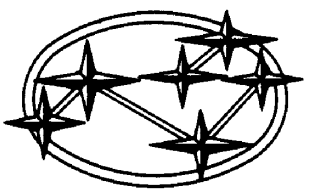
SUBARU

1988



MECHANISM AND FUNCTION

Disc Brake

PAD WEAR INDICATOR

A wear indicator is provided on disc brake pad. If the front pad wears down to 1.5 mm (0.059 in) or the rear pad wears down to 3 mm (0.12 in), the tip of the wear indicator comes into contact with the disc rotor, and it makes a squeaking sound as the wheel rotates, indicating that the pad needs to be replaced. (XT6)

If the pad wears down to 1.5 mm (0.059 in), the tip of the wear indicator comes into contact with the disc rotor, and it makes a squeaking sound as the wheel rotates, indicating that the pad needs to be replaced. (Except XT6)

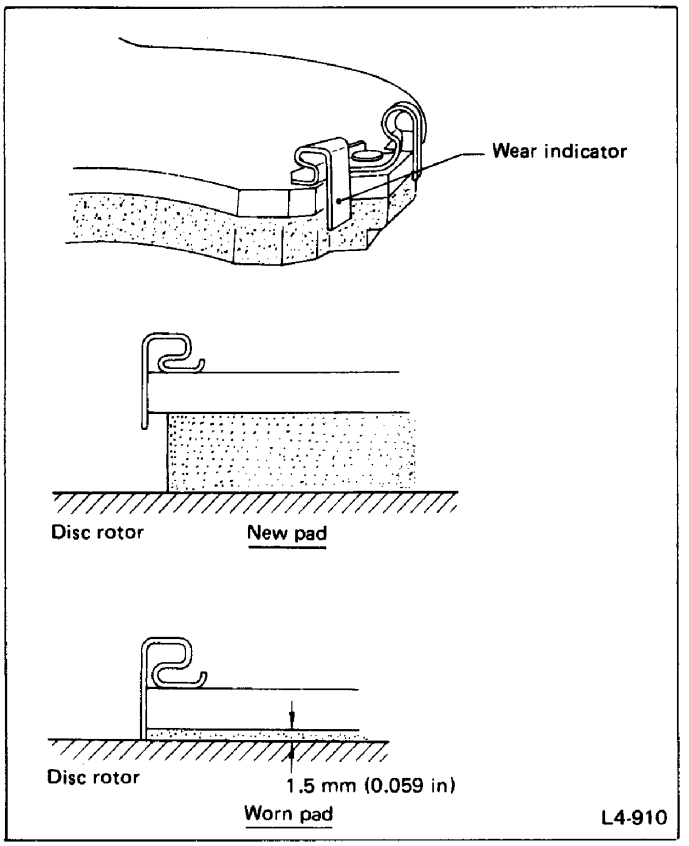


Fig. 1 Front disc brake

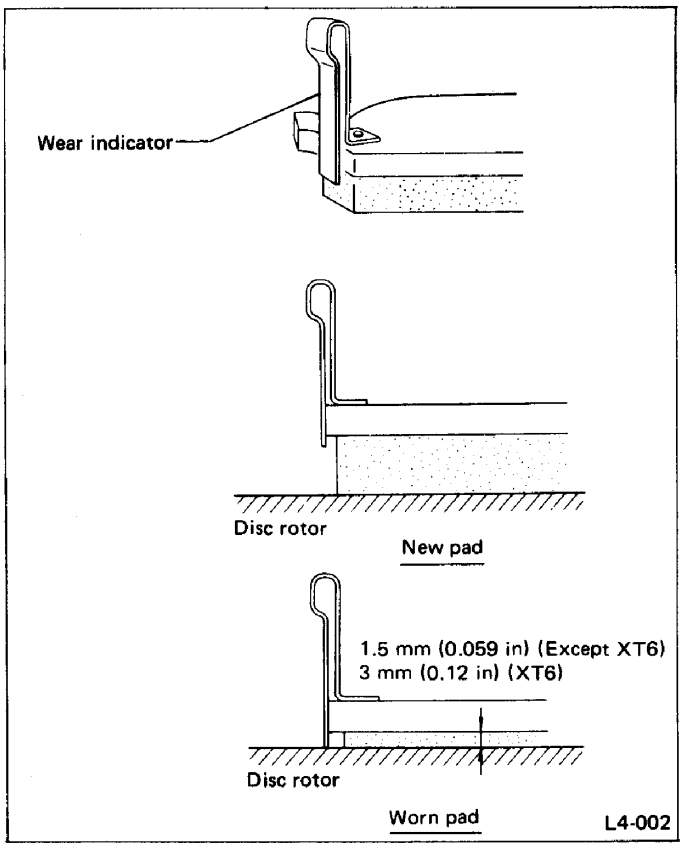


Fig. 2 Rear disc brake

Master Cylinder (Except XT6)

1) The fast-fill mechanism is adopted to improve the pedal operating feel.

2) The sealed reservoir tank is adopted to extend the service life of brake fluid.

3) The fluid leveler is built into the reservoir tank for easy and correct monitoring of the fluid level when adding brake fluid.

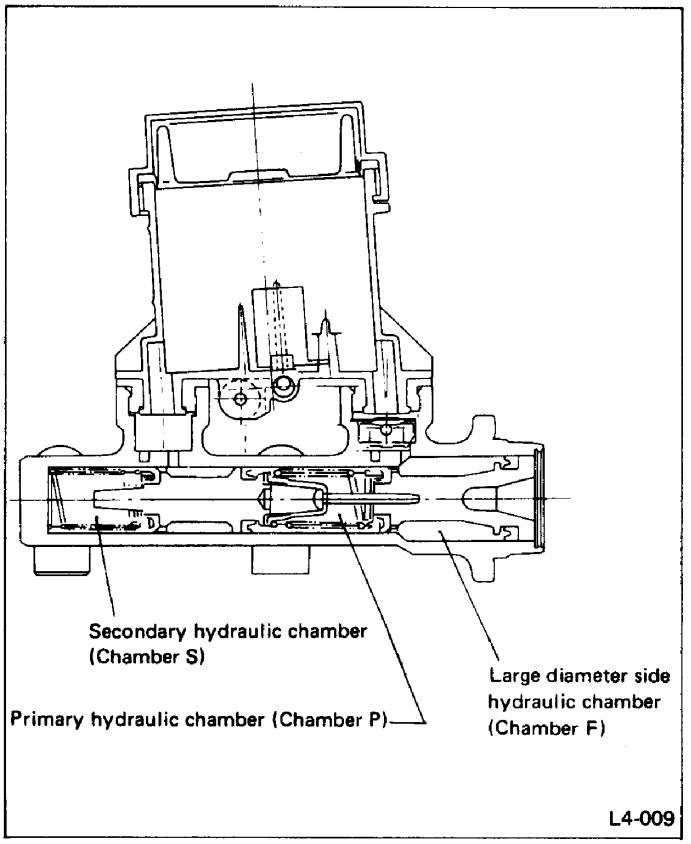


Fig. 3

OPERATION OF FAST-FILL MECHANISM

When compared to a conventional master cylinder, the one with the fast-fill mechanism has the following two unique structural features:

1) It has a large diameter chamber (chamber F) on the inlet side of the master cylinder, and small diameter chambers (chambers P and S) on the inner side. The primary piston is of a stepped construction with those two diameters.

2) A check valve, which is called the fast-fill valve (FFV), is installed between chambers P & F and the reservoir.

This FFV controls the flow of brake fluid from chamber F to reservoir, and vice versa, by ball valve and supply valve, respectively.

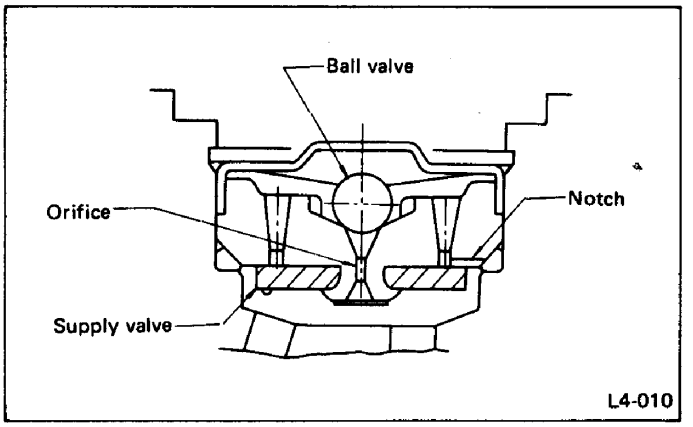


Fig. 4

The ball valve is opened when fluid pressure in chamber F exceeds the preset pressure level. The notch in the supply valve keeps the valve always in a partially opened state, so that no fluid pressure will be left in chambers P and F when the system is not operating.

Operation of fast-fill valve

1) Low fluid pressure period

During the low fluid pressure period which begins immediately after starting the piston and ends when the ball valve in the FFV releases, the fluid pressure generated in chamber F is higher than the one in chamber P; the fluid pressure difference causes fluid to flow from chamber F to chamber P. The amount of fluid flow shortens the brake pedal stroke, i.e. brake fluid is pushed out of the master cylinder through the sectional area of chamber F.

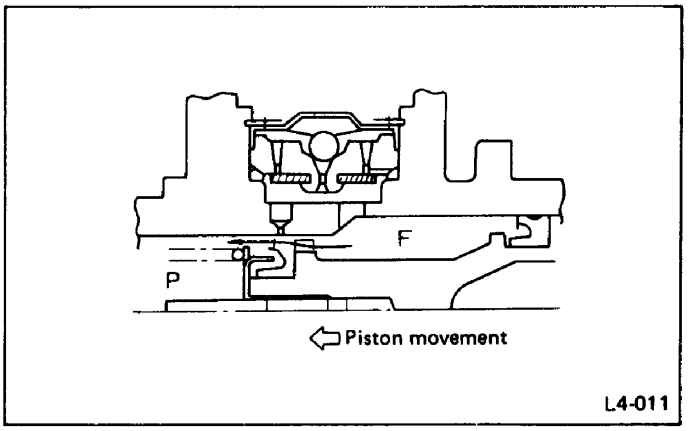


Fig. 5

2) High fluid pressure period

During the high fluid pressure period after releasing fluid from the ball valve, the pressure in chamber P is higher than the pressure in chamber F, and flow of fluid is made stationary by primary cup's sealing the passage. As the fluid pressure in chamber F drops thereafter, the operating pressure is generated by the pedal depressing force and the sectional area of chamber P.

An orifice is provided in the passage between chamber F and the reservoir for smooth pedal feel.

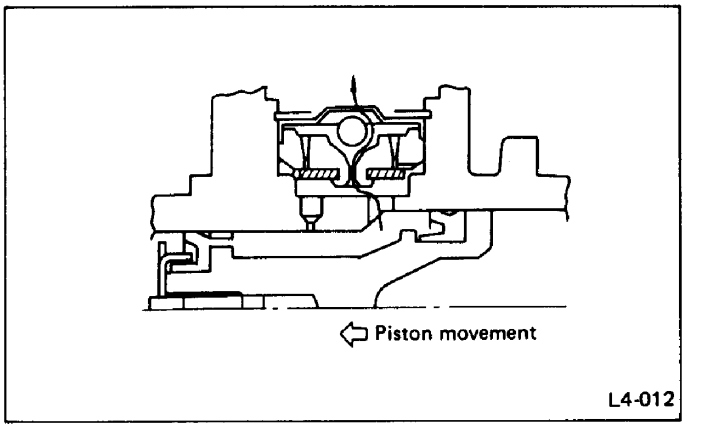


Fig. 6

3) When slackening pedal depression
Brake fluid is supplied from the reservoir through the supply valve by negative pressure generated in chamber F. Fluid is also supplied to chamber P through chamber F.

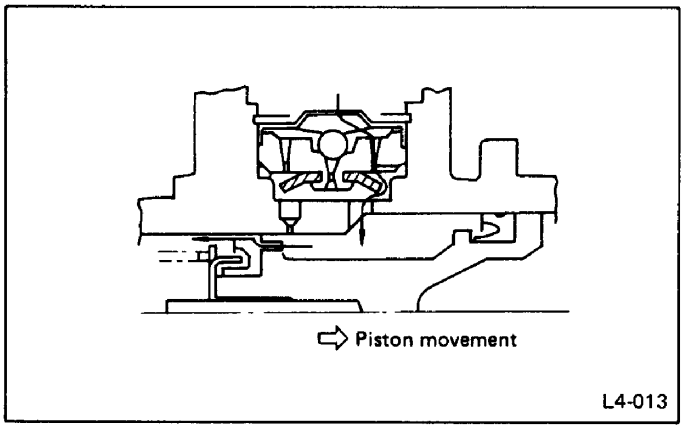


Fig. 7

4) When pedal is released
When the brake pedal is released, a residual pressure is generated by the amount of fluid oversupplied to chamber F while the pedal is being released, the amount of fluid moved from chamber F to chamber P during low pressure period, and the amount of fluid supplied from the reservoir. This excessive amount of fluid in both chambers is returned to the reservoir through the notch mentioned previously until the pressure becomes zero.

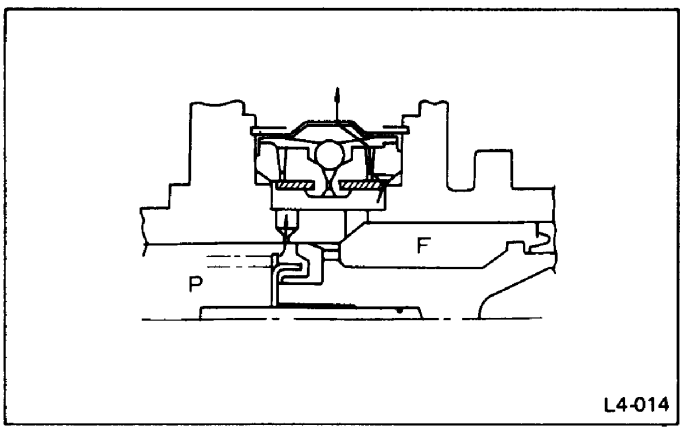


Fig. 8

Fast-fill effect

The pedal stroke on the primary side is shortened because brake fluid flows from chamber F. The secondary side pedal stroke is also shortened since a large amount of fluid fed from chamber F to chamber P separates the primary piston and secondary piston.

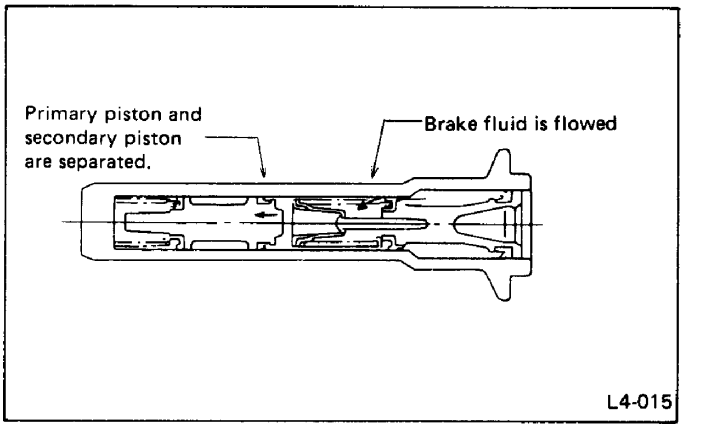


Fig. 9

With the FFV provided, the piston stroke can be made shorter than that of the conventional master cylinder through the above-mentioned process. That is, the brake pedal stroke is shortened, and brake pedal feel is improved.

BRAKE FLUID LEVEL INDICATOR

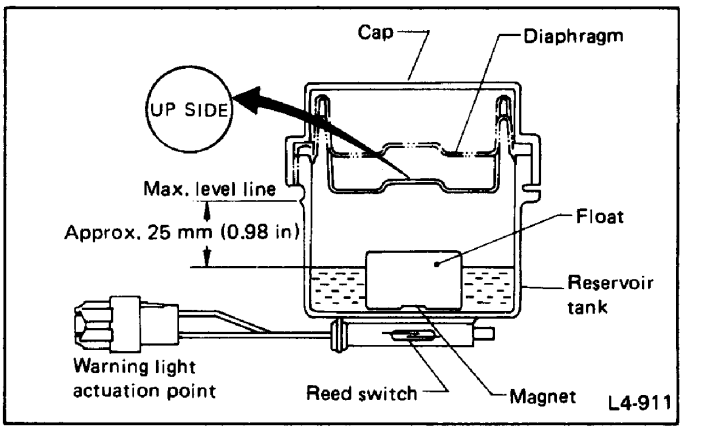


Fig. 10

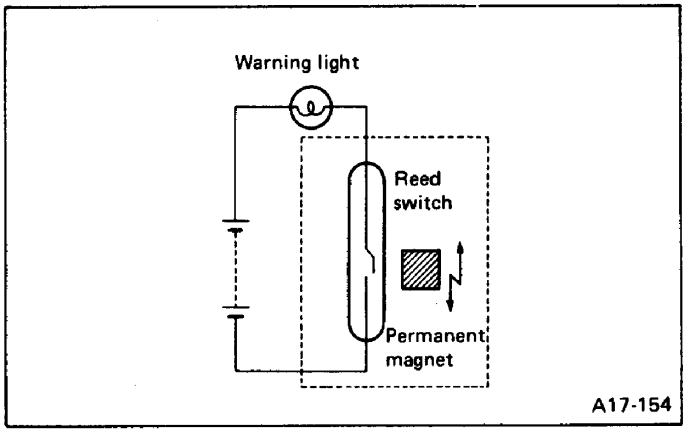


Fig. 11

Under normal conditions, the float remains above the reed switch, and the line of the magnetic force from the permanent magnet in the float is unable to activate the reed switch. Therefore, the circuit is kept open, and the warning light remains off. The float lowers as the brake fluid level lowers, and if it falls below the specified fluid level [approx. 25 mm (0.98 in) below the MAX level line], the reed switch will be activated by the permanent magnet to close the circuit. In this event, the warning light comes on and warns the driver of a reduction of the brake fluid level.
However, the lamp may be lighted momentarily even when the brake fluid surface is still above the specified level, if the vehicle body tilts or swings largely.

Brake Booster

CHECK VALVE

The check valve is built into the vacuum hose. Its orientation is indicated on the label attached to the vacuum hose.

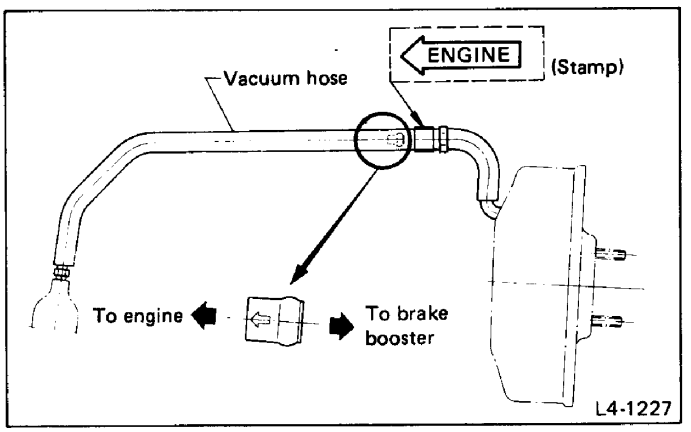


Fig. 12

Proportioning Valve

The proportioning valve for dual piping systems is adopted for controlling the braking force.

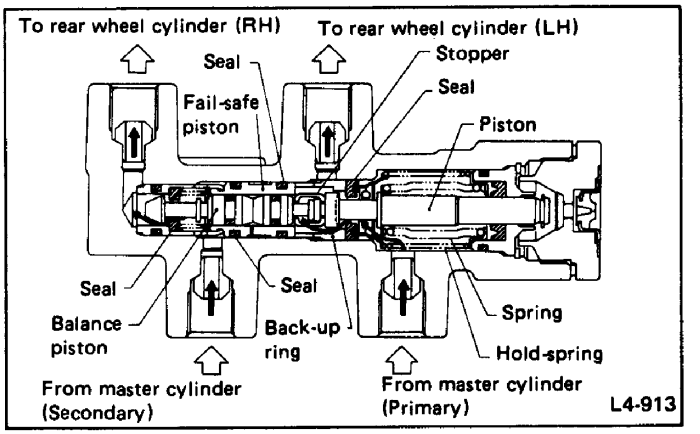


Fig. 13 Construction

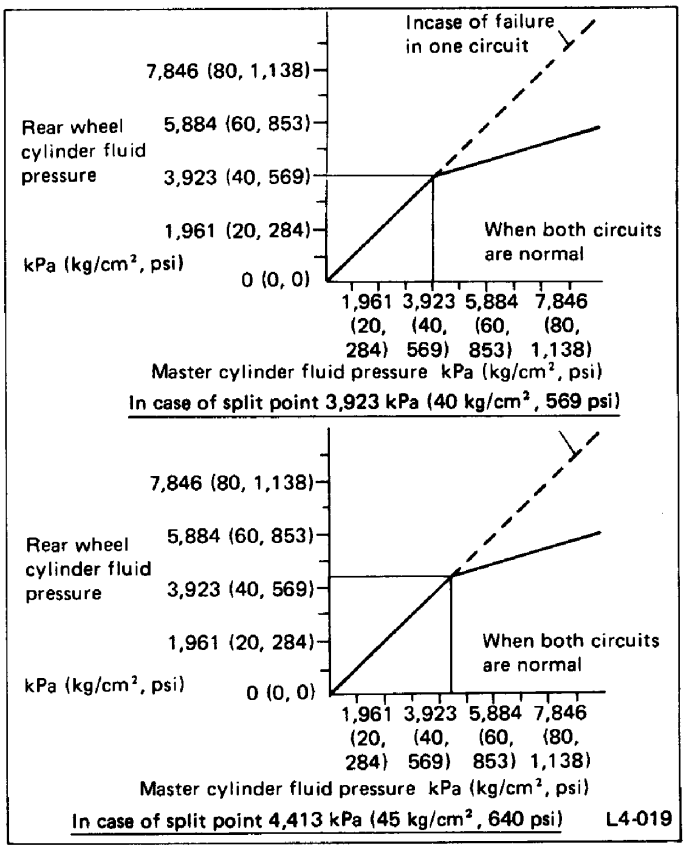


Fig. 14 Characteristic curve

OPERATION

OPERATION DURING NORMAL CONDITIONS

1. Prior to valve operation (Before split point)

When the fluid pressure in the master cylinder is low (the fluid pressure before the split point), the piston is pressed by the spring load and the valve remains inoperative. As a result, the fluid pressure in the master cylinder is held equal to the fluid pressure in the rear wheel cylinder.

2. After valve operation (After split point)

1) When the master cylinder fluid pressure rises, the piston in the primary circuit is moved rightward against the spring load, and brought into contact with the seal (1) (as shown in the figure). The master cylinder fluid pressure chamber (chamber A) is therefore cut off from the rear wheel cylinder fluid pressure chamber (chamber B), and the fluid pressure to the rear wheel cylinder is thus controlled. (The pressure at this moment is the split point pressure.)
If the fluid pressure in chamber A rises further, the piston is moved leftward, off the seal (1), and this causes the fluid pressure in chamber B to rise. The piston is then moved rightward, and brought into contact with the seal (1) again. After this, the piston repeats this contact with the seal (1) in this way, thereby controlling the fluid pressure in the rear wheel cylinder.
2) When the fluid pressure in chamber B is controlled in the secondary circuit, the balance piston is moved rightward by the fluid pressure difference between chamber B and chamber C, and brought into contact with the seal (2), and the fluid pressure in chamber D is controlled. Since sectional areas A1 and A2 are equal, the balance piston is pushed by equal forces from the right and left. If the fluid pressure rises in chamber B, the balance piston performs control to equalize the fluid pressure in chamber D and chamber B by repeating open-close operation with the seal (2).

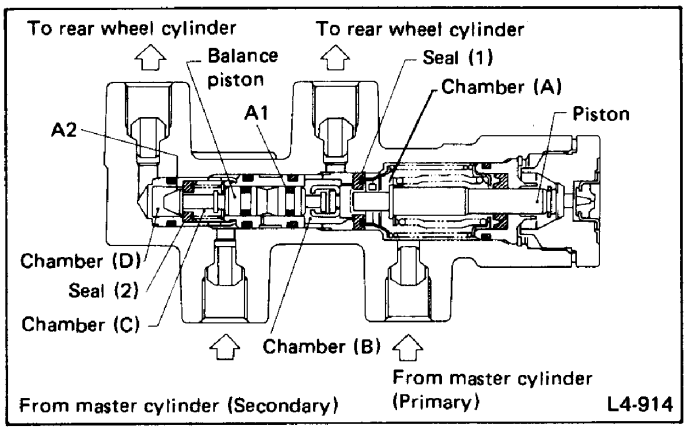


Fig. 15

OPERATION IN CASE OF CIRCUIT FAILURE

1. Failure of primary circuit

If the primary circuit fails, the fail-safe piston and balance piston are moved rightward by the fluid pressure in the master cylinder in the secondary circuit until the piston contacts the plug. In this case, the balance piston remains off the seal (2), and no split point is created in the graph. That is, the fluid pressure in the secondary side rear wheel cylinder is equal to the fluid pressure in the master cylinder.

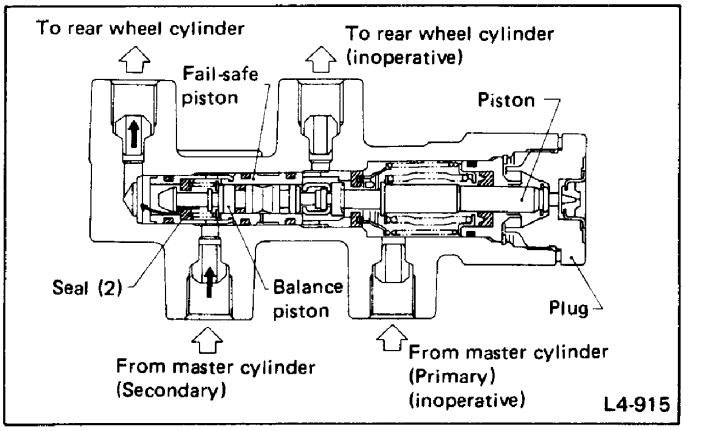


Fig. 16

2. Failure of secondary circuit

If the secondary circuit fails, the balance piston is moved leftward by the fluid pressure in chamber B until the end of the piston contacts the stopper. Since sectional area A1 is greater than A2, the piston remains unmoved even after the master cylinder fluid pressure has reached the split point, and the piston is kept off the seal (1). Hence, no split point is created in the graph, and the rear wheel cylinder fluid pressure of the primary circuit is kept equal to the master cylinder fluid pressure.

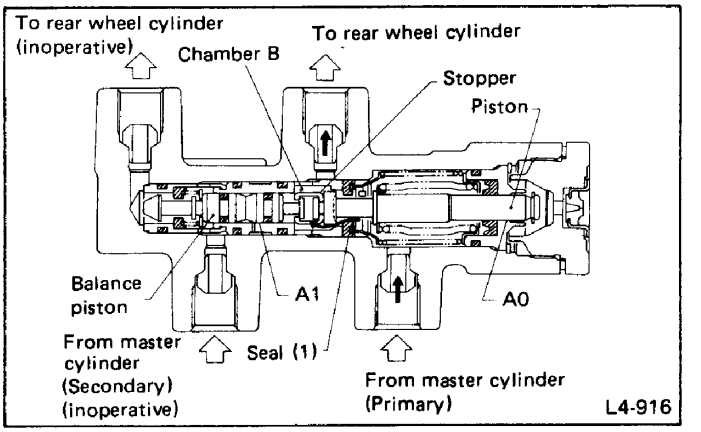


Fig. 17

Hill-Holder

OUTLINE

Hill-holder is a device to make starting on an uphill road easily and permits even a driver not yet familiarized with starting by use of parking brake to start the vehicle smoothly.
When pressing down the clutch pedal with the brake pedal depressed in order to start the vehicle on an uphill road, this device holds the brake temporarily upon taking your foot off the brake pedal (until the clutch pedal is released). Therefore, smooth starting is enabled by usual engagement of the clutch while depressing the accelerator pedal.

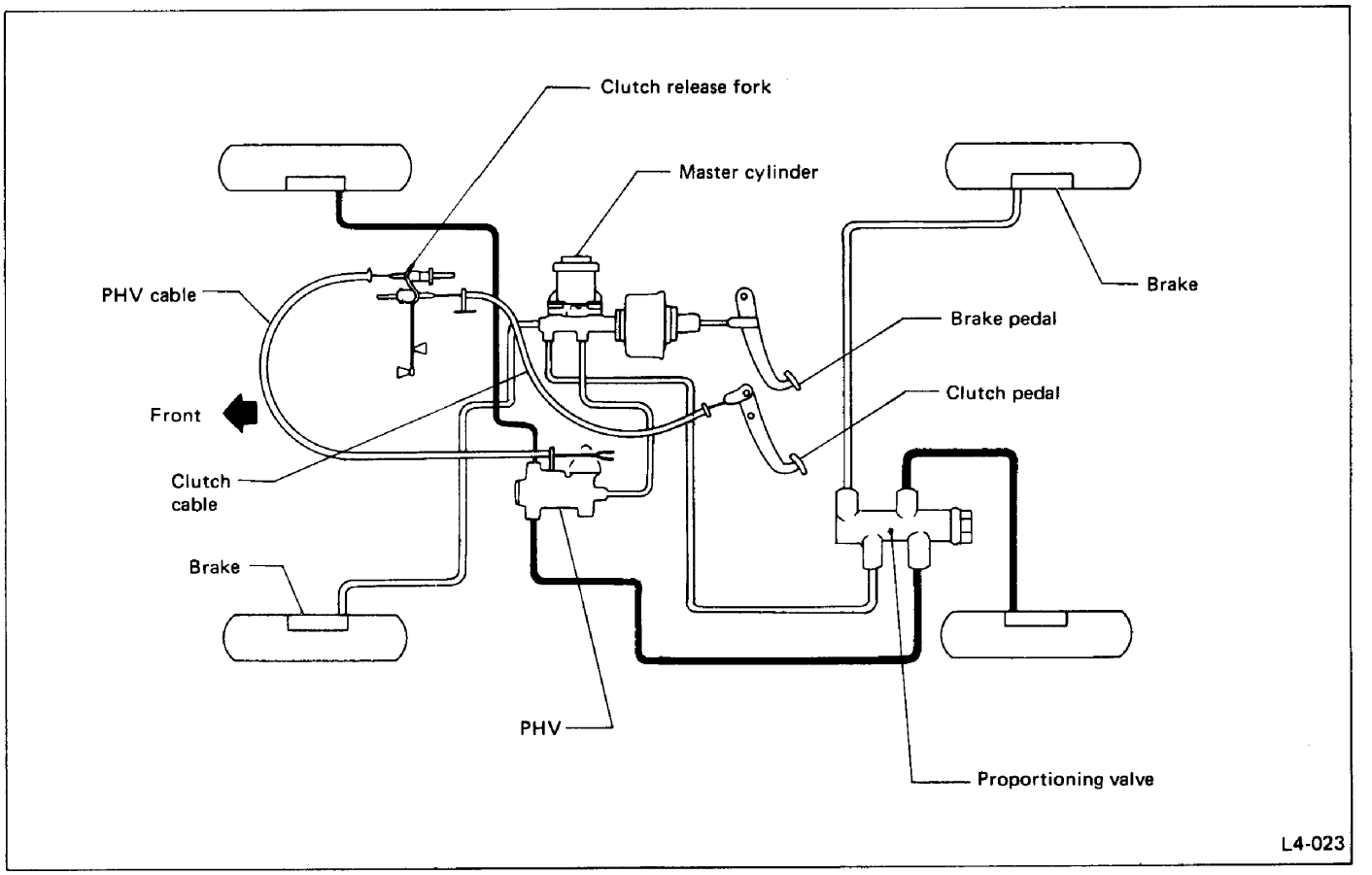


Fig. 18 Outline of hill-holder

PRESSURE HOLD VALVE (PHV)

PHV (Pressure Hold Valve) is connected to one of the service brake pipes and pushrod (8) is pushed in and/or pulled out by cam shaft (2) interlinked with the clutch pedal to change the clearance between ball (3) and seal (5), thereby opening and/or closing the hydraulic circuit. Normally, on a flat road, ball (3) is located at the front and the valve is kept opened regardless of the position of the pushrod. (This status is the same as on a downhill road.)

When stopping the vehicle on an uphill road by depressing both brake and clutch pedals, the ball rolls toward the rear and, at the same time, the pushrod retracts to close the valve, so that hydraulic pressure is maintained. Even when taking your foot off the brake pedal, the hydraulic pressure is maintained so far as the clutch pedal is kept depressed. In this status, when engaging the clutch ordinarily while depressing the accelerator pedal, the maintained hydraulic pressure is released simultaneously with the generation of driving force to permit smooth starting.

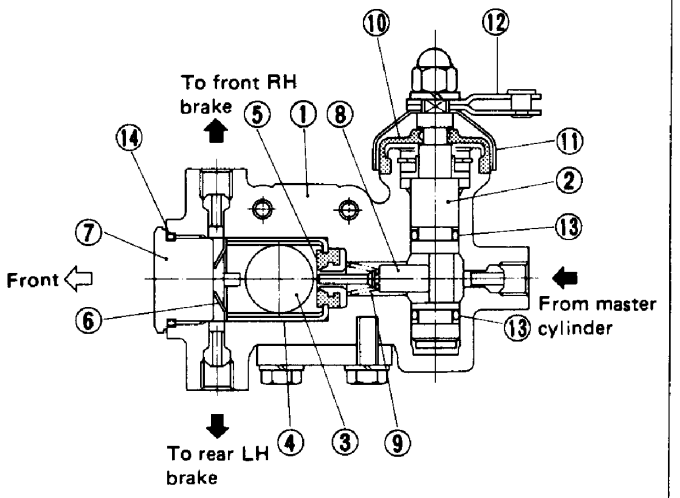


Fig. 19 Pressure hold valve

- Activating condition

This device is activated only when depressing the clutch and brake pedals with the vehicle stopped on an uphill road.

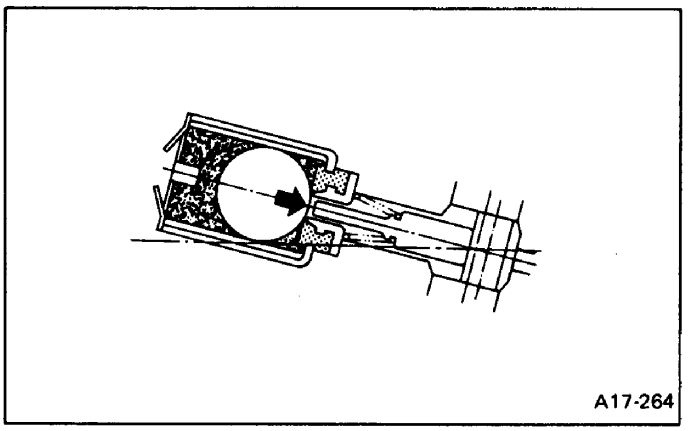


Fig. 20

When stopping the vehicle on an uphill road, the ball rolls toward the rear to seal the port and therefore the hydraulic pressure is maintained even by releasing the brake pedal.

- Inactive status

This accessory is not activated in any status other than the above.

1) While driving

(1) During acceleration or usual driving

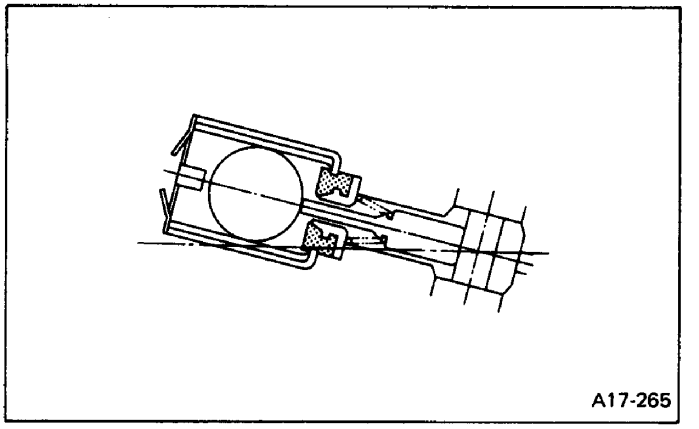


Fig. 21

Since the clutch pedal is not depressed, the pushrod is located outside the port. In this status, hydraulic pressure cannot be maintained.

(2) During deceleration

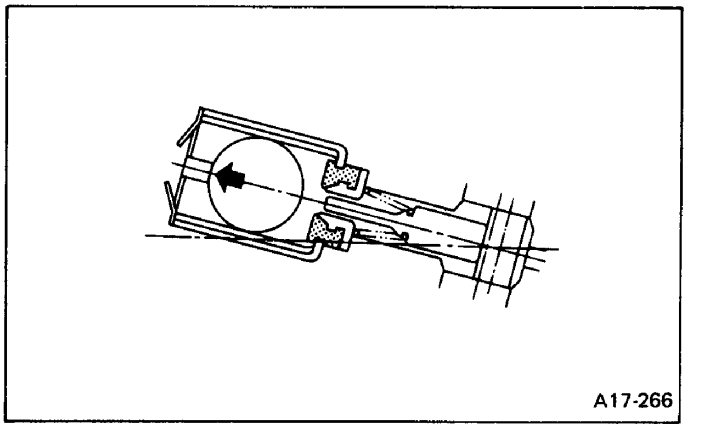


Fig. 22

Even when depressing the clutch pedal, the ball is kept at the front by decelerating force. In this status, hydraulic pressure is not maintained.

2) When stopping

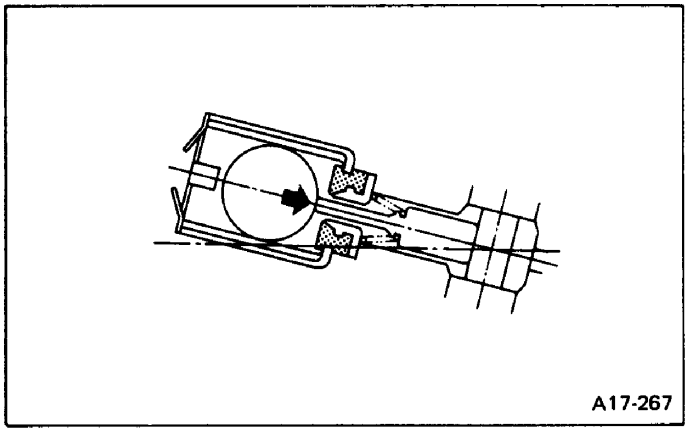


Fig. 23

Even when stopping on an uphill road, hydraulic pressure is not maintained unless the clutch pedal is depressed.

3) On a flat road

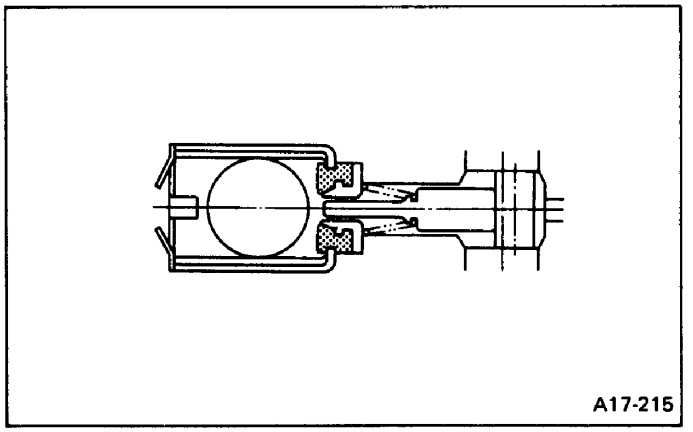


Fig. 24

This device is not designed to operate on a flat road, except for reversing.

OPERATIONAL PRECAUTIONS

1) Hill-holder is a device used to facilitate starting on an uphill road. For stoppage on the uphill road, therefore, you must keep the brake pedal depressed or pull the parking brake.
2) Hill-holder may not be activated on a slope of an extremely small inclination.
3) If the brake is not held sufficiently upon releasing the brake pedal with the clutch pedal depressed, press down the brake pedal a little strongly once again.
4) If depressing the clutch pedal again in the course of starting operation, the brake may be released. In this case, depress the brake pedal again. (Because the brake is released when returning the clutch pedal halfway.) (For example, when interrupting starting operation or shifting gear from other than LOW because of misoperation.)
5) Before you leave the driver's seat, be sure to pull the parking lever and confirm that the vehicle is kept stopped upon releasing the clutch pedal.
6) When reversing the vehicle on a flat road, the following phenomena may be felt. These phenomena are caused by the activation of the hill holder, which does not constitute abnormality.
   (1) Brake effect remains even after releasing the brake pedal if depressing the clutch and brake pedals when reversing the vehicle.
   (2) A slight shock is given to the vehicle when starting the vehicle after stopping the reverse movement.

SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

	Engine	1800 cc		2700 cc	
	Driving system	FWD	4WD	FWD	4WD
Front brake	Type	Disc (AD type, ventilated)			
	Effective disc diameter mm (in)	192 (7.56)		212 (8.35)	
	Disc thickness x outer diameter mm (in)	18 x 242 (0.71 x 9.53)		22 x 262 (0.87 x 10.31)	
	Effective cylinder diameter mm (in)	53.97 (2.1248)			
	Pad dimensions (length x width x thickness) mm (in)	118 x 45.5 x 12 (4.65 x 1.791 x 0.47)			
	Clearance adjustment	Automatic adjustment			
Rear brake	Type	Drum (Leading-Trailing)	Disc (Colette)		
	Effective drum or disc diameter mm (in)	180 (7.09)	190 (7.48)	220 (8.66)	
	Disc thickness x outer diameter mm (in)	–	10 x 226 (0.39 x 8.90)	10 x 256 (0.39 x 10.08)	
	Effective cylinder diameter mm (in)	17.46 (11/16)	30.23 (1.1902)		
	Lining or pad dimensions (length x width x thickness) mm (in)	172 x 30 x 4.5 (6.77 x 1.18 x 0.177)	71 x 36 x 10 (2.80 x 1.42 x 0.39)		
	Clearance adjustment	Manual adjustment	Automatic adjustment		
Master cylinder	Type	Tandem (with fast fill mechanism)		Tandem	
	Effective diameter mm (in)	20.64 (13/16) (Small) 25.40 (1) (Large)		23.81 (15/16)	
	Reservoir	Sealed type			
Brake booster	Type	Vacuum suspended		Vacuum suspended (Tandem)	
	Effective diameter mm (in)	205 (8.07)		180 (7.09)+205 (8.07)	
Proportioning valve	Split point kPa (kg/cm^2, psi)	3,923 (40, 569)	4,413 (45, 640)	3,923 (40, 569)	4,413 (45, 640)
	Reducing ratio	0.3			
Brake line		Dual circuit system			
Brake fluid reservoir capacity cm^3 (cc, cu in)		160 (160, 9.76)			
Parking brake		Mechanical on front brakes			
Hill-holder		–			Equipped

SERVICE DATA

ITEM		STANDARD	SERVICE LIMIT
Front brake (Disc type)	Pad thickness (including back metal)	18 mm (0.71 in)	7.5 mm (0.295 in)
	Disc thickness Ventilated disc Except XT6	18 mm (0.71 in)	16.0 mm (0.630 in)
	Disc thickness Ventilated disc XT6	22 mm (0.87 in)	20.0 mm (0.787 in)
	Disc run-out		0.10 mm (0.0039 in)
Rear brake (Drum type)	Inside diameter	180 mm (7.09 in)	182 mm (7.17 in)
	Lining thickness	4.5 mm (0.177 in)	1.5 mm (0.059 in)
Rear brake (Disc type)	Pad thickness (including back metal) Except XT6	15 mm (0.59 in)	6.5 mm (0.256 in)
	Pad thickness (including back metal) XT6		8.0 mm (0.315 in)
	Disc thickness	10 mm (0.39 in)	8.5 mm (0.335 in)
	Disc run-out		0.10 mm (0.0039 in)
Brake booster	Brake fluid pressure without engine running	At brake pedal force 147 N (15 kg, 33 lb): 392 kPa (4 kg/cm^2, 57 psi) At brake pedal force 294 N (30 kg, 66 lb): 2,452 kPa (25 kg/cm^2, 356 psi) (Except XT6) 1,569 kPa (16 kg/cm^2, 228 psi) (XT6)	
	Brake fluid pressure with engine running and vacuum at 66.7 kPa (500 mmHg, 19.69 inHg)	At brake pedal force 147 N (15 kg, 33 lb): 4,904 kPa (50 kg/cm^2, 711 psi) (Except XT6) 5,394 kPa (55 kg/cm^2, 782 psi) (XT6) At brake pedal force 294 N (30 kg, 66 lb): 6,375 kPa (65 kg/cm^2, 924 psi) (Except XT6) 9,317 kPa (95 kg/cm^2, 1,351 psi) (XT6)	
Parking brake	Lever stroke	3 to 4 notches/245 N (25 kg, 55 lb)	
Hill-holder	Adjusting shim Thickness	0.6 mm (0.024 in) (One shim increases an angle of approx. 0.5°.)	
	Part Number	725807000	

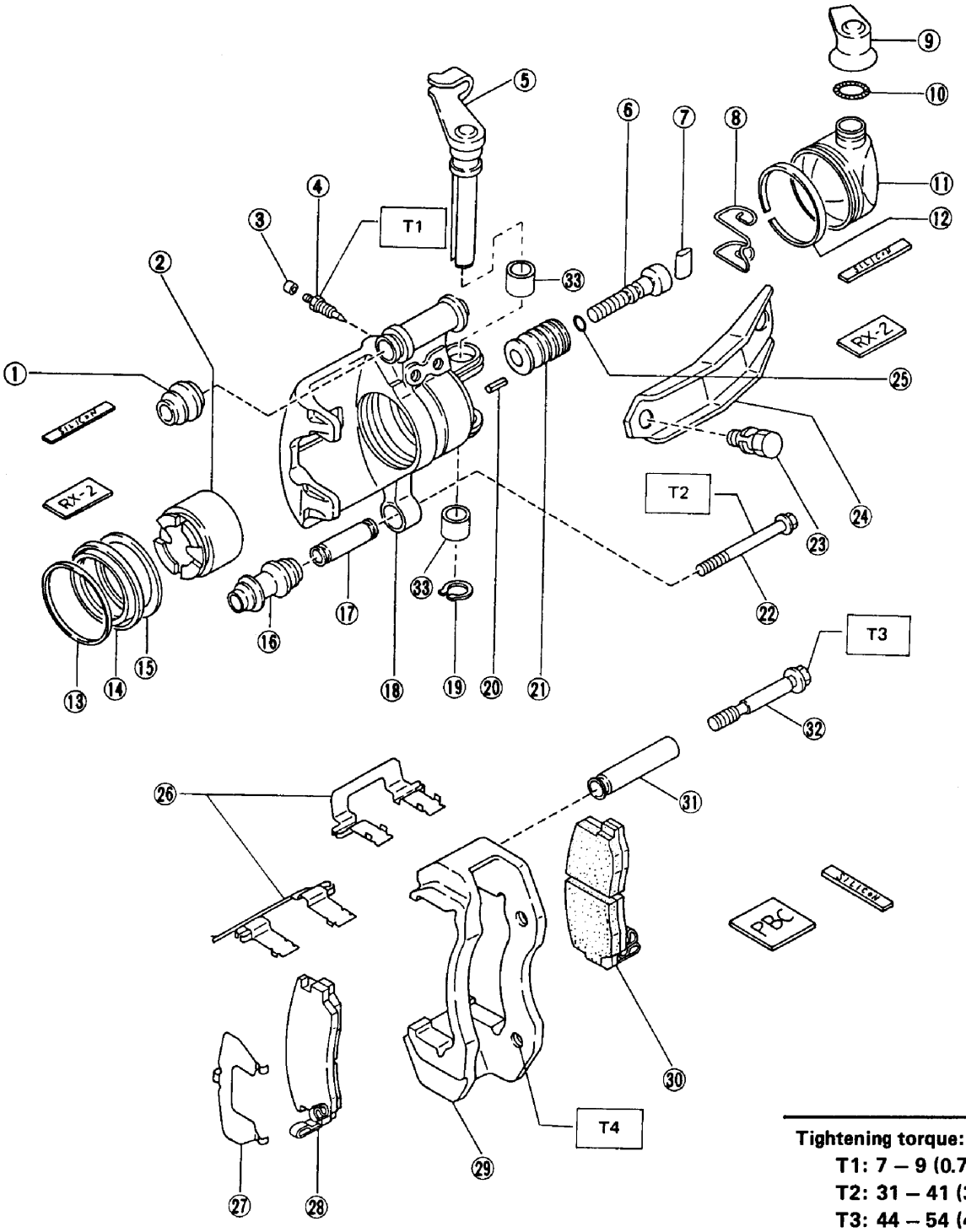
RECOMMENDED BRAKE FLUID

FMVSS No. 116, fresh DOT3 or 4 brake fluid

a. Avoid mixing brake fluid of different brands to prevent the fluid performance from degrading.
b. When brake fluid is supplemented, be careful not to allow any dust into the reservoir.
c. Use fresh DOT3 or 4 brake fluid when replacing or refilling the fluid.

COMPONENT PARTS

Front Disc Brake



1 Guide pin boot
2 Piston
3 Air bleeder cap
4 Air bleeder screw
5 Lever & spindle
6 Spindle
7 Connecting link
8 Return spring
9 Lever cap (upper)
10 Garter spring
11 Lever cap
12 Retainer
13 Boot ring
14 Piston boot
15 Piston seal
16 Lock pin boot
17 Lock pin sleeve
18 Caliper body
19 Retaining spring
20 Spring pin
21 Cone spring
22 Lock pin
23 Bolt ASSY
24 Bracket
25 O-ring
26 Pad clip
27 Shim
28 Outer pad
29 Support
30 Inner pad
31 Guide pin sleeve
32 Guide pin
33 Needle bearing

Tightening torque: N·m (kg-m, ft-lb)
T1: 7 – 9 (0.7 – 0.9, 5.1 – 6.5)
T2: 31 – 41 (3.2 – 4.2, 23 – 30)
T3: 44 – 54 (4.5 – 5.5, 33 – 40)
T4: 49 – 69 (5.0 – 7.0, 36 – 51)

Fig. 25

L4-1327

Rear Disc Brake

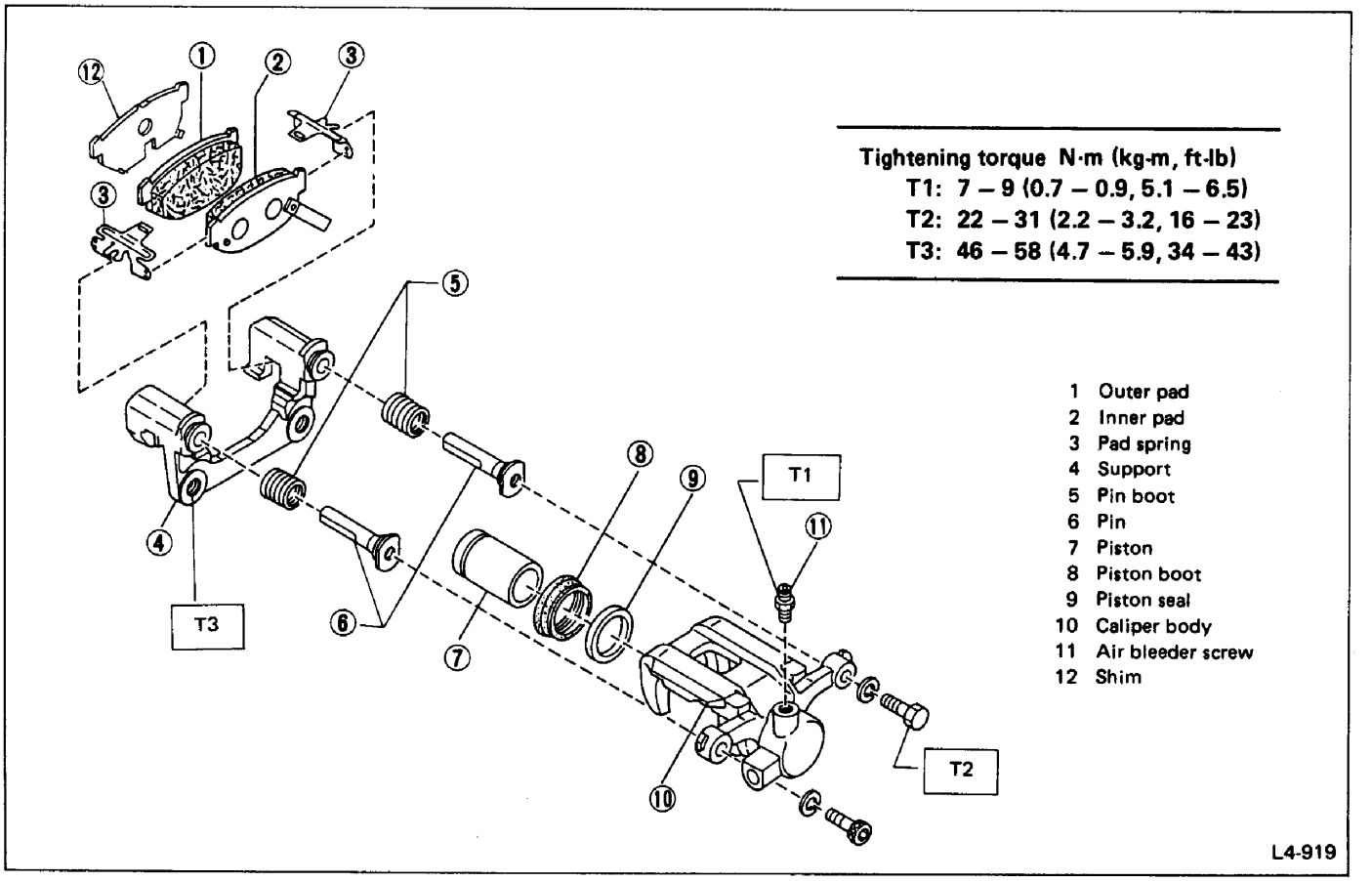
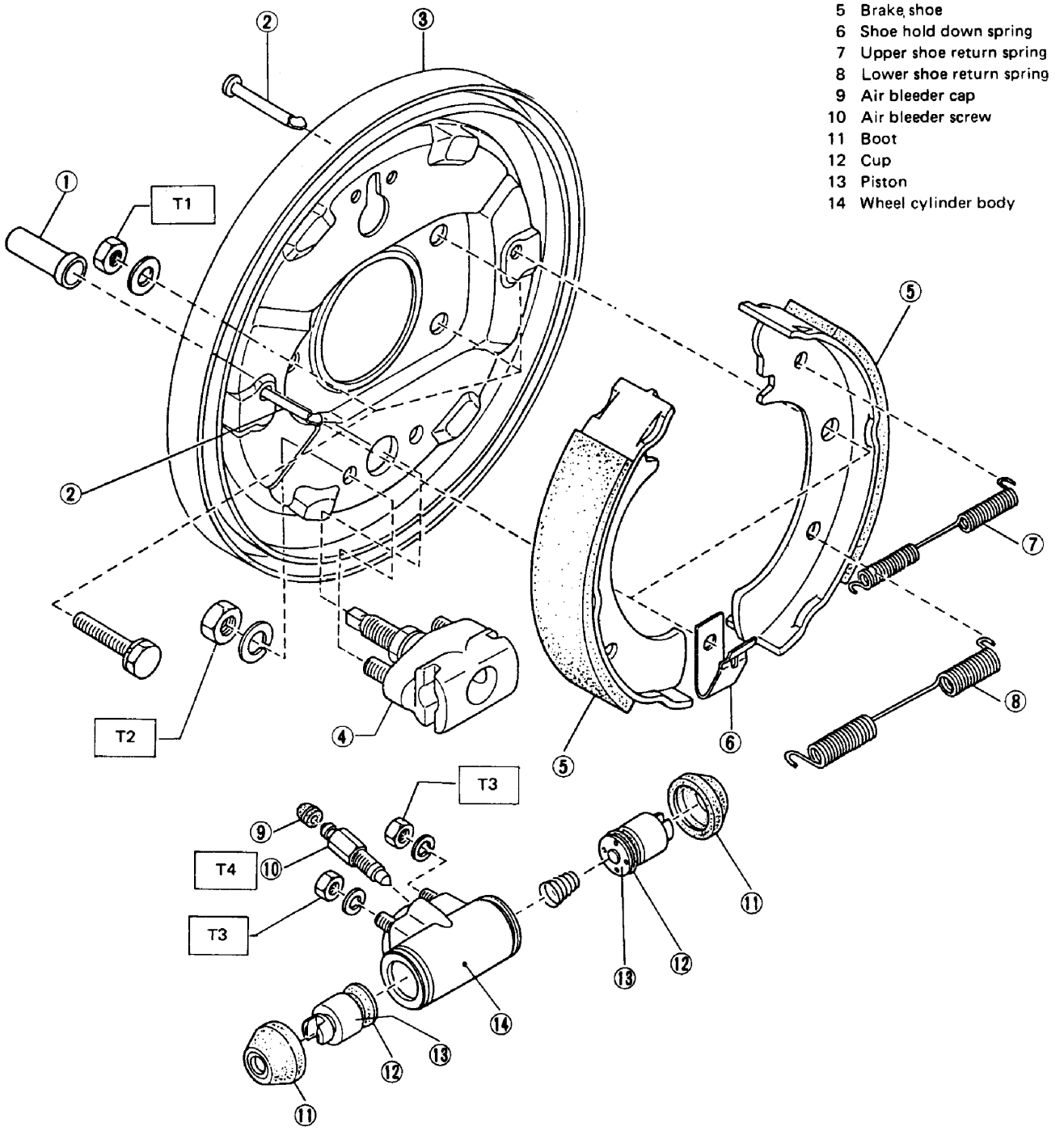


Fig. 26

Rear Drum Brake (FWD)

1 Boot
2 Shoe hold down pin
3 Back plate
4 Adjuster
5 Brake shoe
6 Shoe hold down spring
7 Upper shoe return spring
8 Lower shoe return spring
9 Air bleeder cap
10 Air bleeder screw
11 Boot
12 Cup
13 Piston
14 Wheel cylinder body

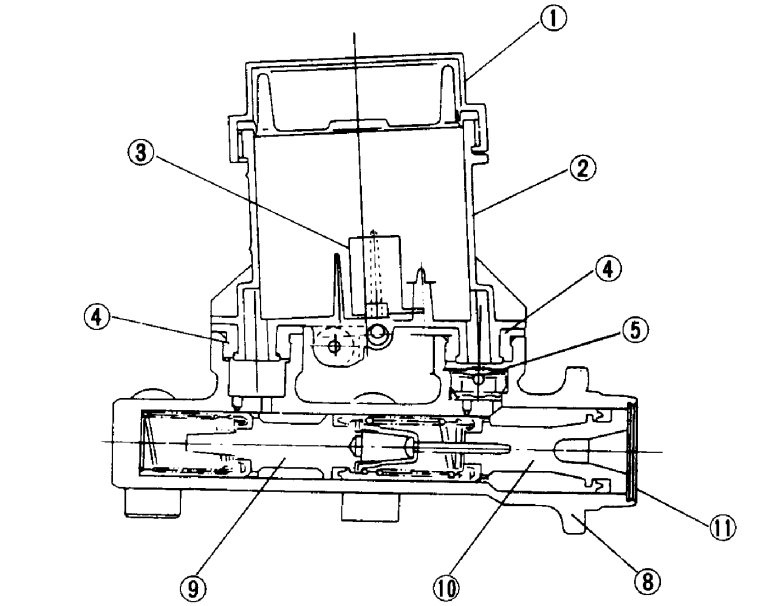


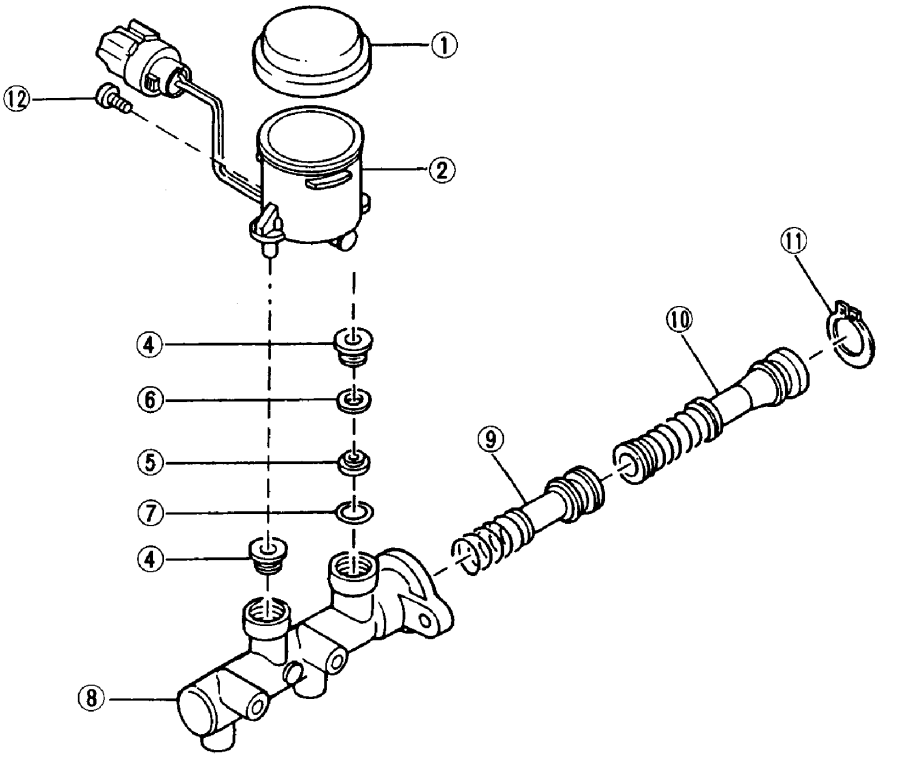
Tightening torque N·m (kg-m, ft-lb)
T1: 46 – 58 (4.7 – 5.9, 34 – 43)
T2: 12.3 – 15.2 (1.25 – 1.55, 9.0 – 11.2)
T3: 8 – 10 (0.8 – 1.0, 5.8 – 7.2)
T4: 7 – 9 (0.7 – 0.9, 5.1 – 6.5)

Fig. 27

L4-920

Master Cylinder (Except XT6)



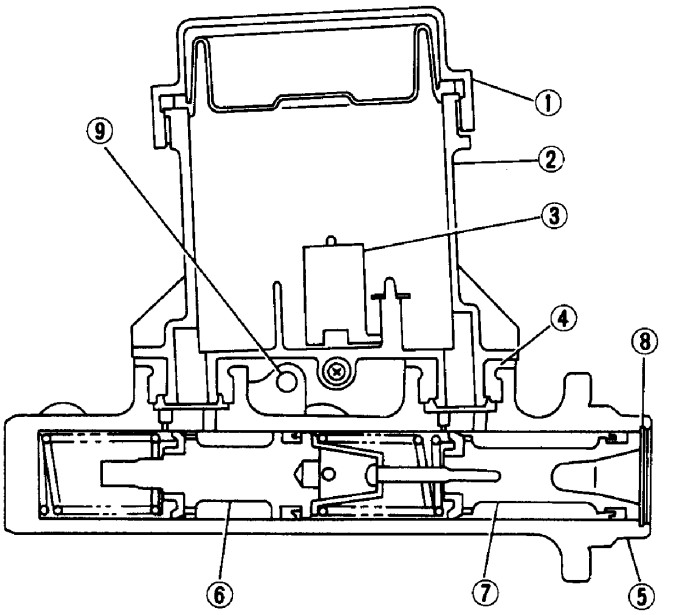


1 Cap
2 Reserve tank
3 Float
4 Seal
5 Valve
6 C-ring
7 O-ring
8 Cylinder body
9 Secondary piston
10 Primary piston
11 C-ring
12 Bolt

Fig. 28

L4-1214

Master Cylinder for XT6



1 Cap
2 Reserve tank
3 Float
4 Seal
5 Cylinder body
6 Secondary piston
7 Primary piston
8 C-ring
9 Bolt

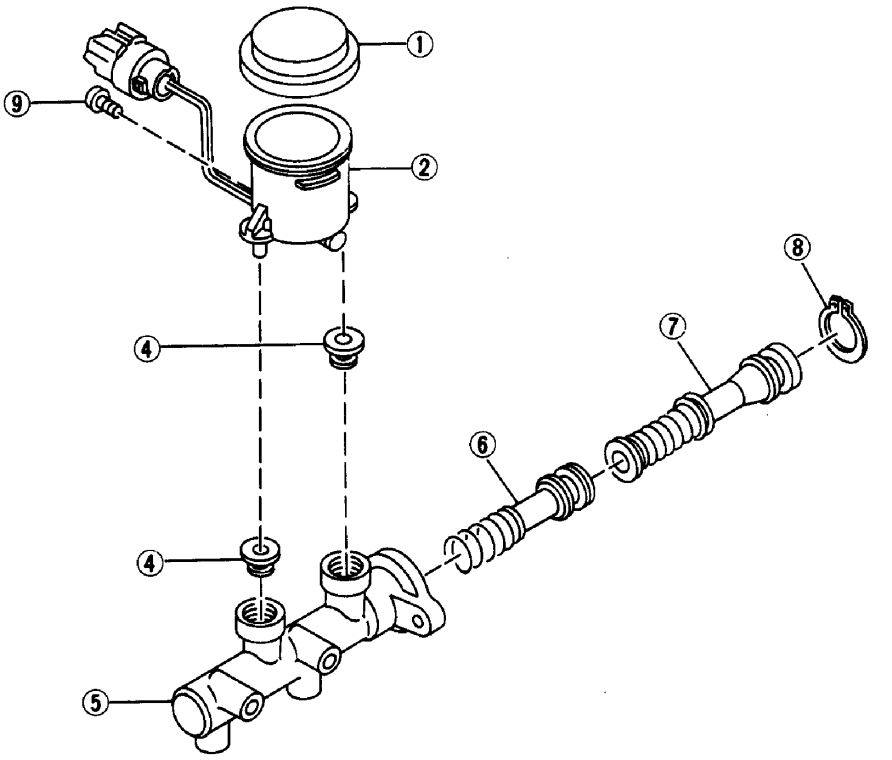
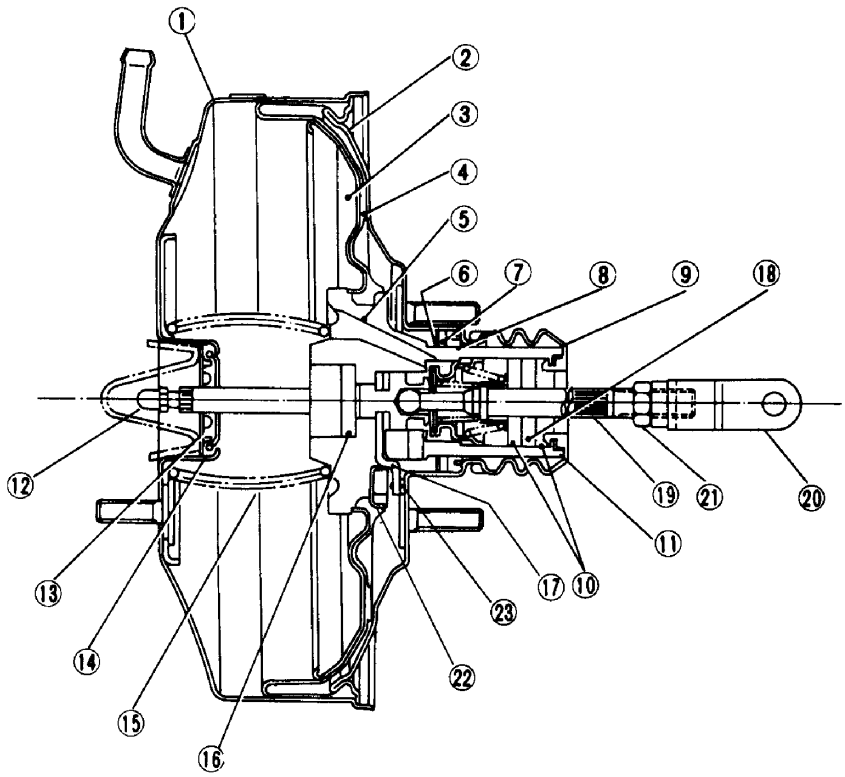


Fig. 29

L4-1328

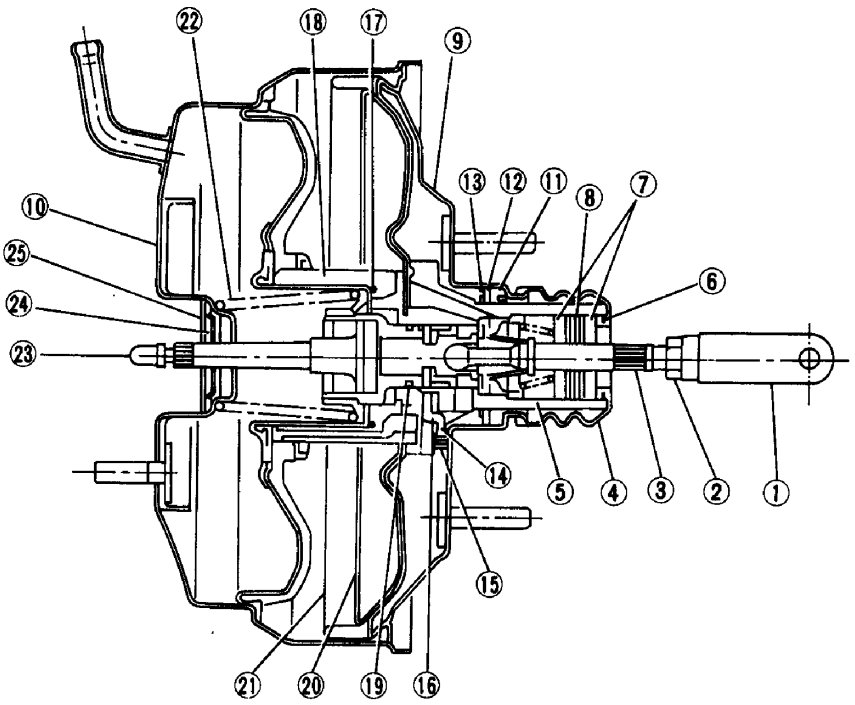
Brake Booster



1 Front shell
2 Rear shell
3 Diaphragm plate
4 Diaphragm
5 Valve body
6 Retainer
7 Bearing
8 Seal
9 Valve body guard
10 Filter
11 Retainer
12 Push rod
13 Retainer
14 Plate & seal ASSY
15 Return spring
16 Reaction disc
17 Key
18 Silencer
19 Operating rod
20 Clevis
21 Nut
22 Retainer
23 Stopper

L4-921

Fig. 30 Except XT6



1 Clevis
2 Nut
3 Operating rod
4 Valve body guard
5 Valve body
6 Retainer
7 Filter
8 Silencer
9 Rear shell
10 Front shell
11 Seal valve body
12 Bearing
13 Retainer
14 Key
15 Stopper
16 Retainer
17 O-ring
18 Center body
19 O-ring
20 Diaphragm plate
21 Diaphragm
22 Return spring
23 Push rod
24 Push rod seal
25 Retainer

L4-1329

Fig. 31 XT6

Hill-Holder

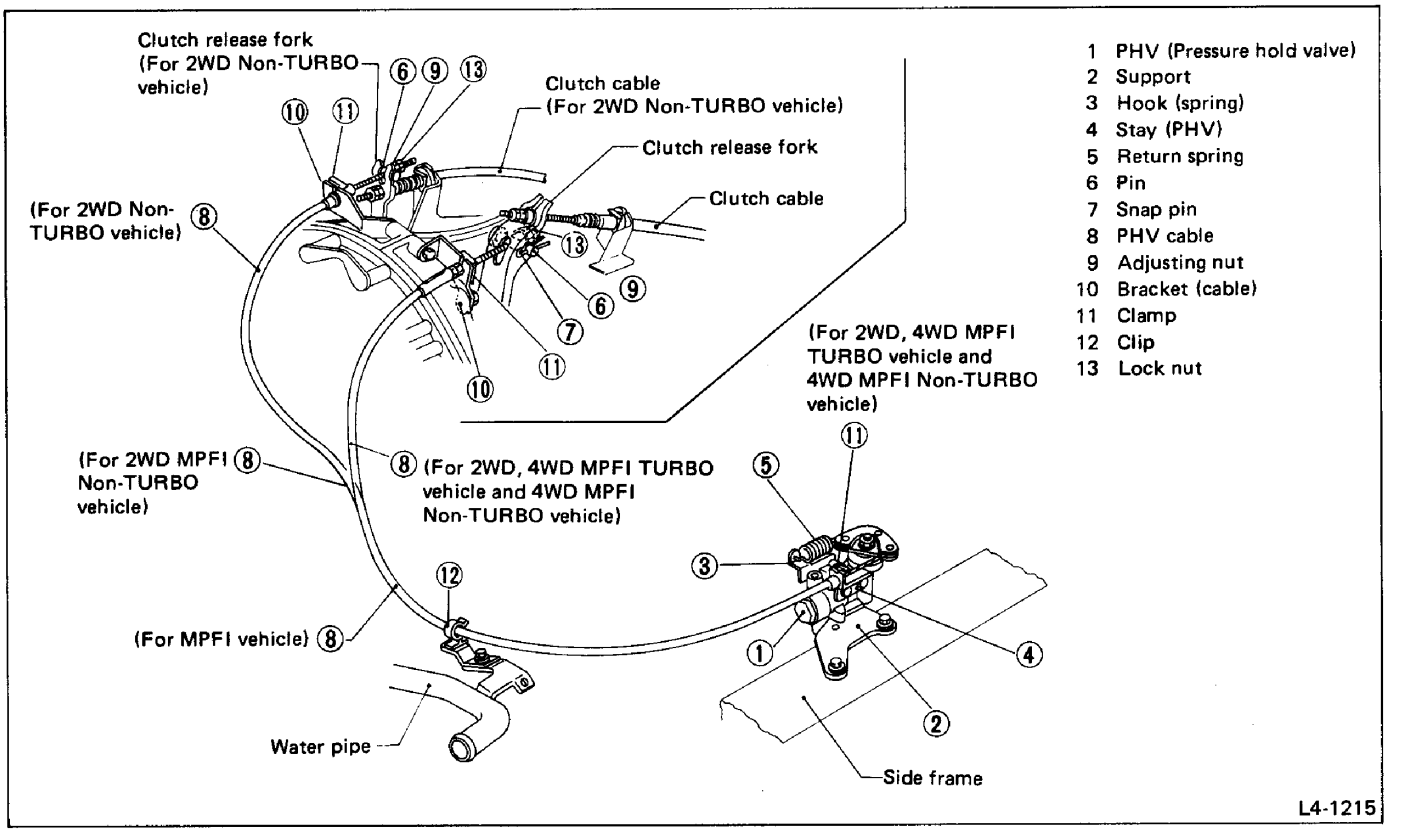


Fig. 32 Component parts of hill-holder (Except XT6)

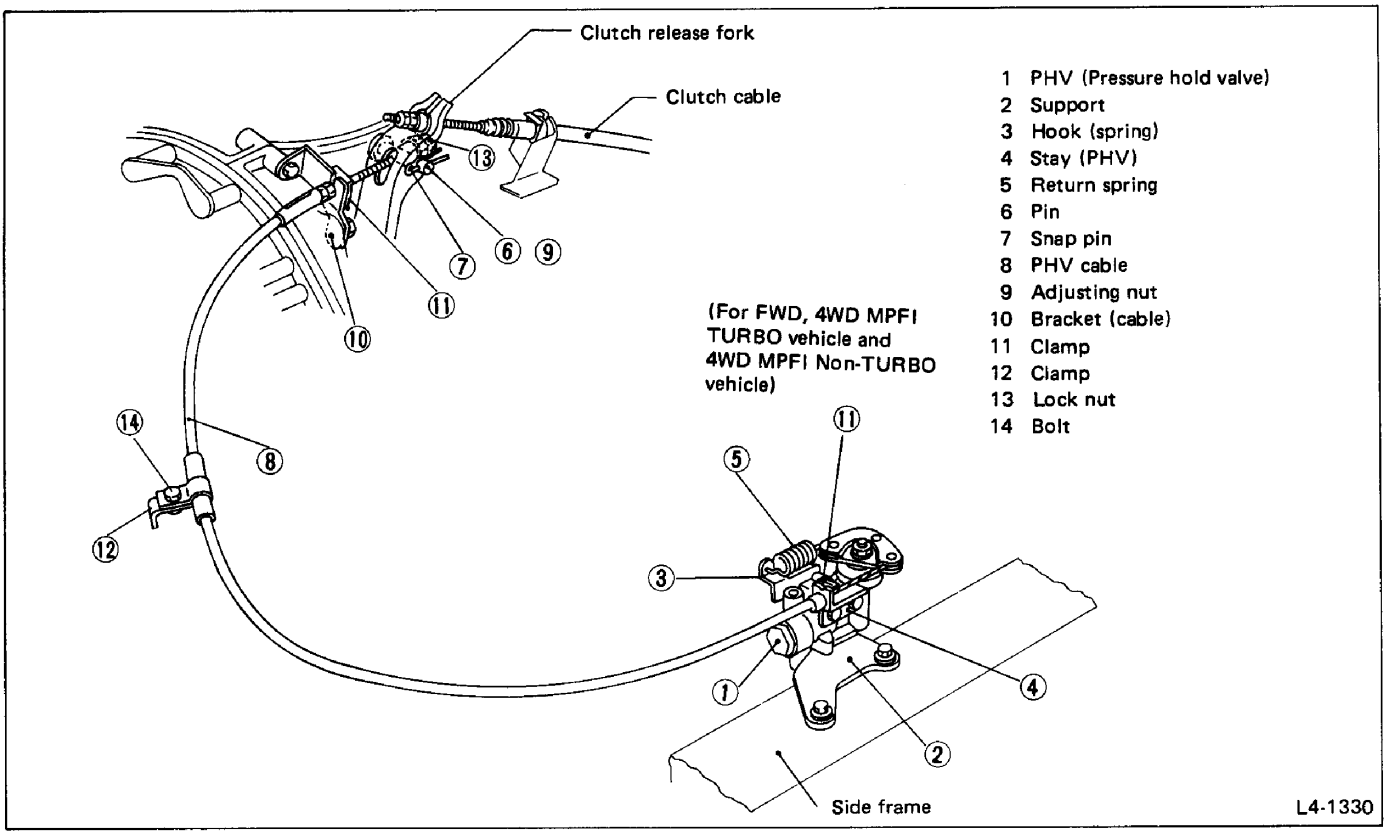
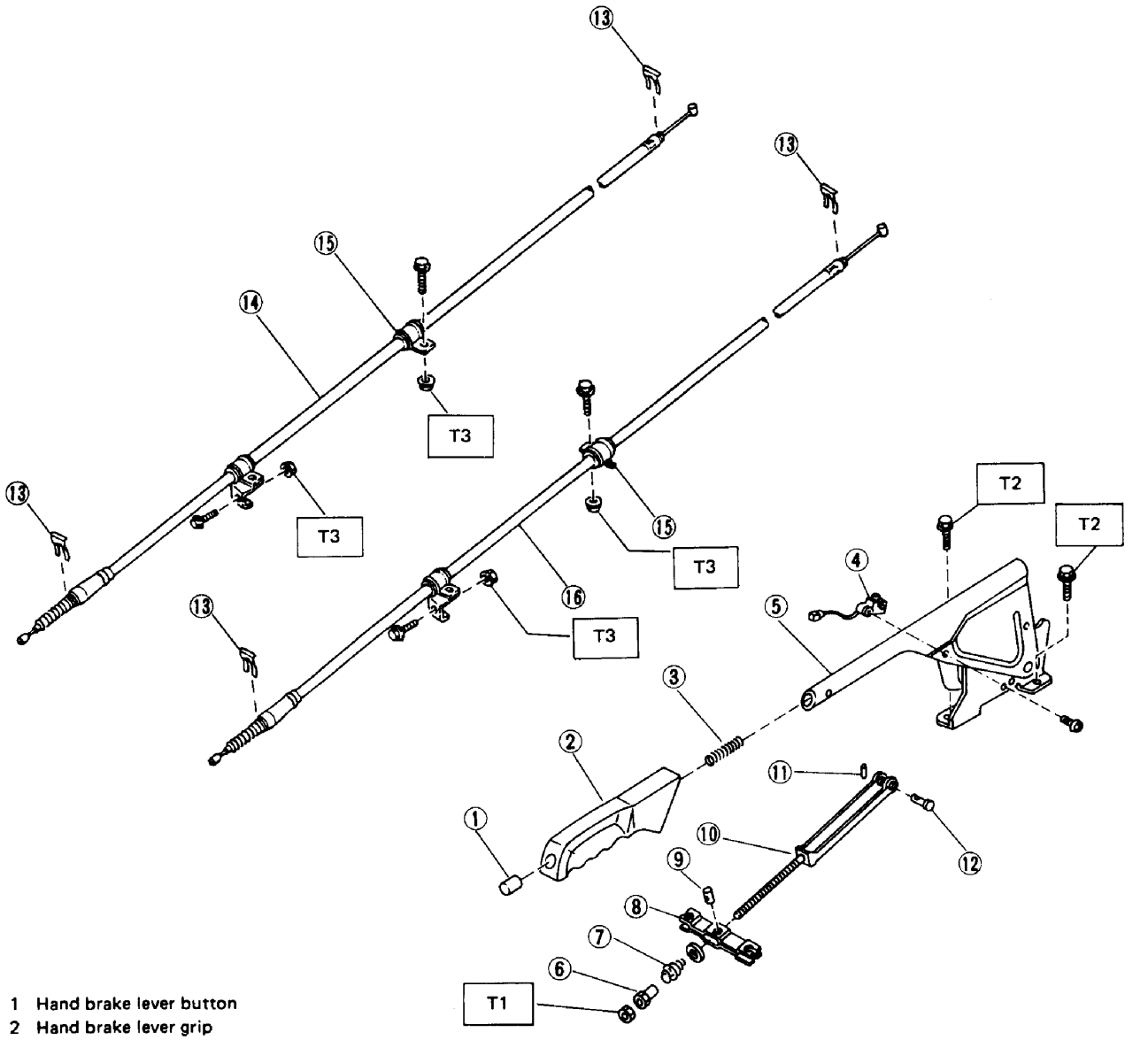


Fig. 33 Component parts of hill-holder for XT6

Parking (Hand) Brake



1 Hand brake lever button
2 Hand brake lever grip
3 Hand brake lever spring
4 Hand brake switch
5 Hand brake lever
6 Hand brake adjuster
7 Hand brake spring
8 Equalizer
9 Hand brake pin
10 Hand brake rod
11 Cotter pin
12 Clevis pin
13 Clamp
14 Hand brake cable RH
15 Clamp
16 Hand brake cable LH

Tightening torque N·m (kg-m, ft-lb)
T1: 4.4 – 7.4 (0.45 – 0.75, 3.3 – 5.4)
T2: 10 – 18 (1.0 – 1.8, 7 – 13)
T3: 10 – 16 (1.0 – 1.6, 7 – 12)

Fig. 34

L4-1216

SERVICE PROCEDURE

Front Disc Brake

Grease Application

N : NIGLUBE RX-2 GREASE (003606000 or 725191040)
S : SILICON COMPOUND (003606010 or 725191050)
P : PBC GREASE (003603000 or 725191060)

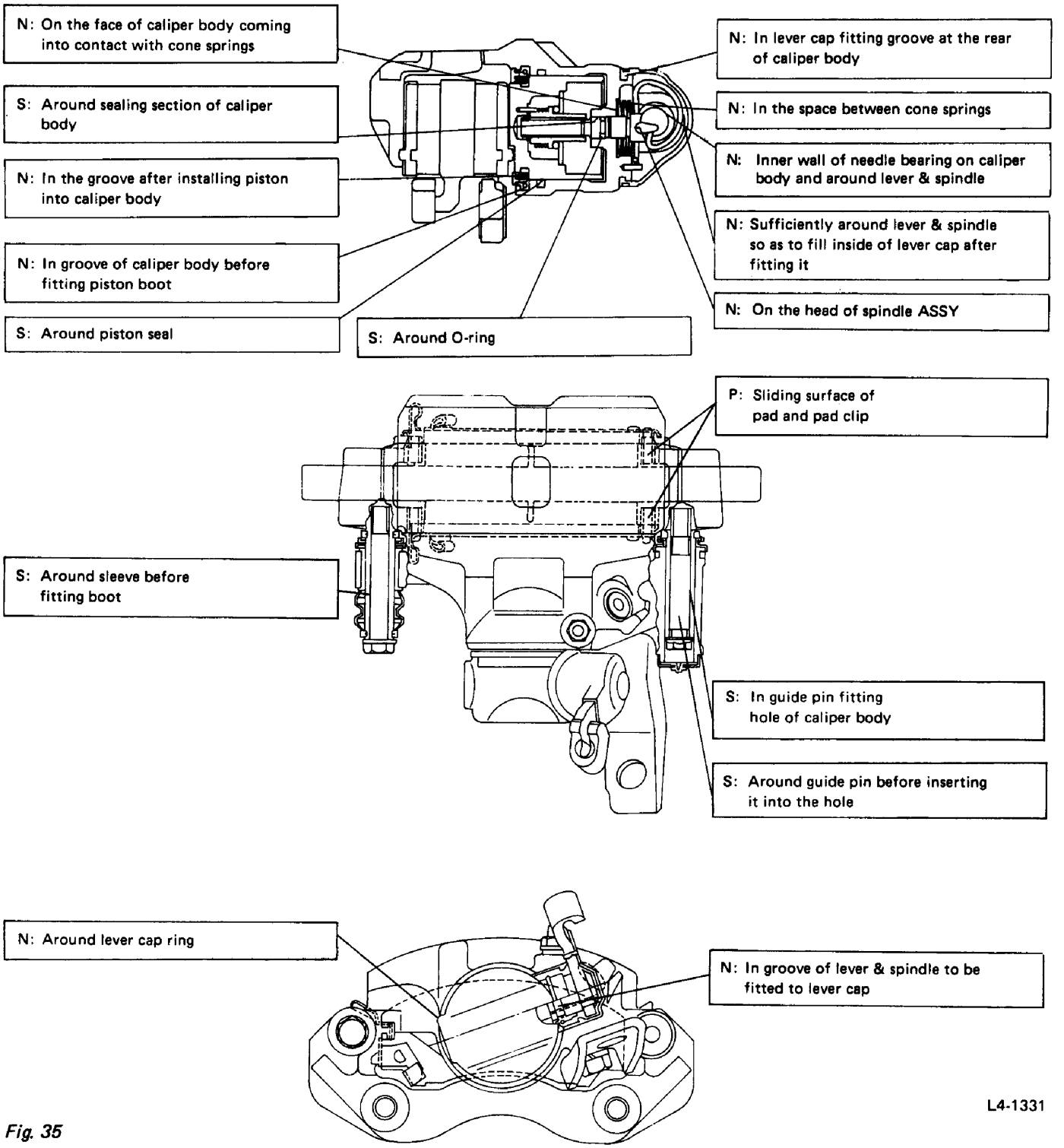


Fig. 35

Replacement of Pad

REMOVAL

1) Return hand brake lever completely.
2) Remove inner cable end from lever, draw out outer cable clamp, then disconnect hand brake cable from caliper body ASSY.

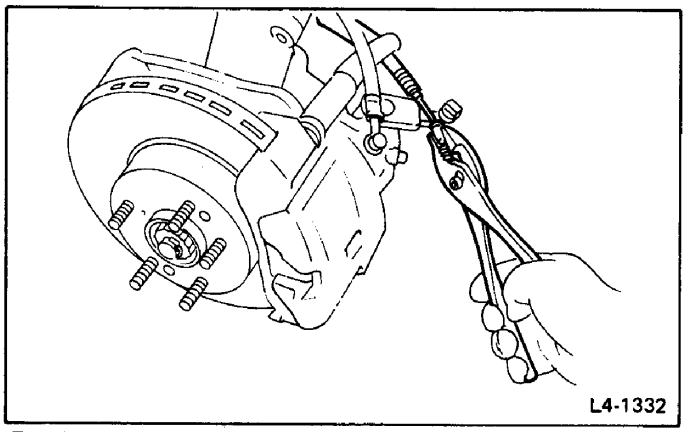


Fig. 36

3) Remove lock pin.

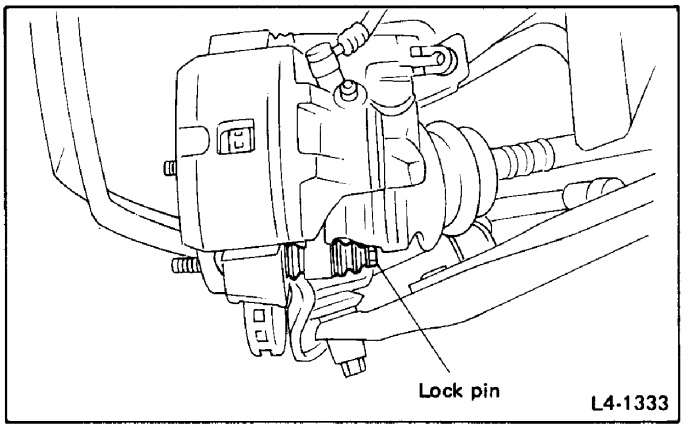


Fig. 37

4) Spin caliper body ASSY on guide pin.

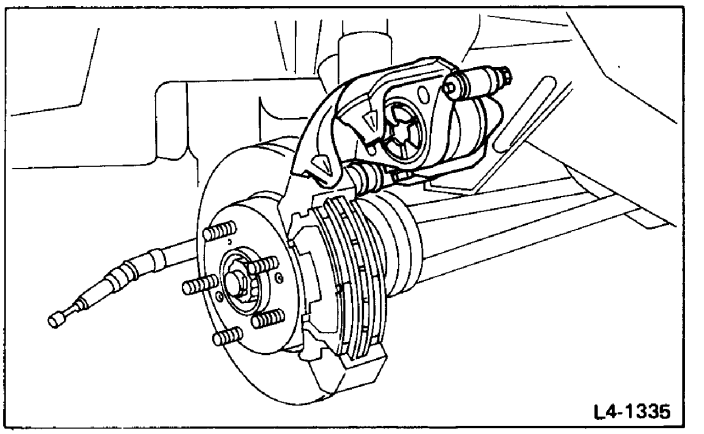


Fig. 38

5) Remove pads from support.

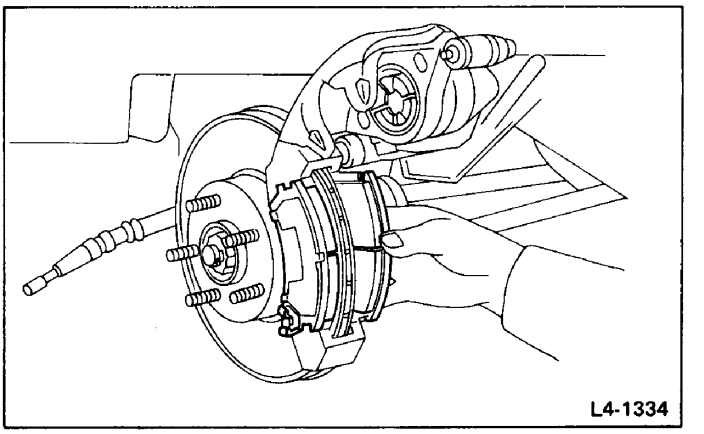


Fig. 39

a. Do not touch the brake pedal after the pads have been removed.
b. Do not disconnect hose.
c. When replacing the pad, do not remove the caliper body, but just turn it enough for removal and installation.

INSPECTION

1) Pad
Check the pad thickness through the inspection hole and replace pads if not within specification.

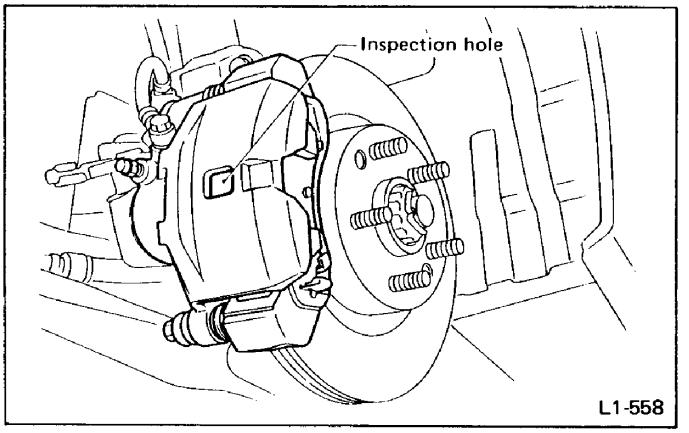


Fig. 40

Pad thickness including back metal:
Standard
18 mm (0.71 in)
Usable limit
7.5 mm (0.295 in)

a. Always replace the pads for both the left and right wheels at the same time.
b. A wear indicator is provided on the disc brake pad. If the pad wears down to such an extent that the end of the wear indicator contacts the disc rotor, a squeaking sound is produced as the wheel rotates. If this sound is heard, replace the pad.

2) Disc rotor
Check for wear and damage, and correct or replace if abnormal.

Disc rotor thickness:
Ventilated disc
Standard
Except XT6: 18 mm (0.71 in)
XT6: 22 mm (0.87 in)
Usable limit
Except XT6: 16 mm (0.63 in)
XT6: 20 mm (0.79 in)

3) Disc rotor runout

Disc rotor runout:
Limit
0.10 mm (0.0039 in)

INSTALLATION

1) It is necessary to push back piston into cylinder, since piston protrudes from cylinder in proportion to the amount of pad wear, and the gap where pads are to be inserted is narrow. Rotate piston clockwise with WRENCH (926430000) and SPACER (926440000) to force in piston to caliper body, and set the piston notch to the specified position.

When using WRENCH, fix SPACER as shown with 6 mm dia. bolts [length: less than 15 mm (0.59 in)].

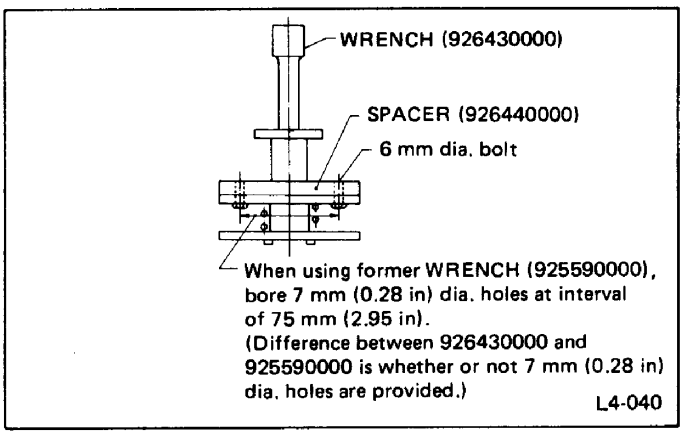


Fig. 41

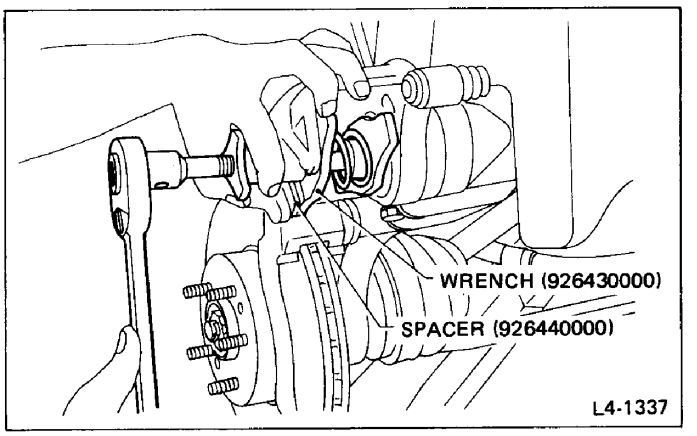


Fig. 42 Pushing back piston

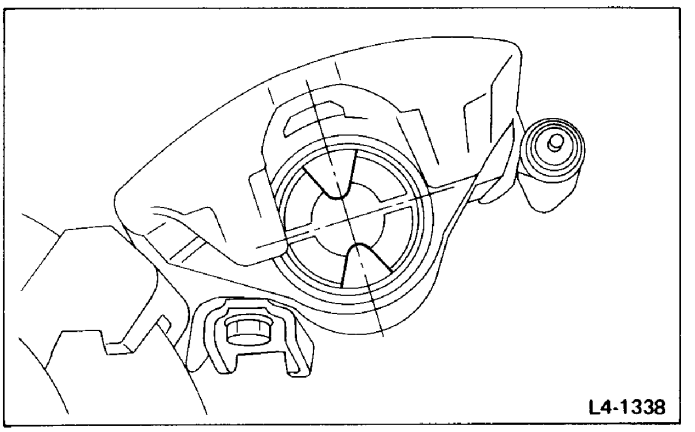


Fig. 43 Specified position of piston notch

After pushing back piston, check piston boot for twist. If twisted, correct twist using a strip driver.

a. Do not disconnect hose.
b. Always return the piston to that point which allows only a minimum clearance for the pad to be inserted.
c. Be sure to use the special tool when pushing in the piston to the caliper body. If the piston is pushed into the caliper body with a vice and without rotating it, the spindle (5-thread) may be buckled. To prevent this, the piston should be rotated clockwise when pushed into the caliper body.

2) Remove rust and foreign materials from the contact area of support with the sliding part of pad. Then, install a new genuine SUBARU pad. Make sure that pad clips are in normal operating condition before installing new pad.

a. Securely attach all pads to the frictional surfaces of their supports.
b. Apply thin coat of PBC GREASE (725191060 or 003603000) to the frictional portion between pad and pad clip.
c. Do not install shim on inner pad.
d. When replacing the pad, replace pads of the right and left wheels at the same time.

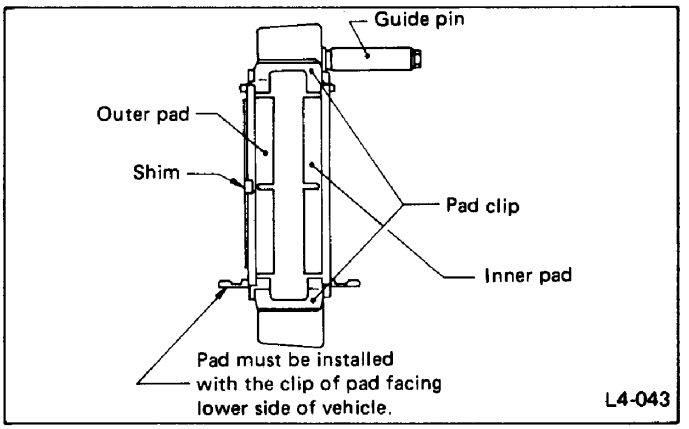


Fig. 44

3) Remove foreign materials from lock pin.
Tighten lock pin to the specified torque.

Torque (Lock pin):
31 – 41 N·m (3.2 – 4.2 kg-m, 23 – 30 ft-lb)

4) Upon completion of installing the brake system, confirm that the pad dowel (rise on pad back metal) fits into the piston notch.
Depress brake pedal several times.
5) Confirm that tire can be rotated with a force of less than 39 N (4 kg, 9 lb) at the outside diameter of tire.

(1) If wheel bearing is worn or disc rotor is not exactly perpendicular to the counterpart, the surface of disc rotor runs out in the axial direction during rotation. This causes disc rotor to be pressed against lining, and rotational resistance increases.
When such trouble occurs, measure the disc rotor runout. If the runout exceeds the limit, change the tightening position of rotor on hub or the meshing position of hub to axle shaft serration. If this does not correct the run-out, replace rotor.

Disc rotor runout:
Limit
0.10 mm (0.0039 in)

Measure the disc rotor runout at a point less than 5 mm (0.20 in) from the outer periphery of the rotor.

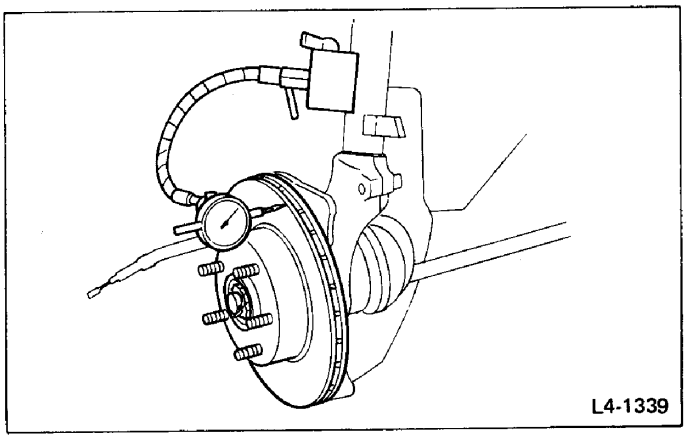


Fig. 45

(2) If the rotational resistance is over the specified value due to the other causes, recheck disc brake ASSY and repair or replace it if necessary.

Caliper Assembly

REMOVAL AND DISASSEMBLY

1) Remove union bolt and disconnect brake hose from caliper body ASSY.

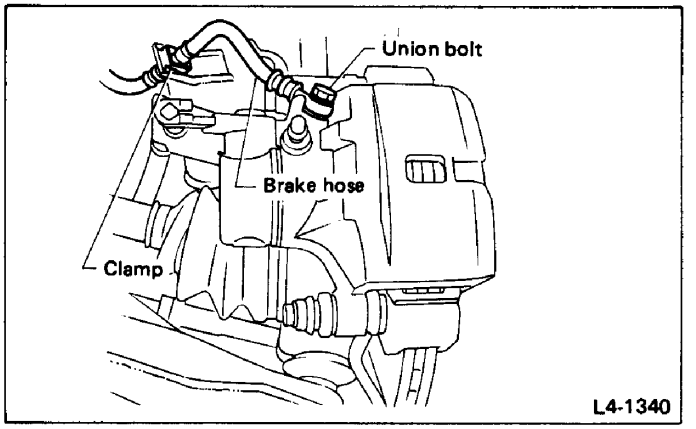


Fig. 46

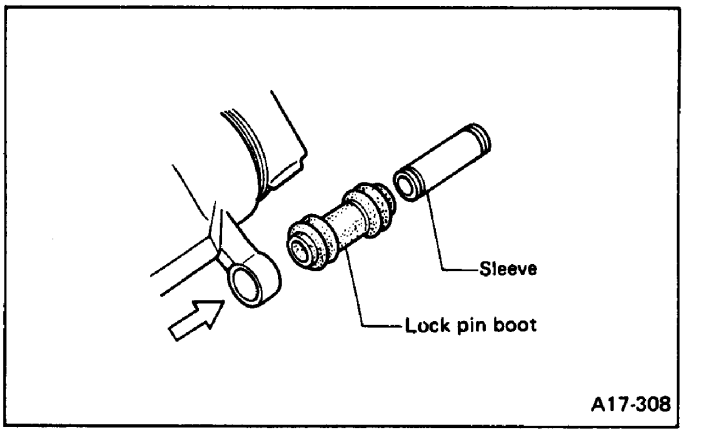


Fig. 48

2) Remove hand brake cable and pad in accordance with the removing procedure of pad.

3) Remove caliper body ASSY by pulling it out of support.

Do not remove guide pin unless it is damaged.

4) Remove support from housing.

The support should be removed only when the disc rotor or the support is replaced, and should not be removed when performing the maintenance of the caliper body ASSY.

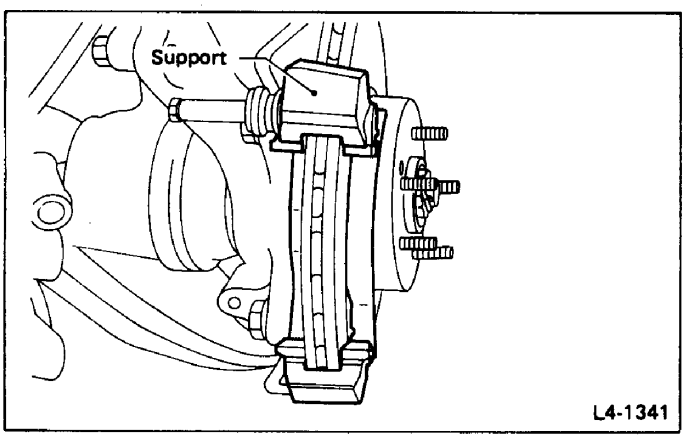


Fig. 47

5) Remove sludge and dirt from support and caliper body ASSY.

Take special care to prevent dirt from entering through the brake fluid inlet.

6) Remove sleeve, then remove lock pin boot, taking care not to scratch it.

7) Remove boot ring by using a strip driver with taking care so as not to scratch piston boot. Then, remove piston boot.

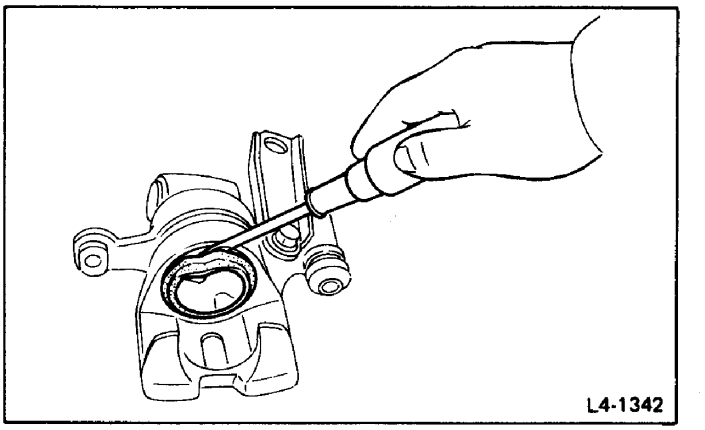


Fig. 49

If the strip driver is not available, use a screwdriver after the tip of the screwdriver is rounded off, and burrs are thoroughly eliminated.

8) Draw out piston from cylinder by applying a compressed air or pressurized liquid gradually from the brake fluid inlet of caliper body ASSY.

Do not apply an excessively high pressure, since such carelessness may cause the piston to spring out of the cylinder.

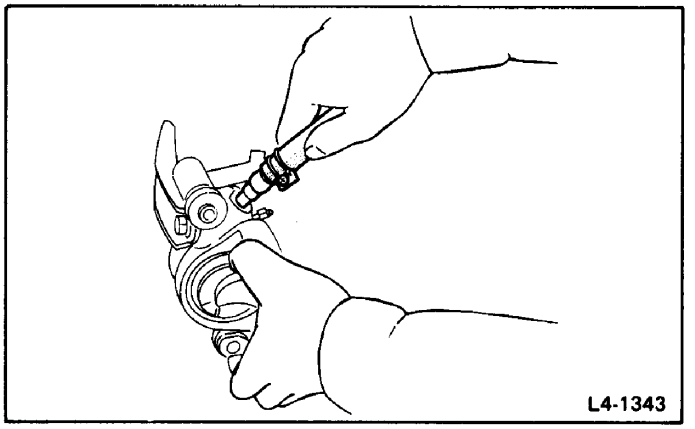


Fig. 50

9) Remove piston seal by using a strip driver with taking special care so as not to scratch the inner wall of cylinder.

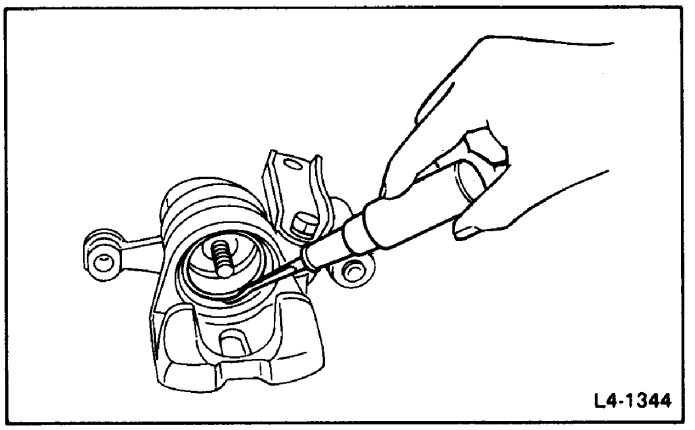


Fig. 51

10) Remove guide pin boot from caliper body.

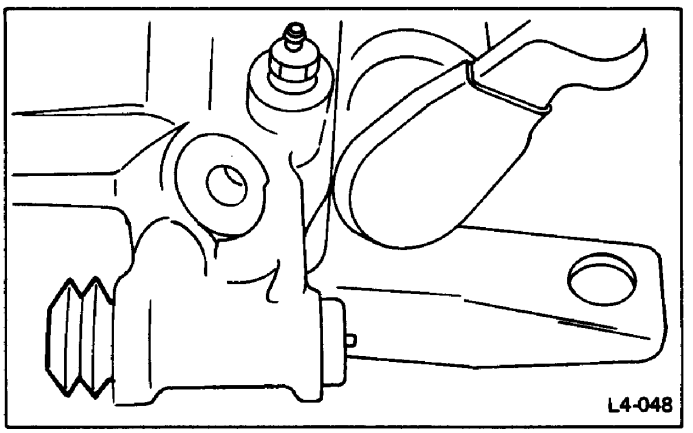


Fig. 52

Replace the removed boot with a new one.

11) Remove retainer and lever cap, then remove retaining spring from lever & spindle.

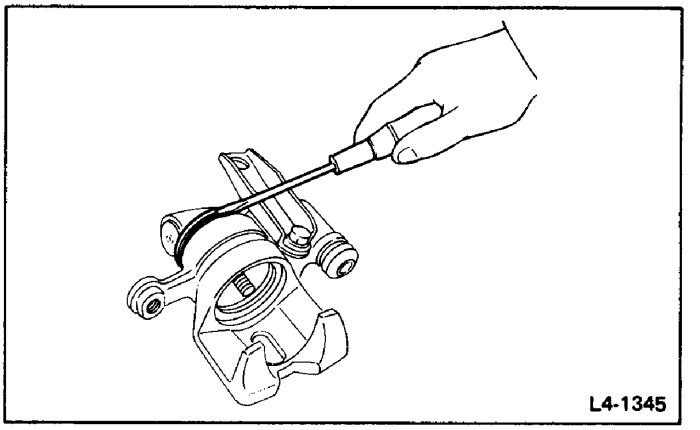


Fig. 53

The lever cap may only be pulled out of the groove in the caliper body.

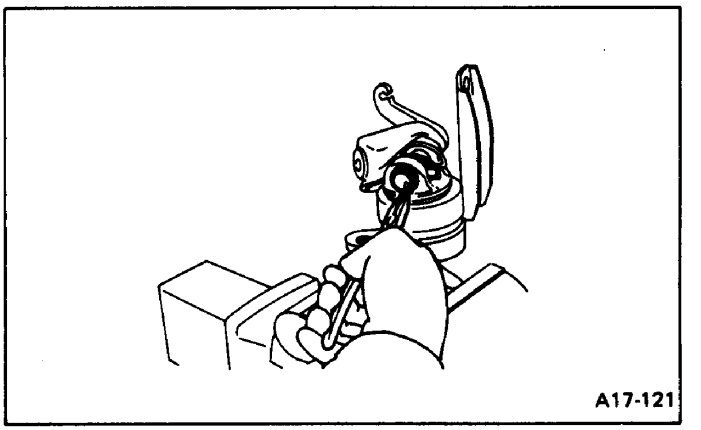


Fig. 54

12) Press spring washer (coned disc spring) with PULLER (925471000) to eliminate a load applied to lever & spindle through spring washer, pull out lever & spindle.
Detach PULLER, and then remove connecting link and return spring.

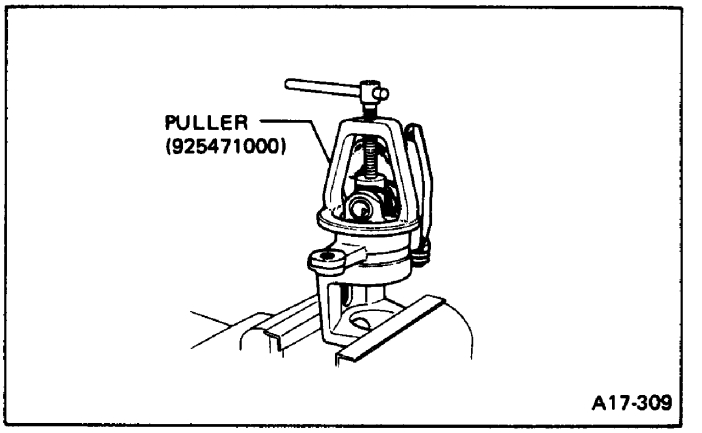


Fig. 55

INSPECTION

Inspect the disassembled parts, correct or replace if defective.
1) Caliper body
Uneven wear, damage or rust.
2) Piston
Uneven wear, damage or rust.
3) Rubber parts
Deformation, wear, damage, deterioration or coat of mineral oil.
4) Pad clip
Deformation, wear, damage or rust.
5) Spindle and cone spring
Damage or rust.
6) Lever & spindle
Damage or rust.
7) Support
Wear, damage or rust.
8) Other parts
Deformation, wear, damage or rust.

If the rubber parts are scratched or coated with mineral oil, replace it with a new one.

ASSEMBLY AND INSTALLATION

1) Clean the inner part of caliper body (cylinder) with brake fluid. Apply a thin coat of SILICON COMPOUND (725191050 or 003606010) to piston seal, and fit the seal to the groove provided in the cylinder with hand.

Pay special attention to prevent the seal from twisting.

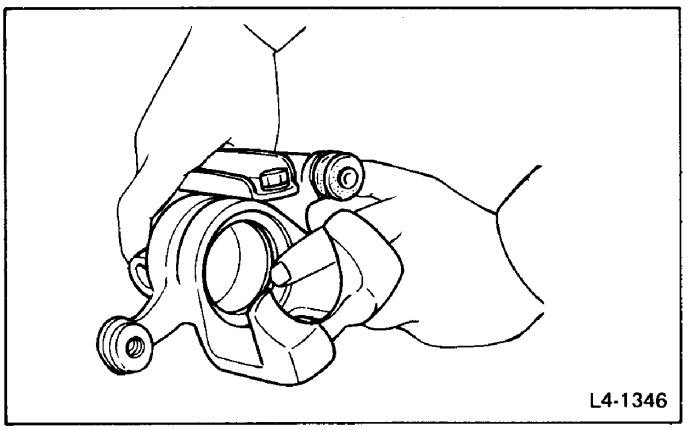


Fig. 56

2) Insert piston into cylinder.

Be sure to insert the piston into the cylinder with hand.
Do not use a vice when inserting the piston.

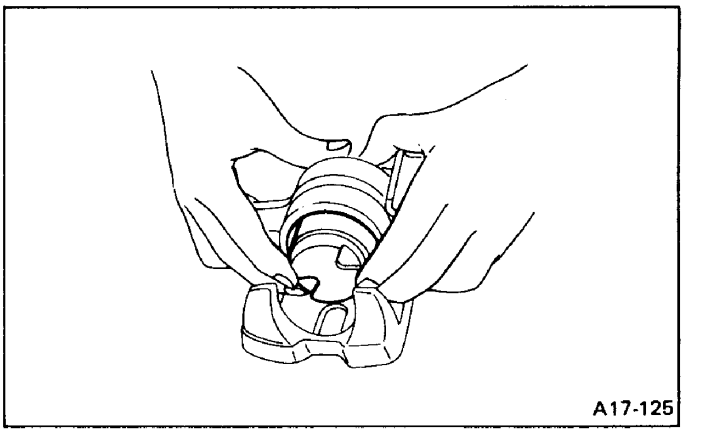


Fig. 57

3) Upon completion of inserting piston into cylinder, apply NIGLUBE RX-2 GREASE (725191040 or 003606000) into the grooves provided in cylinder and along the circumference of piston head. Then fit boot into the grooves. After confirming that boot is not twisted, attach boot ring.

When attaching the boot ring, refer to the figure.

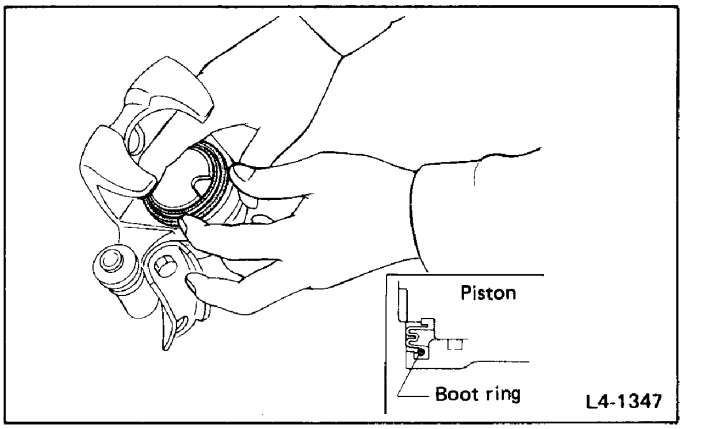
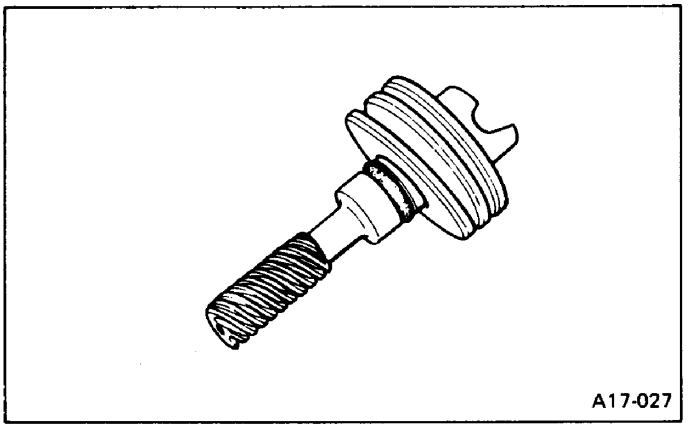


Fig. 58 Fitting piston boot and boot ring

4) Apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to the cone springs fitting section of spindle, into the space between cone springs after fitting them, and onto the face of caliper body coming into contact with cone springs.
Apply a thin coat of SILICON COMPOUND (725191050 or 003606010) to the sealing section of caliper body coming into contact with O-ring of spindle ASSY.
Then, insert spindle ASSY into cylinder by turning clockwise from the opening at the bottom of caliper body.

Never fail to apply the specified grease or compound to the proper sections.



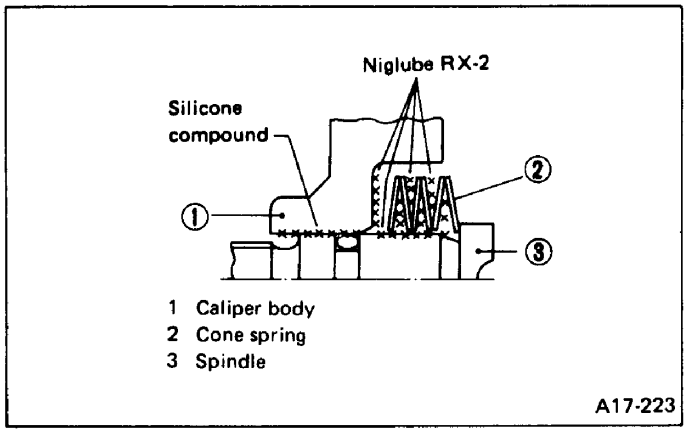


Fig. 59 Spindle ASSY and grease application

a. When the cone spring is replaced due to scratch, be sure to replace the O-ring with a new one. Also, attach a new cone spring before fitting the O-ring.
Six cone springs are incorporated. The assembling combination is as follows.

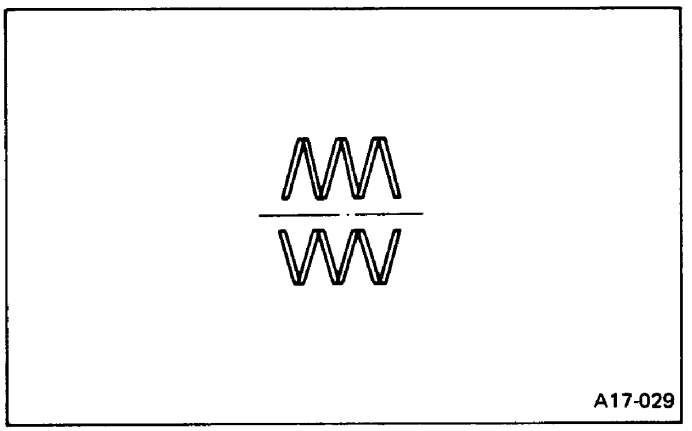


Fig. 60

b. After attaching cone springs, apply thin coat of SILICON COMPOUND (725191050 or 003606010) to the O-ring, and insert it with ADAPTER (925600000) with taking care to prevent the O-ring from being damaged.

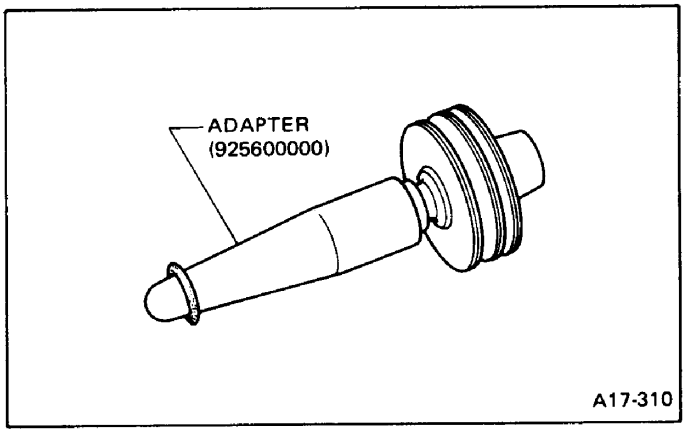
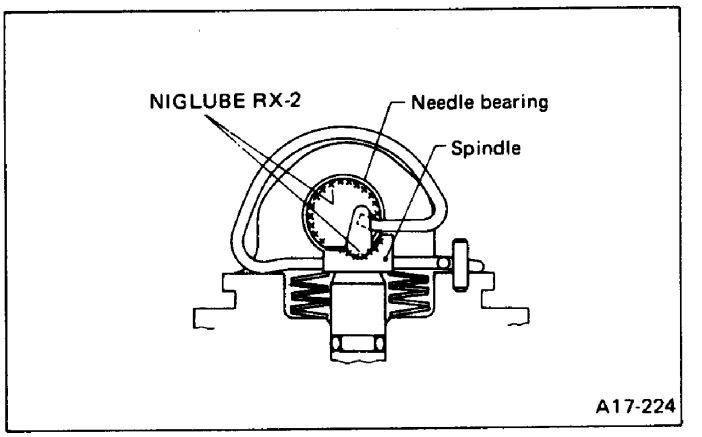


Fig. 61 Fitting O-ring

5) Apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to the head of spindle ASSY and onto the inner wall of needle bearings on caliper body in which lever & spindle is to be fitted. After setting connecting link and return spring, press a set of cone springs by PULLER (925471000).
Apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to grooves of lever & spindle in which lever cap and connecting link are to be fitted. Then, fit connecting link into the groove at the head of spindle. Insert lever & spindle provided with lever cap and garter spring. Be sure to force in the hooked portion of return spring to the groove of lever & spindle as shown. Then, remove PULLER (925471000).



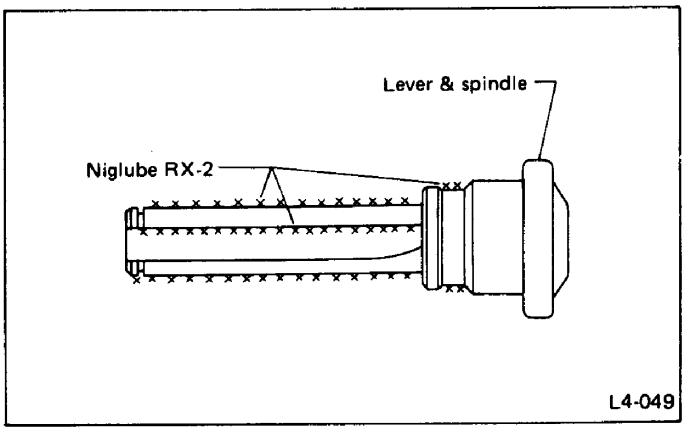


Fig. 62 Grease application

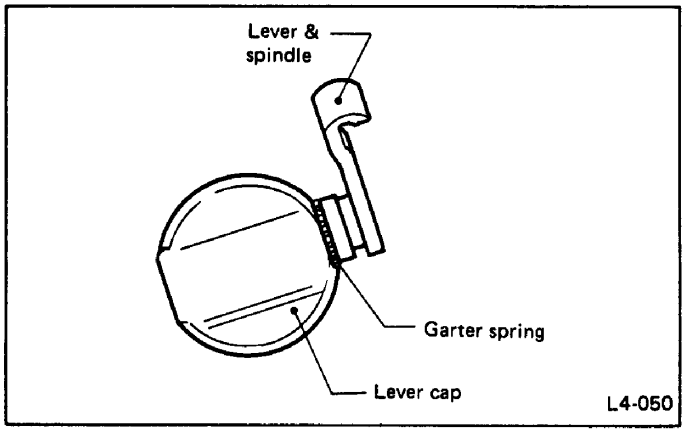


Fig. 63 Lever & spindle, lever cap and garter spring in ASSY

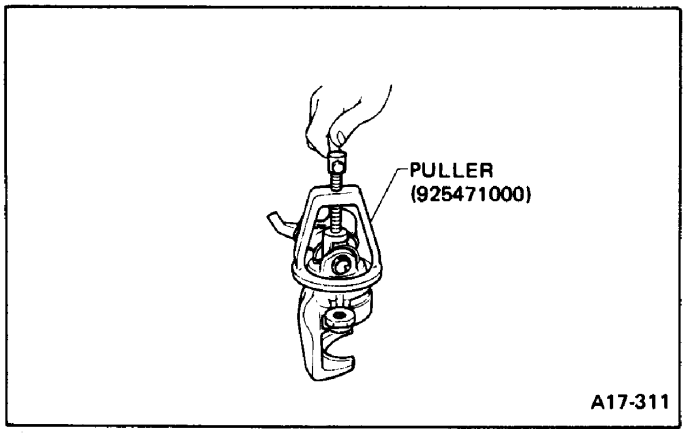


Fig. 64 Inserting lever & spindle

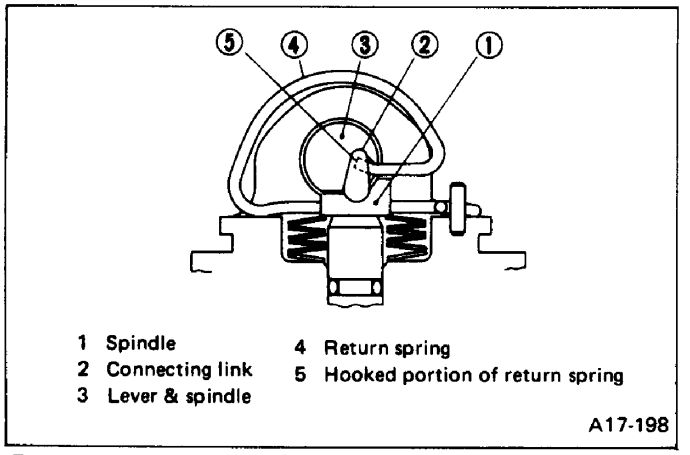


Fig. 65

When inserting the lever & spindle, make sure that the needle bearing of caliper body is clean and free from any foreign matter.

6) Fit retaining spring into the groove of lever & spindle.
Apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to the groove of caliper body in which lever cap is to be fitted and to retaining spring.

Apply sufficient amount of NIGLUBE RX-2 GREASE (725191040 or 003606000) to the space around connecting link and lever & spindle so as to fill inside of lever cap after fitting it.
Fit lever cap properly into the groove at the rear of caliper body.
Attach retainer onto lever cap.

Be careful not to damage the lever cap by the edge of the retainer.

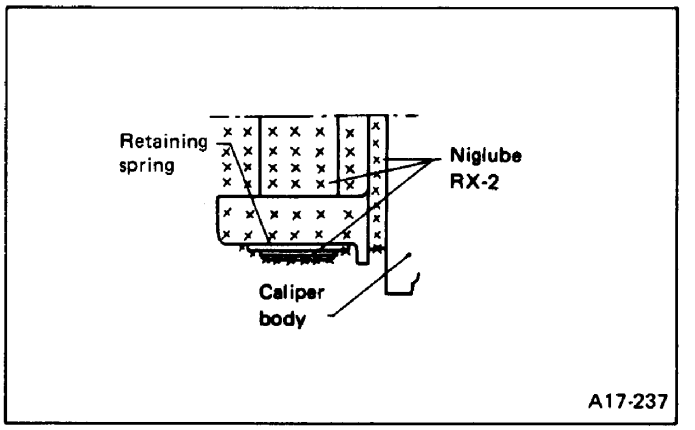


Fig. 66 Grease application

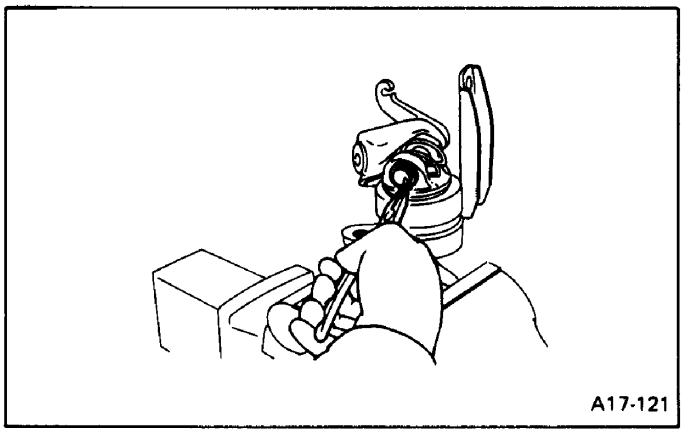


Fig. 67

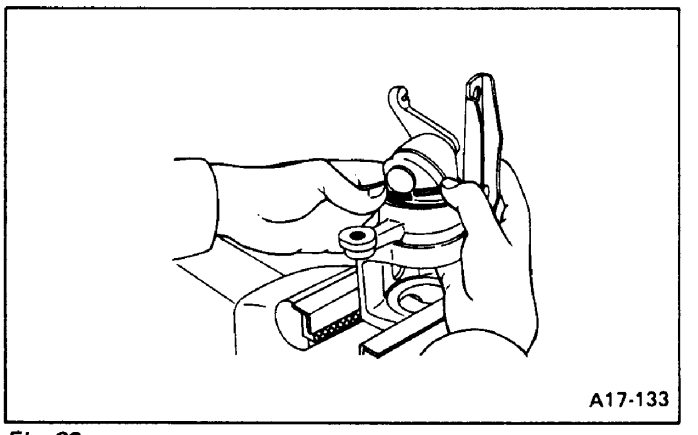


Fig. 68

7) Remove any foreign matter from the guide pin portion in caliper body. Fit guide pin boot. (Be careful not to scratch boot itself.)
After fitting, make sure that boot is not damaged.

Once the guide pin boot is removed, always replace it with a new one.

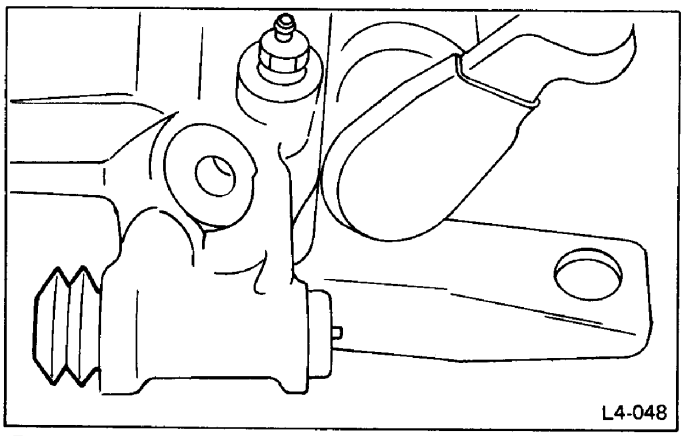


Fig. 69

8) Install lock pin boot to caliper body. Apply SILICON COMPOUND (725191050 or 003606010) to the inside (the sliding surface) of lock pin boot and to the boot-fitting grooves of sleeve. Then insert sleeve into lock pin boot.

Use new lock pin boot.

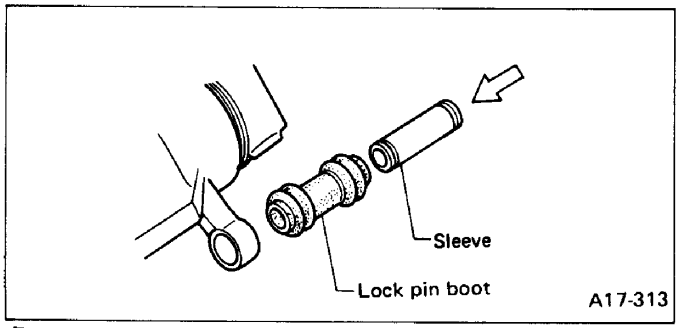


Fig. 70

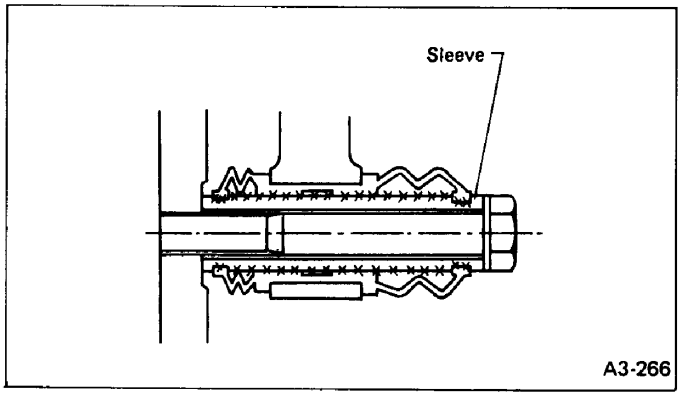


Fig. 71 Grease application to lock pin portion

9) Rotate piston until the notch at the head of piston is set to the specified position, and make sure that all parts are properly attached.
(For pushing back piston, refer to step 1) in "INSTALLATION" of "Replacement of Pad").
10) Install support to housing.

Torque (Support bolt):
49 – 69 N·m (5.0 – 7.0 kg-m, 36 – 51 ft-lb)

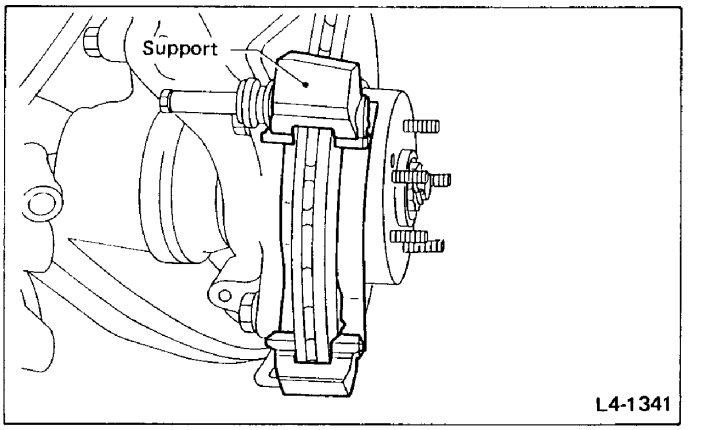


Fig. 72

11) Install pad clips properly.
12) Install outer pad and inner pad properly.

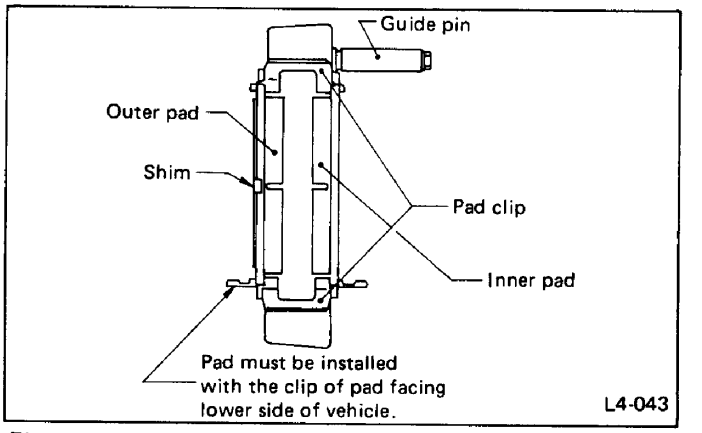


Fig. 73

13) Make sure that caliper body and support are properly coated with grease. Insert the support guide pin into the fitting hole in caliper body. Tighten lock pin to the specified torque.

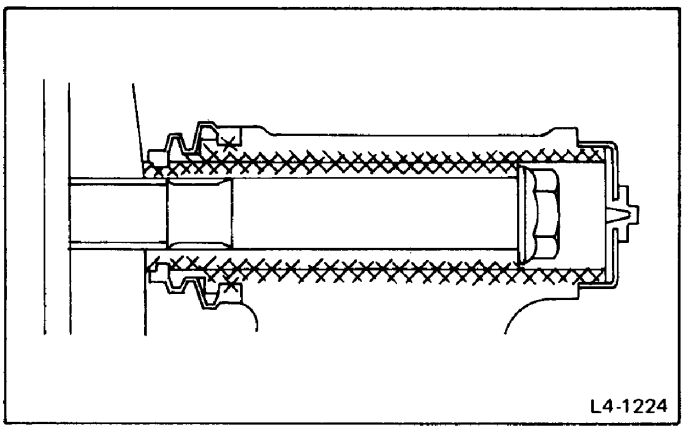


Fig. 74 Grease application to guide pin portion

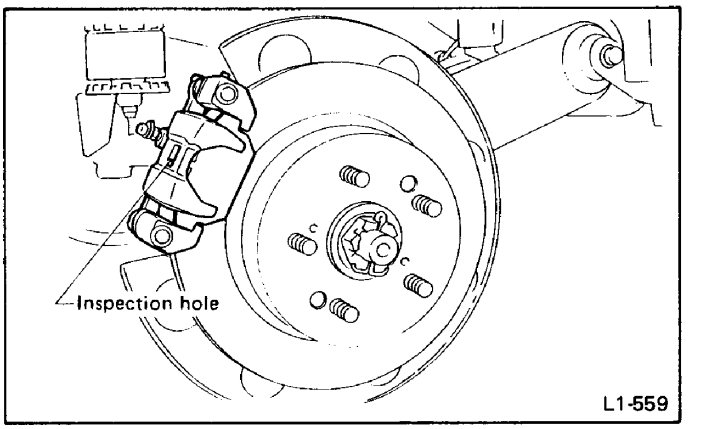


Fig. 75

Torque (Lock pin):
31 – 41 N·m (3.2 – 4.2 kg-m, 23 – 30 ft-lb)

a. Use only SILICON COMPOUND (725191050 or 003606010) grease for the guide pin and lock pin portions.
b. After assembling, make sure that boots are properly fitted in the grooves on the caliper body, guide pin sleeve and lock pin sleeve.
c. If the boot contains too much air and is expanded, press it to purge out some air.

14) Make sure that all parts are properly attached, then connect brake hose and hand brake cable.

Torque (Union bolt):
15 – 21 N·m (1.5 – 2.1 kg-m, 11 – 15 ft-lb)

Replace brake hose gaskets with new ones.

15) Bleed air from the brake system.

Torque (Air bleeder screw):
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

Rear Disc Brake

Replacement of Pad

The thickness of the pad can be visually inspected from the inspection hole of the caliper body.

REMOVAL

1) Remove the lower of the two bolts securing the caliper body to the support. (The upper bolt does not need to be removed.)

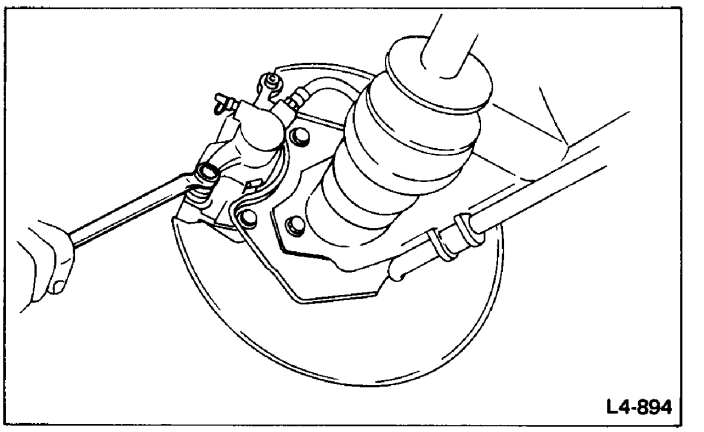


Fig. 76

2) Remove the pad and pad spring by turning up the caliper body using the upper pin as the pivot.

a. The brake pedal must not be depressed when the pad has been removed.
b. When replacing the pad, do not remove the caliper body, but just turn it enough for removal and installation.

INSPECTION

1) Inspection of pad
Check the pad thickness through the inspection hole and replace pads if not within specification.

Thickness of pad (including back metal):
Standard value
15.0 mm (0.591 in)
Service limit
Except XT6: 6.5 mm (0.256 in)
XT6: 8.0 mm (0.315 in)

Replace the pads of the right and left wheels at the same time. Also, replace the pad spring if deformed or strained.

2) Inspection of rotor
Check the rotor for wear and damage, and repair or replace if defective.

Thickness of rotor:
Standard value
10.0 mm (0.394 in)
Service limit
8.5 mm (0.335 in)

INSTALLATION

1) Clean the caliper body and piston end face, and push the piston in the caliper body.

When the piston is difficult to put in place, loosen the air bleeder, then push into place.

2) Install the pad spring taking care of its upper and lower sides. Then install the pad.

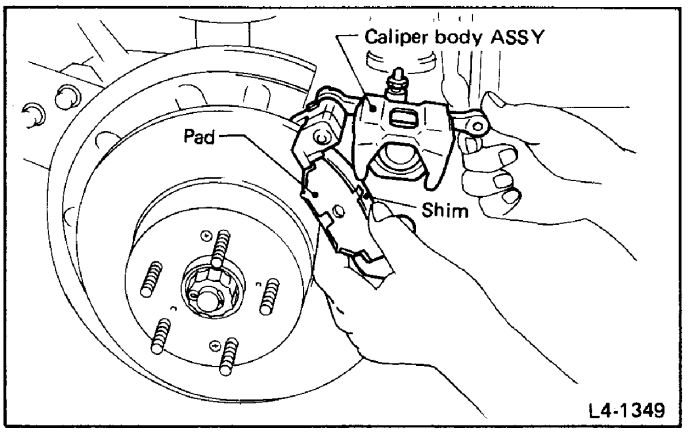


Fig. 77

3) Turn the caliper body back to the original position, and tighten the lower bolt.

Tightening torque:
22 – 31 N·m (2.2 – 3.2 kg-m, 16 – 23 ft-lb)

4) Depress the brake pedal several times with usual braking effort to adjust the relative position between the pad and rotor. Also, make sure that the pedal has a proper stroke.
5) Put back tires and rotate them several times. Then, wind a rope around the circumference of tire, and confirm that tire can be rotated with a force of less than 39 N (4 kg, 9 lb) at the outside diameter of tire.
If wheel bearing is worn or disc rotor is not exactly perpendicular to the counterpart, the surface of disc rotor runs out in the axial direction during rotation. This causes disc rotor to be pressed against lining, and rotational resistance increases.
When such trouble occurs, remove tire and measure the disc rotor runout. If the runout exceeds the limit, check the bearing and replace it if defective. If this does not correct the runout, replace rotor.

Disc rotor runout:
Limit
0.10 mm (0.0039 in)

Measure the disc rotor runout at a point less than 5 mm (0.20 in) from the outer periphery of the rotor.

Caliper Assembly

REMOVAL

1) Disconnect the brake hose from the caliper body.

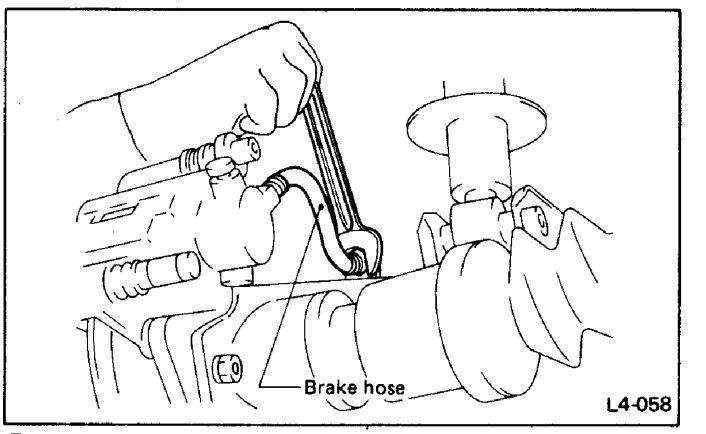


Fig. 78

2) Remove the caliper ASSY from trailing arm by loosening the mounting bolts.

DISASSEMBLY

1) Drain the brake fluid from the caliper body.
2) Remove the bolts and separate the support from the caliper body.
3) Pull out the pads and remove the pad springs.
4) Pull out the piston by blowing air into the caliper body.

Blow in air little by little to prevent the piston from jumping out.

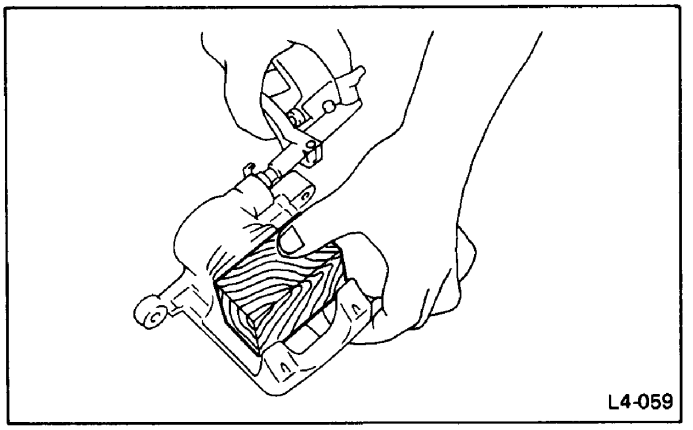


Fig. 79

5) After the piston has been removed, remove the boot and seal.
6) Remove the pins and boots from the support.

INSPECTION

Check all disassembled parts and replace if defective.
1) Check the inner wall of the cylinder for wear, rust and damage.
2) Check the support for wear, rust, cracks and other damage.

Rust and foreign material may be removed with a fine sandpaper. However, if they are excessive, replace the support.

3) Check the piston for wear, rust and damage.

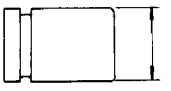
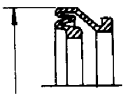
Do not use sandpaper to clean the piston's surface, because it is plated.

4) Check the pin and pin boot for damage.

Be sure to replace the piston seal and piston boot each time the caliper ASSY is disassembled.

ASSEMBLY

a. When replacing piston seal, make sure of the sizes of piston and seal.
b. When replacing piston boot, make sure of the sizes of piston and boot.

	Piston	Piston boot	Seal
Effective cylinder diameter mm (in)			
30.23 (1.1902)	30.2 mm (1.189 in) dia.	41.5 mm (1.634 in) dia.	30.2 mm (1.189 in) dia.

L4-1125

Fig. 80

1) Wash the inner wall of the cylinder with brake fluid. Then apply a small amount of SILICON COMPOUND (725191050 or 003606010) to the piston seal and fit it into the seal groove of the cylinder by hand.

Be careful not to twist the seal when fitting.

2) Apply brake fluid to piston.
3) Apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to the inner surface of piston boot.
4) Install the piston and piston boot to the caliper body. When doing this work, put the piston boot on the piston end in advance and fit the boot into the boot groove of the caliper body, as shown in figure.

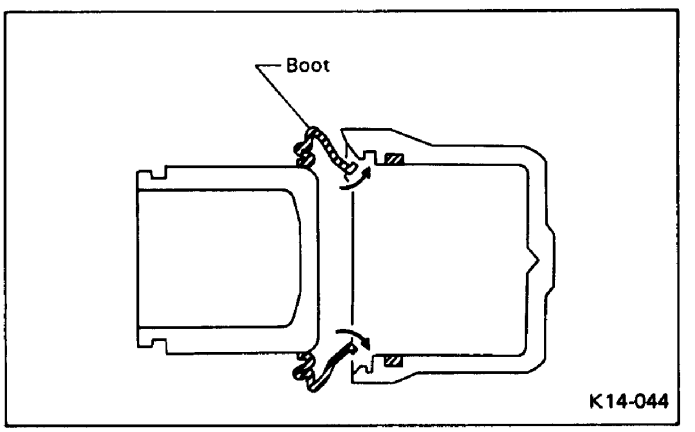


Fig. 81

5) Slowly put the piston into the caliper body, and fit the piston boot into the undercut of the piston just before the piston is completely inserted.

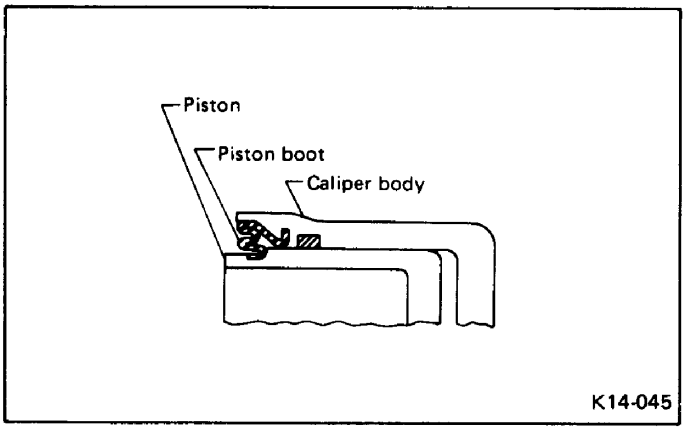


Fig. 82

6) Uniformly apply NIGLUBE RX-2 GREASE (725191040 or 003606000) to the whole sliding surface of the pin, and boot-fitting undercuts of the pin and the support. Then install the boot and pin to the support.

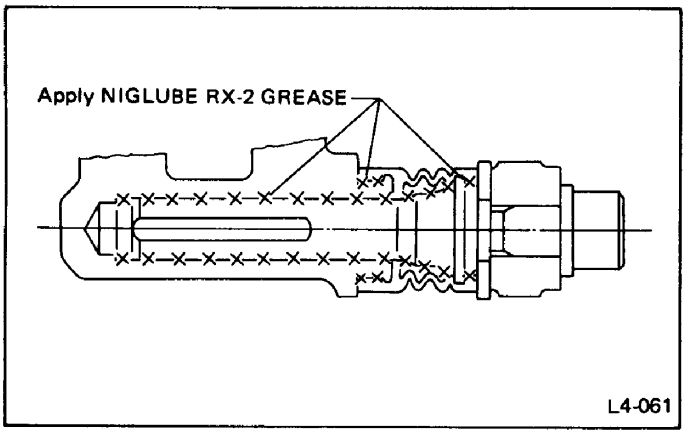


Fig. 83

7) Install the pad, and pad spring to the support. (Refer to sub-section, "Replacement of pad.")

After installing the pad, make sure that the pad is held down by spring force.

8) Install the support to caliper body.

INSTALLATION

1) Install caliper ASSY to trailing arm with bolts.

Bolt tightening torque:
46 – 58 N·m (4.7 – 5.9 kg-m, 34 – 43 ft-lb)

2) Connect the brake hose and bleed out air.

Tightening torque:
Brake hose
16 – 20 N·m (1.6 – 2.0 kg-m, 12 – 14 ft-lb)
Bleeder screw
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

The brake hose must be connected without any twist.

3) After the installation is completed, depress the brake pedal several times to see that the braking system is not leaking any fluid.

Rear Drum Brake (1800 cc FWD model)

REMOVAL

1) Remove brake drum, referring to chapter "WHEELS AND AXLES".
2) Unscrew brake pipe flare nut and disconnect brake pipe.

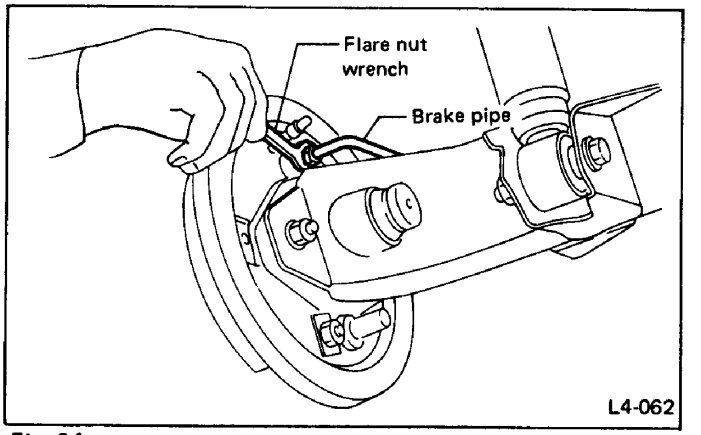
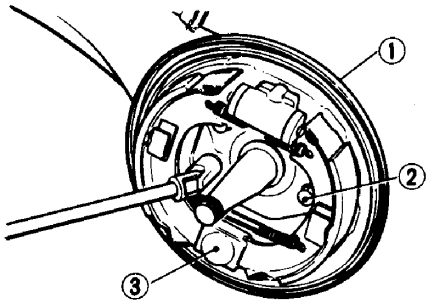


Fig. 84

3) Unscrew back plate installing bolts and remove brake ASSY. Take care so that spindle shaft and bearing are free from dust.



1 Back plate
2 Back plate installing bolt
3 Adjuster A17-351

Fig. 85

4) Remove shoe hold down spring with pliers.
5) Pull out shoe on anchor side.
6) Pull out shoe on cylinder side.

INSPECTION

Check the disassembled parts. Correct or replace if defective.
1) If the inside surface of brake drum is streaked, correct the surface. If it is unevenly worn, taperingly streaked, or the outside surface of brake drum is damaged, correct or replace it.

Drum inner diameter:
Standard
180 mm (7.09 in)
Service limit
182 mm (7.17 in)

2) Measure the lining thickness. If it exceeds the limit, replace shoe ASSY.

Lining thickness:
Standard
4.5 mm (0.177 in)
Service limit
1.5 mm (0.059 in)

Replace the leading and trailing shoes on the right and left brake ASSY at the same time.

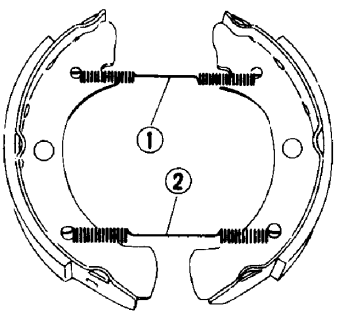
3) If the deformation or wear of back plate, shoe, etc. are notable, replace them.
4) When the shoe return spring tension is excessively weakened, replace it, taking care to identify upper and lower springs.
5) If grease has leaked from brake drum, replace oil seal or drum.
6) If drum bearing is abnormal or loose, replace it.
7) Strut ASSY (4WD only)
(1) Improper operation (due to worn meshing tooth surface or rust etc.) or damage.
(2) Wear on brake shoe contacting portion.

Never disassemble strut ASSY.

INSTALLATION (FWD)

1) Clean back plate and wheel cylinder.
2) Assemble shoe ASSY with springs. Pay attention to the shape and installing position of springs.

	Upper	Lower
Wire diameter	Thin	Thick
Installing position	On wheel cylinder and brake drum side.	On anchor and brake drum side.



1 Upper return spring
2 Lower return spring A17-352

Fig. 86

3) Apply brake grease to the portions shown by arrows in figure.

Brake grease:
Dow Corning Molykote No. 7439 (P/N 725191460)

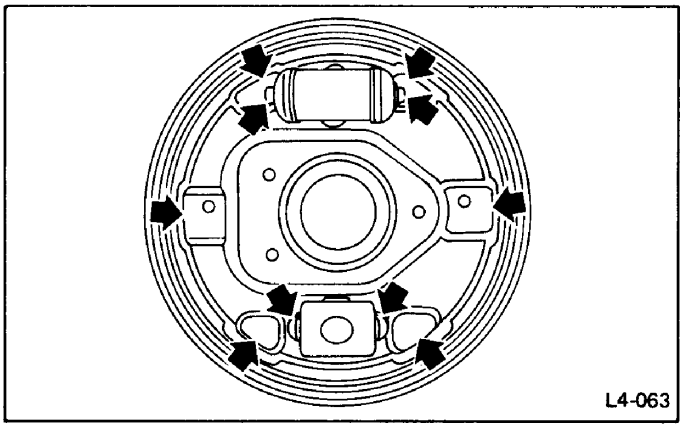


Fig. 87

4) Fit shoe ASSY first to wheel cylinder, then to anchor, and secure both shoes with shoe hold down springs.
5) Adjust the shoe diameter to about 179.8 mm (7.08 in) by turning the wedge. Measure the shoe diameter at three positions, upper, middle, and lower position.
6) Tighten temporarily brake pipe flare nut.
7) Fit spacer (seal) onto spindle and install back plate. In this case, center by using the outer circumference of spacer as a faucet joint. Insert three bolts from the back plate side.

Torque (Back plate):
46 – 58 N·m (4.7 – 5.9 kg-m, 34 – 43 ft-lb)

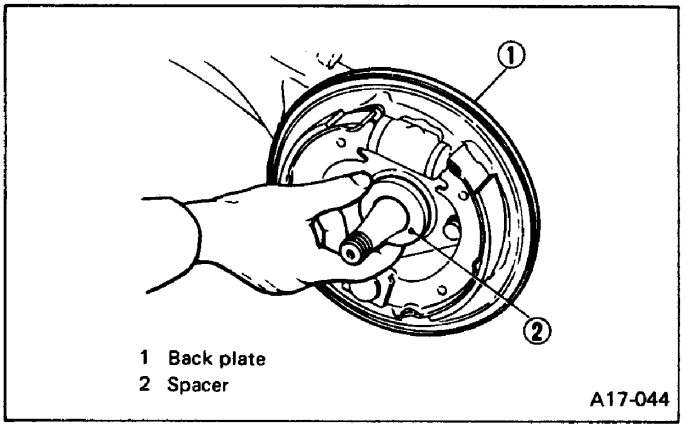


Fig. 88

Do not allow foreign matters to enter the brake ASSY.

8) Tighten brake pipe flare nut to the specified torque.

Torque:
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)

9) Install brake drum in parallel with brake ASSY.
10) Bleed air from the brake system.

Torque (Air bleeder screw):
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

CLEARANCE ADJUSTMENT (FWD)

The adjusting mechanism for the brake lining clearance is of a manual type.
Follow the undermentioned procedure.
1) Jack up vehicle body to release wheel from the ground.
2) Tighten the wedge fully until wheel ceases to rotate. Screwing up the wedge forces anchor to expand on either side by the wedge action and consequently shoes stick to drum.
3) Turn back the wedge for 180°, and the shoe clearance will be 0.1 to 0.15 mm (0.004 to 0.0059 in).
4) Be sure that tire and wheel can be rotated easily by hand.

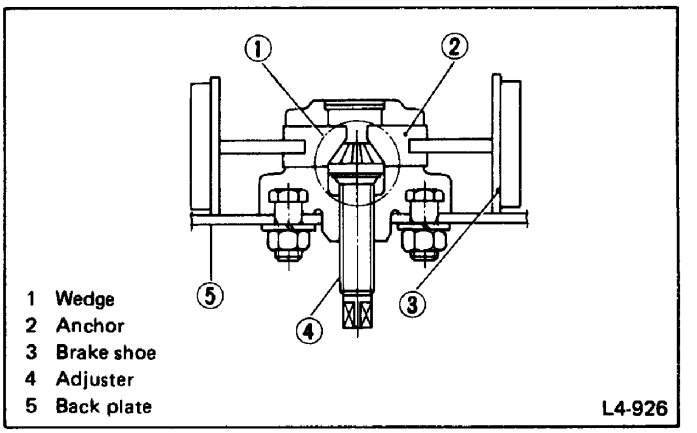


Fig. 89 Adjusting mechanism

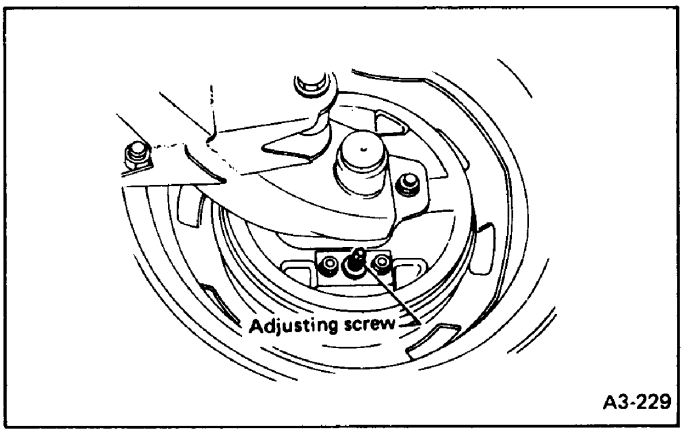


Fig. 90 Adjusting shoe clearance

Wheel Cylinder

DISASSEMBLY

1) Remove boot from cylinder.
2) Take out piston, which is piston ASSY with cup.

a. Wheel cylinder can be disassembled and inspected with it mounted on the back plate. Therefore it should not be removed except replacing the wheel cylinder ASSY etc.
b. When removing the cup from piston, be careful not to damage piston. And be sure to use the new cup.

INSPECTION

Inspect each parts after washing them with brake fluid, and replace if the following defects are found.

Do not use any cleaning solvent other than brake fluid.

1) Cup: Damage, fatigue or wear.
2) Cylinder and piston frictional surfaces: damage, uneven wear, corrosion or rust.
3) Spring: Rust or damage.
4) Boot: Damage.

ASSEMBLY

1) Assembly is the reverse order of disassembly.

a. When installing the cup, use the special tool ADAPTER, apply brake fluid to the frictional surface for smooth installation and pay attention to cup direction.
b. When replacing the repair kit, make sure that the sizes of cylinder and cup are the same as those which were replaced.
c. Special tools (ADAPTERs) are available in different sizes. Use only the tool of the correct size.

ADAPTER	
Part No.	Applicable size
925460000	17.46 mm (11/16 in)

d. While assembling, be careful to prevent any metal chip, dust or dirt from entering the wheel cylinder.

2) Apply rubber grease to the boot inside as shown in figure.

NIGLUBE RX-2 GREASE (P/N 003606000)

Never use brake grease.

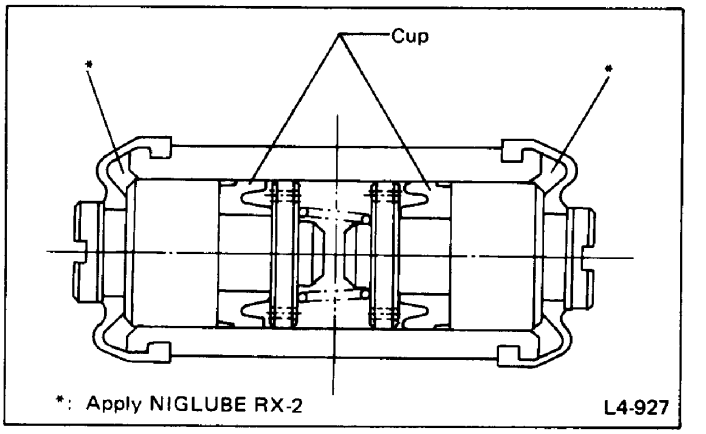


Fig. 91

Master Cylinder

REMOVAL

1) Thoroughly drain brake fluid from reservoir tank.
2) Disconnect fluid level indicator harness connector.
3) Remove brake pipes from master cylinder.
4) Remove master cylinder mounting nuts, and take out master cylinder from brake booster.

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

DISASSEMBLY

PRECAUTIONS FOR DISASSEMBLY

1) Remove mud and dirt from the surface of brake master cylinder.
2) Prepare tools necessary for disassembly operation, and arrange them neatly on work bench.
3) Clean work bench.
4) Tools for disassembly operation:
   - Phillips screwdriver 1
   - C-ring pliers 1

DISASSEMBLY PROCEDURE

1) Remove C-ring with C-ring pliers pushing in primary piston slightly.

Piston may jump out from master cylinder.

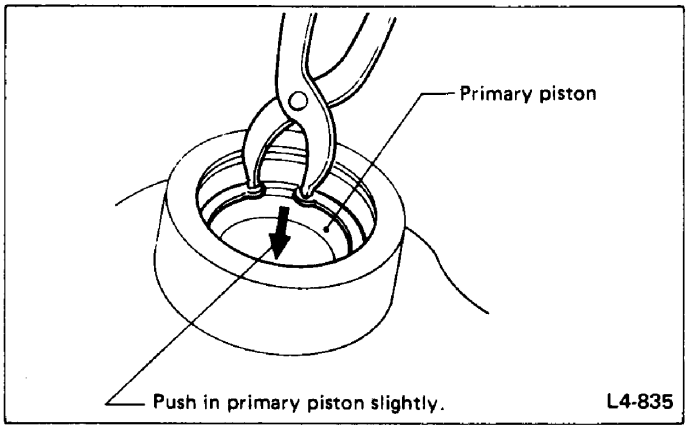


Fig. 92

2) Extract primary piston CP and secondary piston CP.

a. Do not disassemble the piston CP; otherwise, the spring set value may be changed.
b. Use brake fluid or methanol to wash inside wall of cylinder, pistons and piston cups. Be careful not to damage parts when washing. If methanol is used for washing, do not dip rubber parts, such as piston cups, in it for more than 30 seconds; otherwise, they may become swelled.

INSPECTION

If any damage, deformation, wear, swelling, rust, and other faults are found on the primary piston CP, secondary piston CP, secondary piston stopper, or gasket, replace the faulty part.

a. The primary and secondary pistons must be replaced as complete assemblies.
b. The service limit of the clearance between each piston and the master cylinder inner dia. is 0.11 mm (0.0043 in).
c. When handling parts, be extremely careful not to damage or scratch the parts, or let any foreign matter get on them.

ASSEMBLY

PRECAUTIONS FOR ASSEMBLING

1) When assembling, be sure to use recommended brake fluid.
2) Ensure that the inside wall of cylinder, pistons, and piston cups are free from dirt when assembling.
3) Be extremely careful not to damage, scratch, or dent cylinder inside wall, pistons, and piston cups.
4) Do not drop parts. Never attempt to use any part that has been dropped accidentally.

ASSEMBLING OPERATION

1) Assembling piston CP:
Apply recommended brake fluid to inside wall of cylinder, and to outer surface of piston CP, and install piston CPs carefully into cylinder.
2) Assembling C-ring:
With primary piston pushed in slightly, attach C-ring by using C-ring pliers.

After assembling, ensure that the C-ring is fitted securely in the ring groove.

INSTALLATION

To install the master cylinder to the body, reverse the sequence of removal procedure.

Tightening torque:
Master cylinder mounting nut
10 – 18 N·m (1.0 – 1.8 kg-m, 7 – 13 ft-lb)
Piping flare nut
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)

Be sure to use recommended brake fluid.

Brake Booster

REMOVAL

1) Remove the following parts at engine compartment.
   (1) Disconnect connector for brake fluid level indicator.
   (2) Remove brake pipes from master cylinder.
   (3) Remove master cylinder installing nuts.
   (4) Disconnect vacuum hose from brake booster.
2) Remove the following parts from the pedal bracket.
   (1) Snap pin and clevis pin.
   (2) Four brake booster installing nuts.
3) Remove brake booster while shunning brake pipes.

INSTALLATION

1) Mount brake booster in position.

Torque (Brake booster to toe board):
13 – 23 N·m (1.3 – 2.3 kg-m, 9 – 17 ft-lb)

2) Connect operating rod to brake pedal with clevis pin and snap pin.

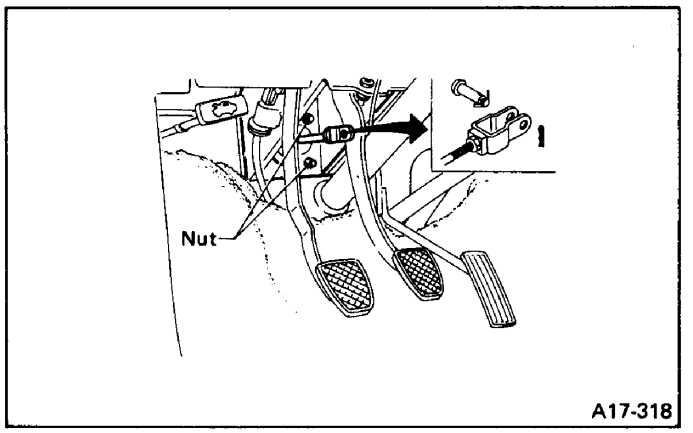


Fig. 93

3) Connect vacuum hose to brake booster.
4) Mount master cylinder onto brake booster.

Torque (Nut):
10 – 18 N·m (1.0 – 1.8 kg-m, 7 – 13 ft-lb)

5) Connect brake pipes to master cylinder.

Torque (Brake pipe flare nut):
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)

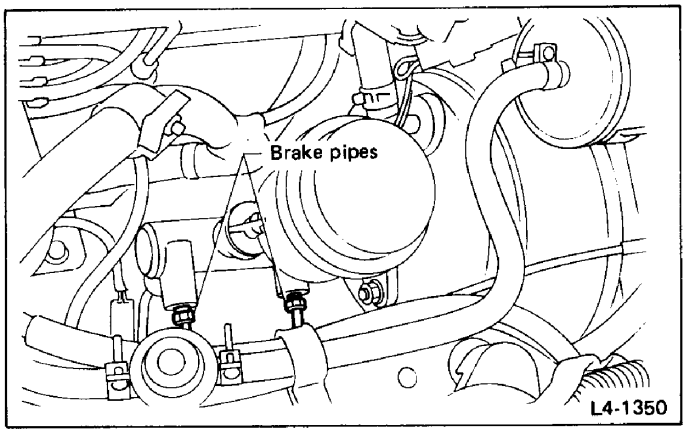


Fig. 94

6) Connect electric connector for brake fluid level indicator.
7) Adjust operating rod of brake booster as follows:
(1) Be sure engine is off. (No vacuum is applied to brake booster.)
(2) There should be play between brake booster clevis and pin at brake pedal installing portion.
(Depress brake pedal pad with a force of less than 10 N [1 kg, 2 lb] to a stroke of 0.5 to 2.5 mm [0.020 to 0.098 in].)

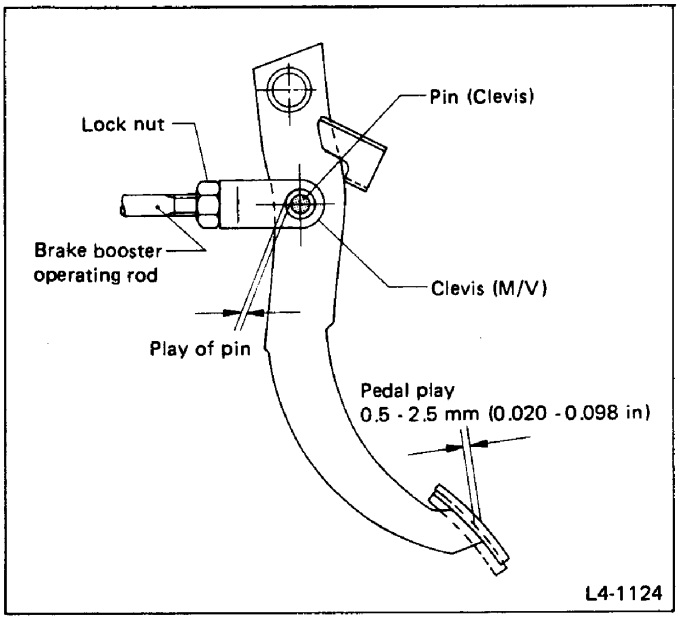


Fig. 95

(3) Depress the surface of brake pad by hand.
(4) If there is no free play between clevis pin and clevis, loosen lock nut for operating rod and adjust operating rod by turning in the direction that shortens it.

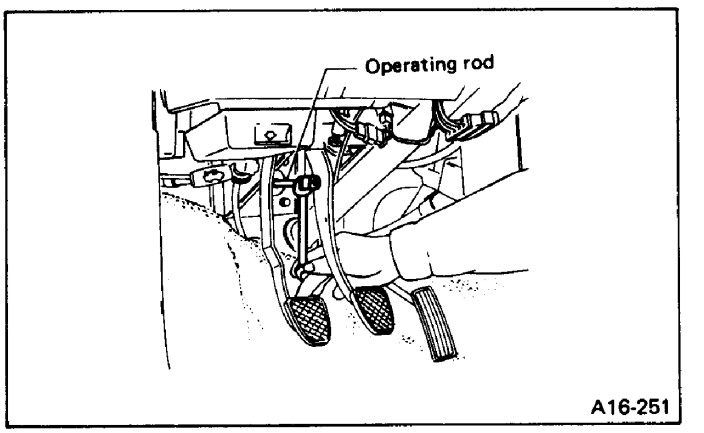


Fig. 96 Tightening lock nut on operating rod ASSY

8) Bleed air from brake system.

Torque (Air bleeder screw):
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

9) Conduct road tests to ensure brakes do not drag.

OPERATION CHECK

When checking operation, be sure to securely apply the hand brake.

CHECKING WITHOUT USING GAUGES

This method cannot determine the exact portion which has failed, but it can provide a rough understanding of the nature of the failure if checking is conducted in accordance with the following procedure.

Air tightness check

Start engine, and run it for 1 to 2 minutes, then turn it off. Depress brake pedal several times applying the same pedal force as that used in ordinary braking operations. The pedal stroke should be greatest on the 1st depression, and it should become smaller with each successive depression. If no change occurs in the pedal height while in a depressed state, brake booster is faulty.

In the event of defective operation, inspect the condition of the check valve and vacuum hose. Replace them if faulty and conduct the test again. If no improvement is observed, check precisely with gauges.

Operation check

1) With engine off, depress brake pedal several times applying the same pedal force and make sure that the pedal height does not vary with each depression of the pedal.
2) With brake pedal depressed, start engine.
3) As engine starts, brake pedal should move slightly toward the floor. If no change occurs in the pedal height, brake booster is faulty.

If faulty, check precisely with gauges.

Loaded air tightness check

Depress brake pedal while engine is running, and turn off engine while the pedal is still depressed. Keep the pedal depressed for 30 seconds; if no change occurs in the pedal height, brake booster is functioning normally; if the pedal height increases, it is faulty.

If faulty, check precisely with gauges.

CHECKING WITH GAUGES

Connect gauges as shown in figure. After bleeding air from pressure gauges, proceed to each check.

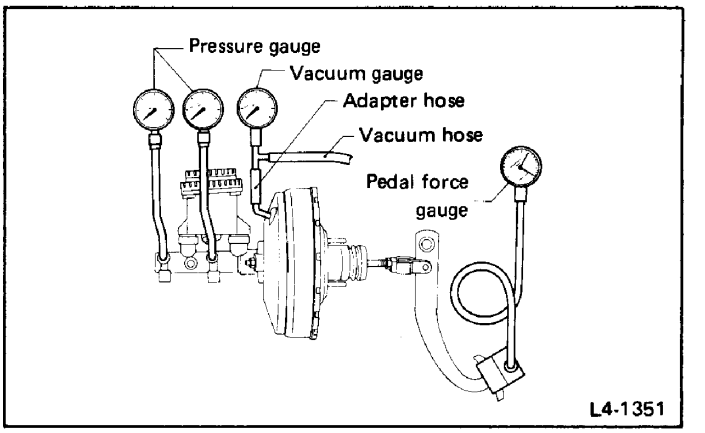


Fig. 97

Air tightness check

1) Start engine and keep it running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) is indicated on vacuum gauge. Do not depress brake pedal.
2) Stop engine and watch the gauge. If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly.
If defective, the cause may be one of those listed below.

- Check valve malfunction
- Leak from vacuum hose
- Leak from the shell jointed portion or stud bolt welded portion
- Damaged diaphragm
- Leak from valve body seal and bearing portion
- Leak from plate & seal ASSY portion
- Leak from poppet valve ASSY portion

Loaded air tightness check

1) Start engine and depress brake pedal with pedal force of 196 N (20 kg, 44 lb). Keep engine running until a vacuum of 66.7 kPa (500 mmHg, 19.69 inHg) is indicated on vacuum gauge while the pedal is still depressed.
2) Stop engine and watch vacuum gauge.
If the vacuum drop range is less than 3.3 kPa (25 mmHg, 0.98 inHg) within 15 seconds after stopping engine, brake booster is functioning properly.
If defective, refer to "Air tightness check" described above.

Lack of boosting action check

Turn off engine, and set the vacuum gauge reading at "0". Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed below.

Pedal force N (kg, lb)	Fluid pressure kPa (kg/cm², psi)
147 (15, 33)	392 (4, 57)
294 (30, 66)	Except XT6: 2,452 (25, 356) XT6: 1,569 (16, 228)

Boosting action check

Set the vacuum gauge reading at 66.7 kPa (500 mmHg, 19.69 inHg) by running engine. Then, check the fluid pressure when brake pedal is depressed. The pressure must be greater than the standard value listed below.

Pedal force N (kg, lb)	Fluid pressure kPa (kg/cm², psi)
147 (15, 33)	Except XT6: 4,904 (50, 711) XT6: 5,394 (55, 782)
294 (30, 66)	Except XT6: 6,375 (65, 924) XT6: 9,317 (95, 1,351)

HANDLING PRECAUTIONS

1) After protector has been removed from push-rod, do not turn the master cylinder side of brake booster downwards.
   (1) If the master cylinder side is turned downwards, push-rod may come loose by virtue of its own weight, and reaction disc may drop into brake booster.
   (2) Whether or not reaction disc has dropped can be determined by measuring the dimension "L".
   The projected amount "L" of pushrod should be as follows:

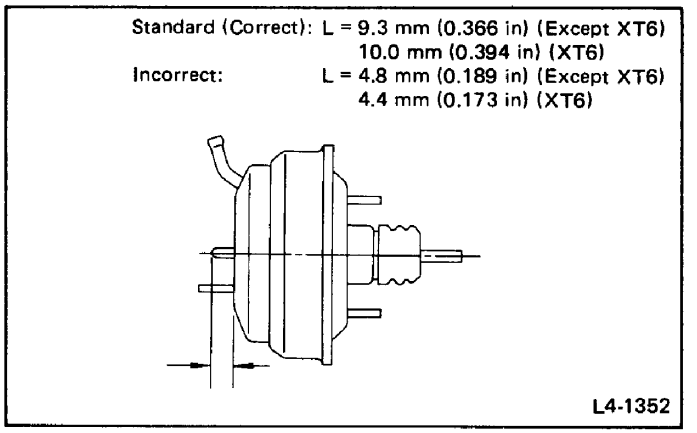


Fig. 98 Push rod projection

   (3) If protector is fitted correctly, reaction disc will not fall out.

2) Be careful not to drop brake booster. Brake booster should be discarded if it has been dropped.
3) Use special care when handling operating rod.
If excessive force is applied to operating rod, sufficient to cause a change in the angle in excess of ±3°, it may result in damage to the power piston cylinder.
4) Use care when placing brake booster on the floor.

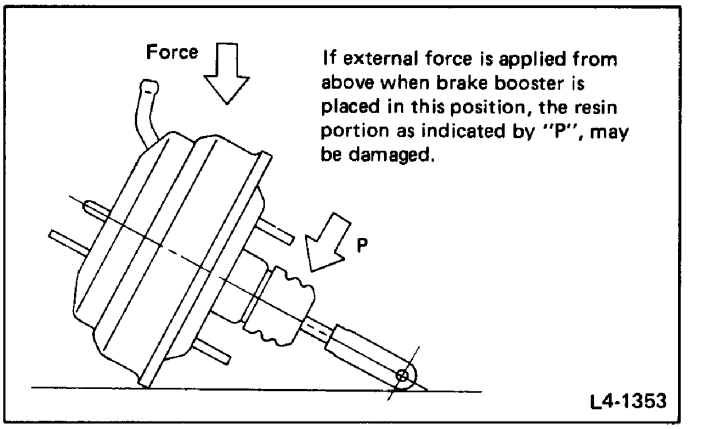


Fig. 99 Handling precaution

Brake Hose

REMOVAL

1) Separate brake pipe from brake hose.
(Always use flare nut wrench and be careful not to deform flare nut.)

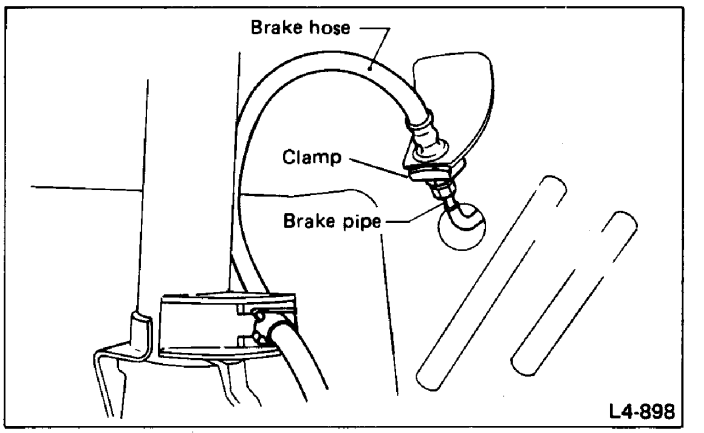


Fig. 100 Separating brake pipe

2) Pull out clamp to remove brake hose.

3) In case of front disc brake, remove clamp at strut and union bolt.

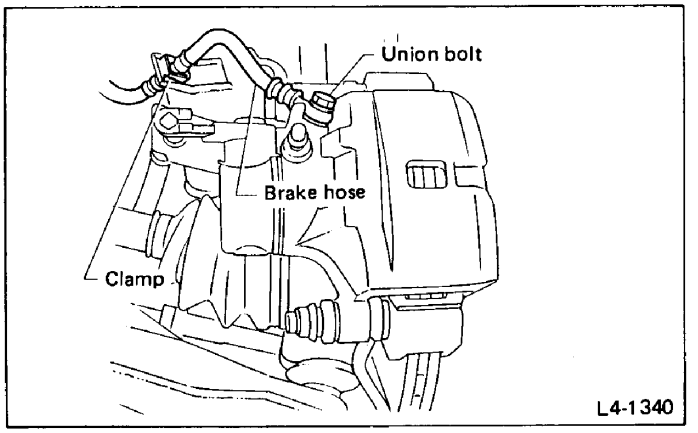


Fig. 101 Removing front brake hose

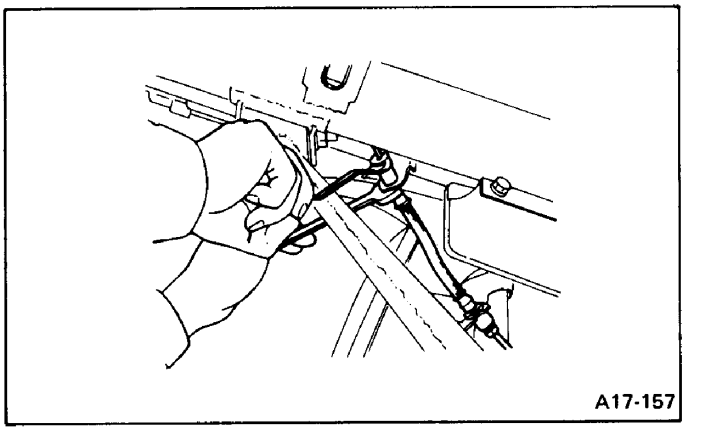


Fig. 102 Tightening flare nut

INSTALLATION

Front brake hose

1) Route end of brake hose (on caliper side) through hole in brake hose bracket at strut location.
2) Tighten end of brake hose at caliper using a union bolt.

Torque (Union bolt):
15 – 21 N·m (1.5 – 2.1 kg-m, 11 – 15 ft-lb)

3) Secure middle fitting of brake hose to bracket at strut location using a clamp.
4) Position disc in straight-forward direction and route brake hose through hole in bracket on wheel apron side. Be sure brake hose is not twisted.
5) Temporarily tighten flare nut to connect brake pipe and hose.
6) Fix brake hose with clamp at wheel apron bracket.
7) While holding hexagonal part of brake hose fitting with a wrench, tighten flare nut to the specified torque.

Torque (Brake pipe flare nut):
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)

8) Bleed air from the brake system.

Rear brake hose

1) Pass brake hose through the hole of bracket, and lightly tighten flare nut to connect brake pipe.
2) Insert clamp upward to fix brake hose.
3) Perform the same procedures as beforementioned in steps 7) and 8).

Proportioning Valve

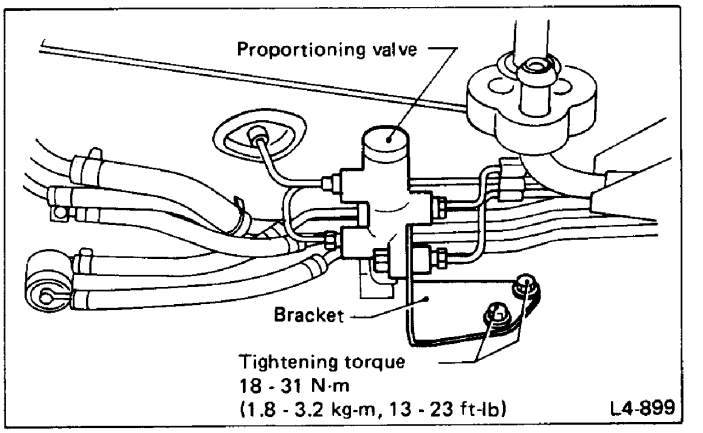


Fig. 103

INSPECTION

1) Install the oil pressure gauges to measure the master cylinder fluid pressure (front wheel brake fluid pressure) and rear wheel cylinder fluid pressure.
2) Bleed air from the oil pressure gauges.
3) Check the master cylinder fluid pressure and rear wheel cylinder fluid pressure.
The standard values are shown in figure.

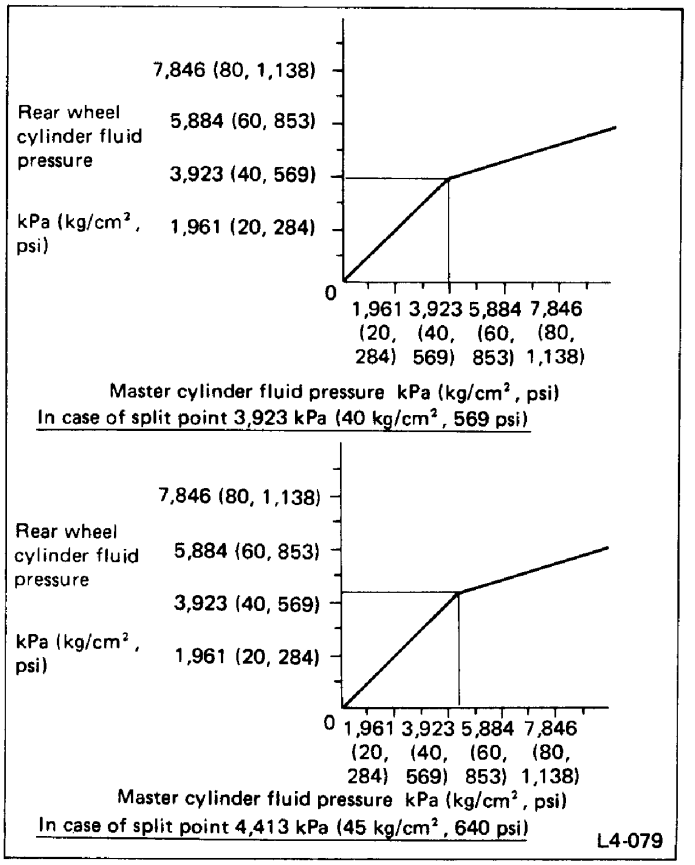


Fig. 104

REMOVAL

1) Remove brake pipe from proportioning valve at four places.
2) Remove proportioning valve from its bracket.

Do not disassemble or adjust the proportioning valve. (The proportioning valve must be replaced as an assembly.)

INSTALLATION

1) Install proportioning valve to bracket.
2) Connect brake pipes correctly to proportioning valve.
3) Bleed air, then check each joint of brake pipe for oil leaks.

Tightening torque:
Proportioning valve to brake pipe flare nut
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)
Proportioning valve to bracket
20.1 – 28.9 N·m
(2.05 – 2.95 kg-m, 14.8 – 21.3 ft-lb)

Hill-Holder

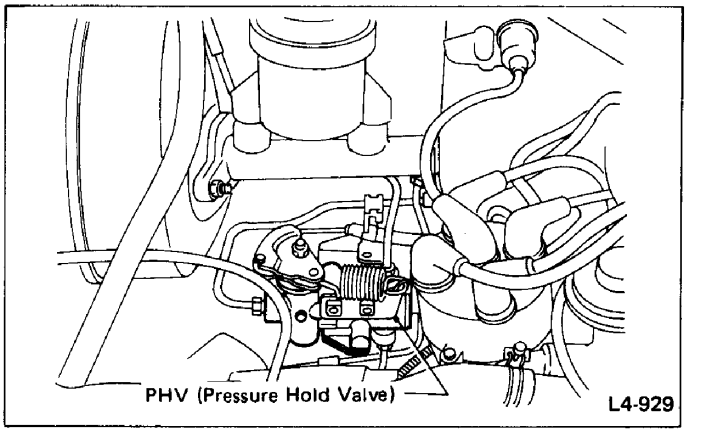


Fig. 105

REMOVAL

1) Drain brake fluid from reservoir on primary side of master cylinder.
2) Remove adjusting nut and cable clamp, and disconnect PHV cable from cable bracket on engine.
3) Detach PHV cable from clips.
4) Remove cable clamp, and disconnect PHV cable from PHV stay.

Carefully protect boots and inner cable from damage when disconnecting PHV cable.

5) Disconnect brake pipes from PHV.

a. Pay attention not to drop brake fluid onto body painting since it may dissolve paint.
b. Pay attention not to damage hexagonal head of flare nut by using pipe wrench without fail.

6) Detach PHV along with support from side frame.

Exercise utmost care to prevent foreign matter from entering into PHV when removing it.

INSPECTION

Check up removed parts as follows, and replace defective ones.
1) Check if boots of PHV cable are damaged or degraded, and if inner cable is damaged or corroded.
2) Check if return spring is worn out, damaged or corroded.

3) Confirm that rolling sound of ball is heard with PHV inclined and lever rotates smoothly.

CAUTION:
Never disassemble PHV. Replace entire PHV ASSY if necessary.

INSTALLATION

1) Assemble bracket with support of PHV.

Torque:
7 – 13 N·m (0.7 – 1.3 kg-m, 5.1 – 9.4 ft-lb)

2) Install PHV onto side frame.

Torque:
7 – 13 N·m (0.7 – 1.3 kg-m, 5.1 – 9.4 ft-lb)

3) Connect brake pipes to PHV.

Torque:
13 – 18 N·m (1.3 – 1.8 kg-m, 9 – 13 ft-lb)

Confirm that brake pipes are not deformed and/or damaged. Replace them with new ones if necessary.

4) Install PHV cable to PHV stay.

If cable clamp (and clips) is damaged, replace it with a new one.

5) Connect PHV cable with clips.

Avoid sharp bending of PHV cable as it may cause breakage.

6) Install PHV cable onto cable bracket on engine.

7) Apply grease to the following points.
- Hook portion of return spring
- Cable end portion of lever
- Cable end portion of clutch release fork

Grease:
SUNLIGHT 2 (P/N 003602010)

8) Be sure to bleed air from the system.

After replacing PHV cable or clutch cable with new one, operate clutch pedal about 30 times as a running-in operation prior to adjustment.

ADJUSTMENTS

1) Inspect free play of clutch pedal by depressing the pedal by hand. If it is out of the specified value, adjust it by turning adjusting nut on engine side end of clutch cable at release fork.

Standard of free play:
At clutch pedal
10 – 20 mm (0.39 – 0.79 in)
At center of cable on clutch release fork:
2WD: 2 – 3 mm (0.08 – 0.12 in)
4WD: 3 – 4 mm (0.12 – 0.16 in)

Torque:
Lock nut of clutch cable
5.4 – 9.3 N·m (0.55 – 0.95 kg-m, 4.0 – 6.9 ft-lb)
Lock nut of PHV cable
2.5 – 4.4 N·m (0.25 – 0.45 kg-m, 1.8 – 3.3 ft-lb)

2) Confirm stopping and starting performances by activating hill-holder on an uphill road of 3° or higher inclination.
(1) If vehicle does not stop;
Tighten adjust nut of PHV cable.
(2) If vehicle does not start properly;
- Case A – When hill-holder is released later than engagement of clutch pedal (Engine tends to stall.):
  Loosen adjust nut gradually until smooth starting is enabled.
- Case B – When hill-holder is released earlier than engagement of clutch pedal (Vehicle slips down slightly.):
  Tighten adjust nut so that hill-holder is released later than engagement of clutch pedal (status in Case A). Then make adjustment the same as in Case A.

CAUTION:
Whenever turning adjust nut, prevent PHV cable from revolving as shown in following figure.

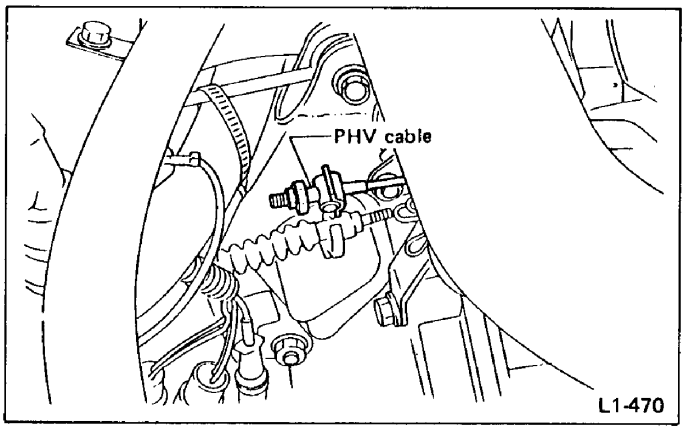


Fig. 106 Turning adjust nut for PHV cable

Parking (Hand) Brake

Parking (Hand) Brake Lever

REPLACEMENT

1) Remove parking brake cover.
2) Disconnect electric connector for parking brake switch.

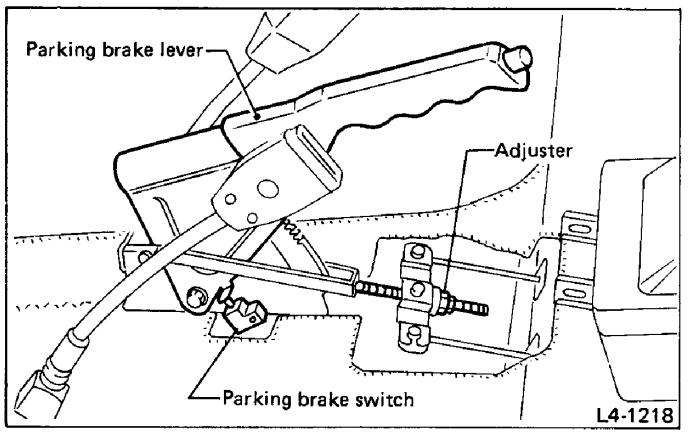


Fig. 107

3) Loosen parking brake adjuster, and remove inner cable end from equalizer.
4) Remove parking brake lever.
5) Install parking brake lever in the reverse order of removal.

Torque (Lever installing bolt):
10 – 18 N·m (1.0 – 1.8 kg-m, 7 – 13 ft-lb)

6) Adjust parking brake. (See "Adjustment of parking brake".)

Parking (Hand) Brake Cable

REPLACEMENT

1) Loosen front wheel nuts.
2) Jack up vehicle, and support it with safety stands (rigid racks).
3) Remove front tires and wheels.
4) Remove parking brake cover.
5) Loosen parking brake adjuster, then remove inner cable end from equalizer, and detach clamps.

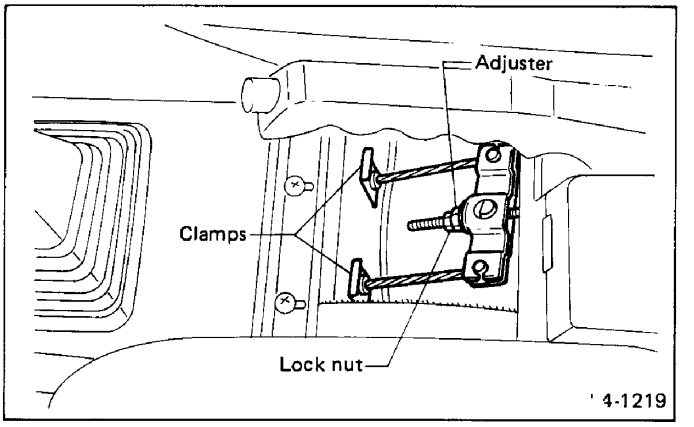


Fig. 108

6) Pull out parking brake cable clamp from caliper, and disconnect cable end.

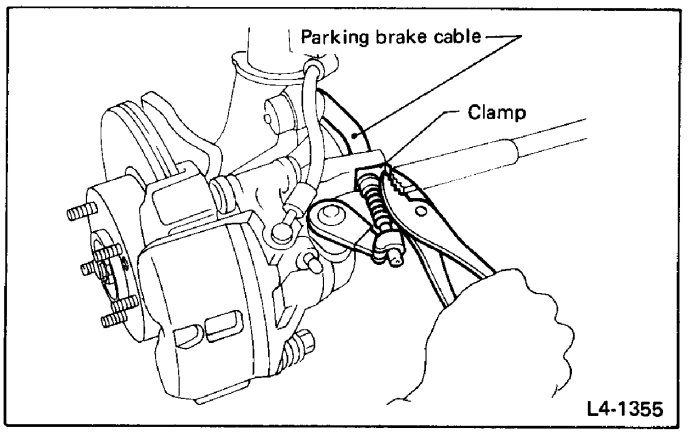


Fig. 109

7) Remove bolt and bracket from transverse link.
8) Remove bolt and clamp from leading bracket.

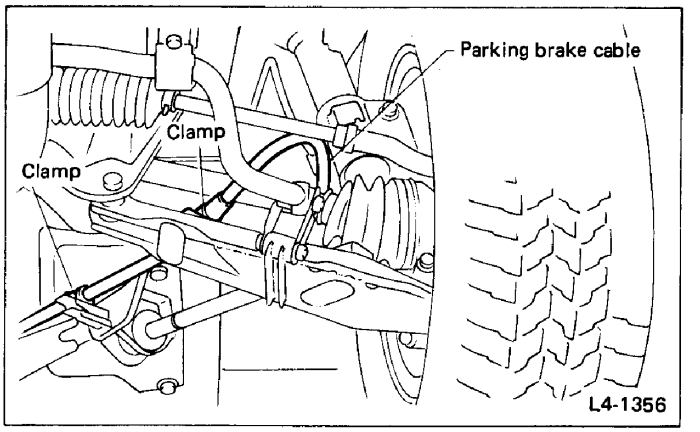


Fig. 110

9) Detach parking brake cable from cable guide at rear crossmember.

10) Remove cable ASSY from cabin by forcibly pulling it forward.
11) Install (new) parking brake ASSY in the reverse order of removal.

a. Be sure to pass cable through cable guide inside the tunnel.
b. Be sure to adjust the lever stroke.
c. Do not twist boot when attaching inner cable to lever of caliper body ASSY.
d. Be careful not to damage boot when driving clamp in.

Torque (Rear crossmember cable clamp):
10 – 16 N·m (1.0 – 1.6 kg-m, 7 – 12 ft-lb)
Torque (Bracket to transverse link):
10 – 16 N·m (1.0 – 1.6 kg-m, 7 – 12 ft-lb)

Adjustment of Parking (Hand) Brake

Before adjusting the hand brake, check the depressed height of brake pedal.
Make sure that the distance above is as specified, then perform the following operations.

Bleed air completely from the brake system before attempting the following operations.

1) Forcibly pull hand brake lever 3 to 5 times.
2) Adjust hand brake lever by turning adjuster until the play at the A portion is set at 0 to 0.5 mm (0 to 0.020 in), then confirm that the lever stroke is as specified.

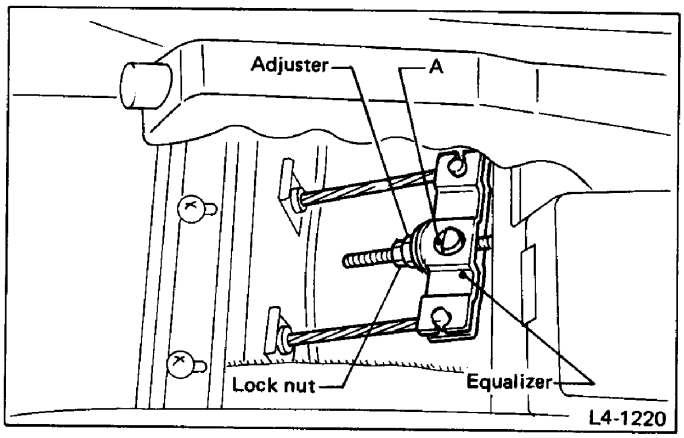


Fig. 111

Lever stroke:
3 to 4 notches when pulled
with a force of 245 N (25 kg, 55 lb)

Torque (Adjuster lock nut):
4.4 – 7.4 N·m (0.45 – 0.75 kg-m, 3.3 – 5.4 ft-lb)

Ensure that front brake is not dragging.

Brake Fluid Level Indicator

INSPECTION

1) Ensure that warning light will come on if brake fluid in reserve tank reduces to the following quantity.
(Check fluid level after starting engine.)

Reserve tank with level indicator:
Residual fluid quantity at light ON
Approx. 80 cm^3 (80 cc, 4.88 cu in)
Tank capacity
160 cm^3 (160 cc, 9.76 cu in)

2) Check float, etc. for deformation, and replace if necessary.

Air Bleeding

Bleed air out the front and rear brakes in the following manner.

General Rules for the Effective Bleeding

1) Start with the brakes (wheels) connecting to the secondary chamber of the master cylinder.
2) The time interval between two brake pedal operations (from the time when the pedal is released to the time when it is depressed another time) shall be approximately 3 seconds.
3) The air bleeder on each brake shall be released for 1 to 2 seconds.

Recommended Brake Fluid

FMVSS No. 116, fresh DOT3 or 4 brake fluid

Bleeding Procedure

a. The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
b. During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
c. Ensure also that the linings and pads are free from brake fluid.

1) Make sure that there is no leak from joints and connections of the brake system.
2) Fit one end of vinyl tube into the air bleeder and put the other end into a brake fluid container.
3) Slowly depress the brake pedal and keep it depressed. Then, open the air bleeder to discharge air together with the fluid.
Release air bleeder for 1 to 2 seconds.
Next, with the bleeder closed, slowly release the brake pedal.
Repeat these steps until there are no more air bubbles in the vinyl tube.
Allow 3 to 4 seconds between two brake pedal operations.

a. Brake pedal operation must be very slow.
b. Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.

4) Tighten air bleeder securely when no air bubbles are visible.

Air bleeder tightening torque:
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

5) Perform these steps for the brakes connecting to the secondary chamber of master cylinder, first, and then for the ones connecting to primary chamber. With all procedures completed, fully depress the brake pedal and keep it in that position for approximately 20 seconds to make sure that there is no leak evident in the entire system.

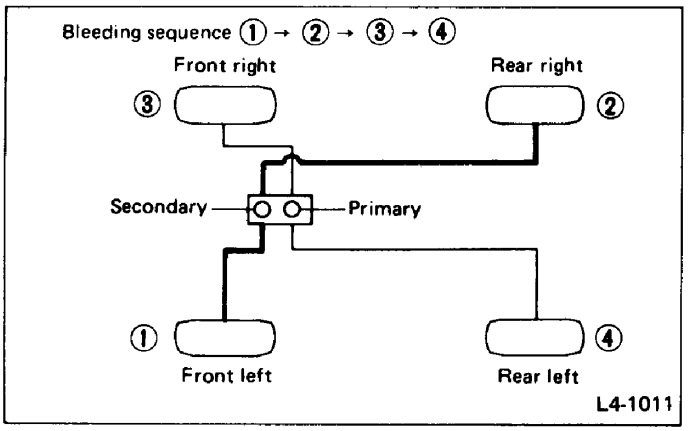


Fig. 112

6) If the pedal action is soft and spongy, or pedal travels excessively, the system must be bled of air again.
7) Add brake fluid to the required level (MAX level) of reserve tank.
8) As a final step, test run the vehicle at low speed and apply brakes relatively hard 2 to 3 times to ensure that brakes provide normal braking action on all four wheels without dragging and uneven braking.

Replacement of Brake Fluid

To always maintain the brake fluid characteristics, replace the brake fluid according to maintenance schedule or earlier than that when used in severe condition.

REPLACEMENT

1) Either jack up the front end of vehicle and place a safety stand under it, or drive vehicle onto the pit and then jack up the front end.
2) Remove both left and right front wheels.
3) Remove filler cap from brake fluid tank.
Install one end of a vinyl tube onto the air bleeder of front brake and insert the other end of the tube into a container to collect the brake fluid.
To drain fluid into container, open the air bleeder and repeatedly depress and release the brake pedal until a small amount of fluid remains in the reservoir tank.
Then tighten the bleeder screw.

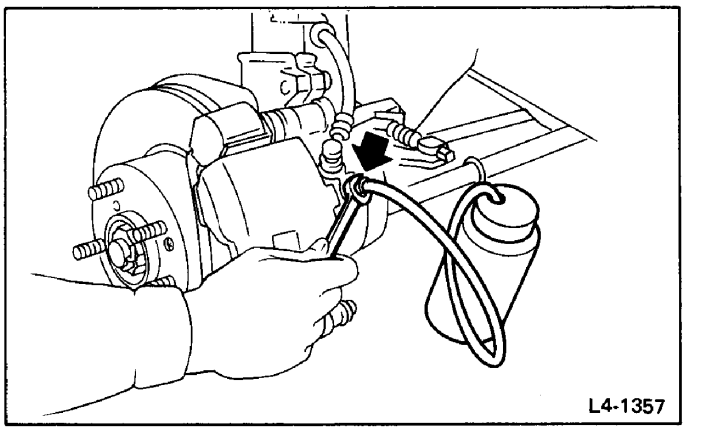


Fig. 113

a. The brake piping consists of a dual system, cross design. The piping on the primary side connects the right front brake and the rear left brake and the piping on the secondary side connects the left front brake and rear right brake.
b. For convenience and safety, it is advisable to have two men working.
c. Be careful not to spill brake fluid onto the painted surface.
d. Discard the drained brake fluid and do not reuse it.

4) Refill reservoir tank with recommended brake fluid.

Recommended brake fluid:
FMVSS No. 116, fresh DOT3 or 4 brake fluid

a. Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
b. Be careful not to allow dirt or dust to get into the reservoir tank.
c. Use fresh DOT3 or 4 brake fluid when replacing or refilling the fluid.
d. Always check to be sure a small amount of brake fluid is in the tank while changing brake fluid.
e. The amount of brake fluid required is approximately 270 mℓ (9.1 US fl oz, 9.5 Imp fl oz) for total brake system.
f. Bleed air according to illustrated sequence.

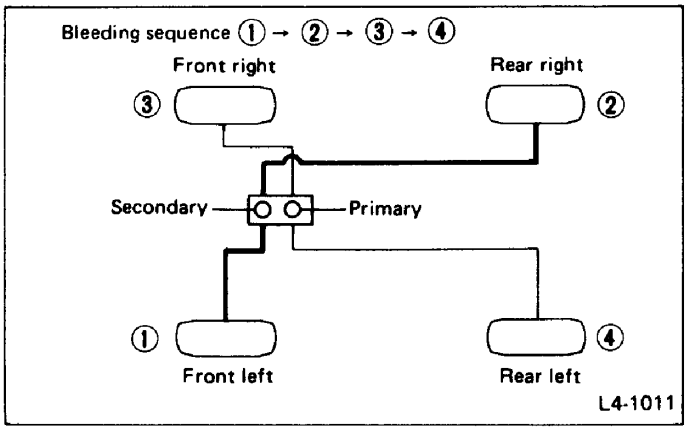


Fig. 114

5) Instruct your co-worker to depress the brake pedal slowly two or three times and then hold it depressed.
6) Loosen bleeder screw approximately 1/4 turn until a small amount of brake fluid drains into container, and then quickly tighten screw.
7) Repeat steps 5) and 6) above until there are no air bubbles in drained brake fluid and new fluid flows through vinyl tube.

Add brake fluid as necessary while performing the air bleed operation, in order to prevent the tank from running short of brake fluid.

8) After completing the bleeding operation, hold brake pedal depressed and tighten screw and install bleeder cap.

Tightening torque (Bleeder screw):
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

9) Bleed air from each wheel cylinder using the same procedures as described in steps 5) through 8) above.

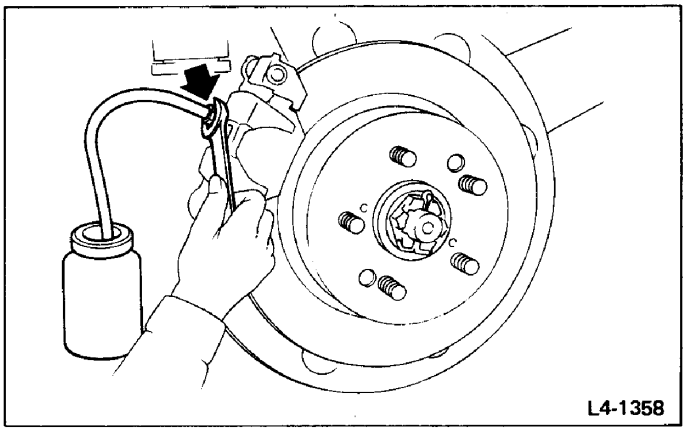


Fig. 115

10) Depress brake pedal with a force of approximately 294 N (30 kg, 66 lb) and hold it there for approximately 20 seconds. At this time check pedal to see if it shows any unusual movement.
Visually inspect bleeder screws and brake pipe joints to make sure that there is no fluid leakage.
11) Install wheels, and drive car for a short distance between 2 to 3 km (1 to 2 miles) to make sure that brakes are operating properly.

TROUBLESHOOTING

Entire Brake System

Trouble and possible cause	Remedy
1. Insufficient braking	
(1) Oil leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
(2) Entry of air into the hydraulic mechanism	Bleed the air.
(3) Excessively wide shoe clearance	Adjust the clearance.
(4) Wear, deteriorated surface material, adhering water or oil on the lining	Replace, grind or clean.
(5) Improper operation of master cylinder, wheel cylinder, disc caliper, brake booster or check valve	Correct or replace.
2. Unstable or uneven braking	
(1) Oil on the lining, drum	Eliminate cause of oil leakage, clean, or replace.
(2) Oil on the pad, rotor	Eliminate cause of oil leakage, clean, or replace.
(3) Drum or rotor eccentricity	Correct or replace the drum or rotor.
(4) Worn brake drum, or damage to the drum caused by sand	Correct by grinding, or replace.
(5) Improper lining or pad contact, deteriorated surface material, improper inferior material, or wear	Correct by grinding, or replace.
(6) Deformed back plate	Correct or replace.
(7) Loosened back plate or the support installing bolts	Retighten.
(8) Loosened rear wheel bearing	Retighten to normal tightening torque or replace.
(9) Trouble in the hydraulic system	Replace the cylinder, brake pipe or hose.
(10) Uneven effect of the hand brake	Check, adjust, or replace the front brake and cable system.
3. Excessive pedal stroke	
(1) Entry of air into the hydraulic mechanism	Bleed the air.
(2) Excessive play in the master cylinder push rod	Adjust.
(3) Oil leakage from the hydraulic mechanism	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
(4) Improperly adjusted shoe clearance	Adjust.
(5) Improper lining contact or worn lining	Correct or replace.
(6) Improper pad contact or worn pad	Correct or replace.

Trouble and possible cause	Remedy
4. Brake dragging or improper brake return	
(1) Insufficient pedal play	Adjust play.
(2) Improper master cylinder return	Clean or replace the cylinder.
(3) Clogged hydraulic system	Replace.
(4) Improper return or adjustment of hand brake	Correct or adjust.
(5) Weakened spring tension or breakage of shoe return spring	Replace the spring.
(6) Excessively narrow shoe clearance	Adjust the clearance.
(7) Improper wheel cylinder operation	Correct or replace.
(8) Improperly adjusted rear wheel bearing	Adjust or replace.
5. Brake noise (1) (creak sound)	
(1) Hardened or deteriorated lining or pad	Replace the shoe ASSY or pad.
(2) Worn lining or pad	Replace the shoe ASSY or pad.
(3) Loosened back plate or the support installing bolts	Retighten.
(4) Loose rear wheel bearing	Retighten to normal tightening torque.
(5) Dirty drum or rotor	Clean the drum or rotor, or clean and replace the brake ASSY.
6. Brake noise (2) (hissing sound)	
(1) Worn lining or pad	Replace the shoe ASSY or pad.
(2) Improperly installed shoe or pad	Correct or replace the shoe ASSY or pad.
(3) Loose or bent drum or rotor	Retighten or replace.
7. Brake noise (3) (click sound)	
In the case of the disc brake.	
(1) Excessively worn pad or the support	Replace the pad or the support.
In the case of the drum brake.	
(1) Excessively worn shoe ridge	Replace the back plate.
(2) Excessively worn wheel cylinder piston	Replace the wheel cylinder ASSY.
(3) Lack of oil on the shoe ridge surface and anchor	Add more grease.

Hill-Holder

Trouble and possible cause	Remedy
1. Counterforce of clutch pedal is too strong	
(1) PHV cable is damaged or does not operate properly	Repair or replace.
(2) Lever of PHV is defective	Replace entire PHV ASSY.
(3) Clutch system is anomalous	Refer to "Clutch and pedal cable system".
2. Vehicle does not stop on uphill road of 3° or higher inclination	
(1) Front side of vehicle is lowered	Refer to "Suspension".
(2) PHV cable is broken	Replace.
(3) Play of clutch is excessive	Adjust.
(4) PHV cable is elongated	Adjust.
(5) Sealing of PHV is poor	Replace entire PHV ASSY.
3. Shock is felt when starting	
(1) Poor adjustment of starting performance	Adjust.
(2) When depressing the brake pedal strongly:	(The stronger brake pedal depressing force, the later hill holder releasing.)
(3) When starting on flat road after stopping reverse movement:	(Because hill holder is activated.)
4. Vehicle slips down when starting	
(1) PHV cable is elongated	Adjust.
(2) Clutch facing is worn out	Adjust or replace.
(3) Bracket (cable) or stay (PHV) is deformed	Repair or replace.
5. Vehicle cannot start after stoppage	
(1) Return spring is fatigued or broken	Replace.
(2) PHV lever won't return	Replace entire PHV ASSY.
(3) When intentionally depressing brake pedal strongly:	[When the brake pedal is depressed by a force of 1,177 N (120 kg, 265 lb) or more.]
6. Abnormal sound is generated upon releasing brake pedal when stopping	
Rotor and pad, drum and lining matched with each other due to inadequate depressing force to brake pedal	(Abnormal sound is not generated when depressing brake pedal a little stronger.)

Trouble and possible cause	Remedy
7. Abnormal sound is generated when operating clutch pedal	
(1) Grease is inadequate for the hook of return spring and sliding portion of PHV cable end	Apply grease.
(2) When releasing after maintaining high fluid pressure:	(Flowing sound of fluid when releasing high fluid pressure.)
(3) Clutch system is anomalous	Refer to "Clutch and pedal cable system".

CAUTION:
a. Description in parentheses is a characteristic of hill-holder and does not indicate abnormality.
Depressing force required for clutch pedal equipped to hill-holder specifications is 20 to 29 N (2 to 3 kg, 4 to 7 lb) larger than the conventional specifications, which does not constitute abnormality.
b. When vehicle cannot travel (brake cannot be released) because return spring is broken, remove adjust nut, disconnect clutch and PHV, and then return PHV lever to release the brake. (Be sure to apply the parking brake before starting this operation.)
c. The hill-holder may not be activated on a slope of an extremely small inclination. If you want to correct it, insert a shim in between the side frame and support, thereby raising the front of PHV.
When inserting a shim, be sure to confirm stopping status on a slope whenever inserting a single shim. It is recommendable to avoid raising front of PHV excessively. Never insert 2 or more shims at a time.

Part Number	Part Name
725807000	Shim

[Thickness of shim is 0.6 mm (0.024 in), and one shim increases an angle of 0.5°.]

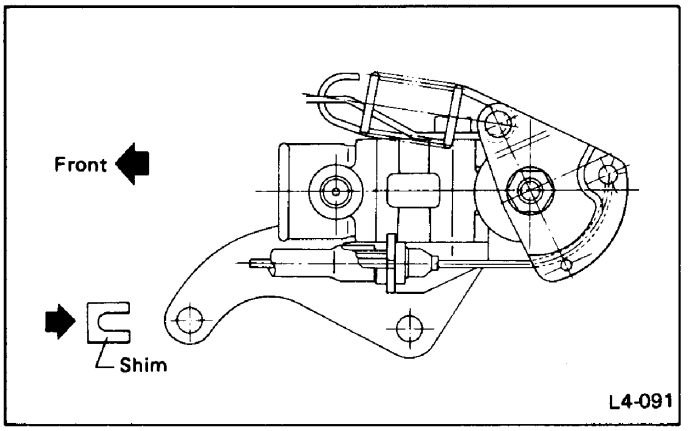


Fig. 116 Inserting shim