

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".

Note: Refer to Foldout page for "TCS Wiring Diagram".

PRECAUTIONS AND PREPARATION

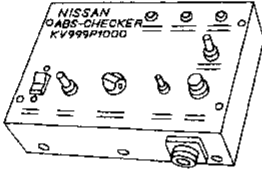
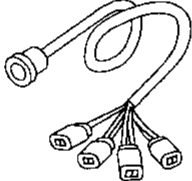
Precautions

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

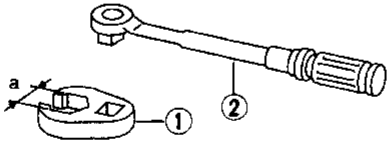
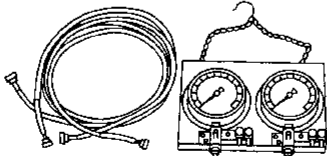
WARNING:

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

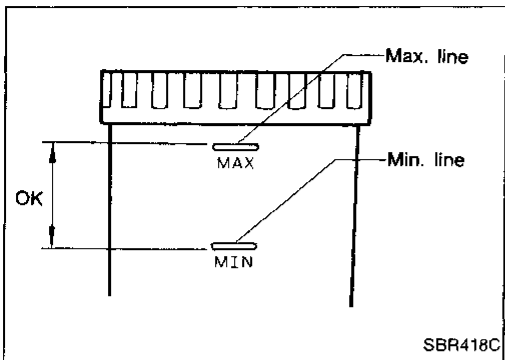
Special Service Tools

Tool number (Kent-Moore No.) Tool name	Description
KV999P1000 (—) ABS checker	 <p>Checking brake fluid pressure of ABS actuator</p> <p>NT165</p>
KV999P1010 (—) ABS checker adapter harness	 <p>Checking brake fluid pressure of ABS actuator</p> <p>NT166</p>

Commercial Service Tools

Tool name	Description
① Flare nut crows foot ② Torque wrench	 <p>NT360</p> <p>a: 10 mm (0.39 in)</p>
Brake fluid pressure gauge	 <p>NT151</p> <p>Measuring brake fluid pressure</p>

CHECK AND ADJUSTMENT



Checking Brake Fluid Level

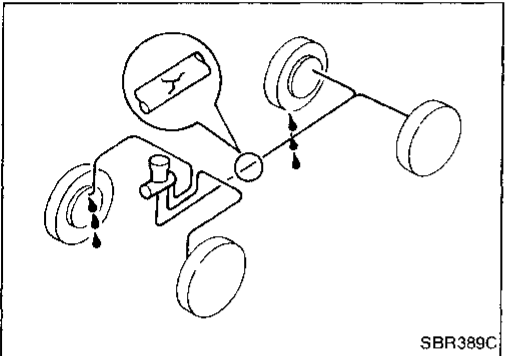
- Check fluid level in reservoir tank. It should be between Max. and Min. lines on reservoir tank.
- If fluid level is extremely low, check brake system for leaks.
- If brake warning lamp comes on, check brake fluid level switch and parking brake switch.

Checking Brake Line

CAUTION:

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

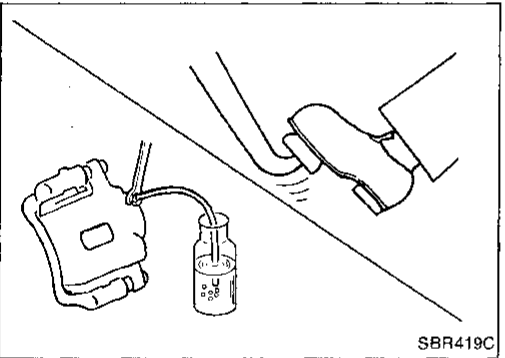
1. Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
2. Check for oil leakage by fully depressing brake pedal while engine is running.



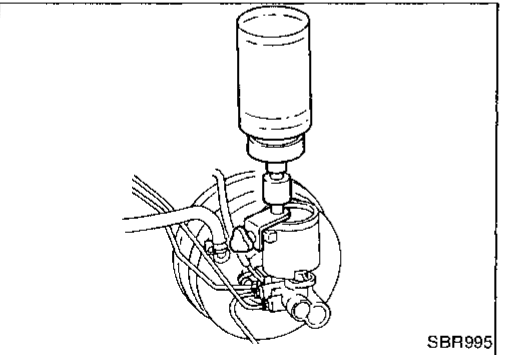
Changing Brake Fluid

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.



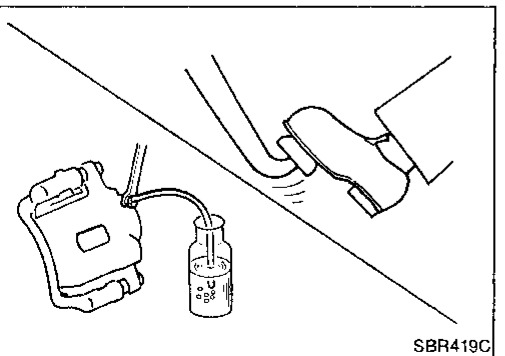
1. Clean inside of reservoir tank, and refill with new brake fluid.
2. Connect a vinyl tube to each air bleeder valve.
3. Drain brake fluid from each air bleeder valve by depressing brake pedal.
4. Refill until brake fluid comes out of each air bleeder valve. Use same procedure as in bleeding hydraulic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



Bleeding Brake System

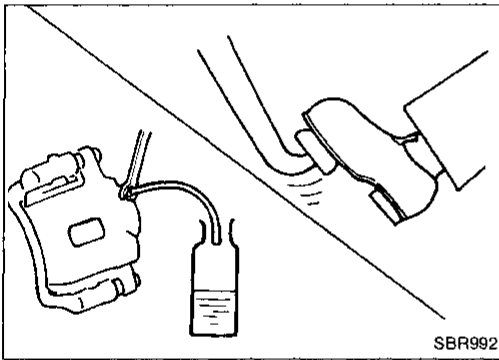
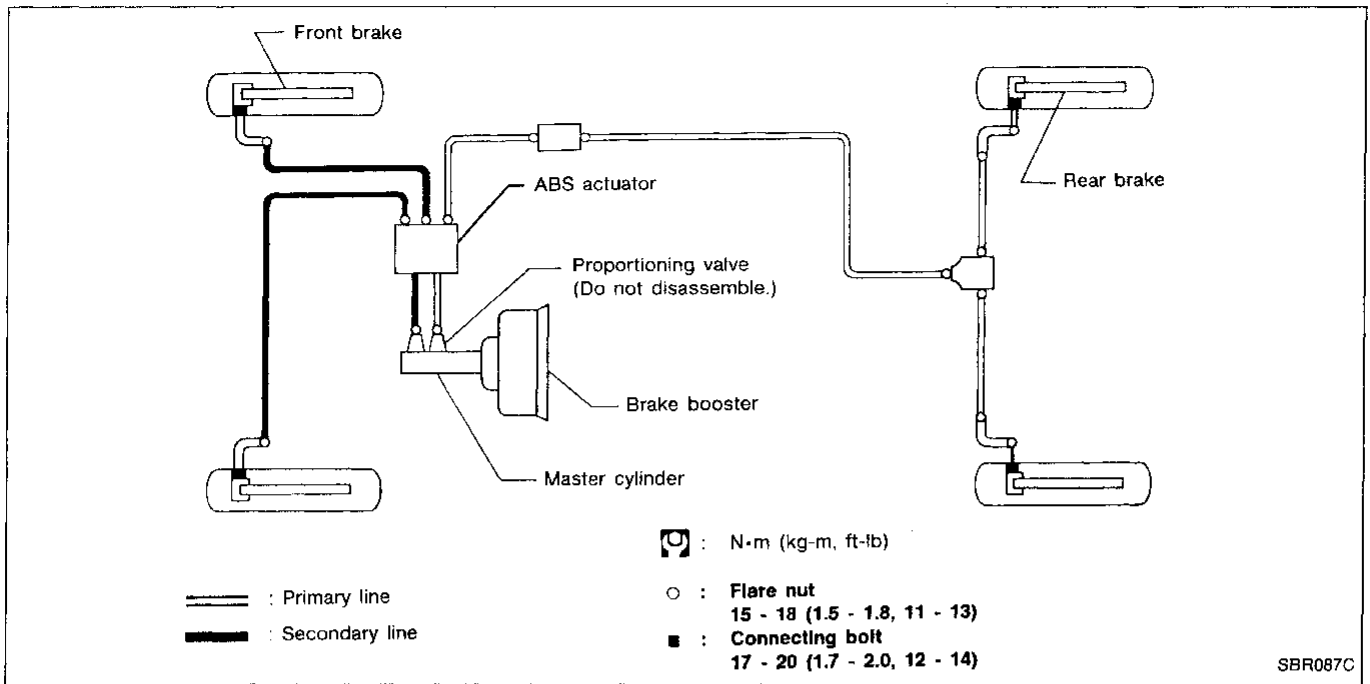
CAUTION:

- 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.
- Turn ignition switch "OFF", and disconnect ABS actuator connectors or battery ground cable.
- Bleed air in the following order.
 1. Left rear caliper
 2. Right rear caliper
 3. Left front caliper
 4. Right front caliper



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.

BRAKE HYDRAULIC LINE/CONTROL VALVE



Removal

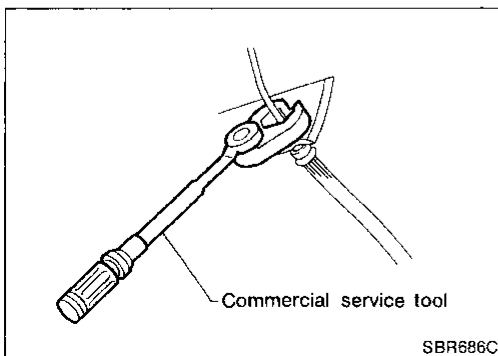
CAUTION:

- 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 lines.

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)

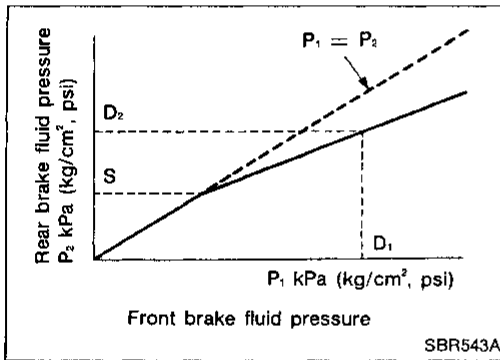
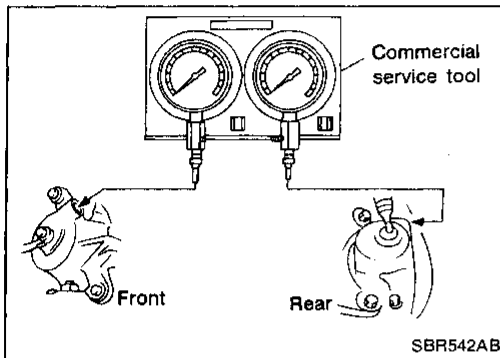
Connecting bolt

17 - 20 N·m (1.7 - 2.0 kg-m, 12 - 14 ft-lb)

BRAKE HYDRAULIC LINE/CONTROL VALVE

Installation (Cont'd)

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



Proportioning Valve

INSPECTION

CAUTION:

- Carefully monitor brake fluid level at master cylinder.
- Use new brake fluid "DOT 3".
- Be careful not to splash brake fluid on painted areas; it may cause paint damage. If brake fluid is splashed on paint areas, wash it away with water immediately.
- Disconnect harness connectors from ABS actuator before checking.

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

Unit: kPa (kg/cm², psi)

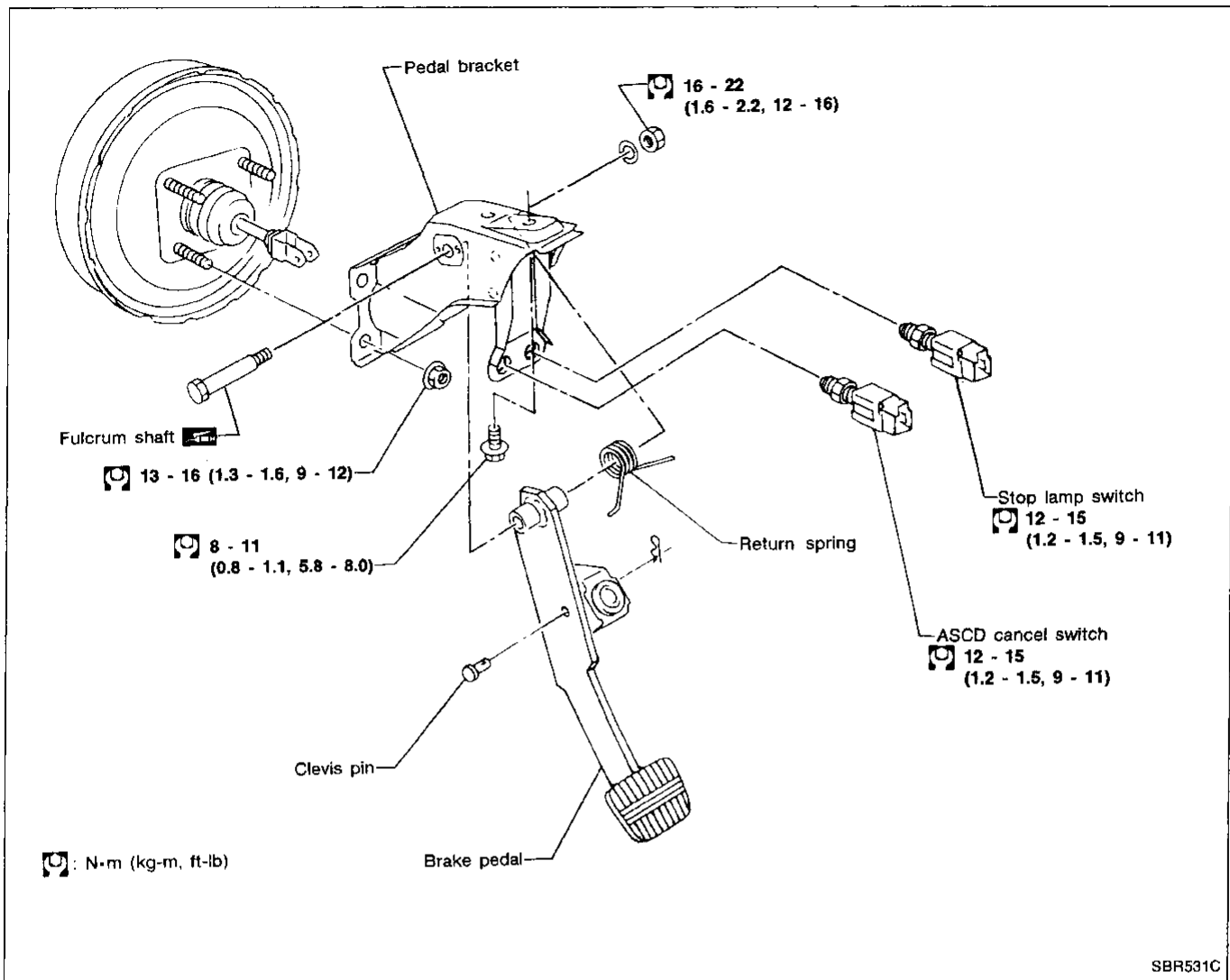
Applied pressure (Front brake)	D ₁	7,355 (75, 1,067)
Output pressure (Rear brake)	D ₂	5,100 - 5,492 (52 - 56, 739 - 796)

If output pressure is out of specifications, replace master cylinder assembly.

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

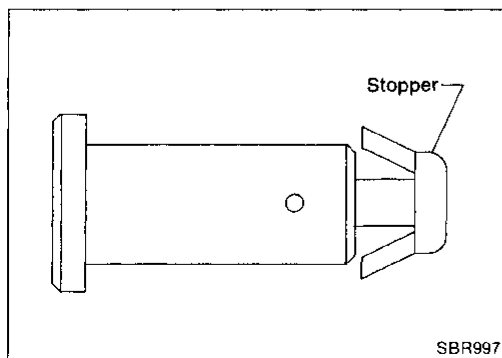
BRAKE PEDAL AND BRACKET

Removal and Installation



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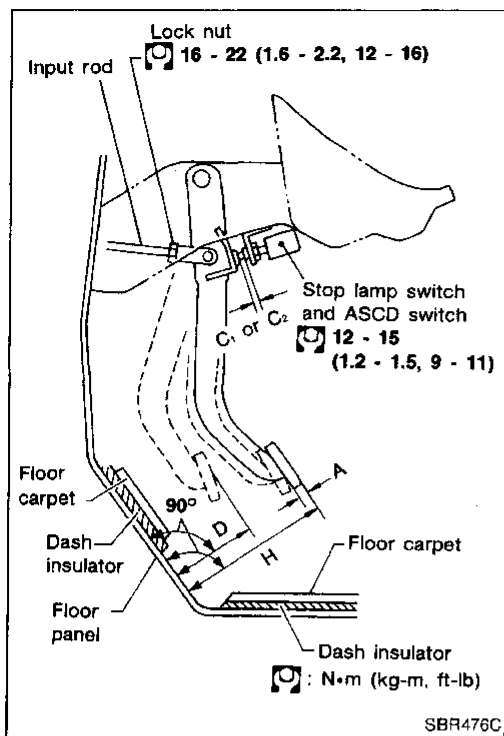


Inspection

Check brake pedal for following items.

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

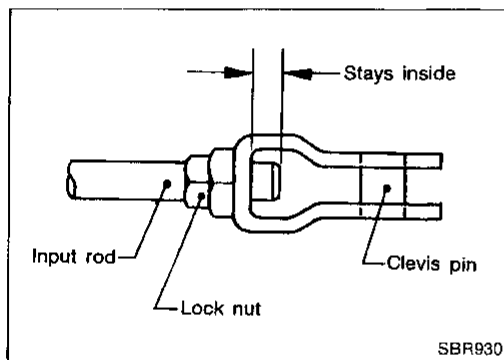
BRAKE PEDAL AND BRACKET



Adjustment

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

- H:** Free height
184 - 194 mm (7.24 - 7.64 in)
- D:** Depressed height
100 - 110 mm (3.94 - 4.33 in)
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
1.0 - 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.

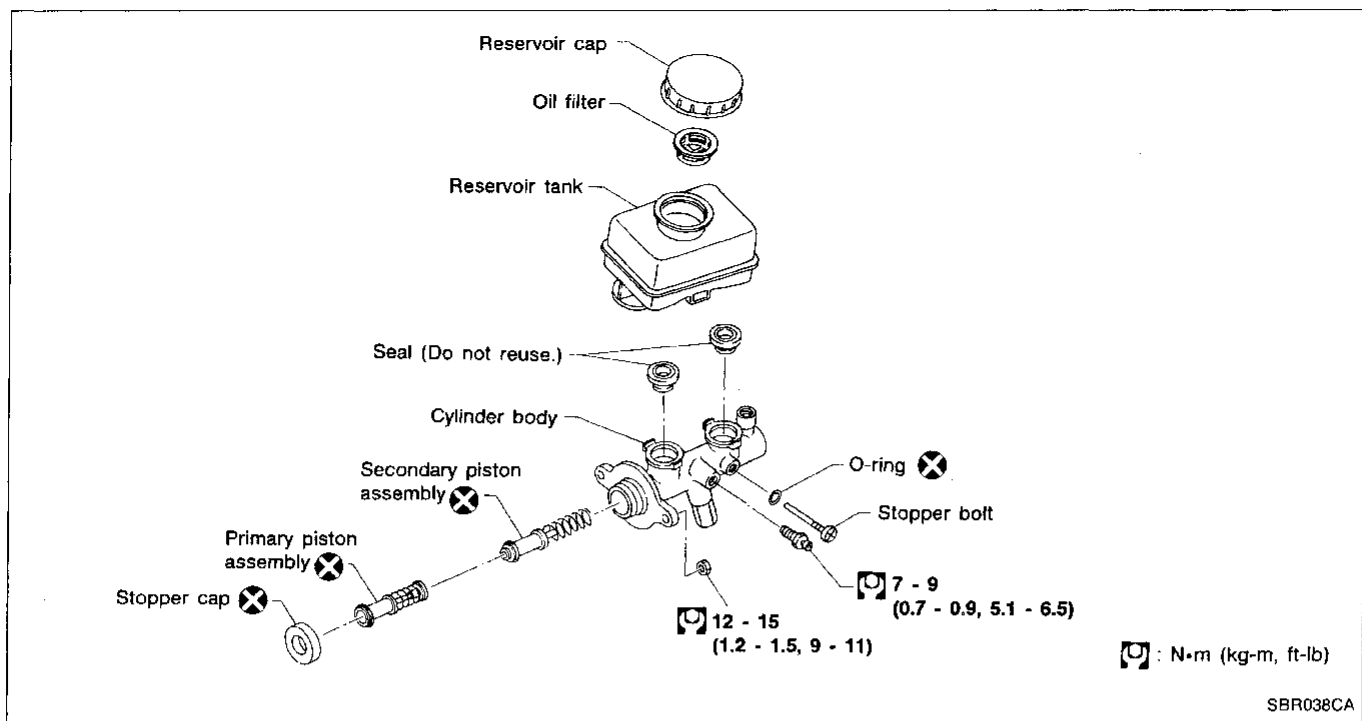
2. Loosen lock nut and adjust clearance "C₁" and "C₂" with stop lamp switch and ASCD switch respectively. Then tighten lock nuts.
3. Check pedal free play.

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

4. Check brake pedal's depressed height while engine is running.

If lower than specification, check for leaks, air in system or damage to components (master cylinder, wheel cylinder, etc.). Then make necessary repair.

MASTER CYLINDER



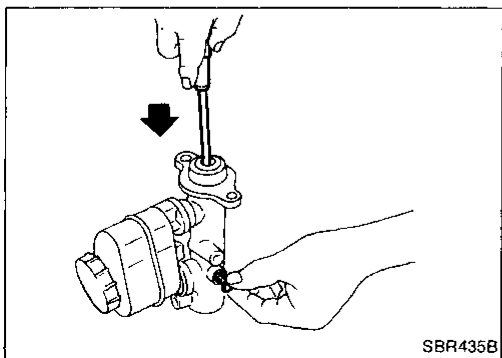
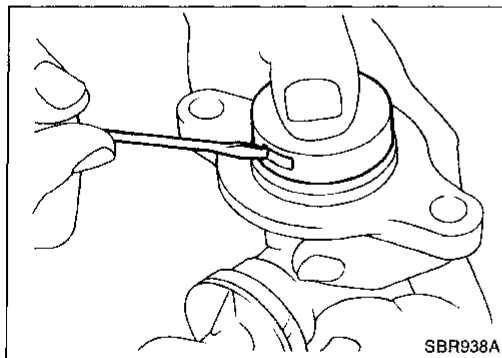
Removal

CAUTION:

- Be careful not to splash brake fluid on painted areas; it may cause of paint damage. If brake fluid is splashed on painted areas, wash it away with water immediately.
1. Connect a vinyl tube to air bleeder valve.
 2. Drain brake fluid from each air bleeder valve, depressing brake pedal to empty fluid from master cylinder.
 3. Remove brake pipe flare nuts.
 4. Remove master cylinder mounting nuts.

Disassembly

1. Bend claws of stopper cap outward.
2. Remove stopper bolt while pushing piston into cylinder.



MASTER CYLINDER

Inspection

Check for the following items.

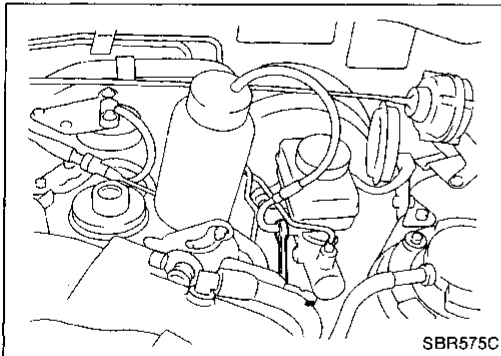
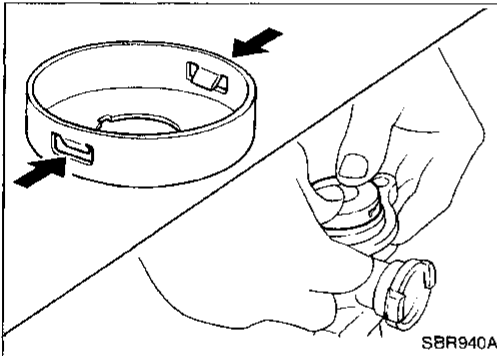
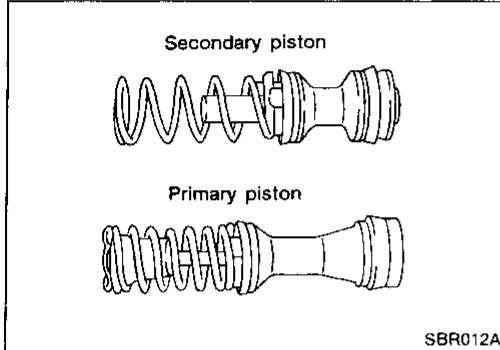
Replace any part if damaged.

Master cylinder:

- Pin holes or scratches on inner wall.

Piston:

- Deformation of or scratches on piston cups.



Assembly

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

1. Lightly push pistons in and assemble valve stopper.

2. Bend claws inward.
3. Install stopper cap.
4. Install reservoir tank oil seals.
5. Push reservoir tank into master cylinder.

Installation

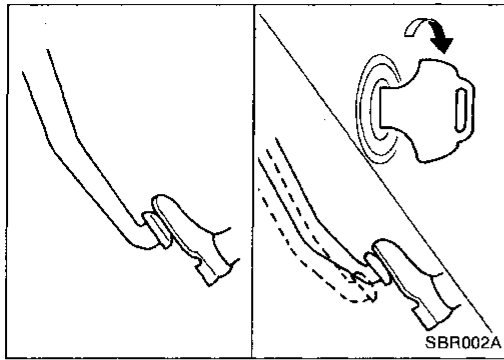
CAUTION:

- 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. Torque mounting nuts.
12 - 15 N·m (1.2 - 1.5 kg-m, 9 - 11 ft-lb)
3. Fit brake lines to master cylinder.
4. Torque flare nuts.
15 - 18 N·m (1.5 - 1.8 kg-m, 11 - 13 ft-lb)
5. Fill up reservoir tank with new brake fluid.
6. Connect a vinyl tube to air bleeder of master cylinder.
7. Open air bleeder of master cylinder
8. Have driver slowly depress brake pedal and hold.
9. Close air bleeder.
10. Have driver release brake pedal slowly.
11. Repeat steps 7. through 10. until no air bubbles come out of air bleeder.
12. Torque air bleeder.
7 - 9 N·m (0.7 - 0.9 kg-m, 5.1 - 6.5 ft-lb)
13. Bleed air from each caliper. Refer to "Bleeding Brake System" (BR-4).

BR-10

BRAKE BOOSTER



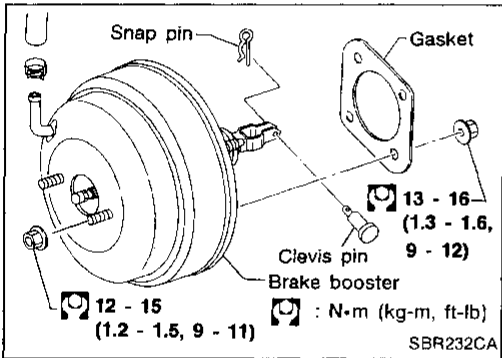
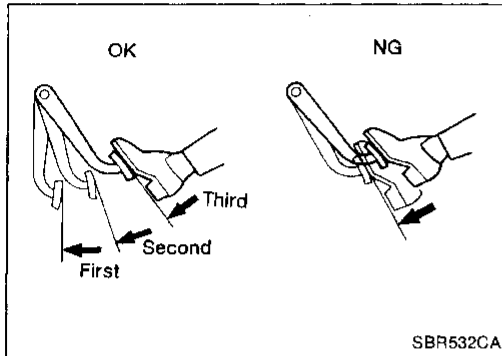
On-vehicle Service

OPERATING CHECK

- Stop engine and depress brake pedal several times. Check that pedal stroke does not change.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.

AIRTIGHT CHECK

- Start engine, and stop it after one or two minutes. Depress brake pedal several times slowly. The pedal should go further down the first time, and then it should gradually rise thereafter.
- Depress brake pedal while engine is running, and stop engine with pedal depressed. The pedal stroke should not change after holding pedal down for 30 seconds.



Removal

CAUTION:

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

1. Remove master cylinder. Refer to "Removal" in "MASTER CYLINDER" (BR-9).
2. Remove clevis pin (brake pedal to booster input rod).
3. Remove mounting nuts (brake pedal bracket to booster).
4. Draw out booster assembly.

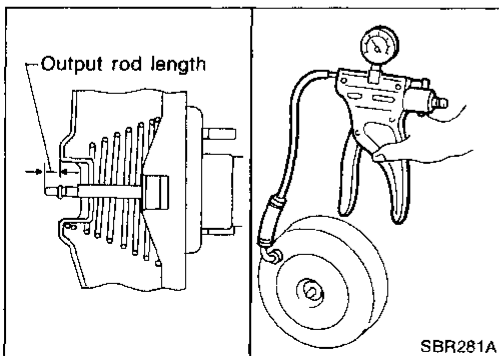
Inspection

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:

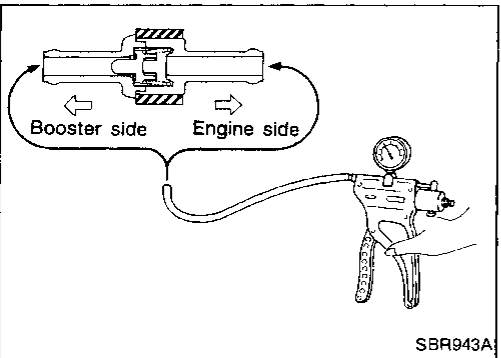
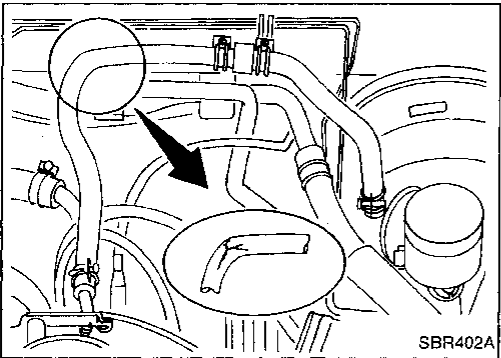
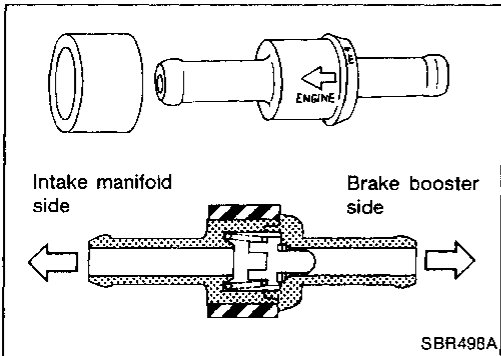
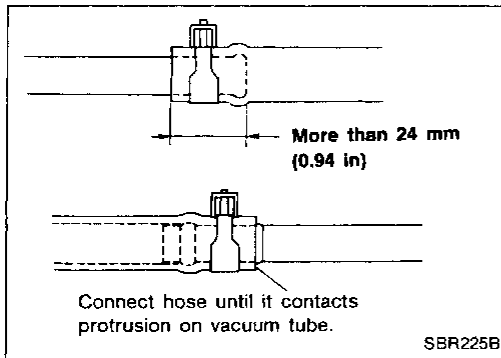
- Be careful not to deform or bend brake lines, during installation of booster.
- Replace clevis pin if damaged.
- Refill with new brake fluid "DOT 3".
- Never reuse drained brake fluid.

1. Fit booster, then secure mounting nuts (brake pedal bracket to master cylinder) lightly.
2. Connect brake pedal and booster input rod with clevis pin.
3. Secure mounting nuts.

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

4. Install master cylinder. Refer to "Installation" in "MASTER CYLINDER" (BR-10).
5. Bleed air. Refer to "Bleeding Brake System" (BR-4).
6. Adjust brake pedal if necessary. Refer to "Adjustment" in "BRAKE PEDAL AND BRACKET" (BR-8).

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 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.

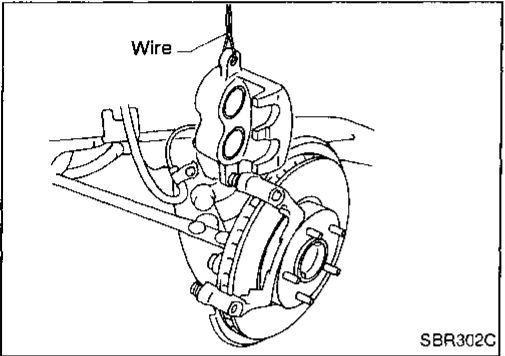
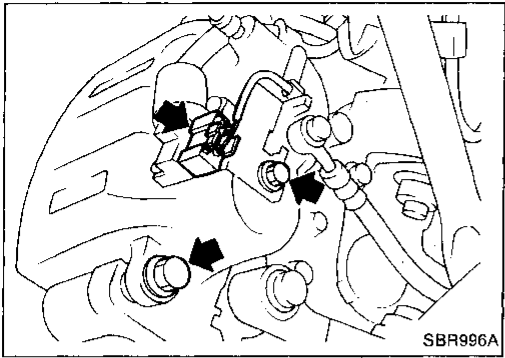
CHECK VALVE

Check vacuum with a vacuum pump.

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

CI
MA
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FRONT DISC BRAKE



Pad Replacement

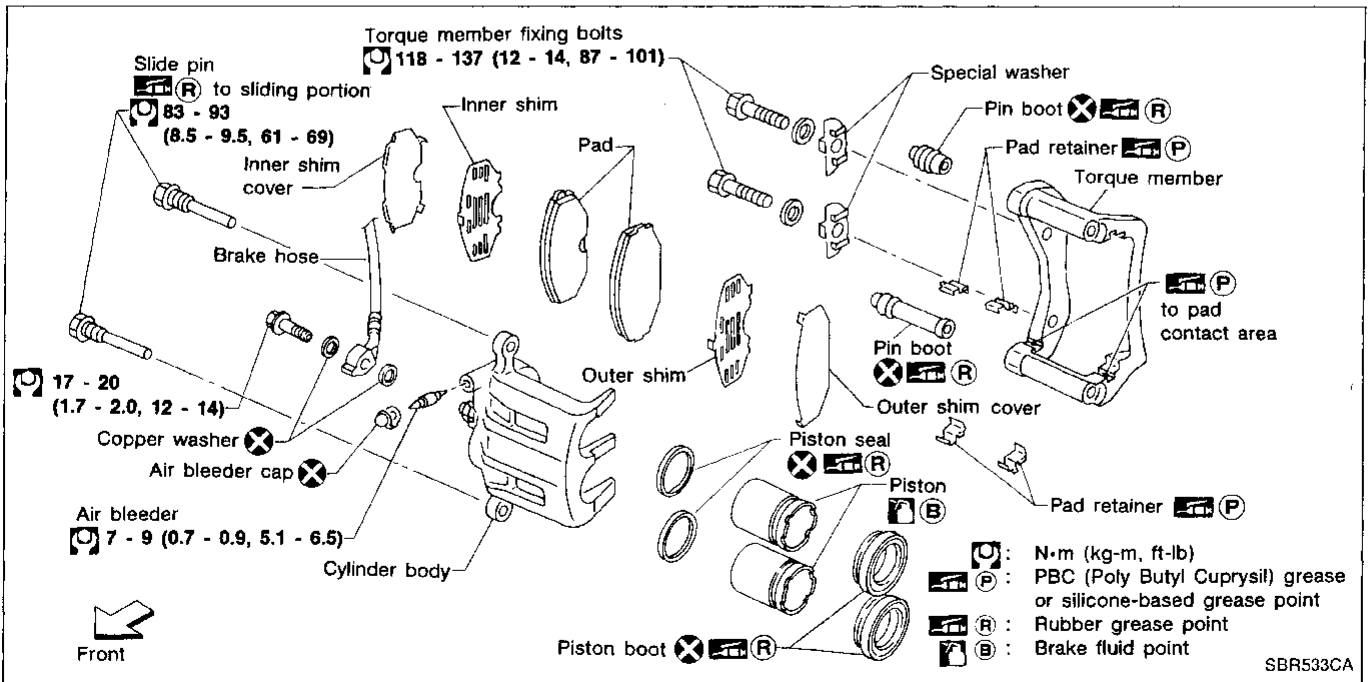
WARNING:

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

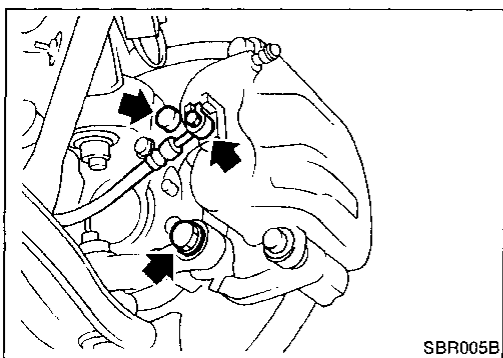
CAUTION:

- 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 in replacing pads.
- If shims are rusted or show peeling of the rubber coat, replace them with new shims.
- It is not necessary to remove brake hose 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 lower slide pin bolt.
2. Pivot cylinder body upward and suspend with wire. Remove pad retainers, and inner and outer shims.
Pad wear limit: 2.0 mm (0.079 in)
3. Replace both inner and outer pads and shims.
4. Apply brake grease to backplate of pads and both sides of inner and outer shims.
5. Install pad retainers and brake pads with the shims.



FRONT DISC BRAKE



Removal

WARNING:

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

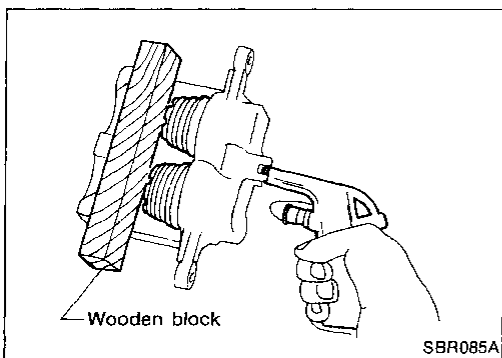
Remove torque member fixing bolts and connecting bolt.

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.

G1

MA

EM



Disassembly

WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

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

LC

EF &
EC

FE

AT

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.

PD

FA

RA

CAUTION:

Use brake fluid to clean. Never use mineral oil.

BR

ST

PISTON

CAUTION:

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

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

RS

BT

HA

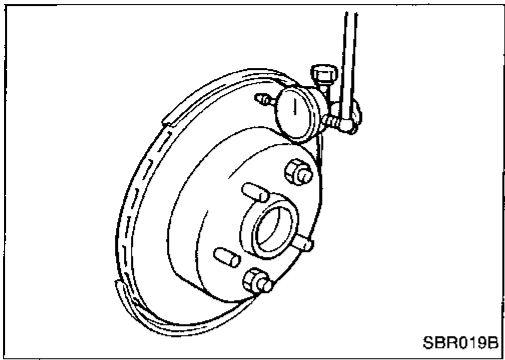
SLIDE PIN, PIN BOLT AND PIN BOOT

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

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FRONT DISC BRAKE



Inspection — Rotor

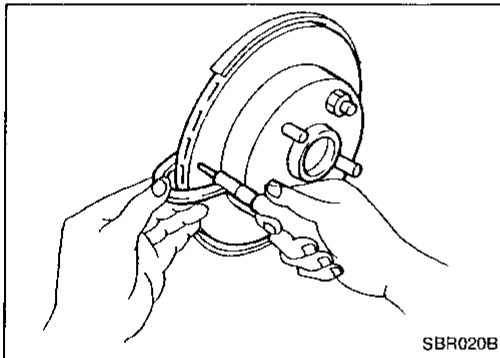
RUNOUT

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 "ON-VEHICLE SERVICE" in FA section.

**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).

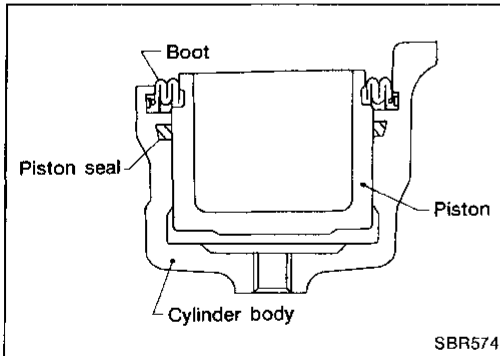


THICKNESS

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

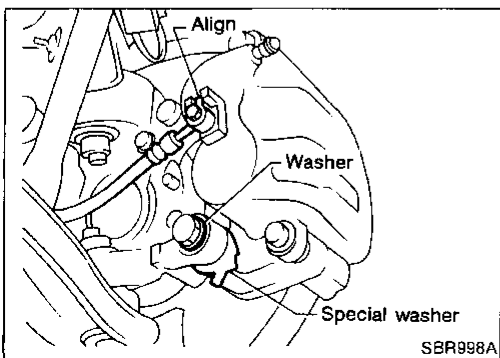
If thickness variation exceeds the specification, turn rotor with on-car brake lathe.

**Rotor repair limit:
26.0 mm (1.024 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.

Do not forget to install washers.

2. Install brake hose to caliper securely.
3. Install all parts and secure all bolts.
4. Bleed air. Refer to "Bleeding Brake System".

REAR DISC BRAKE

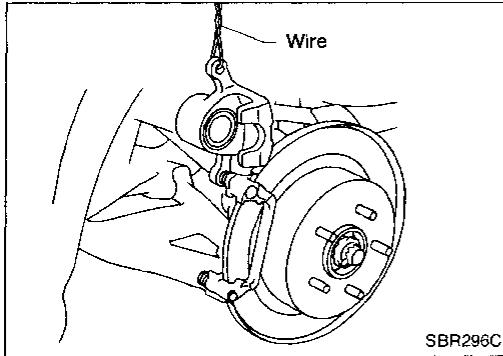
Pad Replacement

WARNING:

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

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 in replacing pads.
- If shims are rusted or show peeling of rubber coat, replace them with new shims.
- It is not necessary to remove connecting bolt except for disassembly or replacement of caliper assembly. In this case, suspend cylinder body with wire so as not to stretch brake hose.

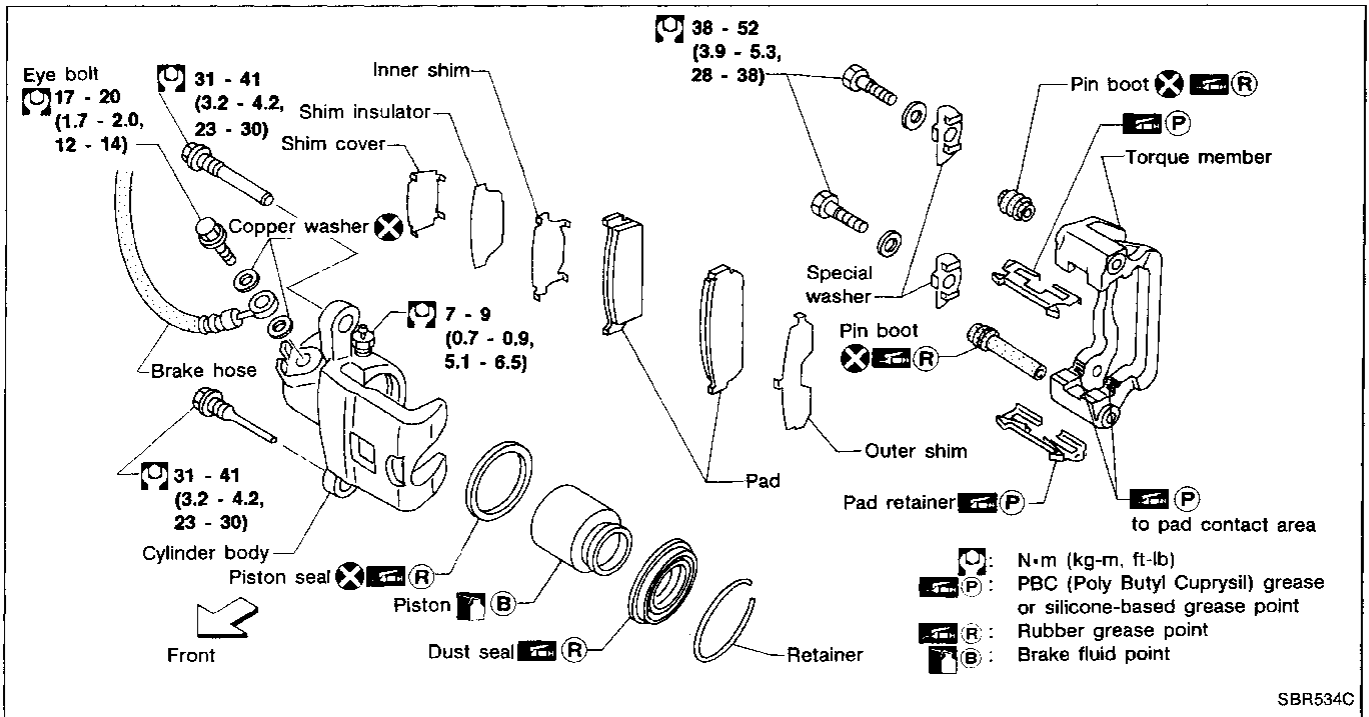


1. Remove master cylinder reservoir cap.
2. Remove lower pin bolt.
3. Open cylinder body upward. Then remove pad retainers, and inner and outer shims.

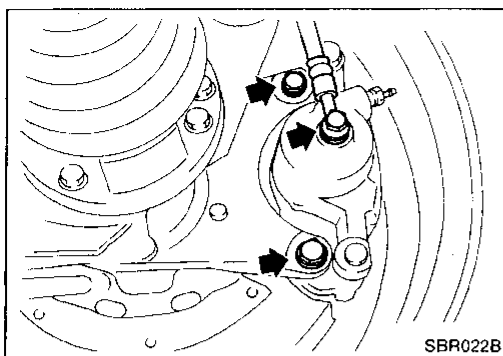
Pad wear limit:

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



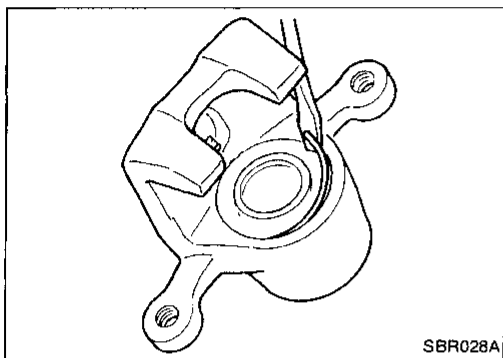
Removal

WARNING:

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

Remove torque member fixing bolts and connecting bolt. On right brake, disconnect sensor harness.

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

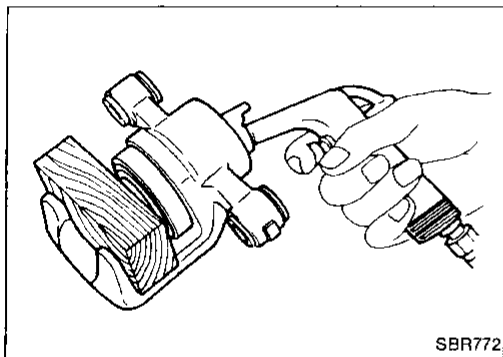
WARNING:

Do not place your fingers in front of piston.

CAUTION:

Do not scratch or score cylinder wall.

1. Remove dust cover retainer with a screwdriver.
2. Push out piston and dust seal with compressed air.
3. Remove piston seal with a suitable tool.



Inspection — Caliper

CYLINDER BODY

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

CAUTION:

Use brake fluid to clean. Never use mineral oil.

PISTON

CAUTION:

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

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

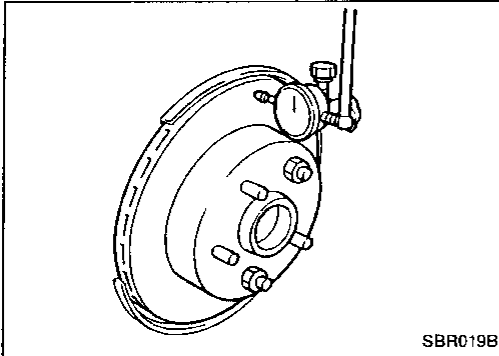
SLIDE PIN, PIN BOLT AND PIN BOOT

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

Inspection — Rotor

RUBBING SURFACE

Check rotor for roughness, cracks or chips.



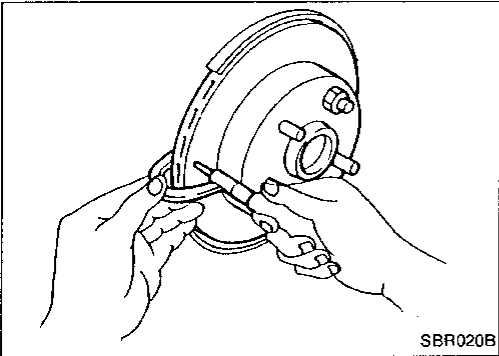
RUNOUT

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

Make sure that axial end play is within the specifications before measuring. Refer to "ON-VEHICLE SERVICE" in RA section.

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

Maximum runout: 0.07 mm (0.0028 in)

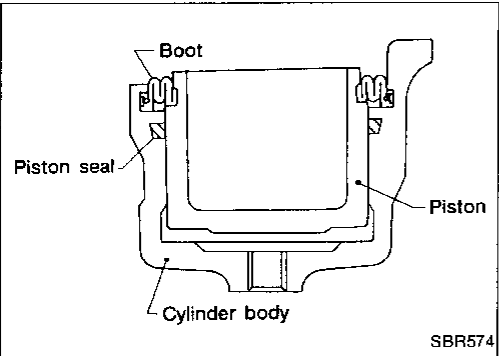


THICKNESS

Rotor repair limit: Minimum thickness

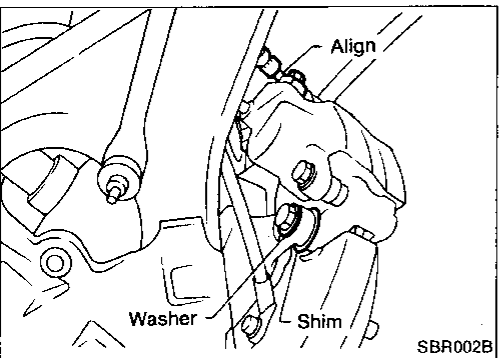
8.0 mm (0.315 in)

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



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.
4. Secure piston boot with retainer.



Installation

CAUTION:

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

1. Install caliper assembly.

Do not forget to install shims and washers.

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).

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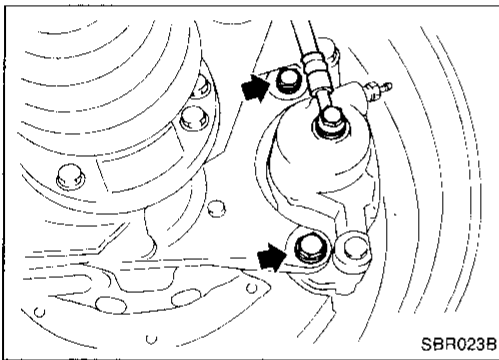
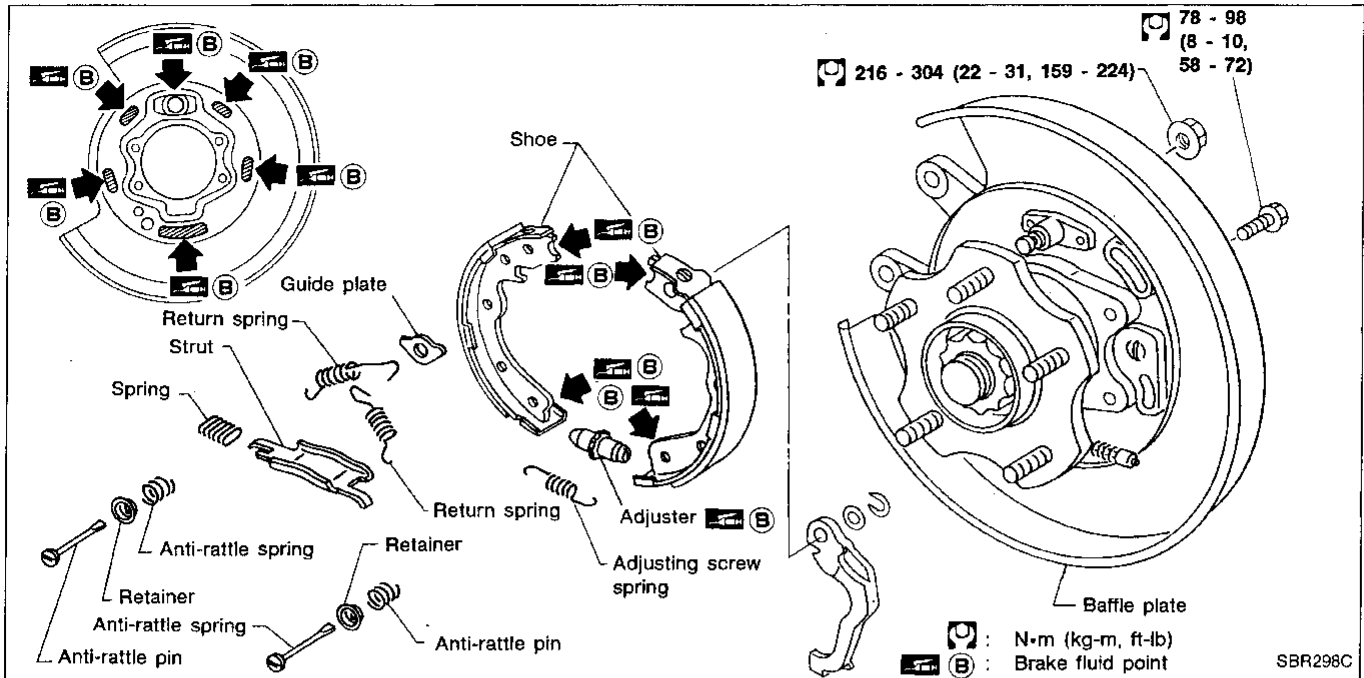
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REAR DISC BRAKE

Parking Drum Brake



REMOVAL

WARNING:

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

CAUTION:

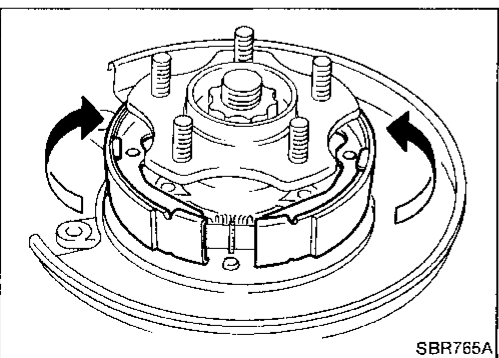
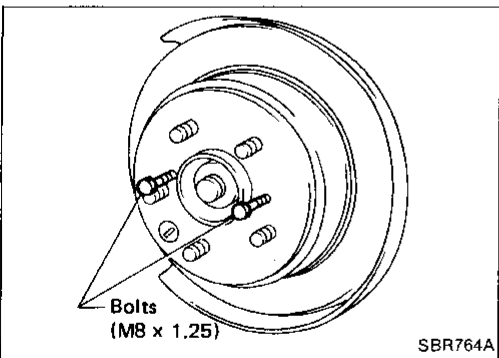
Make sure parking brake lever is released completely.

1. Remove torque member fixing bolts (Rear disc brake assembly mounting bolts).

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

2. Remove disc rotor (With parking drum brake).

Tighten two bolts gradually if disc rotor is hard to remove.



3. After removing retainer, remove spring by rotating shoes. **Be careful not to damage parking brake cable when separating it.**

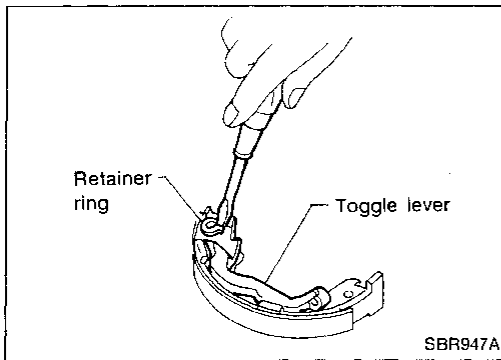
4. Remove adjuster.

5. Remove strut.

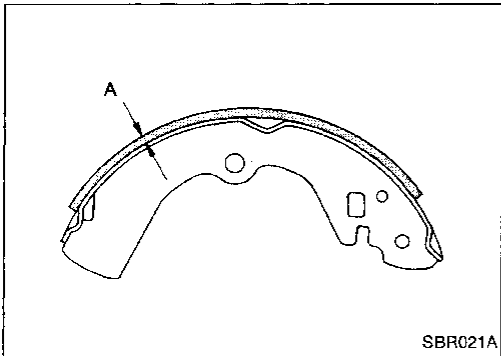
6. Disconnect parking brake cable from toggle lever.

REAR DISC BRAKE

Parking Drum Brake (Cont'd)



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

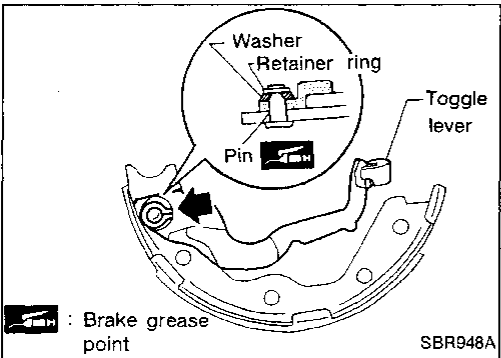


INSPECTION

Check lining thickness.

Lining wear limit (A): 1.5 mm (0.059 in)

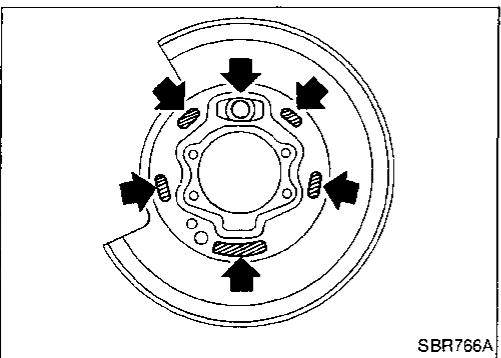
Replace brake shoes if lining is worn beyond wear limit.



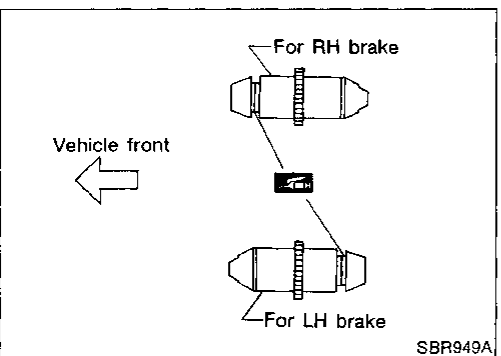
INSTALLATION

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

Pay attention to retainer ring direction.



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.

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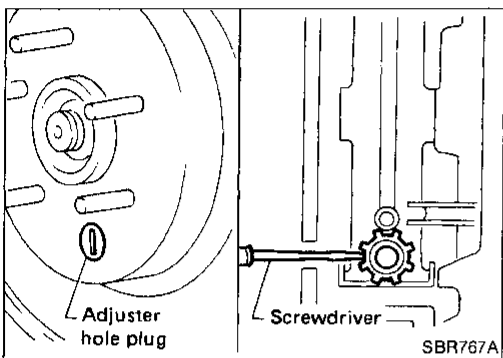
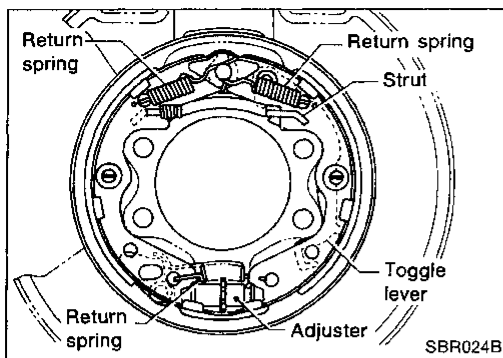
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REAR DISC BRAKE

Parking Drum Brake (Cont'd)

6. Check all parts are installed properly.

Pay attention to direction of adjuster.



SHOE CLEARANCE ADJUSTMENT

1. Remove adjuster hole plug, and turn down adjuster wheel with a screwdriver until brake is locked.

Make sure that parking control lever is released completely.

2. Return adjuster wheel 5 to 6 notches.

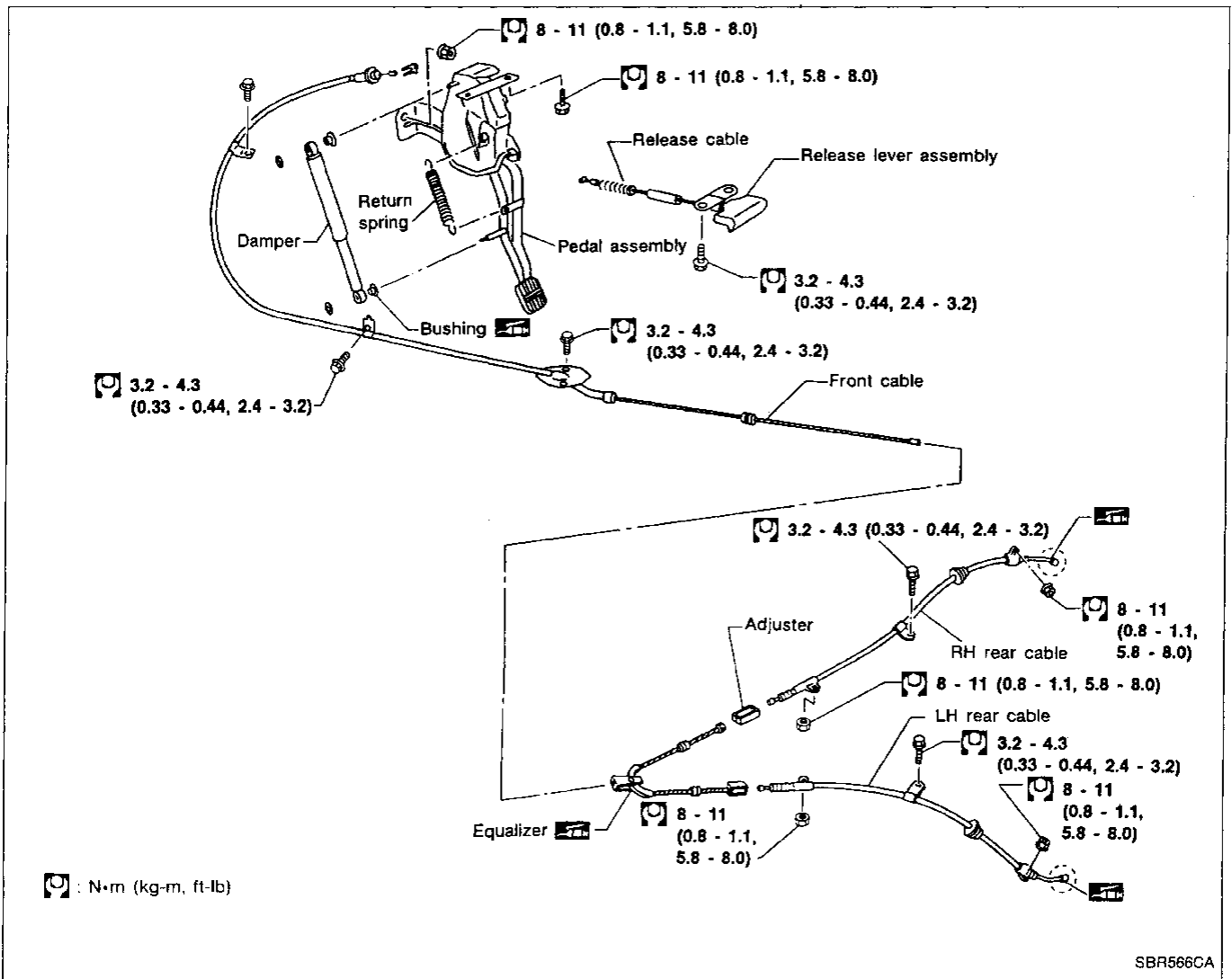
3. Install adjuster hole plug, and make sure that there is no drag between shoes and brake drum when rotating disc rotor.

4. Adjust parking brake cable. Refer to "Adjustment" in "PARKING BRAKE CONTROL" (BR-24).

BREAKING IN DRUM AND LINING

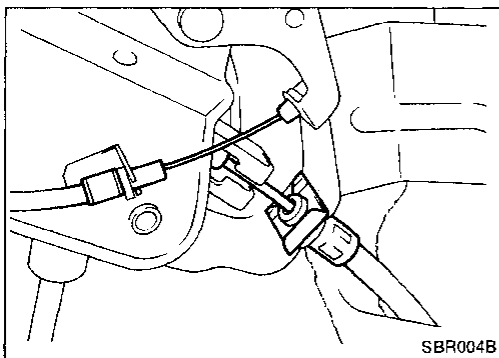
1. Using either low or 2nd transmission speed, drive the unloaded vehicle on a safe, level and dry road.
2. Depress parking brake pedal with a force of 147 N (15 kg, 33 lb).
3. While depressing the pedal, continue to drive the vehicle forward 100 m (328 ft) at approximately 35 km/h (22 MPH).
4. While depressing the pedal, drive the vehicle in reverse 10 m (33 ft) at approximately 10 km/h (6 MPH).
5. Repeat steps 1 through 4 three times and then repeat only step 4 one more time.

PARKING BRAKE CONTROL



Removal and Installation

- Parking brake cables can be removed without removing pedal assembly.
- In order to remove front cable, it is necessary to remove center console. (Refer to "INSTRUMENT PANEL" in BF section.)
- In order to remove pedal assembly, it is necessary to remove instrument panel assembly and air duct. (Refer to "INSTRUMENT PANEL" in BF section.)
- The figure at left shows how front and release cables are connected to pedal assembly.



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PARKING BRAKE CONTROL

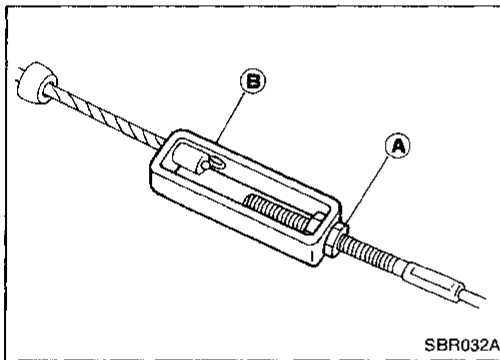
Inspection

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

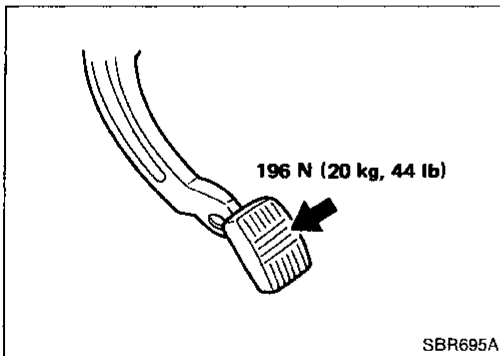
Adjustment

Adjust parking brake pedal stroke as follows.

On models equipped with parking drum brake, perform shoe clearance adjustment before adjusting control lever stroke.



1. Loosen lock nut (A), rotate adjuster (B).
2. Tighten lock nut (A).



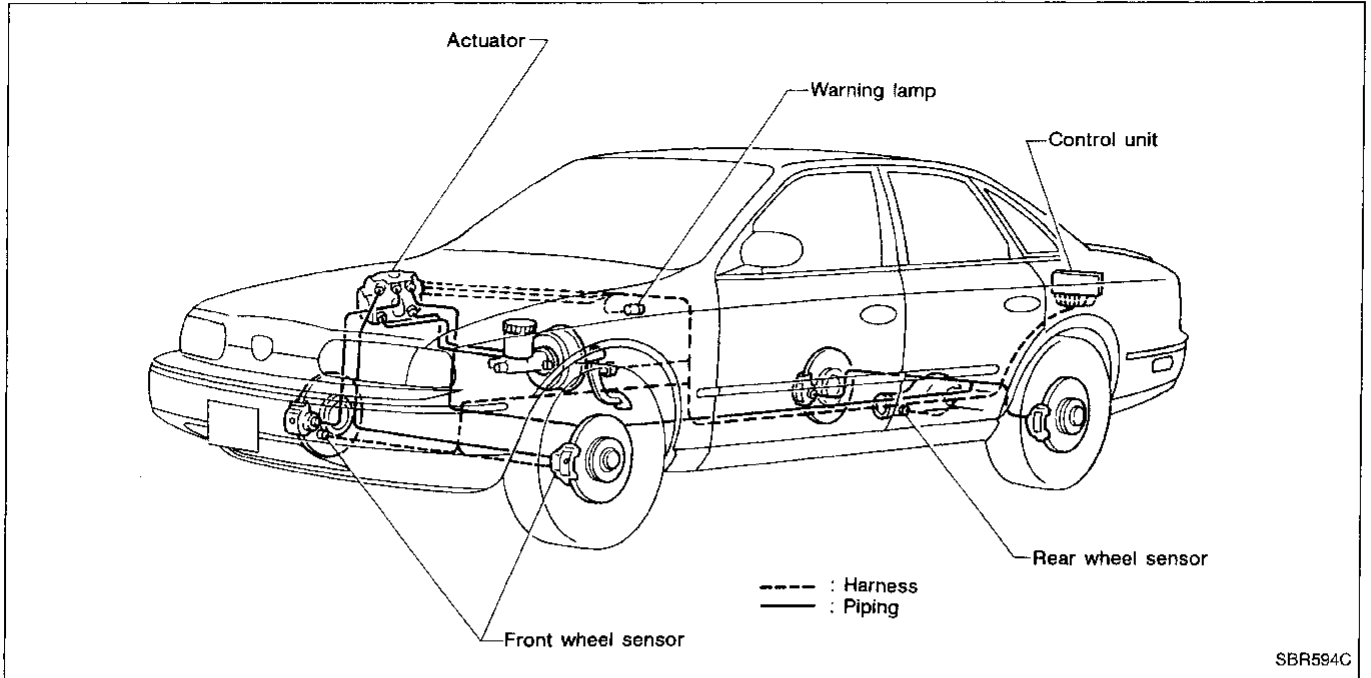
3. Depress parking brake pedal with specified amount of force. Check pedal stroke and ensure smooth operation.

Pedal stroke:

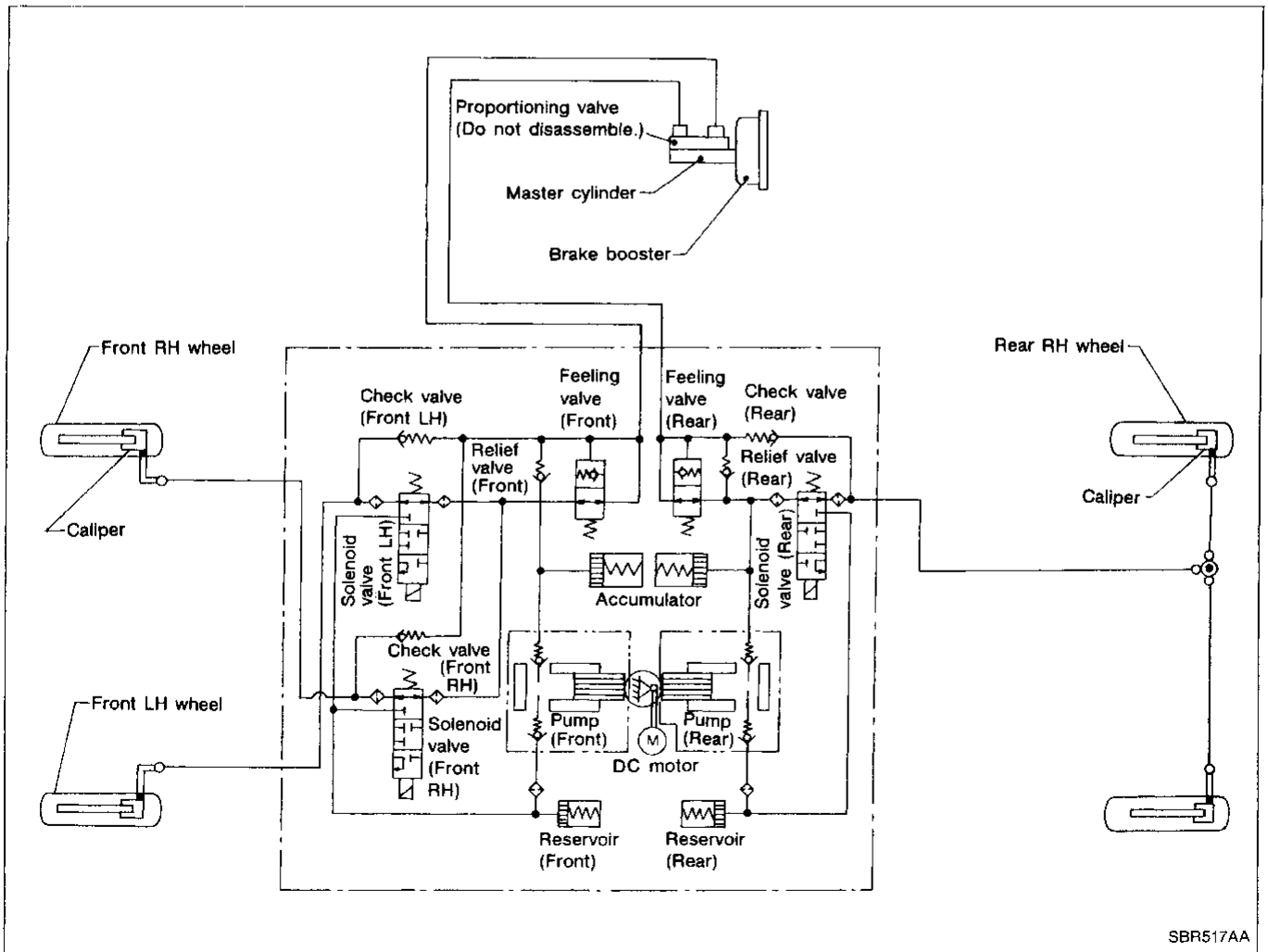
90 - 105 mm (3.54 - 4.13 in)

4. Bend warning lamp switchplate to ensure following. Warning lamp comes on when parking brake pedal is depressed "A" mm ("A" in).
"A": 20 mm (0.79 in) or less

System Components

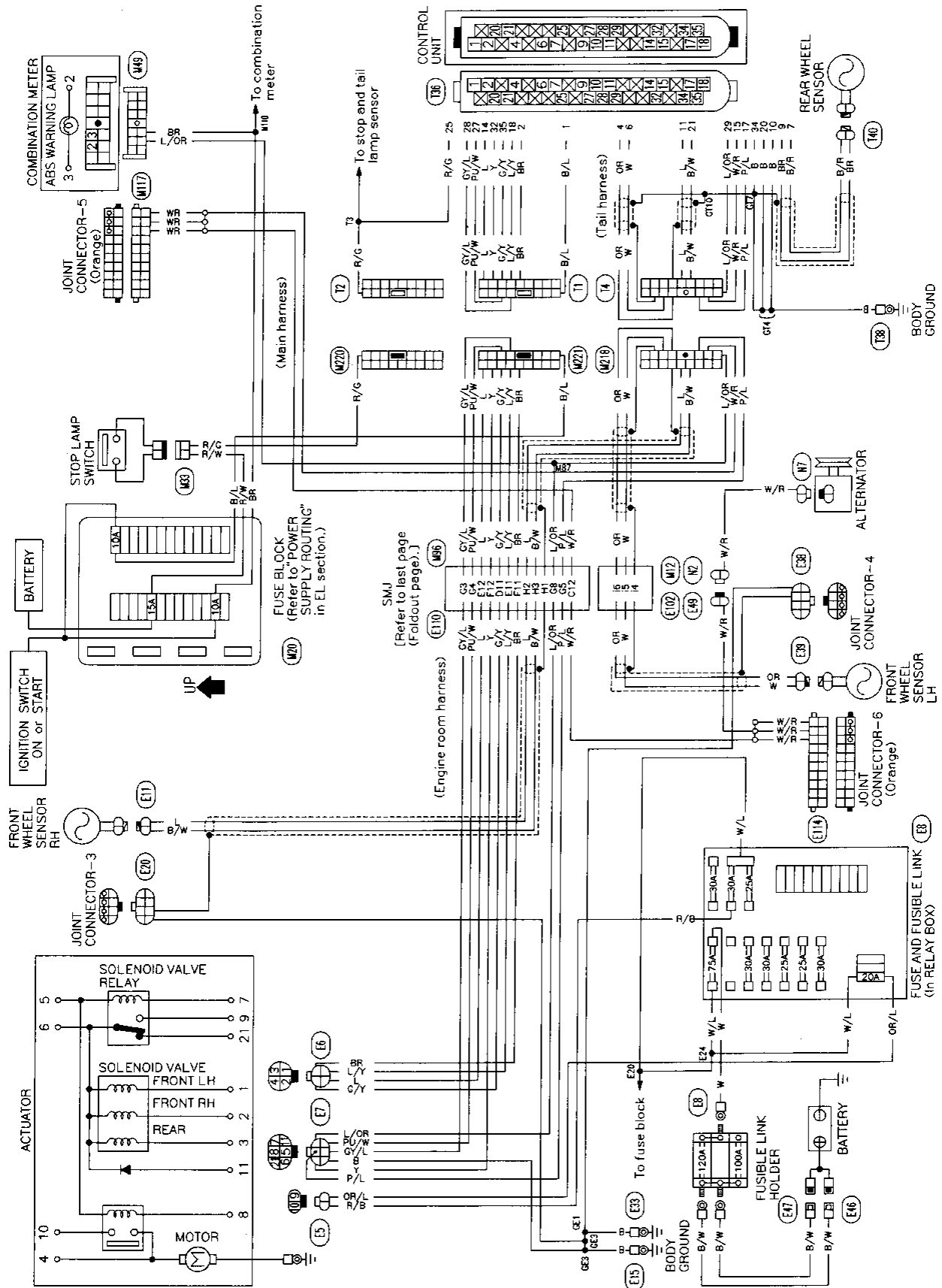


Hydraulic Circuit



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Wiring Diagram

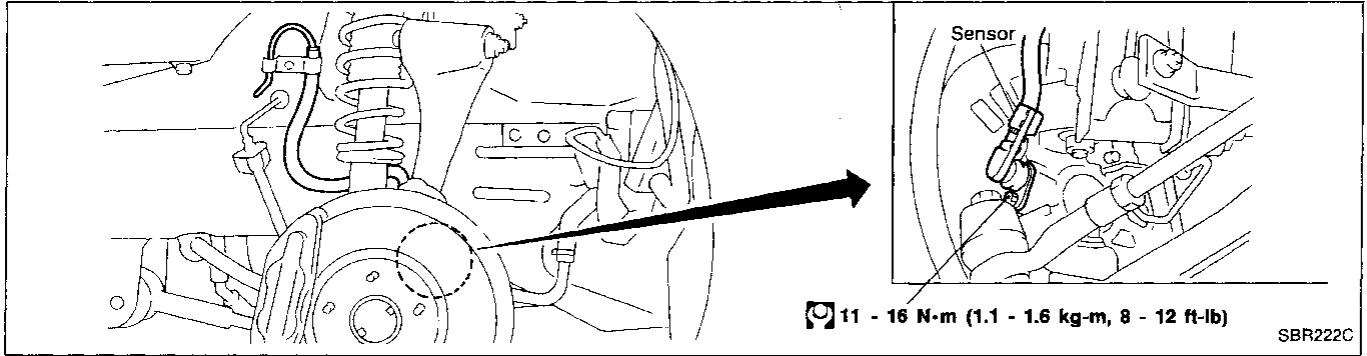


Removal and Installation

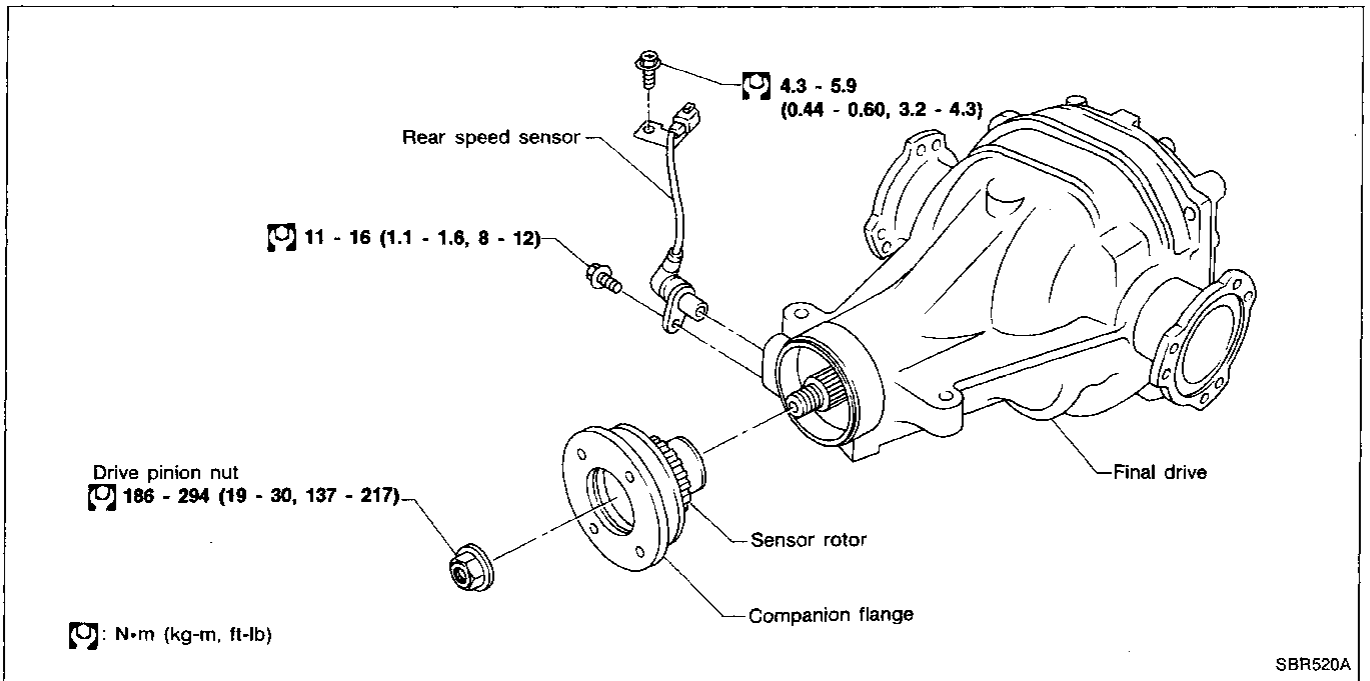
CAUTION:

Be careful not to damage sensor edge and sensor rotor teeth. When removing the front wheel hub or final drive assembly, 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.

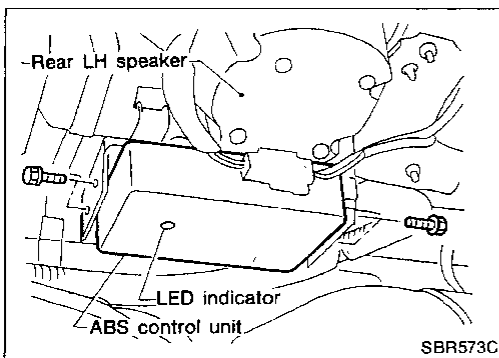
FRONT WHEEL SENSOR



REAR WHEEL SENSOR



ABS CONTROL UNIT



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Removal and Installation (Cont'd)

ACTUATOR

Removal

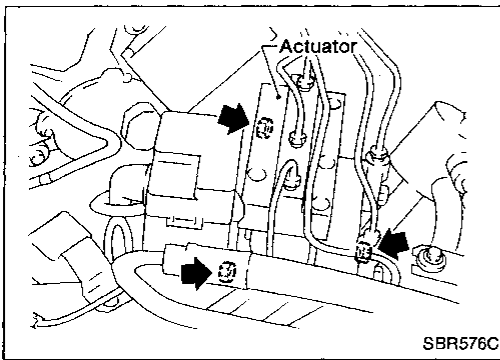
1. Disconnect battery cable.
2. Drain brake fluid. Refer to "Changing Brake Fluid" in "CHECK AND ADJUSTMENT" (BR-4).
3. Disconnect connectors, brake tubes and remove fixing nuts.

Installation

CAUTION:

After installation, refill brake fluid. Then bleed air. Refer to "CHECK AND ADJUSTMENT" (BR-4).

1. Connect brake tubes temporarily.
2. Secure fixing nuts.
3. Torque brake tubes.
4. Connect connectors and battery cable.



TROUBLE DIAGNOSES FOR ABS

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Preliminary Check 2	BR-35	GI
Preliminary Check 3	BR-36	
Self-diagnosis	BR-37	
Component Parts and Connector Locations	BR-38	MA
Ground Circuit Check	BR-39	
Circuit Diagram for Quick Pinpoint Check	BR-39	
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Diagnostic procedure 2 — Long stopping distance	BR-41	
Diagnostic procedure 3 — Abnormal pedal action	BR-42	
Diagnostic procedure 4 — ABS does not work	BR-42	LC
Diagnostic procedure 5 — ABS works but warning activates	BR-43	
Diagnostic procedure 6 — ACTUATOR SOLENOID (LED flashing number 1-4)	BR-43	EF & EC
Diagnostic procedure 7 — WHEEL SPEED SENSOR (LED flashing number 5-8)	BR-44	
Diagnostic procedure 8 — ACTUATOR MOTOR RELAY (LED flashing number 9)	BR-45	
Diagnostic procedure 9 — ACTUATOR SOLENOID VALVE RELAY (LED flashing number 10)	BR-46	FE
Diagnostic procedure 10 — CONTROL UNIT (LED flashing number 16)	BR-47	
Diagnostic procedure 11 — CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but LED comes off.)	BR-47	AT
Electrical Components Inspection	BR-48	

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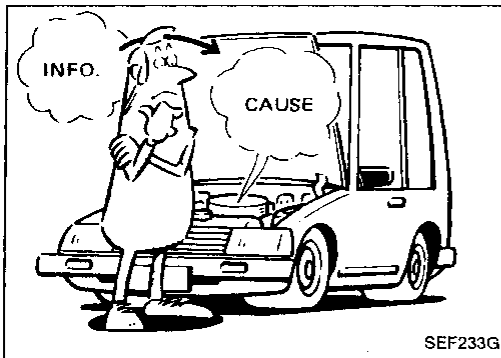
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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

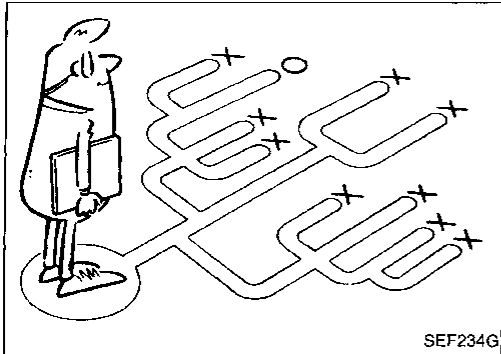
The ABS system has an electronic control unit to control major functions. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. It is also important to check for conventional problems: such as air leaks in the booster or lines, lack of brake fluid, or other problems with the brake system.

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

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

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

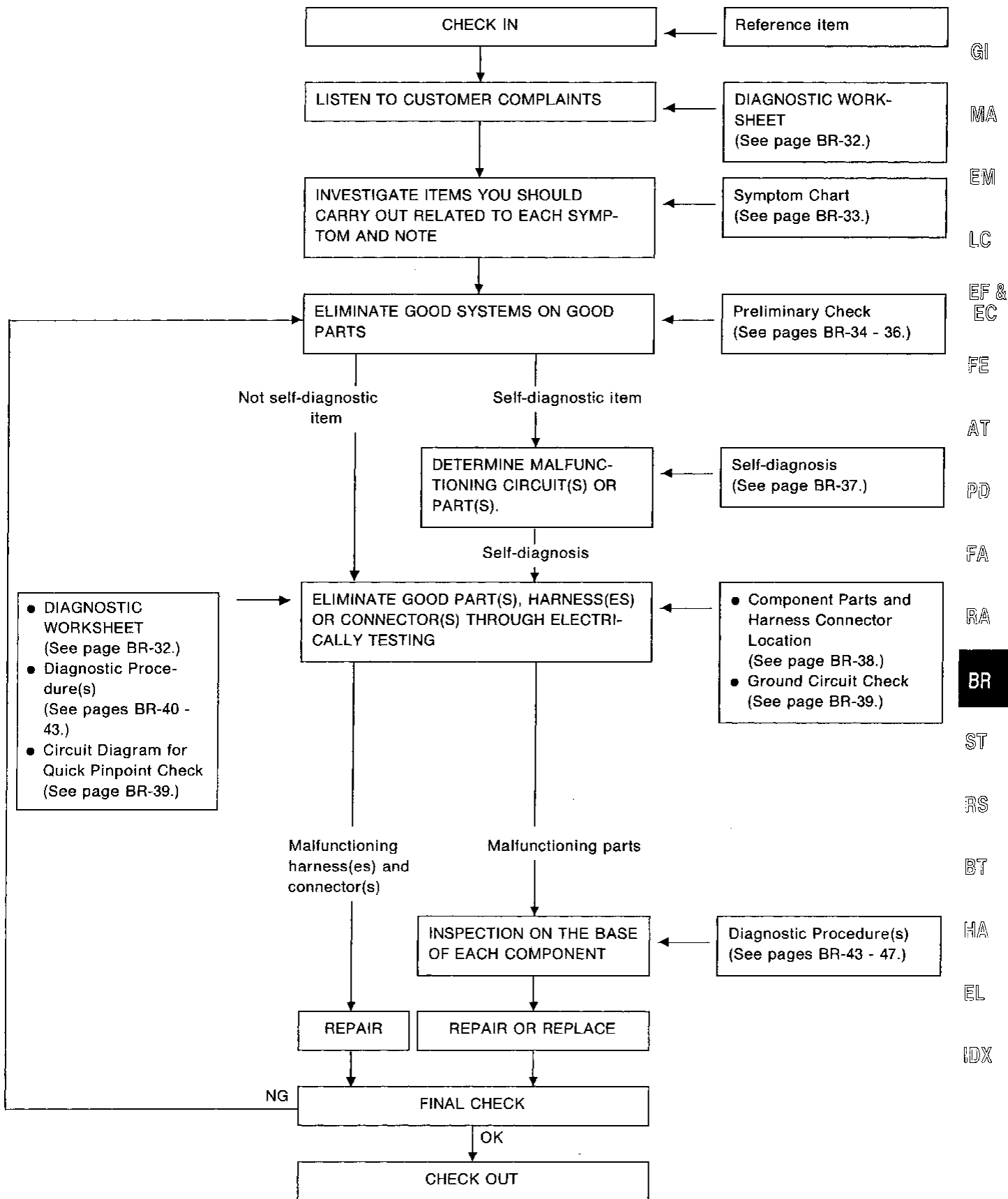
Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot brake problems on an ABS controlled vehicle.



TROUBLE DIAGNOSES FOR ABS

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

WORK FLOW



TROUBLE DIAGNOSES FOR ABS

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

KEY POINTS

- WHAT** Vehicle model
WHEN Date, Frequencies
WHERE Road conditions
HOW Operating conditions,
 Weather conditions,
 Symptoms

SBR339B

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to customer complaints, even if the system is normal.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

In general, feelings for a problem depend on each customer's information. It is therefore important to fully understand the symptoms or under what conditions a customer complains.

Make good use of a diagnostic worksheet (such as the one shown below) in order to utilize all the complaints for trouble-shooting.

Worksheet sample

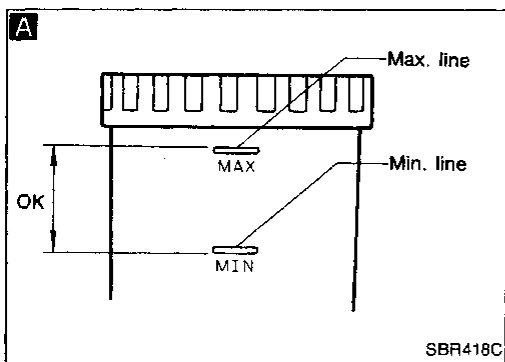
Customer name MR/MS		Model & Year			VIN		
Engine #		Trans.			Mileage		
Incident Date		Manuf. Date			In Service Date		
Symptoms	<input type="checkbox"/> Pedal vibration and noise	<input type="checkbox"/> Warning activates	<input type="checkbox"/> Long stopping distance	<input type="checkbox"/> Abnormal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

TROUBLE DIAGNOSES FOR ABS

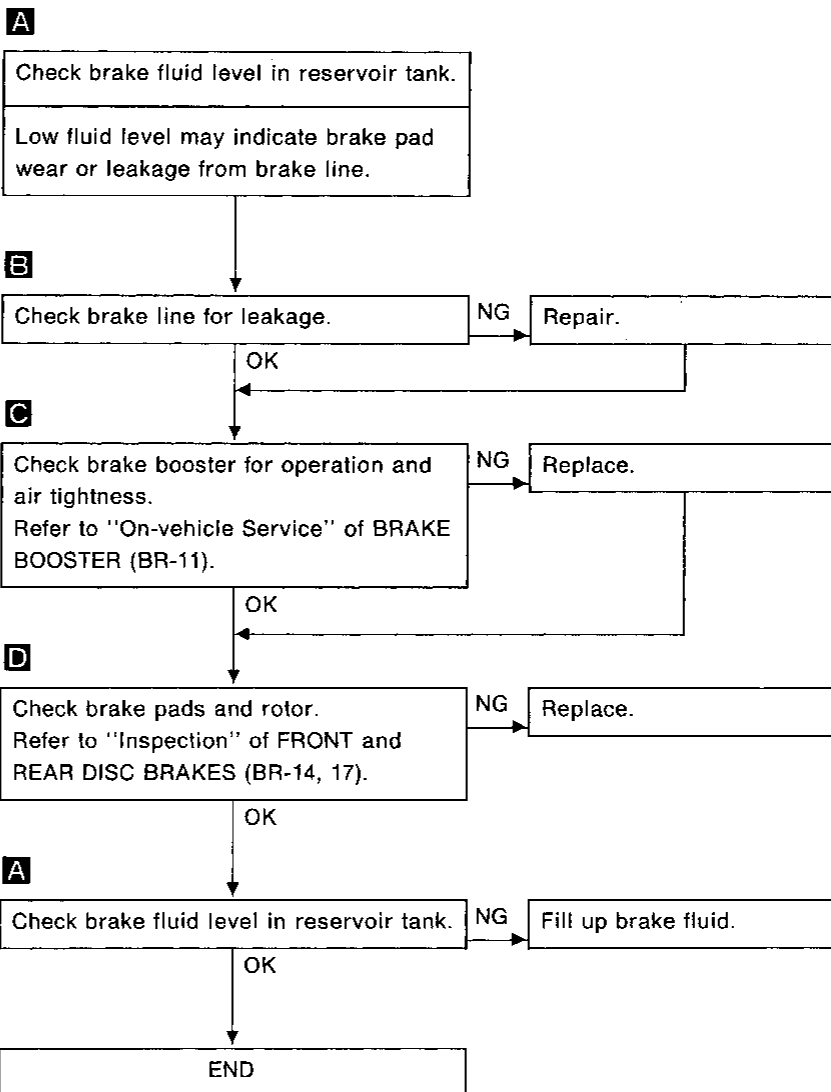
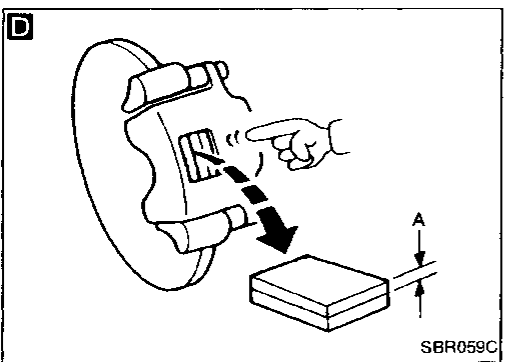
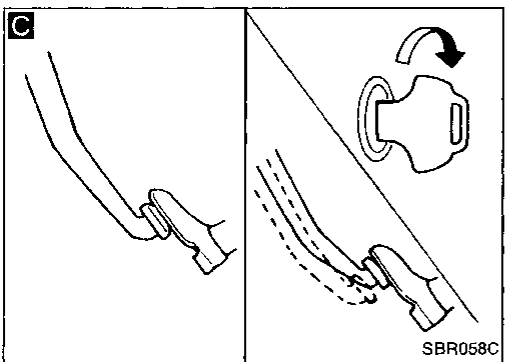
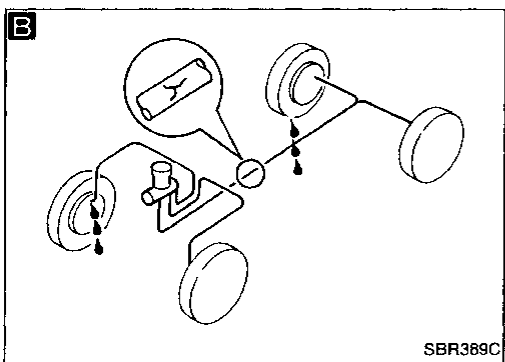
Symptom Chart

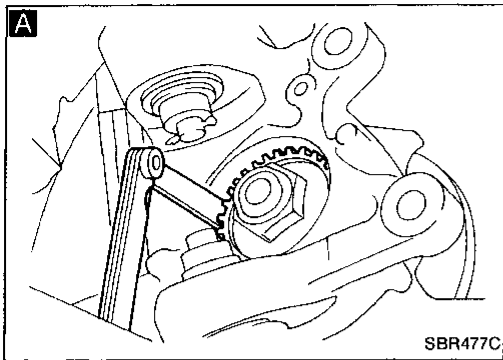
PROCEDURE	REFERENCE PAGE	SYMPTOM	Pedal vibration & noise	Warning activates	Long stopping distance	Abnormal pedal action	ABS does not work	ABS works but warning activates	
Electrical Components Inspection	BR-84	Actuator inspection					○		GI
	BR-39	Motor ground					○		MA
Ground Circuit Check	BR-39	Control unit ground					○		EM
	BR-47	Diagnostic Procedure 11	○	○	○	○	○	○	LC
(Diagnostic Procedure Select inspection with LED flashing No.)	BR-47	Diagnostic Procedure 10	○	○	○	○	○	○	EF & EC
	BR-46	Diagnostic Procedure 9	○	○	○	○	○	○	FE
	BR-45	Diagnostic Procedure 8	○	○	○	○	○	○	AT
	BR-44	Diagnostic Procedure 7	○	○	○	○	○	○	PD
	BR-43	Diagnostic Procedure 6	○	○	○	○	○	○	FA
	BR-43	Diagnostic Procedure 5						○	RA
Diagnostic Procedure	BR-42	Diagnostic Procedure 4					○		BR
	BR-42	Diagnostic Procedure 3				○			ST
	BR-41	Diagnostic Procedure 2			○				RS
	BR-40	Diagnostic Procedure 1	○						BT
	BR-36	Preliminary Check 3	○	○	○	○	○	○	HA
Preliminary Check	BR-35	Preliminary Check 2		○			○		EL
	BR-34	Preliminary Check 1			○	○			IDX

TROUBLE DIAGNOSES FOR ABS



Preliminary Check 1



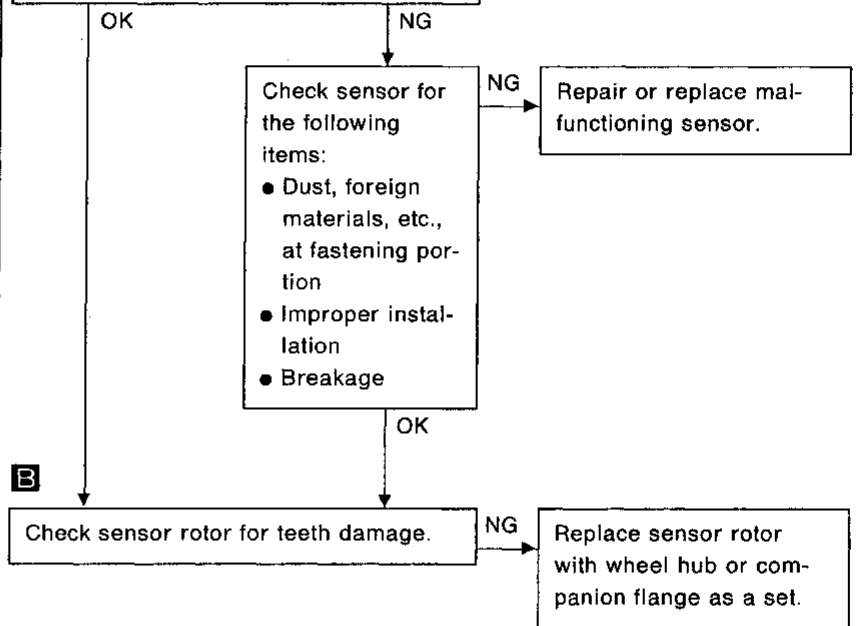
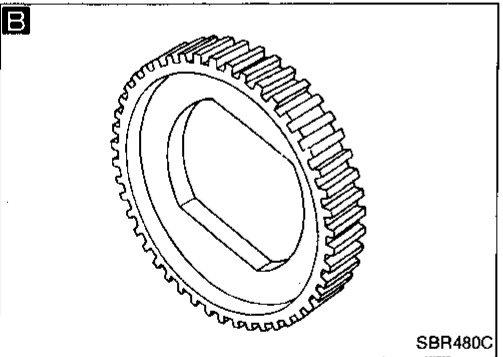
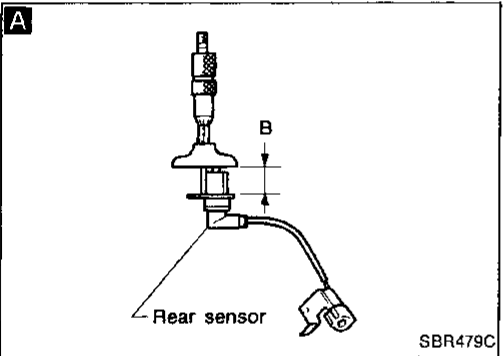
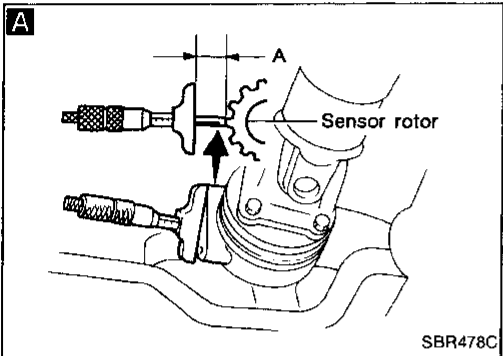


Preliminary Check 2

A

Check sensor clearance.
Clearance = A - B

	Clearance mm (in)
Front wheel sensor	0.21 - 0.71 (0.0083 - 0.0280)
Rear sensor	0.35 - 0.625 (0.0138 - 0.0246)



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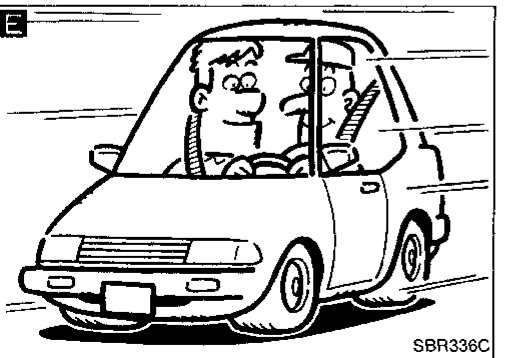
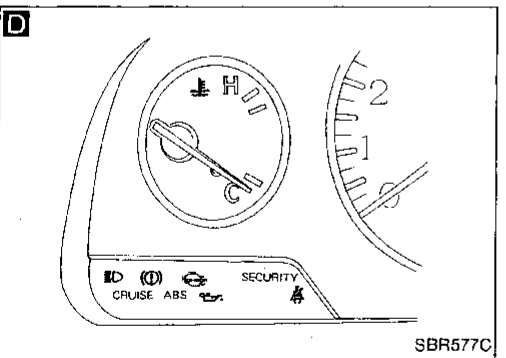
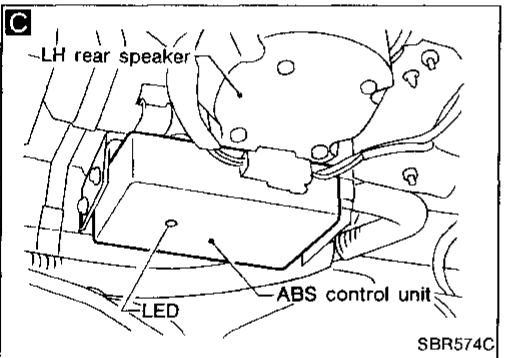
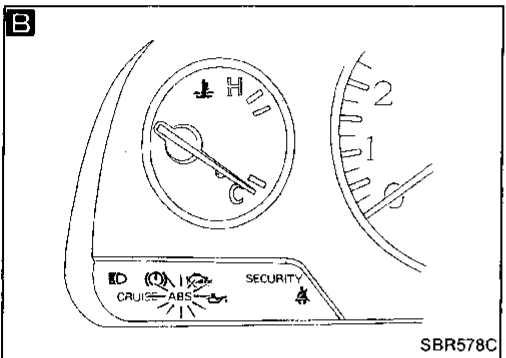
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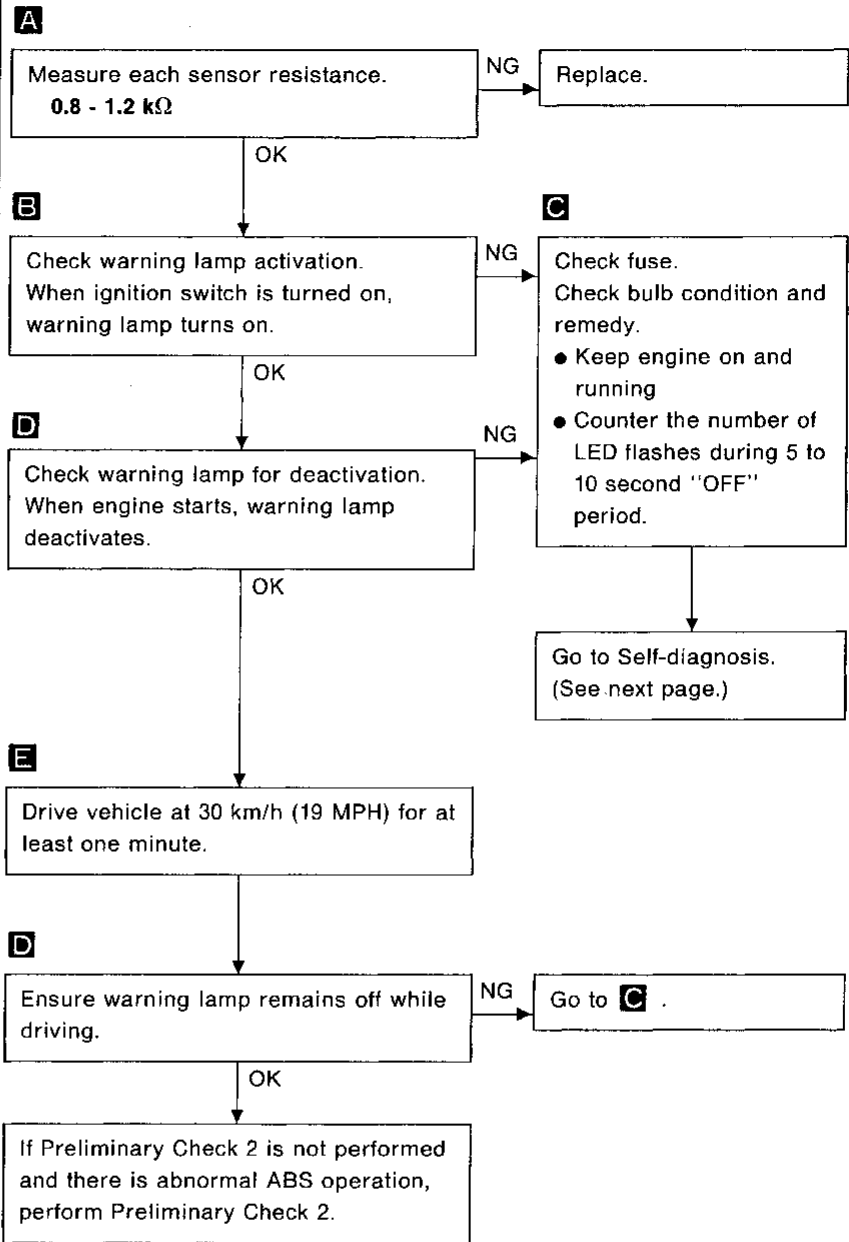
A

See page BR-38
(For the location of connectors)

SBR481C



Preliminary Check 3



Self-diagnosis

CHECKING THE NUMBER OF LED FLASHES

When a problem occurs in the ABS, the warning light on the instrument panel comes on. As shown in the Table, the control unit performs self-diagnosis.

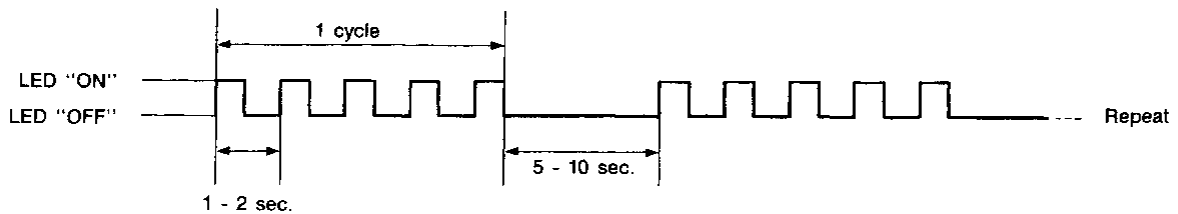
For good self-diagnostic results, drive the vehicle beforehand over 30 km/h (19 MPH) for at least one minute. After the vehicle is stopped, the number of LED flashes is counted while the engine is running. The LED is located on the control unit, identifying a malfunctioning part or unit by the number of flashes. The warning light and LED will not turn off, even after the malfunction is repaired, unless the ignition switch is turned off. After repairs, turn the ignition switch "OFF". Then start the engine and drive the vehicle over 30 km/h (19 MPH) for at least one minute. This will ensure whether proper repair was made for the malfunctioning part or unit.

If more than two circuits malfunction at the same time, the LED will flash to indicate one of the malfunctioning circuits. After the circuit has been repaired, the LED will then flash to indicate that the other circuit is malfunctioning.

No. of LED flashes	Malfunctioning part or unit	Diagnostic Procedure
1	Left front actuator solenoid circuit	Diagnostic Procedure 6
2	Right front actuator solenoid circuit	
3 or 4	Rear actuator solenoid circuit	
5	Left front wheel sensor circuit	Diagnostic Procedure 7
6	Right front wheel sensor circuit	
7 or 8	Rear wheel sensor circuit	
9	Motor and motor relay	Diagnostic Procedure 8
10	Solenoid valve relay	Diagnostic Procedure 9
16 or continuous	Control unit	Diagnostic Procedure 10
Warning activates and LED "OFF"	Power supply or ground circuit for control unit	Diagnostic Procedure 11

Example

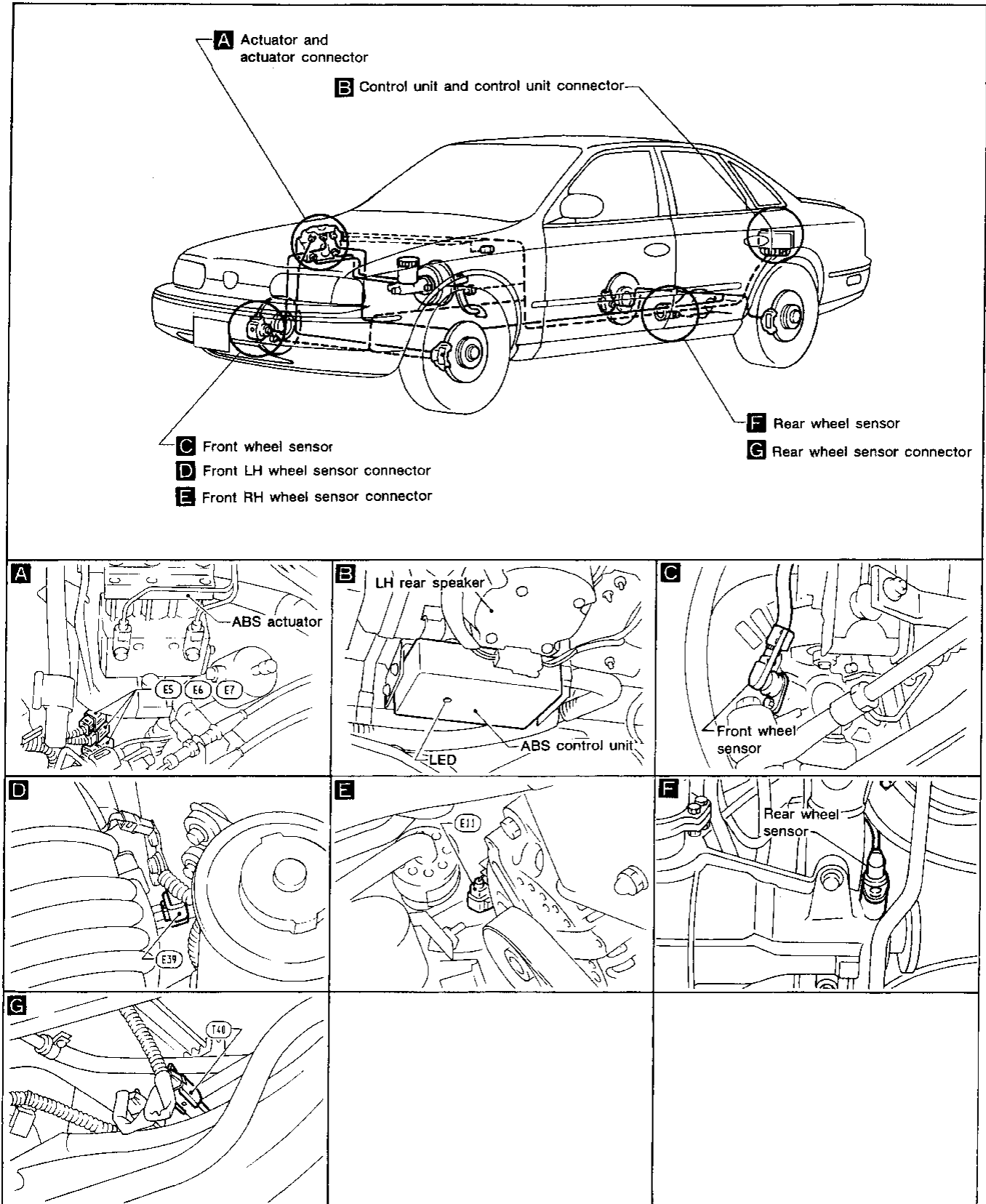
Improper operation of left front rotor sensor circuit



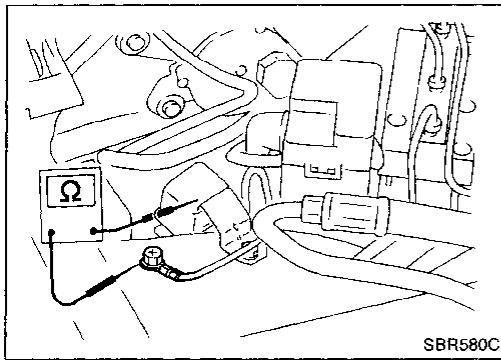
SBR535C

TROUBLE DIAGNOSES FOR ABS

Component Parts and Connector Locations



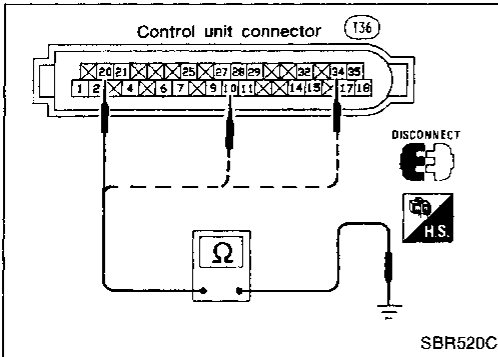
TROUBLE DIAGNOSES FOR ABS



Ground Circuit Check

ACTUATOR MOTOR GROUND

- Check resistance between both terminals.
Resistance: 0Ω

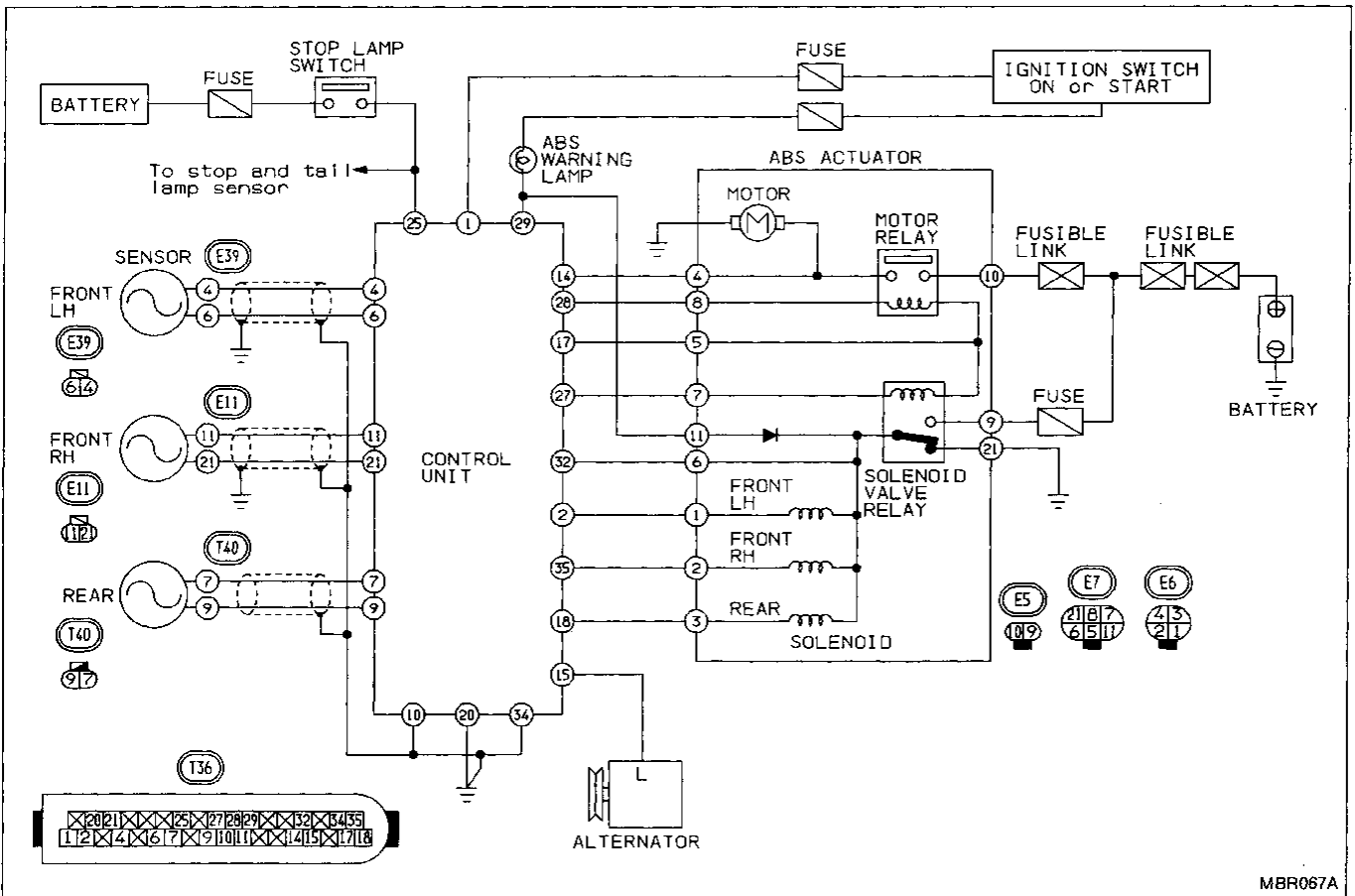


CONTROL UNIT GROUND

- Check resistance between both terminals.
Resistance: 0Ω

Circuit Diagram for Quick Pinpoint Check

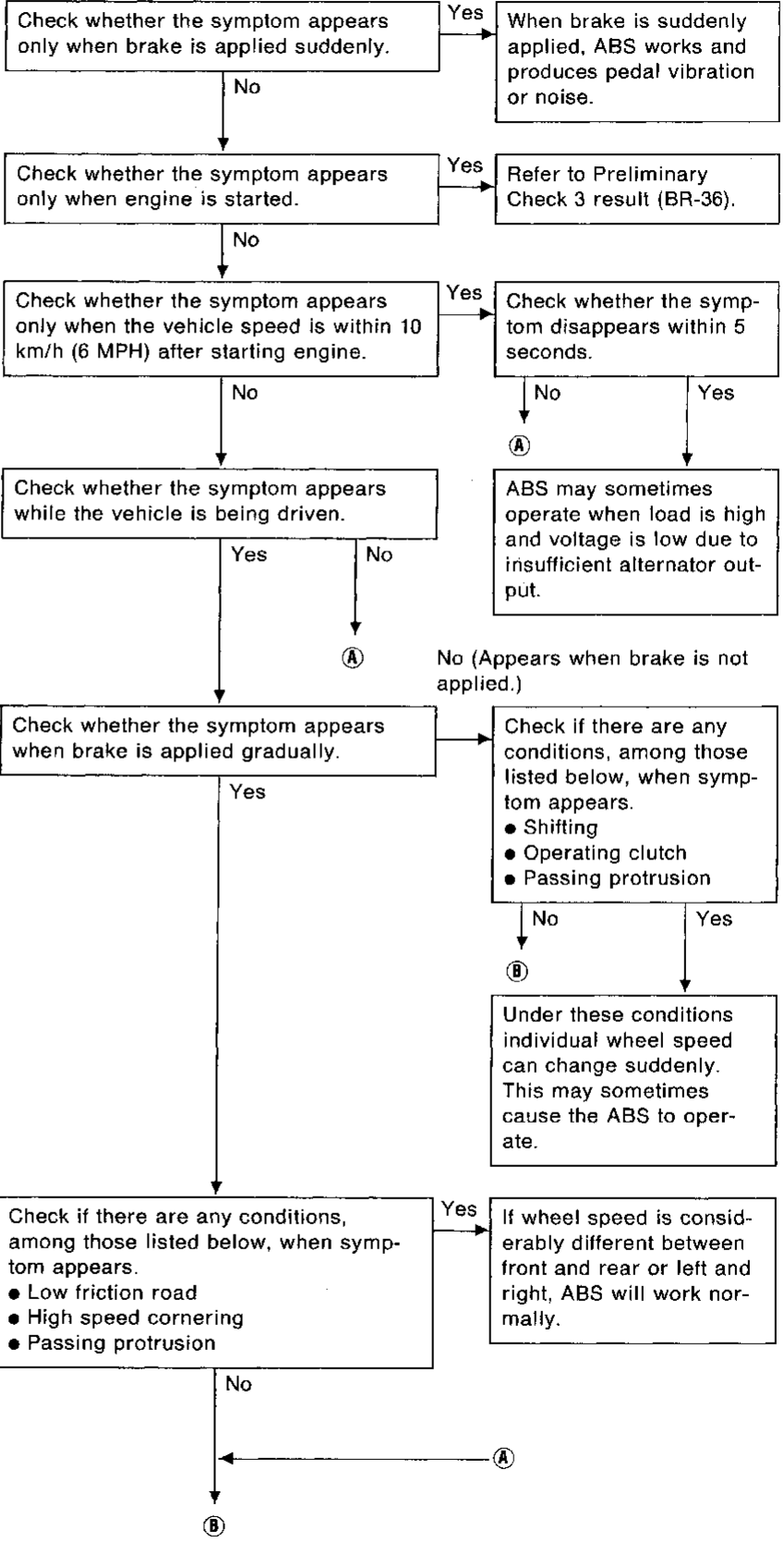
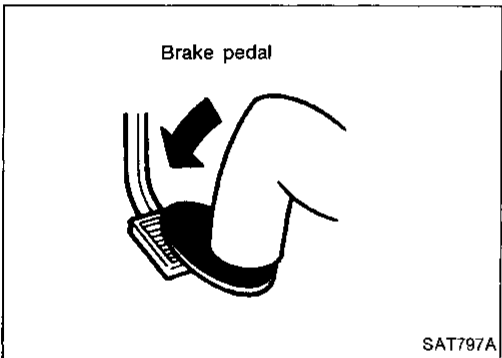
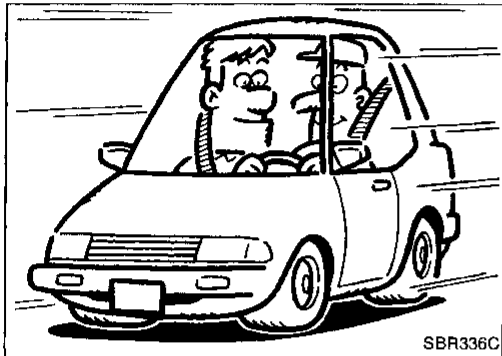
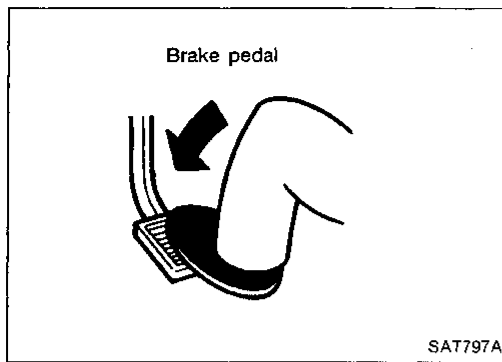
- The unit side connectors with a double circle "⊖" are connected to the harness side connectors shown in the "Component Parts and Connector Locations". (See page BR-38.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".



Diagnostic Procedure 1

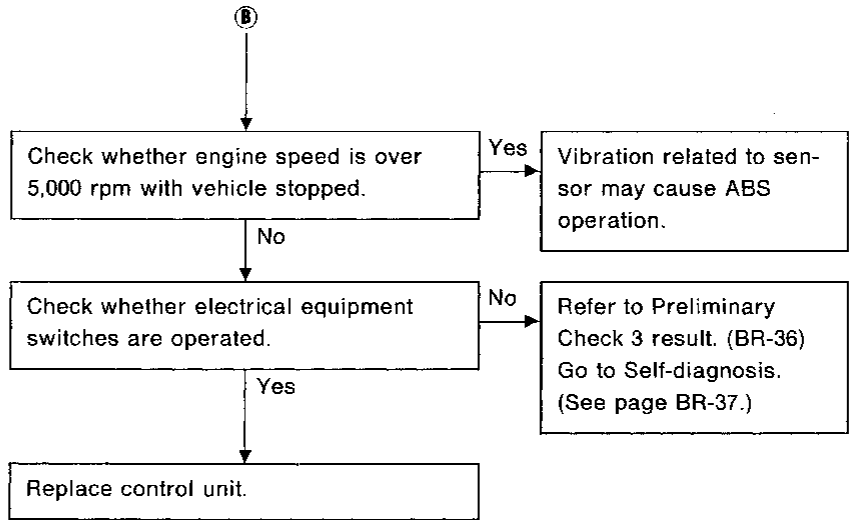
SYMPTOM: Pedal vibration and noise

Refer to worksheet result.

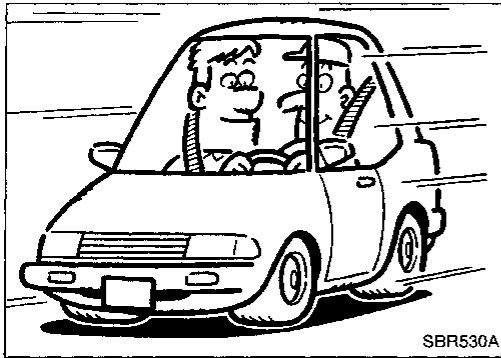


TROUBLE DIAGNOSES FOR ABS

Diagnostic Procedure 1 (Cont'd)



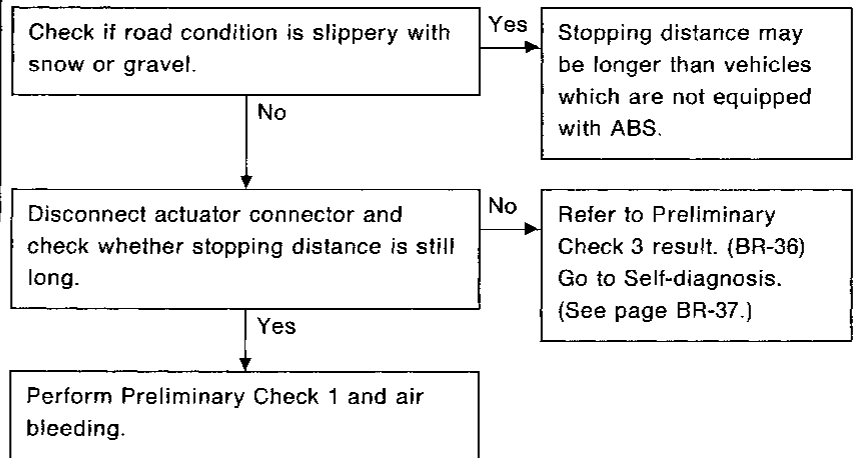
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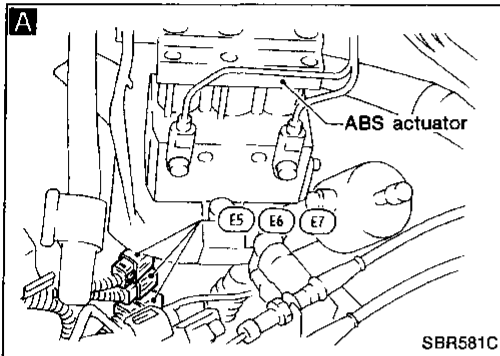
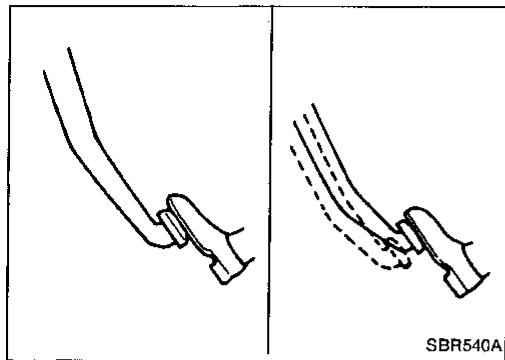
Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results.



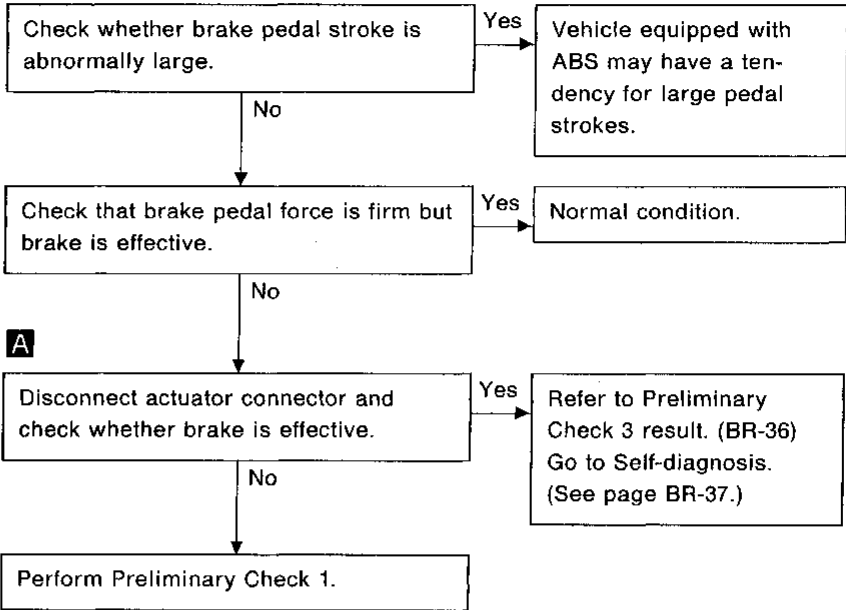
TROUBLE DIAGNOSES FOR ABS



Diagnostic Procedure 3

SYMPTOM: Abnormal pedal action

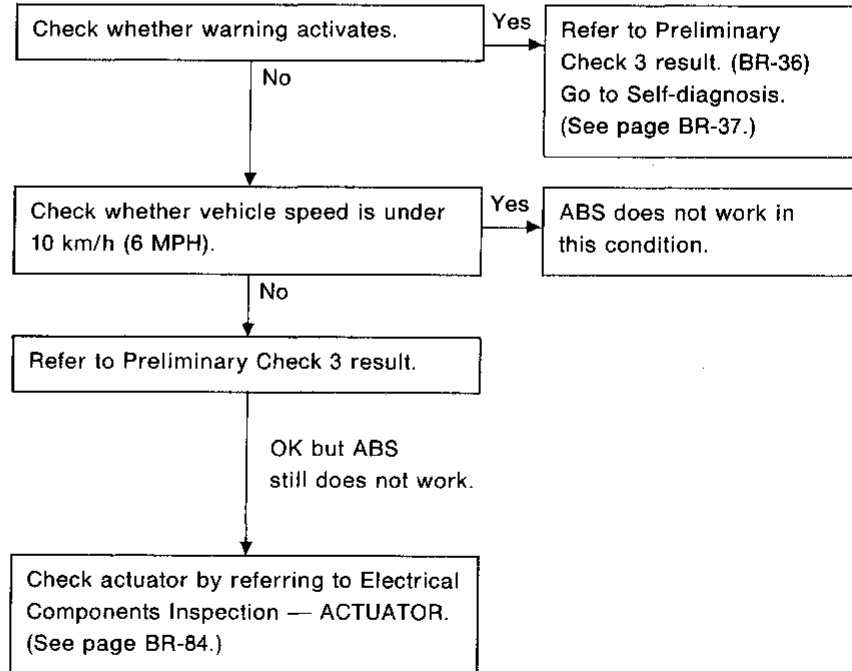
Refer to worksheet results.



Diagnostic Procedure 4

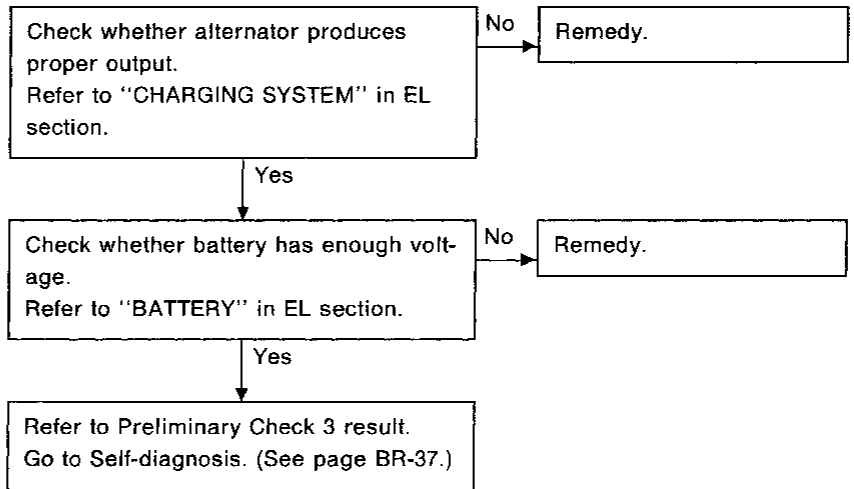
SYMPTOM: ABS does not work.

Refer to worksheet results.

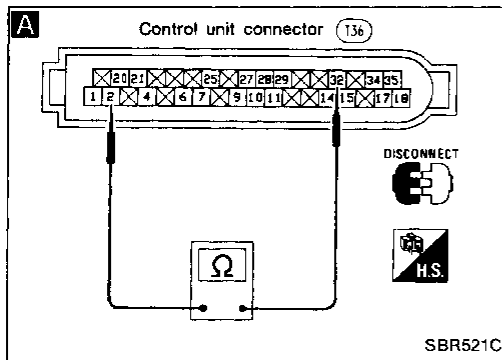


Diagnostic Procedure 5

SYMPTOM: ABS works but warning activates.

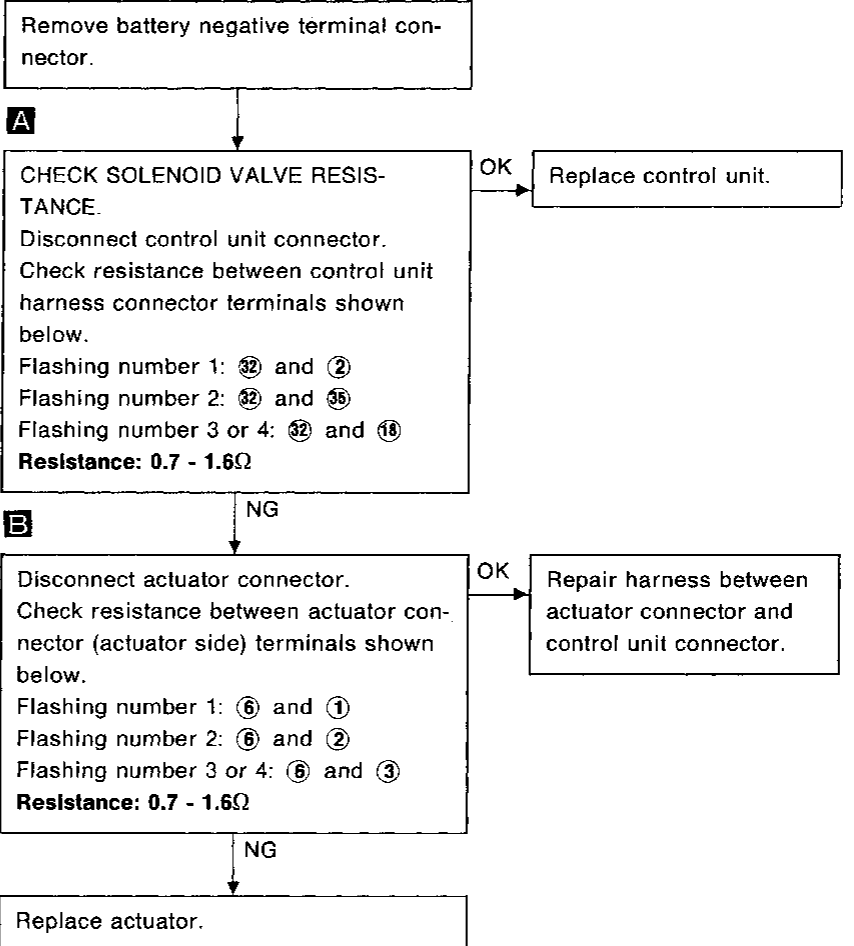


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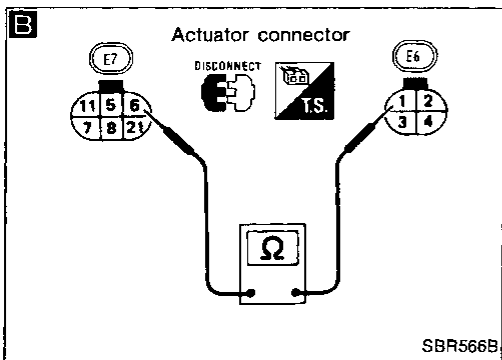


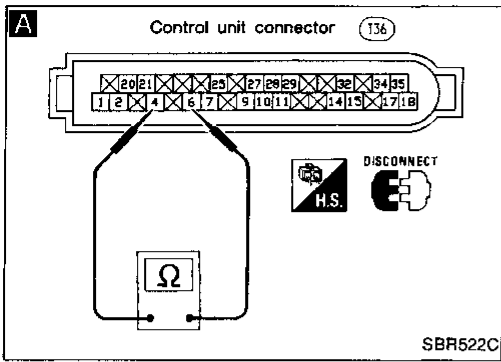
Diagnostic Procedure 6

ACTUATOR SOLENOID (LED flashing number 1 - 4)



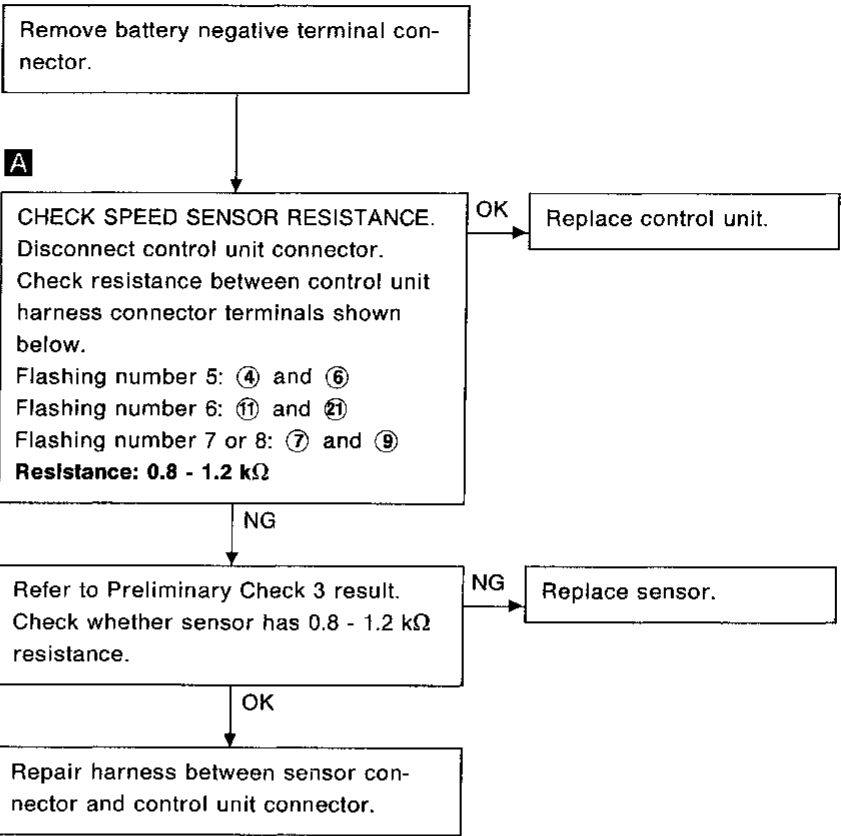
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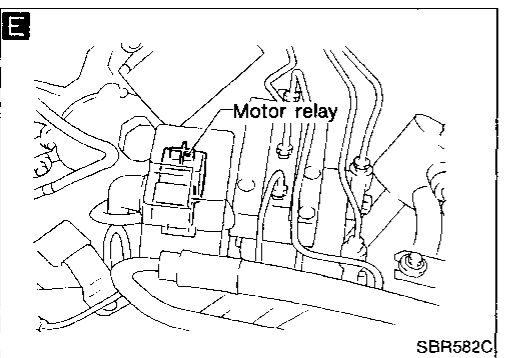
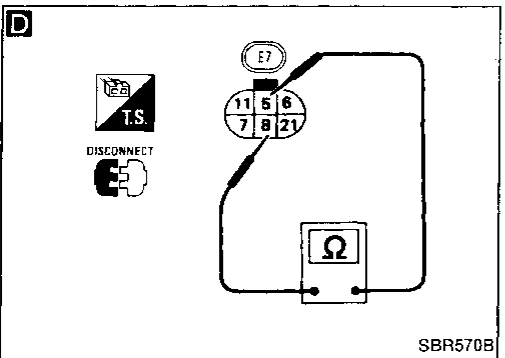
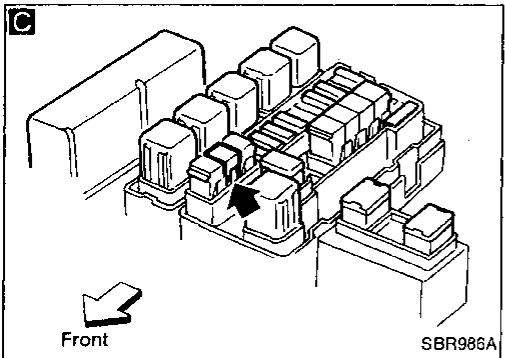
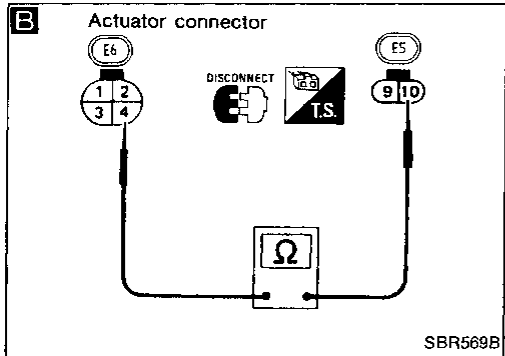
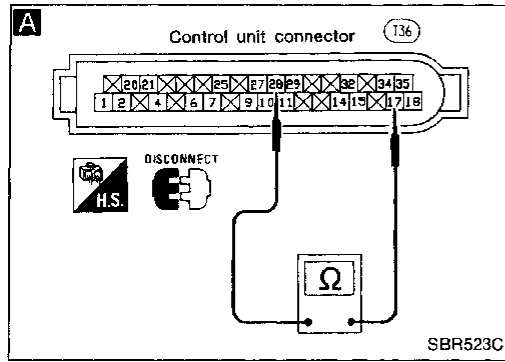
Diagnostic Procedure 7

WHEEL SPEED SENSOR (LED flashing number 5 - 8)



Diagnostic Procedure 8

ACTUATOR MOTOR RELAY (LED flashing number 9)



Remove battery negative terminal connector.

A CHECK MOTOR RELAY COIL RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit harness connector terminals ⑰ and ⑳.
Resistance: 45 - 55Ω

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

OK

E Replace motor relay.

Repair harness between actuator and control unit.

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

E Replace motor relay.

No

C Check if motor's fusible link named "ANTI SKID 30A" is blown.

Yes

Replace fusible link.

No

Perform Electrical Components Inspection — ACTUATOR.
(See page BR-48.)

OK

NG

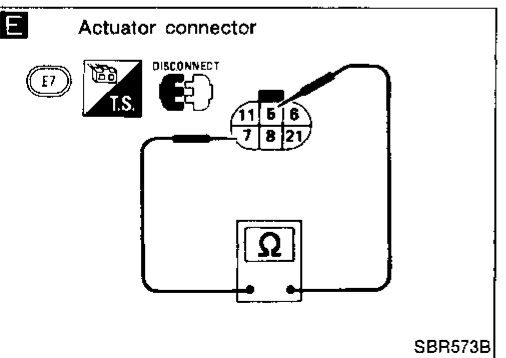
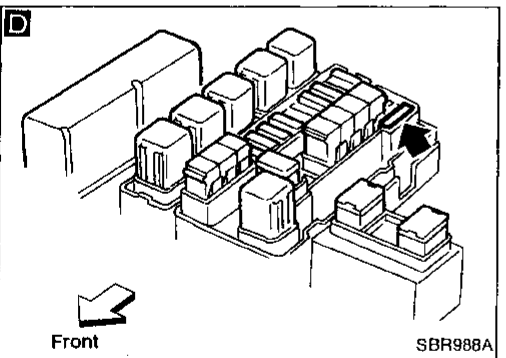
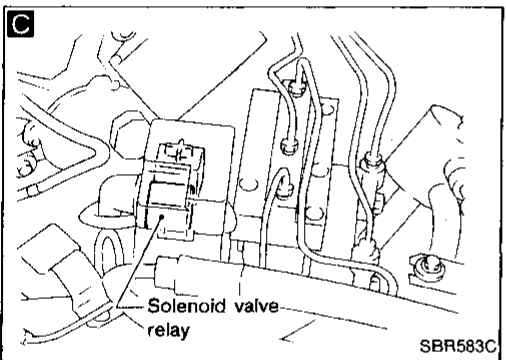
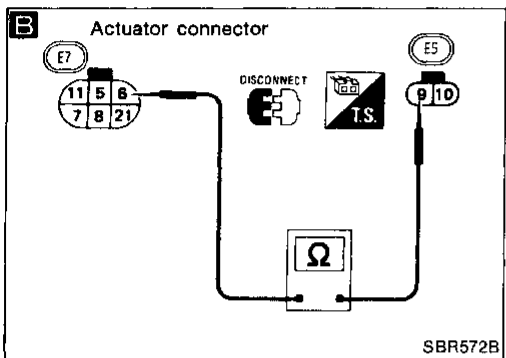
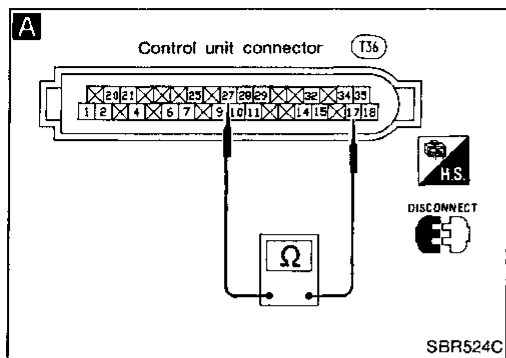
Replace actuator.

Replace control unit.

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Diagnostic Procedure 9

ACTUATOR SOLENOID VALVE RELAY (LED flashing number 10)



Remove battery negative terminal connector.

A CHECK SOLENOID VALVE RELAY COIL RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit harness connector terminals 27 and 17.
Resistance: 80 - 90Ω

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

C Replace solenoid valve relay.

Repair harness between actuator and control unit.

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

C Replace solenoid valve relay.

D Check if solenoid valve relay fuse is blown.

Replace fuse.

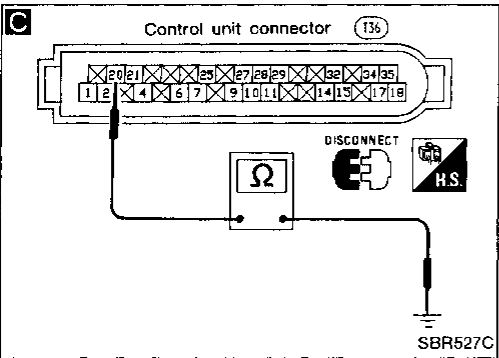
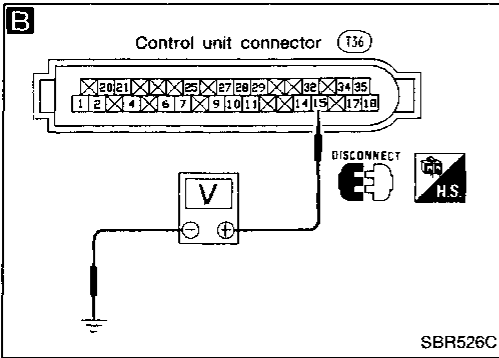
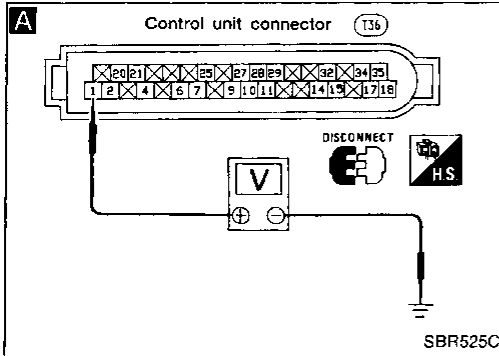
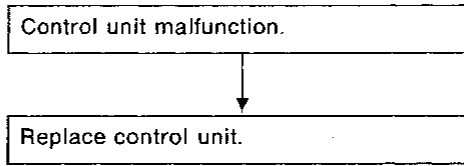
Perform Electrical Components Inspection — ACTUATOR. (See page BR-48.)

Replace control unit.

Replace actuator.

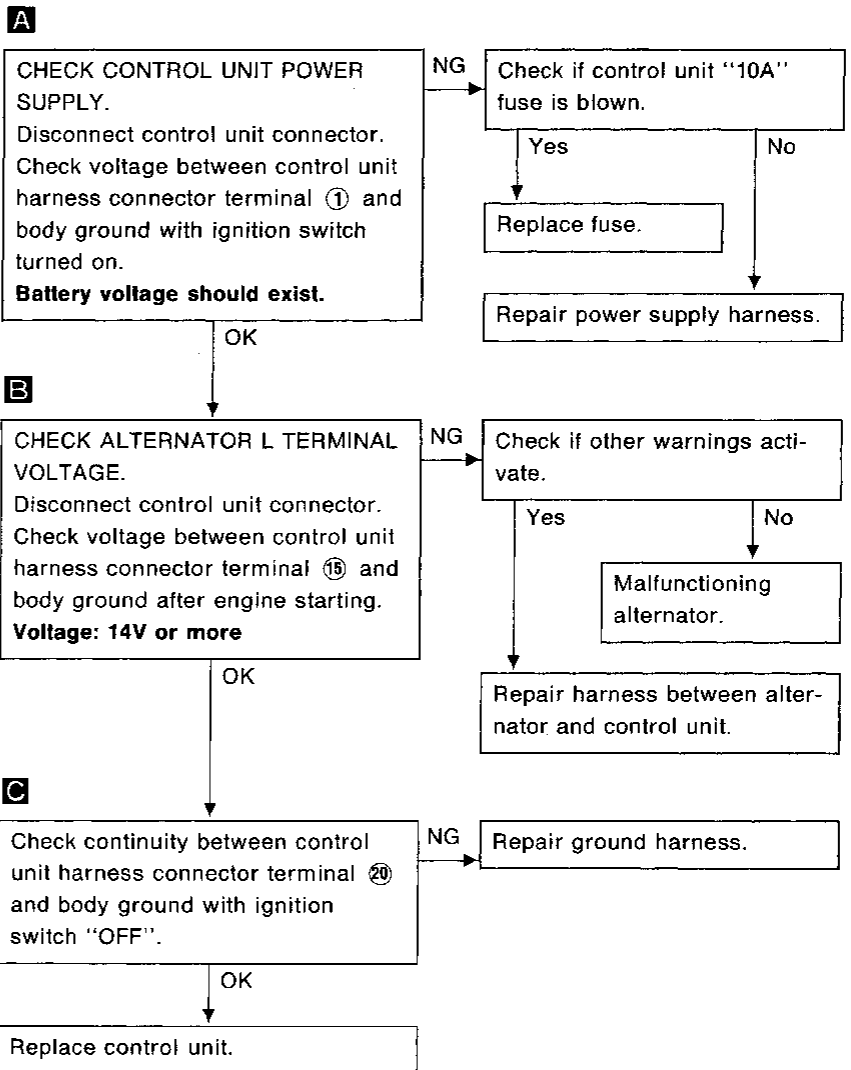
Diagnostic Procedure 10

CONTROL UNIT (LED flashing number 16)



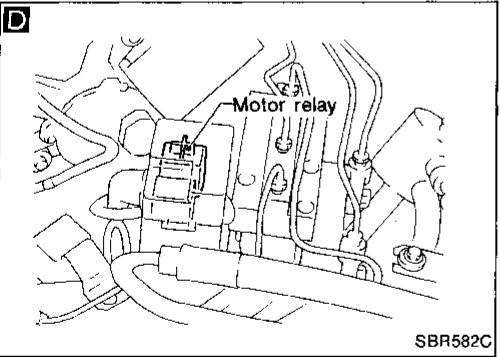
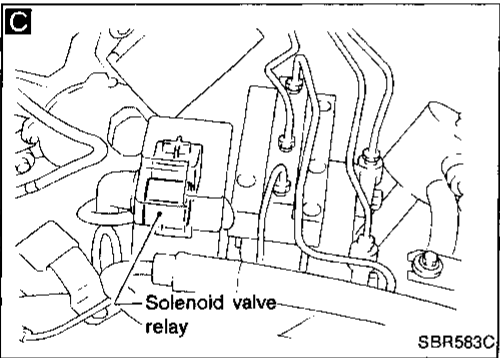
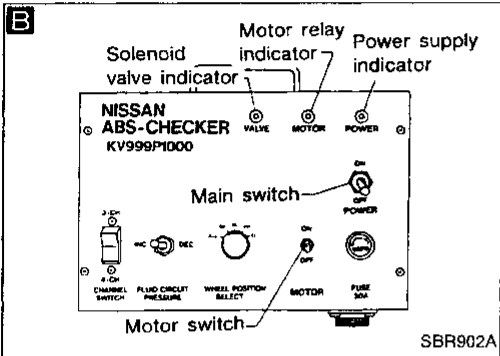
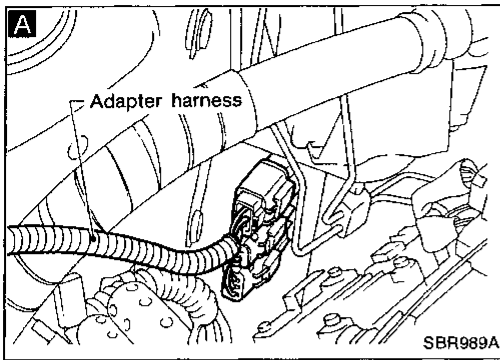
Diagnostic Procedure 11

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



Electrical Components Inspection

ACTUATOR (Not self-diagnostic item)



A
Connect ABS checker to actuator connector and vehicle harness. While doing this, be sure to have battery terminal connected and all checker switches turned off.
Use harness for 3 channel.
Set channel select switch to 3 channel.

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

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

B
Check checker valve relay indicator for coming on.

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

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

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

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

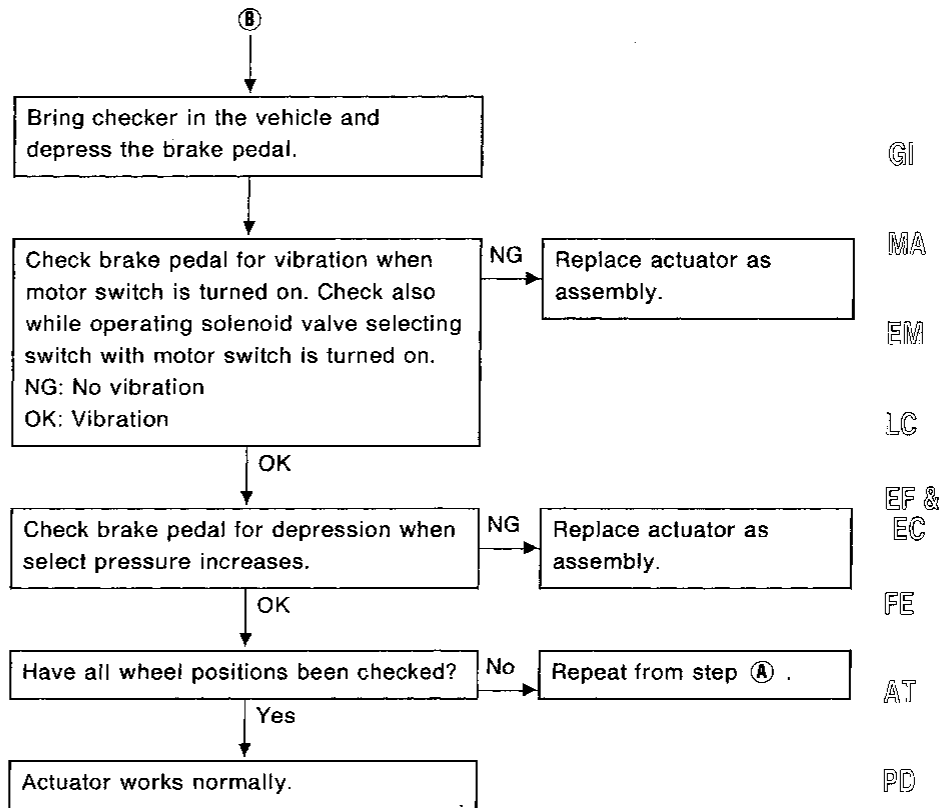
Check motor for operational sound beside the actuator in a quiet place.

No → Replace actuator as assembly, if Diagnostic Procedures 6 - 11 are already performed and checker connection is correct.

⑧

TROUBLE DIAGNOSES FOR ABS

Electrical Components Inspection (Cont'd)



CAUTION:

Do not set checker at pressure decrease position for more than 5 seconds at a time. Actuator solenoid valve may be damaged.

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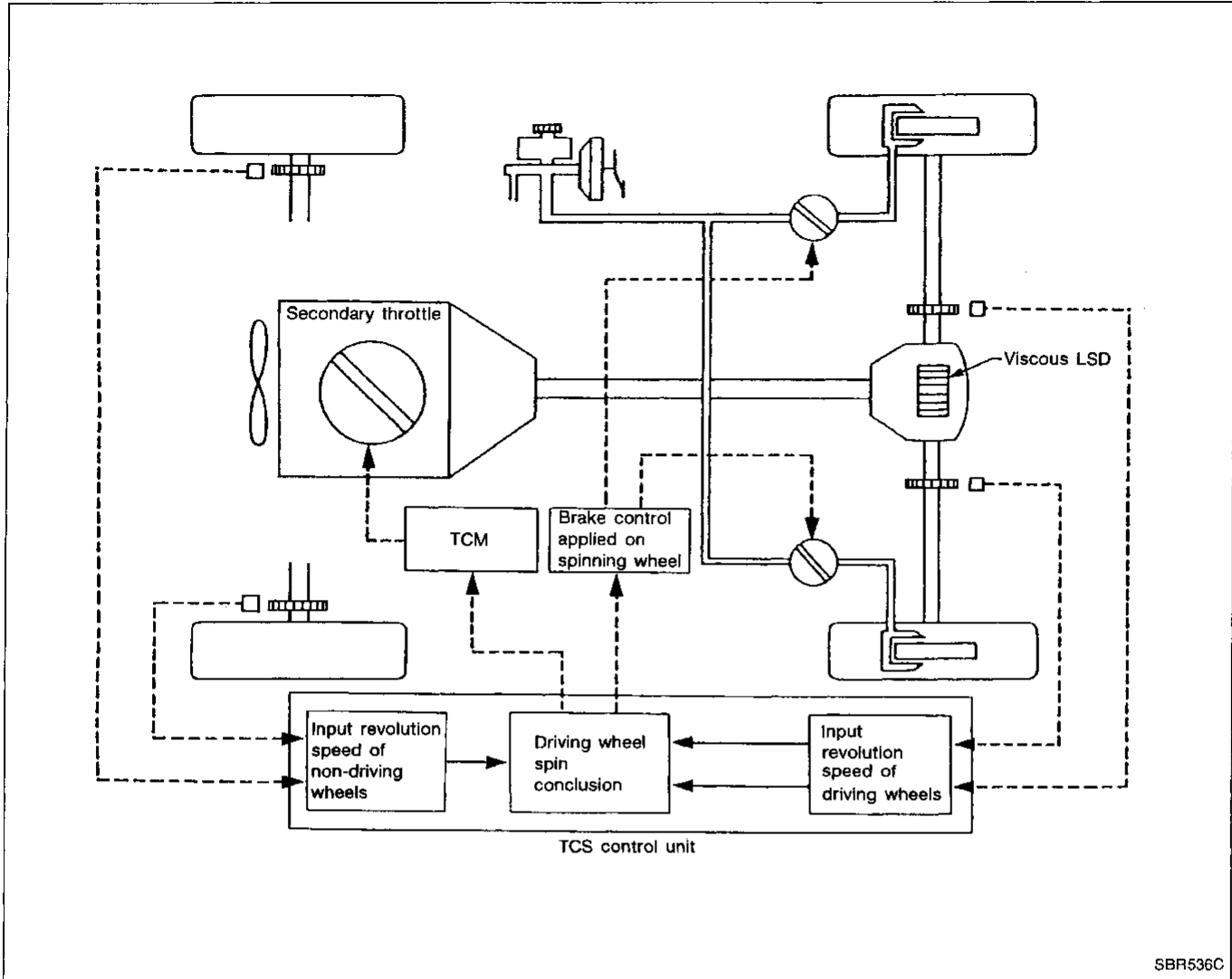
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Purpose of TCS



SBR536C

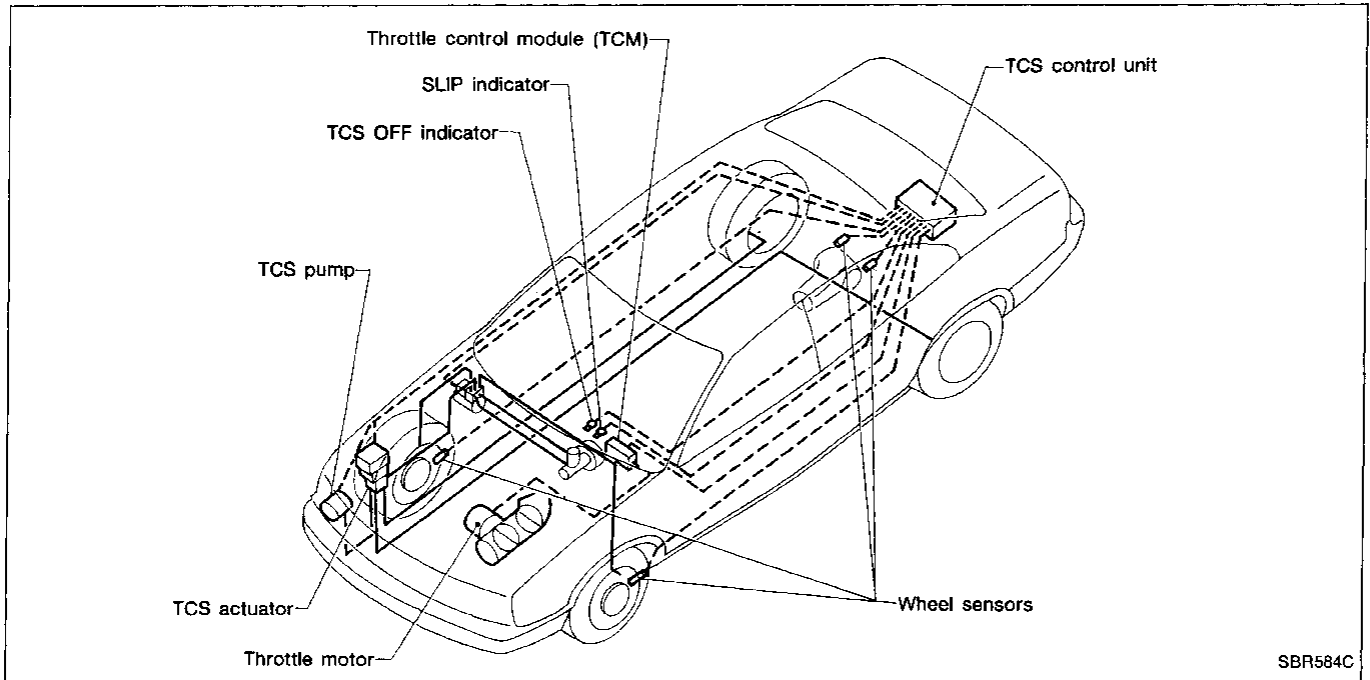
If a driver tries to accelerate hard on a slippery road, the driving wheels will start to spin. This will reduce the rate of acceleration and the vehicle's stability.

The TCS uses engine throttle control. It also uses an advanced system for individual control of the rear left and right brakes. TCS puts an appropriate amount of brake force on the spinning wheel, thus forcing the spin to end. There is also Rear Viscous LSD. This neutralizes wheel spin occurring on uneven surfaces or when accelerating while turning.

If both rear wheels should spin simultaneously, the system prevents the engine from applying further torque. It does this by closing the throttle.

The TCS plus Rear Viscous LSD has brought on new levels of cornering performance and traction. This, combined with improved control of the driving wheels, is a vital factor in relieving the driver of stress. At the same time, the driver retains firm control of the car.

System Components



TCS consists of the following components: 1) Wheel sensors 2) TCS control unit 3) Throttle control module (TCM) 4) Throttle motor 5) TCS actuator 6) SLIP indicator 7) TCS OFF indicator.

Wheel speed sensors

Measure individual revolution speed of each wheel.

TCS control unit

Evaluates factors such as wheel slip and road and driving conditions. Evaluation is made on the basis of input signals from wheel sensors and other sources, sending control signals to TCS actuator. The TCS control unit is provided with both self-diagnosis and fail-safe functions. When a malfunction in TCS is detected, the system releases its control over throttle and brakes. It then automatically changes into fail-safe mode.

In addition, this unit possesses ABS function.

Throttle control module (TCM)

Receives requesting signals from TCS control unit and drives throttle motor. Throttle motor optimally controls the degree of opening of secondary throttle.

TCM is also provided with both self-diagnosis and fail-safe functions. This module can be diagnosed by CONSULT. In fail-safe mode, TCS control unit is alerted and control of the throttle function is immediately released.

Throttle motor

Opens and shuts secondary throttle, positioned upstream of the throttle, in accordance with TCM signals. The engine drive torque is thereby regulated.

TCS actuator

Controls the degree of wheel spin according to the signal from TCM control unit. The degree is controlled by increasing, holding or decreasing the individual brake fluid pressure of the left and right rear brakes.

SLIP indicator

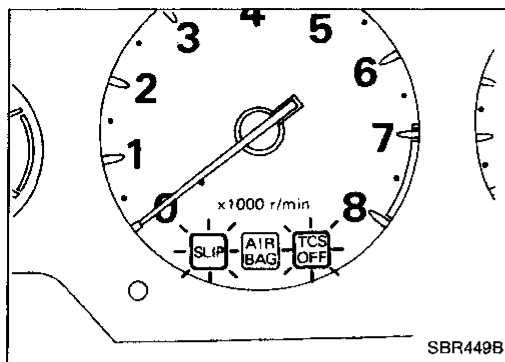
Lights when the TCS is operating, thus alerting the driver to the fact that road surface is slippery. It also warns the driver when the vehicle is nearing its limits of stability.

TCS OFF indicator

When the TCS cancel switch is turned ON, this indicator will light and the TCS will not operate.

When TCS control unit or TCM enters fail-safe mode, the SLIP indicator and the TCS OFF indicator will light. And/or ABS warning lamp will light.

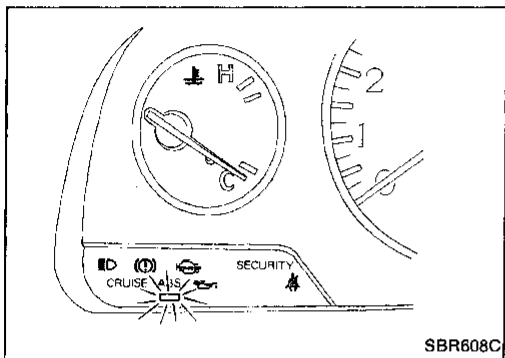
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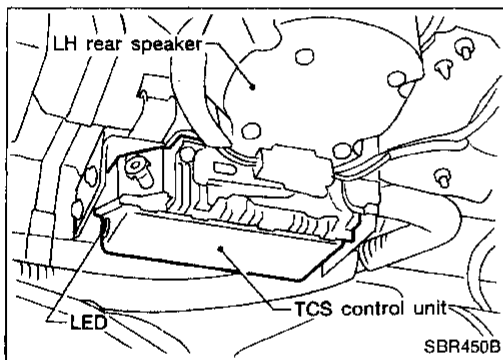
Components for TCS Brake System

TCS CONTROL UNIT

The control unit computes the rotating speed of each wheel using the signal current sent from the sensor. When the unit judges the "SLIP" for the driven wheel(s), it supplies a DC current of about 5A or 2A, or 0A to the TCS actuator pressure solenoid valve provided for each rear brake. The control unit also sends the secondary throttle valve opening signal to the throttle control module (TCM). The TCS control unit also has anti-lock brake system (ABS) control functions.



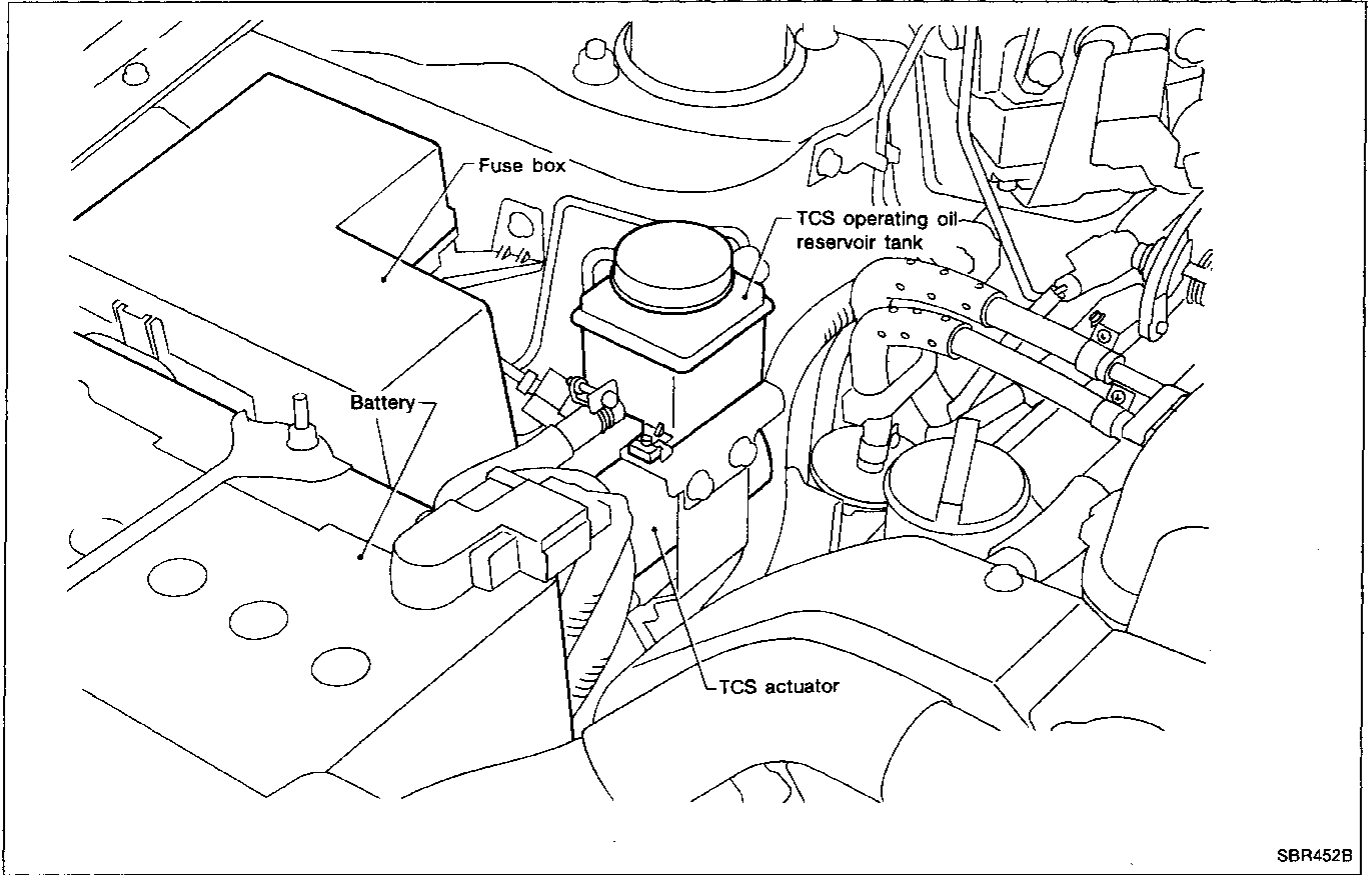
If an electrically detectable malfunction should occur in the system, it prompts the control unit to activate. The control unit will cause the SLIP and TCS OFF indicators, and/or ABS warning lamp to light up. It also causes the LSD indicator to flash the number of times which corresponds to the malfunction location. In this condition, the TCS and/or ABS will be deactivated by the control unit.



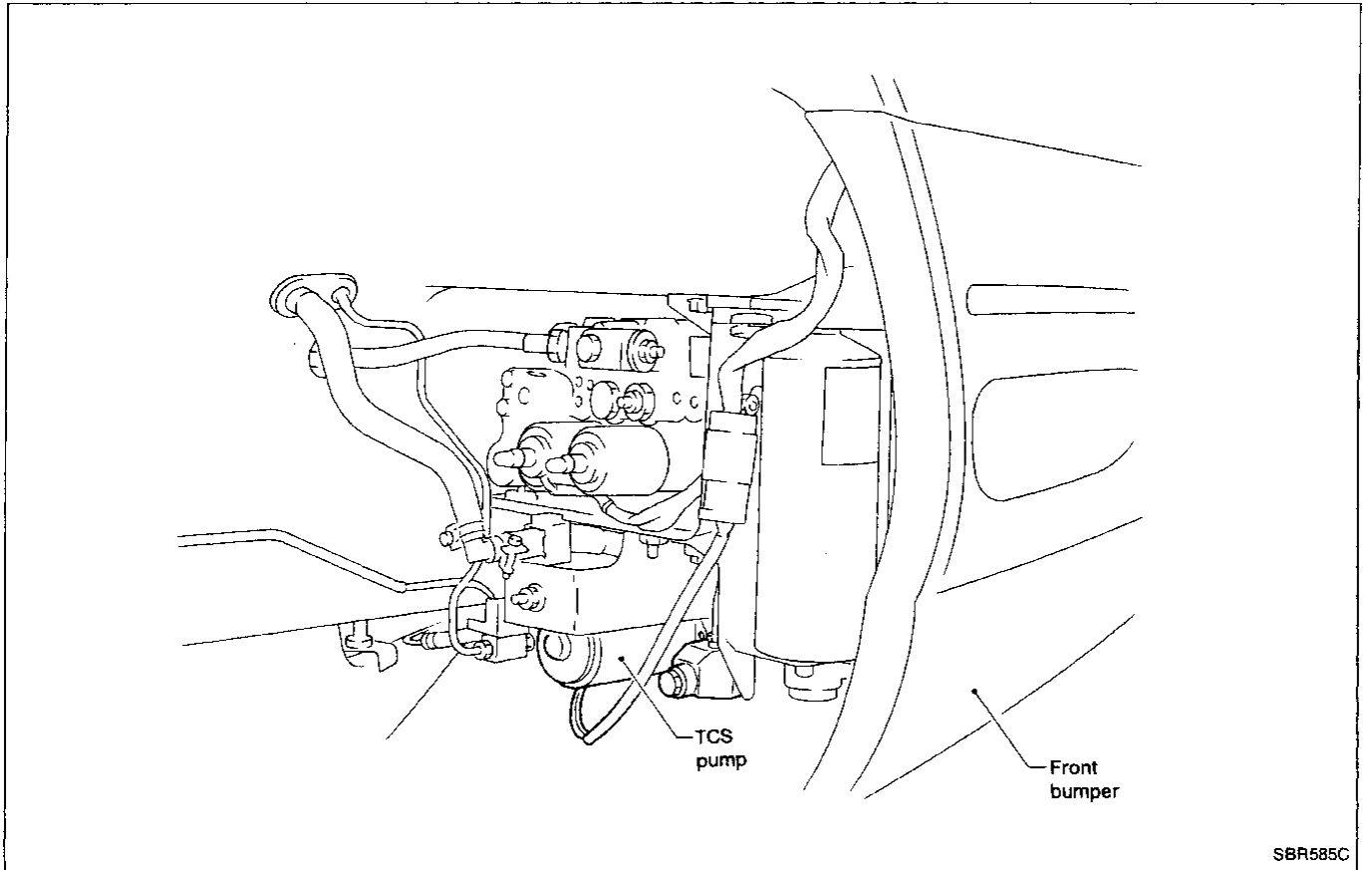
TRACTION CONTROL SYSTEM — TCS —

Components for TCS Brake System (Cont'd)

TCS ACTUATOR



TCS PUMP



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TRACTION CONTROL SYSTEM — TCS —

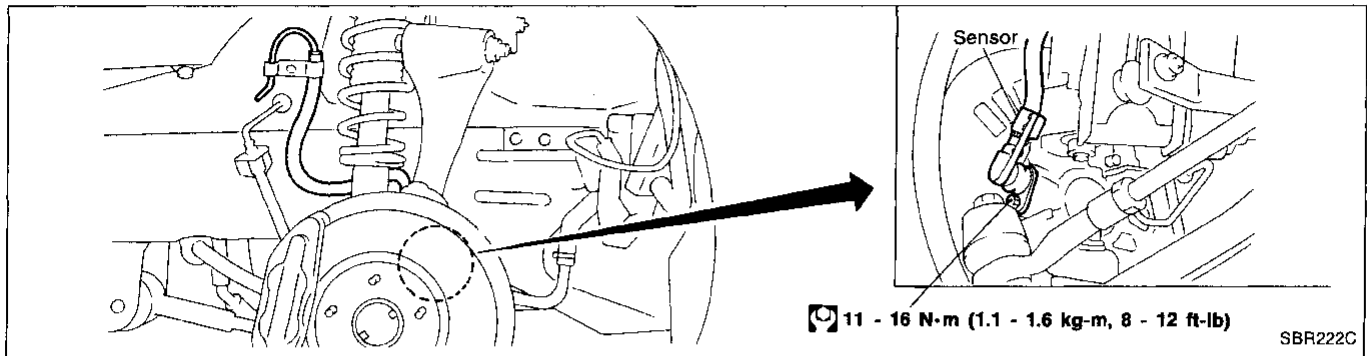
Components for TCS Brake System (Cont'd)

CAUTION:

When removing the front wheel hub or final drive assembly, 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.

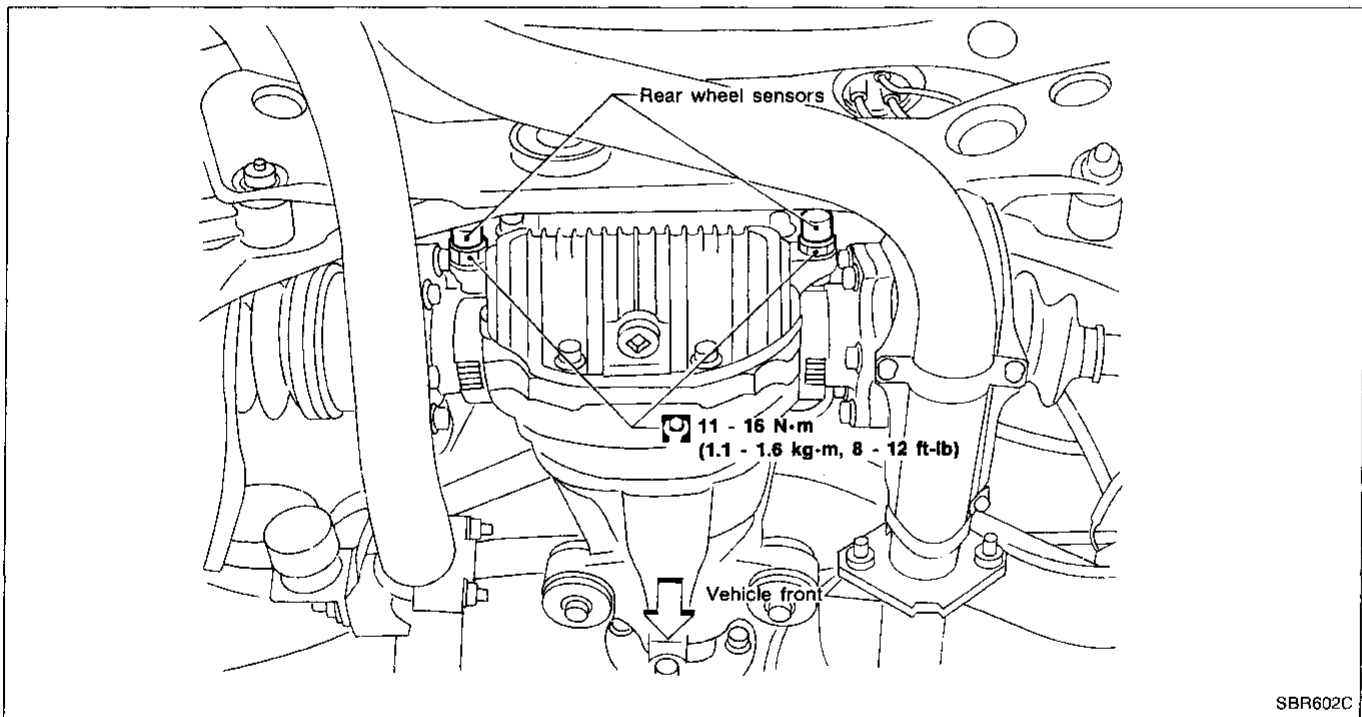
FRONT WHEEL SENSOR

The front wheel sensors are the same as the ones for the ABS.



REAR WHEEL SENSOR

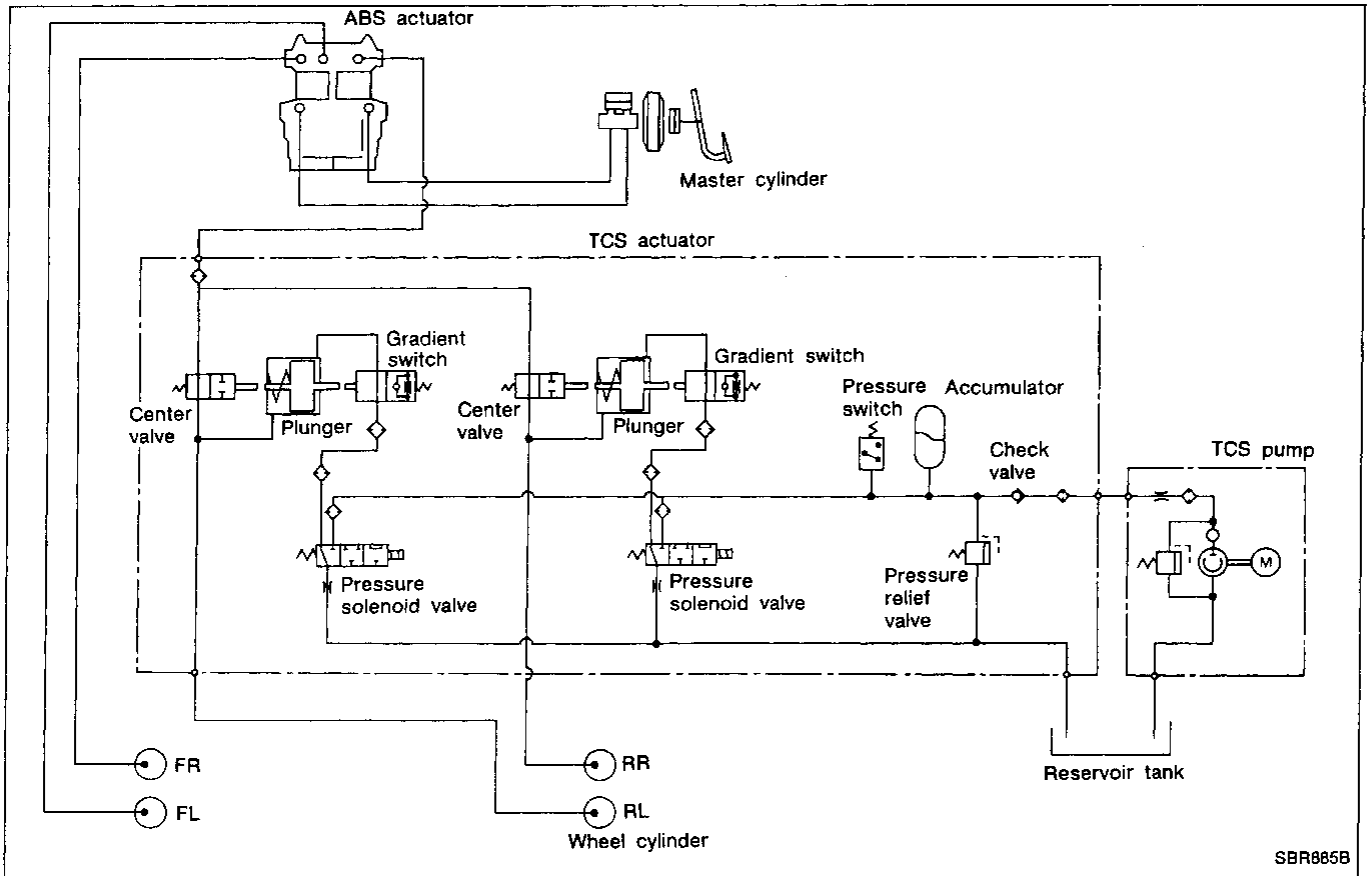
2 wheel sensors are located on both the left and right side flanges individually.



TRACTION CONTROL SYSTEM — TCS —

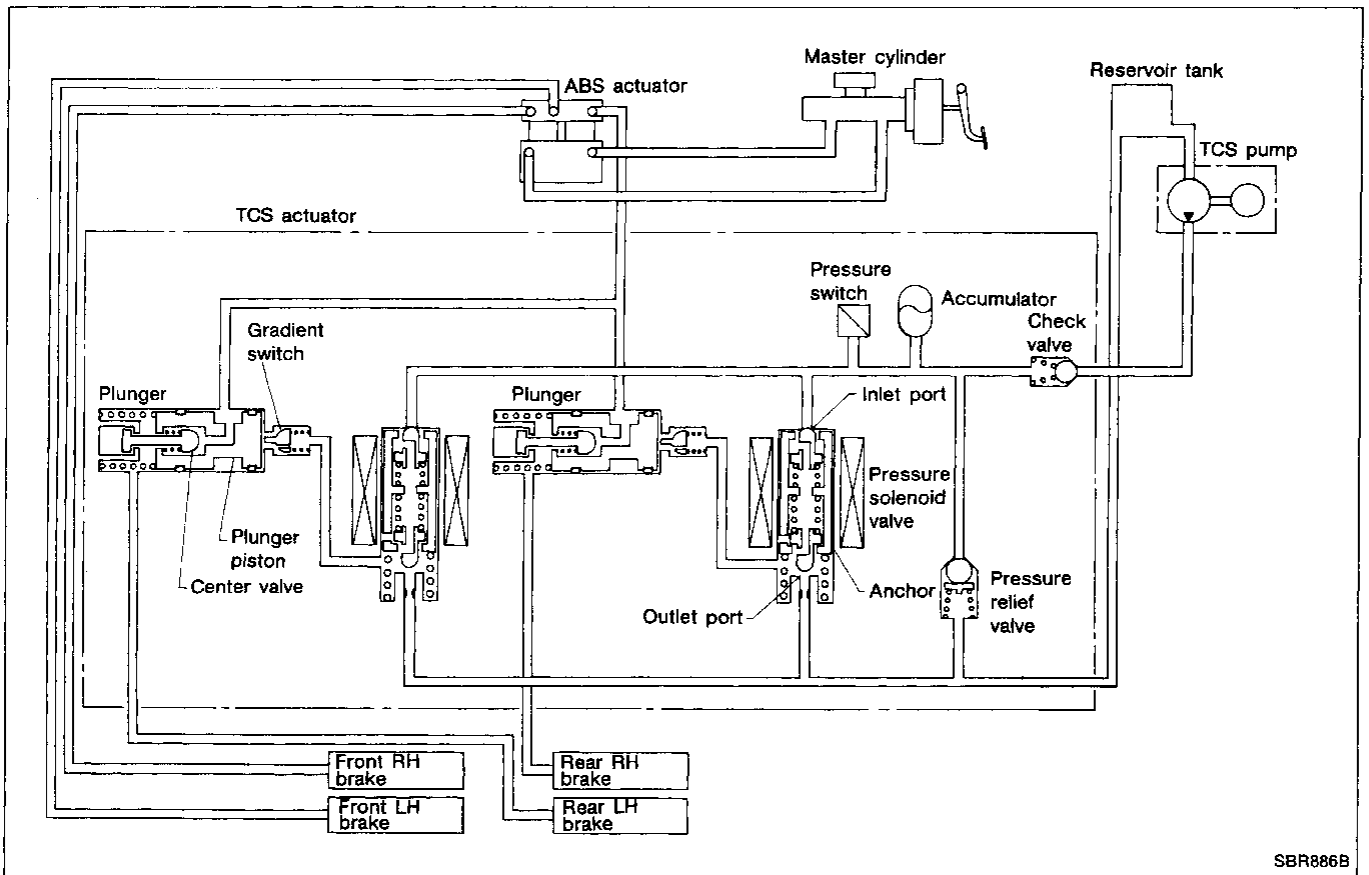
Components for TCS Brake System (Cont'd)

TCS ACTUATOR HYDRAULIC CIRCUIT DIAGRAM



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TCS HYDRAULIC CIRCUIT OPERATION



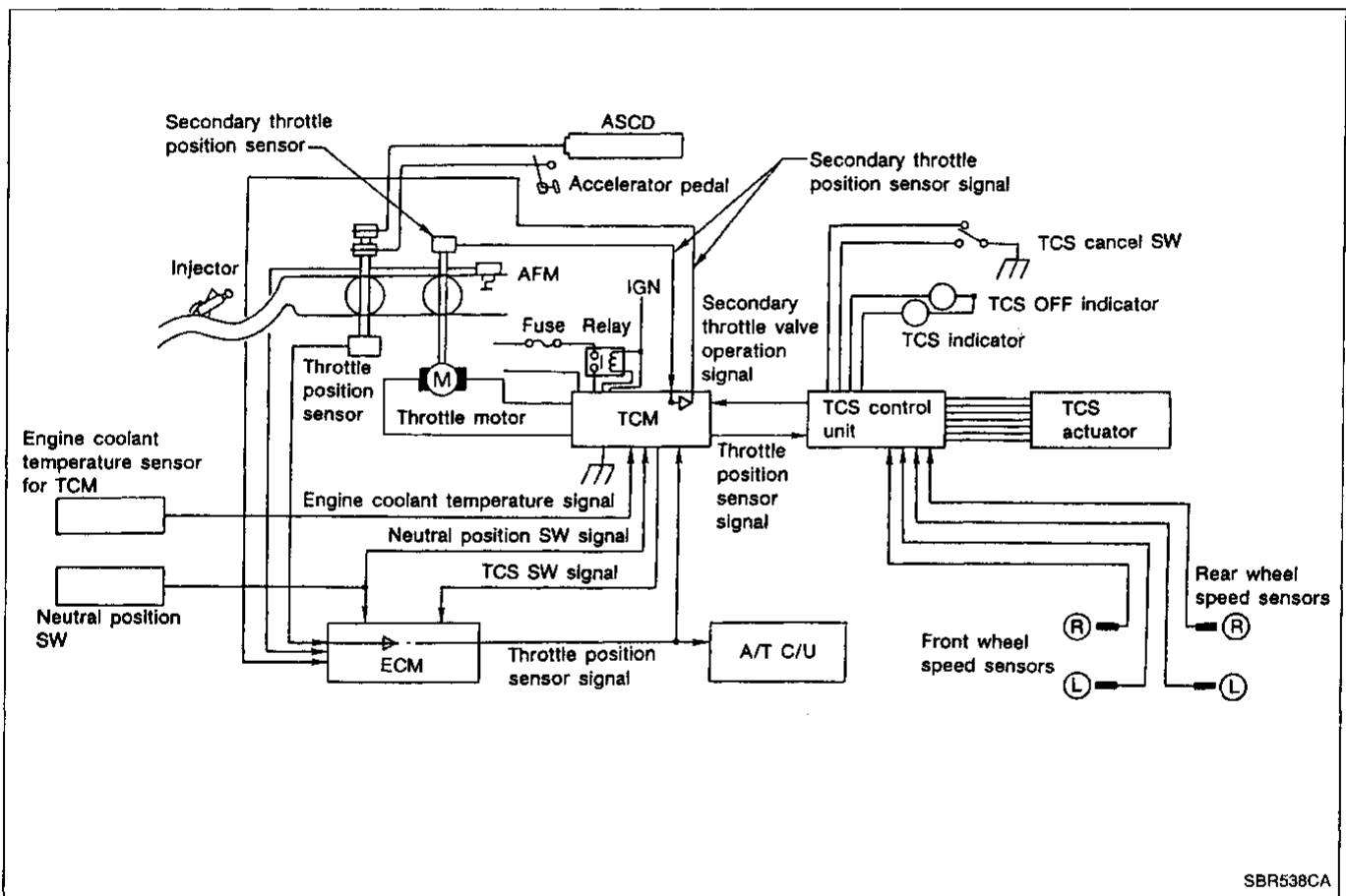
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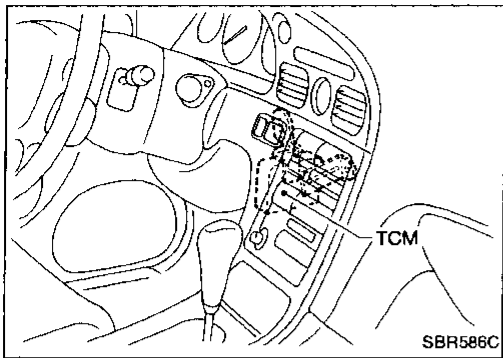
Throttle Valve Control System for TCS

This system has a secondary throttle valve which is opened/closed by a throttle motor. This is in addition to the primary throttle valve linked to the accelerator pedal. The opening angle of this valve is feedback controlled by the secondary throttle sensor.

The secondary throttle valve is normally kept in the fully opened position. When a slip of the drive wheels is detected by the wheel sensor, the TCS control unit controls braking operation. It also determines the optimum opening position of the secondary throttle valve. The TCM then closes the secondary throttle valve to the correct position according to this information. It then reduces the engine output torque, and so avoids occurrence of slip. The TCS control unit needs the primary throttle valve position signal to determine the secondary throttle valve opening position. The TCM receives the throttle sensor position signal through the ECCS control module (ECM), and the TCM sends the signal to the TCS control unit. If the TCM detects trouble in the throttle valve control system, it de-energizes a relay located up-stream of the throttle motor power supply. The secondary throttle valve is then opened fully by means of a return spring. In this case, ordinary vehicle operation is assured by the functioning of the primary throttle valve. At the same time, the TCM stops sending the throttle position sensor signal to the TCS control unit.

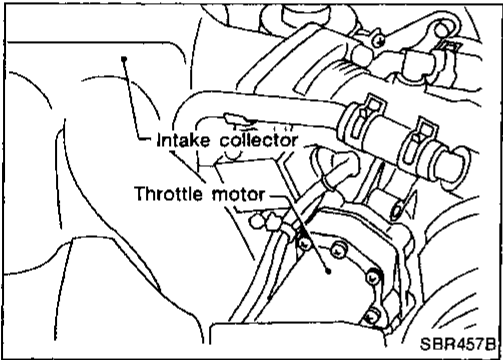
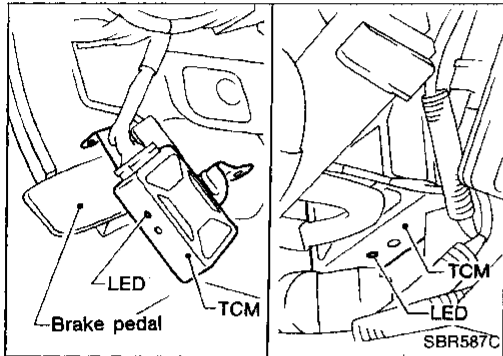
Engine + Brake TCS System Configuration



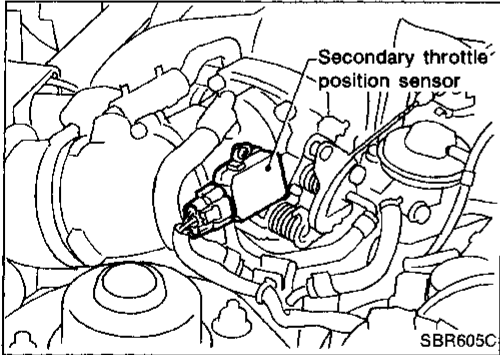


Component

TCM (Throttle Control Module)



THROTTLE MOTOR



SECONDARY THROTTLE POSITION SENSOR

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Throttle Memory Function

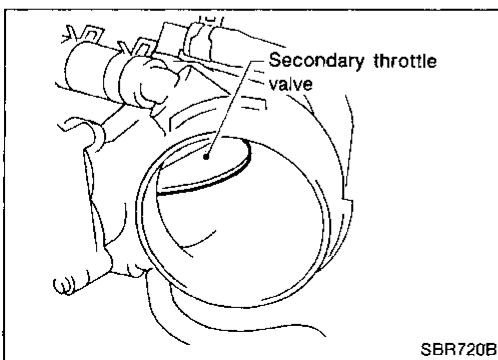
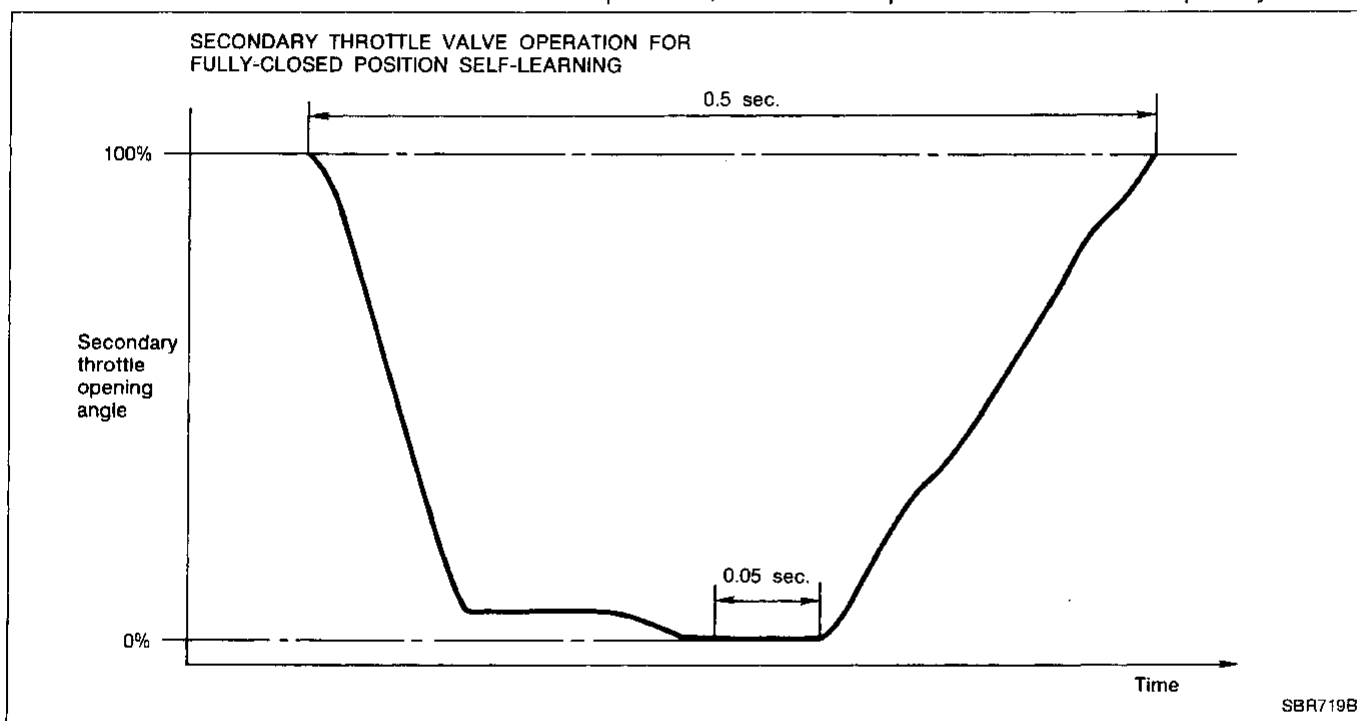
The secondary throttle valve does not fully open. This occurs even when the TCS is turned off by the cancel switch or by the TCS itself. The secondary throttle valve opens wider than the primary throttle valve by the specified opening amount. Because the secondary throttle valve opens wider than the primary throttle valve, no adverse effect is caused during ordinary driving.

The secondary throttle valve opening is smaller than the primary throttle valve only when the TCS is operating.

Secondary Throttle Fully-closed Position Self-learning Control

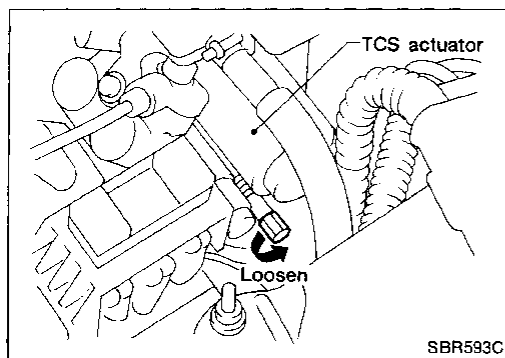
When a certain condition occurs with ignition switch ON, the TCM checks for operation of the throttle control system. It does this by fully closing the secondary throttle and then opening it fully. Simultaneously, the TCM reads the secondary throttle position sensor output values at both the fully closed/opened positions. This data is used for self-diagnosing the secondary throttle driving system. The same data is also used for improving the control accuracy of the secondary throttle.

This learning control is performed at the moment the ignition switch is turned ON under conditions: Automatic transmission is set in "N" or "P" position; Accelerator pedal is released completely.



WARNING:

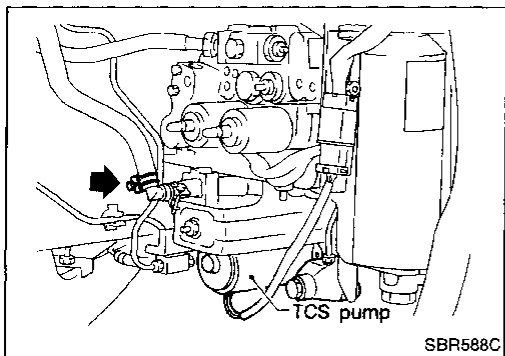
Before touching the secondary throttle valve, be sure to disconnect the throttle valve motor connector. Failure to do so may cause injury due to accidental actuation of the valve.



Removal and Installation of TCS Actuator

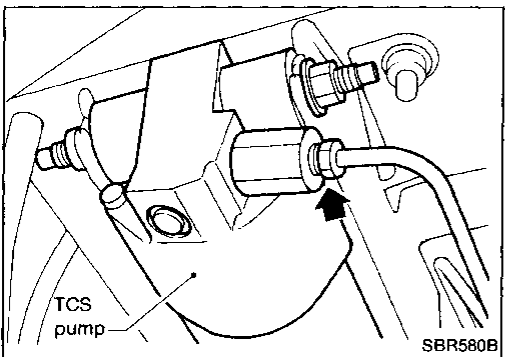
WARNING:

Loosen bleeder of TCS actuator before disconnecting TCS operating oil circuit. This prevents any injury by pressurized oil stored in TCS actuator.



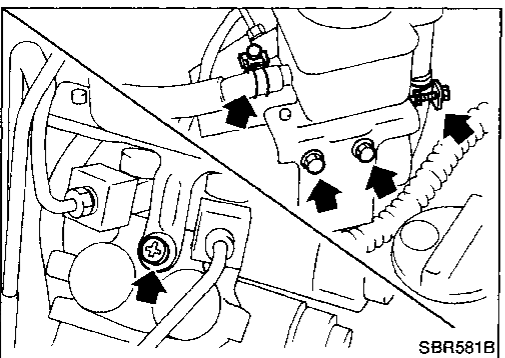
CAUTION:

- Bleed air not only from TCS operating oil circuit but also from brake fluid line.
- Be careful not to splash brake fluid and TCS operating oil on the painted areas. It may cause paint damage. If either fluid is splashed on painted areas, wash it away with water immediately.

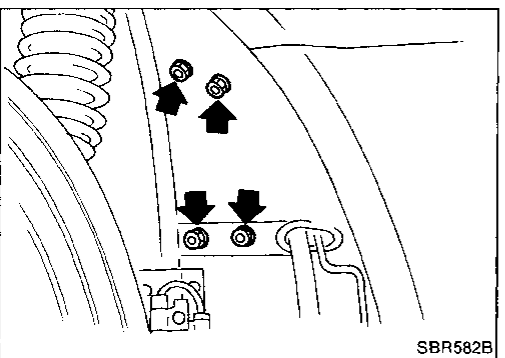


REMOVAL

1. Loosen bleeder for TCS actuator.
2. Drain brake fluid from each rear brake air bleeder valve.
3. Drain TCS operating oil from hose and tube connecting portion, and from outlet of TCS pump as shown.



4. Remove battery and relay box.
5. Remove bolts and hose, and take away reservoir tank with bracket.



6. Disconnect connectors from TCS actuator.
7. Disconnect brake tube (4 portions) from TCS actuator.
8. Remove mounting nuts as shown.
9. Take away TCS actuator with bracket.

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Removal and Installation of TCS Actuator (Cont'd)

INSTALLATION

CAUTION:

- Refill with new brake fluid "DOT 3".
 - Use new brake fluid "DOT 3" for TCS operating oil.
 - Bleed air from brake fluid line and TCS operating oil circuit.
- Installation procedures are in reverse order of removal.

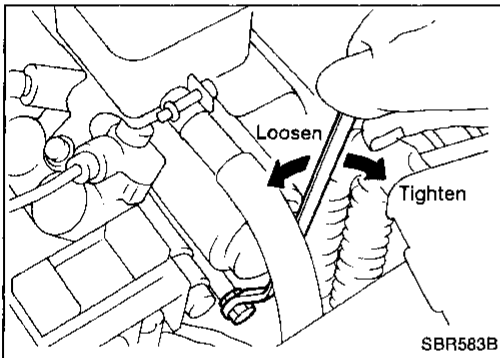
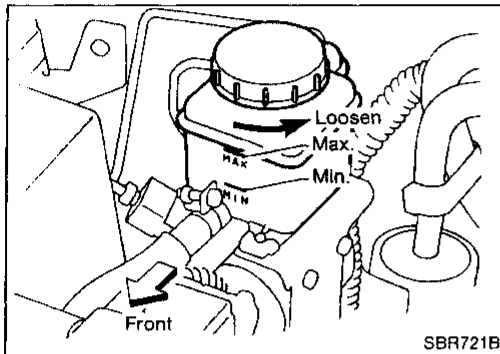
Tightening torque for M8 nut:

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


Air Bleeding for TCS

CAUTION:

- Use new brake fluid "DOT 3" for TCS operating oil.
- Pay attention so as not to damage battery cable and hose for TCS during air bleeding.
- After bleeding air from TCS operating oil circuit, oil level in reservoir tank will be slightly lower. In such a case, do NOT add oil; it may cause oil leaks from reservoir tank.



1. Loosen bleeder of TCS actuator.
2. Refill oil up to MAX. on reservoir tank, but do not fasten cap.
3. Start engine. (at this time, TCS pump operates.)
4. Tighten bleeder by nearly specified torque, and 3 to 5 seconds later (TCS pump has stopped), stop engine.
5. Start engine again and loosen bleeder. At this time, watch oil in reservoir tank.
6. Repeat steps 4 and 5 until oil returning to reservoir tank does not contain air bubbles.
7. Tighten bleeder to specified torque.

: 12.0 - 15.9 N·m (1.22 - 1.62 kg·m, 8.8 - 11.7 ft-lb)

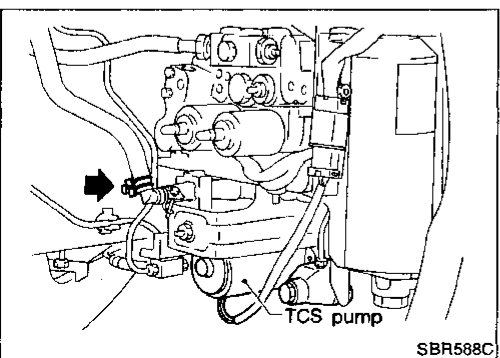
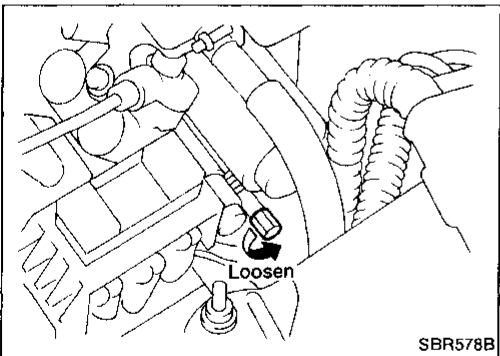
Removal and Installation of TCS Pump

WARNING:

Loosen bleeder of TCS actuator before disconnecting TCS operating oil circuit. This prevents any injury by pressurized oil stored in TCS actuator.

CAUTION:

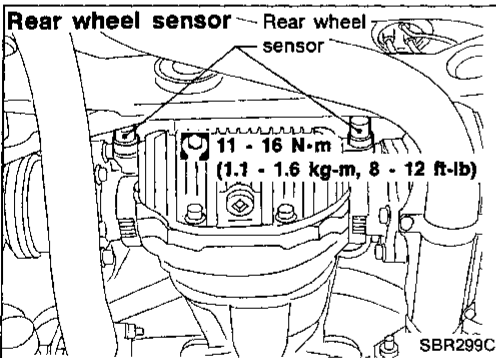
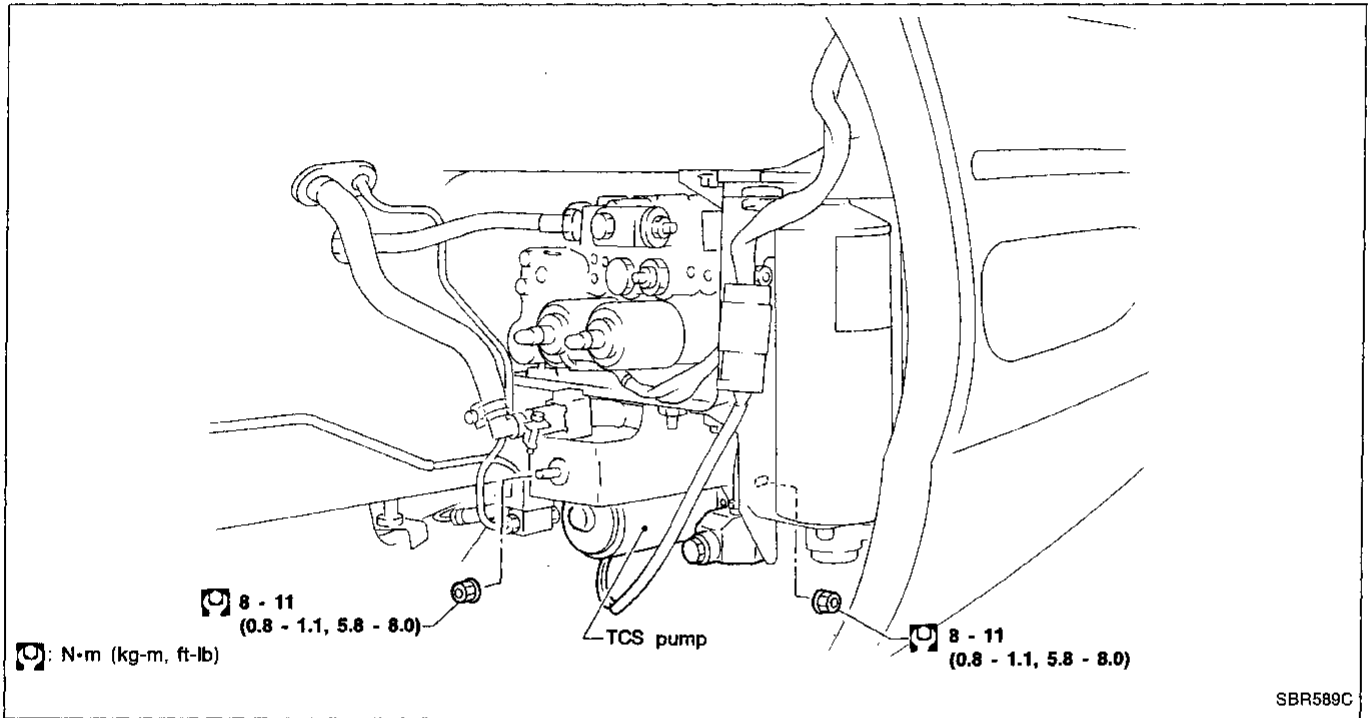
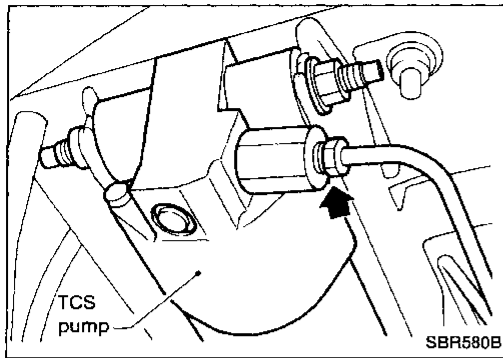
Be careful not to splash TCS operating oil on painted areas; it may cause paint damage. If TCS operating oil is splashed on painted areas, wash it away with water immediately.



1. Drain TCS operating oil as shown.
 - 1) Disconnect hose between reservoir tank and TCS pump.
 - 2) Disconnect tube between TCS actuator and TCS pump (See next page).
2. After installation, bleed air from TCS operating oil circuit.

TRACTION CONTROL SYSTEM — TCS —

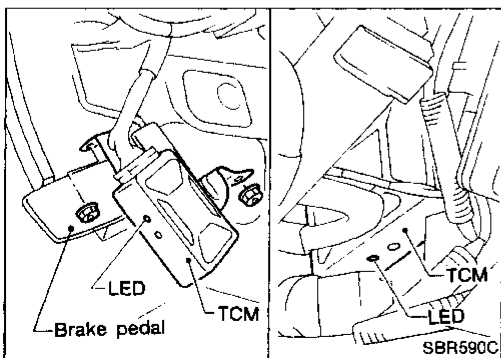
Removal and Installation of TCS Pump (Cont'd)



Removal and Installation of Rear Wheel Sensor

CAUTION:

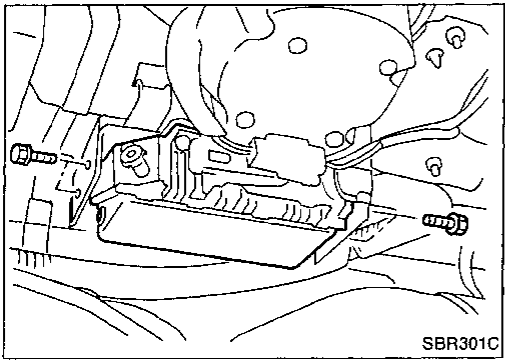
When the final drive assembly or rear axle assembly needs to be removed, disconnect the ABS wheel sensor from the assembly. Then move it away from the final drive/rear axle assembly area. Failure to do so may result in the sensor wires being damaged making the sensor inoperative.



Removal and Installation of TCM

Refer to "INSTRUMENT PANEL" in BF section for details.
 Remove A/T finisher and ashtray assembly.
 Remove cluster lid C.
 Remove cluster lid D.
 Remove lower instrument cover on driver side.
 Remove TCM.

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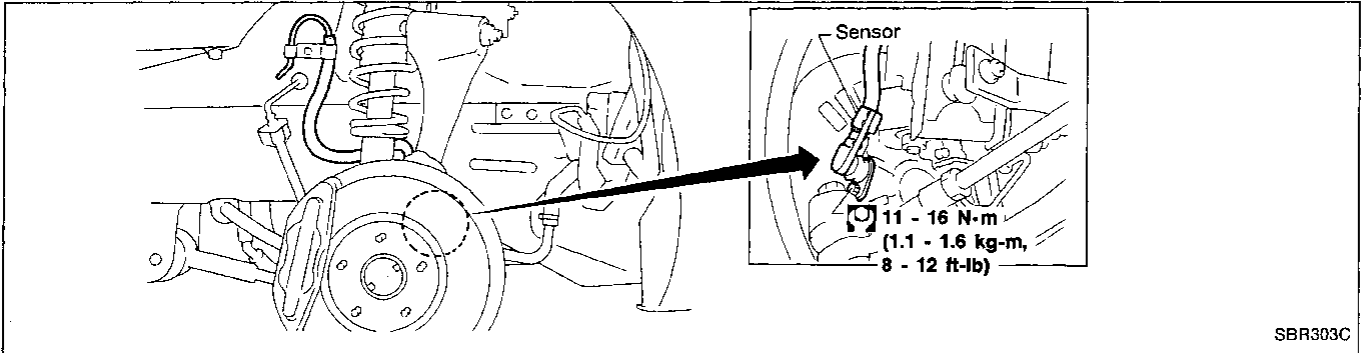


Removal and Installation of TCS Control Unit

Removal and Installation of Front Wheel Sensor

CAUTION:

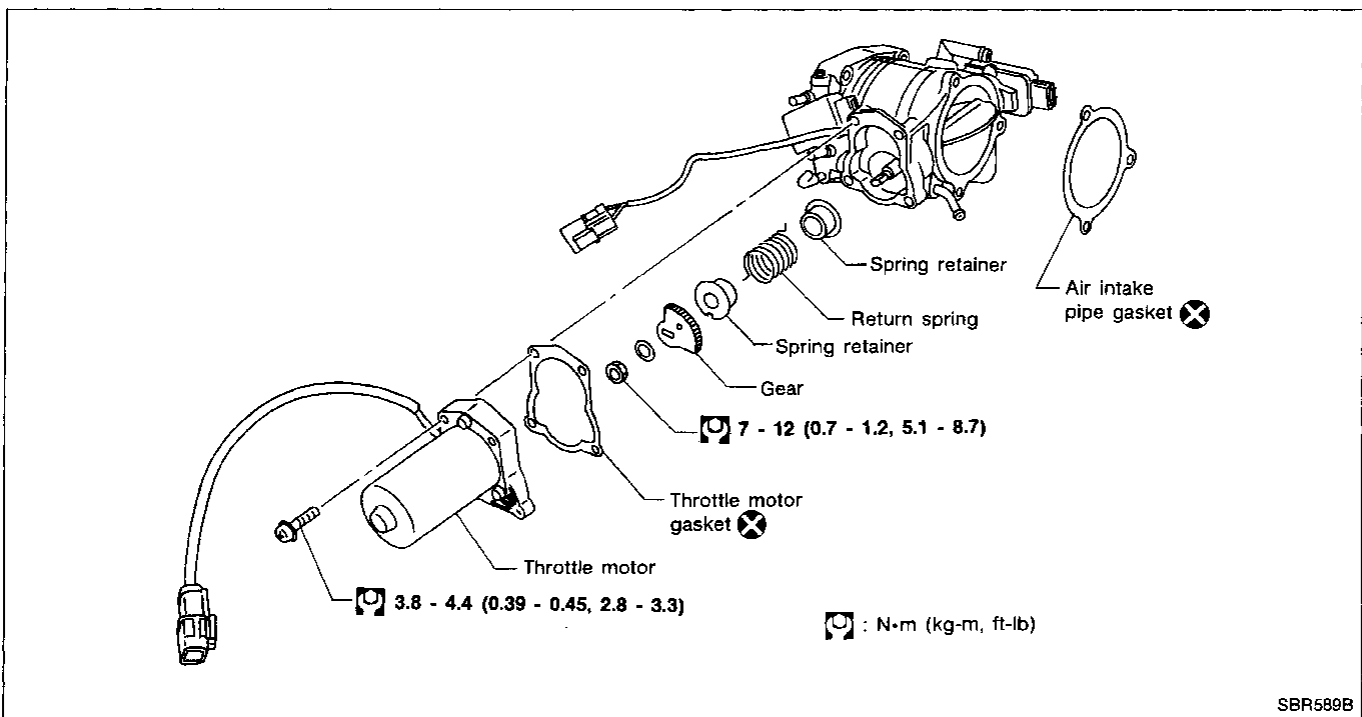
When removing the wheel hub assembly, disconnect the ABS wheel sensor from the assembly and move it away. Failure to do so may result in the sensor wires being damaged making the sensor inoperative.



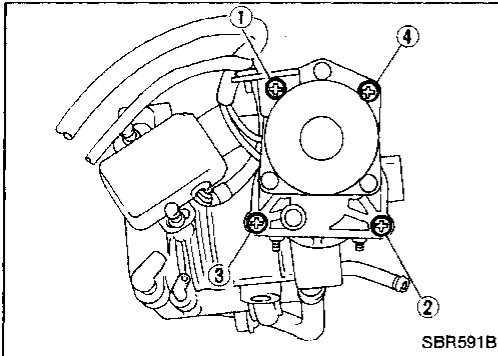
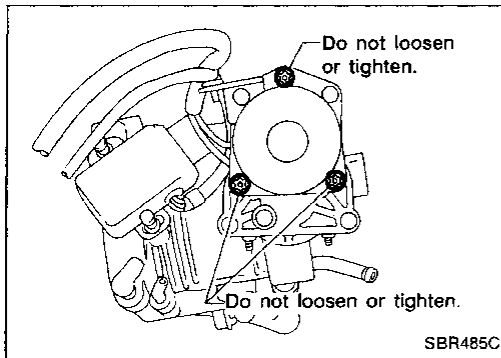
Removal and Installation of ABS Actuator

Refer to "ANTI-LOCK BRAKE SYSTEM". (BR-28)

Removal and Installation of Throttle Motor



Removal and Installation of Throttle Motor (Cont'd)



WARNING:

Before touching the secondary throttle valve, be sure to disconnect the throttle valve motor connector. Failure to do so may cause injury due to accidental actuation of the valve.

CAUTION:

- Always replace throttle chamber gasket with a new one.
- Never loosen or tighten painted screws as shown.

- Tighten throttle chamber mounting bolts in numerical order.

Adjustment for Secondary Throttle Position Sensor

WARNING:

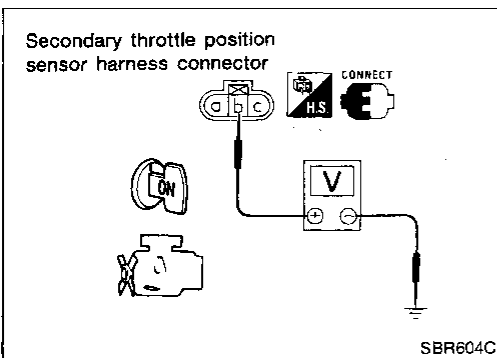
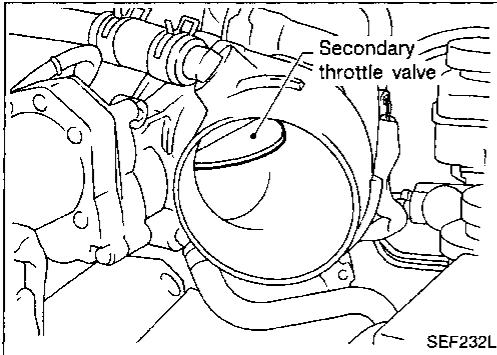
Before touching the secondary throttle valve, be sure to disconnect the throttle motor connector. Failure to do so may cause injury due to accidental actuation of the valve.



1. Perform secondary throttle position sensor adjustment in WORK SUPPORT.
2. Adjust sensor position by referring to the table shown below.



1. Disconnect rubber air duct.
2. Install secondary throttle position sensor body in throttle body.
Do not tighten bolts.
3. Disconnect throttle motor harness connector.
4. Connect secondary throttle position sensor harness connector.
5. Turn ignition switch "ON".



6. Make sure that voltage between terminal **(b)** and ground changes when closing secondary throttle valve by hand.

Secondary throttle valve condition	Voltage (V)
Fully open	4.4 - 4.6
Partially open	0.4 - 4.6
Fully closed	0.4 or more

7. Adjust sensor position if necessary.

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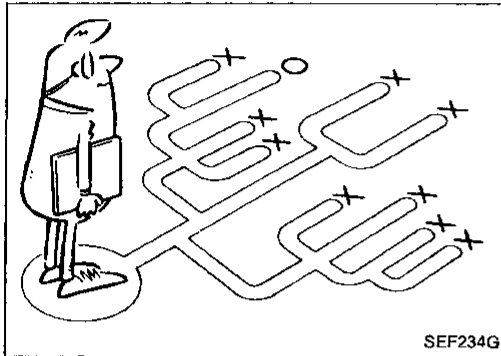
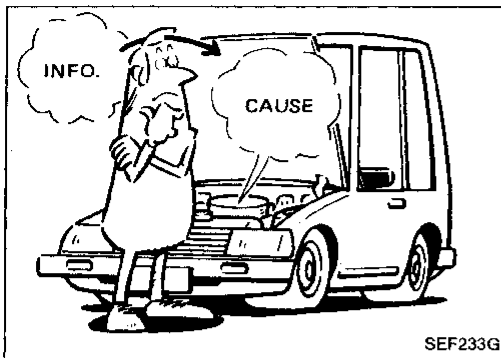
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TROUBLE DIAGNOSES FOR TCS

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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The TCS has two electronic control units. One is called the TCS control unit. It is used to control the functions for applying left and right rear brakes individually, and for the ABS. The other is the throttle control module (TCM) which is used to control the throttle opening. The control units accept input signals from sensors and instantly drive actuators. It is essential that both kinds of signals are proper and stable. Also there should be no such conventional problems as oil leaks in the TCS operating circuits. Nor should there be 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 carried out.

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

It is strongly recommended that the TCS control unit be checked for electrical problems first. Then check the TCM.

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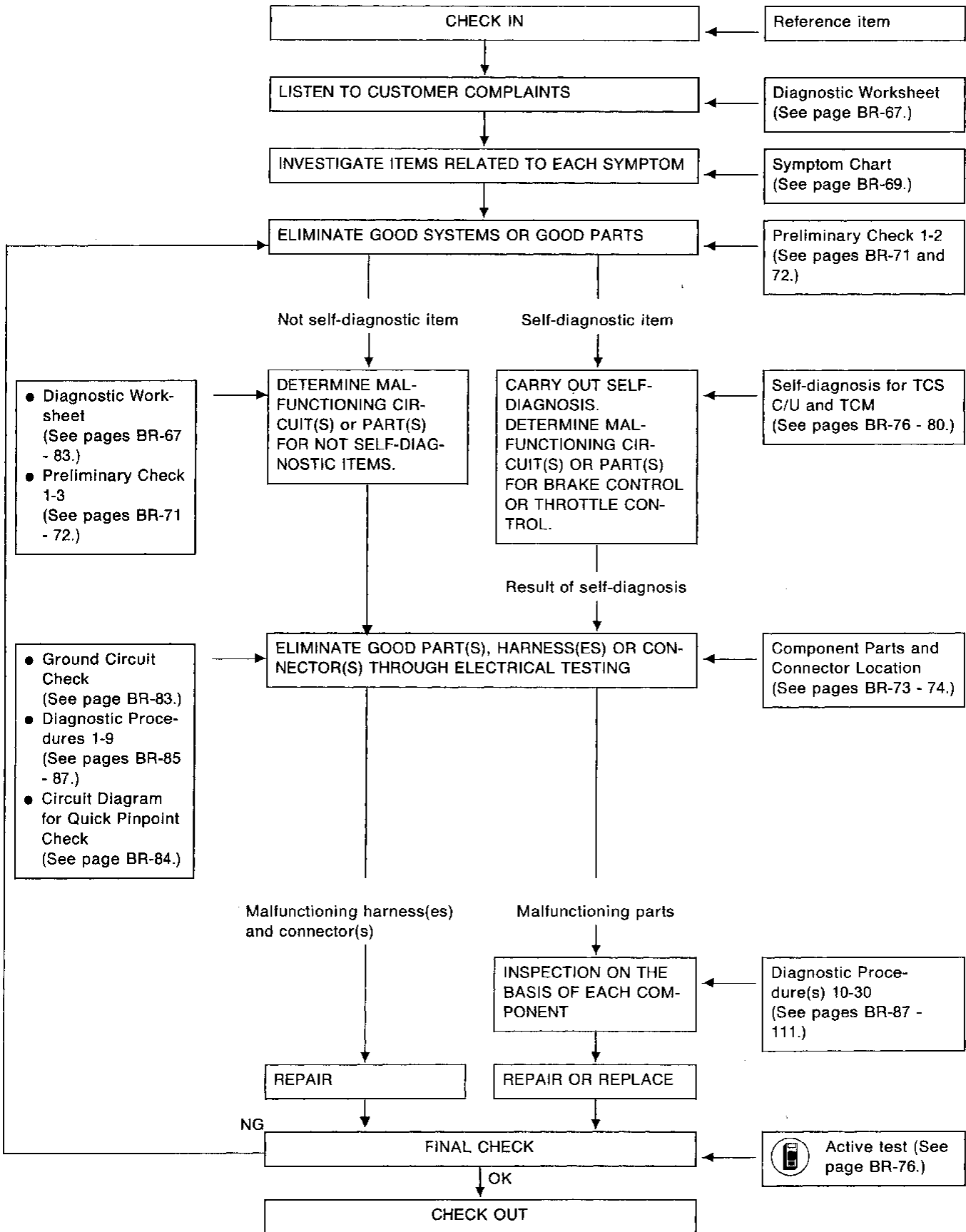
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TROUBLE DIAGNOSES FOR TCS

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

WORK FLOW



TROUBLE DIAGNOSES FOR TCS

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

KEY POINTS

WHAT Vehicle model
WHEN Date, Frequencies
WHERE Road conditions
HOW Operating conditions,
Weather conditions,
Symptoms

SBR339B

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to customer complaints, even if the system is normal.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

It is important to fully understand the symptoms or under what conditions a customer complains.

Make good use of a diagnostic worksheet as shown below in order to utilize all the complaints for troubleshooting.

Worksheet sample

Customer name MR/MS	Model & Year	VIN	
Engine #	Trans.	Mileage	
Incident Date	Manuf. Date	In Service Date	
Symptoms	<input type="checkbox"/> Noise and vibration (from engine compartment)	<input type="checkbox"/> Warning/Indicator activate	<input type="checkbox"/> Firm pedal operation
	<input type="checkbox"/> Noise and vibration (from axle)		<input type="checkbox"/> Large stroke pedal operation
	<input type="checkbox"/> TCS does not work (Rear wheels slip when accelerating)	<input type="checkbox"/> ABS does not work. (wheels slip when braking)	<input type="checkbox"/> Lack of sense of acceleration
Engine conditions	<input type="checkbox"/> When starting <input type="checkbox"/> After starting		
Road conditions	<input type="checkbox"/> Low friction road (<input type="checkbox"/> Snow <input type="checkbox"/> Gravel <input type="checkbox"/> Other) <input type="checkbox"/> Bumps/potholes		
Driving conditions	<input type="checkbox"/> Full-acceleration <input type="checkbox"/> High speed cornering <input type="checkbox"/> Vehicle speed: Greater than 10 km/h (6 MPH) <input type="checkbox"/> Vehicle speed: 10 km/h (6 MPH) or less <input type="checkbox"/> Vehicle is stopped		
Applying brake conditions	<input type="checkbox"/> Suddenly <input type="checkbox"/> Gradually		
Other conditions	<input type="checkbox"/> Operation of electrical equipment <input type="checkbox"/> Shift change <input type="checkbox"/> Other descriptions		

TROUBLE DIAGNOSES FOR TCS

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

When driving a TCS vehicle for the first time, the following phenomena may be felt somewhat uneasy as compared to driving a non-TCS vehicle. However, these phenomena are normal, and should not be considered as signs of trouble. The TCS may also be activated while certain service operations are performed.

Phenomenon	Explanation of phenomenon	Result
Motor operating sound	The TCS and ABS actuators are linked to motors. So, motor operating sound may be heard during activation of the TCS and ABS.	Normal
Sound from suspension area	During operation of the TCS or ABS, wheels are braked and released repeatedly. This may cause some sound from suspension area.	Normal
Activation of the TCS (SLIP indicator lights up.)	The TCS may be activated in the following conditions, if the wheel speed changes abruptly due to wide-open-throttle: 1. when shifting automatic transmission gears, 2. when driving on a surface where the friction coefficient changes largely (such as gravel, potholes, bumps, ice, puddles).	Normal
	The TCS may be activated in the following condition, even if the vehicle is stopping. (For example, when checking automatic transmission) When the position of the A/T shift lever is other than N or P, and the engine speed is increased.	Normal (When checking automatic transmission, it is necessary to cancel the TCS function using the TCS cancel switch.)
	The TCS is activated when a chassis dynamometer is used. With the type of chassis dynamometer which locks the front wheels, the TCS will be activated. And vehicle speed cannot be increased (in case of service inspection). This is because locking the front wheels with the rear wheels rotating is detected by the system as a slip.	Normal (When using a chassis dynamometer, it is necessary to cancel the TCS function using the TCS cancel switch.)
ABS activation	The ABS may be activated in the following conditions, even if the brake is not applied. 1. when shifting automatic transmission gears, or 2. when driving over bumps, and 3. if an abrupt change is caused in the wheel rotation speed. This phenomenon, however, is normal, and will not cause any problems.	Normal
	The ABS may be activated in the following condition, even when the brake is applied gradually. 1. when driving partially over low friction surfaces (such as frozen surfaces, potholes), or 2. when making a turn at high speeds, and 3. if the front and rear or right and left wheel speeds are different. In this case, automatic activation of the ABS provides safer operation.	Normal
Long stopping distance	The stopping distance of an ABS vehicle may become longer on low friction surfaces such as a snowy or graveled road. It is necessary to advise the driver to reduce speed when driving on such roads to ensure safe driving.	Normal
Inactivation of the ABS	The ABS is not activated by abrupt braking at low vehicle speeds [10 km/h (6 MPH) or less].	Normal
Unexpected brake pedal feel	There is little difference of the brake pedal feel between the TCS equipped and non-TCS equipped vehicles. Some drivers may sense the following: ● Large stroke ● Hard pedal	Normal To make sure, check the following: ● Brake pedal depressed height. ● Air bleeding from brake line.
Unexpected acceleration feel	The TCS controls the engine and brake operation to provide optimum traction on any road surface by eliminating wheel slip. This may cause the driver to feel the acceleration is insufficient, depending on circumstances.	Normal

TROUBLE DIAGNOSES FOR TCS

Symptom Chart

PROCEDURE	—	—	Preliminary check					Diagnostic Procedures																			GI		
			71	72	72	83	Not self-diagnostic items									Self-diagnostic result of TCS C/U										MA			
							85	85	85	86	86	86	86	86	86	86	87	87	88	89	90	92	93	93	94			95	96
REFERENCE PAGE (BR-xx)	—	67	71	72	72	83	85	85	85	86	86	86	86	86	86	86	87	87	88	89	90	92	93	93	94	95	96	LC	
SYMPTOM	Priority for TCM*1	Diagnostic Work Sheet	Preliminary Check 1	Preliminary Check 2	Preliminary Check 3	Ground Circuit Check	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	Diagnostic Procedure 7	Diagnostic Procedure 8	Diagnostic Procedure 9	Diagnostic Procedure 10	Diagnostic Procedure 11	Diagnostic Procedure 12	Diagnostic Procedure 13	Diagnostic Procedure 14	Diagnostic Procedure 15	Diagnostic Procedure 16	Diagnostic Procedure 17	Diagnostic Procedure 18	Diagnostic Procedure 19	Diagnostic Procedure 19	FF & EC		
Noise & vibration		○																											FE
Unexpected TCS or ABS operation		○	○	○																								AT	
Long stopping distance		○	○																										PD
Unexpected pedal action		○	○																									FA	
Warning activates, but self-diagnosis does not work.					○	○	○	○	○	○	○	○	○	○	○	○													RA
TCS cannot be canceled by TCS cancel switch															○													BR	
SELF-DIAGNOSTIC RESULT	TCS C/U	Code No. 1, 2, 3, 4														○													ST
		Code No. 5, 6, 7, 8				○												○										RS	
		Code No. 9																	○										
		Code No. 10																		○									HA
		Code No. 13																			○								
		Code No. 14, 15																				○							IDX
		Code No. 16																					○						
		Code No. 17																							○				
		Code No. 18			○																						○		
		Code No. 19			○																						○		
TCM	TCM	No code indication	—																										
		Code No. 11	③																										
		Code No. 12	③																										
		Code No. 13	③														○	○	○	○	(○)	○	○	○	○	○	○	○	
		Code No. 14	③																										
		Code No. 21, 22	③																										
		Code No. 23	②																										
		Code No. 24	②																										
Code No. 31	③																												
Code No. 32	③																												
Code No. 33	③																												
Code No. 34	①																												

*1: TCM displays several malfunction codes at once. Therefore, when performing trouble diagnoses, follow the diagnostic procedure according to the priority.

TROUBLE DIAGNOSES FOR TCS

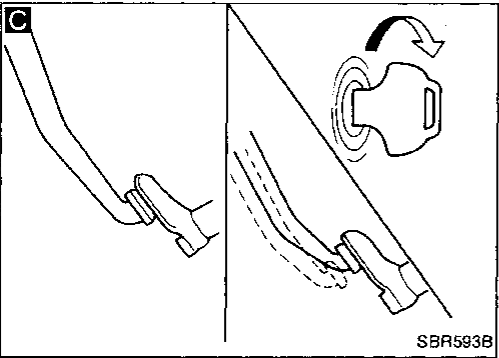
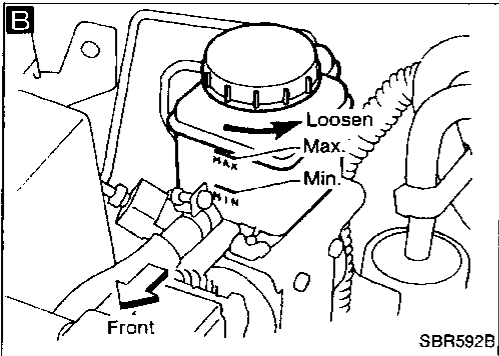
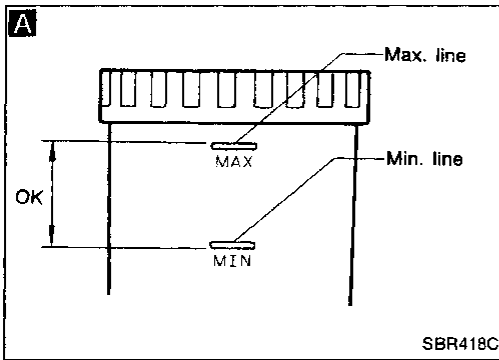
Symptom Chart (Cont'd)

PROCEDURE	Diagnostic Procedures											Electrical Component Inspection																
	Self-diagnostic result of TCM																											
	REFERENCE PAGE (BR-xx)	99	100	101	102	103	104	105	106	108	108	109	111	113	113	113	114	114	114	114	114	114	115	115	112	*2		
SYMPTOM	Priority for TCM*1	Diagnostic Procedure 20	Diagnostic Procedure 21	Diagnostic Procedure 22	Diagnostic Procedure 23	Diagnostic Procedure 24	Diagnostic Procedure 25	Diagnostic Procedure 26	Diagnostic Procedure 27	Diagnostic Procedure 28	Diagnostic Procedure 29	Diagnostic Procedure 30	Diagnostic Procedure 31	TCS Cancel Switch	Wheel Sensor	ABS Actuator Motor Relay	ABS Actuator Solenoid Valve Relay	TCS Pump Relay	Throttle Motor Relay	TCS Pump	Engine Coolant Temperature Sensor for TCM	N & P Relay	Inhibitor Switch	Throttle Motor	TCM	Secondary Throttle Position Sensor		
Noise & vibration																												
Unexpected TCS or ABS operation															○													
Long stopping distance																												
Unexpected pedal action																												
Warning activates, but self-diagnosis does not work.																												
TCS cannot be canceled by TCS cancel switch														○														
SELF-DIAGNOSTIC RESULT	TCS C/U		Code No. 1, 2, 3, 4																									
	TCM		Code No. 5, 6, 7, 8													○												
	TCS C/U		Code No. 9														○											
	TCM		Code No. 10														○											
	TCS C/U		Code No. 13	○	○	○	○		○	○		○		○														
	TCM		Code No. 14, 15																									
	TCS C/U		Code No. 16																									
	TCM		Code No. 17																○									
	TCS C/U		Code No. 18																									
	TCM		Code No. 19																○		○							
	TCS C/U		No code indication	—	○																							
	TCM		Code No. 11	③	○																					○		
	TCS C/U		Code No. 12	④		○																				○	○	
	TCM		Code No. 13	③			○																					
	TCS C/U		Code No. 14	④				○														○						
	TCM		Code No. 21, 22	③					○											○					○	○		
	TCS C/U		Code No. 23	②						○										○					○	○		
	TCM		Code No. 24	②							○									○					○	○		
	TCS C/U		Code No. 31	④									○															
	TCM		Code No. 32	③									○															
TCS C/U		Code No. 33	③										○															
TCM		Code No. 34	①											○											○			

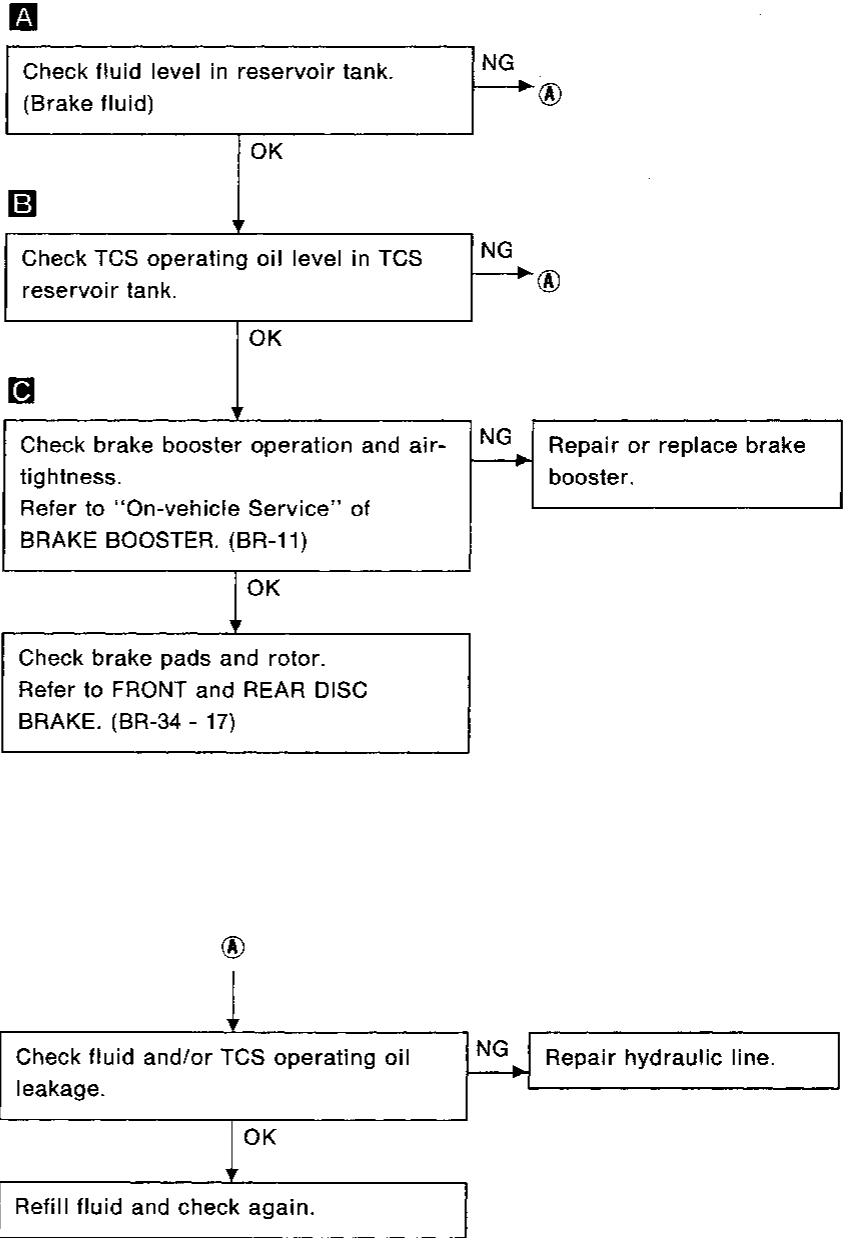
*1: TCM displays several malfunction codes at once. Therefore, when performing trouble diagnoses, follow the diagnostic procedure according to the priority.

*2: For Electrical Component Inspection of Secondary Throttle Position Sensor, refer to "ENGINE AND EMISSION CONTROL PARTS DESCRIPTION" in EF & EC section.

TROUBLE DIAGNOSES FOR TCS

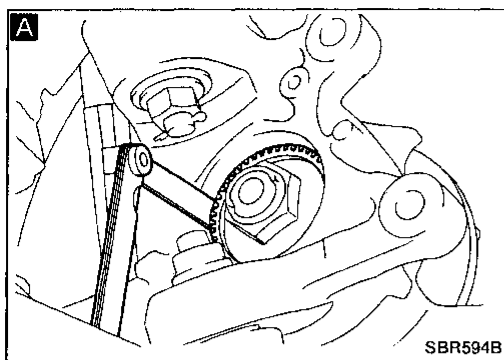


Preliminary Check 1

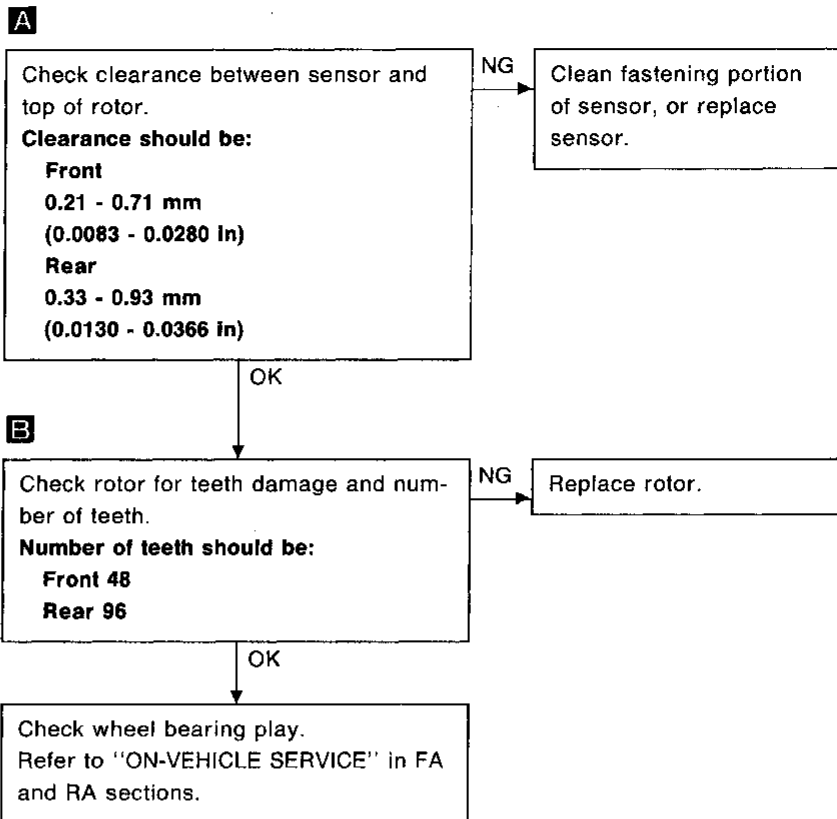
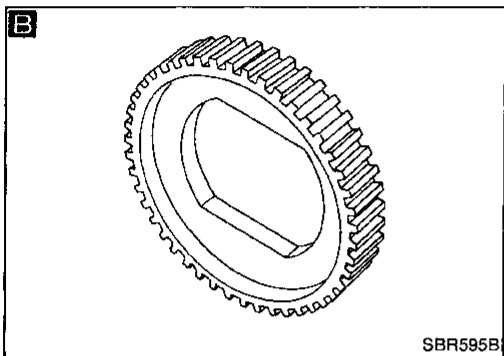


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TROUBLE DIAGNOSES FOR TCS



Preliminary Check 2



Preliminary Check 3

Check indicator/warning lamp operation for not self-diagnostic items as follows:

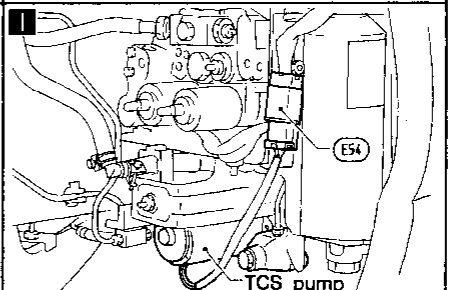
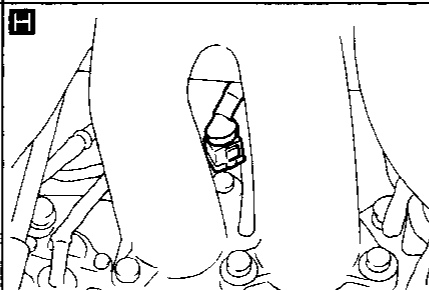
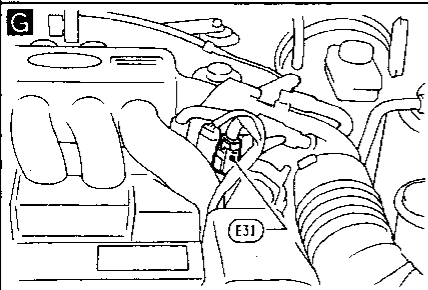
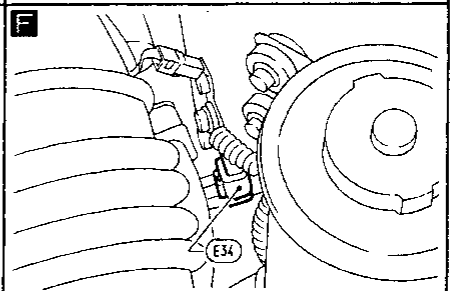
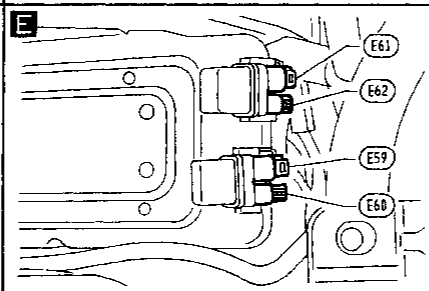
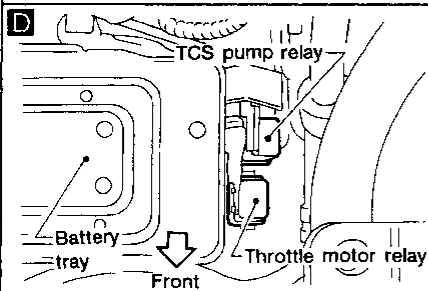
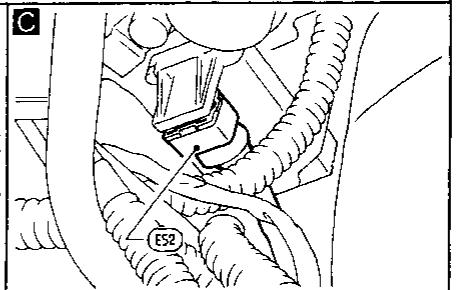
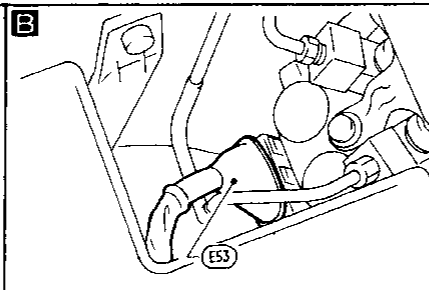
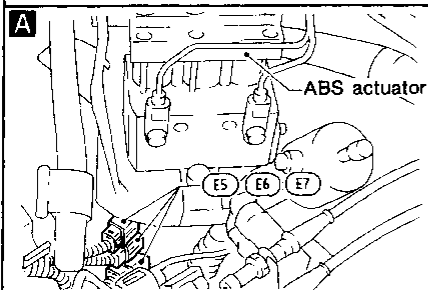
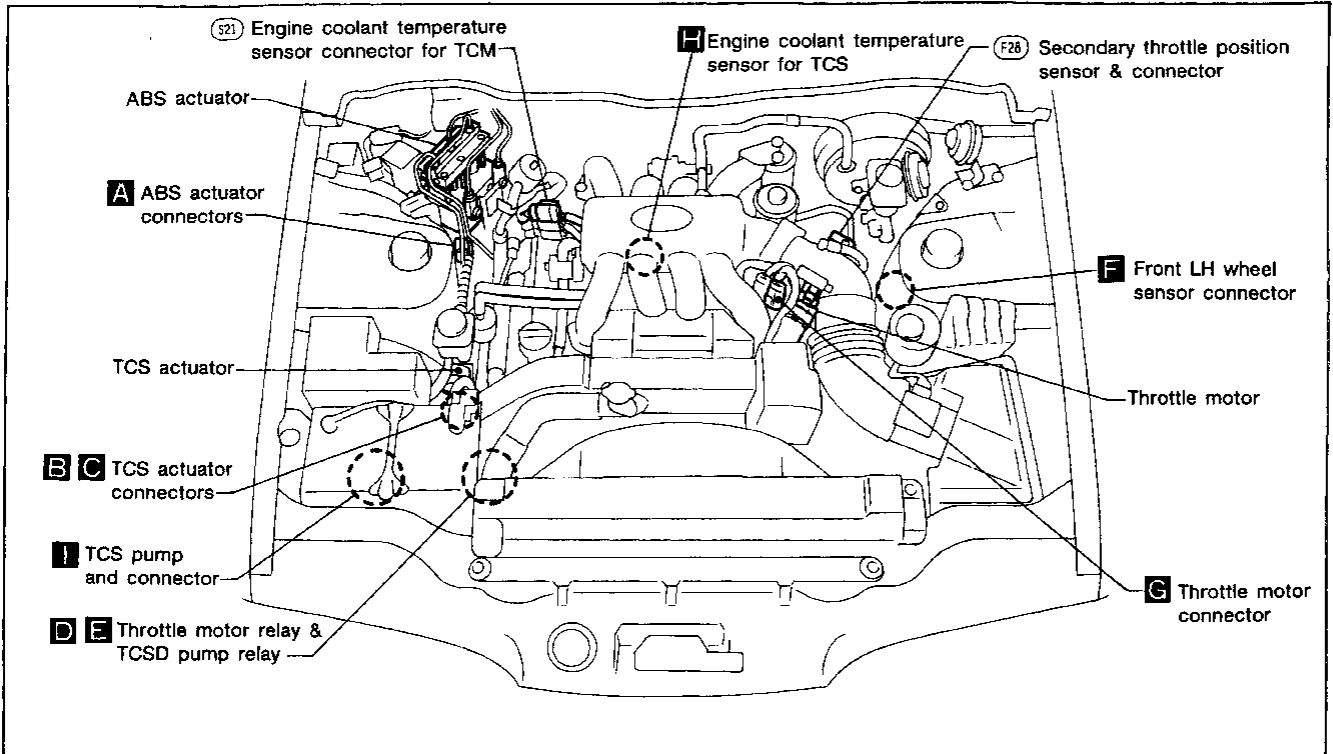
Ignition switch is turned "ON"			After starting engine			Diagnostic procedure
SLIP indicator	TCS OFF indicator	ABS warning lamp	SLIP indicator	TCS OFF indicator	ABS warning lamp	
*1 OFF	ON	ON	*1 OFF	ON	ON	1
ON	ON	ON	*2 ON	*2 ON	*2 ON	2
OFF	OFF	OFF	OFF	ON	ON	3, 4, 5
OFF	ON	ON	OFF	OFF	OFF	3
ON	OFF	ON	OFF	OFF	OFF	4
ON	ON	OFF	OFF	OFF	OFF	5
ON	ON	ON	ON	OFF	OFF	6
ON	ON	ON	OFF	ON	OFF	7
ON	ON	ON	OFF	OFF	ON	8

Note *1: Lamp may light dimly depending on circumstances.

*2: LED of TCS control unit does not indicate code No.

TROUBLE DIAGNOSES FOR TCS

Component Parts and Connector Location ENGINE ROOM

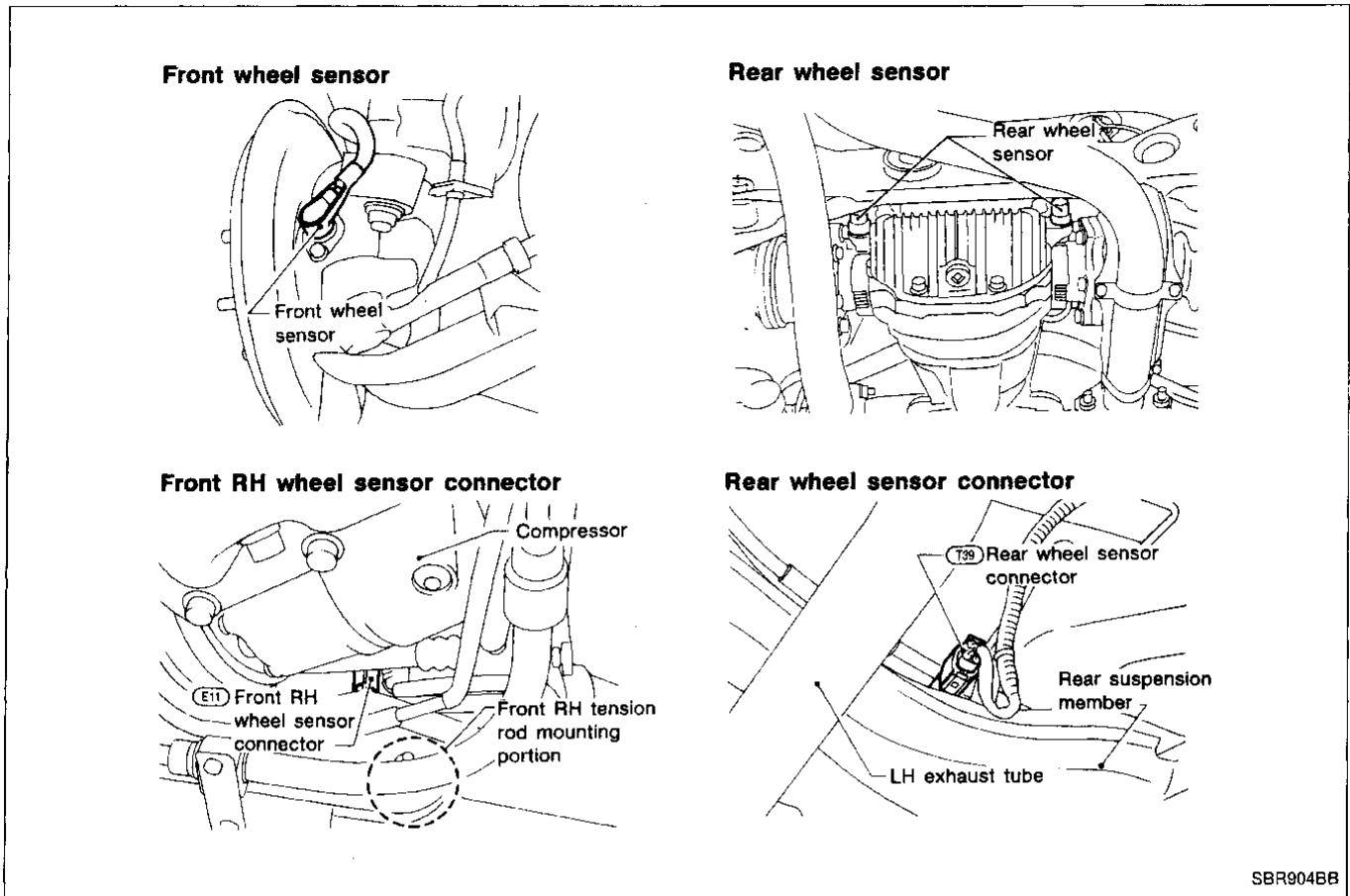


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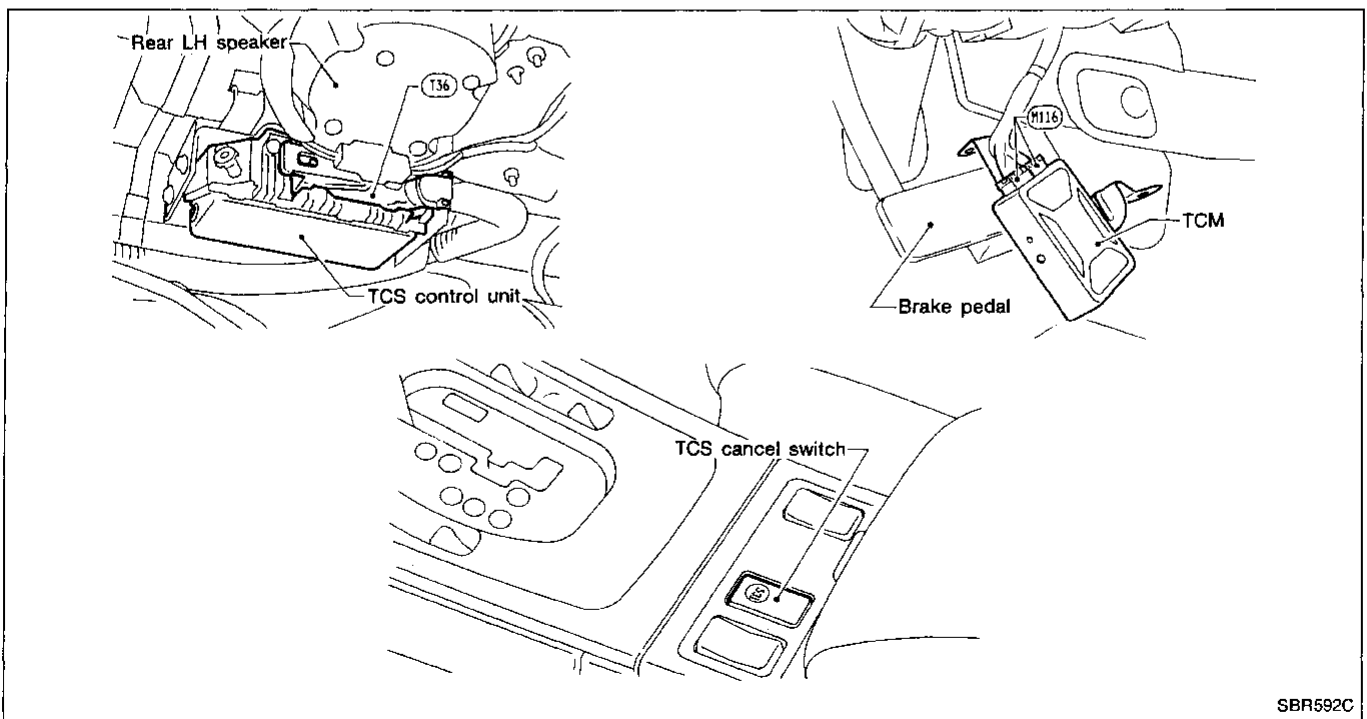
TROUBLE DIAGNOSES FOR TCS

Component Parts and Connector Location (Cont'd)

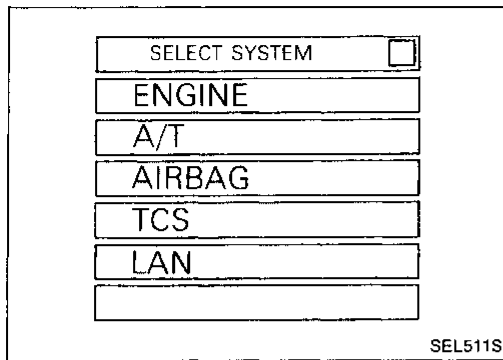
UNDER BODY



INSTRUMENT PANEL AND TRUNK ROOM



TROUBLE DIAGNOSES FOR TCS



Consult

Start up CONSULT and touch "TCS".

TCS COMPONENT PARTS APPLICATION

	WORK SUPPORT	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
Throttle position sensor		X	X	
Secondary throttle position sensor	X	X	X	X
Engine coolant temperature sensor for TCM		X	X	
Closed throttle position switch			X	
Neutral position switch		X	X	
Throttle motor	X	X	X	X
Throttle motor relay		X	X	X

WORK SUPPORT

Work support items	Description
Secondary throttle position sensor adjustment	<ul style="list-style-type: none"> Supports the adjustment of secondary throttle position sensor showing real-time signal voltage from secondary throttle position sensor.
Secondary throttle position sensor check	<ul style="list-style-type: none"> Performs throttle closed position self-learning function while showing and recording data monitor items related to secondary throttle position sensor.
Throttle motor step operation	<ul style="list-style-type: none"> Rotates throttle motor to the desired opening angle while showing and recording data monitor items related to throttle motor operation.
Closed throttle position self-learning memory clear	<ul style="list-style-type: none"> Erase the memory of closed throttle position self-learning of secondary throttle position sensor.

DATA MONITOR

Data monitor items	Description
Throttle position sensor (V)	<ul style="list-style-type: none"> Displays throttle position sensor signal voltage.
Throttle opening angle (degree)	<ul style="list-style-type: none"> Displays throttle opening angle calculated from throttle position sensor signal voltage.
Secondary throttle position sensor (V)	<ul style="list-style-type: none"> Displays secondary throttle position sensor signal voltage.
Secondary throttle valve opening angle (degree)	<ul style="list-style-type: none"> Displays secondary throttle valve opening angle calculated from secondary throttle position sensor signal voltage.
Engine coolant temperature sensor for TCM (°F/°C)	<ul style="list-style-type: none"> Displays engine coolant temperature calculated from output voltage of engine coolant temperature sensor for TCM.
Battery voltage (V)	<ul style="list-style-type: none"> Displays power supply voltage for TCM.
Throttle opening signal (ms)	<ul style="list-style-type: none"> Displays pulse width of requesting signal, from TCS control unit.
Closed throttle position switch (ON/OFF)	<ul style="list-style-type: none"> Displays ON/OFF condition determined by throttle position sensor signal.

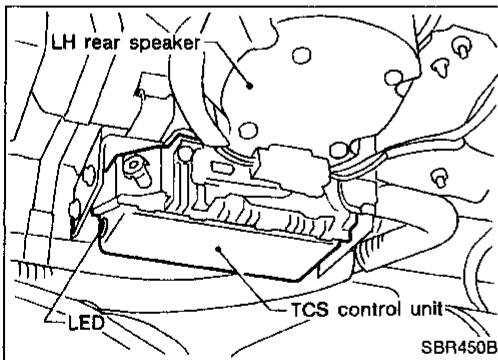
TROUBLE DIAGNOSES FOR TCS

Consult (Cont'd)

Neutral position switch	(ON/OFF)	● Displays ON/OFF condition determined by neutral position switch signal.
Target secondary throttle opening angle	(degree)	● Displays target secondary throttle valve opening angle calculated by TCM.
Motor voltage	(V)	● Displays throttle motor driving voltage.
Motor duty	(%)	● Displays duty ratio of throttle motor.
Motor relay	(ON/OFF)	● Displays ON/OFF condition of throttle motor relay.
TCS operation signal	(ON/OFF)	● Displays ON if secondary throttle valve closes more than a certain degree.
TCS operation flag		● Displays VALID if TCM controls secondary throttle valve receiving the requesting signal from TCS control unit.
Communication condition	(ON/OFF)	● Displays communication condition between TCS control unit and TCM. Displays ON normally.
Self-learning	(DONE/YET)	● Displays self-learning status of fully closed position of secondary throttle valve by TCM.

ACTIVE TEST

Active test items	Description
Secondary throttle valve opening test	● The target opening angle of secondary throttle valve can be set manually. The opening angle of secondary throttle valve and the duty ratio of throttle motor are displayed in realtime.
Throttle motor operation test	● The duty ratio of throttle motor can be set manually. The opening angle of secondary throttle valve is displayed in realtime.
Throttle motor relay test	● The throttle motor relay can be turned on or off manually or alternatively.



Self-diagnosis for TCS Control Unit

TCS CONTROL UNIT LED

The TCS control unit has one LED.

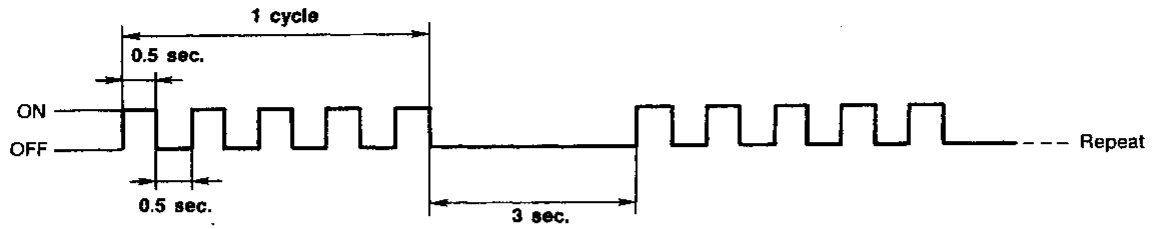
Description

Self-diagnosis is functioning as long as the engine is running. To obtain complete self-diagnosis results, the vehicle must be driven above 30 km/h (19 MPH) for at least one minute, then the malfunction code read while the engine is running. The malfunction code is indicated by the number of flashes of the LED as shown below.

TROUBLE DIAGNOSES FOR TCS

Self-diagnosis for TCS Control Unit (Cont'd)

Example: Code No. 5



SBR454B

For example, the LED flashes five times for 0.5 seconds. This indicates the number "5", and refers to a malfunction in the front left wheel sensor circuit. In this way, the problems are classified by their code numbers.

Code No.	Malfunction
1	Front left solenoid valve circuit for ABS actuator
2	Front right solenoid valve circuit for ABS actuator
3 or 4	Rear solenoid valve circuit for ABS actuator
5	Front left wheel sensor circuit
6	Front right wheel sensor circuit
7	Rear right wheel sensor circuit
8	Rear left wheel sensor circuit
9	ABS actuator motor circuit open or short, or ABS actuator motor relay abnormal
10	ABS actuator solenoid valve relay circuit malfunction
13	Secondary throttle opening signal circuit open, throttle signal circuit open or fail-safe for TCM
14	Left side pressure solenoid valve circuit for TCS actuator
15	Right side pressure solenoid valve circuit for TCS actuator
16	TCS control unit
17	TCS pump relay coil circuit open
18	TCS operating oil pressure in TCS actuator abnormal
19	TCS operating oil pressure circuit for TCS actuator

NOTE:

If TCS control unit displays code No. 13, refer to throttle control module (TCM) for self-diagnosis.

If more than two circuits should malfunction at the same time, the LED flashes to indicate one of the malfunctioning circuits. After the circuit has been repaired, the LED will flash the other code number when self-diagnosis is carried out again properly.

TROUBLE DIAGNOSES FOR TCS

Self-diagnosis for TCS Control Unit (Cont'd)

Code No.	Indicator			Detected items	Malfunction is detected when ...	Check item
	SLIP	TCS OFF	ABS			
1	ON	ON	ON	Front left solenoid for ABS actuator	Front left solenoid circuit for ABS actuator is open.	<ul style="list-style-type: none"> ● Harness and connector ● ABS actuator
2	ON	ON	ON	Front right solenoid for ABS actuator	Front right solenoid circuit for ABS actuator is open.	<ul style="list-style-type: none"> ● Harness and connector ● ABS actuator
3 or 4	ON	ON	ON	Rear solenoid for ABS actuator	Rear solenoid circuit for ABS actuator is open.	<ul style="list-style-type: none"> ● Harness and connector ● ABS actuator
5	ON	ON	ON	Front left wheel sensor	Front left wheel sensor circuit is malfunctioning.	<ul style="list-style-type: none"> ● Harness and connector ● Front left wheel sensor
6	ON	ON	ON	Front right wheel sensor	Front right wheel sensor circuit is malfunctioning.	<ul style="list-style-type: none"> ● Harness and connector ● Front right wheel sensor
7	ON	ON	ON	Rear right wheel sensor	Rear right wheel sensor circuit is malfunctioning.	<ul style="list-style-type: none"> ● Harness and connector ● Rear right wheel sensor
8	ON	ON	ON	Rear left wheel sensor	Rear left wheel sensor circuit is malfunctioning.	<ul style="list-style-type: none"> ● Harness and connector ● Rear left wheel sensor
9	ON	ON	ON	ABS motor and motor relay	<ul style="list-style-type: none"> ● ABS motor circuit is open or shorted. ● ABS motor relay is not operated normally. 	<ul style="list-style-type: none"> ● Harness and connector ● Motor relay ● Motor
10	ON	ON	ON	ABS solenoid valve relay	● ABS solenoid valve relay circuits is malfunctioning.	<ul style="list-style-type: none"> ● Harness and connector ● Solenoid valve relay
13	ON	ON	OFF	Secondary throttle opening signal	● Secondary throttle opening signal (from TCS C/U to TCM) circuit is open.	● Harness and connector
			ABS is operative even if TCS is inoperative.	Throttle position sensor signal	<ul style="list-style-type: none"> ● TCM is entered fail-safe mode. ● Throttle position sensor signal (from TCM to TCS C/U) circuit is open. 	<ul style="list-style-type: none"> ● TCM ● Harness and connector
14	ON	ON	ON	Left side pressure solenoid for TCS actuator	● Left side pressure solenoid circuit for TCS actuator is open.	<ul style="list-style-type: none"> ● Harness and connector ● TCS actuator
15	ON	ON	ON	Right side pressure solenoid for TCS actuator	● Right side pressure solenoid circuit for TCS actuator is open.	<ul style="list-style-type: none"> ● Harness and connector ● TCS actuator
0 or 16	ON	ON	ON	TCS C/U	● TCS C/U is out of order.	● TCS C/U
17	ON	ON	OFF	TCS pump relay	● TCS pump relay coil circuit is open.	<ul style="list-style-type: none"> ● Harness and connector ● TCS pump relay
18	ON	ON	OFF	TCS actuator pressure module	● TCS-operating oil pressure in actuator (accumulator) is abnormally decreased.	<ul style="list-style-type: none"> ● TCS pump ● TCS actuator

TROUBLE DIAGNOSES FOR TCS

Self-diagnosis for TCS Control Unit (Cont'd)

Code No.	Indicator			Detected items	Malfunction is detected when ...	Check item
	SLIP	TCS OFF	ABS			
19	ON	ON	OFF	TCS actuator pressure module	<ul style="list-style-type: none"> ● Pressure switch circuit for TCS pump operation is open. ● Warning switch circuit for TCS-operating oil pressure is open. 	<ul style="list-style-type: none"> ● Harness and connector ● TCS actuator ● TCS pump relay
—	OFF*	ON	ON	Main power supply for TCS C/U	● Main power supply circuit for TCS C/U is open.	● Harness and connector
				TCS C/U	● TCS C/U is out of order.	● TCS C/U
—	ON	ON	ON	Alternator circuit	● Alternator output circuit is open.	● Harness and connector

*: Lamp may light dimly depending on circumstances.

Retention of diagnostic results

This control unit does not have a memory for self-diagnostic results.

Therefore, the malfunction code number is erased each time the ignition switch is turned OFF.

TCS fail-safe

Code No.	Self-diagnosis item Malfunction	Fail-safe condition	
		Type (A)	Type (B)
1	Front left solenoid valve circuit for ABS actuator	X	—
2	Front right solenoid valve circuit for ABS actuator	X	—
3 or 4	Rear solenoid valve circuit for ABS actuator	X	—
5	Front left wheel sensor circuit	X	—
6	Front right wheel sensor circuit	X	—
7	Rear right wheel sensor circuit	X	—
8	Rear left wheel sensor circuit	X	—
9	ABS actuator motor circuit open or shorted, or ABS actuator motor relay abnormal	X	—
10	ABS actuator solenoid valve relay circuit malfunction	X	—
13	Secondary throttle opening signal circuit open or throttle signal circuit open, or fail-safe for TCM	—	X
14	Left side pressure solenoid valve circuit for TCS actuator	X	—
15	Right side pressure solenoid valve circuit for TCS actuator	X	—
0 or 16	TCS control unit	X	—
17	TCS pump relay coil circuit open	—	X
18	TCS operating oil pressure in TCS actuator abnormal	—	X
19	TCS operating oil pressure circuit for TCS actuator	—	X

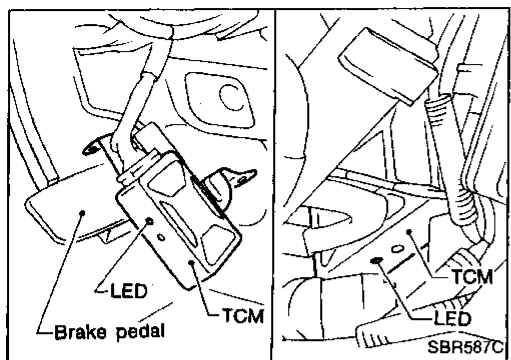
X: Available

—: Not available

Type (A): TCS control unit does not control both ABS and TCS functions.

Type (B): TCS control unit does not control TCS functions. However, TCS control unit does control ABS functions.

TROUBLE DIAGNOSES FOR TCS



Self-diagnosis for TCM

TCM LED

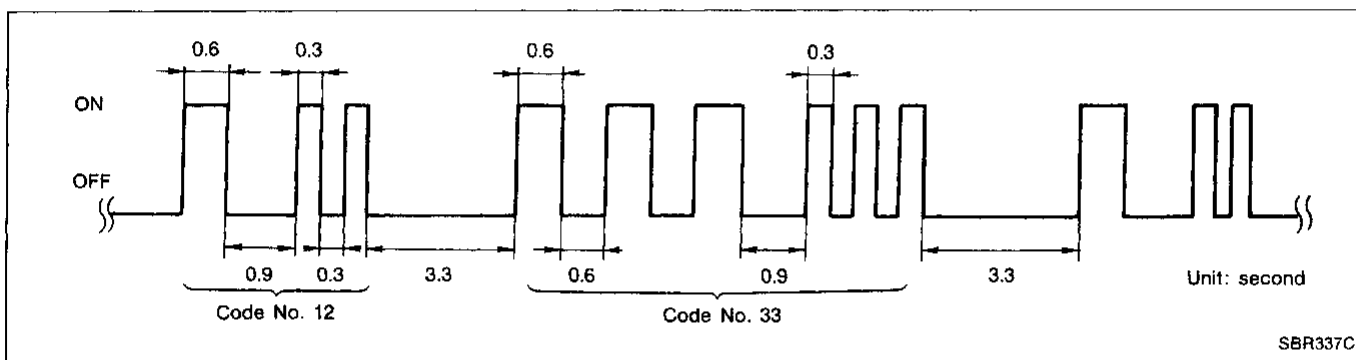
The TCM has only one LED.

Description

Self-diagnosis is always functioning when the ignition switch is set in the "ON" or "START" position and can be read by CONSULT.

The malfunction code is also indicated by the number of flashes of the LED as shown below:

Example: Code No. 12 and Code No. 33



Long (0.6 second) blinking indicates the number of the first digit and short (0.3 second) blinking indicates the number of the second digit.

For example, the LED flashes once for 0.6 seconds and then it flashes twice for 0.3 seconds. This indicates the number "12" and refers to a malfunction in the secondary throttle position sensor circuit. In this way, all the problems are classified by their code numbers.

LED Code No.	CONSULT	Malfunction
11	THROTTLE POSI SEN	Throttle position sensor circuit
12	THROTTLE POSI SEN2	Secondary throttle position sensor circuit
13	THRTL POS/S-2 SIG	Secondary throttle valve operating signal circuit
14	COOLNT TEMP/S (TCM)	Engine coolant temperature sensor for TCM circuit
21	THROTTLE ACTUATOR	Throttle motor circuit (Operation and open circuit check)
22	THROTTLE MOTOR	Throttle motor circuit (Short circuit check)
23	THROTTLE MOTOR RLY [SHORT] (-a)	Throttle motor relay circuit (Short)
24	THROTTLE MOTOR RLY [OPEN] (-b)	Throttle motor relay circuit (Open)
32	THRTL/V RETURN SPR	Secondary throttle valve return spring broken
33	NEUTRAL POSI SW	Neutral position switch circuit
34	TH P/S PWR SUPPLY	Power supply circuit (for sensor)
55		No malfunction in the above circuits

TROUBLE DIAGNOSES FOR TCS

Self-diagnosis for TCM (Cont'd)

LED/CONSULT	Self-diagnostic items	Malfunction is detected when ...	
11 THROTTLE POSI SEN	Throttle position sensor circuit	<ul style="list-style-type: none"> The throttle position sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) 	
12 THROTTLE POSI SEN2	Secondary throttle position sensor circuit	<ul style="list-style-type: none"> The secondary throttle position sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) 	GI
13 THRTL POS/S-2 SIG	Secondary throttle valve operating signal circuit	<ul style="list-style-type: none"> TCS control unit is in fail-safe condition or harness is abnormal. 	MA
14 COOLNT TEMP/S (TCM)	Engine coolant temperature sensor for TCM circuit	<ul style="list-style-type: none"> The engine coolant temperature sensor circuits is open or shorted. (An abnormally high or low output voltage is entered.) 	EM
21 THROTTLE ACTUATOR	Throttle motor circuit (Operation and open circuit check)	<ul style="list-style-type: none"> The throttle motor does not operate normally when the TCS is operating. 	LC
22 THROTTLE MOTOR	Throttle motor circuit (Short circuit check)	<ul style="list-style-type: none"> The throttle motor circuit is shorted. 	EF & EC
23 THROTTLE MOTOR RLY [SHORT] (-a)	Throttle motor relay circuit (Short)	<ul style="list-style-type: none"> The throttle motor relay is shorted. 	FE
24 THROTTLE MOTOR RLY [OPEN] (-b)	Throttle motor relay circuit (Open)	<ul style="list-style-type: none"> The throttle motor relay is open. 	AT
32 THRTL/V RETURN SPR	Secondary throttle valve return spring broken	<ul style="list-style-type: none"> Secondary throttle valve does not fully open when current is not supplied to the motor. 	PD
33 NEUTRAL POSI SW	Neutral position switch circuit	<ul style="list-style-type: none"> Neutral position switch circuit is open. Neutral position switch circuit is shorted. 	FA
34 TH P/S PWR SUPPLY	Power supply circuit (for sensor)	<ul style="list-style-type: none"> Power supply circuit for secondary throttle position sensor is open. 	RA

Retention of diagnostic results

Most of the diagnostic results will remain in the TCM memory.

The TCM memory concerning the following three items is erased after a normal signal is issued.

Code No.	Malfunction
13	Secondary throttle valve operating signal circuit
14	Engine coolant temperature sensor for TCM circuit
33	Neutral position switch circuit

BR

ST

RS

BT

RA

EL

IDX

TROUBLE DIAGNOSES FOR TCS

Self-diagnosis for TCM (Cont'd)

How to erase self-diagnostic results

The self-diagnostic results stored in the TCM can be erased by any of the following four methods.

- (1) Touch "Erase" on CONSULT screen after examining self-diagnostic result.
- (2) Depress the accelerator fully (1st throttle) and set the neutral position switch to OFF (automatic transmission is in other than "P" and "N" positions). In this state, turn ON the ignition key (engine need not be started). After this, set the neutral position switch to ON, and release the accelerator. This will erase the diagnostic results of all items.
- (3) If the backup power supply is disconnected for more than one minute, the diagnostic results on all items are erased. In addition, the values learned by the system are also erased.

TCM fail-safe

Code No.	Self-diagnosis item Malfunction	Fail-safe condition		
		Type (A)	Type (B)	Type (C)
11	Throttle position sensor circuit	—	X	—
12	Secondary throttle position sensor circuit	X	—	—
13	Secondary throttle valve operating signal circuit	—	X	—
14	Engine coolant temperature sensor for TCM circuit	—	—	—
21	Throttle motor circuit (Operation and open circuit check)	X	—	—
22	Throttle motor circuit (Short circuit check)	X	—	—
23	Throttle motor relay circuit (Short)	X	—	—
24	Throttle motor relay circuit (Open)	X	—	—
32	Secondary throttle valve return spring broken	—	—	X
33	Neutral position switch circuit	—	—	—
34	Power supply circuit (for sensor)	X	—	—
55	No malfunction in the above circuits	—	—	—

X: Available

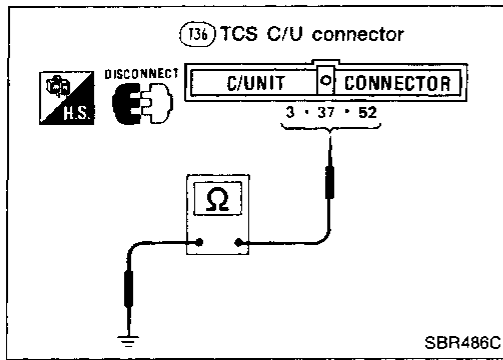
—: Not available

Type (A): TCM does not supply power for throttle motor and secondary throttle valve is fully opened by return spring.

Type (B): Secondary throttle valve is slowly opened by throttle motor.

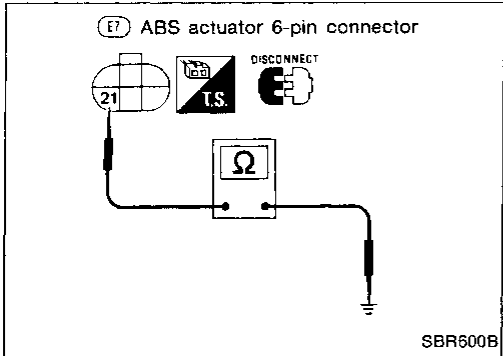
Type (C): Secondary throttle valve is quickly opened by throttle motor.

TROUBLE DIAGNOSES FOR TCS

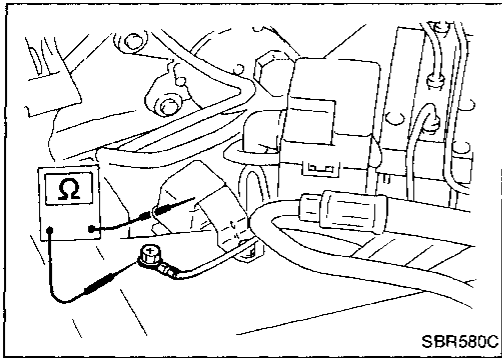


Ground Circuit Check

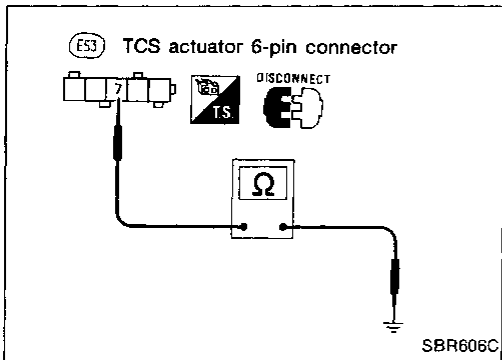
TCS CONTROL UNIT
Continuity should exist.



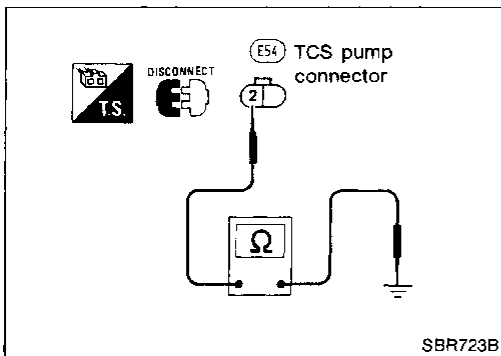
ABS ACTUATOR
Continuity should exist.



ACTUATOR MOTOR GROUND
Continuity should exist.



TCS ACTUATOR
Continuity should exist.



TCS PUMP
Continuity should exist.

GI

MA

EM

LC

EF &
EC

FE

AT

PD

FA

RA

BR

ST

RS

BT

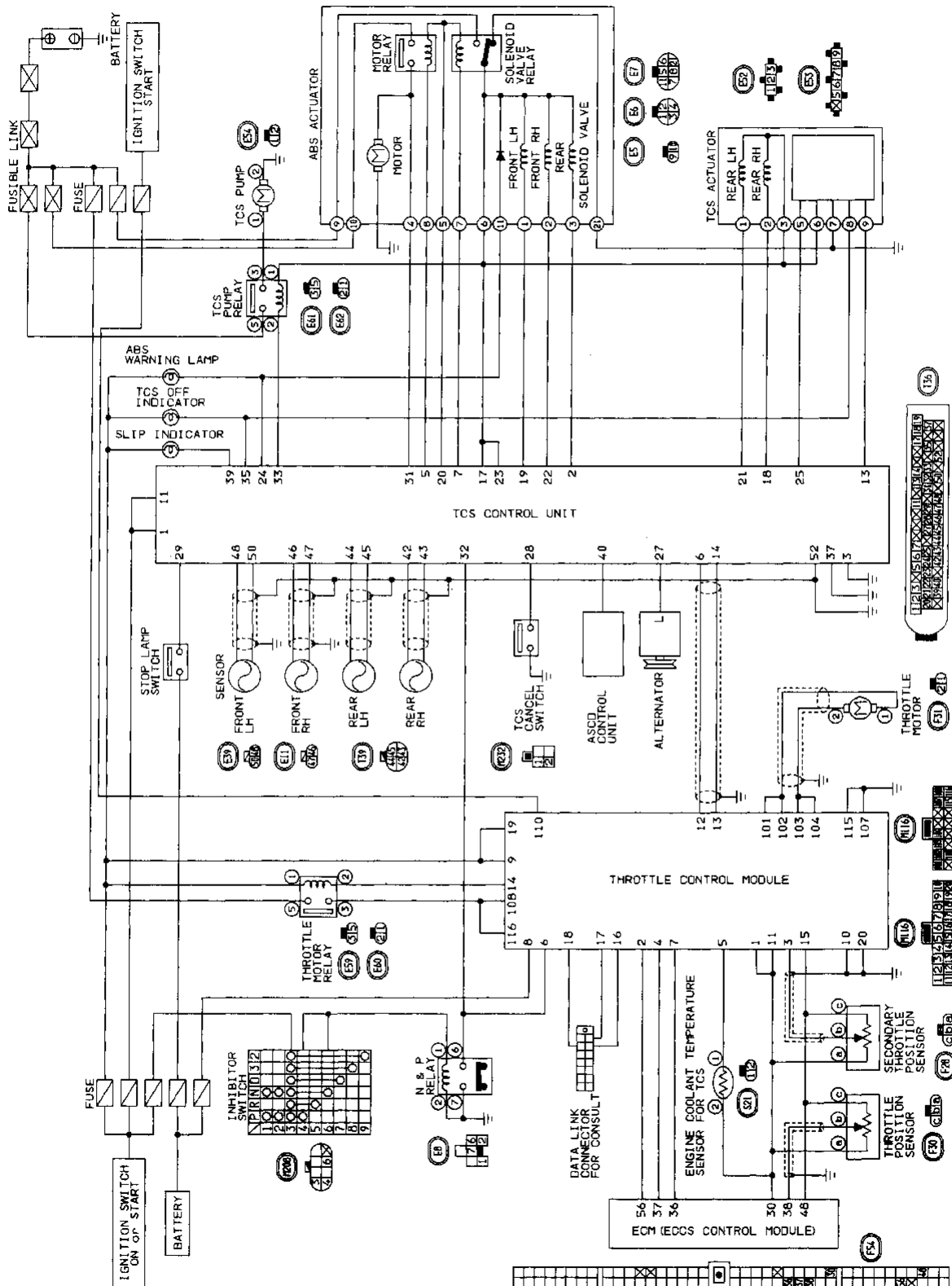
KA

EL

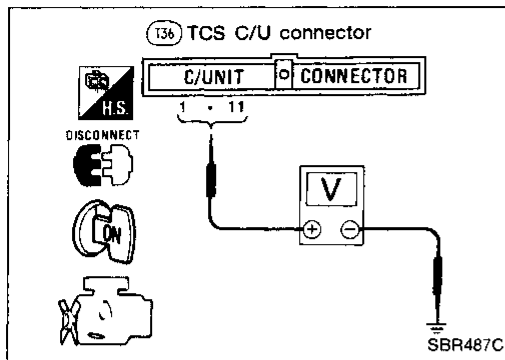
IDX

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-73.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".



TROUBLE DIAGNOSES FOR TCS



Diagnostic Procedure 1

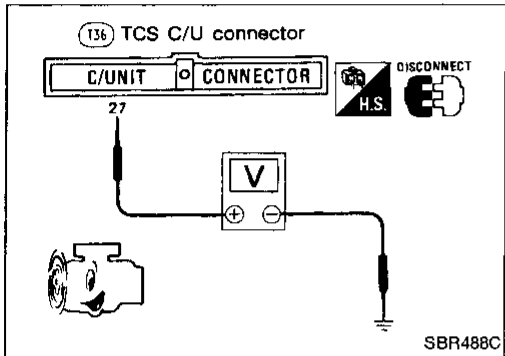
POWER SUPPLY CIRCUIT FOR TCS C/U

Check voltage between TCS C/U terminal ① and ground, and ⑪ and ground.

Battery voltage should exist.

NG

Repair harness and connectors.



Diagnostic Procedure 2

ALTERNATOR OUTPUT SIGNAL FOR TCS C/U

Check voltage between TCS C/U terminal ⑳ and ground with engine running.

Voltage : 14V or more

NG

Repair harness and connectors.

OK

Carry out Diagnostic Procedures 6 through 8.

NG

Repair harness and connectors.

OK

TRY SELF-DIAGNOSIS AGAIN.

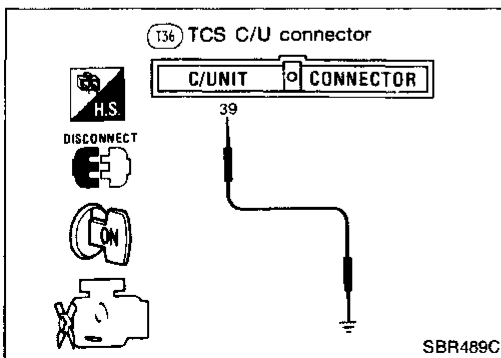
Does TCS C/U display code No. "0" even if all indicators/warnings are activated? ("0" means no indication.)

Yes

Replace TCS C/U.

No

Inspect system referring to displayed code No.



Diagnostic Procedure 3

SLIP INDICATOR CIRCUIT

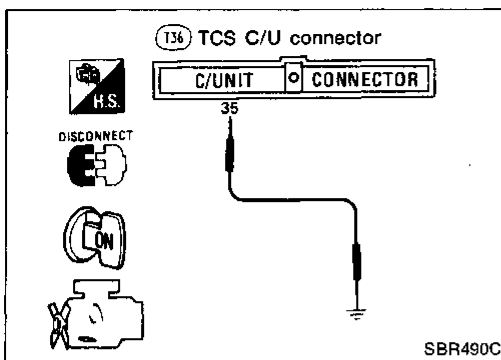
Check SLIP indicator by grounding TCS C/U terminal ㉑.

TCS indicator should be lit.

NG

- Repair harness and connectors.
- or
- Replace bulb.

TROUBLE DIAGNOSES FOR TCS



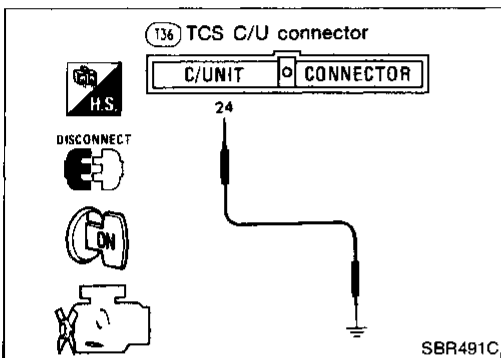
Diagnostic Procedure 4

TCS OFF INDICATOR CIRCUIT

- Disconnect 6-pin connector from TCS actuator.
 - Check TCS OFF indicator by grounding TCS C/U terminal ③⑤.
- TCS OFF indicator should be lit.**

NG

- Repair harness and connectors.
- or
- Replace bulb.



Diagnostic Procedure 5

ABS WARNING LAMP CIRCUIT

- Remove solenoid valve relay from ABS actuator.
 - Check ABS warning lamp by grounding TCS C/U terminal ②④.
- ABS warning lamp should be lit.**

NG

- Repair harness and connectors.
- or
- Replace bulb.

Diagnostic Procedure 6

SLIP INDICATOR CIRCUIT

- Disconnect connector from TCS C/U and turn ignition switch "ON".
- TCS indicator should not be lit.**

NG

- Repair harness and connector between SLIP indicator lamp and TCS C/U terminal ③⑨.

Diagnostic Procedure 7

TCS OFF INDICATOR CIRCUIT

- Disconnect 6-pin connector from TCS actuator.
 - Disconnect connector from TCS C/U and turn ignition switch "ON".
- TCS OFF indicator should not be lit.**

NG

- Repair harness and connectors between TCS OFF indicator lamp and TCS C/U terminal ③⑤.
- or
- Repair harness and connector between TCS OFF indicator lamp and TCS actuator terminal ⑧.

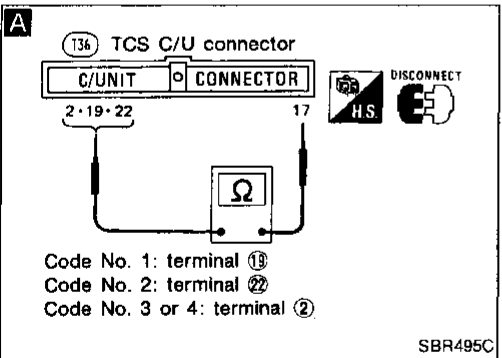
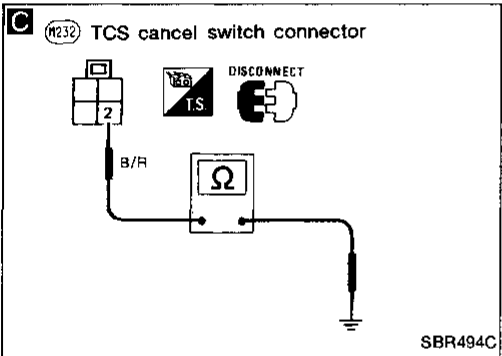
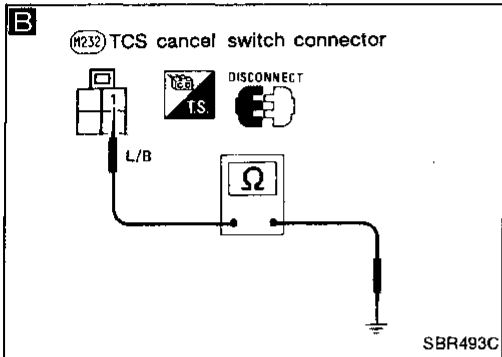
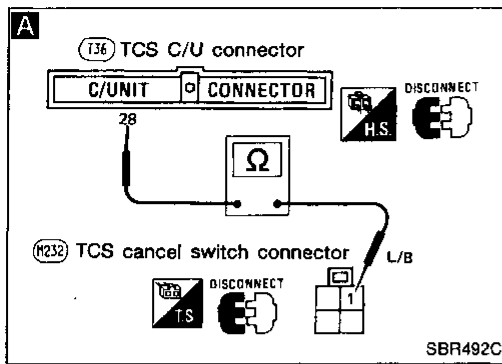
Diagnostic Procedure 8

ABS WARNING LAMP CIRCUIT

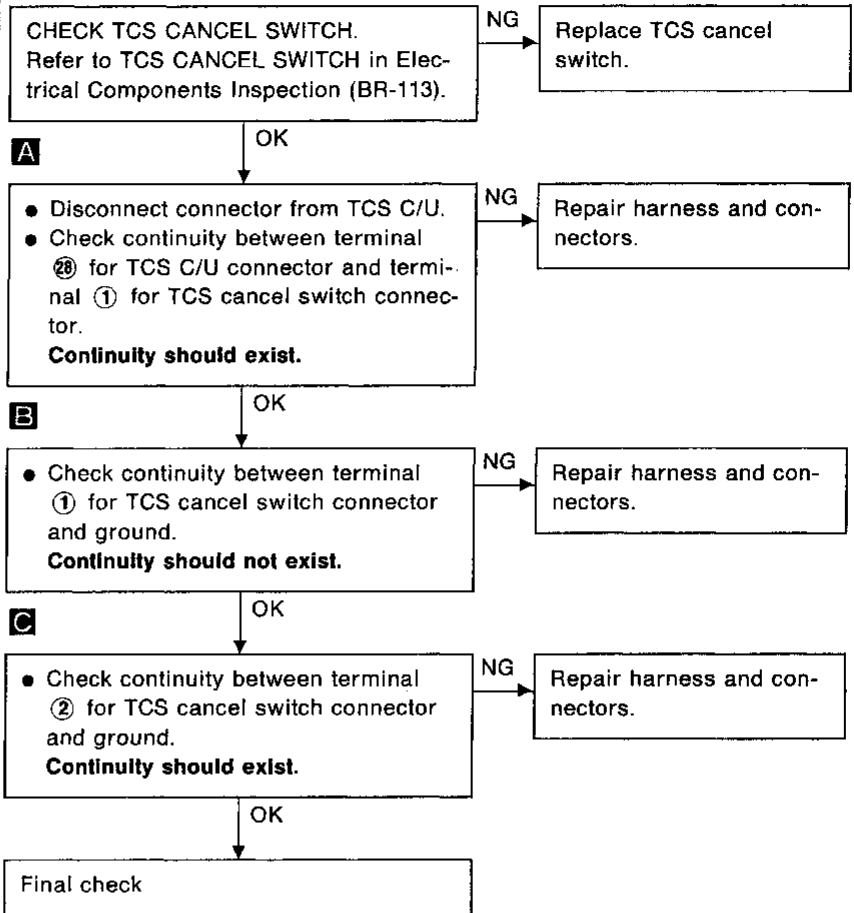
- Remove solenoid valve relay from ABS actuator.
 - Disconnect connector from TCS C/U and turn ignition switch "ON".
- ABS warning lamp should not be lit.**

NG

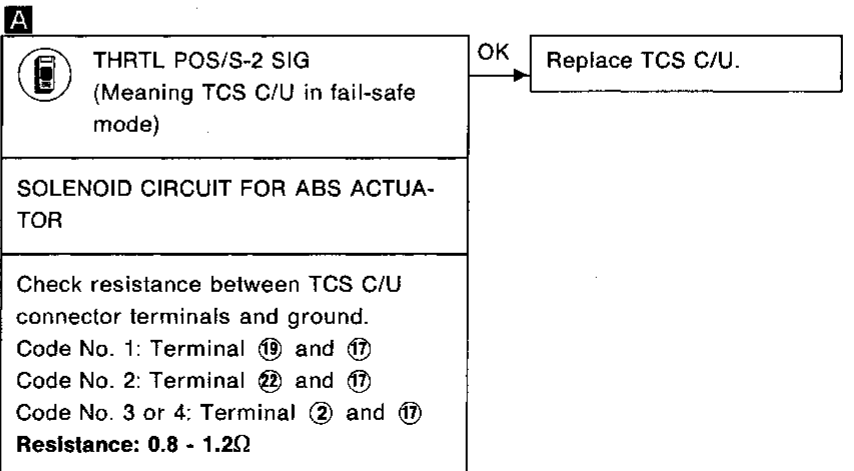
- Repair harness and connectors between ABS warning lamp and TCS C/U terminal ②④.
- or
- Repair harness and connectors between ABS warning lamp and ABS actuator terminal ⑪.



Diagnostic Procedure 9 INOPERATIVE TCS CANCEL SWITCH



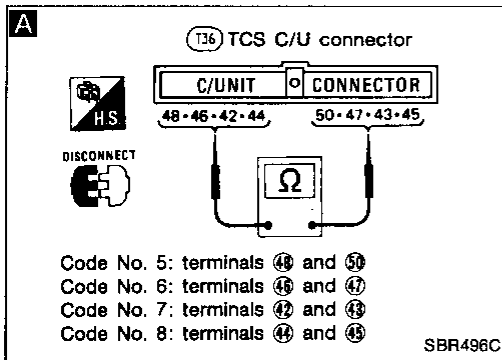
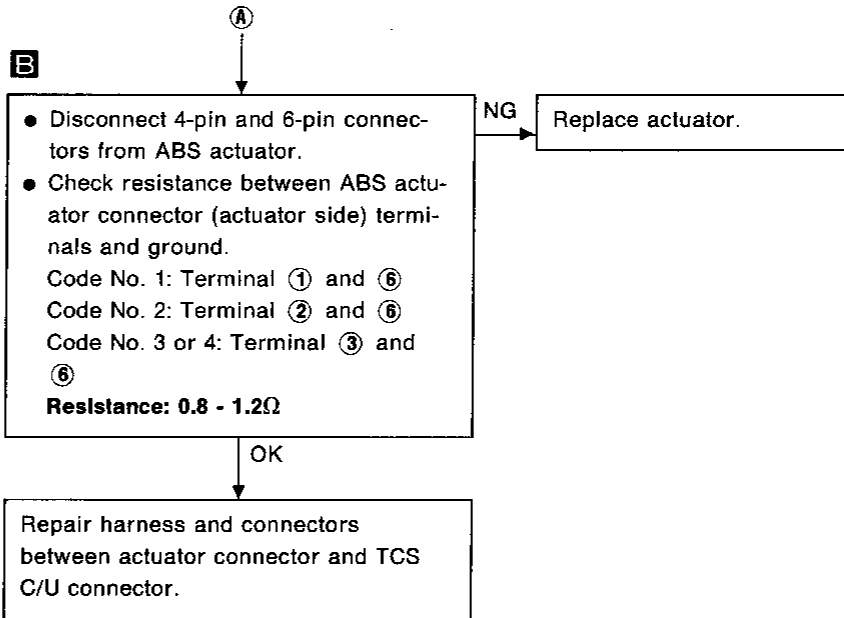
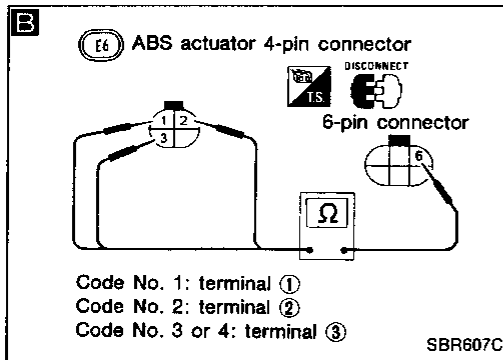
Diagnostic Procedure 10 SOLENOID CIRCUIT FOR ABS ACTUATOR (Code No. 1, 2, 3 or 4 of TCS C/U) (Code No. 13 of TCM)



A

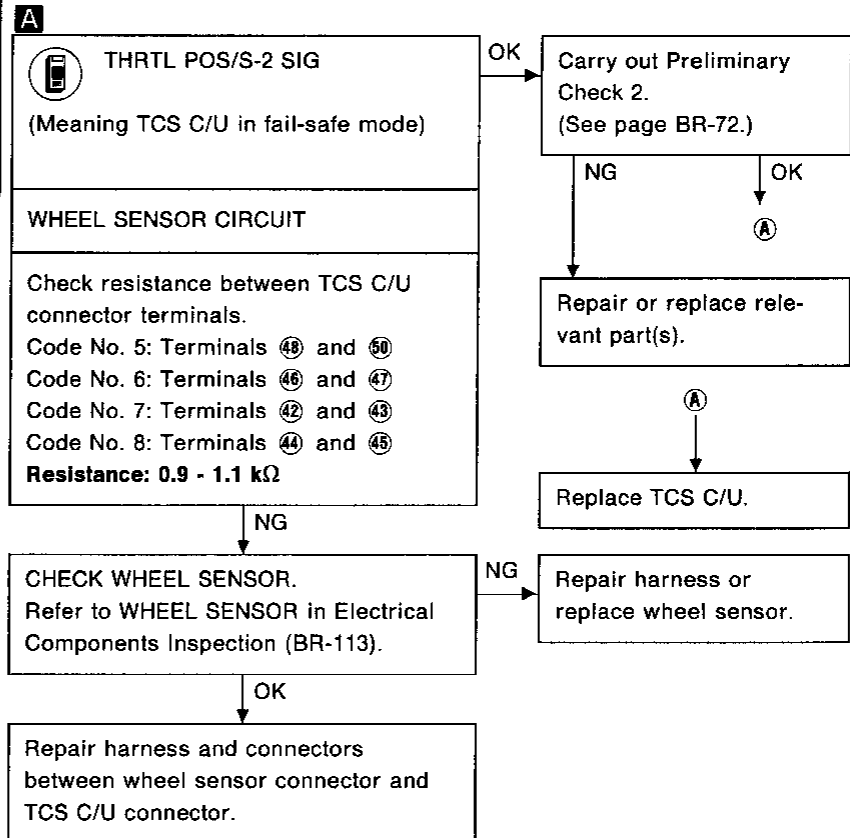
TROUBLE DIAGNOSES FOR TCS

Diagnostic Procedure 10 (Cont'd)



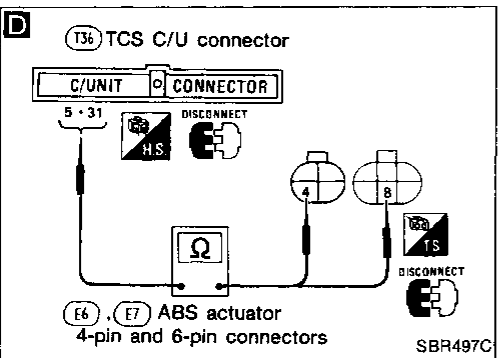
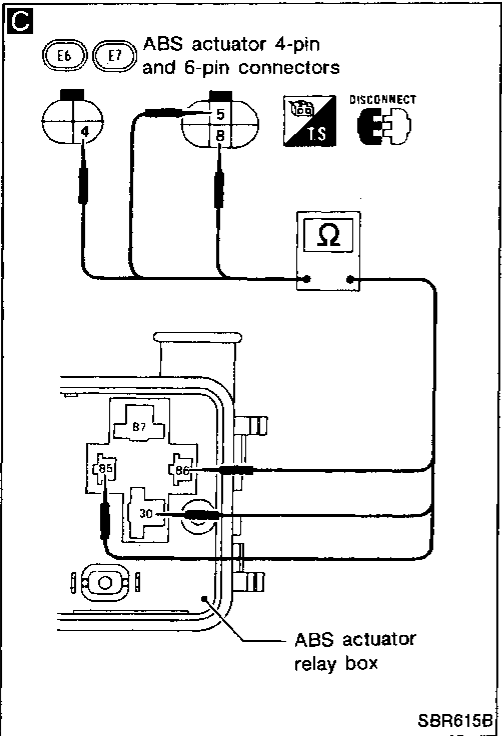
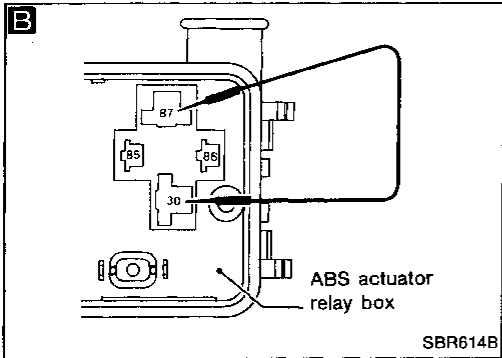
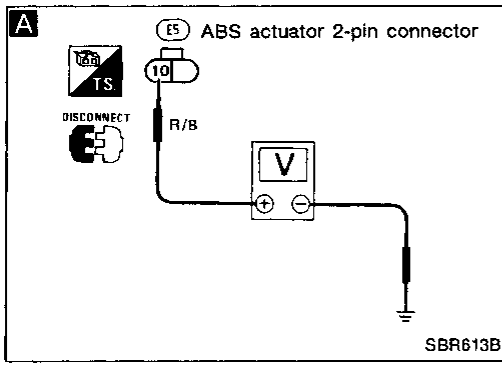
Diagnostic Procedure 11

WHEEL SENSOR CIRCUIT (Code No. 5, 6, 7 or 8 of TCS C/U) (Code No. 13 of TCM)



Diagnostic Procedure 12

ABS ACTUATOR MOTOR AND MOTOR RELAY CIRCUIT
(Code No. 9 of TCS C/U)
(Code No. 13 of TCM)



A

THRTL POS/S-2 SIG
(Meaning TCS C/U in fail-safe mode)

POWER SUPPLY CIRCUIT FOR ABS ACTUATOR MOTOR

Check voltage between 2-pin ABS actuator connector terminal ⑩ and ground. **Battery voltage should exist.**

NG

- Repair harness and connectors.
- or
- Replace fusible link.

OK

B

ABS ACTUATOR MOTOR OPERATION

- Connect connector to ABS actuator and remove ABS actuator motor relay.
- Check ABS actuator motor operation using a jumper cable.

DO NOT connect jumper cable for more than 5 seconds to prevent motor damage. Motor should be operated.

NG

- Repair cable from ABS actuator relay box to motor.
- Repair ground wire of ABS actuator.
- Replace ABS actuator.

OK

CHECK ABS ACTUATOR MOTOR RELAY.
Refer to ABS ACTUATOR MOTOR RELAY in Electrical Component Inspection (BR-113).

NG

Replace ABS actuator motor relay.

OK

C

- Disconnect connectors from ABS actuator.
- Check continuity between connector terminals (actuator side) and motor relay terminals.

④ to ③⑩, ⑤ to ③⑨, ⑧ to ③⑤

Continuity should exist.

NG

Replace ABS actuator.

OK

D

- Disconnect connector from TCS C/U.
- Check continuity between TCS C/U connector terminals and ABS actuator connector terminals.

③① to ④, ⑤ to ⑧

Continuity should exist.

NG

Repair harness and connectors.

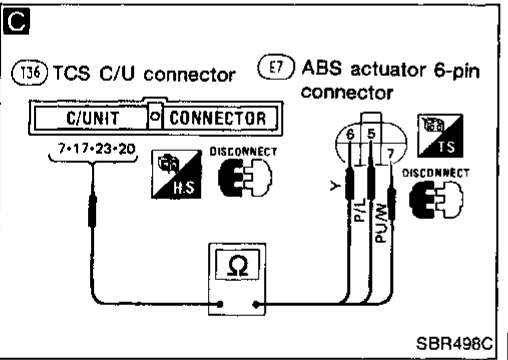
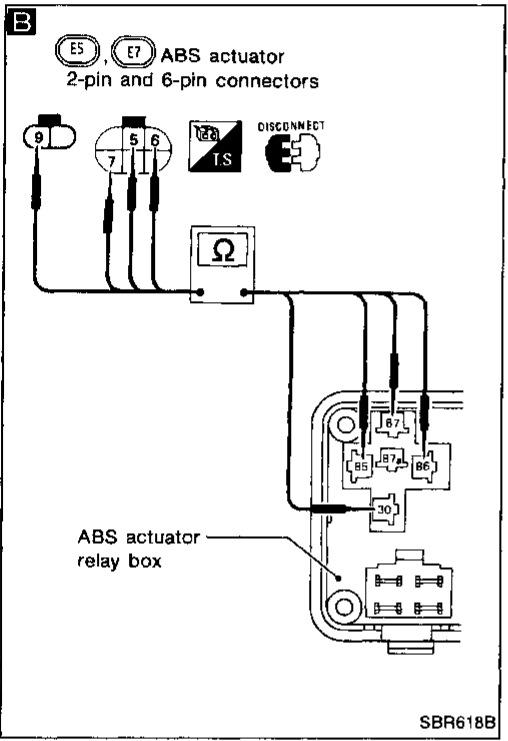
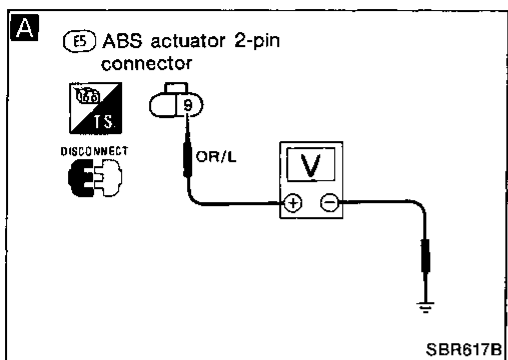
OK

Replace TCS C/U.

GI
MA
EM
LC
EF & EC
FE
AT
PD
FA
RA
BR
ST
RS
BT
HA
EL
IDX

Diagnostic Procedure 13

ABS ACTUATOR SOLENOID VALVE RELAY CIRCUIT (Code No. 10 of TCS C/U) (Code No. 13 of TCM)



(1) THRTL POS/S-2 SIG
(Meaning TCS C/U in fail-safe mode)

POWER SUPPLY CIRCUIT FOR ABS ACTUATOR SOLENOID VALVE

Check fuse No. 43.
For fuse layout, refer to foldout page Circuit Diagram.

A

- Disconnect 2-pin connector from ABS actuator.
- Check voltage between terminal ⑨ and ground.
Battery voltage should exist.

NG → **(A)**

Repair harness and connector.

CHECK ABS ACTUATOR SOLENOID VALVE RELAY.
Refer to ABS ACTUATOR SOLENOID VALVE RELAY in Electrical Component Inspection (BR-114).

NG →

Replace ABS actuator solenoid valve relay.

B

- Disconnect 6-pin connector from ABS actuator.
- Check continuity between connector terminals (actuator side) and solenoid valve relay terminals.
⑨ to ⑧7, ⑦ to ⑧5, ⑥ to ⑧0, ⑤ to ⑧6
- Continuity should exist.**

NG →

Replace ABS actuator.

C

- Disconnect connector from TCS C/U.
- Check continuity between TCS C/U connector terminals and ABS actuator connector terminals.
⑦ to ⑦, ⑰ to ⑥, ⑳ to ⑥, ㉑ to ⑤
- Continuity should exist.**

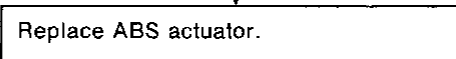
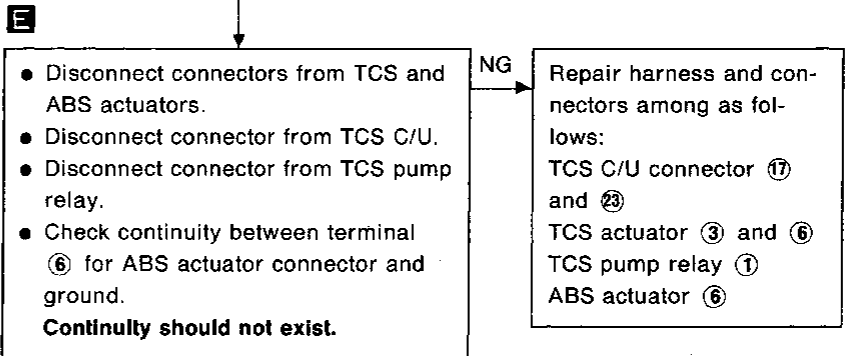
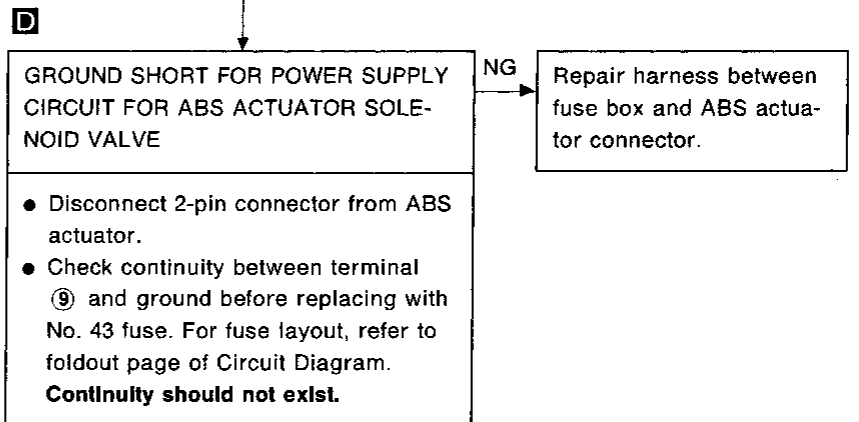
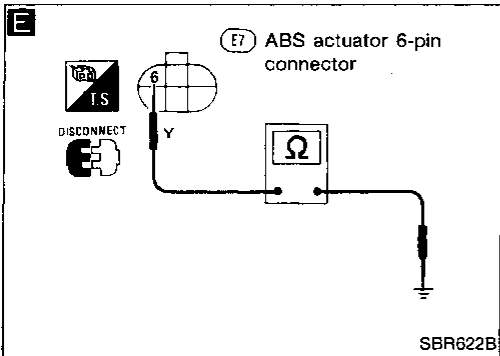
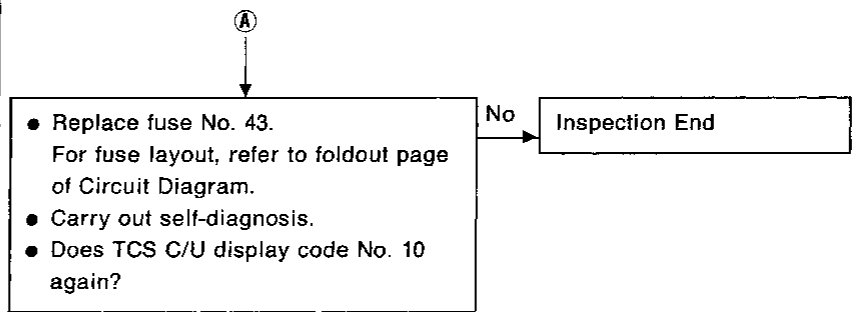
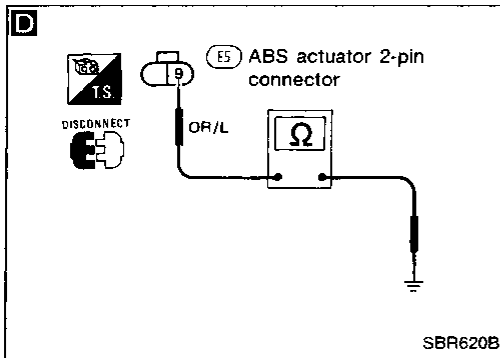
NG →

Repair harness and connector.

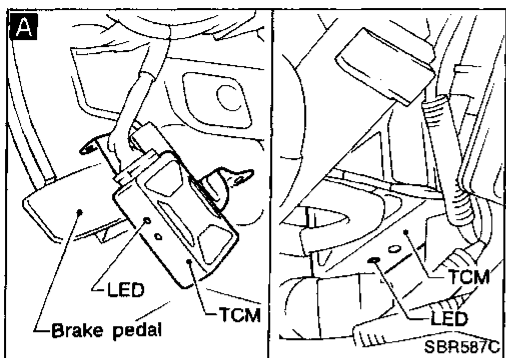
Replace TCS C/U.

TROUBLE DIAGNOSES FOR TCS

Diagnostic Procedure 13 (Cont'd)



GI
MA
EM
LC
EF & EC
FE
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PD
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BR
ST
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BT
HA
EL
IDX

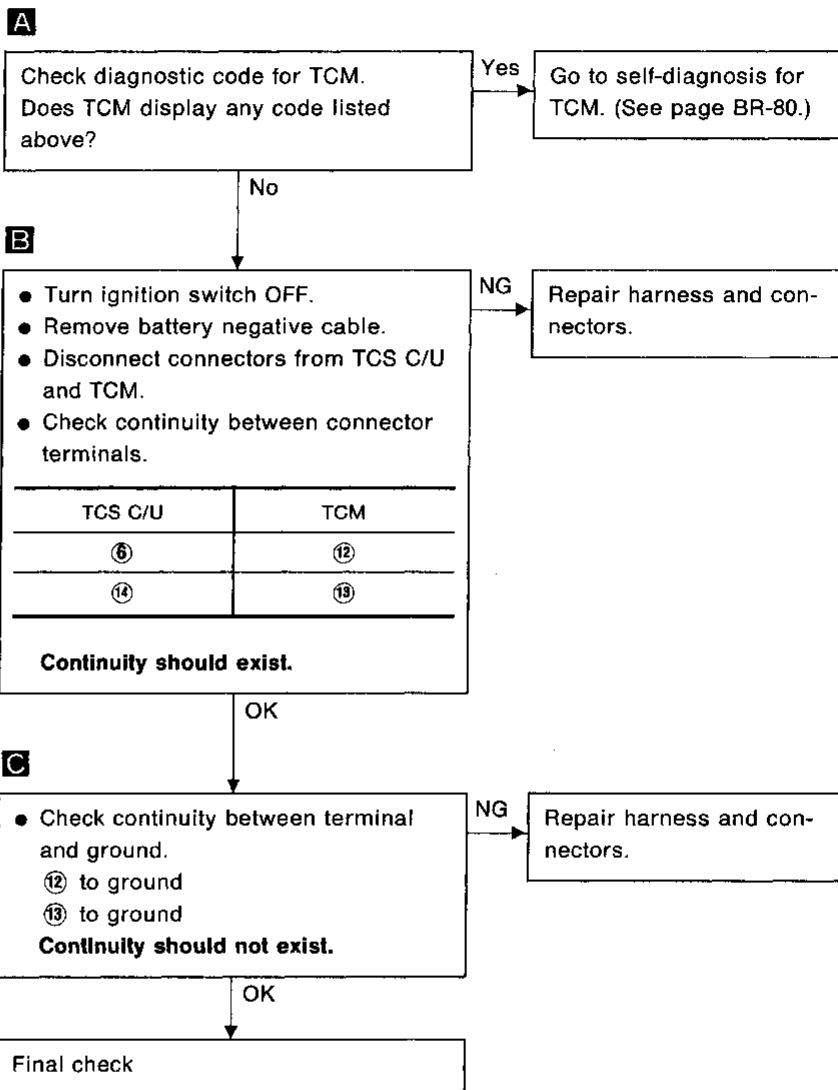
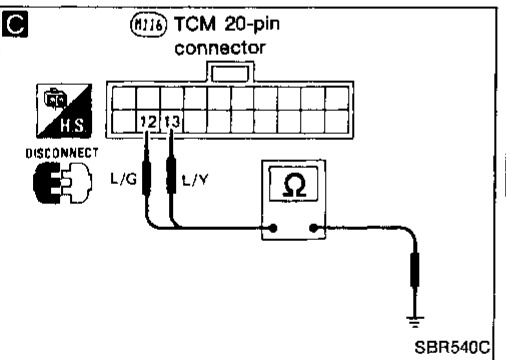
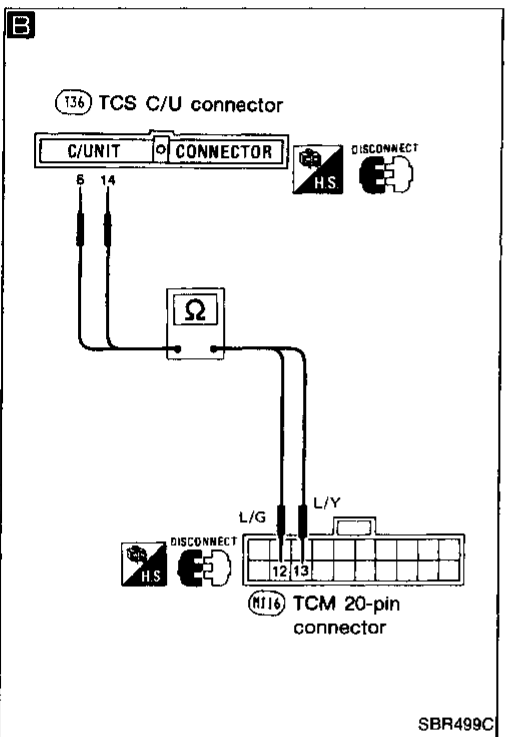


Diagnostic Procedure 14

SECONDARY THROTTLE OPENING SIGNAL CIRCUIT OR THROTTLE SIGNAL CIRCUIT

(Code No. 13 of TCS C/U)

(Code No. 11, 12, 13, 21, 22, 23, 24, 32, 34 of TCM)



A Check diagnostic code for TCM. Does TCM display any code listed above?

Yes → Go to self-diagnosis for TCM. (See page BR-80.)

B

- Turn ignition switch OFF.
- Remove battery negative cable.
- Disconnect connectors from TCS C/U and TCM.
- Check continuity between connector terminals.

TCS C/U	TCM
⑥	⑫
⑭	⑬

Continuity should exist.

NG → Repair harness and connectors.

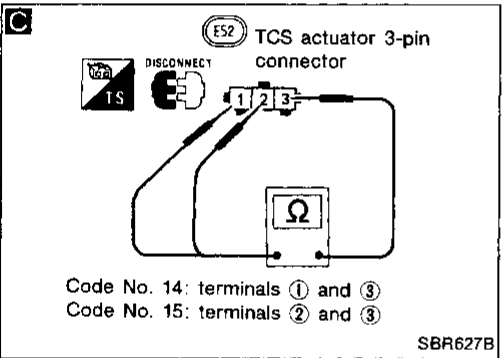
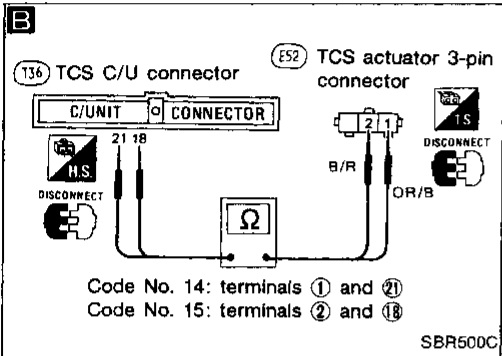
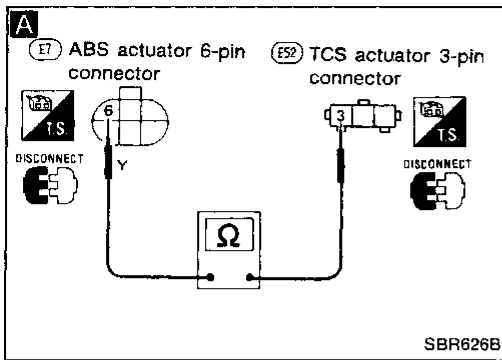
C

- Check continuity between terminal and ground.
- ⑫ to ground
- ⑬ to ground

Continuity should not exist.

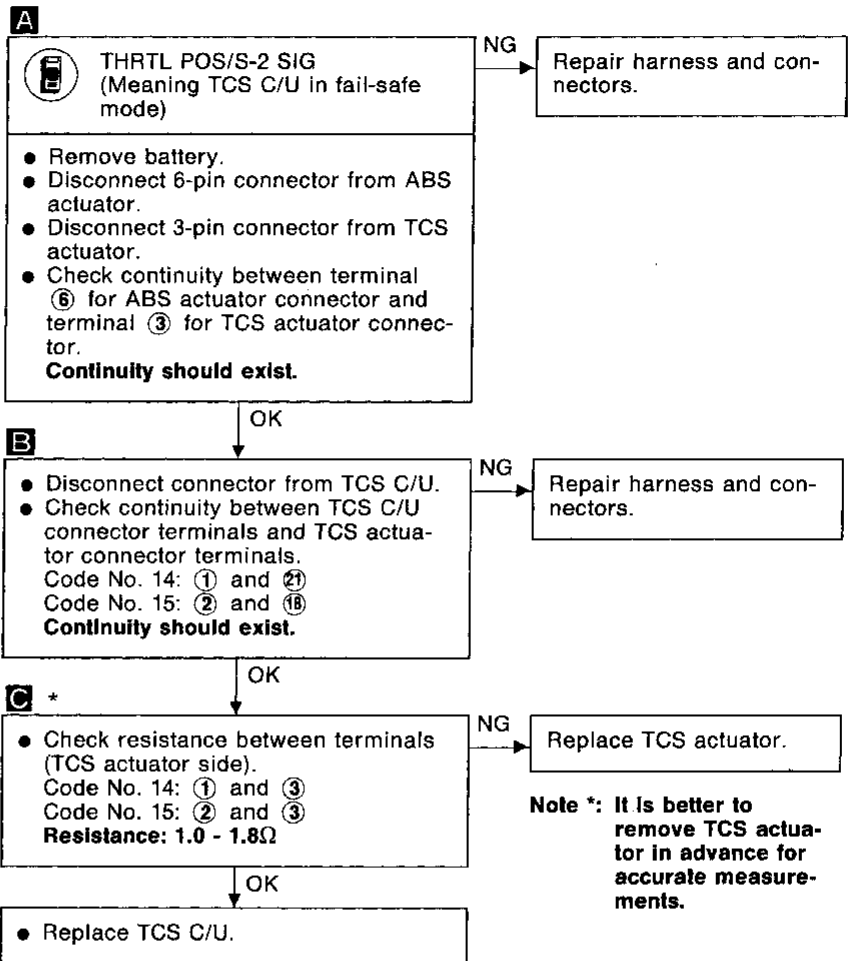
NG → Repair harness and connectors.

Final check



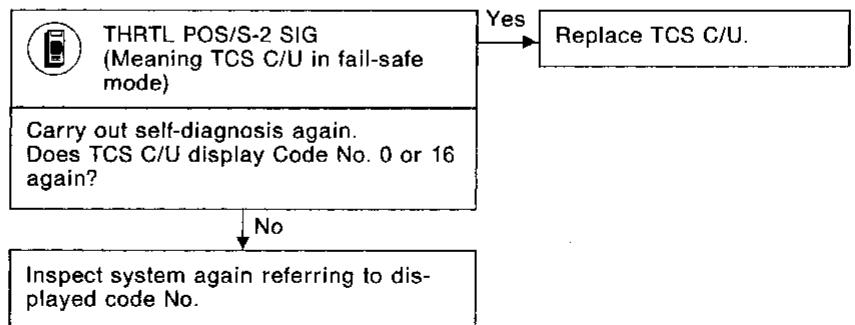
Diagnostic Procedure 15

SOLENOID CIRCUIT FOR TCS ACTUATOR (Code No. 14 or 15 of TCS C/U) (Code No. 13 of TCM)



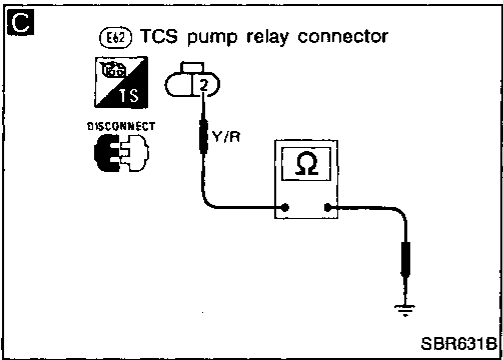
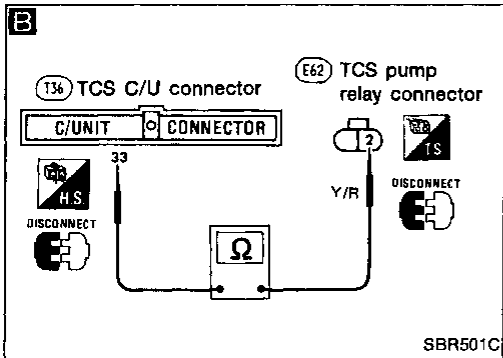
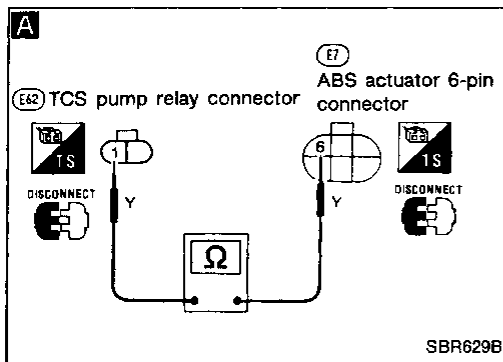
Diagnostic Procedure 16

TCS C/U (Code No. 0 or 16 of TCS C/U) (Code No. 13 of TCM)



Diagnostic Procedure 17

TCS PUMP RELAY CIRCUIT (Code No. 17 of TCS C/U) (Code No. 13 of TCM)



THRTL POS/S-2 SIG
(Meaning TCS C/U in fail-safe mode)

TCS PUMP RELAY CIRCUIT

- Remove battery.
- Remove TCS pump relay.

CHECK TCS PUMP RELAY.
Refer to TCS PUMP RELAY in Electrical Component Inspection (BR-114).

NG → Replace TCS pump relay.

A

- Disconnect 6-pin connector from ABS actuator.
- Check continuity between terminal ⑥ for ABS actuator connector and terminal ① for TCS pump relay connector.

Continuity should exist.

NG → Repair harness and connectors.

B

- Disconnect connector from TCS C/U.
- Check continuity between terminal ③ for TCS C/U connector and terminal ② for TCS pump relay connector.

Continuity should exist.

NG → Repair harness and connector.

C

- Check continuity between terminal ② for TCS pump relay connector and ground.

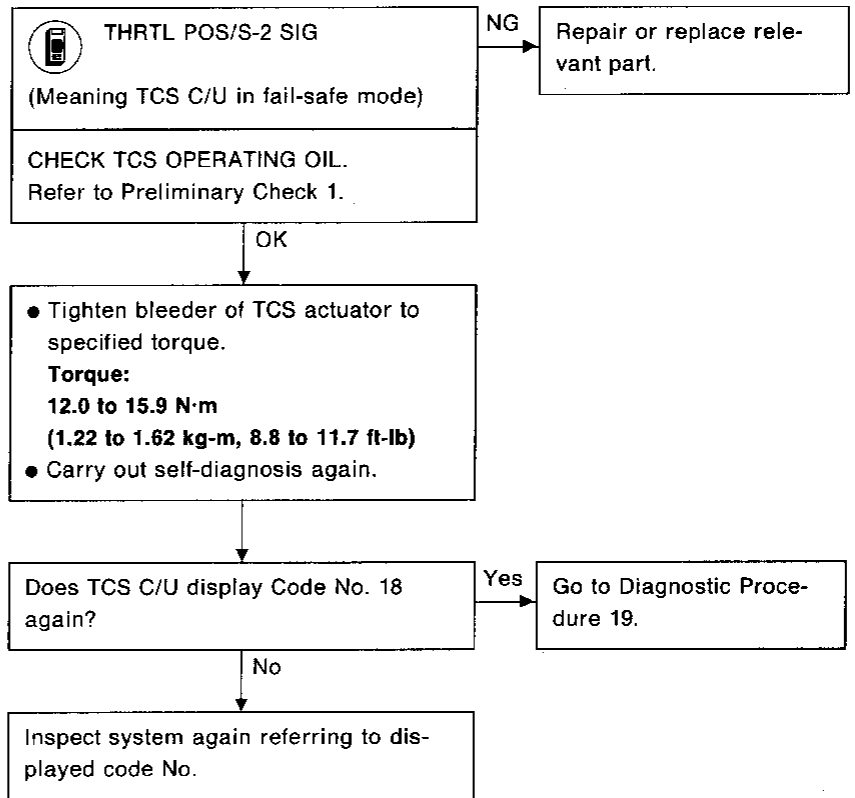
Continuity should not exist.

NG → Repair harness and connector.

Replace TCS C/U.

Diagnostic Procedure 18

TCS OPERATING OIL PRESSURE
(Code No. 18 of TCS C/U)
(Code No. 13 of TCM)



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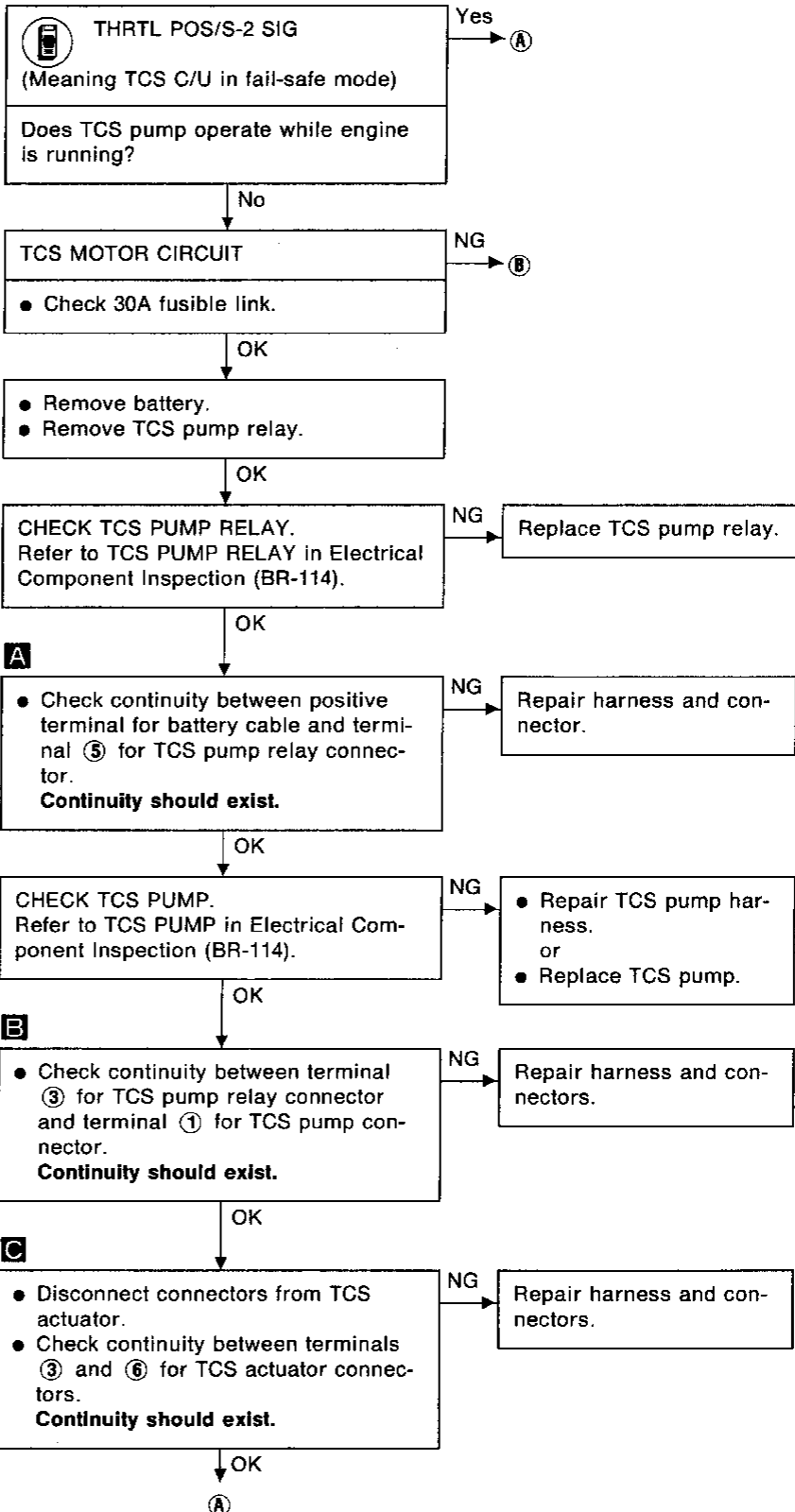
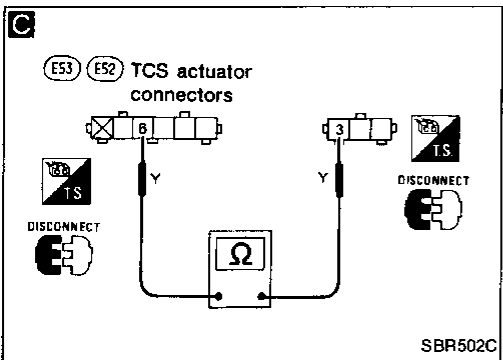
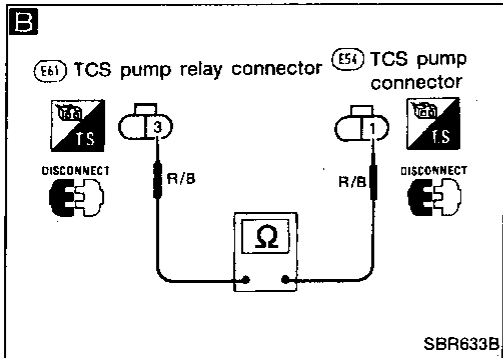
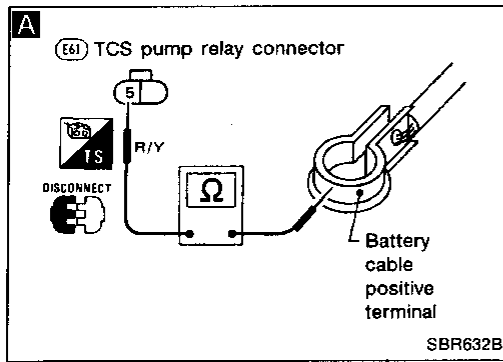
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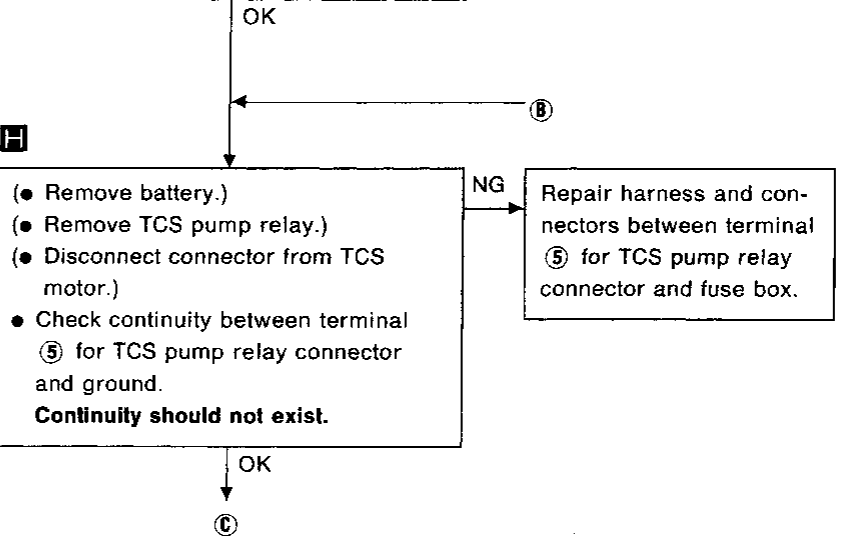
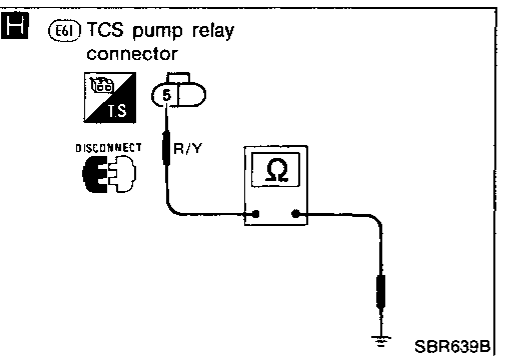
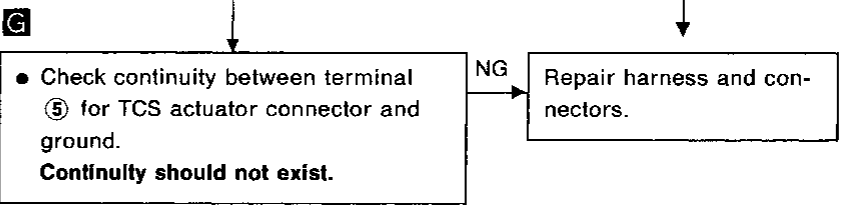
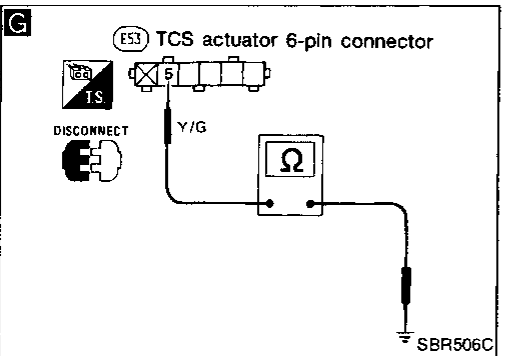
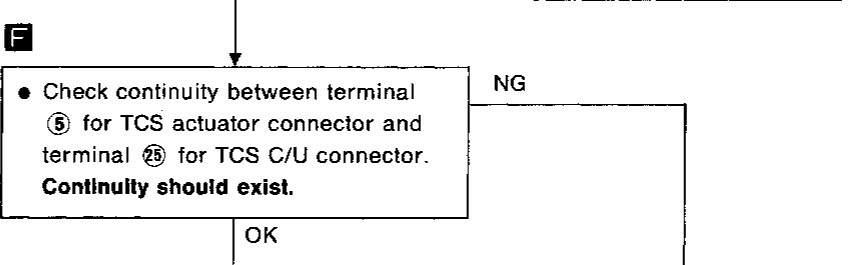
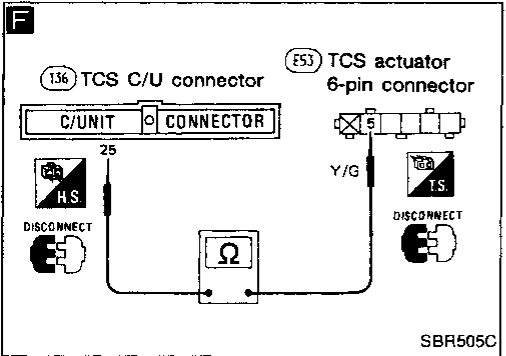
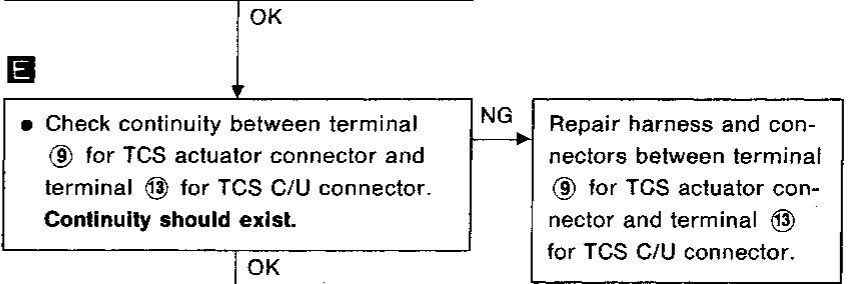
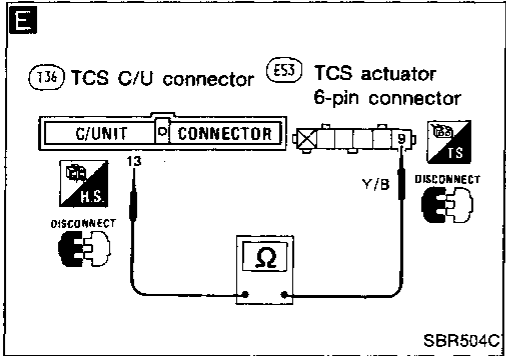
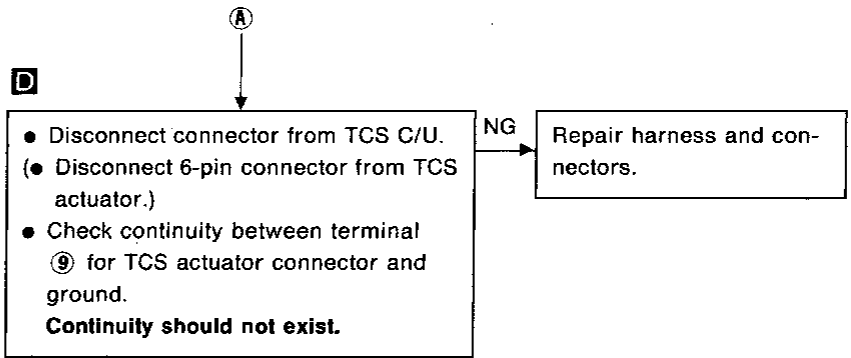
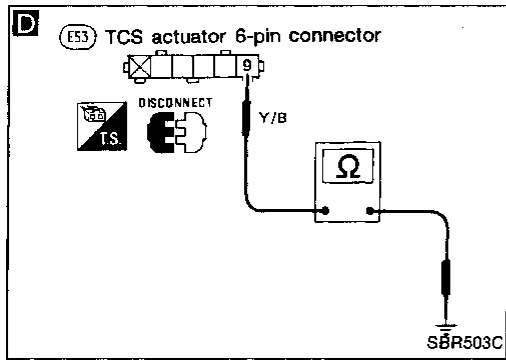
Diagnostic Procedure 19

TCS MOTOR CIRCUIT AND TCS ACTUATOR
(Code No. 19 of TCS C/U)
(Code No. 13 of TCM)



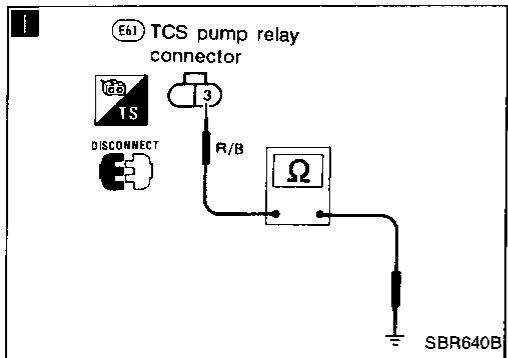
TROUBLE DIAGNOSES FOR TCS

Diagnostic Procedure 19 (Cont'd)



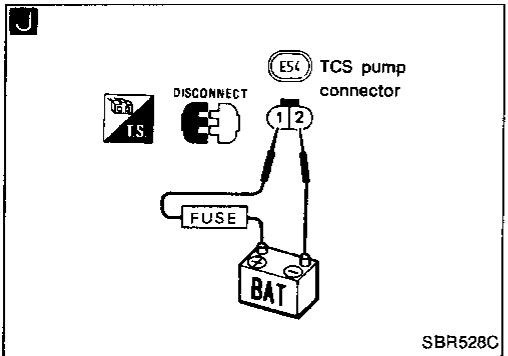
TROUBLE DIAGNOSES FOR TCS

Diagnostic Procedure 19 (Cont'd)

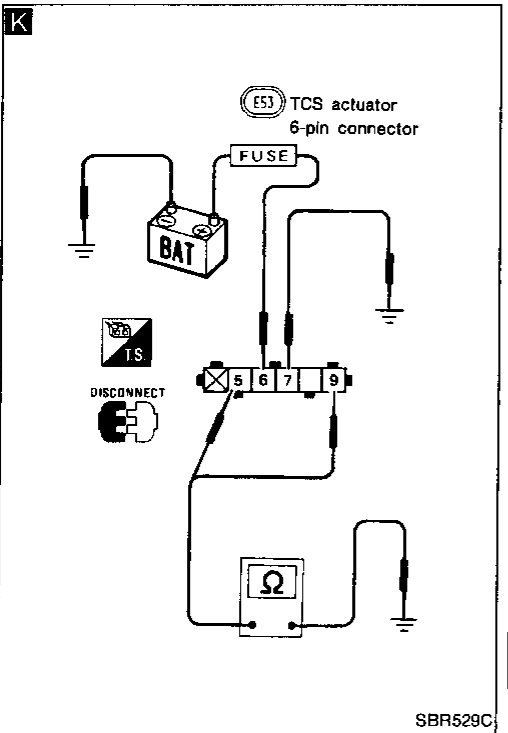


- I**
- Check continuity between terminal ③ for TCS pump relay connector and ground.
Continuity should not exist.

NG → Repair harness between terminal ③ for TCS pump relay connector and terminal ① for TCS pump connector.



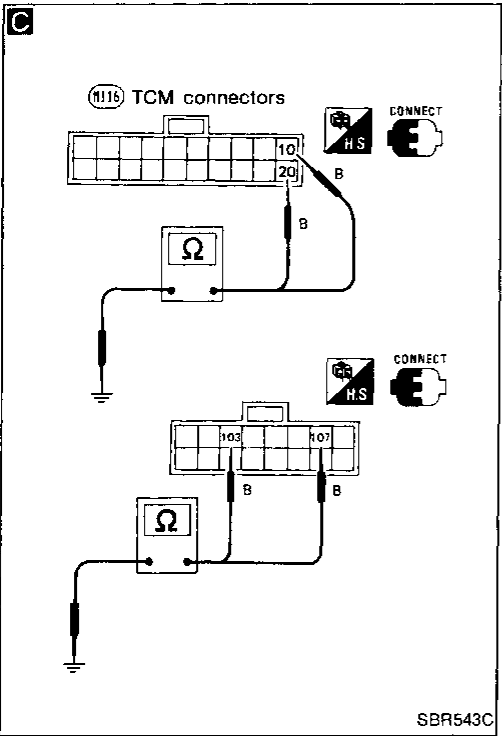
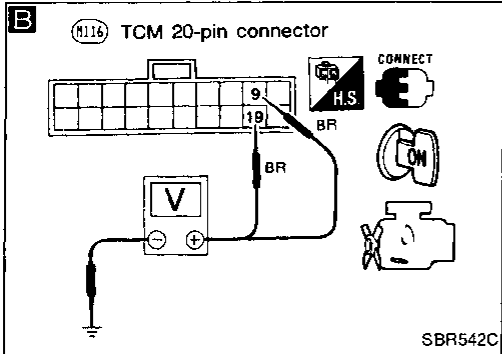
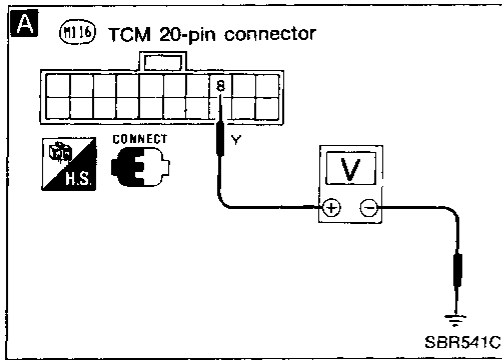
- J**
- Tighten bleeder of TCS actuator to specified torque.
Torque:
12.0 to 15.9 N·m
(1.22 to 1.62 kg·m, 8.8 to 11.7 ft·lb)
 - Apply battery voltage to TCS pump for only 5 SECONDS.
Pay attention to the polarity.



- K**
- Apply battery voltage to terminal ⑥ for TCS actuator with suitable wire.
 - Connect terminal ⑦ for TCS actuator and ground with a suitable wire.
Pay attention so as not to short circuit for both wires.
 - Check continuity between terminals ⑤ and ⑨ for TCS actuator and ground under the following conditions.
Before loosening bleeder of TCS actuator:
Continuity should not exist.
After loosening bleeder of TCS actuator:
Continuity should exist.

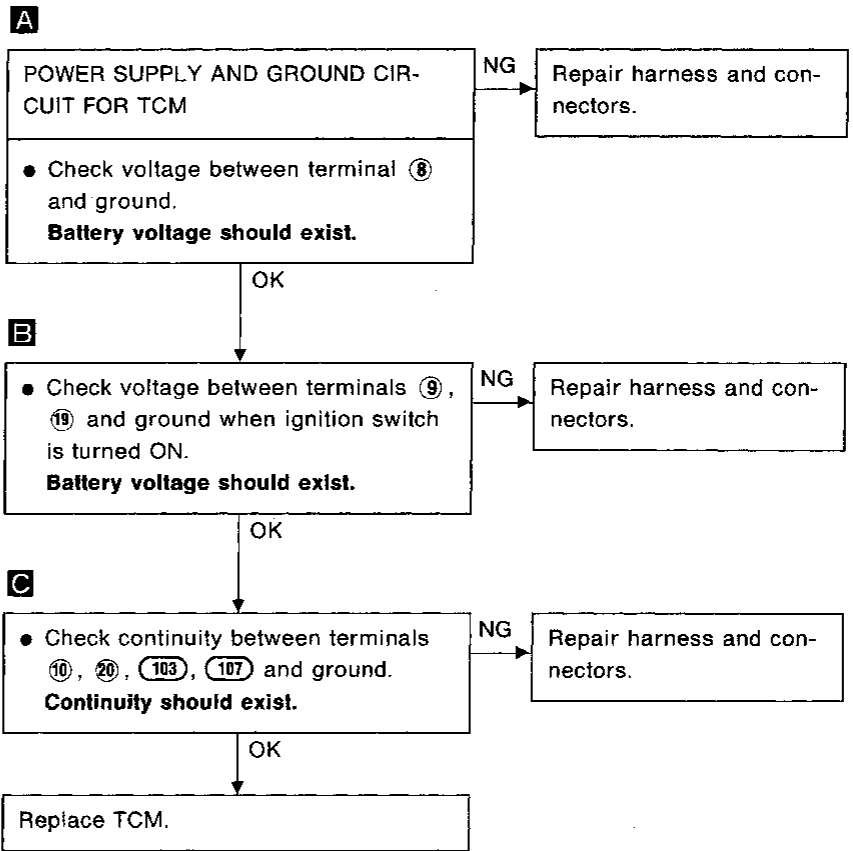
NG → Replace TCS actuator.

OK → Final check



Diagnostic Procedure 20

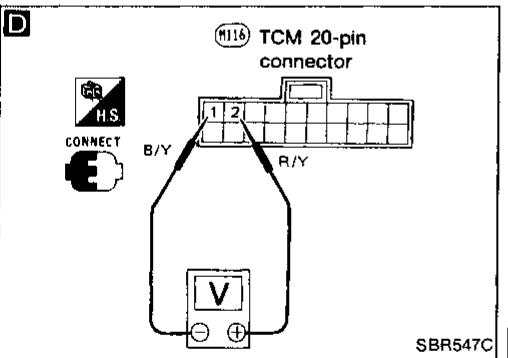
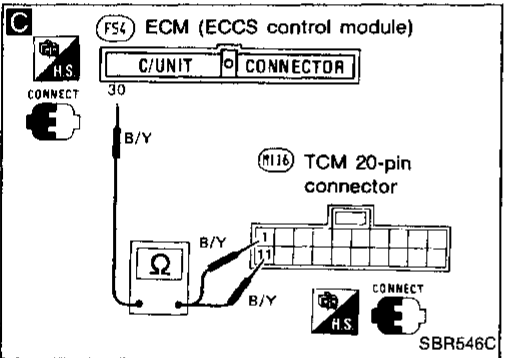
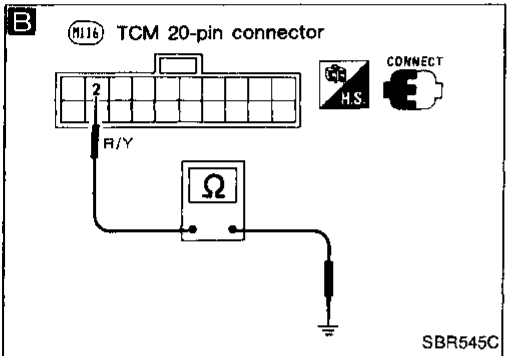
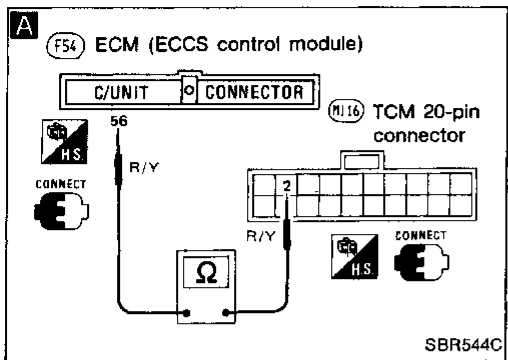
POWER SUPPLY AND GROUND CIRCUIT FOR TCM
 (Code No. 13 of TCS C/U)
 (Code No. 0 ... LED of TCM does not blink)



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Diagnostic Procedure 21

THROTTLE POSITION SENSOR SIGNAL INPUT CIRCUIT (Code No. 13 of TCS C/U) (Code No. 11 of TCM)



THROTTLE POSI SEN

Does TCS C/U display code No. 13?

No → Inspect system referring to code No. displayed by TCS C/U.

Yes → Does ECM (ECCS control module) display code No. 43?

Yes → Check ECM. Refer to "TROUBLE DIAGNOSES" in EF & EC section.

No → **A**

THROTTLE POSITION SENSOR SIGNAL INPUT CIRCUIT

- Check continuity between terminal ② for TCM and terminal ⑤⑥ for ECM. **Continuity should exist.**

OK → **B**

- Check continuity between terminal ② for TCM and ground. **Continuity should not exist.**

OK → **C**

Check continuity between terminals ①, ①① for TCM and terminal ③⑩ for ECM (ECCS control module). **Continuity should exist.**

OK → **D**

Check voltage between terminal ② and terminal ① for TCM. **0.3V to 3.3V should exist depending on accelerator position.**

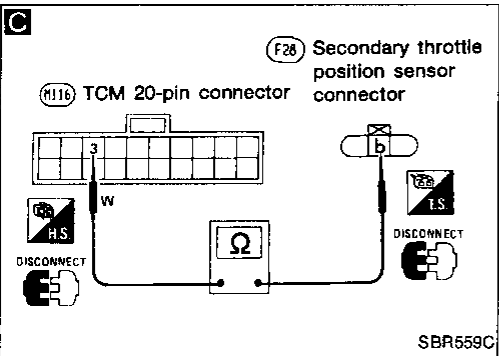
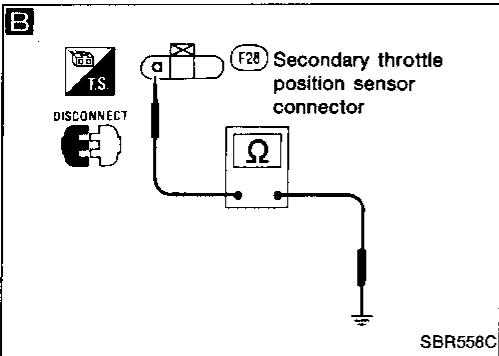
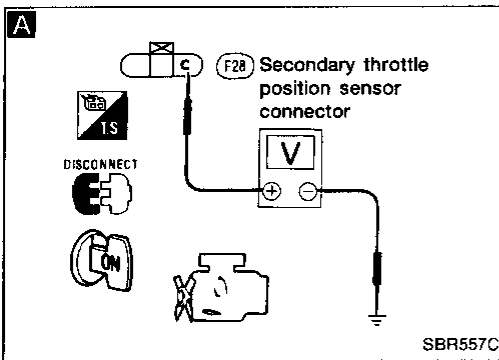
OK → Replace TCM.

NG → Repair harness and connectors.

NG → Repair harness and connectors.

NG → Repair harness and connector.

NG → Replace ECM (ECCS control module).



Diagnostic Procedure 22

SECONDARY THROTTLE POSITION SENSOR SIGNAL INPUT CIRCUIT

(Code No. 13 of TCS C/U)
(Code No. 12 of TCM)

A

THROTTLE POSI SEN2

NG → Repair harness and connectors between terminal ⑮ for TCM connector, ④⑧ for ECM (ECCS control module) connector and terminal ③.

POWER SUPPLY FOR SECONDARY THROTTLE POSITION SENSOR

Check voltage between terminal ③ for secondary throttle position sensor connector and ground when ignition switch is "ON".
Voltage: Approx. 5V

OK ↓

B

GROUND CIRCUIT

NG → Repair harness and connectors between terminals ①, ⑪ for TCM connector, ⑩ for ECM (ECCS control module) connector and terminal ②.

Check continuity between terminal ② for secondary throttle position sensor connector and ground when ignition switch is "OFF".
Continuity should exist.

OK ↓

C

- Disconnect 20-pin connector from TCM.
- Check continuity between terminal ③ for TCM connector and terminal ⑥ for secondary throttle position sensor connector.
Continuity should exist.

NG → Repair harness and connector.

OK ↓

CHECK SECONDARY THROTTLE POSITION SENSOR.
Refer to SECONDARY THROTTLE POSITION SENSOR in EF & EC section.

NG → Replace secondary throttle position sensor.

OK ↓

Final check

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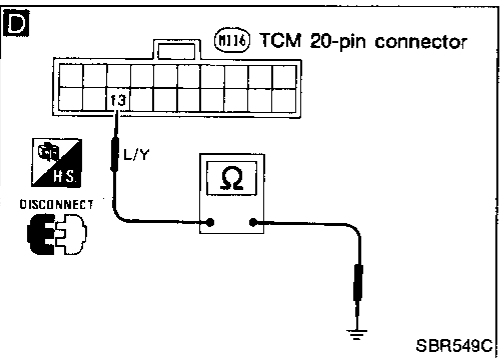
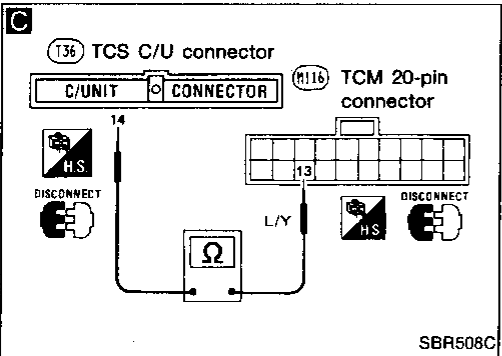
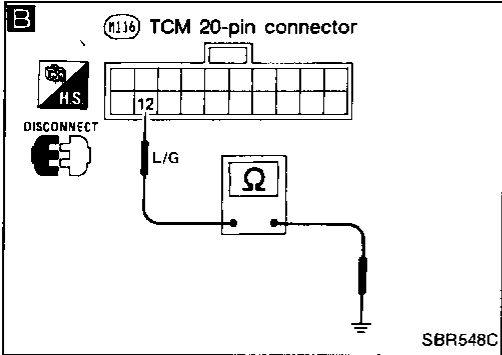
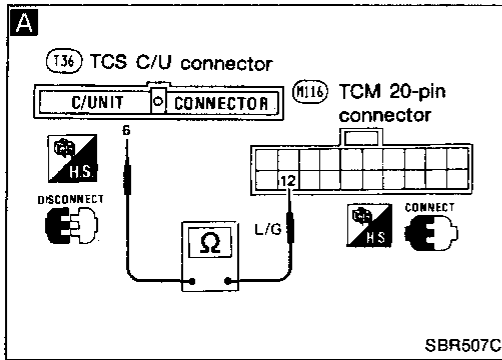
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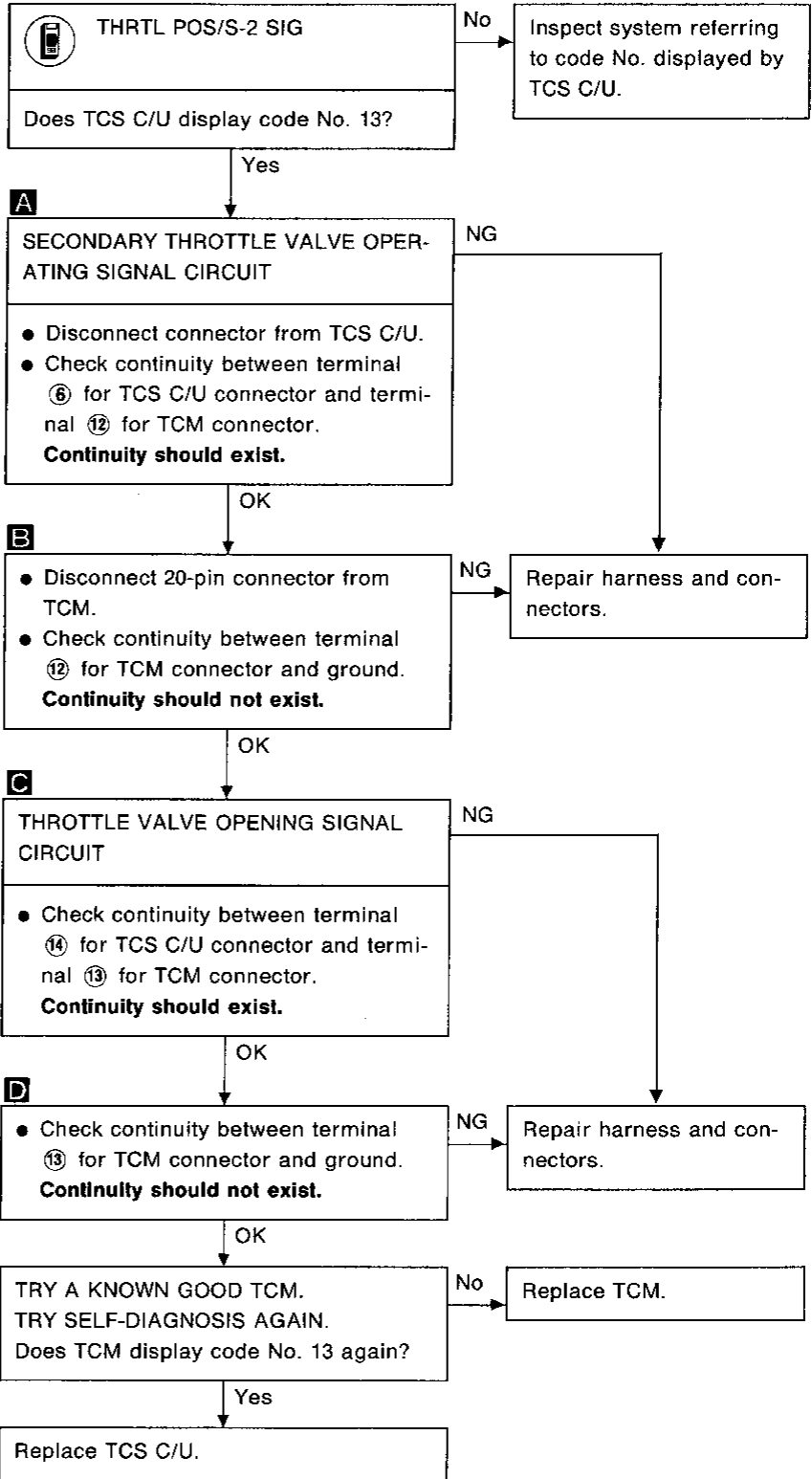
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Diagnostic Procedure 23

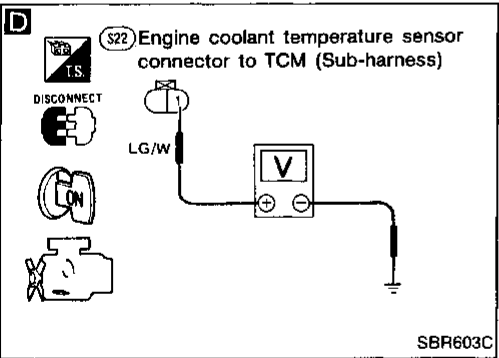
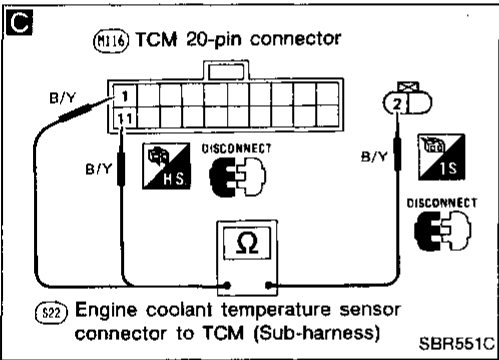
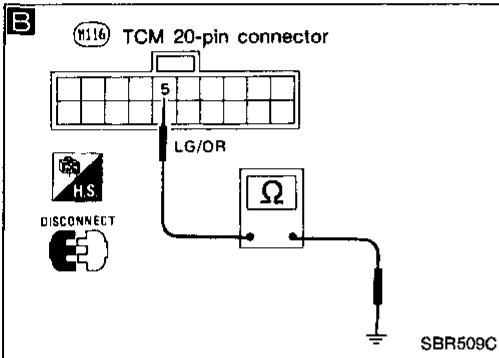
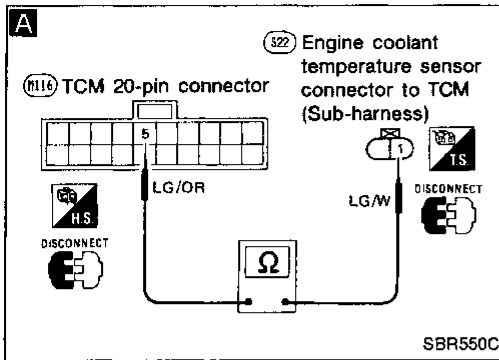
SECONDARY THROTTLE VALVE OPERATING SIGNAL CIRCUIT AND THROTTLE VALVE OPENING SIGNAL CIRCUIT

(Code No. 13 of TCS C/U)
(Code No. 13 of TCM)



Diagnostic Procedure 24

ENGINE COOLANT TEMPERATURE SENSOR FOR TCM CIRCUIT
(Code No. 14 of TCM)



A

COOLNT TEMP/S (TCM)

ENGINE COOLANT TEMPERATURE SENSOR FOR TCM CIRCUIT

- Disconnect connector from engine coolant temperature sensor for TCM and 20-pin connector from TCM.
- Check continuity between terminal ① for engine coolant temperature sensor connector for TCM and terminal ⑤ for TCM connector.
Continuity should exist.

OK

B

Check continuity between terminal ⑤ for TCM connector and ground.
Continuity should not exist.

OK

C

Check continuity between terminal ② for engine coolant temperature sensor connector for TCM, terminals ① and ⑪ for TCM connector.
Continuity should exist.

OK

CH CHECK ENGINE COOLANT TEMPERATURE SENSOR FOR TCM. Refer to ENGINE COOLANT TEMPERATURE SENSOR FOR TCM in Electrical Component Inspection. (BR-114)

OK

D

- Connect connector to TCM.
- Turn ignition switch ON.
- Check voltage between terminal ① for engine coolant temperature sensor for TCM and ground.
Voltage: Approx. 4.8V

OK

Final check

NG

Repair harness and connectors.

Repair harness and connectors.

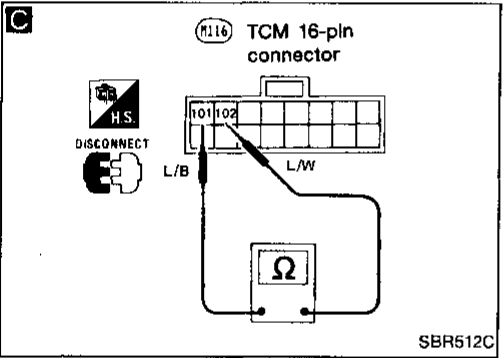
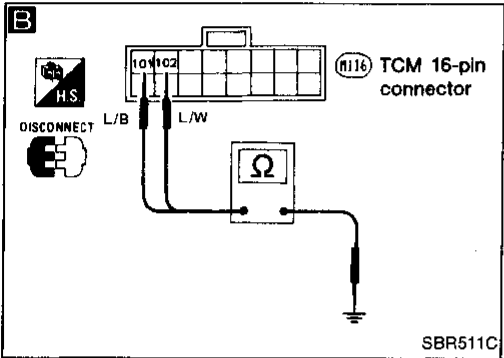
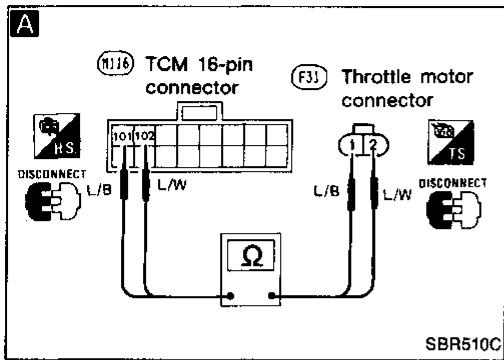
Replace engine coolant temperature sensor for TCM.

Replace TCM.

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Diagnostic Procedure 25

**THROTTLE MOTOR CIRCUIT
(Code No. 13 of TCS C/U)
(Code No. 21 and 22 of TCM)**



A

THROTTLE MOTOR CIRCUIT FOR OPEN

- Disconnect 16-pin connector from TCM and connector from throttle motor.
- Check continuity.

TCM	Motor
101	①
102	②

Continuity should exist.

B

THROTTLE MOTOR CIRCUIT FOR SHORT

- Check continuity between terminals 101, 102 for TCM connector and ground.

Continuity should not exist.

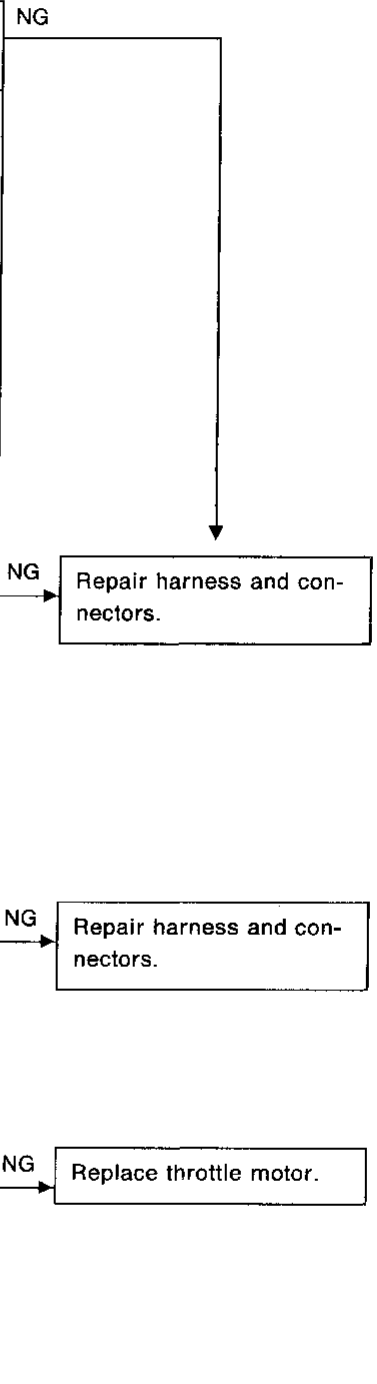
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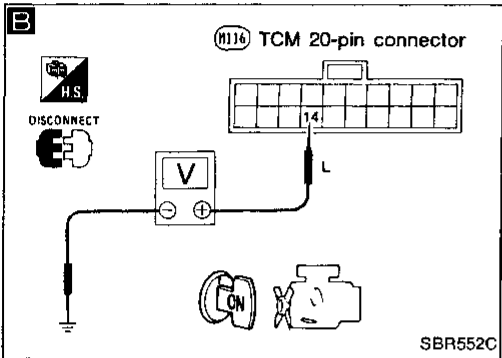
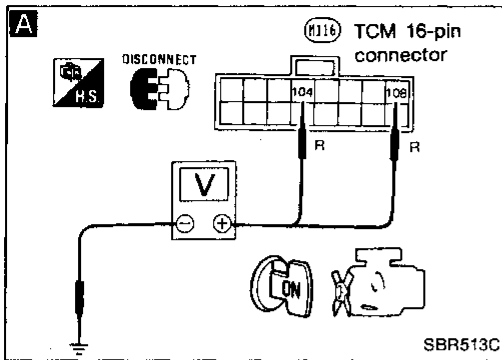
- Disconnect connector from throttle motor.
- Check continuity between terminals 101 and 102 for TCM connector.

Continuity should not exist.

CHECK THROTTLE MOTOR.
Refer to THROTTLE MOTOR in Electrical Component Inspection. (BR-115)

Final Check



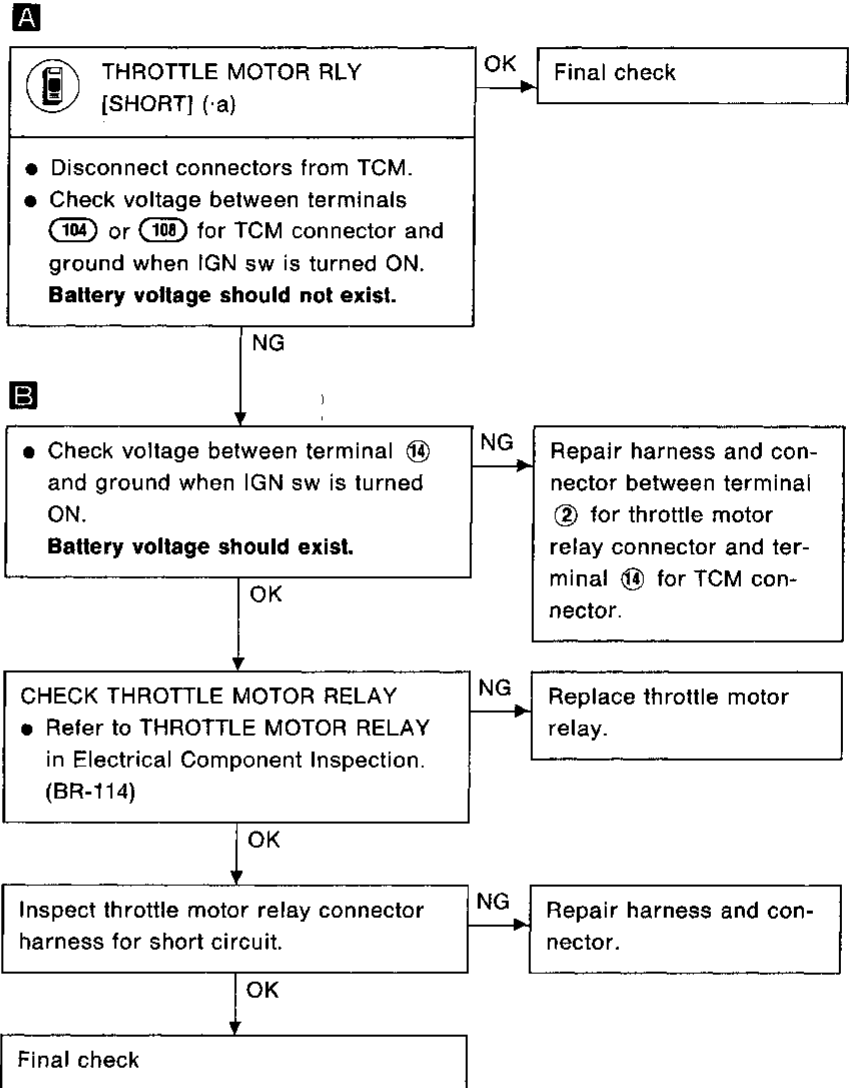


Diagnostic Procedure 26

THROTTLE MOTOR RELAY CIRCUIT FOR SHORT CIRCUIT

(Code No. 13 of TCS C/U)

(Code No. 23 of TCM)



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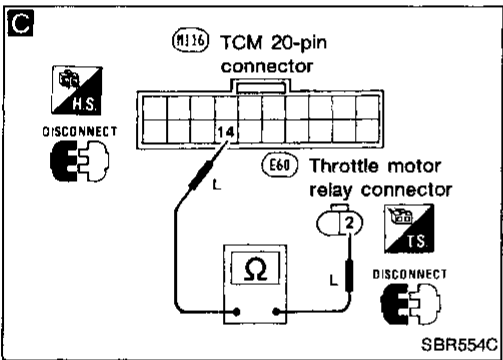
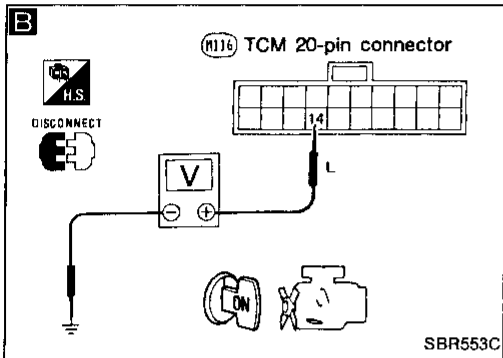
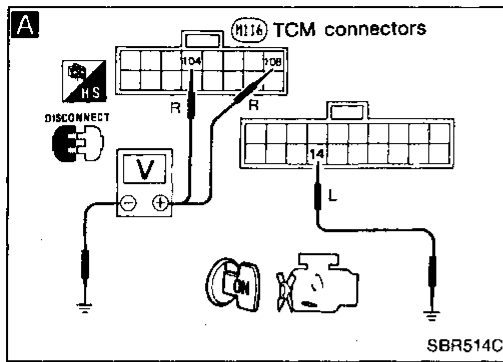
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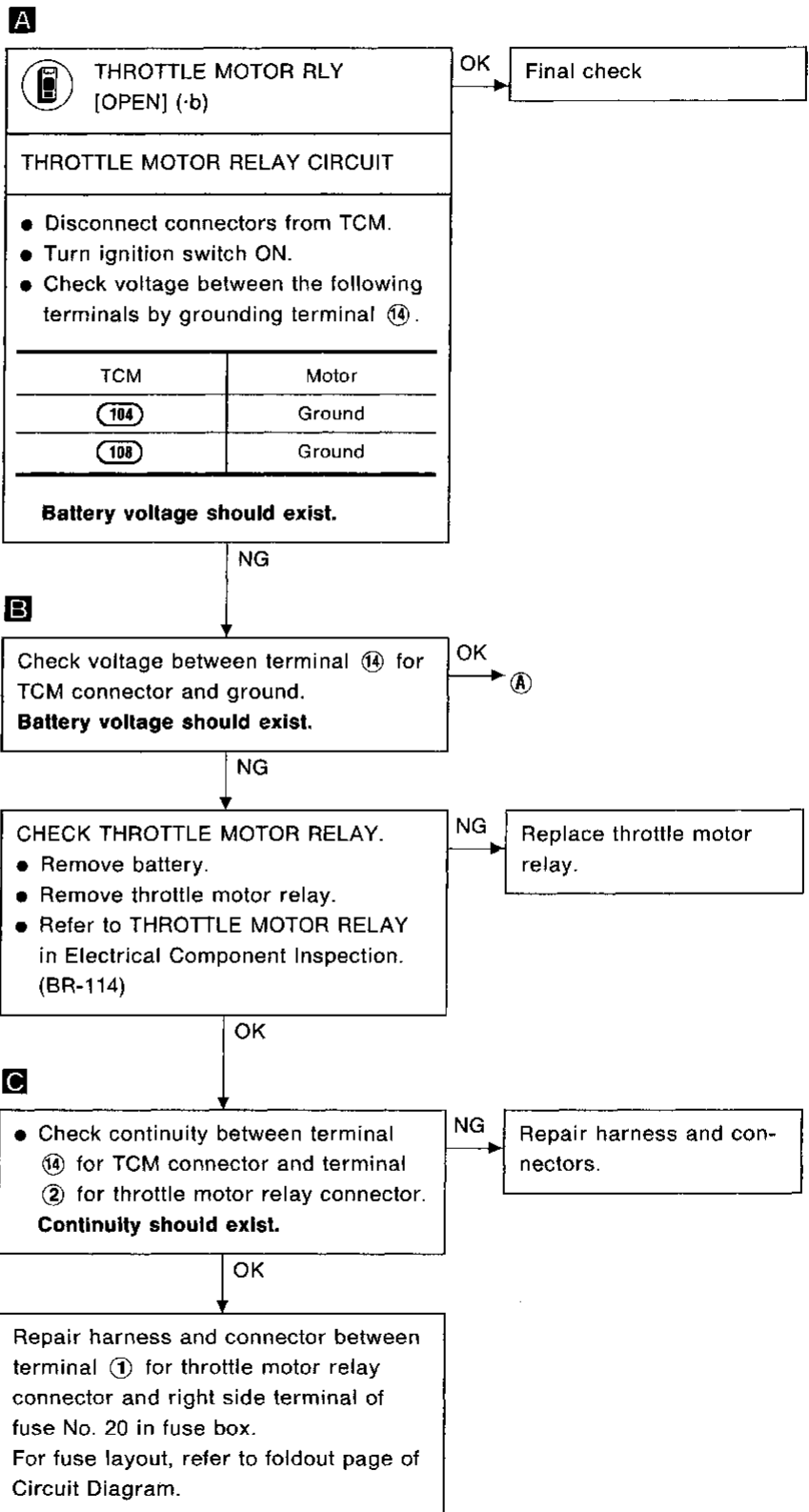
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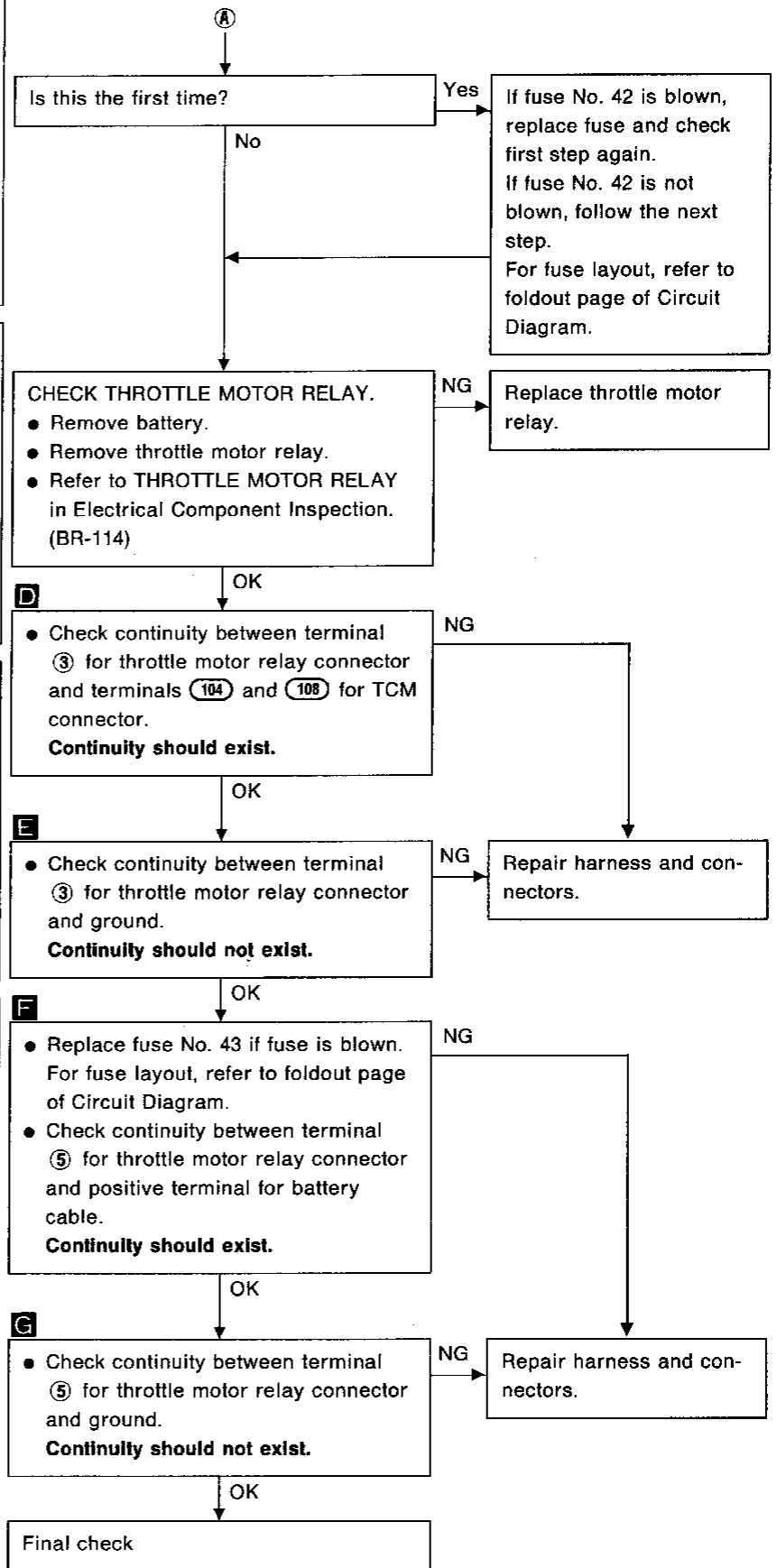
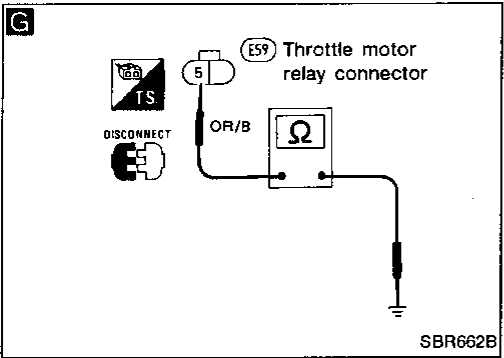
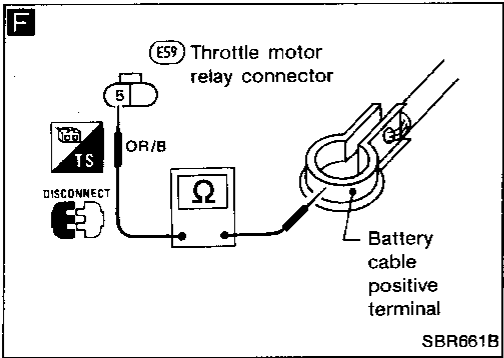
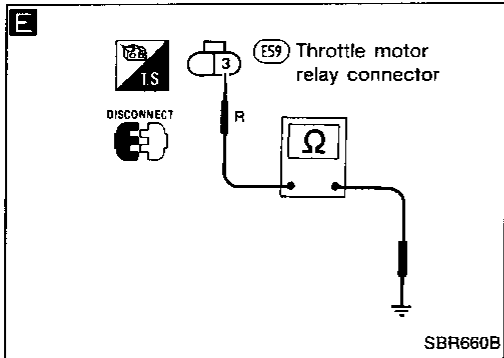
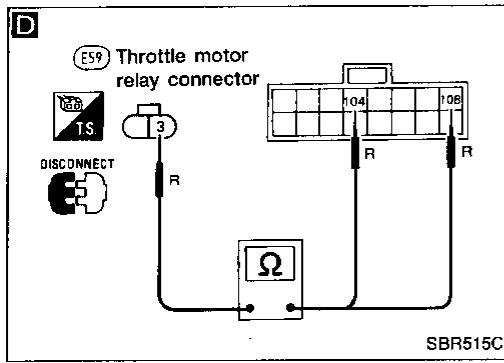
Diagnostic Procedure 27

THROTTLE MOTOR RELAY CIRCUIT FOR OPEN CIRCUIT (Code No. 13 of TCS C/U) (Code No. 24 of TCM)

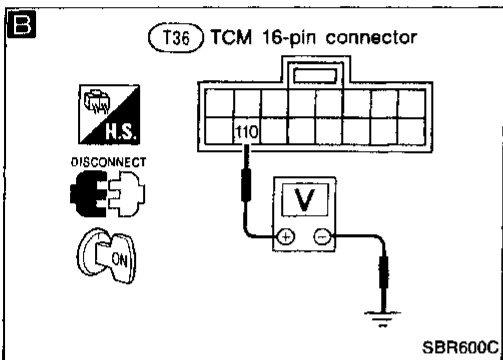
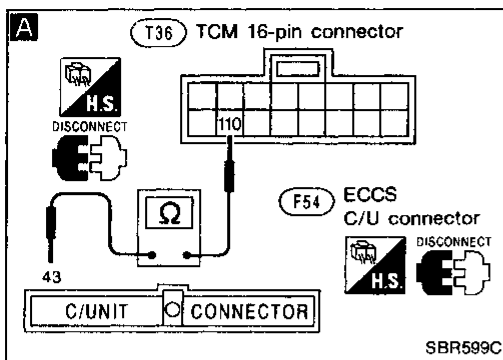


TROUBLE DIAGNOSES FOR TCS

Diagnostic Procedure 27 (Cont'd)

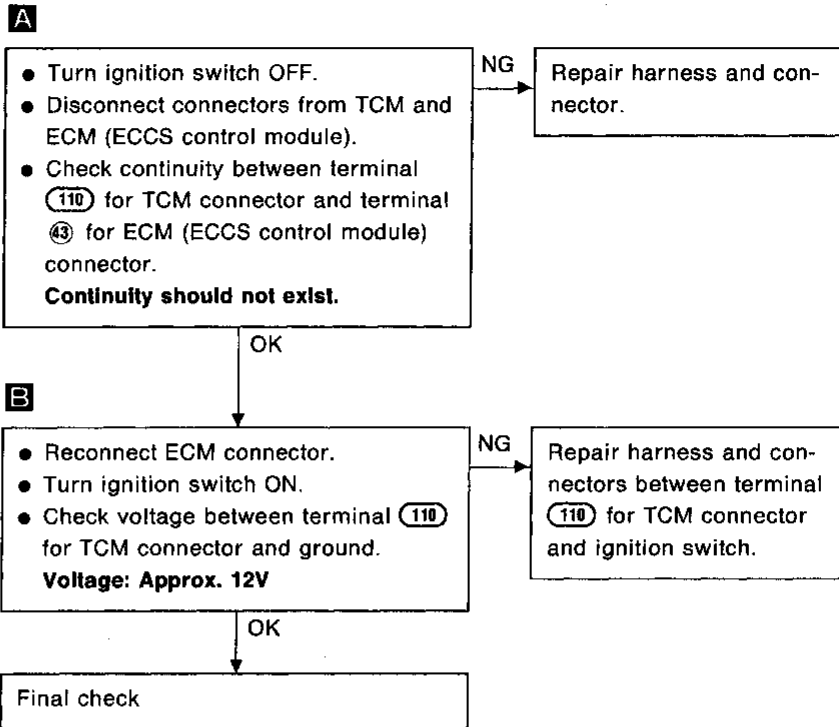


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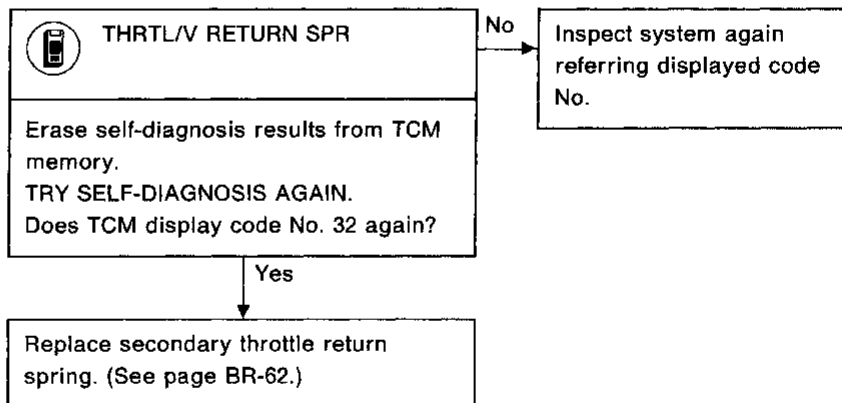
Diagnostic Procedure 28

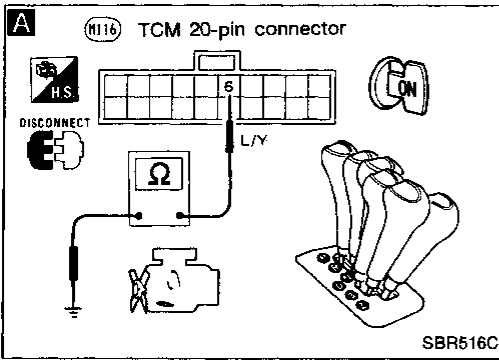
START SIGNAL CIRCUIT (Code No. 31 of TCM)



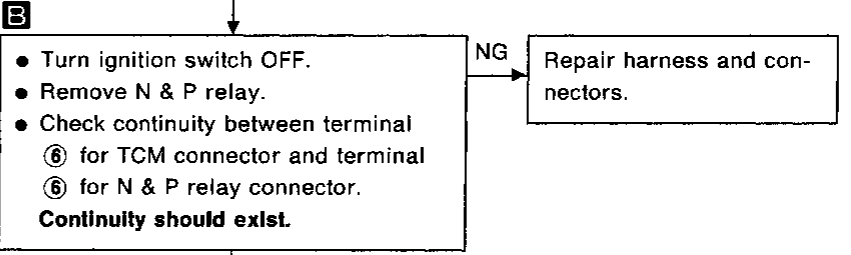
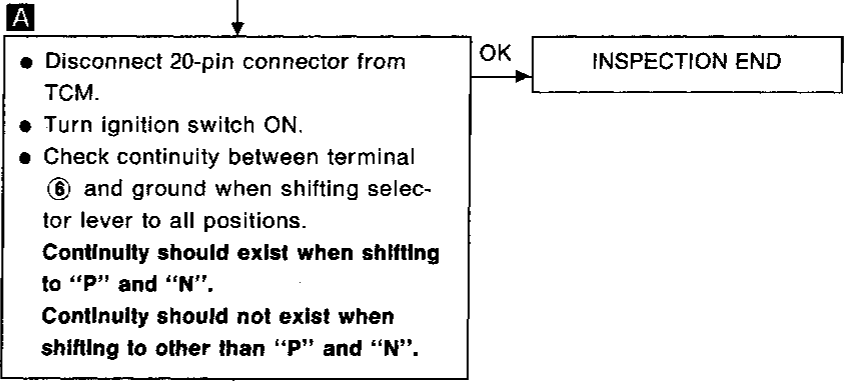
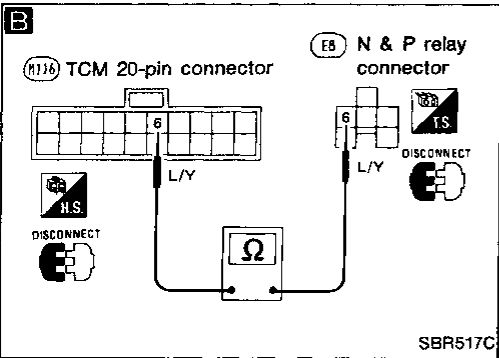
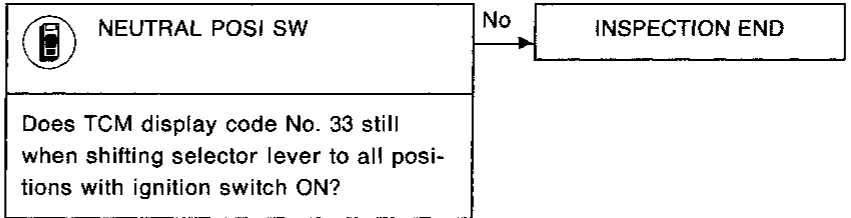
Diagnostic Procedure 29

SECONDARY THROTTLE RETURN SPRING (Code No. 13 of TCS C/U) (Code No. 32 of TCM)





Diagnostic Procedure 30
NEUTRAL POSITION SWITCH CIRCUIT
(Code No. 33 of TCM)

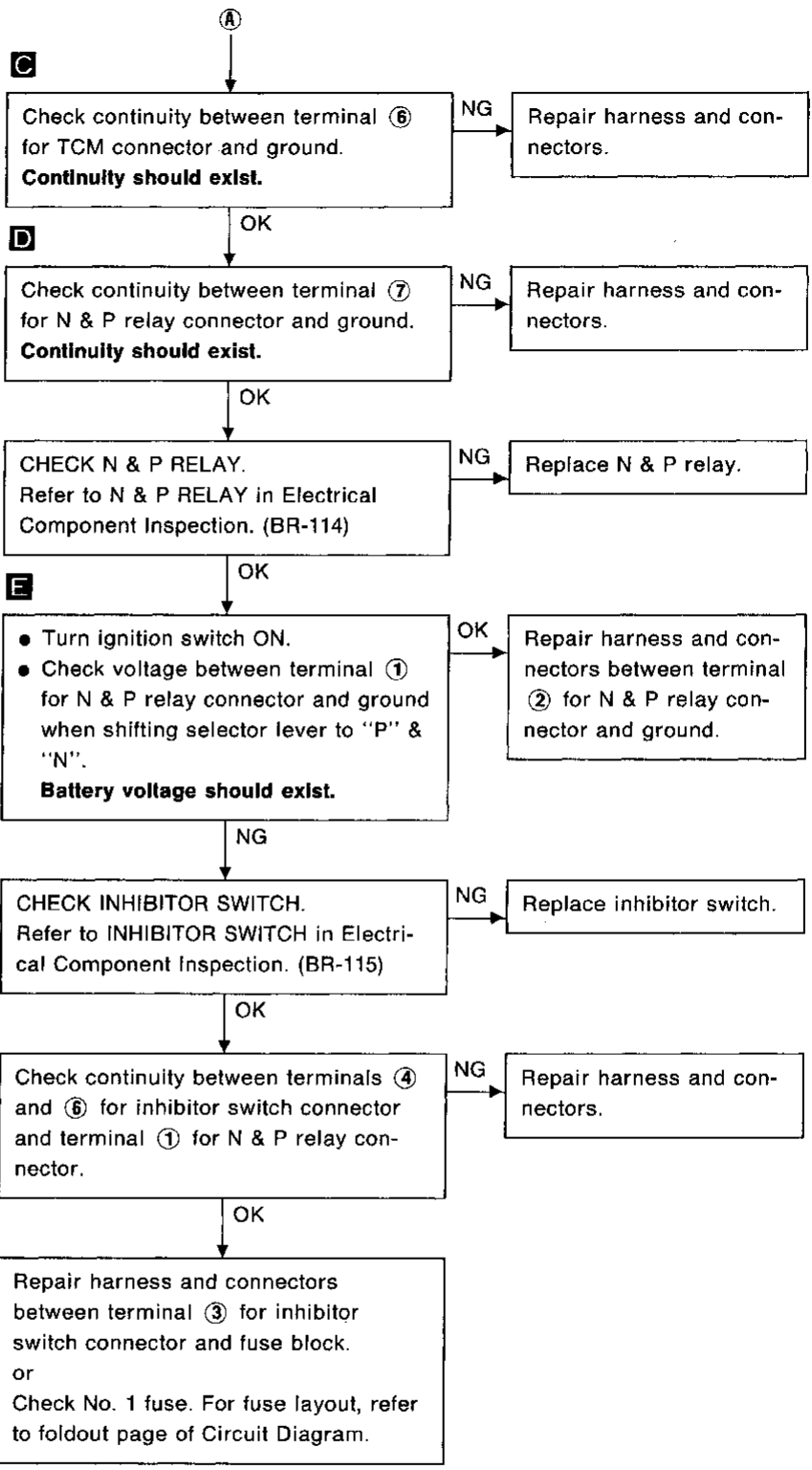
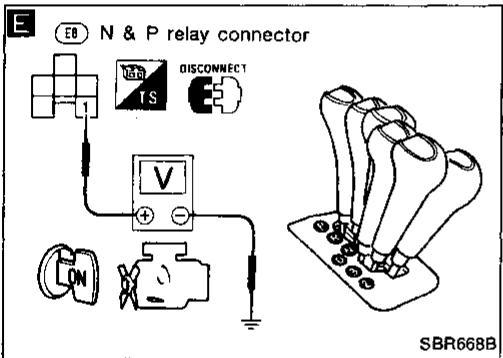
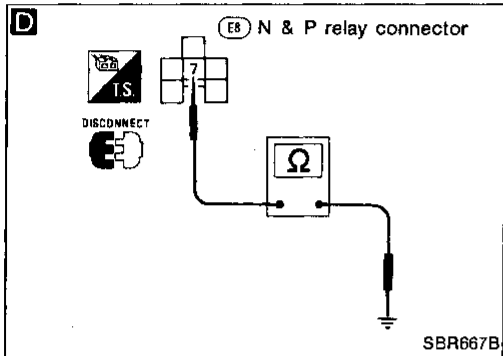
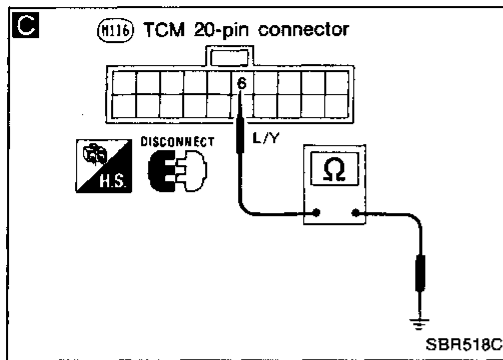


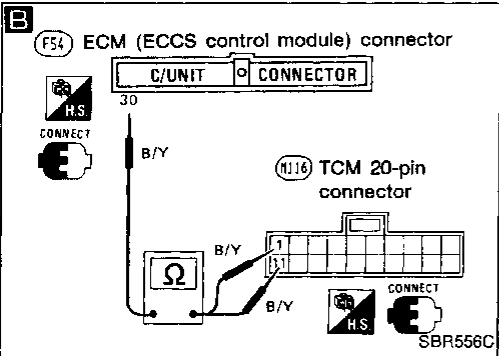
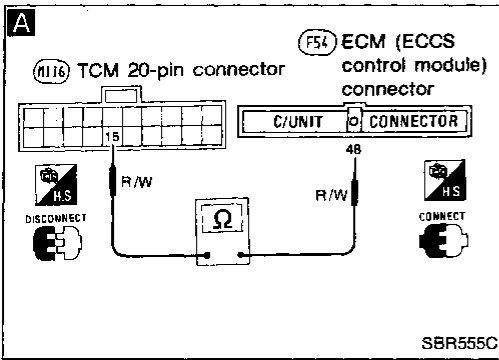
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TROUBLE DIAGNOSES FOR TCS

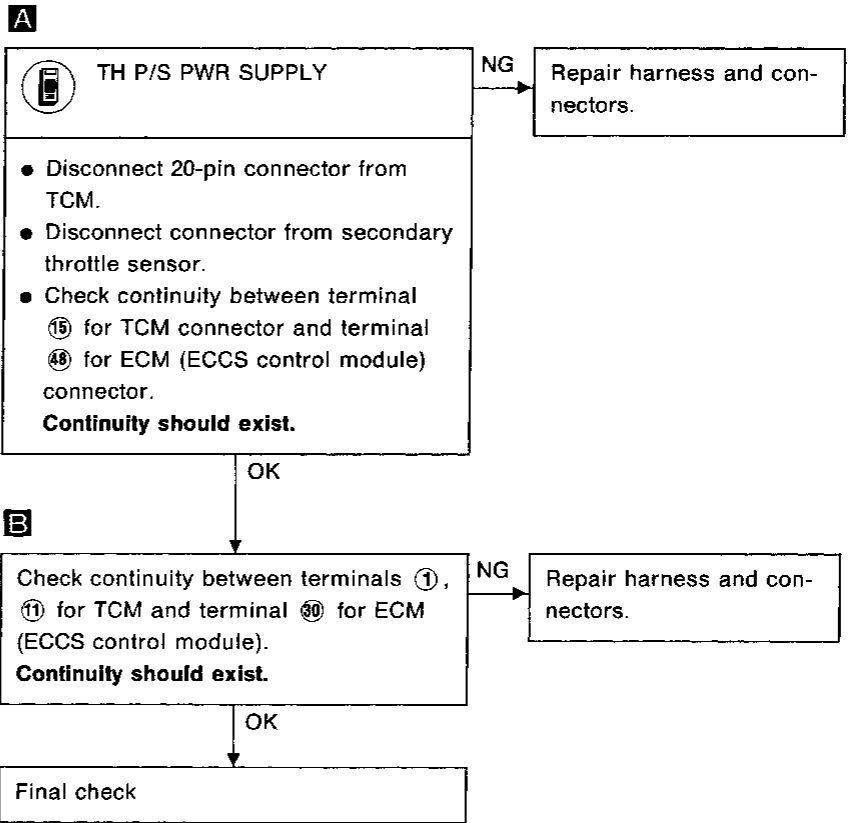
Diagnostic Procedure 30 (Cont'd)





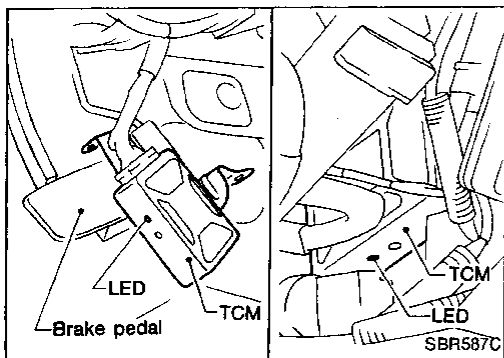
Diagnostic Procedure 31

POWER SUPPLY CIRCUIT FOR SENSOR
 (Code No. 13 of TCS C/U)
 (Code No. 34 of TCM)



GI
 MA
 EM
 LC
 EF & EC
 FE
 AT
 PD
 FA
 RA
 BR
 ST
 RS
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 HA
 EL
 IDX

TROUBLE DIAGNOSES FOR TCS

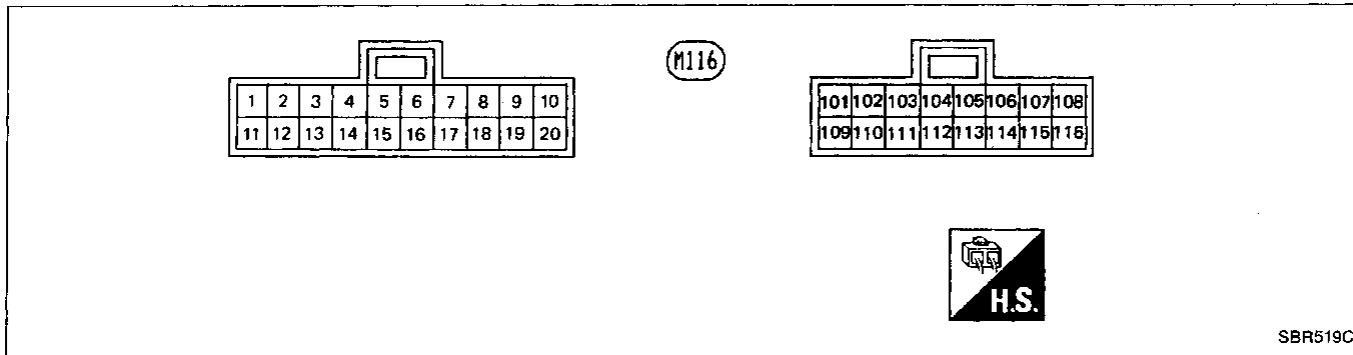


Electrical Component Inspection

INSPECTION OF TCM

- Measure voltage between each terminal and terminal ⑩ or ⑳ by following "TCM INSPECTION TABLE".

- Pin connector terminal layout.



TCM Inspection table

*Data are reference values.

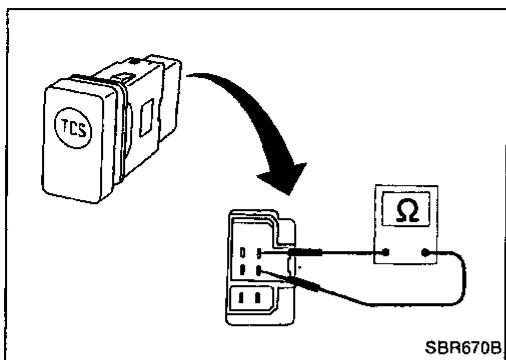
TERMINAL NO.	ITEM	CONDITION	*DATA
2	Throttle opening signal	Ignition switch "ON"	Approximately 0.4 - 3.1V Voltage varies with the throttle valve opening angle.
3	Secondary throttle position sensor	Vehicle is running	Approximately 0.5 - 4.1V Voltage varies with the secondary throttle valve opening angle.
4	Secondary throttle valve signal	Vehicle is running	Approximately 0.4 - 3.1V
5	Engine coolant temperature sensor for TCM	Engine is running	Approximately 0 - 5V Voltage varies with the engine coolant temperature.
7	TCS SW	Ignition switch "ON"	Approximately 10V
14	Throttle motor relay	Ignition switch "ON"	Approximately 1.5V
15	Power supply for sensor	Ignition switch "ON"	Approximately 5V

TROUBLE DIAGNOSES FOR TCS

Electrical Component Inspection (Cont'd)

TCS CANCEL SWITCH

Check continuity between terminals as shown.

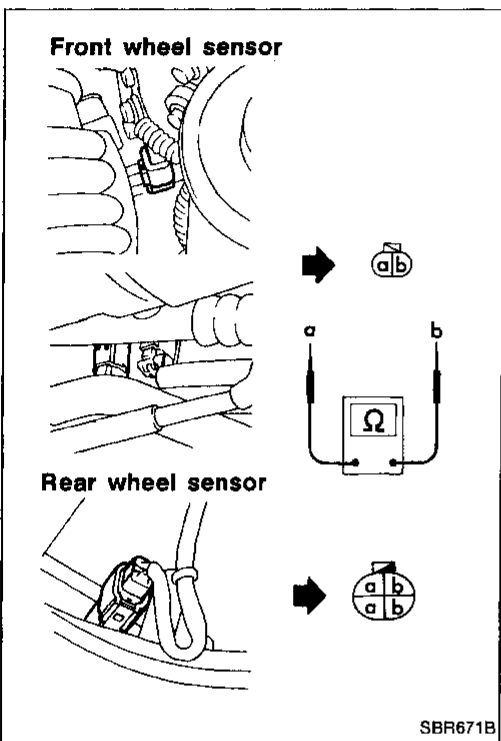


SWITCH condition	Continuity existence
Pushed	Yes
Released	No

GI

MA

EM



WHEEL SENSOR

Check resistance between terminals **a** and **b**.

Resistance: 0.9 - 1.1 kΩ

LC

EF &
EC

FE

AT

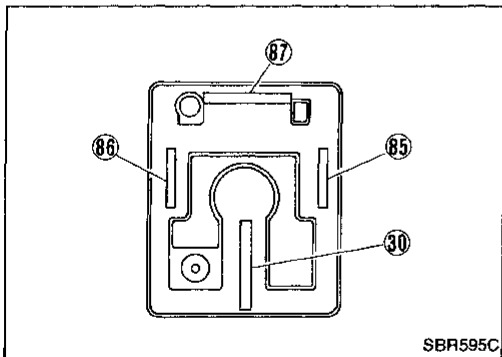
PD

FA

RA

BR

ABS ACTUATOR MOTOR RELAY



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

ST

RS

BT

HA

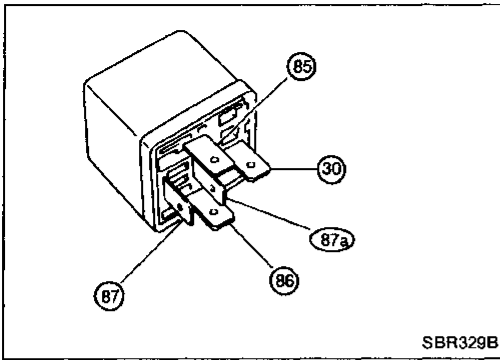
EL

IDX

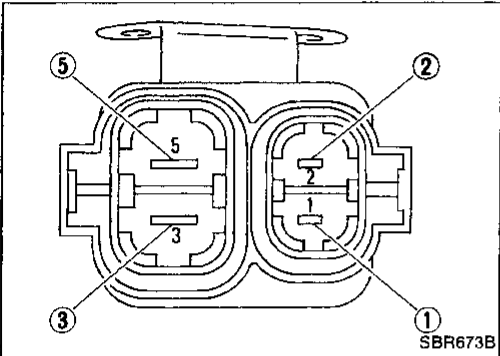
TROUBLE DIAGNOSES FOR TCS

Electrical Component Inspection (Cont'd)

ABS ACTUATOR SOLENOID VALVE RELAY

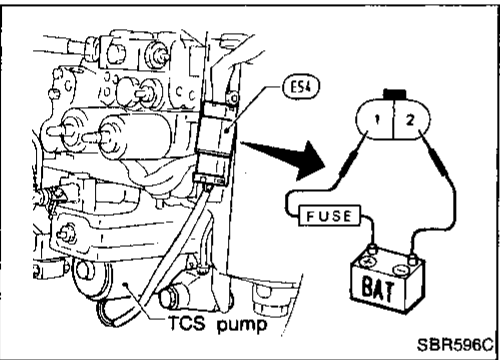


Condition	Continuity existence between terminals ③⑩ and ⑧7a	Continuity existence between terminals ③⑩ and ⑧7
Battery voltage not applied between terminals ⑧⑤ and ⑧⑥.	Yes	No
Battery voltage applied between terminals ⑧⑤ and ⑧⑥.	No	Yes



TCS PUMP RELAY AND THROTTLE MOTOR RELAY

Condition	Continuity existence between terminals ③ and ⑤
Battery voltage not applied between terminals ① and ②.	No
Battery voltage applied between terminals ① and ②.	Yes

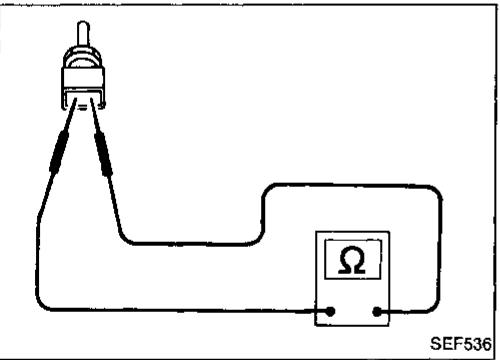


TCS PUMP

TCS pump (motor) should operate when battery voltage is applied.

CAUTION:

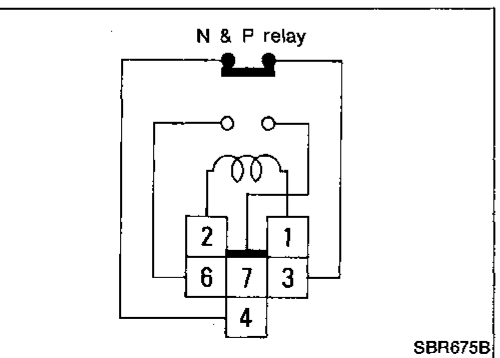
Do not apply battery voltage for more than 5 seconds.



ENGINE COOLANT TEMPERATURE SENSOR FOR TCM

1. Disconnect engine coolant temperature sensor harness connector.
2. Check resistance as shown in the figure.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
80 (176)	0.30 - 0.33



N & P RELAY

Check continuity between terminals ⑥ and ⑦

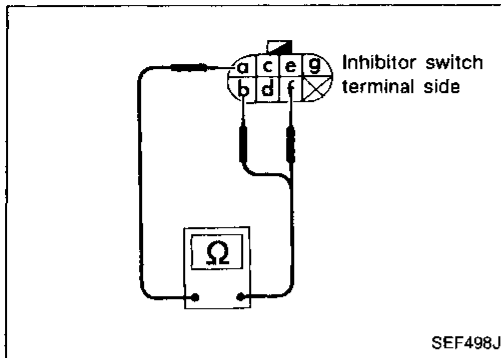
Condition	Continuity
12V direct current supply between terminals ① and ②.	Yes
No current supply	No

TROUBLE DIAGNOSES FOR TCS

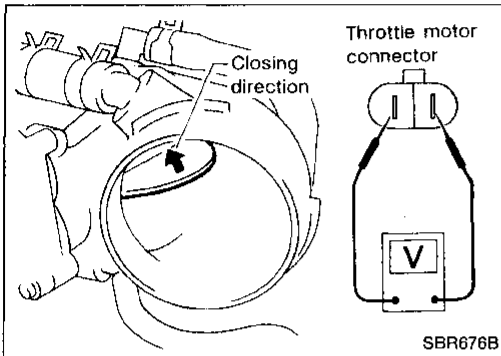
Electrical Component Inspection (Cont'd)

INHIBITOR SWITCH

Check continuity between terminals **(a)** and **(b)**, **(f)**.



Condition	Continuity between terminals (a) and (b)	Continuity between terminals (a) and (f)
Shift to "P" position	Yes	No
Shift to "N" position	No	Yes
Shift to positions other than "P" and "N"	No	No



THROTTLE MOTOR

WARNING:

Before touching the secondary throttle valve, be sure to disconnect the throttle valve motor connector. Failure to do so may cause injury due to accidental actuation of the valve.

Check voltage produced by motor by opening/closing secondary throttle valve as quickly as possible.

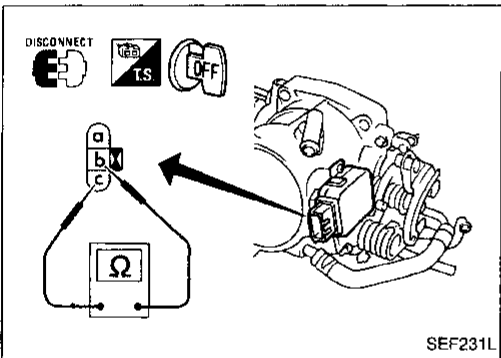
Use needle type voltmeter.

Needle should fluctuate.

Make sure throttle valve moves smoothly from fully closed to fully open position without binding.

SECONDARY THROTTLE POSITION SENSOR

1. Turn ignition switch "OFF".
2. Disconnect secondary throttle position sensor harness connector.
3. Make sure that resistance between terminals **(b)** and **(c)** changes when closing secondary throttle valve by hand.



Secondary throttle valve condition	Resistance (kΩ)
Fully open	Approximately 3.0 - 5.8
Partially open	0.8 - 5.8
Fully closed	Approximately 0.8

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

Front brake	
Brake model	CL28VF disc brake
Cylinder bore diameter x number of pistons mm (in)	42.8 (1.685) x 2
Lining length x width x thickness mm (in)	127 x 56 x 9.5 (5.00 x 2.20 x 0.374)
Rotor outer diameter x thickness mm (in)	280 x 28 (11.02 x 1.10)
Rear brake	
Brake model	AD11B disc brake
Cylinder bore diameter x number of piston mm (in)	38.2 (1.504) x 1
Lining length x width x thickness mm (in)	97.4 x 33.9 x 10 (3.835 x 1.335 x 0.39)
Rotor outer diameter x thickness mm (in)	292 x 9 (11.50 x 0.35)

Parking brake	
Brake model	DS17HD drum brake
Lining length x width x thickness mm (in)	154.1 x 25.0 x 3.0 (6.07 x 0.984 x 0.118)
Drum inner diameter mm (in)	172.0 (6.77)
Master cylinder	
Cylinder bore diameter mm (in)	25.40 (1)
Control valve	
Valve model	Proportioning valve (within master cylinder)
Split point [kPa (kg/cm ² , psi)] x reducing ratio	3,923 (40, 569) x 0.4
Brake booster	
Booster model	M215T
Diaphragm diameter mm (in)	Primary: 230 (9.06) Secondary: 205 (8.07)
Brake fluid	
Recommended brake fluid	DOT 3

TRACTION CONTROL SYSTEM — TCS —

TCS operating oil	Brake fluid "DOT 3"
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Inspection and Adjustment

DISC BRAKE

	Unit: mm (in)	
Location	Front	Rear
Brake model	CL28VF	AD11B
Pad wear limit		
Minimum thickness	2.0 (0.079)	
Rotor repair limit		
Minimum thickness	26.0 (1.024)	8.0 (0.315)

BRAKE PEDAL

	Unit: mm (in)
Free height "H"	184 - 194 (7.24 - 7.64)
Depressed height "D" [under force of 490 N (50 kg, 110 lb) with engine running]	100 - 110 (3.94 - 4.33)
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)

DRUM BRAKE

	Unit: mm (in)
Location	Rear
Brake model	DS17HD
Lining wear limit	
Minimum thickness	1.5 (0.059)
Drum repair limit	
Maximum inner diameter	173.0 (6.81)
Brake shoe "backoff" adjustment	5 - 6 latches

PARKING BRAKE

	Unit: mm (in)
Control type	Foot lever
Pedal stroke [under force of 196 N (20 kg, 44 lb)]	90 - 105 (3.54 - 4.13)
Pedal stroke when warning switch comes on	20 (0.79) or less