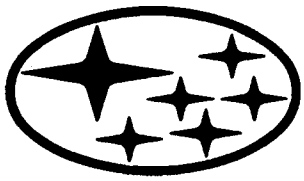
SUBARU

SVX

1992

Precaution for Supplemental Restraint System "Airbag"
The Supplemental Restraint System "Airbag" helps to reduce the risk or severity of injury to the driver in a frontal collision.
The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control unit, warning light, wiring harness and spiral cable.
Information necessary to service the safety is included in the "5-5. SUPPLEMENTAL RESTRAINT SYSTEM" of this Service Manual.
WARNING:
- To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SUBARU dealer.
- Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.
- All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System "Airbag".



M MECHANISM AND FUNCTION

1. Disc Brake

A: OUTLINE

The front brakes are 2-pot piston, 16" ventilated discs which feature high heat dissipation and superb braking stability.
The rear brakes are 15" disc which feature heat dissipation and superb braking stability.
In addition, the disc brake quickly restores the original braking performance even when wet.
The brake disc, which is externally mounted, is secured together with the disc wheel using the hub bolts, to facilitate removal or installation when servicing the vehicle.
The outer brake pad is provided with an indicator which indicates pad wear limits.

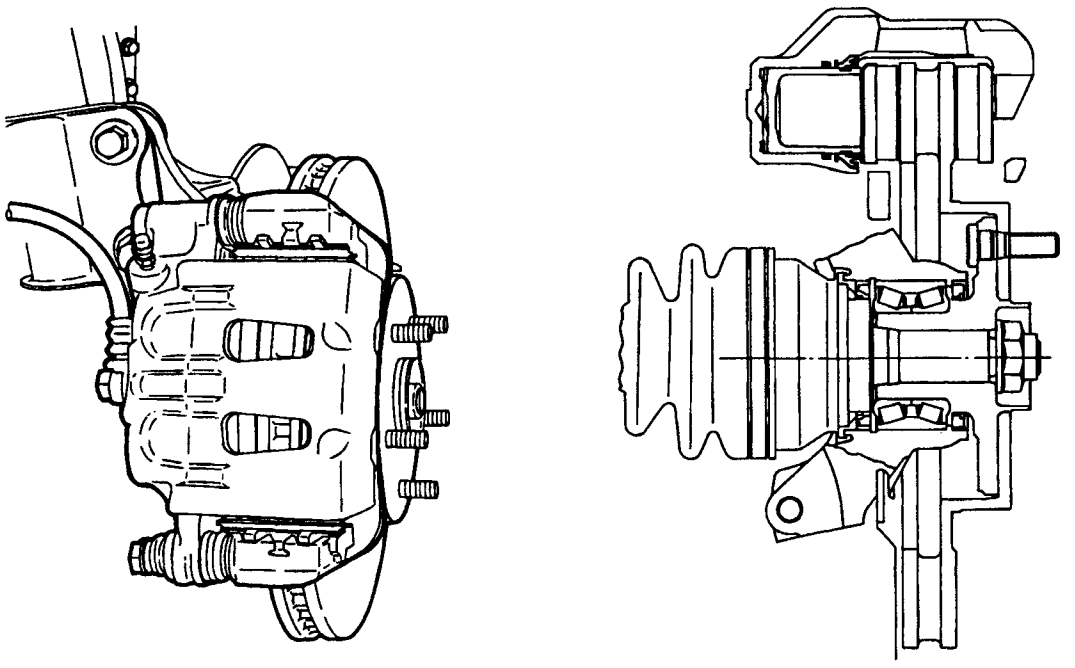


Fig. 1

B: DESCRIPTION OF BRAKE PADS

1. PAD WEAR INDICATOR

A wear indicator is provided on the outer disc brake pads. When 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 makes a squeaking sound as the wheel rotates.
This indicates that the pad needs to be replaced.

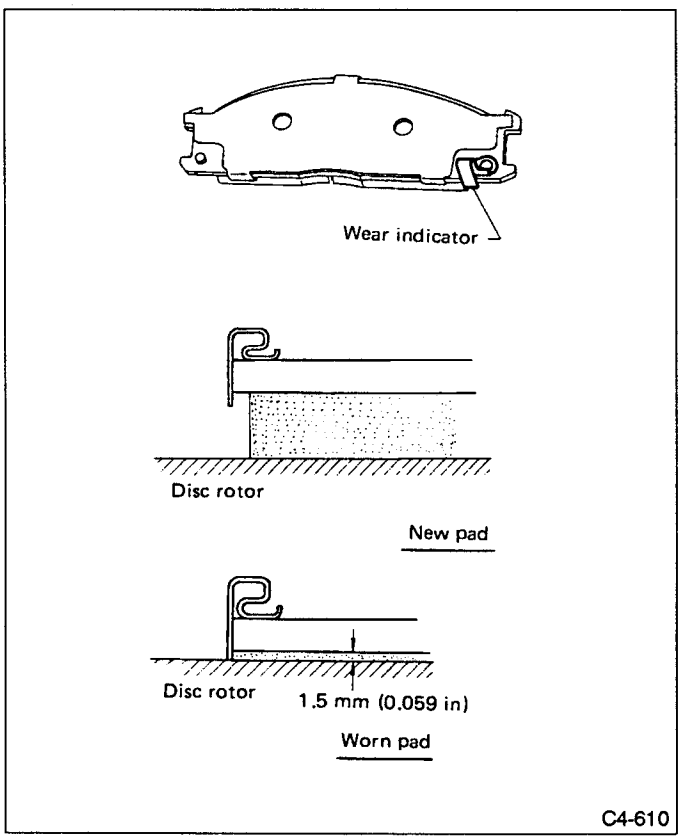


Fig. 2

2. FRICTIONAL MATERIAL OF BRAKE PADS

Frictional brake pad materials do not contain asbestos and are not harmful.

M MECHANISM AND FUNCTION

2. Master Cylinder

A: FUNCTION

1) A sealed reservoir tank is adopted to extend the service life of the brake fluid.
2) The fluid level indicator is built into the reservoir tank for easy and correct monitoring of the fluid level when adding brake fluid.

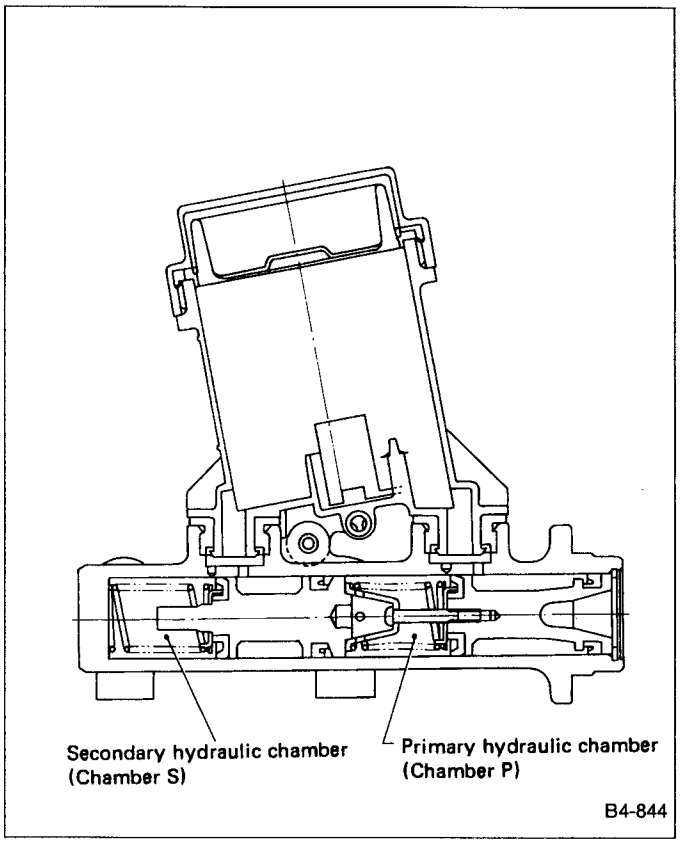


Fig. 1

1. BRAKE FLUID LEVEL INDICATOR

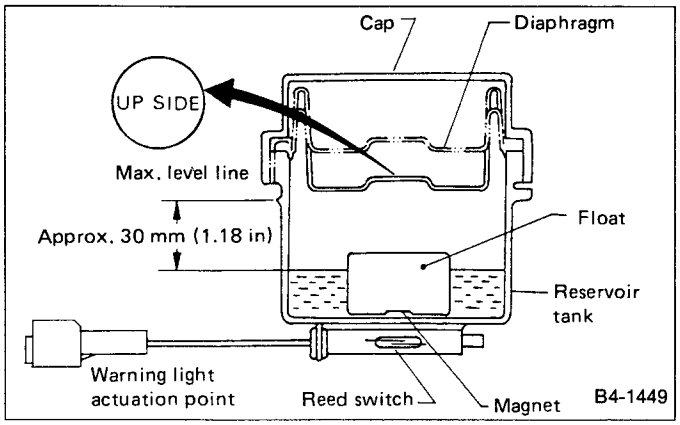


Fig. 2

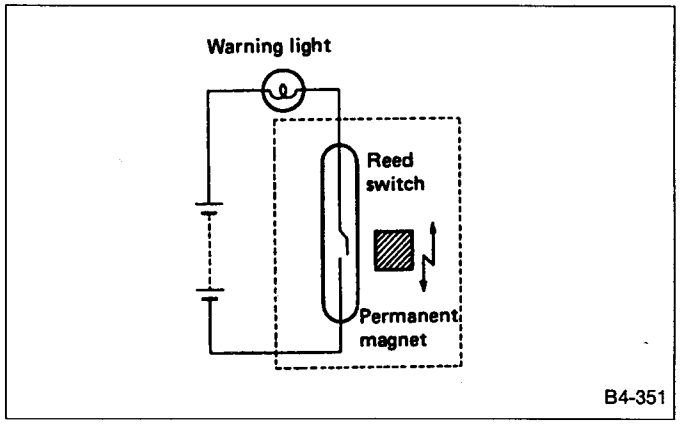


Fig. 3

Under normal conditions, the float remains above the reed switch, and the magnetic force from the permanent magnet in the float is unable to activate it. 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. 30 mm (1.18 in) below the MAX level line], the reed switch will be activated by the permanent magnet, closing 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.

3. Brake Booster

A: GENERAL

The brake booster is a tandem type that utilizes two small diameter diaphragms to provide high brake boosting effects.

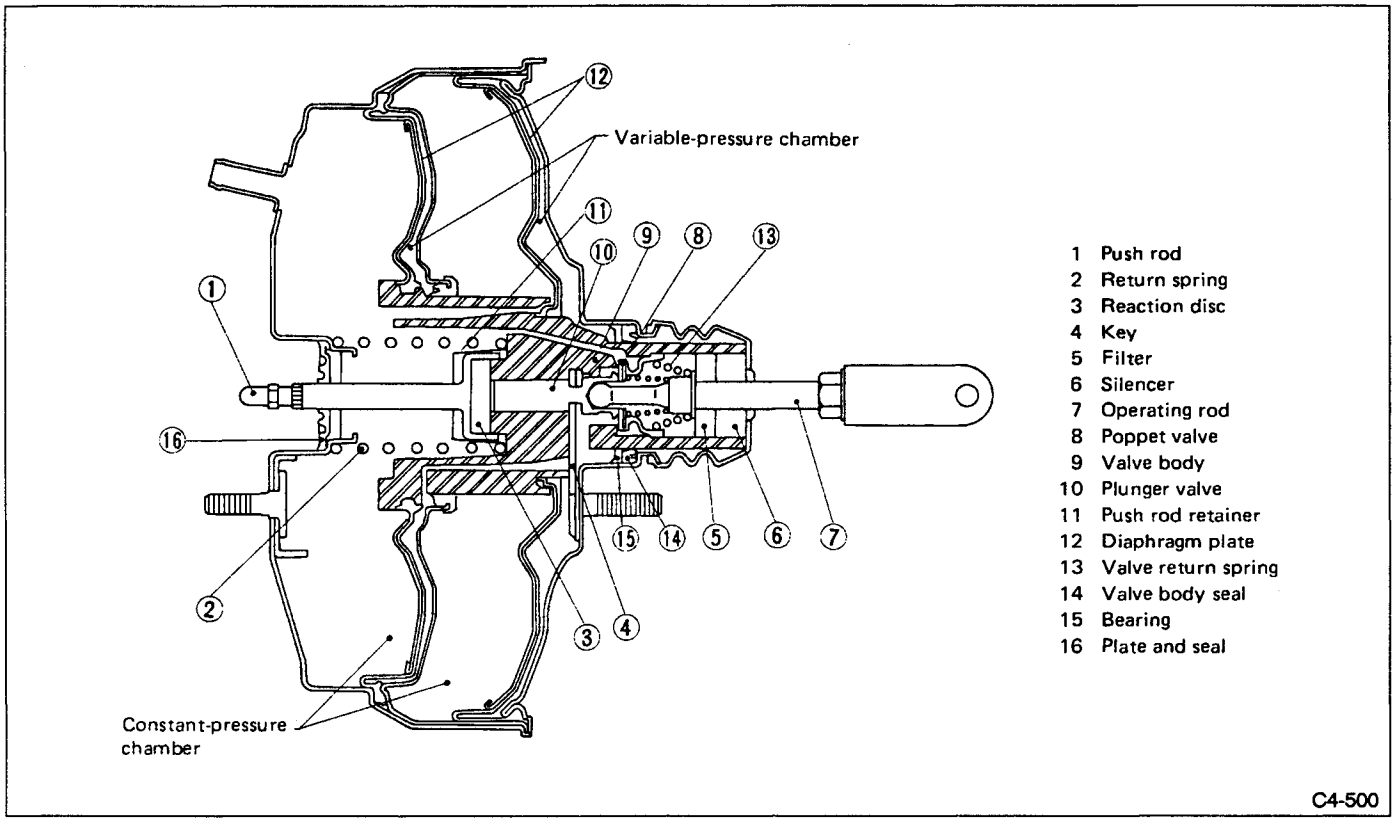


Fig. 6

B: OPERATION

1. BRAKE BOOSTER "OFF"

The plunger valve comes in contact with the poppet valve so that atmospheric air passing through the filter and silencer is shut out by the atmospheric valve (of the poppet valve).
The plunger valve is moved to the key at the right by the return spring so that the poppet valve is held at the right. Since the vacuum valve of the valve body and the poppet valve are kept away from each other, passage A is linked with passage B and the constant-pressure chamber is also linked with the variable-pressure chamber. At this point, pressure differential does not occur between the two chambers; the diaphragm plate is moved back to the right by return spring tension.

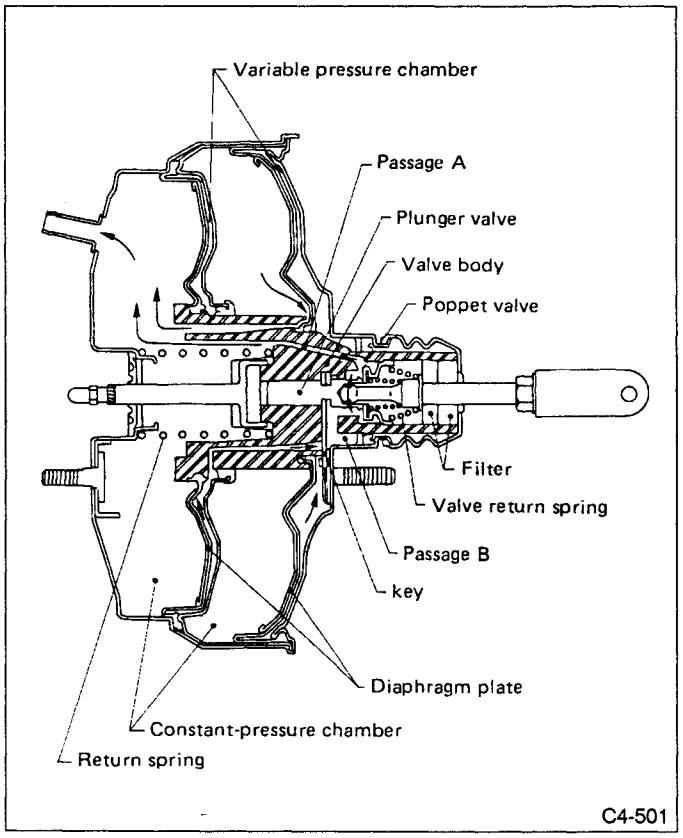


Fig. 7

2. BRAKE BOOSTER "ON"

When the brake pedal is depressed, the operating rod pushes the plunger valve so that the poppet valve comes in contact with the vacuum valve of the valve body. This shuts off the circuit between passages A and B, as well as the circuit between the constant- and variable-pressure chambers.
Further movement of the plunger valve moves the atmospheric valve away from it so that atmospheric air is directed to the variable-pressure chamber via passage B. This produces a pressure differential between the constant- and variable-pressure chambers.
As a result, the diaphragm and its plate are moved to the left as a single unit.
The power applied to the diaphragm plate by the pressure differential is then transmitted to the reaction disc via a hub, as well as to the push rod, and produces a booster output.

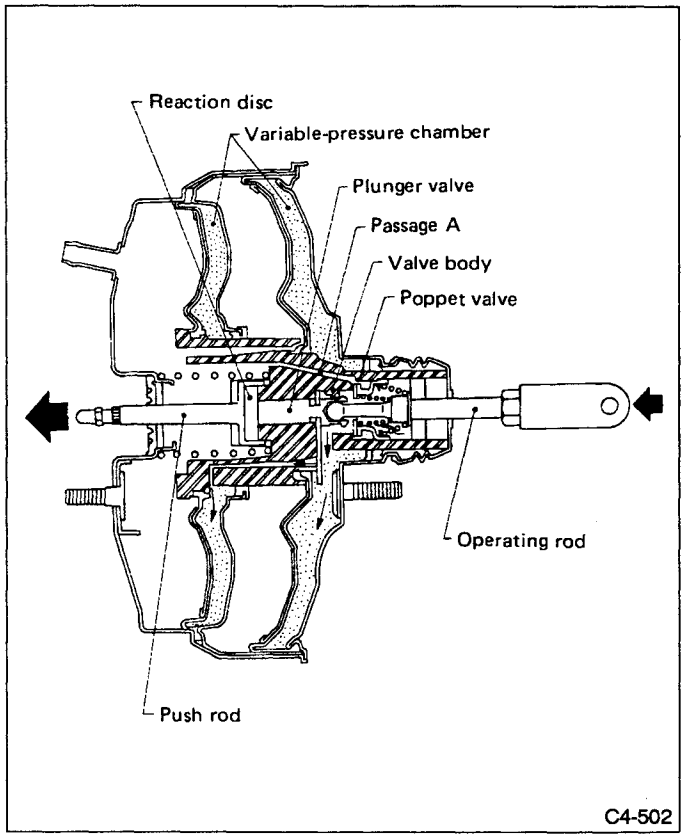


Fig. 8

3. BRAKE BOOSTER UNDER MEDIUM LOAD

The poppet valve comes in contact with the plunger valve and valve body when a force pushes the center of the reaction disc (at the contact portion of the plunger valve) via the operating rod and plunger valve. This occurs when brake pedal depression is balanced with a force pushing the plunger valve (via the push rod and reaction disc) due to the reaction force of oil pressure delivered from the master cylinder.

As a result, pressure differential is maintained between the constant-pressure chamber and variable-pressure chamber unless the pedal depression force is changed.

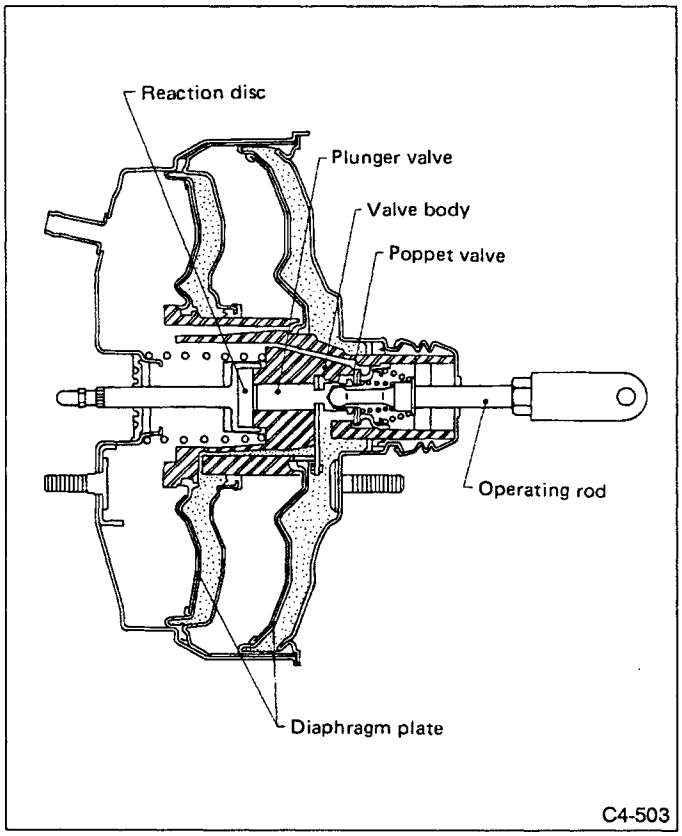


Fig. 9

4. BRAKE BOOSTER UNDER FULL-LOAD CONDITIONS

When pedal depression increases to such an extent that the variable-pressure chamber is maintained at atmospheric pressure, the maximum pressure differential acts on the diaphragm plate.

Further pedal depression does not act on the diaphragm plate but rather on the push rod.

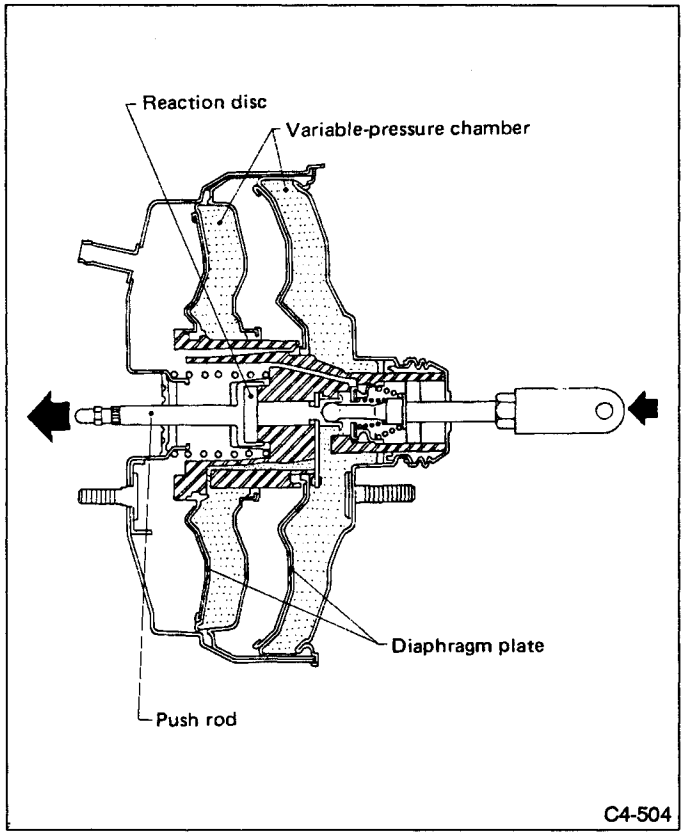


Fig. 10

5. BRAKE BOOSTER RELEASED

When the force of brake pedal depression decreases, the forces acting on the reaction disc and plunger valve are unbalanced, so that the plunger valve is moved to the right.

The plunger valve then comes in contact with the atmospheric valve of the poppet valve to shut off the passage between the variable-pressure chamber and atmospheric air and, at the same time, moves the poppet valve back. Movement of the poppet valve opens the vacuum valve so that passages A and B are linked with each other.

Air from the variable-pressure chamber is then delivered to the constant-pressure chamber. This eliminates any pressure differential between the two chambers. As a result, the diaphragm plate is pushed back to the "release" position by the return spring.

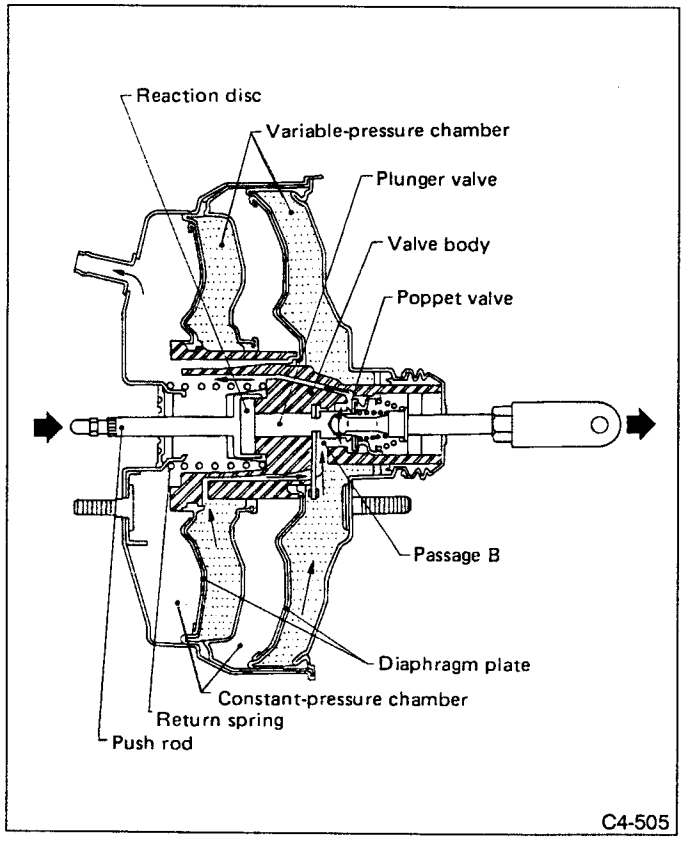


Fig. 11

6. BRAKE BOOSTER WITH NO VACUUM

When the brake pedal is depressed while the constant- and variable-pressure chambers are held at atmospheric pressure, the operating rod moves to the left. This moves the plunger valve which in turn pushes the hub via the key.

The reaction disc (which is built into the hub) then moves the master cylinder piston via the push rod. At this point a boosting force does not occur, but oil pressure is produced by movement of the master cylinder piston. As a result, the system serves as a hydraulic brake.

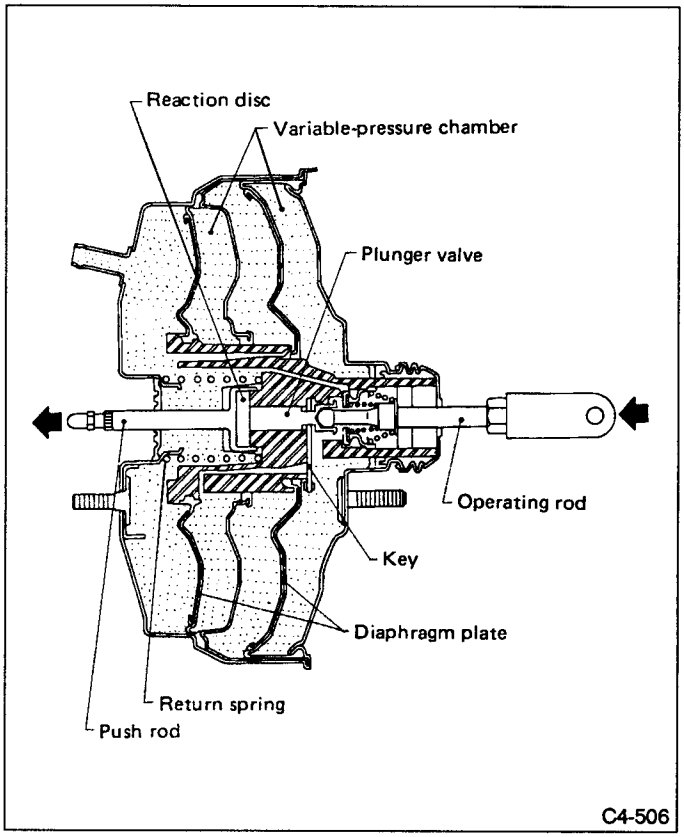


Fig. 12

4. Proportioning Valve

A: GENERAL

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

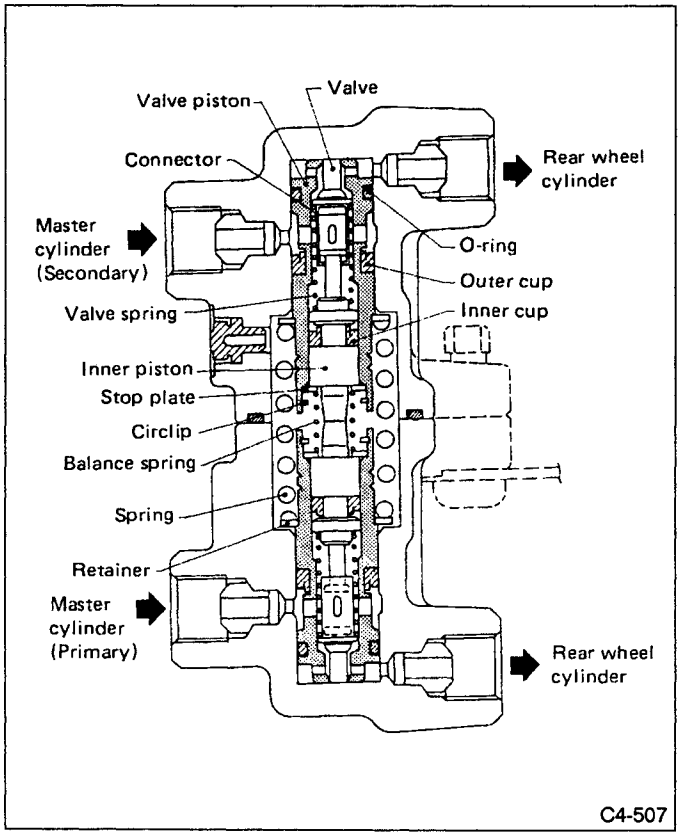


Fig. 13

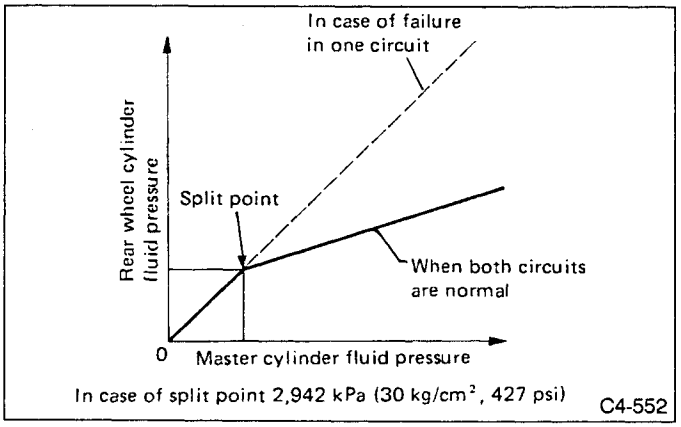


Fig. 14

B: OPERATION

1. OPERATION UNDER NORMAL CONDITIONS

1) Below the "split" point, the valve piston is held open by spring tension so that it is contact with the cylinder body. Under this condition, brake fluid pressure in the master cylinder is maintained equal to fluid pressure in the rear wheel cylinders.

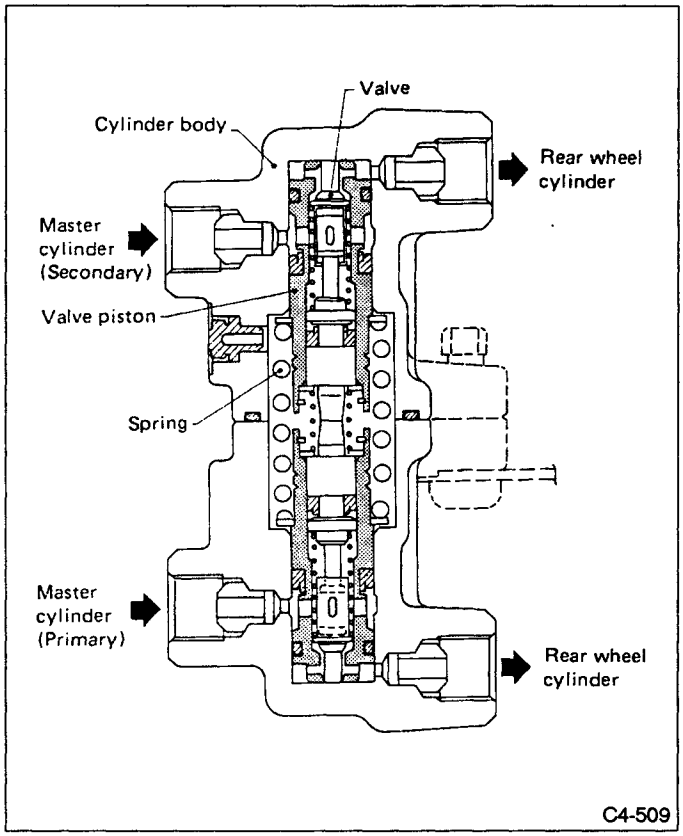


Fig. 15

2) As master cylinder fluid pressure increases, it overcomes spring tension so that the valve piston moves to the center of the master cylinder. This closes the valve to control the fluid pressure applied to the rear wheel cylinder. This is the split-point fluid pressure.

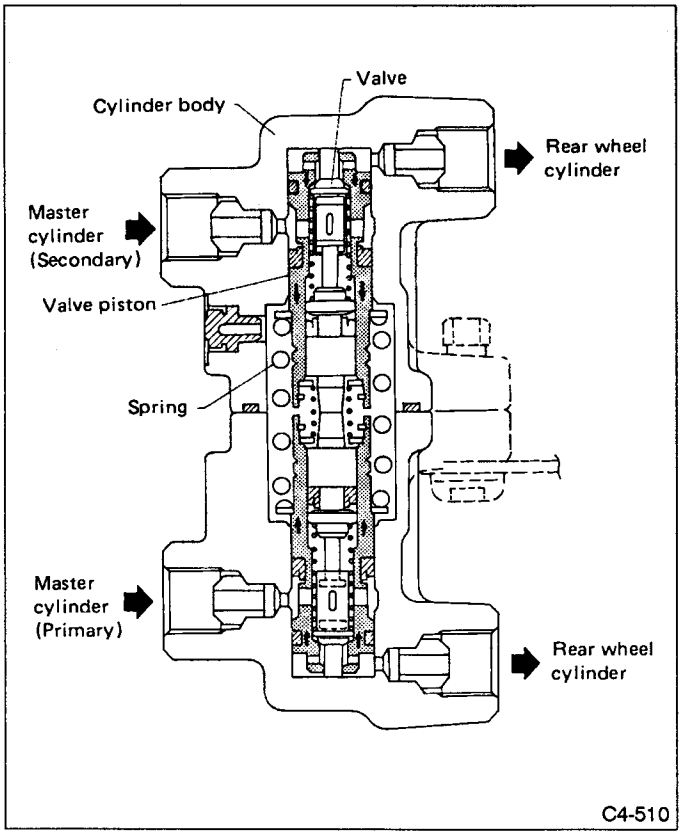


Fig. 16

3) As master cylinder fluid pressure increases further, the valve piston moves further outward. The valve then comes in contact with the cylinder body so that the valve is opened.
As the valve opens, the rear wheel cylinder fluid pressure increases. This moves the valve piston to the center of the master cylinder, closing the valve again.

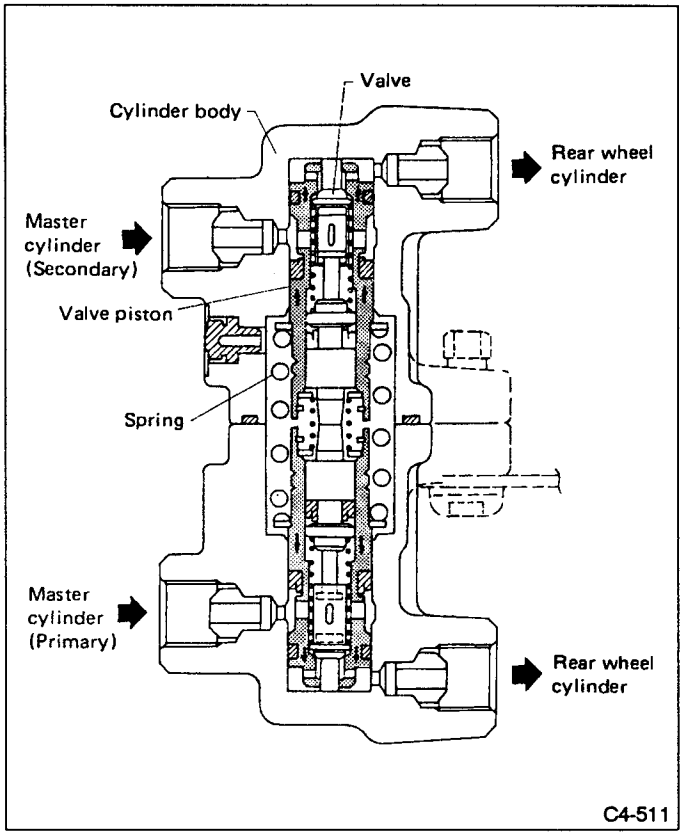


Fig. 17

2. OPERATION IN CASE OF CIRCUIT FAILURE (Failure of primary circuit)

1) If the primary circuit becomes inoperative, the secondary inner piston moves toward the primary circuit and compresses the balance spring until the stop plate is in contact with the circlip.

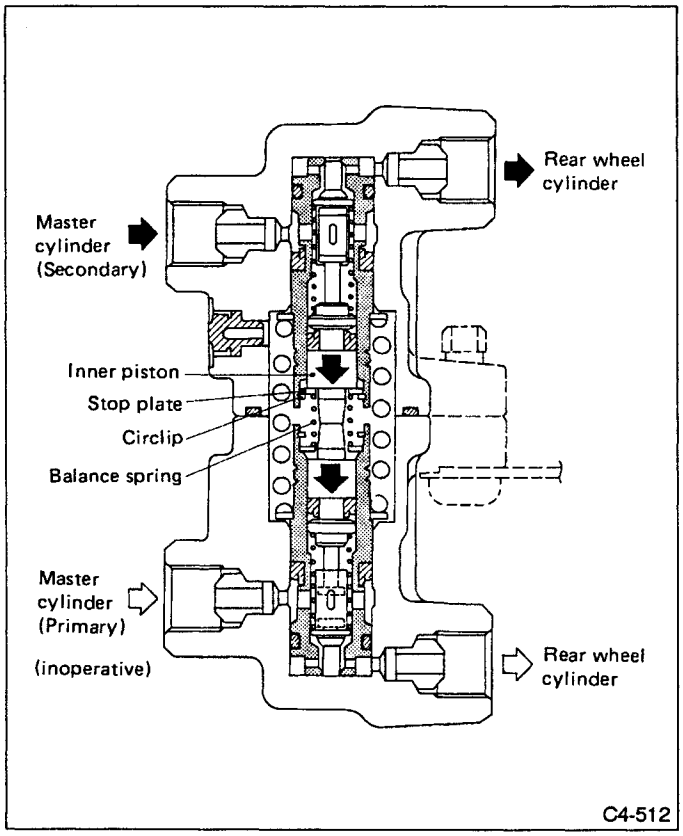


Fig. 18

2) As the master cylinder fluid pressure increases, it overcomes spring tension. This causes the secondary valve piston and inner piston to move toward the primary circuit as a unit. The valve is held open since it is pulled by the inner piston connector. For this reason, the fluid pressure in the secondary circuit of the rear wheel cylinder is not controlled as it decreases.

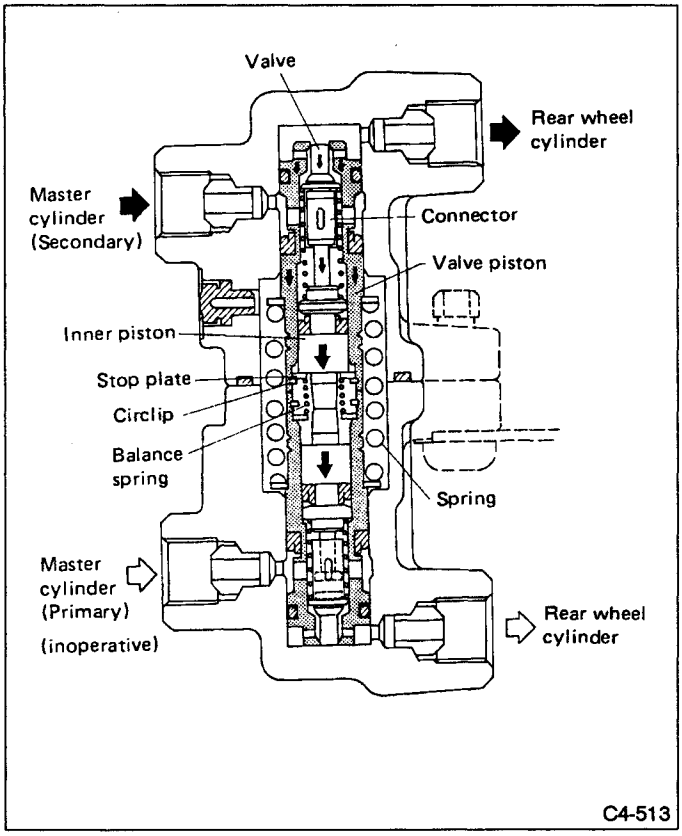


Fig. 19

5. Anti-lock Brake System

A: OUTLINE

1. FEATURE

The ABS (Anti-lock brake system) electrically controls brake fluid pressure to prevent wheel "lock" during braking on slippery road surfaces, thereby improving directional/steering stability as well as shortening the braking distance.

If the ABS becomes inoperative, the fail-safe system activates to ensure it acts as a conventional brake system. The warning light also comes on to indicate that the ABS is malfunctioning.

The front-and-rear wheels utilize a 4-sensor, 4-channel control design: the front wheels have an independent control design*1 and the rear wheels have a select low control design*2.

*1: A system which independently controls fluid pressure to left and right front wheels.

*2: A system which provides the same fluid pressure control for the two rear wheels if either wheel starts to "lock."

2. COMPONENTS

The ABS consists of four tone wheels ⑤, four ABS sensors ④, an electronic control unit ⑦, a hydraulic control unit ⑥, and a warning light ⑨.

ABS component parts

Item	Function
Tone wheel	Attached to each wheel hub and rotates at the same speed as the hub.
ABS sensor	Emits a wheel speed signal during tone wheel rotation.
Electronic control unit	Receives wheel-speed signals from speed sensors and sends a control signal to hydraulic unit so that fluid pressure is optimally controlled.
Hydraulic control unit	Receives a control signal from electronic control unit and controls respective wheel cylinder fluid pressure.
Warning light	Comes on when ABS becomes inoperative.

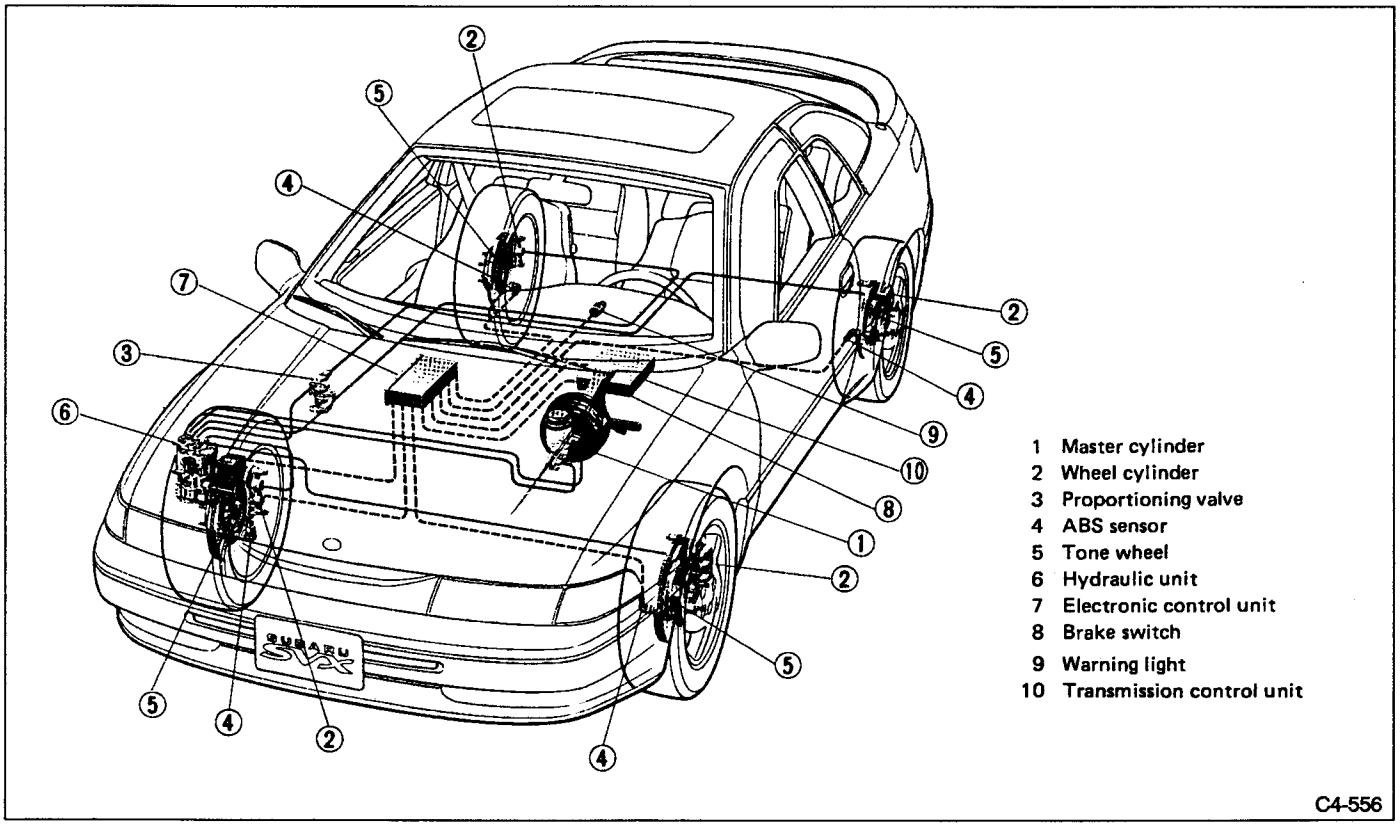


Fig. 20

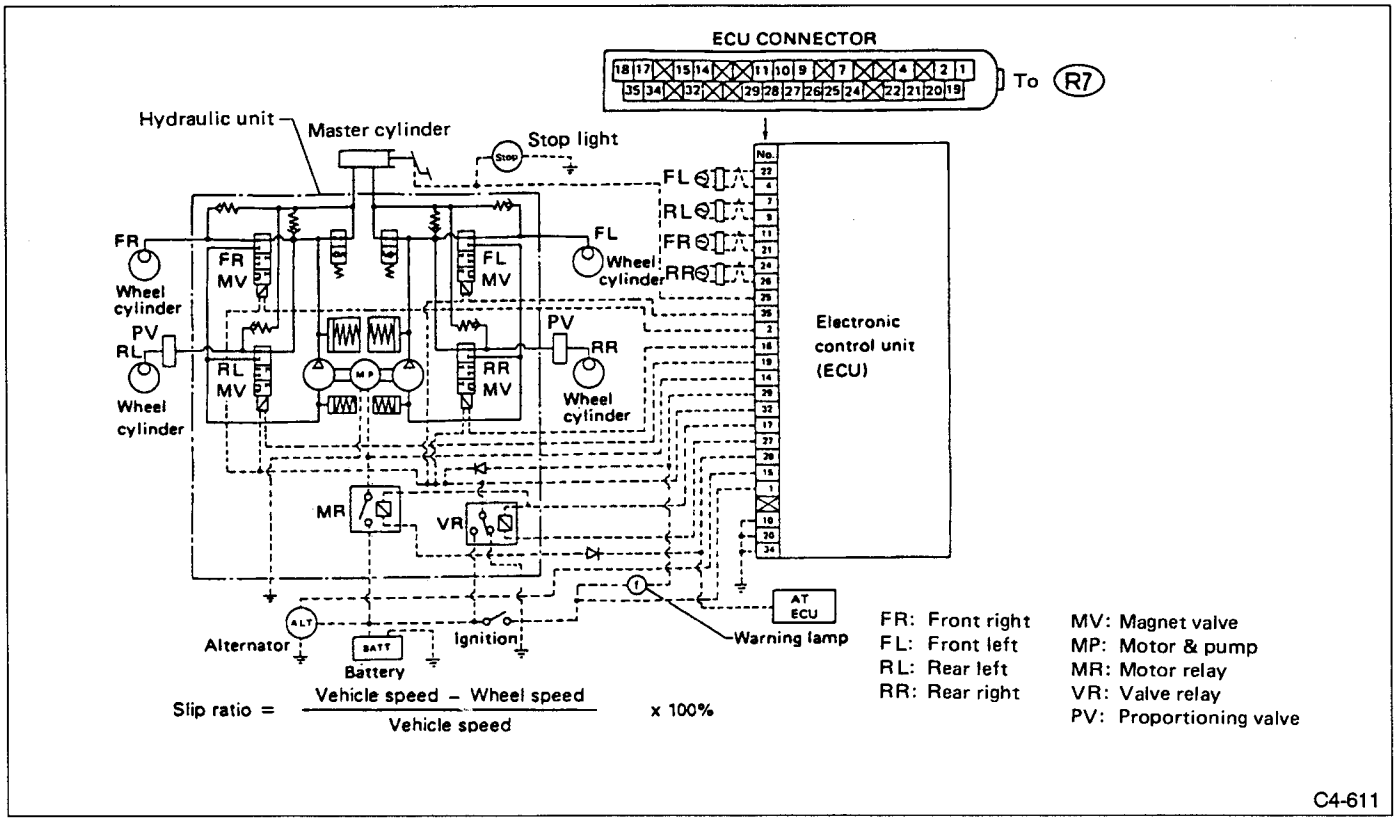


Fig. 21 ABS System diagram

3. THEORY OF ABS CONTROL

When the brake pedal is depressed during operation, wheel speed as well as vehicle speed decreases. The difference which occurs between wheel speed and vehicle speed is called the "slip" phenomenon. The magnitude of this action is expressed by "slip" the ratio which is determined by the following equation:

$$\text{Slip ratio} = \frac{\text{Vehicle speed} - \text{Wheel speed}}{\text{Vehicle speed}} \times 100\%$$

When the "slip" ratio is 0% vehicle speed equals wheel speed and the wheel rotates without any slippage. When the "slip" is 100% the wheel locks and does not rotate (wheel speed = 0) although vehicle speed exists. The relationship between the frictional force of a wheel in the fore-and-aft direction and the "slip" ratio is shown by two characteristic curves in Figure 22.

These curves are determined by the relationship between the wheel and road surface. Where the same type of wheel are used; the curve shown by a solid line indicates wheels driven on asphalt or paved roads, the curve shown by dotted lines refers wheels subjected to slippery (snowy or icy) roads.

When different types of wheels are used, although the road surface is the same, these curves will change. In general, the frictional coefficient between wheel and road surface in relation to an increase in the "slip ratio" will reach the maximum value in the 8 — 30%range and will tend to decrease after that.

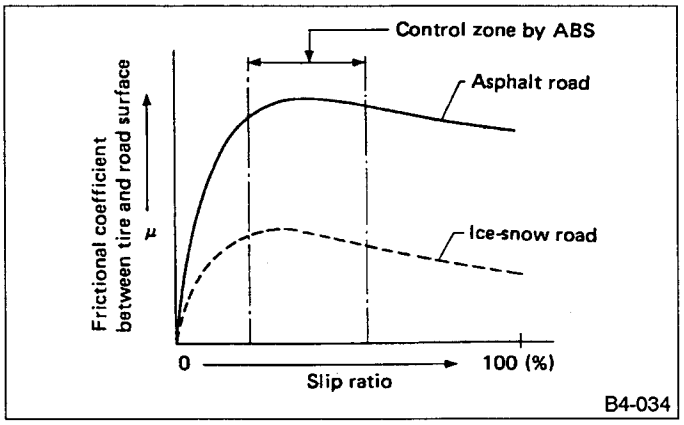


Fig. 22

B: CONSTRUCTION AND OPERATION

1. WHEEL SPEED SENSOR

The wheel speed sensor detects wheel speed and consists of a permanent magnet, coil, tone wheel, etc. The magnetic flux produced by the permanent magnet varies with the tone wheel (which rotates together with the wheel) and the sensor emits an alternating voltage corresponding with the wheel speed by electromagnetic induction.

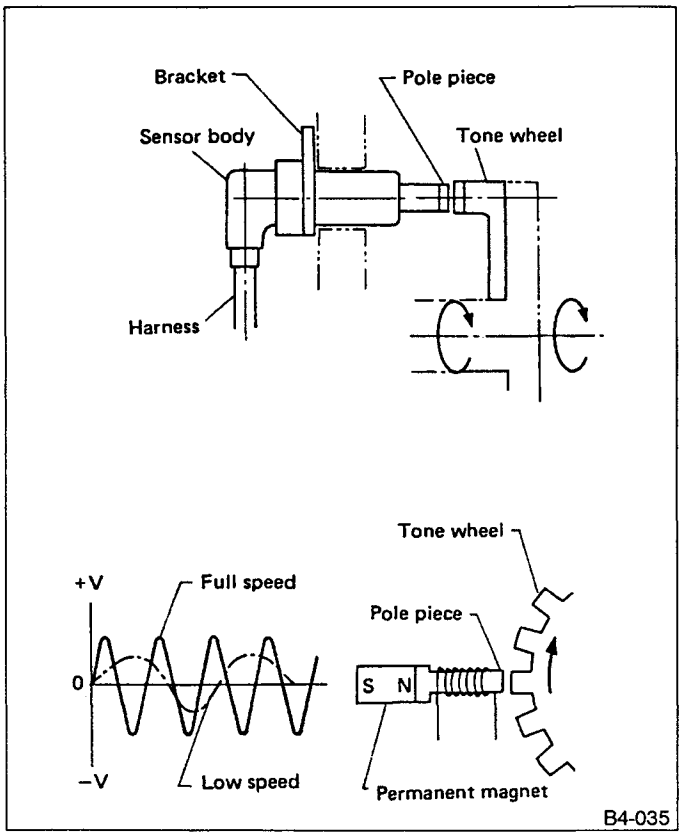


Fig. 23

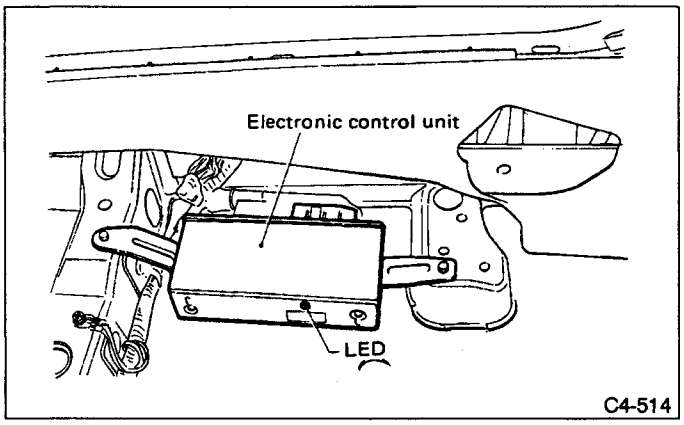


Fig. 24

2. ELECTRONIC CONTROL UNIT (E.C.U.)

The electronic control unit is a digital type that utilizes LSI elements to achieve compact structure and improve circuit reliability.

It consists of an arithmetic circuit, control circuit, signal input-output circuits, a safety circuit and a regulated power circuit. All these circuits are housed in the case located on the PC board.

Figure 36 shows a block diagram of the electronic circuits. When the speed sensor sends an alternating voltage corresponding with the wheel speed to the input amplifier circuit, the signal voltage is converted into a rectangular wave which is sent to the digital signal generating circuit. (This circuit receives two channels of signal at a time.)
The LSI circuit, which consists of approximately 16,000 transistors, computes wheel speed in relation to the signal sent from the speed sensor. It then emits the required control signal as a result of computation. This circuit also contains a safety circuit for monitoring purposes. The control signal emitted from the LSI circuit is then sent to the current-control and -amplification circuits where a signal is produced to operate the magnet valve of the hydraulic control unit.
The memory circuit, which serves to memorize system failure, and monitor the regulated power circuit and others, is housed in a separate IC. When the E.C.U. power is applied with the ignition switch "ON", the safety circuit begins to monitor electronic circuits, sensors, the hydraulic control unit, etc. If any circuits or units malfunction, a warning lamp (dual circuit design) comes on to warn the driver of a problem. The LED in the ECU illuminates to show a trouble code. The brake system then functions as a conventional brake system in place of the ABS.

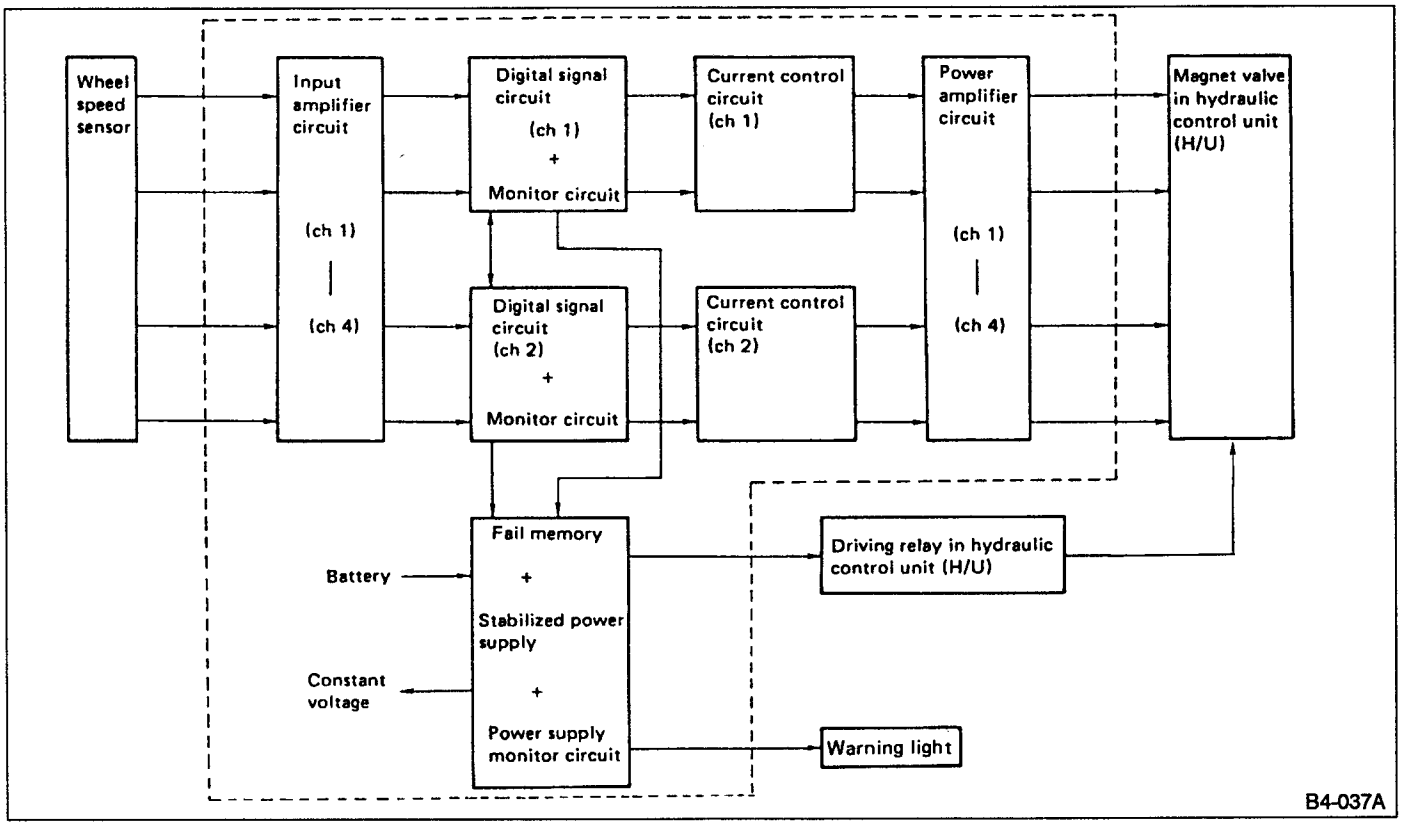


Fig. 25

3. ABS CONTROL CYCLE CURVES

As the brake pedal is depressed, brake fluid pressure increases correspondingly, which in turn decreases wheel speed. When brake fluid pressure reaches point "A" (where wheel deceleration exceeds "$-b_0$"), the control unit transmits a "hold" signal to hold the brake fluid pressure in wheel cylinder at that point. At the same time, the control unit computes a "dummy" vehicle speed. When the wheel speed drops below the slip-ratio setting (= speed less than the dummy vehicle speed based on the predetermined value) at point "B" of the brake fluid pressure, the control unit then transmits a "decrease" signal to prevent wheel lock-up. This causes the brake fluid pressure to decrease.
After brake fluid pressure is decreased, wheel acceleration increases. When it exceeds the wheel acceleration setting "$+b_{10}$" at point "C" (brake fluid pressure), the control unit transmits a "hold" signal to hold the brake fluid pressure at that point. When wheel acceleration setting value "$+b_{10}$" is exceeded and when brake fluid pressure is at point "D", the control unit judges that wheel lockup will not occur and then transmits an "increase" signal to increase brake fluid pressure.
When wheel acceleration drops below "$+b_0$" at point "E" (which occurred due to a brake fluid pressure increase), the repetition of the "hold" and "increase" signals takes place at a constant cycle.
When wheel deceleration exceeds "$-b_0$", at point "F" of the brake fluid pressure, the control unit immediately

transmits a "decrease" signal to decrease brake fluid pressure.

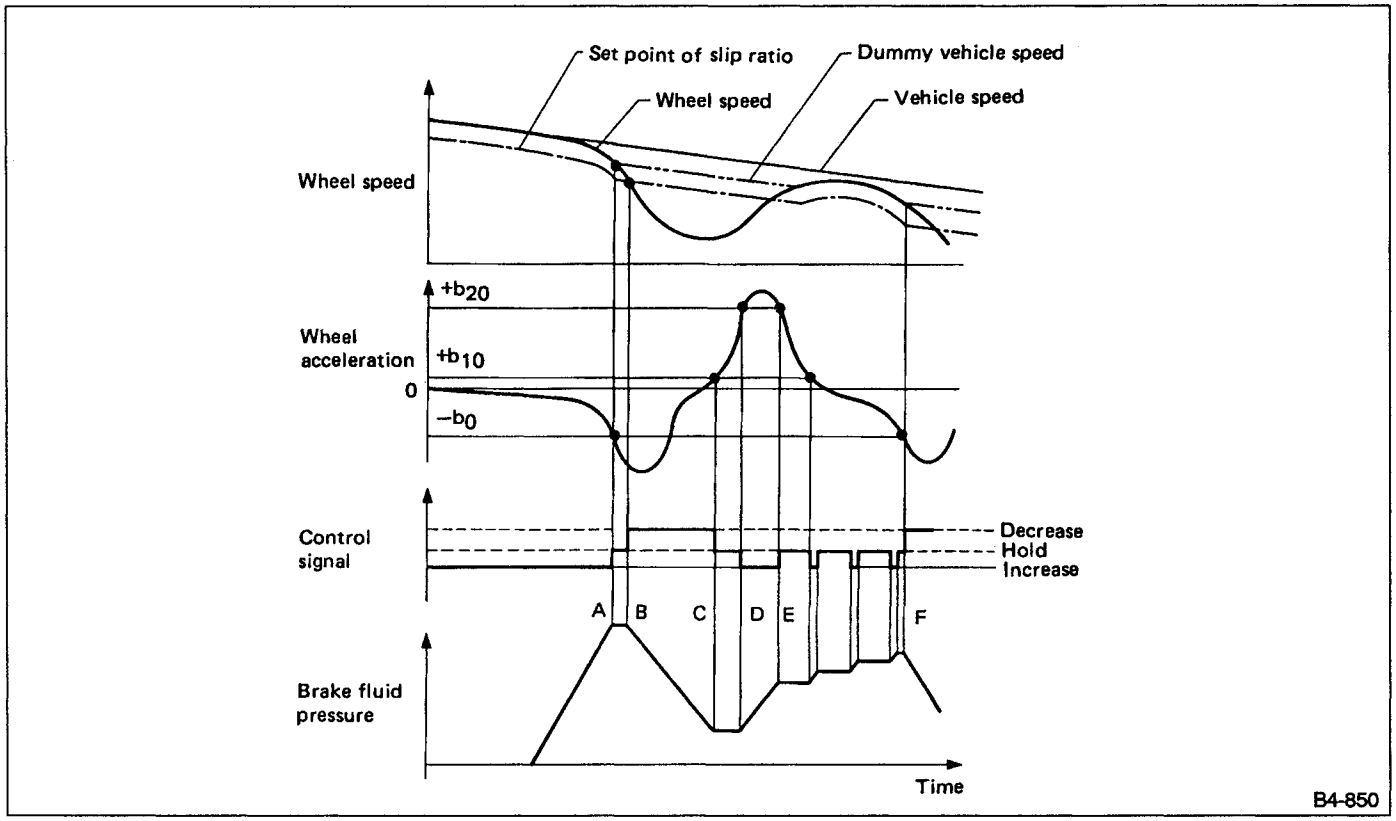


Fig. 26

4. ABS WARNING LIGHT

When a signal system or the electronic control unit (E.C.U.) becomes inoperative, the warning light in the instrument panel comes on to indicate that the system or control unit is malfunctioning. At the same time, current flowing through the hydraulic control unit is interrupted so that the brake system functions as a conventional brake system. The circuit through which the warning light comes on utilizes a dual system design.

If the warning light comes on upon detection of a system malfunction, the control unit's LED also shows a trouble code.

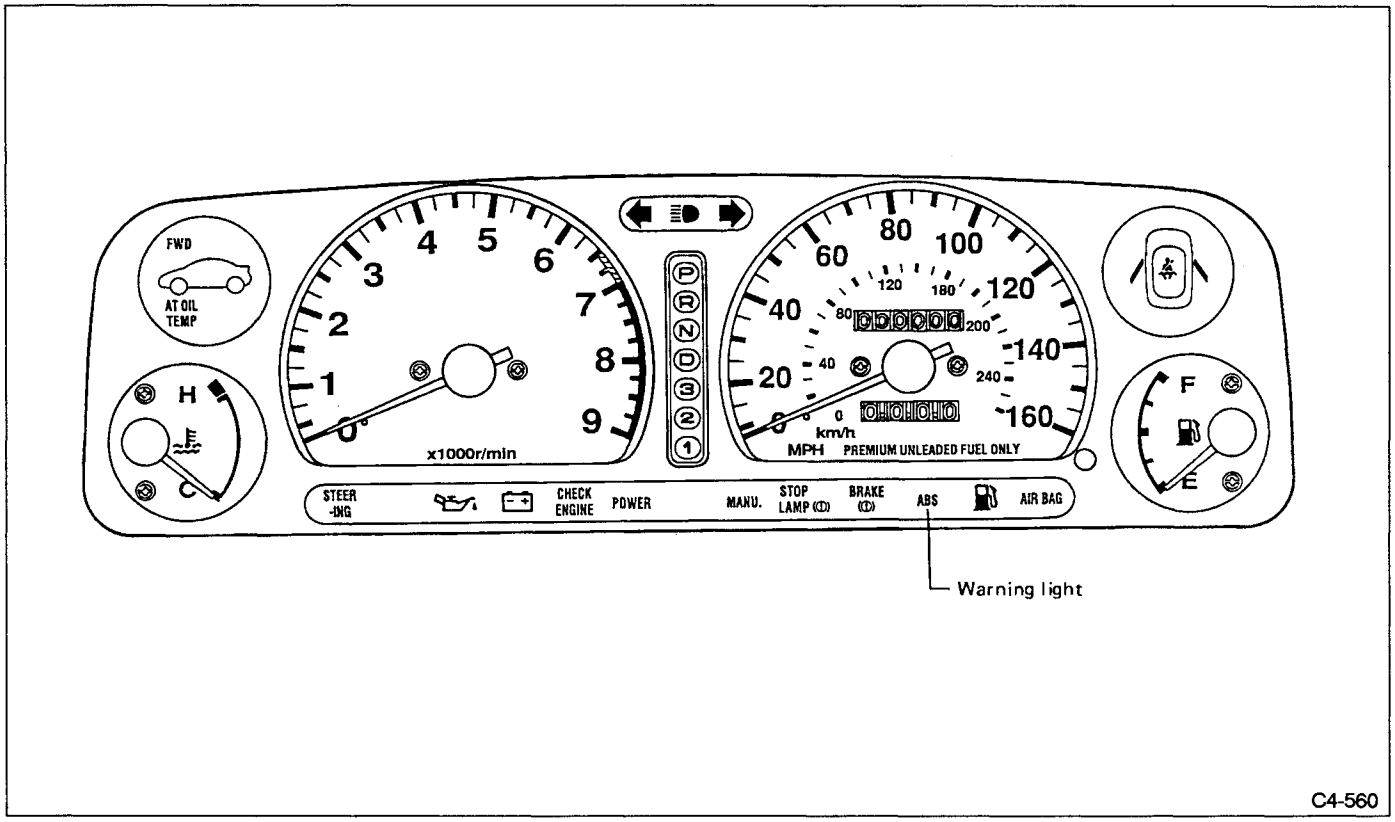


Fig. 27

5. HYDRAULIC CONTROL UNIT

The hydraulic control unit is a fluid pressure control assembly which consists of an electric motor, plunger pump, damper, housing, magnet valve and relay. The magnet valve moves to three positions, as shown in Figure 28. When it is moved to position "1" (current "OFF"), the master cylinder and brake system are connected to each other. With the valve moved to position "2" (part of current flow "ON"), all passages are closed. At position "3" (full-current flow "ON"), master cylinder ports are closed and the line between the hydraulic unit reservoir is connected to the brake system.

As wheel deceleration exceeds the specified deceleration setting during braking, the magnet valve moves to position "2" to hold brake fluid pressure. Further deceleration increases moves the magnet valve to position "3" so that brake fluid pressure is released and, at the same time, the motor starts to drive the plunger pump. When wheel deceleration stops, the magnet valve is held at position "2" to maintain brake fluid pressure.

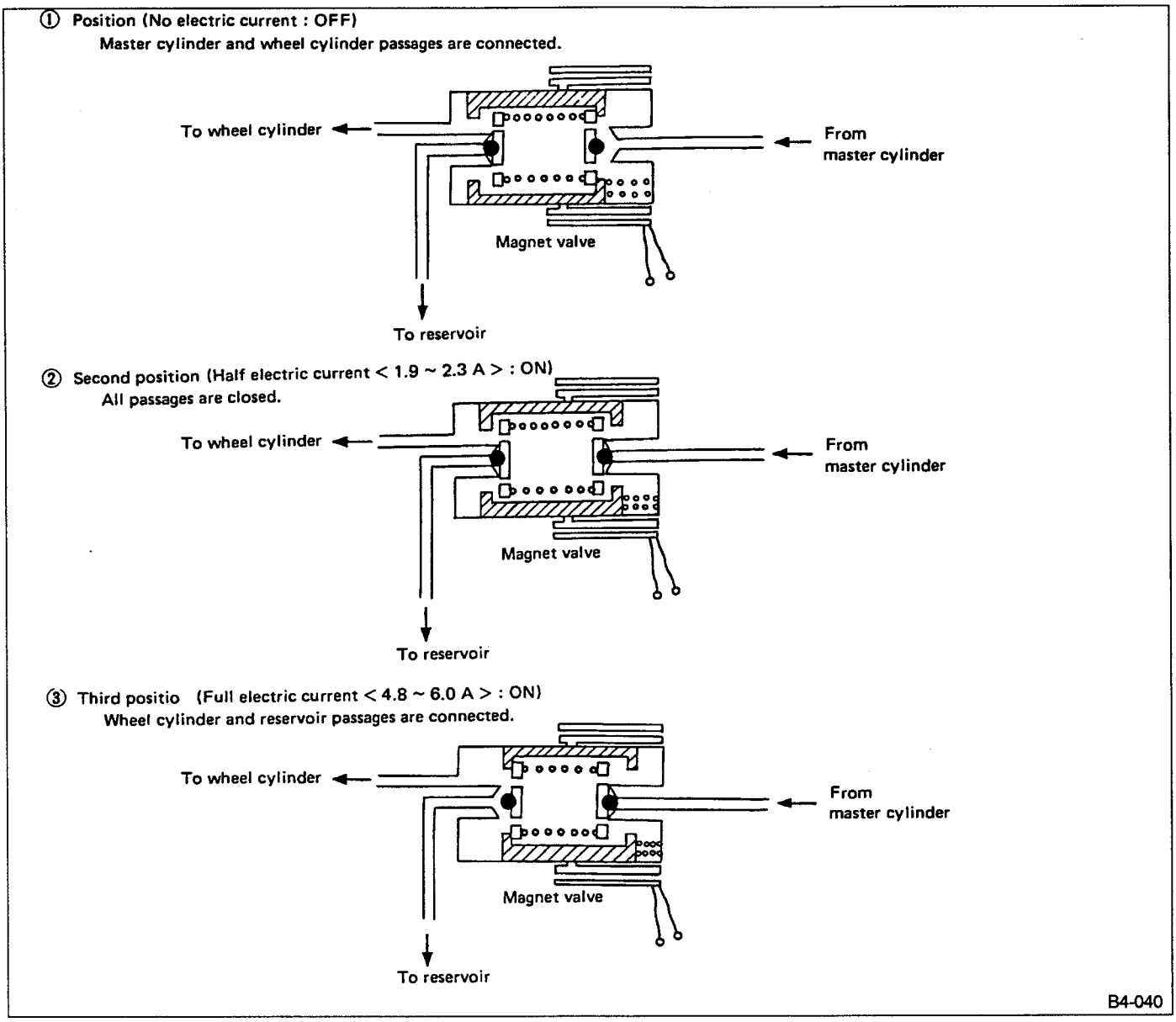


Fig. 28

1) During normal braking

When the brake pedal is depressed, fluid pressure is delivered from master cylinder ① to magnet valve ④ via F-valve ② while moving the ball up. Since current does not flow through the magnet valve, fluid pressure is delivered to wheel cylinder ⑫ so that normal braking force occurs.

Fluid pressure delivered to the F-valve ② also reaches outlet valve ⑧ which is sealed by the ball.

Accumulator ⑪ has its spring set to act by high fluid pressure, and not by normal fluid pressure. When current does not flow through the magnet valve, the outlet port is sealed so that the oil passage to reservoir ⑤ is not linked.

When the brake pedal is released, master cylinder ① fluid pressure will decrease. Wheel cylinder ⑫ pressure will then return to the master cylinder ① while pushing the ball of check valve ③. At this point, F-valve ② is moved up by the ball to prevent wheel cylinder ⑫ pressure from returning to the master cylinder ①.

However, when master cylinder ① pressure drops below approximately 981 kPa (10 kg/cm^2, 142 psi), the F-valve ②'s return spring is moved to the left to push the ball up. This allows a slight amount of residual pressure (applied to check valve ③) to be delivered to wheel cylinder ⑫ via magnet valve ④.

When the brake pedal is slightly released while the ABS is operating, excess wheel cylinder fluid pressure returns to the master cylinder via check valve ③ so that wheel cylinder fluid pressure is balanced with master cylinder fluid pressure.

During the time the excess wheel cylinder fluid pressure returns to the master cylinder, the driver may feel a pedal "kickback".

This is not an indication of a problem.

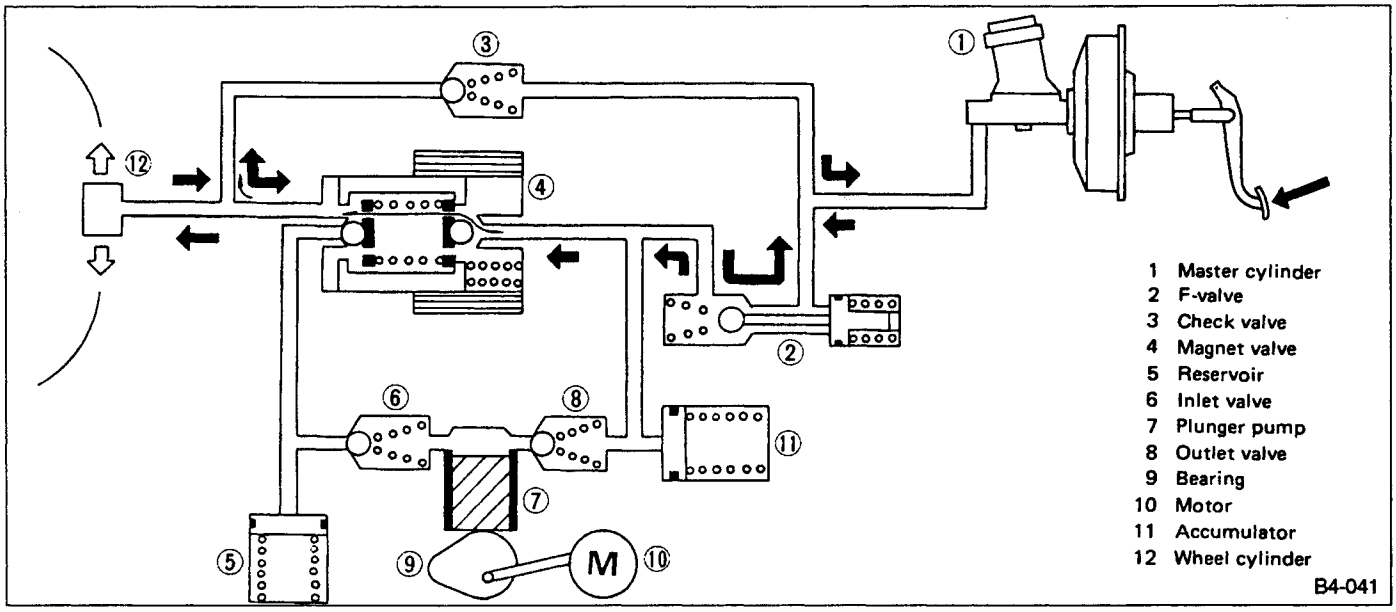


Fig. 29

2) Pressure-decrease action with ABS in operation
When the wheels begin to lock during brake application, the E.C.U. emits an instruction so that a current of 4.8 to flows through magnet valve ④.
This closes the inlet port of the magnet valve ④ and opens the outlet port so that wheel cylinder ⑫ pressure is delivered to reservoir ⑤ via the outlet port. Since current also flows through the motor ⑩ (simultaneously when the current flows through the magnet valve), motor ⑩ will start to activate the plunger pump ⑦ via the bearing ⑨ (provided with an eccentric cam) connected to it. Brake fluid pressure delivered to reservoir ⑤ then passes through inlet valve ⑥ and is increased by plunger pump ⑦. Increased brake fluid then passes through inlet valve ⑥ and is stored in accumulator ⑪. At this point, the increased brake fluid pressure is sealed by the ball of valve F ② to shut out the fluid pressure in master cylinder ①: Fluid pressure in wheel cylinder ⑫ also shuts out the fluid pressure in the master cylinder ① by means of check valve ③.
Wheel cylinder ⑫ fluid pressure will then decrease to prevent the brake pedal from kicking back while it is being controlled to accommodate vehicle deceleration.

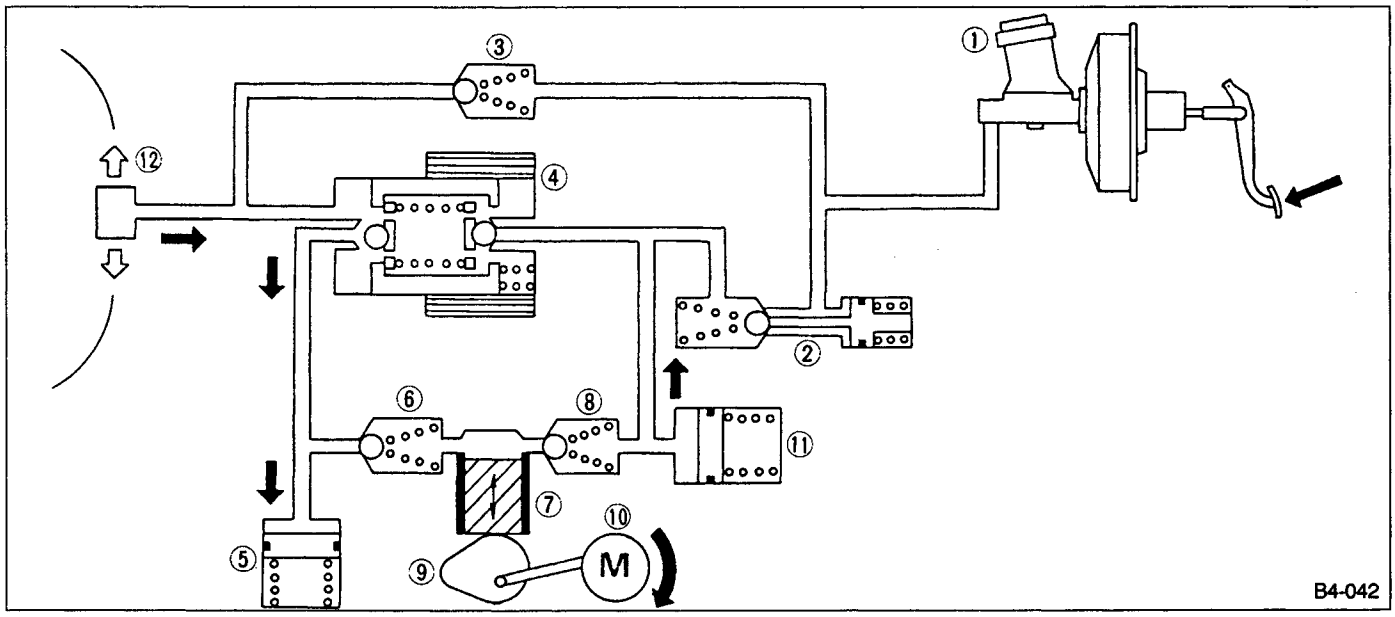


Fig. 30

3) Pressure "hold" action with ABS in operation
When wheel cylinder ⑫ fluid pressure is decreased or increased to the optimum point, the controller emits an instruction so that a hold current of 1.9 to 2.3 amperes flows through magnet valve ④. The inlet and outlet ports will then be closed. At this point, the controlled fluid pressure is held in the wheel cylinder ⑫, the fluid pressure increased by the pump (which increases the decreased wheel cylinder) is stored in accumulator ⑪, the fluid pressure increased by brake pedal depression force is held in master cylinder ① and the fluid pressure discharged from the pump is held in reservoir ⑤.

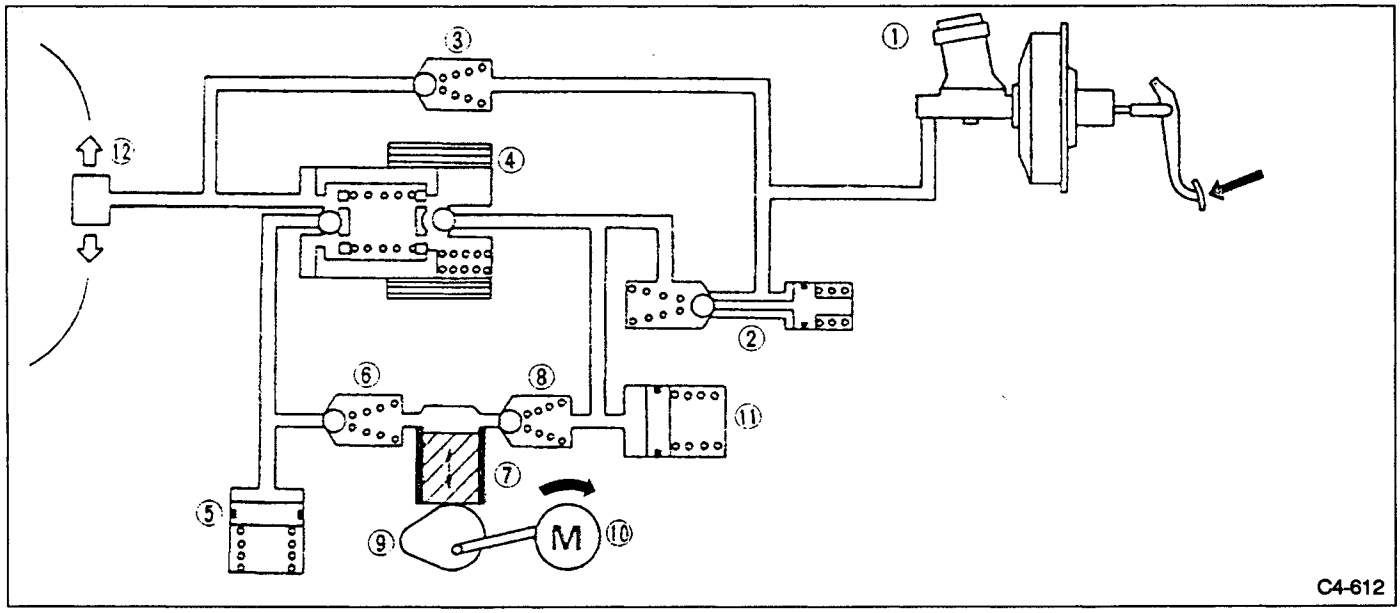


Fig. 31

4) Pressure-increase action with ABS in operation
When current flowing through magnet valve ④ is interrupted (OFF) by an instruction emitted from the E.C.U., the fluid pressure of wheel cylinder ⑫ is increased. (At this point, internal passages of the magnet valve function the same as in a conventional brake system.) When the magnet valve ④ is OFF, the inlet port is opened and the outlet port is closed. High fluid pressure is then delivered from accumulator ⑪ to wheel cylinder ⑫ via the inlet port so that wheel cylinder pressure is increased. Since check valve ③ and F-valve ② remain sealed by the fluid pressure of master cylinder ① and high fluid pressure of accumulator ⑪ respectively, only wheel cylinder ⑫ fluid pressure is increased. Accordingly, a sensation of brake pedal "pull" will not occur.

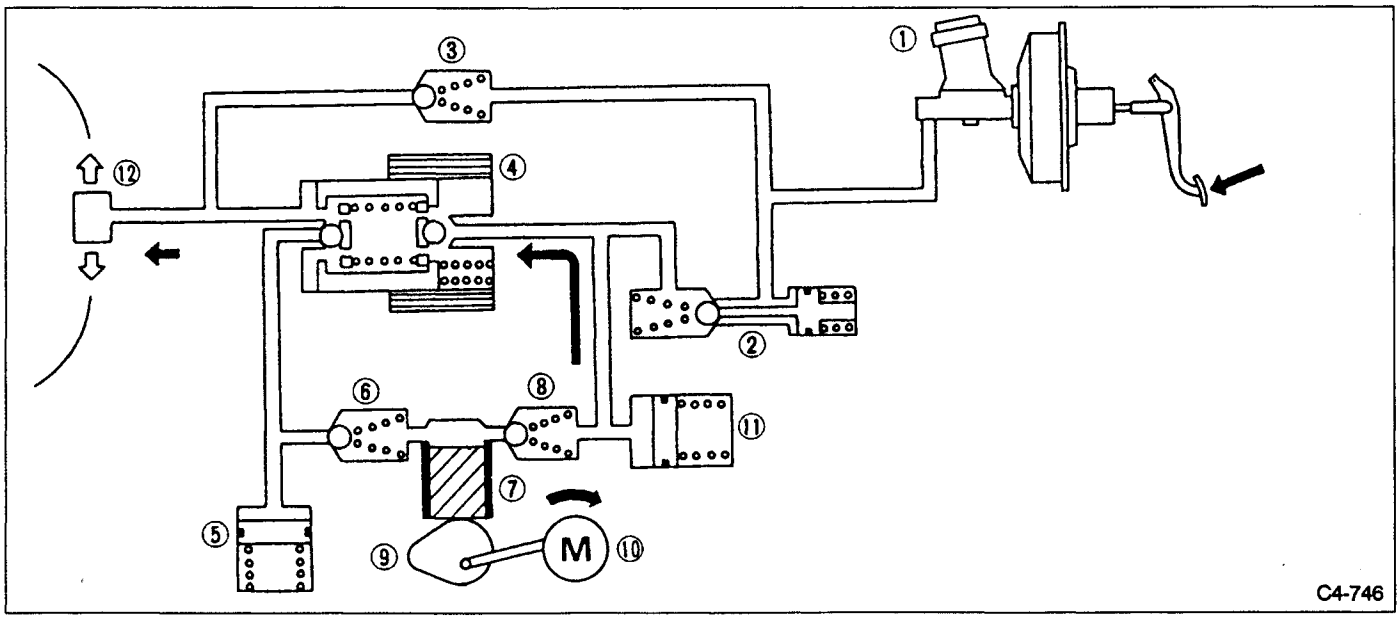


Fig. 32

6. Parking Brake

A: OUTLINE

The rear disc brake has its parking brake drum housed in the disc rotor for improved performance.

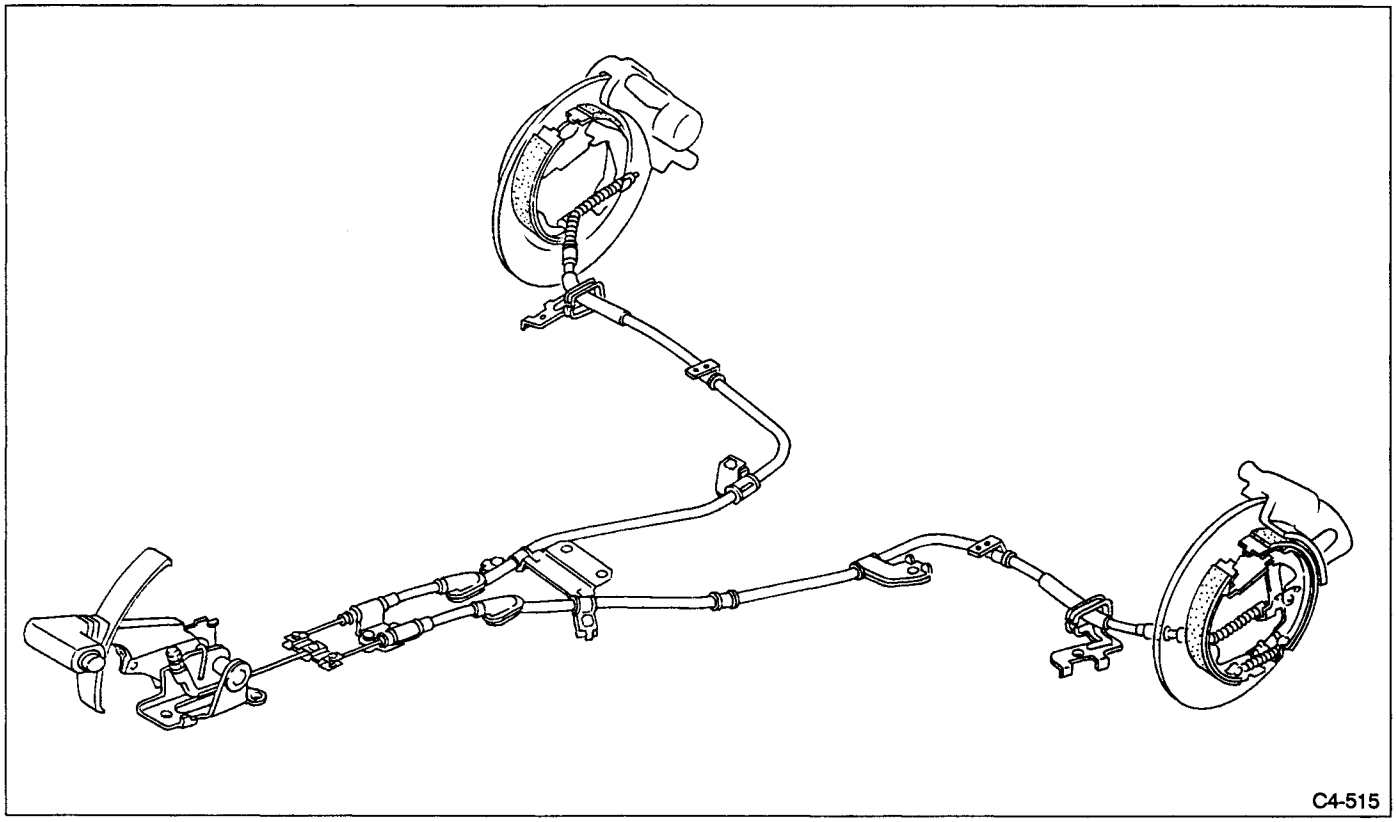


Fig. 33

B: OPERATION

1. PARKING BRAKE APPLICATION

When the parking brake lever is moved back, lever ② located on the end of the parking brake cable ① moves strut ③ in the direction of "A" with point "P" utilized as a fulcrum.

The strut then presses brake shoes ④ and ⑤ against the drum. These brake shoes utilize a floating design and are lightly supported by hold-down pins ⑦. The force applied to brake shoe ④, and the reaction force of "A" applied to brake shoe ⑤ via point "P" provide brake application when the shoes are pressed against the brake drum.

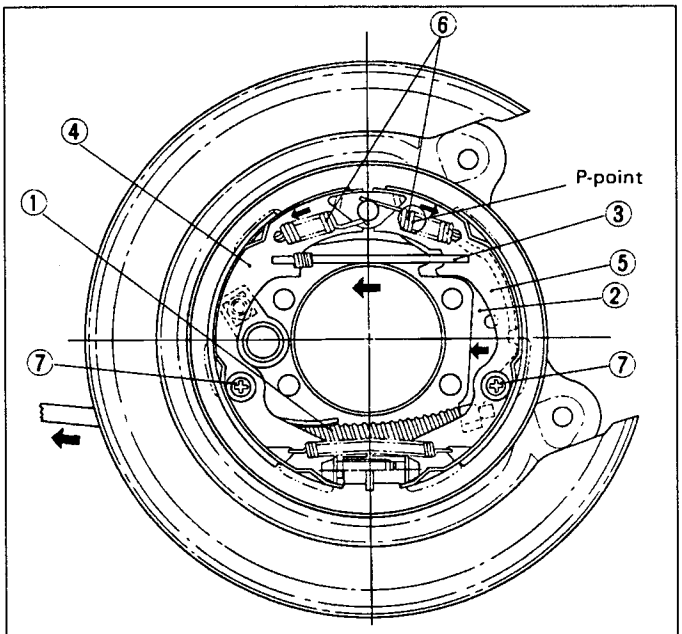


Fig. 34

2. PARKING BRAKE RELEASE

When the parking brake lever is moved forward, parking brake cable ① is loosened. This returns brake shoes ④ and ⑤ to their original position from the tension of return spring ⑥ so that the parking brake is released.

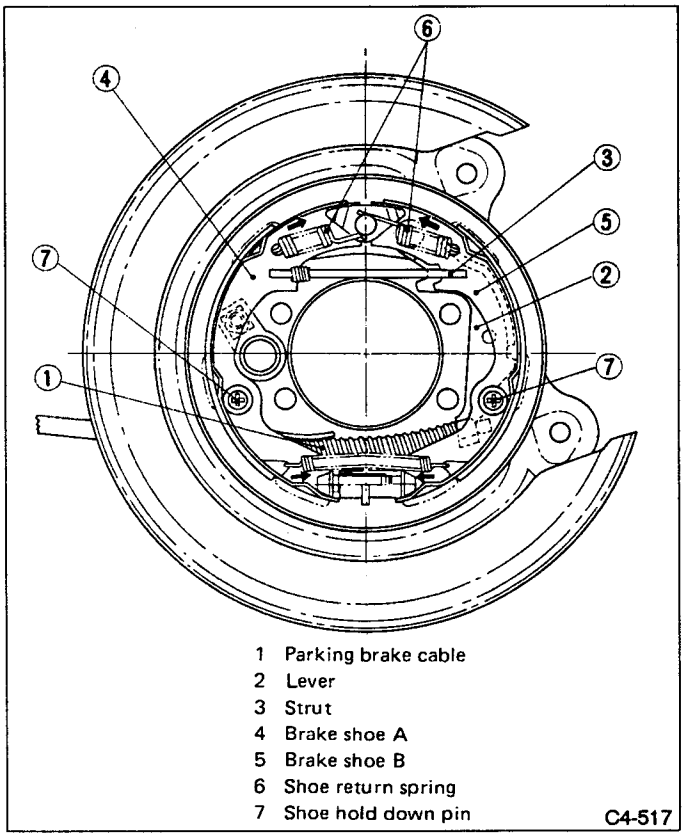


Fig. 35

S SPECIFICATIONS AND SERVICE DATA

A: SPECIFICATIONS

Model		SVX
Engine (cc)		3300
Driving system		FWD
Front brake	Type	Disc (Floating type, ventilated)
	Effective disc diameter mm (in)	253 (9.96)
	Disc thickness x Outer diameter mm (in)	28 x 302 (1.10 x 11.89)
	Effective cylinder diameter mm (in)	42.8 x 2 (1.685 x 0.08)
	Pad dimensions (length x width x thickness) mm (in)	146.6 x 47.0 x 11.0 (5.77 x 1.850 x 0.433)
	Clearance adjustment	Automatic adjustment
Rear brake	Type	Disc (Floating type)
	Effective or disc diameter mm (in)	254 (10)
	Disc thickness x Outer diameter mm (in)	10 x 290 (0.39 x 11.42)
	Effective cylinder diameter mm (in)	34.9 (1.374)
	Pad dimensions (length x width x thickness) mm (in)	92.4 x 33.7 x 10 (3.638 x 1.327 x 0.39)
	Clearance adjustment	Automatic adjustment

Model		SVX
Engine (cc)		3300
Driving system		FWD
Parking brake	Type	Mechanical on rear brakes, drum in disc
	Effective drum diameter mm (in)	190 (7.48)
	Lining dimensions (length x width x thickness) mm (in)	182.3 x 30 x 3.2 (7.18 x 1.18 x 0.126)
	Clearance adjustment	Manual adjustment
Master cylinder	Type	Tandem
	Effective diameter mm (in)	26.99 (1 - 1/16)
	Reservoir type	Sealed type
	Brake fluid reservoir capacity cm^3 (cu in)	180 (10.98)
Brake booster	Type	Vacuum suspended
	Effective diameter mm (in)	205 + 230 (8.07 + 9.06)
Proportioning valve	Split point kPa (kg/cm^2, psi)	2,942 (30 , 427)
	Reducing ratio	0.4
Brake line		Dual circuit system
ABS		Without ABS

B: SERVICE DATA

ITEM		STANDARD	SERVICE LIMIT
Front brake	Pad thickness (including back metal)	17 mm (0.67 in)	7.5 mm (0.295 in)
	Disc thickness ventilated disc	28 mm (1.10 in)	26 mm (1.02 in)
	Disc run-out	—	0.10 mm (0.0039 in)
Rear brake	Pad thickness (including back metal)	15 mm (0.59 in)	6.5 mm (0.256 in)
	Disc thickness disc	10 mm (0.39 in)	8.5 mm (0.335 in)
	Disc run-out	—	0.10 mm (0.0039 in)
Parking brake	Inside diameter	190 mm (7.48 in)	191 mm (7.52 in)
	Lining thickness	3.2 mm (0.126 in)	1.5 mm (0.059 in)
Brake booster		Brake pedal force	All model
	Brake fluid pressure without engine running	147N (15 kg, 33 lb)	490 kPa (5 kg /cm^2, 71 psi)
		294N (30kg, 66 lb)	1,569 kPa (16 kg /cm^2, 228 psi)
	Brake fluid pressure with engine running and vacuum at 66.7 kPa (500 mmHg, 19.69 inHg)	147N (15 kg, 33 lb)	4,511 kPa (46 kg /cm^2, 654 psi)
		294N (30kg, 66 lb)	9,513 kPa (97 kg /cm^2, 1,379 psi)

C: 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.

D: BRAKE FLUID LEVEL INDICATOR

Reserve tank with level indicator:

Residual fluid quantity at light ON

Approx. 80 cm^3 (80cc, 4.88 cu in)

Tank capacity

180 cm^3 (180cc, 10.98 cu in)

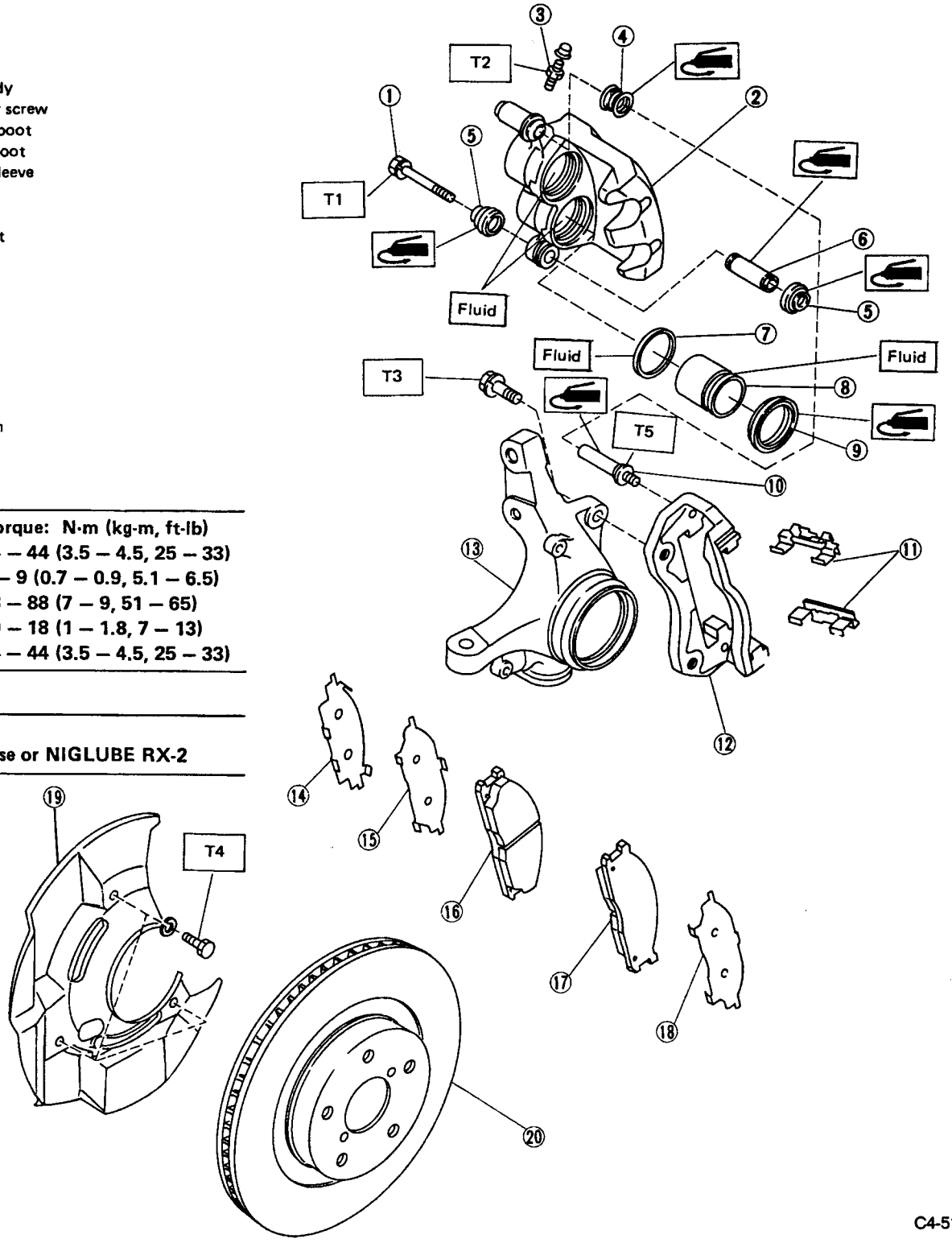
C COMPONENT PARTS

1. Front Disc Brake

1 Lock pin
2 Caliper body
3 Air bleeder screw
4 Guide pin boot
5 Lock pin boot
6 Lock pin sleeve
7 Piston seal
8 Piston
9 Piston boot
10 Guide pin
11 Pad clip
12 Support
13 Housing
14 Shim
15 Inner shim
16 Inner pad
17 Outer pad
18 Outer shim
19 Disc cover
20 Disc rotor

Tightening torque: N·m (kg-m, ft-lb)
T1: 34 – 44 (3.5 – 4.5, 25 – 33)
T2: 7 – 9 (0.7 – 0.9, 5.1 – 6.5)
T3: 68 – 88 (7 – 9, 51 – 65)
T4: 10 – 18 (1 – 1.8, 7 – 13)
T5: 34 – 44 (3.5 – 4.5, 25 – 33)

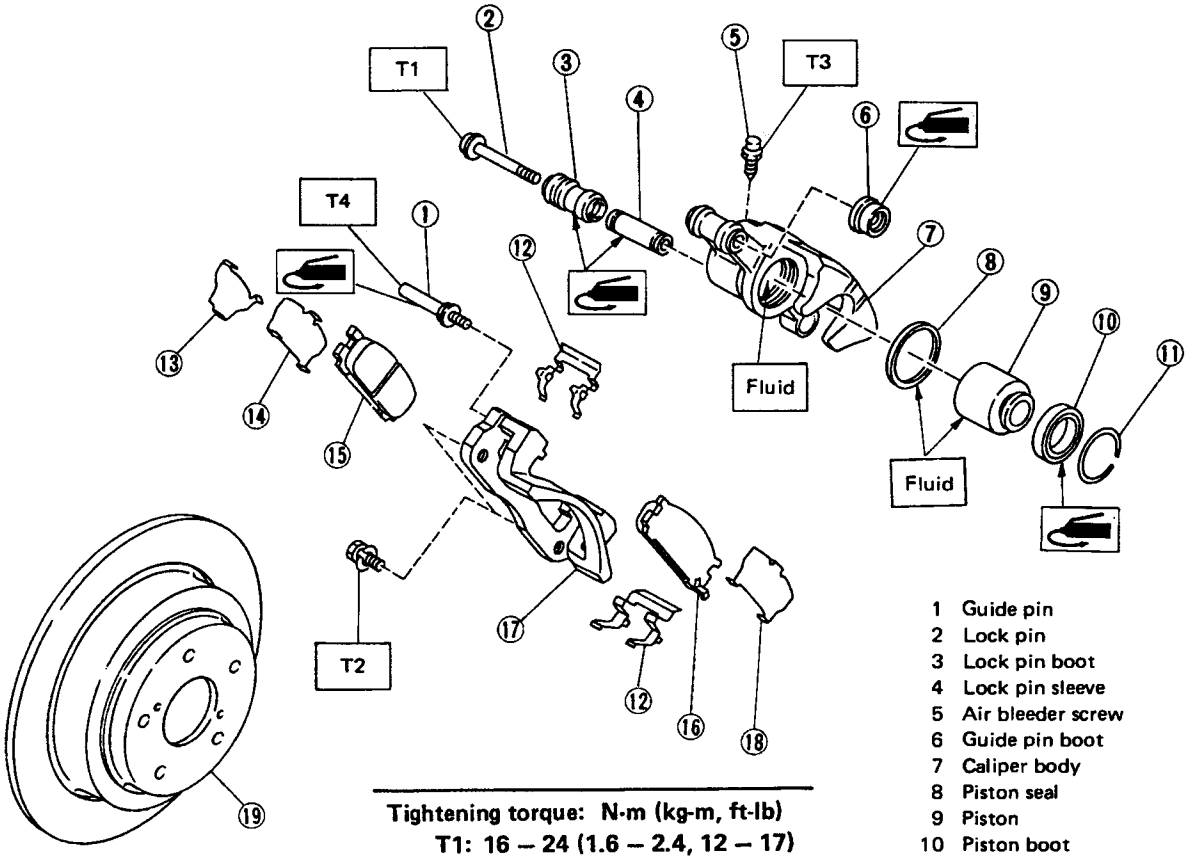
Grease:
Rubber Grease or NIGLUBE RX-2



C4-518

Fig. 36

2. Rear Disc Brake



Tightening torque: N·m (kg-m, ft-lb)
T1: 16 – 24 (1.6 – 2.4, 12 – 17)
T2: 46 – 58 (4.7 – 5.9, 34 – 43)
T3: 7 – 9 (0.7 – 0.9, 5.1 – 6.5)
T4: 22 – 31 (2.2 – 3.2, 16 – 23)

Grease:
RUBBER GREASE or
NIGLUBE RX-2 GREASE

1 Guide pin
2 Lock pin
3 Lock pin boot
4 Lock pin sleeve
5 Air bleeder screw
6 Guide pin boot
7 Caliper body
8 Piston seal
9 Piston
10 Piston boot
11 Boot ring
12 Pad clip
13 Shim
14 Inner shim
15 Inner pad
16 Outer pad
17 Support
18 Outer shim
19 Disc rotor

C4-519

Fig. 37

C COMPONENT PARTS

3. Master Cylinder

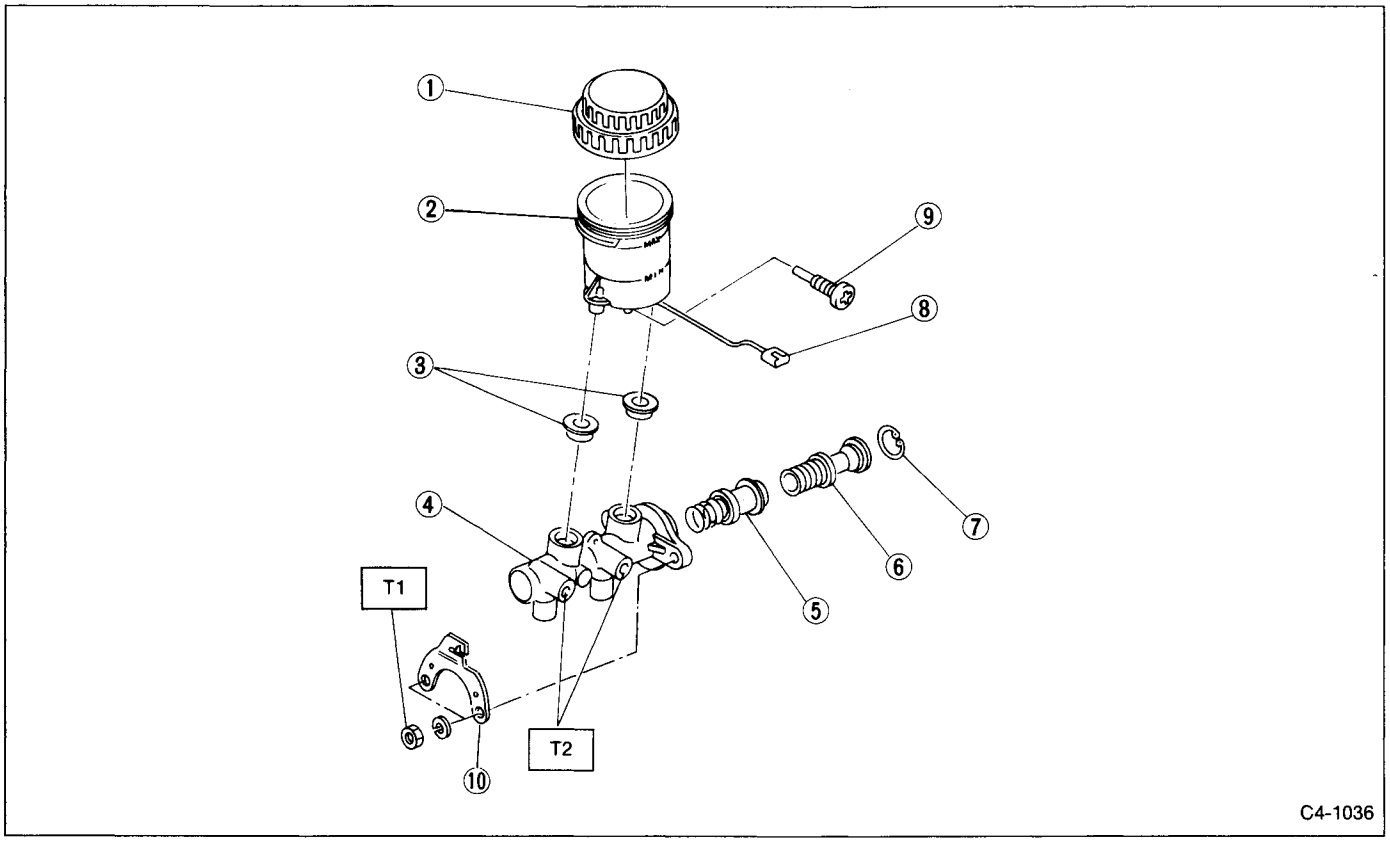


Fig. 4

① Cap
② Reserve tank
③ Seal
④ Cylinder body
⑤ Secondary piston
⑥ Primary piston
⑦ C-ring
⑧ Level indicator ASSY
⑨ Reservoir stopper bolt
⑩ Connector bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 10 — 18 (1.0 — 1.8, 7 — 13)
T2: 13 — 18 (1.3 — 1.8, 9 — 13)

4. Brake Booster

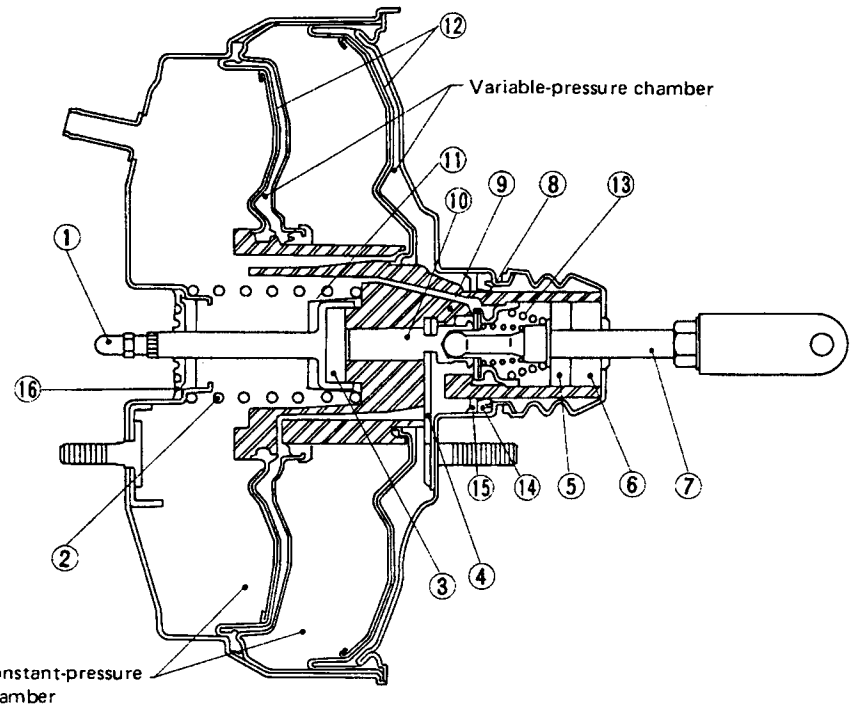
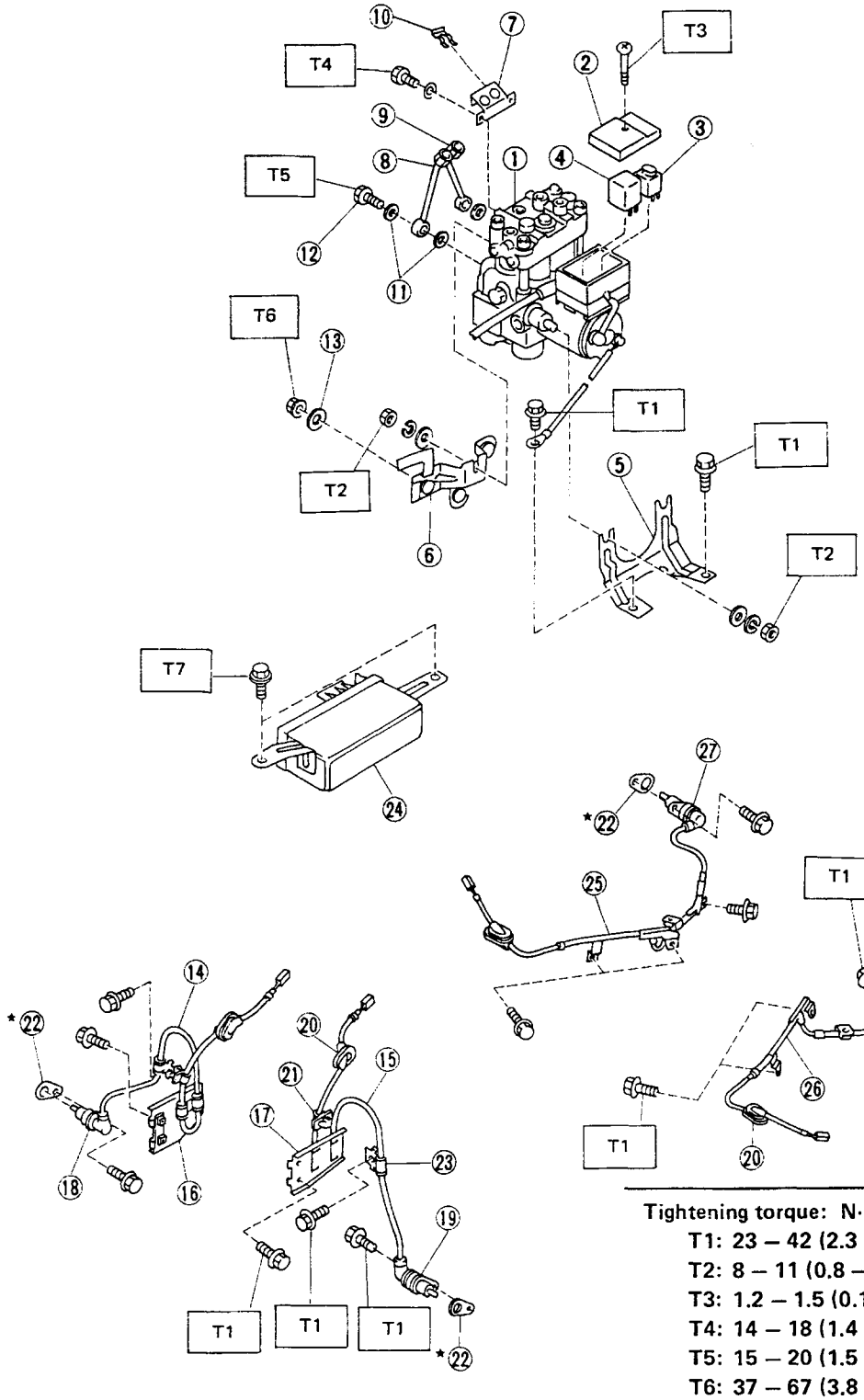


Fig. 39

5. ABS System



* Selective parts
1 Hydraulic control unit ASSY
2 Relay cover
3 Motor relay
4 Valve relay
5 Hydraulic control unit bracket (A)
6 Hydraulic control unit bracket (B)
7 Joint bracket
8 Inlet joint RH
9 Inlet joint LH
10 Clamp
11 Gasket
12 Union bolt
13 Spacer
14 Front sensor sub ASSY RH
15 Front sensor sub ASSY LH
16 Body COMPL bracket RH
17 Body COMPL bracket LH
18 Front ABS sensor RH
19 Front ABS sensor LH
20 Grommet
21 Bracket
22 Control spacer
23 Front harness clamp
24 Electronic control unit ASSY
25 Rear sensor sub ASSY RH
26 Rear sensor sub ASSY LH
26 Rear ABS sensor RH
28 Rear ABS sensor LH

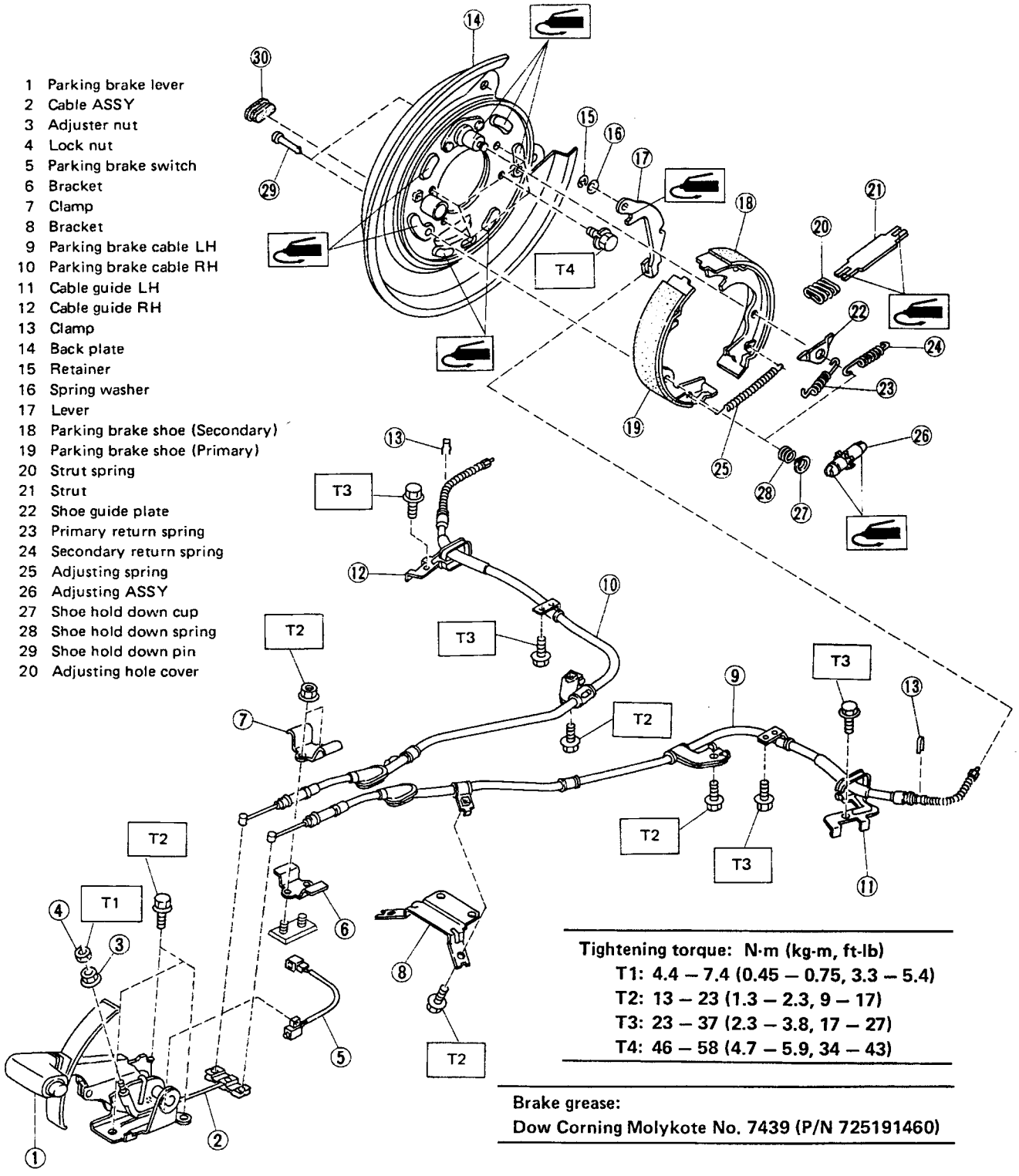
Tightening torque: N·m (kg-m, ft-lb)
T1: 23 – 42 (2.3 – 4.3, 17 – 31)
T2: 8 – 11 (0.8 – 1.1, 5.8 – 8.0)
T3: 1.2 – 1.5 (0.12 – 0.15, 0.9 – 1.1)
T4: 14 – 18 (1.4 – 1.8, 10 – 13)
T5: 15 – 20 (1.5 – 2.0, 11 – 14)
T6: 37 – 67 (3.8 – 6.8, 27 – 49)
T7: 5.4 – 9.3 (0.55 – 0.95, 4.0 – 6.9)
T8: 2.2 – 2.6 (0.22 – 0.27, 1.6 – 2.0)

C4-520

Fig. 40

6. Parking Brake

1 Parking brake lever
2 Cable ASSY
3 Adjuster nut
4 Lock nut
5 Parking brake switch
6 Bracket
7 Clamp
8 Bracket
9 Parking brake cable LH
10 Parking brake cable RH
11 Cable guide LH
12 Cable guide RH
13 Clamp
14 Back plate
15 Retainer
16 Spring washer
17 Lever
18 Parking brake shoe (Secondary)
19 Parking brake shoe (Primary)
20 Strut spring
21 Strut
22 Shoe guide plate
23 Primary return spring
24 Secondary return spring
25 Adjusting spring
26 Adjusting ASSY
27 Shoe hold down cup
28 Shoe hold down spring
29 Shoe hold down pin
20 Adjusting hole cover



Tightening torque: N·m (kg-m, ft-lb)
T1: 4.4 – 7.4 (0.45 – 0.75, 3.3 – 5.4)
T2: 13 – 23 (1.3 – 2.3, 9 – 17)
T3: 23 – 37 (2.3 – 3.8, 17 – 27)
T4: 46 – 58 (4.7 – 5.9, 34 – 43)

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

C4-521

Fig. 41

W SERVICE PROCEDURE

1. Front Disc Brake

1 Lock pin
2 Caliper body
3 Air bleeder screw
4 Guide pin boot
5 Lock pin boot
6 Lock pin sleeve
7 Piston seal
8 Piston
9 Piston boot
10 Guide pin
11 Pad clip
12 Support
13 Housing
14 Shim
15 Inner shim
16 Inner pad
17 Outer pad
18 Outer shim
19 Disc cover
20 Disc rotor

Tightening torque: N·m (kg-m, ft-lb)
T1: 34 – 44 (3.5 – 4.5, 25 – 33)
T2: 7 – 9 (0.7 – 0.9, 5.1 – 6.5)
T3: 68 – 88 (7 – 9, 51 – 65)
T4: 10 – 18 (1 – 1.8, 7 – 13)
T5: 34 – 44 (3.5 – 4.5, 25 – 33)

Grease:
Rubber Grease or NIGLUBE RX-2

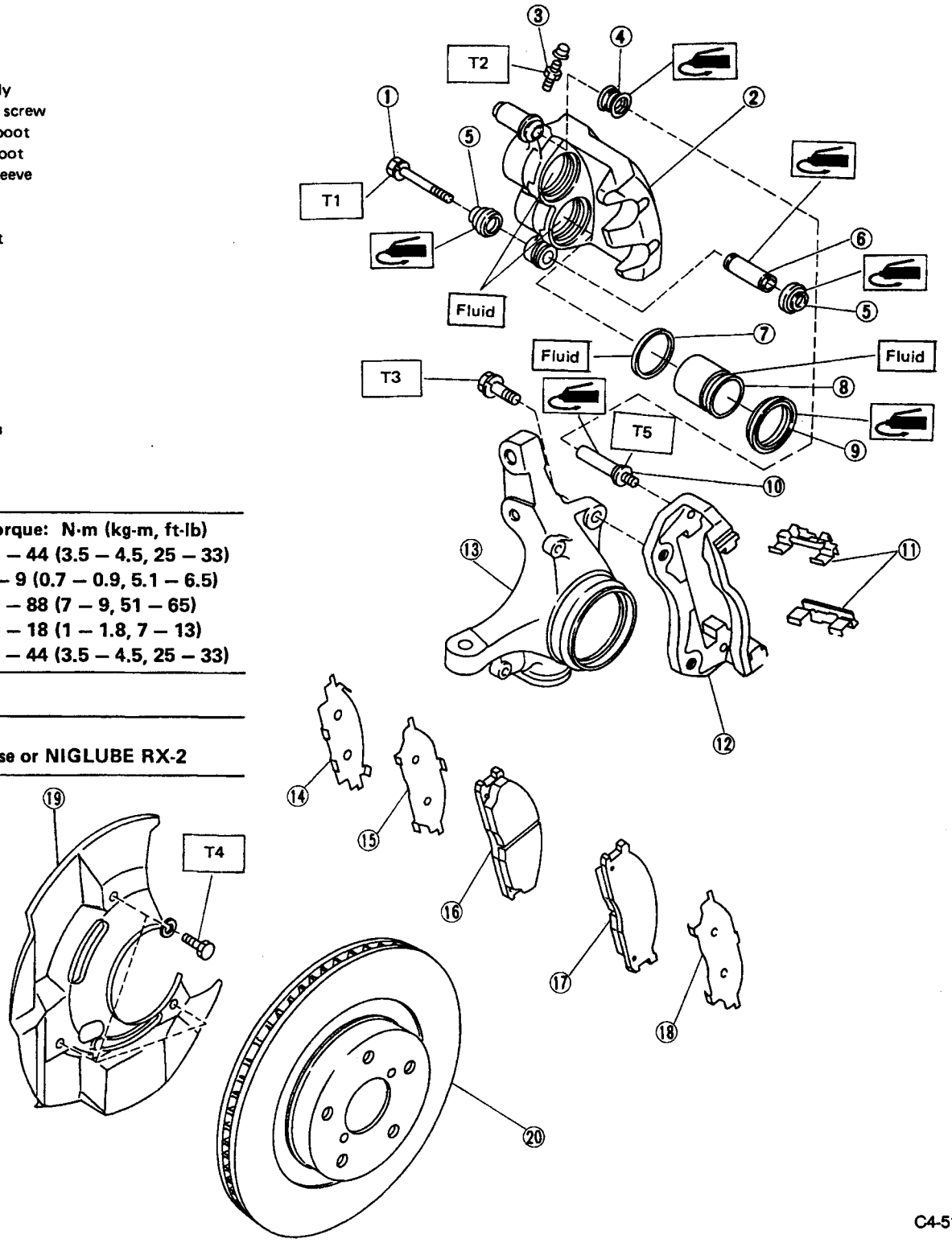


Fig. 42

A: ON-CAR SERVICE

1. PAD

1) Disconnect brake hose from strut.
2) Remove lock pin.

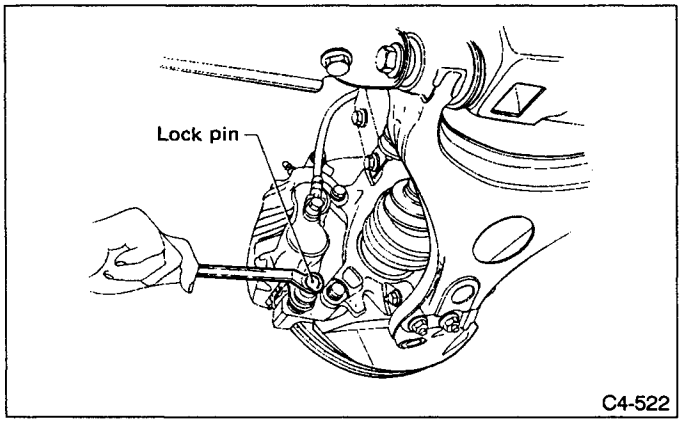


Fig. 43

3) Raise caliper body.
4) Remove pad.

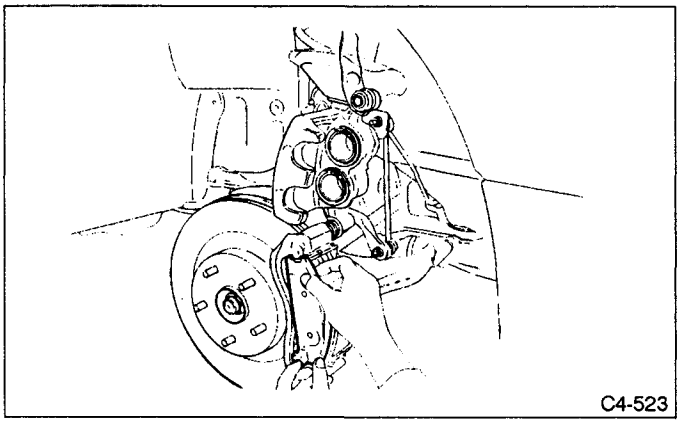


Fig. 44

5) Check pad thickness A.

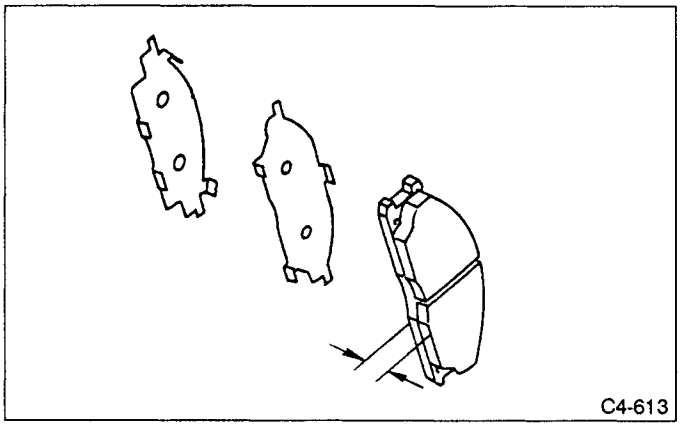


Fig. 45

Pad thickness (including back metal) mm (in)	Standard value	17 (0.67)
	Wear limit	7.5 (0.295)

a. Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
b. A wear indicator is provided on the outer 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.
c. Replace pad if there is oil or grease on it.
6) Apply thin coat of PBC GREASE (725191330 or 003607000) to the frictional portion between pad and pad clip.
7) Install pads on support.

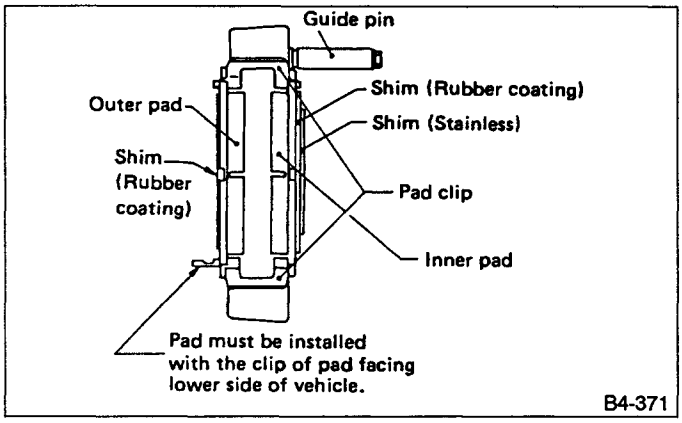


Fig. 46

8) Install caliper body on support.
If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

2. DISC ROTOR

1) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.
Make sure that dial gauge is set 5 mm (0.20 in) inward of rotor outer perimeter.

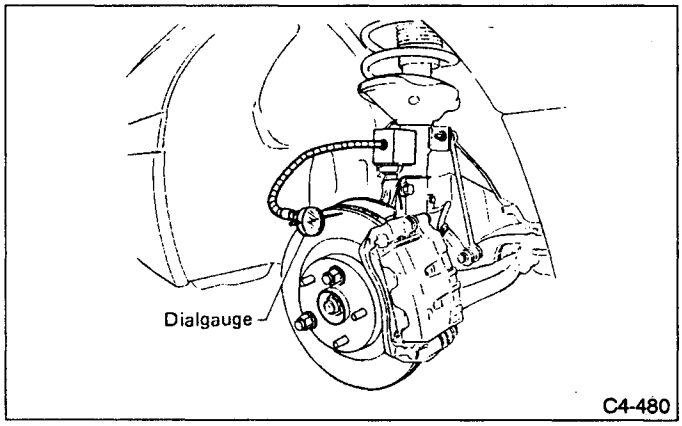


Fig. 47

Disc rotor runout limit:
0.1 mm (0.004 in)

2) Measure disc rotor thickness.
Make sure that micrometer is set 5 mm (0.20 in) inward of rotor outer perimeter.

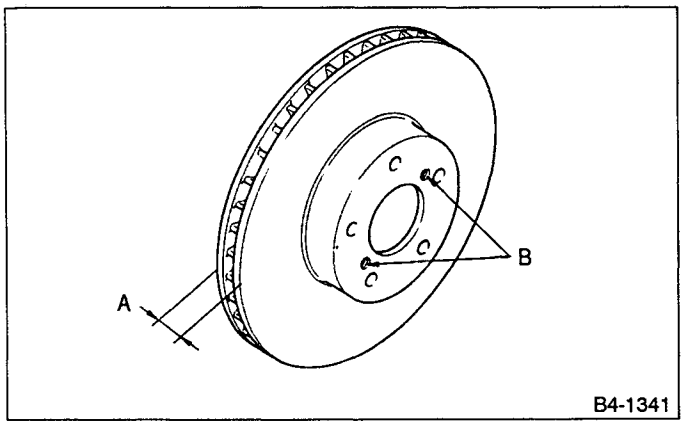


Fig. 48

Disc rotor thickness A mm (in)	Standard value	Service limit
	28.0 (1.102)	26.0 (1.024)

B: REMOVAL

1) Lift up vehicle and remove wheels.
2) Disconnect brake hose from caliper body ASSY.
Do not allow brake fluid to come in contact with vehicle body; wipe off completely if spilled.

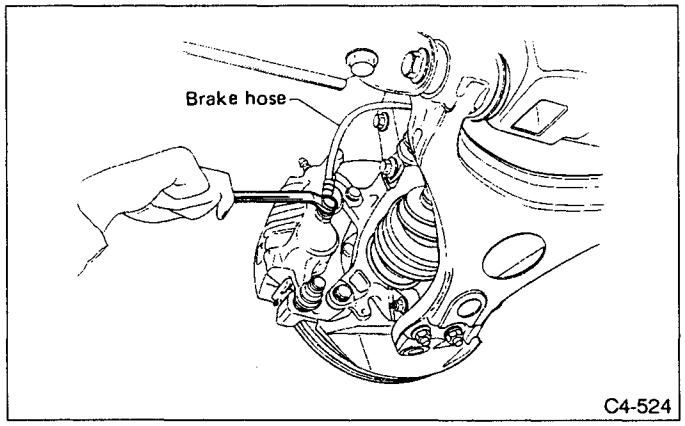


Fig. 49

3) Remove lock pin.

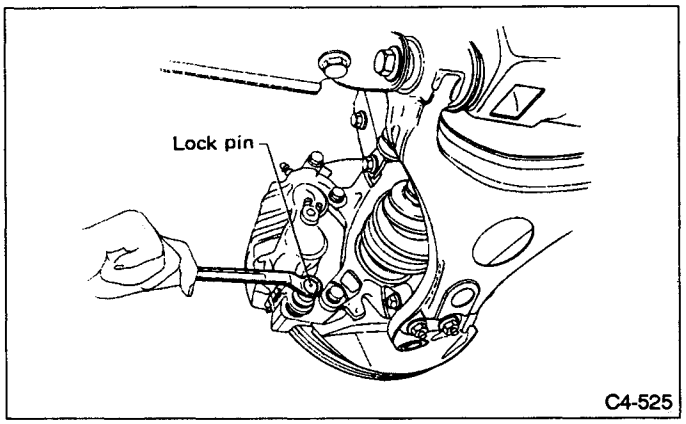


Fig. 50

4) Raise caliper body and move it toward vehicle center to separate it from support.
5) Remove support from housing.
Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body ASSY.

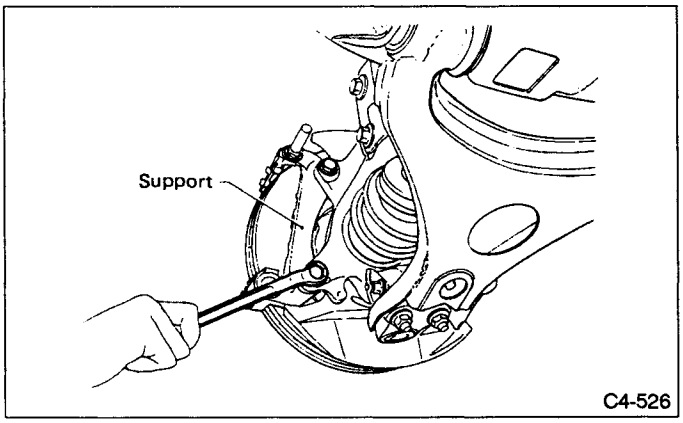


Fig. 51

6) Remove disc rotor from hub.
If disc rotor seizes up within hub, drive disc rotor out by installing an 8-mm bolt in holes B on the rotor.

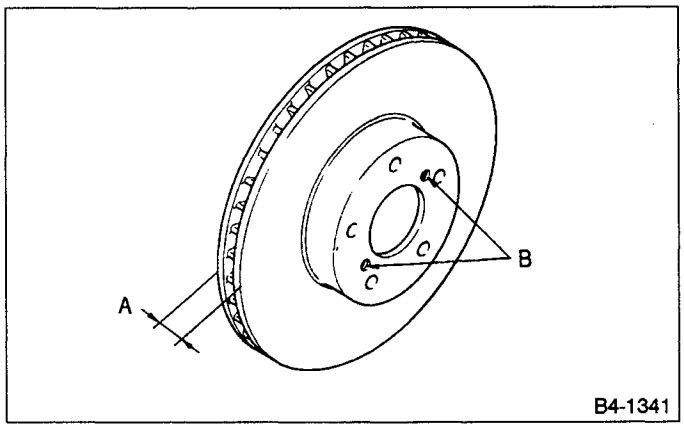


Fig. 52

7) Clean mud and foreign particles from caliper body ASSY and support.
Be careful not to allow foreign particles to enter inlet (at brake hose connector).

C: DISASSEMBLY

1) Gradually supply compressed air via inlet of caliper body to force piston out.
a. Place a wooden block as shown in Fig.53 to prevent damage to piston.
b. Do not apply excessively high pressure.

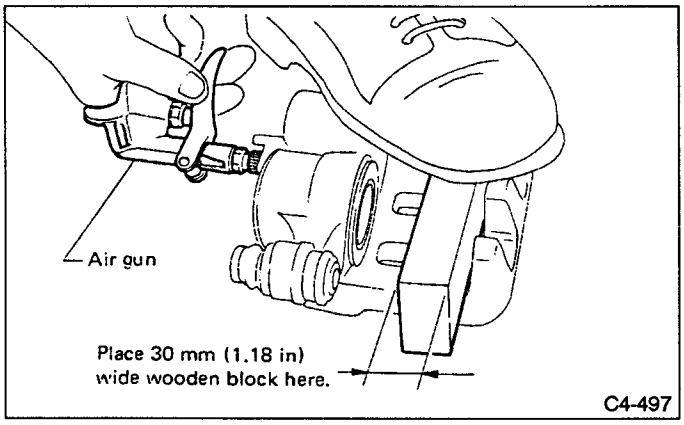


Fig. 53

2) Remove piston boot.
3) Remove piston seal from caliper body cylinder.

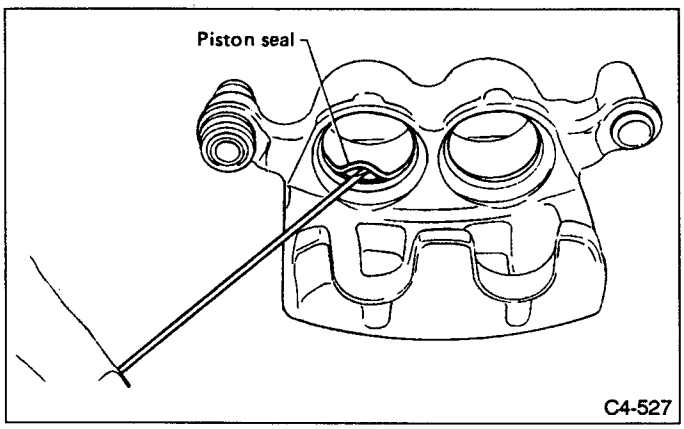


Fig. 54

4) Remove lock pin sleeve and boot from caliper body.
5) Remove guide pin boot.

D: INSPECTION

1) Repair or replace faulty parts.
2) Check caliper body and piston for uneven wear, damage or rust.
3) Check rubber parts for damage or deterioration.

E: ASSEMBLY

1) Clean caliper body interior using brake fluid.
2) Apply a coat of brake fluid to piston seal and fit piston seal in groove on caliper body.
3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.
4) Apply a coat of specified grease to boot and fit in groove on ends of cylinder and install piston boot onto caliper body.

Grease:
RUBBER GREASE or NIGLUBE RX-2

5) Insert piston into boot and cylinder.
Do not force piston into cylinder.

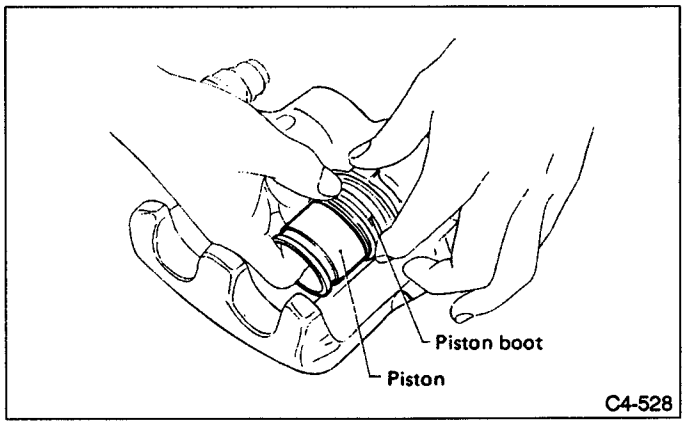


Fig. 55

6) Position boot in grooves on cylinder and piston.

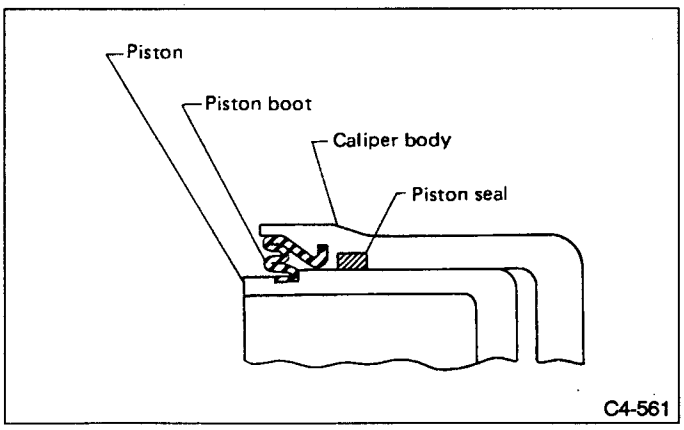


Fig. 56

7) Apply a coat of specified grease to guide pin outer surface, sleeve outer surface, cylinder inner surface and boot grooves.

Grease:
RUBBER GREASE or NIGLUBE RX-2

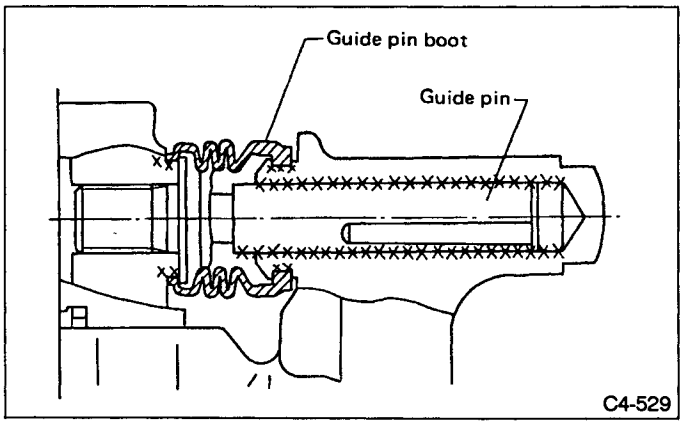


Fig. 57 Grease application to guide pin portion

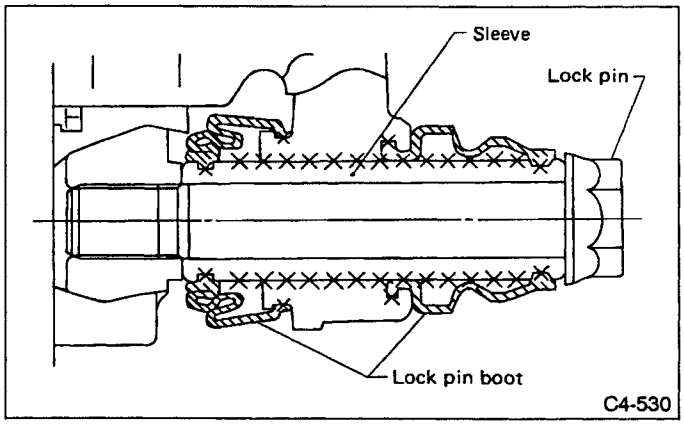


Fig. 58 Grease application to lock pin portion

8) Install guide pin boot on caliper body.
9) Install lock pin boot on caliper body and insert lock pin sleeve into place.

F: INSTALLATION

1) Install disc rotor on housing.
2) Install support on housing.
a. Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
b. A wear indicator is provided on the outer 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.
c. When replacing the pad, replace pads of the right and left wheels at the same time.
3) Apply thin coat of PBC GREASE (725191330 or 003607000) to the frictional portion between pad and pad clip.
4) Install pads, rubber coated shim and stainless shim on support.

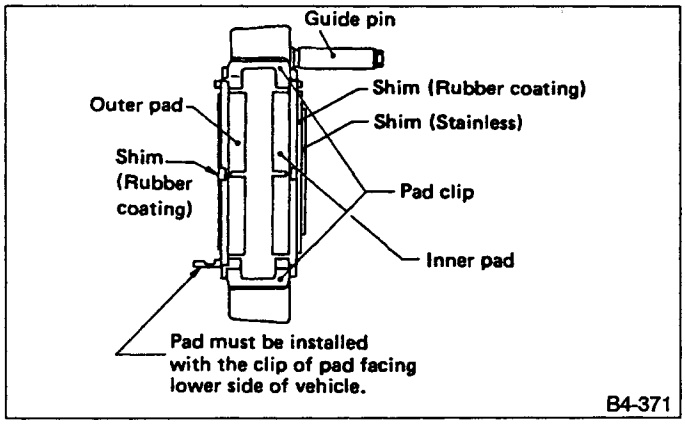


Fig. 59

5) Install caliper body on support.
6) Connect brake hose.
7) Bleed air from brake system.

2. Rear Disc Brake

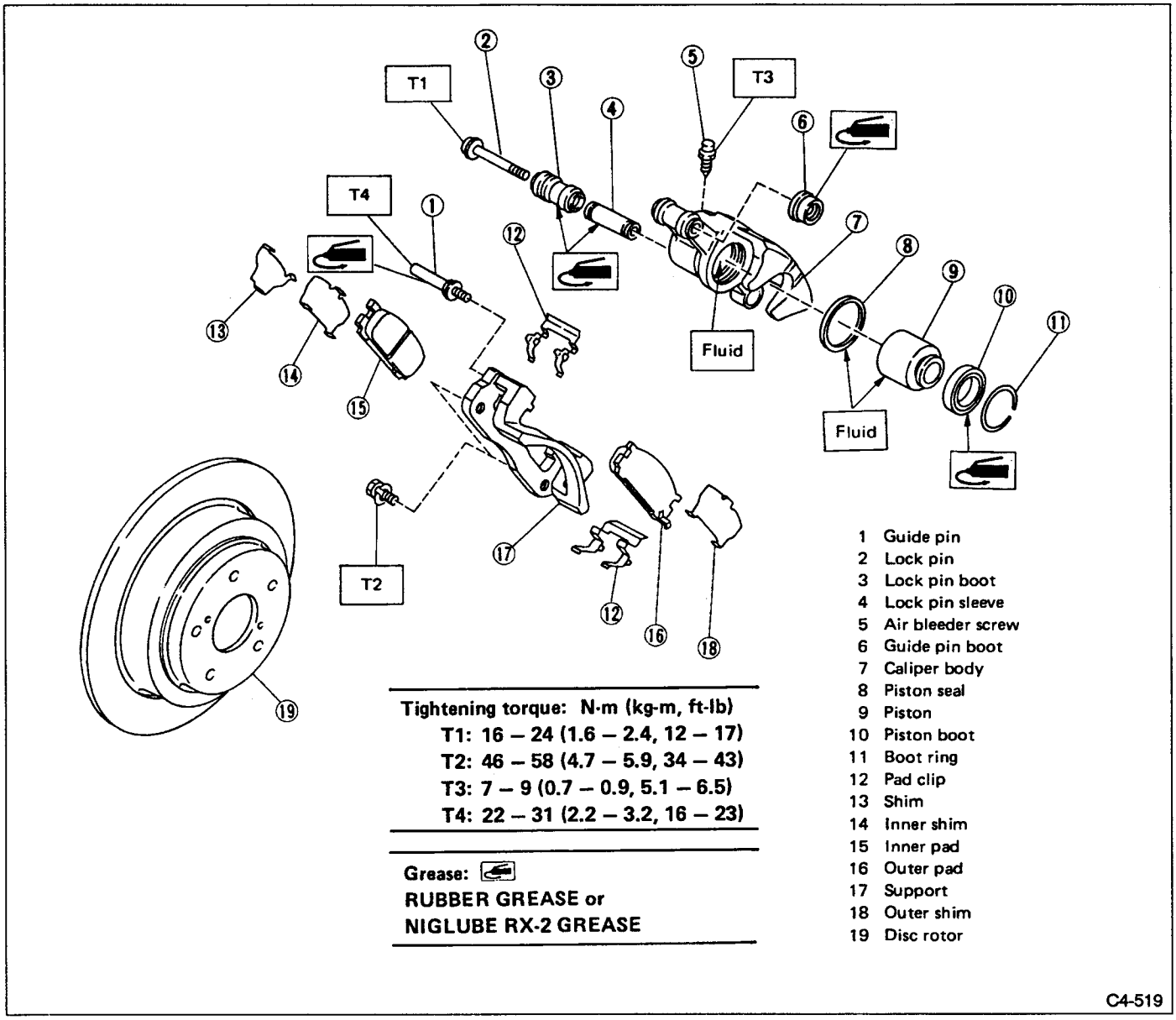


Fig. 60

A: ON-CAR SERVICE

1. PAD

1) Disconnect brake hose from strut.
2) Remove lock pin.

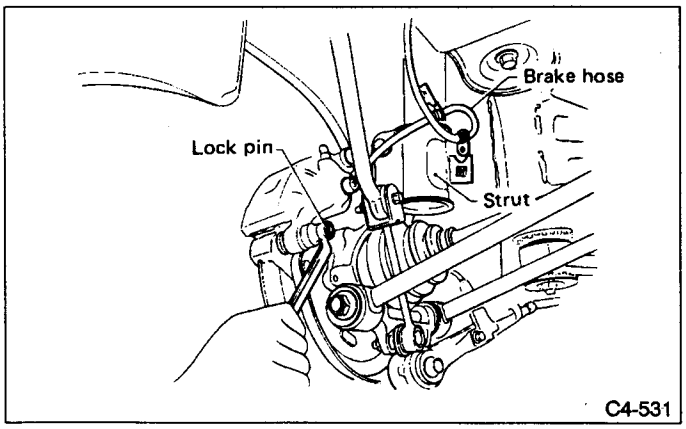


Fig. 61

3) Raise caliper body.
4) Remove pad from support.

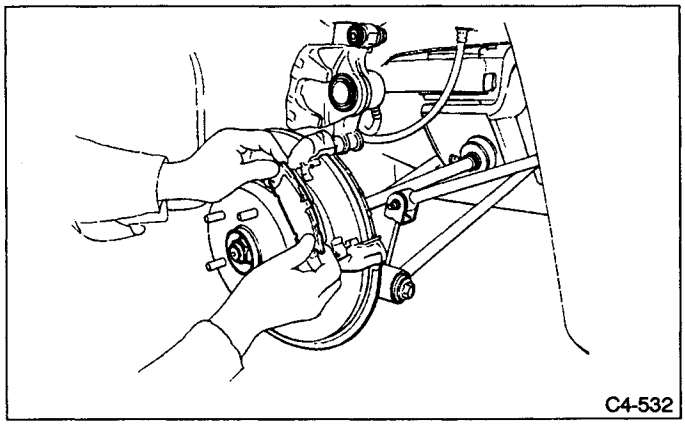


Fig. 62

5) Check pad thickness A.

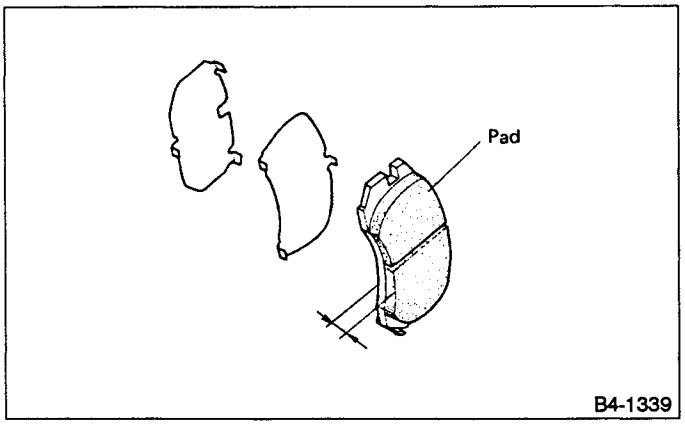


Fig. 63

Pad thickness (including back metal) mm (in)	Standard value	15.0 (0.591)
	Wear limit	6.5 (0.256)

a. Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.
b. A wear indicator is provided on the outer 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.
c. Replace pad if there is oil or grease on it.
6) Apply thin coat of PBC GREASE (725191330 or 003607000) to the frictional portion between pad and pad clip.
7) Install pad on support.

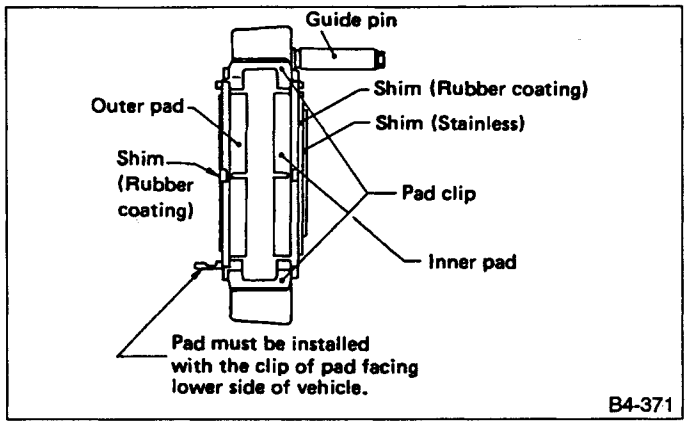


Fig. 64

8) Install caliper body on support.
If it is difficult to push piston during pad replacement, loosen air bleeder to facilitate work.

2. DISC ROTOR

1) Set a dial gauge on the disc rotor. Turn disc rotor to check runout.
Make sure that dial gauge is set 5 mm (0.20 in) inward of rotor outer perimeter.

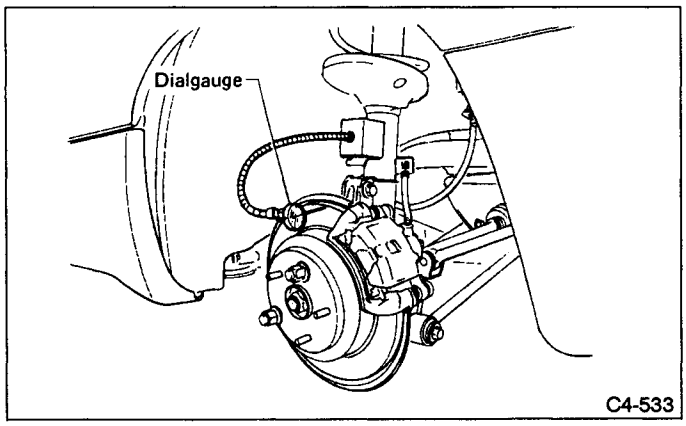


Fig. 65

Disc rotor runout limit:
0.1 mm (0.004 in)

2) Measure disc rotor thickness.
Make sure that micrometer is set 5 mm (0.20 in) inward of rotor outer perimeter.

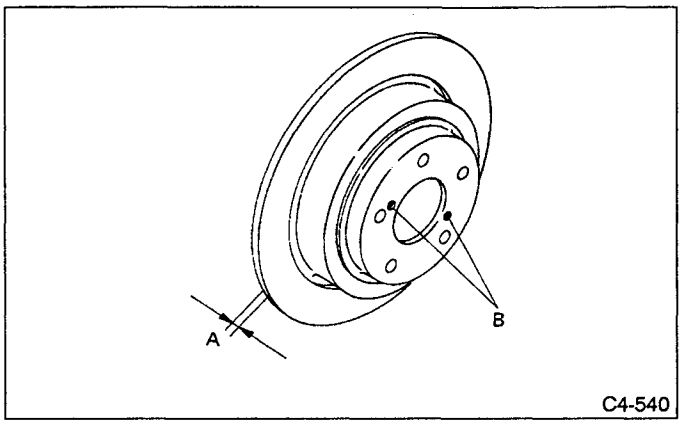


Fig. 66

Disc rotor thickness A mm (in)	Standard value	Service limit
	10 (0.39)	8.5 (0.335)

When removing disc rotor, refer to instructions under Parking Brake [W3A0].

B: REMOVAL

1) Lift up vehicle and remove wheels.
2) Disconnect brake hose from caliper body ASSY.
Do not allow brake fluid to come in contact with vehicle body; wipe off completely if spilled.

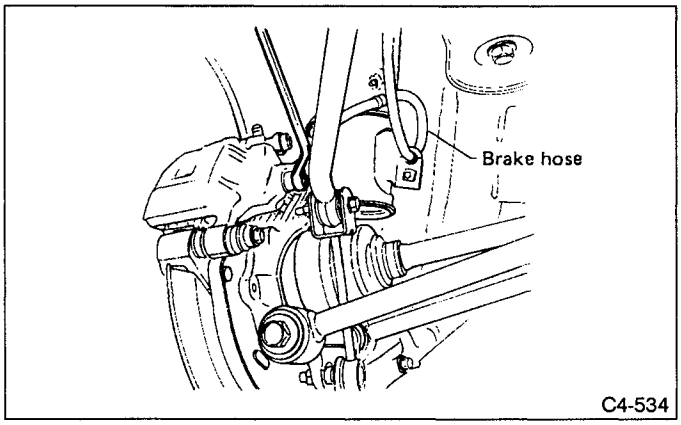


Fig. 67

3) Remove lock pin.

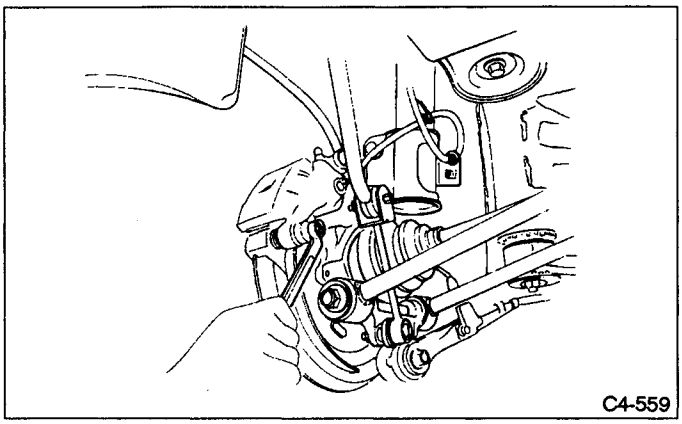


Fig. 68

4) Raise caliper body and move it toward vehicle center to separate it from support.
5) Remove support from back plate.
Remove support only when replacing it or the rotor. It need not be removed when servicing caliper body ASSY.
6) Clean mud and foreign particles from caliper body ASSY and support.
Be careful not to allow foreign particles to enter inlet (at brake hose connector).

C: DISASSEMBLY

1) Remove the boot ring.

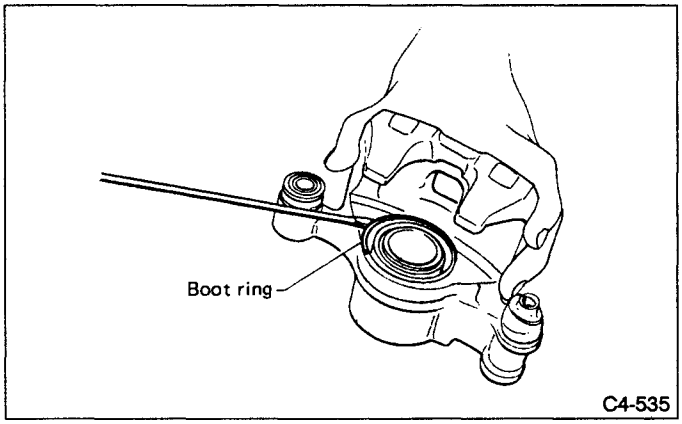


Fig. 69

2) Remove the piston boot.

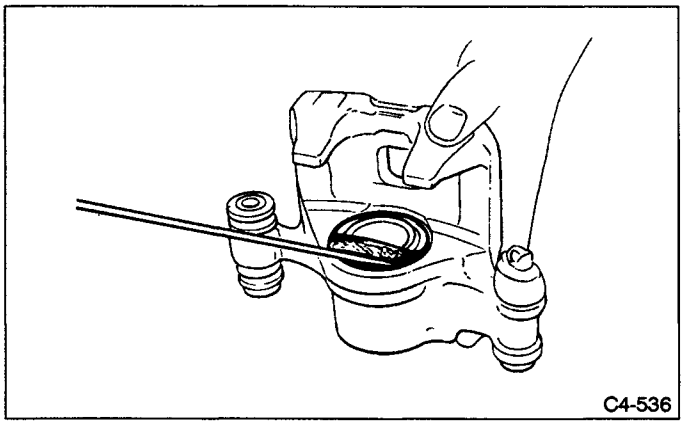


Fig. 70

3) Gradually supply compressed air via inlet of caliper body to force piston out.
a. Place a wooden block as shown in Fig. 71 to prevent damage to piston.
b. Do not apply excessively high pressure.

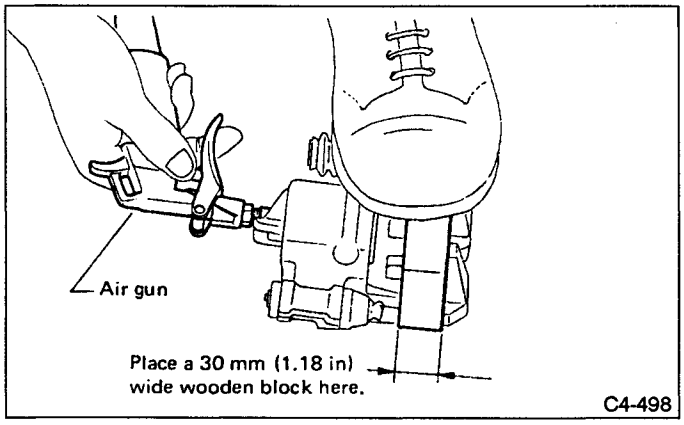


Fig. 71

4) Remove piston seal from caliper body cylinder.

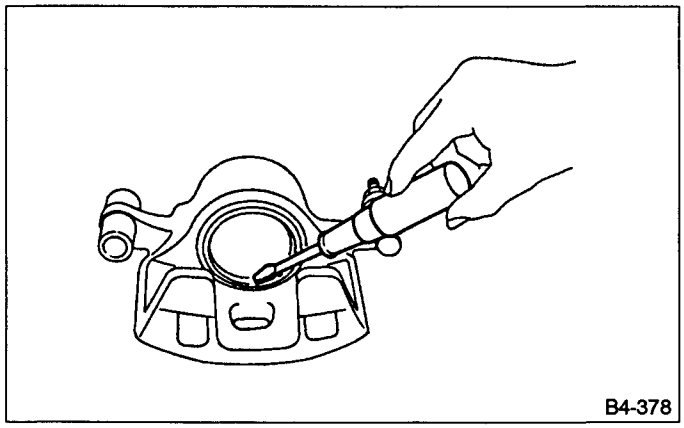


Fig. 72

5 Remove lock pin sleeve and boot from caliper body.
6) Remove guide pin boot.

D: INSPECTION

1) Repair or replace faulty parts.
2) Check caliper body and piston for uneven wear, damage or rust.
3) Check rubber parts for damage or deterioration.

E: ASSEMBLY

1) Clean caliper body interior using brake fluid.
2) Apply a coat of brake fluid to piston seal and fit piston seal in groove on caliper body.
3) Apply a coat of brake fluid to the entire inner surface of cylinder and outer surface of piston.
4) Insert piston into cylinder.
Do not force piston into cylinder.
5) Apply a coat of specified grease to boot and fit in groove on ends of cylinder and piston.

Grease:
RUBBER GREASE or NIGLUBE RX-2

6) Install the piston boot to the caliper body, and attach boot ring.

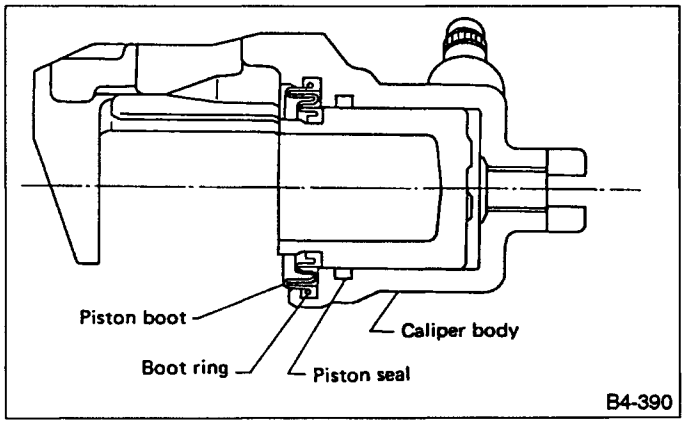


Fig. 73

7) Apply a coat of specified grease to guide pin, outer surface, sleeve outer surface, cylinder inner surface, and boot grooves.

Grease:
RUBBER GREASE or NIGLUBE RX-2

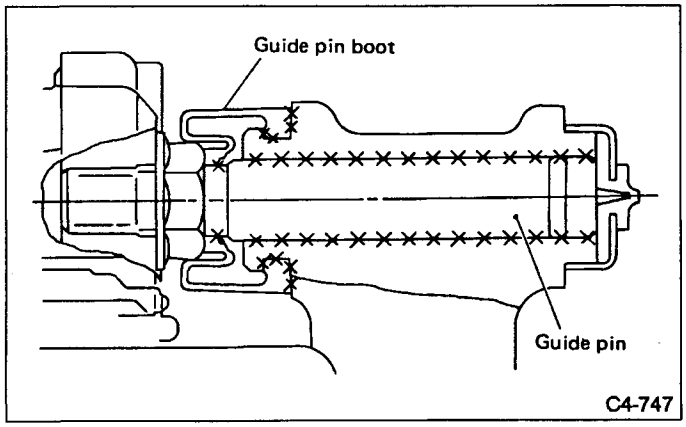


Fig. 74

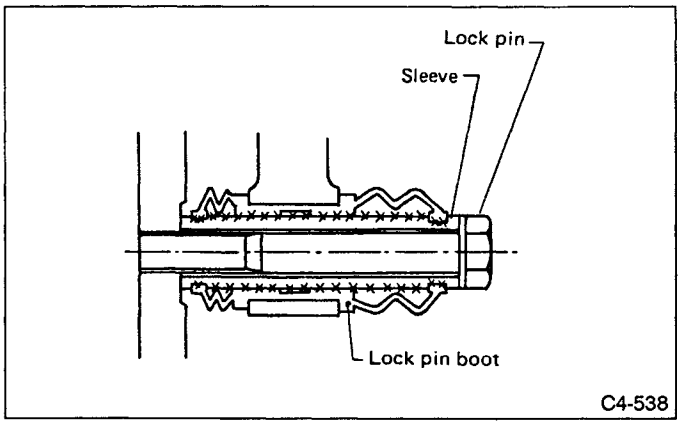


Fig. 75

8) Install guide pin boots on caliper body.
9) Install lock pin boots on caliper body and insert lock pin sleeve into place.

F: INSTALLATION

1) Install disc rotor on hub.
2) Install support on back plate.

a. Always replace the pads for both the left and right wheels at the same time. Also replace pad clips if they are twisted or worn.

b. A wear indicator is provided on the outer 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.

c. Replace pads if there is oil or grease on them.

3) Apply thin coat of PBC GREASE (725191330 or 003607000) to the frictional portion between pad and pad clip.
4) Install pads on support.

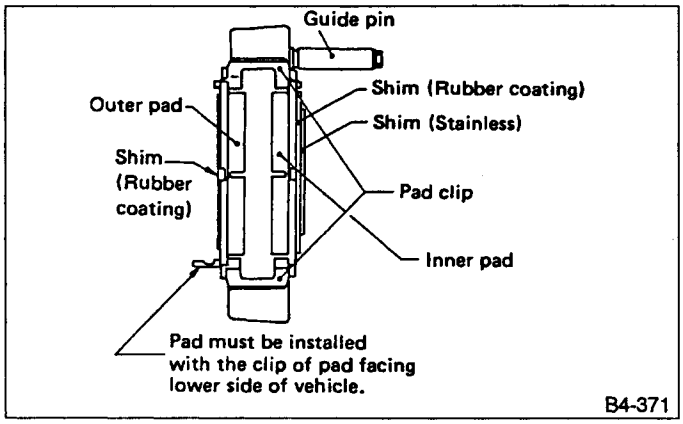


Fig. 76

5) Install caliper body on support.
6) Connect brake hose.
7) Bleed air from brake system.

3. Parking Brake

A: REMOVAL

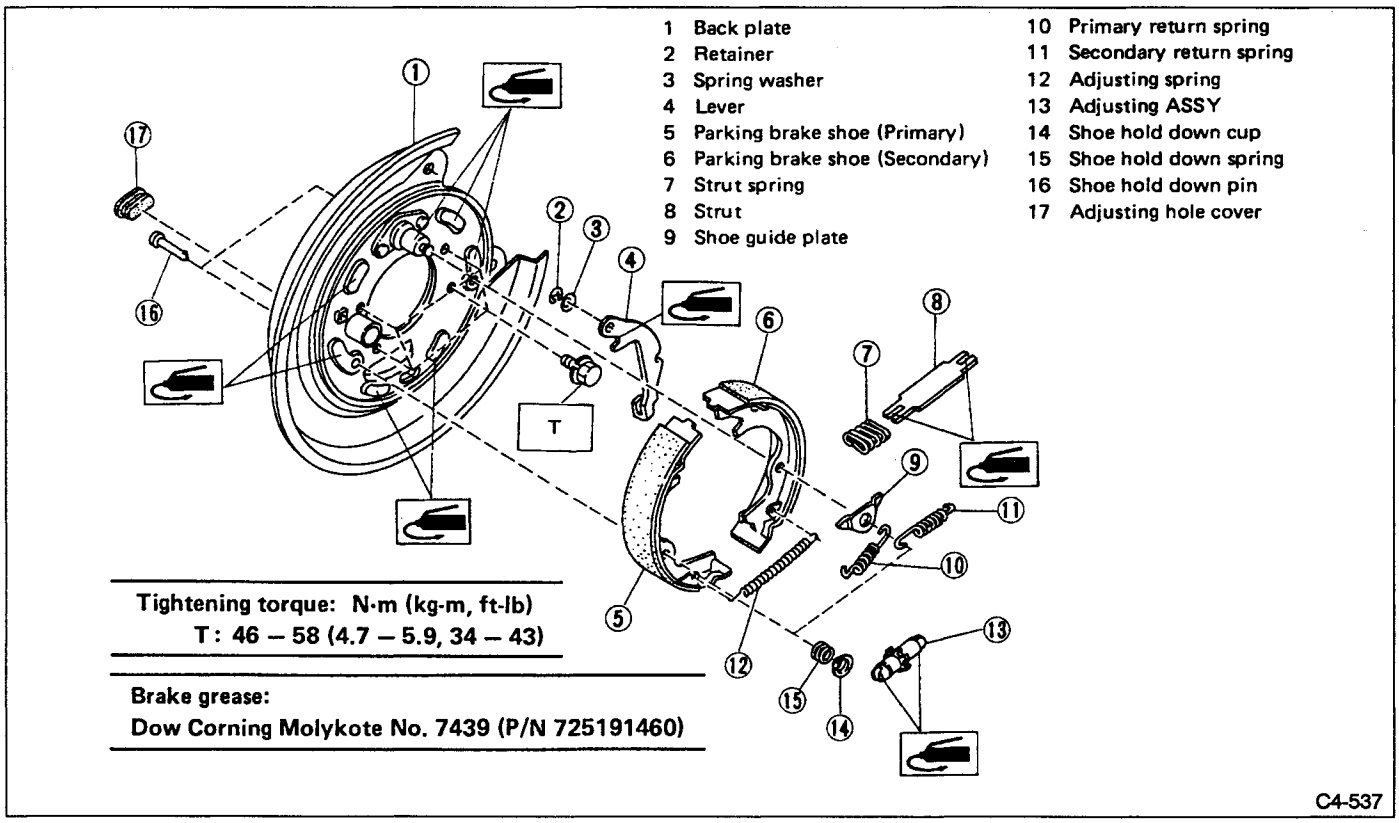


Fig. 77

1) Lift up vehicle and remove rear wheel.
2) Release parking brake lever.
3) Remove console box lid.

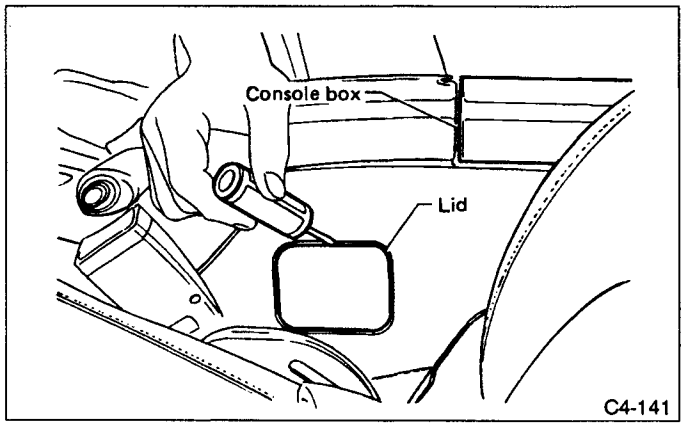


Fig. 78

4) Loosen adjuster.

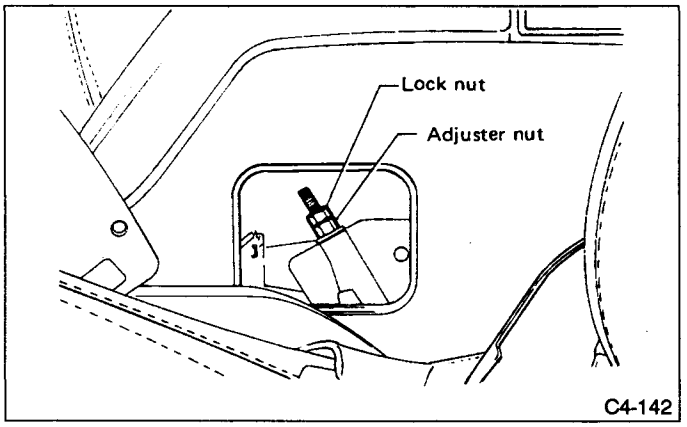


Fig. 79

5) Remove brake hose clamp from strut.
6) Remove brake caliper ASSY.

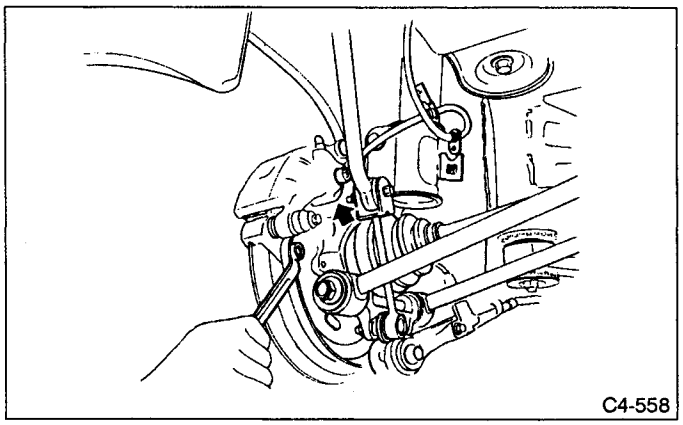


Fig. 80

7) Fasten caliper assembly to strut with wire.

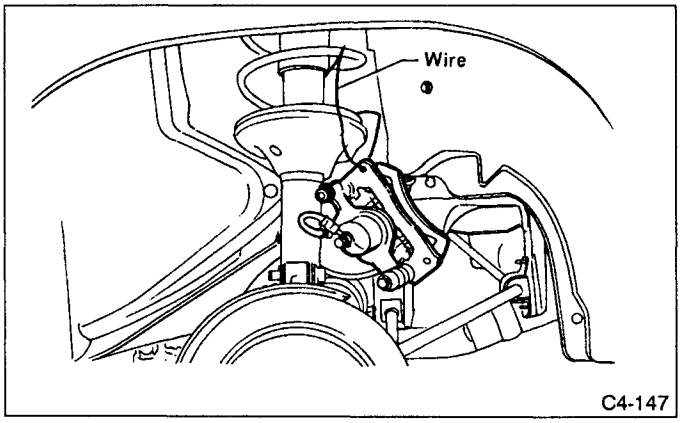


Fig. 81

8) Remove disc rotor.
If disc rotor seizes up within hub, drive it out by installing 8-mm bolts into holes "B" in disc rotor.

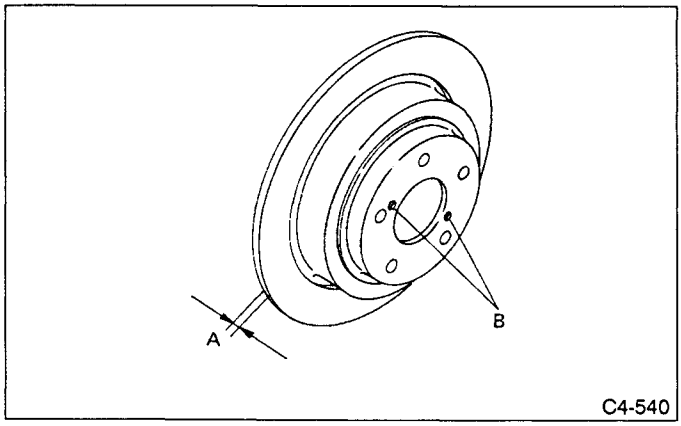


Fig. 82

9) Remove shoe return spring from parking brake ASSY.
10) Disconnect hold-down cup from hold-down pin by rotating hold-down cup.
11) Remove strut and strut spring.
12) Remove adjuster ASSY and adjuster spring.
13) Disconnect lever from parking brake cable.

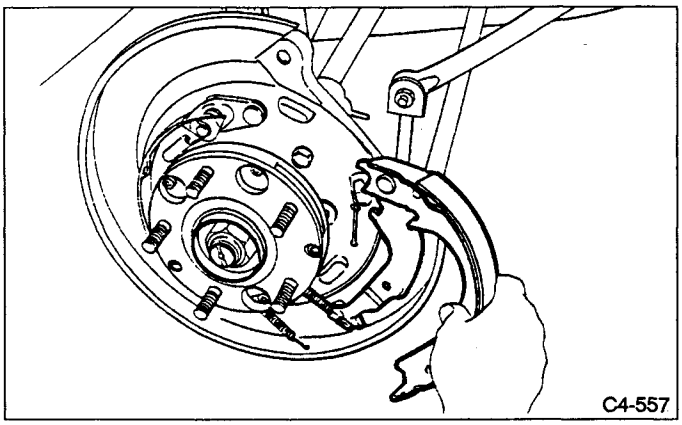


Fig. 83

B: INSPECTION

1) Measure brake disc inside diameter. If the disc is scored or worn, replace the brake disc.

Disc inside diameter:
Standard
190 mm (7.48 in)
Service limit
191 mm (7.52 in)

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

Lining thickness:
Standard
3.2 mm (0.126 in)
Service limit
1.5 mm (0.059 in)

Replace the brake shoes on the right and left brake ASSY at the same time.
Use new retainers and clinch them when installing brake shoes to levers.

C: INSTALLATION

Be sure lining surface is free from oil contamination.

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

1) Apply brake grease to the following places. (Refer to Figure 77.)
(1) Six contact surfaces of shoe rim and back plate packing.
(2) Contact surface of shoe wave and anchor pin
(3) Contact surface of lever and strut
(4) Contact surface of shoe wave and adjuster assembly
(5) Contact surface of shoe wave and strut
(6) Contact surface of lever and shoe wave

2) Installation is in reverse order of removal.
a. Use new retainers and clinch them when installing brake shoes to levers.
b. Ensure that parking lever moves smoothly.
c. Do not confuse left parking lever with right one.
d. Do not confuse left strut with right one.
e. Ensure that adjuster assembly is securely installed with screw in the left side.

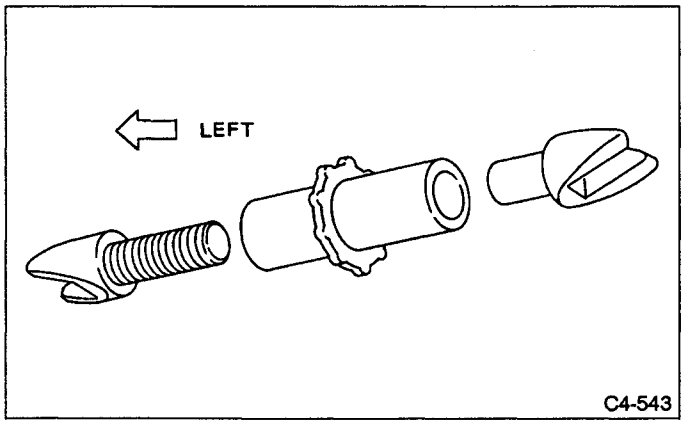


Fig. 84

f. Ensure that shoe return spring is installed as shown in Fig. 85.

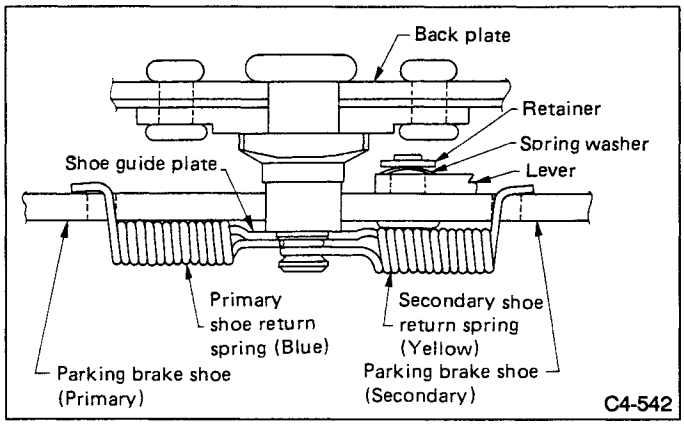


Fig. 85

3) Adjust parking brakes. Refer to 4-4 [W3D1].
a. After replacing parking brake lining, be sure to drive vehicle for "break-in" purposes.
b. Drive the vehicle about 35 km/h (22 MPH).
c. With the parking brake release button pushed in, pull the parking brake lever gently.
d. Drive the vehicle for about 200 meter (0.12 mile) in this condition.
e. Wait 5 to 10 minutes for the parking brake to cool down. Repeat this procedure once more.
f. After breaking-in, re-adjust parking brakes.

4) Check back plate bolt tightening torque as follows:
(1) Remove caliper and disc rotor.
(2) Remove tone wheel attaching bolts.

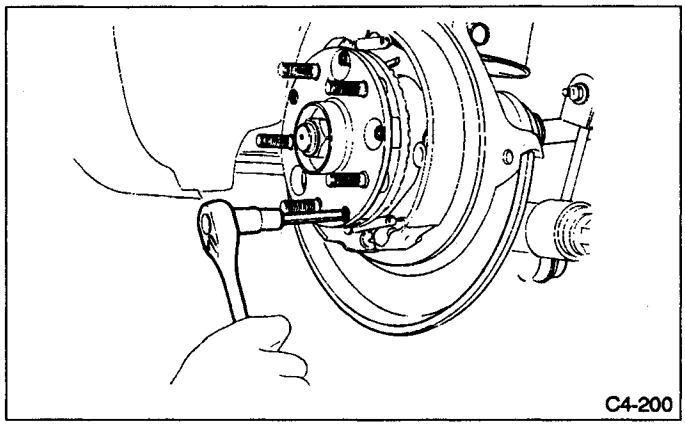


Fig. 86

(3) Check tightening torque of four back plate bolts through service hole in hub.

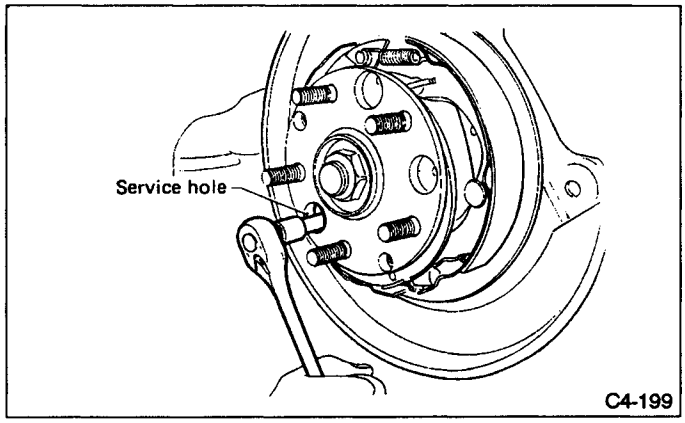


Fig. 87

D: PARKING BRAKE ADJUSTMENT

1. SHOE CLEARANCE ADJUSTMENT

1) Remove adjusting hole cover from back plate.
2) Turn adjusting screw using a slot-type screw driver until brake shoe is in close contact with disc rotor.
3) Turn back (downward) adjusting screw 3 or 4 notches.

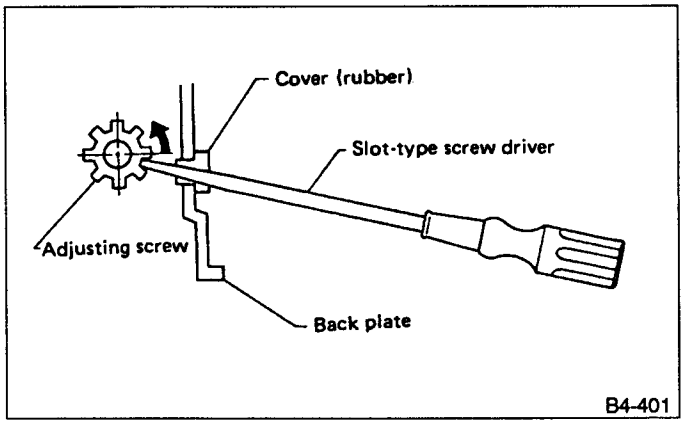


Fig. 88

4) Install adjusting hole cover to back plate.

2. LEVER STROKE ADJUSTMENT

1) Remove console box lid.

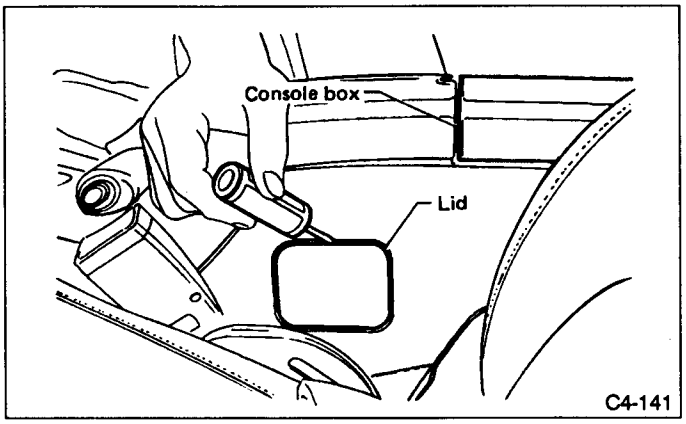


Fig. 89

2) Forcibly pull parking brake lever 3 to 5 times.
3) Adjust parking brake lever by turning adjuster until parking brake lever stroke is set at 6 to 7 notches with operating force of 196 N (20 kg, 44 lb).
4) Tighten lock nut.

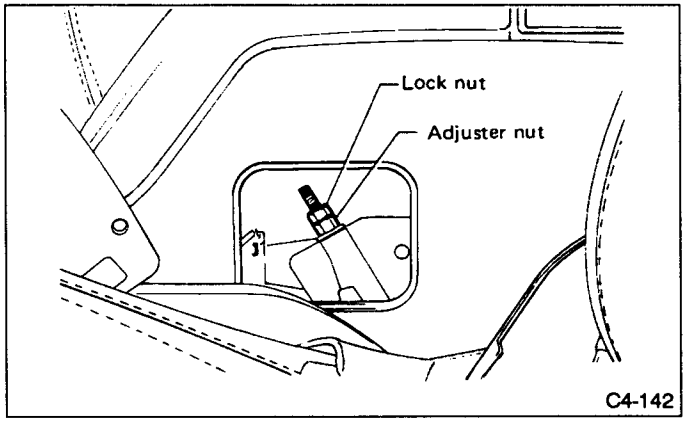


Fig. 90

5) Install console box lid.

Lever stroke:
6 to 7 notches when pulled with a force of 196 N (20 kg, 44 lb)

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

4. Parking Brake Cable

A: REPLACEMENT

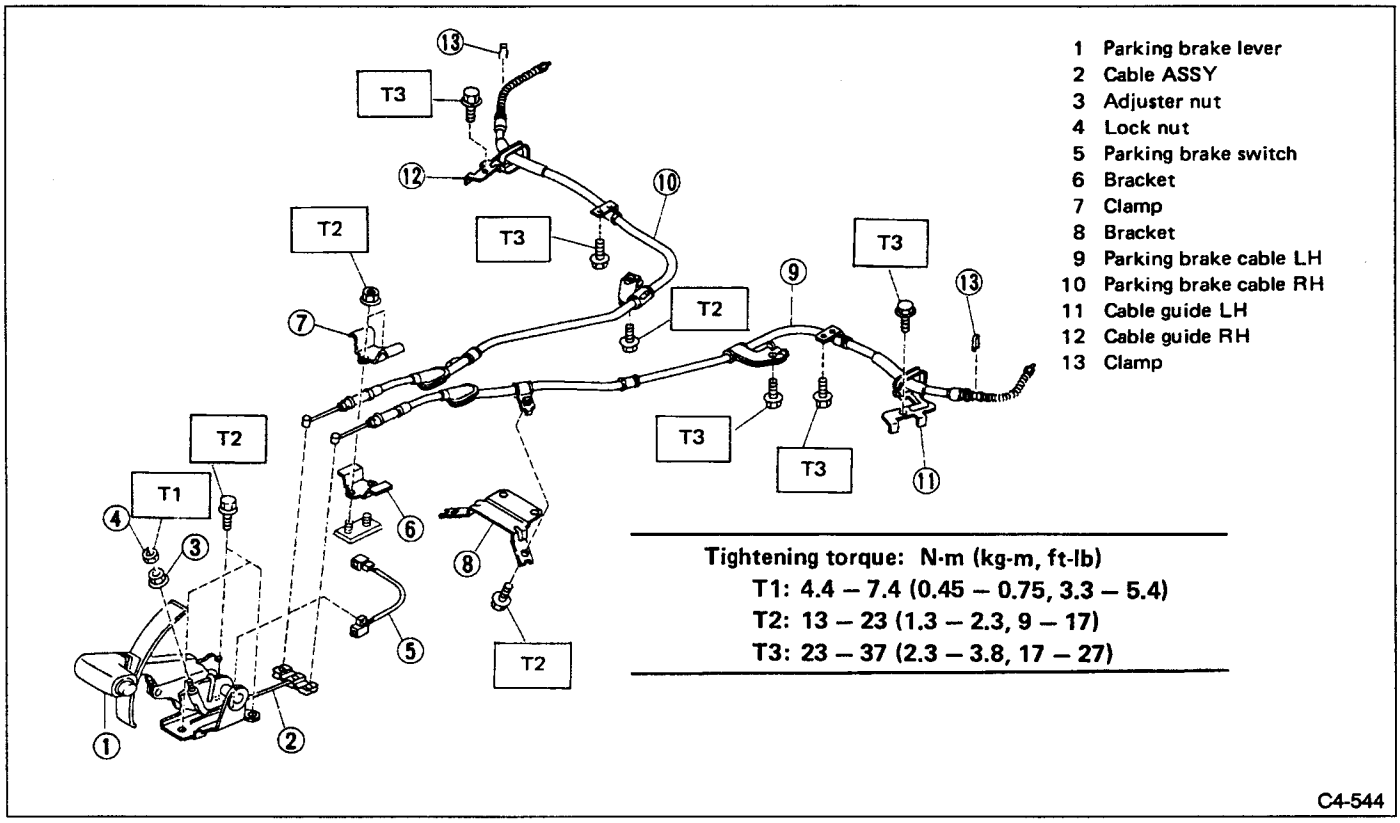


Fig. 91

1) Lift up vehicle and remove rear wheels.
2) Remove console box from front floor.
3) Remove adjuster and lock nut from parking brake cable.

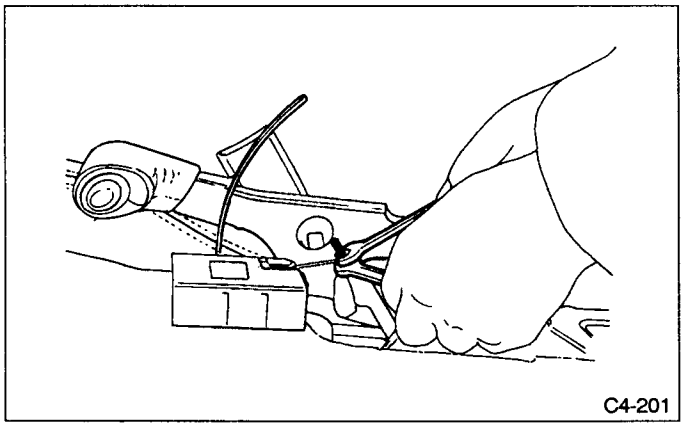


Fig. 92

4) Remove console bracket.

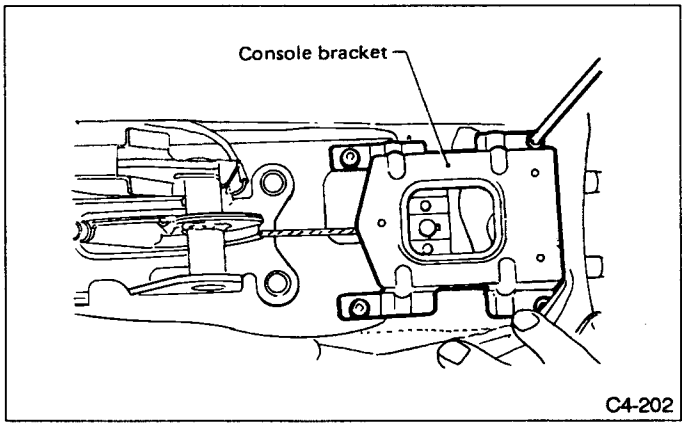


Fig. 93

5) Remove clamp.

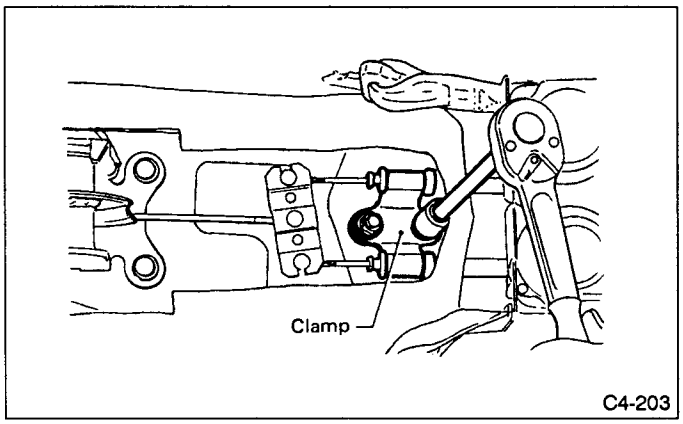


Fig. 94

6) Remove inner cable end from equalizer.

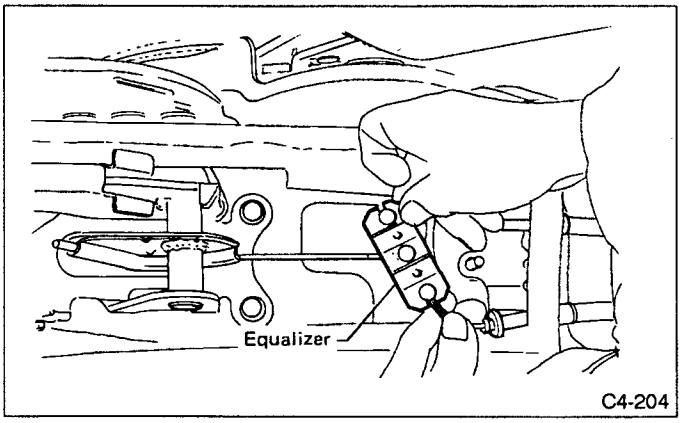


Fig. 95

7) Push grommet out of compartment.

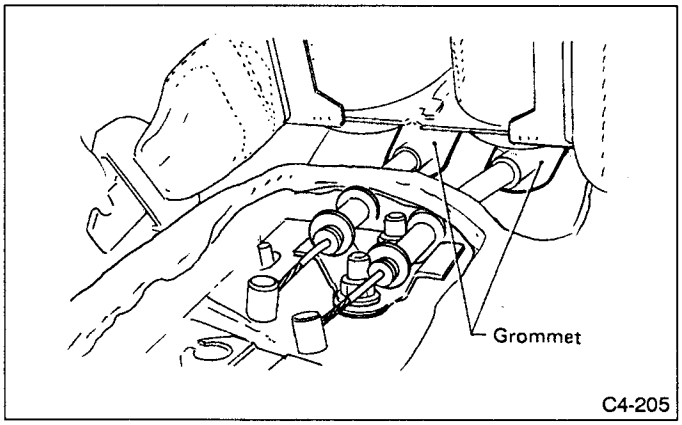


Fig. 96

8) Remove parking brake cable from cable guide.

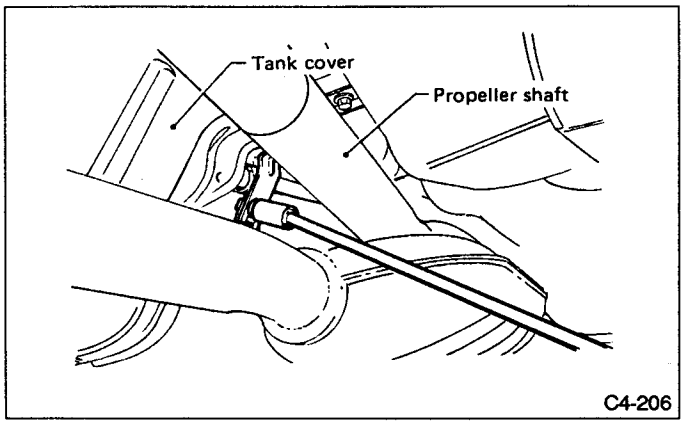


Fig. 97

9) Remove two bolts securing front of tank cover.

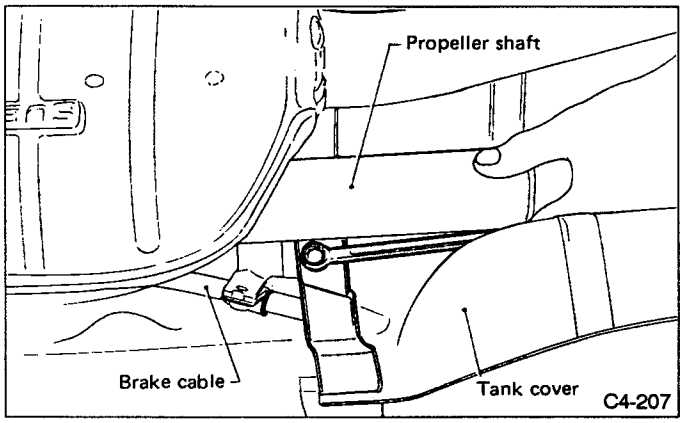


Fig. 98

10) While pushing brake cable, remove brake cable clamp from tank cover.

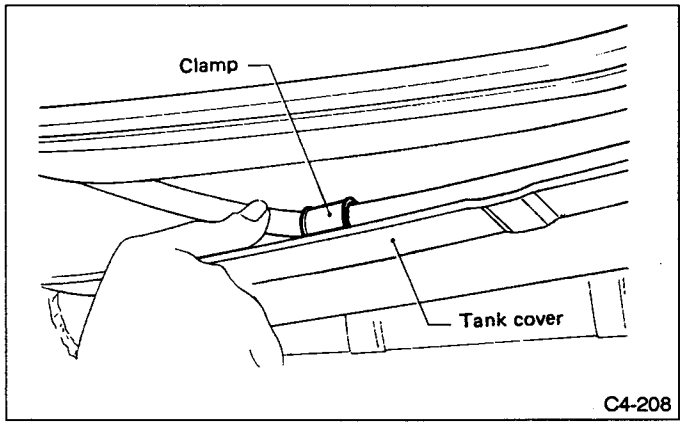


Fig. 99

11) Remove cable clamp.

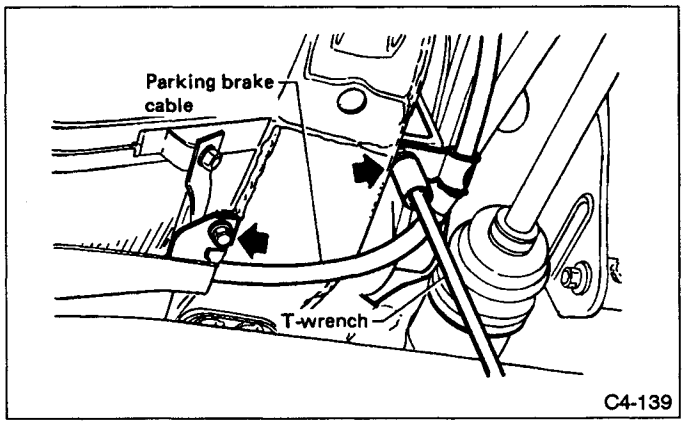


Fig. 100

12) Remove cable guide from trailing link.

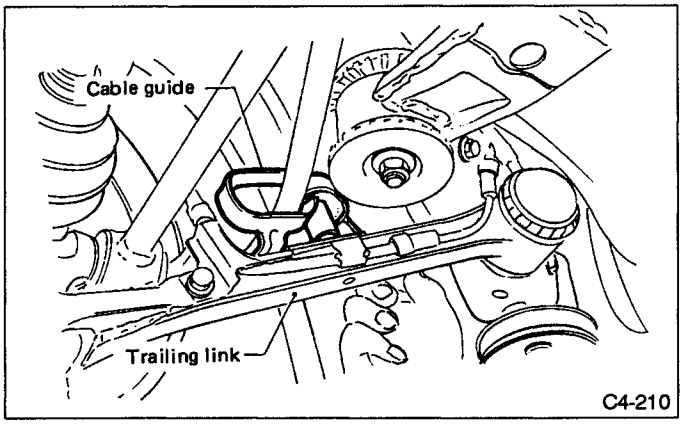


Fig. 101

13) Remove clamp from back plate.

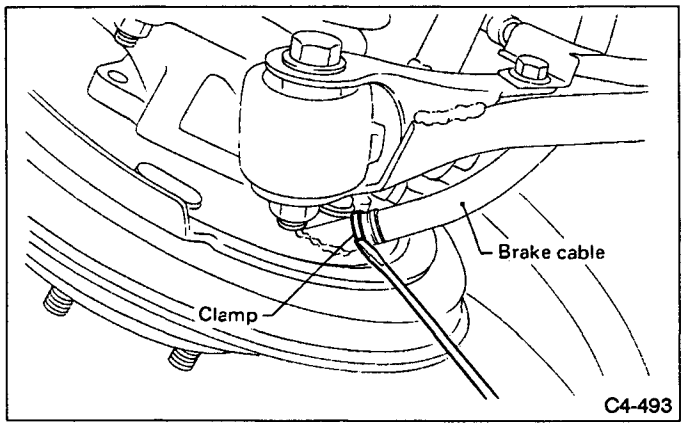


Fig. 102

14) Remove parking brake shoe (secondary) (Refer to 4-4 W3A0.)
15) Disconnect lever from parking brake cable.

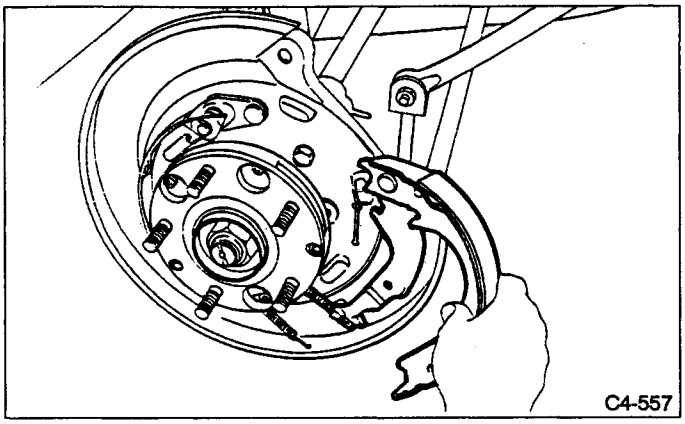


Fig. 103

16) Remove parking brake cable from vehicle.
17) Install (new) parking brake cable in the reverse order of removal.
Be sure to adjust the lever stroke and shoe clearance. (Refer to 4-4 W3D1.)

5. Parking Brake Lever

A: REPLACEMENT

1) Remove console box from front floor.
2) Disconnect electric connector for parking brake switch.
3) Disconnect shift lock unit for parking brake lever.
4) Remove adjuster and lock nut.
5) Remove parking brake lever.

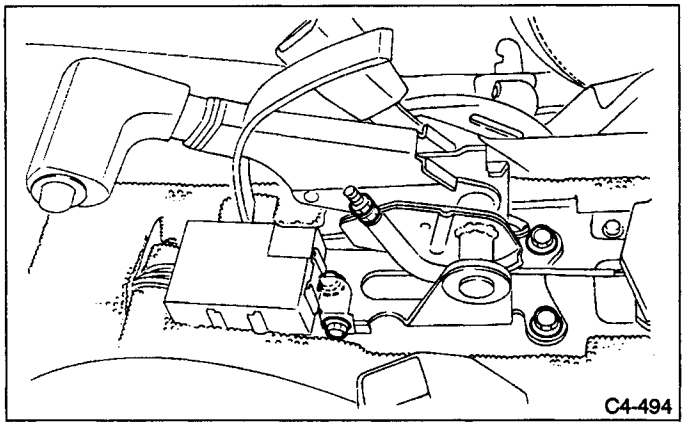


Fig. 104

6) Install parking brake lever in the reverse order of removal.
Be sure to adjust the lever stroke and shoe clearance. (Refer to 4-4 W3D1.)

W SERVICE PROCEDURE

6. Master Cylinder

A: REMOVAL

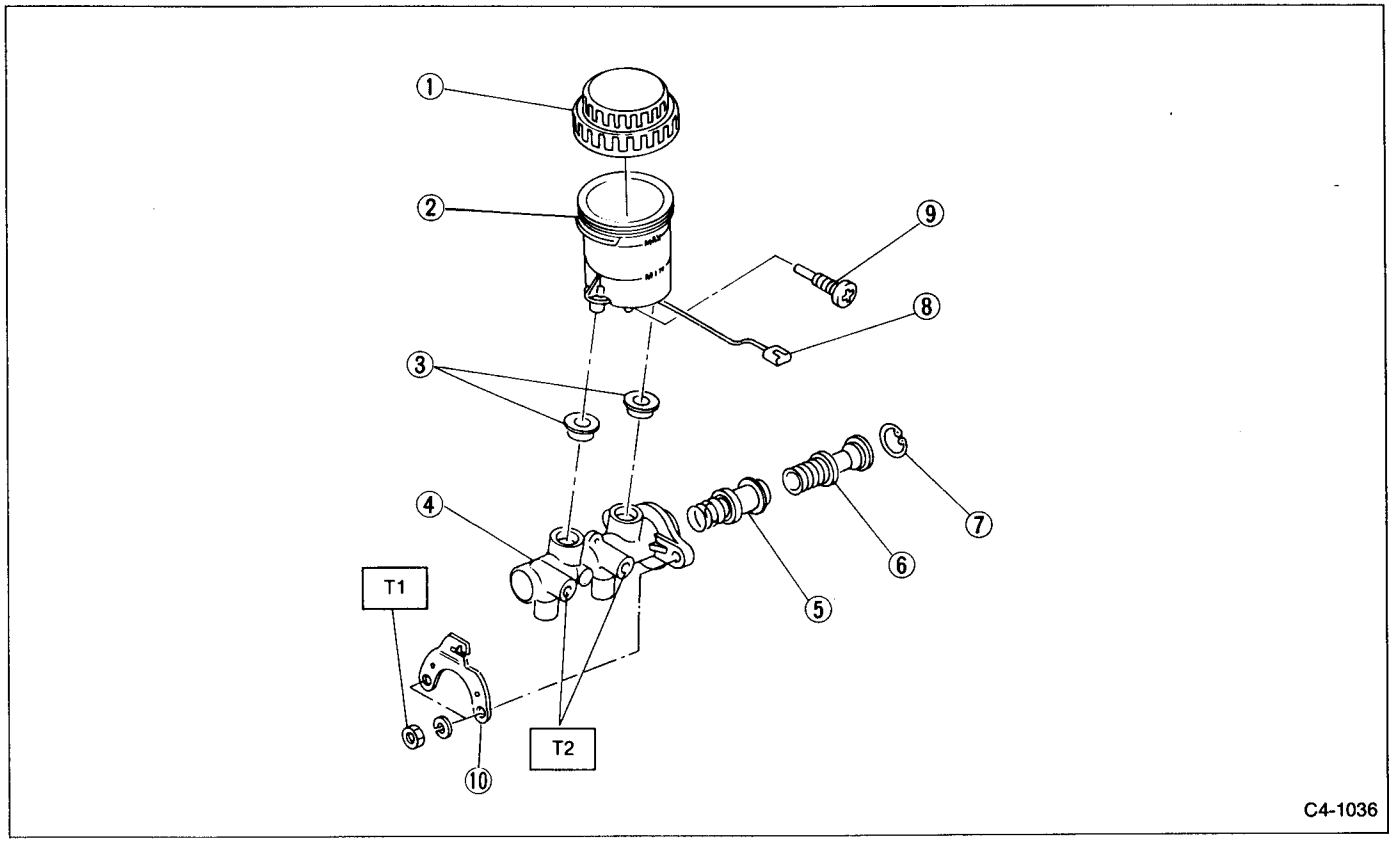


Fig. 5

① Cap
② Reserve tank
③ Seal
④ Cylinder body
⑤ Secondary piston
⑥ Primary piston
⑦ C-ring
⑧ Level indicator ASSY
⑨ Reservoir stopper bolt
⑩ Connector bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 10 — 18 (1.0 — 1.8, 7 — 13)
T2: 13 — 18 (1.3 — 1.8, 9 — 13)

1) Disconnect battery ground cable.
2) Remove brake fluid using a syringe or similar tool.

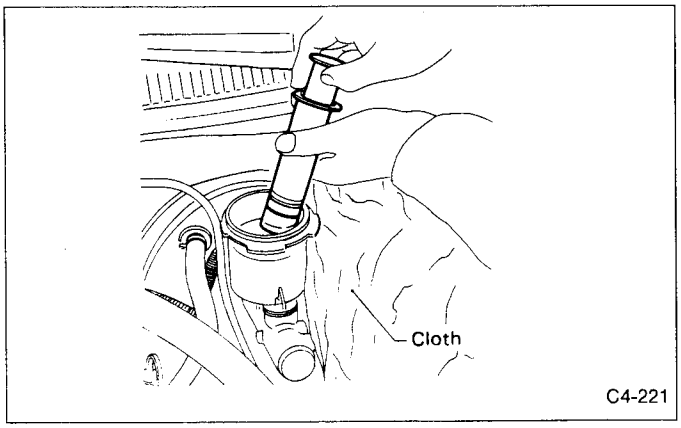


Fig. 6

3) Disconnect fluid level indicator harness connector.

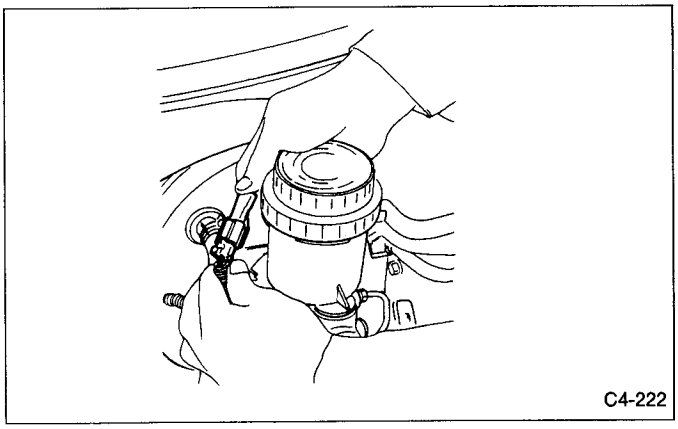


Fig. 7

4) Disconnect brake pipes from master cylinder.

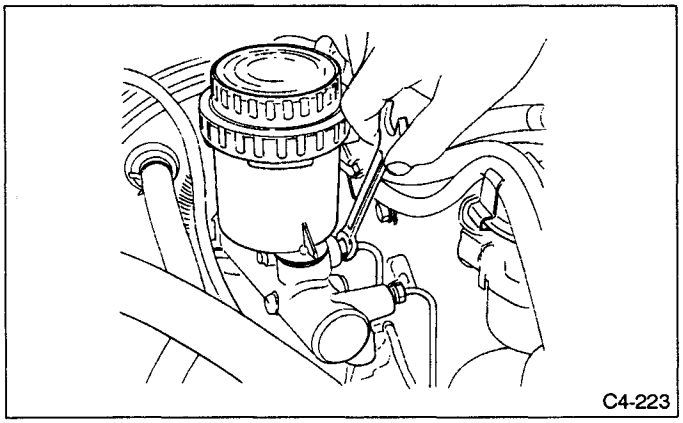


Fig. 108

5) Remove master cylinder from brake booster.

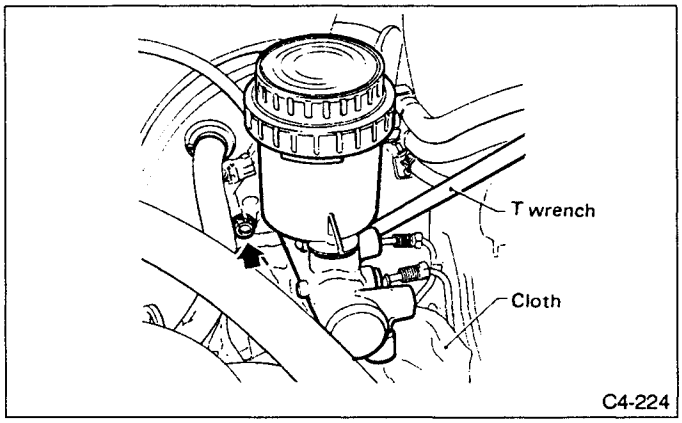


Fig. 109

Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wipe it off quickly if spilt.

B: DISASSEMBLY

1. 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

2. DISASSEMBLY PROCEDURE

1) Remove supply valve stopper.
2) Remove C-ring with C-ring pliers pushing in primary piston slightly.

Piston may jump out from master cylinder.

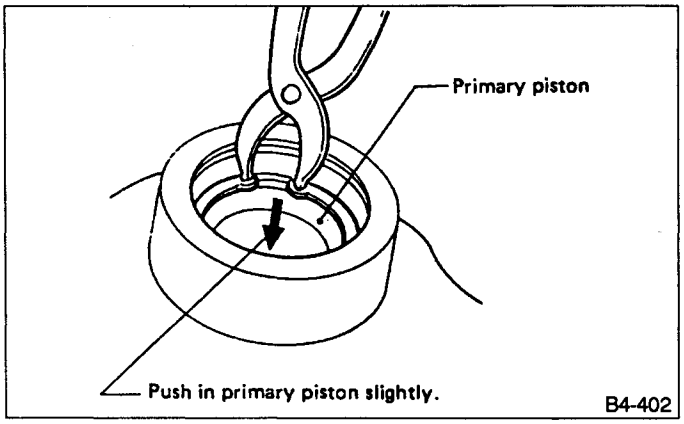


Fig. 110

3) 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.

C: INSPECTION

If any damage, deformation, wear, swelling, rust, and other faults are found on the primary piston CP, secondary piston CP, supply valve 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.

D: ASSEMBLY

1. 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.

2. 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 supply valve stopper:
After installing piston into cylinder, push primary piston in about 10 mm (0.39 in), using a rod, such as push rod then assemble gasket and supply valve stopper.

Tightening torque:
1.5 — 2.9 N•m (0.15 — 0.3 kg-m, 1.1 — 2.2 ft-lb)

If the gasket and secondary piston stopper are assembled without pushing in the primary piston, scratches may be caused on the secondary piston, and no pressure may be built up in the secondary side. To avoid such an error, be sure to push in the primary piston before assembling these parts.
3) 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.

E: INSTALLATION

Installation is in the reverse order of removal.
After installing master cylinder, bleed air from the brake system.
Be sure to use recommended brake fluid.

7. Brake Booster

A: REMOVAL

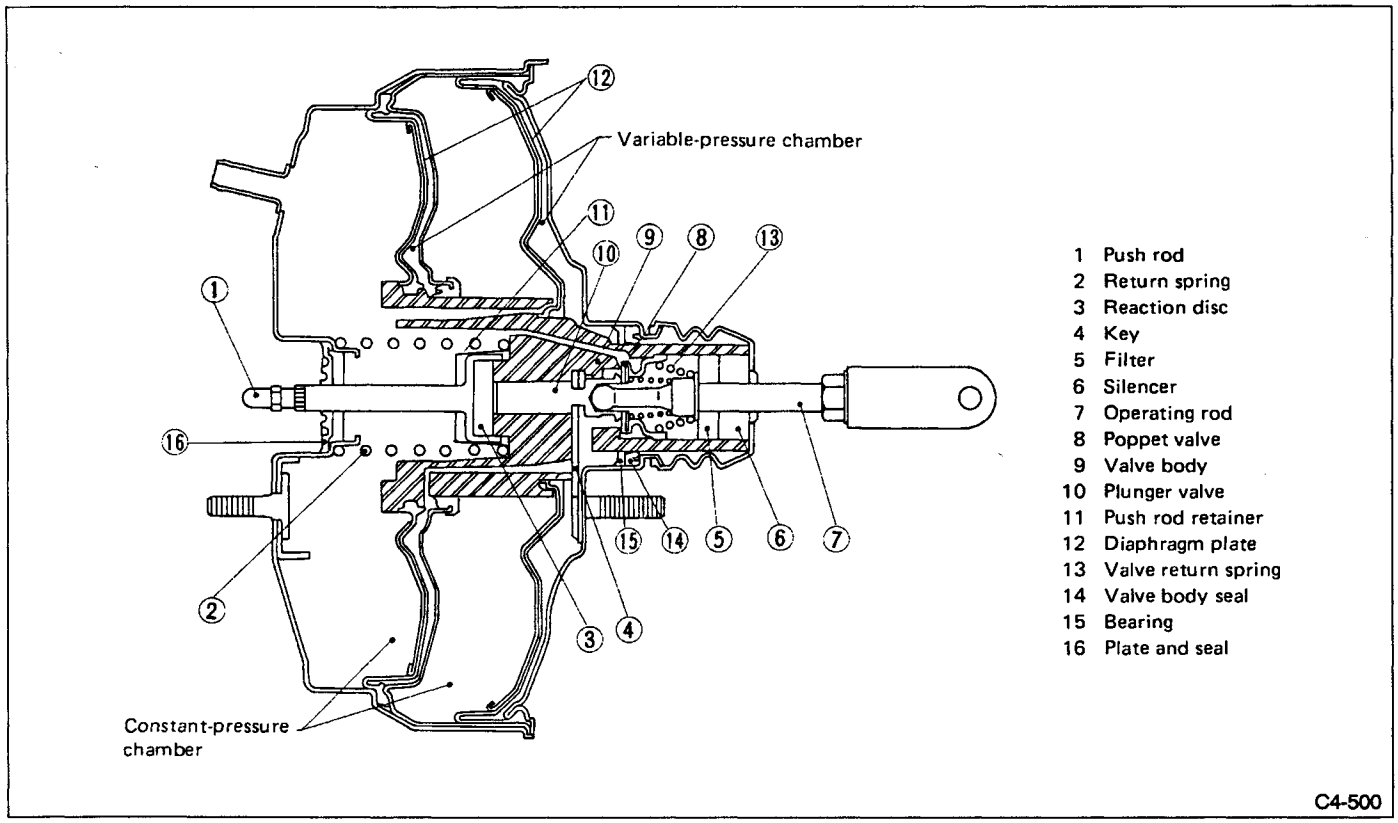


Fig. 111

1) Disconnect battery ground cable.
2) Raise vehicle using a jack.
3) Disconnect performance rod from sub frame.

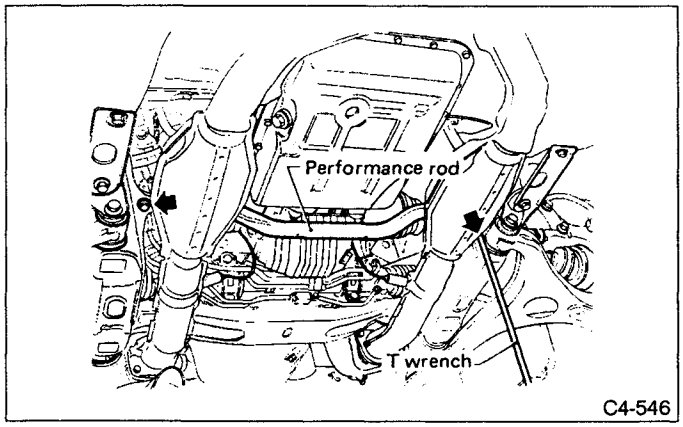


Fig. 112

4) Drain approximately 1 liter (1.1 US qt, 0.9 Imp qt) of ATF (automatic transmission fluid).
5) Loosen bolt securing upper side of ATF level guide pipe.
6) Remove bolt securing lower side of ATF level guide pipe.
7) Remove cruise control actuator.

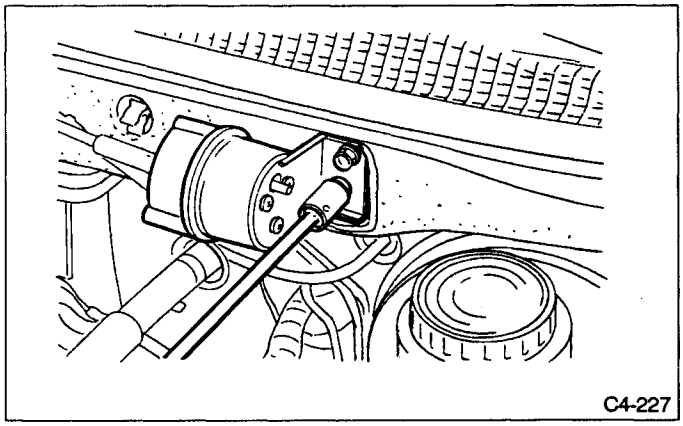


Fig. 113

8) Disconnect positive ⊕ terminal from starter motor.

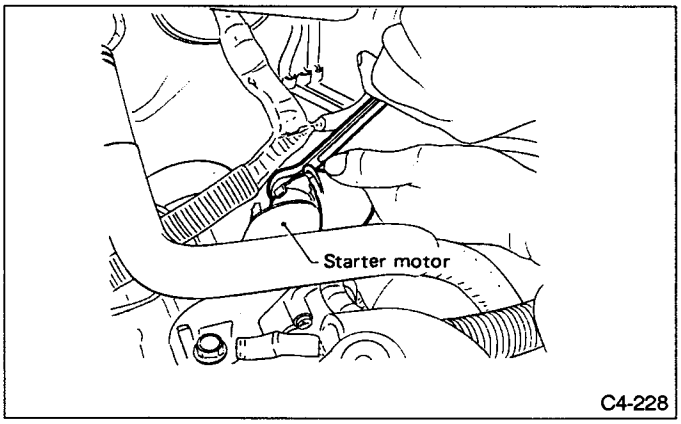


Fig. 114

9) Disconnect low-pressure air conditioner pipe. (Refer to 4-7 [W2A0].)
10) Disconnect vacuum hose from brake booster.

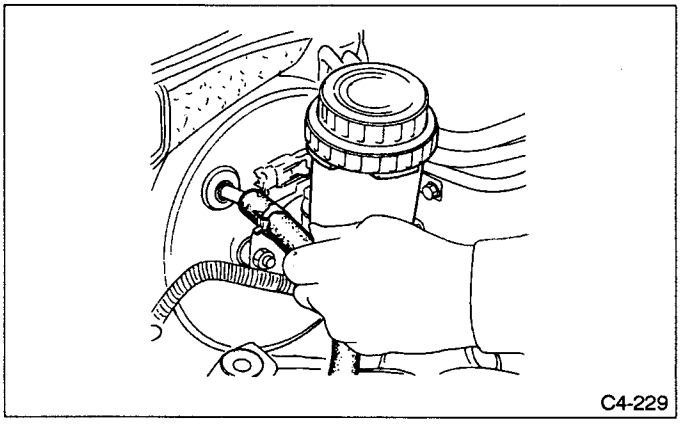


Fig. 115

11) Remove master cylinder. (Refer to 4-4 [W6A0].)
12) Remove snap pin and clevis pin.

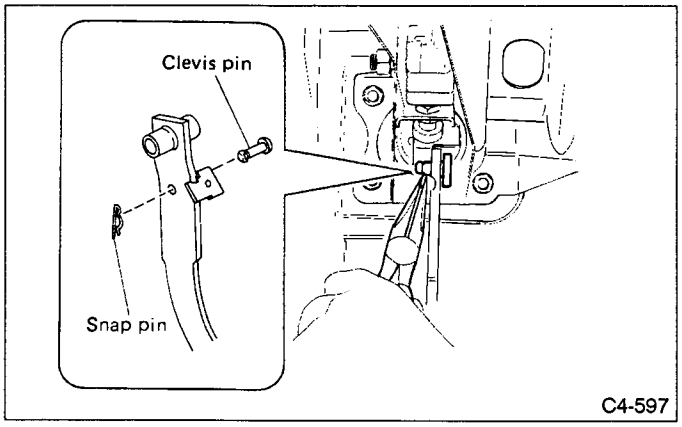


Fig. 116

13) Remove four nuts securing brake booster to pedal bracket.

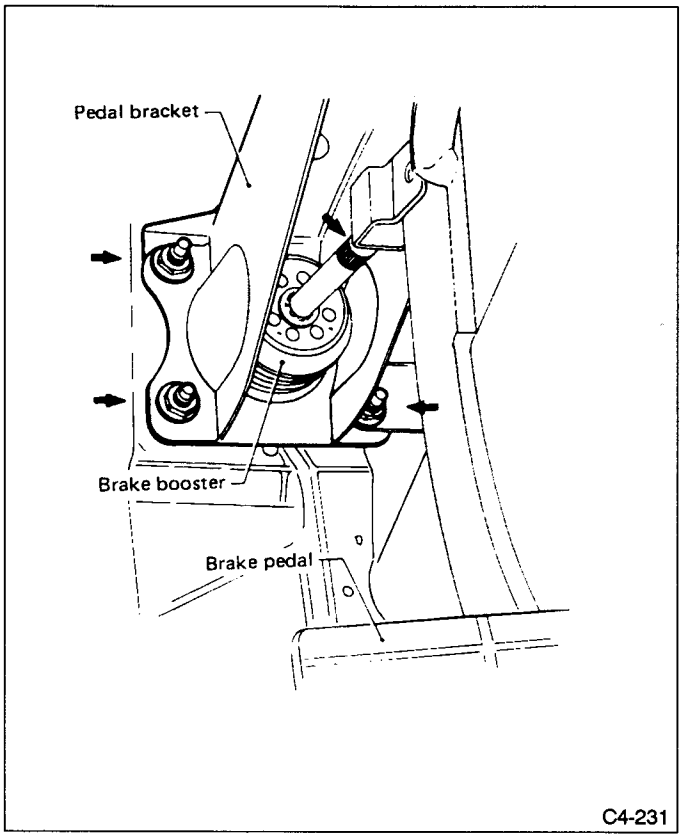


Fig. 117

14) Remove brake booster from engine compartment.

B: INSTALLATION

1) To install, reverse removal procedures.
2) 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 1 to 3 mm [0.04 to 0.12 in].)

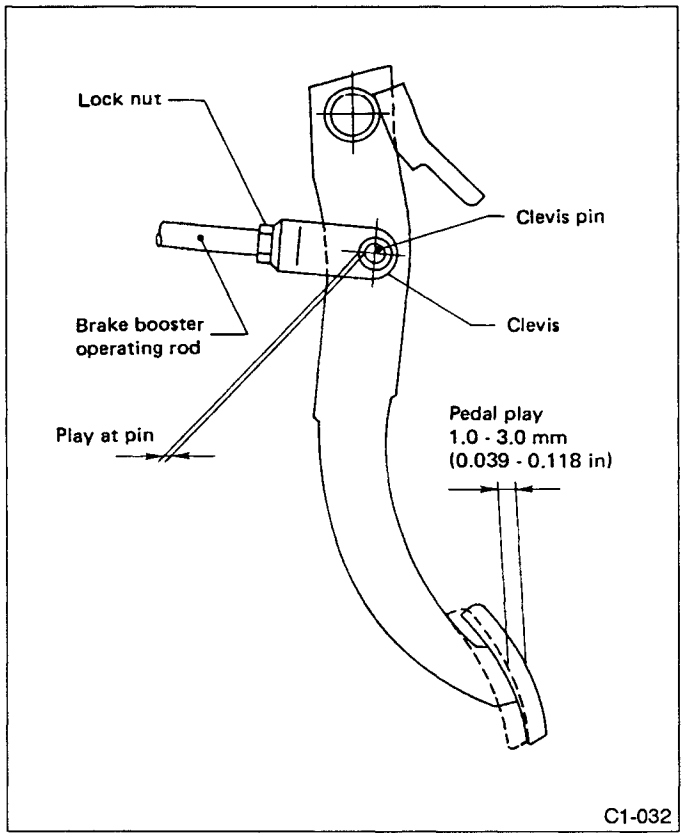


Fig. 118

   (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.
3) Bleed air from brake system.
4) Conduct road tests to ensure brakes do not drag.

C: OPERATION CHECK

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

1. 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.

2. 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.

3. 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.

4. 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.

5. CHECKING WITH GAUGES

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

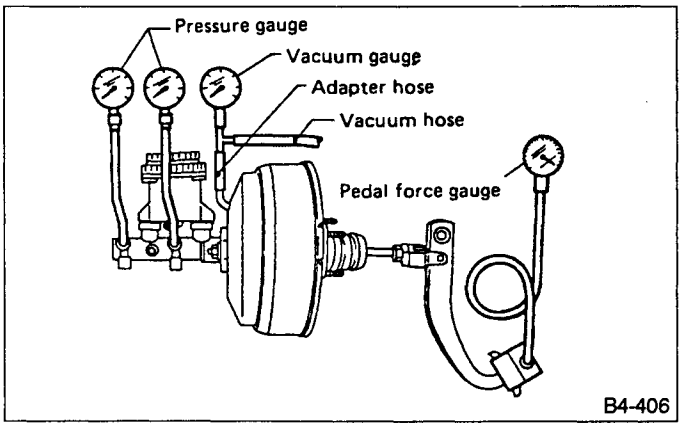


Fig. 119

6. 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 and seal ASSY portion
- Leak from poppet valve ASSY portion

7. 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.

8. 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.

Brake pedal force	All model
147N (15 kg, 33 lb)	490 kPa (5 kg/cm^2, 71 psi)
294N (30kg, 66 lb)	1,569 kPa (16 kg/cm^2, 228 psi)

9. 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.

Brake pedal force	All model
147N (15 kg, 33 lb)	4,511 kPa (46 kg/cm^2, 654 psi)
294N (30kg, 66 lb)	9,513 kPa (97 kg/cm^2, 1,379 psi)

D: 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:

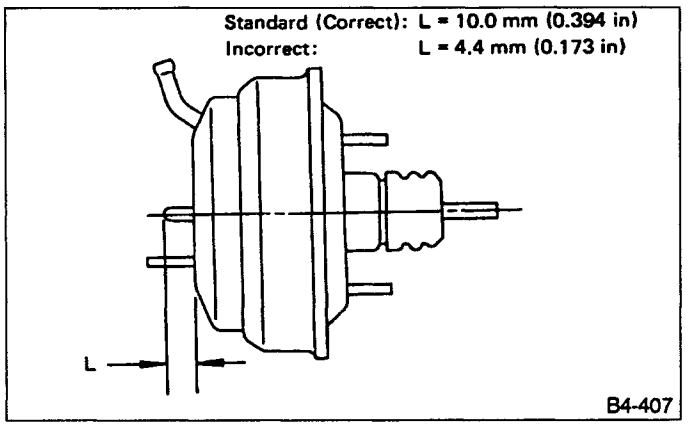


Fig. 120 Push rod projection

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

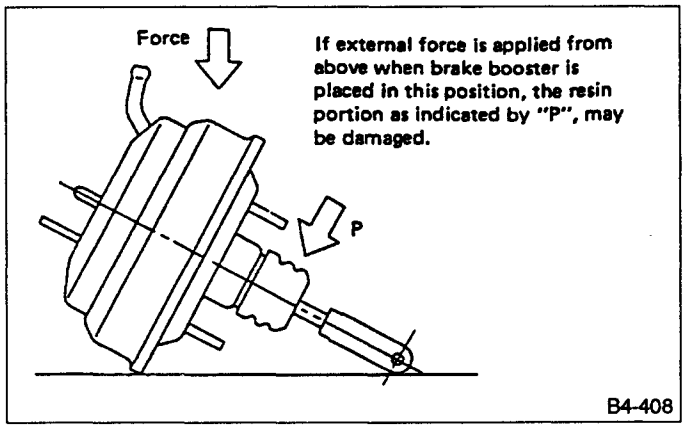


Fig. 121 Handling

8. Brake Hose and Pipe AIRBAG

Supplemental Restraint System "Airbag"

Airbag system wiring harness is routed near the brake pipe.

a. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

b. Be carefull not to damage Airbag system wiring harness when servicing the brake pipe.

A: REMOVAL AND INSTALLATION

a. When removing and installing the brake pipe, make sure that it is not bent.

b. After installing the brake pipe and hose, bleed the air.

c. After installing the brake hose, make sure that it does not touch the tire or suspension ASSY, etc.

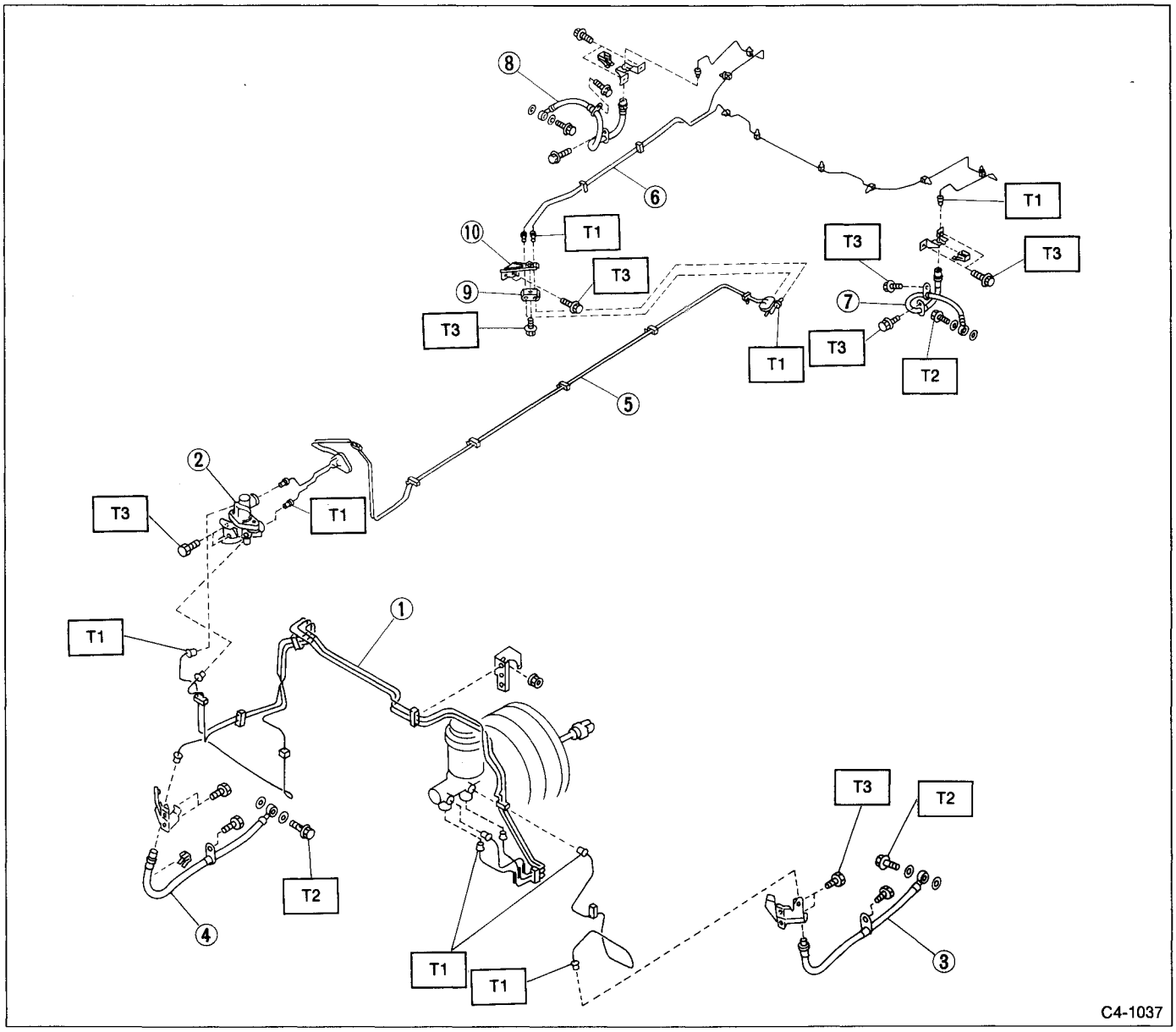


Fig. 10

① Front brake pipe ASSY
② Proportioning valve
③ Front brake hose LH
④ Front brake hose RH
⑤ Center brake pipe ASSY
⑥ Rear brake pipe ASSY
⑦ Rear brake hose LH
⑧ Rear brake hose RH
⑨ Two-way connector
⑩ Connector bracket

Tightening torque: N·m (kg-m, ft-lb)
T1: 13 — 18 (1.3 — 1.8, 9.6 — 13.3)
T2: 13 — 23 (1.3 — 2.3, 9.6 — 16.6)
T3: 15 — 21 (1.5 — 2.1, 11.1 — 15.5)

9. Air Bleeding

A: BLEEDING PROCEDURE

a. The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
b. Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
c. Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
d. Be careful not to allow dirt or dust to get into the reservoir tank.
e. During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
f. Brake pedal operating must be very slow.
g. For convenience and safety, it is advisable to have two man working.
1) Make sure that there is no leak from joints and connections of the brake system.

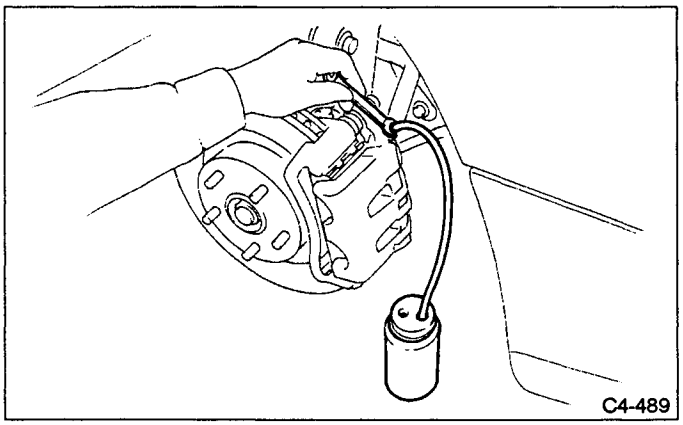


Fig. 123

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

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

5) Bleed air from brake system in numerical sequence shown in Figure 124 and 125 using above steps as a guide.

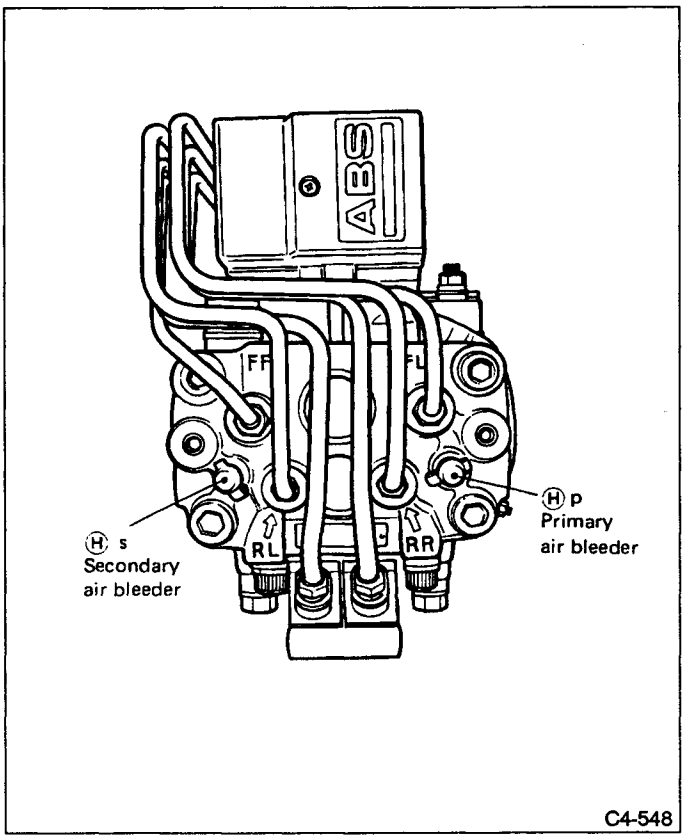


Fig. 124 Hydraulic unit

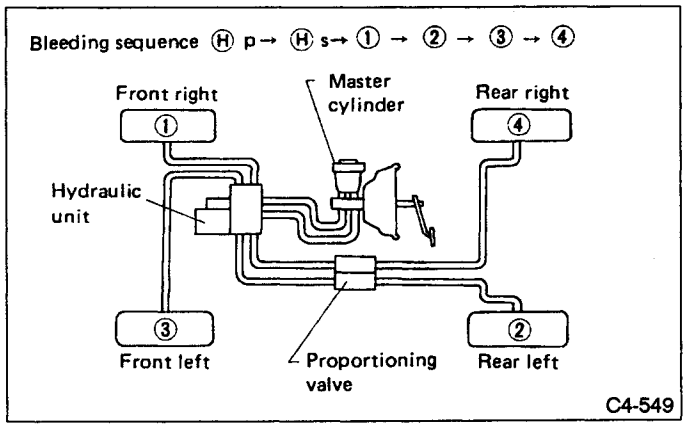


Fig. 125

6) If the pedal action is soft and spongy, or pedal travels excessively, the system must be bled of air again.
7) 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.
8) Add brake fluid to the required level (MAX level) of reserve tank.
9) 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.

10. Brake Fluid Replacement

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

A: REPLACEMENT

a. The FMVSS No. 116, fresh DOT3 or 4 brake fluid must be used.
b. Cover bleeder with waste cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
c. Avoid mixing different brands of brake fluid to prevent degrading the quality of the fluid.
d. Be careful not to allow dirt or dust to get into the reservoir tank.
e. During bleeding operation, keep the brake reserve tank filled with brake fluid to eliminate entry of air.
f. Brake pedal operating must be very slow.
g. For convenience and safety, it is advisable to have two man working.
h. The amount of brake fluid required is approximately 300 mℓ (10.1 US fl oz, 10.6 Imp fl oz) for total brake system.
1) Either jack up vehicle and place a safety stand under it, or left up vehicle.
2) Remove both front and rear wheels.
3) Draw out the brake fluid from master cylinder with syringe.

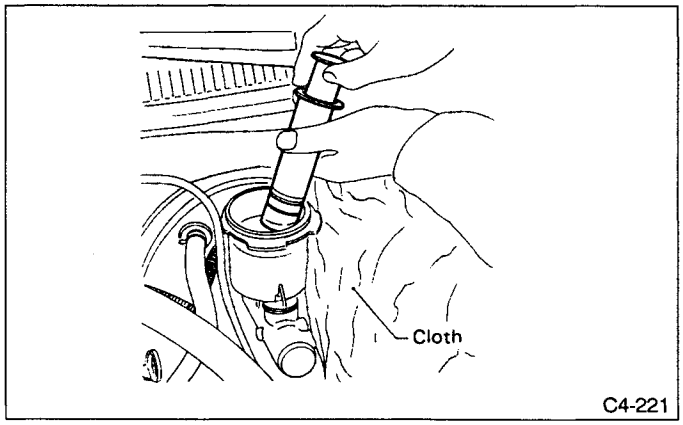


Fig. 126

4) Refill reservoir tank with recommended brake fluid.

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

5) Install one end of a vinyl tube onto the air bleeder of and insert the other end of the tube into a container to collect the brake fluid.

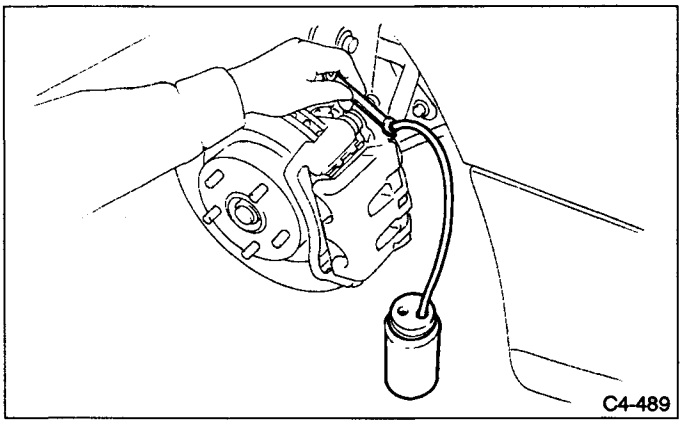


Fig. 127

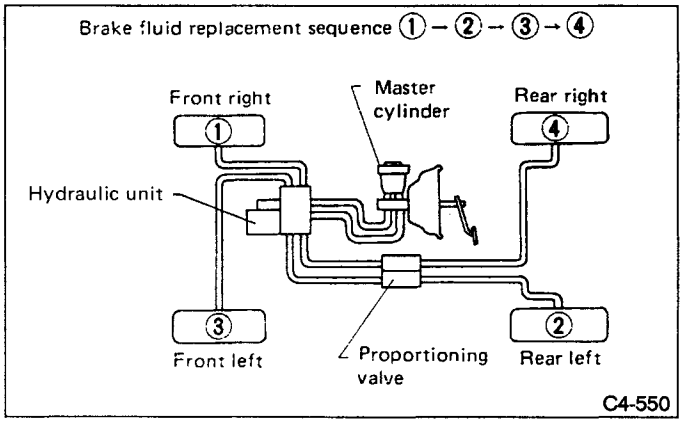


Fig. 128

6) Instruct your co-worker to depress the brake pedal slowly two or three times and then hold it depressed.
7) Loosen bleeder screw approximately 1/4 turn until a small amount of brake fluid drains into container, and then quickly tighten screw.
8) Repeat steps 6) and 7) 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.
9) 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)

10) Bleed air from each wheel cylinder using the same procedures as described in steps 5) through 9) above.
11) 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.
12) 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.

11. Proportioning Valve

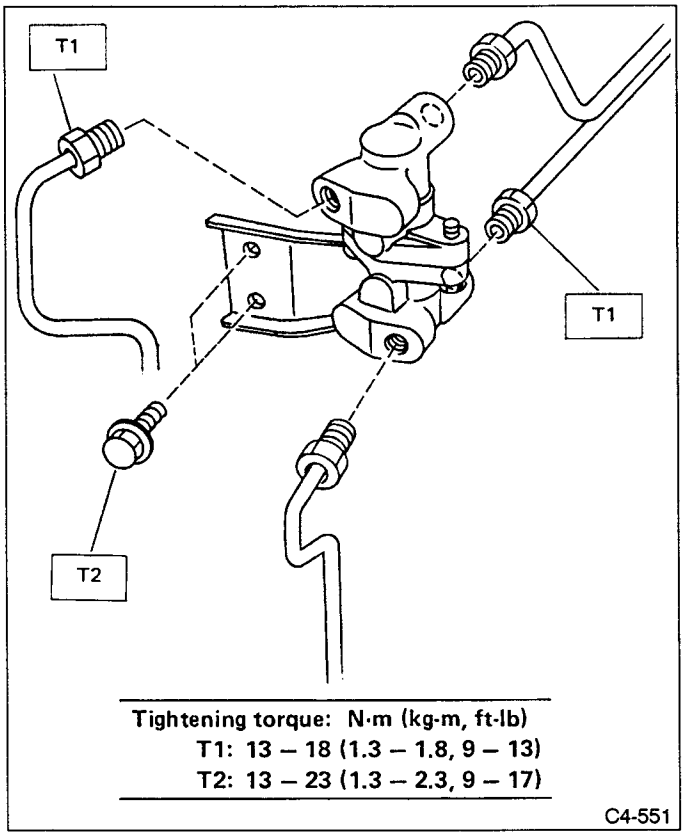


Fig. 129

A: 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.

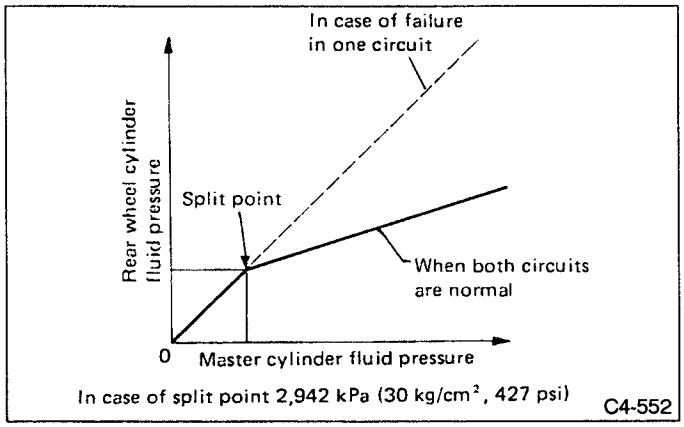


Fig. 130

B: REMOVAL

1) Remove washer cover.
2) Disconnect washer motor connector.
3) Disconnect washer pipe from body.

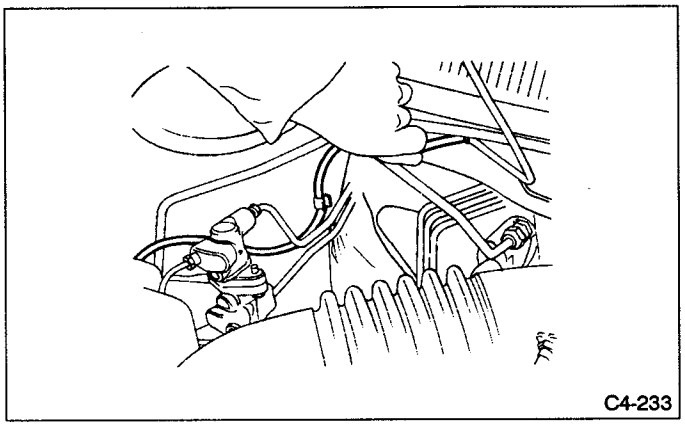


Fig. 131

4) Remove washer tank.

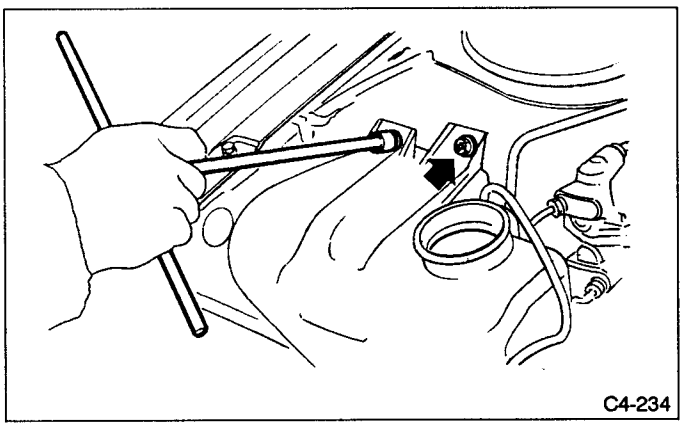


Fig. 132

5) Disconnect brake pipe from proportioning valve.

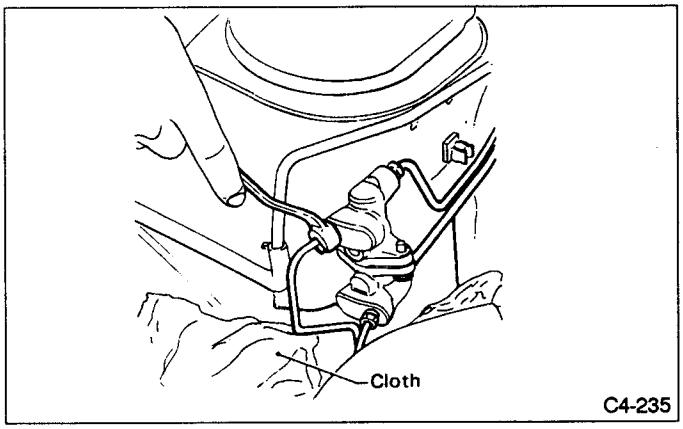


Fig. 133

Be extremely careful not to spill brake fluid. Brake fluid spilt on the vehicle body will harm the painted surface; wipe it off quickly if spilt.

6) Remove proportioning valve.

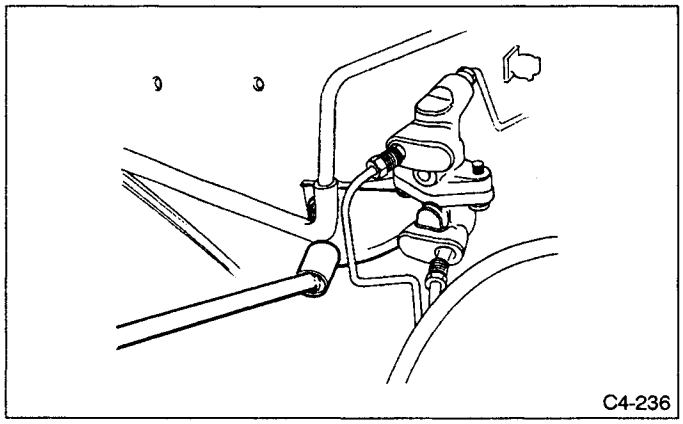


Fig. 134

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

C: INSTALLATION

1) To install, reverse removal procedures.
2) Bleed air from the brake system.
3) Check each brake pipe joint for oil leaks.

12. ABS Sensor

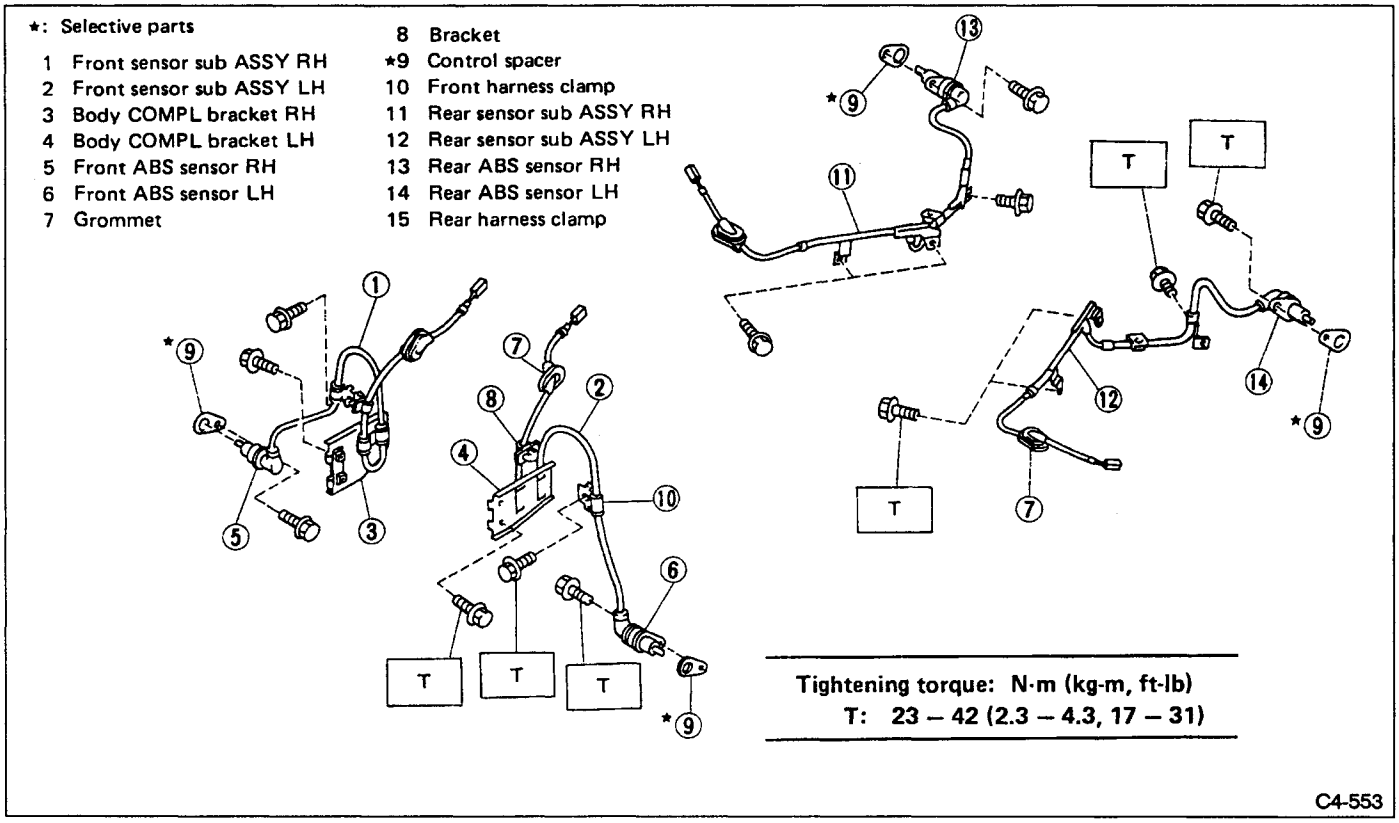


Fig. 135

A: REMOVAL

1. FRONT

1) Disconnect battery ground cable.
2) Disconnect ABS sensor connector located in engine compartment.
3) Remove ABS sensor and clamp.

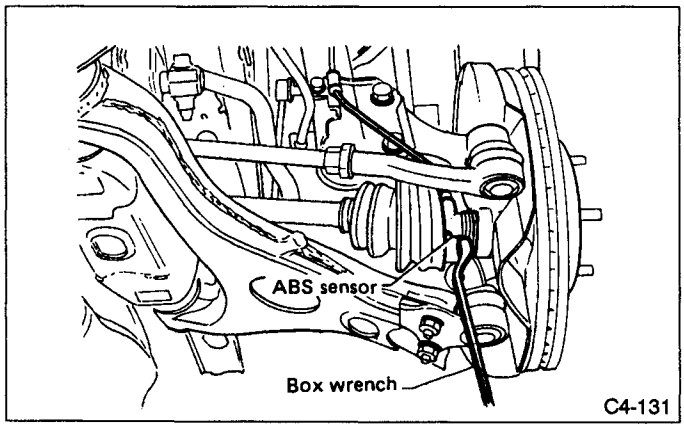


Fig. 136

Be careful not to damage pole piece located at tip of the sensor during removal.

4) Remove ABS sensor bracket and brake pipe bracket.

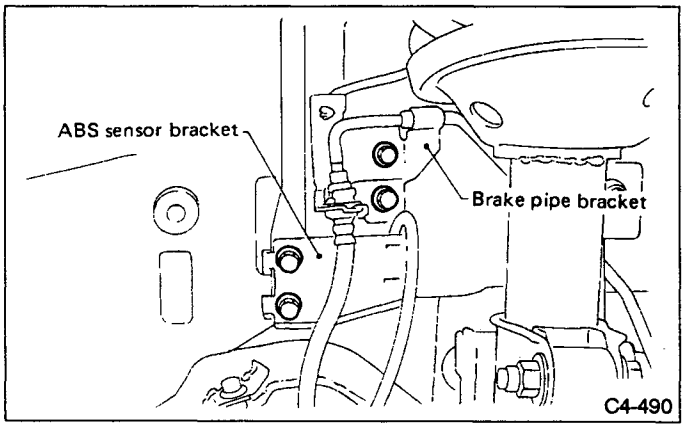


Fig. 137

5) Remove grommet and ABS sensor.
6) Remove tone wheel. 〈Refer to 4-2 [W1A0].〉

2. REAR

1) Disconnect battery ground cable.
2) Remove rear seat.
3) Disconnect ABS sensor connector.

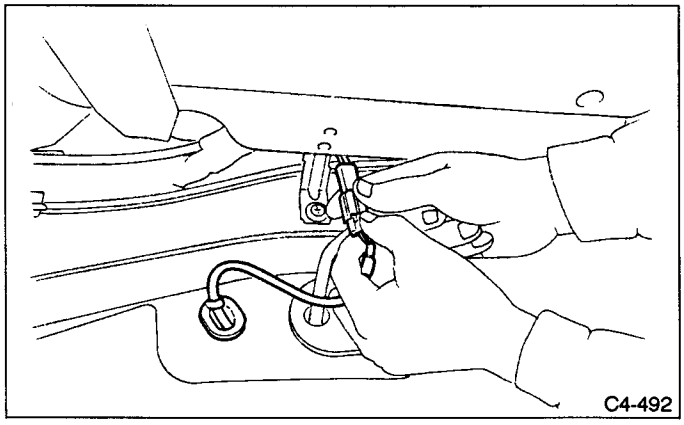


Fig. 138

4) Push grommet and ABS sensor connector out of compartment.
5) Remove ABS sensor and clamp.

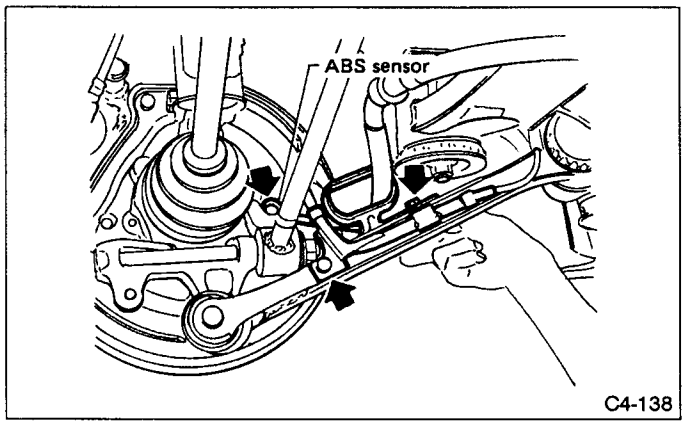


Fig. 139

Be careful not to damage pole piece located at tip of the sensor during removal.
6) Remove ABS sensor clamp.

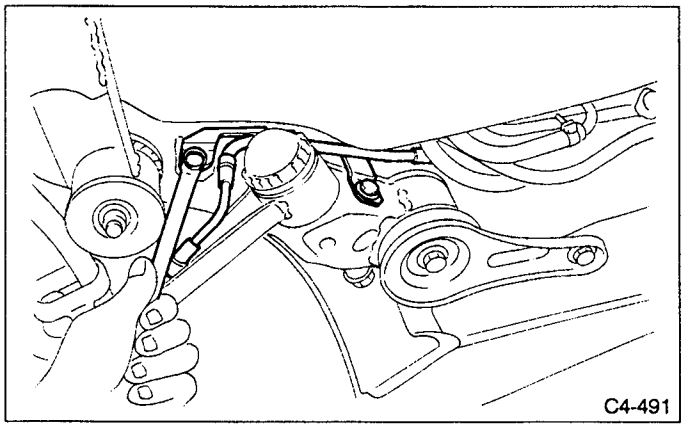


Fig. 140

7) Remove tone wheel. ⟨Refer to 4-2 [W4A0].⟩

B: INSPECTION

1. ABS SENSOR

1) Check pole piece of ABS sensor for foreign particles or damage. If necessary, clean pole piece or replace speed sensor.
2) Measure resistance between speed sensor terminals.

ABS sensor	Terminal No.	Standard
Front - LH	22 and 4	1.0 ± 0.2 kΩ
Front - RH	11 and 21	
Rear - LH	7 and 9	
Rear - RH	24 and 26	
Front - LH	22 and 10, 20, 34	More than 1,000 kΩ (Insulation resistance)
Front - RH	11 and 10, 20, 34	
Rear - LH	7 and 10, 20, 34	
Rear - RH	24 and 10, 20, 34	

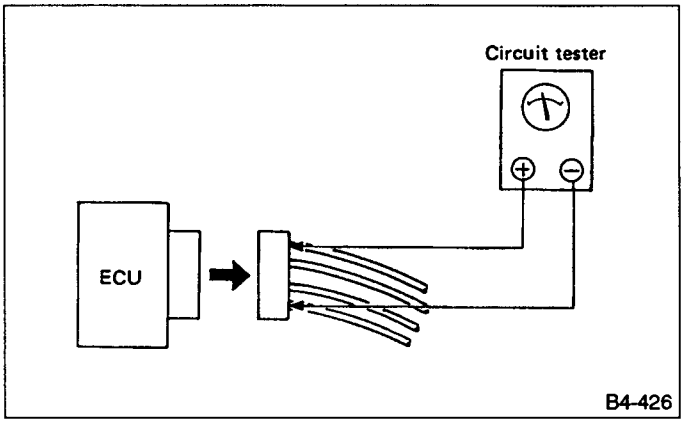


Fig. 141

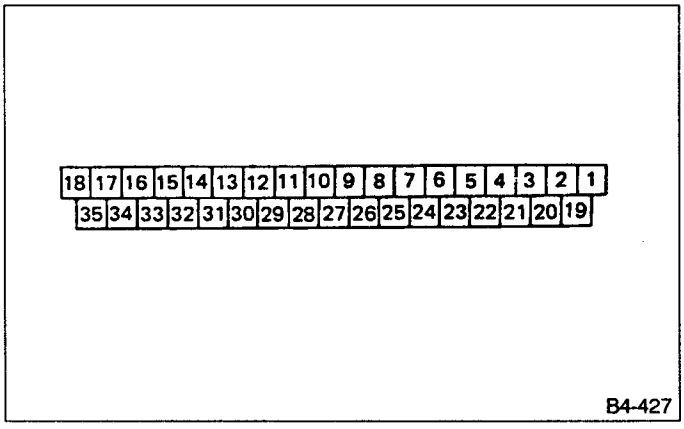


Fig. 142

a. If resistance is outside the standard value, replace wheel ABS sensor with new one or adjust sensor gap between ABS sensor and tone wheel.
b. Check ABS sensor cable for discontinuity. If necessary, replace with a new one.

2. TONE WHEEL

1) Check tone wheel's teeth (45 pieces) for cracks or dents. If necessary, replace tone wheel with a new one.
2) Clearances (sensor gaps) should be measured one by one to ensure tone wheel and ABS sensor are installed correctly.

ABS sensor clearance:
Front
0.7 — 1.0 mm (0.028 — 0.039 in)
Rear
0.5 — 1.0 mm (0.020 — 0.039 in)

a. If clearance is narrow, adjust by using ADJUSTMENT SPACER (P/# 26755AA000)
b. If clearance is wide, check the outputted voltage then replace ABS sensor or tone wheel if the outputted voltage is outside the specification.

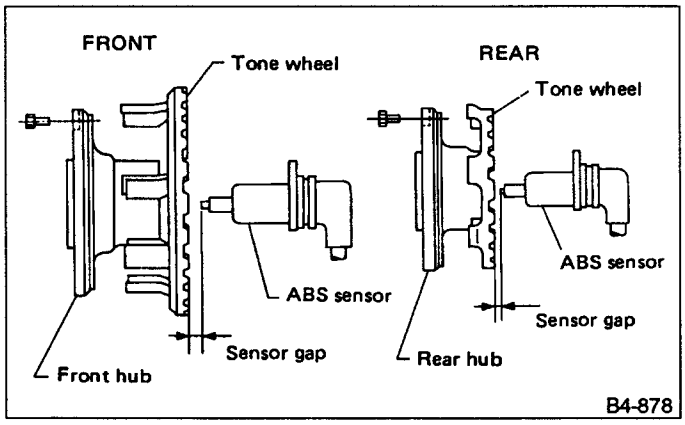


Fig. 143

3. OUTPUT VOLTAGE

1) Output voltage can be checked by the following method. Install resistor and condenser as follows, then rotate wheel about 2.75 km/h (1.7 MPH) or equivalent.

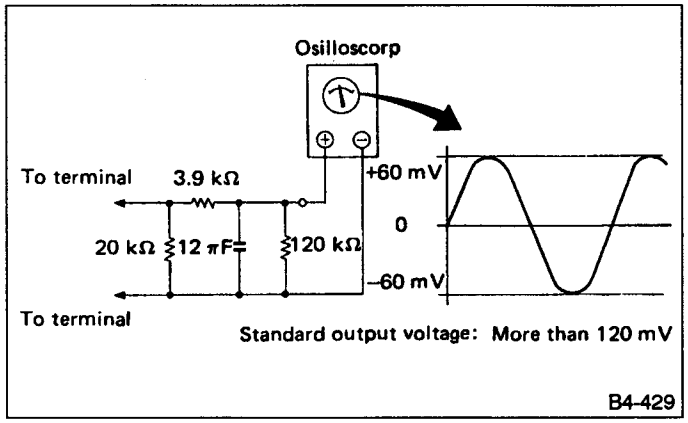


Fig. 144

Regarding terminal No., please refer to item ABS SENSOR.

C: INSTALLATION

1) To install, reverse removal procedures.
2) Place a thickness gauge between ABS sensor's pole piece and tone wheel's tooth face. After ABS sensor clearance is obtained over the entire perimeter, tighten ABS sensor on housing to specified torque.

ABS sensor clearance:
Front
0.7 — 1.0 mm (0.028 — 0.039 in)
Rear
0.5 — 1.0 mm (0.020 — 0.039 in)

a. If the clearance is outside specifications, readjust.
b. Sometimes adjustment spacer may not need be installed.

13. Hydraulic Unit for ABS System

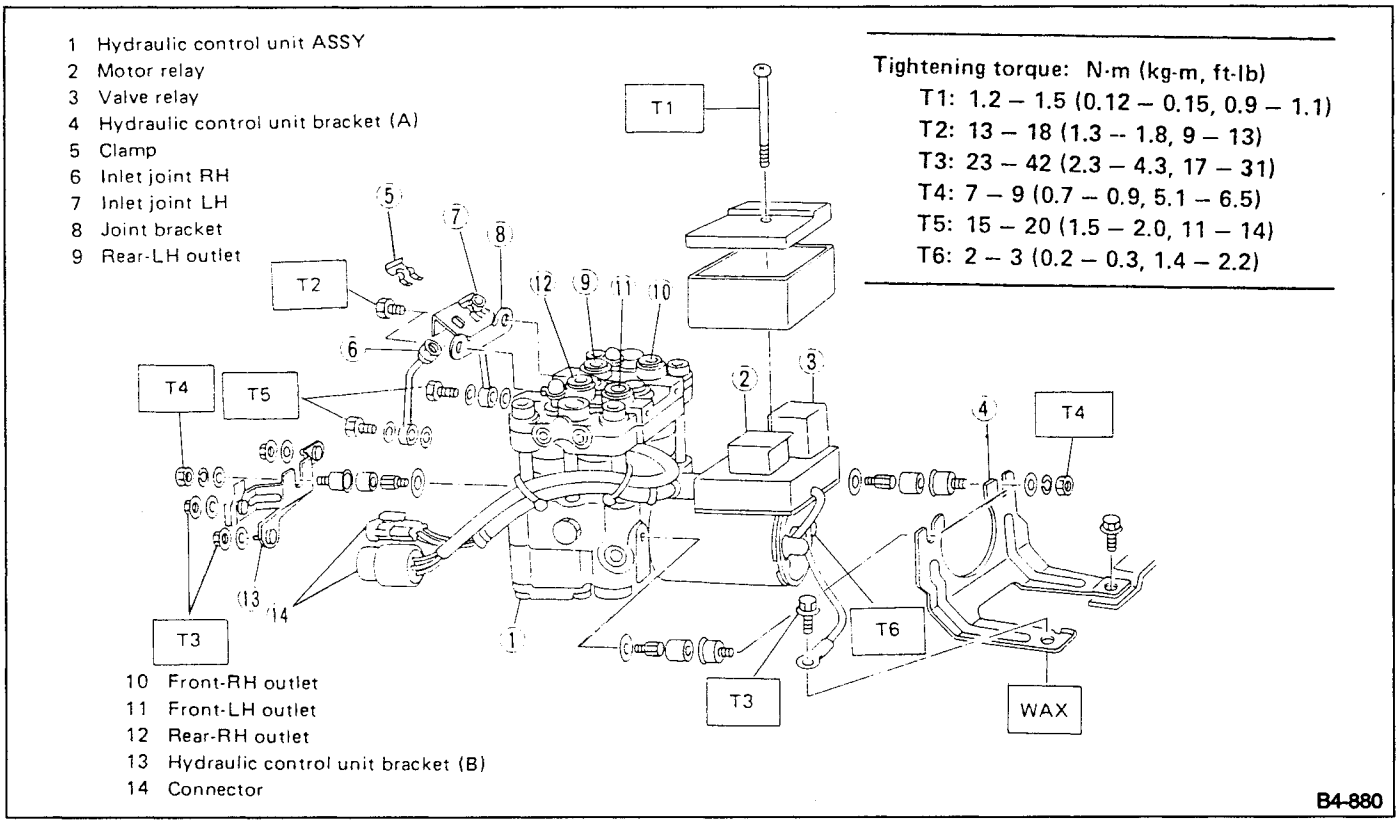


Fig. 145

A: REMOVAL

1) Disconnect battery ground cable.
2) Disconnect hydraulic unit connector.

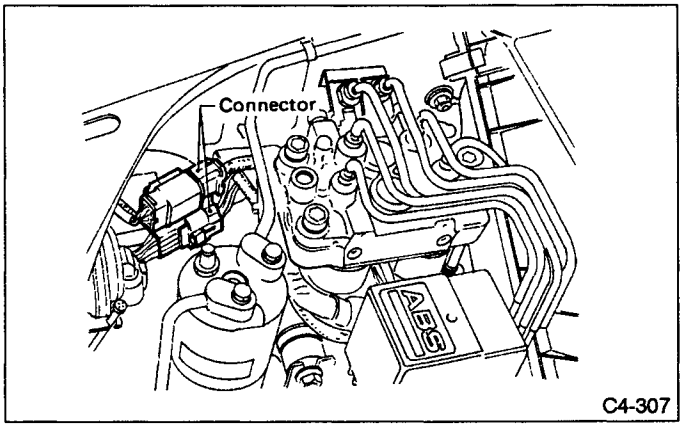


Fig. 146

3) Disconnect air flow meter connector.
4) Remove upper air cleaner cover.

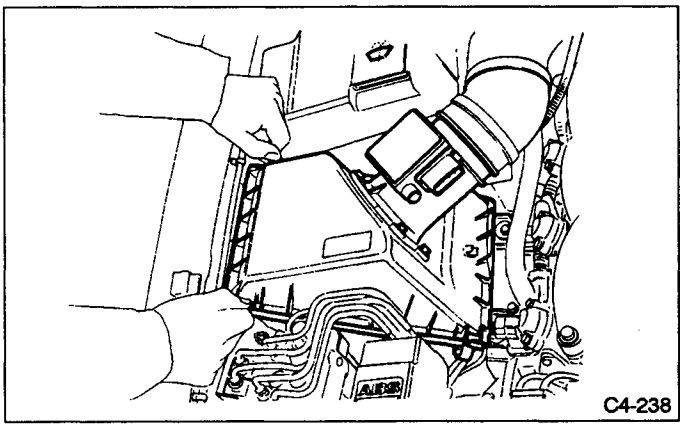


Fig. 147

5) Remove lower air cleaner cover.

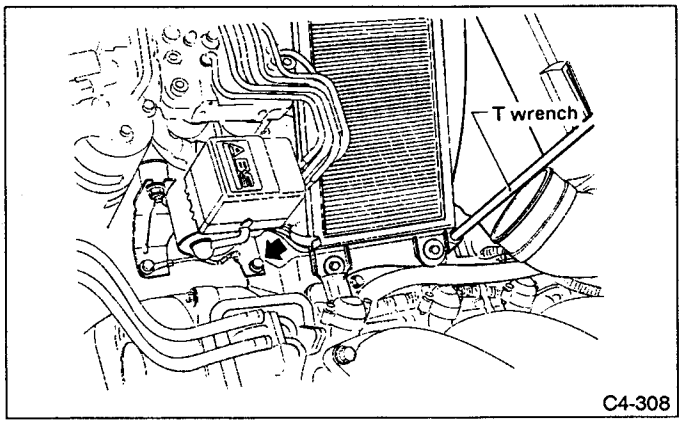


Fig. 148

6) Disconnect brake pipes from hydraulic unit.

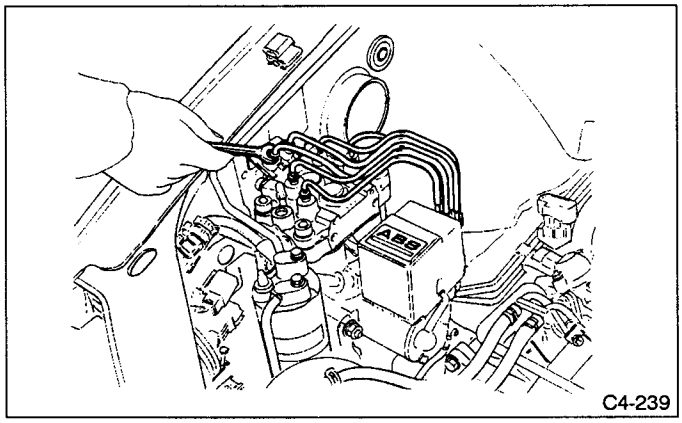


Fig. 149

7) Remove hydraulic unit mounting nuts and bolts.

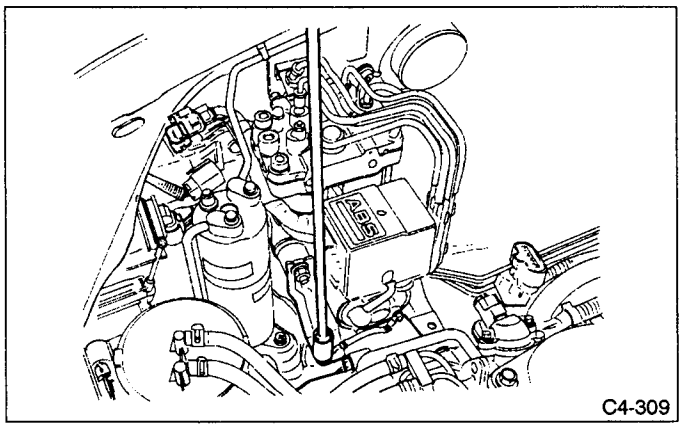


Fig. 150

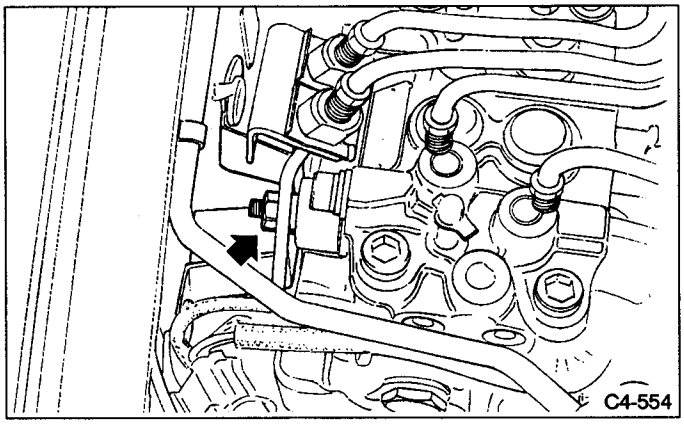


Fig. 151

8) Remove hydraulic unit.

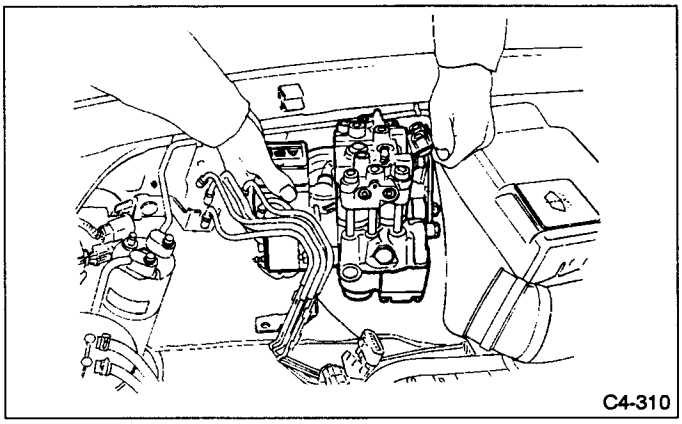


Fig. 152

a. Hydraulic unit cannot be disassembled. Do not attempt to loosen bolts and nuts.
b. Do not drop or bump hydraulic unit.
c. Do not turn the hydraulic unit upside down or place it on its side.
d. Be careful to prevent foreign particles from getting into hydraulic unit.
e. When a new hydraulic unit is installed, apply a coat of rust-preventive wax (Nippeco LT or GB) to bracket attaching bolts after tightening.
f. Do not pull harness disconnecting harness connector.
g. Be careful not to spill brake fluid onto painted surfaces.

B: INSPECTION

1) Check bracket (on vehicle) for looseness.
2) Check connected and fixed condition of connector.
3) Open hydraulic unit relay box and check for discontinuity or short-circuits.

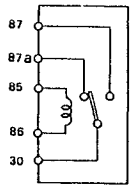
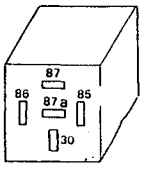
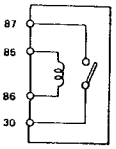
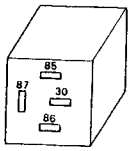
	Condition	Terminal number	Standard	Diagram	Terminal location
Valve relay	Turning off electricity.	85 — 86	93 — 113 Ω		
		30 — 87a	0 Ω		
		30 — 87	∞		
	Turning on electricity between 85 and 86. (DC 12 V)	30 — 87a	0Ω		
		30 — 87	0Ω		
			—		
Motor relay	Turning off electricity.	85 — 86	72 — 88 Ω		
		30 — 87	∞		
	Turning on electricity between 85 and 86. (DC 12 V)	30 — 87	0 Ω		

Fig. 153 B4-435

C: INSTALLATION

1) To install, reverse above removal procedures.
2) Bleed air from brake system.

14. Electronic Control Unit for ABS System

A: REMOVAL

1) Remove right front seat.
2) Remove floor mat located under lower right side of front seat.
3) Remove bolts which secure electronic control unit to body.

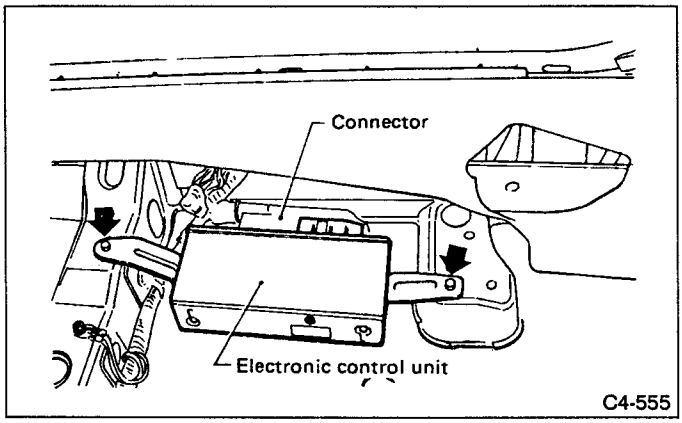


Fig. 154

4) Remove screws which secure connector to electronic control unit and disconnect connector.

B: INSPECTION

Check that connector is connected correctly and that connector terminal sliding resistance is correct.

C: INSTALLATION

To install, reverse above removal procedures.

T TROUBLESHOOTING AIRBAG

Supplemental Restraint System "Airbag"

Airbag system wiring harness is routed near the brake systems.

a. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

b. Be careful not to damage Airbag system wiring harness when servicing the brake systems.

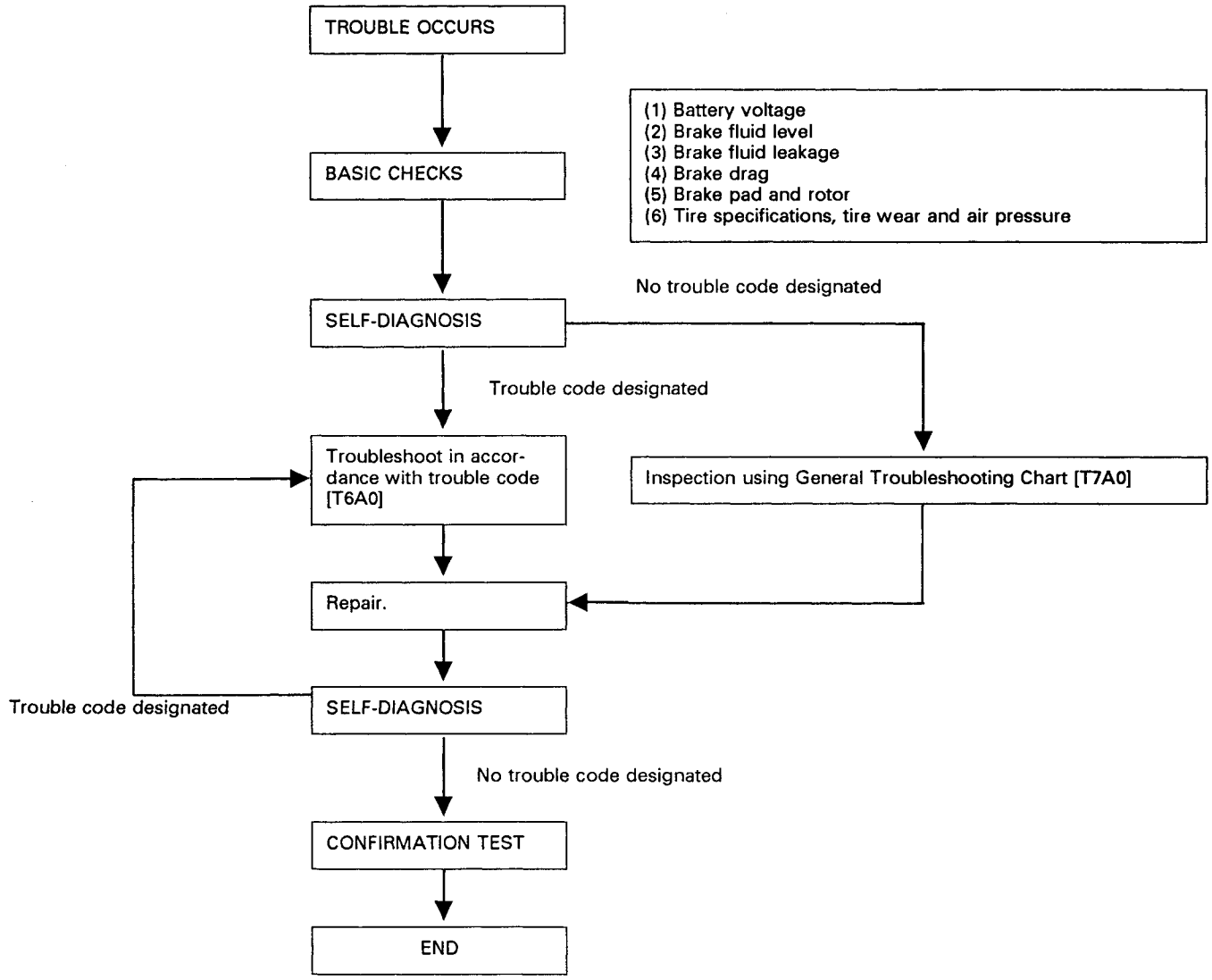
1. Entire Brake System

Trouble and possible cause	Corrective action
1. Insufficient braking	
(1) Fluid leakage from the fluid line	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).
(2) Entry of air into the fluid line	Bleed the air.
(3) Excessively wide shoe clearance	Adjust the clearance.
(4) Wear, deteriorated surface material, adhering water or fluid on the lining	Replace, grind or clean.
(5) Improper operation of master cylinder, disc caliper, brake booster or check valve	Correct or replace.
2. Unstable or uneven braking	
(1) Fluid on the lining, rotor	Eliminate cause of fluid leakage, clean, or replace.
(2) Rotor eccentricity	Correct or replace the rotor.
(3) Improper lining contact, deteriorated surface material, improper inferior material, or wear	Correct by grinding, or replace.
(4) Deformed back plate	Correct or replace.
(5) Improper tire inflation	Inflate to correct pressure.
(6) Disordered wheel alignment	Adjust alignment.
(7) Loosened back plate or the support installing bolts	Retighten.
(8) Loosened 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 parking brake	Check, adjust, or replace the rear brake and cable system.
3. Excessive pedal stroke	
(1) Entry of air into the fluid line	Bleed the air.
(2) Excessive play in the master cylinder push rod	Adjust.
(3) Fluid leakage from the fluid line	Repair or replace (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose).

Trouble and possible cause	Corrective action
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 parking 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 disc caliper operation	Correct or replace.
(8) Improper adjusted wheel bearing	Adjust or replace.
5. Brake noise (1) (creak sound)	
(1) Hardened or deteriorated pad	Replace the pad.
(2) Worn pad	Replace the pad.
(3) Loosened back plate or the support installing bolts	Retighten.
(4) Loose wheel bearing	Retighten to normal tightening torque.
(5) Dirty rotor	Clean the rotor, or clean and replace the brake ASSY.
6. Brake noise (2) (hissing sound)	
(1) Worn pad	Replace the pad.
(2) Improper installed pad	Correct or replace the pad.
(3) Loose or bent rotor	Retighten or replace.
7. Brake noise (3) (click sound)	
(1) Excessively worn pad or the support	Replace the pad or the support.

2. Troubleshooting for ABS

A: BASIC TROUBLESHOOTING PROCEDURE



a. To check harness for broken wires or short-circuits, shake it while holding it or the connector.

b. When ABS warning lamp illuminates, read and record trouble code indicated by ECU's LED.

B: SELF-DIAGNOSIS

Conduct self-diagnosis after driving the vehicle at speeds greater than 30 km/h (19 MPH) for at least one minute. The vehicle must be stopped with the engine operating. When a problem is detected by self-diagnosis, the warning light in the instrument panel comes on.
Approximately 5 — 12 seconds after the warning light has come on, the problem detected by the ABS control unit (located under the right front seat) is displayed by a trouble code in terms of "the number of LED's blinks."
a. Both the warning light and the LED remain activated unless the ignition key is turned OFF. With the ignition key turned OFF, the contents of the problem stored in the memory are reset.
b. Only one trouble code is displayed at a time. When a multiple of problems occur, only the first problem detected is displayed.
c. If the LED does not activate (though the warning light is ON), the power supply may be inoperative.

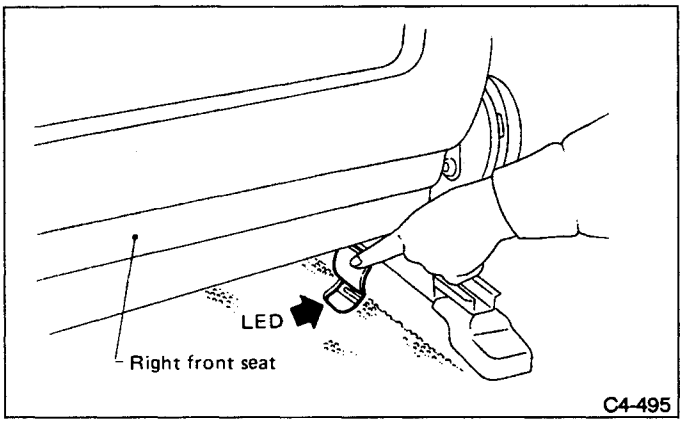


Fig. 155

C: LIST OF TROUBLE CODES

1. TROUBLE CODES

Trouble code	Contents of diagnosis	
0 [LED OFF]	Improper power line voltage or faulty harness	
1	Broken or shorted solenoid valve circuit(s) in hydraulic unit	Left front wheel control
2		Right front wheel control
3		Right rear wheel control
4		Left rear wheel control
5	Faulty wheel ABS sensor	Left front wheel speed
6		Right front wheel speed
7		Right rear wheel speed
8		Left rear wheel speed
9	Faulty motor and/or motor relay or broken or shorted harness circuit	
10	Faulty valve relay or broken or shorted harness circuit Faulty valve relay or broken or shorted harness, or interrupted ABS (causing brakes to function as a conventional brake system). Unidentified fault that are not equivalent to trouble codes 1 — 16.	
16	Faulty ABS control unit or broken or shorted harness circuit Faulty ABS control unit or broken or shorted harness, or malfunctioning system or line unidentified by vehicle ABS sensor fail-safe function.	

2. HOW TO READ TROUBLE CODE

The LED in the ABS control unit flashes the code corresponding to the faulty part.

Trouble codes are displayed by the number of LED blinks.

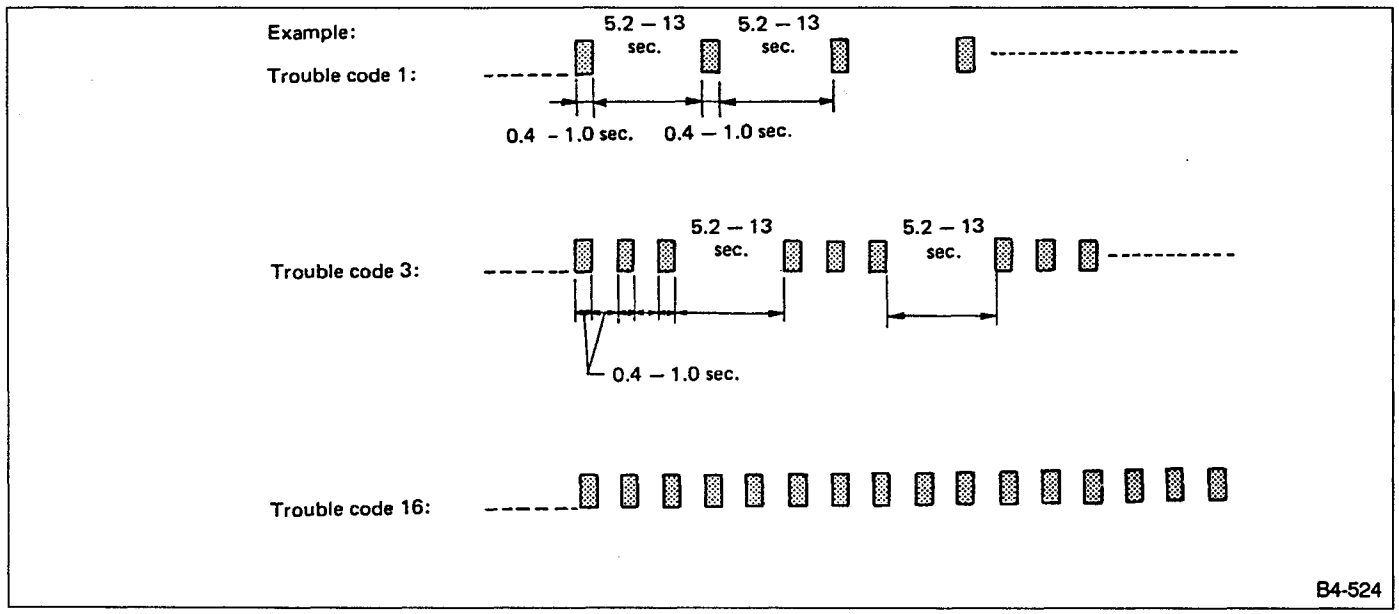


Fig. 156

3. ABS Control Unit I/O Signal

A: I/O SIGNAL VOLTAGE

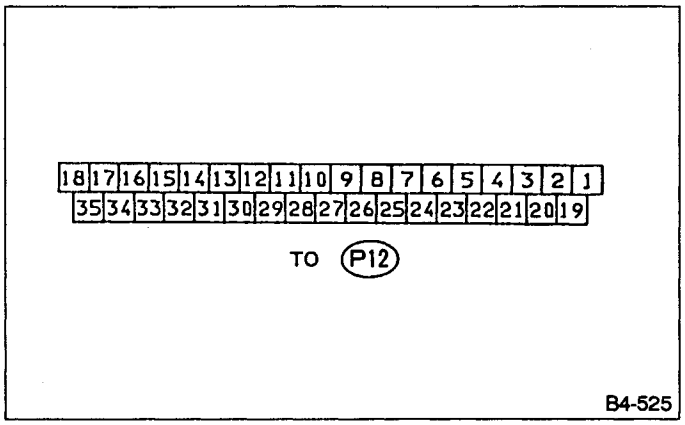


Fig. 157

Contents			Terminal No.	With engine idling	Input/output signals	
					Measured value	Measuring conditions
Wheel ABS sensors	Left front wheel		22	0V	200 — 300 mV (AC range)	• No. 22 — No. 4 • Vehicle speed 2.75 km/h (1.7 MPH)
	GND		4			
	Right front wheel		11	0V	200 — 300 mV (AC range)	• No. 11 — No. 21 • Vehicle speed 2.75 km/h (1.7 MPH)
	GND		21			
	Left rear wheel		7	0V	200 — 300 mV (AC range)	• No. 7 — No. 9 • Vehicle speed 2.75 km/h (1.7 MPH)
	GND		9			
	Right rear wheel		24	0V	200 — 300 mV (AC range)	• No. 24 — No. 26 • Vehicle speed 2.75 km/h (1.7 MPH)
	GND		26			
Stop light switch			25	0V	13 — 14V	When brake pedal is depressed.
Motor monitoring			14	0V	13 — 14V	When motor operates.
Valve power-supply monitoring			32	13 — 14V	13 — 14V	—
Hydraulic unit	Solenoid	Left front wheel	2	13 — 14V	0V	When solenoid is energized to produce output.
		Right front wheel	35	13 — 14V	0V	
		Left rear wheel	18	13 — 14V	0V	
		Right rear wheel	19	13 — 14V	0V	
	Valve relay coil		27	0V	0V	—
	Motor relay coil		28	13 — 14V	0V	When motor operates to produce output
Warning light			29	0V	13 — 14V	Ignition switch ON (Engine OFF)
Power supply	Alternator		15	13 — 14V	1.7V	Ignition switch ON (Engine OFF)
	Battery		1	13 — 14V	13 — 14V	—
	Relay coil (valve, motor, etc.)		17	13 — 14V	13 — 14V	—
Grounding line			10	0V	0V	—
			20	0V	0V	—
			34	0V	0V	—

B: I/O SIGNAL DIAGRAM

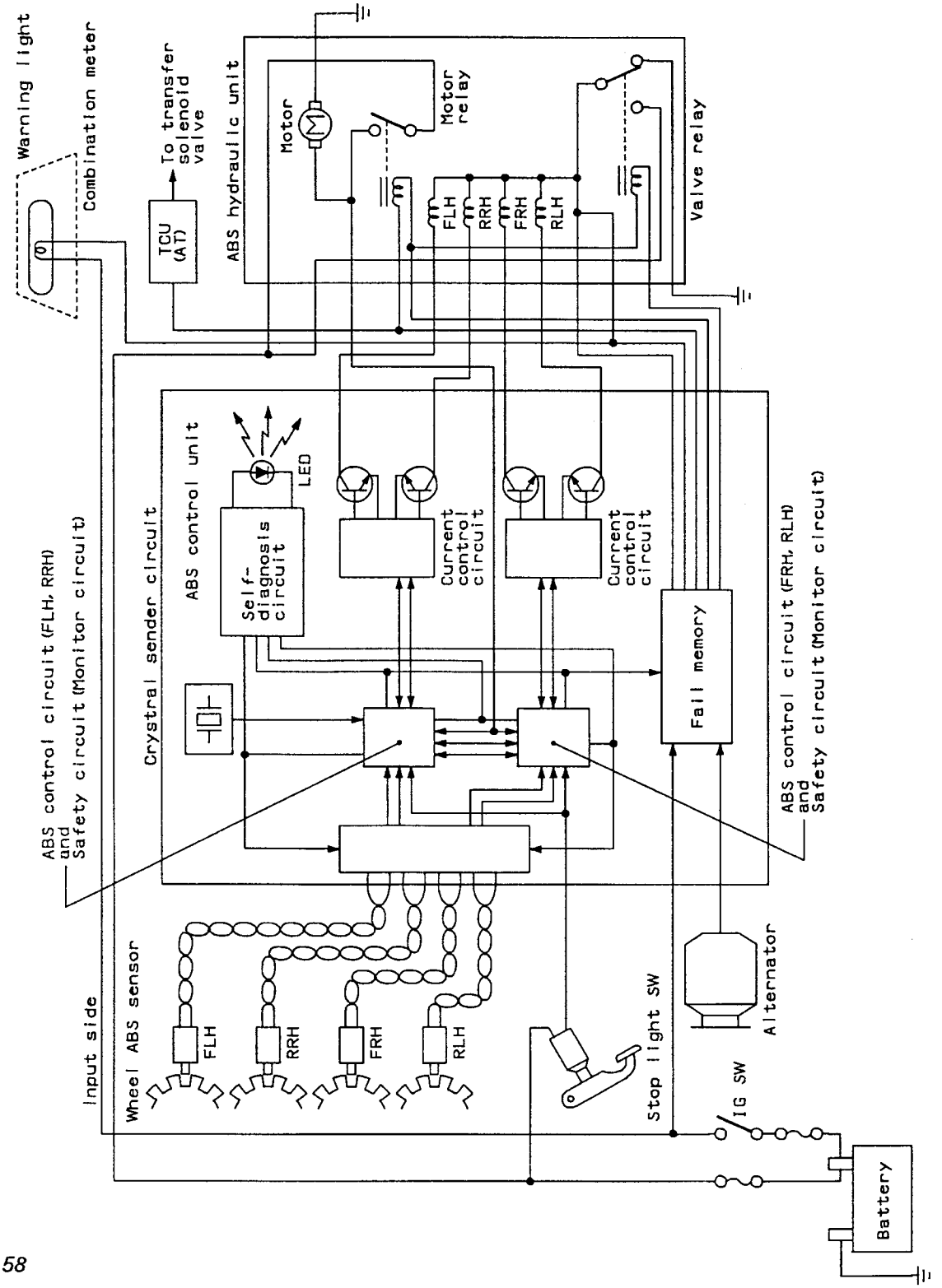
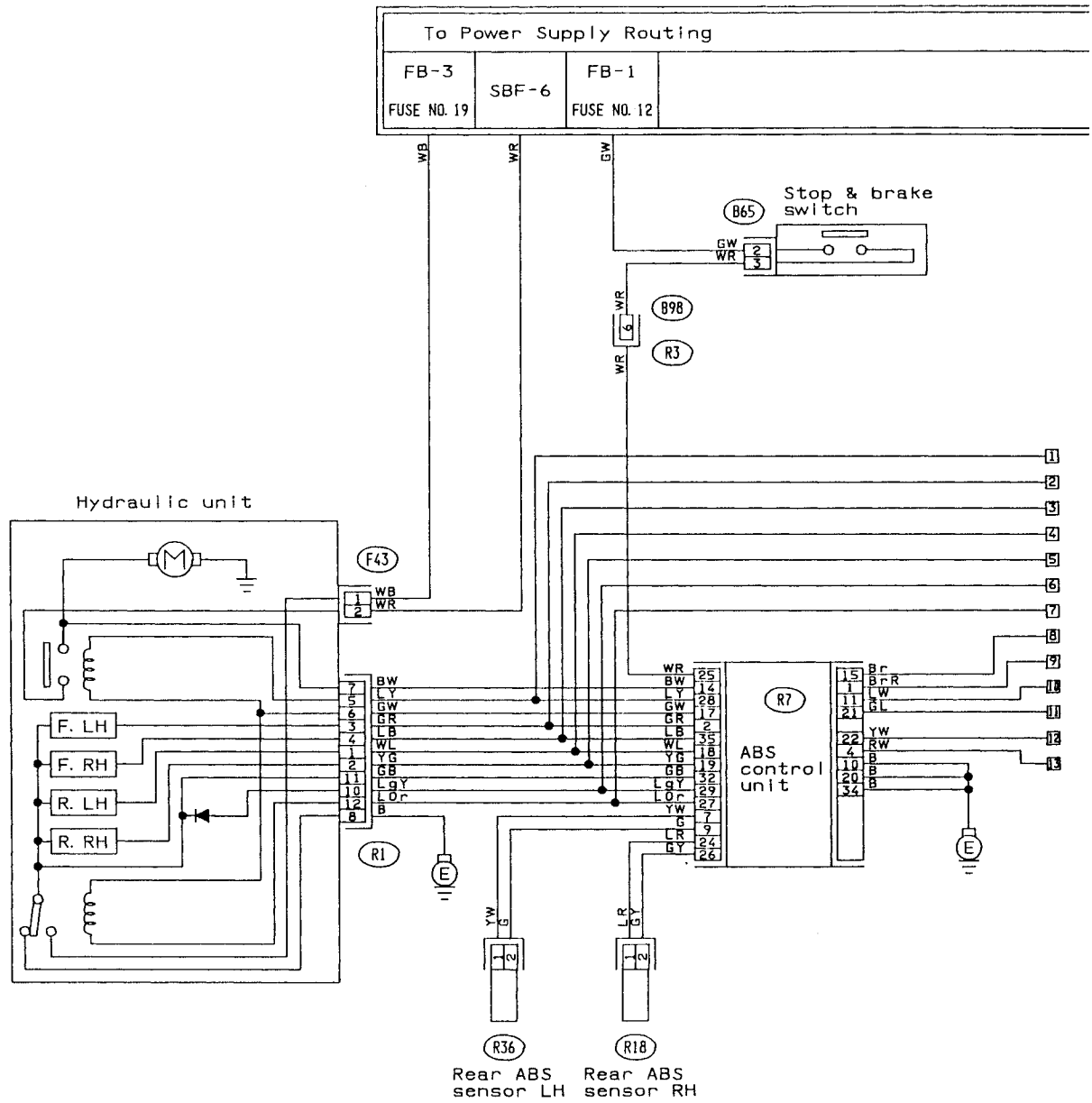


Fig. 158

4. Diagram of ABS



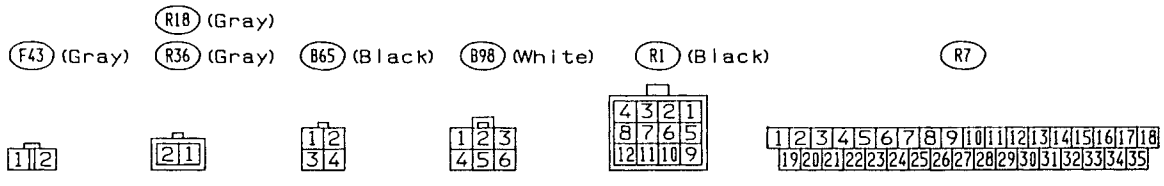
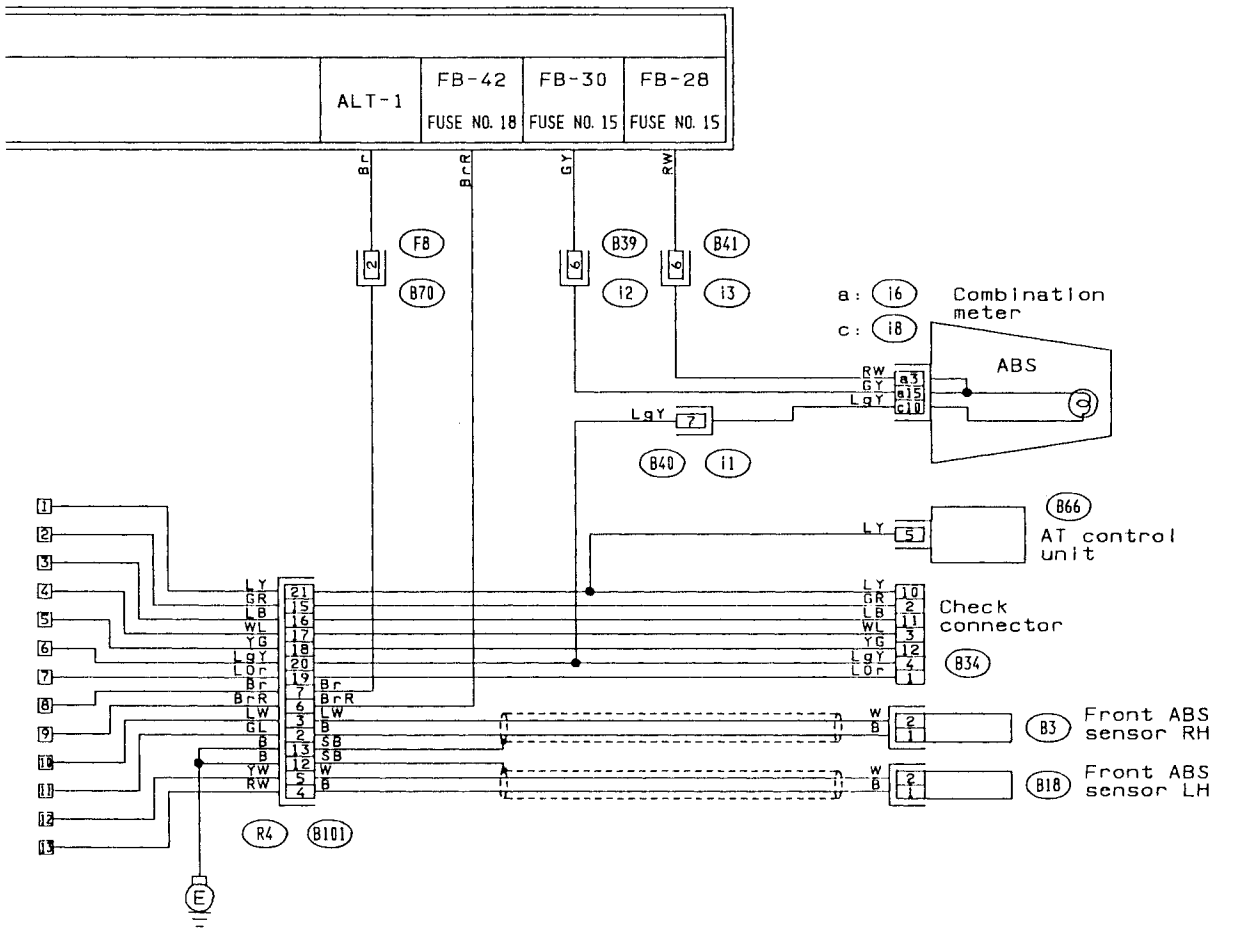
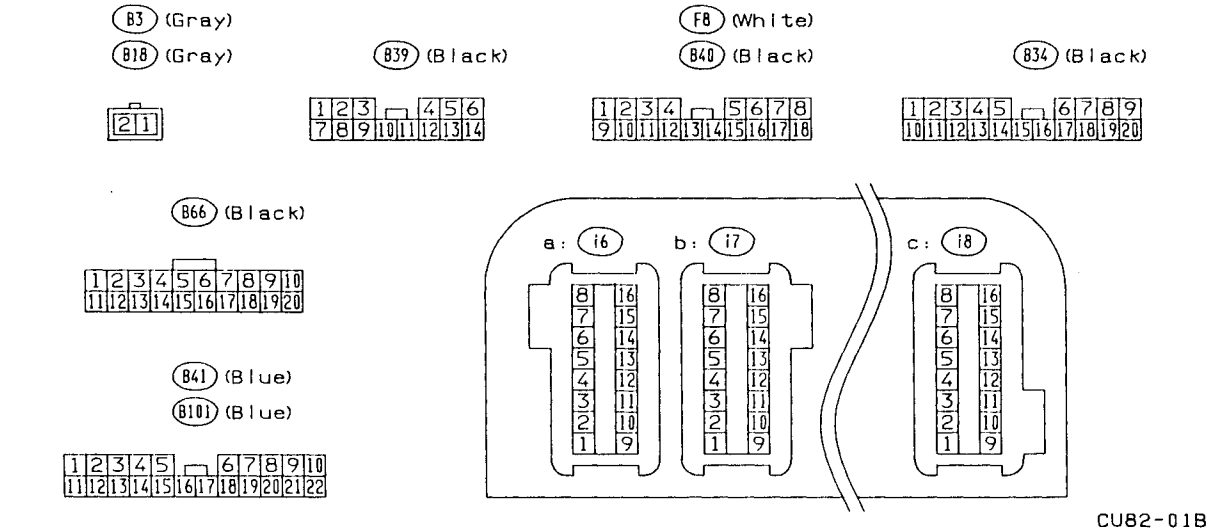


Fig. 159

CU82-01A


ALT-1
FB-42
FUSE NO. 18
FB-30
FUSE NO. 15
FB-28
FUSE NO. 15
Br
BrR
GY
RW
F8
B70
B39
i2
B41
i3
a: i6
c: i8
Combination meter
ABS
LgY
B40
i1
B66
AT control unit
Check connector
B34
B3
Front ABS sensor RH
B18
Front ABS sensor LH
R4
B101


B3 (Gray)
B18 (Gray)
B39 (Black)
F8 (White)
B40 (Black)
B34 (Black)
B66 (Black)
B41 (Blue)
B101 (Blue)
a: i6
b: i7
c: i8

CU82-01B

5. Troubleshooting Chart with Trouble Code

A: TROUBLE CODE (0) — Improper power line voltage or faulty harness

CONTENTS OF DIAGNOSIS:
- Faulty ABS control unit
- Faulty harness
- Faulty alternator

TROUBLE SYMPTOM:
- Warning light comes on but ABS control unit LED does not.
- Normal ABS function resumes although ignition switch remains ON.

1	Check power supply (voltage) to ABS control unit.	Not OK	Repair harness/connector.
	↓ OK		
2	Check input voltage of ABS control unit to alternator.	Not OK	Repair harness/connector or alternator.
	↓ OK		
3	Check ABS control unit ground line (body metal).	Not OK	Repair ground harness.
	↓ OK		
	Repair ABS C/U terminal poor contact. (Replace ABS C/U.)		

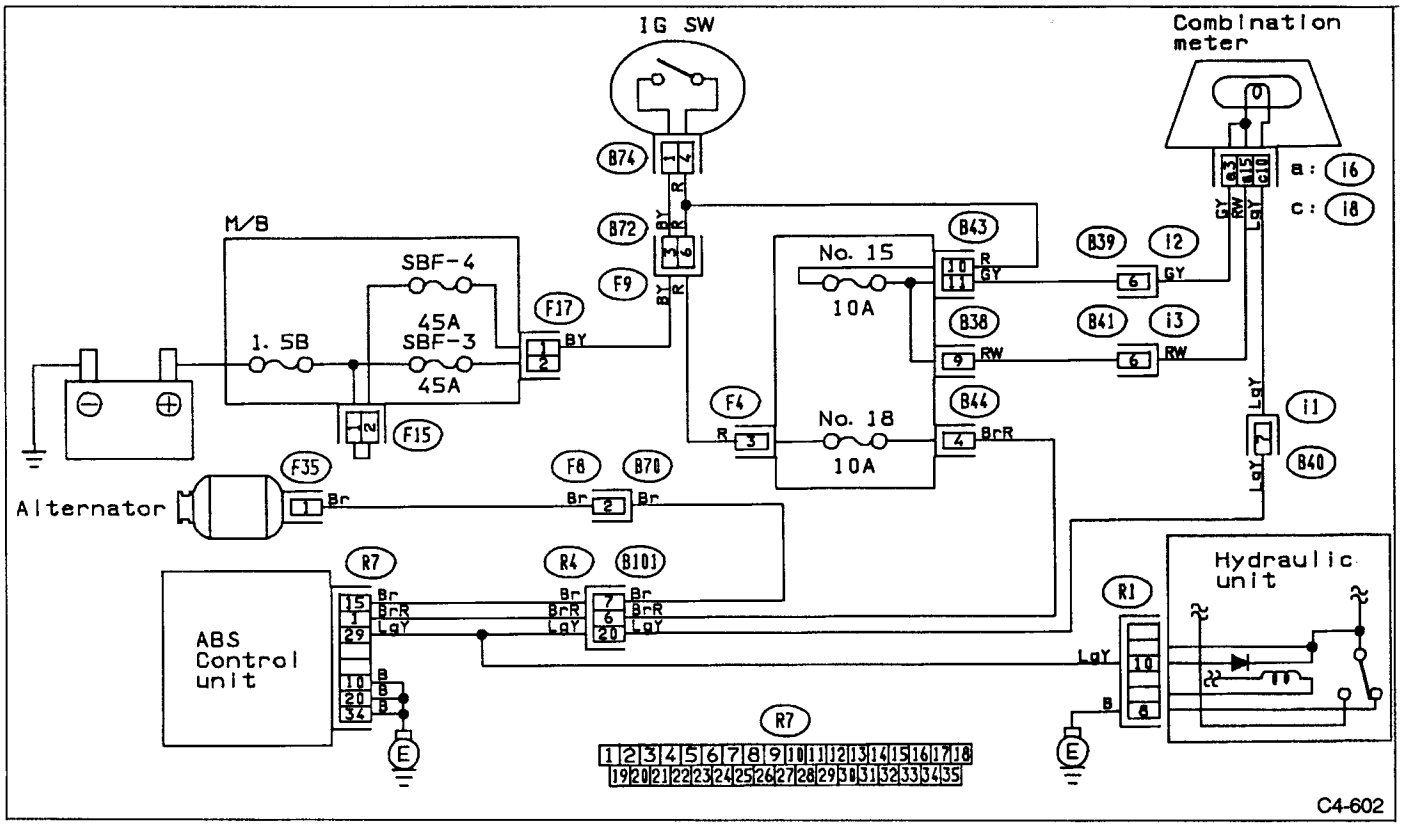


Fig. 160

1. CHECK POWER SUPPLY (VOLTAGE) TO ABS CONTROL UNIT

1) Turn ignition switch OFF.
2) Disconnect connector from ABS control unit.
3) Disassemble connector.
a) While pushing portion ① , disconnect connector.
b) Remove screw from portion ② .
c) Move rubber boot ③ back (toward harness).
d) Slide cover ④ in direction shown by arrow and remove.

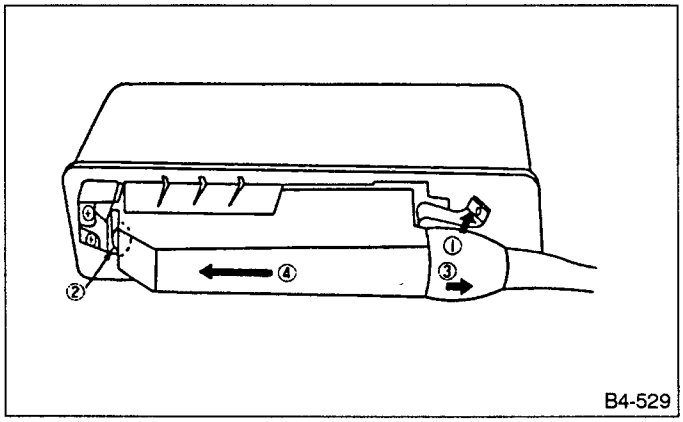


Fig. 161

4) Turn ignition switch ON.
5) Measure voltage between ABS control unit connector and ground.

Connector & terminal/Specified Voltage:
(R7) No. 1 — Body/10 — 12 V

2. CHECK INPUT VOLTAGE OF ABS CONTROL UNIT TO ALTERNATOR

1) Start the engine.
2) Measure voltage between ABS control unit connector and ground.

Connector & terminal/Specified Voltage:
(R7) No. 15 — Body/Approx. 13.5 V

3. CHECK ABS CONTROL UNIT GROUND SYSTEM

1) Turn ignition switch OFF.
2) Connect connector to ABS control unit.
3) Turn ignition switch ON.
4) Measure voltage between ABS control unit terminal and ground.

Terminal/Specified Voltage:
(R7) No. 20 — Body/0 V

B: TROUBLE CODE (1 — 4) Faulty solenoid valve circuit(s) in hydraulic unit

CONTENTS OF DIAGNOSIS:
- Faulty harness/connector in hydraulic unit
- Faulty solenoid valve in hydraulic unit

TROUBLE SYMPTOM:
- ABS does not operate.

1	Check hydraulic unit solenoid.	Not OK	Replace hydraulic unit.
	↓ OK		
2	Check signal emitted from solenoid (on ABS control unit side).	Not OK	Repair harness/connector between ABS control unit and hydraulic unit.
	↓ OK		
	Replace ABS control unit.		

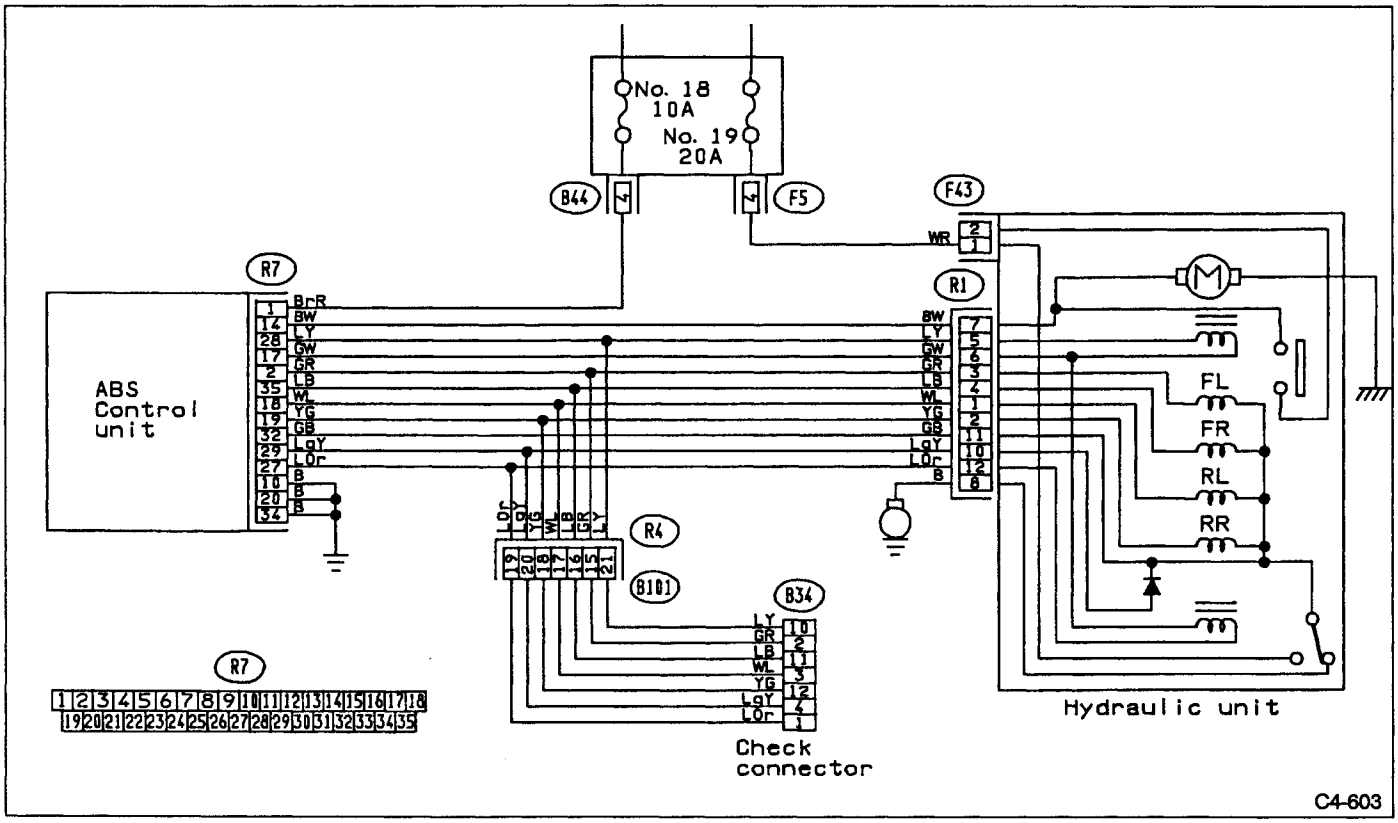


Fig. 162

1. CHECK HYDRAULIC UNIT SOLENOID

1) Turn ignition switch ON.
2) Ground check-connector terminal, and check solenoid valve for operation (sound which indicates proper operation).

Each time solenoid activates, system circuit is interrupted. To check again, first turn ignition switch OFF and then ON.

TROUBLE CODE/Connector & Terminal:
1 / (B34) No. 2 — Body
2 / (B34) No. 11 — Body
3 / (B34) No. 12 — Body
4 / (B34) No. 3 — Body

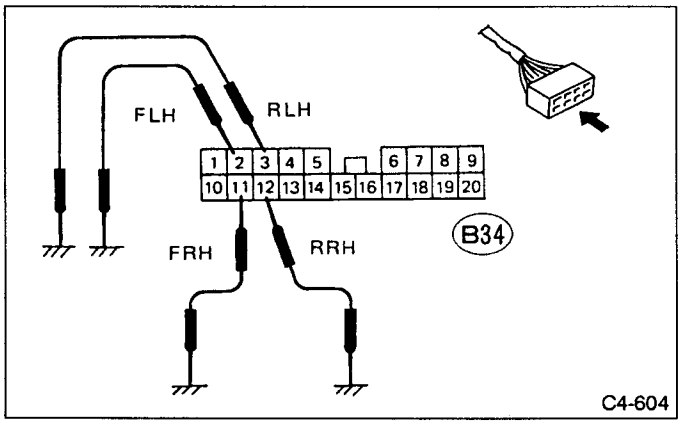


Fig. 163

2. CHECK SOLENOID (ON ABS CONTROL UNIT SIDE)

1) Turn ignition switch ON.
2) Attach circuit tester's positive probe to terminal (corresponding with solenoid) and ground probe to ground and measure voltage between terminal and ground.

Each time solenoid activates, system circuit is interrupted. To check again, first turn ignition switch OFF and then ON.

TROUBLE CODE/Connector & Terminal:
1 / (R7) No. 2 — Body
2 / (R7) No. 35 — Body
3 / (R7) No. 19 — Body
4 / (R7) No. 18 — Body
Specified Voltage: 0 V (solenoid in operation)

C: TROUBLE CODE (5 and 6) — Faulty front ABS sensor

CONTENTS OF DIAGNOSIS:
- Faulty front wheel speed sensor or harness
- Faulty ABS control unit

TROUBLE SYMPTOM:
- ABS does not operate.

1	Check signal emitted from sensor (on ABS control unit side).	OK	Replace ABS C/U terminal poor contact. (Replace ABS C/U.)
	Not OK		
2	Check sensor.	OK	Repair harness/connector.
	Not OK		
	(after tone wheel check) Replace sensor.		

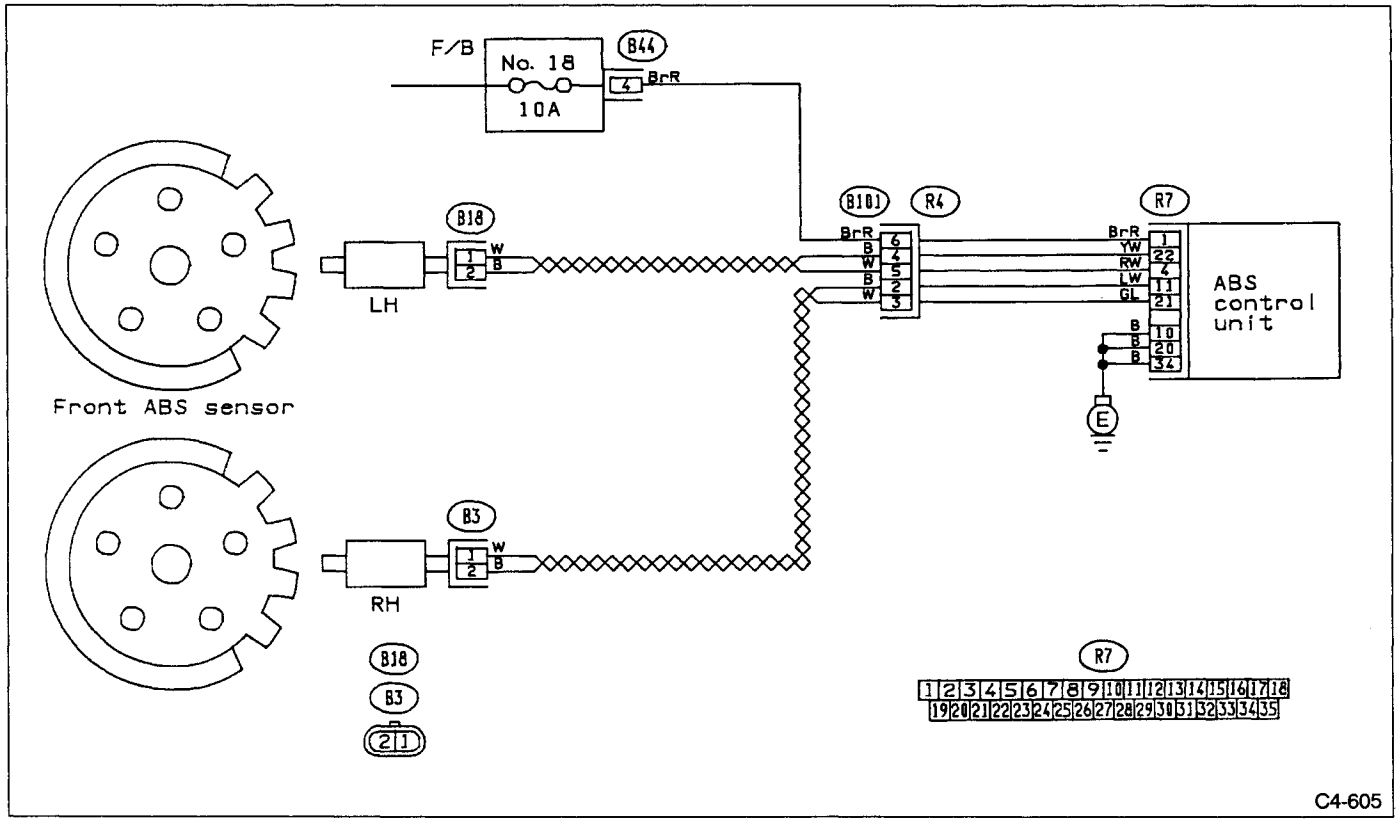


Fig. 164

1. CHECK SIGNAL EMITTED FROM SENSOR (ON ABS CONTROL UNIT SIDE)

1) Disconnect connector from ABS control unit. ⟨Refer to No. T6A1⟩
2) Raise all four wheels off ground.
3) Measure voltage between ABS control unit terminals using a digital circuit tester (set in "AC" range) according to trouble code.

TROUBLE CODE/Connector & Terminal:
5 / (R7) No. 4 — No. 22
6 / (R7) No. 11 — No. 21
Specified Voltage:
200 — 300 mV (at "creep" speed of AT model)

4) Disconnect ABS control unit connector, and measure resistance between sensor and ground.

Connector & terminal/Specified Resistance:
(R7) No. 22 — Body/1 MΩ min.
(R7) No. 21 — Body/1 MΩ min.

2. CHECK SENSOR

1) Disconnect sensor connector.
2) Measure resistance between sensor terminals.

TROUBLE CODE/Connector & Terminal:
5 / Sensor LH No. 1 — No. 2
6 / Sensor RH No. 1 — No. 2
Specified Resistance: 0.8 — 1.3 kΩ

3) Measure resistance between sensor connector terminal and ground.

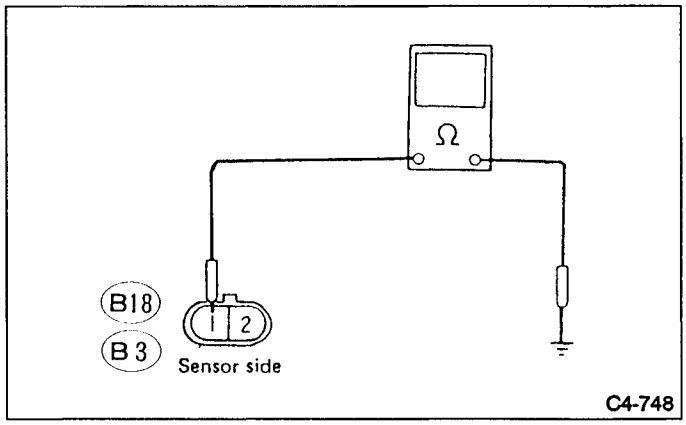


Fig. 165

Connector & terminal/Specified Resistance:
(B18) No. 1 — Body/1 MΩ min.
(B3) No. 1 — Body/1 MΩ min.

D: TROUBLE CODE (7 and 8) — Faulty rear ABS sensor

CONTENTS OF DIAGNOSIS:
- Faulty rear wheel ABS sensor or harness
- Faulty ABS control unit

TROUBLE SYMPTOMS:
- ABS does not operate.
- Rear wheels only are occasionally controlled by ABS.

1	Check signal emitted from sensor (on ABS control unit side).	OK	Replace ABS C/U terminal poor contact. (Replace ABS C/U.)
	▼ Not OK		
2	Check sensor.	OK	Repair harness/connector.
	▼ Not OK		
	Faulty sensor		

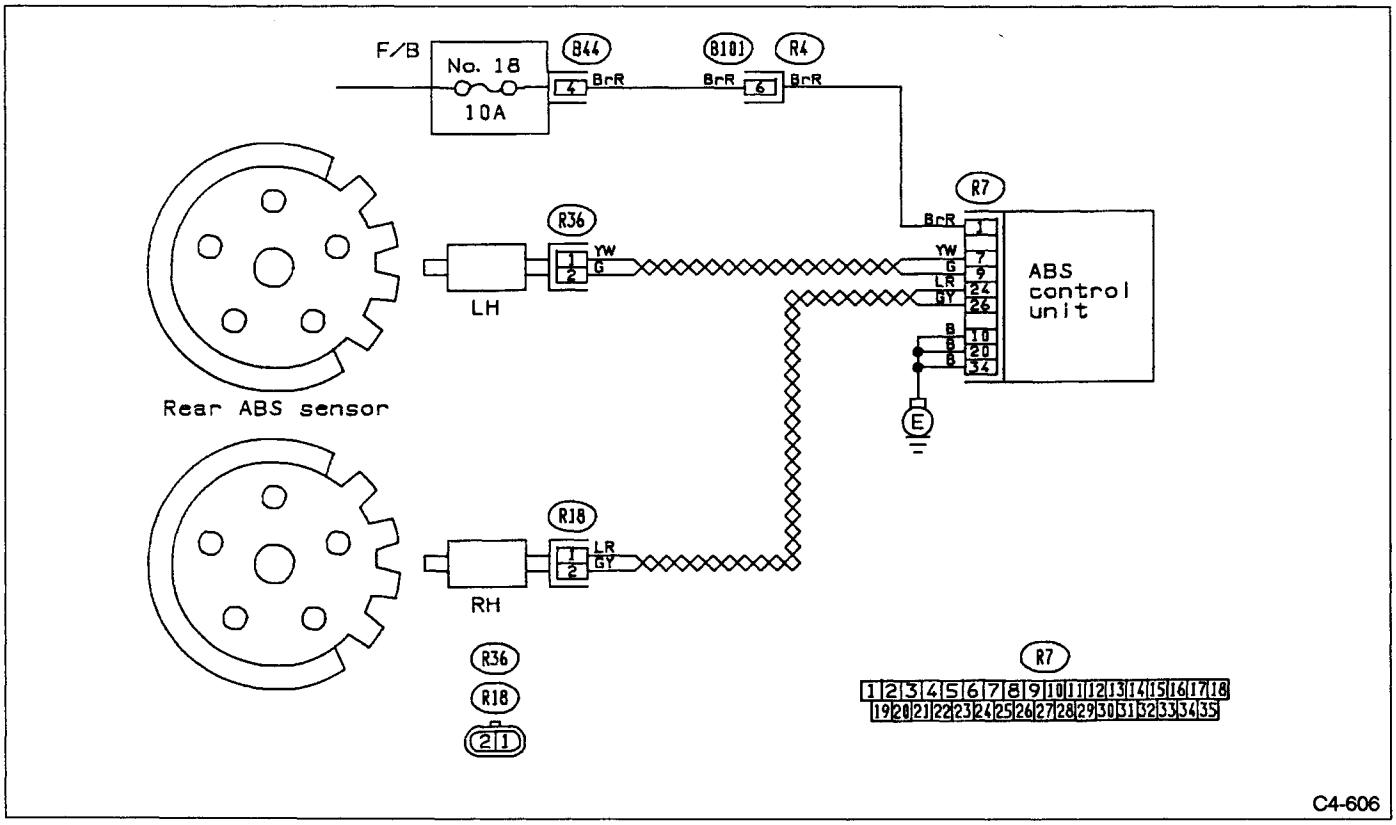


Fig. 166

1. CHECK INPUT SIGNAL OF SENSOR TO ABS CONTROL UNIT

1) Disconnect connector from ABS control unit. ⟨Refer to No. T6A1⟩
2) Raise wheels off ground.
3) Measure voltage between ABS control unit terminals using a digital circuit tester, (Set in "AC" range) according to trouble code.

TROUBLE CODE/Connector & Terminal:
7/(R7) No. 24 — No. 26
8/(R7) No. 7 — No. 9
Specified Voltage:
200 — 300 mV (at "creep" speed of AT model)

4) Disconnect ABS control unit connector and measure resistance between sensor and ground.

Connector & Terminal/Specified Resistance:
(R7) No. 26 — Body/1 MΩ min.
(R7) No. 9 — Body/1 MΩ min.

2. CHECK SENSOR

1) Disconnect sensor connector.
2) Measure resistance between sensor terminals.

TROUBLE CODE/Connector & Terminal:
7/Sensor RH No. 1 — No. 2
8/Sensor LH No. 1 — No. 2
Specified Voltage: 0.8 — 1.3 kΩ

3) Measure resistance between sensor connector terminal and ground.

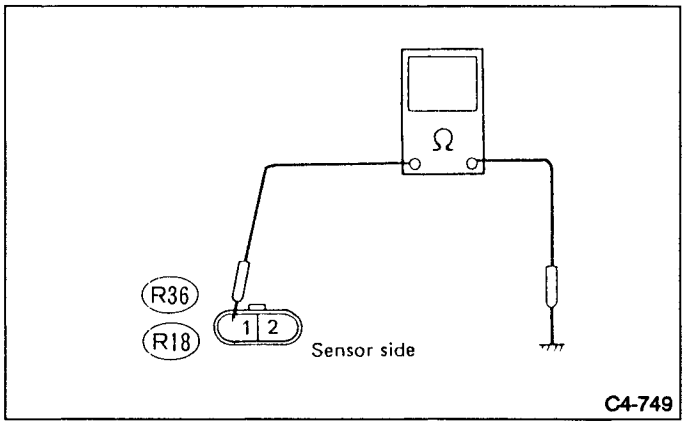


Fig. 167

Connector & Terminal/Specified Resistance:
(R36) No. 1 — Body/1 MΩ min.
(R18) No. 1 — Body/1 MΩ min.

E: TROUBLE CODE (9) — Faulty hydraulic motor or motor relay

CONTENTS OF DIAGNOSIS:
- Faulty main power supply
- Faulty hydraulic motor or motor relay built into hydraulic unit

TROUBLE SYMPTOM:
- ABS does not operate.

1 Check motor relay coil (on ABS control unit side).
- Not OK → 4 Check relay coil (on hydraulic unit side).
- OK ↓

2 Check motor relay contacts (on hydraulic unit side).
- OK → 5 Check and repair motor power line harness.
- Not OK ↓

3 Check motor relay.
- Not OK → Replace motor relay.
- OK ↓

Replace hydraulic unit.

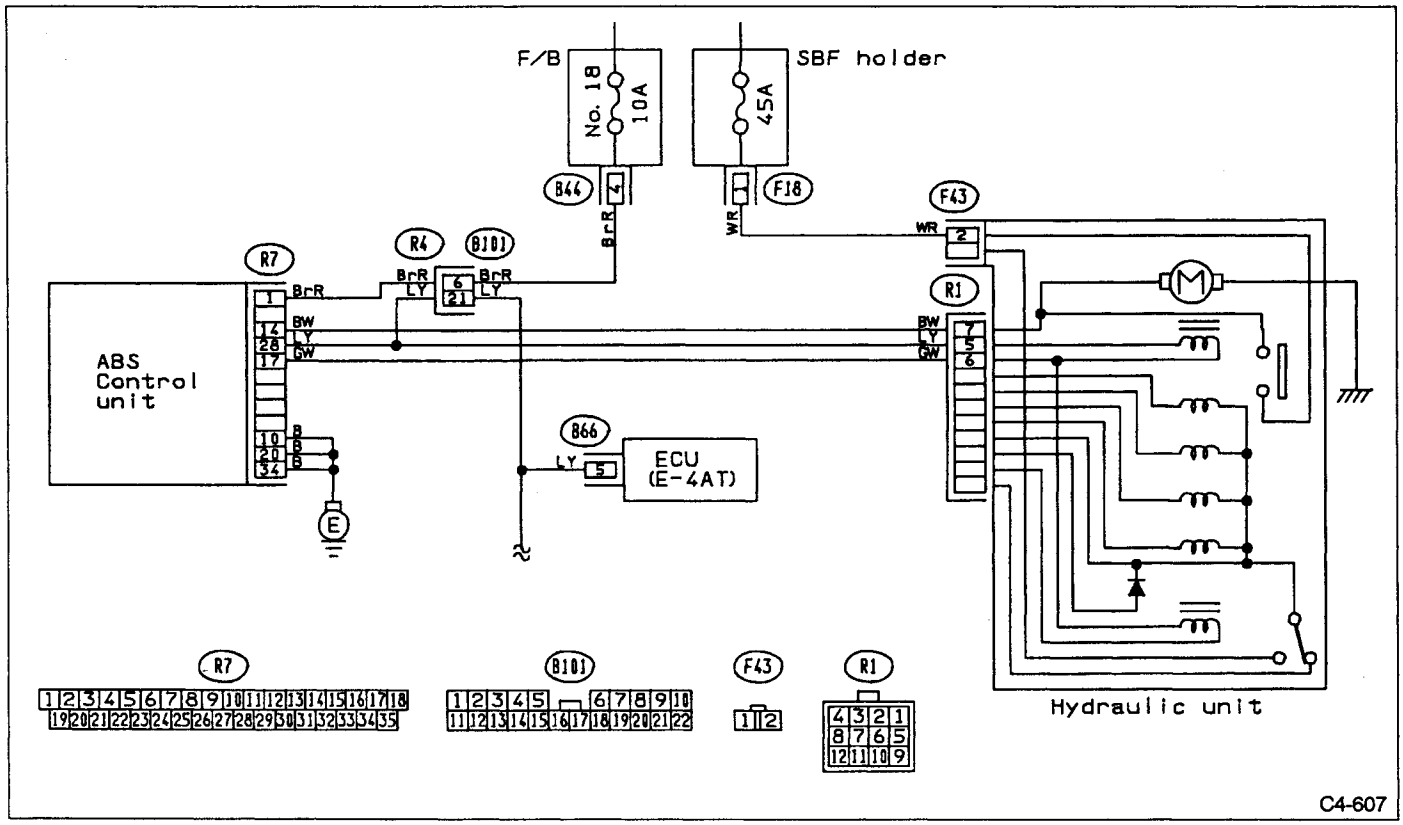


Fig. 168

1. CHECK RELAY COIL (ON ABS CONTROL UNIT SIDE)

1) Turn ignition switch OFF.
2) Disconnect ABS control unit connector.
3) Disassemble ABS control unit connector.
4) Measure resistance between ABS control unit terminals.

Connector & terminal/Specified Resistance:
(R7) No. 17 — No. 28/45 — 55 Ω

2. CHECK MOTOR RELAY CONTACTS (ON HYDRAULIC UNIT SIDE)

1) Disconnect connectors from hydraulic unit.
2) Measure resistance between hydraulic unit terminals.

Terminal/Specified Resistance:
(To F43) No. 2 — (To R1) No. 4/1 MΩ min.

3. CHECK MOTOR RELAY

1) Remove motor relay.
2) Attach circuit tester probes to terminals, as shown in Figure.

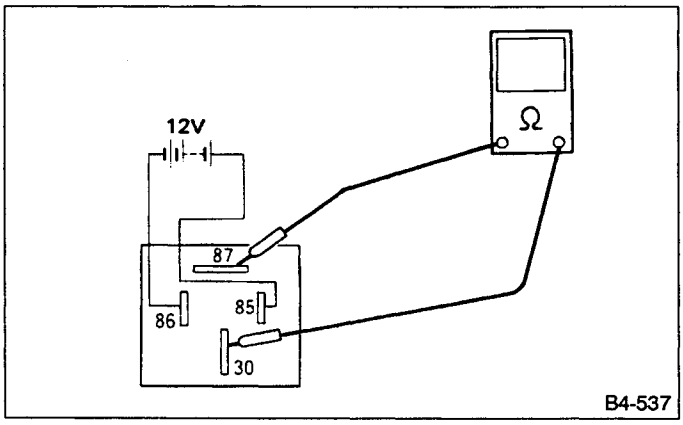


Fig. 169

3) Measure resistance between terminals.

Terminal/Specified Resistance:
No. 30 — 87/0 Ω (when 12 volts applied)
No. 30 — 87/1 MΩ min. (when no voltage is applied)

4. CHECK RELAY COIL (ON HYDRAULIC UNIT SIDE)

1) Disconnect connector from hydraulic unit.
2) Measure resistance between hydraulic unit terminals.

Terminal/Specified Resistance:
No. 5 — No. 6/45 — 55 Ω

When resistance checks out "Not OK", check relay as a single unit.
- **If resistance checks out "OK", replace hydraulic unit.**
- **If "Not OK", repair harness connector between ABS control unit and hydraulic unit.**

3) Disconnect connectors from ABS control unit and hydraulic unit. Measure resistance between connectors, and between each connector and ground.

Connector & terminal/Specified Resistance:
(R1) No. 5 — (R7) No. 28/0 Ω
(R1) No. 6 — (R7) No. 17/0 Ω
(R1) No. 5 — Body/1 MΩ min.
(R1) No. 7 — Body/1 MΩ min.

5. CHECK AND REPAIR MOTOR POWER HARNESS

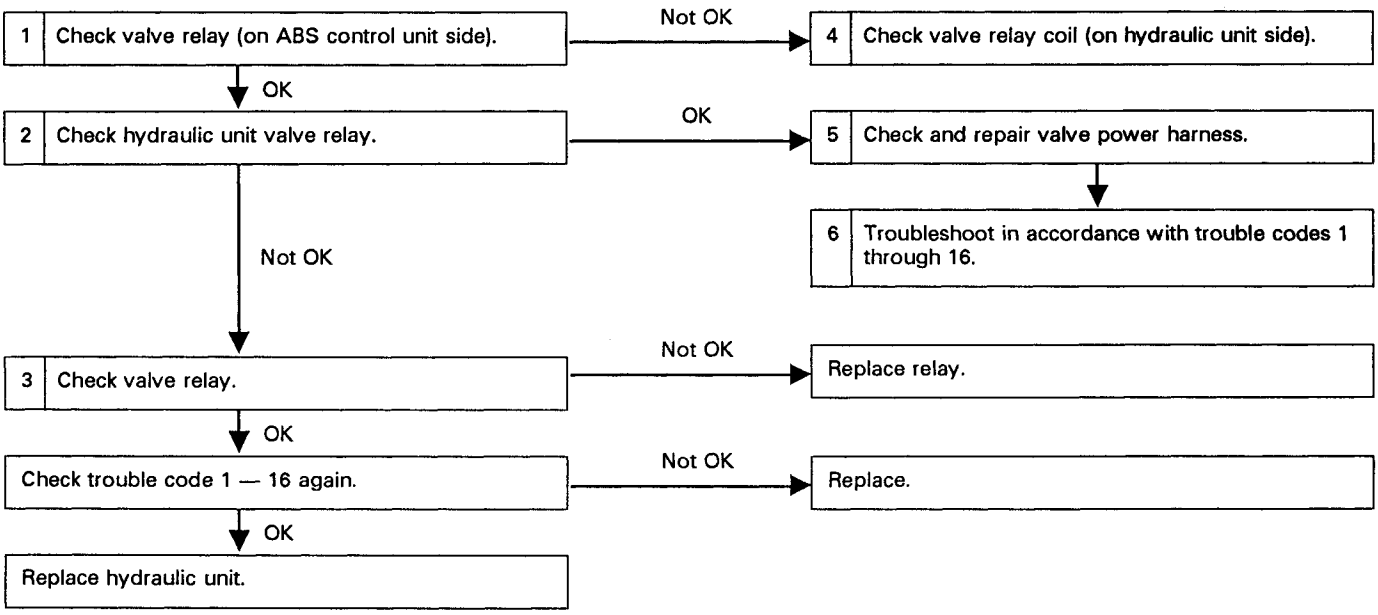
1) Turn ignition switch ON.
2) Measure voltage between hydraulic unit connector and ground.

Connector & terminal/Specified Voltage:
(F43) No. 2 — Body/10 — 12 V

F: TROUBLE CODE (10) — Faulty valve relay or interrupted system operation (caused by symptoms other than those indicated at left.), unidentified fault are not equivalent to trouble codes (1) — (16).

CONTENTS OF DIAGNOSIS:
- Faulty main power supply (include earth pint)
- Faulty hydraulic unit valve relay
- Interference with other system

TROUBLE SYMPTOM:
- ABS does not operate.



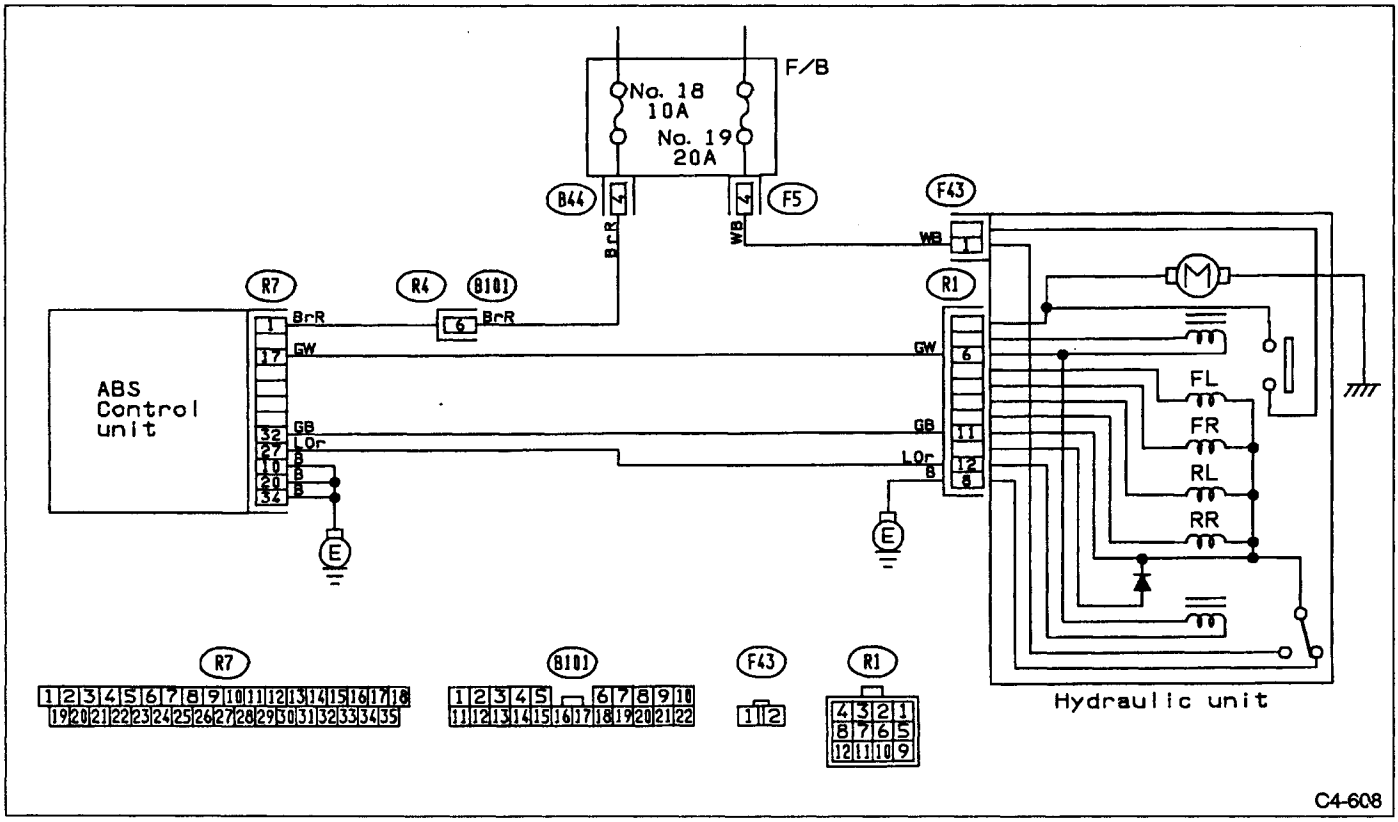

F/B
No. 18
10A
No. 19
20A
B44
F5
F43
WB
BrR
R7
R4
B101
R1
ABS
Control
unit
BrR
GW
GB
LOr
B
FL
FR
RL
RR
Hydraulic unit
C4-608

Fig. 170

1. CHECK VALVE RELAY COIL (ON ABS CONTROL UNIT SIDE)

1) Turn ignition switch OFF.
2) Disconnect ABS control unit connector.
3) Disassemble connector. (Refer to No. T6A1.)
4) Measure resistance between ABS control unit terminals.

Connector & terminal/Specified Resistance:
(R7) No. 17 — No. 27/80 — 90 Ω

2. CHECK HYDRAULIC UNIT VALVE RELAY

1) Disconnect connector from hydraulic unit.
2) Measure resistance between hydraulic unit terminals.

Terminal/Specified Resistance:
(To F43) No. 1 — (To R1) No. 11/1 MΩ min.

3. CHECK VALVE RELAY AS A SINGLE UNIT

1) Remove valve relay.
2) Attach circuit tester probes to terminals, as shown in Figure.

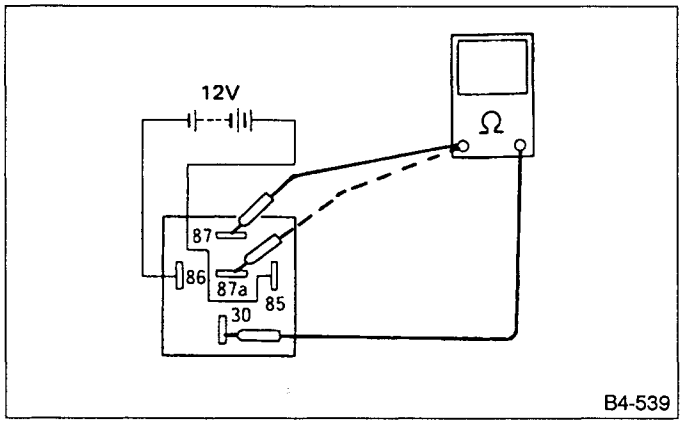


Fig. 171

3) Measure resistance between respective terminals.

Terminal/Specified Resistance:
No. 87 — 30/0 Ω (when 12 volts applied)
No. 87 — 30/1 MΩ (when no voltage is applied)
No. 87a — 30/1 MΩ (when 12 volts applied)
No. 87a — 30/0 Ω (when no voltage is applied)

4. CHECK HYDRAULIC UNIT VALVE RELAY COIL

1) Disconnect connector from hydraulic unit.
2) Measure resistance between hydraulic unit terminals.

Terminal/Specified Resistance:
(To R1) No. 6 — No.12/80 — 90 Ω

When resistance checks out "Not OK", check relay as a single unit.
3) Disconnect connectors from ABS control unit and hydraulic unit. Measure resistance between connectors.

Connector & terminal/Specified Resistance:
(R1) No. 6 — (R7) No. 17/0 Ω
(R1) No. 12 — (R7) No. 27/0 Ω
(R1) No. 6 — Body/1 MΩ min.
(R1) No. 12 — Body/1 MΩ min.

If resistance checks out "OK", replace hydraulic unit; if "Not OK", repair harness/connector between ABS control unit and hydraulic unit.

5. CHECK AND REPAIR POWER HARNESS

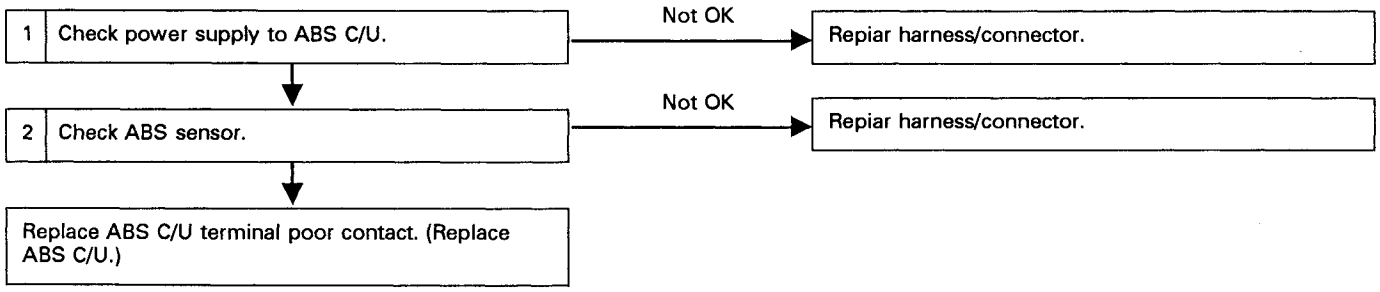
1) Turn ignition switch ON.
2) Measure resistance between hydraulic unit connector and ground.

Connector & terminal/Specified Voltage:
(F43) No. 1/10 — 12 V

G: TROUBLE CODE (16) — Faulty ABS control unit

CONTENTS OF DIAGNOSIS:
- Faulty ABS control unit
- Faulty power supply to ABS control unit or faulty ground system
- Faulty ABS sensor

TROUBLE SYMPTOMS:
- ABS control unit does not operate.
- ABS activates faster than specifications when braking on high "μ" (dry asphalt) road.



1. CHECK POWER SUPPLY TO ABS CONTROL UNIT

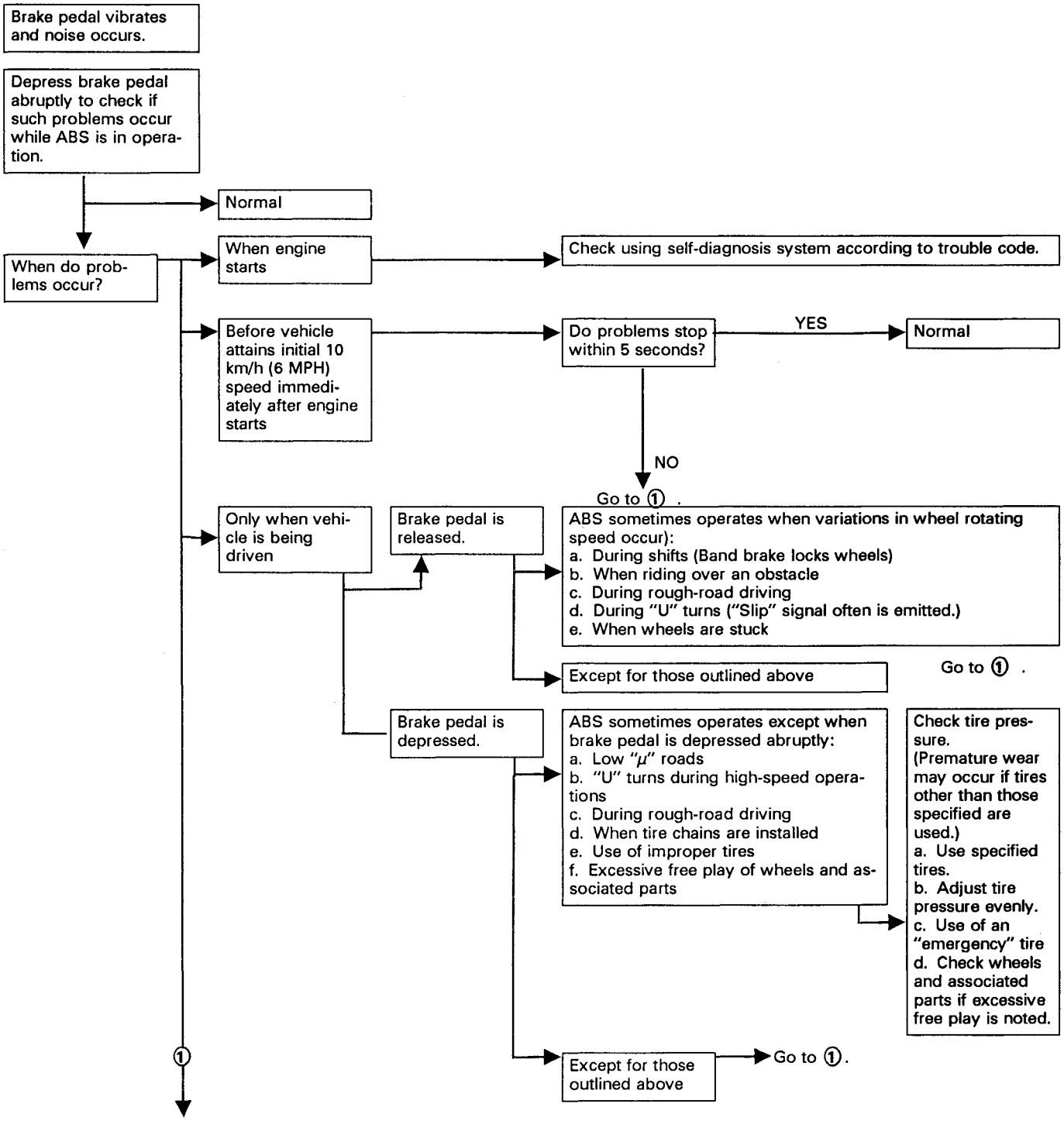
1) Refer to trouble code (0)[T5A0].

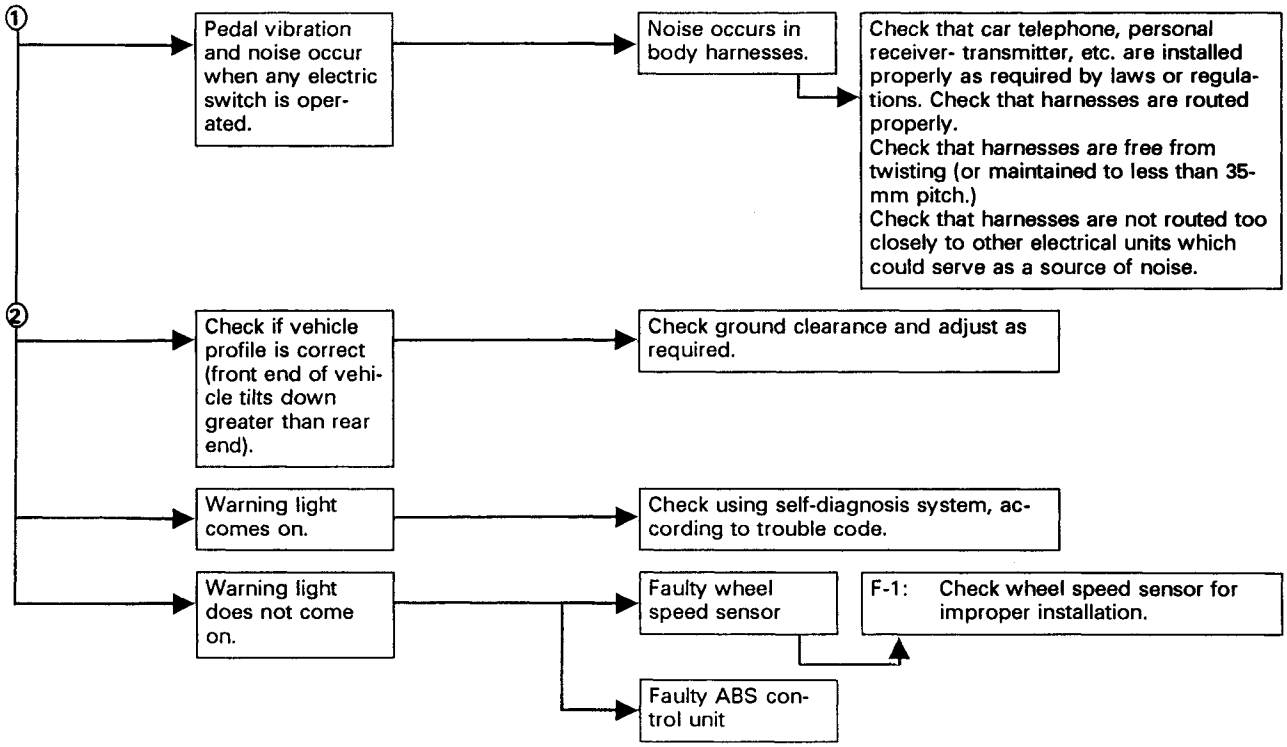
2. CHECK ABS SENSOR

1) Refer to trouble code (5 and 6)[T5C0] and trouble code (7 and 8)[T5D0].

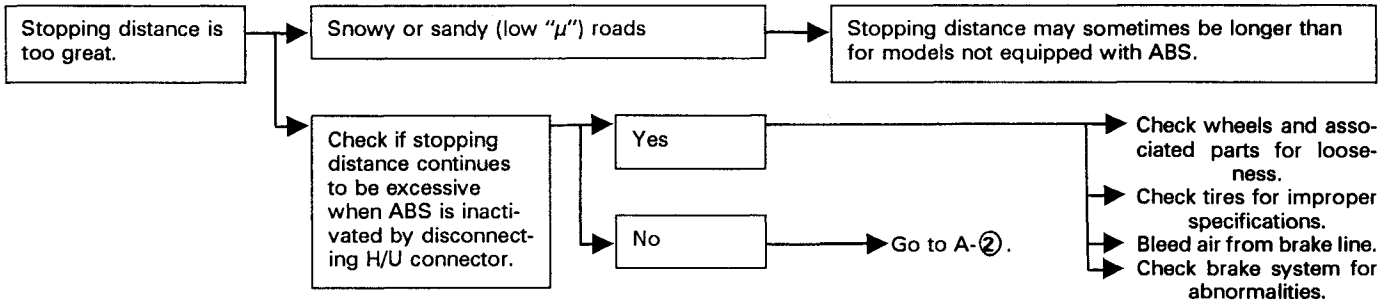
6. General Troubleshooting Chart

A: VIBRATING PEDAL AND NOISE

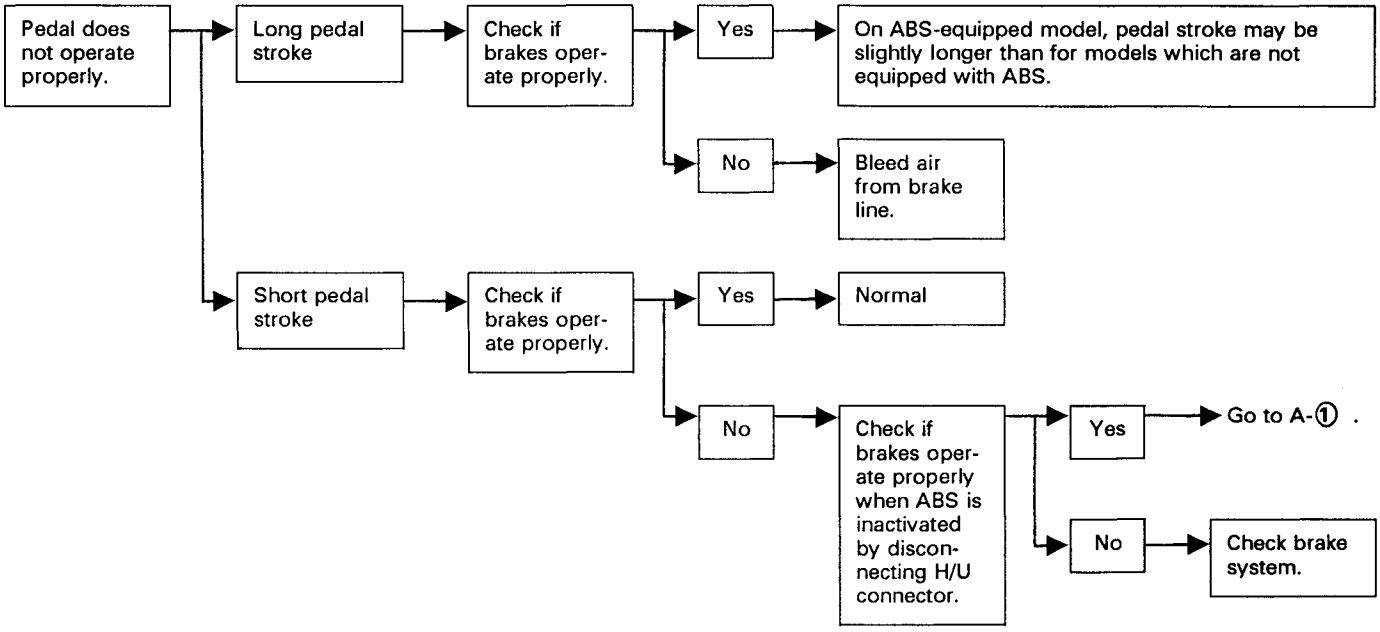



①
Pedal vibration and noise occur when any electric switch is operated.
Noise occurs in body harnesses.
Check that car telephone, personal receiver- transmitter, etc. are installed properly as required by laws or regulations. Check that harnesses are routed properly.
Check that harnesses are free from twisting (or maintained to less than 35-mm pitch.)
Check that harnesses are not routed too closely to other electrical units which could serve as a source of noise.
②
Check if vehicle profile is correct (front end of vehicle tilts down greater than rear end).
Check ground clearance and adjust as required.
Warning light comes on.
Check using self-diagnosis system, according to trouble code.
Warning light does not come on.
Faulty wheel speed sensor
F-1: Check wheel speed sensor for improper installation.
Faulty ABS control unit

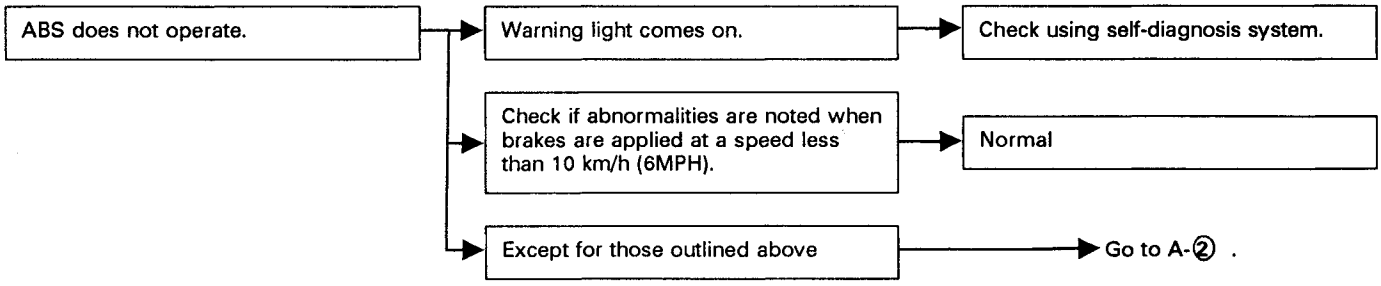
B: EXCESSIVE STOPPING DISTANCE



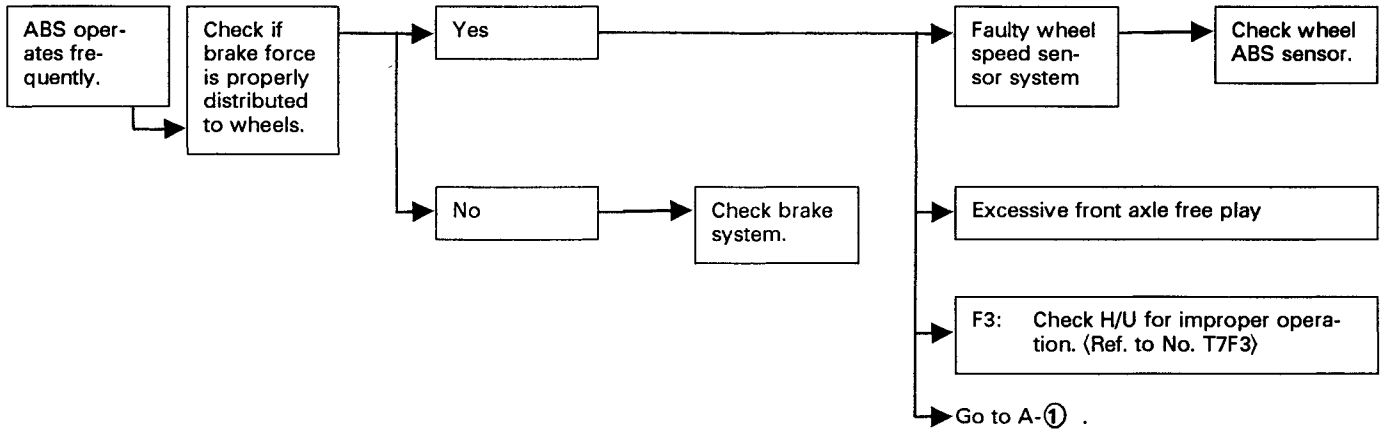
C: IMPROPER PEDAL OPERATION



D: ABS INOPERATIVE



E: FREQUENT ABS OPERATION



F: INSPECTION OF COMPONENTS

1. ABS SENSOR INSTALLATION

1) Dismount brake as outlined in manual to gain access to speed sensor and tone wheel for inspection.
2) Check pole piece and tone wheel for accumulation of foreign particles. If necessary, remove foreign particles and clean.
3) Check tone wheel teeth for cracks for deformities. If necessary, replace tone wheel (No. of teeth: 44) with a new one.
4) Check tone wheel for looseness.

Tightening torque:
10 — 16 N·m (1 — 1.6 kg-m, 7 — 12 ft-lb)

5) Measure tone wheel-to-pole piece gap over entire perimeter of the wheel.

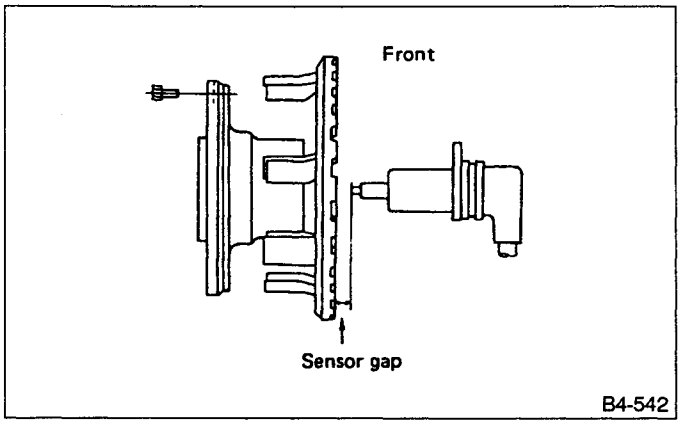


Fig. 172

Specifications	Front wheel	Rear wheel
	0.7 — 1.0 mm (0.028 — 0.039 in)	0.5 — 1.0 mm (0.020 — 0.039 in)

If measurements check out "Not OK", adjust the gap using spacers (Part No. 26755AA000). If spacers cannot correct the gap, replace worn sensor or worn tone wheel.
6) Check hub runout.

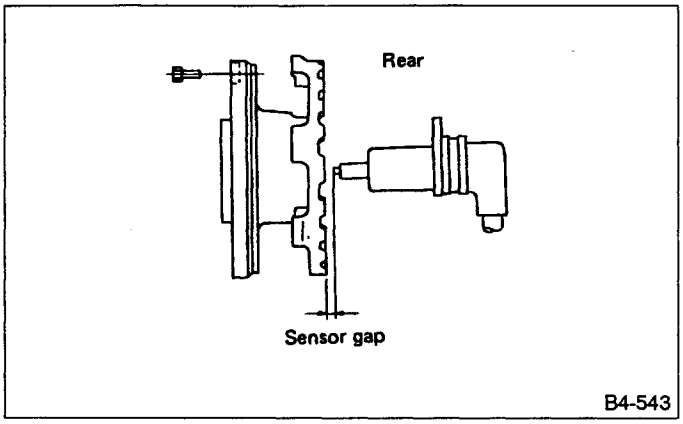


Fig. 173

Specifications	0.05 mm (0.0020 in)

7) For inspection procedures of sensors, refer to "Trouble Codes 5, 6, 7 and 8".

2. HYDRAULIC UNIT INSPECTION

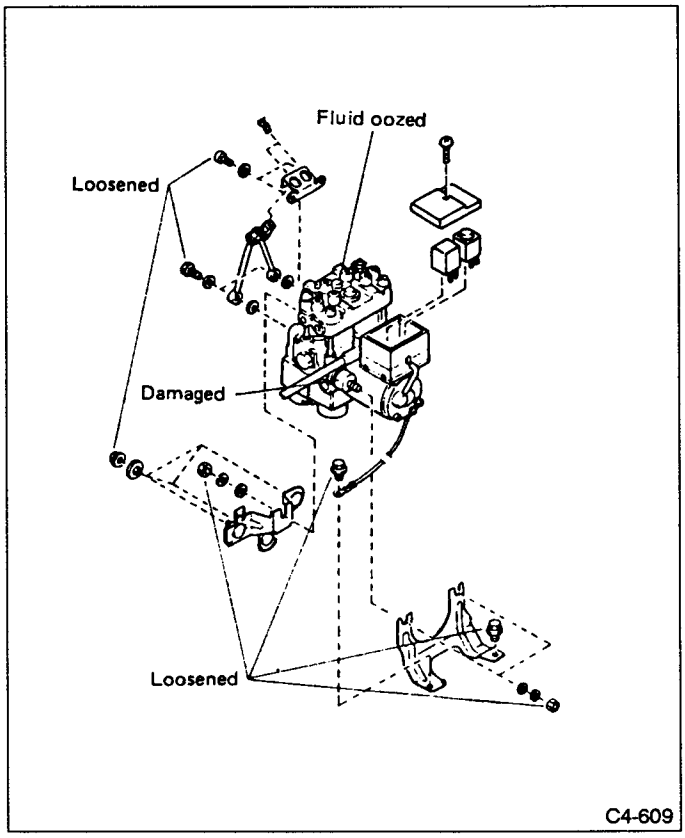


Fig. 174

1) Check parts for traces of brake fluid or dents. Clean parts and tighten pipe connections, etc. if traces of brake fluid are noted. Replace hydraulic unit if parts are excessively dented or damaged.
2) Check bracket for looseness or improper installation, damper for damage, and attaching nuts for looseness.

Specifications	Parts must be tightly in place and free from damage.

3) Check connectors for improper installation.

Specifications	Connectors must be tight and secure.

4) Check each relay as a single unit. Refer to "Trouble Code 9" for inspection of motor relay and "Trouble Code 10" for valve relay.
5) Valve inspection
Refer to step 1 under "Trouble Code 1 through 4" for instructions. OK