



**GROUP 22**

# BRAKES

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**GROUP 22**

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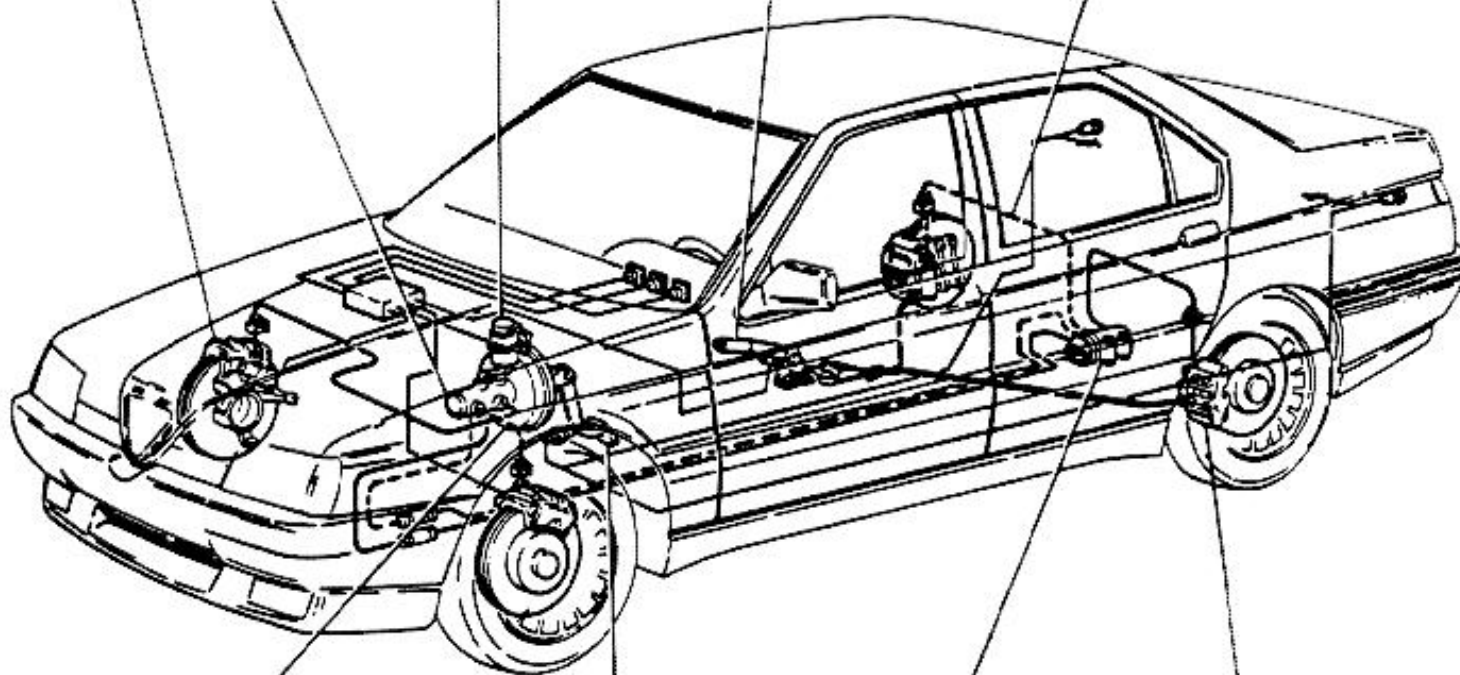
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## BRAKES

### DESCRIPTION

The braking system of the Alfa Romeo 164 model, due to its technical configuration and sizing of its components, is fully adequate to the high performances of the vehicle.

The system is of the dual hydraulic circuit type, diagonally connected, and includes four disc brakes.

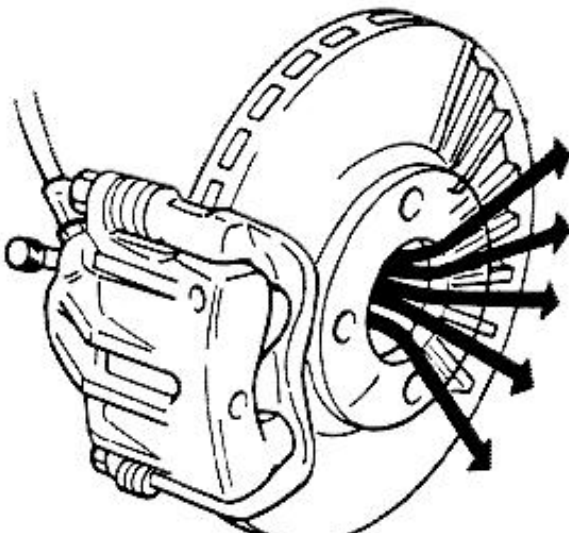
The system is provided with a vacuum servo unit that allows the driver to brake without applying high pressure on the brake pedal.

A load proportioning valve acts on the rear brakes as a function of braking load.

The parking brake, actuated by a manual control lever and mechanical linkage, acts on the rear brakes.

The use of a dual-stage brake master cylinder and of the two crossed circuits will assure the 50% of braking power is still available in case of seizing of one piston of the brake master cylinder, or in case of failure of one system.

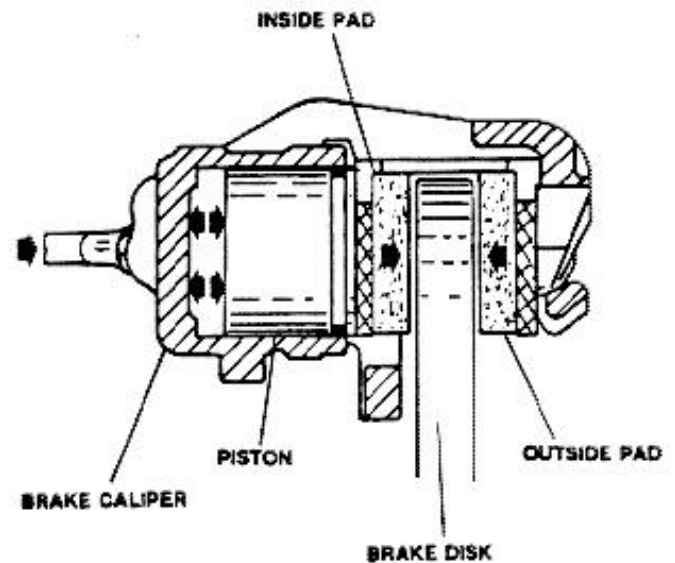
The brake calipers are of the floating type (with guides protected against possible soiling), in other words the piston acts on one side only of the brake disc; this solution, as well as the use of suitably sized discs and self-ventilating discs on the front brakes, allows a better dissipation of heat produced during braking and a lower temperature of the brake fluid with respect to other conventional solutions.



### OPERATIONAL DESCRIPTION

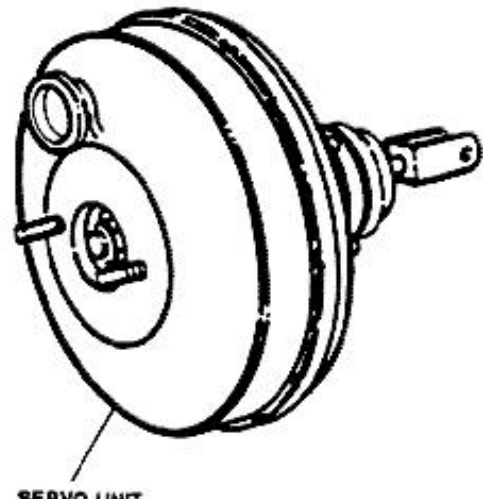
Pressure on the brake pedal pressurizes the hydraulic circuit that acts directly on the piston located inside the brake caliper.

The piston pushes the inner brake pad against the disc, while the disc slides on drive pins and moves against the outer brake pad.



The efficiency of the braking action is implemented by a servo unit that contributes to optimize and amplify the pressure applied by the driver on the brake pedal.

Pressure for the servo unit is obtained by the differential pressure between vacuum in the engine intake manifold and the atmospheric pressure.



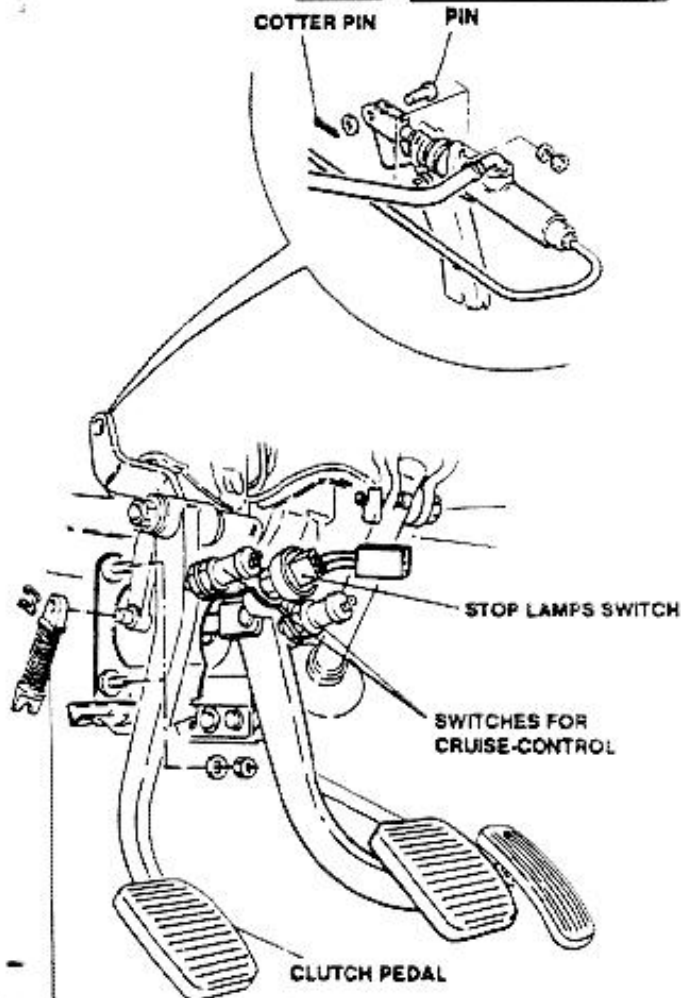




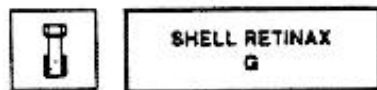
## BRAKE PEDAL

### REMOVAL/INSTALLATION

1. Remove the steering column lower shroud.
2. Remove the stop lamps switch and the 2 switches for cruise-control.
3. Remove the servo clutch mechanism spring.
4. Remove the cotter pin and remove pin attaching the pump-clutch pedal.

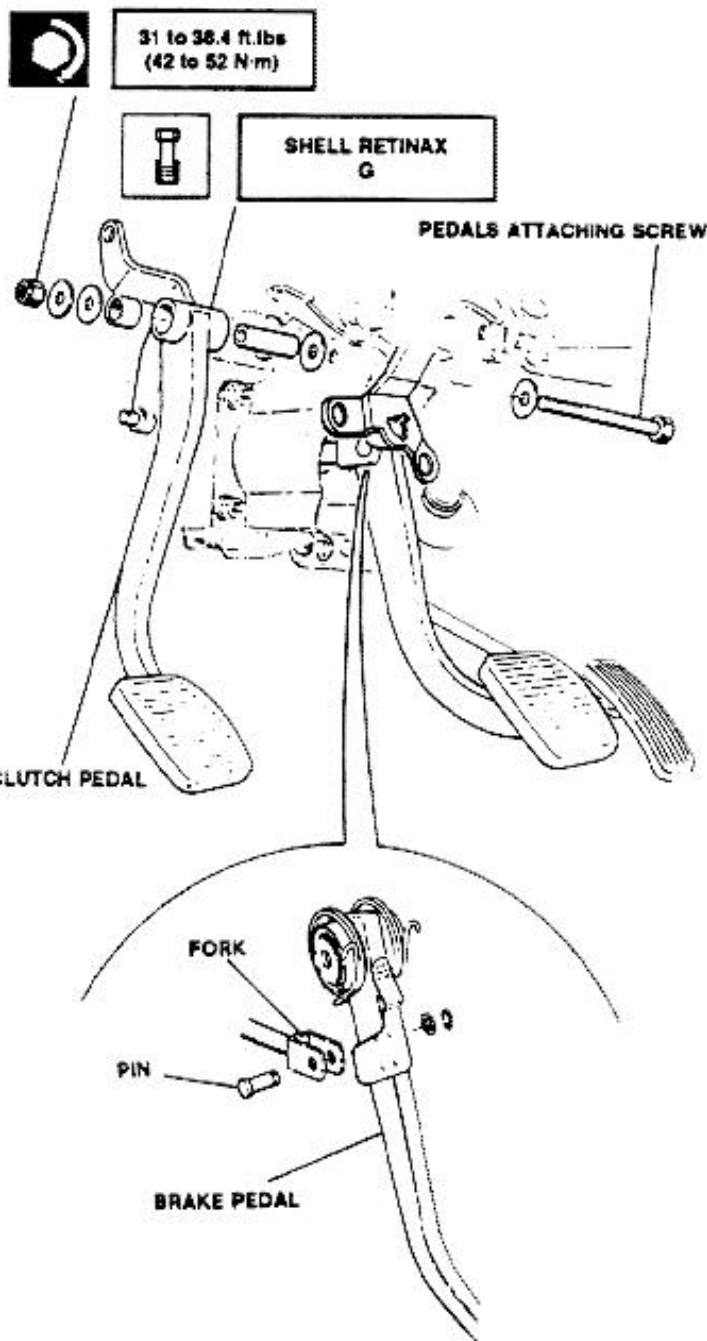


SERVO CLUTCH MECHANISM SPRING



5. Remove nut and screw attaching the pedal group to its support.
6. Remove clutch pedal.
7. Withdraw pin connecting brake master cylinder control fork.

8. Unfasten spring from support and remove brake pedal.



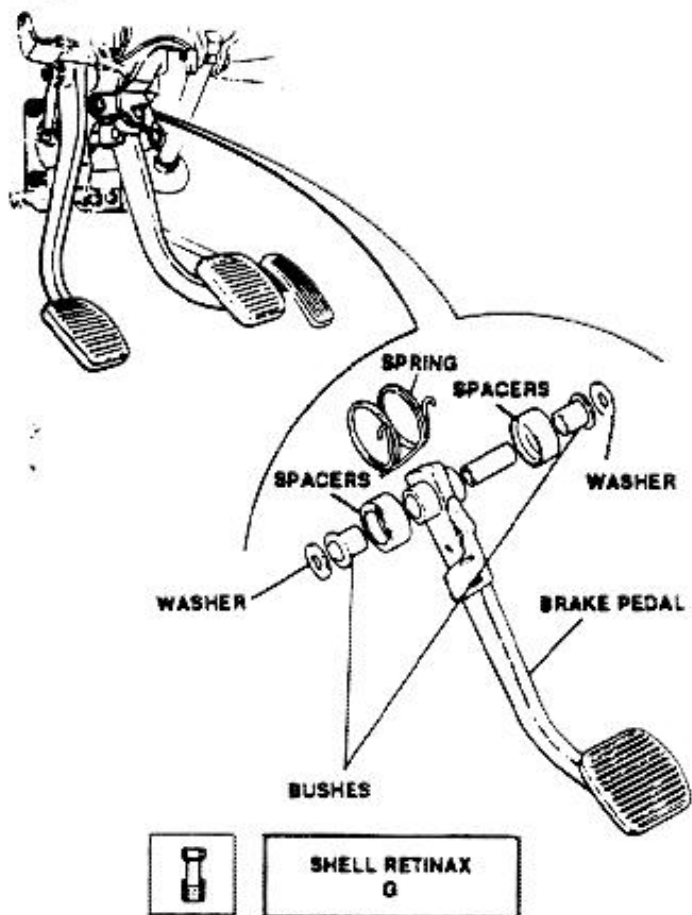
### DISASSEMBLY/REASSEMBLY

1. Remove washers, bushes, spacers, spring and brake pedal.



Lubricate affected parts with grease prior to definitive reassembly.

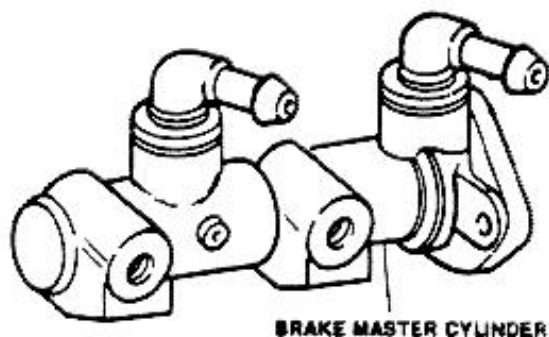




### BRAKE MASTER CYLINDER

The dual-stage brake master cylinder, bolted onto the brake servo unit, is composed mainly by a steel cylinder which contains a piston.

The brake master cylinder is connected by rigid pipes to the brake calipers and to the brake fluid tank; it assures operation of one circuit in case of failure in the system. Overhaul of brake master cylinder can not be performed replace master cylinder in case of failure.



### REMOVAL/INSTALLATION

1. Drain brake fluid tank by opening out fluid with a

syringe; remove tank.

2. Disconnect fittings of brake master cylinder supply pipes.
3. Disconnect fittings of brake master cylinder delivery rigid pipes.
4. Remove attaching nuts, and remove brake master cylinder.

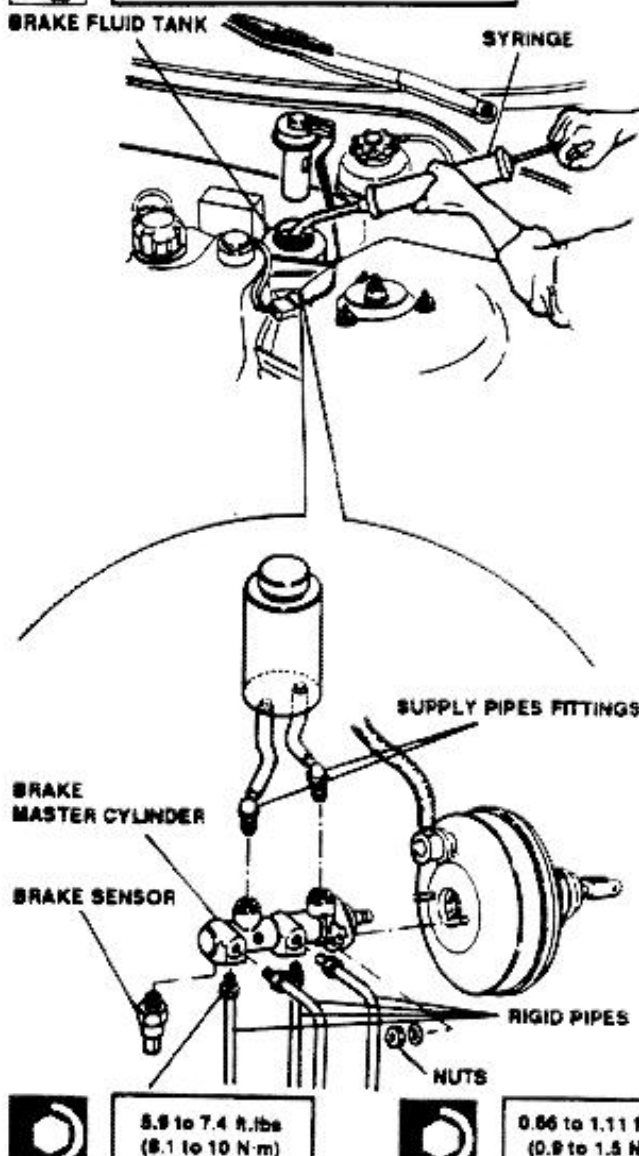


After brake master cylinder installation, bleed trapped air from brake system.

5. On "S" versions only: remove brake sensor from brake master cylinder.



Alfa Romeo BRAKE FLUID super DOT 4  
AGIP BRAKE FLUID DOT 4



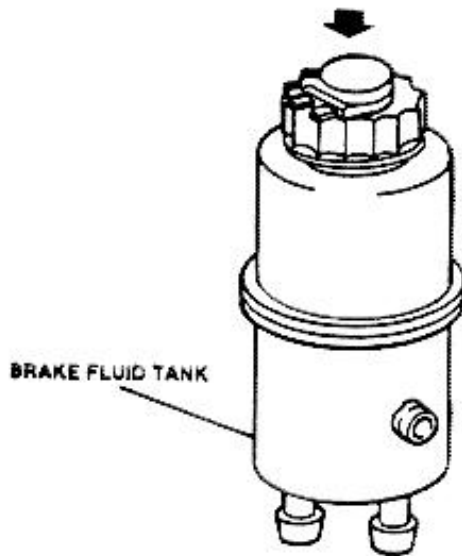
1. Drain brake fluid tank by sucking out fluid with a



## BRAKE FLUID TANK

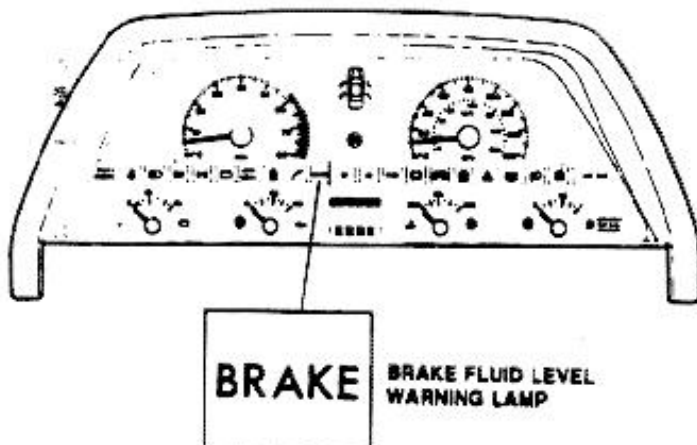
The brake fluid tank supplies hydraulic fluid to the brake system and to the clutch actuating system.

The tank consists of two separate and independent chambers that assure constant presence of fluid even in the event of failure of the system.



The tank, located above the brake master cylinder, includes a device on the cap that turns on a warning lamp on the instrument panel in case the level of the brake fluid decreases to an unsafe level. This device is located inside a damping cylinder to prevent generation of abnormal signals during driving (turns or bounces).

Total capacity of the system is of 0.6 liters (0.15 Gals); on vehicles equipped with Anti Lock Brake System (ABS) the capacity is of 0.8 liters (0.21 Gals).



## REMOVAL/INSTALLATION

1. Disconnect electrical connector and remove cap from tank.
2. Drain brake fluid tank by sucking fluid with a syringe.



### CAUTION:

The brake/clutch fluid is harmful for the body work. Pay extreme care to prevent fluid from contacting painted surfaces and subsequent damage.

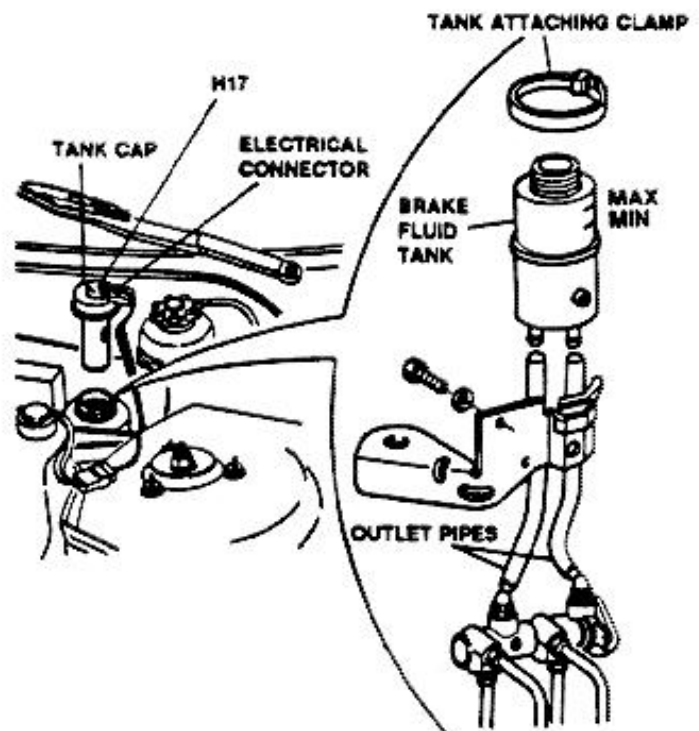


### CAUTION:

The brake fluid is hygroscopic, and then it easily absorbs water when exposed to humid environment.

Always use for top-up fluid contained in sealed cans, opened only just before use.

3. Remove attaching clamp and tank after outlet pipes have been disconnected from lower side of tank.









**NOTE:** Any time a component of the system is removed, bleed air from the system.

**NOTE:** Periodically check the operation of the fluid low level sensor pressing on top of tank cap (In the direction shown in the illustration); with the ignition key rotated to the first position, the brake fluid level warning lamp on instrument panel will simultaneously illuminate.

4. Carry-out installation of tank by reversing the order of removal procedure.

**NOTE:** Check brake fluid level with the vehicle standing on a flat and level surface.

## BRAKE SERVO UNIT

The vacuum brake servo unit includes a unidirectional valve connected by a hose to the engine intake manifold.

This valve allows passage of ambient air from the servo unit to the manifolds, and not in reverse direction, thus permitting to maintain always the maximum vacuum inside the servo unit when not in use.

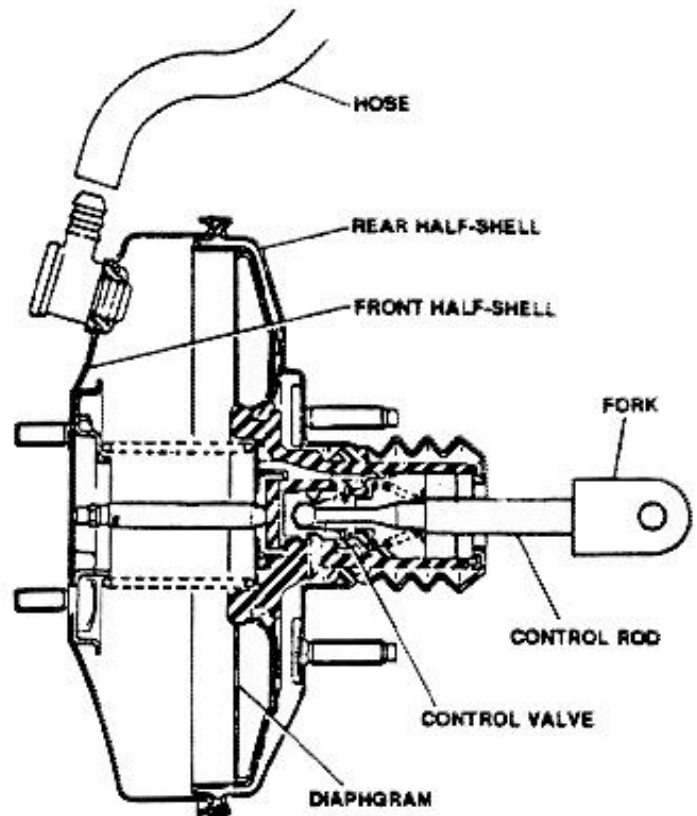
The servo unit consists essentially of two-shells, a diaphragm that separates two chambers, a control rod directly connected to the brake pedal, and a control valve.

Overhaul of the servo unit can not be performed: replace the unit in case of failure.



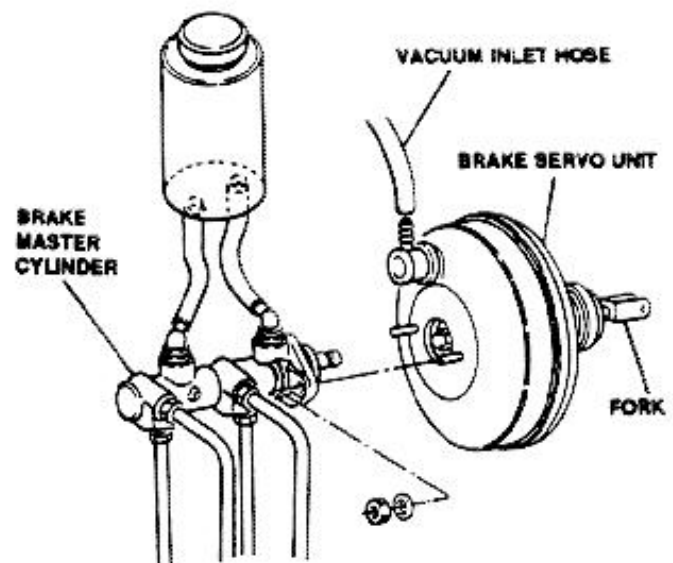
### WARNING:

In the event of a collision or maintenance of the body, check integrity of the servo unit since even a minor surface dent of the outer body could prevent normal operation of the braking system, thus demanding as a consequence a higher pressure on brake pedal.



## REMOVAL/INSTALLATION

1. Disconnect vacuum inlet hose from servo unit (engine compartment).
2. Remove brake master cylinder.





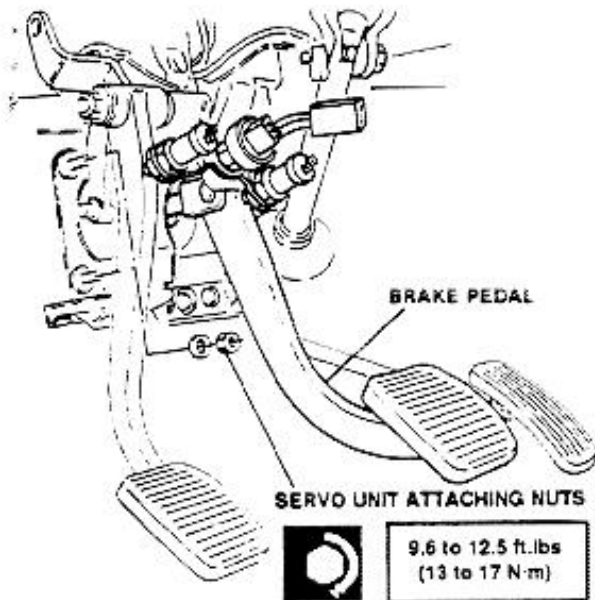


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3. Disconnect brake pedal from brake master cylinder control fork (from vehicle interior).
4. Remove nuts attaching the servo unit to pedals group support (from vehicle interior), then remove the servo unit from engine compartment.

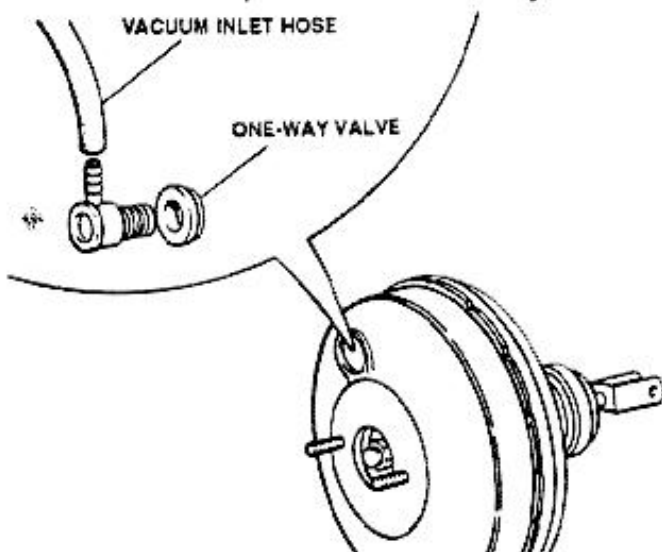


After installation, bleed the brake system.

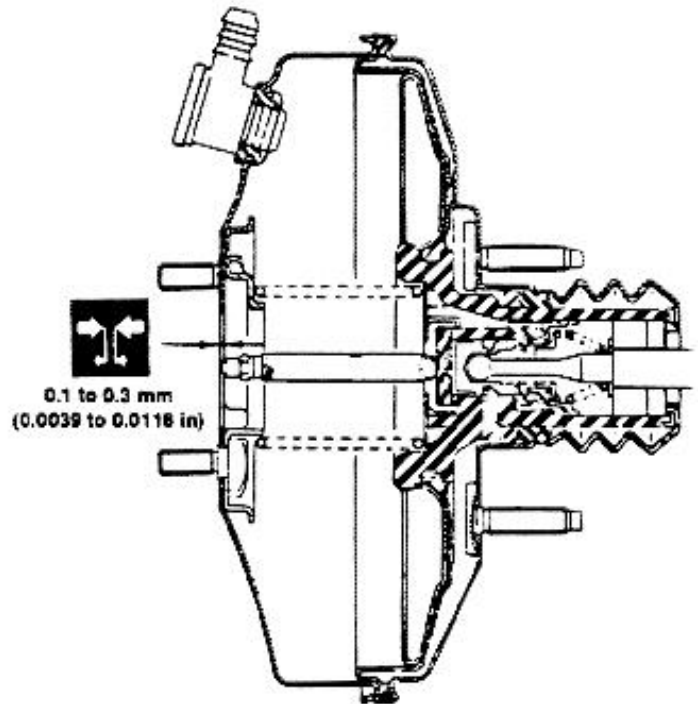


## CHECKS AND INSPECTIONS

1. Check proper operation of brake servo unit. In case of abnormal operation, check integrity of vacuum inlet hose and operation of the one-way valve.



2. Check servo unit for proper adjustment. When unit is not in use, the end of adjustment screw must be 0.1 to 0.3 mm (0.0039 to 0.0118 in) lower than plane of the front cover.



## BLEEDING THE BRAKE SYSTEM



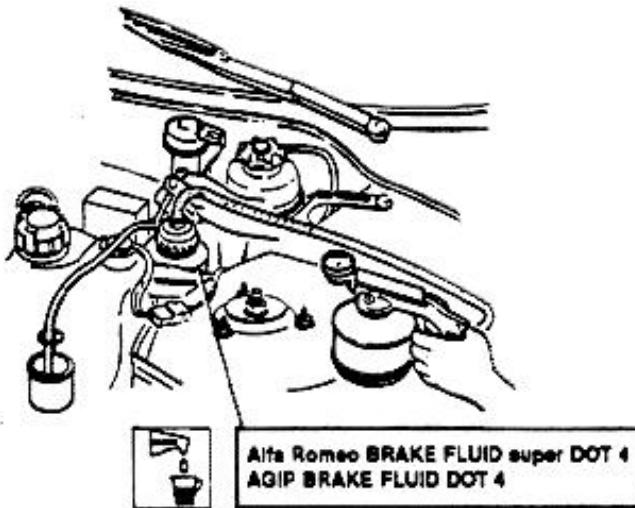
### CAUTION:

- During bleeding operations check that fluid level does not decrease below minimum level.
- Do not re-use fluid drained during bleeding operations.
- Prevent contact of fluid with painted surfaces to avoid damaging of paintwork.
- Bleeding operations must be carried-out simultaneously on front and rear brake calipers of the same side of vehicle, than perform bleeding on calipers of opposite side.

As an alternative to the traditional method the "pre stop"



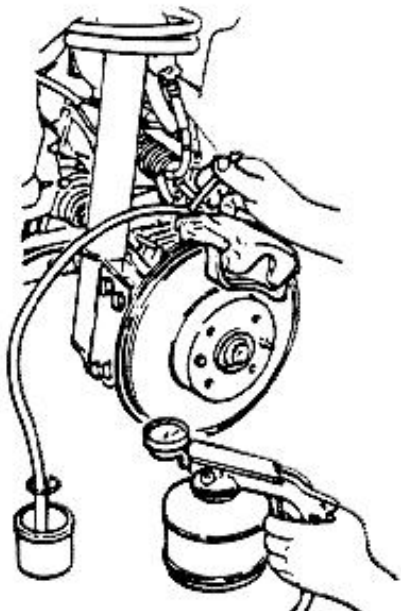
As an alternative to the traditional method, the pre-step tool can be used as indicated below:



1. Place vehicle on auto lift.
2. If necessary, fill up the brake fluid tank with prescribed fluid.
3. Lift vehicle and remove dust plugs from bleed screw on brake calipers.
4. Fit a section of hose onto the bleed screws and immerse hose end in a container full of prescribed brake fluid.



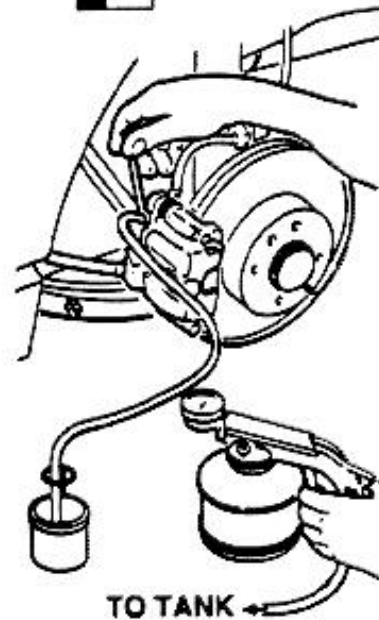
FRONT BRAKES



5. Loosen bleed screws and press repeatedly the brake pedal, making sure the pedal is returned to initial position after each application and an interval of a few seconds is observed between subsequent brake pedal pressures. Repeat the process until brake fluid flowing into the container is free of air bubbles, then press the brake pedal completely and tighten bleed screws.



REAR BRAKES



6. Remove the hose sections, re-install the dust plugs and top-up brake fluid in tank, if required.
7. If bleeding of the system has been carried-out properly, the pedal response will be free on any spongy reaction after an initial idle travel.




**CAUTION:**

For bleeding of rear brakes it is necessary to compress the rear suspension so that the load proportioning valve is actuated.

**BRAKE SYSTEM PIPING**

**CHECKS AND INSPECTIONS**

Check piping of the brake system (rigid pipes and hoses) for absence of distortions, cracks and evidence of exterior

TO TANK 

| oxidation.

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22 - 10



**CAUTION:**

- In the event of removal and installation of brake piping, suck fluid from brake and clutch fluid tank using a syringe.
- Any time pipes or hoses are removed, plug ends to prevent entry of foreign matter.
- After re-installation, make sure the front and rear hoses are not twisted.
- When installation is completed top-up fluid in tank and bleed the system (refer to paragraph "BLEEDING THE BRAKE SYSTEM").



**CAUTION:**

The rigid pipes are fragile and must not be twisted or bent.







## FRONT BRAKES

### FRONT BRAKE DISCS

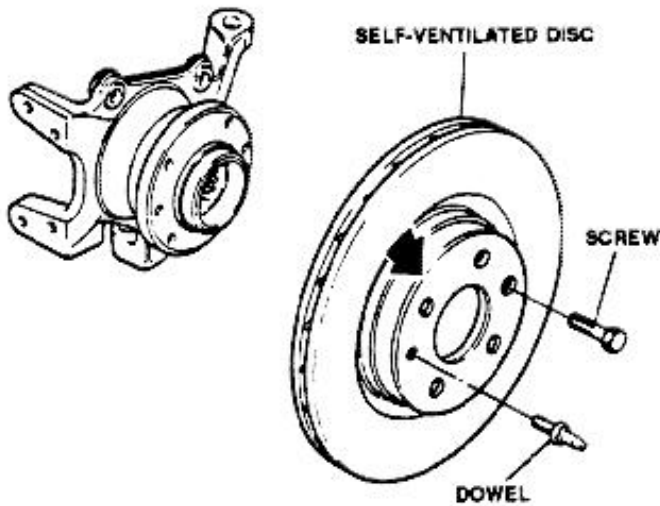
The front brake discs are of the self-ventilating type to provide improved dissipation of heat.

The discs have a diameter of 284 mm (11.18 in) and a thickness of 22 mm (0.87 in).

The discs are fixed in position on the hub flange by two screws (one of the two screws also acts as dowel for centering of the wheel rim) and are attached to the hub flange by means of the wheel attaching screws.

The outer edge of discs is engraved with a minimum allowable wear limit mark as shown by the arrow in the illustration.

The wear limit is 20.2 mm (0.795 in).



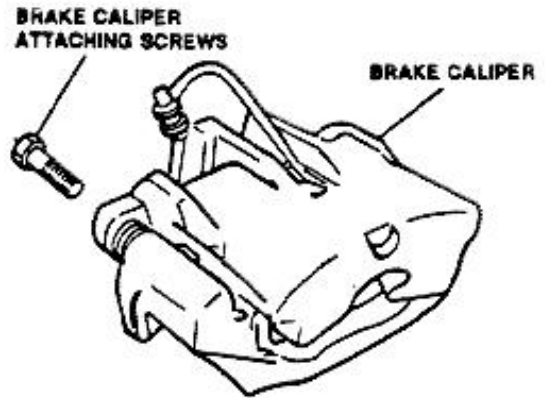
### FRONT BRAKE CALIPERS

The front brake calipers are of the single-cylinder floating type (GIRLING).

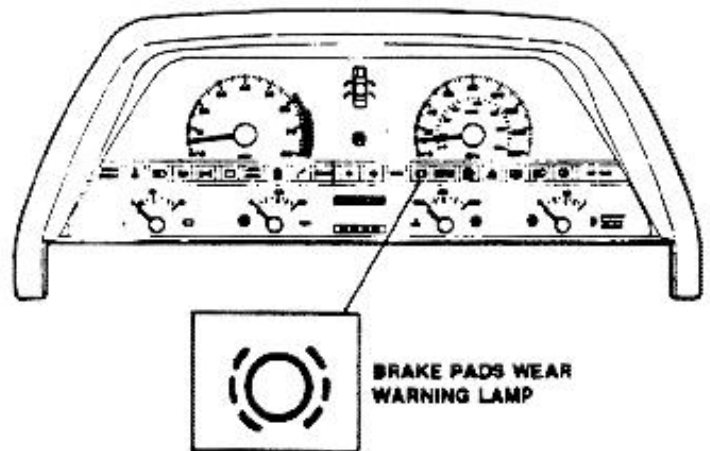
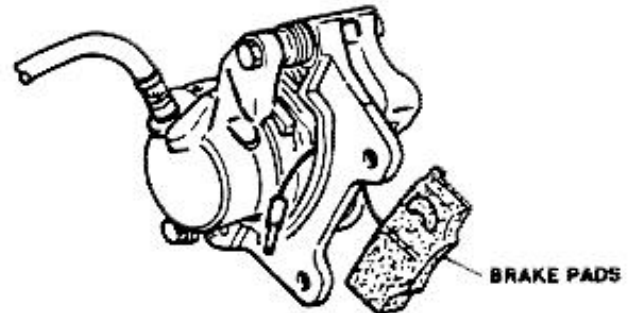
The caliper includes two brake pads, with gaskets made of anti-pollution material (free of asbestos) with a total braking surface of 50 cm<sup>2</sup> (7.75 sq.in). The inner diameter of the cylinder is of 54 mm (2.12 in).

The caliper body attaching screws are of self-locking type, and must be replaced any time they are loosened or removed.

Overhaul of brake calipers can not be performed: operations allowed on brake calipers are limited to replacement



The inner brake pad (in contact with caliper cylinder) includes a wear sensor that provides an input signal for the illumination of a warning lamp on instrument panel when the pad wear limit is exceeded.

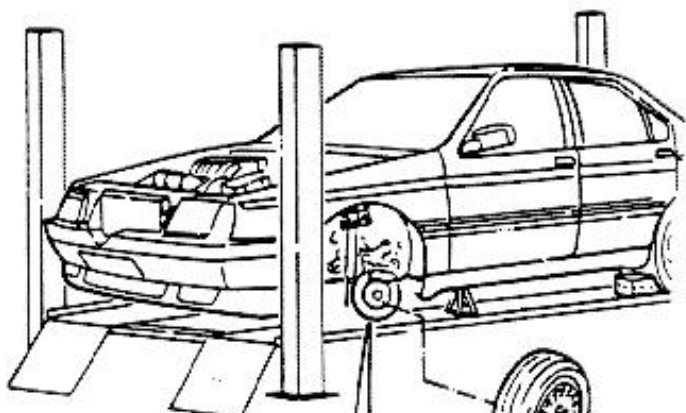
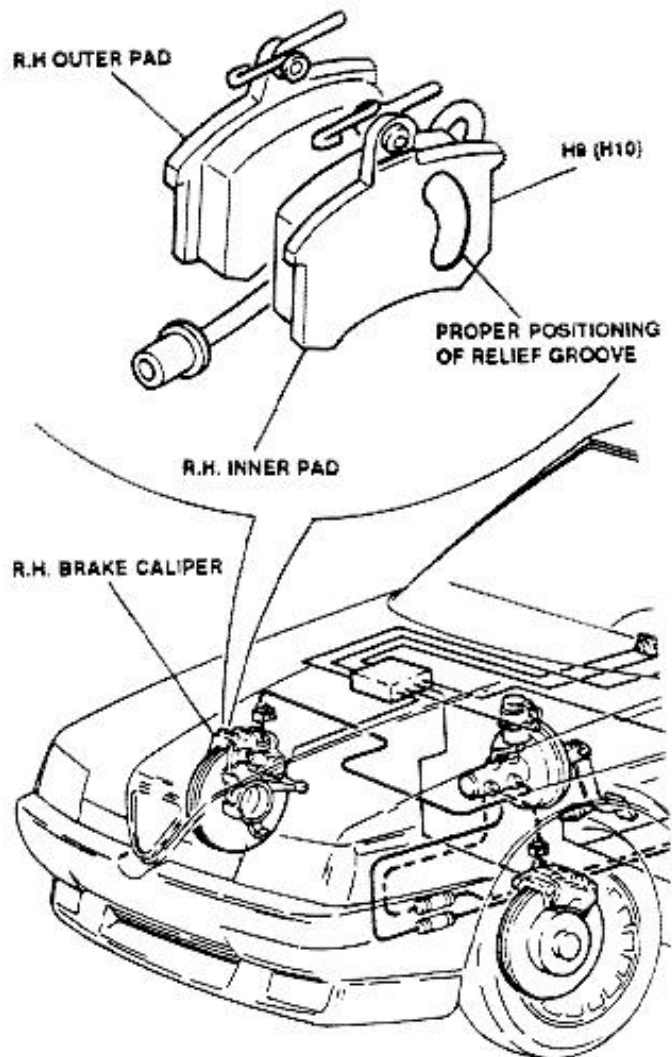


**NOTE:** At reassembly, install brake pad provided with wear sensor on inner side of disc (on piston side of brake caliper). Furthermore, position inner brake pad with relief groove faced towards the rear end of vehicle; no mounting direction is required


of inner seal ring and of dust bellow.

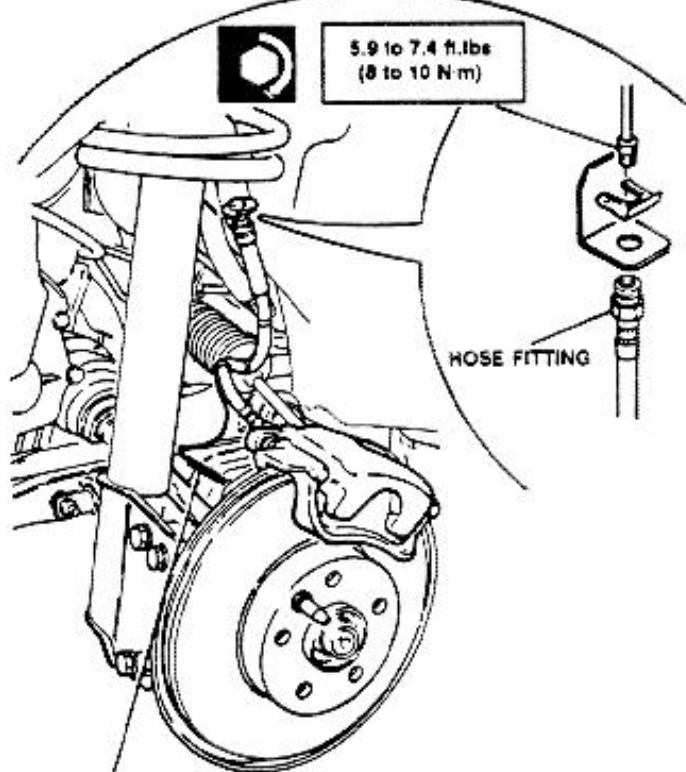
F


for the outer brake pad.



FRONT WHEEL

 70.1 to 77.4 ft.lbs  
(95 to 105 N·m)



 5.9 to 7.4 ft.lbs  
(8 to 10 N·m)

HOSE FITTING

ELECTRICAL CONNECTOR

### REMOVAL/INSTALLATION

1. Remove front wheel.
2. Disconnect fitting and hose from valance




Bleed the brake system after installation.

4. Disconnect electrical connector from brake pad wear sensor.
5. Remove attaching screw and remove brake caliper.



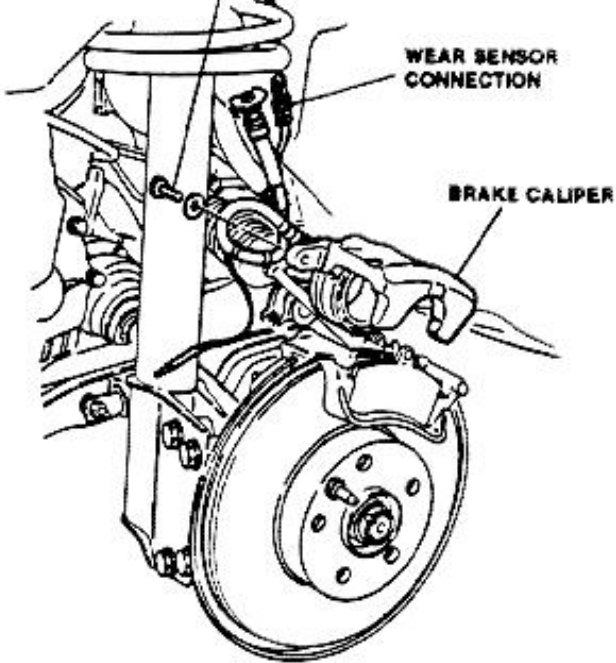
At installation, replace brake caliper body at

3. Disconnect electrical connection from brake pad. |  taching screws.

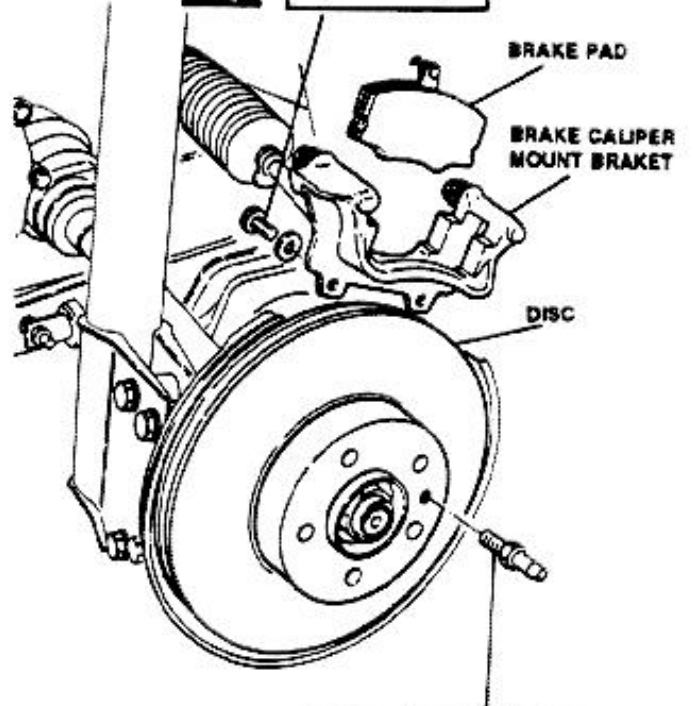


22.9 to 28.0 ft.lbs  
(31 to 38 N·m)

BRAKE CALIPER  
ATTACHING SCREWS



38.4 to 42.8 ft.lbs  
(52 to 58 N·m)



4.8 to 8.6 ft.lbs  
(6.2 to 13 N·m)

DISASSEMBLY/REASSEMBLY

1. Disconnect hose fitting from brake caliper.
2. Removal bleed screw.



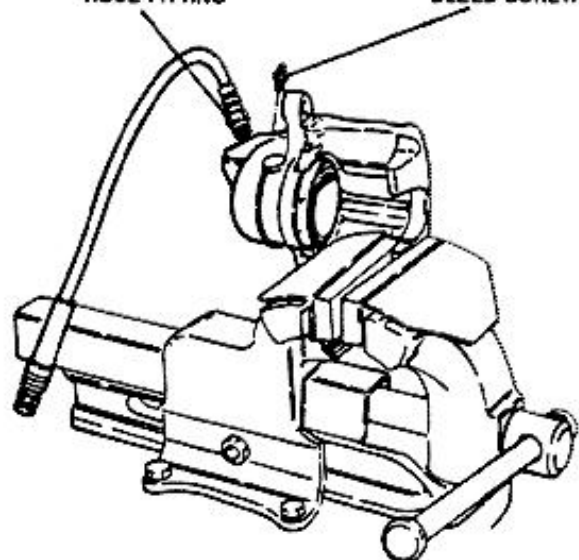
6.9 to 7.4 ft.lbs  
(8 to 10 N·m)

HOSE FITTING



2.9 to 4.4 ft.lbs  
(4 to 6 N·m)

BLEED SCREW



6. Remove brake pads.

NOTE: For re-Installation, refer to paragraph "BRAKE PADS REPLACEMENT".

7. Remove brake caliper mount bracket.



At installation, check for integrity of dust bellows; replace bellows if damaged.

8. Remove brake disc.



At installation, remove any trace of rust to assure perfect disc to hub perpendicularity.





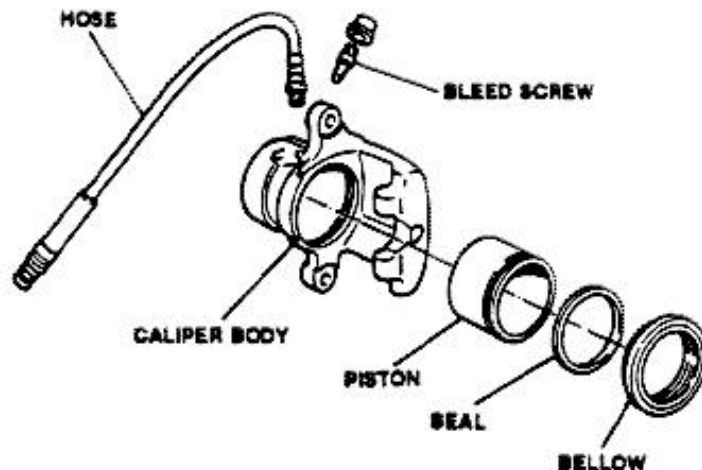
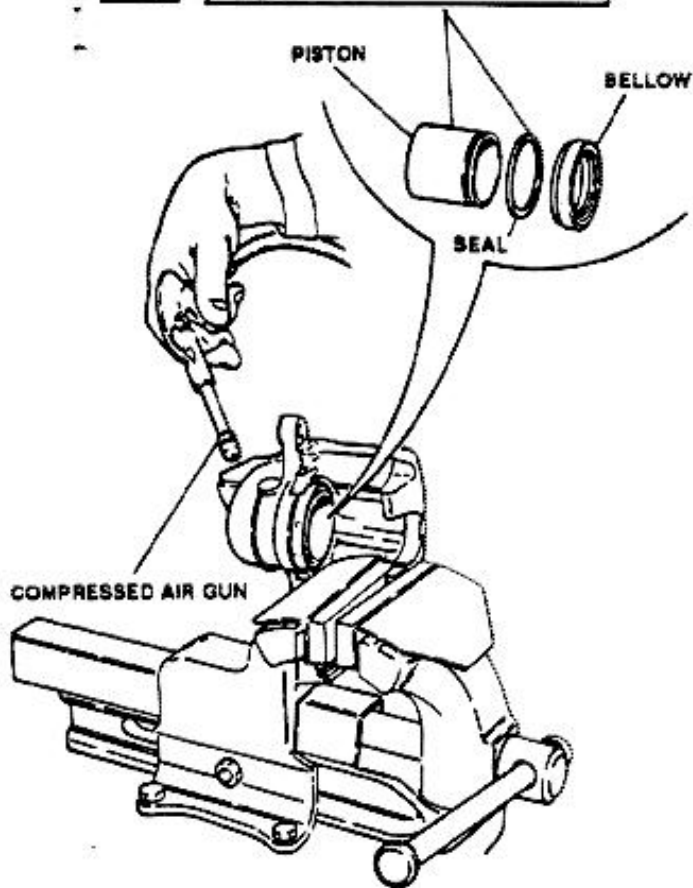
3. Blow compressed air into inlet port to press out caliper cylinder.
4. Remove piston, seal and bellow.



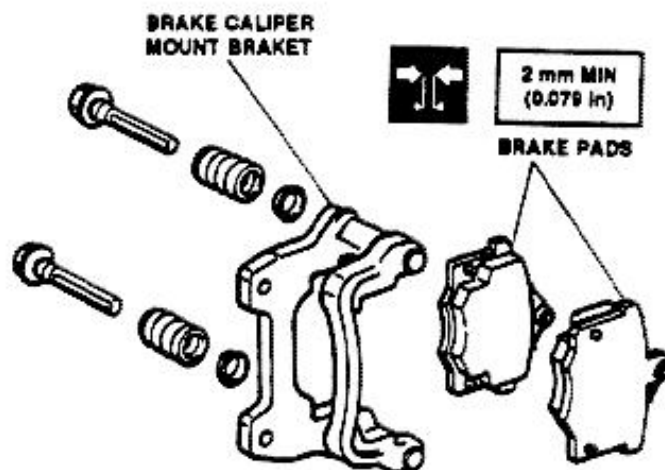
At reassembly, lubricate parts with brake fluid.



Alfa Romeo **BRAKE FLUID super DOT 4**  
AGIP **BRAKE FLUID DOT 4**



4. Replace brake pads if thickness is lower than 2 mm (0,079 in).
5. Check caliper mount bracket for absence of cracks or distortions.



**CHECKS AND INSPECTIONS**

**Brake caliper and pads**

1. Check brake caliper body and piston for absence of abrasions and seizing: replace caliper complete of piston if damages are found.
2. Make sure the bleed screw is unobstructed.
3. Check hose for absence of swelling and cracks

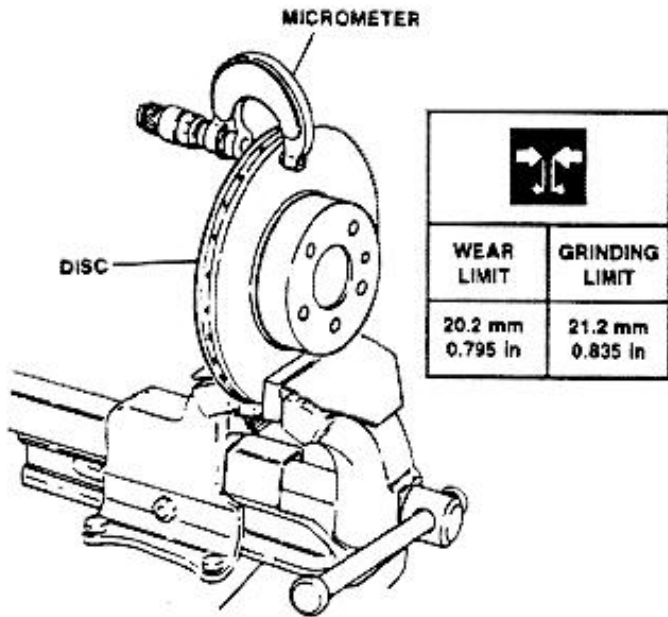
**CHECKS AND INSPECTIONS**

**Brake disc**

1. Check disc thickness using a micrometer, and inspect the work surfaces for absence of deep scoring or porosit. Grind the disc within specified limits, if necessary.

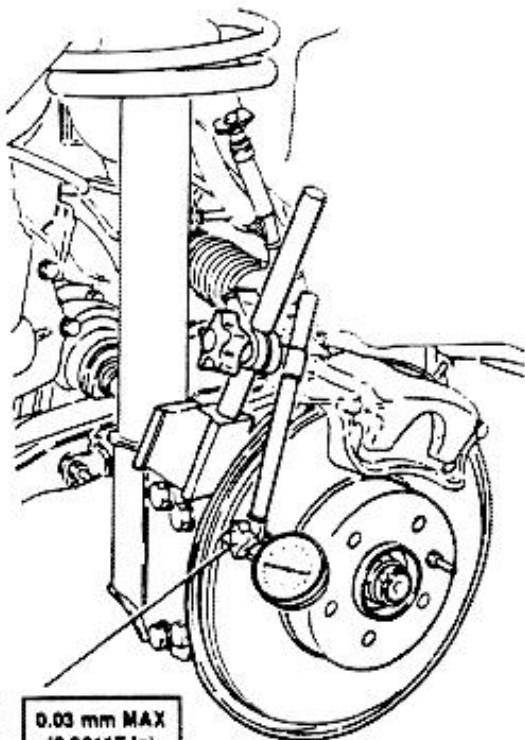







2. If only the brake pads are replaced, check disc misalignment with respect to rotation axis does not exceed 0.15 mm (0.0059 in).

**NOTE:** Measure misalignment 2 mm (0.078 in) at disc outer diameter.



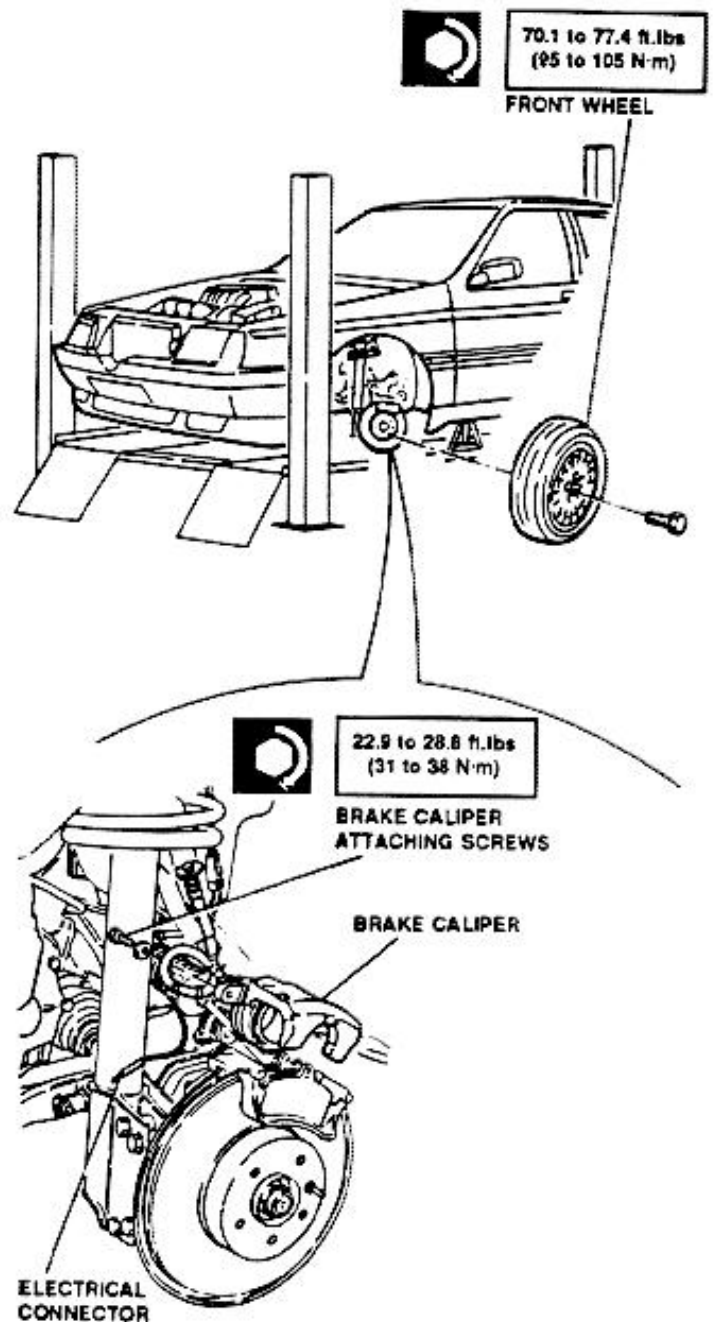
 0.03 mm MAX  
(0.00117 in)

### BRAKE PADS REPLACEMENT

1. Remove front wheel.
2. Disconnect electrical connector from brake pad .
3. Remove securing screws and brake caliper.



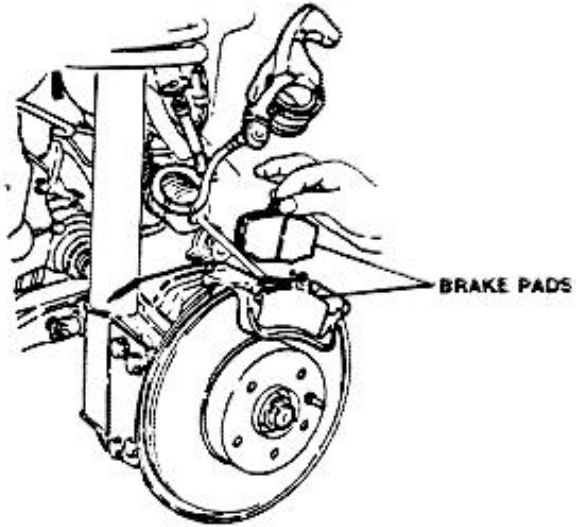
At installation, replace screws securing caliper body.







4. Press manually on caliper piston until fully in.
5. Replace brake pads.







## REAR BRAKES

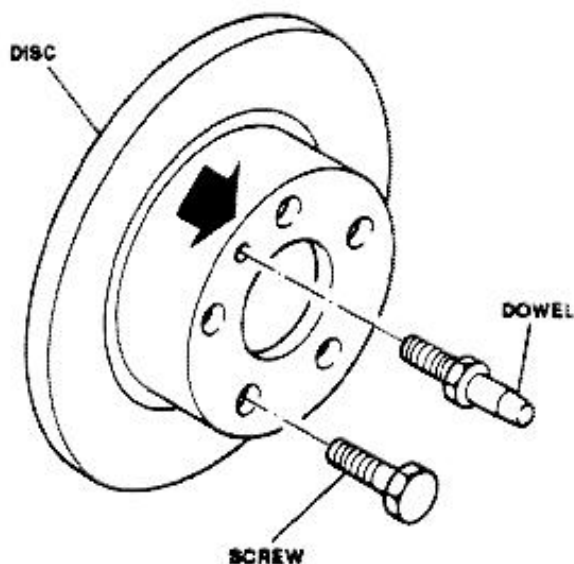
### REAR BRAKE DISCS

The rear brake discs have a diameter of 251 mm (9.88 in) and a thickness of 10 mm (0.39 in).

The discs are fixed in position on the hub flange by two screws (one of the two screws also acts as dowel for centering of the wheel rim) and are attached to the hub flange by means of the wheel attaching screws.

The outer edge of discs is engraved with a minimum allowable wear limit mark as shown by the arrow in the illustration.

The wear limit is 9 mm (0.35 in).



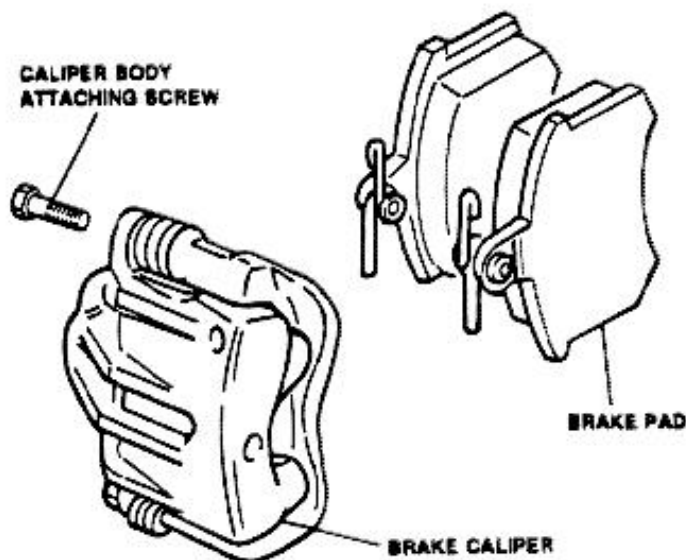
### REAR BRAKE CALIPERS

The rear brake calipers are of the GIRLING single-cylinder floating type, with automatic slack take-up of the parking brake.

The caliper includes a cylinder with a diameter of 36 mm (1.42 in) and two brake pads, with gaskets made of anti-pollution material (free of asbestos) with a total braking surface of 30 cm<sup>2</sup> (4.65 sq.in).

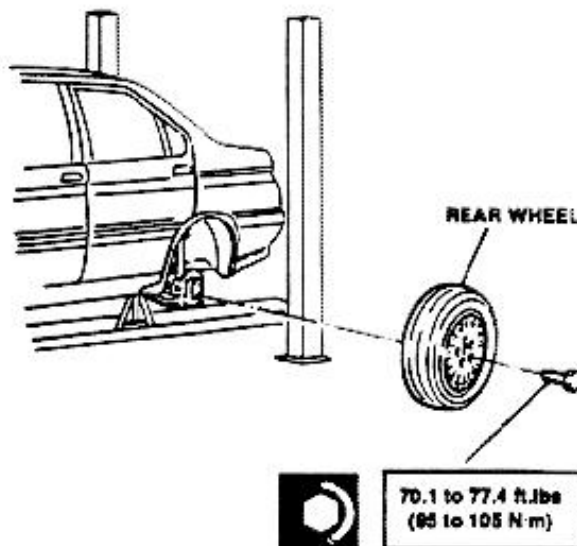
The caliper body attaching screws are of self-locking type, and must be replaced any time they are loosened or

Overhaul of brake calipers can not be performed: operations allowed on brake calipers are limited to replacement of inner seal ring and of dust bellow.



### REMOVAL/INSTALLATION

1. Remove rear wheel.



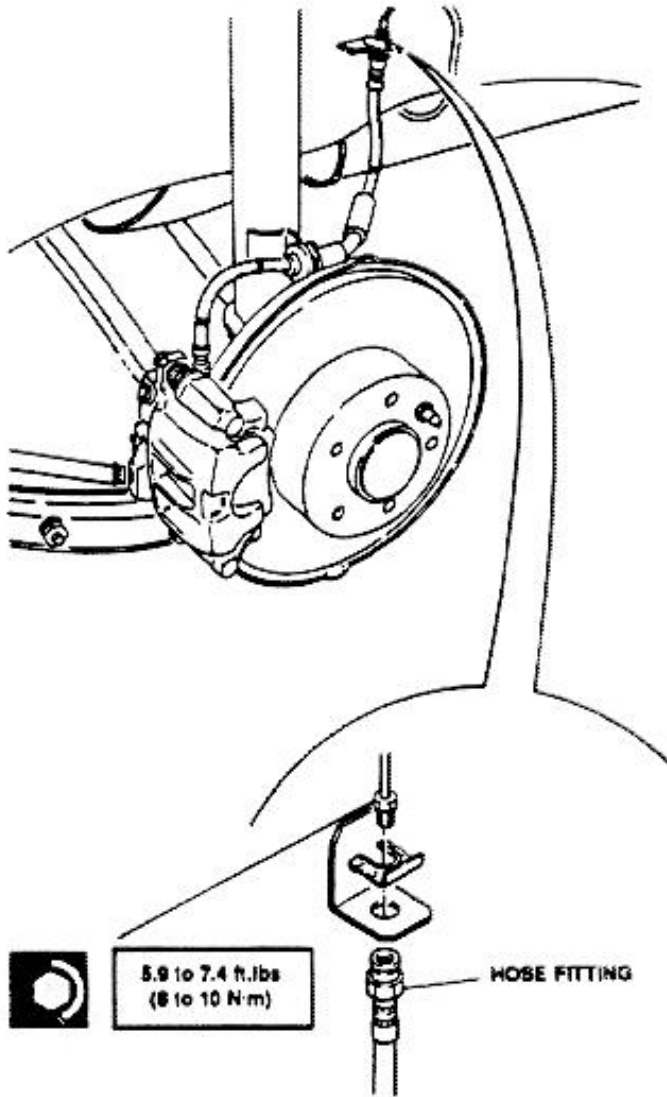
removed.



2. Disconnect fitting and hose.



Bleed the brake system after installation.

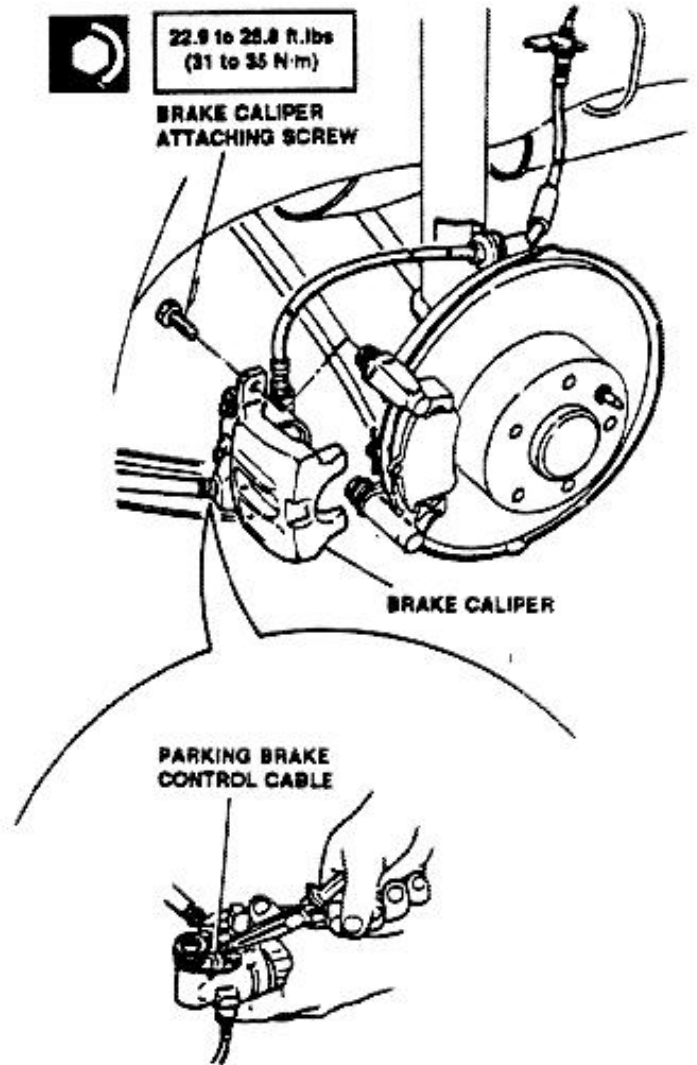


4. Disconnect parking brake control cable from brake caliper.



22.9 to 28.8 ft.lbs  
(31 to 35 N·m)

BRAKE CALIPER  
ATTACHING SCREW



3. Remove attaching screw and remove brake caliper.



At installation, replace brake caliper body at-

5. Remove brake pads.

**NOTE:** No mounting direction is required for rear brake pads.

6. Remove brake caliper mount bracket.



At installation, check for integrity of dust bel-



taching screws.

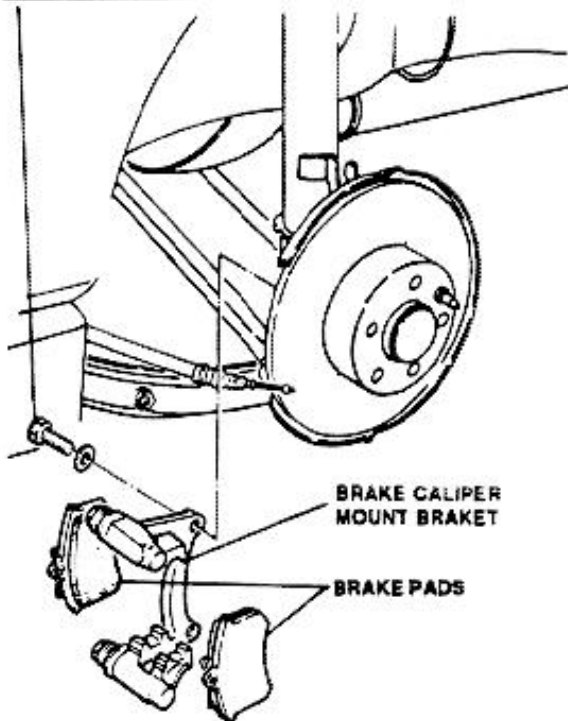


lows; replace bellows if damaged.





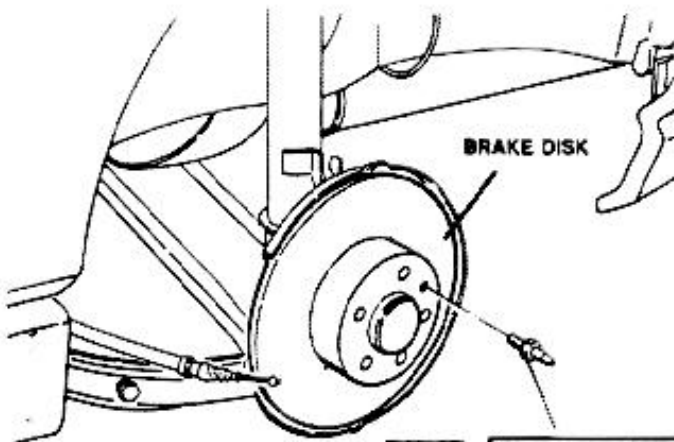
32.7 to 36.1 ft.lbs  
(44.3 to 49 N·m)



7. Remove brake disc.



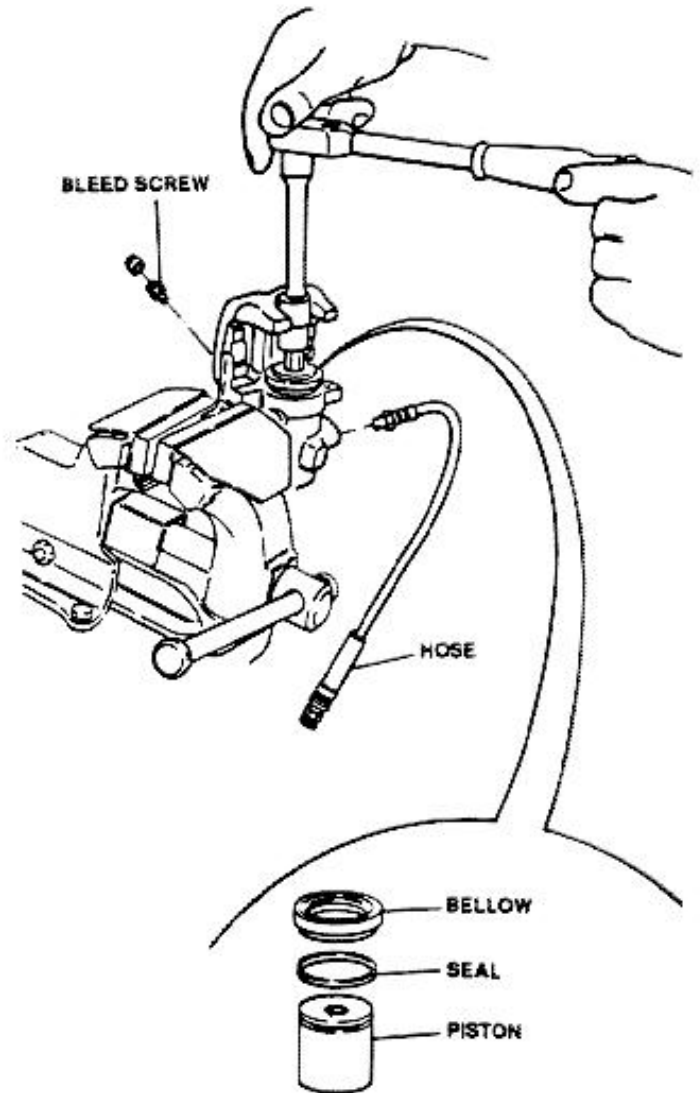
At installation, remove any trace of rust to assure perfect disc to hub perpendicularity.



4.6 to 9.6 ft.lbs  
(6.2 to 13 N·m)

### DISASSEMBLY

1. Disconnect hose fitting from brake caliper.
2. Removal bleed screw.
3. Remove piston, seal and bellow.



### REASSEMBLY

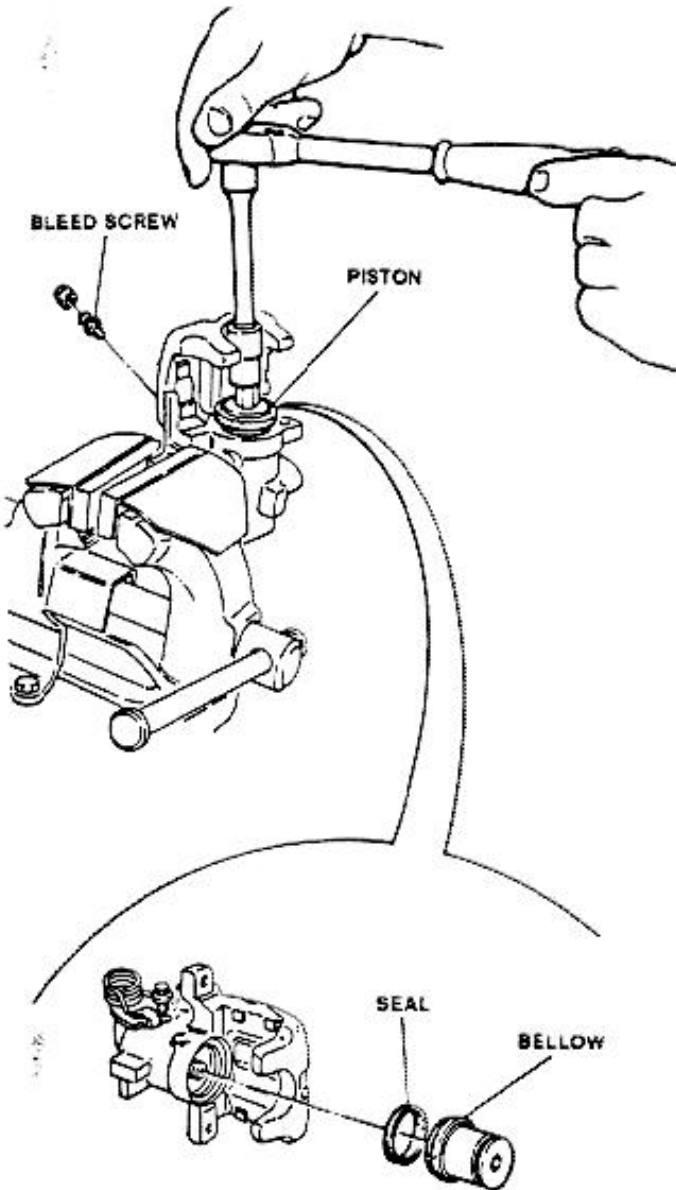
1. Install seal into brake caliper body .
2. Position bellow on rear end of piston.
3. Insert piston in caliper body.





**NOTE:** The inner side of piston includes a self-adjusting telescopic device that automatically takes-up the slack of parking brake as the wear of brake pads increases. Being submerged in fluid, this device is not subject to wear, and does not require repair.

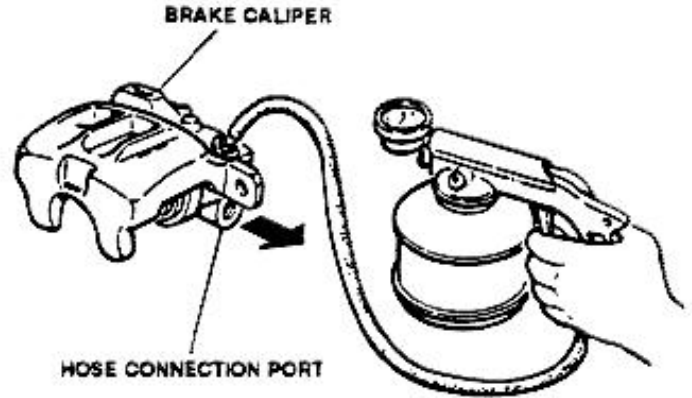
4. Install bleed screw.



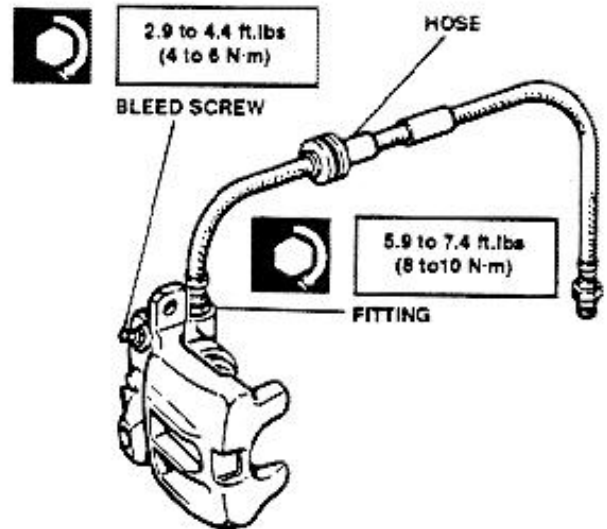
After restoring of brake caliper, and prior to installation on the vehicle, replenish caliper as follow:

5. Remove bleed screw and insert end of a section of

6. Fill brake caliper with prescribed brake fluid until fluid free of any air bubbles flows from the section of tube.



7. Install bleed screw and tighten to prescribed torque.  
8. Connect hose and tighten fitting to the prescribed torque.



### CHECKS AND INSPECTIONS

#### Brake caliper and pads

1. Check brake caliper body for absence of abrasion and seizing: replace caliper complete of piston if damages are found.

**WIDE INTO SCREW HOLE.**

**2. Make sure the bleed screw is unobstructed.**

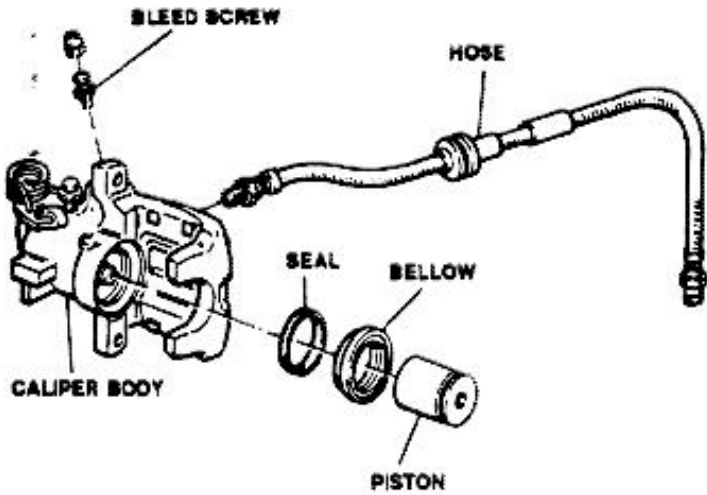
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**22 - 21**

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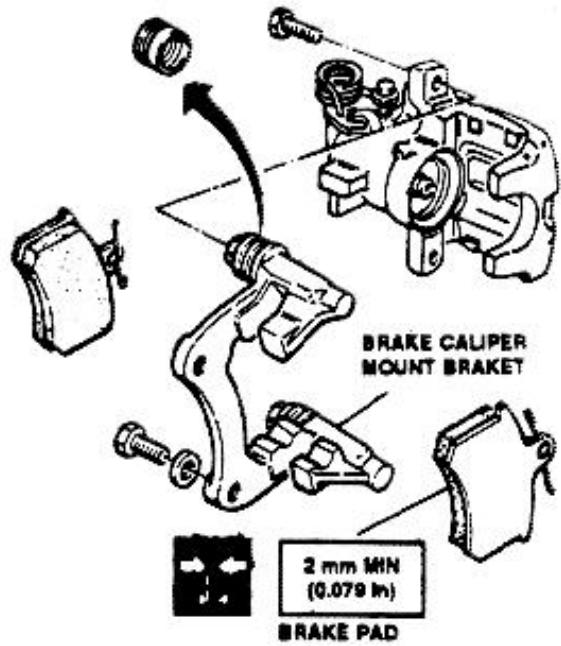


3. Check hose for absence of swelling and cracks.



4. Replace brake pads if thickness is lower than 2 mm (0,079 in).

5. Check caliper mount bracket for absence of cracks or distortions.



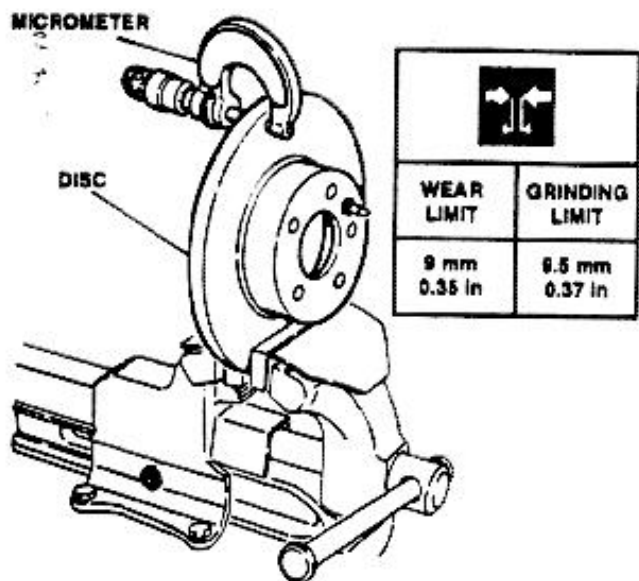




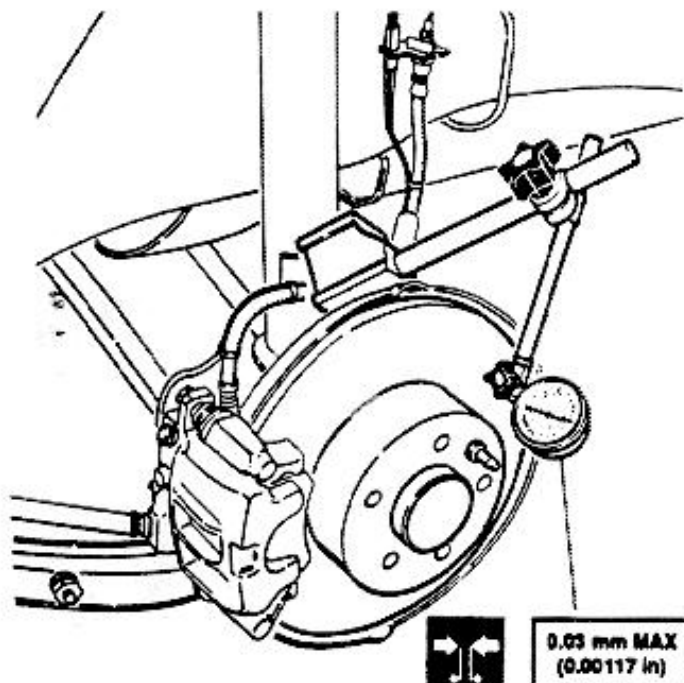
## CHECKS AND INSPECTIONS

### Brake disc

1. Check disc thickness using a micrometer, and inspect the work surfaces for absence of deep scoring or porosity. Grind the disc within specified limits, if necessary.



2. If only the brake pads are replaced, check disc misalignment with respect to rotation axis does not exceed 0.15 mm (0.0059 in).



**NOTE:** Measure misalignment 2 mm (0.078 in) at disc outer diameter.

## BRAKE PADS REPLACEMENT

1. Remove rear wheel.
2. Remove securing screws and brake caliper.



At installation, replace screws securing caliper body.

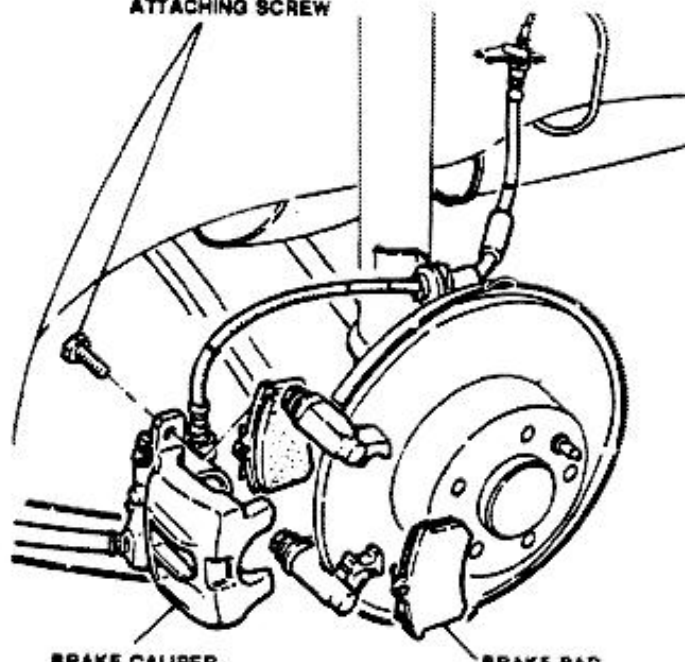
3. Replace brake pads.

**NOTE:** Prior to position the new brake pads press manually on caliper piston until fully in, then start the engine and press brake pedal several times to restore automatic slack take-up of parking brake; subsequently, adjust parking brake acting on the control lever.



22.9 to 25.8 ft.lbs  
(31 to 35 N·m)

BRAKE CALIPER  
ATTACHING SCREW









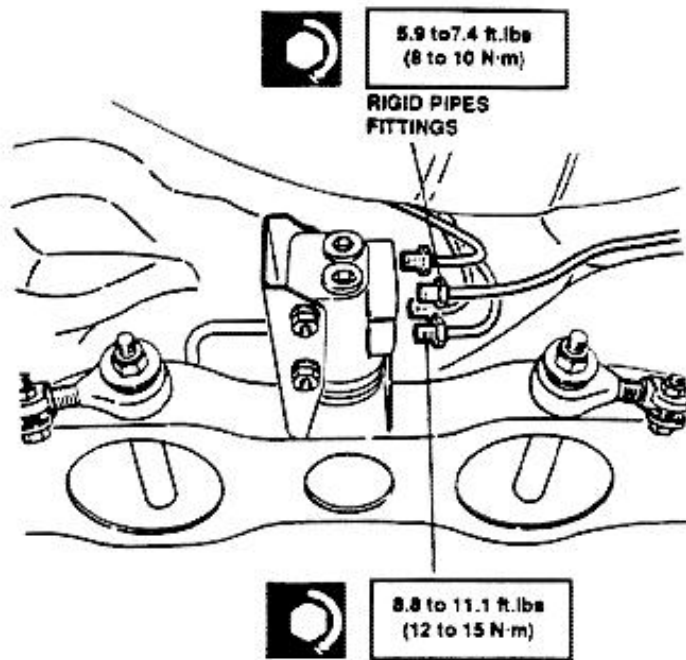
### LOAD PROPORTIONING VALVE

The load proportioning valve regulates the pressure of fluid which operates the rear brakes as a function of the load on the vehicle rear axle; the load is measured instant per instant by measuring the distance between the rear wheels axle and the vehicle body.

As the load increases, with consequent reduction of rear axle to body distance, the grip of rear wheels is improved, and a higher braking action can be obtained without locking the wheels.

The load proportioning valve is secured to the rear cross beam, and is connected through a torque bar and a rocking lever, to the rear suspension cross arms in order to measure, by the angle of the torque bar, the load acting on both the left and right rear suspensions.

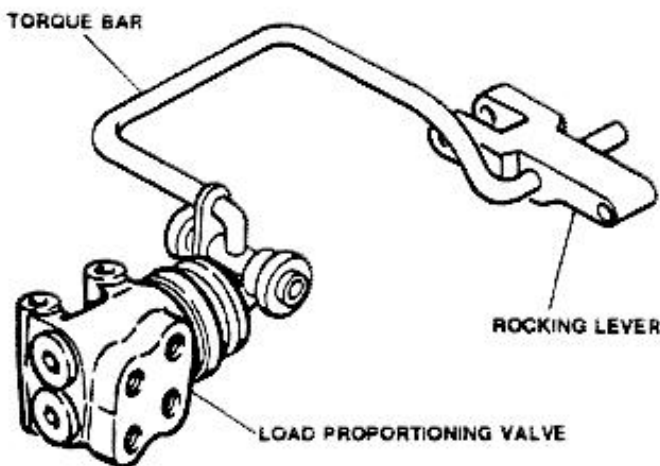
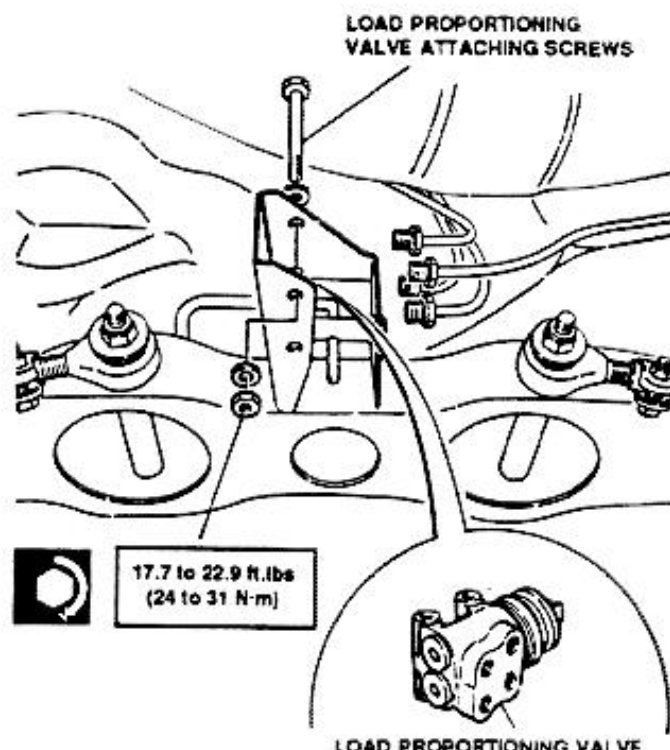
Overhaul of the load proportioning valve cannot be performed; therefore, replace load proportioning valve in case of failure.



- 2. Remove attaching screws and remove load proportioning valve.



After installation, bleed the brake system.



### REMOVAL/INSTALLATION

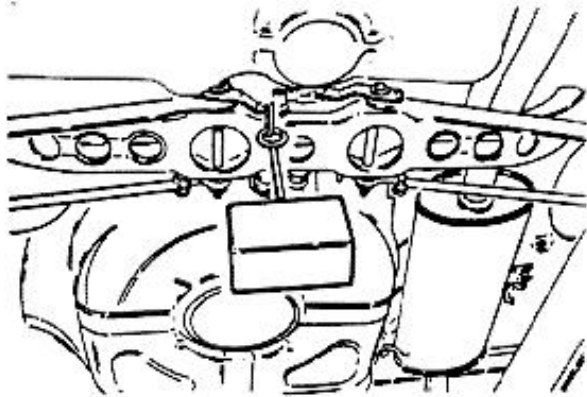
- 1. Disconnect fittings of fluid lines

1. Disconnect fittings of rigid lines.



### ADJUSTMENT

1. Settle rear suspension.
2. Place vehicle in running order on a level surface, with wheels touching the ground.
3. Place a 75 Kg (165.3 lbs) load in the trunk and fill fuel tank to capacity.
4. Check load proportioning valve linkage for freedom of movement.



5. Loosen adjustment screw.
6. Apply a weight of 5 Kg (11.02 lbs) to lever hole.
7. Lock adjustment screw.

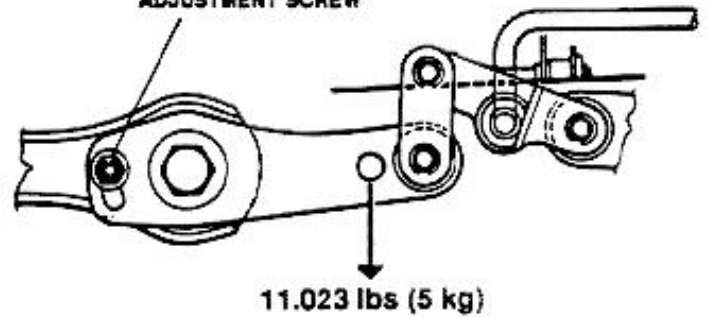


Replace load proportioning valve if not operating properly.



42.0 to 46.5 ft.lbs  
(57 to 63 N-m)

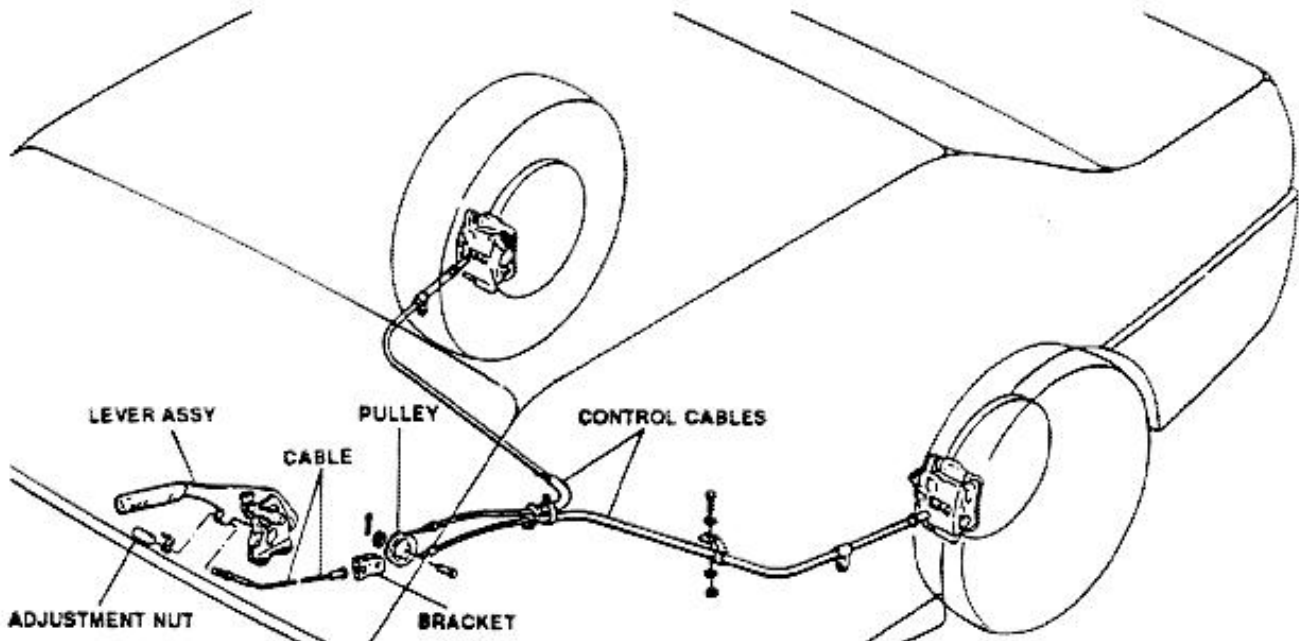
ADJUSTMENT SCREW



### PARKING BRAKE

The parking brake acts on rear brakes of vehicle through a mechanical connection.

In case of failure of the hydraulic circuit of brakes system, the parking brake allows simultaneous locking of both rear wheels since the two hydraulic systems are separate and independent.







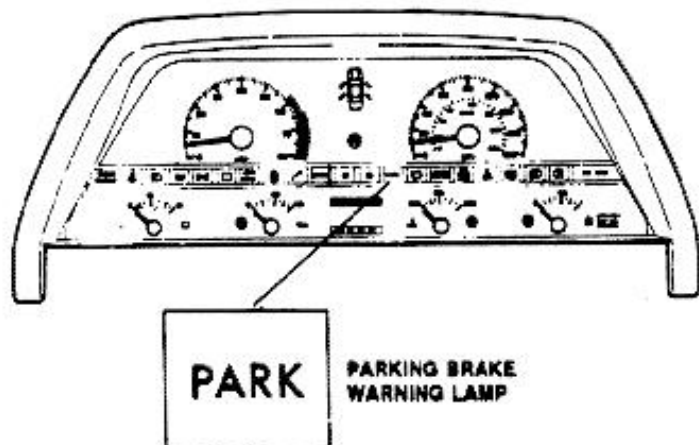
The main components of the parking brake system are the control lever, control cables and the automatic slack take-up device.

The control lever is located in cabin between the two front seats, and prevents movement of the vehicle when parked.

The control cables are made of steel and are connected to the control lever by a cable and pulley.

Tension of control cables can be adjusted acting on an adjustment nut.

With the Ignition key rotated to first position, a switch located below the control lever turns on the parking brake warning lamp on instrument panel when ever the control lever is moved from rest position.



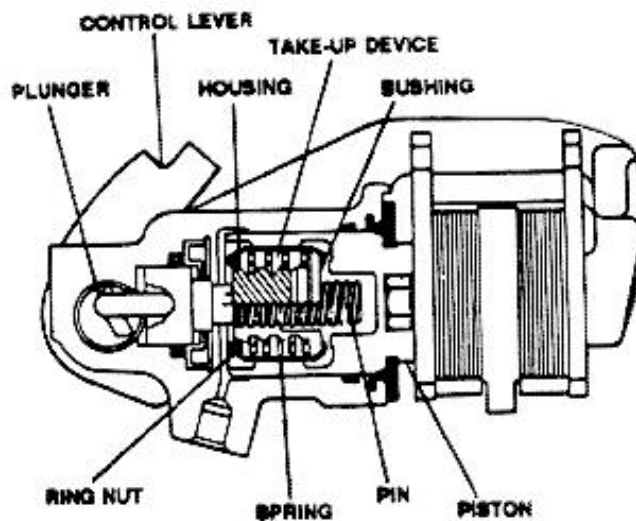
## PARKING BRAKE AUTOMATIC SLACK TAKE-UP DEVICE

The parking brake automatic slack take-up device is located inside the rear brake calipers; the function of this device is to maintain constant the travel of parking brake lever, which could tend to increase as the brake pads wear up.

If gap between brake disc and pads exceeds the initial prescribed gap, due to wear of the pads, the plunger of the device moves forward to ensure proper braking effect.

In these conditions the device is actuated to take-up the slack and restore the initial prescribed gap as follows:

- Advancement of plunger due to brake application causes an increase of pressure that overcomes the force of spring, and consequent movement of the device housing.
- The housing drags the ring nut that, being locked by the tapered seat of housing, forces the bushing to unscrew on the pin.
- When the brake is released, the return of spring to rest position drags the ring nut which, being no longer locked from the housing, rotates on the bushing, which remains steady, and returns to the initial position.
- Unscrewing of the bushing on the pin determines a different positioning of these items, which in turn takes-up the slack due to wear of brake pads, and maintain the gap to a constant value.







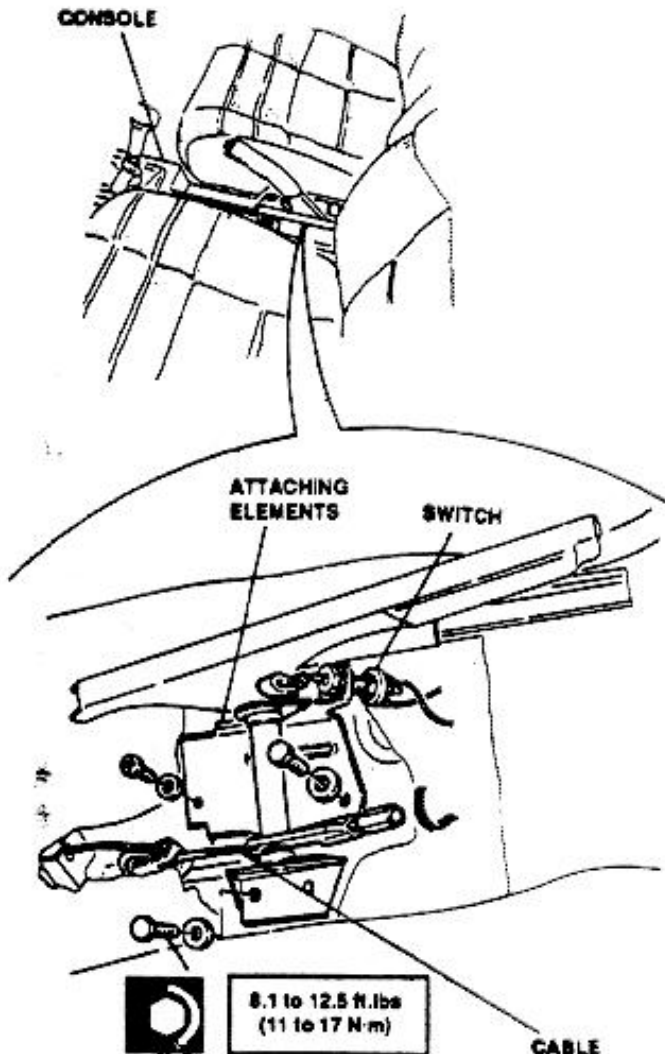
## CONTROL LEVER

### REMOVAL/INSTALLATION

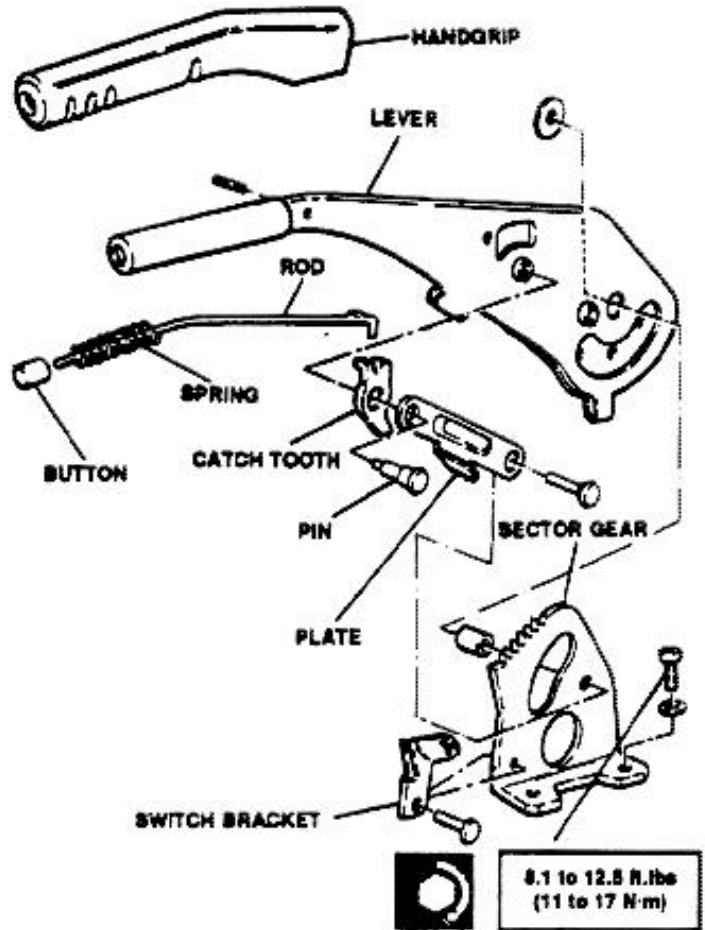
1. Remove center console surrounding the gear shift lever (refer to Group 66).
2. Remove parking brake switch.
3. Disconnect cable from bracket.
4. Remove attaching elements and remove control lever.



After installation, adjust the parking brake system.



### DISASSEMBLY/REASSEMBLY



## CONTROL CABLES

### REMOVAL/INSTALLATION

**NOTE:** Check each component for proper operation, and sliding of cable into its sheath. Replace affected components in case of wear or binding.

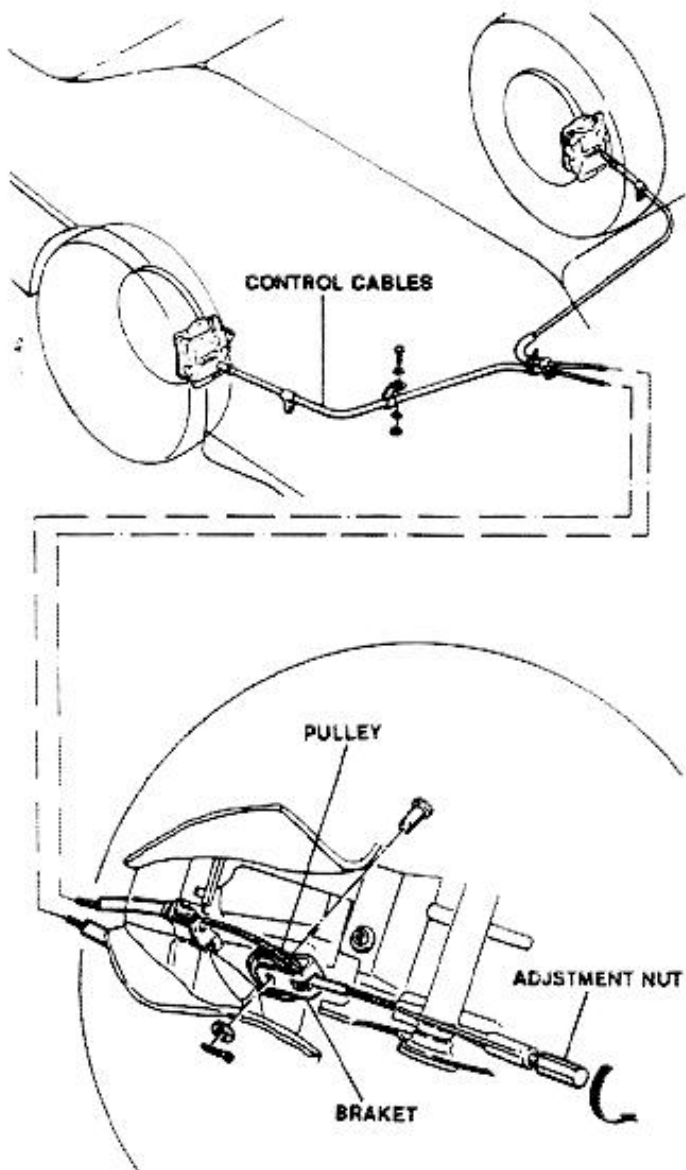
1. Remove gear shift lever console (refer to Group 66).
2. Loosen adjustment nut.
3. Disconnect pulley from bracket.
4. Disconnect control cables from brake calipers (refer to paragraph "REAR BRAKES: REMOVAL/INSTALLATION") and from fasteners under the vehicle body.



After installation, adjust the parking brake system.





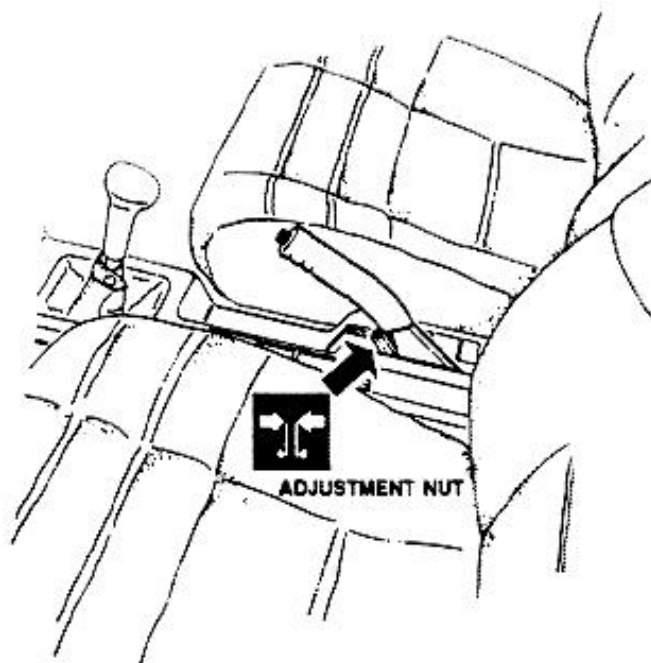


1. With parking brake control cables disconnected from brake calipers, perform at least 10 powerful applications of brake pedal to allow the automatic slack take-up device to resume the normal operating position.
2. Connect control cables to brake calipers.
3. Set parking brake control lever to third detent of sector gear.
4. Act on the adjustment nut until the wheels are blocked.
5. Actuate control lever 4 or 5 times with a force of about 40 Kg (88.2 lbs) and check that:
  - The sector gear does not trip more than 7 teeth when a force of about 40 Kg (88.2 lbs) is applied to the control lever.
  - The wheels are free when the control lever is in rest position.

### PARKING BRAKE ADJUSTMENT



Parking brake adjustment must be carried-out only after the brake pads, the cable or the brake caliper have been replaced, since take-up of slack is automatic.





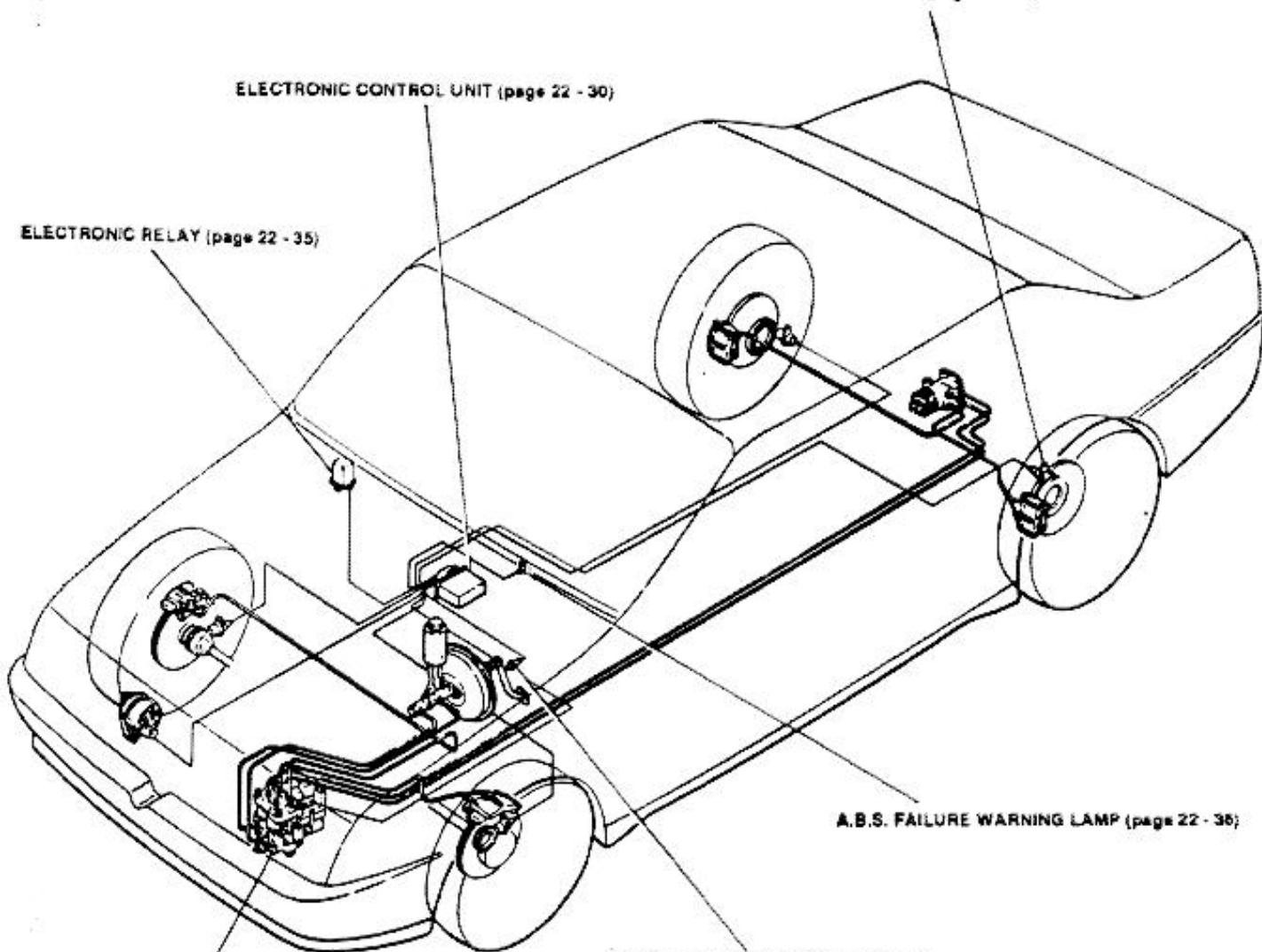


# ANTI LOCK BRAKE SYSTEM (ABS) ILLUSTRATED INDEX

PHONIC WHEEL SENSOR AND PULSE GENERATORS (page 22 - 33)  
FRONT PHONIC WHEEL SENSOR (page 22 - 34)  
REMOVAL/INSTALLATION (page 22 - 34)  
REAR PHONIC WHEEL SENSOR (page 22 - 35)  
REMOVAL/INSTALLATION (page 22 - 35)

ELECTRONIC CONTROL UNIT (page 22 - 30)

ELECTRONIC RELAY (page 22 - 35)



A.B.S. FAILURE WARNING LAMP (page 22 - 36)

STOP LAMPS SWITCH (page 22 - 36)

ELECTRO-HIDRAULIC UNIT (page 22 - 31)  
REMOVAL/INSTALLATION (page 22 - 32)





## **DESCRIPTION AND OPERATION**

The A.B.S. is a high-safety device that prevents locking of the wheels during braking when pressure on the brake pedal is excessive with respect to the grip of tires on the ground (e.g. in case the surface is frozen, covered with snow or slippery for any other reason).

The operation of the ABS is based on continuous detection of wheels angular speeds, that decrease during braking.

If in case the tire grip is lost, and the wheel tends to lock, its angular deceleration increases with respect to the remaining wheels.

The phenomenon is detected and the ABS reduces instantaneously the pressure on the brake caliper of the affected wheel.

Therefore, the wheel will continue to rotate, and the tire will not lose its grip on the surface.

As soon as the angular deceleration has resumed the value of the other wheels, pressure is restored on the affected wheel.

The cycle can be repeated indefinitely with a frequency of 10 cycles per second. In this way the grip of the tire on the road surface is assured continuously, and the average braking pressure is maintained to the maximum value compatible with tire grip, even if pressure applied on brake pedal is excessive.

Even abrupt braking is possible when the grip of two wheels is satisfactory (on tarmac), and grip of the two other wheels is poor (e.g. on frozen surface), since locking of the two wheels having a poor grip is prevented. To optimize maintaining of the direction even when braking in extreme tire grip conditions, the A.B.S. has been designed with a 3 channel scheme.

In other words, the two front wheels are monitored separately since subject to the maximum brake force and the two rear wheels are monitored collectively; this feature permits maintaining of the direction during braking.

During the start phase, the ABS performs the self-test of all its functions on the basis of memory programs.

During this phase, simulated signals are generated and transmitted to the electro-hydraulic unit that verifies proper operation of the system.

Following the start, the whole logic sequence of the signals is performed automatically and values are veri-

fied. Failure of the sensors, of the control unit and of the electro-hydraulic unit causes automatic disengagement of the A.B.S., and the brake system will continue to operate in the conventional mode.

Any failure of the system is indicated by the illumination of the relevant warning lamp on the instrument panel.

When braking in normal conditions, the A.B.S. is not actuated and the vehicle behaves as if the A.B.S. was not installed.

On the opposite, when the A.B.S. is actuated since the grip of a tire is nearly lost, the driver will feel slight pulses on the brake pedal: in this condition the A.B.S. is checking the pressure.

The A.B.S. has been adjusted to engage at vehicle speeds above 3.1 MPH (5 Km/h).

The A.B.S. consists of the following components in addition to those of the conventional brake system:

- **ELECTRONIC CONTROL UNIT**
- **ELECTRO-HYDRAULIC UNIT**
- **PHONIC WHEEL SENSOR AND PULSE GENERATORS**
- **ELECTRONIC RELAY**
- **A.B.S. FAILURE WARNING LAMP**

## **ELECTRONIC CONTROL UNIT**

The electronic control unit is a microprocessor that receives and processes sensor signals according to a pre-determined logic, and supplies control signals to the solenoid valves located on the electro-hydraulic unit.

The control unit is located below the instrument panel, in the proximity of the central tunnel, and is secured to a bracket with two screws.

When the driver presses the brake pedal, the wheels decelerate, even with different rates among each other.

From combining of the speed of each single wheel, a datum speed is processed, stored and continuously updated to indicate the vehicle's speed at each instant of braking.

Comparison between speed of each single wheel and datum speed allows continuous monitoring of skidding signals of each wheel.





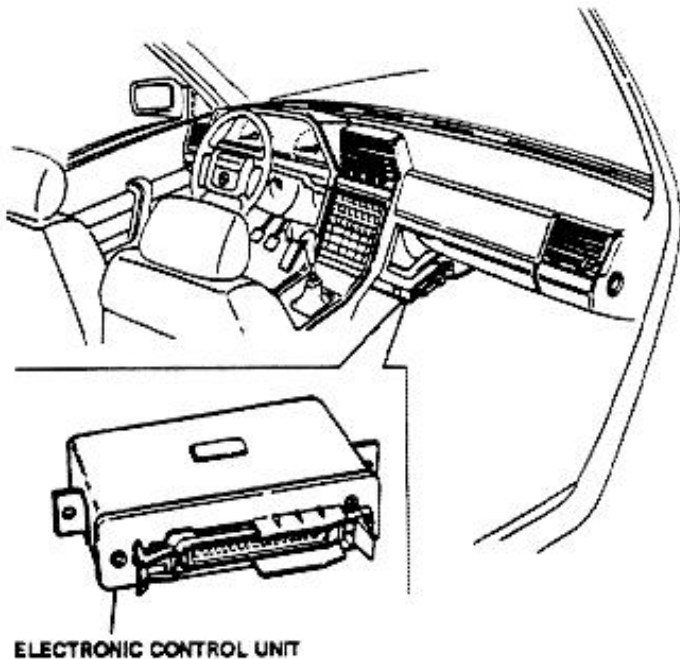
The control unit includes a safety circuit that monitors the efficiency of system before engine start and during the run.

In case a malfunction is detected, the safety circuit disables the A.B.S., but normal braking with traditional brake system is anyway assured.

The driver is alerted of disabling of the A.B.S. by the illumination of the relevant warning lamp on the instrument panel.

The safety circuit continuously monitors also the battery voltage, and disables the A.B.S. in case of over or under voltage.

Overhaul of the control unit can not be performed: replace the unit in case of malfunction.



## RECOMMENDATIONS

- Prior to any arc welding operation on the vehicle disconnect electrical connector from control unit.
- During painting operations of vehicle the control unit can be exposed to temperature of 95 °C (203 °F) only for a short time, and for a longer time (about 2 hours) to the maximum temperature of 85 °C (185 °F).

## ELECTRO-HYDRAULIC UNIT

The function of the electro-hydraulic unit is to change, by means of solenoid valves, the brake fluid pressure to the brake caliper piston in accordance with input signals delivered by the electronic control unit.

The four solenoid valves, one for each wheel, are of the three-position type; they receive from the electronic control unit a current signal to control the A.B.S., as follows:

**0A = pressure loading position**

**1.9 to 2.3A = pressure hold position**

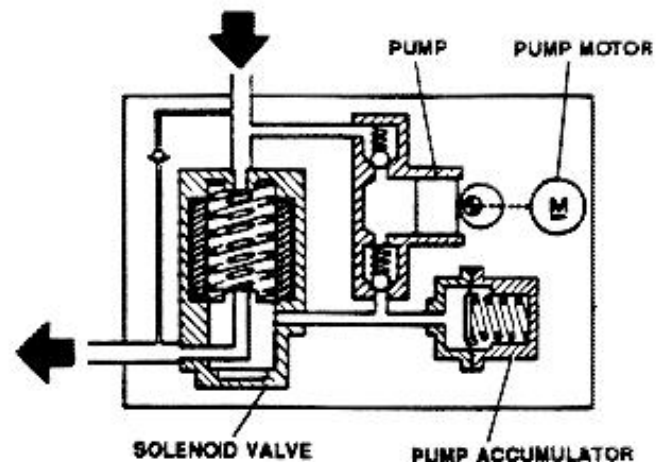
**4.5 to 6A = pressure relief position**

The scavenge pump is activated through the relevant relay by the electronic control unit when the A.B.S. is actuated.

The pump allows scavenge of brake fluid during the pressure reduction phase, and transfers it upstream the solenoid valve to be re-used during subsequent pressure loading phase.

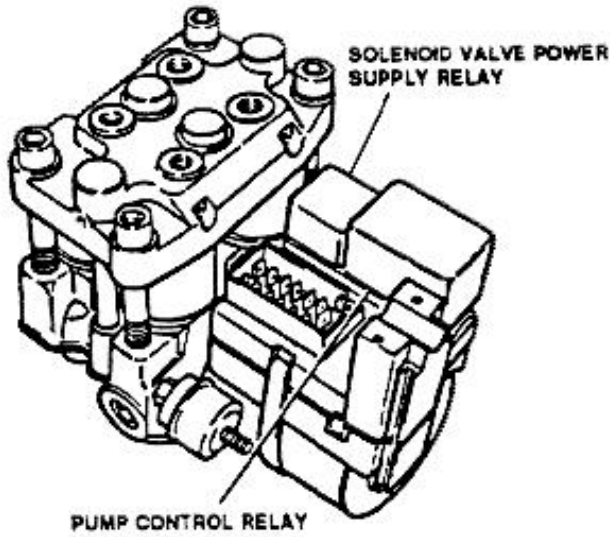
The solenoid valves power supply relay is energized directly by the electronic control unit; the solenoid valves are therefore de-energized in case of total disabling of the A.B.S.

Furthermore, the peculiar connection of the relay with a safety diode allows illumination of the A.B.S. warning lamp on instrument panel independently from the inputs of the electronic control unit.





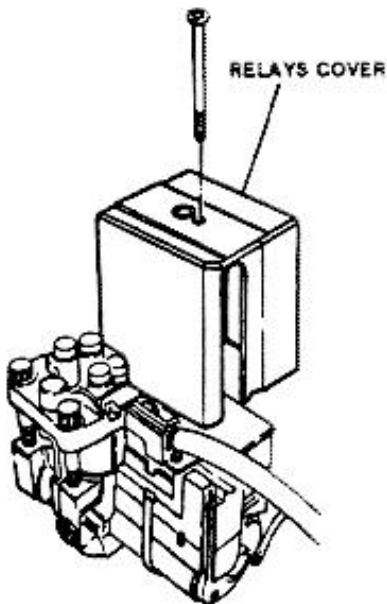




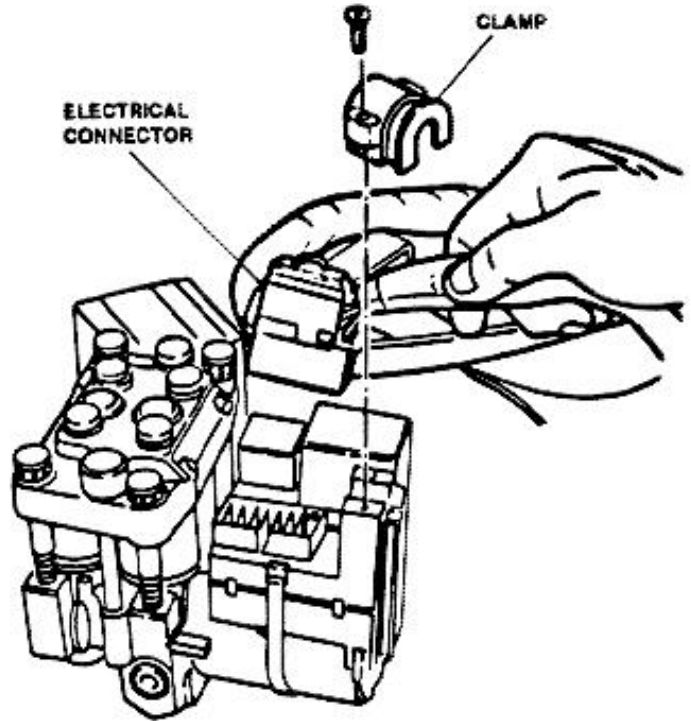
The electro-hydraulic unit can not be overhauled: replace complete unit if a malfunction has been identified. Replacement units are supplied fully serviced with brake fluid and with solenoid valves open; therefore, bleeding and servicing of the brake system can be carried out in analogy to that of a conventional brake system.

### REMOVAL/INSTALLATION

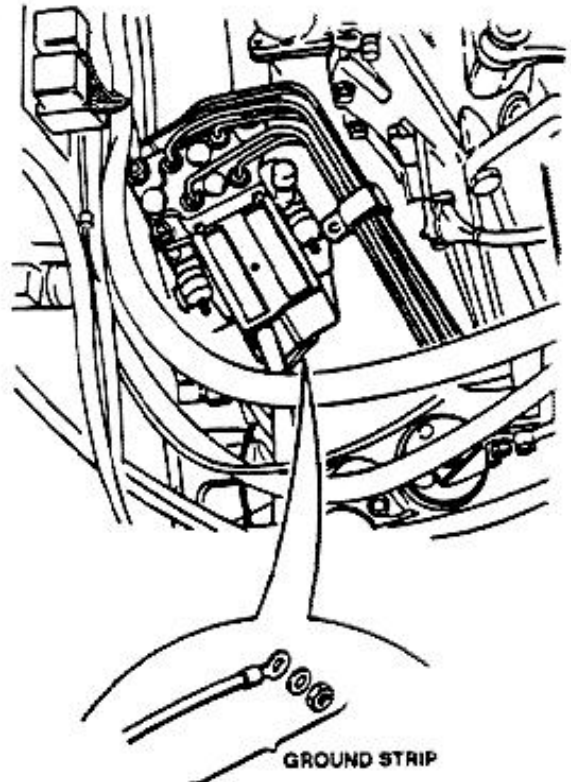
1. Remove relays cover.



2. Remove clamp securing harness.
3. Disconnect harness connector.



4. Disconnect ground strip.







5. Disconnect the two front pipes delivering fluid to the electro-hydraulic unit.
6. Disconnect the four upper pipes delivering fluid to brakes.



**CAUTION:**  
Operate with precaution to prevent damaging the rigid tubes that could be easily cracked.

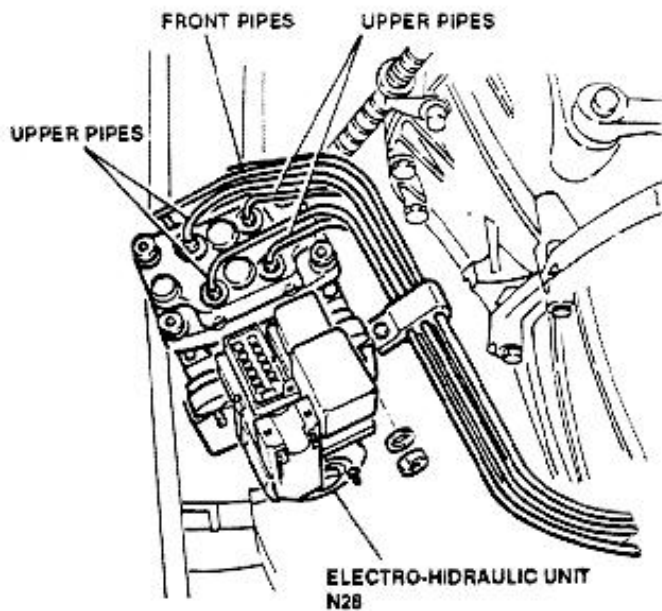
**NOTE:** Plug pipes and ports on the electro-hydraulic unit as they are disconnected using suitable plugs.

7. Remove the electro-hydraulic unit from the support.



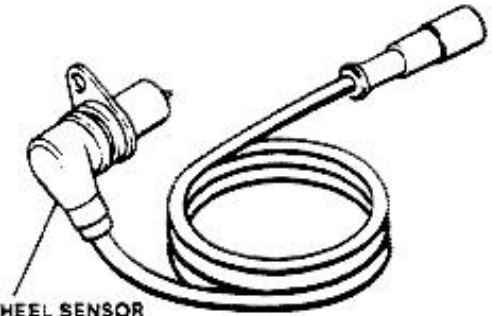
Bleed the brake system after installation.

8. At installation, reverse the removal procedures.



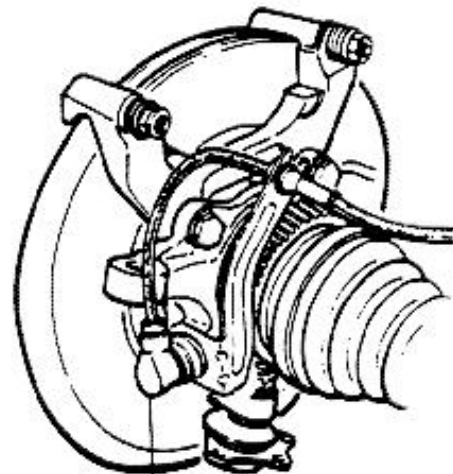
## PHONIC WHEEL SENSOR AND PULSE GENERATORS

The phonic wheel sensor supply with due continuity the electronic control unit with all information necessary for proper piloting of the electro-hydraulic unit.

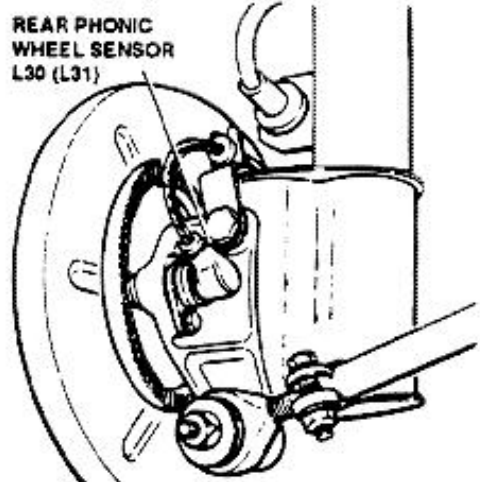


PHONIC WHEEL SENSOR

The sensors measure the vehicle speed, and deceleration, acceleration and skidding of the wheels. The sensors are installed on wheel spindles.



FRONT PHONIC WHEEL SENSOR L28 (L29)



REAR PHONIC WHEEL SENSOR L30 (L31)

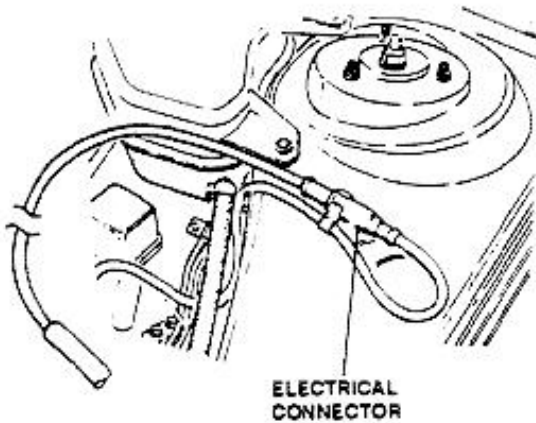




The magnetic field lines close through the tooth of a toothed wheel (pulse generator) facing the sensor and driven by the vehicle wheels. The passage from "solid to void" due to the presence or absence of the tooth determines a variation of the magnetic field sufficient to generate an induced electromotive force at sensor terminals, and therefore to generate an alternate electric signal to the electronic control unit.

### FRONT PHONIC WHEEL SENSOR REMOVAL/INSTALLATION

1. Disconnect electrical connector aside left wheel.

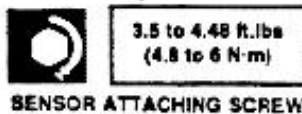
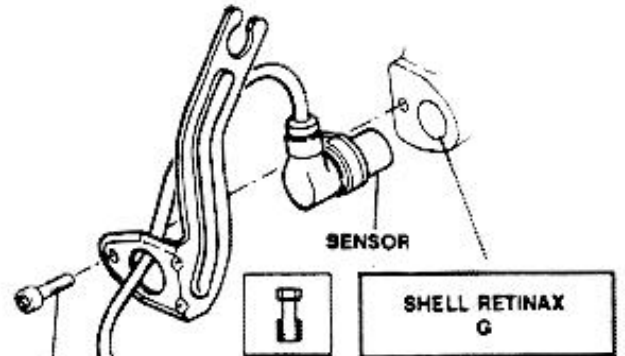


ELECTRICAL CONNECTOR



2. Remove attaching screws.
3. Remove sensor.

**NOTE:** At installation, wipe seating of sensor with prescribed grease.

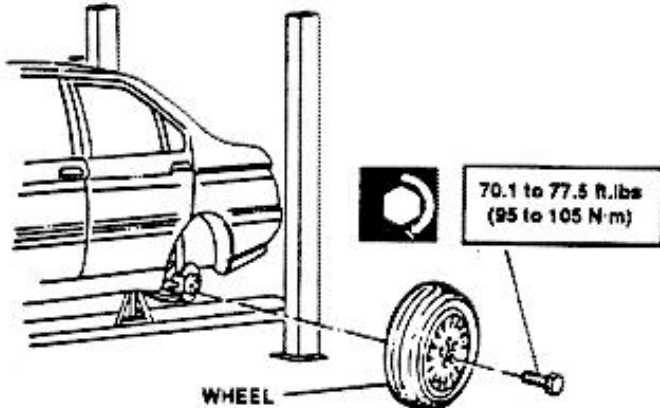






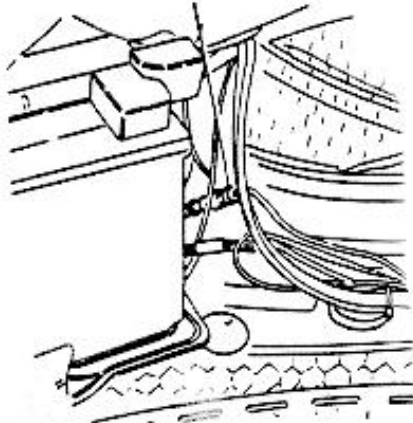
# REAR PHONIC WHEEL SENSOR REMOVAL/INSTALLATION

1. Remove wheel.

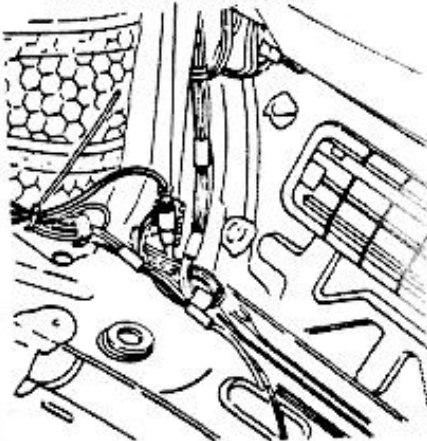


2. Disconnect electrical connector located in the trunk.

L.H. PHONIC WHEEL SENSOR  
ELECTRICAL CONNECTOR



R.H. PHONIC WHEEL SENSOR  
ELECTRICAL CONNECTOR



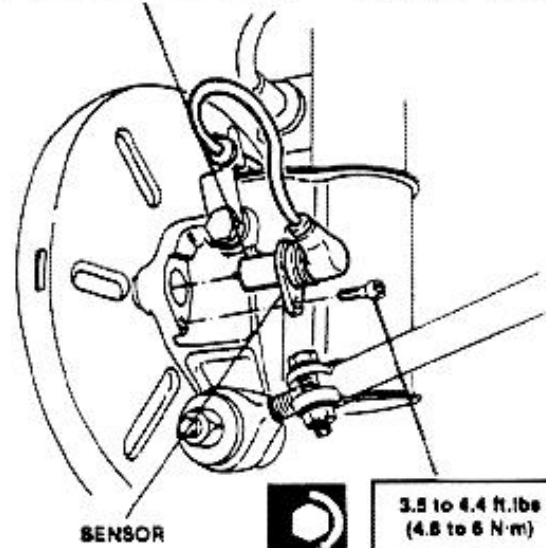
- 3. Remove attaching screw.
- 4. Remove sensor.

**NOTE:** At installation, wipe sensor housing with prescribed grease.



SHELL RETINAX  
G

*AIR GAP  
.25mm - .75mm  
Prefer .40mm - .60mm.*

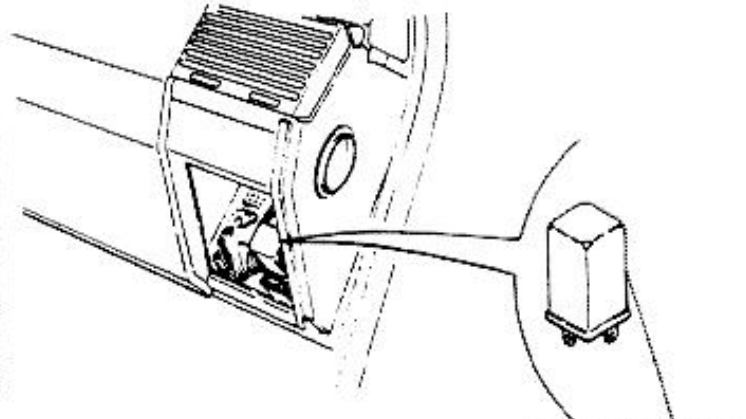


3.5 to 4.4 ft.lbs  
(4.8 to 6 N·m)

SENSOR ATTACHING SCREW

## ELECTRONIC RELAY

When the ignition key is rotated to first position, the A.B.S. electronic relay allows energization of the electronic control unit and of the two other relay of the system. The electronic relay contains a protection device that breaks the outer protection fuse in case of excessive voltage of power supply that could damage the electronic control unit (refer to Group 40).









## **A.B.S. FAILURE WARNING LAMP**

The A.B.S. warning lamp is located on the instrument panel and is identified by the labeling "ANTI LOCK". With the ignition key rotated to first position the red warning lamp illuminates; the warning lamp extinguishes as the engine is started.



The alternator supplies the electronic control unit with a signal indicating that engine is running.

The warning lamp remains off if all the A.B.S. components are operational; otherwise the warning lamp is switched on; the A.B.S. is automatically disabled if answer-back is negative and braking is performed in the conventional mode.

During this phase the warning lamp remains illuminated.

## **STOP LAMPS SWITCH**

With gear engaged and brake pedal pressed, the electronic control unit receives a signal that the driver has applied the brake, and the A.B.S. is engaged.

This information is particularly useful when driving on uneven surface roads (wavings, steps, etc.), that could cause variations of wheels speed not due to braking actions, to prevent erroneous signals being delivered to the electronic control unit.





## TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

### BRAKE MASTER CYLINDER

Type	Benditalia	
Diameter	22.22 mm	0.875 in
Stroke	17.75 mm	0.699 in

### BRAKE SERVO

Type	Benditalia	
Operating cylinder diameter		9 in

### FRONT BRAKE CALIPERS

Type	Girling	
Piston diameter	54 mm	2.12 in
Brake pad area	50 cm <sup>2</sup>	7.75 sq.in
Brake pad nominal thickness	18.3 mm	0.72 in

### REAR BRAKE CALIPERS

Type	Girling	
Piston diameter	38.1 mm	1.4859 in
Brake pad area	30 cm <sup>2</sup>	4.65 sq.in
Brake pad nominal thickness	16.4 mm	0.646 in

### FLUIDS AND LUBRICANTS

Application	Type	Name
Pedal bushes and joints	GREASE	SHELL RETINAX G
Brake/clutch hydraulic system refill	FLUID *	Alfa Romeo BRAKE FLUID super DOT4 AGIP BRAKE FLUID DOT4
Brake master cylinder seal ring	GREASE	ATE - Bremszylinder Paste DBA Paste
Seat for anti-lock front/rear phonic wheel sensor	GREASE	SHELL RETINAX G

\* - 0.6 l. or 0.5 Kg (0.15 Gals or 1.1 lbs)

- 0.8 l. or 0.7 Kg (0.21 Gals or 1.5 lbs) with A.B.S.

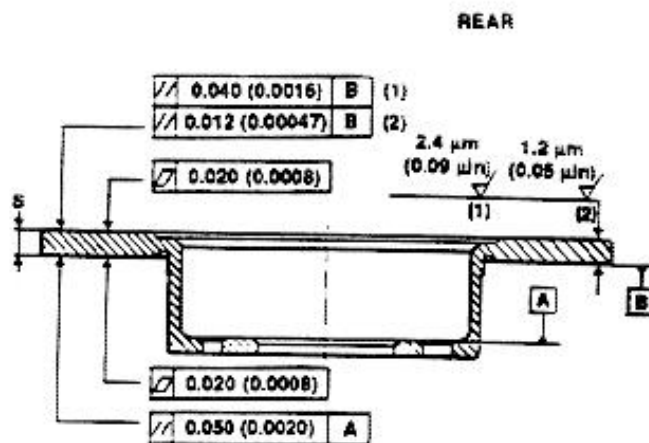
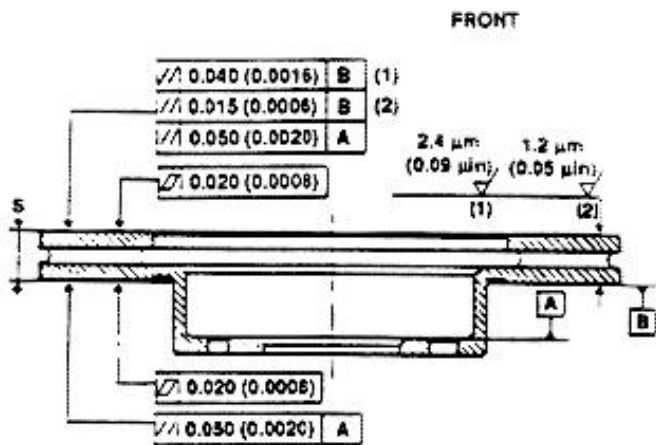




### CHECKS AND ADJUSTMENTS

Brake disk	Front	Rear
Min. operating thickness	20.2 mm (0.795 in)	9.0 mm (0.354 in)
Min. thickness after grinding	21.2 mm (0.835 in)	9.5 mm (0.374 in)
Max. out-of-parallel	0.03 mm (0.00117 in)	0.03 mm (0.00117 in)

### BRAKE DISK GRINDING DIMENSIONS: mm (in)



- (1) Radial
- (2) Circumferential

**PARKING BRAKE LEVER TRAVEL ADJUSTMENT:**

Number of free notches on sector gear before wheels lock: 3





## TIGHTENING TORQUES

Nut securing pedals to support	31.0 to 38.4 ft.lbs	42 to 52 Nm
Pipe fitting on brake master cylinder	5.9 to 7.4 ft.lbs	8 to 10 Nm
Nut securing brake master cylinder	0.66 to 1.1 ft.lbs	0.9 to 1.5 Nm
Nut securing brake servo to pedal support	9.6 to 12.5 ft.lbs	13 to 17 Nm
Columns (screws) securing front and rear wheels	70.0 to 77.4 ft.lbs	95 to 105 Nm
Screw securing front brake calipers	22.9 to 28.0 ft.lbs	31 to 38 Nm
Screw securing front brake calipers bracket	38.3 to 42.8 ft.lbs	52 to 58 Nm
Screw with dowel securing front and rear brake discs	4.6 to 9.6 ft.lbs	6.2 to 13 Nm
Screw securing front and rear brake discs	4.6 to 9.6 ft.lbs	6.2 to 13 Nm
Bleed screw on brake calipers	2.9 to 4.4 ft.lbs	4 to 6 Nm
Fitting connecting hoses to brake calipers	5.9 to 7.4 ft.lbs	8 to 10 Nm
Screw securing rear brake calipers	22.9 to 25.8 ft.lbs	31 to 35 Nm
Screw securing rear brake calipers bracket	32.7 to 36.1	44.3 to 49 Nm
Screw securing load proportioning valve to rear crossmember	17.7 to 22.9 ft.lbs	24 to 31 Nm
Fitting connecting pipes to load proportioning valve (M10 x 1 / M12 x 1)	5.9 to 7.4 / 8.8 to 11.1 ft.lbs	8 to 10 / 12 to 15 Nm
Nut securing load proportioning valve control lever	42 to 46.5 ft.lbs	57 to 63 Nm
Screw securing parking brake to body	8.1 to 12.5 ft.lbs	11 to 17 Nm
Screw securing front and rear phonic wheel sensor	3.5 to 4.4 ft.lbs	4.8 to 6 Nm







## TROUBLESHOOTING PROCEDURE

### PRELIMINARY CHECKS

- Check tires inflation pressure and wear.
- Check wheels attitude and characteristic angles.
- Check that brake fluid is of the approved type.

7.

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
EXCESSIVE PEDAL TRAVEL	When pedal is depressed, travel is longer than normal.	<b>A</b>
DAMPENED PEDAL TRAVEL	When pedal is depressed, dampening is found at end of travel; the braking action is reduced.	<b>B</b>
STIFFENING OF PEDAL TRAVEL	The pedal travel becomes stiff during normal use of brakes.	<b>C</b>
INSUFFICIENT BRAKING	Braking is not proportional to force applied to pedal.	<b>D</b>
CAR DRIFTS DURING BRAKING	Car pulls to one side (right or left) during braking.	<b>E</b>
VIBRATIONS DURING BRAKING	Vibrations are felt in cabin during braking.	<b>F</b>
SQUEAK OR CREAKING DURING BRAKING	Squeak or creaking, coming from pad-to-disc contact area, is heard during braking.	<b>G</b>
JAMMING OF REAR BRAKES	Rear brakes jam when brakes are actuated.	<b>H</b>

(Cont. d)










**TROUBLESHOOTING PROCEDURE**

<b>TROUBLES AND SYMPTOMS</b>	<b>FAULT ISOLATION</b>	<b>TEST REFERENCE</b>
<b>INEFFICIENT PARKING BRAKE</b>	Rear wheels are not locked when parking brake is actuated.	<b>I</b>
<b>REAR BRAKES REMAIN JAMMED WHEN PARKING BRAKE IS RELEASED</b>		<b>J</b>





<b>EXCESSIVE PEDAL TRAVEL</b>	<b>TEST A</b>
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TEST STEPS		RESULTS	REMEDY
<b>A1</b>	<b>FLUID LEAKAGE VISUAL CHECK</b>		
<ul style="list-style-type: none"> <li>- Visually check for fluid leakage from brake pump, brake regulator, lines and fittings of brake system</li> </ul>		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	<p>Carry-out step A2</p> <p>Tighten fittings or replace damaged parts</p>
<b>A2</b>	<b>TRAPPED AIR CHECK</b>		
<ul style="list-style-type: none"> <li>- Check for presence of air trapped into brakes hydraulic circuit</li> </ul>		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	<p>Carry-out step A3</p> <p>See TEST B</p>
<b>A3</b>	<b>SLACK ADJUSTER CHECK</b>		
<ul style="list-style-type: none"> <li>- Check slack adjuster of parking brake for proper operation</li> </ul>		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	<p>Replace affected rear brake callper</p>

End of test A





<b>DAMPENED PEDAL TRAVEL</b>	<b>TEST B</b>
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TEST STEPS		RESULTS	REMEDY
<b>B1</b>	<b>TRAPPED AIR CHECK</b>		
	- Check for presence of air trapped into brakes hydraulic circuit	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Carry-out <b>step B2</b>
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	<b>Purge trapped air</b> from circuit
<b>B2</b>	<b>HOSES CHECK</b>		
	- Check that hoses are not bulged due to deterioration	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Carry-out <b>step B3</b>
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Replace hoses and <b>purge trapped air</b> from circuit
<b>B3</b>	<b>CALIPERS CHECK</b>		
	- Check that seals of brake calipers are not worn	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Carry-out <b>step B4</b>
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Replace affected <b>brake caliper</b>
<b>B4</b>	<b>BRAKE FLUID CHECK</b>		
	- Check that brake fluid is of approved type and quantity	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	Replace with approved <b>brake fluid</b> and <b>purge trapped air</b> from circuit















<b>STIFFENING OF PEDAL TRAVEL</b>	<b>TEST C</b>
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TEST STEPS		RESULTS	REMEDY
<b>C1</b>	<b>ONE-WAY VALVE CHECK</b>		
	- Check that one-way valve is not damaged	<div style="display: flex; align-items: center; gap: 20px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step C2</b>
		<div style="display: flex; align-items: center; gap: 20px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace <b>one-way valve</b>
<b>C2</b>	<b>CALIPERS CHECK</b>		
	- Check integrity of vacuum line (from servo-unit to intake manifold)	<div style="display: flex; align-items: center; gap: 20px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step C3</b>
		<div style="display: flex; align-items: center; gap: 20px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace <b>vacuum-level</b>
<b>C3</b>	<b>FITTINGS AND CLAMPS CHECK</b>		
	- Check fittings and clamps of servo-unit vacuum line for integrity	<div style="display: flex; align-items: center; gap: 20px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace defective parts. If trouble remains, replace <b>servo-unit</b>






<b>INSUFFICIENT BRAKING</b>	<b>TEST D</b>
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TEST STEPS		RESULTS	REMEDY
<b>D1</b>	<b>TRAPPED AIR CHECK</b>		
	- Check for presence of air trapped into brakes hydraulic circuit	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step D2</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Purge trapped air from circuit
<b>D2</b>	<b>BRAKE PADS SURFACE CHECK</b>		
	- Check for presence of grease, oil, mud or water on pads surface	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step D3</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Clean and check pads; eliminate causes of trouble; replace pads if necessary
<b>D3</b>	<b>DISCS AND PADS CHECK</b>		
	- Check discs and pads for wear or damage; check that pads are of approved type	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step D4</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace pads; grind or replace discs, as necessary
<b>D4</b>	<b>PEDAL TRAVEL CHECK</b>		
	- Check brake pedal for overtravel	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step D5</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	See <b>TEST A</b>





















<b>INSUFFICIENT BRAKING</b>	<b>TEST D</b>
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<b>TEST STEPS</b>		<b>RESULTS</b>	<b>REMEDY</b>
<b>D5</b>	<b>CALIPERS PISTON CHECK</b>	 A circle containing the letters "OK" with a diagonal slash through it, followed by a right-pointing triangle.	<b>Replace calipers</b>
	↻ Check calipers pistons for wear or seizing		





<b>CAR DRIFTS DURING BRAKING</b>	<b>TEST E</b>
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TEST STEPS		RESULTS	REMEDY
<b>E1</b>	<b>TIRES INFLATION PRESSURE CHECK</b>		
	- Check that tires are inflated to correct pressure	 	Carry-out <b>step E2</b>
		 	Restore correct inflation pressure
<b>E2</b>	<b>BRAKE PADS SURFACE CHECK</b>		
	- Check for presence of grease, oil, mud or water on pads surface	 	Carry-out <b>step E3</b>
		 	Clean and check pads; eliminate causes of trouble; replace pads if necessary
<b>E3</b>	<b>BRAKE PADS WEAR CHECK</b>		
	- Check pads installed on same axle for different wear	 	Carry-out <b>step E4</b>
		 	Replace pads and check calipers for proper operation; replace calipers if necessary
<b>E4</b>	<b>DISCS CHECK</b>		
	- Check that discs are of same manufacturer and dimension	 	Carry-out <b>step E5</b>
		 	Replace discs

(Cont'd)







<b>CAR DRIFTS DURING BRAKING</b>	<b>TEST E</b>
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TEST STEPS		RESULTS	REMEDY
<b>E5</b>	<b>LOAD PROPORTIONING VALVE CHECK</b>		
	- Check that load proportioning valve is serviceable and properly adjusted	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">OK</div> <div style="font-size: 24px; margin-right: 10px;">▶</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;"><del>OK</del></div> <div style="font-size: 24px; margin-right: 10px;">▶</div> </div> </div>	<p>Carry-out step E6</p> <p>Adjust or release load proportioning valve as necessary</p>
<b>E6</b>	<b>WHEEL ALIGNMENT CHECK</b>		
	- Check that wheel alignment is correctly adjusted	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;"><del>OK</del></div> <div style="font-size: 24px; margin-right: 10px;">▶</div> </div>	Adjust wheel alignment (see Group 21)

End of test








<b>VIBRATIONS DURING BRAKING</b>	<b>TEST F</b>
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TEST STEPS		RESULTS	REMEDY
<b>F1</b>	<b>BRAKE DISCS CHECK</b>		
	- Check that brake discs are not buckled or oxidated	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="text-align: center; margin-right: 10px;">  </div> <div style="margin-right: 10px;">▶</div> </div> <div style="display: flex; align-items: center;"> <div style="text-align: center; margin-right: 10px;">  </div> <div style="margin-right: 10px;">▶</div> </div>	<p>Carry-out <b>step F2</b></p> <p>Grind or replace affected <b>disc</b>, as necessary</p>
<b>F2</b>	<b>DISCS OVERHEATING CHECK</b>		
	- Check discs for overheating (due to excessive stress)	<div style="display: flex; align-items: center;"> <div style="text-align: center; margin-right: 10px;">  </div> <div style="margin-right: 10px;">▶</div> </div>	<p>Replace <b>pads</b>; grind or replace <b>discs</b> as necessary</p>





<b>SQUEAK OR CREAKING DURING BRAKING</b>	<b>TEST G</b>
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TEST STEPS		RESULTS	REMEDY
<b>G1</b>	<b>BRAKE PADS SURFACE CHECK</b>		
	- Check that braking surfaces of pads are not "vitrified"	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out step G2
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace pads and check disc
<b>G2</b>	<b>BRAKE PADS CHECK</b>		
	- Check that brake pads are of approved type	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace with approved-type pads

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**End of test G**


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**22 - 50**

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<b>JAMMING OF REAR BRAKES</b>	<b>TEST H</b>
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<b>TEST STEPS</b>		<b>RESULTS</b>	<b>REMEDY</b>
<b>H1</b>	<b>LOAD PROPORTIONING VALVE CHECK</b>		
- Check load proportioning valve for proper operation			Replace load proportioning valve












<b>INEFFICIENT PARKING BRAKE</b>	<b>TEST I</b>
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TEST STEPS		RESULTS	REMEDY
<b>I1</b>	<b>ADJUSTMENT CHECK</b>		
	- Check that adjusting nut is properly set	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step I2</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Re-adjust by nut located under parking brake
<b>I2</b>	<b>CONTROL CABLE CHECK</b>		
	- Check control cable for damage or breaking	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Carry-out <b>step I3</b>
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Replace <b>control cable</b>
<b>I3</b>	<b>CABLE CONNECTION CHECK</b>		
	- Check cable connection for damage	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">  </div> <div style="font-size: 2em;">▶</div> </div>	Check and eliminate cause of trouble





<b>REAR BRAKES REMAIN JAMMED WHEN PARKING BRAKE IS RE-LEASED</b>	<b>TEST J</b>
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TEST STEPS		RESULTS	REMEDY
<b>J1</b>	<b>CONTROL CABLE TRAVEL CHECK</b>		
	- Check return travel of cable for freedom of movement	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	<p>Carry-out <b>step J2</b></p> <p>Eliminate any interference or replace <b>control cable</b></p>
<b>J2</b>	<b>LEVER PUSHBUTTON CHECK</b>		
	- Check pushbutton for freedom of movement	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	<p>Carry-out <b>step J3</b></p> <p>Disassemble and repair <b>pushbutton</b>; replace entire <b>lever</b> if necessary</p>
<b>J3</b>	<b>CABLE CONNECTION</b>		
	- Check cable connection for damage	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">▶</div> </div>	<p>Replace <b>cable</b></p>

