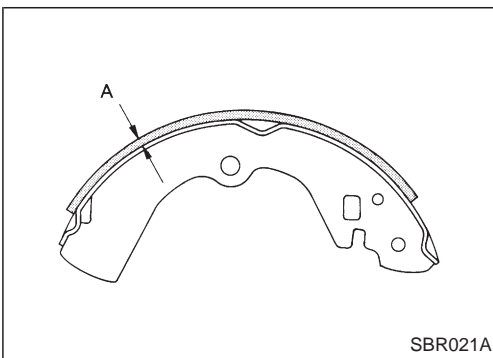
Out-of-roundness (Ellipticity):

0.03 mm (0.0012 in) or less

Radial runout (Total indicator reading):

0.05 mm (0.0020 in) or less

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



Inspection — Lining

- Check lining thickness.

Lining wear limit:

1.5 mm (0.059 in)

Lining standard thickness:

5.1 mm (0.201 in)

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

After installation, adjust shoe-to-drum clearance. Refer to Removal and Installation.

ANTI-LOCK BRAKE SYSTEM

Purpose

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

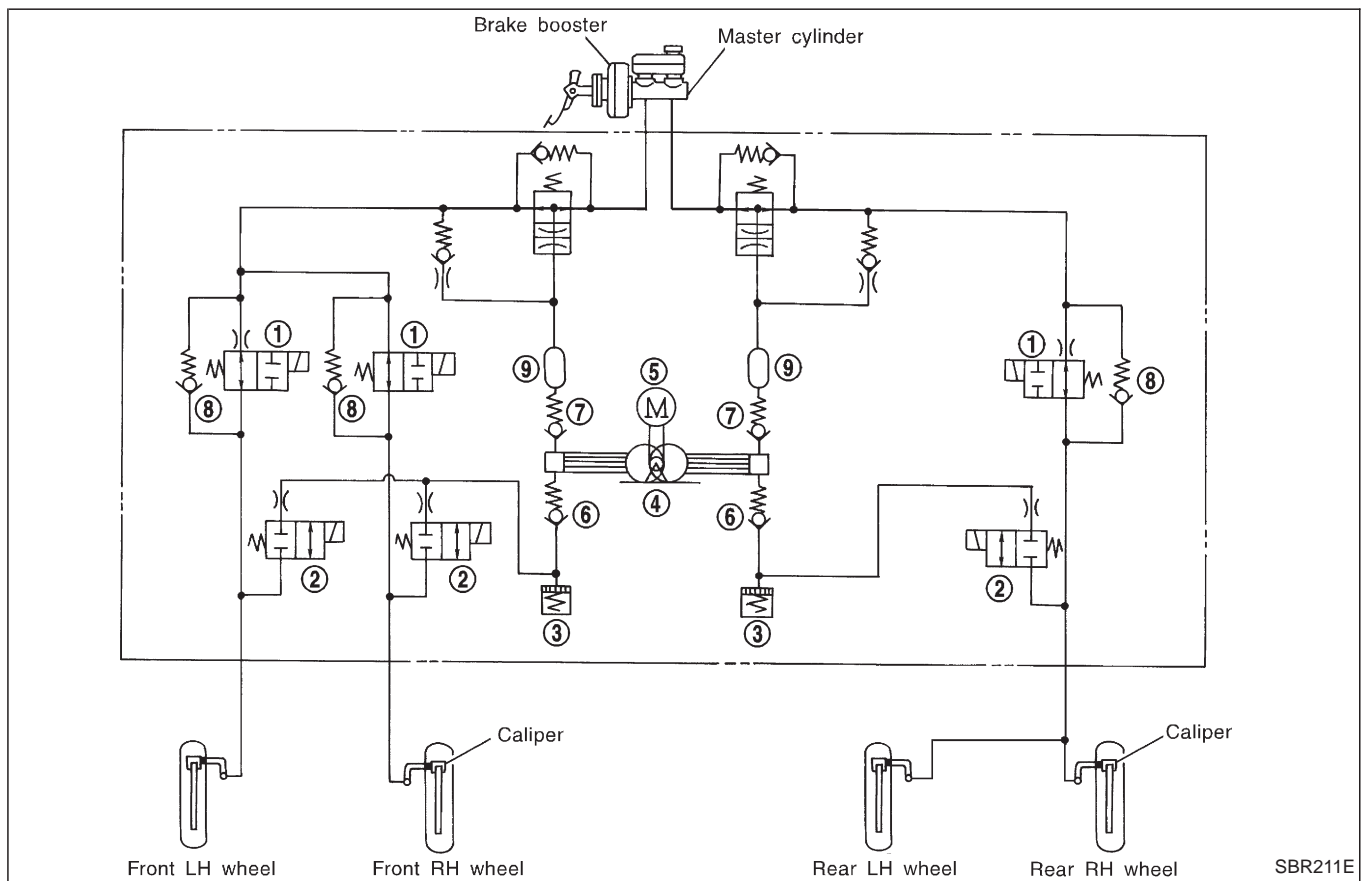
The ABS:

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

Operation

- When the vehicle speed is less than 10 km/h (6 MPH) this system does not work.
- The Anti-Lock Brake System (ABS) has a self-test function. The system turns on the ABS warning lamp for 1 second each time the ignition switch is turned "ON". After the engine is started, the ABS warning lamp turns off. The system performs a test the first time the vehicle reaches 6 km/h (4 MPH). A mechanical noise may be heard as the ABS performs this self-test. This is a normal part of the self-test feature. If a malfunction is found during this check, the ABS warning lamp will stay on.
- While driving, a mechanical noise may be heard during ABS operation. This is a normal condition.
- While DIFF-LOCK is on, the anti-lock brake warning light flashes. This indicates that anti-lock may not be fully operated. (ABS only)

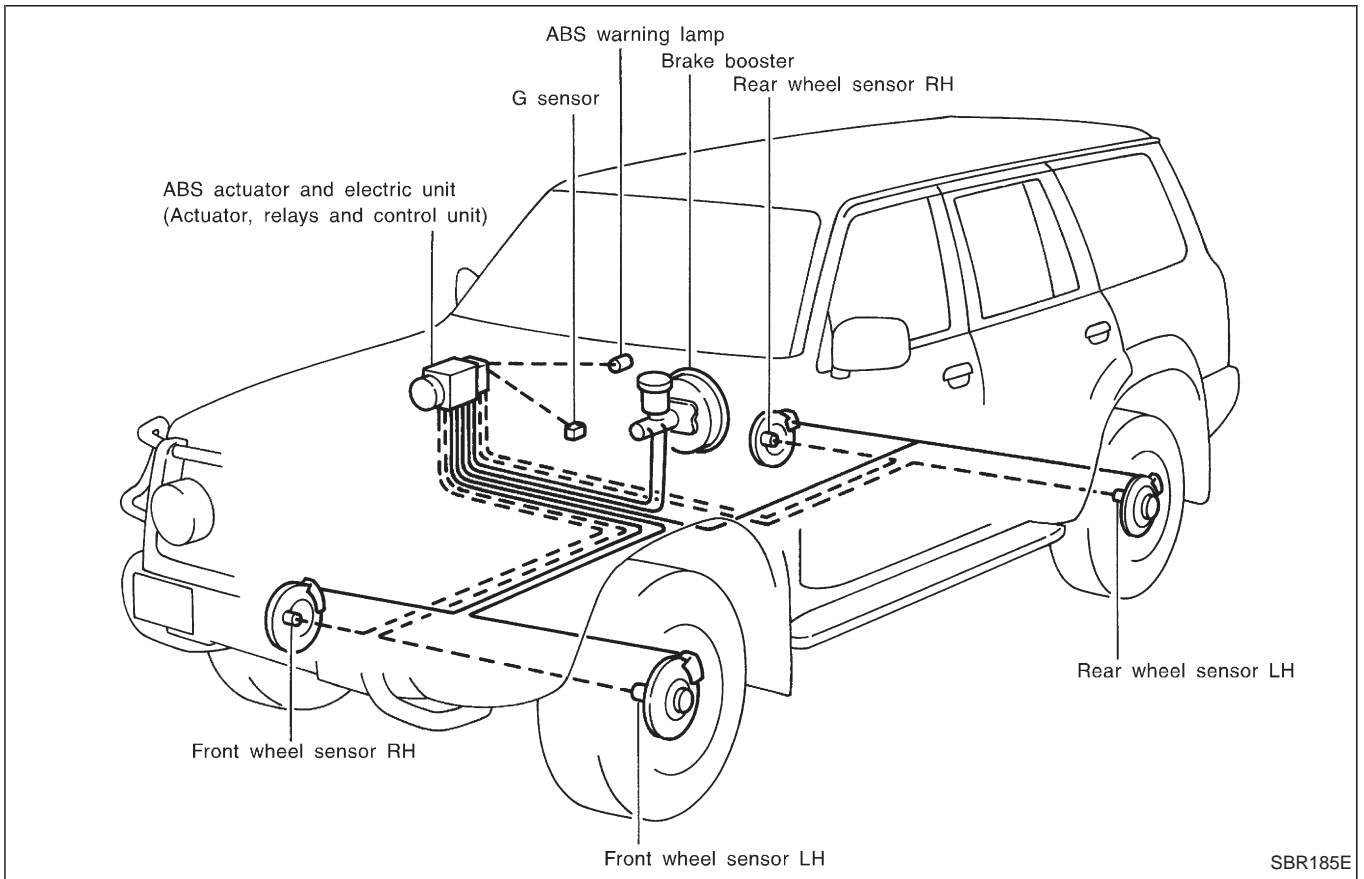
ABS Hydraulic Circuit



- | | | |
|-------------------------|---------------|----------------------|
| ① Inlet solenoid valve | ④ Pump | ⑦ Outlet valve |
| ② Outlet solenoid valve | ⑤ Motor | ⑧ Bypass check valve |
| ③ Reservoir | ⑥ Inlet valve | ⑨ Damper |

ANTI-LOCK BRAKE SYSTEM

System Components



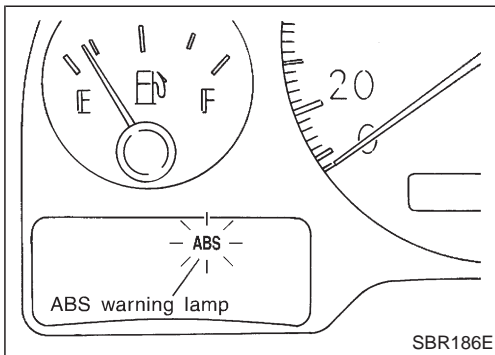
System Description

WHEEL SENSOR

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

CONTROL UNIT (built in ABS actuator and electric 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 valve relay and motor relay. If any electrical malfunction should be detected in the system, the control unit causes the warning lamp to light up. In this condition, the ABS will be deactivated by the control unit, and the vehicle's brake system reverts to normal operation. (For control unit layout, refer to ABS ACTUATOR AND ELECTRIC UNIT, BR-34.)

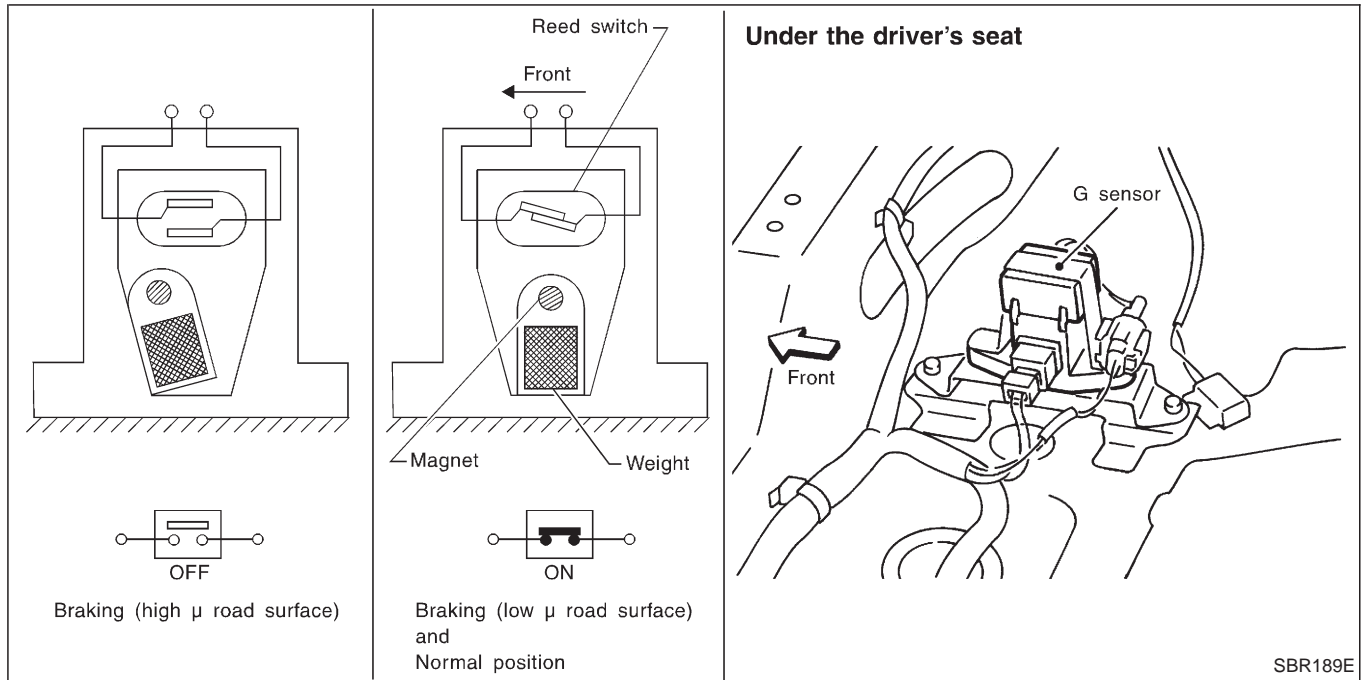


ANTI-LOCK BRAKE SYSTEM

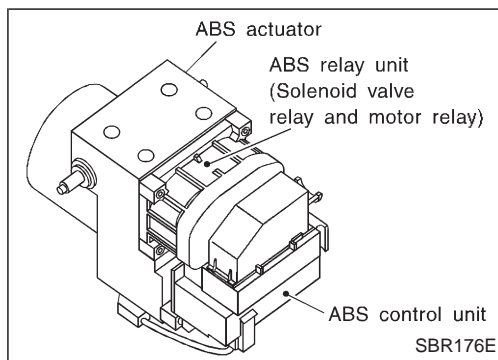
System Description (Cont'd)

G SENSOR

The G sensor senses deceleration during braking to determine whether the vehicle is being driven on a high μ road (asphalt road, etc.) or a low μ road (snow-covered road, etc.). It then sends a signal to the ABS control unit.



The reed switch turns on when it is affected by a magnetic field. During sudden deceleration (braking on a high μ road), the weight moves and the magnet in the weight moves away from the reed switch. The magnetic field then diminishes and the reed switch turns off.



ABS ACTUATOR AND ELECTRIC UNIT

The ABS actuator and electric unit contains:

- An electric motor and pump
- Two relays
- Six solenoid valves, each inlet and outlet for
 - LH front
 - RH front
 - Rear
- ABS control unit

This component controls the hydraulic circuit and increases, holds or decreases hydraulic pressure to all or individual wheels. The ABS actuator and electric unit are not disassemble.

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 wheel cylinder via the inlet solenoid valve.
ABS operation	Pressure hold	ON (Closed)	OFF (Closed)	Hydraulic circuit is shut off to hold the wheel cylinder brake fluid pressure.
	Pressure decrease	ON (Closed)	ON (Open)	Wheel cylinder 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 wheel cylinder.

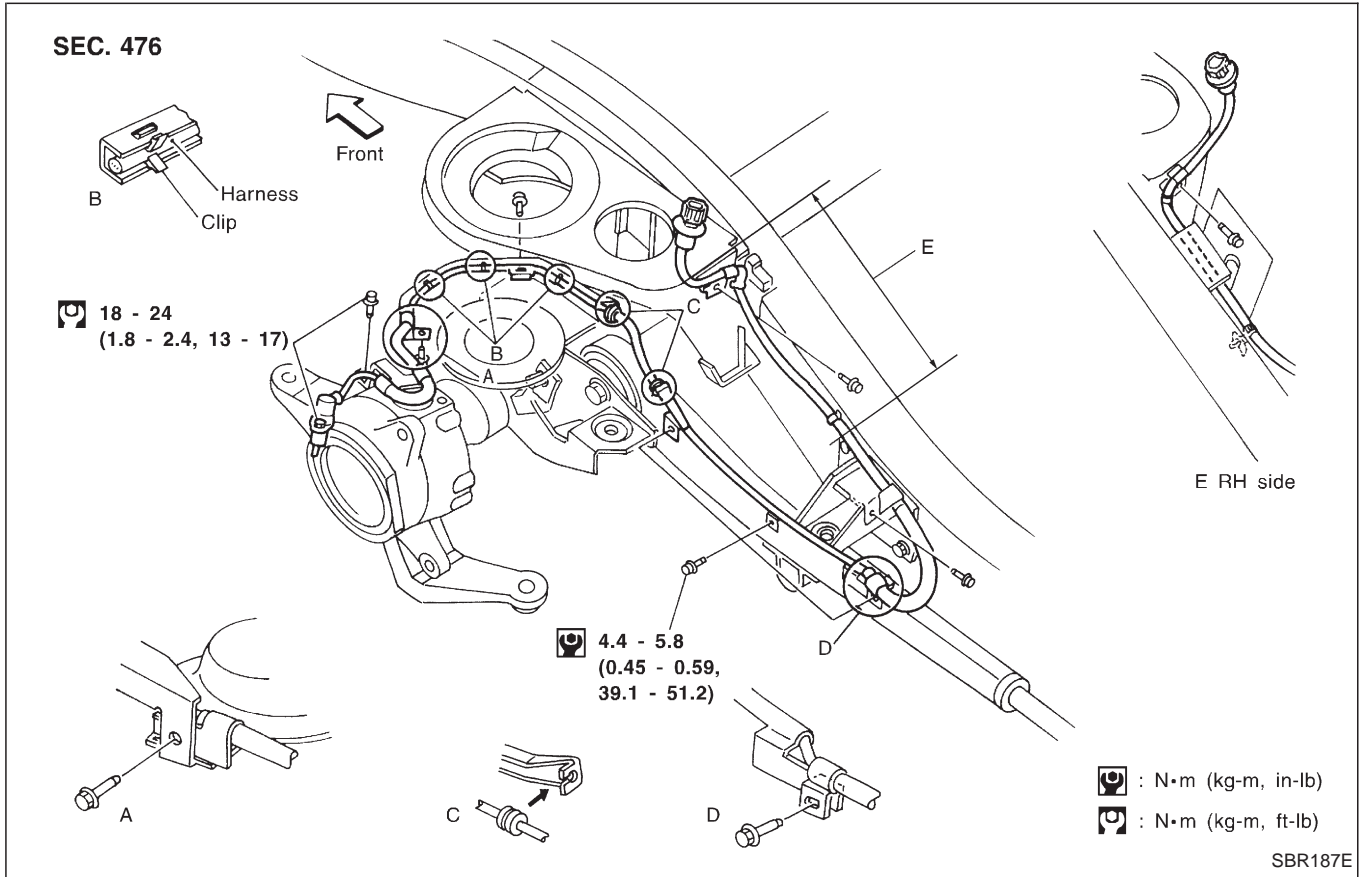
ANTI-LOCK BRAKE SYSTEM

Removal and Installation

CAUTION:

Be careful not to damage sensor edge and sensor rotor teeth. When removing the front wheel hub or rear axle shaft assembly, disconnect the ABS wheel sensor from the assembly and move it away.

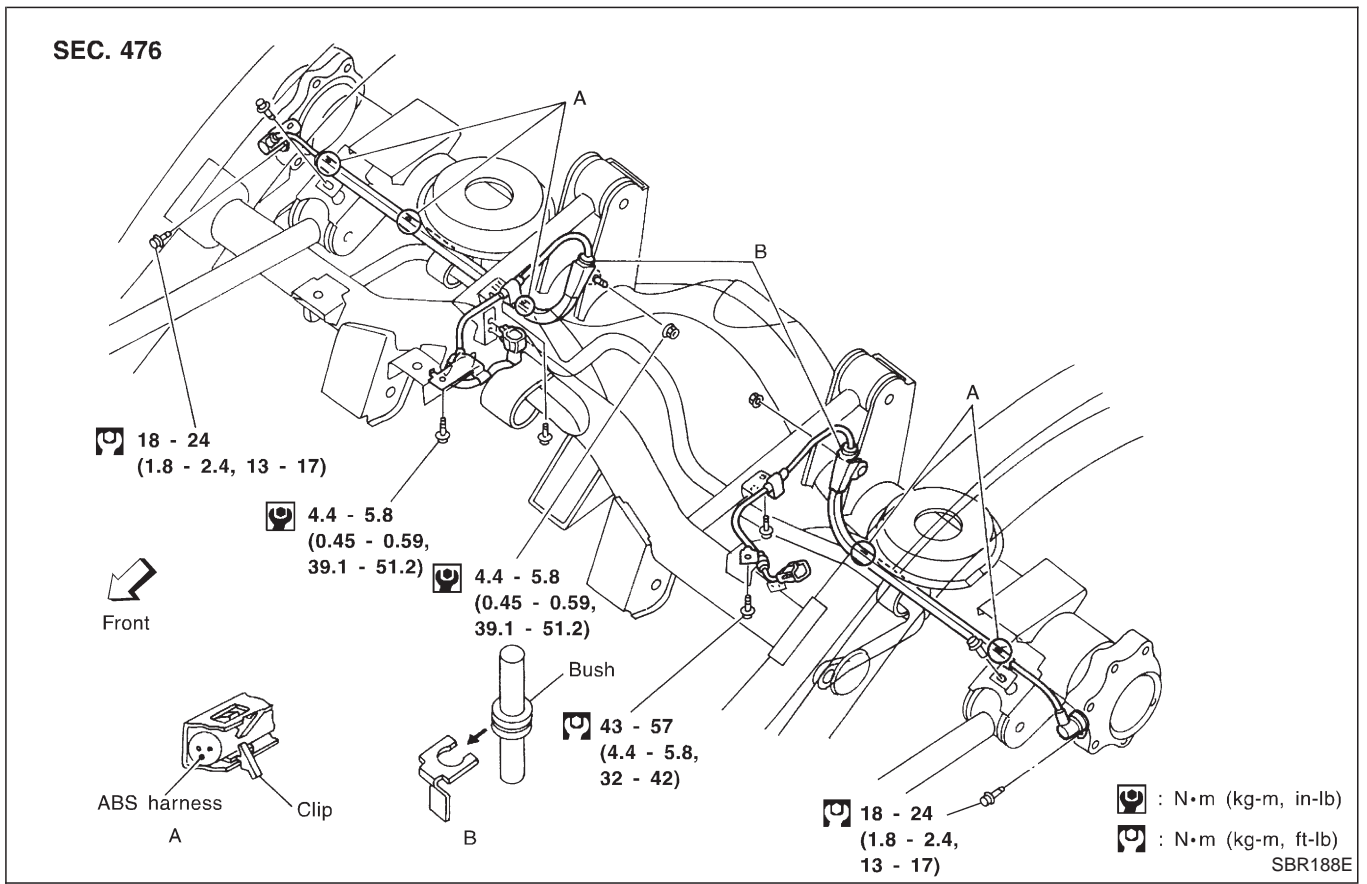
FRONT WHEEL SENSOR



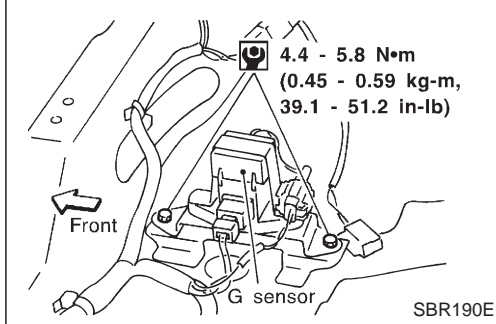
ANTI-LOCK BRAKE SYSTEM

Removal and Installation (Cont'd)

REAR WHEEL SENSOR



Under the driver's seat



G SENSOR

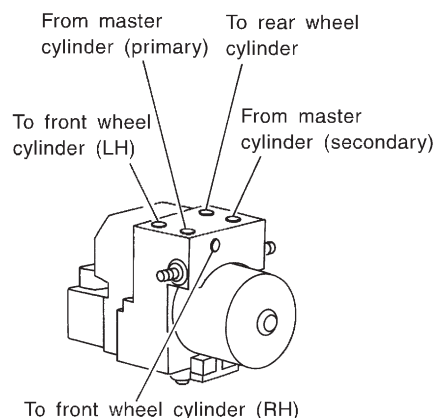
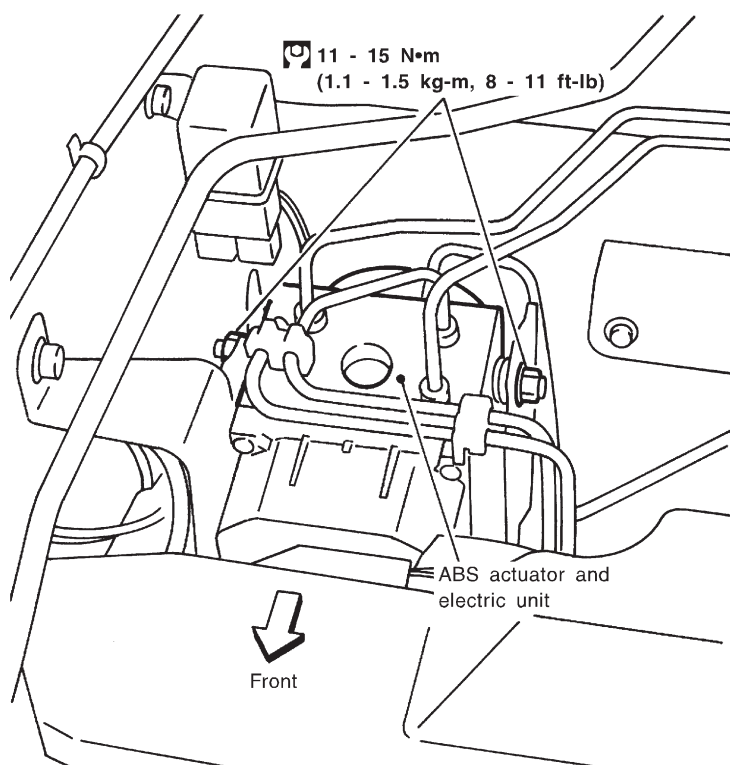
Always replace G sensor if bumped or dropped. Otherwise, performance characteristics of G sensor will be changed, which in turn changes ABS control performance characteristics.

ANTI-LOCK BRAKE SYSTEM

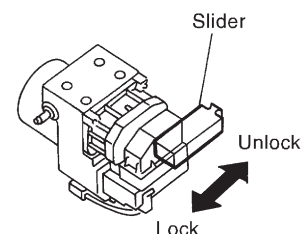
Removal and Installation (Cont'd)

ABS ACTUATOR AND ELECTRIC UNIT

SEC. 476



The way of connector lock



SBR191E

Removal

1. Disconnect battery cable.
2. Drain brake fluid. Refer to "Changing Brake Fluid", BR-3.
3. Remove mounting bracket fixing bolts and nuts.
4. Disconnect connector, brake pipes and remove fixing nuts.

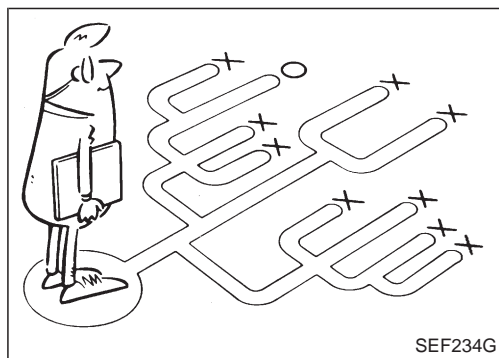
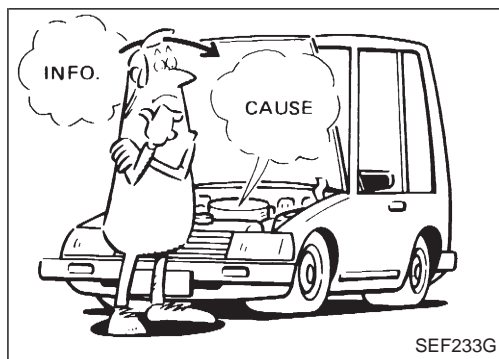
Installation

CAUTION:

After installation, refill brake fluid. Then bleed air. Refer to "Bleeding Brake System", BR-4.

1. Connect brake pipes temporarily.
2. Tighten fixing bolts and nuts.
3. Tighten brake pipes.
4. Connect connector and battery cable.

TROUBLE DIAGNOSES



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 the 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 booster lines, lack of brake fluid, or other problems with the brake system.

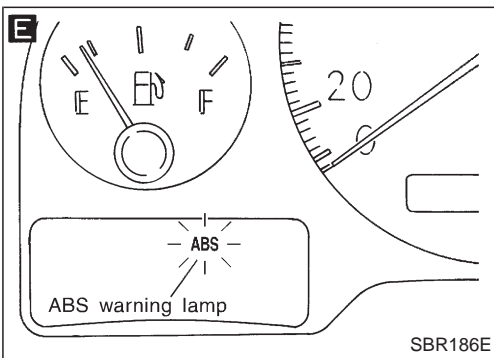
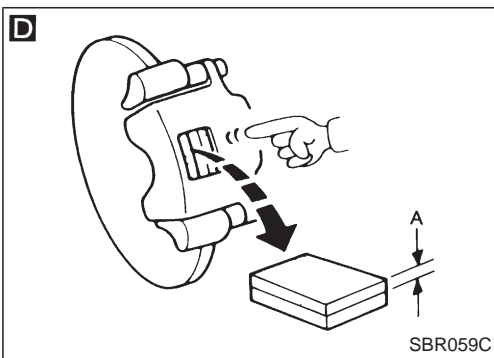
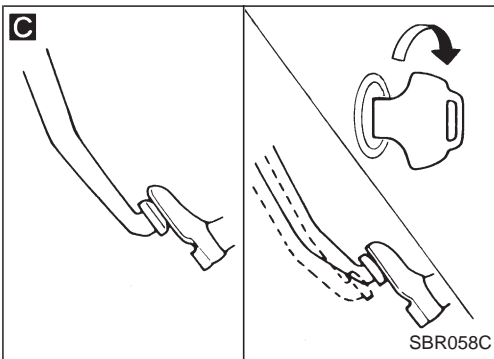
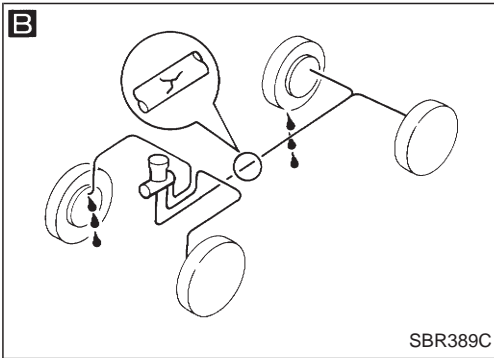
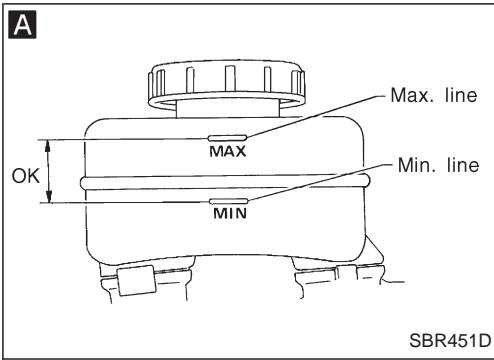
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspicious circuits may help prevent the replacement of good parts.

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

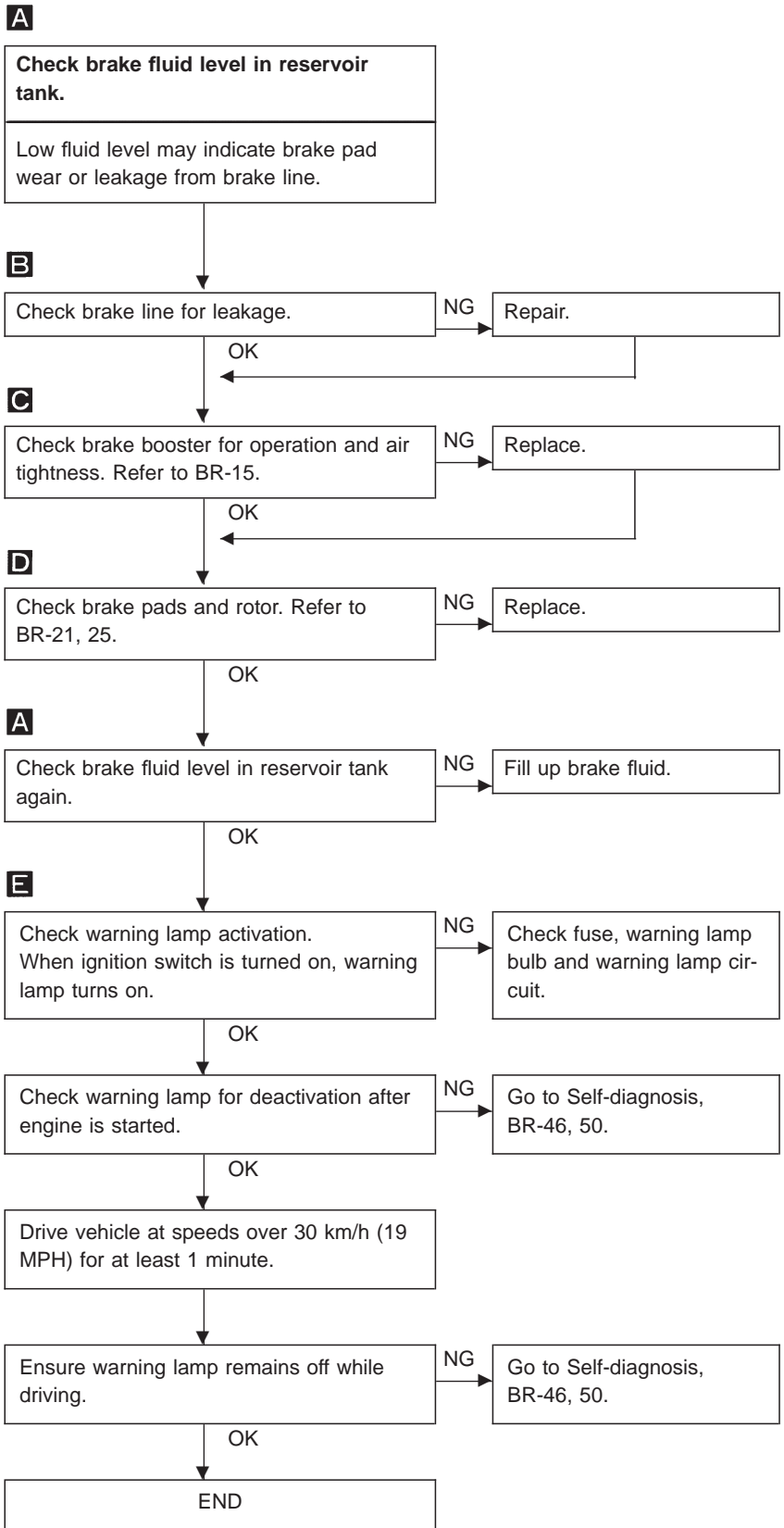
Before undertaking actual checks, take a few minutes to talk with a customer who approaches with a ABS complaint. The customer is a very good source of information on such problems; especially intermittent ones. Through the talks with the customer, find out what symptoms are present and under what conditions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

TROUBLE DIAGNOSES

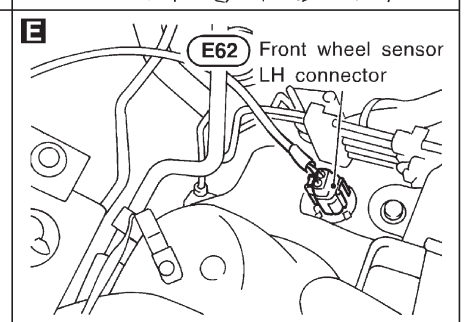
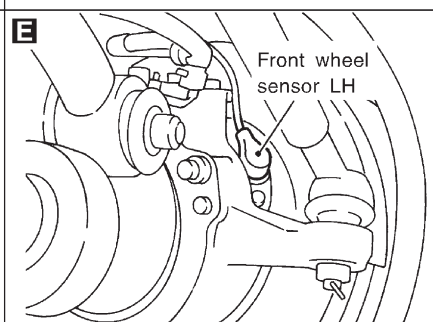
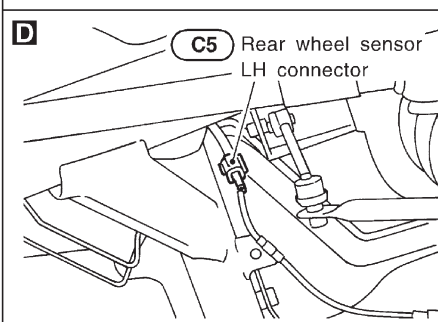
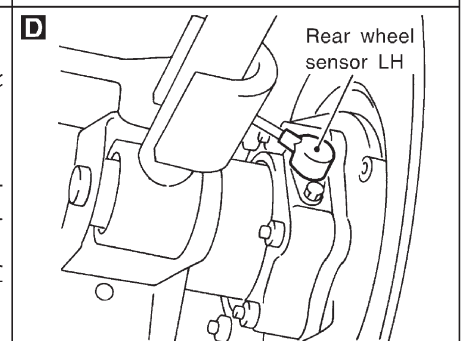
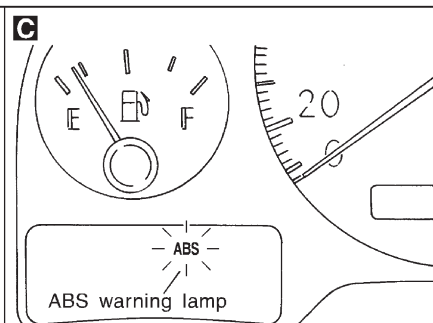
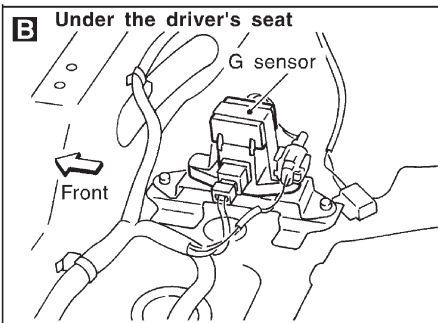
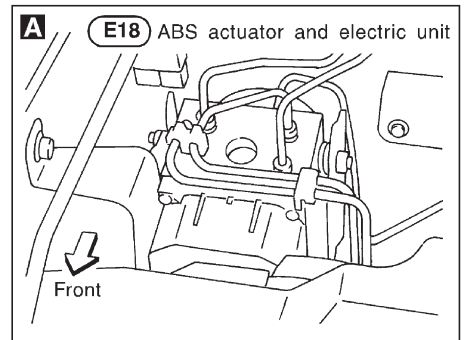
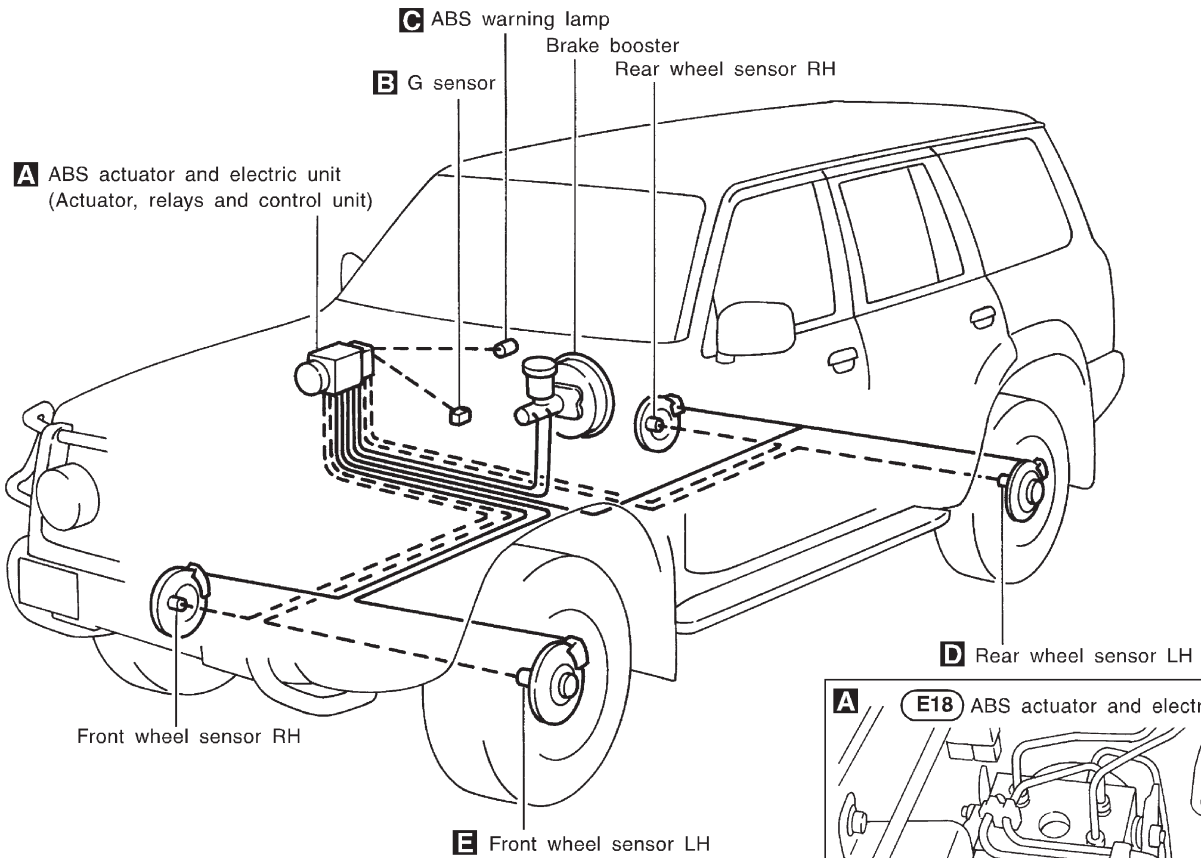


Preliminary Check



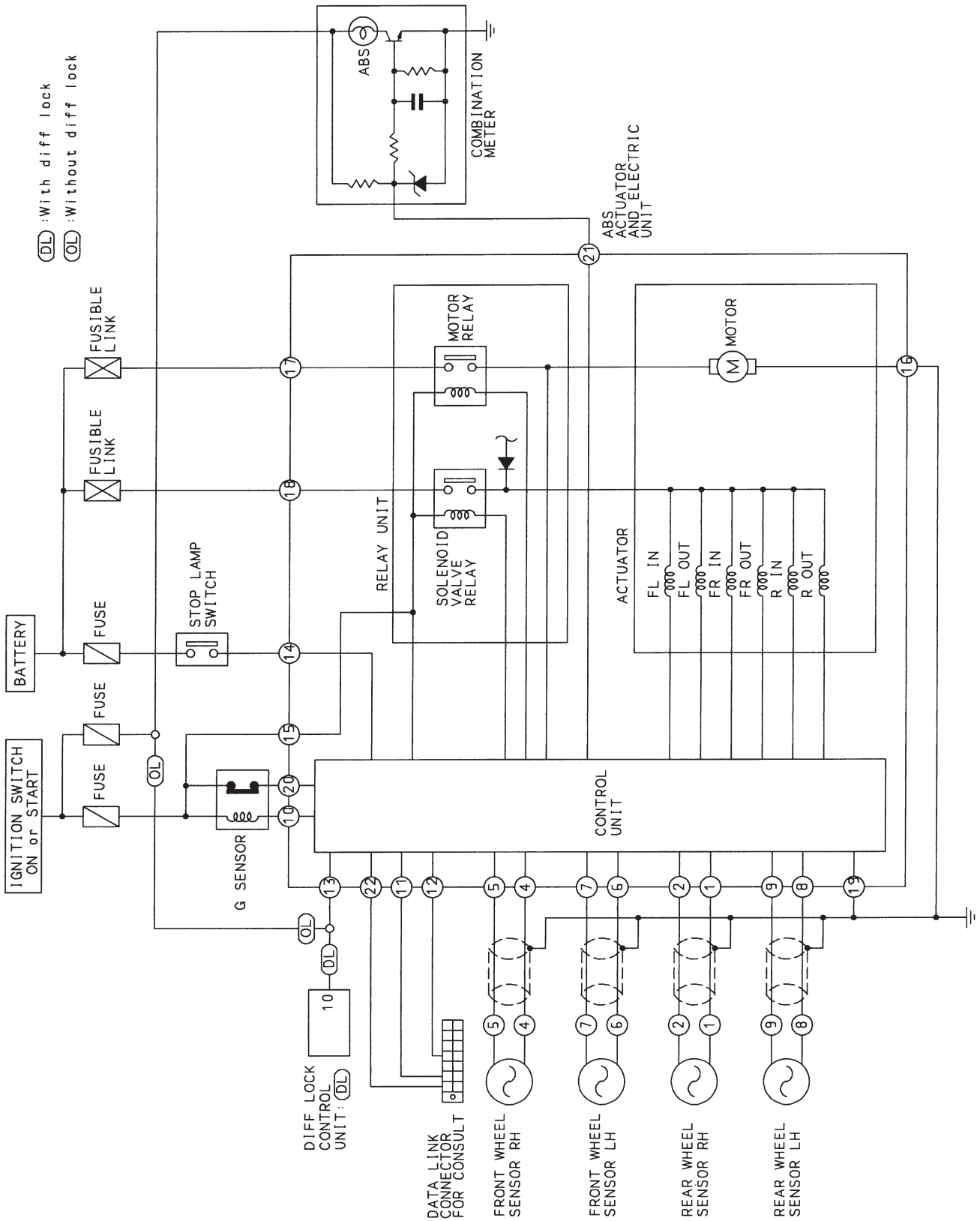
TROUBLE DIAGNOSES

Component Parts and Harness Connector Location



TROUBLE DIAGNOSES

Circuit Diagram for Quick Pinpoint Check

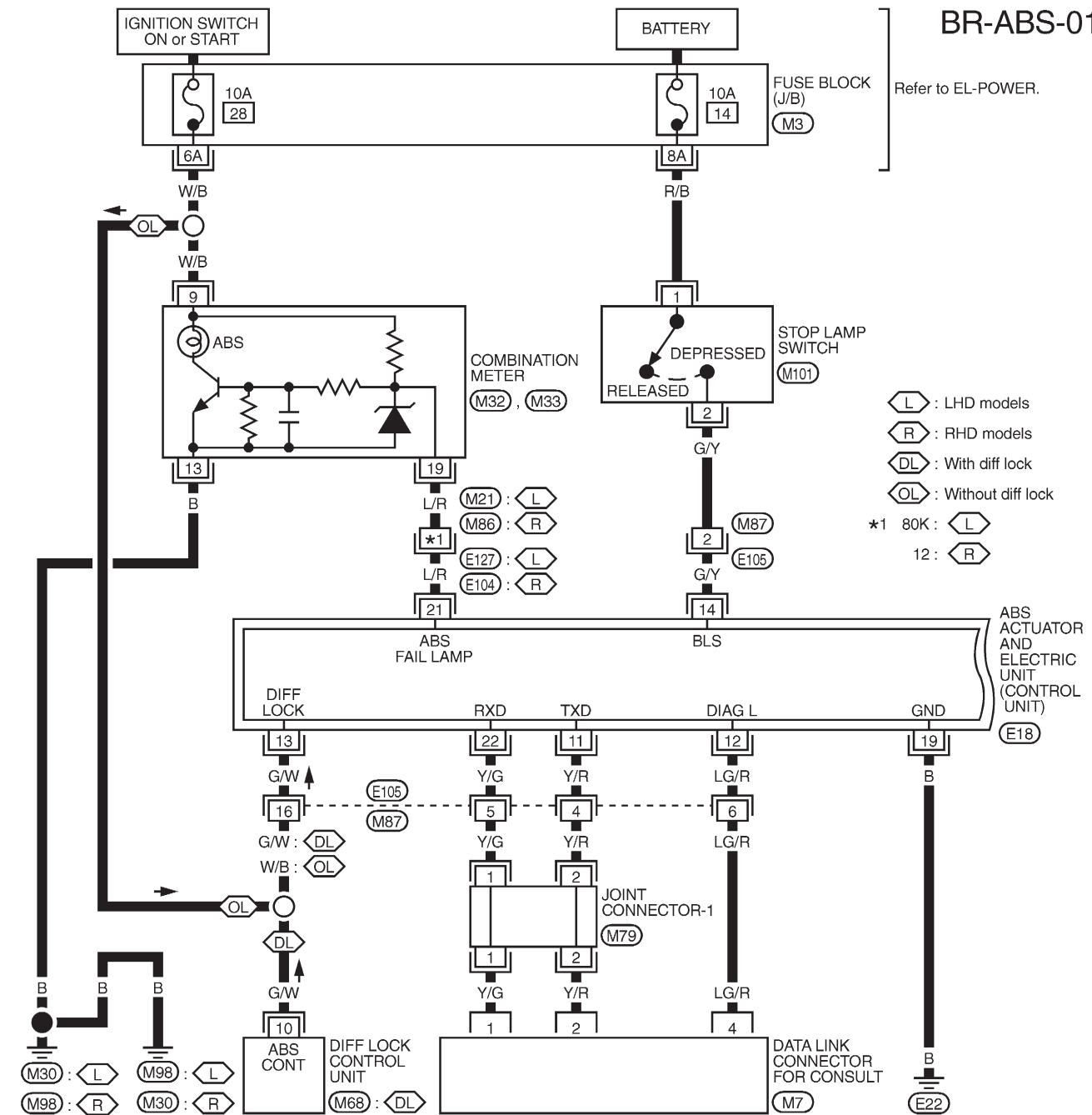


TROUBLE DIAGNOSES

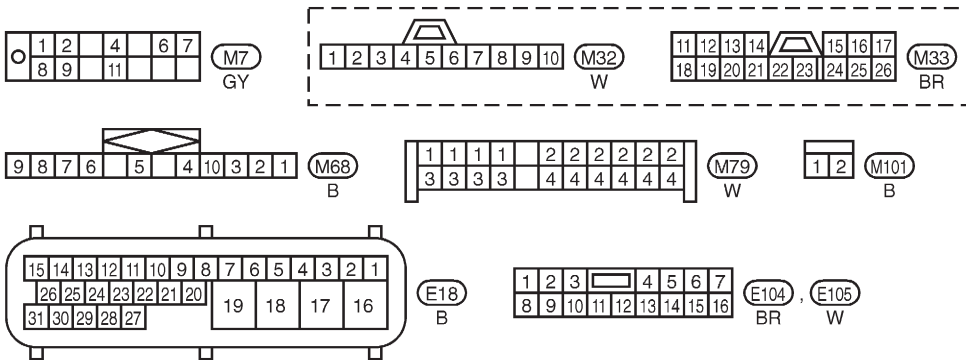
Wiring Diagram — ABS —

BR-ABS-01

Refer to EL-POWER.



- ⬡ L : LHD models
- ⬡ R : RHD models
- ⬡ DL : With diff lock
- ⬡ OL : Without diff lock
- *1 80K : ⬡ L
- 12 : ⬡ R



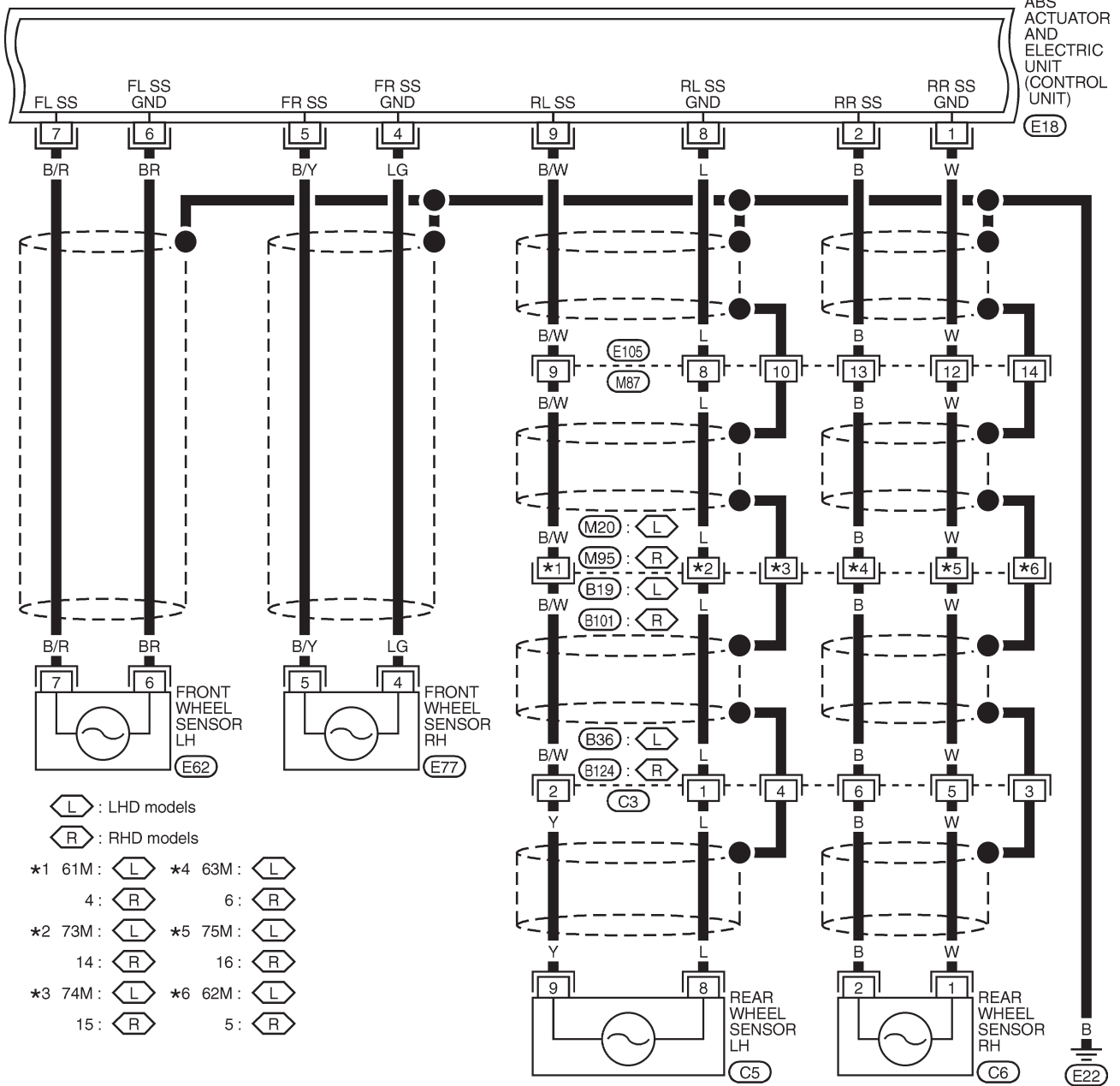
Refer to last page (Foldout page).

- ⬡ M21, ⬡ E127
- ⬡ M3

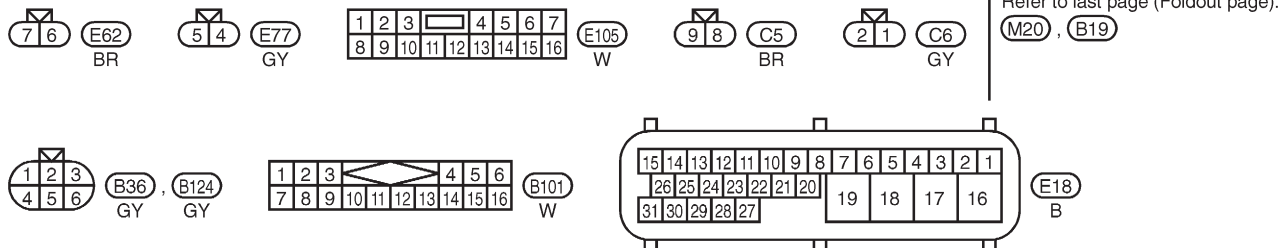
TROUBLE DIAGNOSES

Wiring Diagram — ABS — (Cont'd)

BR-ABS-03



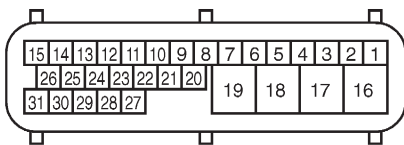
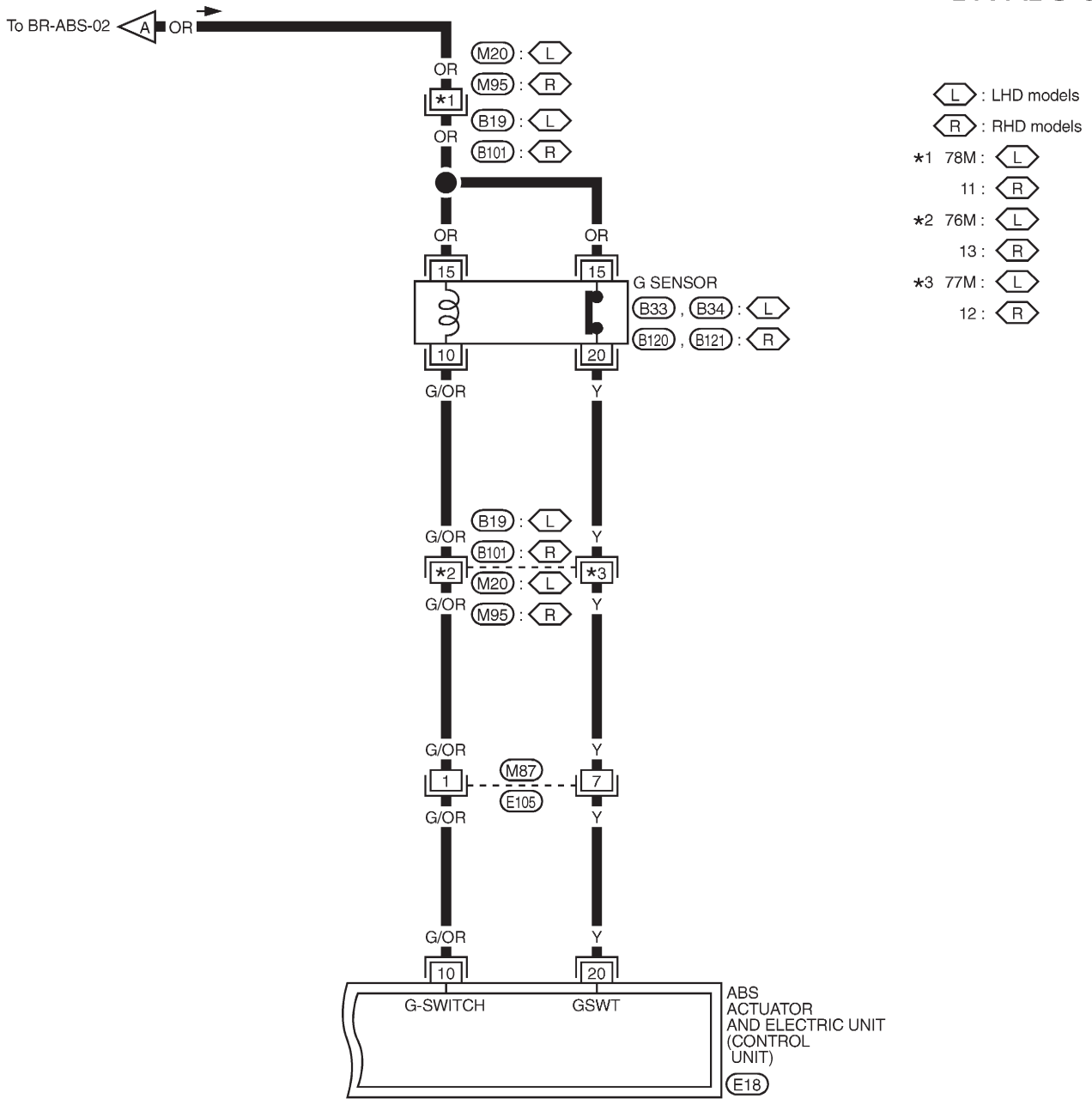
- ◁ L : LHD models
- ▷ R : RHD models
- *1 61M: ◁ L *4 63M: ◁ L
- 4: ▷ R 6: ▷ R
- *2 73M: ◁ L *5 75M: ◁ L
- 14: ▷ R 16: ▷ R
- *3 74M: ◁ L *6 62M: ◁ L
- 15: ▷ R 5: ▷ R



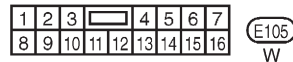
TROUBLE DIAGNOSES

Wiring Diagram — ABS — (Cont'd)

BR-ABS-04



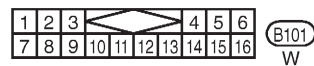
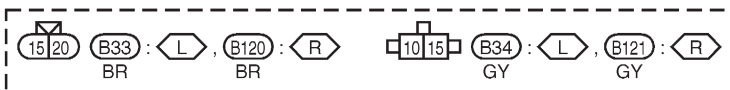
(E18)
B



(E105)
W

Refer to last page (Foldout page).

(M20), (B19)



(B101)
W

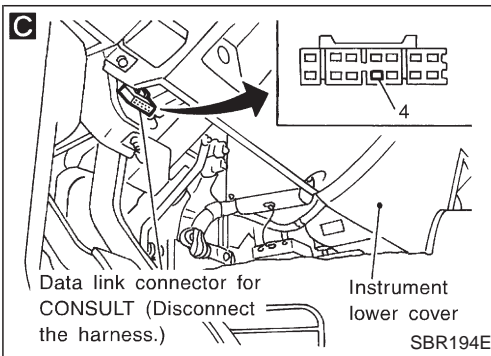
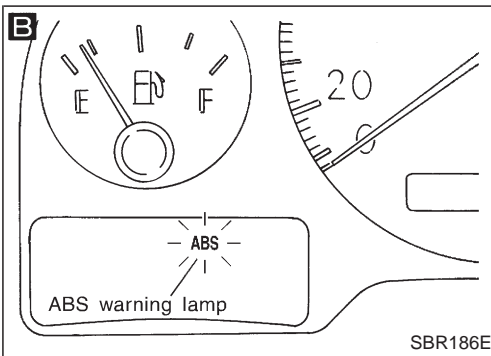
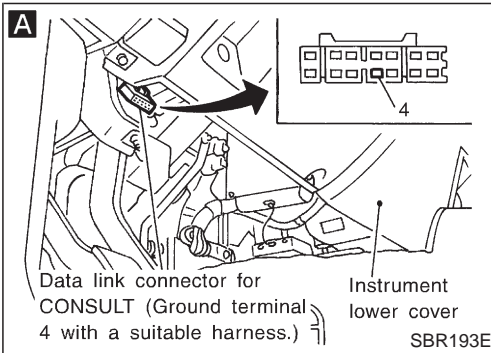
TROUBLE DIAGNOSES

Self-diagnosis

FUNCTION

- When a problem occurs in the ABS, the warning lamp on the instrument panel comes on. To start the self-diagnostic results mode, ground the self-diagnostic (check) terminal located on "Data Link Connector for CONSULT". The location of the malfunction is indicated by the warning lamp flashing.
- While DIFF-LOCK is on, anti-lock warning light flashes.

SELF-DIAGNOSIS PROCEDURE



Turn off DIFF-LOCK switch.
Drive vehicle over 30 km/h (19 MPH) for at least one minute.

Turn ignition switch "OFF".

A

Ground terminal "4" of "Data link connector for CONSULT" with a suitable harness.

Turn ignition switch "ON" while grounding terminal "4".
Do not depress brake pedal.

B

After 3.0 seconds, the warning lamp starts flashing to indicate the malfunction code No. (See NOTE.)

Verify the location of the malfunction with the malfunction code chart. Refer to BR-48. Then make the necessary repairs following the diagnostic procedures.

After the malfunctions are repaired, erase the malfunction codes stored in the control unit. Refer to BR-47.

Rerun the self-diagnostic results mode to verify that the malfunction codes have been erased.

C

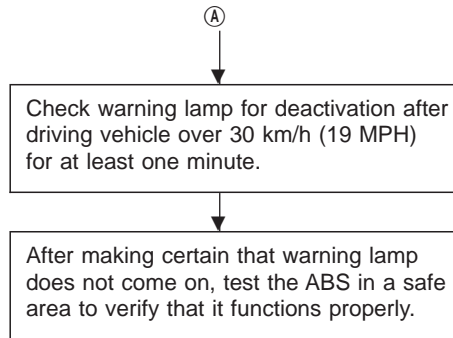
Disconnect the check terminal from the ground. The self-diagnostic results mode is now complete.

NOTE: The indication terminates after five minutes. However, when the ignition switch is turned from "OFF" to "ON", the indication starts flashing again.

Ⓐ

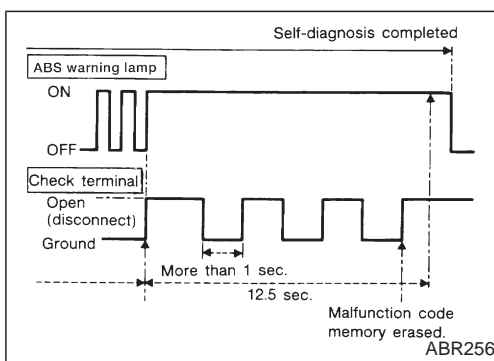
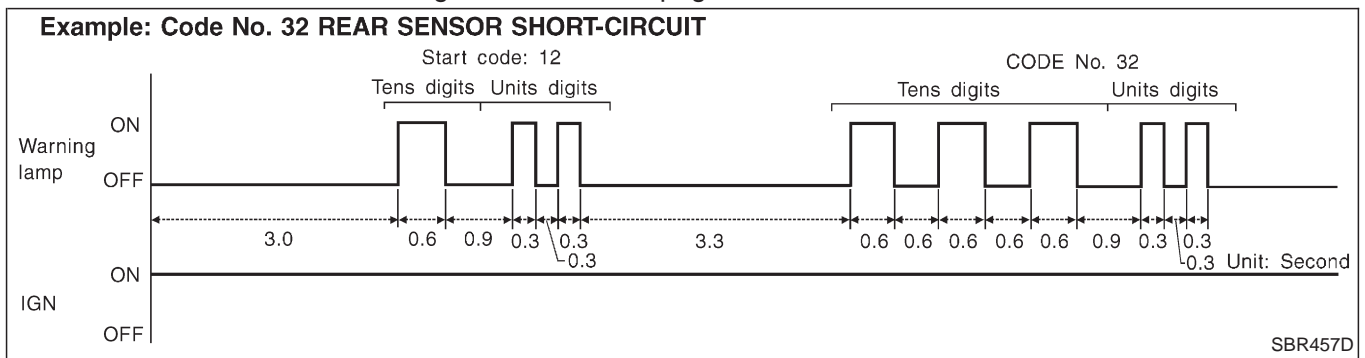
TROUBLE DIAGNOSES

Self-diagnosis (Cont'd)



HOW TO READ SELF-DIAGNOSTIC RESULTS (Malfunction codes)

- Determine the code No. by counting the number of times the warning lamp flashes on and off.
- When several malfunctions occur at one time, up to three code numbers can be stored; the latest malfunction will be indicated first.
- The indication begins with the start code 12. After that a maximum of three code numbers appear in the order of the latest one first. The indication then returns to the start code 12 to repeat (the indication will stay on for five minutes at the most).
- The malfunction code chart is given on the next page.



HOW TO ERASE SELF-DIAGNOSTIC RESULTS (Malfunction codes)

1. Disconnect the check terminal from ground (ABS warning lamp will stay lit).
2. Within 12.5 seconds, ground the check terminal 3 times. Each terminal ground must last more than 1 second. The ABS warning lamp goes out after the erase operation has been completed.
3. Perform self-diagnosis again. Refer to BR-47. Only the start-code should appear, no malfunction codes.

TROUBLE DIAGNOSES

Self-diagnosis (Cont'd)

MALFUNCTION CODE/SYMPTOM CHART

Code No. (No. of warning lamp flashes)	Malfunctioning part	Diagnostic procedure
45	Actuator front left outlet solenoid valve	2
46	Actuator front left inlet solenoid valve	2
41	Actuator front right outlet solenoid valve	2
42	Actuator front right inlet solenoid valve	2
55	Actuator rear outlet solenoid valve	2
56	Actuator rear inlet solenoid valve	2
25	★1 Front left sensor (open-circuit)	1
26	★1 Front left sensor (short-circuit)	1
21	★1 Front right sensor (open-circuit)	1
22	★1 Front right sensor (short-circuit)	1
31	★1 Rear right sensor (open-circuit)	1
32	★1 Rear right sensor (short-circuit)	1
35	★1 Rear left sensor (open-circuit)	1
36	★1 Rear left sensor (short-circuit)	1
18	★1 Sensor rotor	1
17	G sensor and circuit	5
61	★3 Actuator motor or motor relay	3
63	Solenoid valve relay	2
57	★2 Power supply (Low voltage)	4
71	Control unit	6
Warning lamp stays on when ignition switch is turned on	Control unit power supply circuit Warning lamp bulb circuit Control unit or control unit connector Solenoid valve relay stuck Power supply for solenoid valve relay coil	13
Warning lamp does not come on when ignition switch is turned on	Fuse, warning lamp bulb or warning lamp circuit Control unit	12
Pedal vibration and noise	—	11
Long stopping distance	—	9
Unexpected pedal action	—	8
ABS does not work	—	10
ABS works frequently	—	7

★1: If one or more wheels spin on a rough or slippery road for 40 seconds or more, the ABS warning lamp will illuminate. This does not indicate a malfunction. Only in the case of the short-circuit (Code Nos. 26, 22, 32 and 36), after repair the ABS warning lamp also illuminates when the ignition switch is turned "ON". In this case, drive the vehicle at speeds greater than 30 km/h (19 MPH) for approximately 1 minute as specified in "SELF-DIAGNOSIS PROCEDURE", BR-47. Check to ensure that the ABS warning lamp goes out while the vehicle is being driven.

★2: The trouble code "57", which refers to a low power supply voltage, does not indicate that the ABS control unit is malfunctioning. Do not replace the ABS control unit with a new one.

★3: The trouble code "61" can sometimes appear when the ABS motor is not properly grounded. If it appears, be sure to check the condition of the ABS motor ground circuit connection.

TROUBLE DIAGNOSES

CONSULT

CONSULT APPLICATION TO ABS

EE960 program card is not applicable to ABS. Use on board diagnostic system with ABS warning lamp until the next program card will be introduced. (Refer to "Self-diagnosis", BR-47.)

ITEM	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
Front right wheel sensor	X	X	—
Front left wheel sensor	X	X	—
Rear right wheel sensor	X	X	—
Rear left wheel sensor	X	X	—
G switch (G sensor)	X	X	X
Stop lamp switch	—	X	—
Front right inlet solenoid valve	X	X	X
Front right outlet solenoid valve	X	X	X
Front left inlet solenoid valve	X	X	X
Front left outlet solenoid valve	X	X	X
Rear inlet solenoid valve	X	X	X
Rear outlet solenoid valve	X	X	X
Actuator solenoid valve relay	X	X	—
Actuator motor relay (ABS MOTOR is shown on the Data Monitor screen.)	X	X	X
ABS warning lamp	—	X	—
Battery voltage	X	X	—

X: Applicable

—: Not applicable

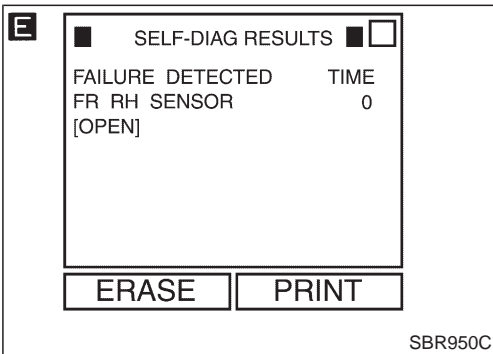
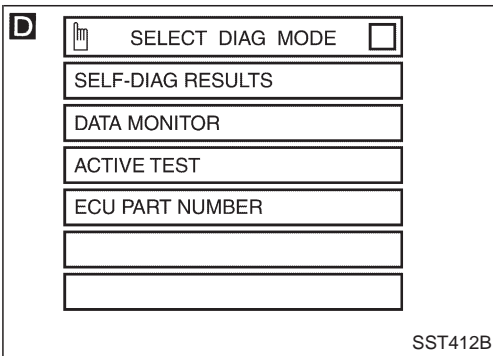
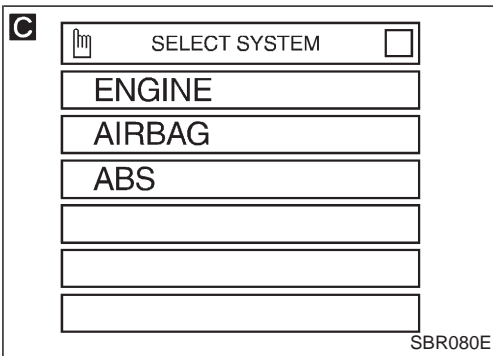
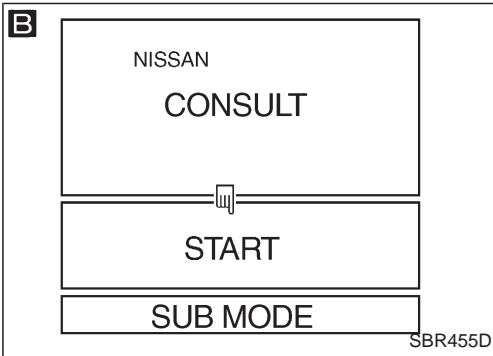
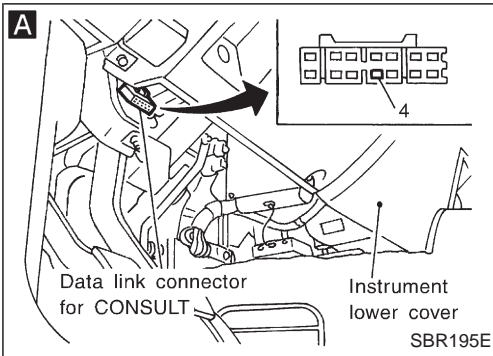
ECU (ABS control unit) part number mode

Ignore the ECU part number displayed in the ECU PART NUMBER MODE. Refer to parts catalog to order the ECU.

TROUBLE DIAGNOSES

CONSULT Inspection Procedure

SELF-DIAGNOSIS PROCEDURE



- A**
- 1) Turn ignition switch OFF.
 - 2) Connect CONSULT to Data Link Connector for CONSULT.

- 1) Start engine.
- 2) Drive vehicle over 30 km/h (19 MPH) for at least one minute.

- B** 1) Stop vehicle with engine running and touch "START" on CONSULT screen.
- C** 2) Touch "ABS".
- D** 3) Touch "SELF-DIAG RESULTS".
- The screen shows the detected malfunction and how many times the ignition switch has been turned since the malfunction.

Make the necessary repairs following the diagnostic procedures.

- E** After the malfunctions are repaired, erase the self-diagnostic results stored in the control unit by touching "ERASE".

Check warning lamp for deactivation after driving vehicle over 30 km/h (19 MPH) for at least one minute.

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

Note: "SELF-DIAG RESULTS" screen shows the detected malfunction and how many times the ignition switch has been turned since the malfunction.

TROUBLE DIAGNOSES

CONSULT Inspection Procedure (Cont'd)

SELF-DIAGNOSTIC RESULTS MODE

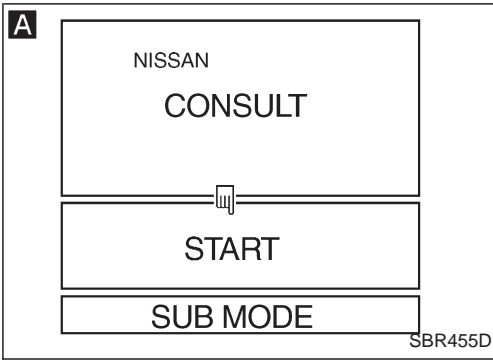
Diagnostic item	Diagnostic item is detected when ...	Diagnostic procedure
FR RH SENSOR [OPEN] ★1	● Circuit for front right wheel sensor is open. (An abnormally high input voltage is entered.)	1
FR LH SENSOR [OPEN] ★1	● Circuit for front left wheel sensor is open. (An abnormally high input voltage is entered.)	1
RR RH SENSOR [OPEN] ★1	● Circuit for rear right sensor is open. (An abnormally high input voltage is entered.)	1
RR LH SENSOR [OPEN] ★1	● Circuit for rear left sensor is open. (An abnormally high input voltage is entered.)	1
FR RH SENSOR [SHORT] ★1	● Circuit for front right wheel sensor is shorted. (An abnormally low input voltage is entered.)	1
FR LH SENSOR [SHORT] ★1	● Circuit for front left wheel sensor is shorted. (An abnormally low input voltage is entered.)	1
RR RH SENSOR [SHORT] ★1	● Circuit for rear right sensor is shorted. (An abnormally low input voltage is entered.)	1
RR LH SENSOR [SHORT] ★1	● Circuit for rear left sensor is shorted. (An abnormally low input voltage is entered.)	1
ABS SENSOR [ABNORMAL SIGNAL] ★1	● Teeth damage on sensor rotor or improper installation of wheel sensor. (Abnormal wheel sensor signal is entered.)	1
FR RH IN ABS SOL [OPEN]	● Circuit for front right inlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
FR LH IN ABS SOL [OPEN]	● Circuit for front left inlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
RR IN ABS SOL [OPEN]	● Circuit for rear inlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
FR RH IN ABS SOL [SHORT]	● Circuit for front right inlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
FR LH IN ABS SOL [SHORT]	● Circuit for front left inlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
RR IN ABS SOL [SHORT]	● Circuit for rear inlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
FR RH OUT ABS SOL [OPEN]	● Circuit for front right outlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
FR LH OUT ABS SOL [OPEN]	● Circuit for front left outlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
RR OUT ABS SOL [OPEN]	● Circuit for rear outlet solenoid valve is open. (An abnormally low output voltage is entered.)	2
FR RH OUT ABS SOL [SHORT]	● Circuit for front right outlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
FR LH OUT ABS SOL [SHORT]	● Circuit for front left outlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
RR OUT ABS SOL [SHORT]	● Circuit for rear outlet solenoid valve is shorted. (An abnormally high output voltage is entered.)	2
ABS ACTUATOR RELAY [ABNORMAL]	● Actuator solenoid valve relay is ON, even if control unit sends off signal. ● Actuator solenoid valve relay is OFF, even if control unit sends on signal.	2
ABS MOTOR RELAY [ABNORMAL]	● Circuit for ABS motor relay is open or shorted. ● Circuit for actuator motor is open or shorted. ● Actuator motor relay is stuck.	3
BATTERY VOLT [VB-LOW]	● Power source voltage supplied to ABS control unit is abnormally low.	4
CONTROL UNIT	● Function of calculation in ABS control unit has failed.	6
G-SENSOR [ABNORMAL]	● G sensor circuit is open or shorted.	5

★1: If one or more wheels spin on a rough or slippery road for 40 seconds or more, the ABS warning lamp will illuminate. This does not indicate a malfunction. Only in the case of the short-circuit (Code Nos. 26, 22, 32 and 36), after repair the ABS warning lamp also illuminates when the ignition switch is turned "ON". In this case, drive the vehicle at speeds greater than 30 km/h (19 MPH) for approximately 1 minute as specified in "SELF-DIAGNOSIS PROCEDURE", BR-47. Check to ensure that the ABS warning lamp goes out while the vehicle is being driven.

TROUBLE DIAGNOSES

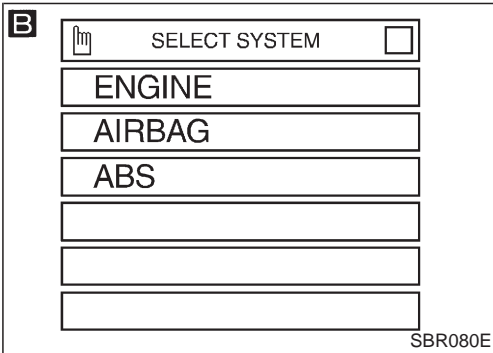
CONSULT Inspection Procedure (Cont'd)

DATA MONITOR PROCEDURE

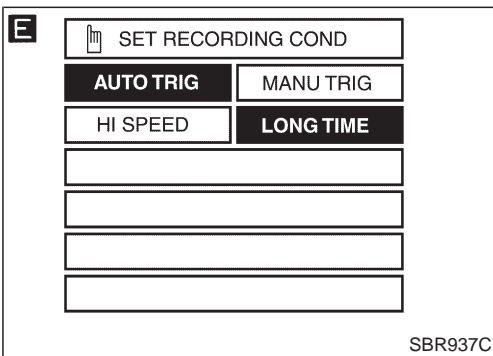
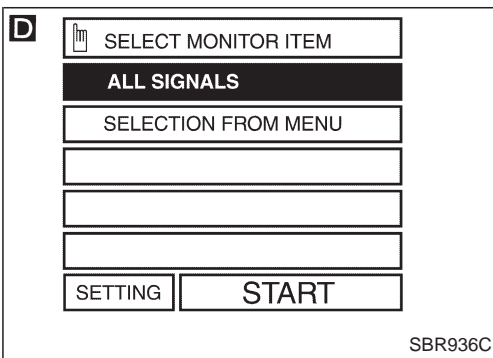
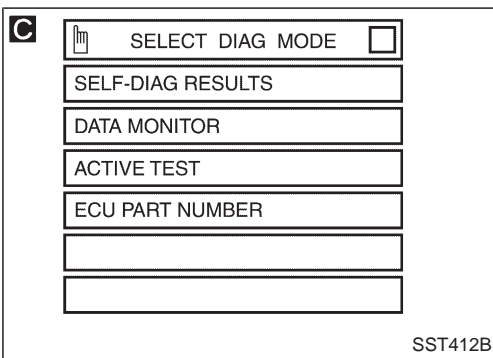


- 1) Turn ignition switch OFF.
- 2) Connect CONSULT to Data Link Connector for CONSULT.
- 3) Turn ignition switch ON.

- A** 1) Touch "START" on CONSULT screen.
- B** 2) Touch "ABS".
- C** 3) Touch "DATA MONITOR".



- D** 1) Touch "SETTING" on "SELECT MONITOR ITEM" screen.
- E** 2) Touch "LONG TIME" on "SET RECORDING COND" screen.
- D** 3) Touch "START" on "SELECT MONITOR ITEM".



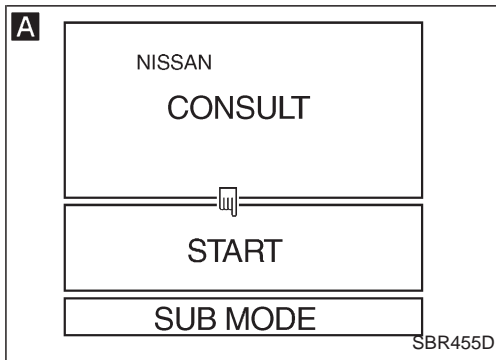
TROUBLE DIAGNOSES

CONSULT Inspection Procedure (Cont'd)

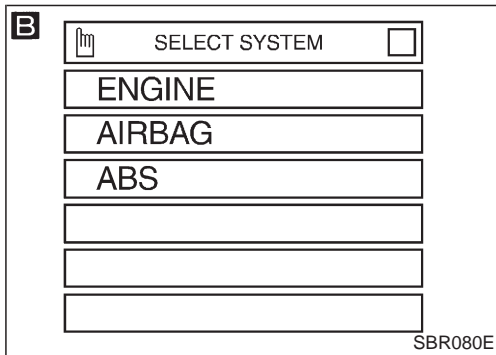
ACTIVE TEST PROCEDURE

- When conducting Active test, vehicle must be stationary.
- When ABS warning lamp stays on, never conduct Active test.

- 1) Turn ignition switch OFF.
- 2) Connect CONSULT to Data Link Connector for CONSULT.
- 3) Start engine.

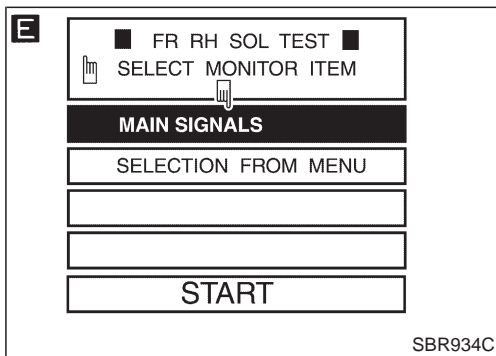
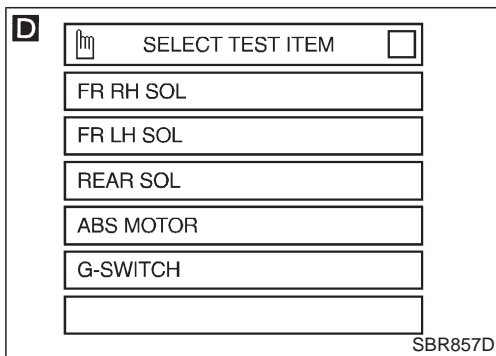
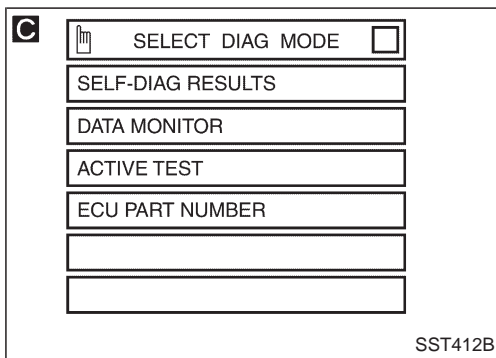


- 1) Touch "START" on CONSULT screen.
- 2) Touch "ABS".
- 3) Touch "ACTIVE TEST".



- 1) Select active test item by touching screen.
- 2) Touch "START".

Carry out the active test by touching screen key.



TROUBLE DIAGNOSES

CONSULT Inspection Procedure (Cont'd)

DATA MONITOR MODE

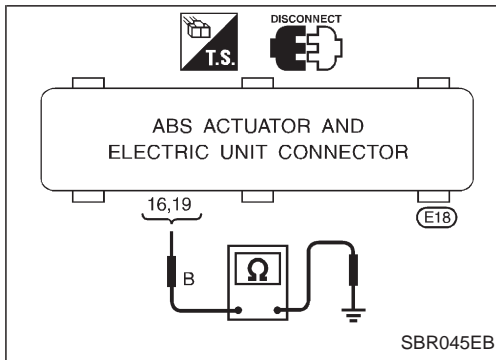
MONITOR ITEM	CONDITION	SPECIFICATION
FR RH SENSOR FR LH SENSOR RR SENSOR RR RH SENSOR RR LH SENSOR	Drive vehicle. (Each wheel is rotating.)	Wheel speed signal (Almost the same speed as speedometer.)
STOP LAMP SW	Brake is depressed.	Depress the pedal: ON Release the pedal: OFF
G-SWITCH	Vehicle is driven. Vehicle is stopped. Brake is applied.	During sudden braking while driving on high μ roads (asphalt roads, etc.): OFF While vehicle is stopped or during constant-speed driving: ON
FR RH IN SOL FR RH OUT SOL FR LH IN SOL FR LH OUT SOL RR IN SOL RR OUT SOL	1. Drive vehicle at speeds over 30 km/h (19 MPH) for at least one minute. 2. Engine is running.	Operating conditions for each solenoid valve are indicated. ABS is not operating: OFF
MOTOR RELAY		ABS is not operating: OFF ABS is operating: ON
ACTUATOR RELAY		Ignition switch ON (Engine stops): OFF Engine running: ON
WARNING LAMP	Ignition switch is ON or engine is running.	ABS warning lamp is turned on: ON ABS warning lamp is turned off: OFF
BATTERY VOLT		Power supply voltage for control unit

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT												
FR RH SOLENOID FR LH SOLENOID REAR SOLENOID	Engine is running.	Brake fluid pressure control operation <table style="margin-left: 40px;"> <tr> <td></td> <td style="text-align: center;">IN SOL</td> <td style="text-align: center;">OUT SOL</td> </tr> <tr> <td>UP (Increase):</td> <td style="text-align: center;">OFF</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td>KEEP (Hold):</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td>DOWN (Decrease):</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">ON</td> </tr> </table>		IN SOL	OUT SOL	UP (Increase):	OFF	OFF	KEEP (Hold):	ON	OFF	DOWN (Decrease):	ON	ON
	IN SOL	OUT SOL												
UP (Increase):	OFF	OFF												
KEEP (Hold):	ON	OFF												
DOWN (Decrease):	ON	ON												
ABS MOTOR		ABS actuator motor ON: Motor runs (ABS motor relay ON) OFF: Motor stops (ABS motor relay OFF)												
G SWITCH	Ignition switch is ON.	G SWITCH (G SENSOR), ON: Set G SWITCH MONITOR "ON" (G switch circuit is closed.) OFF: Set G SWITCH MONITOR "OFF" (G switch circuit is open.)												

Note: Active test will automatically stop ten seconds after the test starts. (LIMIT SIGNAL monitor shows ON.)

TROUBLE DIAGNOSES



Ground Circuit Check

ABS ACTUATOR AND ELECTRIC UNIT GROUND

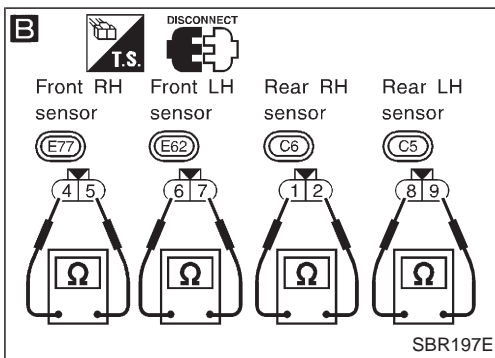
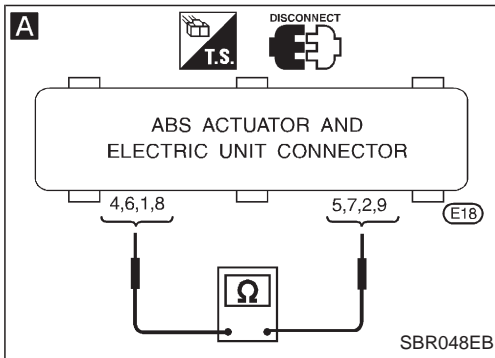
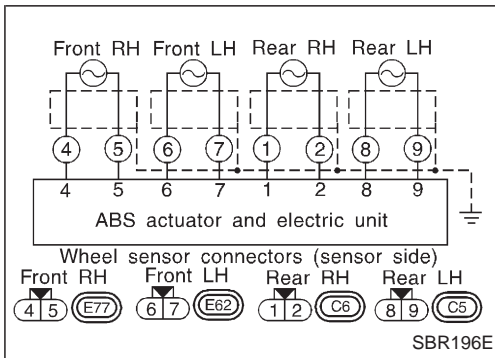
- Check resistance between ABS actuator and electric unit connector terminals and ground.

Resistance: approximately 0Ω

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 1 (Wheel sensor or rotor)

Malfunction code No. 21, 22, 25, 26, 31, 32, 35, 36 or 18



INSPECTION START

No → Inspection end

1. Disconnect connectors from ABS actuator and electric unit and wheel sensor of malfunction code No. Check terminals for damage or loose connections. Then reconnect connectors.
 2. Carry out self-diagnosis again.
- Does warning lamp activate again?**

Yes

A

CHECK WHEEL SENSOR ELECTRICAL.

OK → (Go to next page.)

1. Disconnect ABS actuator and electric unit connector.
 2. Check resistance between ABS actuator and electric unit connector (E18) (body side) terminals.
- Code No. 21 or 22 (Front RH wheel) Terminals ④ and ⑤
- Code No. 25 or 26 (Front LH wheel) Terminals ⑥ and ⑦
- Code No. 31 or 32 (Rear RH wheel) Terminals ① and ②
- Code No. 35 or 36 (Rear LH wheel) Terminals ⑧ and ⑨
- Resistance: 1.44 - 1.76 kΩ**

NG

B

CHECK WHEEL SENSOR.

Check each sensor for resistance.

Resistance: 1.44 - 1.76 kΩ

- OK →
- Check the following.
- Harness connectors (E18), (E77), (E62), (C6), (C5)
 - Harness for open or short between wheel sensor connectors and ABS actuator and electric unit
- If NG, repair harness or connectors.

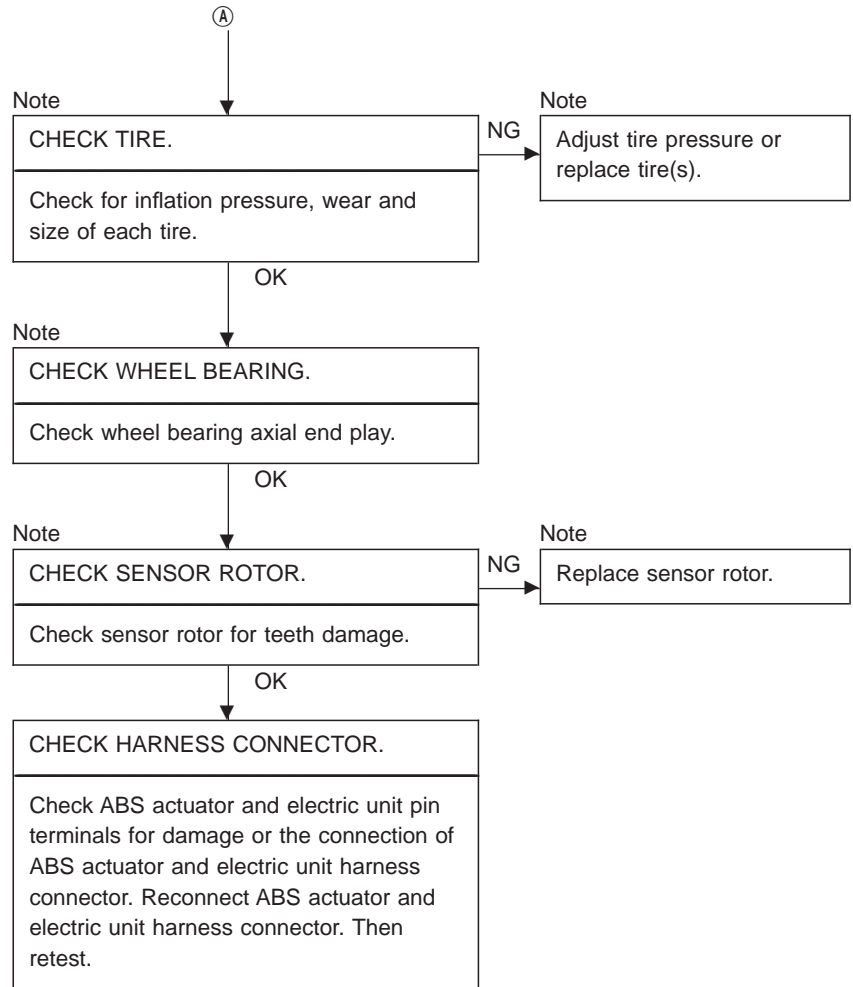
NG

REPLACE.

Replace wheel sensor.

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 1 (Wheel sensor or rotor) (Cont'd)

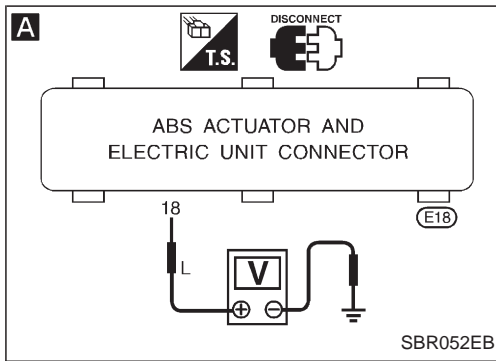
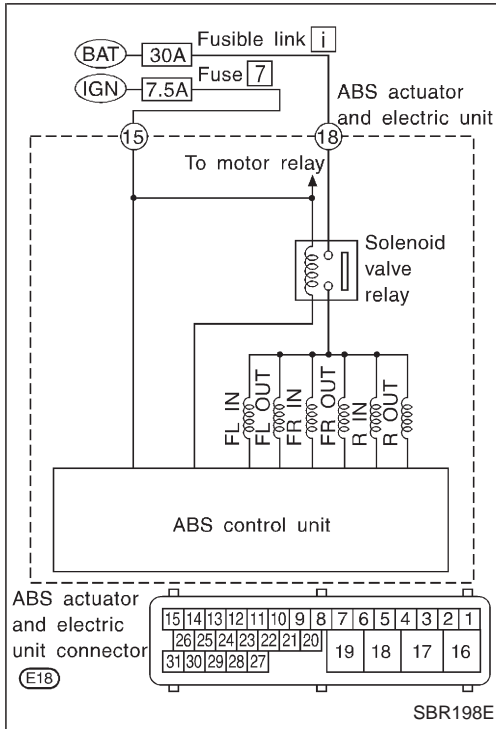


Note: Wheel position should be distinguished by code numbers except code No. 18 (sensor rotor).

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 2 (ABS actuator solenoid valve and solenoid valve relay)

Malfunction code No. 41, 45, 55, 42, 46, 56, 63



CHECK FUSIBLE LINK.

Check 30A fusible link **i**. For fusible link layout, refer to POWER SUPPLY ROUTING in EL section.

NG → **A** (Go to next page.)

CHECK FUSE.

Check 7.5A fuse **7**. For fuse layout, refer to POWER SUPPLY ROUTING in EL section.

NG → **B** (Go to next page.)

CHECK CONNECTOR.

1. Disconnect ABS actuator and electric unit connector. Check terminals for damage or loose connection. Then reconnect connector.
2. Carry out self-diagnosis again.

Does warning lamp activate again?

No → Inspection end

CHECK ABS ACTUATOR AND ELECTRIC UNIT GROUND CIRCUIT.

Refer to ABS ACTUATOR AND ELECTRIC UNIT GROUND in Ground Circuit Check, BR-56.

NG → Repair harness and connector.

CHECK SOLENOID VALVE RELAY POWER SUPPLY CIRCUIT.

1. Disconnect ABS actuator and electric unit connector.
2. Check voltage between ABS actuator and electric unit connector **(E18)** (body side) terminal **18** and ground. **Battery voltage should exist.**

NG → Check the following.

- Harness connector **(E18)**
- Harness for open or short between ABS actuator and electric unit and fusible link

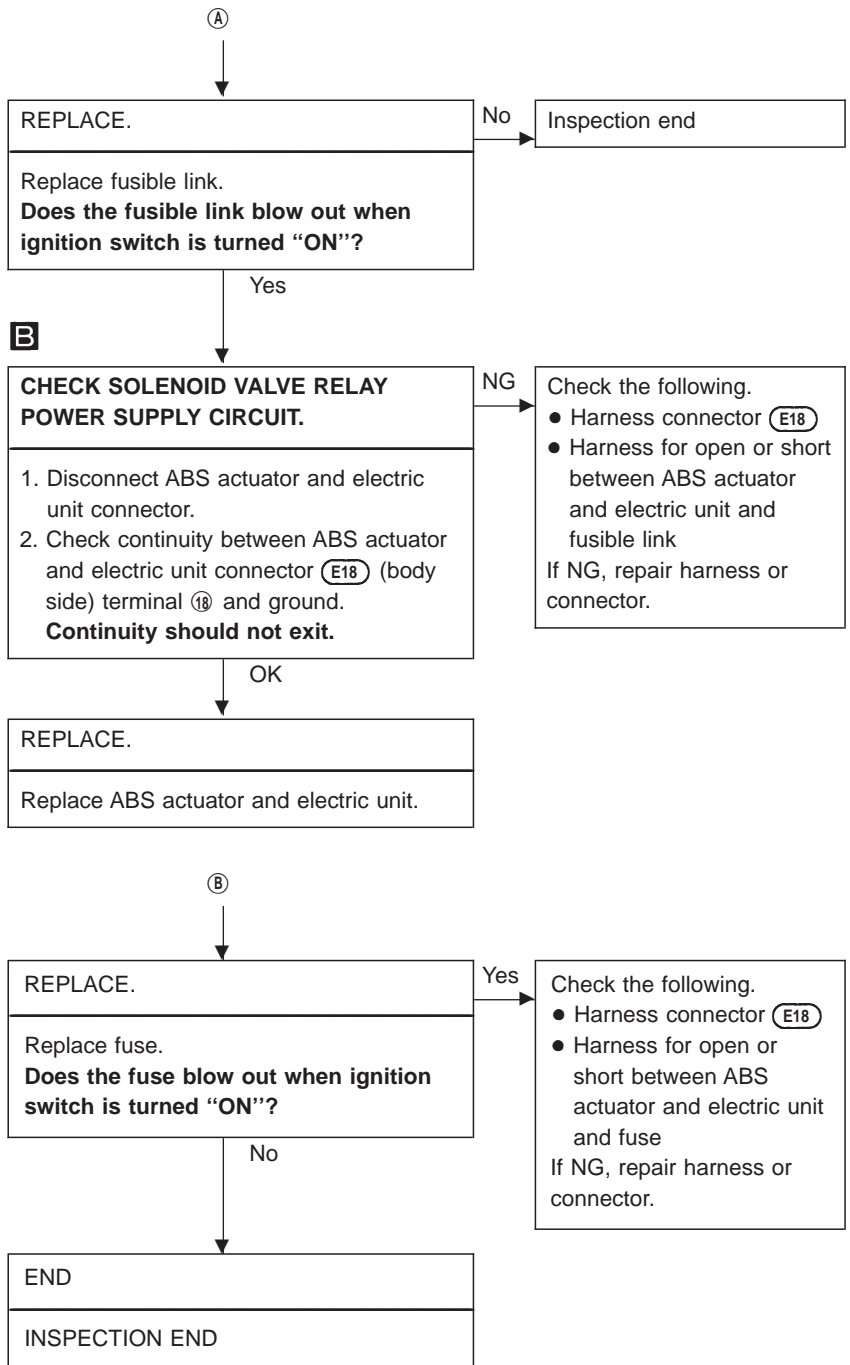
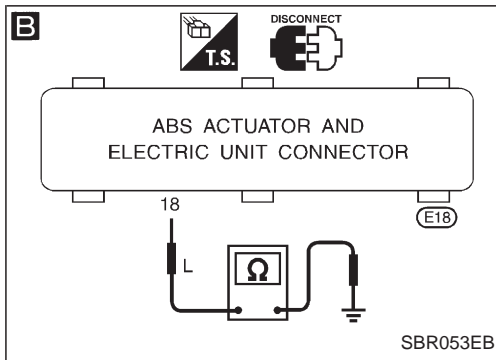
If NG, repair harness or connector.

REPLACE.

Replace ABS actuator and electric unit.

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

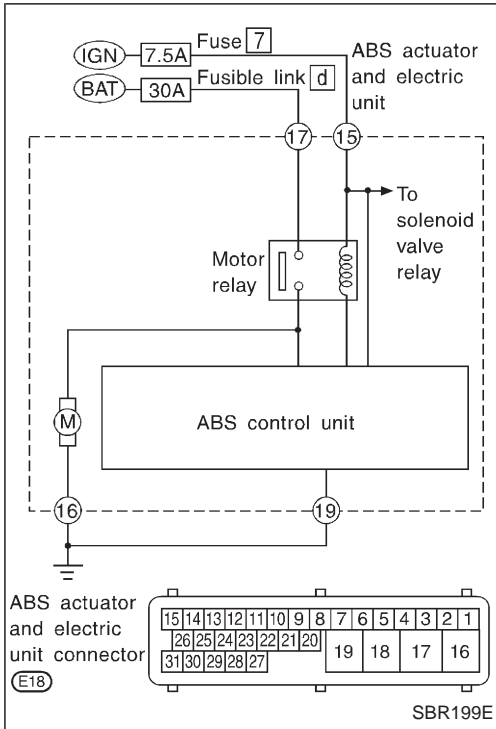
Diagnostic Procedure 2 (ABS actuator solenoid valve and solenoid valve relay) (Cont'd)



TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 3 (Motor relay or motor)

Malfunction code No. 61



CHECK FUSIBLE LINK.

NG

→ A (Go to next page.)

Check 30A fusible link **d**. For fusible link layout, refer to POWER SUPPLY ROUTING in EL section.

OK

CHECK CONNECTOR.

No

Inspection end

1. Disconnect ABS actuator and electric unit connector. Check terminals for damage or loose connection. Then reconnect connector.

2. Carry out self-diagnosis again.

Does warning lamp activate again?

Yes

A

CHECK MOTOR RELAY POWER SUPPLY CIRCUIT.

NG

Check the following.

- Harness connector **E18**
 - Harness for open or short between ABS actuator and electric unit and fusible link
- If NG, repair harness or connector.

1. Disconnect ABS actuator and electric unit connector.

2. Check voltage between ABS actuator and electric unit connector **E18** (body side) terminal **17** and ground.

Battery voltage should exist.

OK

CHECK ABS ACTUATOR AND ELECTRIC UNIT GROUND.

NG

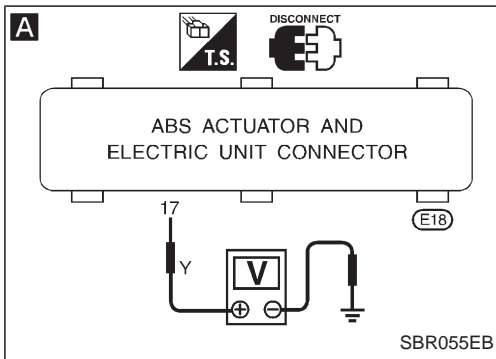
Repair harness and terminals.

Refer to ABS ACTUATOR AND ELECTRIC UNIT GROUND in Ground Circuit Check, BR-56.

OK

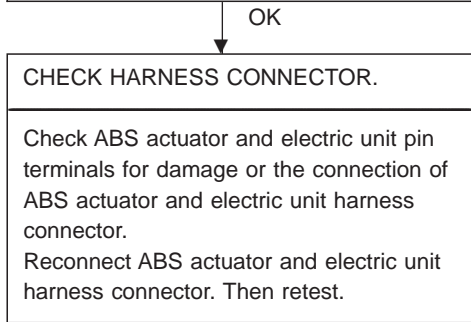
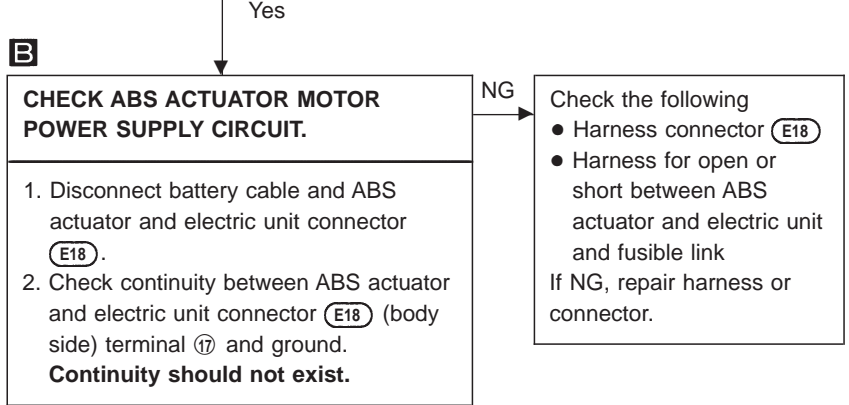
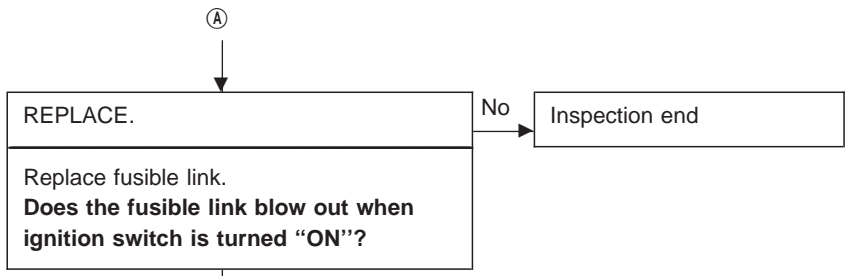
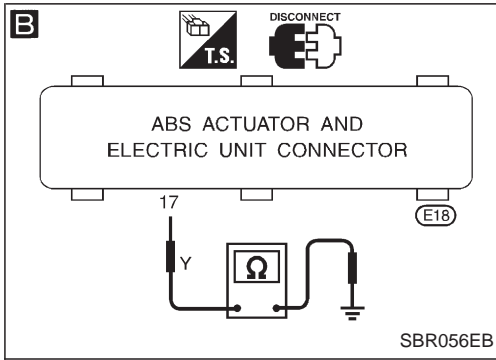
REPLACE.

Replace ABS actuator and electric unit.



TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

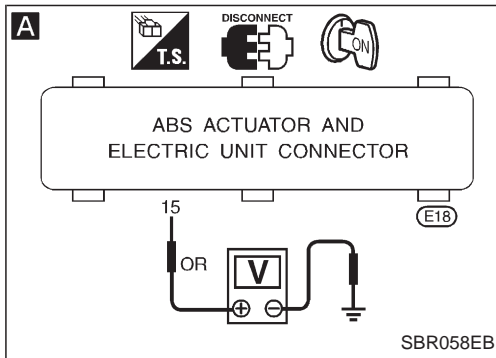
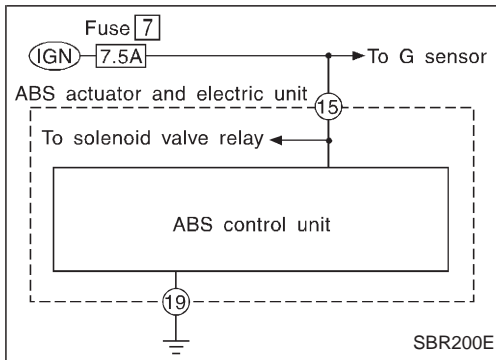
Diagnostic Procedure 3 (Motor relay or motor) (Cont'd)



TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 4 (Low voltage)

Malfunction code No. 57



CHECK CONNECTOR.

No → Inspection end

1. Disconnect ABS actuator and electric unit connector. Check terminals for damage or loose connection. Then reconnect connector.
2. Carry out self-diagnosis again.
Does warning lamp activate again?

Yes

A

CHECK ABS CONTROL UNIT POWER SUPPLY CIRCUIT.

NG → (A) (See below.)

1. Disconnect ABS actuator and electric unit connector.
2. Check voltage between ABS actuator and electric unit connector (E18) (body side) terminal 15 and ground.
Battery voltage should exist when ignition switch is turned ON.

OK

CHECK ABS CONTROL UNIT GROUND.

NG → Repair harness and connector.

Refer to ABS ACTUATOR AND ELECTRIC UNIT GROUND in Ground Circuit Check, BR-56.

OK

CHECK HARNESS CONNECTOR.

Check ABS actuator and electric unit pin terminals for damage or the connection of ABS actuator and electric unit harness connector. Reconnect ABS actuator and electric unit harness connector. Then retest.

(A)

CHECK FUSE.

NG → Replace fuse.

Check 7.5A fuse 7. For fuse layout, refer to POWER SUPPLY ROUTING in EL section.

OK

CHECK ABS CONTROL UNIT POWER SUPPLY CIRCUIT.

NG → Check the following.
 ● Harness connector (E18)
 ● Harness for open or short between ABS actuator and electric unit and fuse
 If NG, repair harness or connector.

Check continuity between battery and ABS actuator and electric unit connector (E18) (body side) terminal 15.

OK

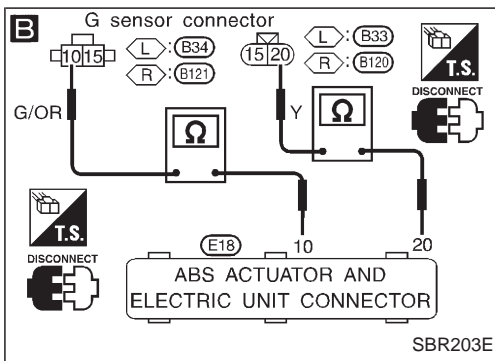
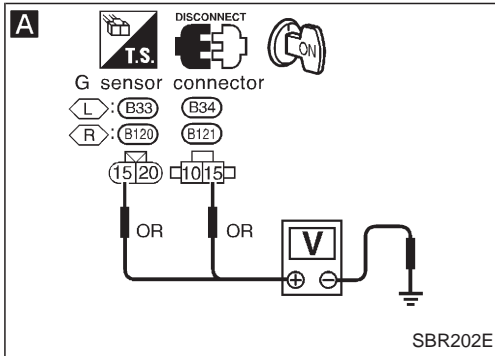
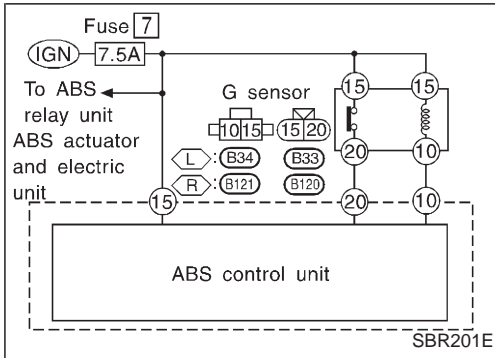
CHECK BATTERY.

Check battery. Refer to BATTERY in EL section.

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 5 (G sensor)

Malfunction code No. 17



CHECK G SENSOR POWER SUPPLY CIRCUIT.

Check 7.5A fuse 7. For fuse layout, refer to POWER SUPPLY ROUTING in EL section.

NG → Replace fuse.

OK

CHECK CONNECTOR.

1. Disconnect ABS actuator and electric unit connector. Check terminals for damage or loose connection. Then reconnect connector.
2. Carry out self-diagnosis again.
Does warning lamp activate again?

No → Inspection end

Yes

CHECK G SENSOR.

Refer to G SENSOR in Electrical Components Inspection, BR-64.

NG → Replace G sensor.

OK

CHECK G SENSOR POWER SUPPLY CIRCUIT.

1. Disconnect G sensor connector.
2. Check voltage between G sensor connector (L): B34, B33, (R): B121, B120 (body side) terminal 15 and ground.
Battery voltage should exist.

NG → Check the following.

- Harness connectors (L): B34, B33, E18, (R): B121, B120, E18
- Harness for open or short between G sensor and ABS actuator and electric unit

If NG, repair harness or connectors.

OK

CHECK G SENSOR GROUND.

1. Disconnect ABS actuator and electric unit connector and G sensor connectors.
2. Check continuity between ABS actuator and electric unit connector (E18) (body side) terminals 10, 20 and G sensor connectors (L): B34, B33, (R): B121, B120 (body side) terminals 10, 20.
Continuity should exist.

NG → Check the following.

- Harness connectors (L): B34, B33, E18, (R): B121, B120, E18
- Harness for open or short between G sensor and ABS actuator and electric unit

If NG, repair harness or connectors.

OK

CHECK HARNESS CONNECTOR.

Check ABS actuator and electric unit pin terminals for damage or the connection of ABS actuator and electric unit harness connector. Reconnect ABS actuator and electric unit harness connector. Then retest.

TROUBLE DIAGNOSES FOR SELF-DIAGNOSTIC ITEMS

Diagnostic Procedure 5 (G sensor) (Cont'd) ELECTRICAL COMPONENTS INSPECTION

G sensor

CAUTION:

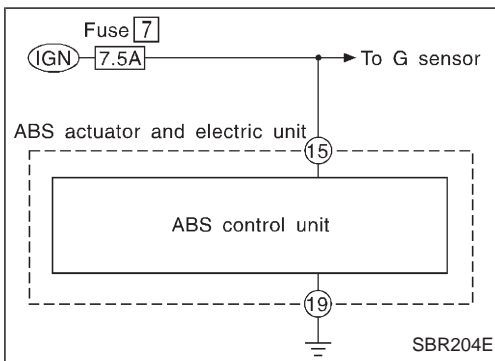
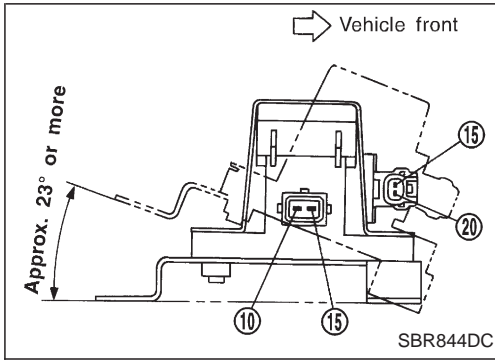
The G sensor is easily damaged if it sustains an impact. Be careful not to drop or bump it.

1. Measure resistance between terminals ⑮ and ⑳ of G sensor unit connector.

G sensor condition	Resistance between terminals ⑮ and ⑳	G sensor switch condition
Installed in vehicle	1.4 - 1.6 kΩ	"ON"
Tilted as shown in figure	4.7 - 5.5 kΩ	"OFF"

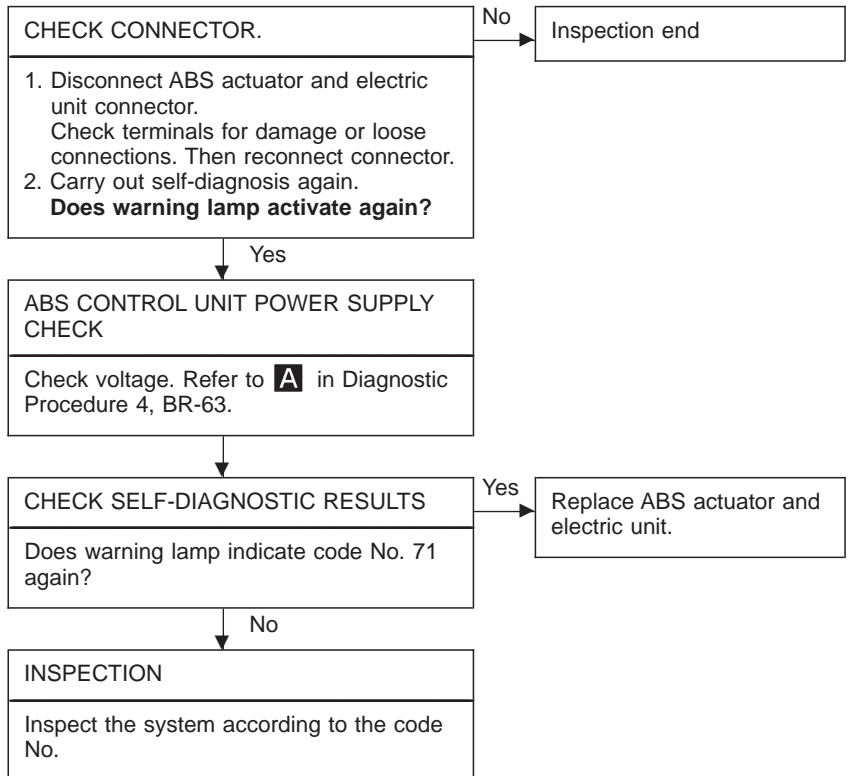
2. Measure resistance between terminals ⑩ and ⑮ of the G sensor unit connector.

Resistance:	70 - 124 Ω
-------------	------------



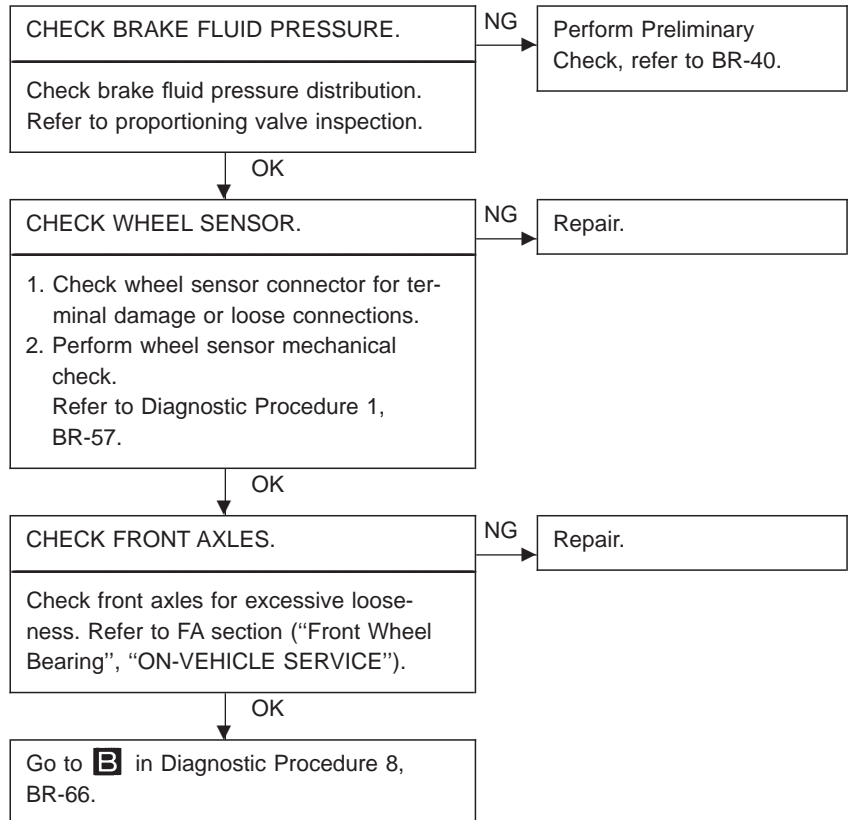
Diagnostic Procedure 6 (Control unit)

Malfunction code No. 71

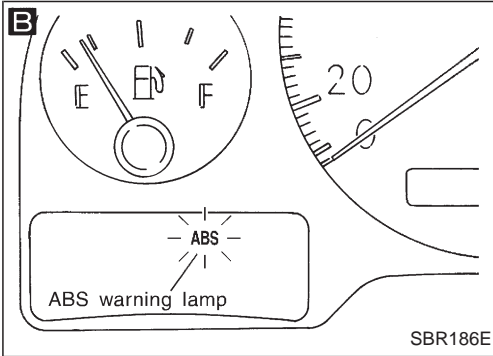
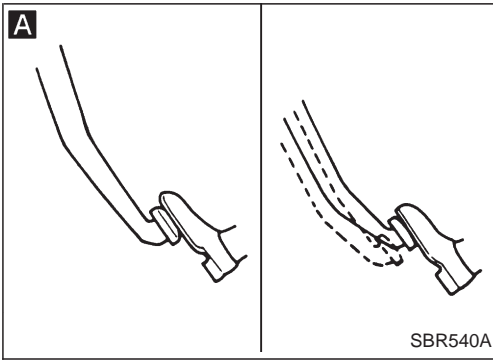


TROUBLE DIAGNOSES FOR SYMPTOMS

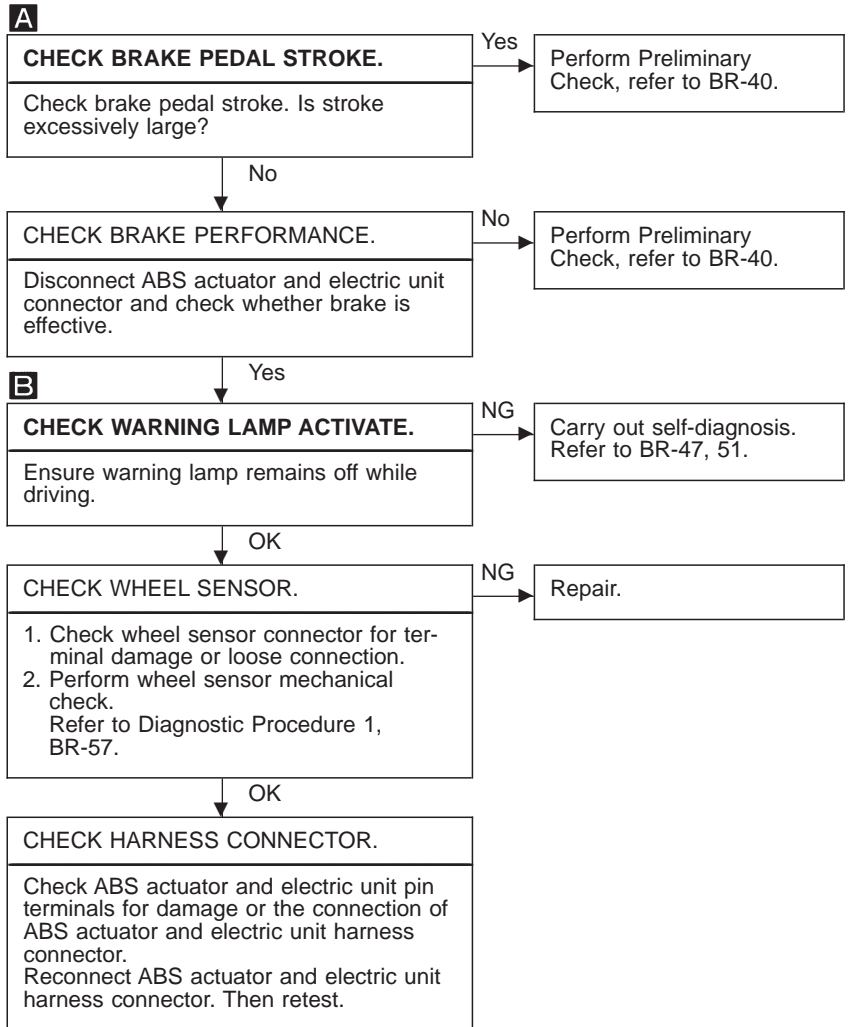
Diagnostic Procedure 7 (ABS works frequently.)



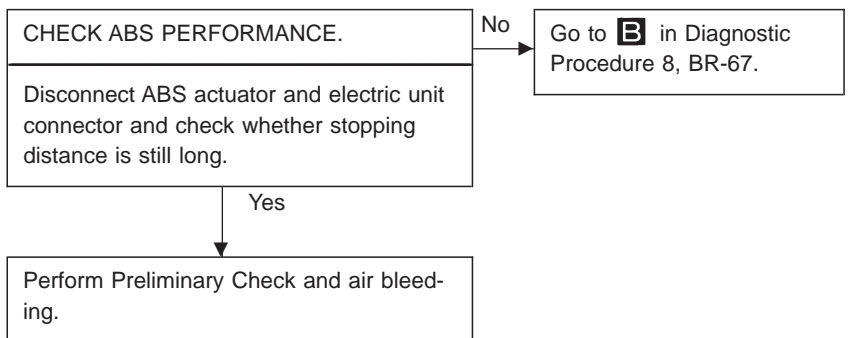
TROUBLE DIAGNOSES FOR SYMPTOMS



Diagnostic Procedure 8 (Unexpected pedal action)



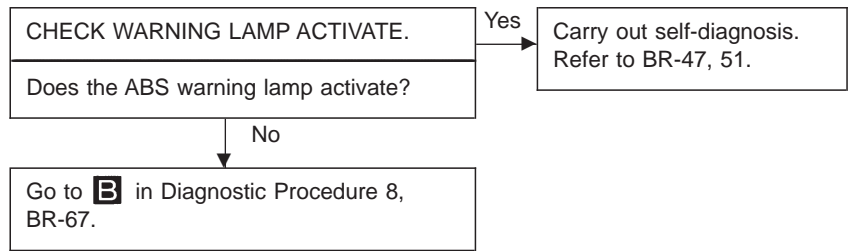
Diagnostic Procedure 9 (Long stopping distance)



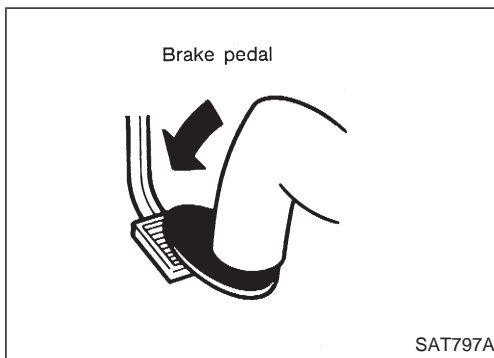
Note: Stopping distance may be larger than vehicles without ABS when road condition is slippery.

TROUBLE DIAGNOSES FOR SYMPTOMS

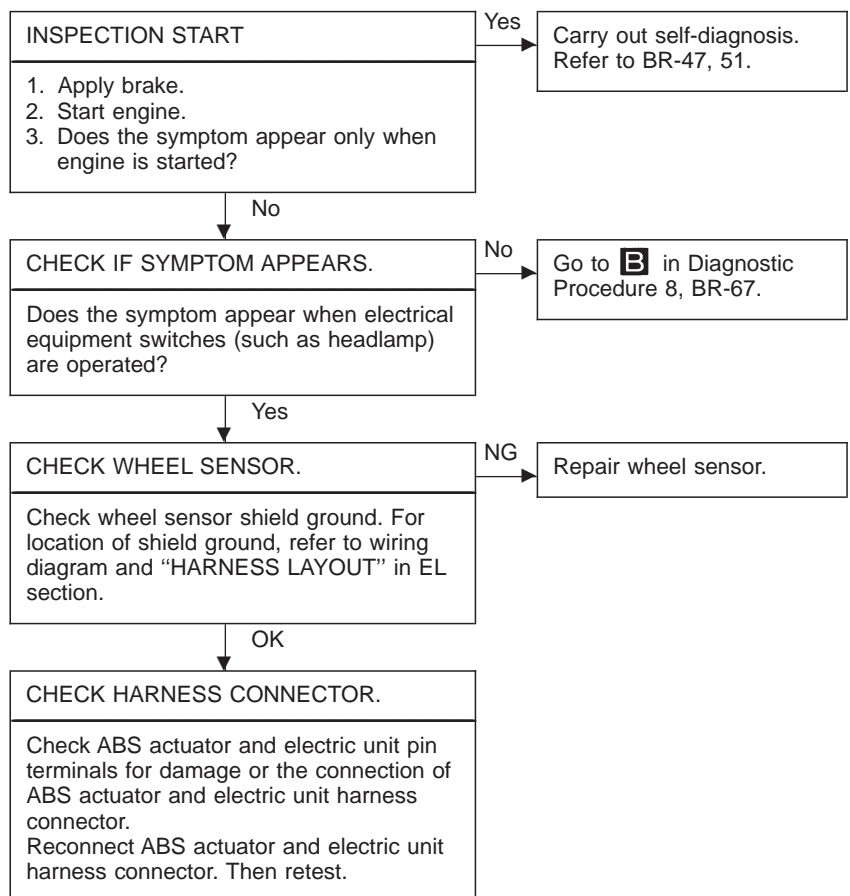
Diagnostic Procedure 10 (ABS does not work.)



Note: ABS does not work when vehicle speed is under 10 km/h (6 MPH).



Diagnostic Procedure 11 (Pedal vibration and noise)



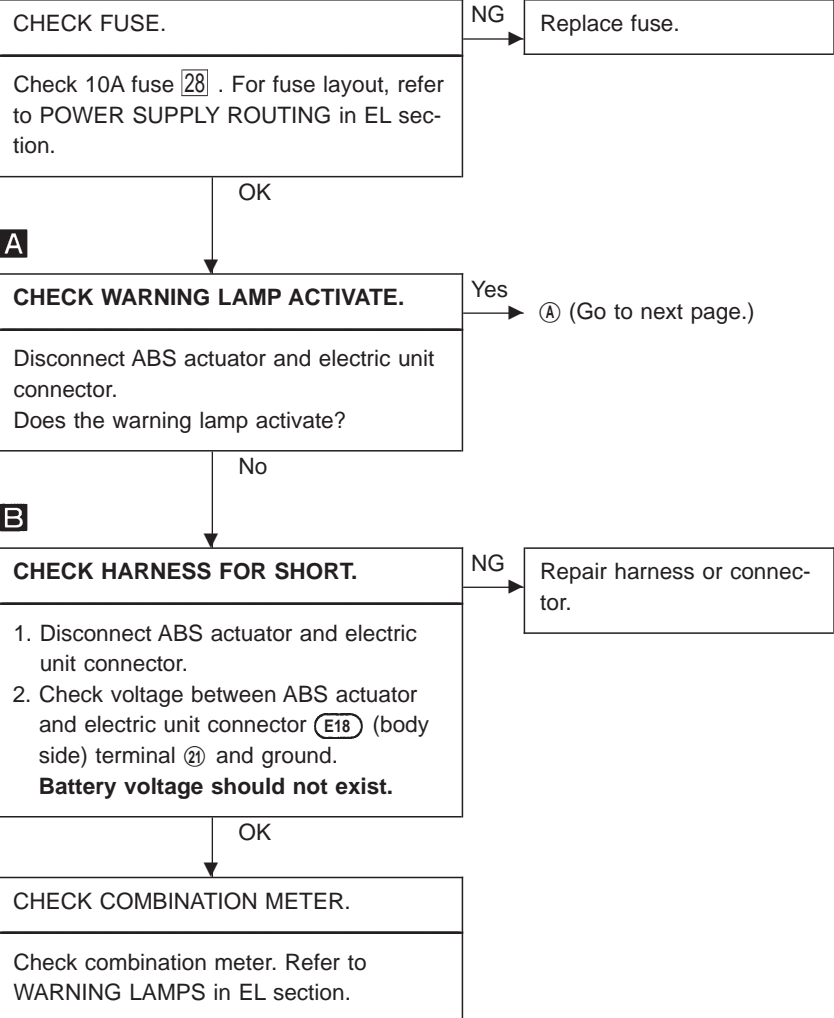
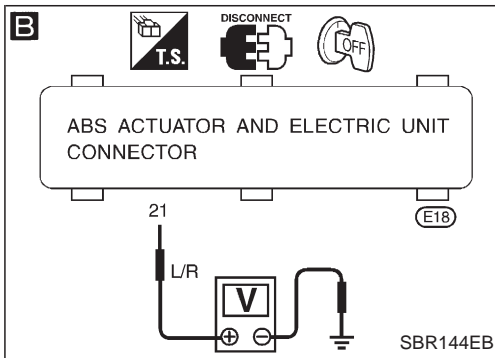
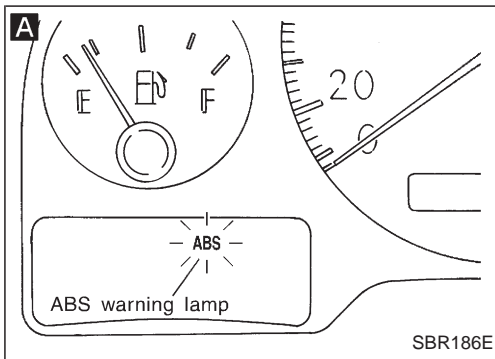
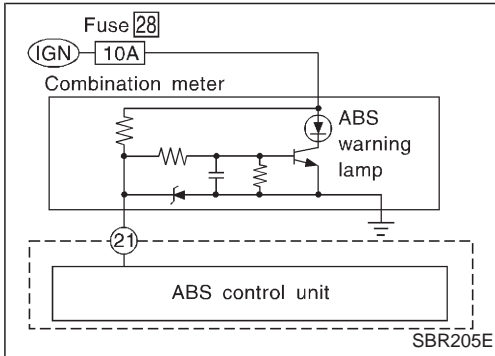
TROUBLE DIAGNOSES FOR SYMPTOMS

Diagnostic Procedure 11 (Pedal vibration and noise) (Cont'd)

Note: ABS may operate and cause vibration under any of the following conditions.

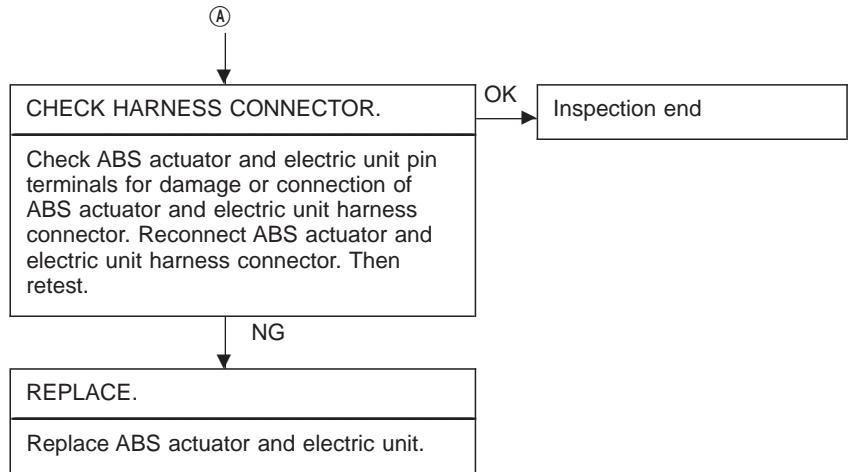
- Applying brake gradually when shifting or operating clutch.
- Low friction (slippery) road.
- High speed cornering.
- Driving over bumps and pot holes.
- Engine speed is over 5,000 rpm with vehicle stopped.

Diagnostic Procedure 12 (Warning lamp does not come on when ignition switch is turned ON.)



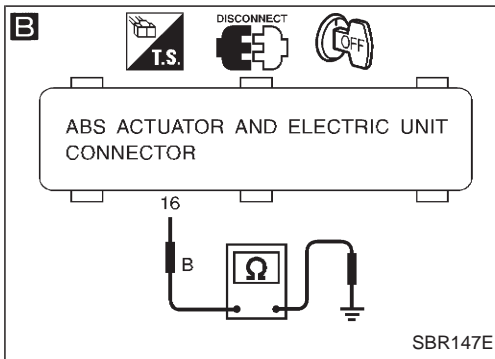
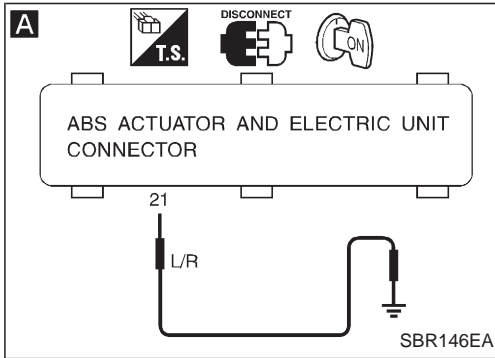
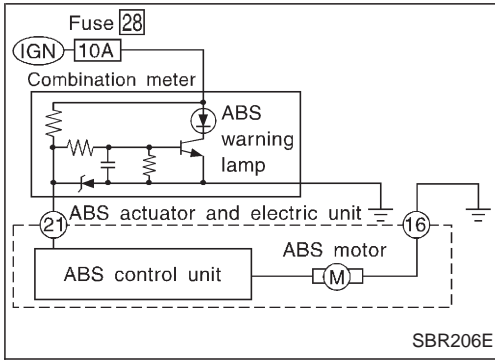
TROUBLE DIAGNOSES FOR SYMPTOMS

Diagnostic Procedure 12 (Warning lamp does not come on when ignition switch is turned ON.) (Cont'd)



TROUBLE DIAGNOSES FOR SYMPTOMS

Diagnostic Procedure 13 (Warning lamp stays on when ignition switch is turned ON.)



A

CHECK WARNING LAMP.

1. Disconnect ABS actuator and electric unit connector.
2. Connect suitable wire between ABS actuator and electric unit connector (E18) (body side) terminal ②1 and ground.

Warning lamp should not activate.

NG

Repair combination meter. Check the following.

- Harness connector (E18)
- Harness for open or short between ABS actuator and electric unit and fuse

If NG, repair harness or connector.

OK

CHECK HARNESS CONNECTOR.

OK

Inspection end

Check ABS actuator and electric unit pin terminals for damage or the connection of ABS actuator and electric unit harness connector. Reconnect ABS actuator and electric unit harness connector. Then retest.

NG

B

CHECK ABS MOTOR GROUND.

NG

1. Turn ignition switch "OFF".
2. Disconnect ABS actuator and electric unit connector.
3. Check continuity between ABS actuator and electric unit connector (E18) (body side) terminal ①6 and ground.

Continuity should exist.

Check the following.

- Harness connector (E18)
- Harness for open or short between ABS actuator and electric unit and ground

If NG, repair harness or connector.

OK

REPLACE.

Replace ABS actuator and electric unit.

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

Applied model	Except for Europe, Australia and Middle East		Europe, Australia and Middle East
	Standard	Option	All
Front brake	CL36VE disc brake		
Type	CL36VE disc brake		
Cylinder bore diameter	mm (in)	48.1 (1.894) x 2	
Pad dimension Length x width x thickness	mm (in)	147 x 56.5 x 12 (5.79 x 2.224 x 0.47)	
Rotor outer diameter x thickness	mm (in)	306 x 32 (12.05 x 1.26)	
Rear brake	LT30 drum brake		CL18VF disc brake
Type	LT30 drum brake		CL18VF disc brake
Cylinder bore diameter	mm (in)	25.4 (1.00)	48.1 (1.894)
Lining or pad dimension Length x width x thickness	mm (in)	296 x 50 x 6.1 (11.65 x 1.97 x 0.240)	111 x 41.8 x 10 (4.37 x 1.646 x 0.39)
Drum inner diameter	mm (in)	295 (11.61)	—
Rotor outer diameter x thickness	mm (in)	—	316 x 18 (12.44 x 0.71)

Applied model	Except for 4-door rear disc brake	4-door rear disc brake
Brake booster	235T	
Model	235T	
Diaphragm diameter	mm (in)	Primary: 252 Secondary: 230
Master cylinder bore diameter	mm (in)	25.4 (1.00)
Control valve	LSV	
Type	LSV	
Split point x reducing ratio kPa (bar, kg/cm ² , psi)	(Variable) x 0.15	(Variable) x 0.3
Recommended brake fluid	DOT 3	

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment

DISC BRAKE

Unit: mm (in)		
Brake model	CL36VE	CL18VF
Pad wear limit		
Minimum thickness	2.0 (0.079)	
Rotor repair limit		
Minimum thickness	30.0 (1.181)	16.0 (0.630)

PARKING CENTER BRAKE

Unit: mm (in)	
Brake model	DS20HB
Lining wear limit	
Minimum thickness	1.5 (0.059)
Drum repair limit	
Maximum inner diameter	204.5 (8.05)

BRAKE PEDAL

Unit: mm (in)	
Applied model	M/T
Free height "H"*	184 - 194 (7.24 - 7.64)
Depressed height "D" [under force of 490 N (50 kg, 110 lb) with engine running]	More than 80 (3.15)
Clearance "C" between pedal stopper and threaded end of stop lamp switch or ASCD switch	0.3 - 1.0 (0.012 - 0.039)
Pedal free play	
At clevis	1.0 - 3.0 (0.039 - 0.118)
At pedal pad	3.0 - 11.0 (0.118 - 0.433)

*: Measured from surface of melt sheet to pedal pad.

PARKING CENTER BRAKE CONTROL

Control type	Center lever
Lever stroke [under force of 196 N (20 kg, 44 lb)]	7 - 9
Lever stroke when warning switch comes on	2