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When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

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

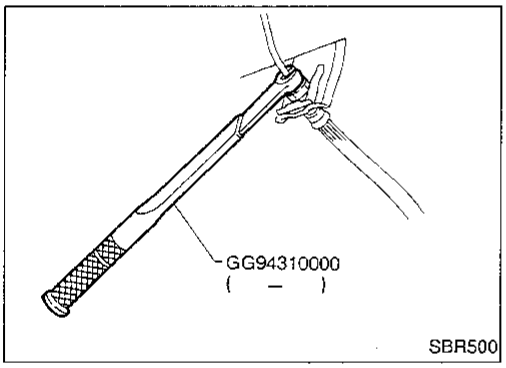
Precautions

SUPPLEMENTAL RESTRAINT SYSTEM SUPPLEMENTAL "AIR BAG"

The Supplemental Restraint System Supplemental "Air Bag", used along with seat belts, helps to reduce the risk or severity of injury to the driver in a frontal collision. The Supplemental Restraint System consists of a supplemental air bag module (located in the center of the steering wheel), sensors, a diagnosis (control) unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **BF section** of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could lead to personal injury or death in the event of a severe frontal collision, 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.**
- **All SRS electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the SRS Supplemental "Air Bag".**



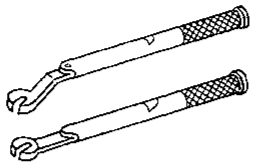
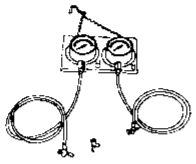
BRAKE SYSTEM

- **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 or wash all parts of master cylinder, disc brake caliper and wheel cylinder, use clean brake fluid.**
- **Never use mineral oils such as gasoline or kerosene. They will ruin rubber parts of hydraulic system.**
- **Use flare nut wrench when removing or installing brake tubes.**
- **Always torque brake lines when installing.**

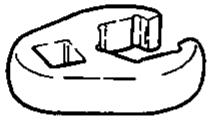
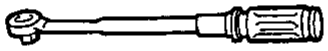
WARNING:

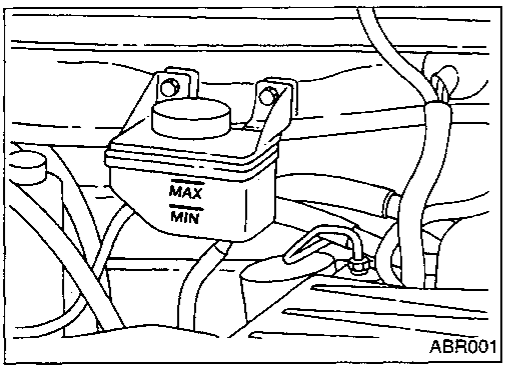
- **Clean brake pads and shoes with a vacuum dust collector to minimize the hazard of airborne materials.**

Special Service Tools

Tool number (Kent-Moore No.) Tool name	Description	
GG94310000 (—) Flare nut wrench		Removing and installing each brake piping
KV991V0010 (—) Brake fluid pressure gauge		Measuring brake fluid pressure

Commercial Service Tools

Tool name	Description
Flare nut crows foot	
Torque wrench	



Checking Brake Fluid Level

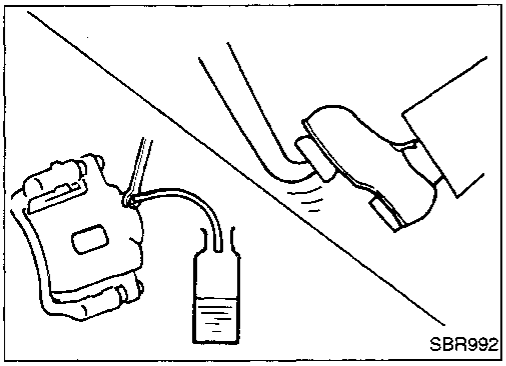
- Check fluid level in reservoir tank. It should be between MAX and MIN lines on reservoir tank.
- If fluid level is extremely low, check brake system for leaks.
- If brake warning lamp comes on, check brake fluid level switch and parking brake switch.

Checking Brake Line

CAUTION:

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

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

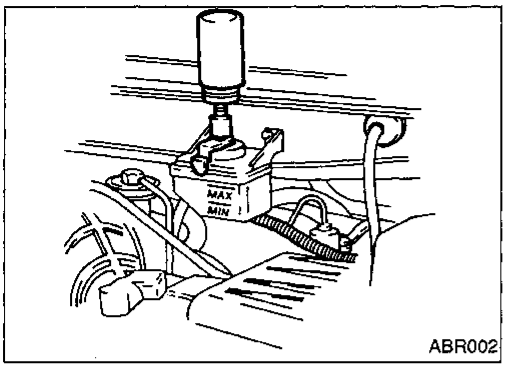


Changing Brake Fluid

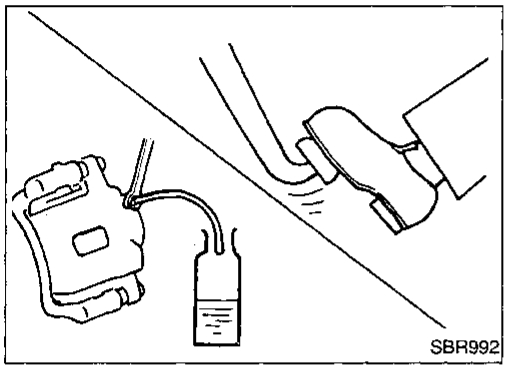
CAUTION:

- **Refill with new brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**

1. Connect a vinyl tube to each air bleeder valve.
2. Drain brake fluid from each air bleeder valve by depressing brake pedal.
3. Refill until new brake fluid comes out of each air bleeder valve.
   Use bleeding procedure to refill brake fluid.
   Refer to BR-5.



ABR002


SBR992

Bleeding Procedure

CAUTION:

- **Carefully monitor brake fluid level at master cylinder during bleeding operation.**
- **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.**

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.

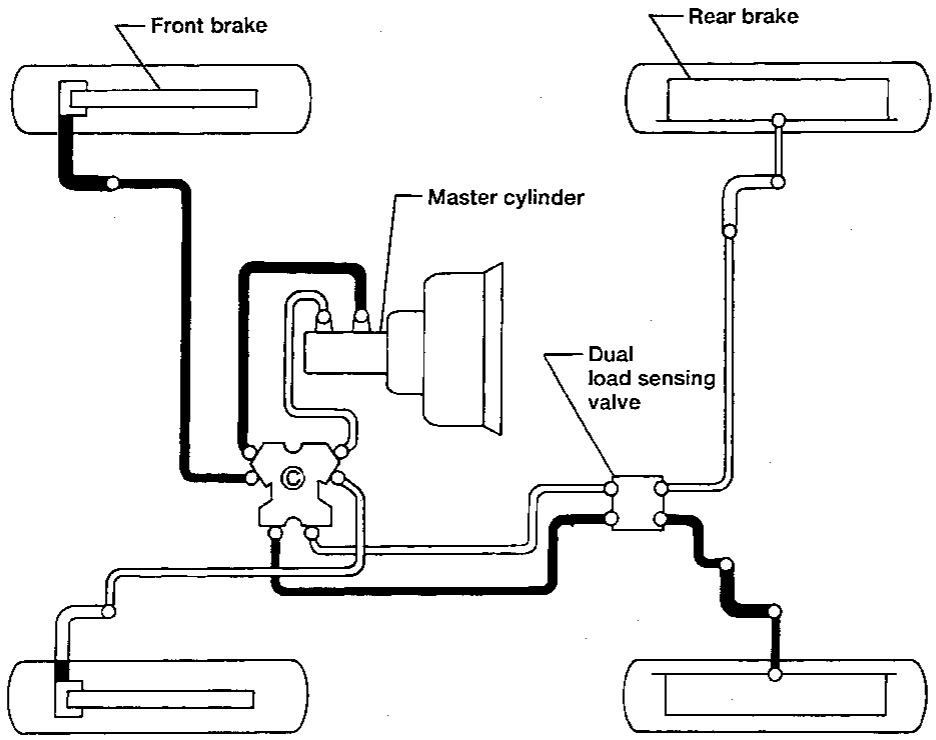
Without ABS

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

With ABS

- Bleed air in the following order, with ignition "OFF" and battery positive (+) terminal disconnected.
  Left front brake
  ↓
  Right front brake
  ↓
  Left rear brake
  ↓
  Right rear brake

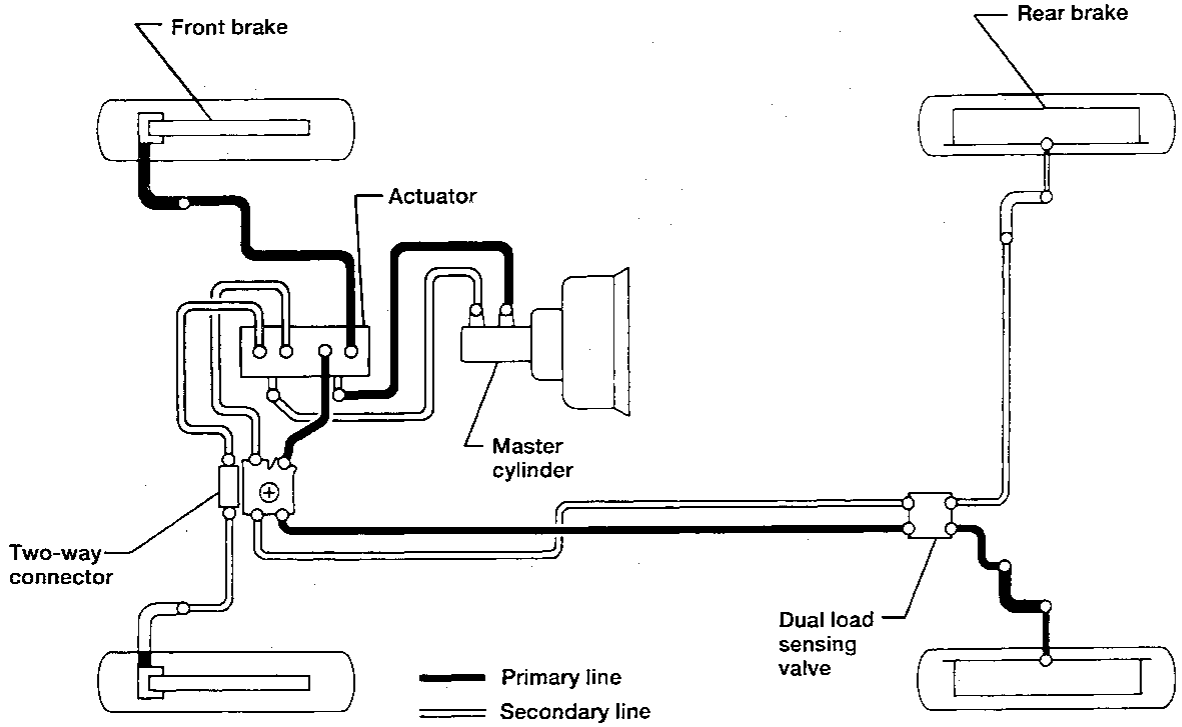
Without ABS



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

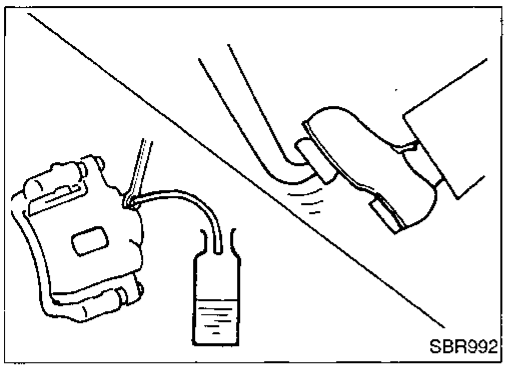
ABR003

With ABS



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

ABR004



Removal

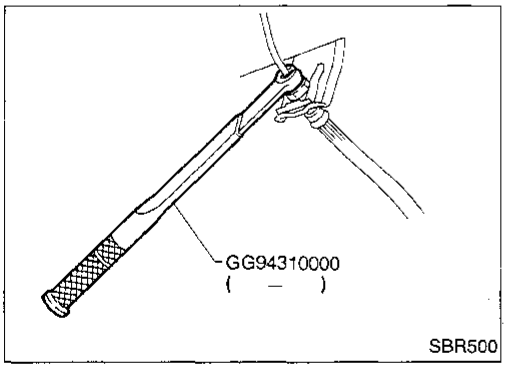
CAUTION:

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

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

Inspection

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



Installation

CAUTION:

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

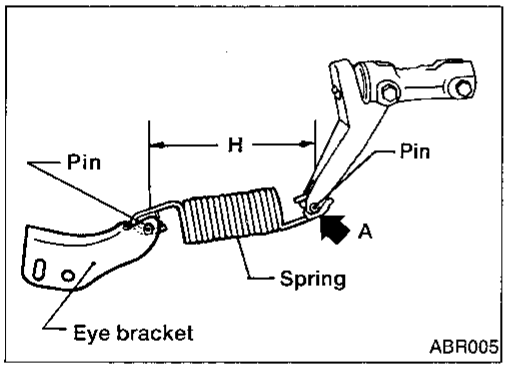
1. Tighten all flare nuts and connecting bolts.
   Specification:
   Flare nut
   15 - 18 N·m
   (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
   Connecting bolt
   17 - 20 N·m
   (1.7 - 2.0 kg-m, 12 - 14 ft-lb)
2. Refill until new brake fluid comes out of each air bleeder valve.
3. Bleed air. Refer to BR-5.

Dual 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.**

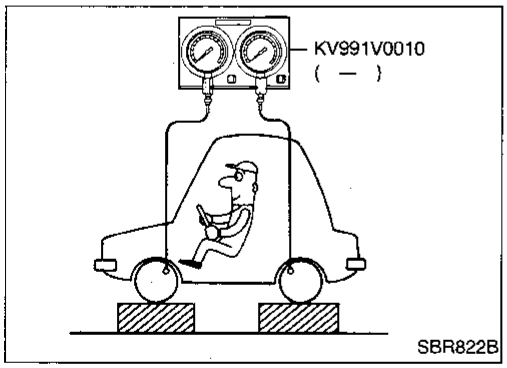


1. Check length "H" in unladen* condition.
   *: Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.

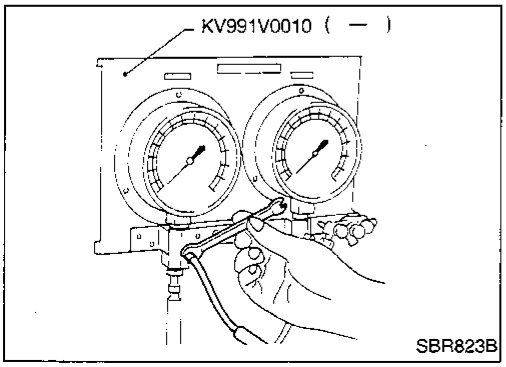
a. Have one person sit on the rear end. Then have the person slowly get off the vehicle. This is necessary to stabilize suspension deflection.

b. Measure length "H".
   Length "H":
   Approx. 152.5 ± 1.5 mm (6.004 ± 0.059 in)

- Adjust spring length by moving eye bracket while pushing lever toward **A.**



2. Connect tool to air bleeders of front and rear brakes on either LH and RH side.



3. Bleed air from Tool.

Dual Load Sensing Valve (Cont'd)

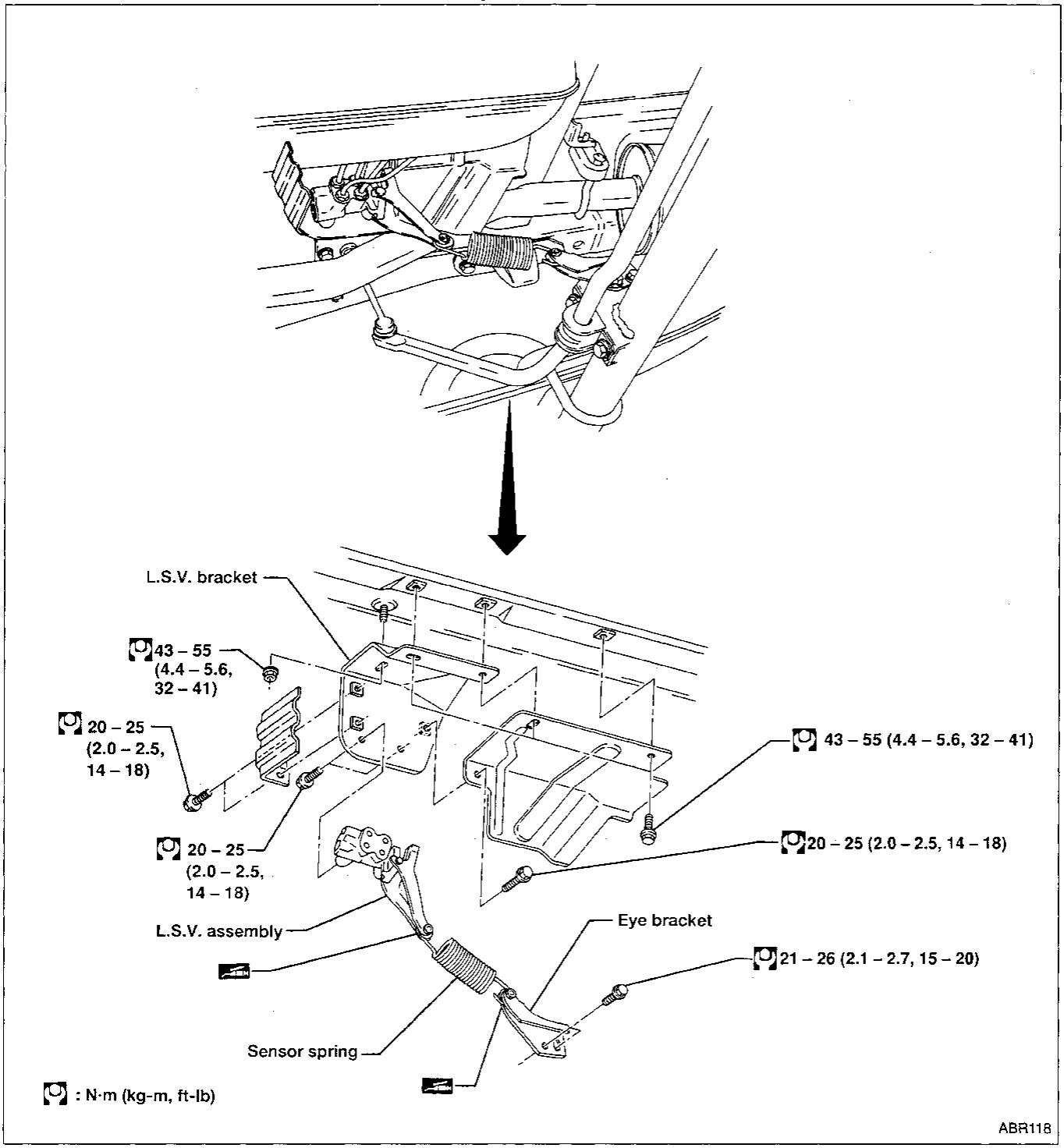
4. With one person aboard, depress brake pedal until front brake fluid pressure reaches **5,884 kPa (60 kg/cm^2, 853 psi).** Hold brake pedal in that position and read rear brake fluid pressure on pressure gauge indicator.
   Rear brake pressure:
   3,295 - 5,688 kPa
   (33.6 - 58.0 kg/cm^2, 478 - 825 psi)
5. Depress brake pedal until front brake fluid pressure reaches **11,768 kPa (120 kg/cm^2, 1,706 psi).** With brake pedal held in that position, read rear brake fluid pressure on pressure gauge indicator.
   Rear brake pressure:
   5,610 - 7,336 kPa
   (57.2 - 74.8 kg/cm^2, 813 - 1,064 psi)
6. If rear brake pressure is not within specifications, replace load sensing valve with a new one. After replacement, check load sensing valve by following steps 1 through 6.

Dual Load Sensing Valve (Cont'd)

REMOVAL AND INSTALLATION

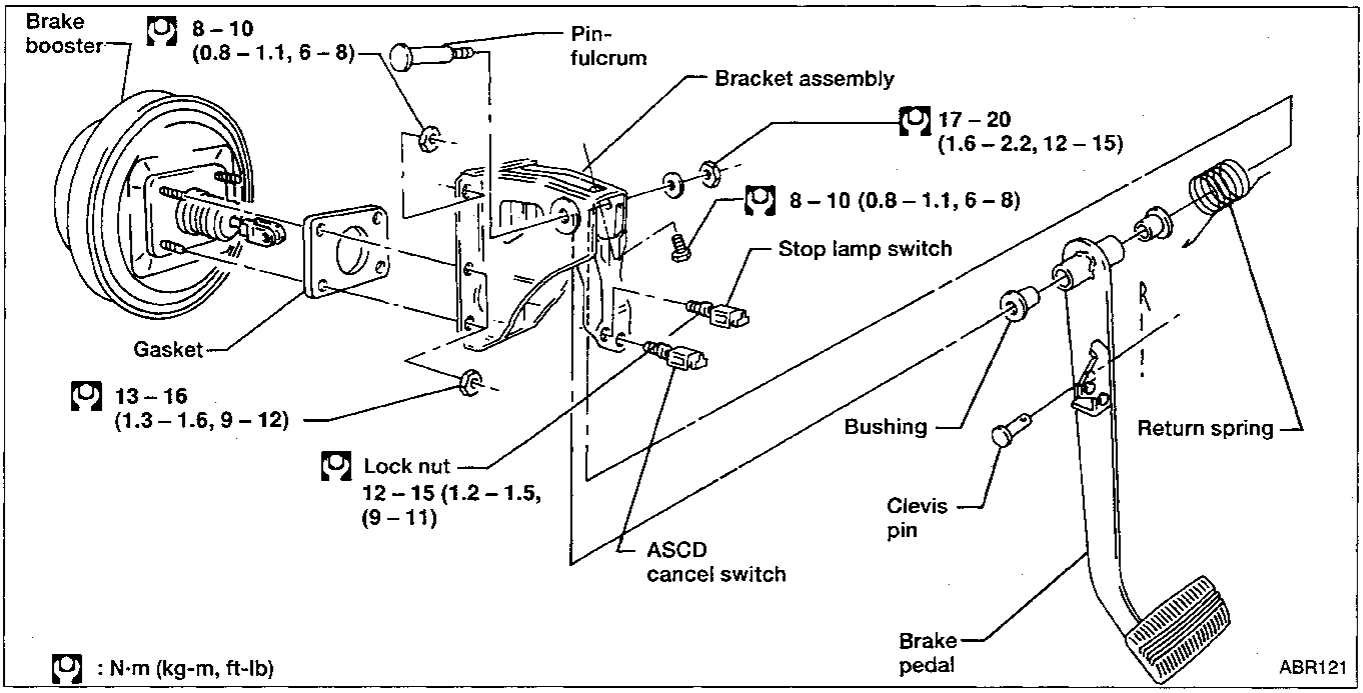
CAUTION:

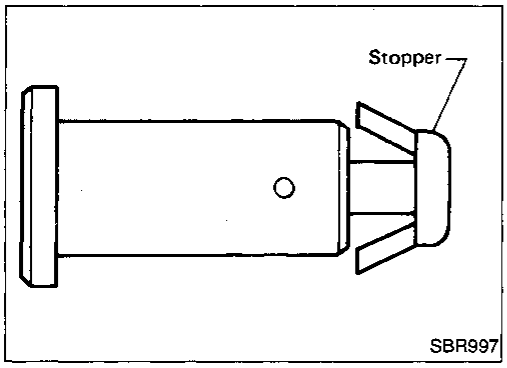
- **Refill with new brake fluid "DOT 3".**
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**
- Replace damaged Dual Load Sensing Valve as an assembly.



- Tighten all flare nuts.
  : 15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
- Bleed air. Refer to BR-5.

Removal and Installation

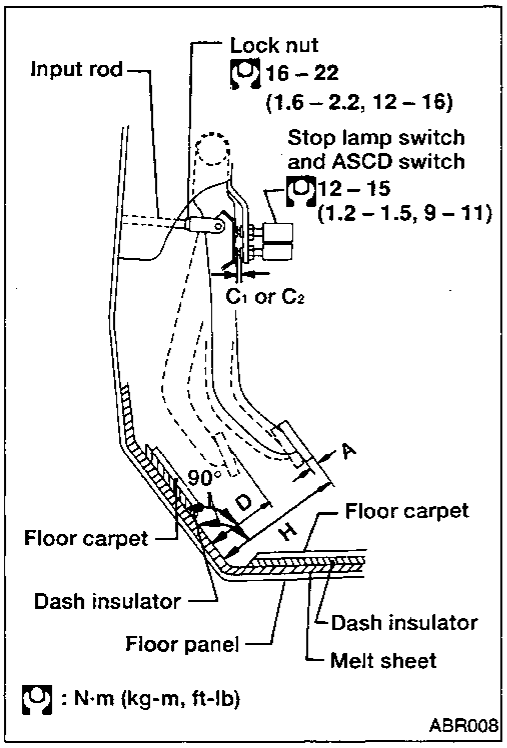




Inspection

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

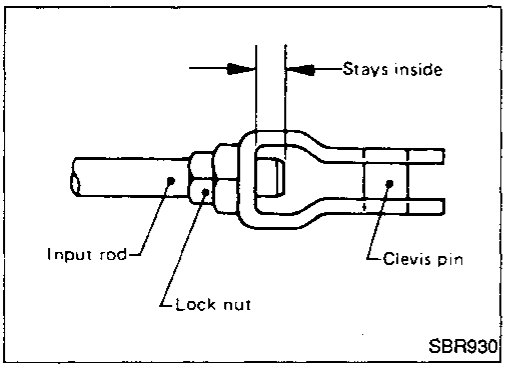
Check brake pedal free height from dash reinforcement panel. Adjust if necessary.

H: Free height
195 - 205 mm (7.68 - 8.07 in)

D: Depressed height
115 - 130 mm (4.53 - 5.12 in)
Under force of 490 N (50 kg, 110 lb) with engine running

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

A: Pedal free play
1.0 - 3.0 mm (0.039 - 0.118 in)



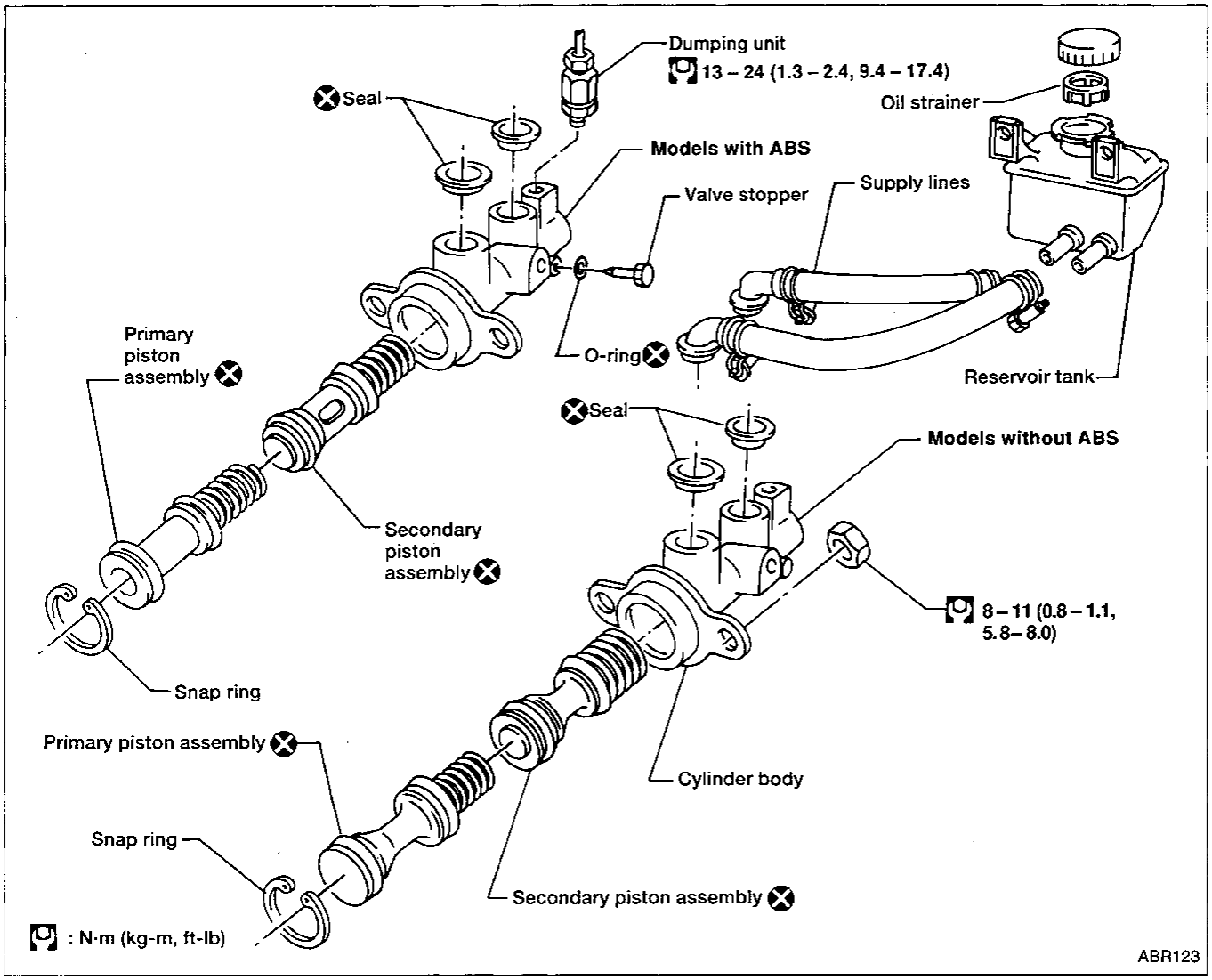
1. Loosen lock nut and adjust pedal free height by turning brake booster input rod. Then tighten lock nut.

Make sure that tip of input rod stays inside.

2. Loosen lock nut and adjust clearance "C_1" and "C_2" with stop lamp switch and ASCD switch respectively. Then tighten lock nuts.
3. Check pedal free play.

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

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

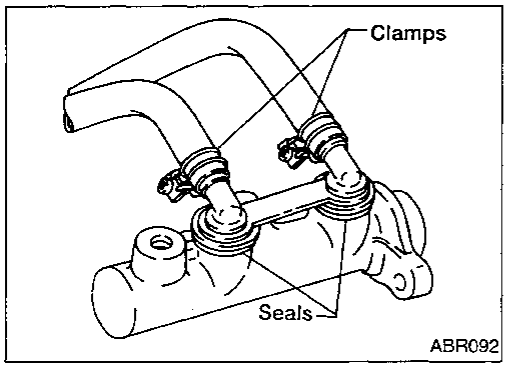


Removal

CAUTION:

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

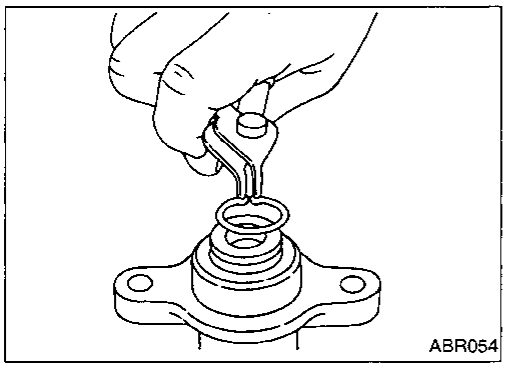
1. Connect a vinyl tube to air bleeder valve.
2. Drain brake fluid from each air bleeder valve, depressing brake pedal to empty fluid from master cylinder.
3. Remove brake pipe flare nuts.
4. Remove master cylinder mounting nuts.



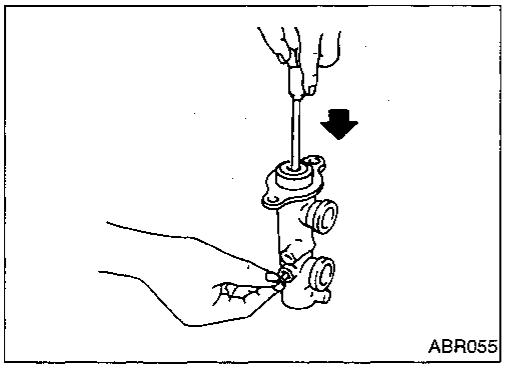
Disassembly

1. Remove rubber seals.
2. Remove clamps to supply lines.

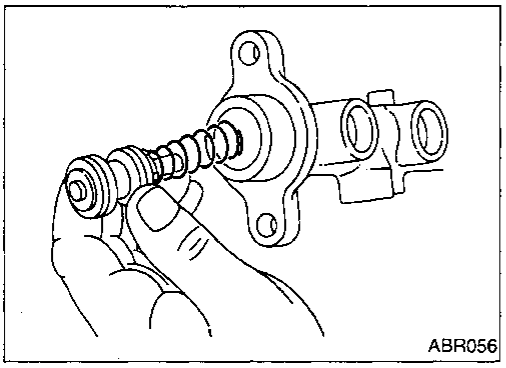
Disassembly (Cont'd)



3. Remove snap ring.



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



5. Remove piston assemblies.

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

Inspection

Check for the following items.

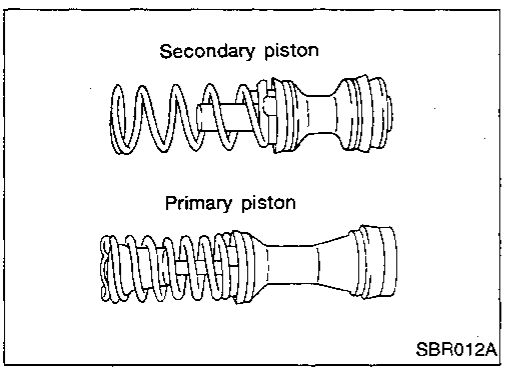
Replace any part if damaged.

Master cylinder:

- Pin holes or scratches on inner wall.

Piston:

- Deformation of or scratches on piston cups.

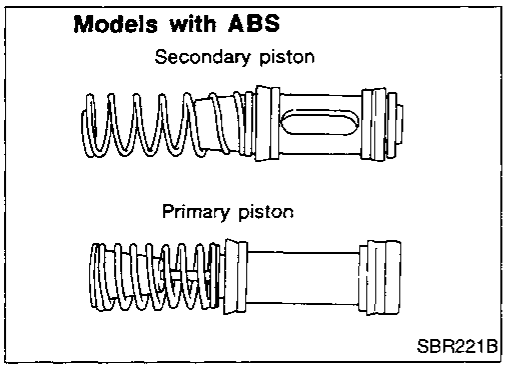


Assembly

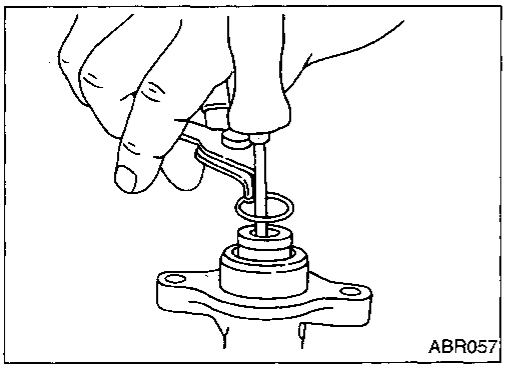
1. Insert secondary piston assembly. Then insert primary piston assembly.

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

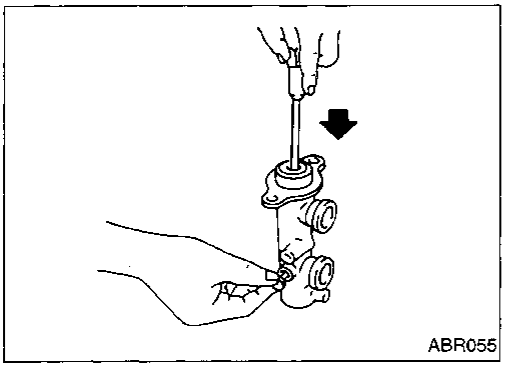
Assembly (Cont'd)



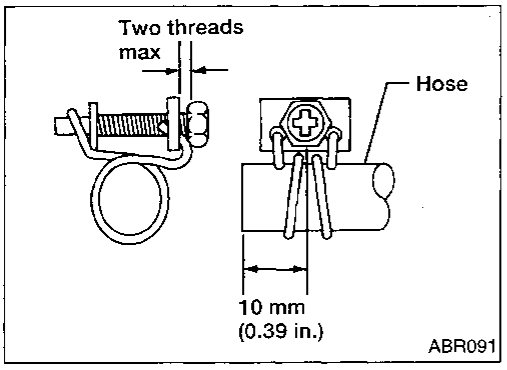
- **Pay attention to alignment of secondary piston slit with valve stopper mounting hole of cylinder body (For models with ABS only).**



2. Install snap ring while pushing down on piston assemblies.



3. Install valve stopper while piston is pushed into cylinder. (Models with ABS only)
4. Install seals and supply lines to master cylinder.

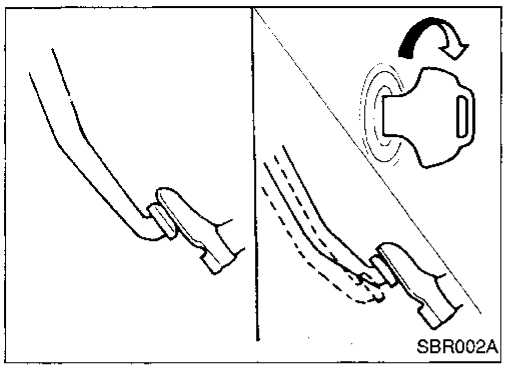


Installation

CAUTION:

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

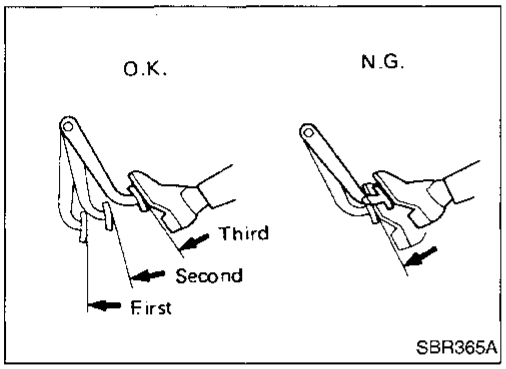
1. Place master cylinder onto brake booster and secure mounting nuts lightly.
2. Fit flare nuts to master cylinder.
3. Tighten mounting nuts.
   : 8 - 11 N·m (0.8 - 1.1 kg-m, 5.8 - 8.0 ft-lb)
4. Tighten flare nuts.
   : 15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
5. Tighten all hose clamps as shown at left.
6. Bleed air. Refer to BR-5.



On-vehicle Service

OPERATING CHECK

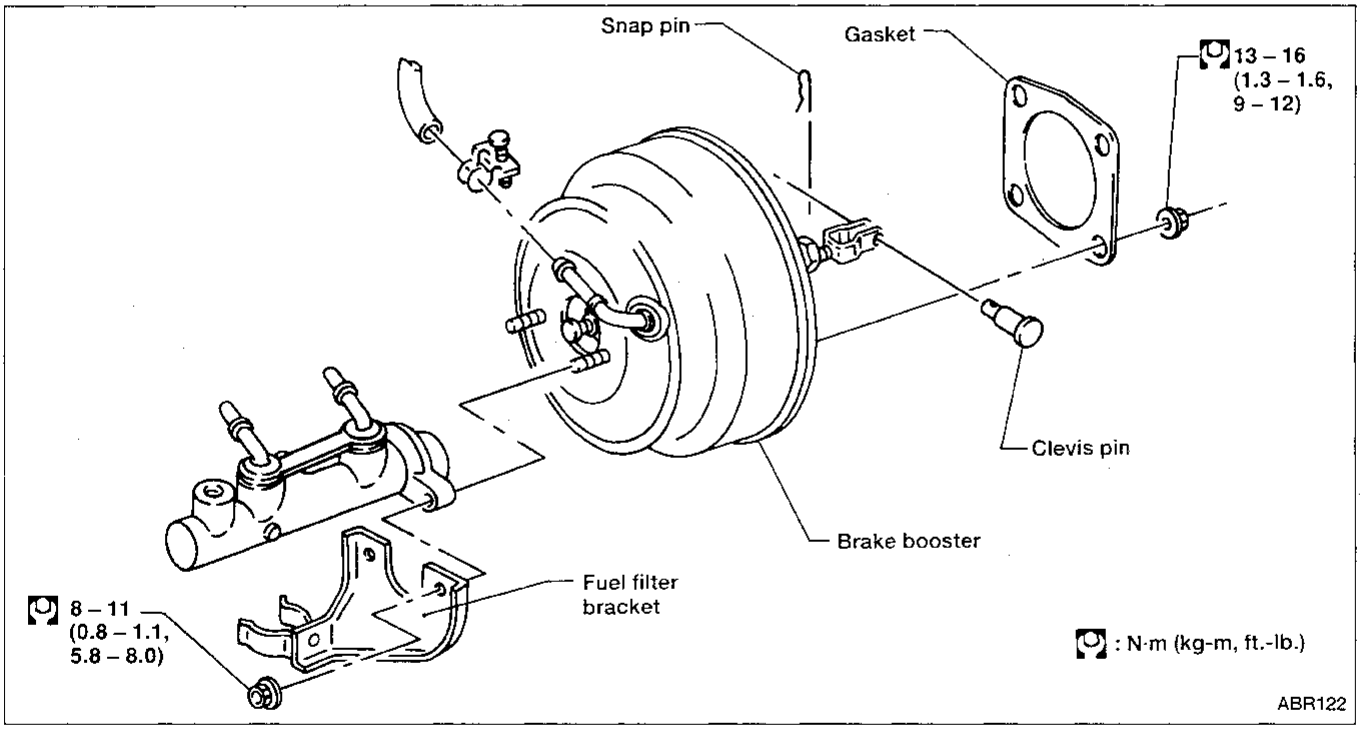
- Depress brake pedal several times with engine off, and check that there is no change in pedal stroke.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.



AIRTIGHT CHECK

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

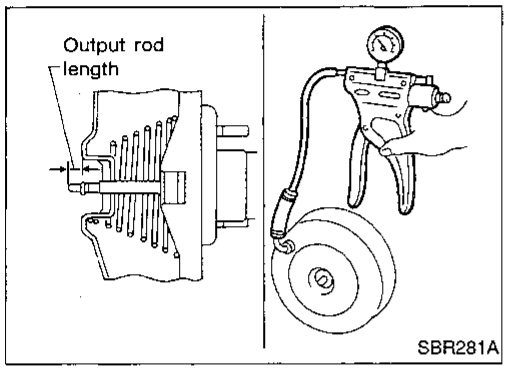
Removal



Removal (Cont'd)

CAUTION:

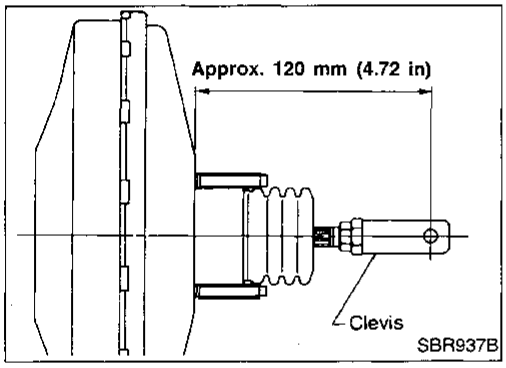
- **Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.**
- **Be careful not to deform or bend brake pipes, during removal of booster.**



Inspection

OUTPUT ROD LENGTH CHECK

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

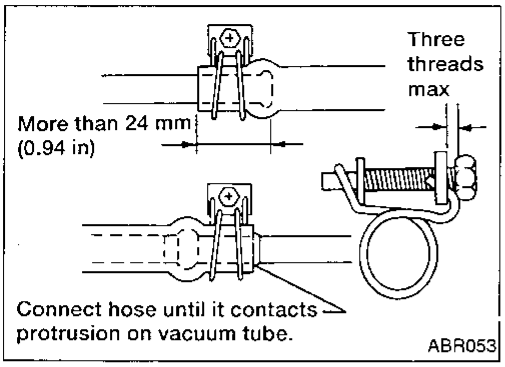


Installation

CAUTION:

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

1. Before fitting booster, temporarily adjust clevis to dimension shown.
2. Fit booster, then secure mounting nuts (brake pedal bracket to brake booster) loosely.
3. Connect brake pedal and booster input rod with clevis pin.
4. Tighten mounting nuts.
   : 13 - 16 N·m (1.3 - 1.6 kg-m, 9 - 12 ft-lb)
5. Install master cylinder. Refer to BR-15.
6. Bleed air. Refer to BR-5.

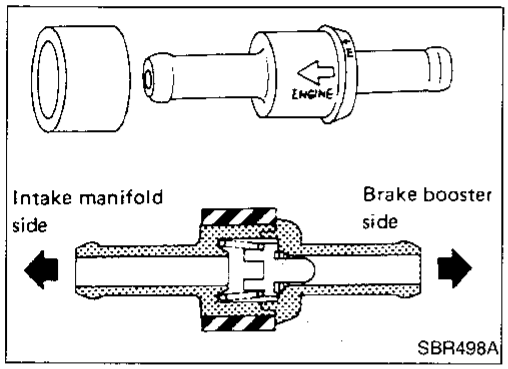


Removal and Installation

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 more than 24 mm (0.94 in).**

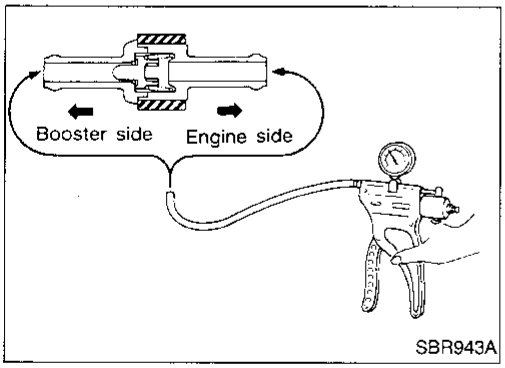


- **Install check valve, paying attention to its direction.**

Inspection

HOSES AND CONNECTORS

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



CHECK VALVE

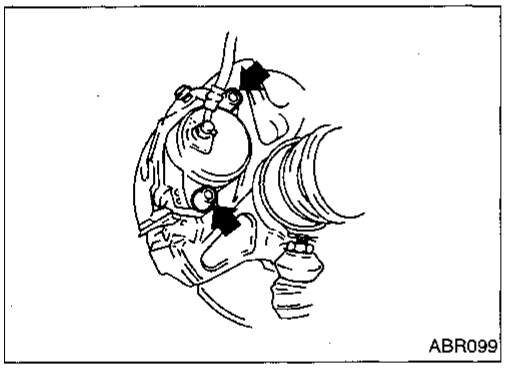
Check vacuum with a vacuum pump.

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

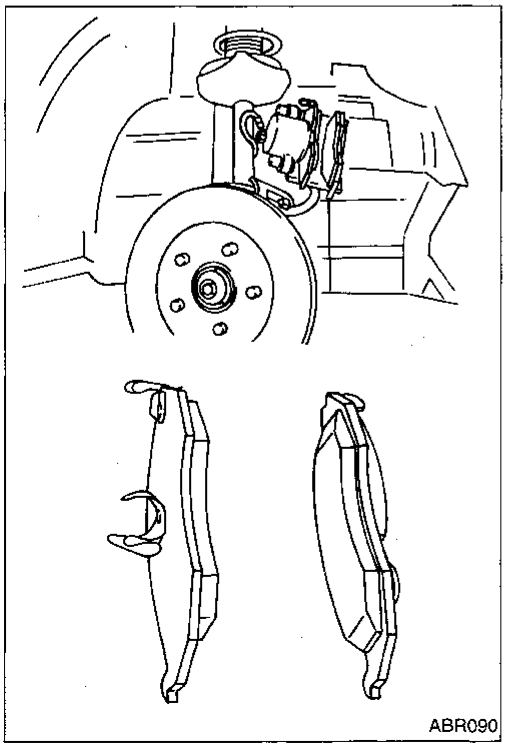
Pad Replacement

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

CAUTION:
- **When cylinder body is open, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage piston boot or get oil on rotor.**
- **If shims are rusted or show peeling of the rubber coat, replace with new pads.**
- **Suspend cylinder body with wire so as not to stretch brake hose.**

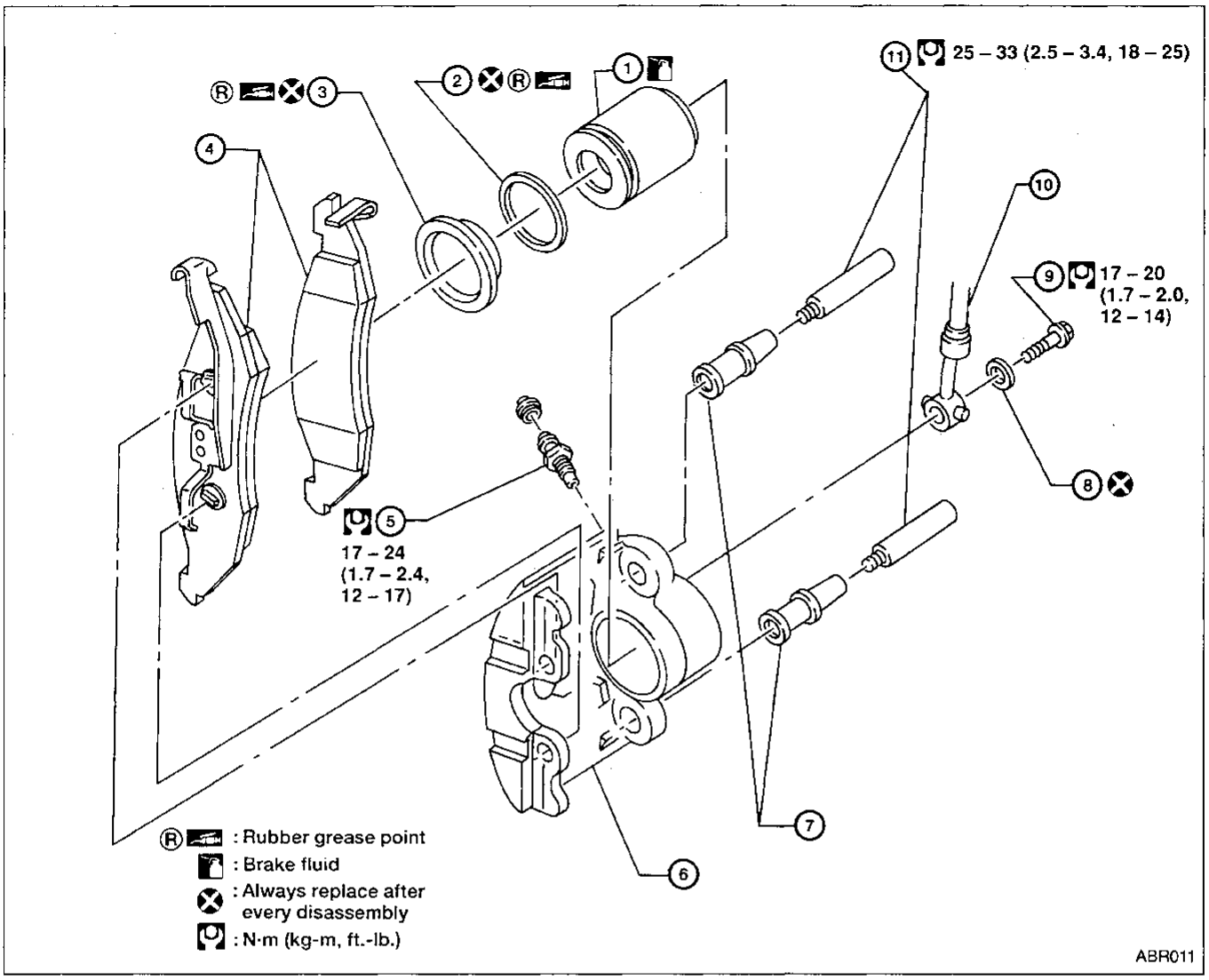


1. Remove master cylinder reservoir cap.
2. Remove two pin bolts.



3. Lift cylinder body off rotor. Then replace pads.
   Standard pad thickness:
   9.67 mm (0.3807 in)
   Pad wear limit:
   2.0 mm (0.079 in)

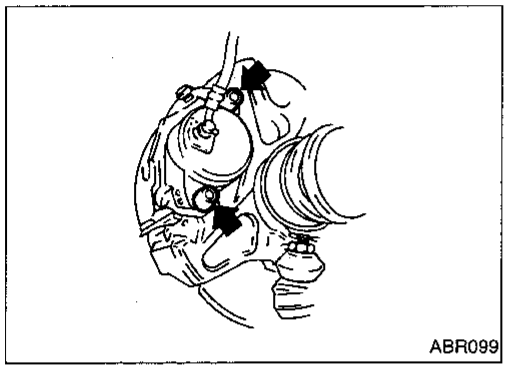
- **Carefully monitor brake fluid level because brake fluid will return to reservoir when pushing back piston.**
- **Be careful not to bend pad clips during installation into caliper. Install top of pad first, then install bottom of pad.**



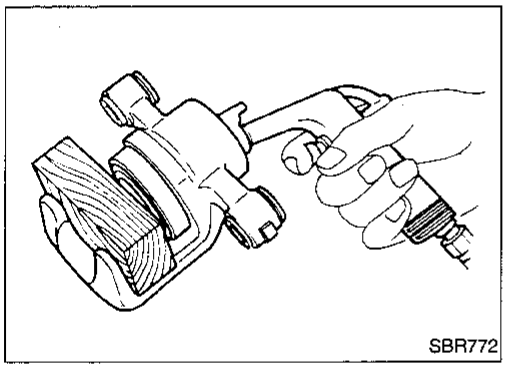
① Piston
② Piston seal
③ Dust seal
④ Pad
⑤ Air bleeder
⑥ Cylinder body
⑦ Pin boot
⑧ Copper washer
⑨ Connecting bolt
⑩ Brake hose
⑪ Main pin bolt

Removal

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


ABR099

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


SBR772

Disassembly

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

CAUTION:
- **Do not scratch or score cylinder wall.**
- **Do not pry directly against plastic piston when removing it from cylinder.**

1. Push out piston and 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 materials. If any of the above conditions are observed, replace cylinder body.
- Minor damage from rust or foreign materials may be eliminated by polishing surface with a fine emery paper. Replace cylinder body if necessary.

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

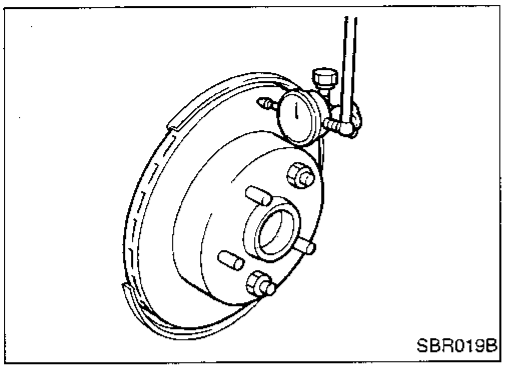
PISTON

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

CAUTION:
Piston is made of plastic. Do not polish with emery paper even if foreign materials are stuck to sliding surface.

SLIDE PIN, PIN BOLT AND PIN BOOT

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


SBR019B

Inspection — Rotor

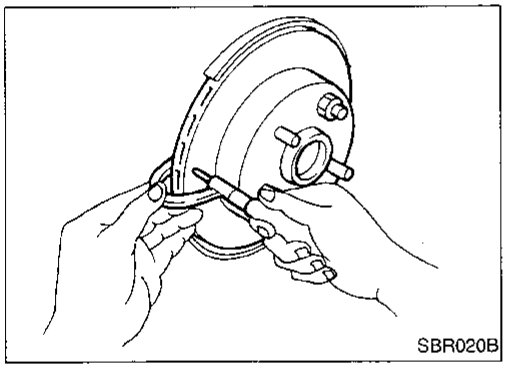
RUNOUT

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:
0.07 mm (0.0028 in)

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

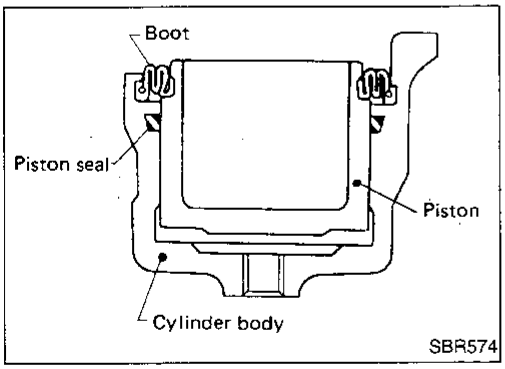

SBR020B

THICKNESS

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

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

Rotor repair limit:
Minimum thickness
24.0 mm (0.945 in)



SBR574

Assembly

CAUTION:

- **Be careful not to scratch or damage piston when installing it into cylinder.**

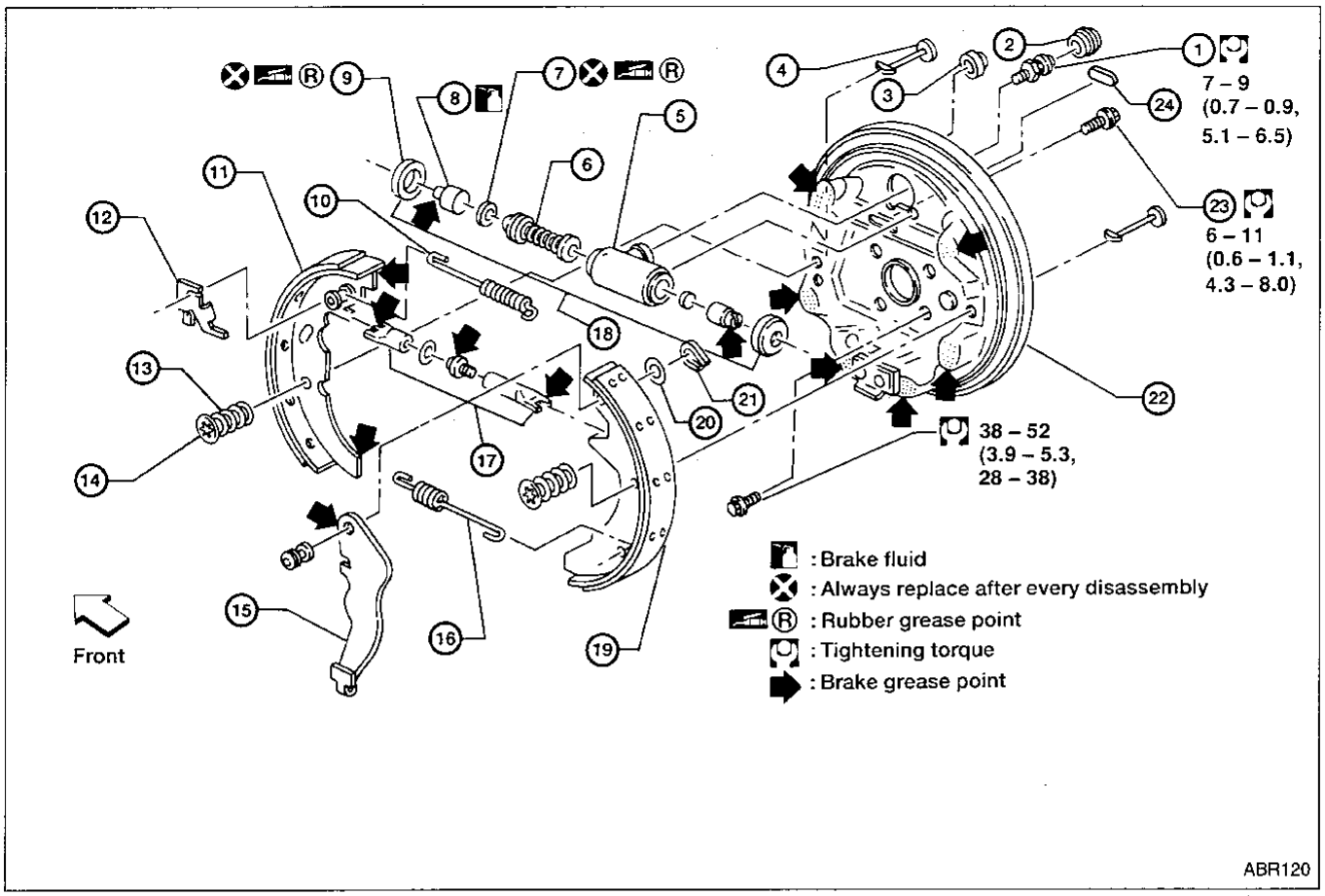
1. Insert piston seal into groove on cylinder body.
2. With piston boot fitted to piston, insert piston boot into groove on cylinder body and install piston.
3. Properly secure piston boot.

Installation

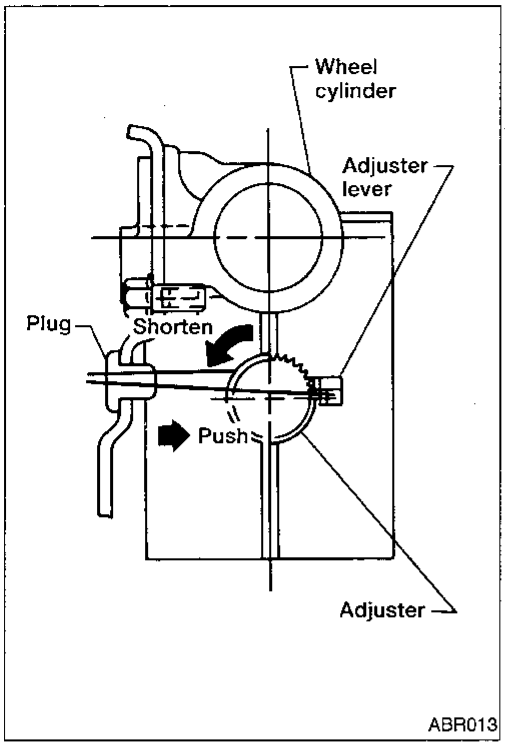
CAUTION:

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

1. Install brake hose to caliper securely.
   Tighten connecting bolt.
   : 17 - 20 N·m (1.7 - 2.0 kg-m, 12 - 14 ft-lb)
2. Install all parts and secure all bolts.
3. Bleed air. Refer to BR-5.



① Air bleeder
② Air bleeder cap
③ Shoe inspection hole plug
④ Shoe hold-down pin
⑤ Cylinder body
⑥ Spring
⑦ Piston cap
⑧ Piston
⑨ Dust cover
⑩ Adjuster spring
⑪ Shoe
⑫ Adjusting lever
⑬ Shoe hold-down spring
⑭ Retainer
⑮ Toggle lever
⑯ Return spring
⑰ Adjuster
⑱ Wheel cylinder
⑲ Shoe
⑳ Washer
㉑ Retainer ring
㉒ Back plate
㉓ Wheel cylinder bolt
㉔ Adjuster plug



Removal

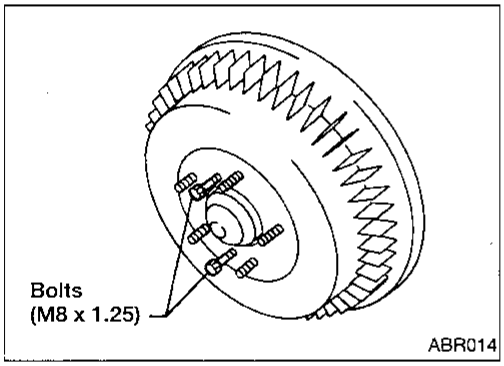
WARNING:
Clean brake lining with a vacuum dust collector to minimize the hazard of airborne materials.

CAUTION:
Make sure parking brake lever is released completely.

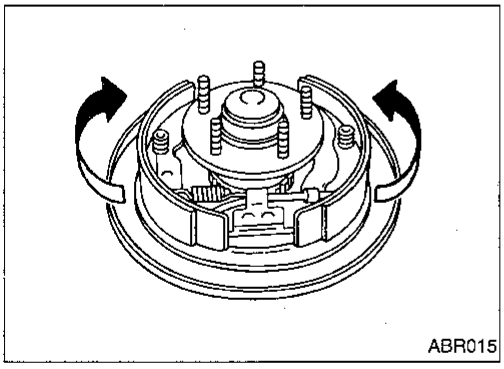
1. Release parking brake lever fully, then remove drum.

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

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



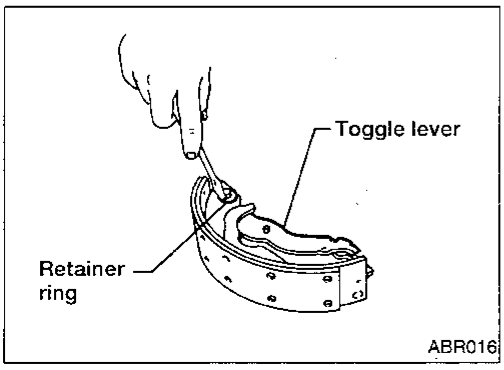
b. Tighten the two bolts gradually.



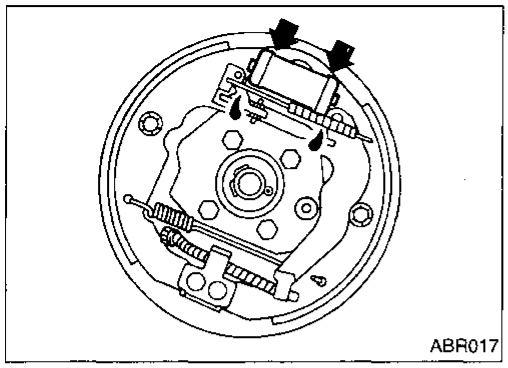
2. After removing retainer, remove spring by rotating shoes.

Be careful not to damage parking brake cable when separating it.

3. Remove adjuster.
4. Disconnect parking brake cable from toggle lever.

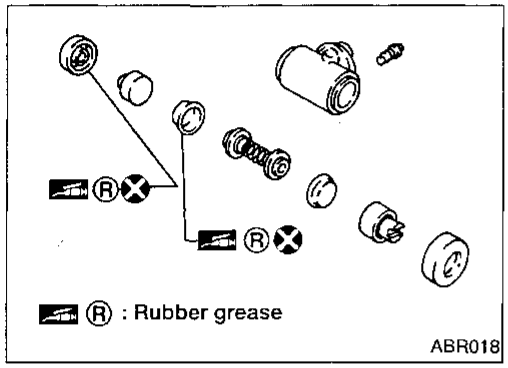


5. Remove retainer ring with a suitable tool. Then separate toggle lever and brake shoe.


ABR017

Inspection — Wheel Cylinder

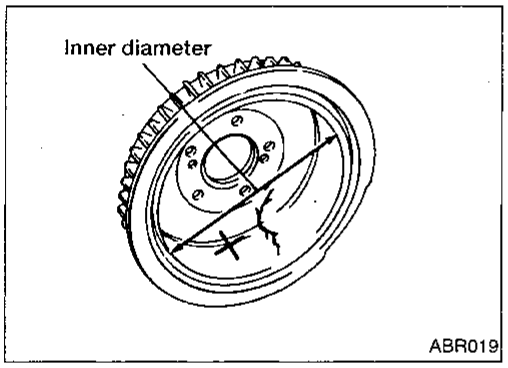
- Check wheel cylinder for leakage.
- Check for wear, damage and loose conditions. Replace if any such condition exists.



ABR018

Wheel Cylinder Overhaul

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

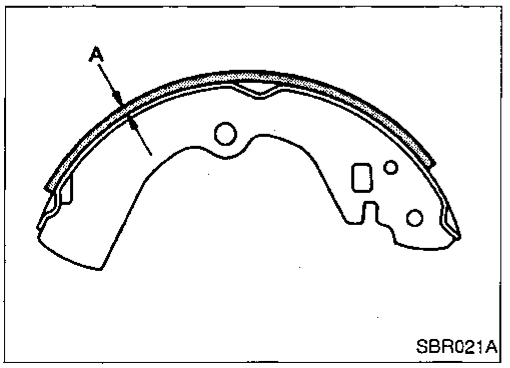


ABR019

Inspection — Drum

Standard inner diameter
250.0 mm (9.84 in)
Maximum inner diameter:
251.5 mm (9.90 in)
Out-of-roundness:
0.015 mm (0.0006 in) or less
Radial runout:
0.05 mm (0.0020 in) or less

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

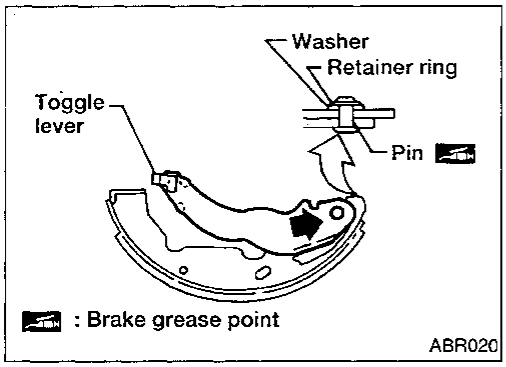


SBR021A

Inspection — Lining

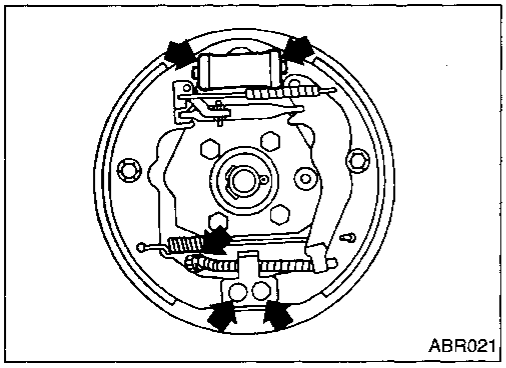
Check lining thickness.

Standard lining thickness:
5.9 mm (0.232 in)
Lining wear limit (A):
2.0 mm (0.079 in)

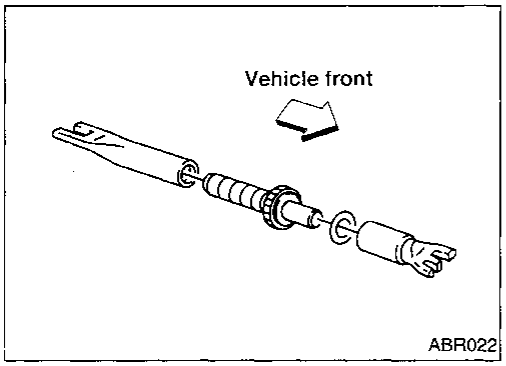


Installation

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



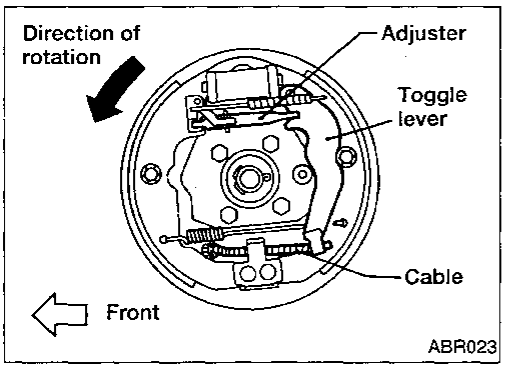
2. Apply brake grease to the contact areas shown at left.



3. Shorten adjuster by rotating it.

Pay attention to direction of adjuster.

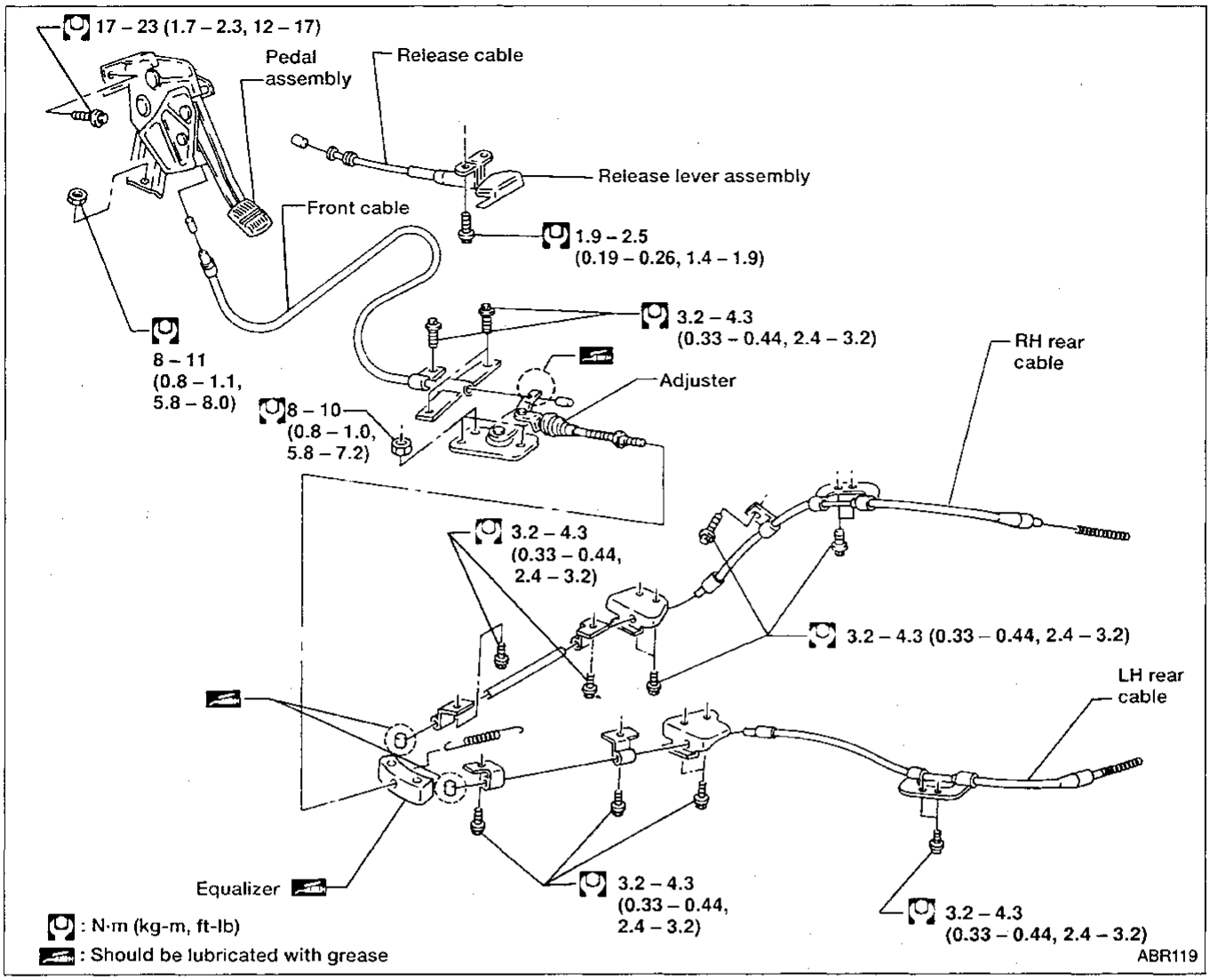
4. Connect parking brake cable to toggle lever.
5. Install all parts.



6. Check all parts are installed properly.

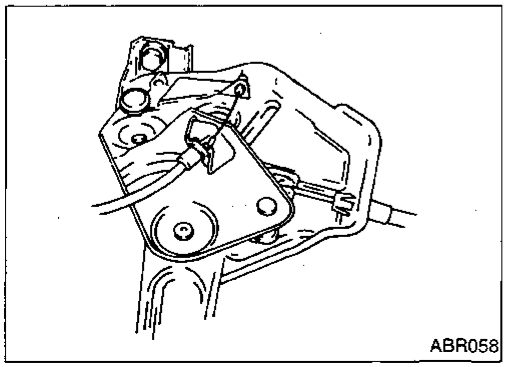
Pay attention to direction of adjuster.

7. Install brake drum.
8. When installing new wheel cylinder or overhauling wheel cylinder, bleed air. Refer to BR-5.
9. Adjust clearance between shoe and drum by depressing brake pedal several times until clicking sound from rear brake is not present.
10. Adjust parking brake cable. Refer to BR-28.



Removal and Installation

- Parking brake cables can be removed without removing pedal assembly.
- In order to access front cable, it is necessary to remove both storage compartment side panels, then pull carpet back.



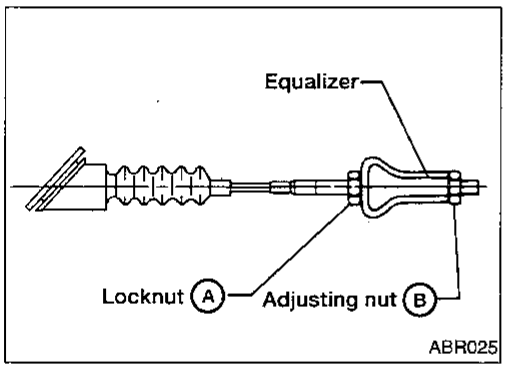
- The figure at left shows how front and release cables are connected to pedal assembly.

Inspection

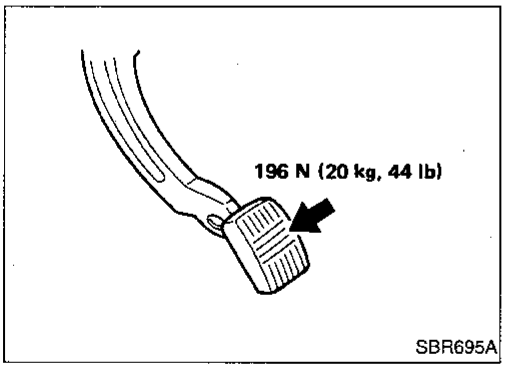
1. Check pedal assembly for wear or other damage. Replace if necessary.
2. Check wires for discontinuity or deterioration. Replace if necessary.
3. Check parking brake switch and warning lamp. Replace if necessary.
4. Check parts at each connecting portion and, if found deformed or damaged, replace.

Adjustment

- **Before adjustment, to adjust clearance between shoe and drum correctly, depress service brake pedal several times until clicking sound from rear brake is not present.**
- **After adjustment, make sure that there is no drag when parking brake pedal is released.**



1. Loosen lock nut Ⓐ, rotate adjusting nut Ⓑ.
2. Tighten lock nut Ⓐ and adjusting nut Ⓑ.
   : 7.8 - 10.8 N·m (0.8 - 1.1 kg-m, 5.8 - 8.0 ft-lb)



3. Depress parking brake pedal with specified amount of force. Check pedal stroke and ensure smooth operation.
   Number of notches:
   11 - 12

Purpose

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

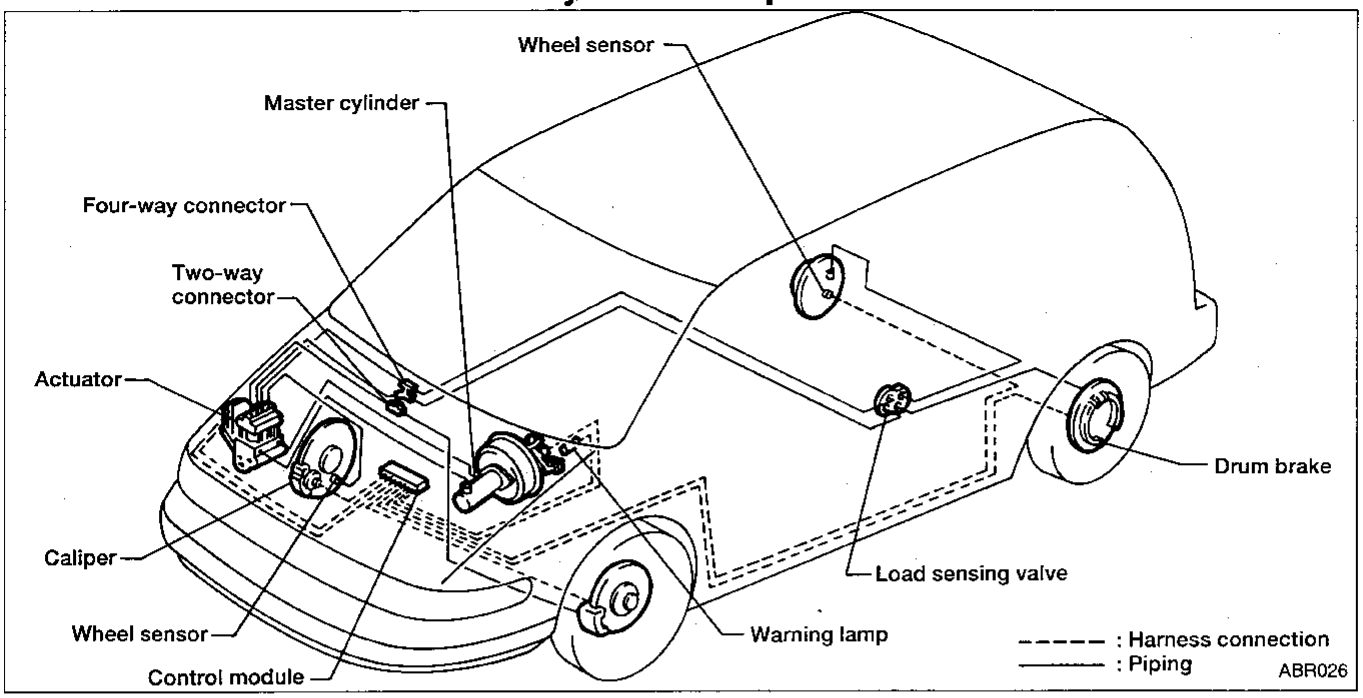
The ABS, by the use of electronic and hydraulic components, allows for control of braking force so that locking of the wheels can be avoided in the circumstances described above.
The ABS:

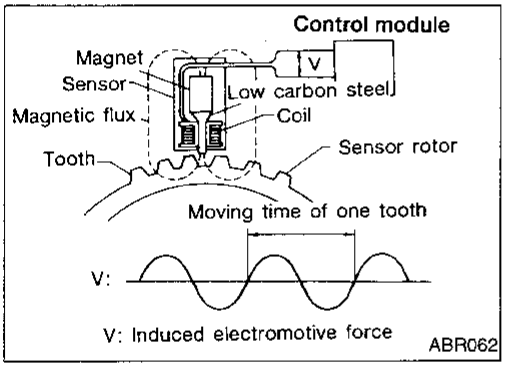
1) Ensures proper tracking performance through steering wheel operation.
2) Enables obstacles to be avoided through steering wheel operation.
3) Ensures vehicle stability by preventing flat spins.

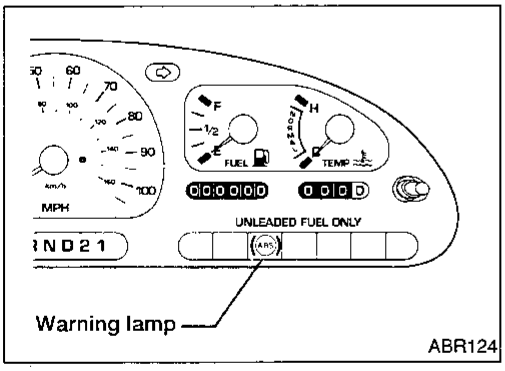
Operation

- When the vehicle speed is less than 10 km/h (6 MPH) this system does not work.
- The Anti-Lock Brake System (ABS) has self-test capabilities. The system turns on the anti-lock warning lamp each time the engine is started. After the engine is started and the anti-lock warning lamp turns off, the system performs another test the first time the vehicle reaches 6 km/h (4 MPH). A mechanical noise may be heard as the ABS performs a self-test. This is a normal part of the self-test feature. If a malfunction is found during this check, the anti-lock warning lamp will come on.
- During ABS operation, a mechanical noise may be heard. This is a normal condition.

System Components







System Description

SENSOR

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

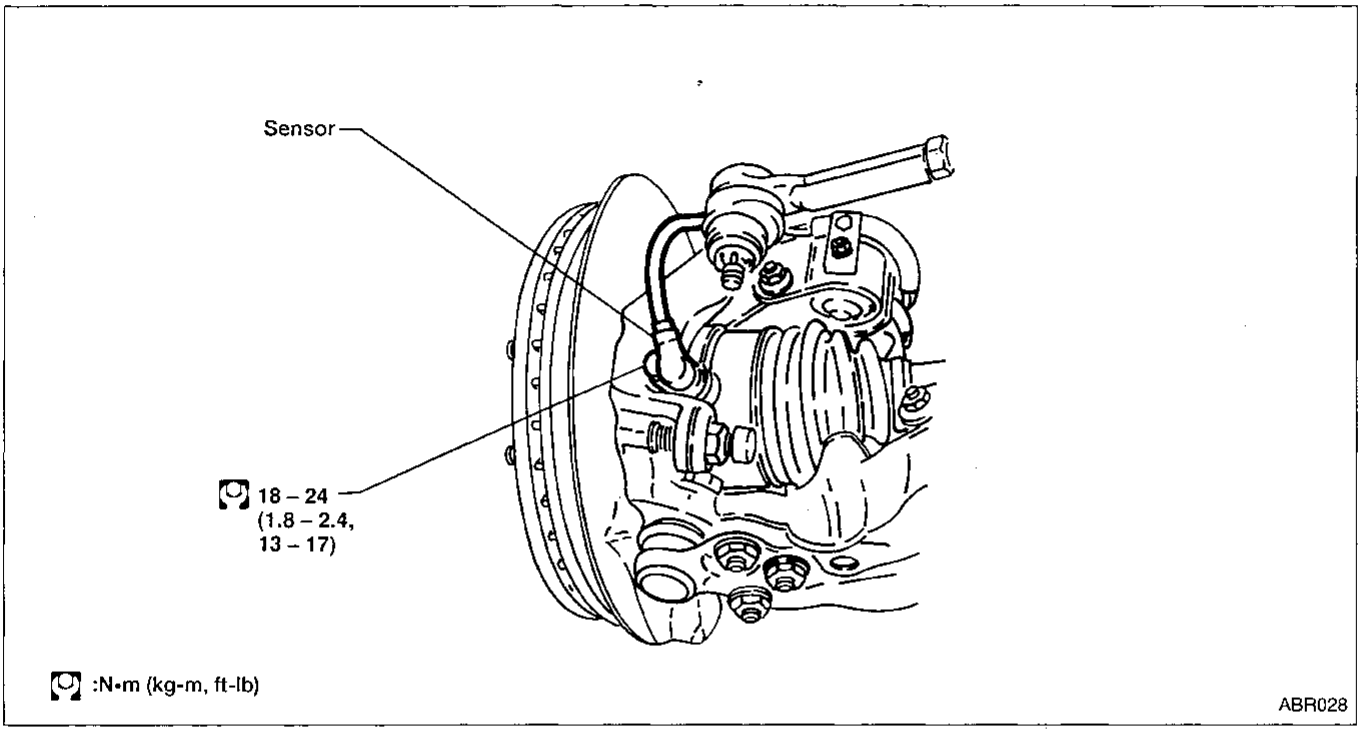
CONTROL MODULE

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

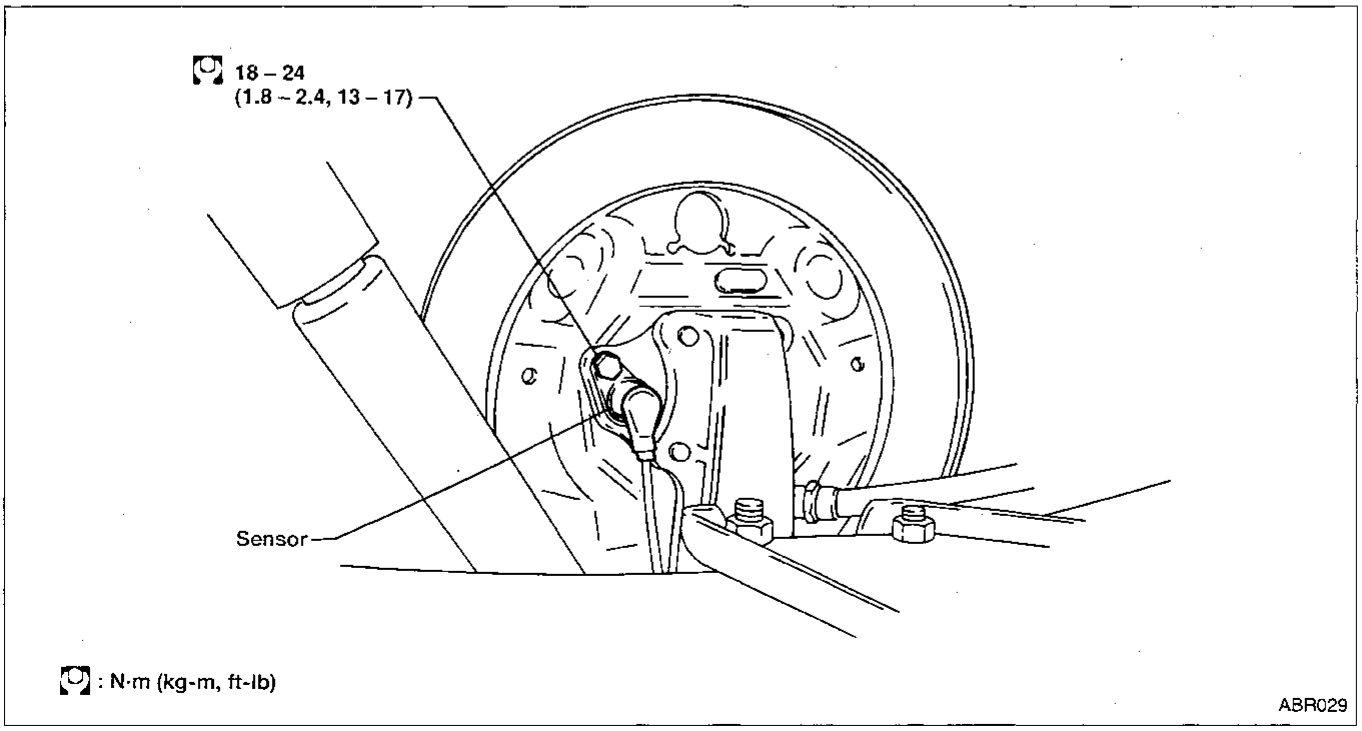
Removal and Installation

CAUTION:
Be careful not to damage sensor edge and sensor rotor teeth.
In case the front or rear wheel hub assembly needs to be removed, disconnect the ABS wheel sensor from the assembly and move it away. Failure to do so may result in damage to the sensor wires making the sensor inoperative.

FRONT WHEEL SENSOR

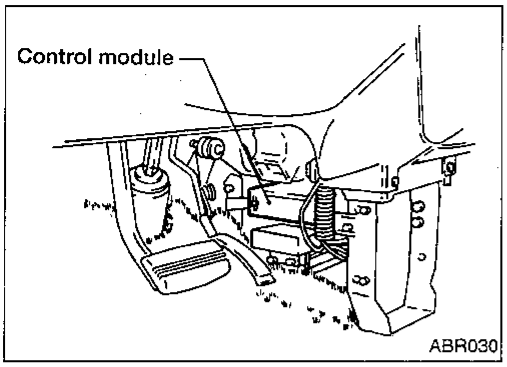


REAR WHEEL SENSOR



Removal and Installation (Cont'd)

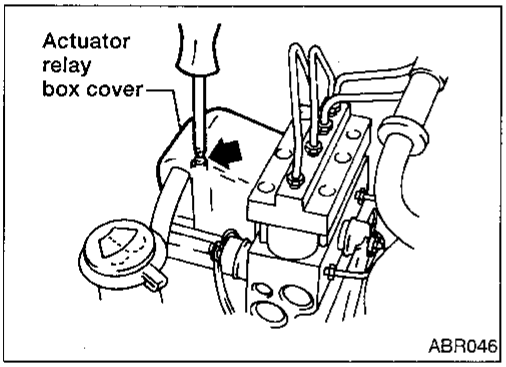
CONTROL MODULE



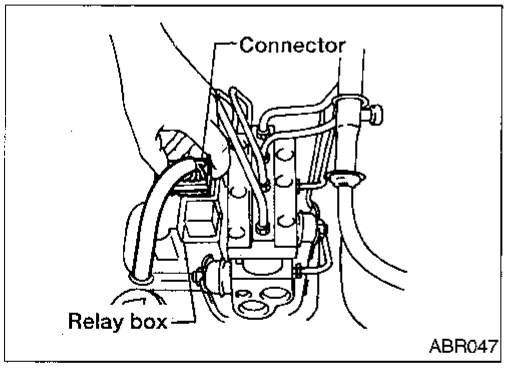
Location: Front passenger side dash side lower.

ACTUATOR

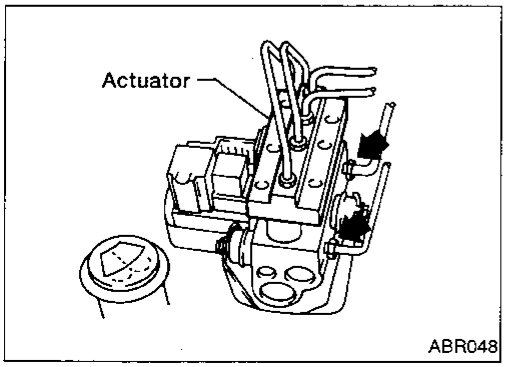
1. Disconnect battery cable.



2. Remove screw from actuator relay box cover.
3. Remove cover.



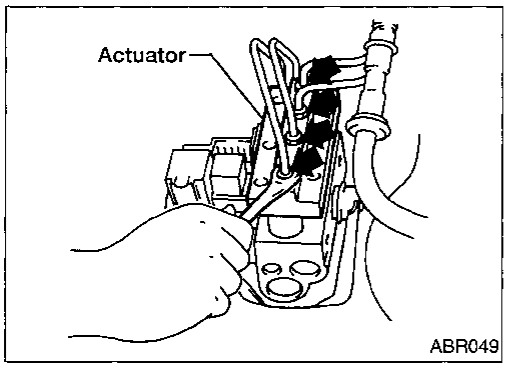
4. Release actuator connector lock tab. Disconnect connector from actuator relay box.



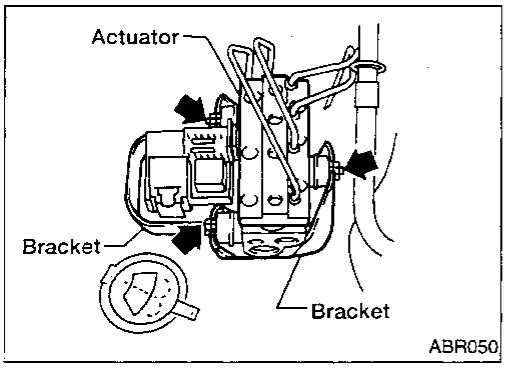
5. Disconnect two side brake pipes from actuator. (Pipes from master cylinder to actuator).

It is not necessary to remove these pipes.

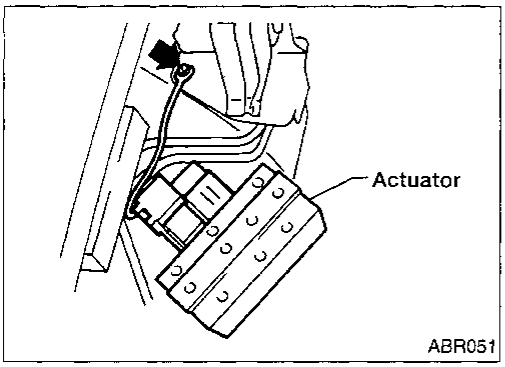
Removal and Installation (Cont'd)



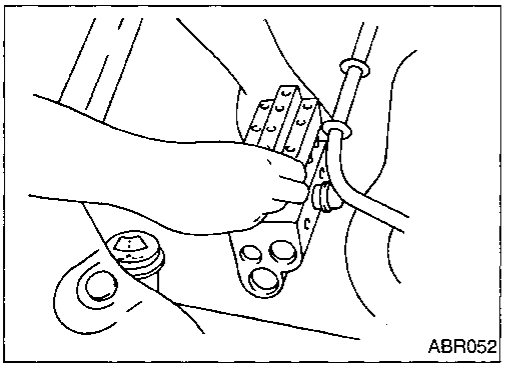
6. Disconnect top four brake pipes from actuator. (Pipes from actuator to wheels).



7. Remove/loosen mounting nuts between actuator and bracket.



8. Remove the actuator grounding screw.

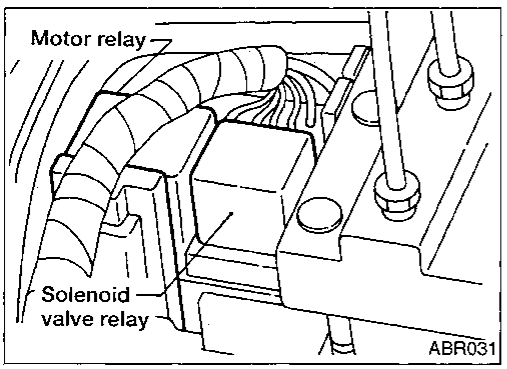


9. Draw out the actuator as shown.

CAUTION:

After installation, refill brake fluid and bleed air. Refer to BR-4 and BR-5 respectively.

- Installation procedure is basically the reverse order of removal.

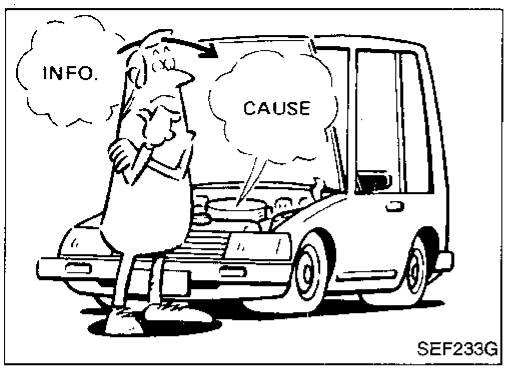


ACTUATOR RELAYS

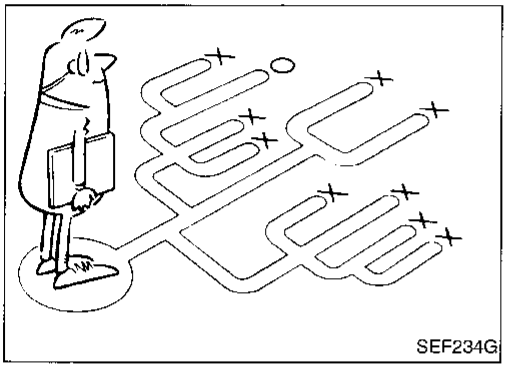
LARGE: MOTOR RELAY
SMALL: SOLENOID VALVE RELAY

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

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



SEF233G


SEF234G

How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

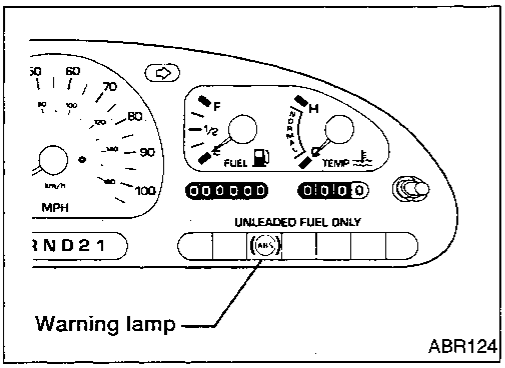
The ABS system has an electronic control module to control major functions. The control module accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems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

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electrical 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.

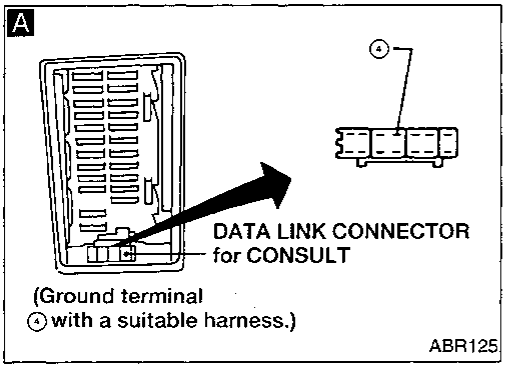
Before performing actual checks, take just a few minutes to talk with a customer with an ABS complaint. The customer is a very good source of information on such problems; especially intermittent ones. Through the talks with the customer, find out what symptoms are present and under what conditions they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



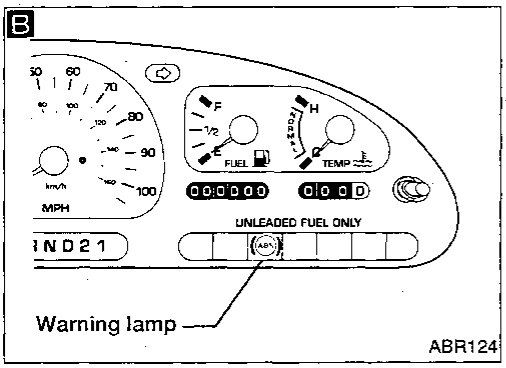
ABR124

A



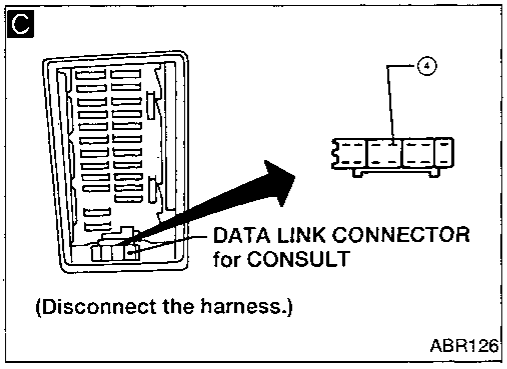
ABR125

B



ABR124

C



ABR126

Self-diagnosis

FUNCTION

- When a problem occurs in the ABS, the warning lamp on the instrument panel comes on. The warning lamp is also lit by grounding the self-diagnostic (check) terminal ④ located on the "Data Link Connector for CONSULT" to actuate the self-diagnostic results mode. The location of the malfunction is indicated by the warning lamp flashing on the instrument panel.

SELF-DIAGNOSIS PROCEDURE

Check fuses before starting Self-diagnosis.

↓

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 3.2 seconds, the warning lamp starts flashing to indicate the malfunction code No.

↓

After verifying the location of the malfunction with the malfunction code chart, make the necessary repairs following the instructions in the diagnostic procedures.

↓

After the malfunctions are repaired, erase the malfunction codes stored in the control module. (Refer to BR-37.)

↓

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.

↓

Ⓐ

Self-diagnosis (Cont'd)

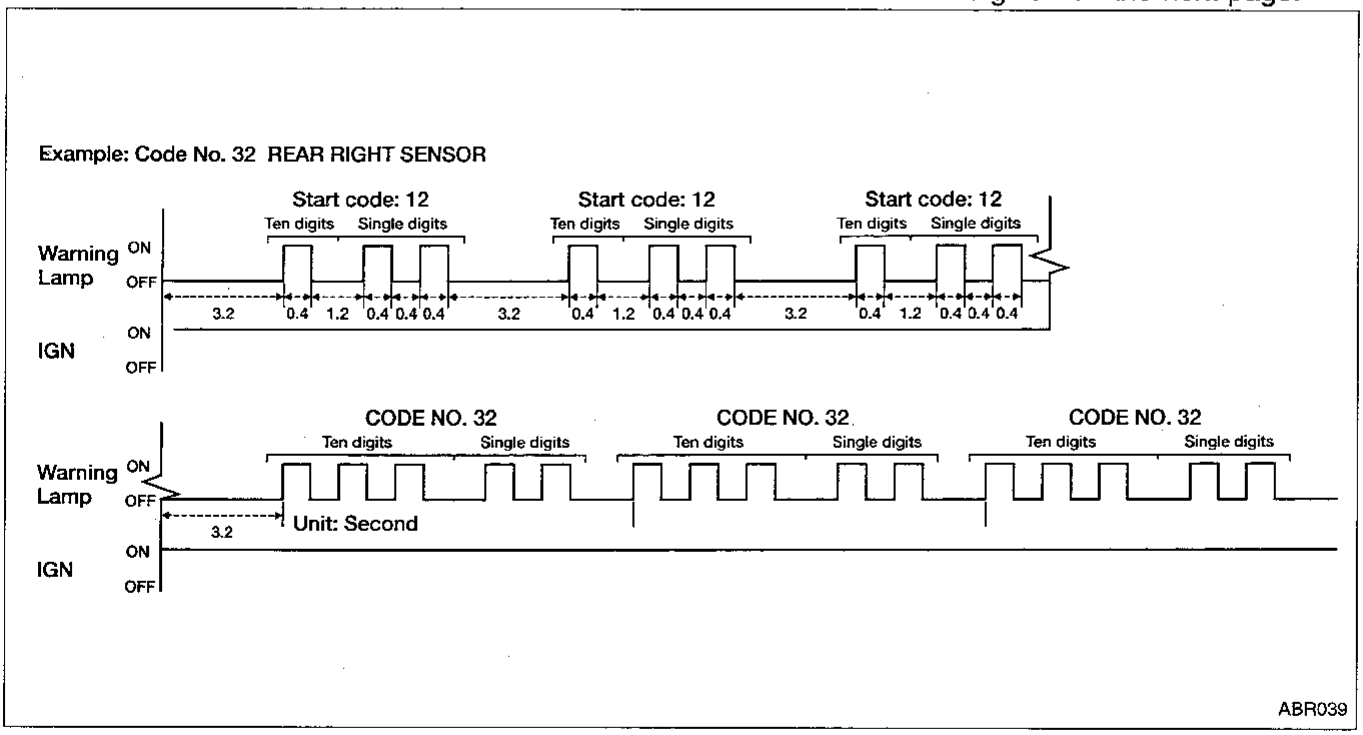
Ⓐ

Check warning lamp for deactivation after driving vehicle over 30 km/h (20 MPH) for at least one minute.

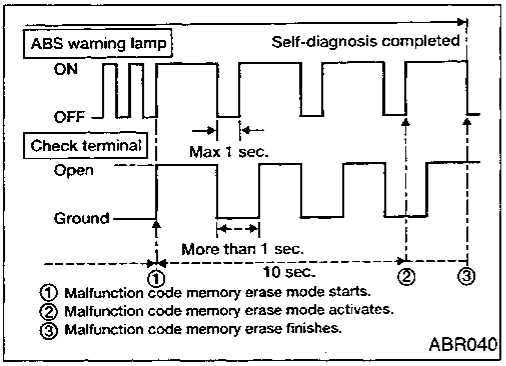
After making certain that warning lamp does not come on, test the ABS in a safe area to verify that it functions properly.

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 Nos. can be stored; the latest malfunction will be indicated first.
- The indication begins with the start code 12, after which a maximum of three code Nos. appear in the order of the latest one first. The indication then returns to the start code to repeat.
- The malfunction code chart is given on the next page.



Self-diagnosis (Cont'd)



HOW TO ERASE SELF-DIAGNOSTIC RESULTS (Malfunction codes)

a. Under the self-diagnostic results mode, the malfunction memory erase mode starts when the check terminal is disconnected from the ground.

b. The self-diagnostic results (malfunction codes) can be erased by grounding the check terminal more than three times in succession within 10 seconds after the erase mode starts. (Each grounding must be longer than one second.)
The ABS warning lamp stays on while the self-diagnosis is in the erase mode, and goes out after the erase operation has been completed.
The self-diagnosis is also completed at the same time.

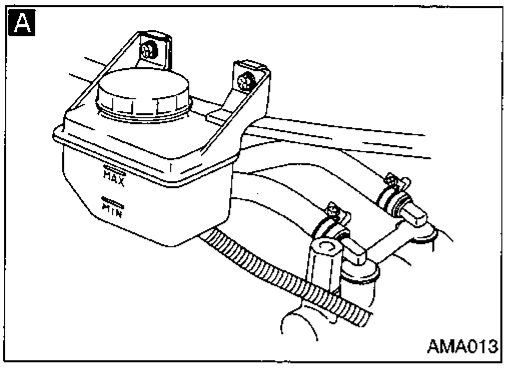
After the erase operation is completed, it is necessary to rerun the self-diagnostic mode to verify that malfunction codes no longer appear. Only the start code should be indicated when erase operation is completed and system is functioning normally.

MALFUNCTION CODE CHART

Code No.	Malfunctioning part	Diagnostic procedure
45*	Front left actuator solenoid	—
41*	Front right actuator solenoid	—
55*	Rear actuator solenoid	—
25	Front left sensor (open-circuit)	3
26	Front left sensor (frequency error)	3
21	Front right sensor (open-circuit)	3
22	Front right sensor (frequency error)	3
35	Rear left sensor (open-circuit)	3
36	Rear left sensor (frequency error)	3
31	Rear right sensor (open-circuit)	3
32	Rear right sensor (frequency error)	3
61	Actuator motor or motor relay	4
63*	Solenoid valve relay	—
71	Control module	5
Warning lamp stays on, does not blink.	Solenoid valve relay stuck or control module power supply circuit	2
Warning lamp does not come on.	Warning lamp bulb	1

* Malfunction code will appear only after repaired. (When these malfunctions occur, warning lamp stays on; does not blink.)

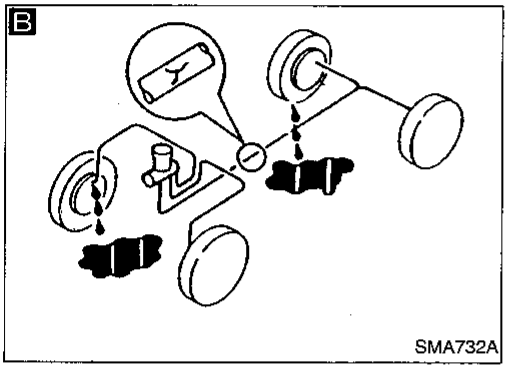
Preliminary Check



A

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

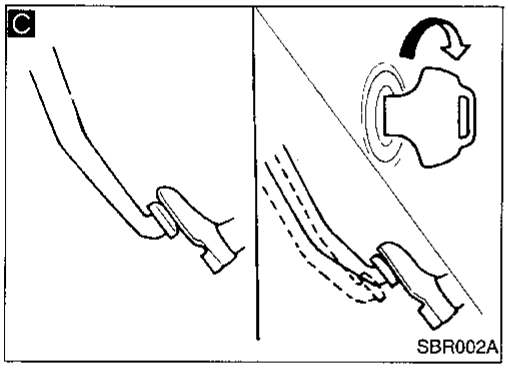
OK



B

Check brake system.
Refer to BR-4. → NG → Repair brake system.

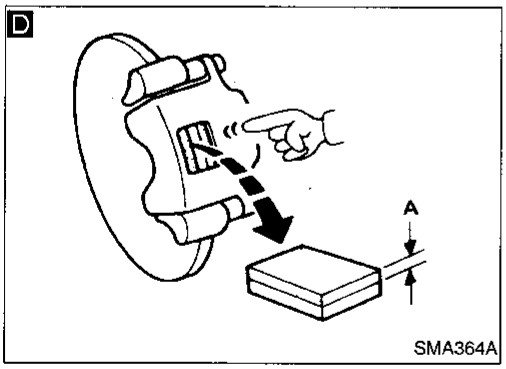
OK



C

Check brake booster operation and air-tightness.
Refer to BR-16. → NG → Repair or replace booster system.

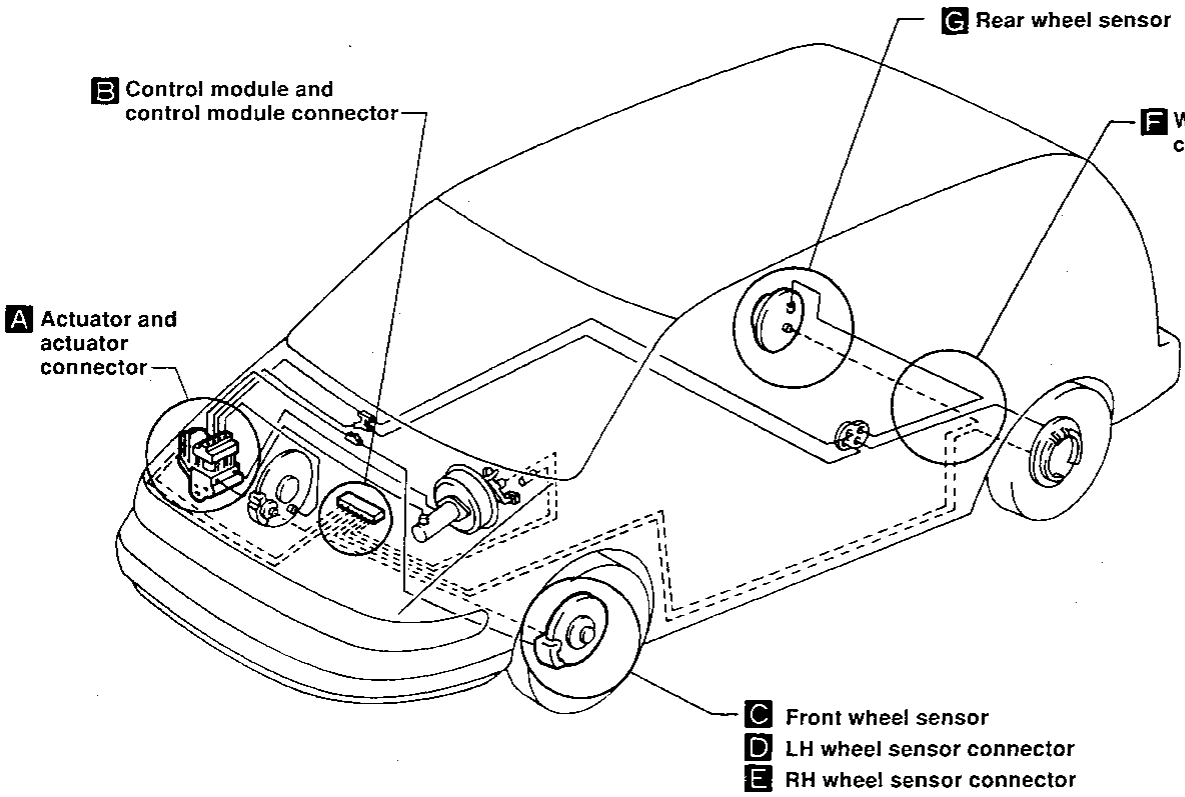
OK

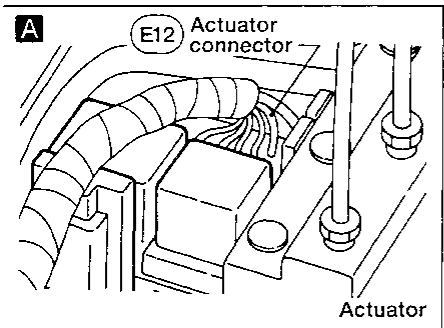


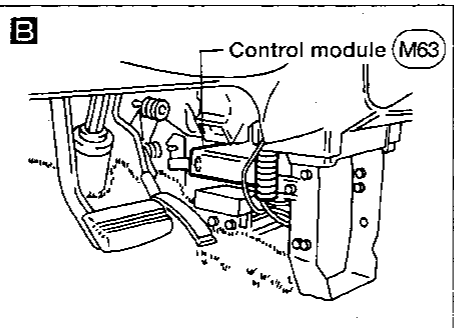
D

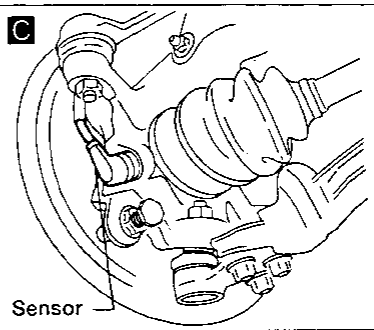
Check brake pads and rotor/shoe and drum.
Refer to BR-19, BR-22 and BR-25 respectively. → NG → Replace malfunctioning parts.

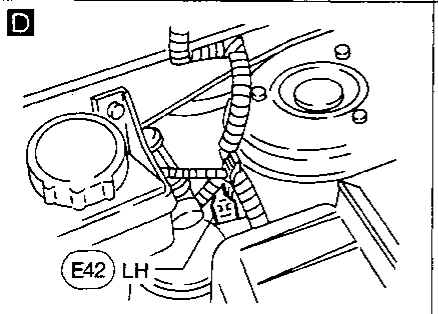
Component Parts and Harness Connector Location

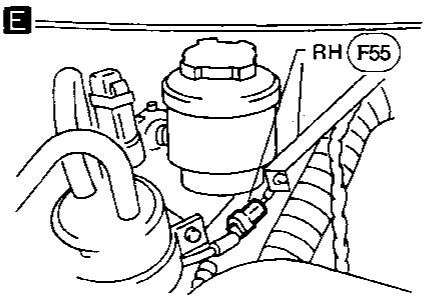


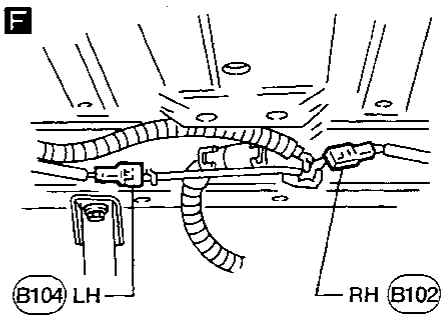


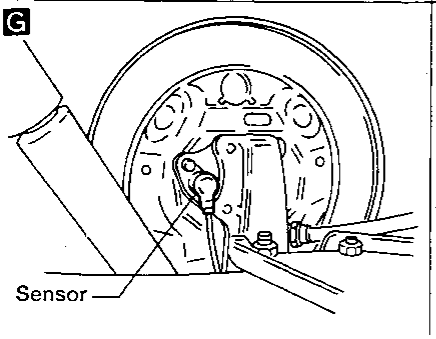








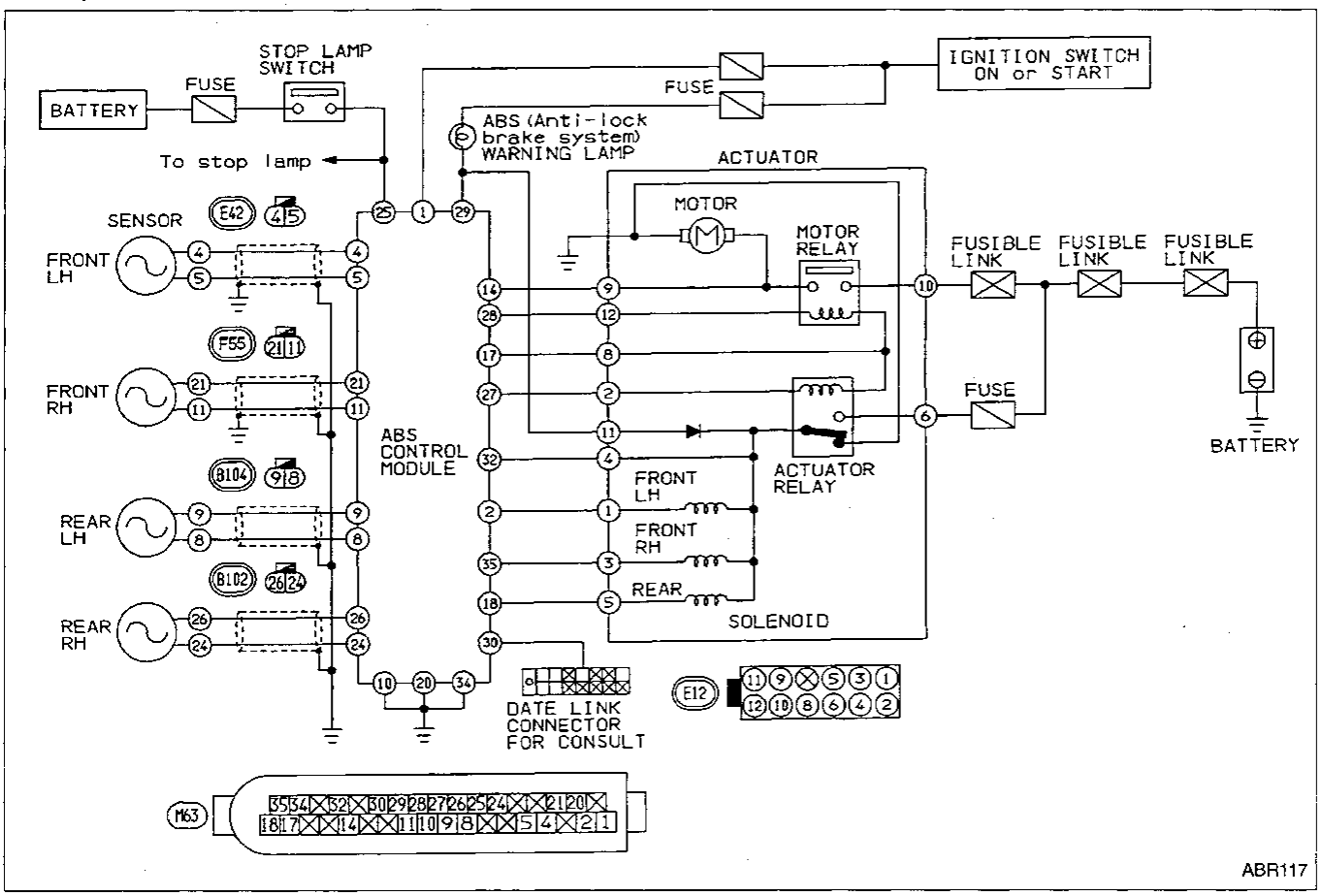




ABR127

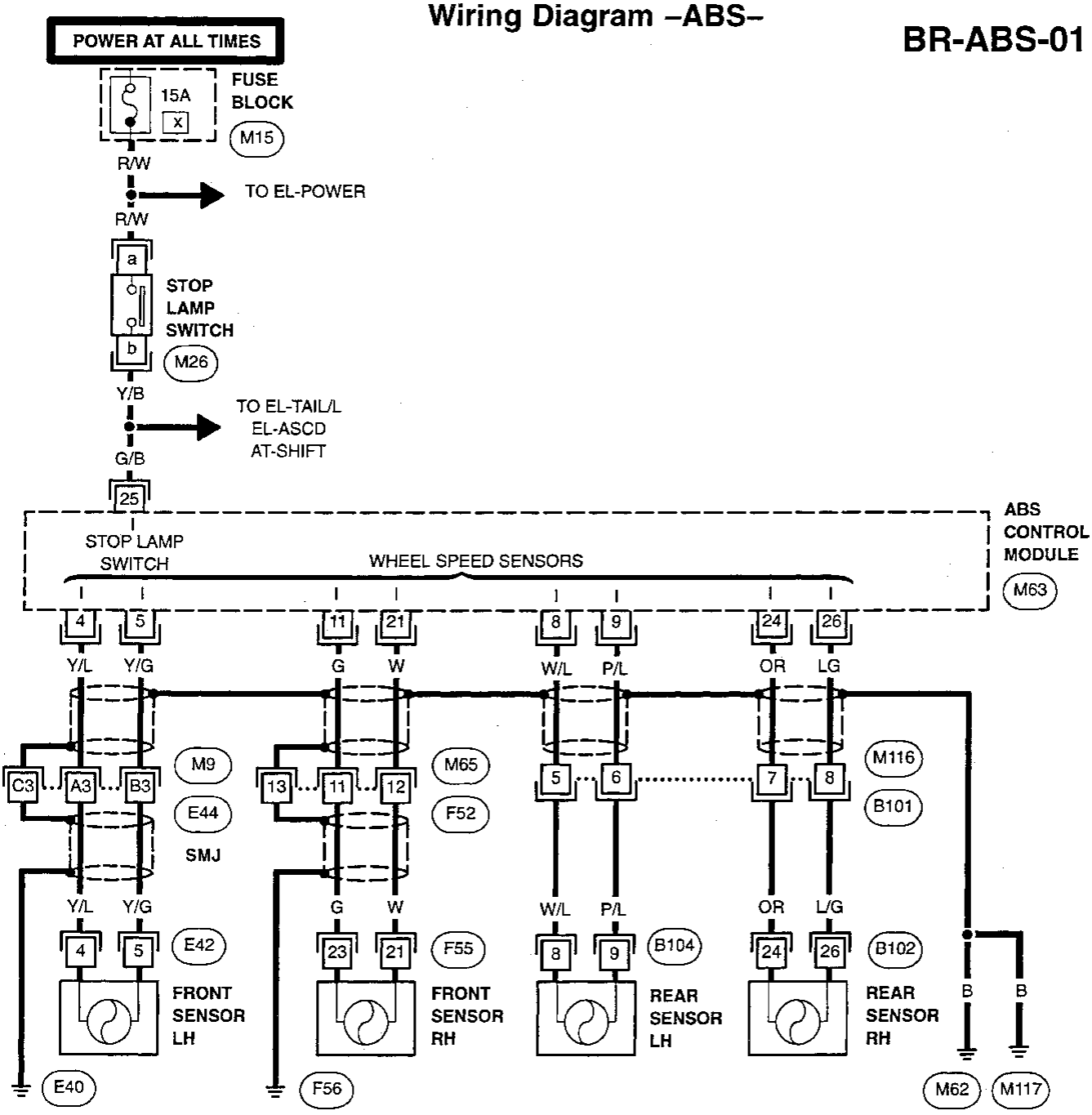
Circuit Diagram for Quick Pinpoint Check

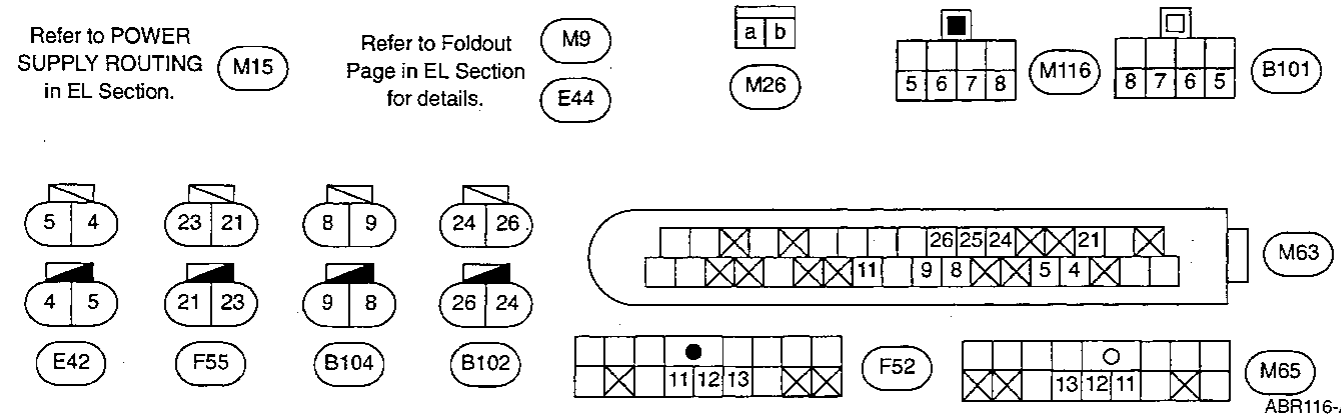
- The unit side connectors with a double circle "⬭" are connected to the harness side connectors shown in the "Component Parts and Connector Location". (See page BR-39.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".



Wiring Diagram –ABS–

BR-ABS-01

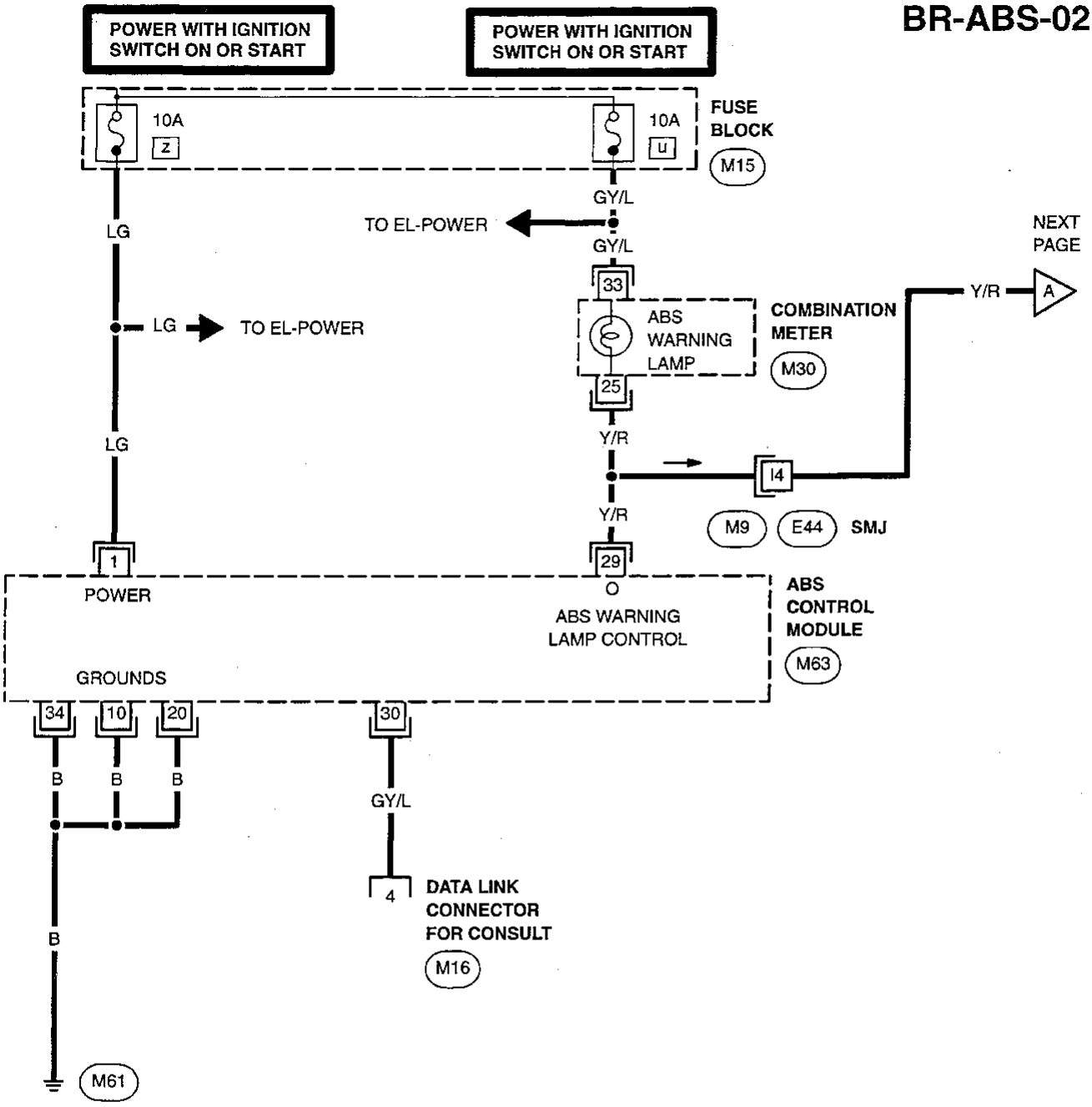




ABR116-A

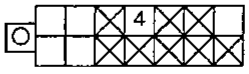
Wiring Diagram –ABS– (Cont'd)

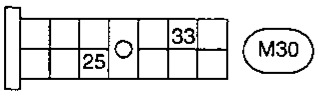
BR-ABS-02

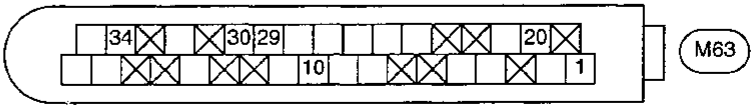


Refer to POWER SUPPLY ROUTING in EL Section. M15

Refer to Foldout Page in EL Section for details. M9 E44



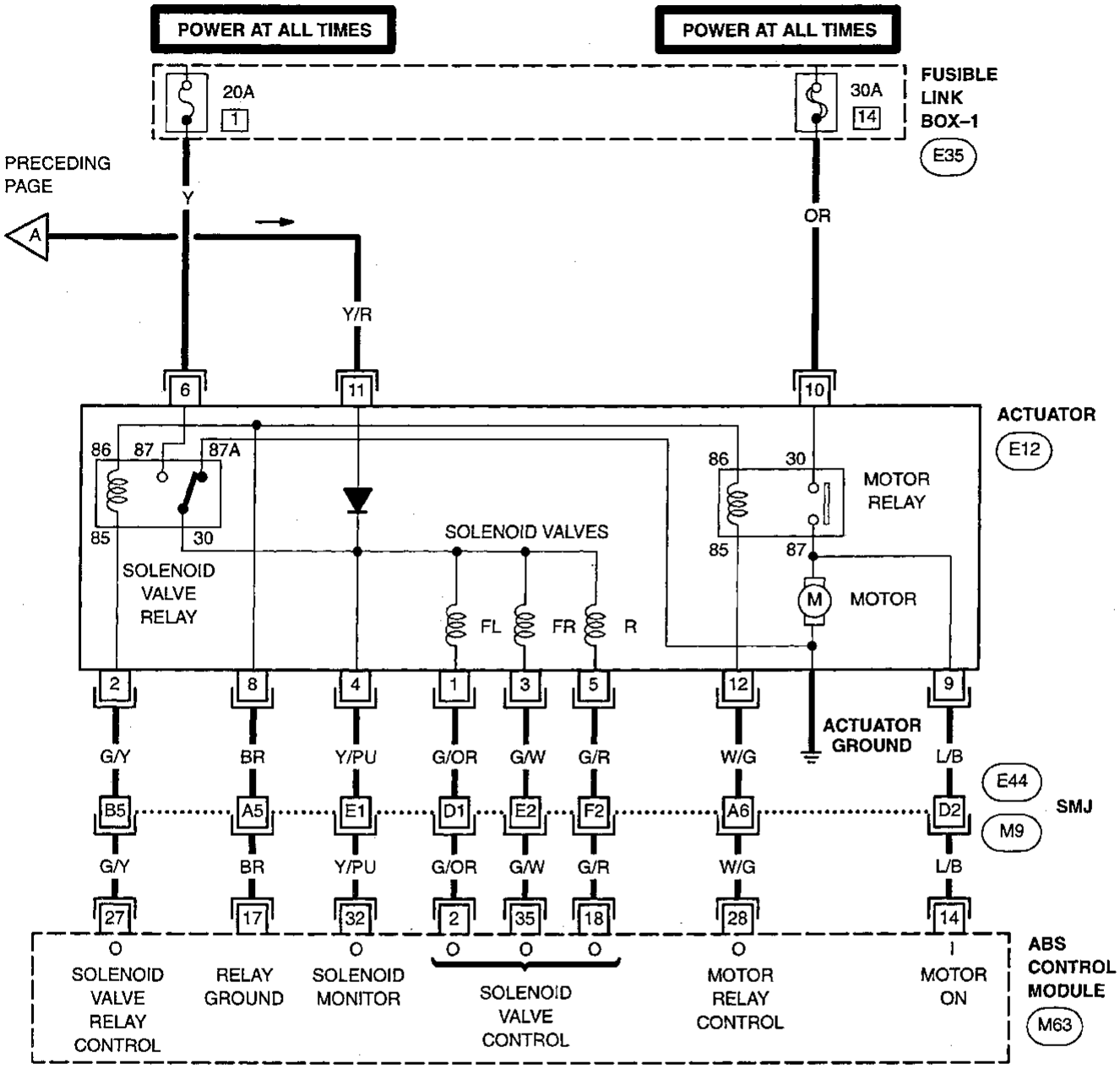




ABR116-B

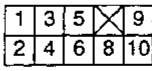
Wiring Diagram –ABS– (Cont'd)

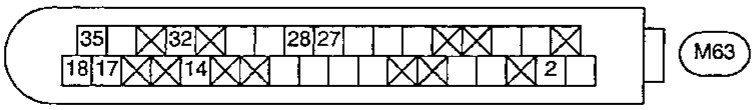
BR-ABS-03



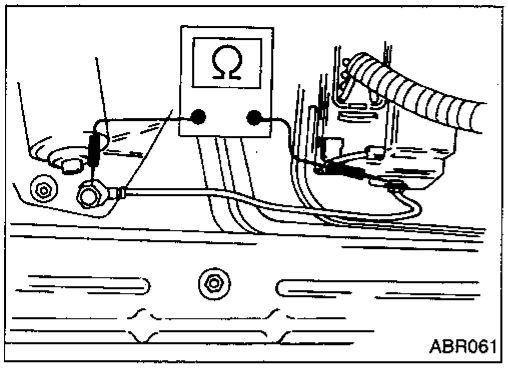
Refer to POWER SUPPLY ROUTING in EL Section. E35

Refer to Foldout Page in EL Section for details. M9 E44





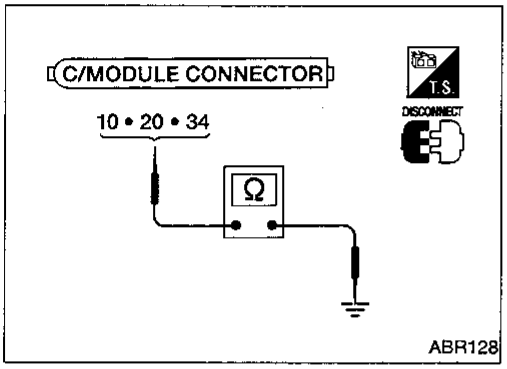
ABR116-C



Ground Circuit Check

ACTUATOR MOTOR GROUND

- Check resistance between both terminals.
  Resistance: 0Ω

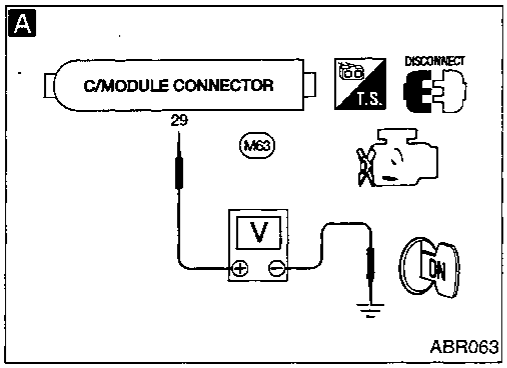


CONTROL MODULE GROUND

- Check resistance between all terminals.
  Resistance: 0Ω

Diagnostic Procedure 1 (Not self-diagnostic item)

Warning lamp does not work before engine starts.



WARNING LAMP CIRCUIT CHECK

Check 10A fuse ([u]). For fuse arrangement, refer to POWER SUPPLY ROUTING in EL section.

NG → Replace fuse.

OK ↓

Check warning lamp bulb.

NG → Replace bulb.

OK ↓

A

- Install 10A fuse and bulb.
- Disconnect connectors from control module and actuator.
- Check voltage between terminal (29) and ground after turning ignition switch "ON".

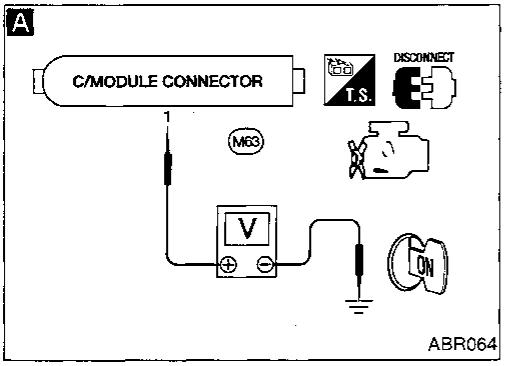
Battery positive voltage should exist.

NG → Repair harness and connectors.

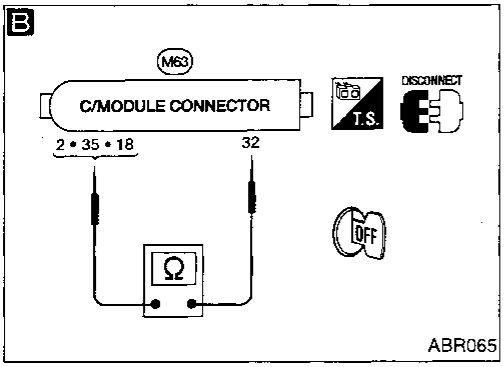
OK ↓

Carry out self-diagnosis.

A



B



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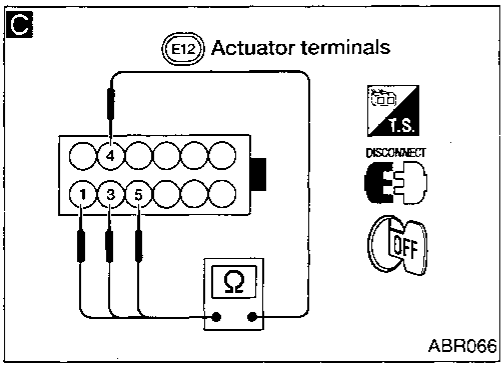


Diagnostic Procedure 2

Warning lamp does not blink but stays on continuously.

A

CONTROL MODULE POWER SUPPLY CIRCUIT

- Disconnect connector from control module.
- Check voltage between control module connector terminal ① and ground after turning ignition switch "ON".

Battery positive voltage should exist.

NG → Repair harness and connector.

OK ↓

B

ACTUATOR SOLENOID VALVE CHECK

- Turn ignition switch "OFF".
- Check continuity between control module connector terminals.

Terminals ㉜ and ②
Terminals ㉜ and ㉟
Terminals ㉜ and ⑱

Continuity should exist.

OK → GROUND-SHORT CHECK FOR WARNING LAMP CIRCUIT

- Disconnect actuator connector.
- Check whether warning lamp goes on after turning ignition switch "ON".

Warning lamp should not go on.

- Turn ignition switch "OFF".

NG → Repair harness and connector.

OK → Ⓐ

NG ↓

C

- Disconnect actuator connector.
- Check resistance between actuator terminals.

Terminals ④ and ①
Terminals ④ and ③
Terminals ④ and ⑤

Resistance 1.07 - 1.17Ω

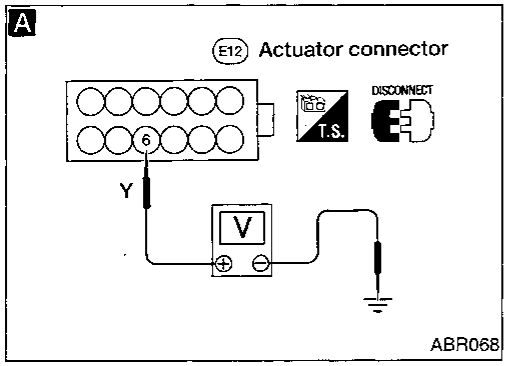
OK → Repair harness and connector between actuator connector terminal and control module connector terminal.

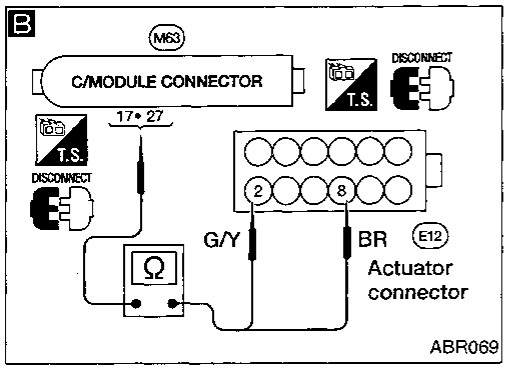
NG ↓

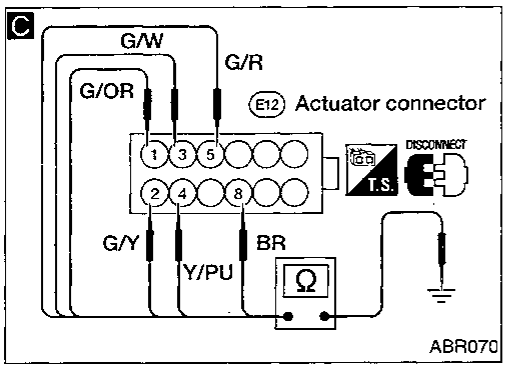
Replace actuator.

Re-run the self-diagnostic procedure to verify the malfunction has been repaired correctly. (Malfunction code 45, 41, or 55 will appear.)

Diagnostic Procedure 2 (Cont'd)







In the case of malfunctions of short circuit between ①, ③, ⑤ and ground, no malfunction code will appear.

Ⓐ

A

SOLENOID VALVE POWER SUPPLY CHECK

Check voltage between actuator connector terminal ⑥ and ground.
Battery voltage should exist.

NG → Repair harness and connector. → Ⓑ

OK ↓

SOLENOID VALVE RELAY CHECK

See "SOLENOID VALVE RELAY" in "Electrical Components Inspection". Refer to BR-52.

NG → Replace solenoid valve relay. → Ⓑ

OK ↓

B

CIRCUIT CHECK

Check continuity between control module connector terminals and actuator connector terminals.

Control module	Actuator
⑰	⑧
㉗	②

Continuity should exist.

NG → Repair harness and connectors. → Ⓑ

OK ↓

C

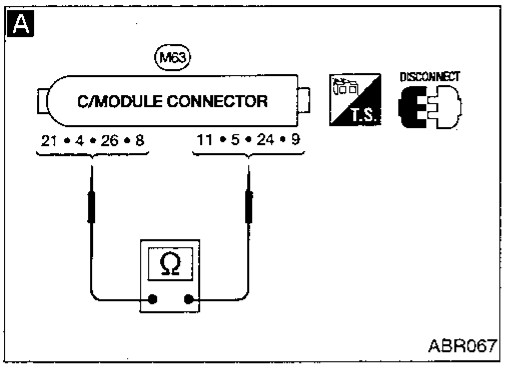
Check continuity between actuator connector terminals ⑧, ②, ④, ①, ③, ⑤, and ground.
Continuity should not exist.

NG → Repair harness and connectors. → Ⓑ

OK ↓

Replace control module. → Ⓑ

Re-run the self-diagnostic result mode to verify the malfunction has been repaired correctly. (Malfunction code No. 63 will appear.)



Diagnostic Procedure 3

WHEEL SENSOR

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

A

WHEEL SENSOR ELECTRICAL CHECK → OK → Ⓐ

- Disconnect connector from control module.
- Check resistance between control module connector terminals.

Code No. 21 or 22 (Front RH wheel)
Terminals ㉑ and ⑪
Code No. 25 or 26 (Front LH wheel)
Terminals ④ and ⑤
Code No. 31 or 32 (Rear RH wheel)
Terminals ㉖ and ㉔
Code No. 35 or 36 (Rear LH wheel)
Terminals ⑧ and ⑨
Resistance: 0.9 - 1.1 kΩ

NG ↓

Note

CHECK WHEEL SENSOR → NG → Note: Replace wheel sensor.

See "WHEEL SENSOR" in "Electrical Components Inspection". Refer to BR-52.

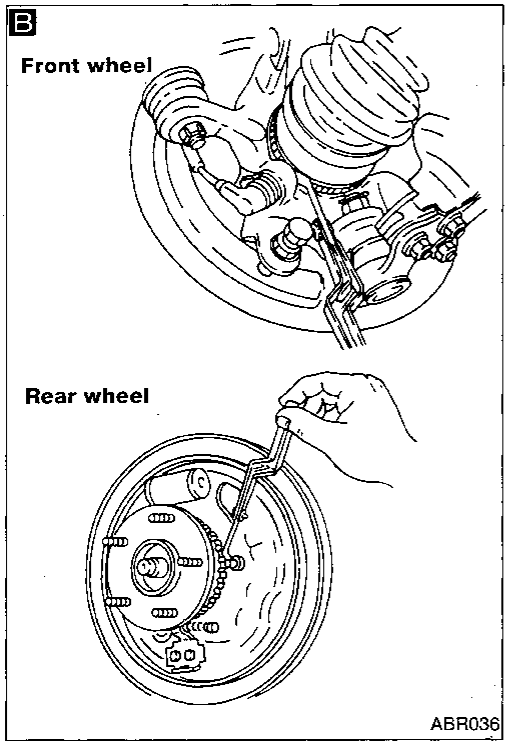
OK ↓

Note

Repair harness and connectors between control module connector and wheel sensor connector.

Note: Wheel position should be distinguished by code No.

Diagnostic Procedure 3 (Cont'd)



Ⓐ

Note

WHEEL SENSOR MECHANICAL CHECK

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

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

OK ↓

Note

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

NG → Note: Follow the direction in FA or RA section.

OK ↓

B Note

Check clearance between sensor and rotor.

Clearance: 0.16 - 0.94 mm (0.0063 - 0.0370 in) (Front)
0.16 - 0.94 mm (0.0063 - 0.0370 in) (Rear)

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

OK ↓

Note

Check sensor rotor for teeth damage.

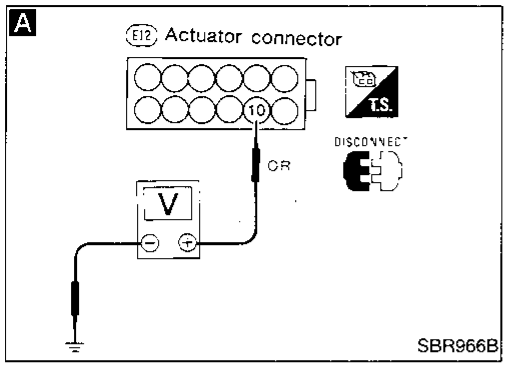
NG → Note: Replace sensor rotor (with drive shaft, wheel hub).

OK ↓

Replace control module.

Note: Wheel position should be distinguished by code No.

A



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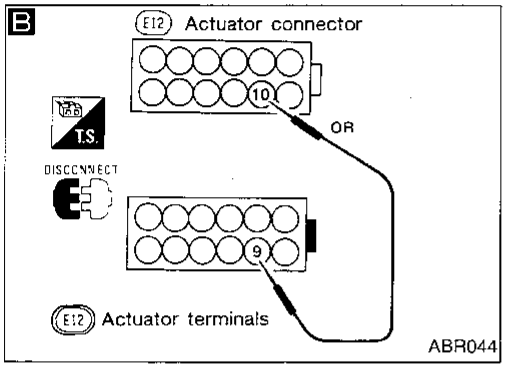

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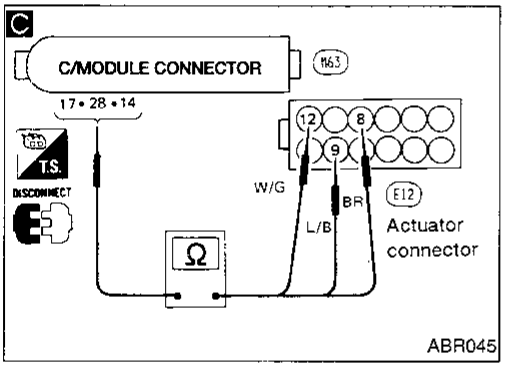
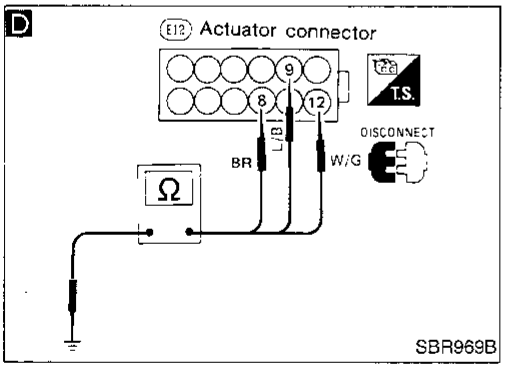


D



Diagnostic Procedure 4

MOTOR RELAY OR MOTOR

(Malfunction code No. 61)

A

MOTOR POWER SUPPLY CHECK

- Disconnect connector from actuator.
- Check voltage between terminal ⑩ and ground.

Battery positive voltage should exist.

NG → Repair harness and connectors.

OK ↓

MOTOR RELAY CHECK

See "ACTUATOR MOTOR RELAY" in "Electrical Components Inspection". Refer to BR-52.

NG → Replace motor relay.

OK ↓

B

MOTOR CHECK

Check motor by connecting terminal ⑩ for connector and terminal ⑨ for actuator terminals with a suitable harness.

Motor should operate.

Do not connect harness for more than 5 seconds.

NG →
- Check continuity between actuator and ground.
- Check and repair harness between actuator connector terminal ⑨ and control module connector terminal ⑭ for open circuit.

or

- Replace actuator.

OK ↓

C

CIRCUIT CHECK

- Disconnect connector from control module.
- Check continuity between control module connector terminals and actuator connector terminals.

Control module	Actuator
⑰	⑧
㉘	⑫
⑭	⑨

Continuity should exist.

NG → Repair harness and connectors.

OK ↓

D

Check continuity between actuator connector terminals ⑧, ⑫, ⑨ and ground.

Continuity should not exist.

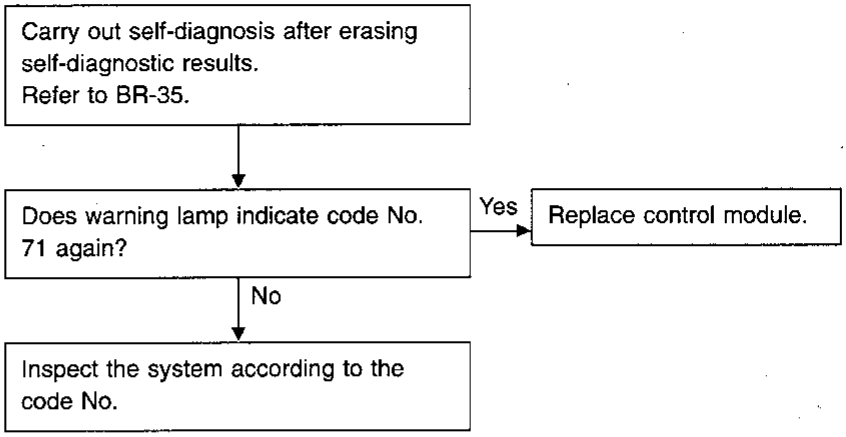
NG → Repair harness and connectors.

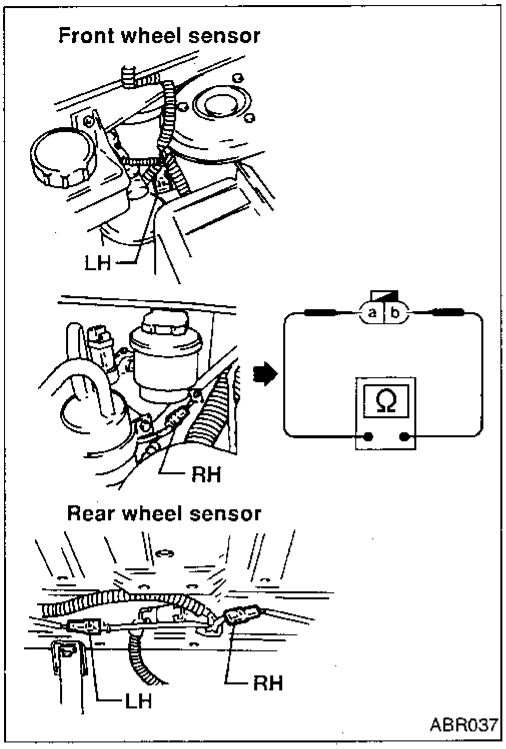
OK ↓

Replace control module.

Diagnostic Procedure 5

CONTROL MODULE
(Malfunction code No. 71)



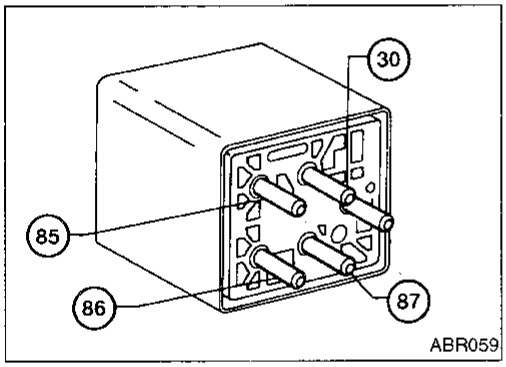


Electrical Components Inspection

WHEEL SENSOR

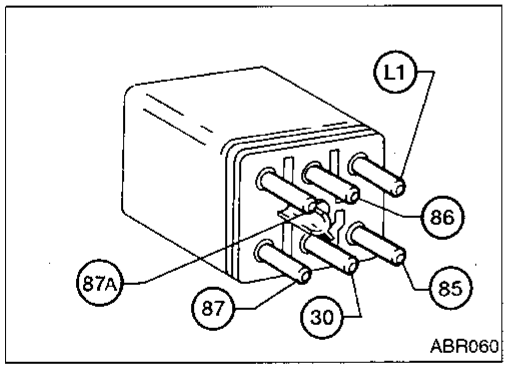
Check resistance between terminals ⓐ and ⓑ.

Resistance: 0.9 - 1.1 kΩ



ACTUATOR MOTOR RELAY

Condition	Continuity existence between terminals 30 and 87
Battery positive voltage not applied between terminals 85 and 86.	No
Battery positive voltage applied between terminals 85 and 86.	Yes



SOLENOID VALVE RELAY

Condition	Continuity existence between terminals 30 and 87a	Continuity existence between terminals 30 and 87
Battery positive voltage not applied between terminals 85 and 86.	Yes	No
Battery positive voltage applied between terminals 85 and 86.	No	Yes

General Specifications

Front brake	
Brake model	AD28VX
Cylinder bore diameter mm (in)	60.0 (2.362)
Lining length x width x thickness mm (in)	144.0 x 44.9 x 9.67 (5.67 x 1.768 x 0.3807)
Rotor outer diameter x thickness mm (in)	277 x 26 (10.91 x 1.02)
Rear brake	
Brake model	LT25X
Cylinder bore diameter mm (in)	25.40 (1)
Lining length x width x thickness mm (in)	247.5 x 55.0 x 5.9 (9.74 x 2.165 x 0.232)
Drum inner diameter mm (in)	250 (9.84)

Master cylinder	
Cylinder bore diameter mm (in)	25.40 (1)
Control valve	
Valve model	Dual load sensing valve
Split point [kPa (kg/cm^2, psi)] x reducing ratio	Variable x 0.3
Brake booster	
Booster model	M215T
Diaphragm diameter mm (in)	Primary: 230 (9.06) Secondary: 205 (8.07)
Brake fluid	
Recommended brake fluid	DOT 3

Inspection and Adjustment

DISC BRAKE

Unit: mm (in)

Pad wear limit	
Minimum thickness	2.0 (0.079)
Rotor repair limit	
Minimum thickness	24.0 (0.945)

DRUM BRAKE

Unit: mm (in)

Lining wear limit	
Minimum thickness	2.0 (0.079)
Drum repair limit	
Maximum inner diameter	251.5 (9.90)

BRAKE PEDAL

Unit: mm (in)

Free height "H"	195 - 205 (7.68 - 8.07)
Depressed height "D" [under force of 490 N (50 kg, 110 lb) with engine running]	115 - 130 (4.53 - 5.12)
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	1.0 - 3.0 (0.039 - 0.118)

PARKING BRAKE

Unit: Number of notches

Control type	Foot lever
Pedal stroke [under force of 196 N (20 kg, 44 lb)]	11 - 12