

BRAKE SYSTEM

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PRECAUTIONS

1. Care must be taken to replace each part properly as it could affect the performance of the brake system and result in a driving hazard. Replace the parts with parts of the same part number of equivalent.
2. It is very important to keep parts and the area clean when repairing the brake system.

TROUBLESHOOTING

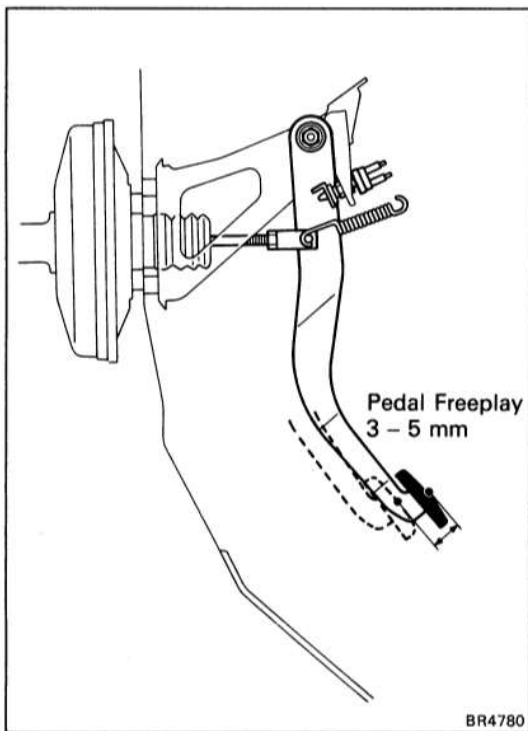
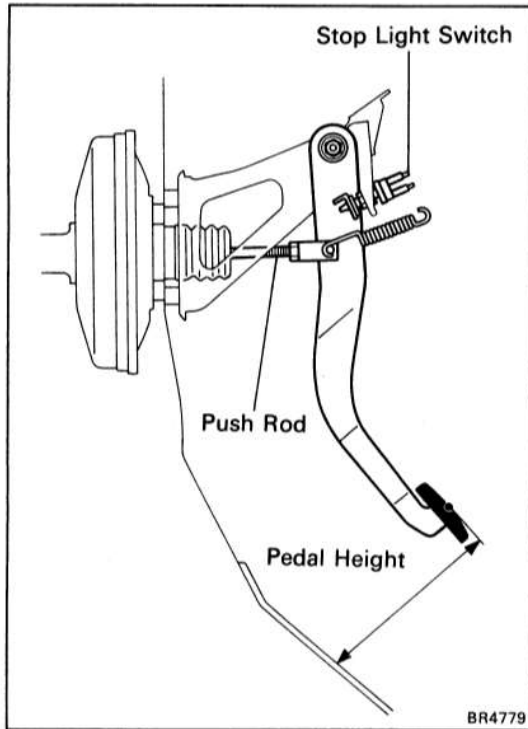
Problem	Possible cause	Remedy	Page
Low or spongy pedal	Brake pads worn	Replace pads	BR-17, 25, 33
	Leak in brake system	Repair leak	
	Master cylinder faulty	Repair or replace master cylinder	BR-9
	Air in brake system	Bleed brake system	BR-7
	Brake cylinder faulty	Repair cylinder	BR-17, 25, 33
	Piston seals worn or damaged	Repair brake cylinder	BR-17, 25, 33
	Rear brake automatic adjuster faulty	Repair or replace adjuster	
Brakes drag	Parking brake out of adjustment	Adjust parking brake	BR-7
	Binding parking brake wire	Repair as necessary	
	Booster push rod out of adjustment	Adjust push rod	BR-16
	Brake line restricted	Repair as necessary	
	Pad cracked or distorted	Replace pad	BR-17, 25, 33
	Caliper piston sticking	Repair as necessary	BR-17, 25, 33
	Adjuster broken	Replace adjuster	
Brakes pull	Master cylinder faulty	Repair or replace master cylinder	BR-9
	Tires improperly inflated	Inflate tires to proper pressure	
	Oil or grease on pads	Check for cause. Replace shoes	
	Brake pads distorted, worn or glazed	Replace pads	BR-17, 25, 33
	Disc out of round	Replace disc	BR-30, 40
	Brake cylinder faulty	Repair cylinder	BR-17, 25, 33
	Piston frozen in brake cylinder	Repair cylinder	BR-17, 25, 33
	Brake pad sticking	Replace pads	BR-17, 25, 33

TROUBLESHOOTING (Cont'd)

Problem	Possible cause	Remedy	Page
Hard pedal but brakes inefficient	Oil or grease on shoes or pads	Check for cause. Replace pads	BR-17, 25, 33
	Brake pads distorted, worn or glazed	Replace pads	BR-17, 25, 33
	Piston frozen in brake cylinder	Repair cylinder	BR-17, 25, 33
	Brake booster faulty	Replace booster	BR-15
	Vacuum leaks	Repair as necessary	
	Brake line restricted	Repair as necessary	
Snapping or clicking noise when brakes are applied	Loose or missing pad support plate	Replace pad support plate	BR-17, 25, 33
	Loose installation bolt	Tighten	BR-17, 25, 33
Scraping or grinding noise when brakes are applied	Worn brake pads	Replace or refinish rotors if heavily scored	BR-17, 25, 33
	Caliper to rotor interference	Replace as required	BR-17, 25, 33
	Dust cover to rotor or backing plate to drum interference	Correct or replace	BR-17, 25, 33
	Other brake system components faulty	Repair or replace as necessary	
	Tires rubbing against chassis and/or body	Repair as necessary	
Groaning, clicking or rattling noise when brakes are not applied	Stones or foreign material trapped inside wheel covers	Remove foreign material	
	Loose wheel nuts	Tighten to correct torque	
		Replace if stud holes are elongated	
	Mal-adjustment of brake pedal or booster push rod	Inspect and adjust	BR-5, 16
	Worn, damaged or dry wheel bearings	Inspect and lubricate or replace	
	Loose or missing anti-rattle spring or pad support plate or crimping on outer pad	Inspect, repair or replace	BR-17, 25, 33
	Failure of shim	Inspect, replace if necessary	BR-17, 25, 33
	Wear on slide bushing	Inspect, replace if necessary	BR-17, 25, 33
	Loose installation bolt	Inspect, tighten is necessary	BR-17, 25, 33
Squealing and squeaking noise when brakes are not applied	Poor return of piston	Inspect, repair or replace	BR-17, 25, 33
	Mal-adjustment of brake pedal or booster push rod	Inspect and adjust	BR-5, 16
	Poor return of brake booster or master cylinder or cylinder	Inspect, repair or replace	BR-9, 14
	Rusted or stuck piston	Inspect and lubricate as necessary	BR-17, 25, 33
	Improper positioning of pad in caliper	Repair or replace	BR-17, 25, 33
	Rotor rubbing against caliper housing	Repair or replace	BR-17, 25, 33
	Improper installation of disc brake pad support plate	Repair or replace	BR-17, 25, 33
	Other brake system components	Inspect, repair or replace as necessary	
	Loose or extra parts in brakes		
	Worn, damaged or insufficiently lubricated wheel bearings		

TROUBLESHOOTING (Cont'd)

Problem	Possible cause	Remedy	Page
Squeaking, squealing, groaning or chattering noise when brakes are applied Note: Brake friction materials inherently generate noise and heat in order to dissipate energy. As a result, occasional squeal is normal and is aggravated by severe environmental conditions such as cold, heat, wetness, snow, salt, mud, etc. This occasional squeal is not a functional problem and does not indicate any loss of brake effectiveness.	Rotors and pads worn or scored	Inspect, repair or replace	BR-17, 25, 33
	Dirty, greased, contaminated or glazed pads	Clean or replace	BR-17, 25, 33
	Improper pads using	Inspect for correct usage or replace	BR-17, 25, 33
	Mal-adjustment of brake pedal or booster push rod	Inspect and adjust	BR-5, 16
	Missing or damaged brake pad anti-squeal shim	Replace	BR-17, 25, 33
	Burred or rusted calipers	Clean or deburr	BR-17, 25, 33



CHECKS AND ADJUSTMENTS

CHECK AND ADJUSTMENT OF BRAKE PEDAL

1. CHECK THAT PEDAL HEIGHT IS CORRECT, AS SHOWN

Pedal height from asphalt sheet:

177 – 187 mm (6.968 – 7.362 in.)

If the pedal height is incorrect, adjust it.

2. IF NECESSARY, ADJUST PEDAL HEIGHT

- Disconnect the connector from the stop light switch.
- Loosen the stop light switch lock nut.
- Sufficiently loosen the stop light switch.
- Loosen the push rod lock nut.
- Adjust the pedal height by turning the pedal push rod.
- Return the stop light switch until it lightly contact the pedal stopper.
- Tighten the lock nut and connect the connector to the stop light switch.
- Check that the stop lights light when the brake pedal is depressed.
- After adjusting the pedal height, check and adjust the pedal freeplay.

3. CHECK THAT PEDAL FREEPLAY IS CORRECT, AS SHOWN

- Stop the engine and depress the brake pedal several times until there is no more vacuum left in the booster.
- (Single booster)
Push in the pedal until the beginning of resistance is felt. Measure the distance, as shown.
(Tandem booster)
Push in the pedal until the beginning of the second resistance is felt. Measure the distance, as shown.

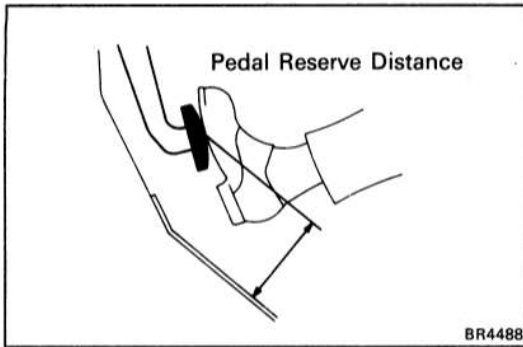
Pedal freeplay: 3 – 5 mm (0.12 – 0.20 in.)

(Tandem booster)

HINT: The freeplay to the first resistance is due to the play between the clevis and pin. And it is 1 – 3 mm (0.04 – 0.12 in.) on the pedal.

4. IF NECESSARY, ADJUST PEDAL FREEPLAY

- If incorrect, adjust the pedal freeplay by turning the pedal push rod.
- Start the engine and confirm that there is pedal freeplay.
- After adjusting the pedal freeplay, check the pedal height.



5. CHECK THAT PEDAL RESERVE DISTANCE IS CORRECT, AS SHOWN

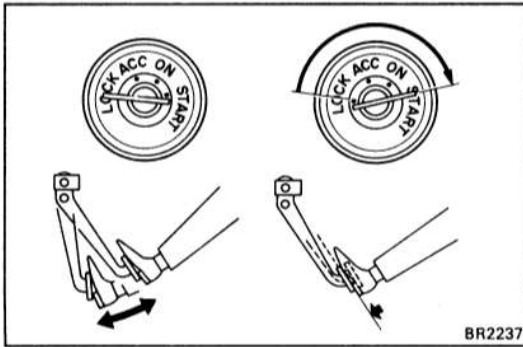
Release the parking brake.

With the engine running, depress the pedal and measure the pedal reserve distance, as shown.

Pedal reserve distance from asphalt sheet at 50 kg (110.2 lb, 490 N):

More than 117 mm (4.61 in.)

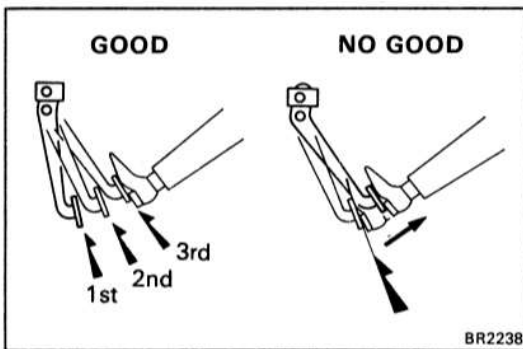
If the reserve distance is incorrect, troubleshoot the brake system.



OPERATIONAL TEST OF BRAKE BOOSTER

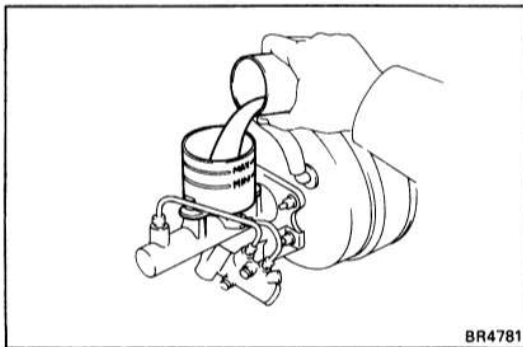
1. OPERATING CHECK

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



2. AIR TIGHTNESS

- Start the engine and stop it after one or two minutes. Depress the brake pedal several times slowly. If the pedal goes down the farthest the first time, but gradually rises after the second or third time, the booster is air tight.
- Depress the brake pedal while the engine is running, and stop the engine with the pedal depressed. If there is no change in the pedal reserve travel after holding the pedal for thirty seconds, the booster is air tight.



BLEEDING OF BRAKE SYSTEM

HINT: If any work is done on the brake system or if air in the brake lines is suspected, bleed the system of air.

NOTICE: Do not let brake fluid remain on a painted surface. Wash it off immediately.

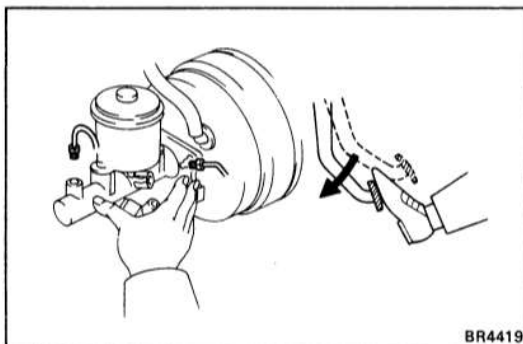
1. FILL BRAKE RESERVOIR TANK WITH BRAKE FLUID

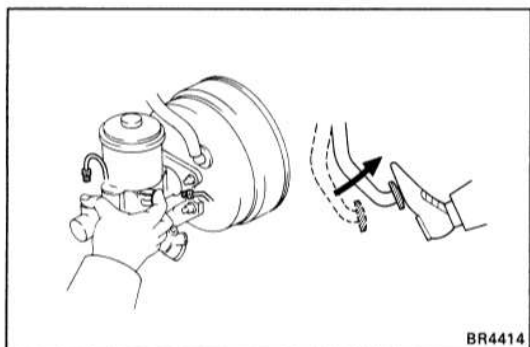
Fluid: SAEJ1703 or FMVSS No. 116 DOT3

2. BLEED MASTER CYLINDER

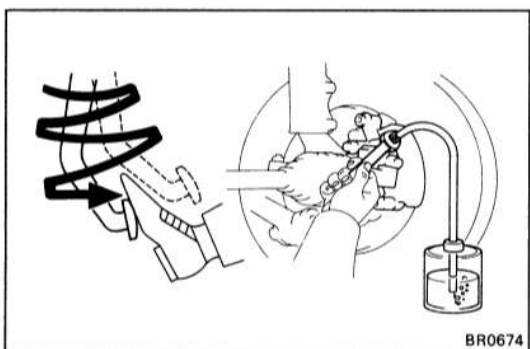
HINT: If the master cylinder has been disassembled or if the reservoir tank becomes empty, bleed the air from the master cylinder.

- Disconnect the brake tubes from the master cylinder.
- Slowly depress the brake pedal and hold it.





- (c) Block off the outlet plug with your finger and release the brake pedal.
- (d) Repeat (b) and (c) three or four times.



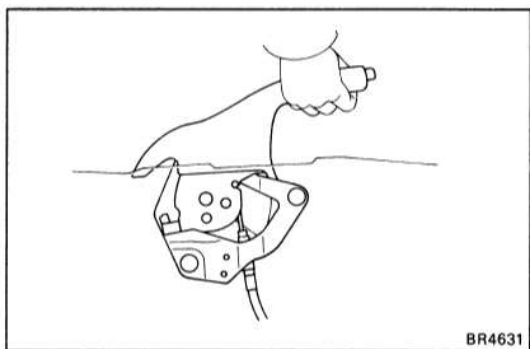
3. BLEED BRAKE LINE

- (a) Connect the vinyl tube to the brake cylinder.
- (b) Depress the brake pedal several times, then loosen the bleeder plug with the pedal held down.
- (c) At the point when fluid stops coming out, tighten the bleeder plug, then release the brake pedal.
- (d) Repeat (b) and (c) until all the air in the fluid has been bled out.
- (e) Repeat the above procedure to bleed the out of the brake line for each wheel.

4. CHECK FLUID LEVEL IN RESERVOIR TANK

Check the fluid level and add fluid if necessary.

Fluid: SAEJ 1703 or FMVSS No. 116 DOT3



CHECK AND ADJUSTMENT OF PARKING BRAKE

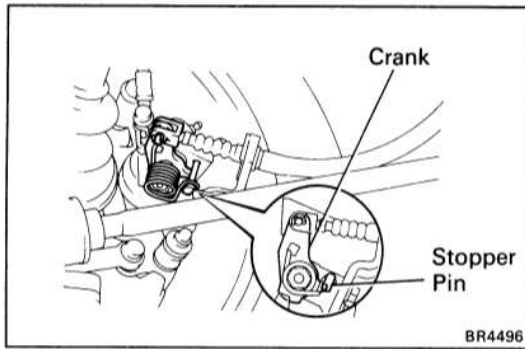
1. CHECK THAT PARKING BRAKE LEVER TRAVEL IS CORRECT

- (a) Pull the parking brake lever all the way up and down for two or three times. Then return the parking brake lever.
- (b) Depress the brake pedal for several times.
- (c) Pull the parking brake lever all the way up, and count the notches of lever travel.

Parking brake lever travel

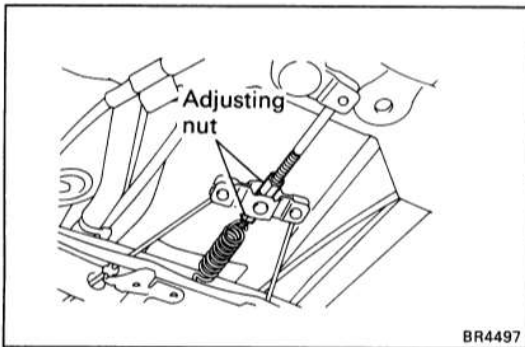
at 20 kg (44.1 lb, 196 N): 5 – 8 clicks

If incorrect, adjust the parking brake.



2. IF NECESSARY, ADJUST PARKING BRAKE

- (a) Pull the parking brake lever all the way up and down for two or three times. Then return the parking brake lever.
- (b) Depress the brake pedal for several times.
- (c) Remove the fuel tank protector.
- (d) Loosen the adjusting nut and brake cable, and check that the parking brake crank touches stopper pin.



- (e) Stretch the brake cable by turning the adjusting nut before the parking brake crank begin moving.
- (f) Tighten the adjusting nuts.

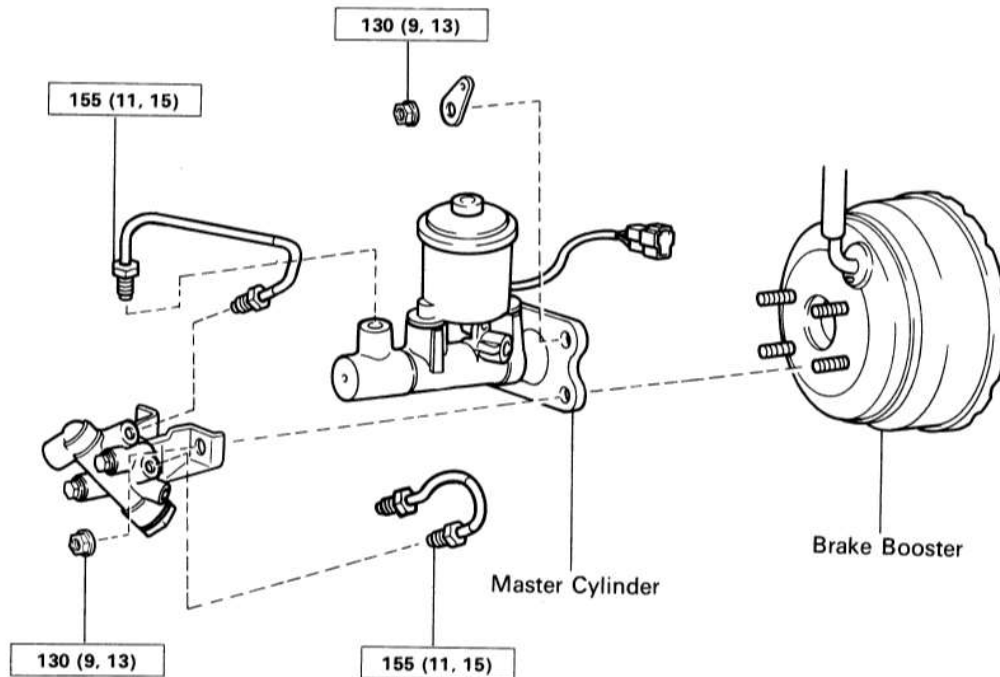
HINT: Tighten the adjusting nuts so the equalizer is horizontal to the ground.

Torque: 160 kg-cm (12 ft-lb, 16 N·m)

- (g) Install the fuel tank protector.

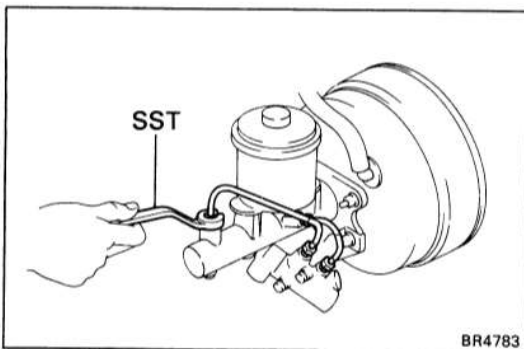
MASTER CYLINDER

REMOVAL OF MASTER CYLINDER



kg-cm (ft-lb, N·m) : Specified torque

BR4782



1. DISCONNECT LEVEL WARNING SWITCH CONNECTOR

2. DRAW OUT FLUID WITH SYRINGE

NOTICE: Do not let brake fluid remain on a painted surface. Wash it off immediately.

3. DISCONNECT BRAKE TUBES

Using SST, disconnect the brake tubes from the master cylinder.

SST 09751-36011

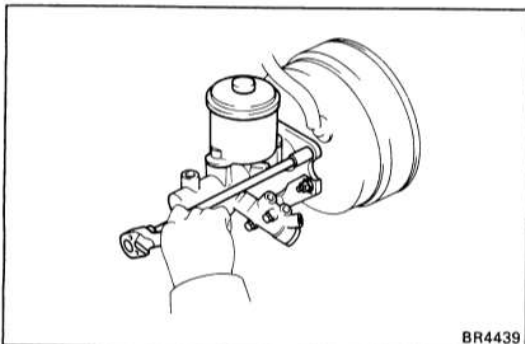
4. REMOVE MASTER CYLINDER

(a) Remove the four nuts.

(b) (w/ABS)

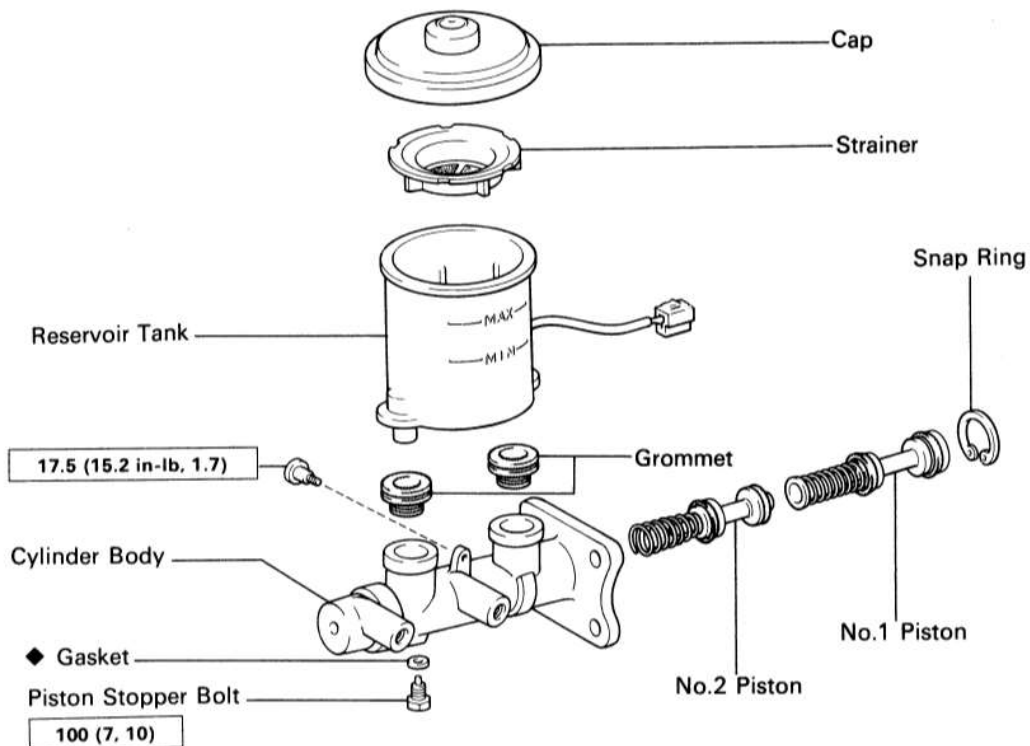
Remove the P valve with the P valve bracket.

(c) Remove the master cylinder.

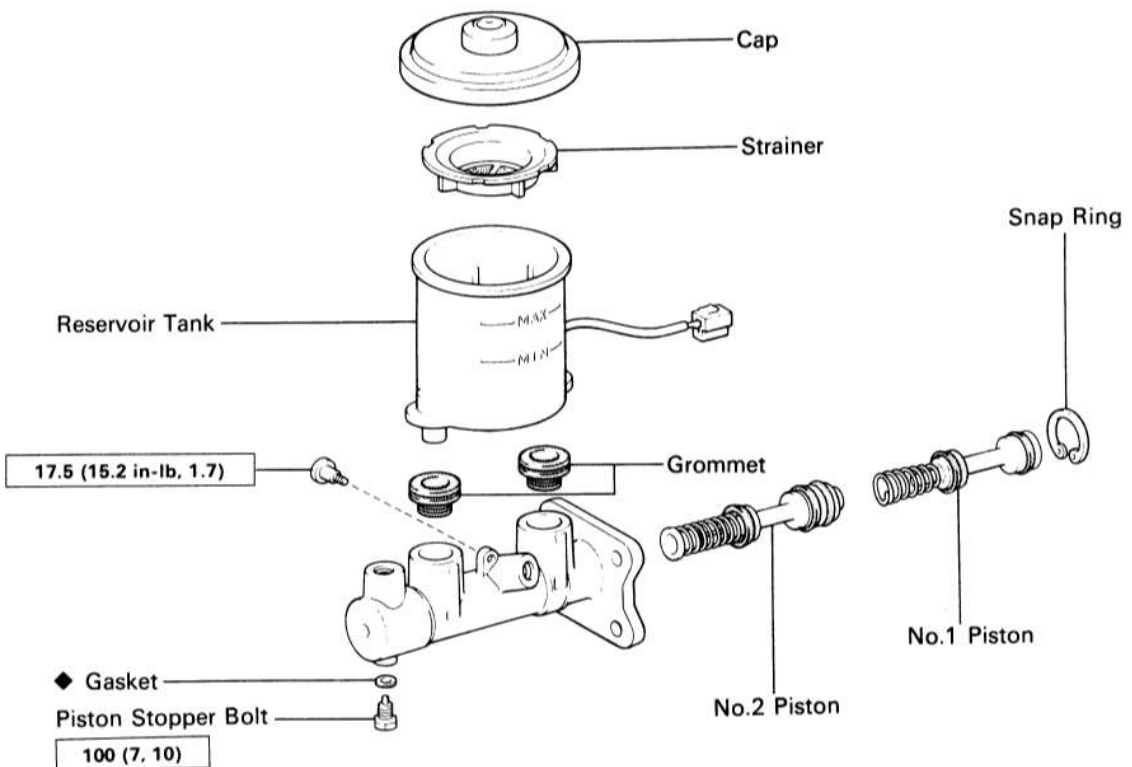


COMPONENTS

w/o ABS

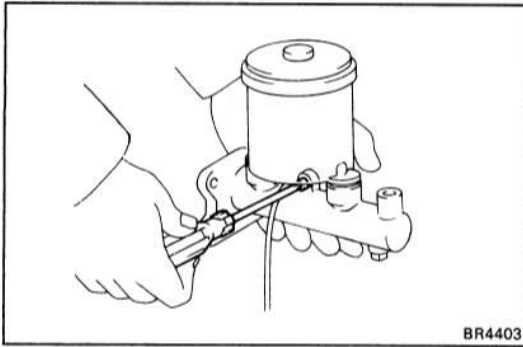


w/ ABS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part



BR4403

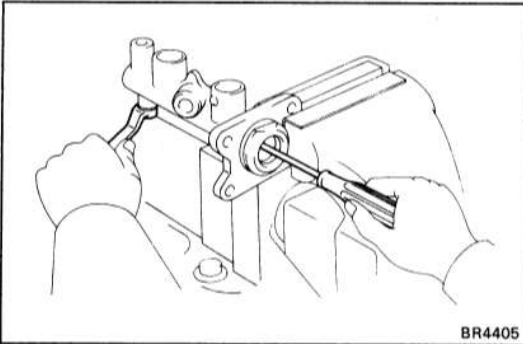
DISASSEMBLY OF MASTER CYLINDER

1. REMOVE RESERVOIR TANK

- (a) Remove the set screw and pull out the reservoir tank.
- (b) Remove the cap and strainer from the reservoir tank.

2. REMOVE TWO GROMMETS

3. PLACE CYLINDER IN VISE

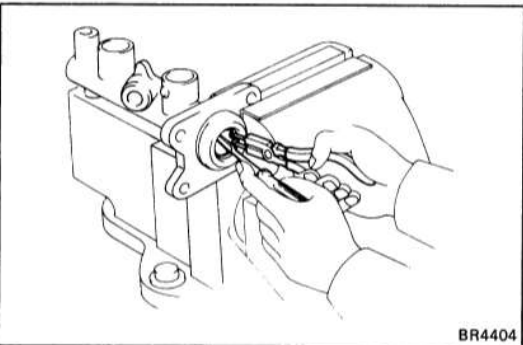


BR4405

4. REMOVE PISTON STOPPER BOLT

Using a screwdriver, push the pistons in all the way and remove the piston stopper bolt and gasket.

HINT: Tape the screwdriver tip before use.

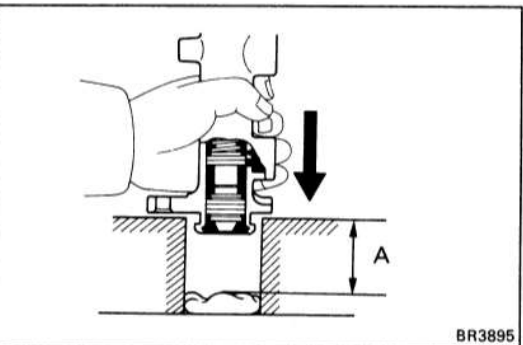


BR4404

5. REMOVE TWO PISTONS

- (a) Push in the piston with a screwdriver and remove the snap ring with snap ring pliers.
- (b) Remove the No. 1 piston and spring by hand, pulling straight out, not at an angle.

NOTICE: If pulled out at an angle, there is possibility that the cylinder bore could be damaged.



BR3895

- (c) Place a rag and two wooden blocks on the work table and lightly tap the cylinder flange against the block edges until the piston drops out of the cylinder.

HINT: Make sure the distance (A) from the rag to the top of the blocks is at least 100 mm (3.94 in.).

INSPECTION OF MASTER CYLINDER COMPONENTS

HINT: Clean the disassembled parts with compressed air.

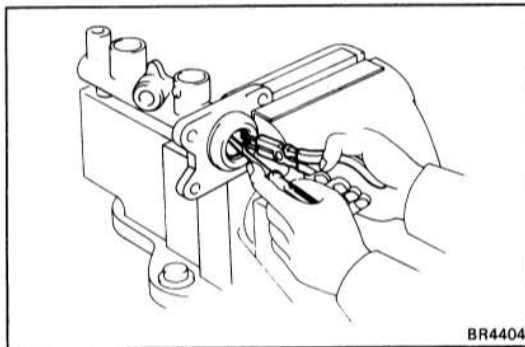
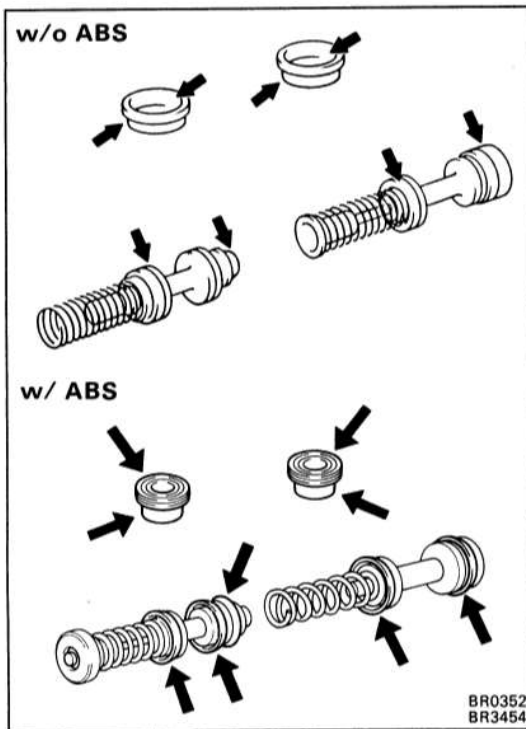
1. **INSPECT CYLINDER BORE FOR RUST OR SCORING**
2. **INSPECT CYLINDER FOR WEAR OR DAMAGE**

If necessary, clean or replace the cylinder.

ASSEMBLY OF MASTER CYLINDER

(See page BR-10)

1. **APPLY LITHIUM SOAP BASE GLYCOL GREASE TO RUBBER PARTS INDICATED BY ARROWS**



2. **INSTALL TWO SPRINGS**

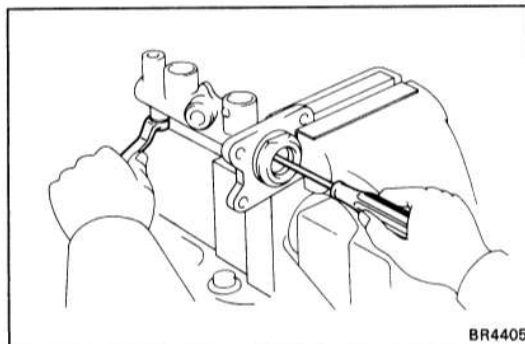
NOTICE: Be careful not to damage the rubber lips on the pistons.

(a) Insert the two piston straight in, not at an angle.

NOTICE: If inserted at angle, there is a possibility that the cylinder bore could be damaged.

(b) Push in the piston with a screwdriver and install the snap ring with snap ring pliers.

HINT: Tape the screwdriver tip before use.

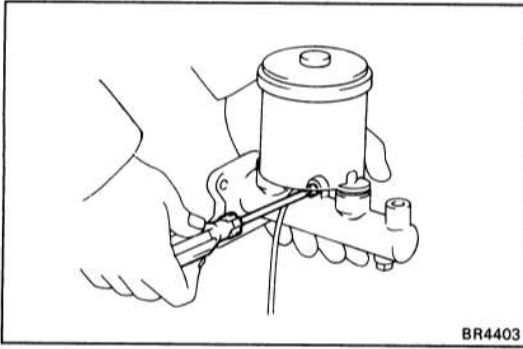


3. **INSTALL PISTON STOPPER BOLT**

Using a screwdriver, push the piston in all the way and install the piston stopper bolt over the gasket. Torque the bolt.

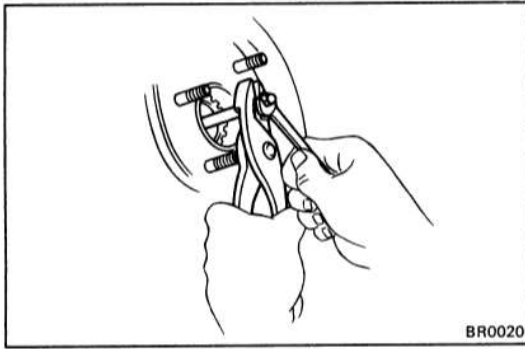
Torque: 100 kg-cm (7 ft-lb, 10 N·m)

4. **INSTALL TWO GROMMETS**

**5. INSTALL RESERVOIR TANK**

- (a) Install the cap and strainer to the reservoir tank.
- (b) Push the reservoir tank onto the cylinder.
- (c) Install the set screw while pushing on the reservoir tank.

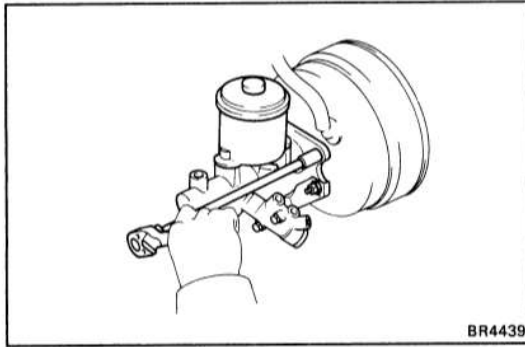
Torque: 17.5 kg-cm (15.2 in.-lb, 1.7 N·m)



INSTALLATION OF MASTER CYLINDER

(See page BR-9)

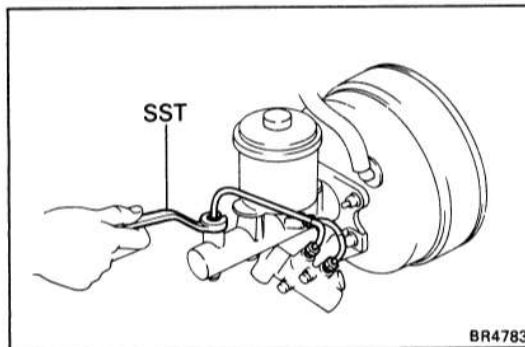
1. **ADJUST LENGTH OF BRAKE BOOSTER PUSH ROD BEFORE INSTALLING MASTER CYLINDER**
(See page BR-16)



2. **INSTALL MASTER CYLINDER**

- (a) Install the master cylinder.
- (b) Install the P & BV with the P & BV bracket.
- (c) Install the four nuts and torque nuts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



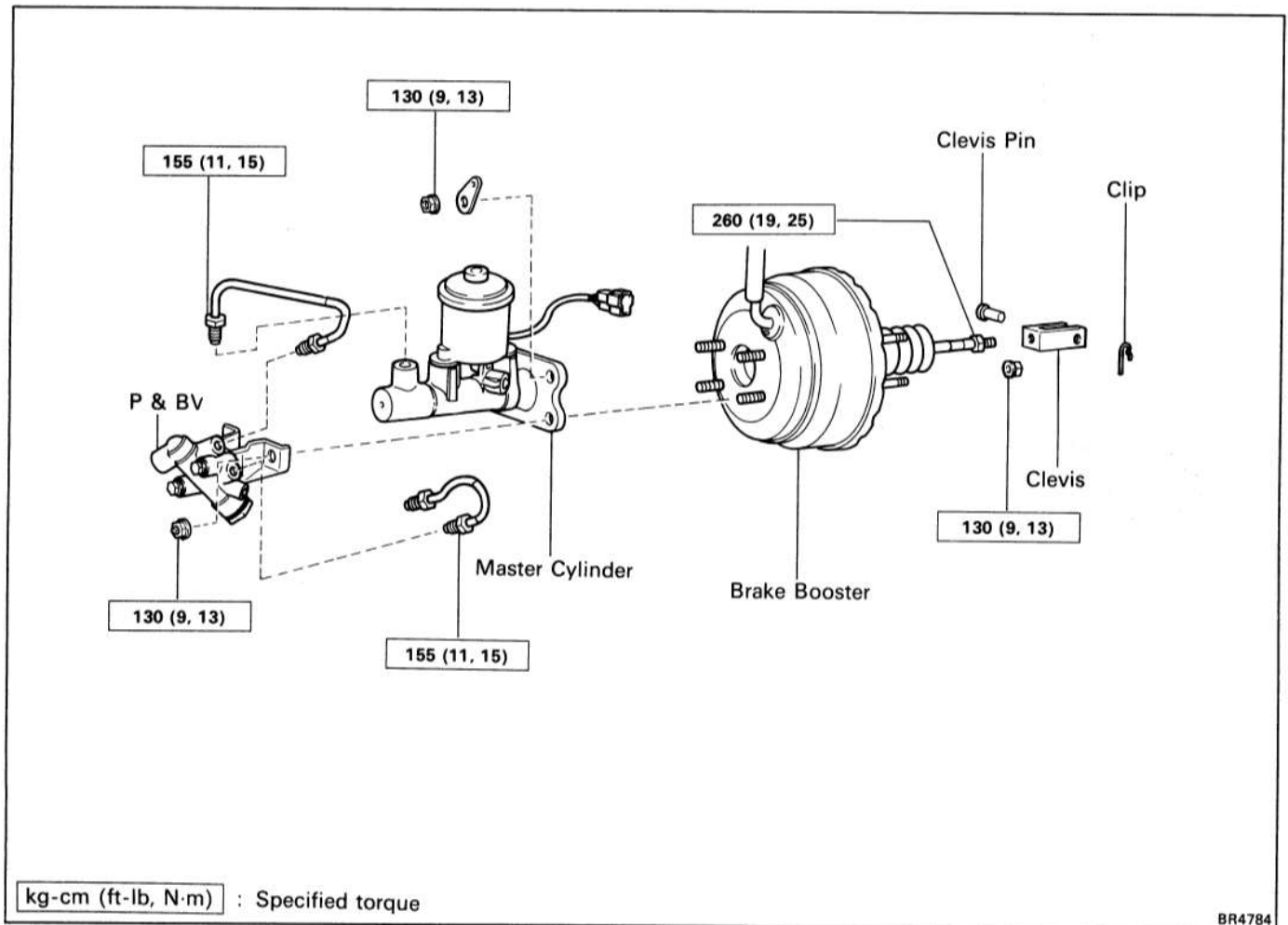
3. **CONNECT TWO BRAKE TUBES**

Using SST, connect the brake tubes to the master cylinder. Torque the union nuts.

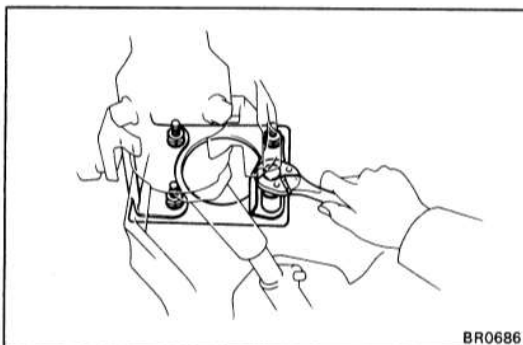
SST 09751-36011

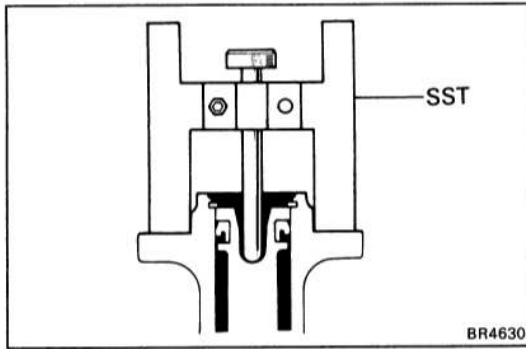
Torque: 155 kg-cm (11 ft-lb, 15 N·m)

4. **CONNECT LEVEL WARNING SWITCH CONNECTOR**
5. **FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM**
(See page BR-6)
6. **CHECK FOR FLUID LEAKAGE**
7. **CHECK AND ADJUST BRAKE PEDAL**
(See page BR-5)

BRAKE BOOSTER**REMOVAL OF BRAKE BOOSTER**

1. **REMOVE MASTER CYLINDER**
(See page BR-9)
2. **DISCONNECT VACUUM HOSE FROM BRAKE BOOSTER**
3. **REMOVE PEDAL RETURN SPRING**
4. **REMOVE CLIP AND CLEVIS PIN**
5. **REMOVE BRAKE BOOSTER**
Remove the four nuts, and pull out the brake booster.





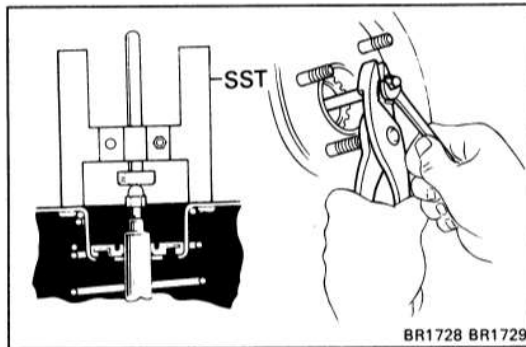
INSTALLATION OF BRAKE BOOSTER

(See page BR-15)

1. ADJUST LENGTH OF BOOSTER PUSH ROD

- (a) Set the SST on the master cylinder, and lower the pin until its tip slightly touches the piston.

SST 09737-00010



- (b) Turn the SST upside down, and set it on the booster.

SST 09737-00010

- (c) Measure the clearance between the booster push rod and pin head (SST).

Clearance: 0 mm (0 in.)

- (d) Adjust the booster push rod length until the push rod lightly touches the pin head.

2. INSTALL VACUUM HOSE

3. INSTALL MASTER CYLINDER

(See page BR-9)

4. FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM

(See page BR-6)

5. CHECK FOR FLUID LEAKAGE

6. CHECK AND ADJUST BRAKE PEDAL

(See page BR-5)

Check and adjust the brake pedal, then tighten the clevis lock nut.

Torque: 260 kg-cm (19 ft-lb, 25 N·m)

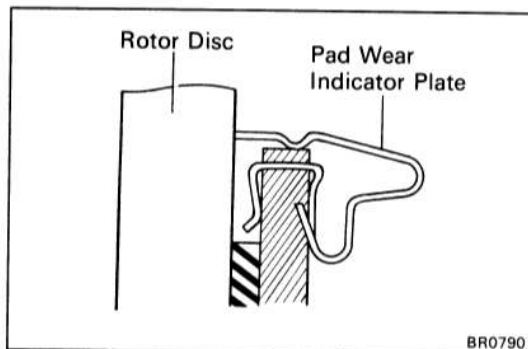
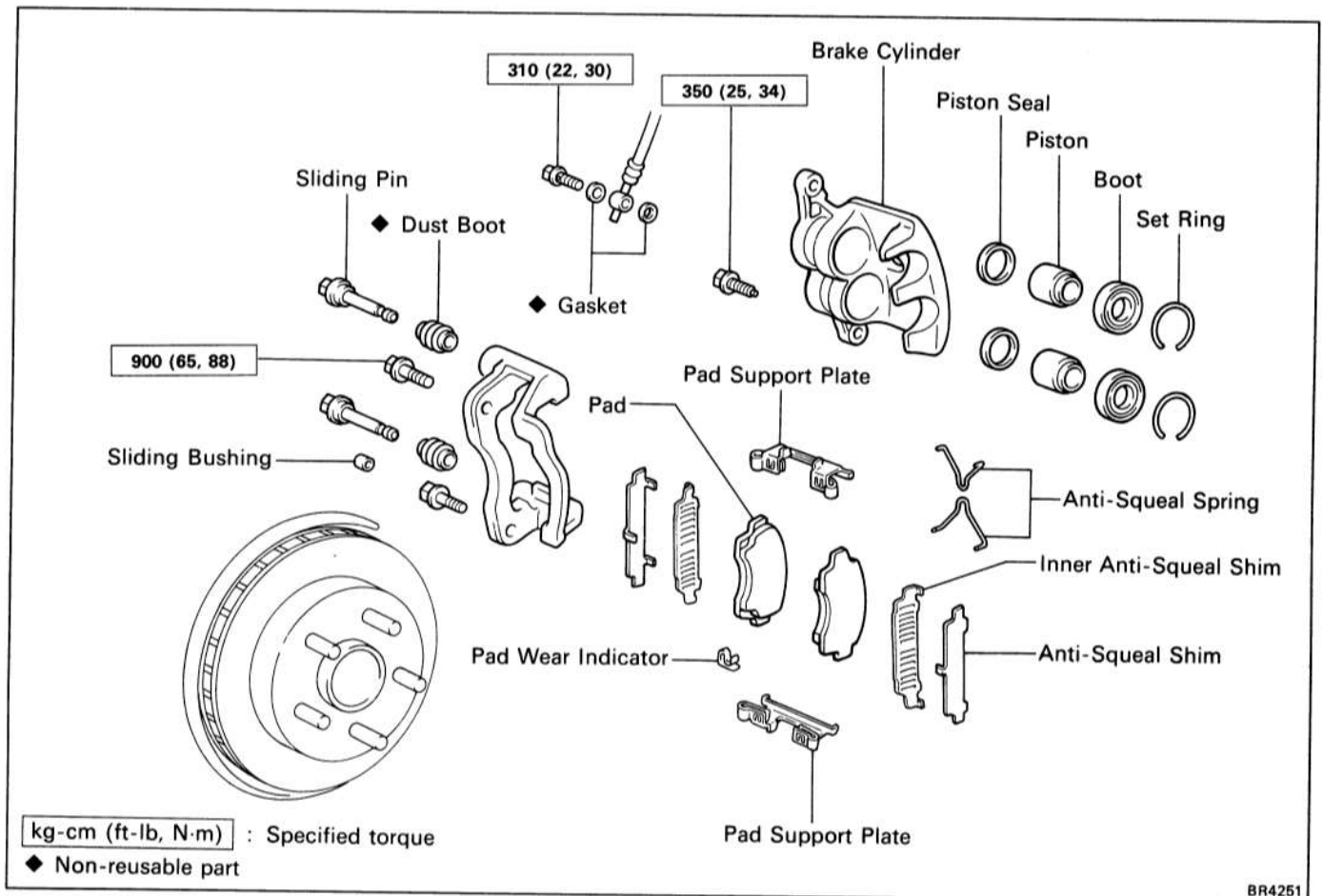
7. PERFORM OPERATIONAL CHECK

(See page BR-6)

FRONT BRAKE

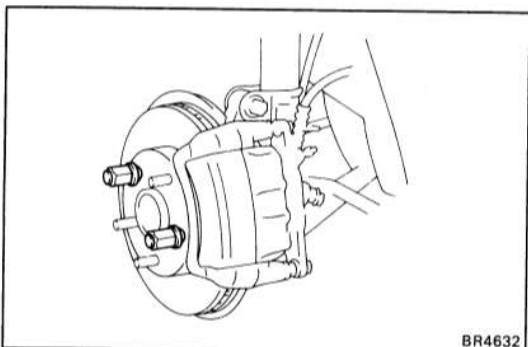
PE36T DISC (For 3S-GTE)

COMPONENTS



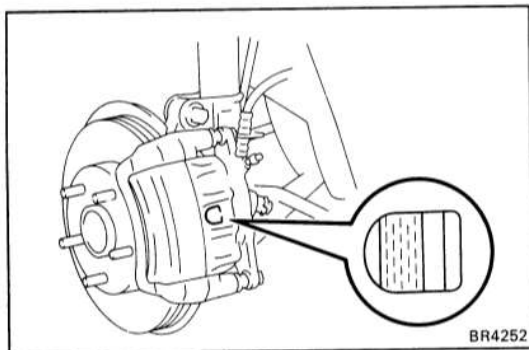
REPLACEMENT OF BRAKE PADS

HINT: If a squealing noise is made by the front brakes while driving, check the pad wear indicator. If there is evidence of the indicator contacting the rotor disc, the brake pad should be replaced.



1. REMOVE FRONT WHEEL

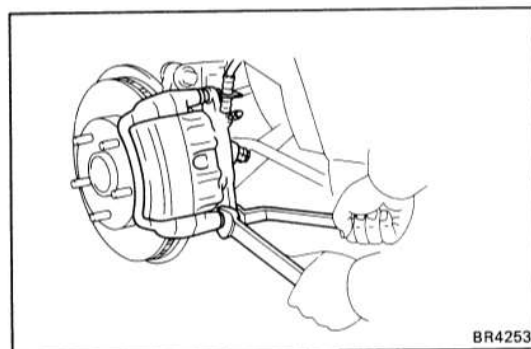
Remove the wheel and temporarily fasten the rotor disc with the hub nuts.



2. INSPECT PAD LINING THICKNESS

Check the pad thickness through the cylinder inspection hole and replace the pads if it is not within specification.

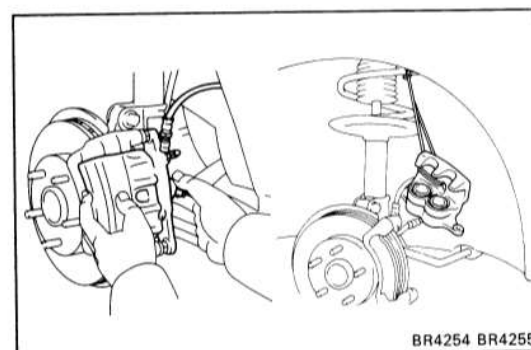
Minimum thickness: 1.0 mm (0.039 in.)



3. REMOVE CYLINDER FROM TORQUE PLATE

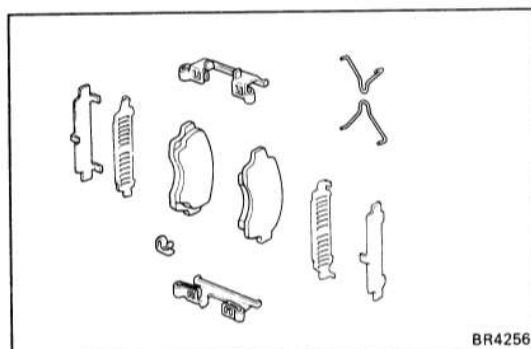
(a) Hold the sliding pin and loosen the two installation bolts.

(b) Remove the installation bolts.



(c) Remove the brake cylinder and suspend it so the hose is not stretched.

HINT: Do not disconnect the brake hose.



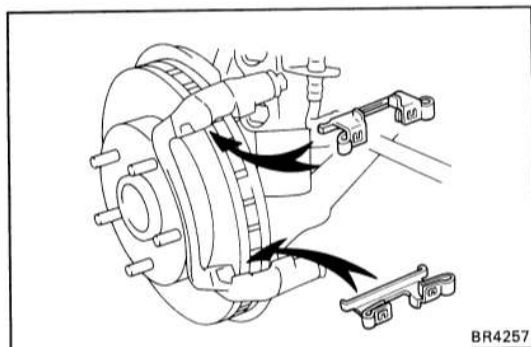
4. REMOVE FOLLOWING PARTS:

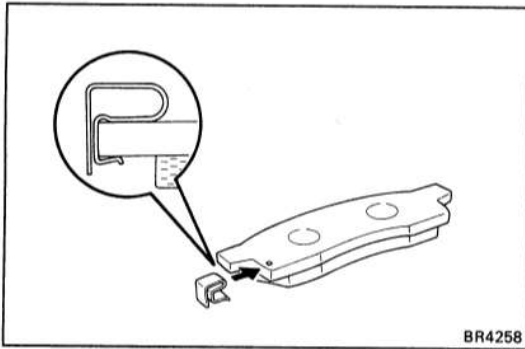
- (a) Two anti-squeal springs
- (b) Two brake pads
- (c) Four anti-squeal shims
- (d) Pad wear indicator plate
- (e) Two pad support plates

5. CHECK ROTOR DISC THICKNESS (See step 2 on page BR-22)

6. CHECK ROTOR DISC RUNOUT (See step 3 on page BR-22)

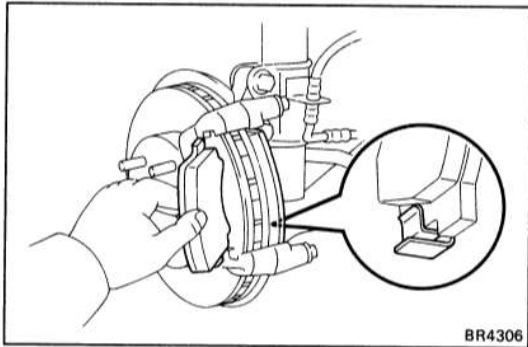
7. INSTALL PAD SUPPORT PLATES Install the two pad support plates.





8. INSTALL NEW PADS

- (a) Install a pad wear indicator plate on the inside pad.
- (b) Apply disc brake grease to both sides of the two inner anti-squeal shims.
- (c) Install the two anti-squeal shims to the each pad.

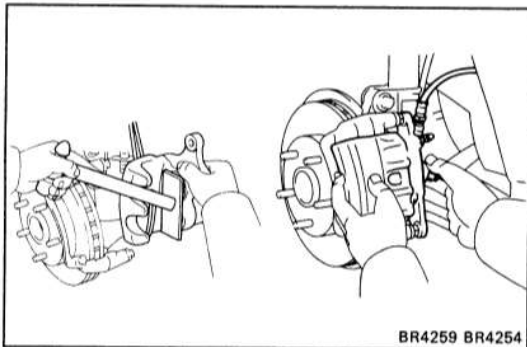


- (d) Install inside pad with the pad wear indicator plate facing downward.

- (e) Install outside pad.

NOTICE: There should be no oil grease adhering to the friction surfaces of the pads or the rotor disc.

- (f) Install the two anti-squeal springs.

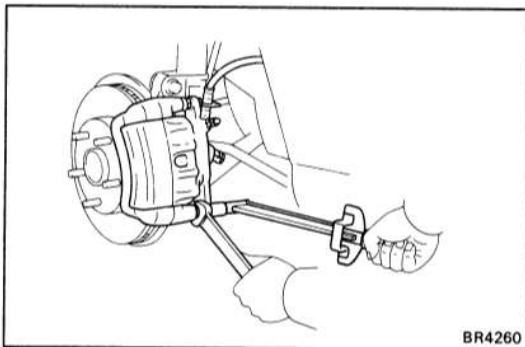


9. INSTALL CYLINDER

- (a) Draw out a small amount of brake fluid from the reservoir tank.

- (b) Place a wooden plate on the piston, and press in the piston with a hammer handle or similar implement.

HINT: If the piston is difficult to push in, loosen the bleeder plug and push in the piston while letting some brake fluid escape.



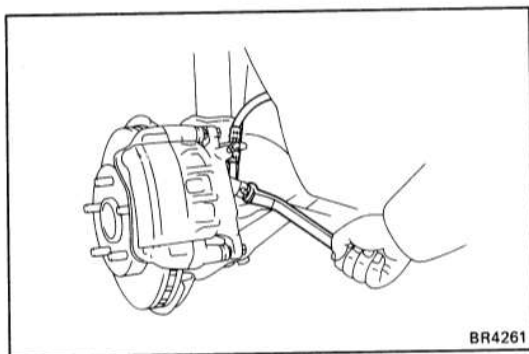
- (c) Temporarily install the cylinder on the torque plate with two installation bolts.

- (d) Hold the sliding pin and torque the installation bolts.

Torque: 350 kg-cm (25 ft-lb, 34 N·m)

10. INSTALL FRONT WHEEL

11. CHECK THAT FLUID LEVEL IS MAX LINE

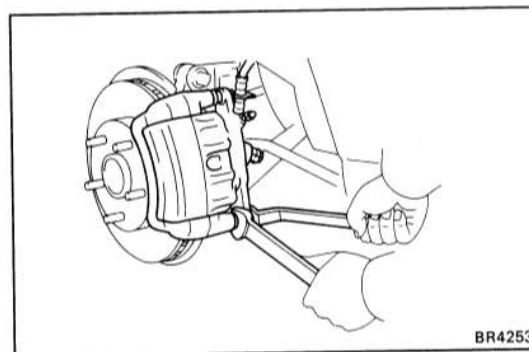


REMOVAL OF CYLINDER

(See page BR-17)

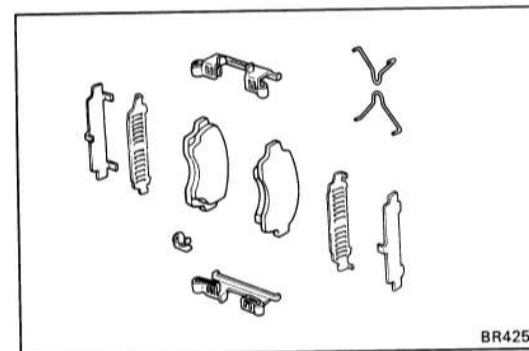
1. DISCONNECT FLEXIBLE HOSE

- Remove the union bolt and two gaskets from the brake cylinder, then disconnect the flexible hose from the brake cylinder.
- Use a container to catch the brake fluid as it drains out.



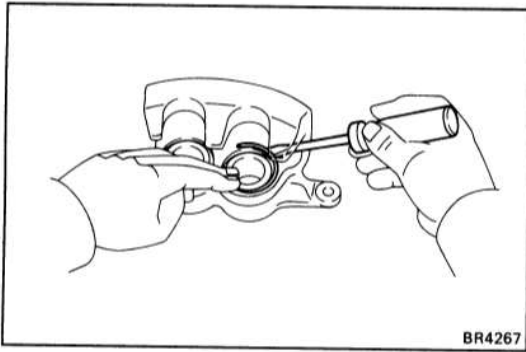
2. REMOVE CYLINDER FROM TORQUE PLATE

- Hold the sliding pin and loosen the two installation bolts.
- Remove the two installation bolts.
- Remove the cylinder from the torque plate.



3. REMOVE FOLLOWING PARTS:

- Two anti-squeal springs
- Two brake pads
- Four anti-squeal shims
- Pad wear indicator
- Two pad support plates



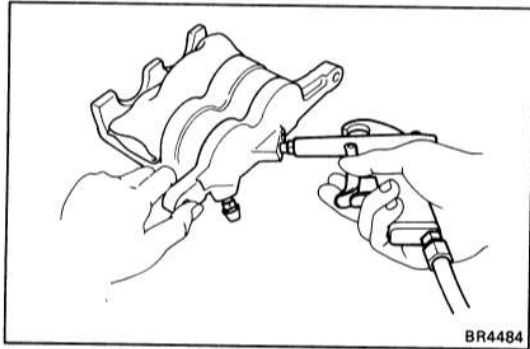
BR4267

DISASSEMBLY OF CYLINDER

(See page BR-17)

1. REMOVE CYLINDER BOOT SET RINGS AND CYLINDER BOOTS

Using a screwdriver, remove the cylinder boot set rings and cylinder boots from the cylinder.



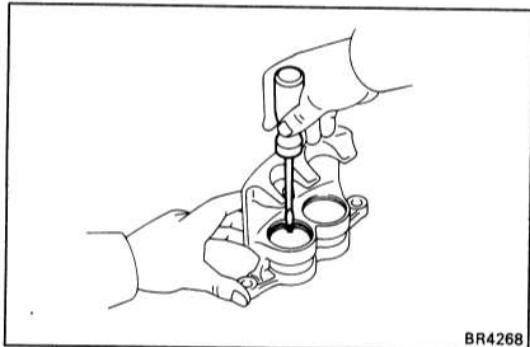
BR4484

2. REMOVE PISTONS

(a) Place a piece of cloth or similar article between the pistons and the cylinder.

(b) Use compressed air to remove the pistons from the cylinder.

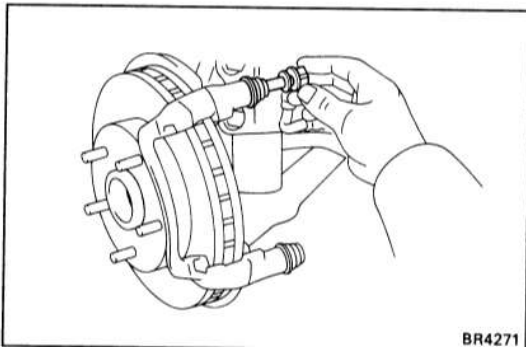
CAUTION: Do not place your fingers in front of the piston when using compressed air.



BR4268

3. REMOVE PISTON SEALS

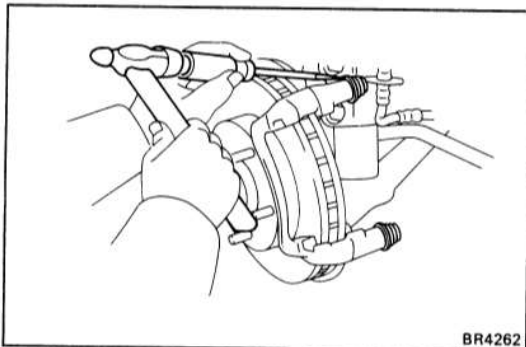
Using a screwdriver, remove the piston seals from the cylinder.



BR4271

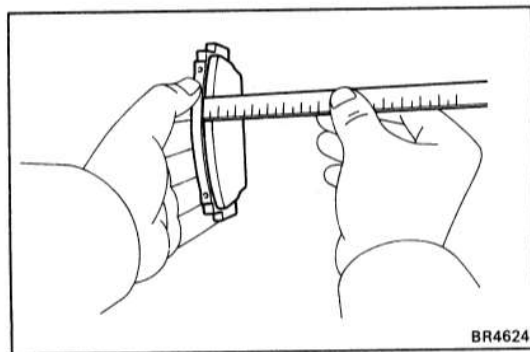
4. REMOVE SLIDING PINS AND DUST BOOTS

(a) Remove the two sliding pins from the torque plate.



BR4262

(b) Using a chisel and hammer, tap out the two dust boots.



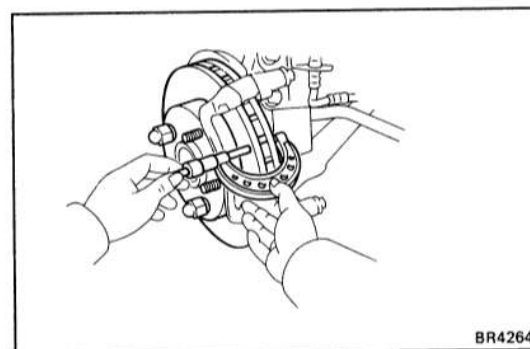
INSPECTION OF FRONT BRAKE COMPONENTS

1. MEASURE PAD LINING THICKNESS

Standard thickness: 10.0 mm (0.39 in.)

Minimum thickness: 1.0 mm (0.039 in.)

Replace the pad if the thickness is less than the minimum or if it shows sign of uneven wear.

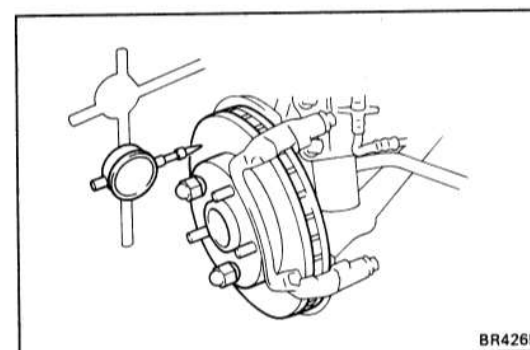


2. MEASURE ROTOR DISC THICKNESS

Standard thickness: 25.0 mm (0.984 in.)

Minimum thickness: 24.0 mm (0.945 in.)

If the disc is scored or worn, or if thickness is less than minimum, repair or replace the disc



3. MEASURE ROTOR DISC RUNOUT

HINT: Before measuring the runout, confirm that the front hub bearing play is within specification.

Measure the rotor disc runout at 10 mm (0.39 in.) from the outer edge of the disc.

Maximum disc runout: 0.07 mm (0.0028 in.)

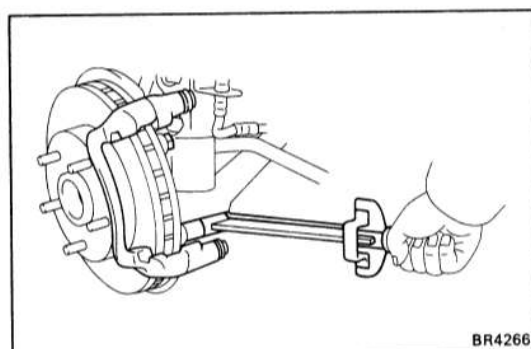
If the runout is greater than the maximum, inspect and adjust if following the procedure below.

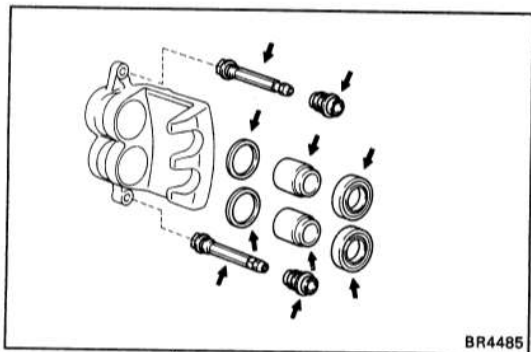
Then replace the disc if necessary.

- (a) Remove the torque plate from the knuckle.
- (b) Remove the hub nuts of the temporarily installed disc and pull off the rotor disc.
- (c) Check that the hub axial play is within specification, and replace the bearing if not within specification. (See page SA-10)
- (d) Install the rotor disc and measure the disc runout, then shift the rotor disc one fifth of a turn or one fourth of a turn, and measure the disc runout. Similarly measure the runout at each position, and select the position where the runout is minimum.
- (e) In this position, if the runout is within specification, install the torque plate and torque the mounting bolts.

Torque: 900 kg-cm (65 ft-lb, 88 N·m)

- (f) If not within specification, replace the rotor disc, and repeat (d) and (e).

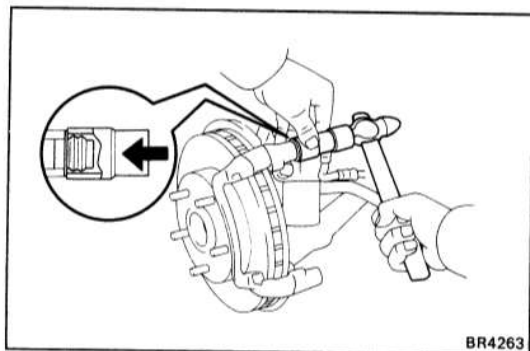




ASSEMBLY OF CYLINDER

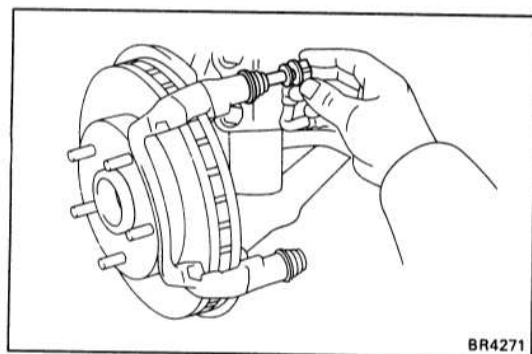
(See page BR-17)

1. **APPLY LITHIUM SOAP BASE GLYCOL GREASE TO PARTS INDICATED WITH ARROWS**



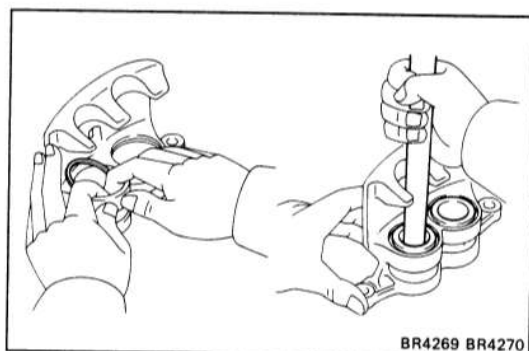
2. **INSTALL DUST BOOTS AND SLIDING PINS**

- (a) Using a 19 mm socket wrench and hammer, tap in two new dust boots into the torque plate.
- (b) Confirm that the metal plate portion of the dust boot fits snugly in the torque plate.

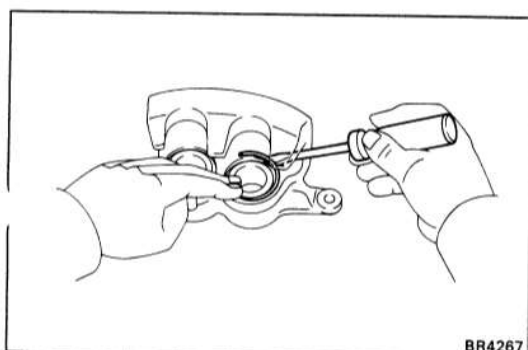


- (c) Insert two sliding pins into the torque plate.

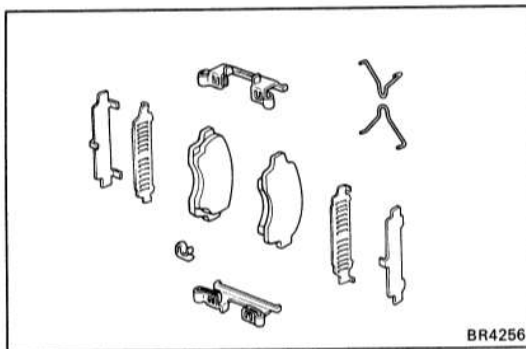
NOTICE: Insert the sliding pin with sliding bushing into the bottom side.



3. **INSTALL PISTON SEALS AND PISTONS IN CYLINDER**



4. **INSTALL CYLINDER BOOTS AND CYLINDER BOOT SET RINGS**



INSTALLATION OF CYLINDER

(See page BR-17)

1. INSTALL FOLLOWING PARTS:

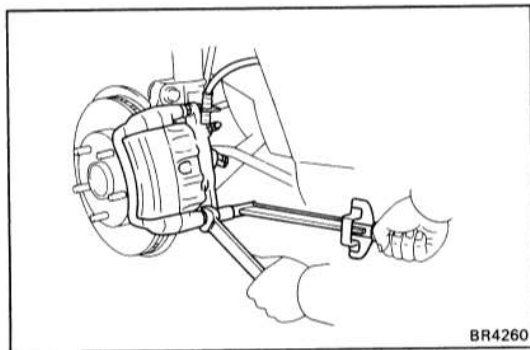
- (a) Two pad support plates
- (b) Pad wear indicator
- (c) Four anti-squeal shims
- (d) Two brake pads
- (e) Two anti-squeal springs

(See steps 7 and 8 on pages BR-18 and 19)

2. INSTALL CYLINDER

- (a) Temporarily install the cylinder on the torque plate with two installation bolts.
- (b) Hold the sliding pin and torque the installation bolts.

Torque: 350 kg-cm (25 ft-lb, 34 N·m)

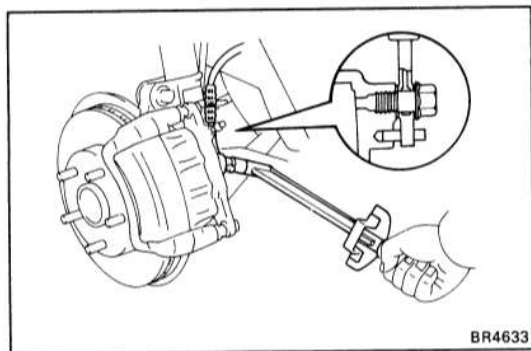


3. CONNECT FLEXIBLE HOSE

Install the flexible hose on the brake cylinder with two new gaskets.

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

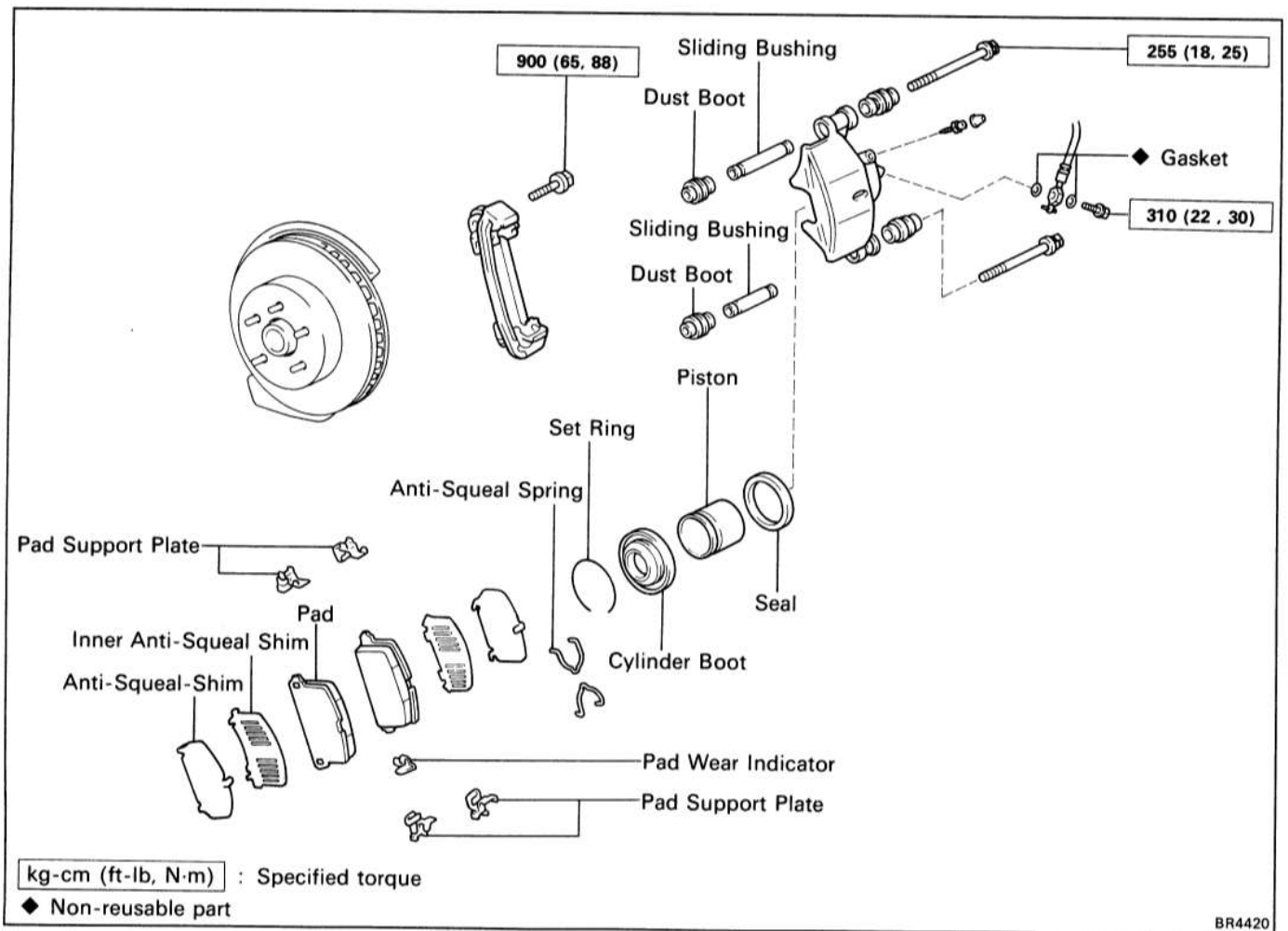
HINT: Insert the flexible hose lock securely in the lock hole in the brake cylinder.



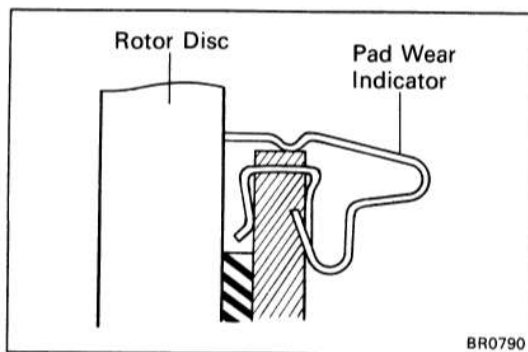
4. FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM (See page BR-6)

5. CHECK FOR LEAKS

PD51 DISC (For 5S-FE) COMPONENTS



BR4420



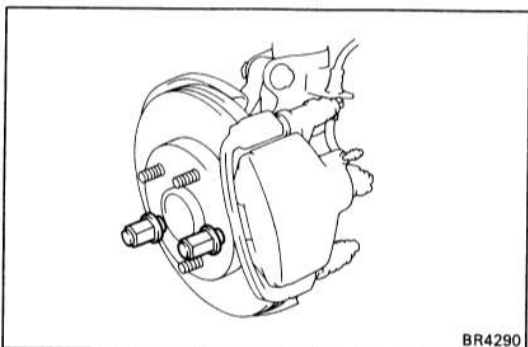
BR0790

REPLACEMENT OF BRAKE PADS

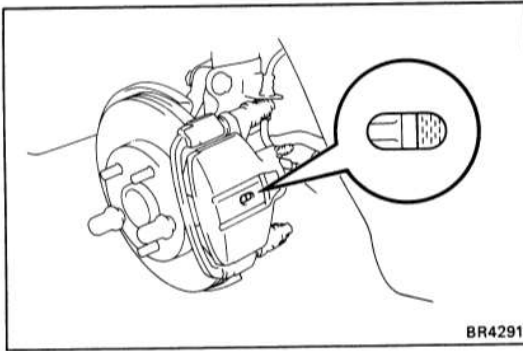
HINT: If a squealing noise is made by the front brakes while driving, check the pad wear indicator. If there is evidence of the indicator contacting the rotor disc, the brake pad should be replaced.

1. REMOVE FRONT WHEEL

Remove the wheel and temporarily fasten the rotor disc with the hub nuts.



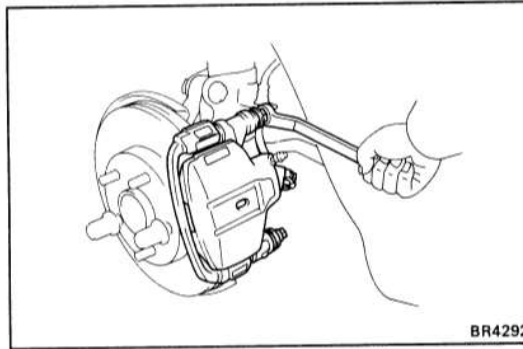
BR4290



2. INSPECT PAD LINING THICKNESS

Check the pad thickness through the cylinder inspection hole and replace the pads if it is not within specification.

Minimum thickness: 1.0 mm (0.039 in.)

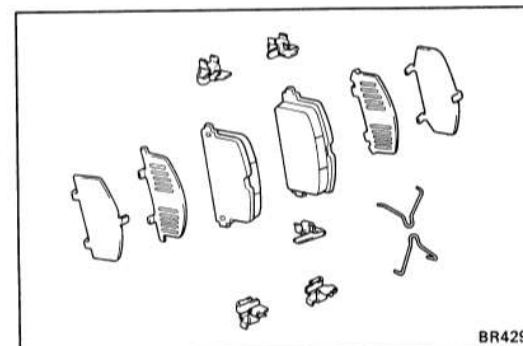
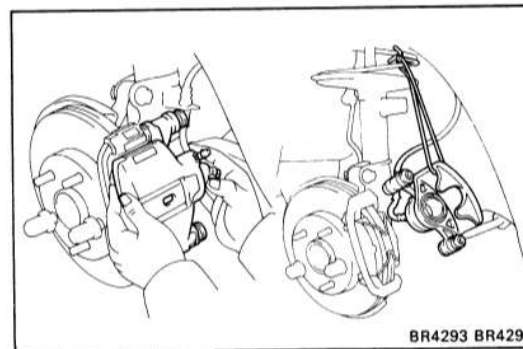


3. REMOVE CYLINDER FROM TORQUE PLATE

(a) Remove two installation bolts from the torque plate.

(b) Remove the brake cylinder and suspend it so the hose is not stretched.

HINT: Do not disconnect the brake hose.



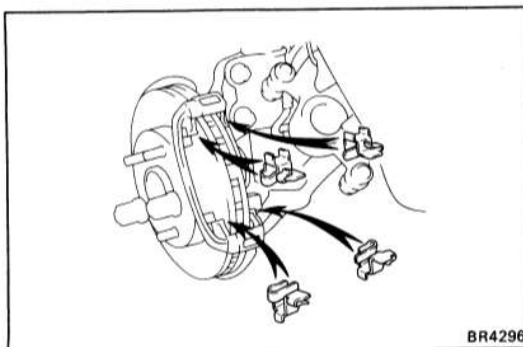
4. REMOVE FOLLOWING PARTS:

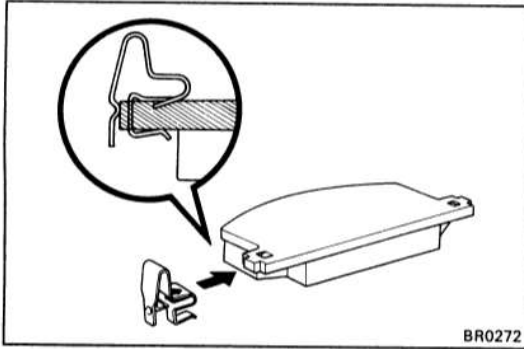
- (a) Two anti-squeal springs
- (b) Two brake pads
- (c) Four anti-squeal shims
- (d) Pad wear indicator plate
- (e) Four pad support plates

5. CHECK ROTOR DISC THICKNESS (See step 2 on page BR-30)

6. CHECK ROTOR DISC RUNOUT (See step 3 on page BR-30)

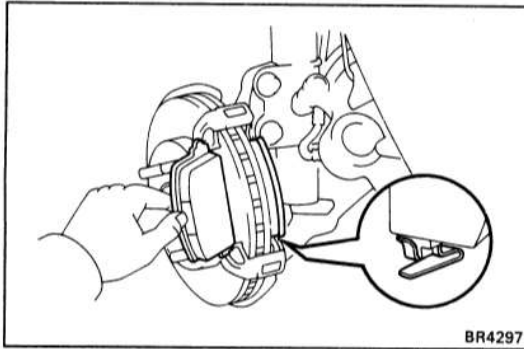
7. INSTALL PAD SUPPORT PLATES Install the pad support plates.





8. INSTALL NEW PADS

- (a) Install a pad wear indicator plate on the inside pad.
- (b) Apply disc brake grease to both sides of the two inner anti-squeal shims.
- (c) Install the two anti-squeal shims to the each pad.

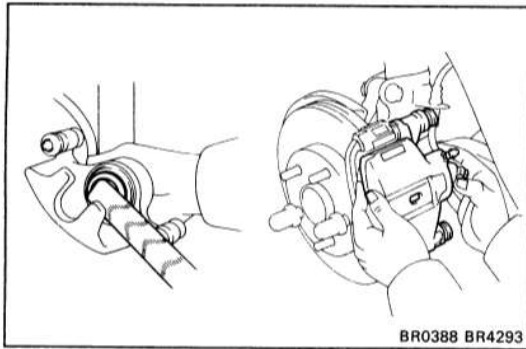


- (d) Install inside pad with the pad wear indicator plate facing downward.

- (e) Install outside pad.

NOTICE: There should be no oil or grease adhering to the friction surfaces of the pads or the rotor disc.

- (f) Install the two anti-squeal springs.

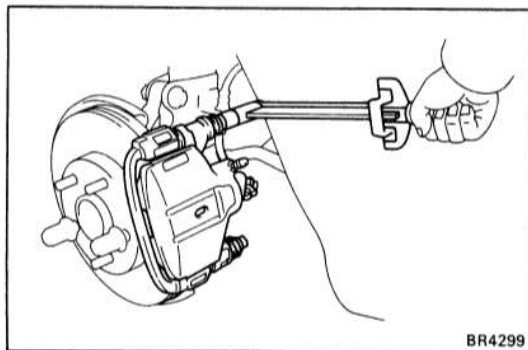


9. INSTALL CYLINDER

- (a) Draw out a small amount of brake fluid from the reservoir tank.

- (b) Press in the piston with a hammer handle or an equivalent.

HINT: If the piston is difficult to push in, loosen the bleeder plug and push in the piston while letting some brake fluid escape.



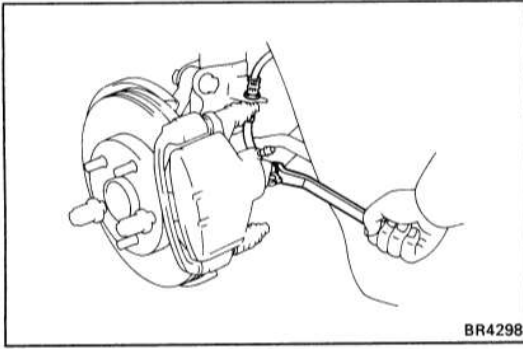
- (c) Install the brake cylinder.

- (d) Install and torque the two installation bolts.

Torque: 255 kg-cm (18 ft-lb, 25 N·m)

10. INSTALL FRONT WHEEL

11. CHECK THAT FLUID LEVEL IS MAX LINE

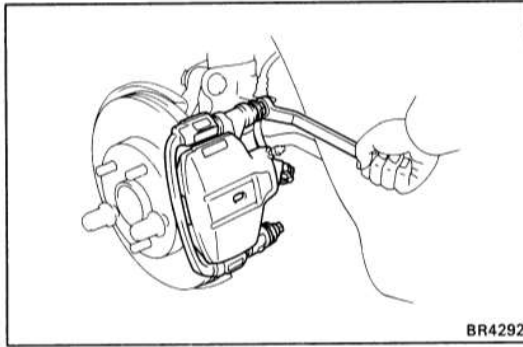


REMOVAL OF CYLINDER

(See page BR-25)

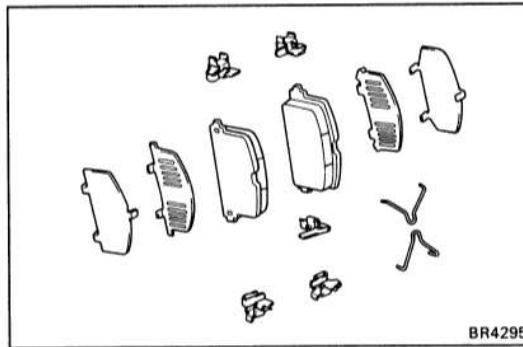
1. DISCONNECT FLEXIBLE HOSE

- (a) Remove the union bolt and two gaskets from the brake cylinder, then disconnect the flexible hose from the brake cylinder.
- (b) Use a container to catch the brake fluid as it drains out.



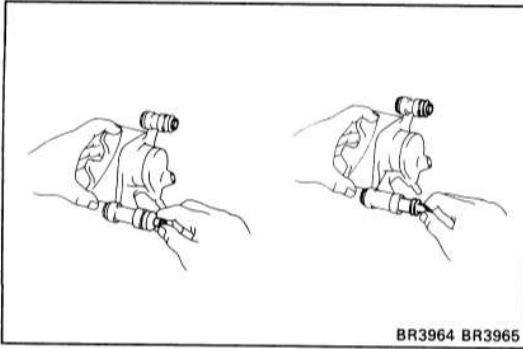
2. REMOVE CYLINDER FROM TORQUE PLATE

Remove the two installation bolts and cylinder.



3. REMOVE FOLLOWING PARTS:

- (a) Two anti-squeal springs
- (b) Two brake pads
- (c) Four anti-squeal shims
- (d) Pad wear indicator
- (e) Four pad support plates

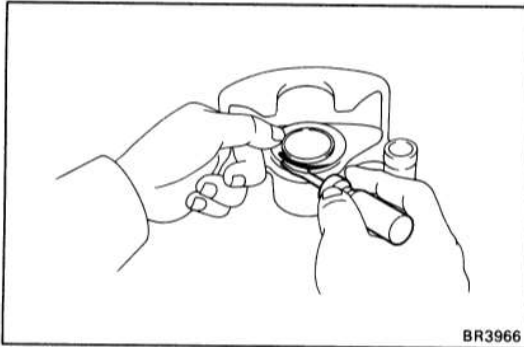


DISASSEMBLY OF CYLINDER

(See page BR-25)

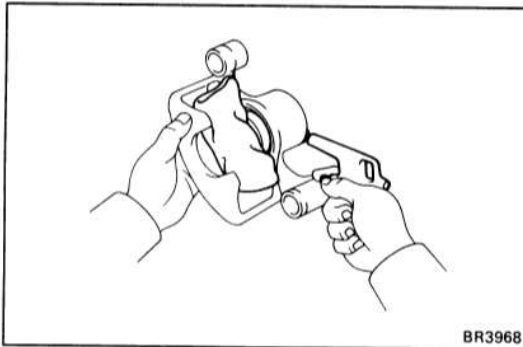
1. REMOVE FOLLOWING PARTS:

- (a) Two sliding bushings
- (b) Four dust boots



2. REMOVE CYLINDER BOOT SET RING AND CYLINDER BOOT

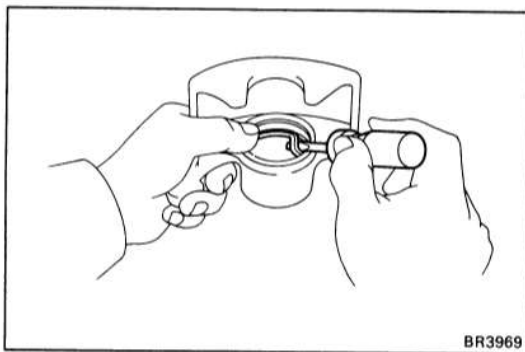
Using a screwdriver, remove the cylinder boot set ring and cylinder boot.



3. REMOVE PISTON FROM CYLINDER

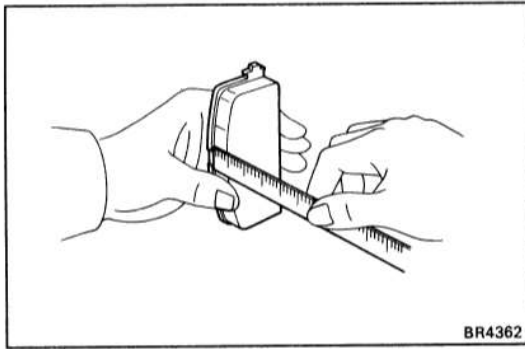
- (a) Put a piece of cloth or an equivalent between the piston and the cylinder.
- (b) Use compressed air to remove the piston from the cylinder.

CAUTION: Do not place your fingers in front of the piston when using compressed air.



4. REMOVE PISTON SEAL FROM BRAKE CYLINDER

Using a screwdriver, remove the piston seal.



BR4362

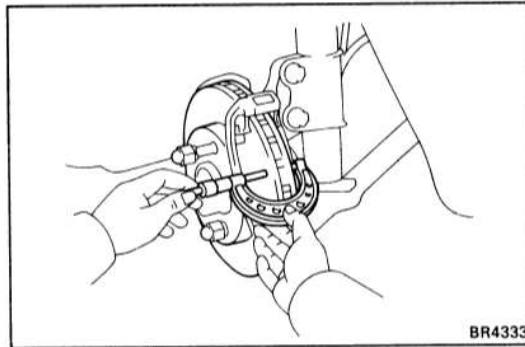
INSPECTION OF FRONT BRAKE COMPONENTS

1. MEASURE PAD LINING THICKNESS

Standard thickness: 10.0 mm (0.39 in.)

Minimum thickness: 1.0 mm (0.039 in.)

Replace the pad if the thickness is less than the minimum or if it shows sign of uneven wear.



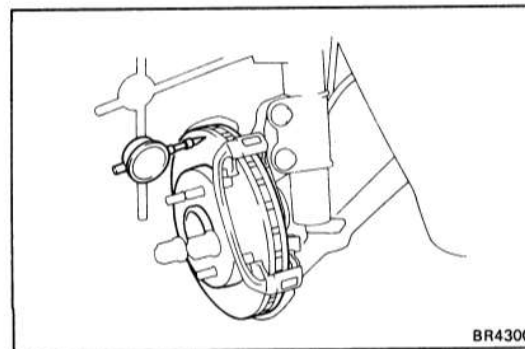
BR4333

2. MEASURE ROTOR DISC THICKNESS

Standard thickness: 25.0 mm (0.984 in.)

Minimum thickness: 24.0 mm (0.945 in.)

If the disc is scored or worn, or if thickness is less than minimum, repair or replace the disc.



BR4300

3. MEASURE ROTOR DISC RUNOUT

HINT: Before measuring the runout, confirm that the front hub bearing play is within specification.

Measure the rotor disc runout at 10 mm (0.39 in.) from the outer edge of the rotor disc.

Maximum disc runout: 0.07 mm (0.0028 in.)

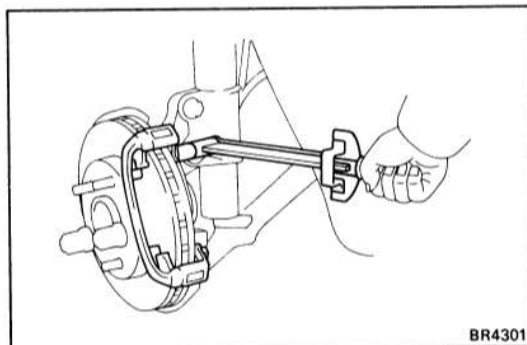
If the runout is greater than the maximum, inspect and adjust if following the procedure below.

Then replace the disc if necessary.

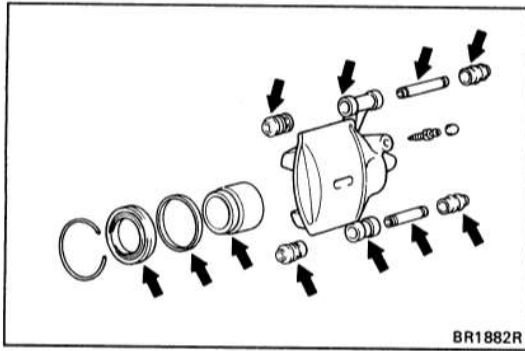
- (a) Remove the torque plate from the knuckle.
- (b) Remove the hub nuts of the temporarily installed disc and pull off the rotor disc.
- (c) Check that the hub axial play is within specification, and replace the bearing if not within specification. (See page SA-10)
- (d) Install the rotor disc and measure the disc runout, then shift the rotor disc one fifth of a turn or one fourth of a turn, and measure the disc runout. Similarly measure the runout at each position, and select the position where the runout is minimum.
- (e) In this position, if the runout is within specification, install the torque plate and torque the mounting bolts.

Torque: 900 kg-cm (65 ft-lb, 88 N·m)

- (f) If not within specification, replace the rotor disc, and repeat (d) and (e).



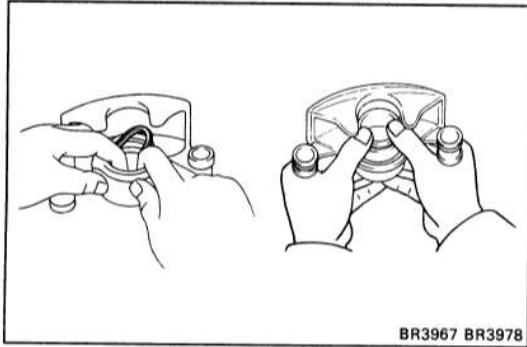
BR4301



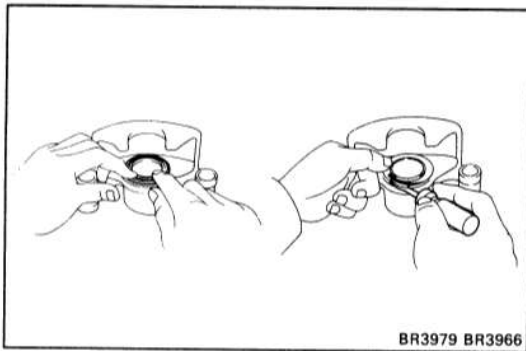
ASSEMBLY OF CYLINDER

(See page BR-25)

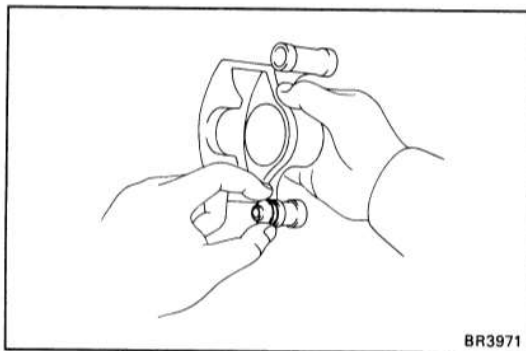
1. APPLY LITHIUM SOAP BASE GLYCOL GREASE TO PARTS INDICATED WITH ARROWS



2. INSTALL PISTON SEAL AND PISTON IN CYLINDER

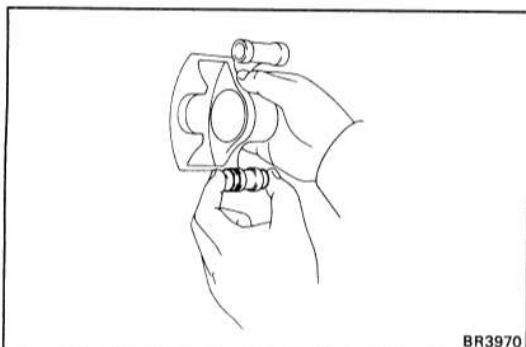


3. INSTALL CYLINDER BOOT AND RING IN CYLINDER

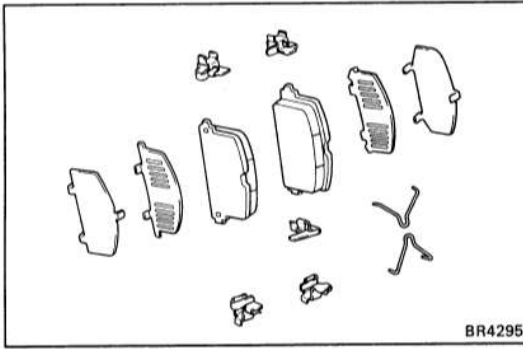


4. INSTALL DUST BOOTS AND CYLINDER SLIDING BUSHINGS

- (a) Install the dust boots into the brake cylinder.
- (b) Insure that the boots is secured firmly to the brake cylinder grooves.



- (c) Install the bushing into the boots.
- (d) Insure that the boots is secured firmly to the bushing grooves.

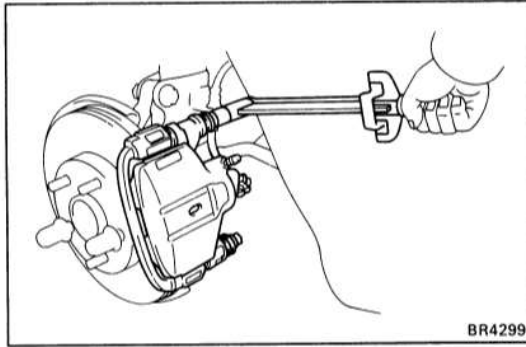


INSTALLATION OF CYLINDER

(See page BR-25)

1. INSTALL FOLLOWING PARTS:

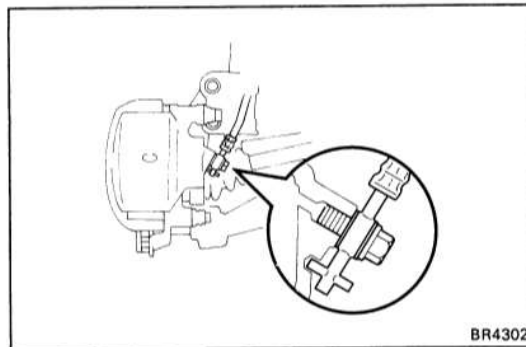
- (a) Four pad support plates
- (b) Pad wear indicator
- (c) Four anti-squeal shims
- (d) Two brake pads
- (e) Two anti-squeal springs
(See steps 7 and 8 on pages BR-26 and 27)



2. INSTALL CYLINDER

- (a) Install the brake cylinder.
- (b) Install and torque the two installation bolts.

Torque: 255 kg-cm (18 ft-lb, 25 N·m)



3. INSTALL FLEXIBLE HOSE

Install the flexible hose on the brake cylinder with two new gaskets.

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

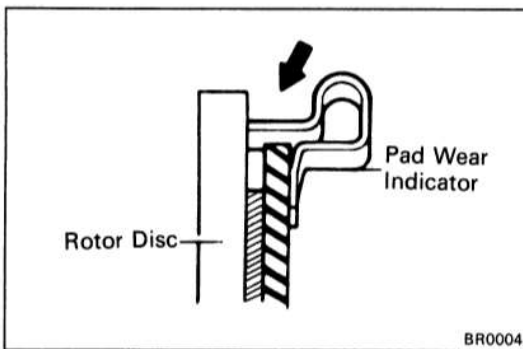
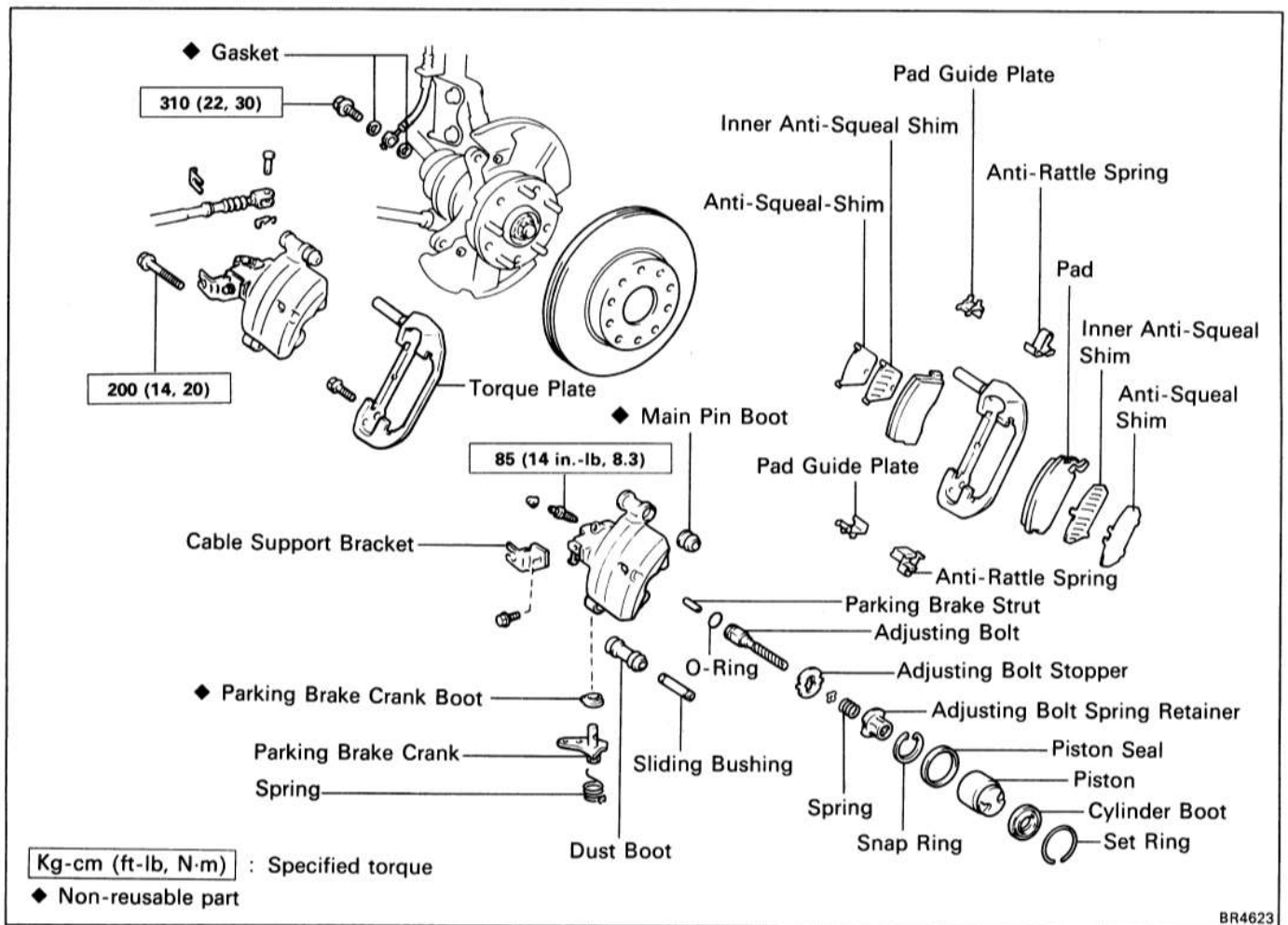
HINT: Insert the flexible hose lock securely in the lock hole in brake cylinder.

4. FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM

(See page BR-6)

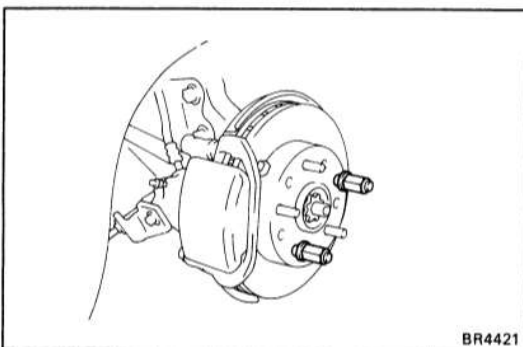
5. CHECK FOR LEAKS

REAR BRAKE COMPONENTS



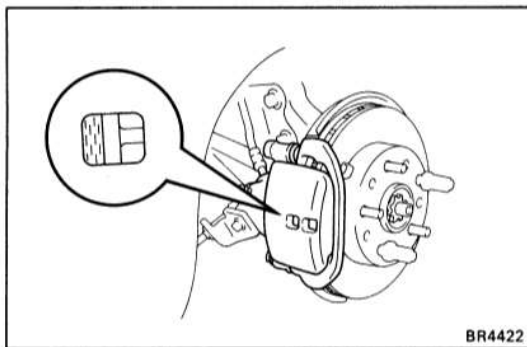
REPLACEMENT OF BRAKE PADS

HINT: If a squealing noise is made by the front brakes while driving, check the pad wear indicator. If there is evidence of the indicator contacting the rotor disc, the brake pad should be replaced.



1. REMOVE FRONT WHEEL

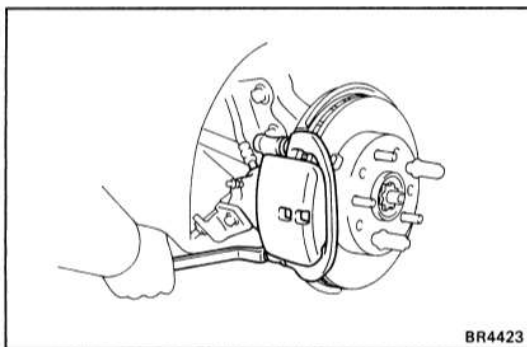
Remove the wheel and temporarily fasten the rotor disc with the hub nuts.



2. INSPECT PAD LINING THICKNESS

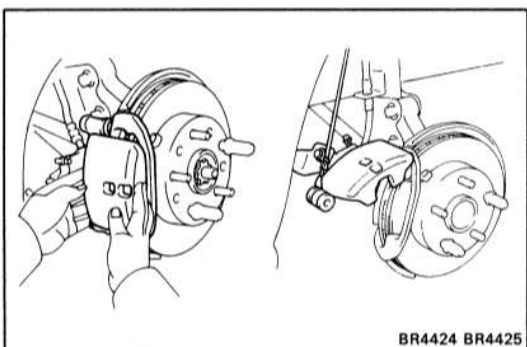
Check the pad thickness through the cylinder inspection hole and replace the pads if it is not within specification.

Minimum thickness: 1.0 mm (0.039 in.)



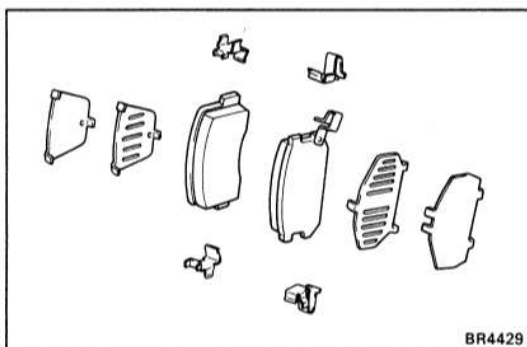
3. LIFT UP CYLINDER

(a) Remove the installation bolt from the torque plate.



(b) Lift up the brake cylinder and suspend the cylinder with string.

HINT: Do not disconnect the flexible hose from the brake cylinder.



4. REMOVE FOLLOWING PARTS:

- (a) Two brake pads
- (b) Four anti-squeal shims
- (c) Two anti-rattle springs
- (d) Two pad guide plates

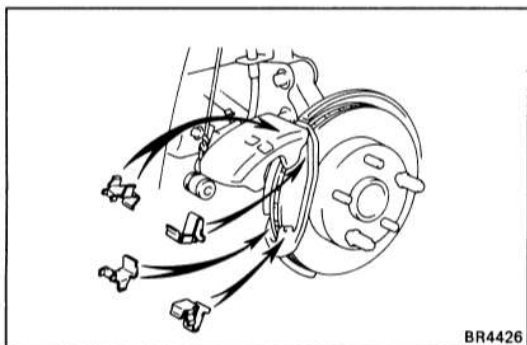
5. CHECK ROTOR DISC THICKNESS

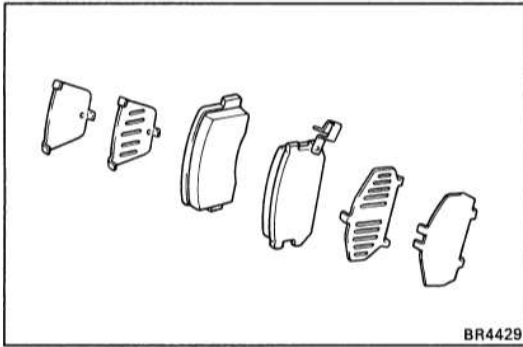
(See step 2 on page BR-40)

6. CHECK ROTOR DISC RUNOUT

(See step 3 on page BR-40)

7. INSTALL ANTI-RATTLE SPRINGS AND PAD GUIDE PLATES



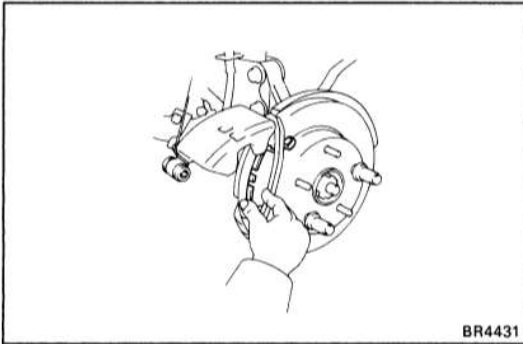


8. INSTALL NEWPADS

- (a) Apply disc brake to both sides of the two inner anti-squeal shims.
- (b) Install the two anti-squeal shims to the each pad.

- (c) Install the two pads.

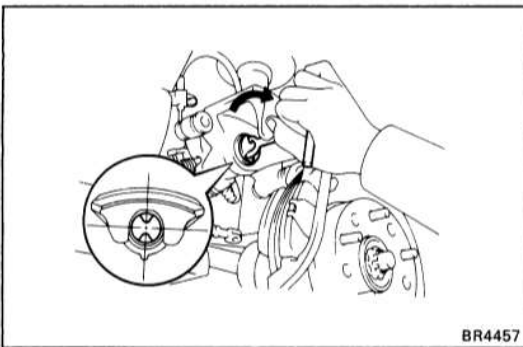
NOTICE: There should be no oil grease adhering to the friction surfaces of the pads or the rotor disc.



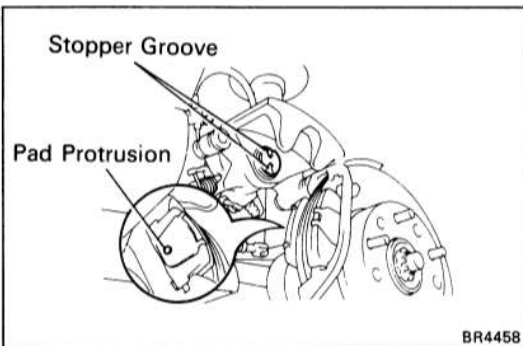
9. INSTALL CYLINDER

- (a) Using SST, slowly turn piston clockwise until the piston turns freely, then align the cylinder protrusion and piston stopper groove.

SST 09719-14020 (09719-00020)



- (b) Fit the pad protrusion into the piston stopper groove and install the cylinder.



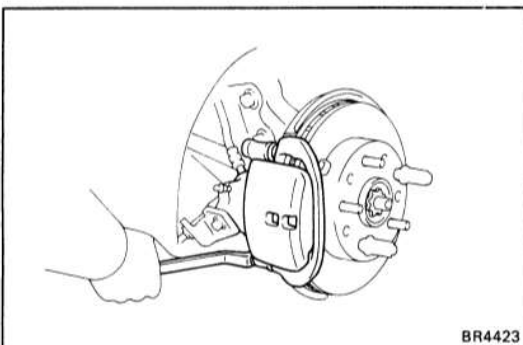
- (c) Install and torque the installation bolt.
Torque: 200 kg-cm (14 ft-lb, 20 N-m)

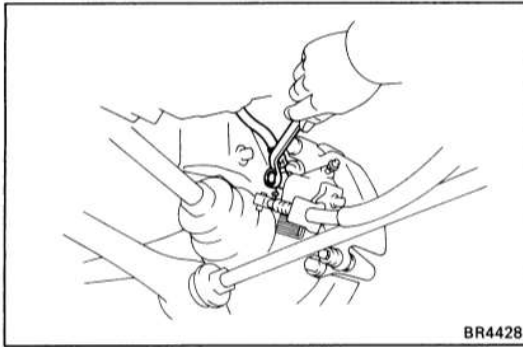
10. INSTALL REAR WHEEL

11. CHECK THAT FLUID LEVEL IS MAX LINE

12. ADJUST PAD CLEARANCE

Depress the brake pedal for several times.





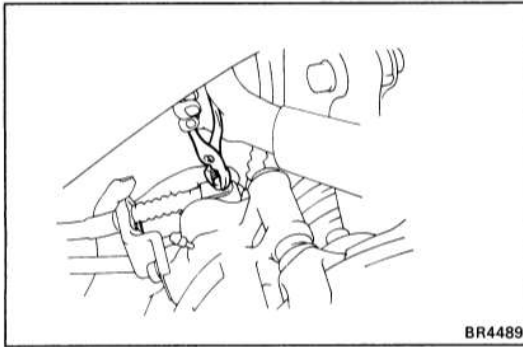
BR4428

REMOVAL OF CYLINDER

(See page BR-33)

1. DISCONNECT FLEXIBLE HOSE

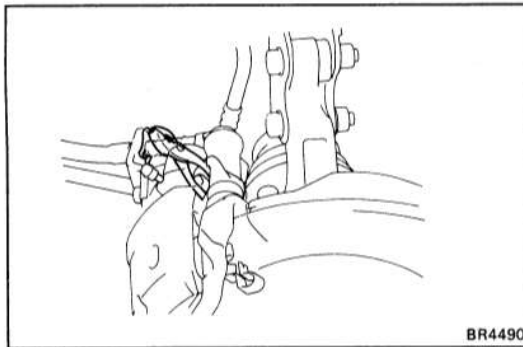
- (a) Remove the union bolt and two gaskets, and disconnect the flexible hose.
- (b) Use a container to catch the brake fluid.



BR4489

2. DISCONNECT PARKING BRAKE CABLE

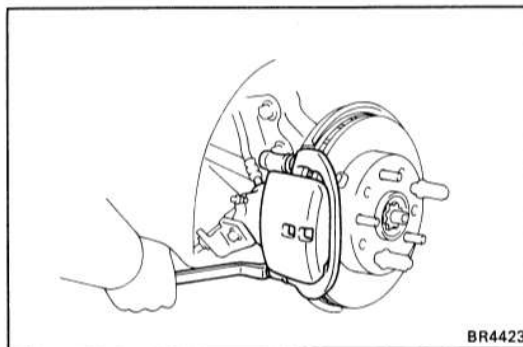
- (a) Remove the pin clip.
- (b) Pull out the hole pin while pushing the parking brake crank.



BR4490

- (c) Remove the clip.

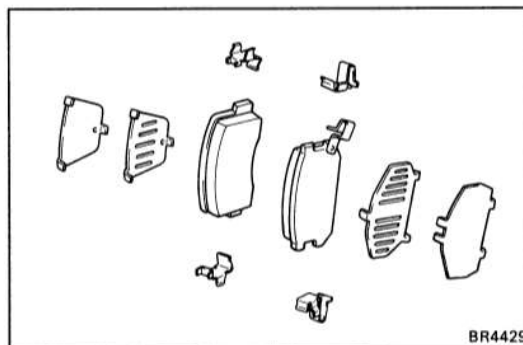
- (d) Remove the parking brake cable from the cable support bracket.



BR4423

3. REMOVE CYLINDER

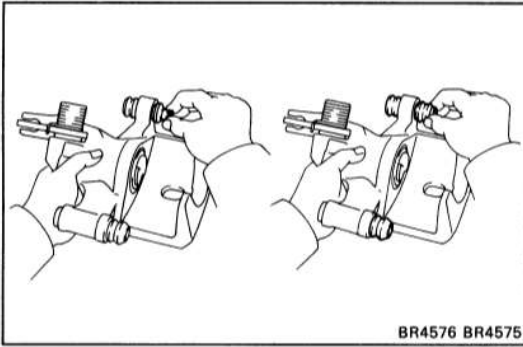
Remove the installation bolt, and remove the brake cylinder.



BR4429

4. REMOVE FOLLOWING PARTS:

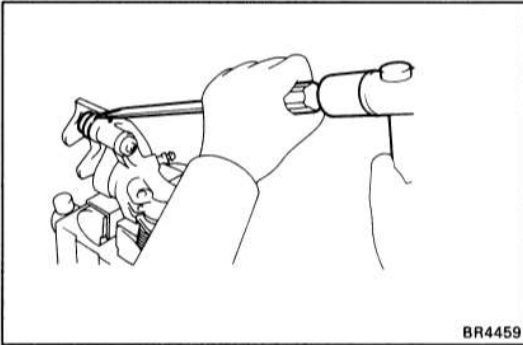
- (a) Two brake pads
- (b) Four anti-squeal shims
- (c) Two anti-rattle springs
- (d) Two pad guide plates



DISASSEMBLY OF CYLINDER

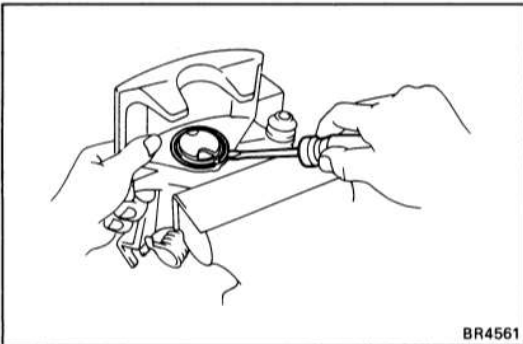
(See page BR-33)

1. REMOVE DUST BOOT AND SLIDING BUSHING



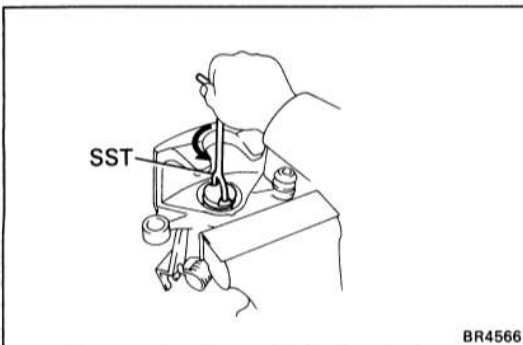
2. REMOVE MAIN PIN BOOT

Using a chisel and hammer, tap out the dust boots.



3. REMOVE CYLINDER BOOT SET RING AND CYLINDER BOOT

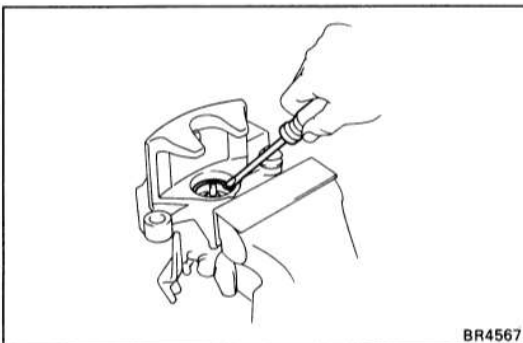
Using a screwdriver, remove the cylinder boot set ring and cylinder boot.



4. REMOVE PISTON FROM CYLINDER

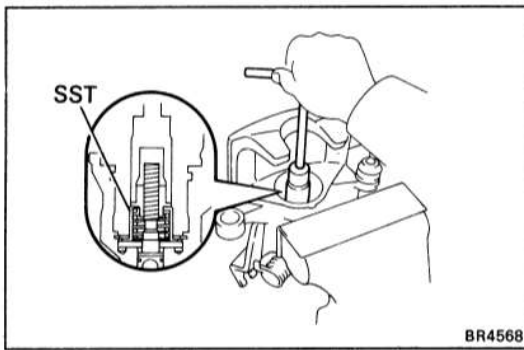
Using SST, turn the piston counterclockwise and remove it.

SST 09719-14020 (09719-00020)



5. REMOVE PISTON SEAL FROM CYLINDER

Using a screwdriver, remove the piston seal.



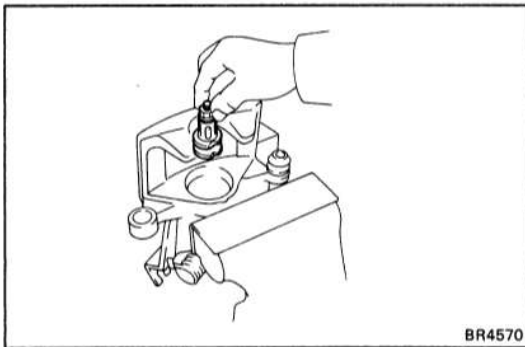
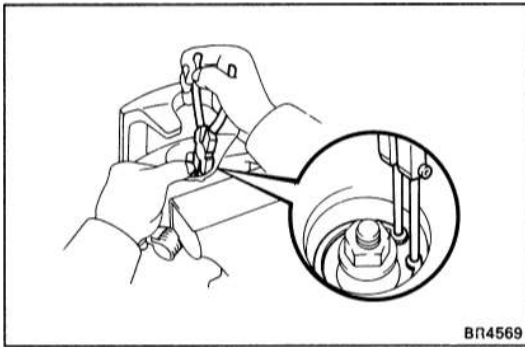
6. REMOVE ADJUSTING BOLT

- (a) Set SST onto the adjusting bolt, and lightly tighten it with a 14 mm socket.

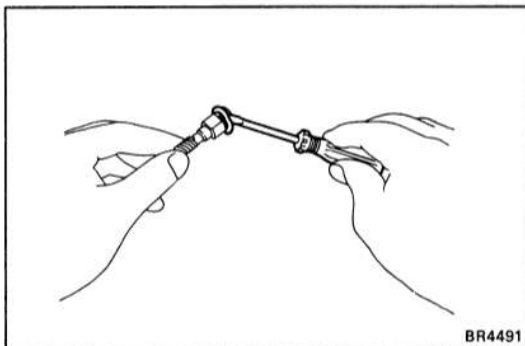
SST 09756-00010

CAUTION:

- To insure safety, always use SST as there is a possibility of the spring flying out, causing injury or damaging to the interior surface of the cylinder.
 - Be careful not to tighten the SST too tightly as this may damage the spring retainer.
- (b) Using snap ring pliers, remove the snap ring from the cylinder.



- (c) Remove the parking brake strut, spring retainer, spring, spring plate and stopper together with the adjusting bolt from the cylinder.

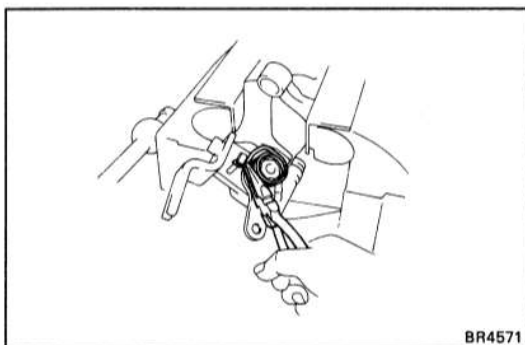


7. DISASSEMBLE ADJUSTING BOLT

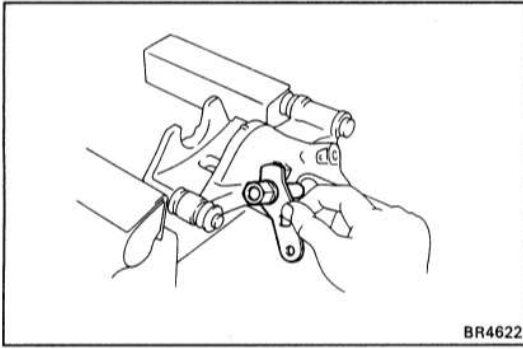
- (a) Remove SST.

SST 09756-00010

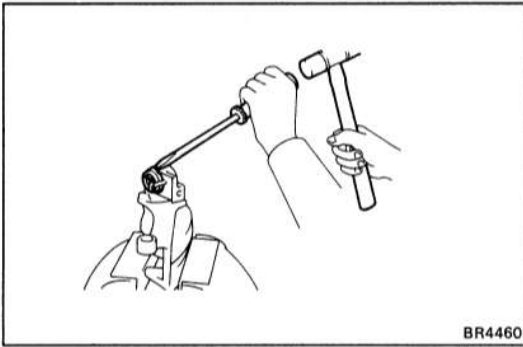
- (b) Remove the spring retainer, spring, spring plate and stopper from the adjusting bolt.
- (c) Remove the O-ring from the adjusting bolt.



8. REMOVE TORSION SPRING FROM PARKING BRAKE CRANK



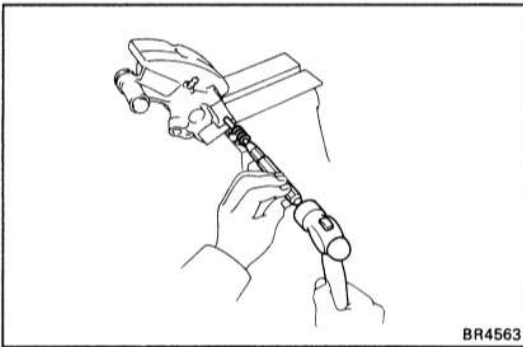
9. REMOVE PARKING BRAKE CRANK FROM CYLINDER



10. REMOVE PARKING BRAKE CRANK BOOT

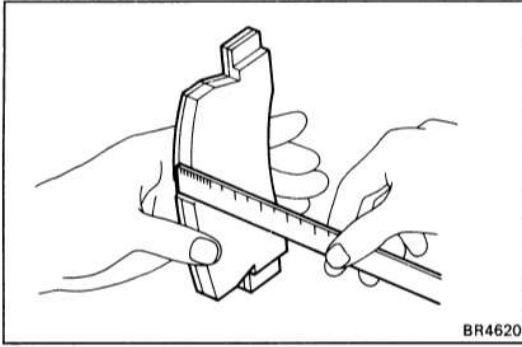
Using a chisel and hammer, tap out the parking brake crank boot.

11. REMOVE CABLE SUPPORT BRACKET



12. REMOVE STOPPER PIN

Using a pin punch, tap out the pin.



BR4620

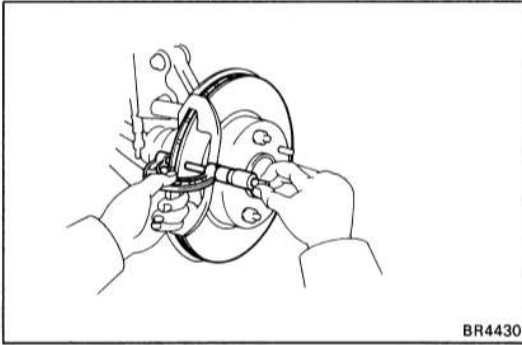
INSPECTION OF REAR BRAKE COMPONENTS

1. MEASURE PAD LINING THICKNESS

Standard thickness: 10.0 mm (0.394 in.)

Minimum thickness: 1.0 mm (0.039 in.)

Replace the pad if the thickness is less than the minimum or if it shows sign of uneven wear.



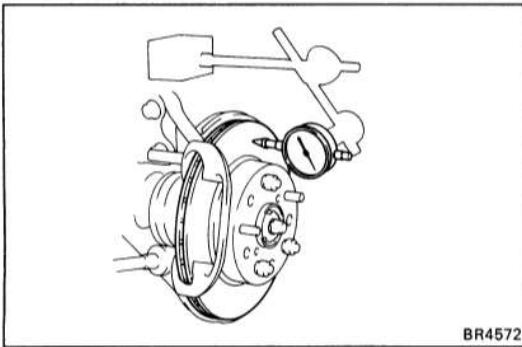
BR4430

2. MEASURE ROTOR DISC THICKNESS

Standard thickness: 16.0 mm (0.630 in.)

Minimum thickness: 15.0 mm (0.591 in.)

If the disc is scored or worn, or if thickness is less than minimum, repair or replace the disc.



BR4572

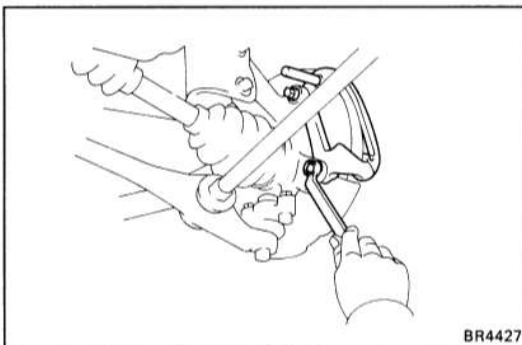
3. MEASURE ROTOR DISC RUNOUT

HINT: Before measuring the runout, confirm that the rear hub bearing play is within specification.

Measure the rotor disc runout at 10 mm (0.39 in.) from the outer edge of the rotor disc.

Maximum disc runout: 0.10 mm (0.0039 in.)

If the runout is greater than the maximum, replace the disc.



BR4427

4. IF NECESSARY, REPLACE ROTOR DISC

(a) Remove the disc brake cylinder mounting from the dust cover.

(b) Remove the hub nuts and rotor disc.

(c) Install a new rotor disc and temporarily fasten the disc with hub nuts.

(d) Install the torque plate to the rear axle carrier.

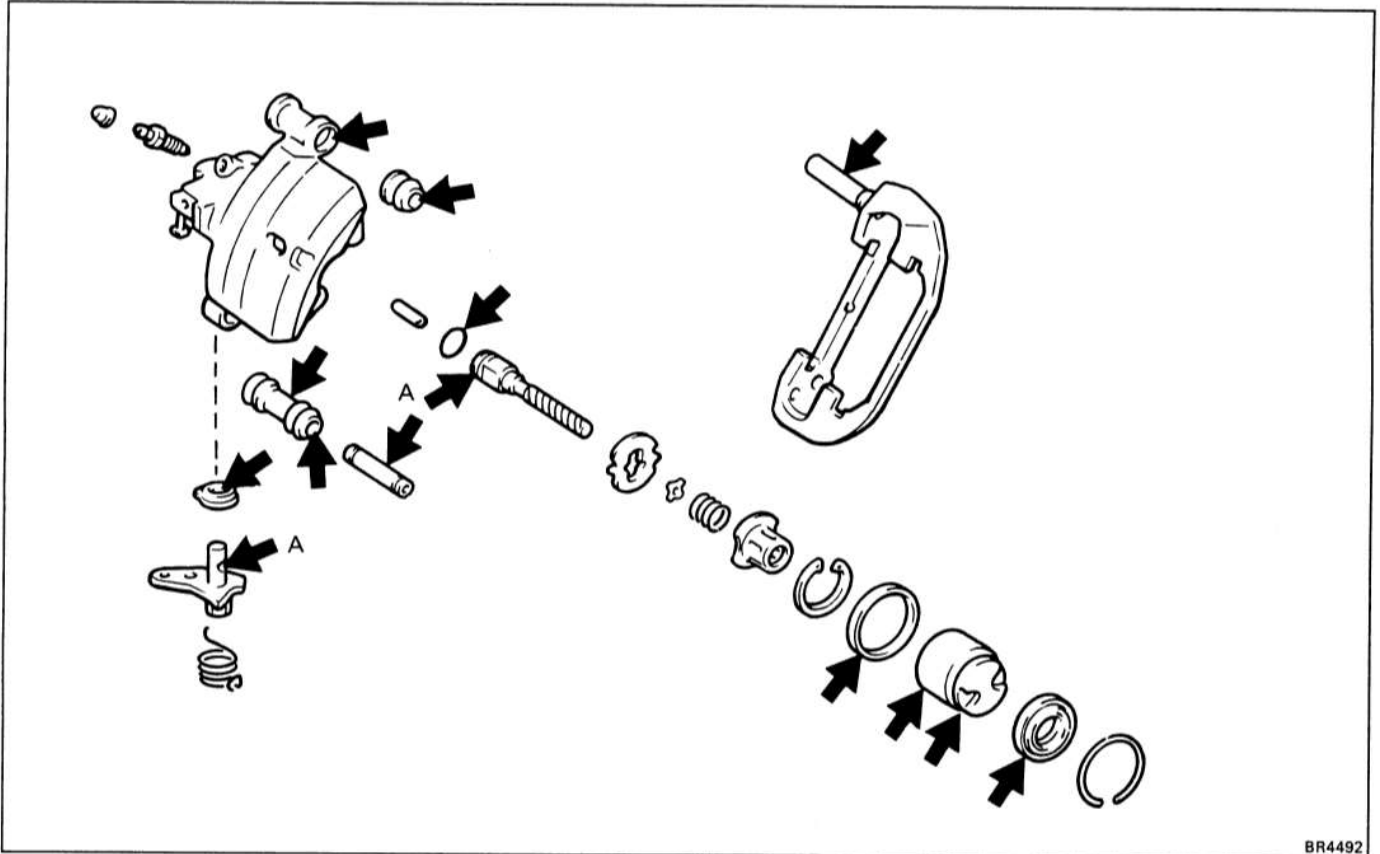
Torque: 600 kg-cm (43 ft-lb, 59 N·m)

ASSEMBLY OF CYLINDER

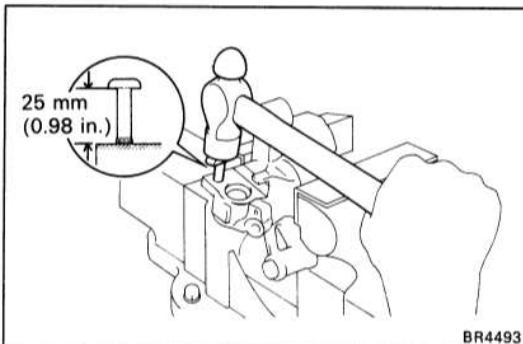
(See page BR-33)

1. **APPLY LITHIUM SOAP BASE GLYCOL GREASE TO PARTS INDICATED BY ARROWS**

HINT: Pack the lithium soap base glycol grease into areas marked "A".



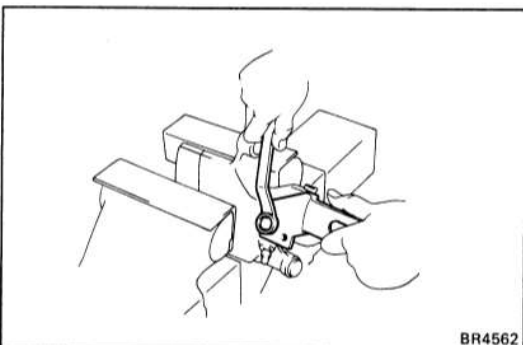
BR4492



BR4493

2. **INSTALL STOPPER PIN**

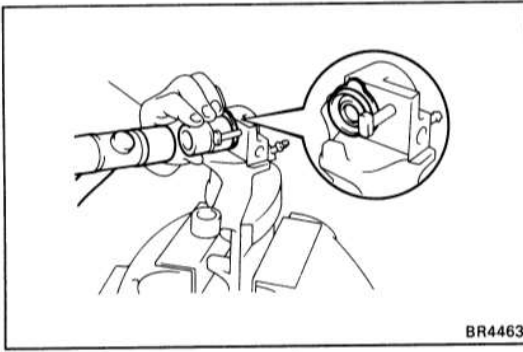
Tap in the pin to the brake cylinder until the stopper pin extends 25 mm (0.98 in.).



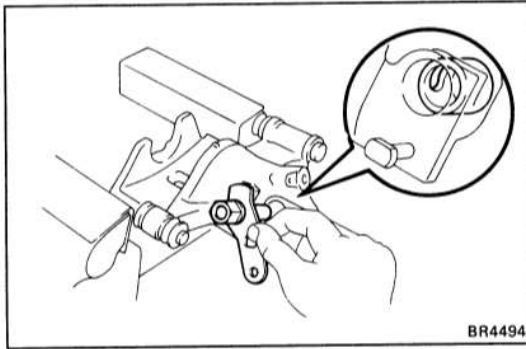
BR4562

3. **INSTALL CABLE SUPPORT BRACKET**

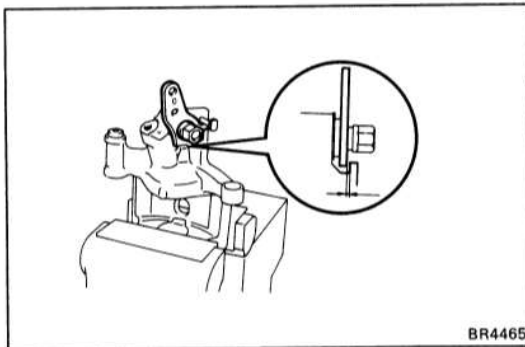
Torque: 475 kg-cm (34 ft-lb, 47 N·m)

**4. INSTALL PARKING BRAKE CRANK BOOT**

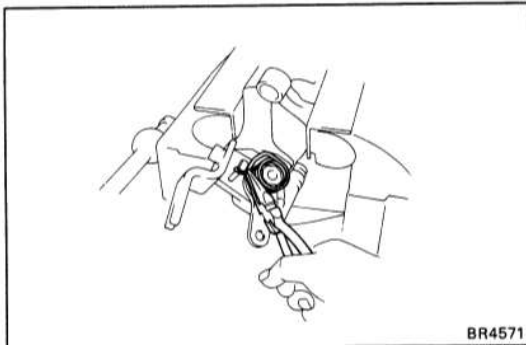
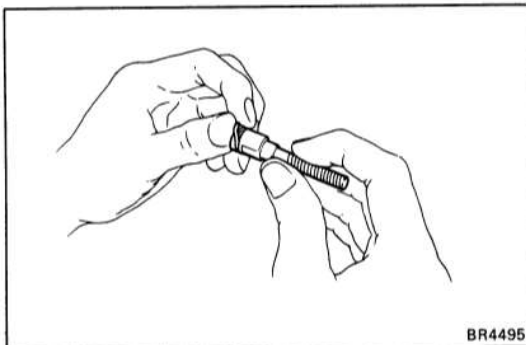
- (a) Using a 24 mm socket wrench and hammer, tap in new parking brake crank boot shown in the figure.
- (b) Confirm that the metal plate portion of the parking brake crank boot fits snugly in the cylinder.

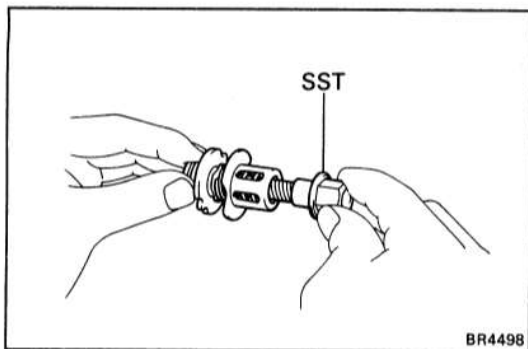
**5. INSTALL PARKING BRAKE CRANK**

- (a) Check that the needle roller bearing is not covering the cylinder hole.
- (b) Install the parking brake crank in cylinder.



- (c) Check that there is clearance between the parking brake crank and cylinder.

**7. INSTALL TORSION SPRING****8. INSTALL O-RING TO ADJUSTING BOLT**

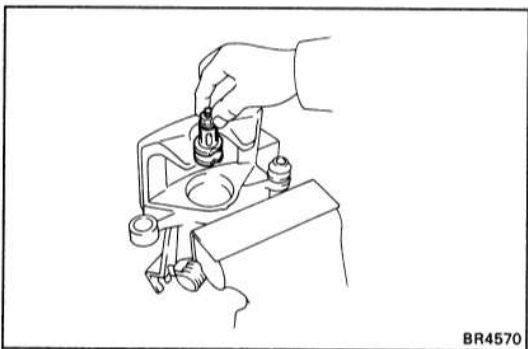
**9. INSTALL ADJUSTING BOLT SUB ASSEMBLY**

- (a) Assemble the parking brake stopper, spring plate, spring, spring retainer and parking brake strut to the adjusting bolt, and using SST, fully tighten them down by hand.

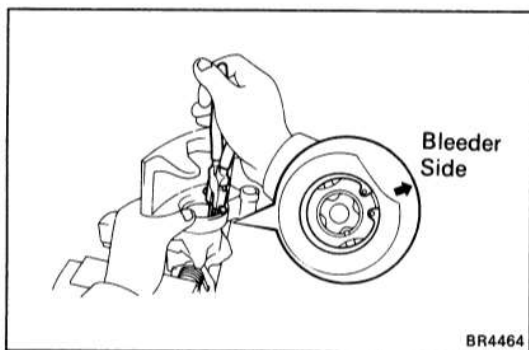
SST 09756-00010

HINT:

- Position the inscribed surface of the stopper upward.
- Align the notches of the spring retainer and stopper.



- (b) Install the adjusting bolt sub-assembly into the cylinder.



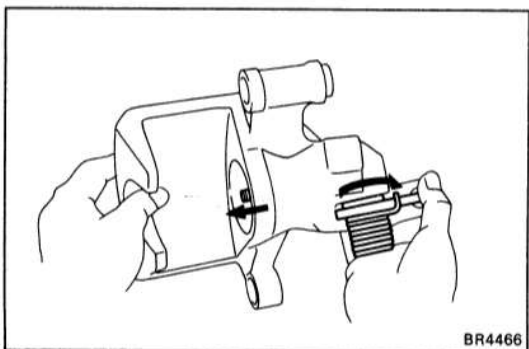
- (c) Using snap ring pliers, install the snap ring.

HINT: Face the snap ring opening toward the bleeder side.

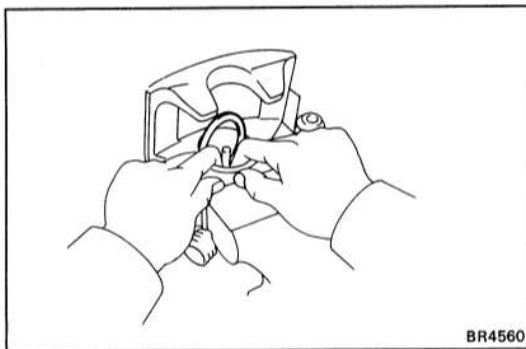
- (d) Remove the SST.

SST 09756-00010

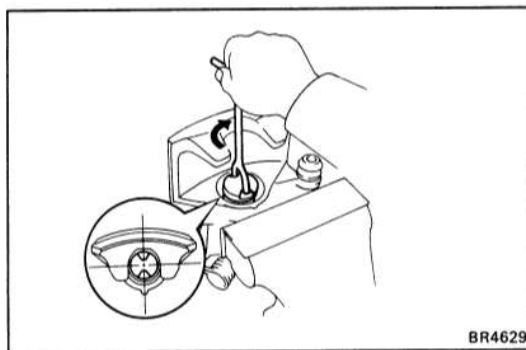
- (e) Firmly pull up the adjusting bolt by hand and insure that it does not move.

**10. OPERATIONAL CHECK**

Move the parking brake crank by hand and insure that the adjusting bolt moves smoothly.



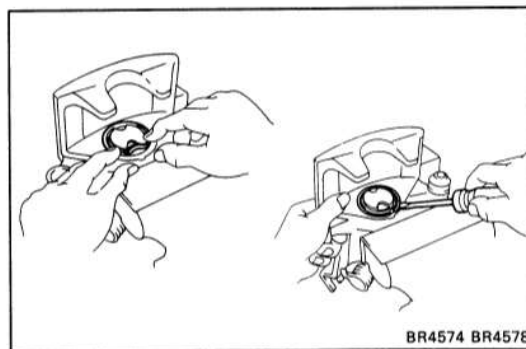
BR4560

11. INSTALL PISTON SEAL IN CYLINDER

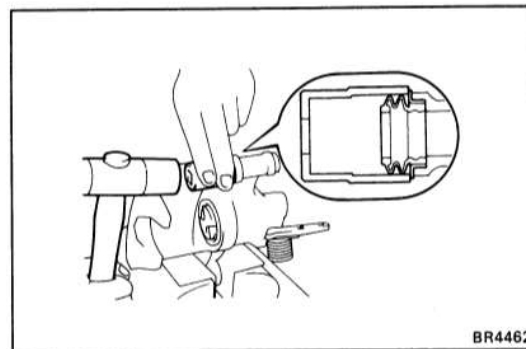
BR4629

12. INSTALL PISTON IN CYLINDER

Using SST, slowly turn the piston clockwise until the piston turns freely, then align the cylinder protrusion and piston stopper groove.



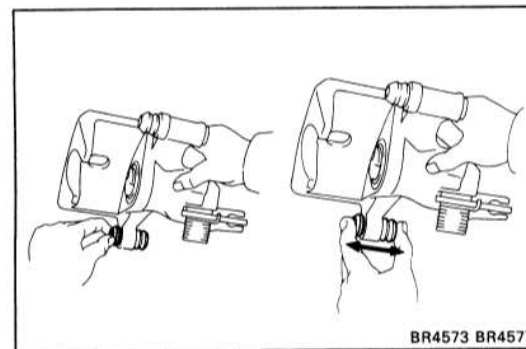
BR4574 BR4578

13. INSTALL CYLINDER BOOT AND SET RING IN CYLINDER

BR4462

14. INSTALL MAIN PIN BOOT

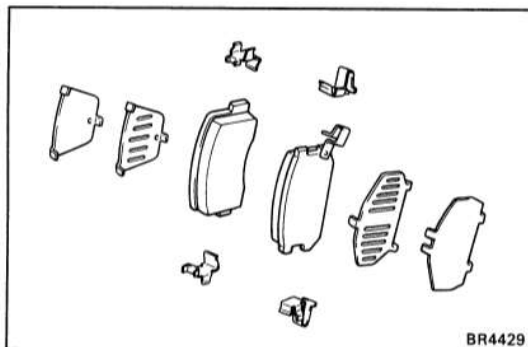
- (a) Using a 19 mm socket wrench and hammer, tap in new main pin boot into the cylinder.
- (b) Confirm that the metal plate portion of the main pin boot fits snugly in the cylinder.



BR4573 BR4577

15. INSTALL DUST BOOT AND SLIDING BUSHING

- (a) Install the dust boot.
- (b) Install the bushing into the boot, with the flange facing inside.

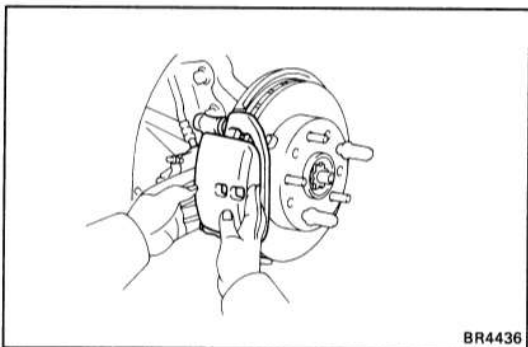


INSTALLATION OF CYLINDER

(See page BR-33)

1. INSTALL FOLLOWING PARTS:

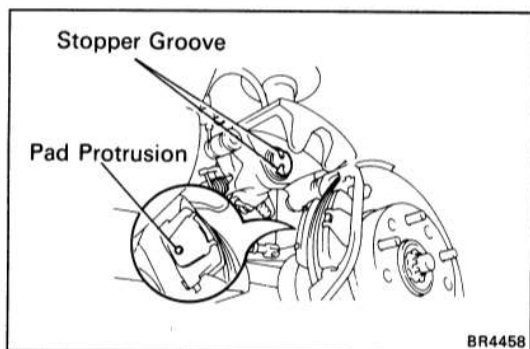
- (a) Two pad guide plates
- (b) Two anti-rattle springs
- (c) Four anti-squeal shims
- (d) Two brake pads
(See step 7 and 8 on pages BR-26 and 27)



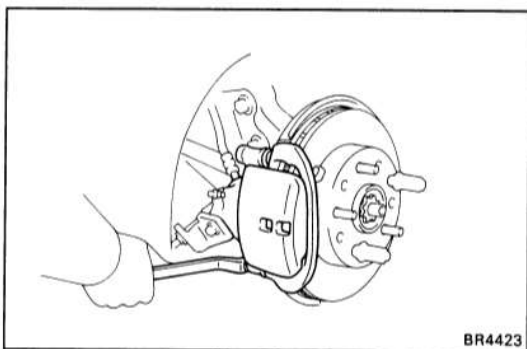
2. INSTALL CYLINDER

- (a) Install the cylinder onto the main pin.

HINT: Make sure that the boot end is installed into the groove of the main pin.

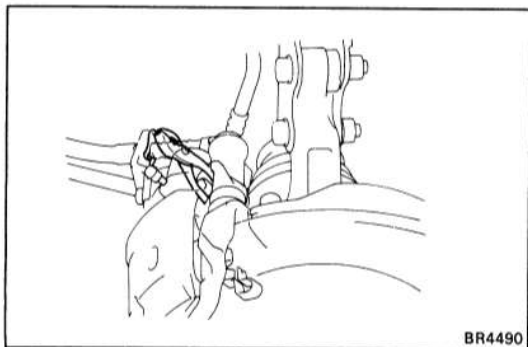


- (b) Fit the pad protrusion into the piston stopper groove, and install the cylinder.



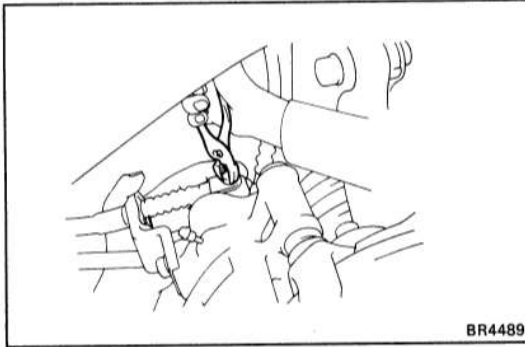
- (c) Install and torque the installation bolt.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

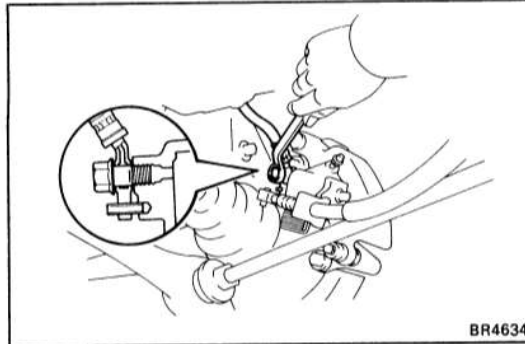


3. CONNECT PARKING BRAKE CABLE

- (a) Install the parking brake cable to the cable support bracket and install the retainer.



- (b) Install the hole pin while pushing the parking brake lever, and install the clip.



4. CONNECT BRAKE HOSE

Install the flexible hose on the brake cylinder with two new gaskets.

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

HINT: Insert the flexible hose lock securely in the lock hole in the brake cylinder.

5. FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM (See page BR-6)

6. CHECK FOR FLUID LEAKAGE

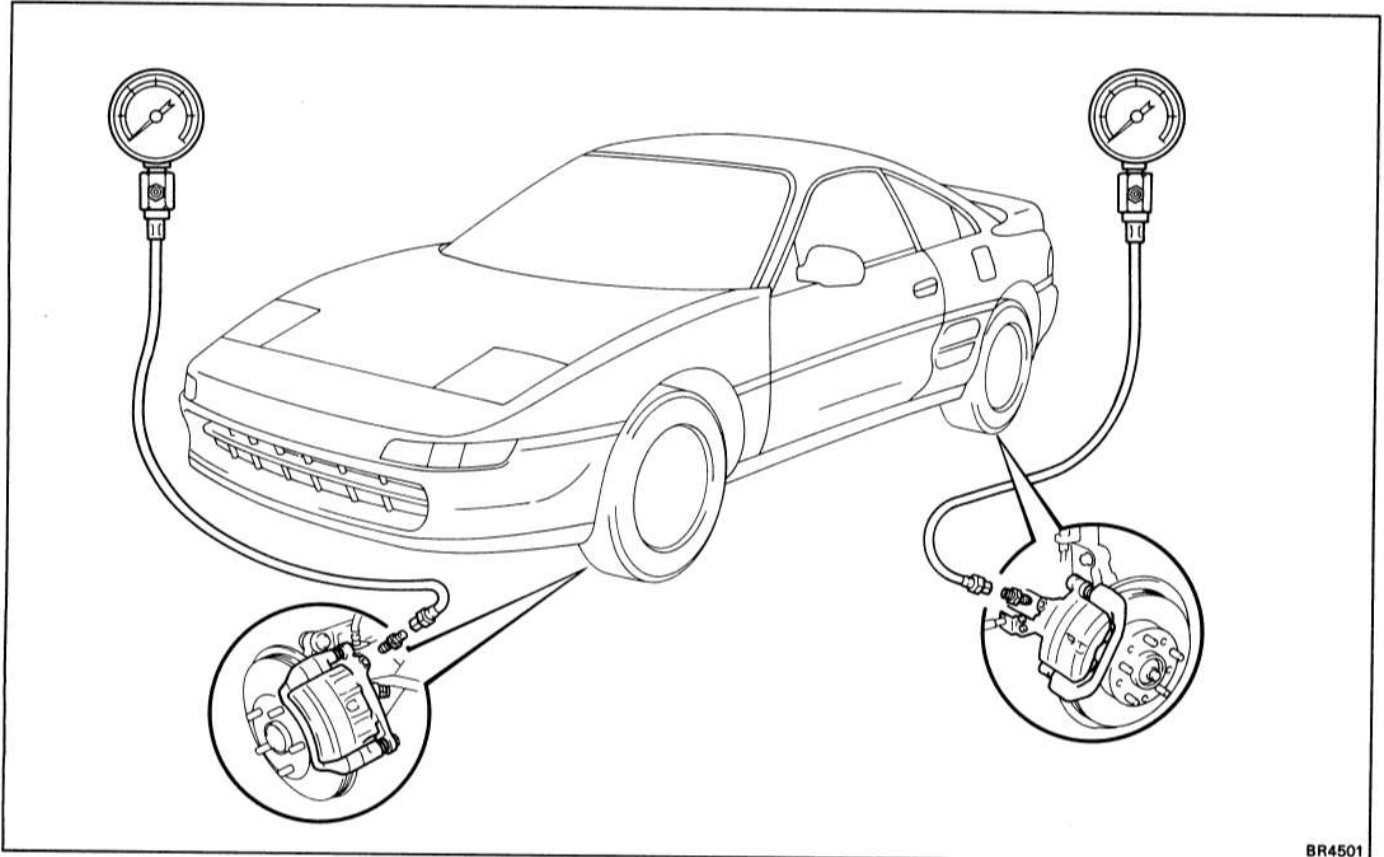
7. ADJUST REAR BRAKE

Depress the brake pedal several times and adjust the rear brake automatically.

PROPORTIONING AND BY-PASS VALVE (P & BV)

INSPECTION OF FLUID PRESSURE

1. **INSTALL LSPV GAUGE (SST) AND BLEED AIR**
SST 09709-29017



BR4501

2. **RAISE MASTER CYLINDER PRESSURE AND CHECK REAR WHEEL CYLINDER PRESSURE**

Specifications

	Master cylinder pressure	Rear Wheel cylinder pressure
5S-FE	30 kg/cm ² (427 psi, 2,942 kPa)	30 kg/cm ² (427 psi, 2,942 kPa)
	80 kg/cm ² (1,138 psi, 7,845 kPa)	60 kg/cm ² (853 psi, 5,884 kPa)
3S-GTE	60 kg/cm ² (853 psi, 5,884 kPa)	60 kg/cm ² (853 psi, 5,884 kPa)
	100 kg/cm ² (1,422 psi, 9,807 kPa)	84 kg/cm ² (1,195 psi, 8,238 kPa)

If the rear wheel cylinder pressure is incorrect, replace the P & B valve assembly.

3. **BLEED BRAKE SYSTEM**
4. **CHECK FOR FLUID LEAKAGE**

ANTI-LOCK BRAKE SYSTEM (ABS)

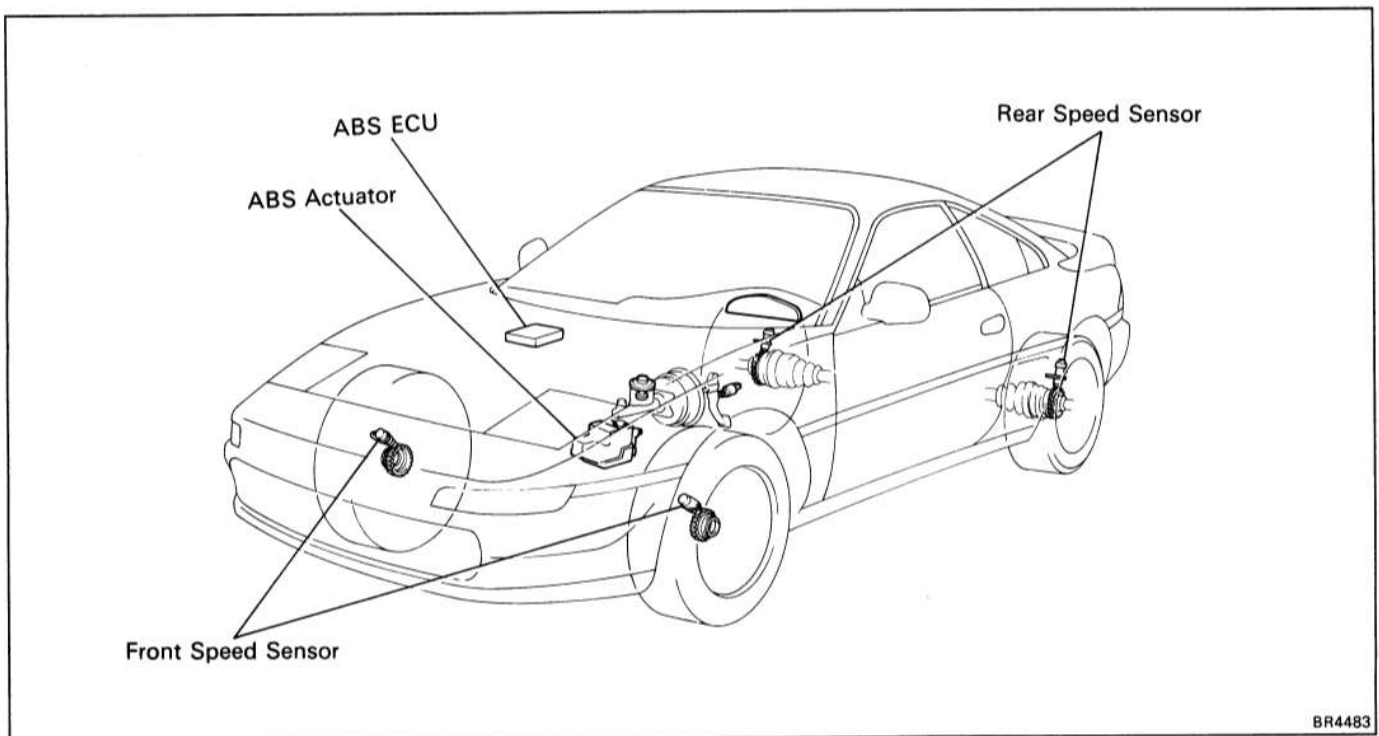
Description

- The ABS is a brake system which controls the wheel cylinder hydraulic pressure of all four wheels during sudden braking and braking on slippery road surfaces, preventing the wheels from locking. This ABS provides the following benefits:
 - (1) Enables steering round and obstacle with a greater degree of certainty even when panic braking.
 - (2) Enables stopping in a panic brake while keeping effect upon stability and steerability to minimum, even on curves.
- The function of the ABS is to help maintain directional stability and vehicle steerability on most road conditions. However, the system cannot prevent the vehicle from skidding if the cornering speed limit is exceeded.
- In case a malfunction occurs, a diagnosis function and fail-safe system have been adopted for the ABS to increase serviceability.

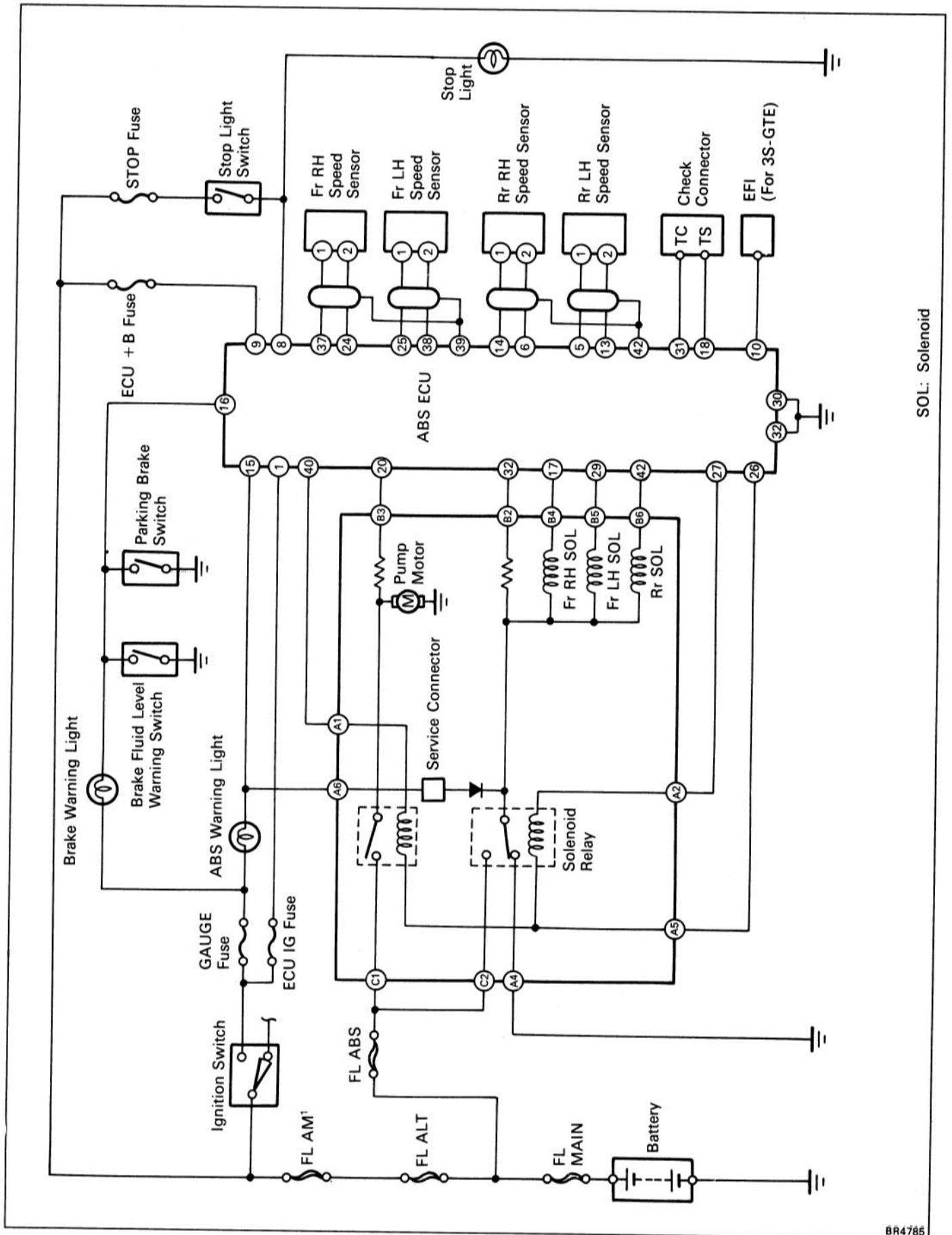
FUNCTION OF COMPONENTS

Component	Function
Front Speed Sensor	Detects the wheel speed of each of the left and right front wheels.
Rear Speed Sensor	Detects the wheel speed of each of the left and right rear wheels.
ABS Warning Light	Lights up to alert the driver when trouble has occurred in the Antilock Brake System.
Actuator	Controls the brake fluid pressure to each disc brake cylinder through signals from the computer.
ABS ECU	From the wheel speed signals from each sensor, it calculates acceleration, deceleration and slip values and sends signals to the actuator to control brake fluid pressure.

LOCATION OF SYSTEM PARTS



WIRING DIAGRAM

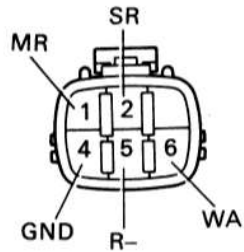


SOL: Solenoid

CONNECTORS

ABS Actuator

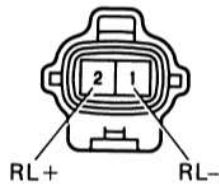
CONNECTOR A



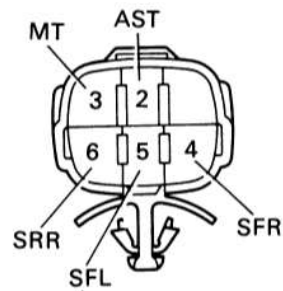
Front Speed Sensor (LH)



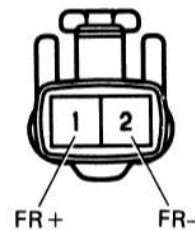
Rear Speed Sensor (LH)



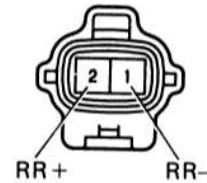
CONNECTOR B



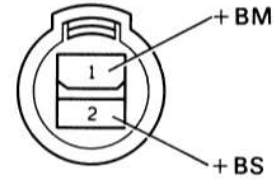
Front Speed Sensor (RH)



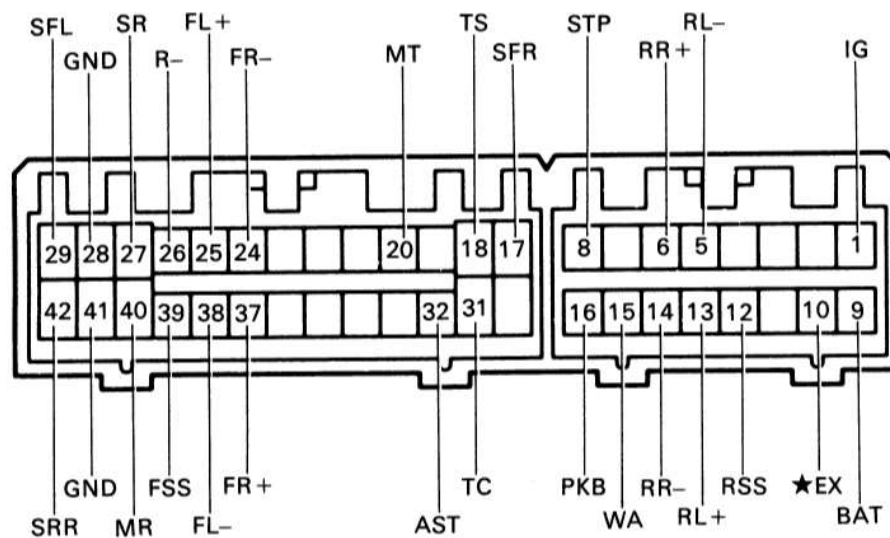
Rear Speed Sensor (RH)



CONNECTOR C

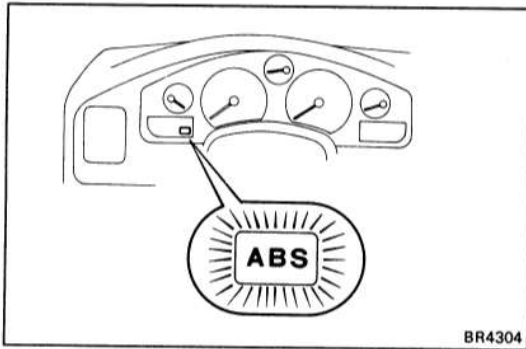


ABS ECU



★ For 3S-GTE

BR4625 BR4626 ID-2-2
 le-2-1-T le-2-1-T
 le-2-2-T le-2-2-T
 BR4078



BR4304

Diagnosis System

DESCRIPTION

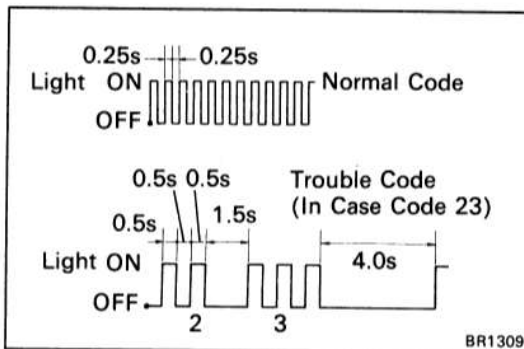
If a malfunction occurs, the system will identify the problem and the ECU will store the codes for the trouble items.

At the same time, the system informs the driver of a malfunction via the "ABS" warning light in the combination meter.

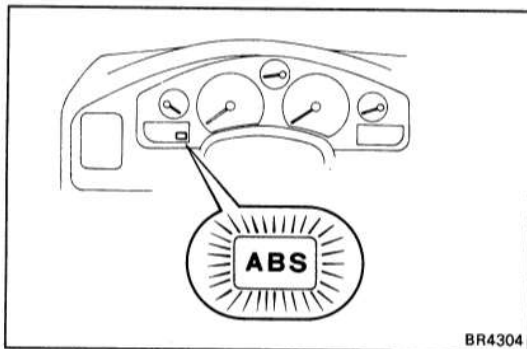
To identify the trouble by the number of blinks (diagnostic code) of the warning light turn on the ignition switch, disconnect the service connector, and use SST to connect Tc and E1 of the check connector.

In the event of two codes, that having the smallest number (code) will be identified first.

HINT: The warning light does not show the diagnostic codes while the vehicle is running.



BR1309



BR4304

INSPECTION OF DIAGNOSIS SYSTEM

1. INSPECT BATTERY VOLTAGE

Inspect that the battery voltage is about 12 V.

2. CHECK THAT WARNING LIGHT TURNS ON

- Turn the ignition switch on.
- Check that the "ABS" warning light turns on for 3 seconds.

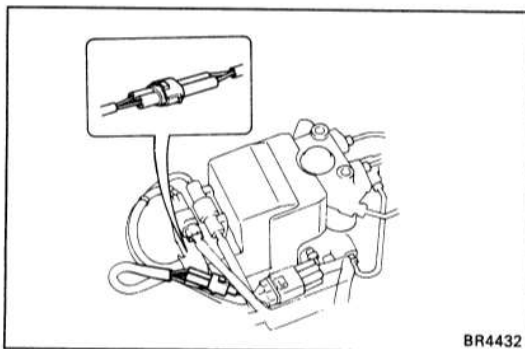
If not, inspect and repair or replace the fuse, bulb and wire harness.

3. READ DIAGNOSTIC CODE

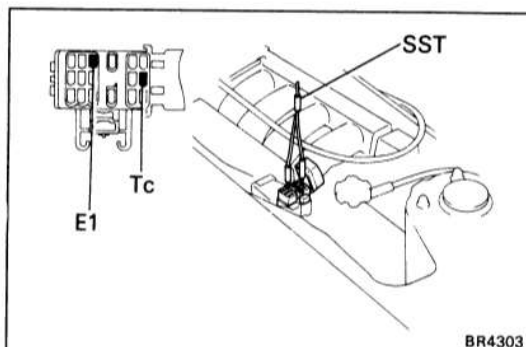
- Turn the ignition switch on.
- Disconnect the service connector.

- Using SST, connect terminals Tc and E1 of the check connector.

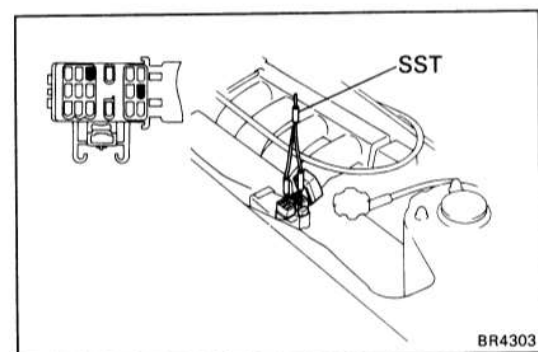
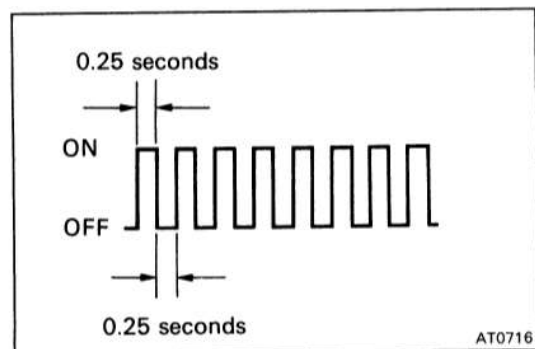
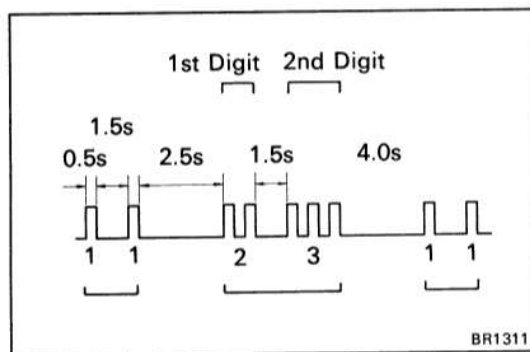
SST 09843-18020



BR4432



BR4303



- (d) In event of a malfunction, 4 seconds later the warning light will begin to blink. Read the number of blinks.

(See DIAGNOSTIC CODE on page BR-53)

HINT: The first number of blinks will equal the first digit of a two digit diagnostic code. After a 1.5 second pause, the 2nd number of blinks will equal the 2nd number of a two digit code. If there are two or more codes, there will be a 2.5 second pause between each, and indication will begin after 4.0 second pause from the smaller value and continue in order to larger.

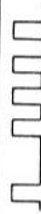
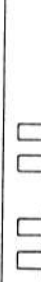
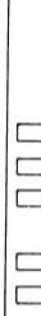
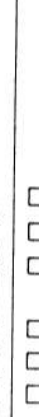
- (e) If the system is operating normally (no malfunction), the warning light will blink once every 0.5 seconds.
- (f) Repair the system.
- (g) After the malfunctioning components has been repaired, clear the diagnostic codes stored in the ECU. (See page BR-54)

HINT: If you disconnect the battery cable while repairing, all diagnostic codes in the ECU will erased.

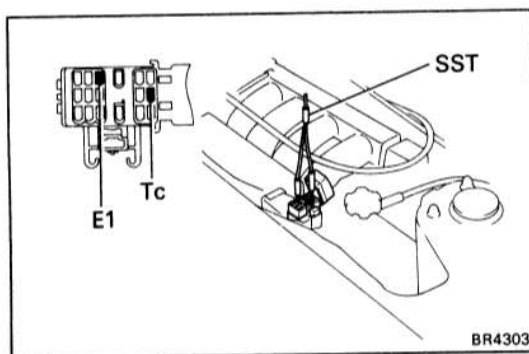
- (h) Remove the SST from terminals Tc and E1 of the check connector.

SST 09843-18020

- (i) Connect the service connector.
- (j) Turn the ignition switch on, and check that the "ABS" warning light goes off after the warning light goes on for 3 seconds.

Code No.	Light Pattern	Diagnosis	Trouble Part
11	ON OFF 	Open circuit in solenoid relay circuit	• Actuator inside wire harness • Solenoid relay • Wire harness and connector of solenoid relay circuit
12		Short circuit in solenoid relay circuit	
13		Open circuit in pump motor relay circuit	• Actuator inside wire harness • Pump motor relay • Wire harness and connector of pump motor relay circuit
14		Short circuit in pump motor relay circuit	
21		Open or short circuit in 3 position solenoid of front right wheel	
22		Open or short circuit in 3 position solenoid of front left wheel	
23		Open or short circuit in 3 position solenoid of rear wheels	
31		Front right wheel speed sensor signal malfunction	• Actuator solenoid • Wire harness and connector of actuator solenoid circuit
32		Front left wheel speed sensor signal malfunction	
33		Rear right wheel speed sensor signal malfunction	• Speed sensor • Sensor rotor • Wire harness and connector of speed sensor
34		Rear left wheel speed sensor signal malfunction	
35		Open circuit in front left or rear right wheel speed sensor	
36		Open circuit in front right or rear left wheel speed sensor	
41		Abnormal battery voltage (9.5 V less than or 17 V more than)	• Battery • Voltage regulator
51		Pump motor of actuator locked or open circuit in pump motor circuit in actuator	• Pump motor, relay and battery • Wire harness, connector and ground bolt or actuator pump motor circuit
Always on		Malfunction in computer	• ECU

BR4418



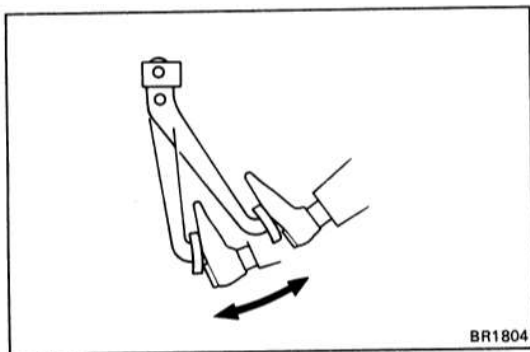
CLEARING OF DIAGNOSTIC CODES

CLEAR DIAGNOSTIC CODES

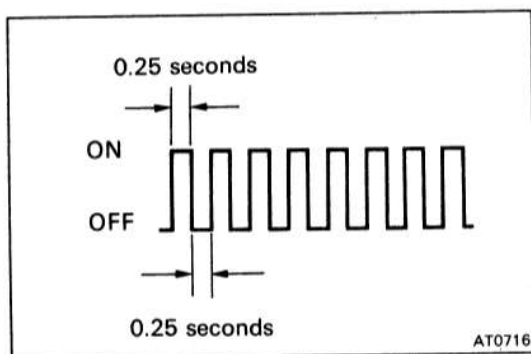
- (a) Turn the ignition switch on.
- (b) Using SST, connect terminals Tc and E1 of the check connector.

SST 09843-18020

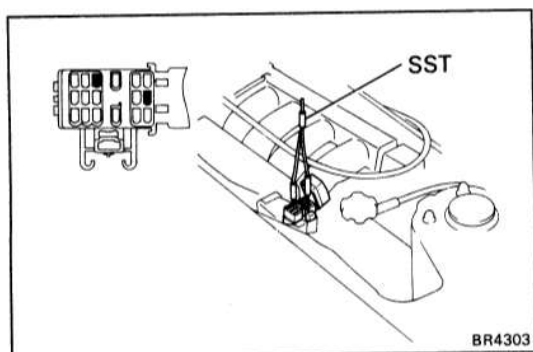
HINT: Keep the vehicle stopped vehicle speed 0 km/h (0 mph).



- (c) Clear the diagnostic codes stored in ECU by depressing the brake pedal 8 or more times within 3 seconds.

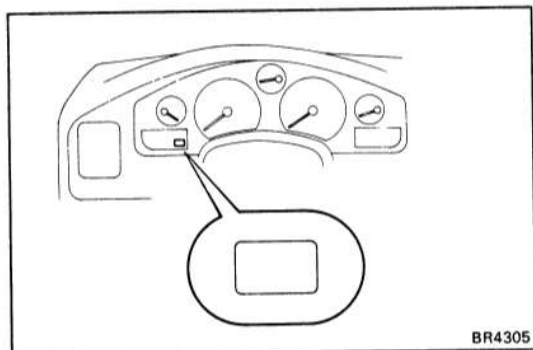


- (d) Check that the warning light shows the normal code.



- (e) Remove the SST from terminals Tc and E1 of the check connector.

SST 09843-18020

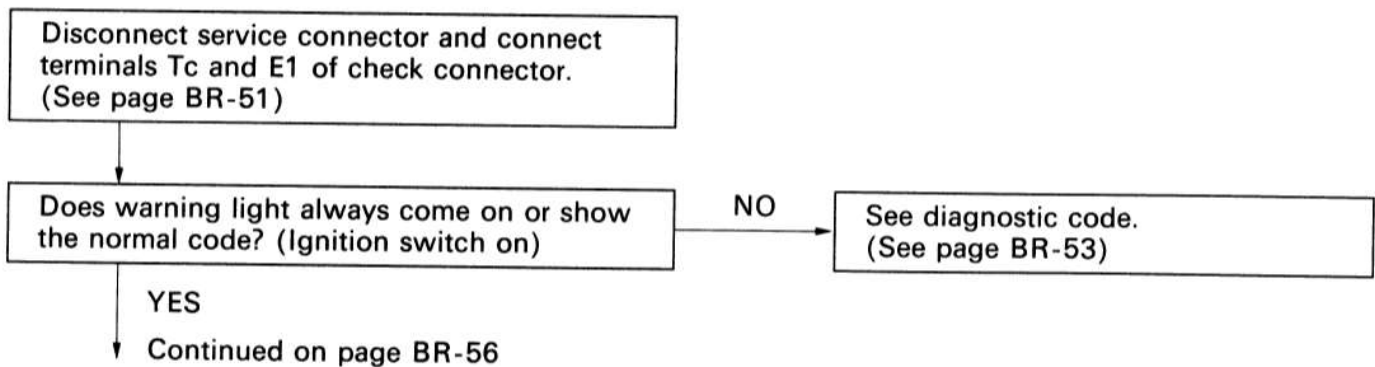


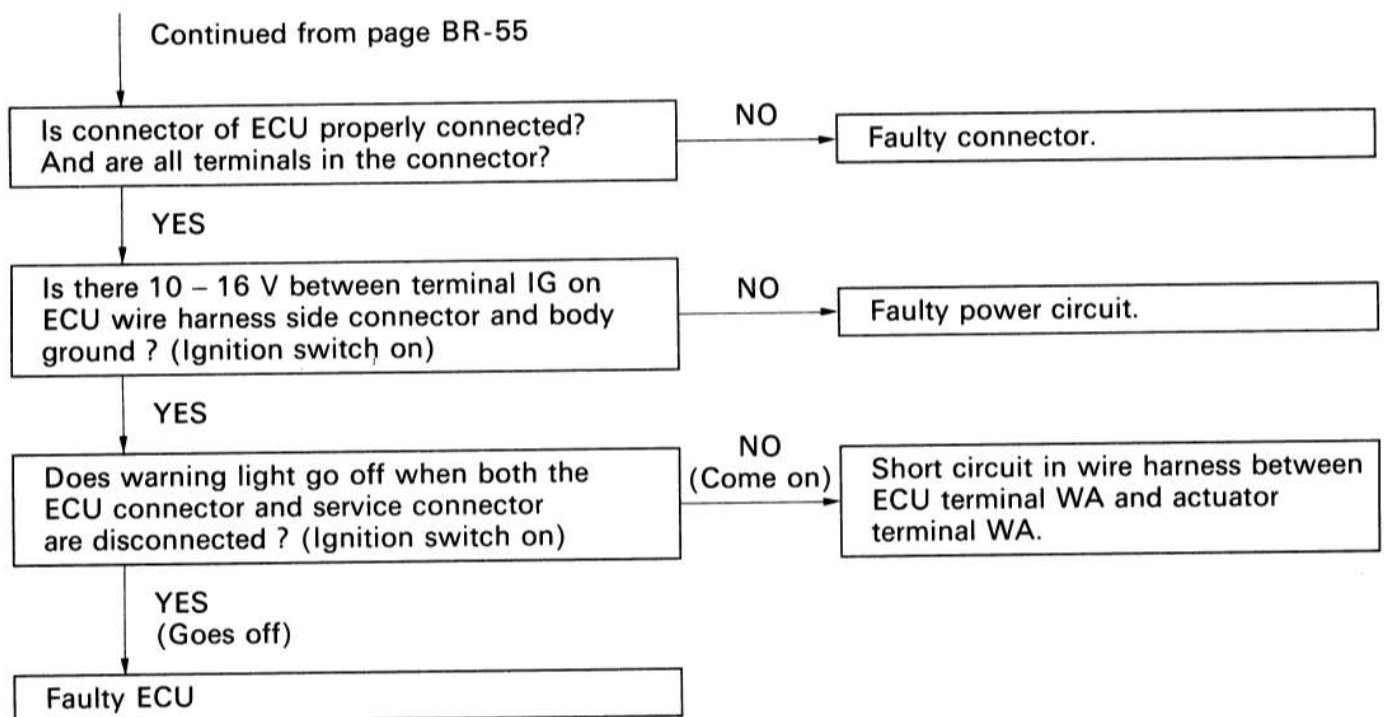
- (f) Check that the warning light goes off.

Troubleshooting

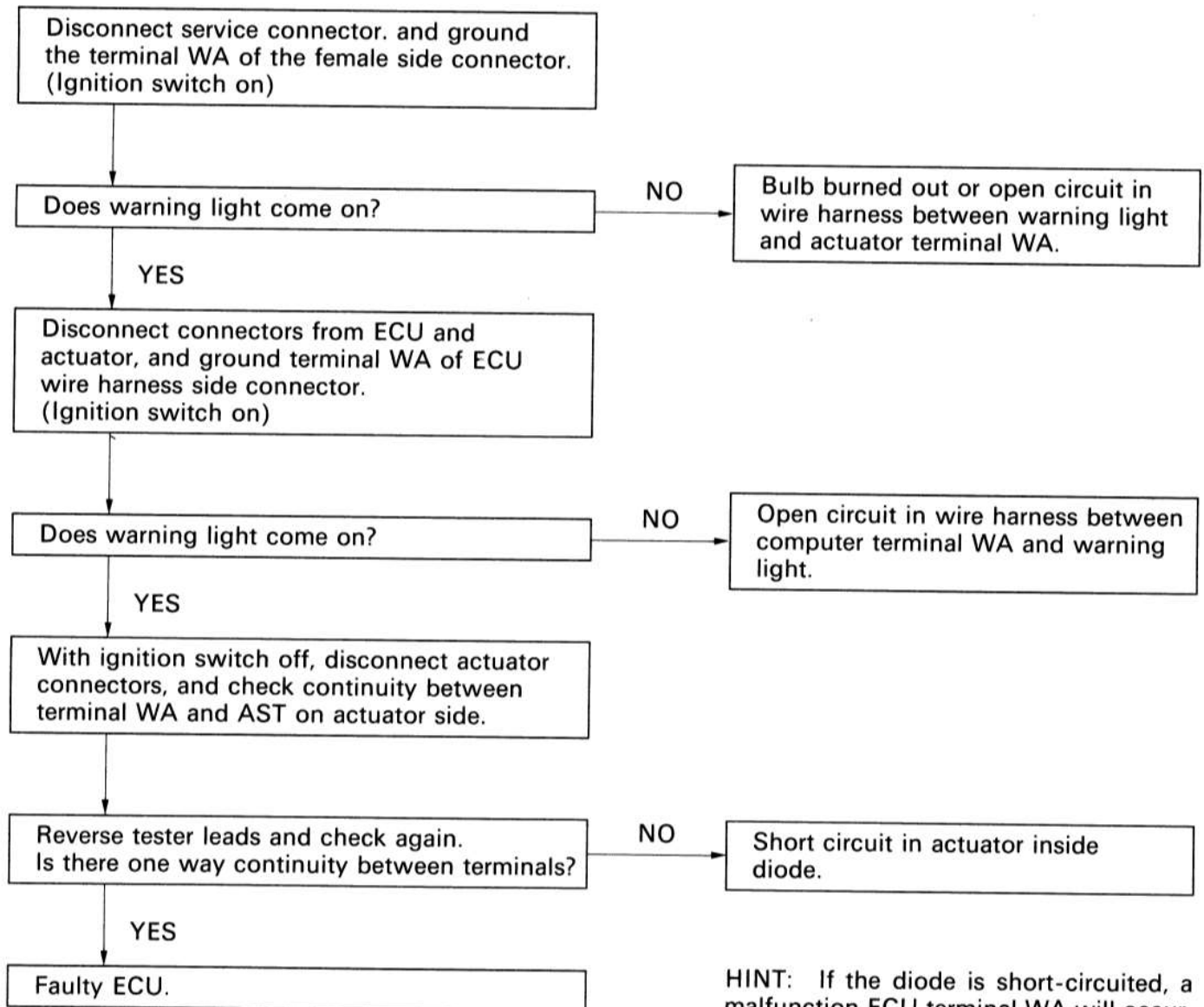
Problem		No.
"ABS" warning light	Always comes on after ignition switch is turned on.	1
	Does not come on for 3 seconds after ignition switch on.	2
	Comes on and off.	3
	Comes on while running.	1
Brake working	Brakes pull.	4
	Braking inefficient.	4
	ABS operates at ordinary braking.	4
	ABS operates just before stopping at ordinary braking.	4
	Brake pedal pulsates abnormally while ABS is operating.	4
	Skidding noise occurs while ABS working. (ABS works inefficiently)	5

1	"ABS" warning light comes on.
---	-------------------------------





2 "ABS" warning light does not come on for 3 seconds after ignition switch on.

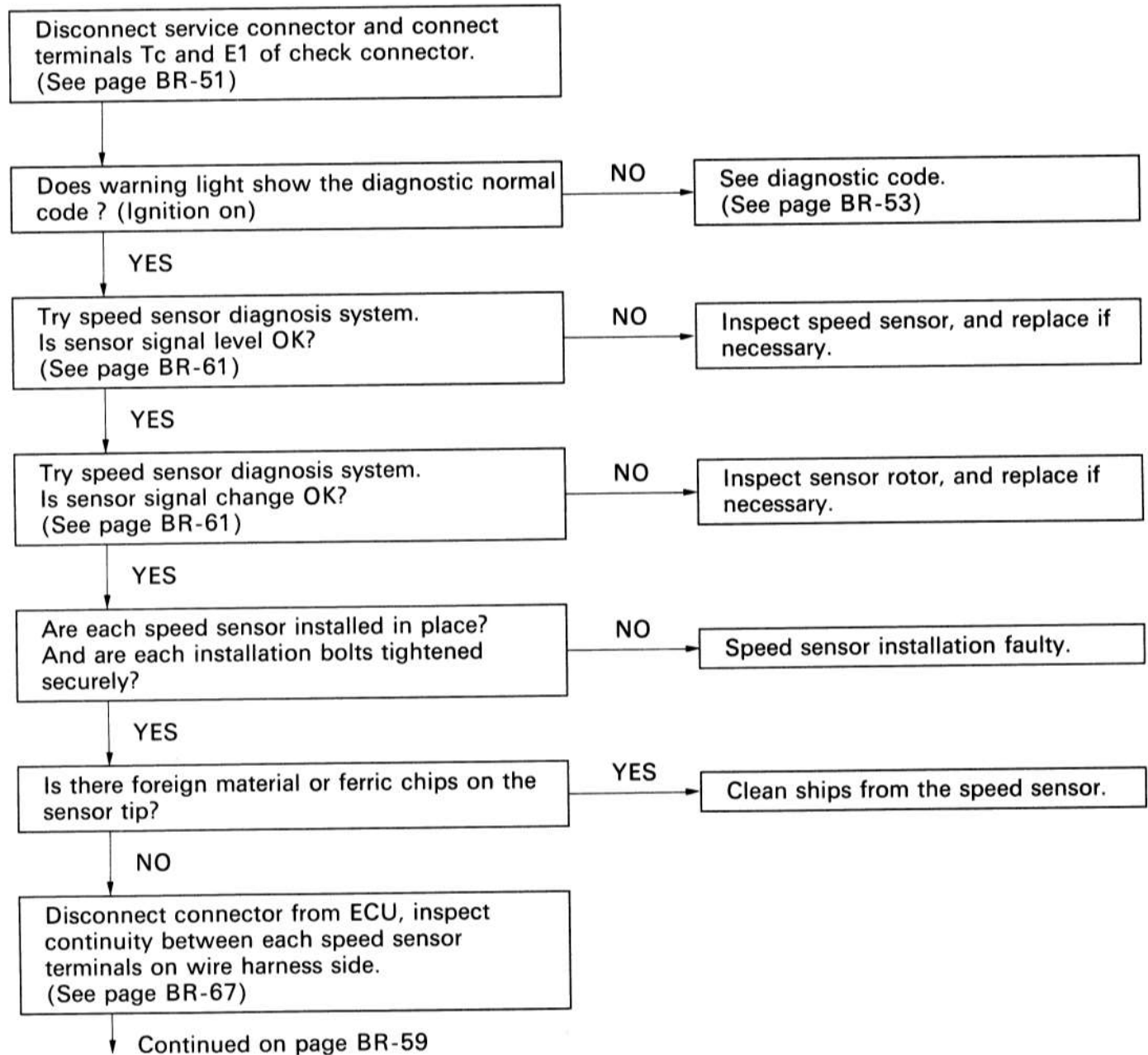


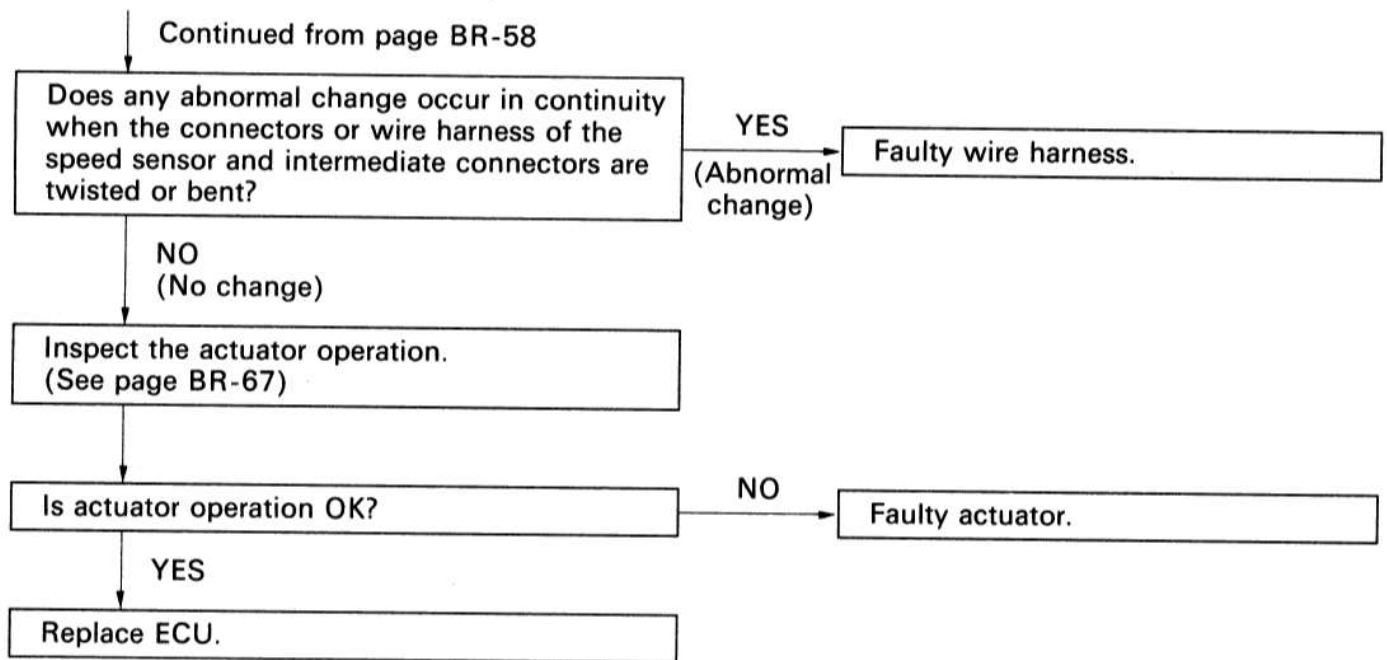
HINT: If the diode is short-circuited, a malfunction ECU terminal WA will occur. When inspecting the terminal, connect the ECU connector and disconnect actuator connectors and service connector. Then turn the ignition switch on, and check that the warning light goes on. If it does, the ECU terminal is OK.

3	"ABS" warning light comes on and off.
---	---------------------------------------

- Check for short circuit in wire harness between terminal Tc and E1 or Ts and E₁ of check connector.

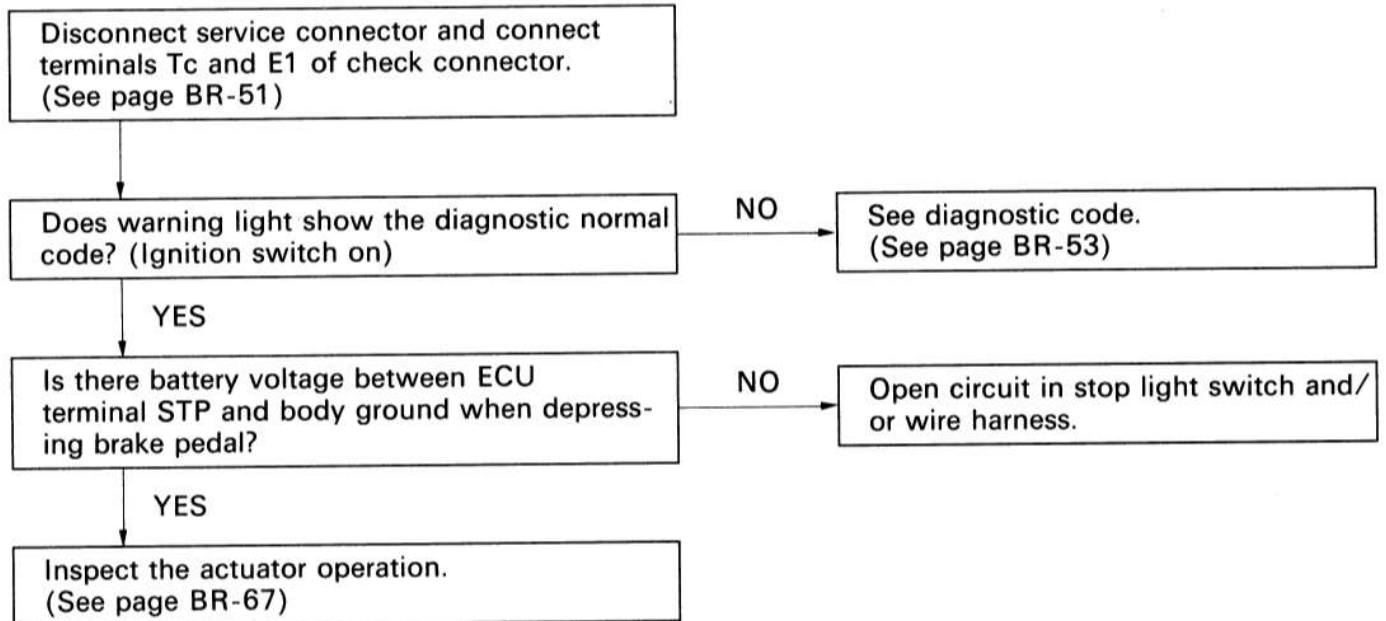
4	• Brakes pull. • Braking inefficient. • ABS operates at ordinary braking. • ABS operates just before stopping at ordinary braking. • Brake pedal pulsates abnormally while ABS working.
---	---





5

Antilock brake system works inefficiently.



Speed Sensor Diagnosis System

PRECAUTION

While checking the speed sensor diagnosis system, ABS does not work and brake system works as normal brake system.

INSPECTION OF DIAGNOSIS SYSTEM

1. INSPECT BATTERY VOLTAGE

Inspect that the battery voltage is about 12 V.

2. CHECK THAT WARNING LIGHT TURNS ON

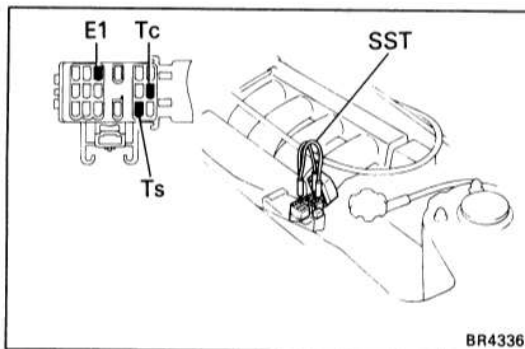
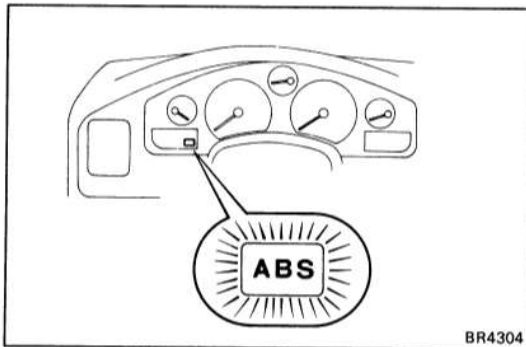
(a) Turn the ignition switch on.

(b) Check that the "ABS" warning light turns on for 3 seconds.

If not, inspect and repair or replace the fuse, bulb and wire harness.

(c) Check that the "ABS" warning light turns off.

(d) Turn the ignition switch off.



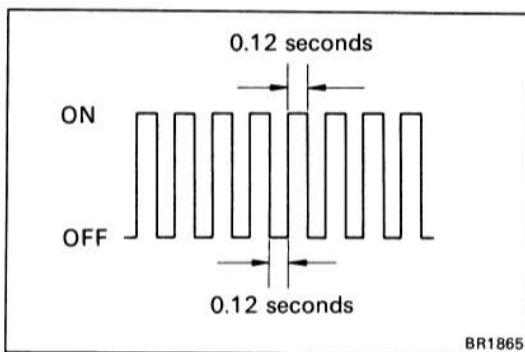
3. PERFORM FOLLOWING STEPS

(a) Using SST, connect terminals E1 and Tc, Ts of the check connector.

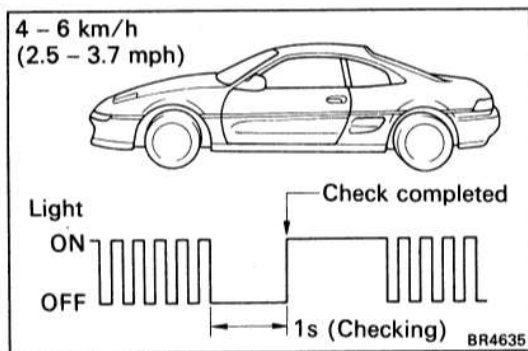
SST 09843-18020

(b) Pull the parking brake lever up, and start the engine.

HINT: Do not depress the brake pedal.



(c) Check that the warning light blinks about 4 times every 1 second as shown.



4. INSPECT SENSOR SIGNAL LEVEL

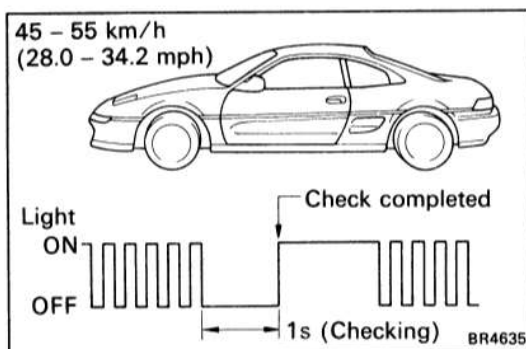
Drive the vehicle straight ahead at about 4 – 6 km/h (2.5 – 3.7 mph), and check that the warning light turns on after a 1 second pause.

If the warning light turns on without blinking when the vehicle speed is not within the specified speed range above, stop the vehicle and read the diagnostic code, and repair the malfunctioning parts.

(See step 6 on this page)

HINT: If the warning light turns on while the vehicle speed is within specified speed range above, the check is completed. And when the vehicle speed exceeds 6 km/h (3.7 mph), the warning light will blink again. In this condition, speed sensors are OK.

NOTICE: While the warning light is off, do not give any shocks to vehicle such as acceleration, deceleration, braking, shift change, steering or shocks from the road condition.



5. INSPECT SENSOR SIGNAL CHANGE

Drive the vehicle straight ahead at about 45 – 55 km/h (28.0 – 34.2 mph), and check that the warning light turns on after a 1 second pause.

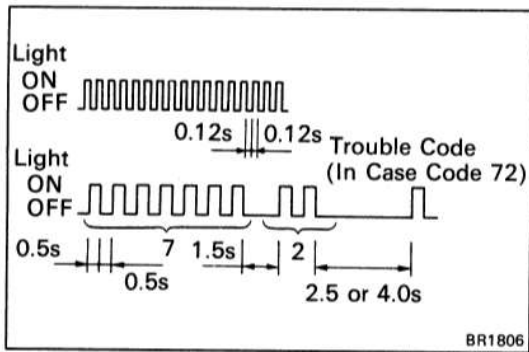
If the warning light turns on without blinking when the vehicle speed is not within the specified speed range above, stop the vehicle and read the diagnostic code, and repair the malfunctioning parts. (See step 6 on this page)

HINT: If the warning light turns on while the vehicle speed is within specified speed range above, the check is completed. And when the vehicle speed is not within specified speed range, the warning light will blink again. In this condition, sensor rotors are OK.

NOTICE: While the warning light is off, do not give any shocks to vehicle such as acceleration, deceleration, braking, shift change, steering or shocks from the road condition.

6. READ DIAGNOSTIC CODE

Stop the vehicle, and warning light will begin to blink. Read the number of blinks. (See DIAGNOSTIC CODE on page BR-64)



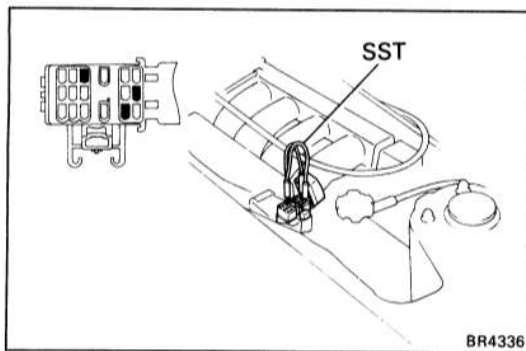
HINT: The first number of blinks will equal the first digit of a two digit diagnostic code. After a 1.5 second pause, the 2nd number of blinks will equal the 2nd number of a two digit code. If there are two or more codes, there will be a 2.5 second pause between each code, and then indication will begin again after a 4.0 second pause, continuing in order from the smaller value up to the larger one.

7. REPAIR MALFUNCTIONING PARTS

Repair or replace the malfunctioning parts.

8. PERFORM FOLLOWING STEPS

(a) Turn the ignition switch off.



(b) Remove the SST from terminals E1 and Tc, Ts of the check connector.

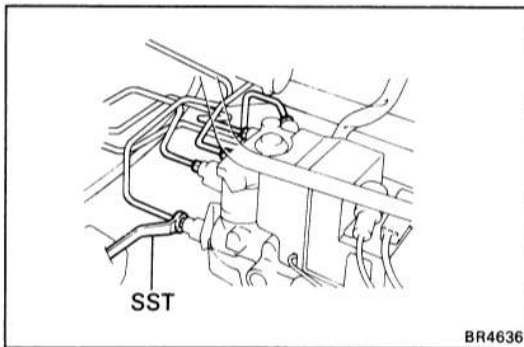
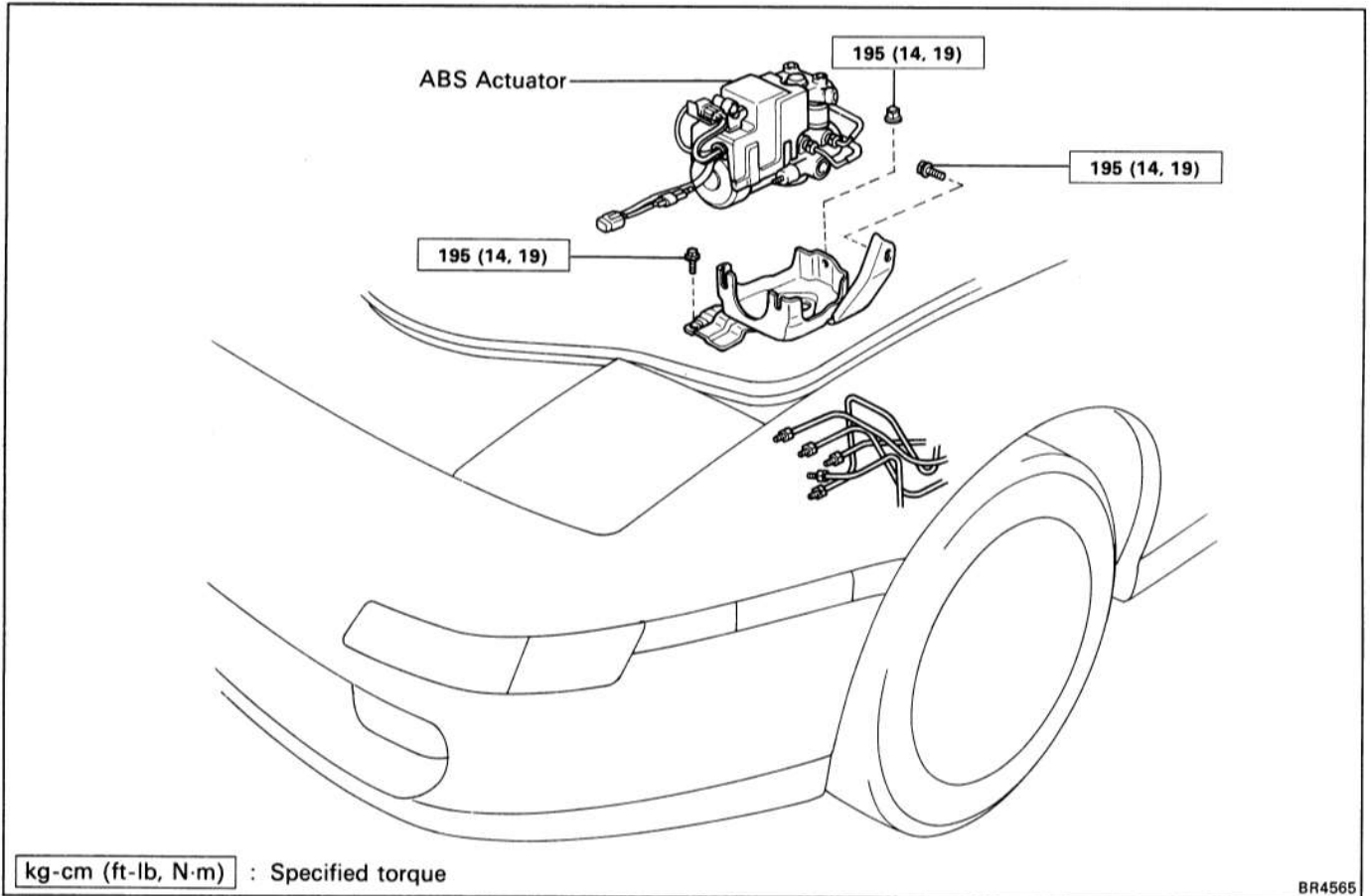
DIAGNOSTIC CODE

Code No.	Light Pattern	Diagnosis	Malfunctioning Part
	ON  OFF	All speed sensors and sensor rotors are normal	
71		Low voltage of front right speed sensor signal	● Front right speed sensor ● Sensor installation
72		Low voltage of front left speed sensor signal	● Front left speed sensor ● Sensor installation
73		Low voltage of rear right speed sensor signal	● Rear right speed sensor ● Sensor installation
74		Low voltage of rear left speed sensor signal	● Rear left speed sensor ● Sensor installation
75		Abnormal change of front right speed sensor signal	● Front right sensor rotor ● Front sealed wire
76		Abnormal change of front left speed sensor signal	● Front left sensor rotor ● Front sealed wire
77		Abnormal change of rear right speed sensor signal	● Rear right sensor rotor ● Rear sealed wire
78		Abnormal change of rear left speed sensor signal	● Rear left sensor rotor ● Rear sealed wire

ABS Actuator

REMOVAL AND INSTALLATION OF ABS ACTUATOR

Remove and install the parts as shown.



1. DISCONNECT AND CONNECT BRAKE TUBE

Using SST, disconnect and connect the brake tubes from/to the ABS actuator.

SST 09751-36011

Torque: 155 kg-cm (11 ft-lb, 15 N·m)

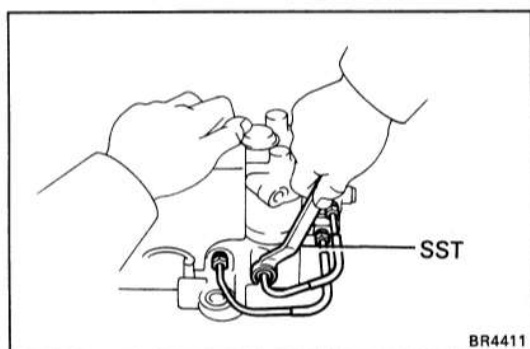
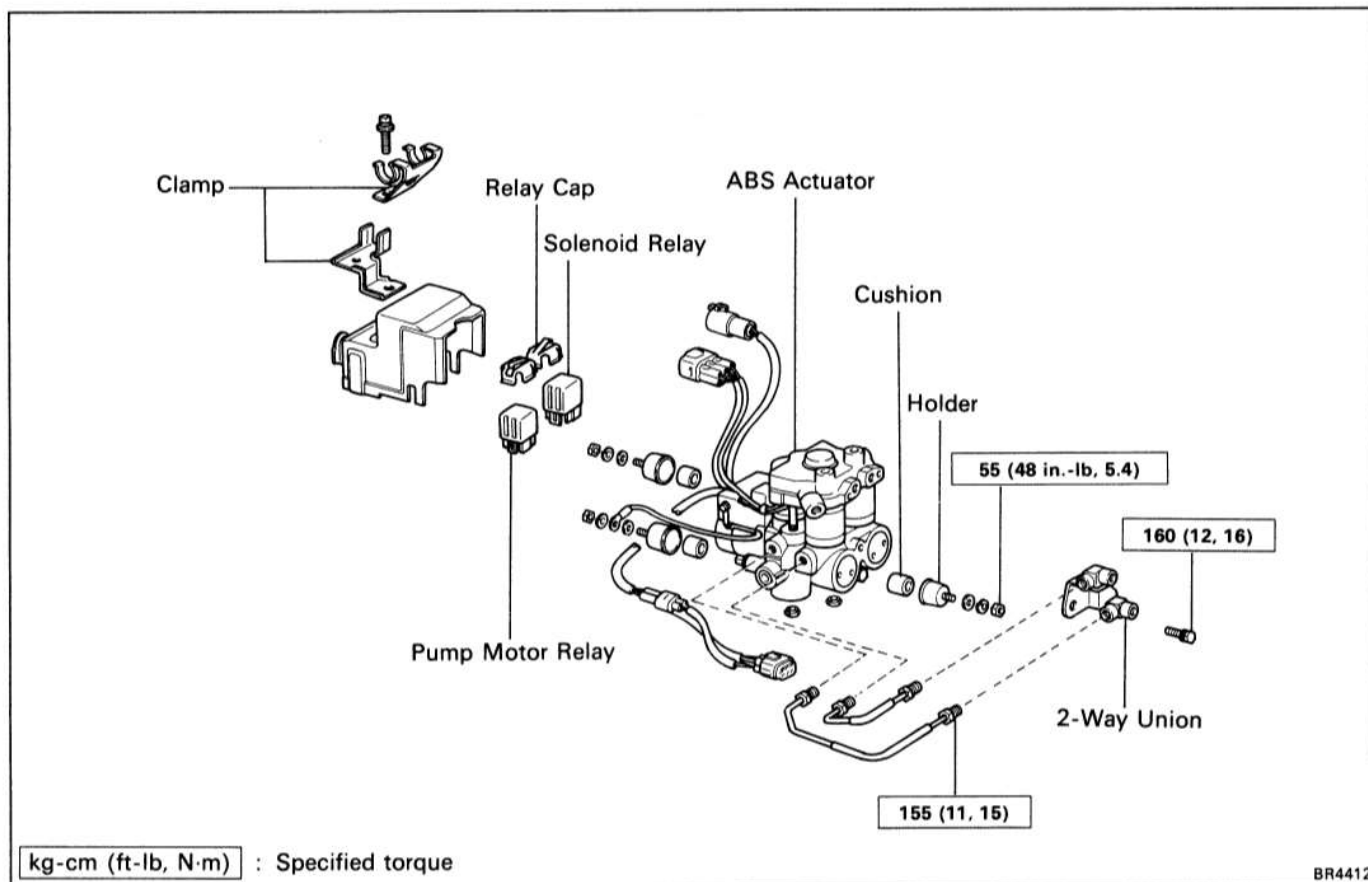
2. FILL BRAKE RESERVOIR WITH BRAKE FLUID AND BLEED BRAKE SYSTEM

(See page BR-6)

DISASSEMBLY AND ASSEMBLY OF ABS ACTUATOR

Remove and install the parts as shown.

COMPONENTS



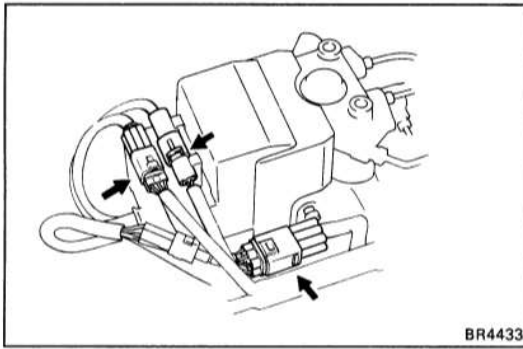
(MAIN POINT OF REMOVAL AND INSTALLATION)

1. DISCONNECT AND CONNECT BRAKE TUBE

Using SST, disconnect and connect the brake tubes from/to the ABS actuator.

SST 09751-36011

Torque: 155 kg-cm (11 ft-lb, 15 N·m)



INSPECTION OF ABS ACTUATOR OPERATION

1. INSPECT BATTERY VOLTAGE

Battery voltage: 10 – 14.5 V

2. DISCONNECT CONNECTORS

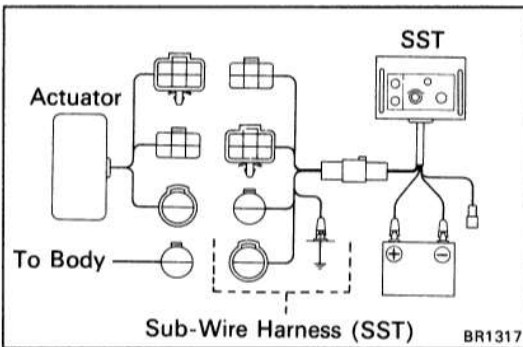
Disconnect the three connectors from the actuator as shown.

3. CONNECT ACTUATOR CHECKER (SST) TO ACTUATOR

- (a) Connect the actuator checker (SST) to the actuator and body side wire harness through the sub-wire harness (SST) as shown.

SST 09990-00150

- (b) Connect the red cable of the checker to the battery positive (+) terminal and black to the negative (-) terminal. Connect the black cable of the sub-wire harness to the battery negative (-) terminal or body ground.



4. INSPECT BRAKE ACTUATOR OPERATION

- (a) Start the engine, and run it at idle.
 (b) Turn the MAIN selector switch of the actuator checker to "FRONT RH" position.
 (c) Push and hold in the SUB MOTOR switch for a few seconds.
 (d) Depress the brake pedal and hold it until the step (g) is completed.

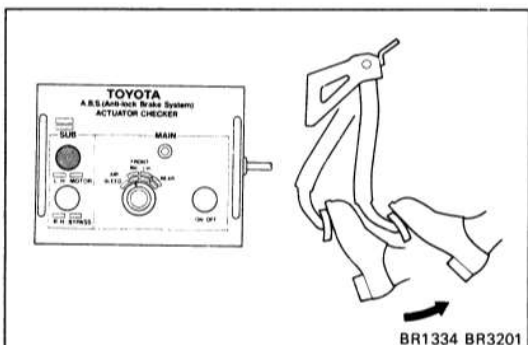
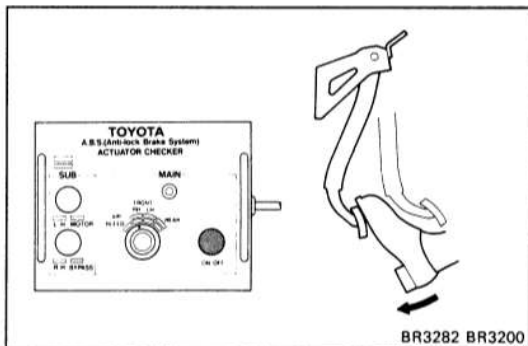
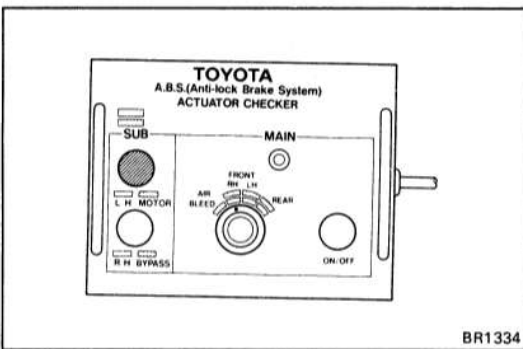
- (e) Push the MAIN push switch and check that the brake pedal does not go down.

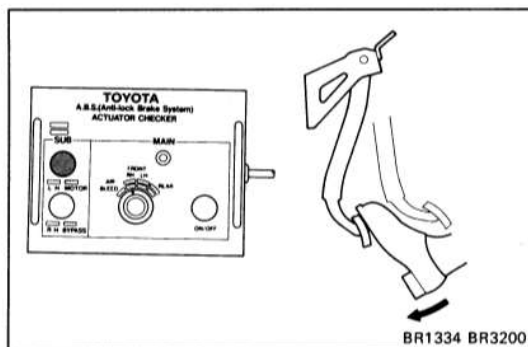
NOTICE: Do not keep the MAIN push switch pushing more than 10 seconds.

- (f) Release the switch, and check that the pedal go down.

- (g) Push and hold in the SUB MOTOR switch for a few seconds, and check that the pedal returns.

- (h) Release the brake pedal.

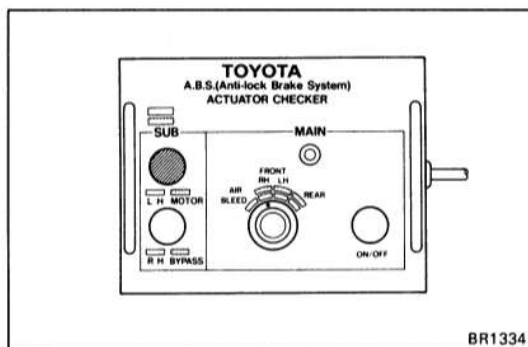




- (i) Push and hold in the SUB MOTOR switch for a few seconds.
- (j) Depress the brake pedal and hold it for about 15 seconds. As you hold the pedal down, push the SUB MOTOR switch for a few seconds. Check that the brake pedal does not pulsate.

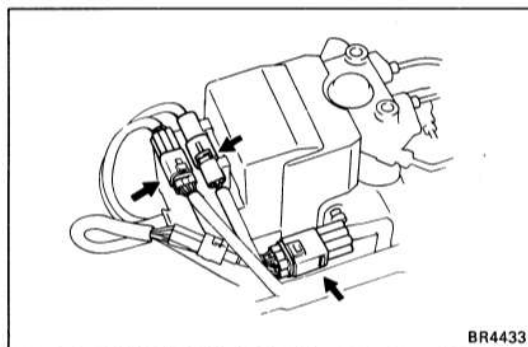
5. INSPECT FOR OTHER WHEELS

- (a) Turn the MAIN selector switch to "FRONT LH" position.
- (b) Repeating (c) to (j) of the step 4, check the actuator operation similarly.
- (c) Similarly, inspect "REAR" position.



6. PUSH SUB MOTOR SWITCH

Push and hold in the SUB MOTOR switch for a few seconds.

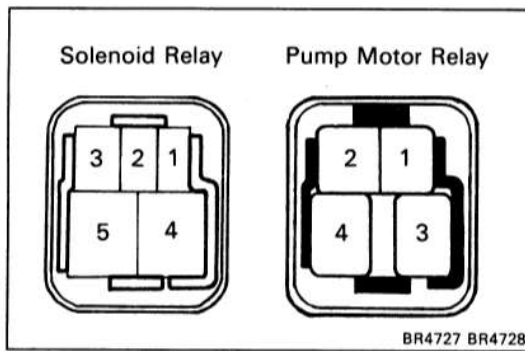


7. DISCONNECT ACTUATOR CHECKER (SST) FROM ACTUATOR

- (a) Disconnect the actuator (SST) and sub-wire harness (SST) from the actuator.

SST 09990-00150

- (b) Connect the actuator connectors.
- (c) Clear the diagnostic codes.
(See page BR-54)

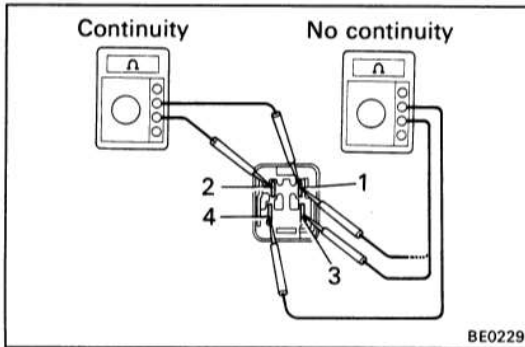


Control Relays

INSPECTION CONTROL RELAYS

1. REMOVE CONTROL RELAYS

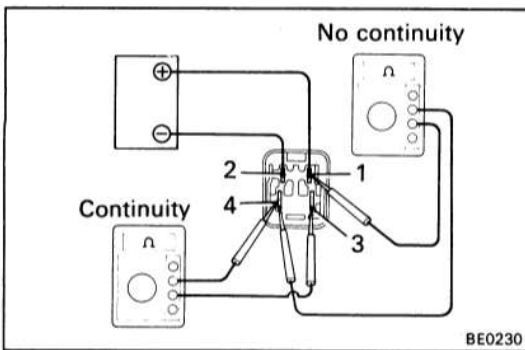
Remove the two control relays from the actuator.



2. INSPECT PUMP MOTOR RELAY CONTINUITY

- Check that there is continuity between terminals 1 and 2.
- Check that there is no continuity between terminals 3 and 4.
- Check that there is no continuity between terminals 1 and 4.

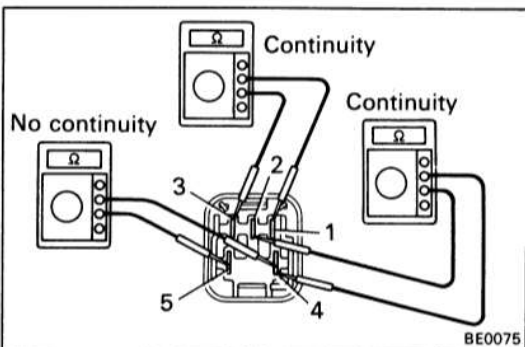
If continuity is not as specified, replace the relay.



3. INSPECT PUMP MOTOR RELAY OPERATION

- Apply battery voltage to terminals 1 and 2.
- Check that there is continuity between terminals 3 and 4.
- Check that there is no continuity between terminals 1 and 4.

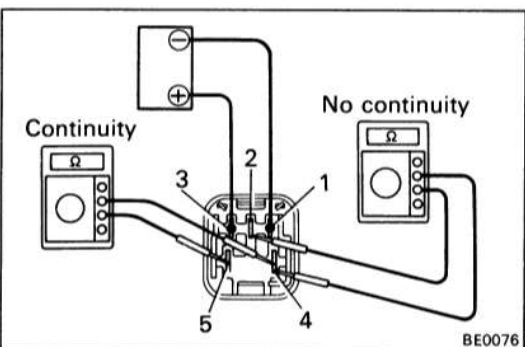
If operation is not as specified, replace the relay.



4. INSPECT SOLENOID RELAY CONTINUITY

- Check that there is continuity between terminals 1 and 3.
- Check that there is continuity between terminals 2 and 4.
- Check that there is no continuity between terminals 4 and 5.

If continuity is not as specified, replace the relay.



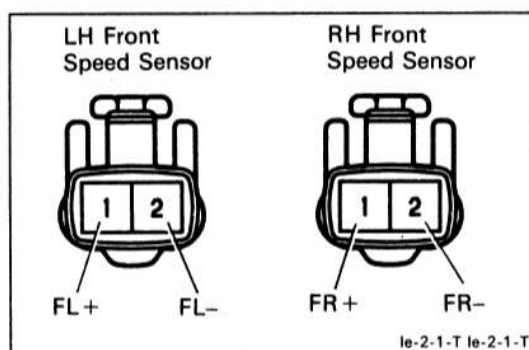
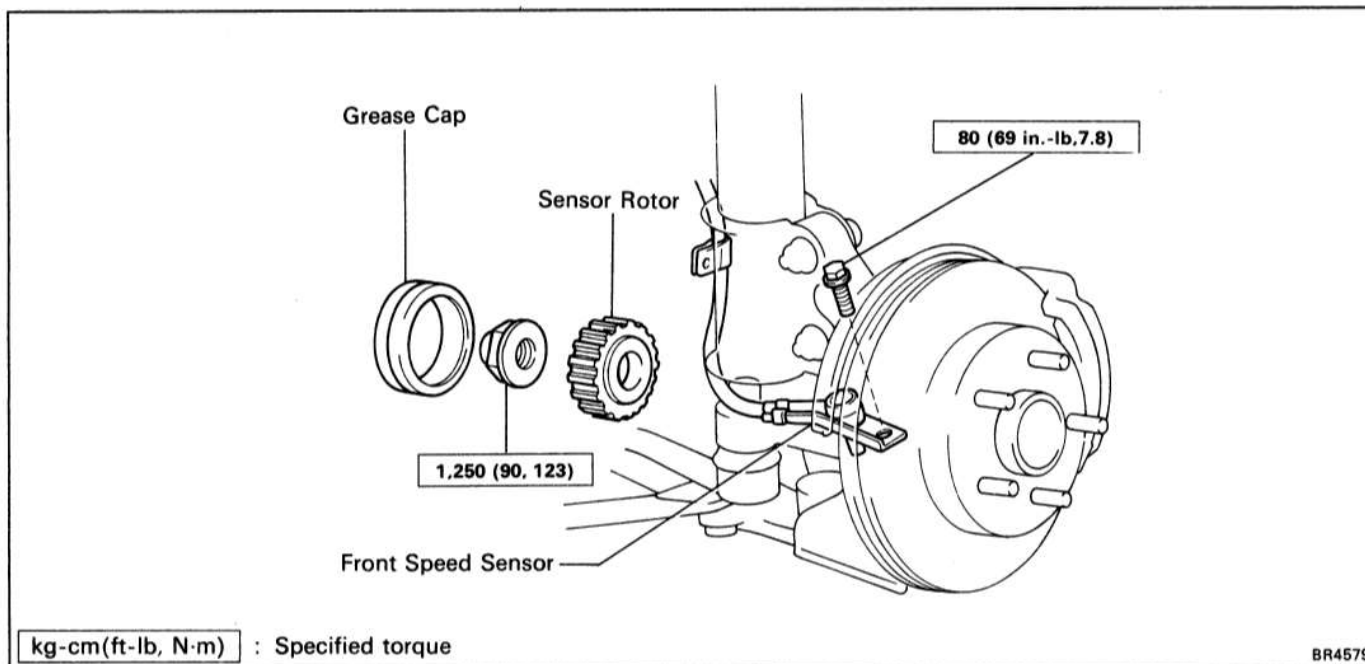
5. INSPECT SOLENOID RELAY OPERATION

- Apply battery voltage to terminals 1 and 3.
- Check that there is continuity between terminals 4 and 5.
- Check that there is no continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

6. INSTALL TWO CONTROL RELAYS

Front Speed Sensor



INSPECTION OF FRONT SPEED SENSOR

1. INSPECT SPEED SENSOR

- Disconnect the speed sensor connector.
- Measure the resistance between terminals.

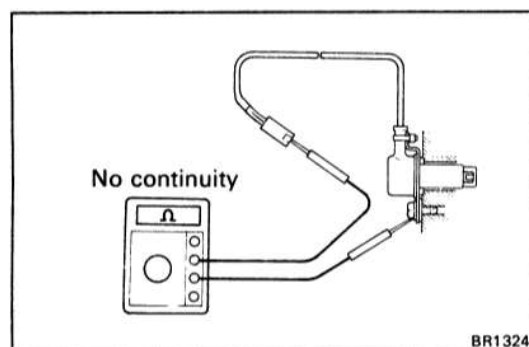
Resistance: 0.9 – 1.5 kΩ

If resistance value is not as specified, replace the sensor.

- Check that there is no continuity between each terminal and sensor body.

If there is continuity, replace the sensor.

- Connect the speed sensor connector.



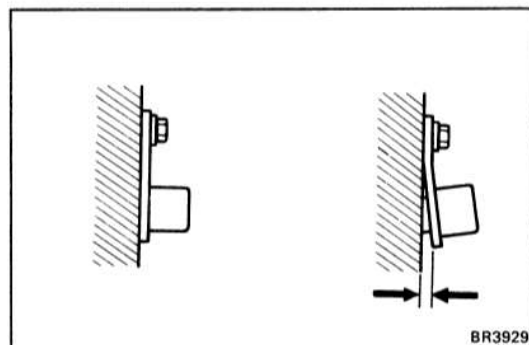
2. INSPECT SENSOR INSTALLATION

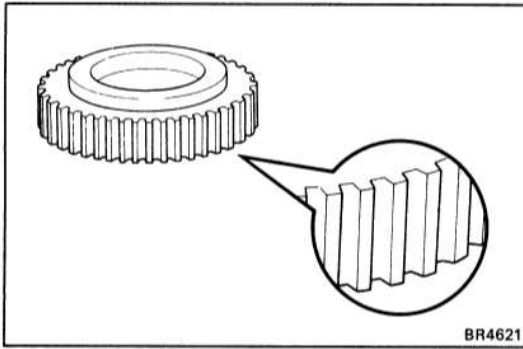
- Check that the sensor installation bolt is tightened properly. If not, tighten the bolt.

Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)

- Check that there is no clearance between the sensor and rear axle carrier as shown.

If there is clearance, replace the sensor.

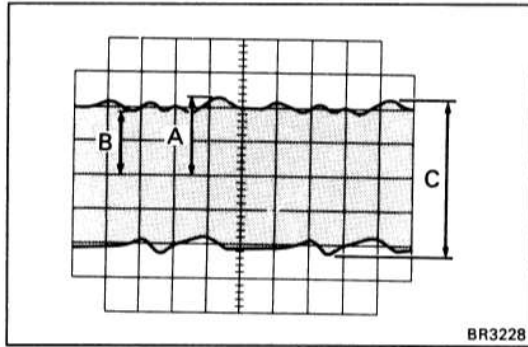




3. VISUALLY INSPECT SENSOR ROTOR SERRATIONS

- (a) Remove the sensor rotor.
(See page SA-12)
- (b) Inspect the sensor rotor serrations for scratches, cracks, warping or missing teeth.
- (c) Install the sensor rotor.
(See page SA-14)

NOTICE: To prevent damage to the serrations, do not strike the sensor rotor.

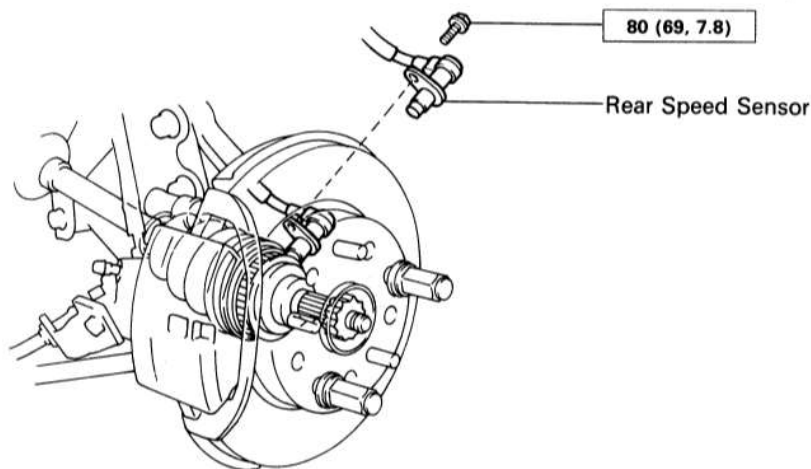


INSPECTION OF FRONT SPEED SENSOR AND SENSOR ROTOR SERRATIONS (REFERENCE)

INSPECT FRONT SPEED SENSOR AND SENSOR ROTOR SERRATIONS BY USING OSCILLOSCOPE

- (a) Connect an oscilloscope to the speed sensor connector.
- (b) Run the vehicle at 20 km/h (12.4 mph), and inspect speed sensor output wave.
- (c) Check that C is 0.5 V or more.
If not as specified, replace the speed sensor.
- (d) Check that B is 50 % or more of A.
If not as specified, replace the sensor rotor.

Rear Speed Sensor



kg-cm (in.-lb, N·m) : Specified torque

BR4435

LH Rear Speed Sensor



RH Rear Speed Sensor



le-2-2-T le-2-2-T

INSPECTION OF REAR SPEED SENSOR

1. INSPECT SPEED SENSOR

- Disconnect the speed sensor connector.
- Measure the resistance between terminals.

Resistance: 0.9 – 1.5 kΩ

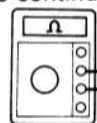
If resistance value is not as specified, replace the sensor.

- Check that there is no continuity between each terminal and sensor body.

If there is continuity, replace the sensor.

- Connect the speed sensor connector.

No continuity



BR1324

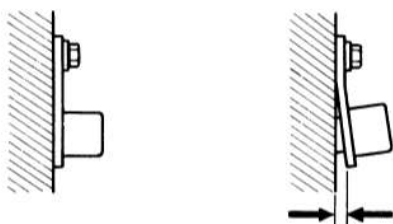
2. INSPECT SENSOR INSTALLATION

- Check that the sensor installation bolt is tightened properly. If not, tighten the bolt.

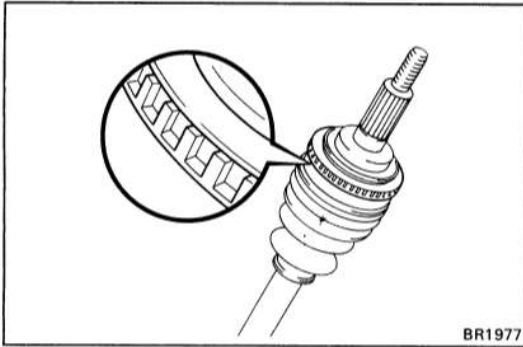
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)

- Check that there is no clearance between the sensor and rear axle carrier as shown.

If there is clearance, replace the sensor.



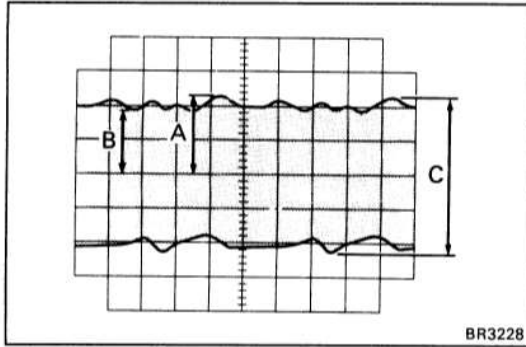
BR3929



3. VISUALLY INSPECT SENSOR ROTOR SERRATIONS

- (a) Remove the drive shaft.
(See page SA-39 or 52)
- (b) Inspect the sensor rotor serrations for scratches, cracks, warping or missing teeth.
- (c) Install the drive shaft.
(See page SA-49 or 66)

NOTICE: To prevent damage to the serrations, do not strike the drive shaft.



INSPECTION OF REAR SPEED SENSOR AND SENSOR ROTOR SERRATIONS (REFERENCE)

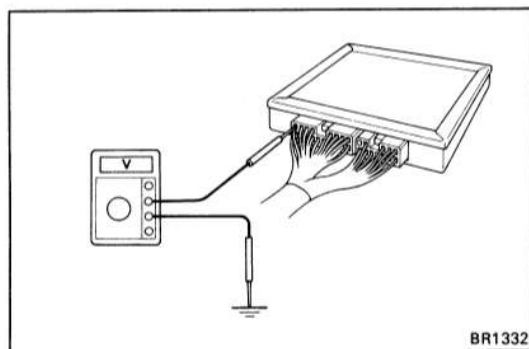
INSPECT REAR SPEED SENSOR AND SENSOR ROTOR SERRATIONS BY USING AN OSCILLOSCOPE

- (a) Connect an oscilloscope to the speed sensor connector.
- (b) Run the vehicle at 20 km/h (12.4 mph), and inspect speed sensor output wave.
- (c) Check that C is 0.5 V or more.

If not as specified, replace the speed sensor.

- (d) Check that B is 50 % or more of A.

If not as specified, replace the rear axle hub.

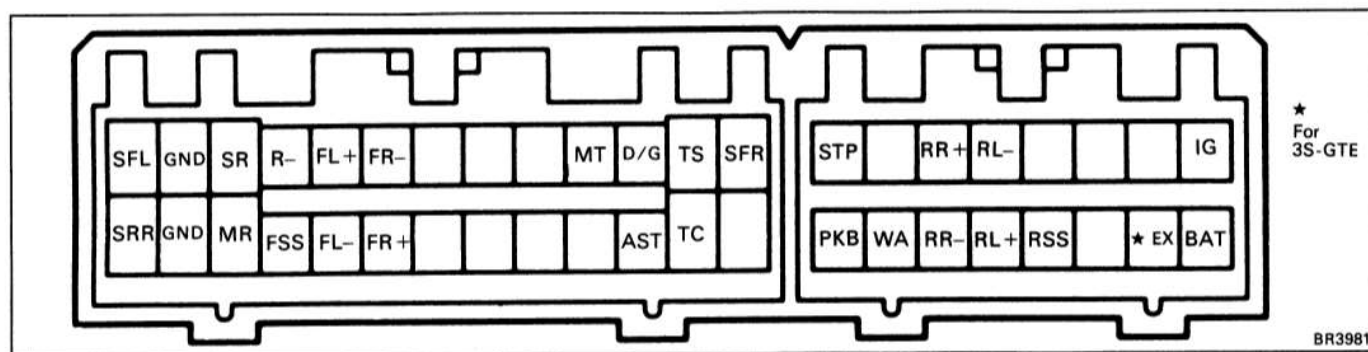


Anti-Lock Brake System Circuit

INSPECTION OF SYSTEM CIRCUIT

1. INSPECT SYSTEM CIRCUIT WITH CONNECTOR CONNECTED

- Remove the ABS ECU.
- Using a voltmeter with high impedance (10 K ohm/V minimum), measure the voltage at each terminal and body ground.



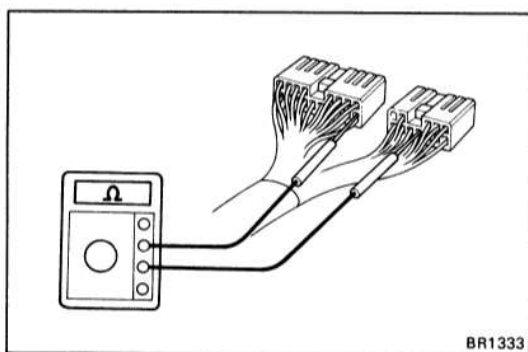
Tester Connection	Check Item	Condition	Specified Value	Trouble Part
IG	Voltage	IG switch on	Battery voltage	ECU-IG Fuse
RL-	Continuity	IG switch off	Continuity	ABS ECU
STP	Voltage	IG switch off and brake pedal depressed	Battery voltage	Stop light switch Stop light
	Continuity	IG switch off and brake pedal returned	Continuity	
BAT	Voltage	IG switch off	Battery voltage	ECU + B Fuse
EX	Voltage	IG switch on	Battery voltage	ABS ECU, EFI ECU
RSS	Continuity	IG switch off	Continuity	ABS ECU
RR-	Continuity	IG switch off	Continuity	ABS ECU
WA	Voltage	IG switch on and "ABS" warning light goes on	About 0V	ABS ECU "ABS" warning light
		IG switch on and "ABS" warning light goes off	Battery voltage	
PKB	Voltage	IG switch on and PKB lever pulled	About 0V	Parking brake switch Level warning switch
		Engine running on and PKB lever returned	Battery voltage	
SFR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
TS	Voltage	IG switch on and check connector Ts-E ₁ not connected	Battery voltage	ABS ECU
		IG switch on and check connector Ts-E ₁ connector	About 0V	
FR-	Continuity	IG switch off	Continuity	
R-	Continuity	IG switch off	Continuity	ABS ECU
SR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	
		IG switch on and "ABS" warning light goes off	Battery voltage	
GND	Continuity	IG switch off	Continuity	Wiring harness
SFL	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	

Continued on page BR-75

Continued from page BR-74

Tester Connection	Check Item	Condition	Specified Value	Trouble Part
TC	Voltage	IG switch on and check connector Tc-E ₁ not connected	Battery voltage	ABS ECU
		IG switch on and check connector Tc-E ₁ connected	About 0V	
AST	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
FL-	Continuity	IG switch off	Continuity	ABS ECU
FSS	Continuity	IG switch off	Continuity	
SRR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	

If the circuit is not as specified, check and repair or replace the trouble part shown in the table above.



2. INSPECT SYSTEM CIRCUIT WITH CONNECTOR DISCONNECTED

- (a) Disconnect the connectors from the ECU, inspect at the wire harness side connector.

Tester Connection	Check Item	Specified Value	Trouble Part	Tester Connection	Check Item	Specified Value	Trouble Part
RR+ ↔ RR-	Resistance	0.9 ~ 1.5 kΩ	Rear RH speed sensor	SFL ↔ AST	Resistance	About 6 Ω	Actuator
RL+ ↔ RL-	Resistance	0.9 ~ 1.5 kΩ	Rear LH speed sensor	AST ↔ Body ground	Resistance	About 5 Ω	Actuator
SFR ↔ AST	Resistance	About 6 Ω	Actuator	FR+ ↔ FR-	Resistance	0.8 ~ 1.5 Ω	Front RH speed sensor
MT ↔ Body ground	Resistance	About 5 Ω	Actuator	MR ↔ R-	Resistance	50 ~ 80 Ω	Control relay
FL+ ↔ FL-	Resistance	0.8 ~ 1.5 kΩ	Front LH speed sensor	SRR ↔ AST	Resistance	About 6 Ω	Actuator
SR ↔ R-	Resistance	60 ~ 100 Ω	Control relay				

If the circuit is not as specified, check and repair or replace the trouble part shown in the table above.

- (b) Connect the connectors, and install the ECU in place.