

GROUP 22

CONTENTS

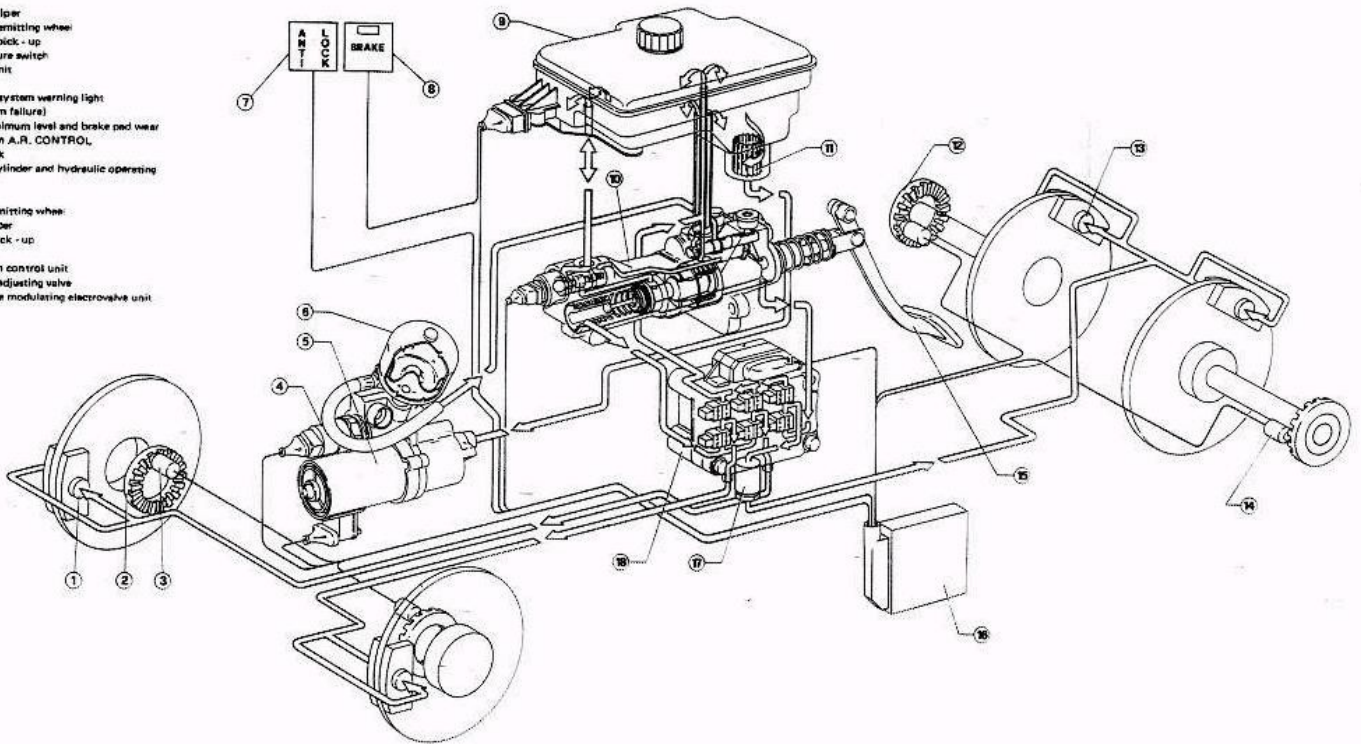
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| | | TROUBLE SHOOTING FOR THE | |
| | | (ABS) MARK II WHEEL ANTILOCK | |
| | | BRAKING SYSTEM | 22-37 |

This group is structurally similar to that of the vehicle **01V625** and consequently the disassembly and reassembly procedures remain the same except for the following:

- (ABS) MARK II wheel antilock braking system
- parking brake control lever

(ABS) MARK II BRAKING SYSTEM WITH WHEEL ANTILOCK

- 1 Front brake calliper
- 2 Front impulse emitting wheel
- 3 Front impulse pick - up
- 4 Min/max pressure switch
- 5 Electropump unit
- 6 Accumulator
- 7 ABS MARK II system warning light (antilock system failure)
- 8 Brake fluid minimum level and brake pad wear warning light on A.R. CONTROL
- 9 Brake fluid tank
- 10 Brake master cylinder and hydraulic operating cylinder
- 11 Filter
- 12 Rear impulse emitting wheel
- 13 Rear brake calliper
- 14 Rear impulse pick - up
- 15 Brake pedal
- 16 Antilock system control unit
- 17 Brake pressure adjusting valve
- 18 Braking pressure modulating electrovalve unit



The  warning light is indicated in the text with the symbol .

- The (ABS) MARK II wheel antilock system is a sophisticated computerized system designed to increase driving safety and in fact constitutes the ultimate technical guarantee as regards braking.
- An impulse pick-up (3) is assembled on each wheel and records the r.p.m. by means of an impulse emitting wheel (2) and sends it to the electronic unit (16) for data processing. The electronic unit takes direct action, if one or more wheels tend to lock, by means of electrovalves (18), adjusting the braking pressure on each wheel to prevent it locking. The electronic unit thus "takes" the pressure from the brake caliper of the wheel that is locking to "return" it only when locking no longer occurs; this "giving and taking" of pressure takes place in very short intervals of time and continues until braking ends that is of course if locking persists and independent of the pressure exerted on the brake pedal.
- On a dry, or even wet, surface the ABS system may not even go into operation for thousands of kilometers. However, in the event of sudden braking due to an unexpected obstacle or immediate danger when a traditional braking system would tend to lock, the ABS system intervenes and ensures that the "correct" braking force is applied at all times to each wheel thus allowing the vehicle to stop in the shortest possible distance compatible with the road surface.
- Other important advantages offered by the ABS system are:
 - **Complete vehicle control:** the driver at the wheel of a vehicle equipped with the ABS system can avoid any obstacles by turning the steering wheel while the driver of a vehicle without the ABS system, in the event of wheel locking, would not be able to carry out the same maneuver in as much as the vehicle goes out of control and may skid dangerously.
 - **More even tyre wear:** as the wheels never lock; the tyres will never suffer damage due to tyre abrasion on the asphalt.
- The (ABS) MARK II wheel anti-

lock braking system is equipped with a hydraulic brake booster; an electropump unit (5) with accumulator (6) sucks in oil directly from the tank (9) and, having taken it to a pressure of 140 thru 180 bar (13.970 thru 17.960 kPa; 142.5 thru 183.2 kg/cm²;) then sends it to the hydraulic operating cylinder. During normal braking, that is when no wheels lock and therefore without antilock system activation, the hydraulic operating cylinder sends oil under pressure to the brake calipers of the rear wheels only while those of the front wheels are supplied with oil directly by the brake master cylinder (see: Operating principles).

- The instances where a high probability, of ABS system activation exists are examined hereafter.

Braking on a wet road surface

On a wet road surface, the (ABS) MARK II wheel antilock system guarantees considerable reduction in stopping distances and is particularly advantageous in the event of AQUAPLANING (at a certain vehicle speed the water can no longer be disposed of by the tread grooves and a film of water consequently forms between the wheel and the road surface, causing the tyre to lose its grip and impeding it from absorbing braking and steering impacts). If a vehicle not equipped with the ABS system is running at speed and yet this phenomenon has not yet arisen if the wheels lock during braking the outrush of water from the tread grooves is impeded and the phenomenon of aquaplaning may thus occur.

The ABS system, on the other hand, removes this danger because by preventing wheel lock from occurring, it allows the disposal of water via the tread grooves to continue and the tyre remains in contact with the road surface. If, however, the phenomenon of aquaplaning has already begun, the ABS system, although it comes into action, is no longer able to

assure efficacious control of the vehicle during braking.

Braking on a slippery road surface

The ABS system may activate more frequently on a slippery road surface since the tyre grip limit is reached immediately subsequent to brake activation.

If the vehicle is to be stopped in the shortest distance possible, the brake pedal may be pressed down hard to solicit the activation of the ABS on all wheels.

Braking on loose road surface

If, on the other hand the road surface is not compact (sand, gravel, soft snow or mud), vehicles equipped with the ABS system can stop in shorter distances compared to vehicles without locked wheels, in fact, penetrate deeper into the ground and allow increased tyre function surface, thus guaranteeing a shorter stopping distance; this notwithstanding, the ABS system is most useful on this type of surface because it still assures complete handling of the vehicle.

Braking on different holding coefficients

It is possible for the wheels of the same axis to be running on surfaces which have varying holding co-efficients (for example, on ice at the right and dry asphalt at the left).

During braking the vehicle will tend to turn towards the dry asphalt, that is towards the side with the greater holding coefficient due to the arisal of a swaying torque as compared to the vertical axis of the vehicle.

This phenomenon arises both on vehicles equipped with the ABS system and those with a traditional braking system; whereas for the latter there is no remedy, in the former steering is by no means jeopardized and the driver may compensate for the swaying torque by counter-steering the vehicle and thus keeping it straight.

Traffic conditions permitting, on these occasions it is wise not to press the brake too hard so that the driver can apply the adequate steering reaction necessary.

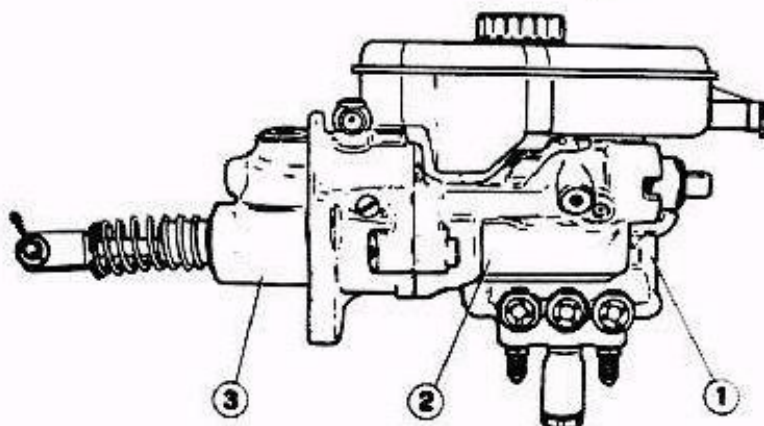
WARNING:

Under no circumstances should the (ABS) MARK II antilock system induce the driver to drive dangerously or take risks. For the safety of the driver and others it is always necessary to observe speed limits, safe distances and to maintain a prudent approach to driving especially when road surface conditions so demand.

(ABS) MARK II WHEEL ANTILOCK SYSTEM COMPONENTS

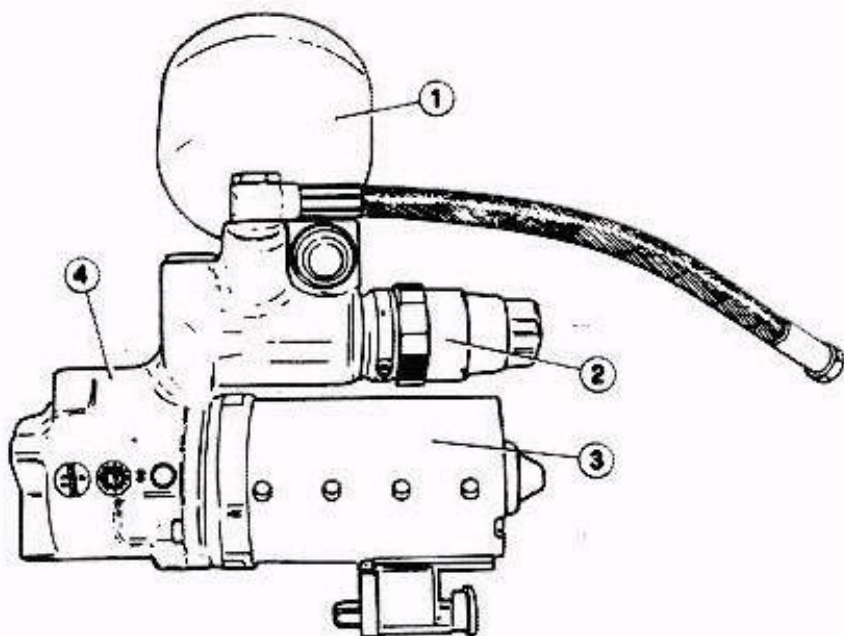
The ABS system installed by Alfa Romeo on some of its cars is manufactured by ALFRED TEVES GmbH (ATE): the system components are:

Hydraulic assembly: comprising a high pressure hydraulic operating cylinder (3), a master cylinder (2) and braking pressure modulating electrovalves (1).



- 1 Braking pressure modulating electrovalve unit
- 2 Brake master cylinder
- 3 Hydraulic operating cylinder

Electropump unit: comprising a pump (4) activated by an electric motor (3), an accumulator (1) (containing the brake fluid at a pressure between 140 and 180 bar (13,970 thru 17,960 kPa; 142.5 thru 183.2 kg/cm²;) and a pressure switch (2).



- 1 Accumulator
- 2 Pressure switch
- 3 Electric motor
- 4 Pump

FRONT AND REAR BRAKES

Impulse pick-ups and impulse emitting wheels: assembled one on each wheel to detect r.p.m..

Electronic unit: this represents the intelligent unit of the entire system in that it is capable of processing all the input signals deriving from the impulse pick-ups

and outputting the control signals to the braking pressure modulating electrovalves.

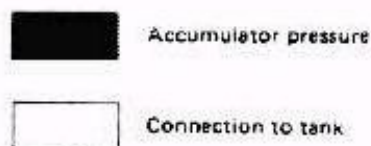
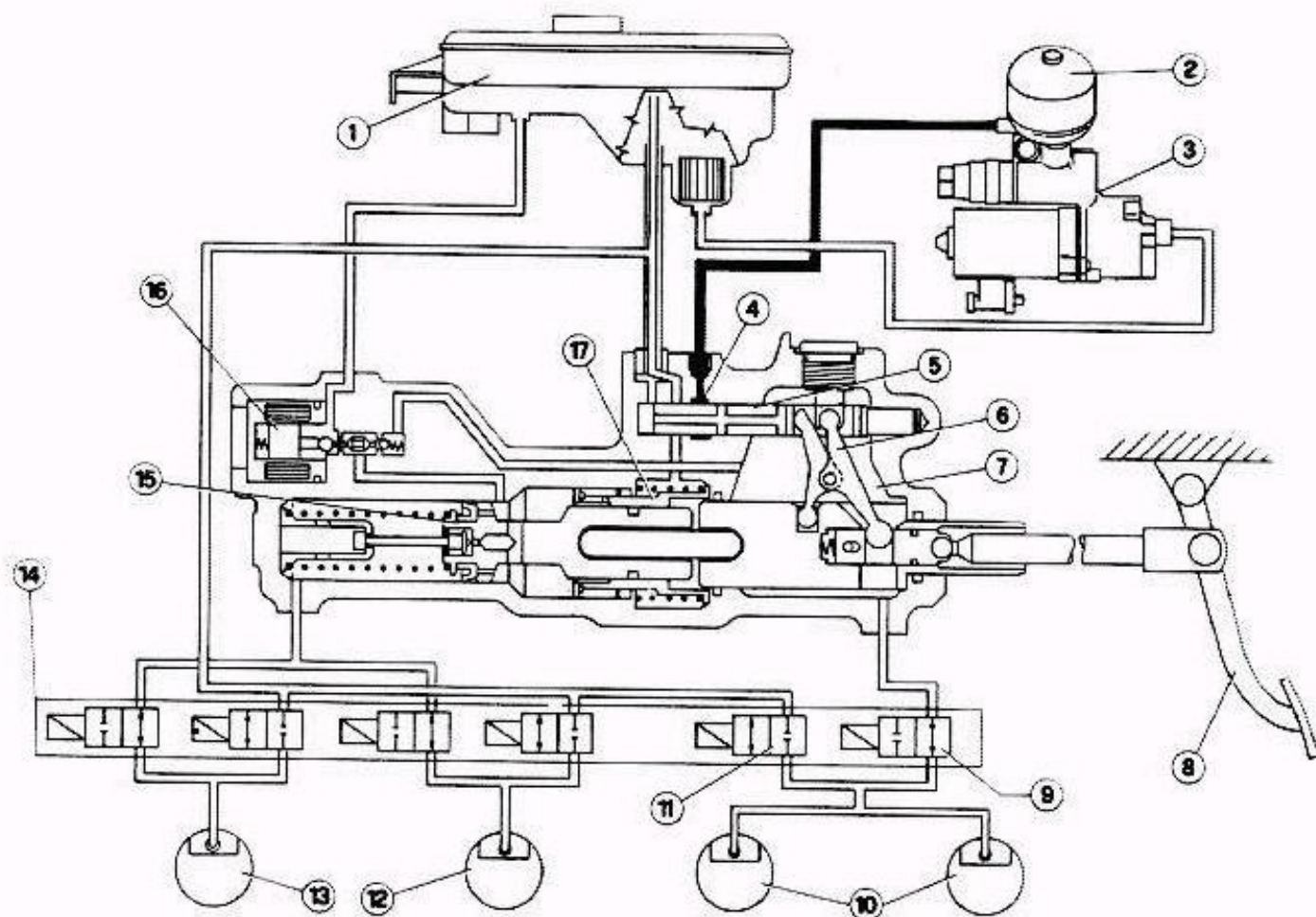
ABS MARK II system warning light **A.L.** system: assembled on the instrument panel, it notifies the driver of ABS system auto cut off

when the electronic unit has encountered a failure (which may only be temporary).

With the warning light **A.L.** illuminated but "BRAKE" on the A.R. CONTROL extinguished it is still possible to carry out normal servoassisted braking actions.

OPERATING PRINCIPLES

BRAKE NON APPLIED



- | | | | |
|---|--|----|---|
| 1 | Brake fluid tank | 10 | Rear wheels |
| 2 | Accumulator | 11 | Drain electrovalve, normally closed |
| 3 | Electropump unit | 12 | R.H. front wheel |
| 4 | Chamber with high pressure brake fluid | 13 | L.H. front wheel |
| 5 | Adjusting valve | 14 | Braking pressure modulation electrovalves |
| 6 | Leverage | 15 | Brake master cylinder |
| 7 | Hydraulic operating cylinder | 16 | Main electrovalve |
| 8 | Brake pedal | 17 | Positioning bush |
| 9 | Load electrovalve, normally open | | |

FRONT AND REAR BRAKES

The braking circuit is subdivided into three sections:

- Front wheels: controlled by separate hydraulic circuits.
- Rear wheels: controlled by a single hydraulic circuit.

The ABS system is thus based on **INDIVIDUAL ADJUSTMENT** of the front wheels and according to the **SELECT-LOW** principle for the rear wheels. The term select-low means that the electronic unit processes the signals coming from the

impulse pick-ups of the rear wheels separately and carries out the same adjustment on both wheels according to which one tends to lock.

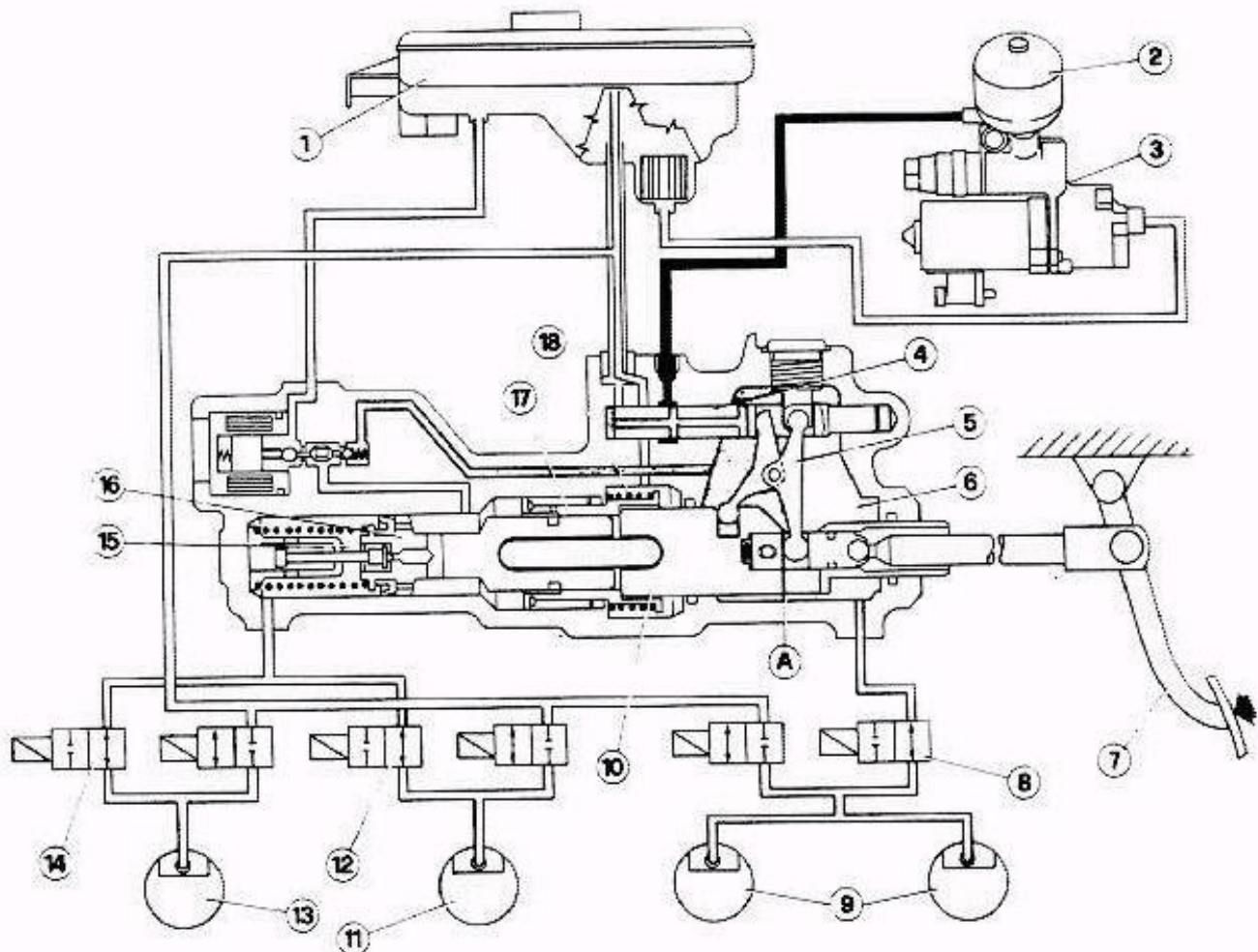
Bear in mind that brake fluid is always present in the accumulator (2) at a pressure between 140 and 180 bar (13,970 thru 17,960 kPa; 142.5 thru 183.2 kg/cm²; 2025.67 thru 2604.42 p.s.i.) and that this high pressure is exerted right up to the chamber (4) of the adjusting valve (5).

If braking is not in progress none of the other areas are under pressure (*).

(*) Prior to carrying out repair work involving the removal of system components, it is necessary to discharge braking system pressure as follows:

- remove the ignition key.
- press the brake pedal down repeatedly (at least 20 times) until it sticks.

BRAKING WITHOUT ANTILOCK SYSTEM ACTIVATION



■ Accumulator pressure

□ Connection to tank

■ Dynamic circuit

□ Static circuit

1 Brake fluid tank

2 Accumulator

3 Electropump unit

4 Adjusting valve

5 Leverage

6 Hydraulic operating cylinder

7 Brake pedal

8 Load electrovalve, normally open

9 Rear wheels

10 Brake piston

11 R.H. front wheel

12 Load electrovalve, normally open

13 L.H. front wheel

14 Load electrovalve, normally open

15 Cylinder

16 Brake master cylinder

17 Positioning bush

18 Spring

FRONT AND REAR BRAKES

During normal braking the ABS control system is not activated in as much as none of the wheels decelerates at such a rate as to be interpreted by the electronic unit as a tendency to lock; braking therefore occurs as a normal servo assisted action. Each of the three hydraulic circuits (two front and a single rear one) is controlled by means of two electrovalves: a load one which is normally open and a drain one, normally closed.

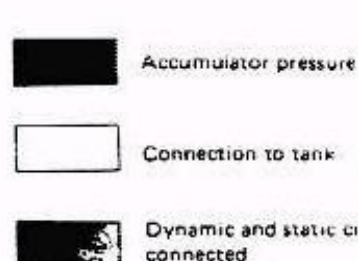
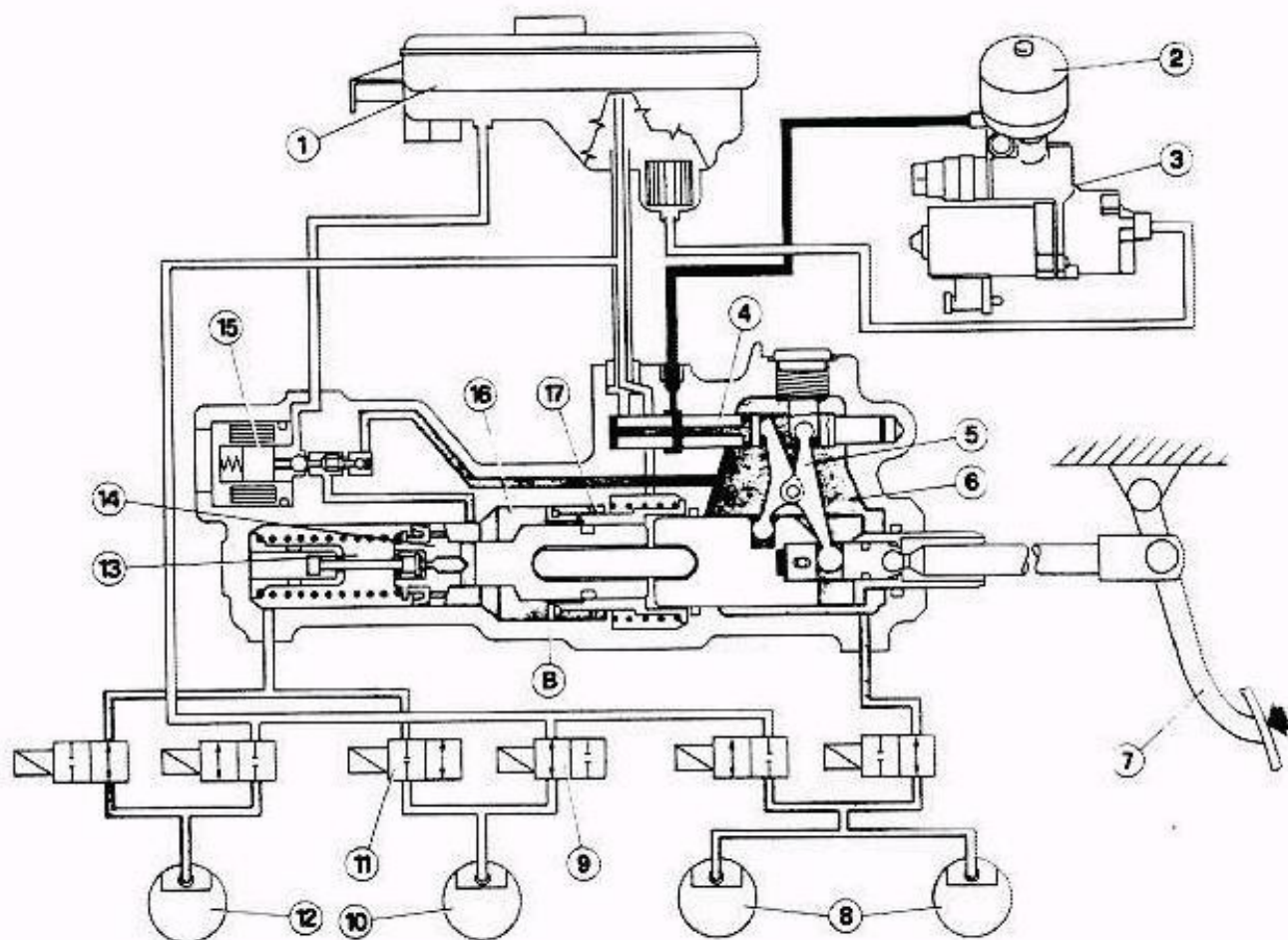
On activation of the brake pedal, the adjusting valve (4) opens by means of the

leverage (5) thus generating in the hydraulic operating cylinder (6) a pressure which is proportional to the force applied to the brake pedal. This pressure is used directly to activate the rear axis brakes (DYNAMIC CIRCUIT) by means of the load electrovalve (8), normally open. Moreover, by acting on surface (A) of brake piston (10), this pressure produces a force which goes to aid of that exerted by the driver on the brake pedal; these two forces simultaneously activate the master cylinder

(16) and a further braking pressure is created, in the cylinder (15), which is transmitted to the front brake calipers (STATIC CIRCUIT) by means of load electrovalves (12) and (14), normally open.

By further increasing pressure on the brake pedal, piston (10) reaches positioning bush (17), pulling it into motion. This does not affect the activation however in as much as the pressure of the spring (18) against the bushing is very slight and therefore imperceptible at the pedal.

BRAKING WITH ACTIVATION OF THE ANTILOCK SYSTEM



- | | | | |
|---|-------------------------------------|----|---------------------------------------|
| 1 | Brake fluid tank | 10 | R, H, front wheel |
| 2 | Accumulator | 11 | Load electrovalve, normally open |
| 3 | Electropump unit | 12 | L, H, front wheel |
| 4 | Adjusting valve | 13 | Cylinder |
| 5 | Leverage | 14 | Brake master cylinder |
| 6 | Hydraulic operating cylinder | 15 | Main electrovalve |
| 7 | Brake pedal | 16 | Chamber behind master cylinder gasket |
| 8 | Rear wheels | 17 | Positioning bush |
| 9 | Drain electrovalve, normally closed | | |

If, during activation of the braking system, a wheel, the front RH (10) for example, tends to lock, then the associated loading electrovalve (11) closes and the drain electrovalve (9) opens.

Following this the pressure on the brake caliper decreases, on account of the return circuit to the brake fluid tank (1) being opened.

At the same time the main electrovalve (15) is energized and the dynamic circuit (rear) is connected to the static one (front). When the wheel being braked starts to regain speed, following the decrease in pressure at the calipers, the drain electrovalve is closed and the loading one opened again. In this way, pressure is gradually restored to the brake calipers by means of the main electrovalve (15) which connects the hydraulic operating cylinder (6), to the cylinder (13), until the next tendency to lock is detected, at which point the cycle repeats itself.

During ABS control, the high pressure acting on the surface (B) of the positioning bush (17) restricts brake pedal travel. This means that, even in the event of a failure during ABS system operation, there is always a certain volume of reserve fluid. ABS control concluded (during or on termination of the braking action), the main electrovalve is de-activated, thus severing the connection between the hydraulic operating cylinder and master cylinder.

Besides this, the chamber (16), at the rear of the master cylinder gasket, is reconnected to the tank and the positioning bush (17) de-activated.

Normal brake activation is thus restored.

BRAKE SYSTEM BLEEDING

CAUTION:

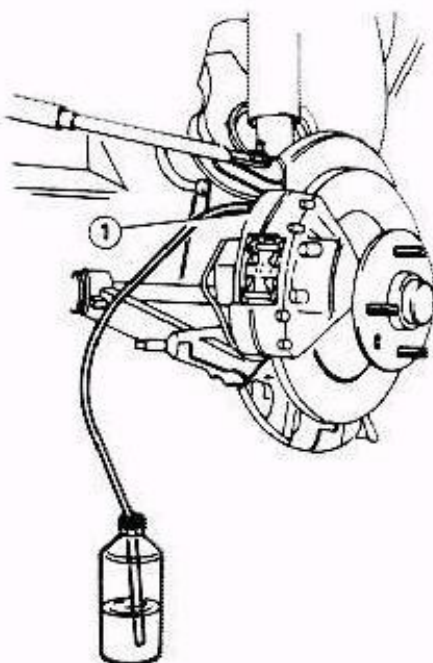
- a) Check that fluid level does not fall below minimum during bleeding, especially when working on the rear calipers as the high pressure oil tends to spurt.

- b) Do not reuse fluid after draining.
- c) Brake fluid is harmful to paintwork: avoid contact.
- d) Do not carry out this operation simultaneously on front and rear brake calipers, but first on one side, then on the other.
- e) The electropump should never idle as this may cause damage; ensure that there is sufficient fluid in the tank.

WARNING:

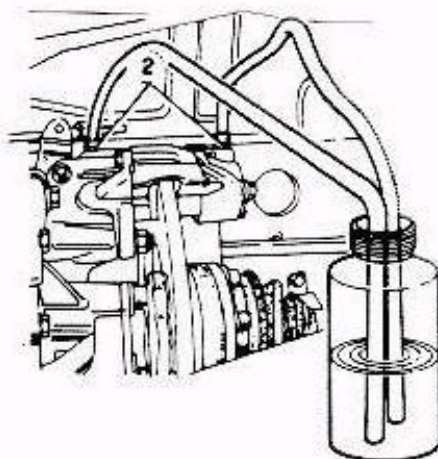
The system contains pressurized fluid; WORK WITH CAUTION.

1. Place car on a lift.
2. If necessary, fill up tanks with the recommended fluid (ATE "S" or AGIP Brake Fluid Super or IP Auto Fluid FR).
3. Raise car and remove dust excluders from brake calipers bleed points.
4. Front brake system bleeding.
 - a. Connect a hose to bleed screw (1) and dip the other hose end in a container filled with the recommended brake fluid.



1 Front brake bleed screw

- b. Slacken bleed screw and pump the brake pedal; allow brake pedal to return and pause a few seconds between each stroke and the next; keep pumping until issuing fluid is free from air bubbles. Tighten bleed screw and remove hose.
- c. Repeat steps a. and b. on the other front caliper.
- 5. Rear brake system bleeding.
 - a. Turn key to IGNITION, check electropump activation and await disconnection.
 - b. Connect a hose to bleed screws (2) and dip the other hose ends in a container filled with the recommended brake fluid.



2 Rear brake bleed screws

- c. Slacken bleed screws and keep brake pedal slightly pressed until issuing fluid is free from bubbles. Tighten bleed screws and remove hoses.
- d. Repeat the operations described at steps b. and c. on the other two rear bleed screws.
- 6. Reinstall dust excluders and top up level in tank.
- 7. If bleeding has been carried out correctly, no sponginess should be felt after initial free travel; contrarily, repeat bleeding.

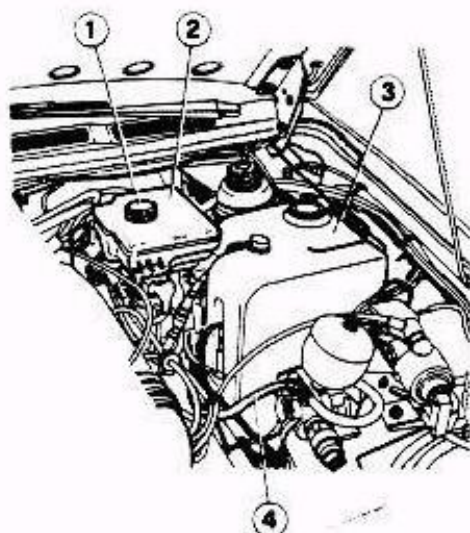
PEDALS

REMOVAL

WARNING:

Prior to removing, discharge brake system pressure; with the ignition key removed, press the brake pedal down hard repeatedly (at least 20 times) until it sticks.

1. Disconnect the battery.
2. Remove windshield washing liquid container (3) to create greater working space.
3. Drain the clutch and brake fluid from the tank thus.
 - a. Remove plug (1) from tank (2).

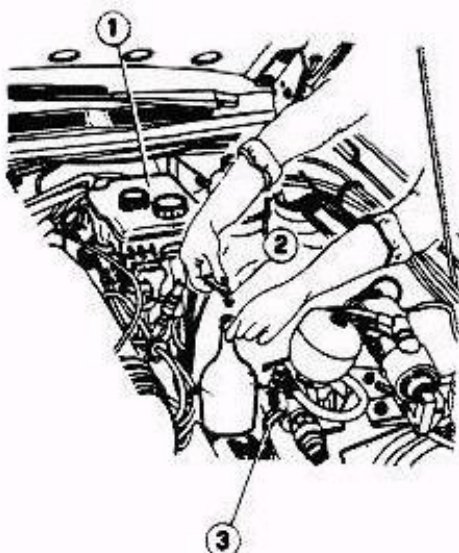


- 1 Plug
- 2 Clutch and brake fluid tank
- 3 Windshield washing liquid container
- 4 Electropump feed hose

- b. Disconnect the feed hose (2), from the electropump (3) and collect fluid directly beneath the tank (1).

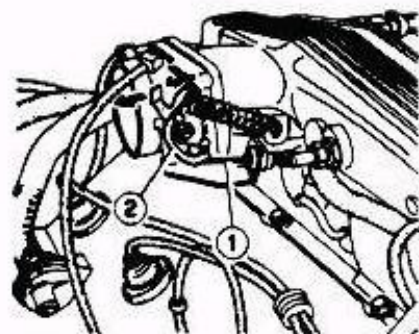
CAUTION:

Clutch and brake fluid is corrosive; protect paintwork adequately.



- 1 Clutch and brake fluid tank
- 2 Electropump feed hose
- 3 Electropump

4. Detach the pawl from the accelerator control lever (2) then slip out the cable (1) complete with sheath from under the plenum chamber and release it from the sheath fastener on the pedal assy.

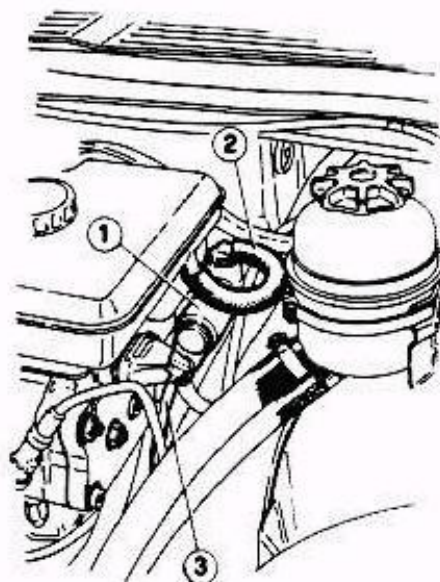


- 1 Accelerator control cable
- 2 Accelerator control lever

5. Disconnect pipe union (3) and supply duct (2) from the clutch master cylinder (1).

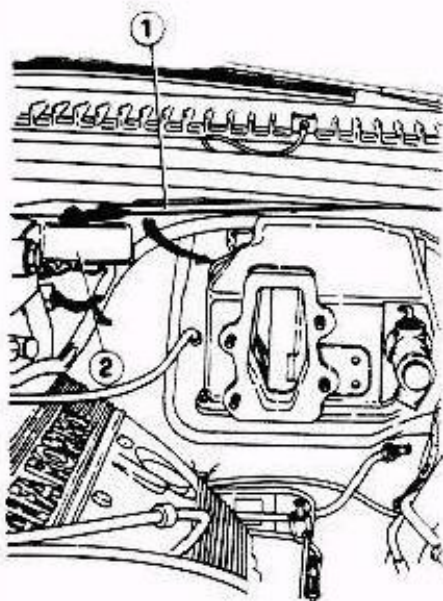
CAUTION:

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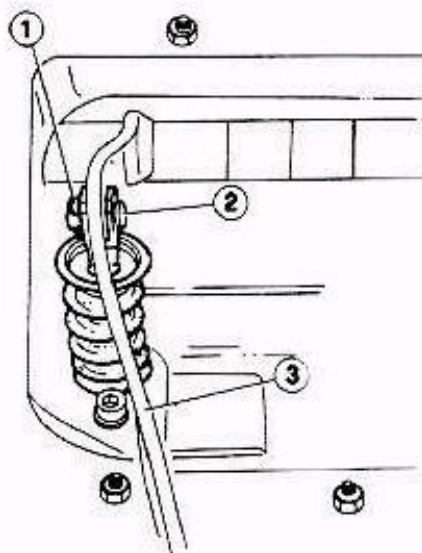
- 1 Clutch master cylinder
- 2 Clutch master cylinder feed duct
- 3 Clutch system pipe

6. Carry out the operations described at steps 4., 5., 6., 7., 8. and 9. - Hydraulic Assembly - Removal.
7. Disconnect 5th and 6th cylinder spark plug cables; disconnect wiring harness from terminal board to permit pedal removal.
8. Back off the nut and disconnect the lever ① from the motor ② then turn the lever as shown by the arrow to extract the pedal.



- 1 Windshield wiper control lever
- 2 Windshield wiper motor

9. From car interior, slip off the cable sheath from the previously disconnected accelerator cable.
10. Remove from clutch pedal ③, cotter pin ① with washer and slide off pin ②.



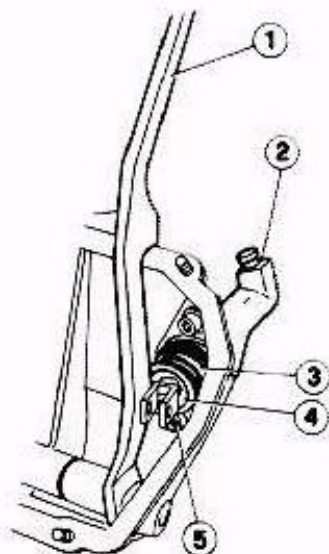
- 1 Cotter pin
- 2 Pin
- 3 Clutch pedal

11. Back off nuts securing pedal assy to body.
12. Extract pedal assy from engine compartment.

DISASSEMBLY

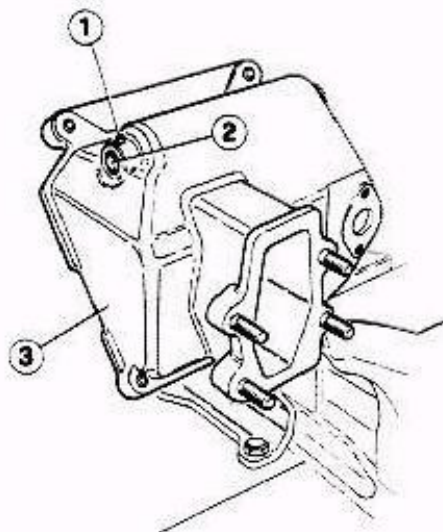
Disassemble pedal as follows:

1. Remove cup ④ and slip off return spring ③ of clutch pedal ①.
2. Back off and remove the two screws ⑤, securing the clutch master cylinder ② and take off pump.



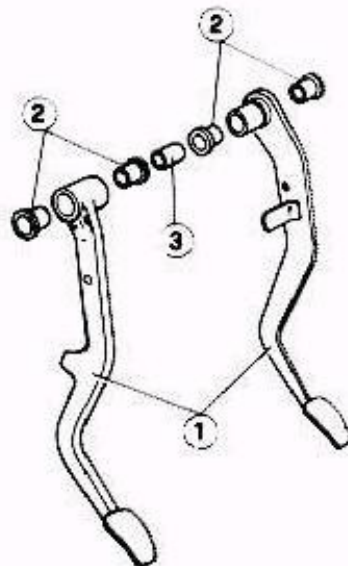
- 1 Clutch pedal
- 2 Clutch master cylinder
- 3 Return spring
- 4 Cup
- 5 Screw securing clutch master cylinder to pedal support

3. Extract check pin ① and remove pedal pin ② from the pedal support ③.



- 1 Pin
- 2 Pedal pin
- 3 Pedal support

4. Disassemble the pedals ①, remove the bushings ② and keep the spacer ③.



- 1 Pedal
- 2 Bush
- 3 Spacer

Inspection

1. Check bushings and associated housings on pedals, pin and spacer for wear and seizure, replacing as necessary.
2. Check return springs of clutch pedal for weakness, replacing as necessary.

ASSEMBLY

Assemble pedals in reverse order of removal, adhering to the instructions given below.

- Apply a film of the recommended grease (ISECO Molykote Longterm no. 2) to sliding parts.

- Install clutch pedal taper spring positioning larger dia end in contact with pedals.
- Lubricate pins connecting pedals - clutch master cylinder forks with recommended grease (AGIP Grease 15).

INSTALLATION

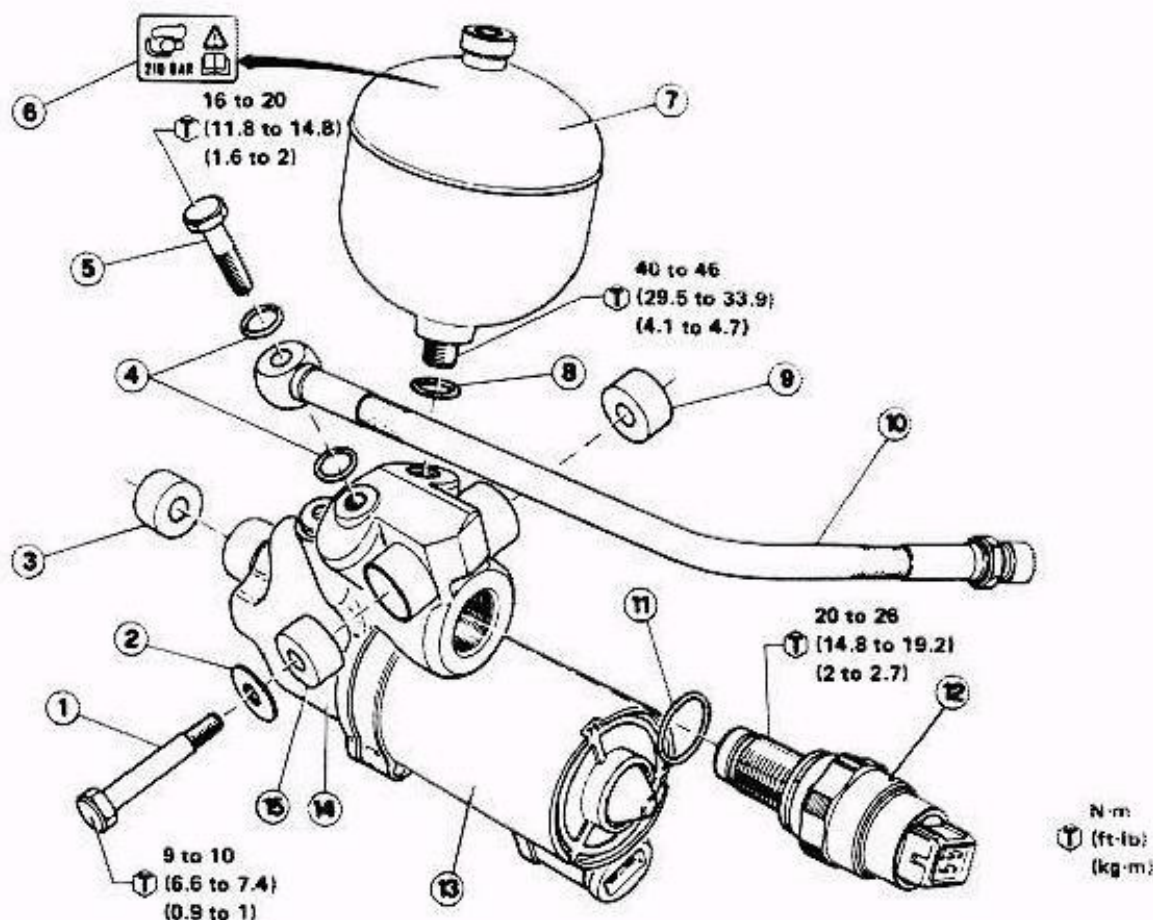
Install in reverse order of removal, adhering to the following instructions.

- Replace seal between pedal support and body if necessary.
- Observe the following tightening torque.

Ⓣ : Tightening torque
Brake and clutch hydraulic system pipe fittings
 10 thru 12 N·m
 (7.4 thru 8.9 ft·lb)
 (1 thru 1.2 kg·m)

- To install hydraulic assy to pedal assy follow steps 1 and 2 - Hydraulic Assembly - Installation.
- Fill tank with recommended fluid (ATE S; AGIP Brake Fluid Super; IP Auto Fluid FR).
- Bleed the brake system (see: (ABS) MARK II Braking System with Wheel Antilock - Brake System Bleeding)

ELECTROPUMP UNIT



- 1 Electropump unit - support securing screw
- 2 Washer
- 3 Spring bushing
- 4 O-Rings
- 5 Screw

- 6 Label
- 7 Accumulator
- 8 O-Ring
- 9 Spring bushing
- 10 Pressurized fluid feed hose

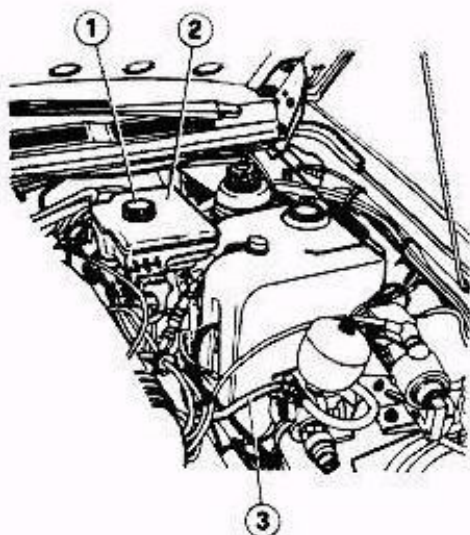
- 11 O-Ring
- 12 Pressure switch
- 13 Electric motor
- 14 Pump
- 15 Spring bushing

REMOVAL

WARNING:

Prior to removing the electropump unit it is necessary to discharge the braking system pressure; remove the ignition key and press the brake pedal right down repeatedly (at least 20 times) until it sticks.

1. Disconnect the battery.
2. Drain the brake and clutch fluid by operating as follows.
 - a. Remove plug ① from tank ②.

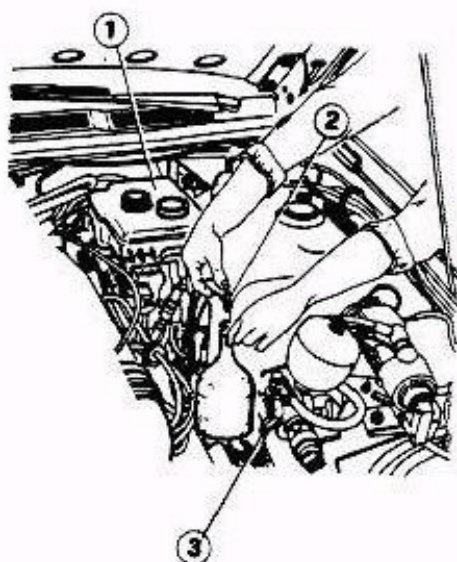


- 1 Plug
- 2 Clutch and brake fluid tank
- 3 Electropump feed hose

- b. Disconnect the feed hose ② from the electropump ③ and catch fluid drained directly from tank ①.

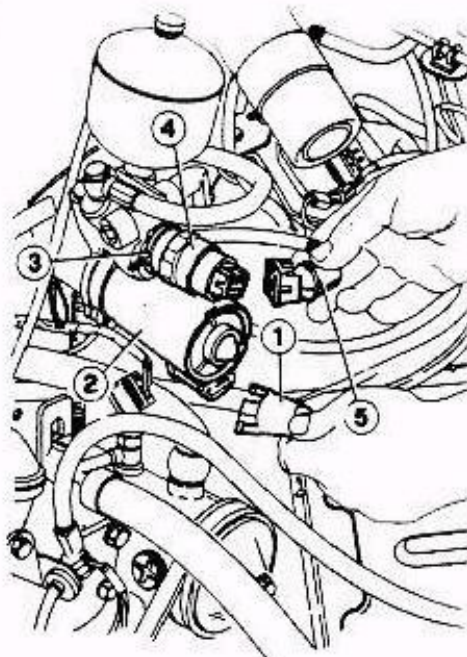
CAUTION:

Clutch and brake fluid is corrosive; protect paintwork adequately.



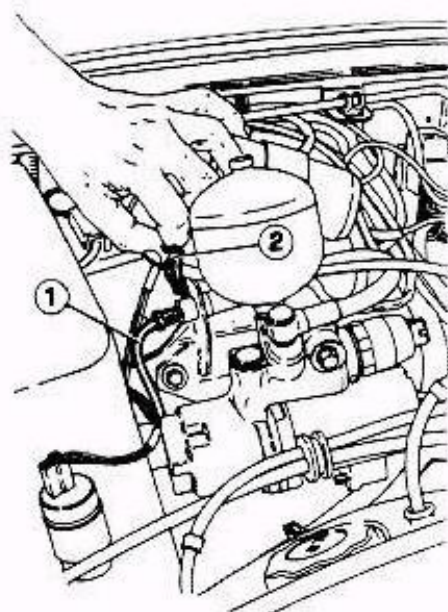
- 1 Clutch and brake fluid tank
- 2 Electropump feed hose
- 3 Electropump

3. Disconnect connector ① from the electric motor ② and connector ⑤ from the pressure switch ④. Remove clip ③.



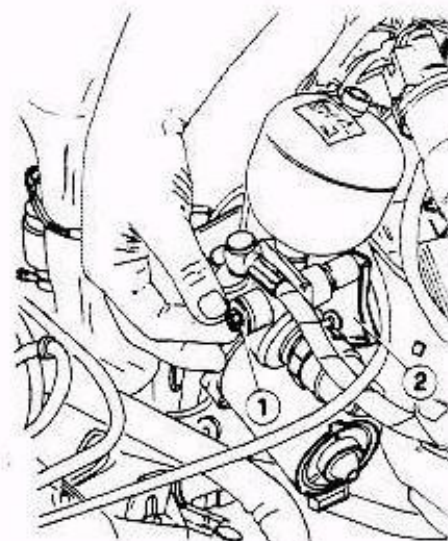
- 1 Connector for electric motor
- 2 Electric motor
- 3 Clip
- 4 Pressure switch
- 5 Connector for pressure switch

4. Disconnect the pipe ① from the electropump unit; keep spring ②.



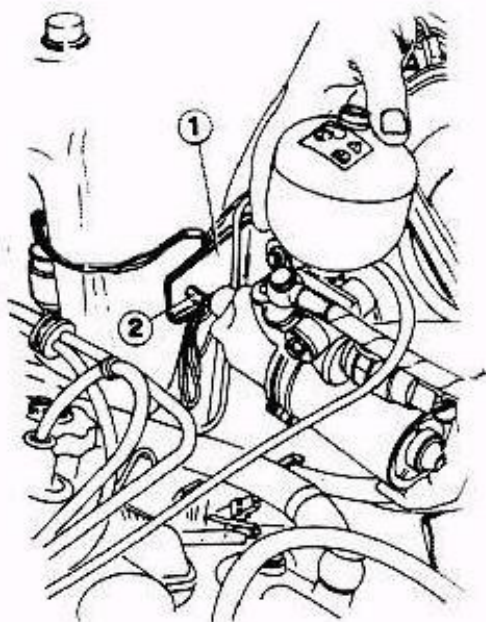
- 1 Pressurized fluid delivery pipe
- 2 Spring

5. Back off screw ① securing the electropump unit to the support ②.



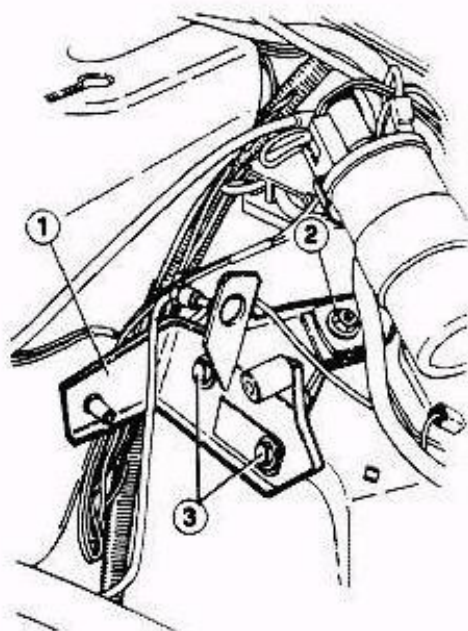
- 1 Screw
- 2 Support

6. Remove the electropump unit from the support ①, by sliding it off the pin ②.



1 Support
2 Pin

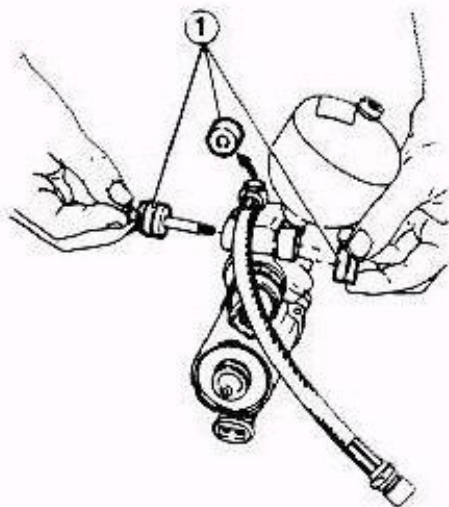
7. If necessary, remove the support ① by unscrewing screws ③ and nuts ②.



1 Support
2 Nut
3 Screws

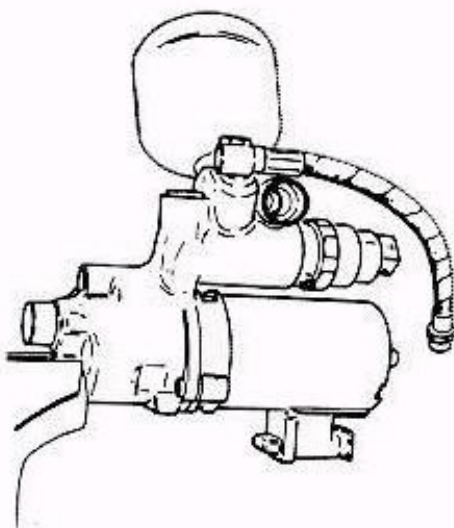
DISASSEMBLY

1. Get hold of spring bushings ①.

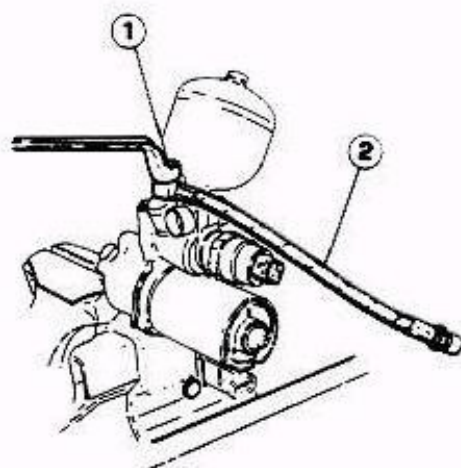


1 Spring bushings

Having clamped the electropump unit in a vise provided with jaw lines, disassemble as follows.

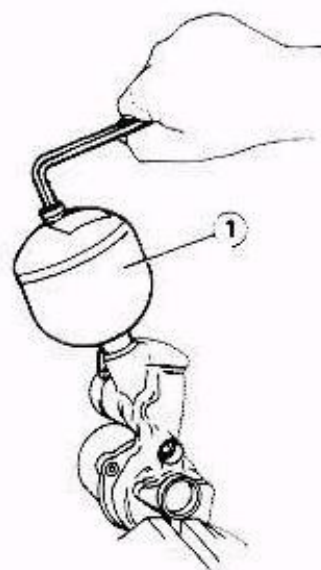


2. Unscrew screw ① and remove hose ②, retrieving the O-Rings.



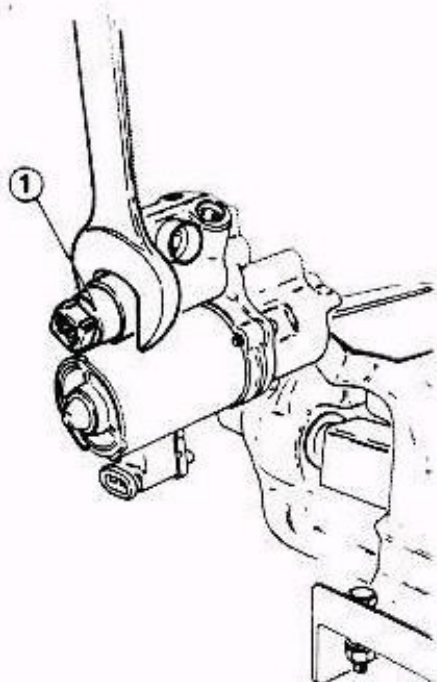
1 Screw securing hose - electropump unit
2 Hose

3. With a suitable tool, unscrew the accumulator ① from the electropump unit and retrieve the O-Ring.



1 Accumulator

4. Unscrew the pressure switch ① and remove it from the electropump unit, retrieving the O-Ring.



1 Pressure switch

Accumulator - electropump unit connection

40 thru 46 N·m
(29.5 thru 33.9 ft·lb)
(4.1 thru 4.7 kg·m)

Screw connecting hose on electropump unit

16 thru 20 N·m
(11.8 thru 14.8 ft·lb)
(1.6 thru 2 kg·m)

T : Tightening torques

Screws and nuts securing support - body

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Screw securing electropump unit - support

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Hose - pressurized fluid delivery pipe connection

16 thru 20 N·m
(11.8 thru 14.8 ft·lb)
(1.6 thru 2 kg·m)

INSTALLATION

Re-install by operating in reverse order of removal, adhering to the following instructions.

- Replace the spring bushings if damaged or worn.
- Observe the following tightening torques.
- Fill tank with recommended fluid (see: Service Data and Specifications) then bleed (see: (ABS) MARK II Braking System with Wheel Antilock - Braking System Bleeding).

CAUTION:

Do not separate the pump from the electric motor.

REASSEMBLY

Reassemble the electropump unit by operating in reverse order of removal, taking care to lock the various connections to the specified torques.

WARNING:

The circuit is a high pressure one and correct reassembly is extremely important for the safety of the vehicle during braking; adhere strictly to instructions.

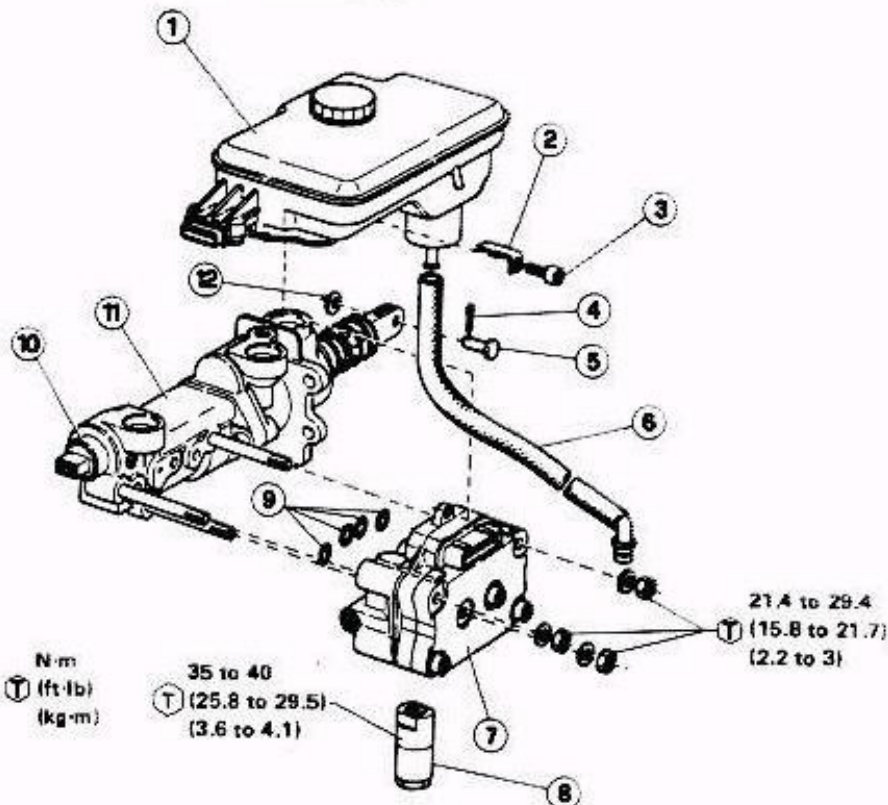
- Replace the O-Rings.
- Observe the following tightening torques.

T : Tightening torques

Pressure switch - electropump unit connection

20 thru 26 N·m
(14.8 thru 19.2 ft·lb)
(2 thru 2.7 kg·m)

HYDRAULIC ASSEMBLY



- 1 Clutch and brake fluid tank
- 2 Bracket
- 3 Screw
- 4 Cotter pin
- 5 Pin
- 6 Electropump feed hose
- 7 Braking pressure modulating electrovalve unit

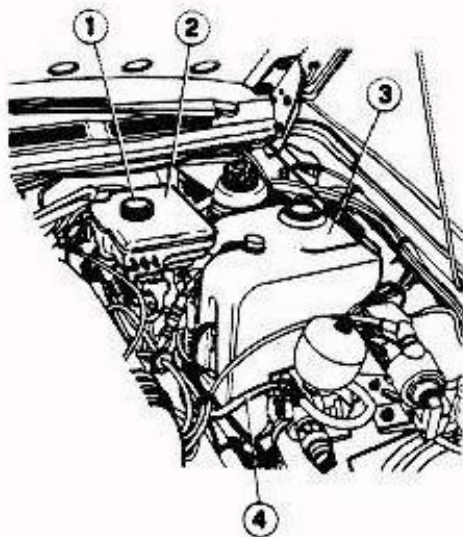
- 8 Brake pressure adjusting valve
- 9 O-Rings
- 10 Main electrovalve (cannot be separated from 11)
- 11 Brake master cylinder and hydraulic operating cylinder
- 12 Washer

REMOVAL

WARNING:

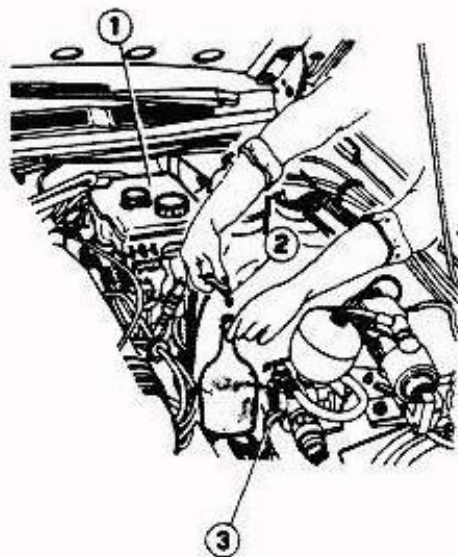
Prior to removing the hydraulic assembly it is necessary to discharge the braking system pressure; remove the ignition key and press the brake pedal right down repeatedly (at least 20 times) until it sticks.

1. Disconnect the battery.
2. Remove the windshield washing liquid container (3) to create greater working space.
3. Drain the clutch and brake fluid from the tank by operating thus.
 - a. Remove plug (1) from tank (2).



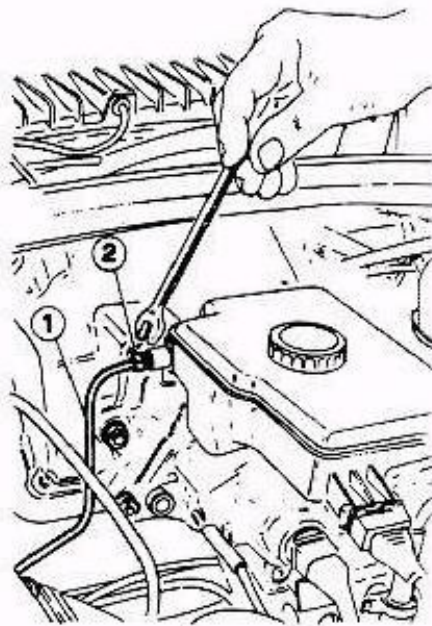
- 1 Plug
- 2 Clutch and brake fluid tank
- 3 Windshield washing liquid container
- 4 Electropump feed hose

- b. Disconnect the feed hose (2) from the electropump (3) and collect the fluid draining directly from the tank (1).



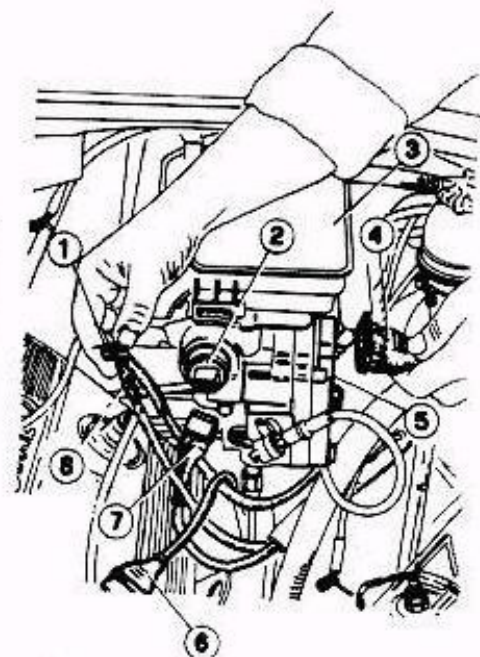
- 1 Clutch and brake fluid tank
- 2 Electropump feed hose
- 3 Electropump

4. Unscrew the union (2) and disconnect the pipe (1) from the hydraulic assembly.



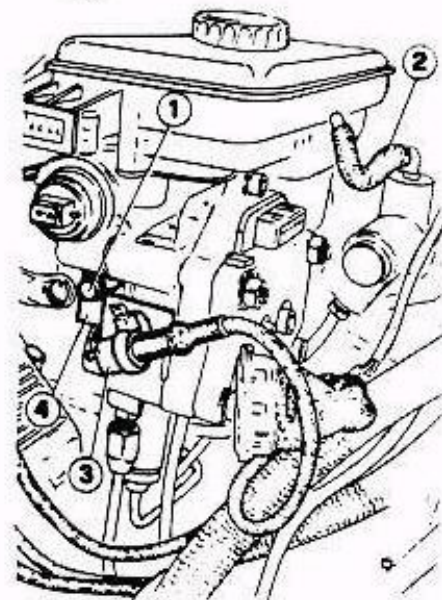
- 1 Pipe carrying pressurized fluid from the electropump unit to the hydraulic assy
- 2 Union

5. Back off the screw (1) tying the ground wires (8) to the hydraulic assy. Disconnect connector (7) from the main electrovalve (2), connector (4) from the electrovalve unit (5) and connector (6) from the tank (3).



- 1 Screw
- 2 Main electrovalve
- 3 Brake fluid tank
- 4 Connector for electrovalve unit
- 5 Electrovalve unit
- 6 Connector for brake fluid tank
- 7 Connector for main electrovalve
- 8 Ground wires

6. Back off the screw (1) securing the bracket (4) for connection (3) of the front wheel impulse pick-up to the hydraulic assy. Disconnect the clutch master cylinder supply duct (2).



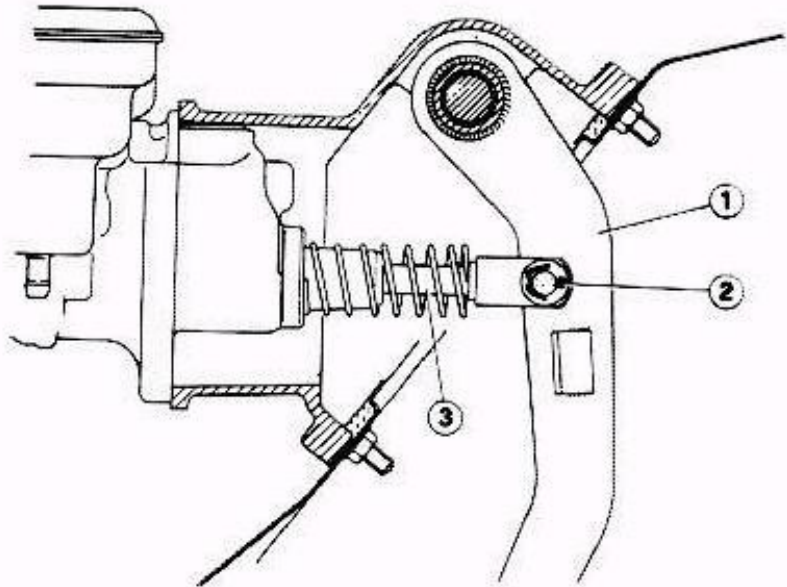
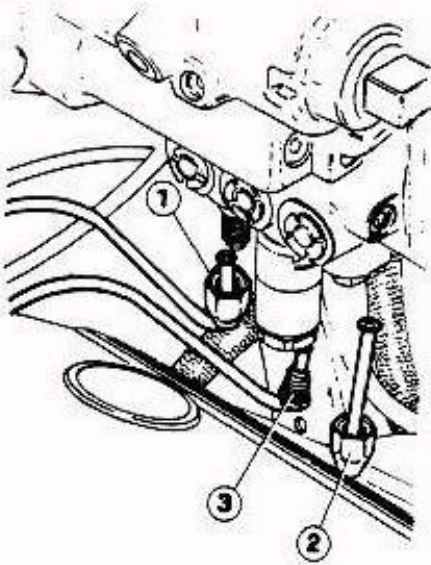
- 1 Screw
- 2 Clutch master cylinder supply duct
- 3 L.H. front wheel impulse pick-up connection
- 4 Bracket

7. Unscrew unions (1), (2) and (3) then disconnect corresponding pipes from the hydraulic assy.

CAUTION:

Clutch and brake fluid is corrosive; protect paintwork adequately.

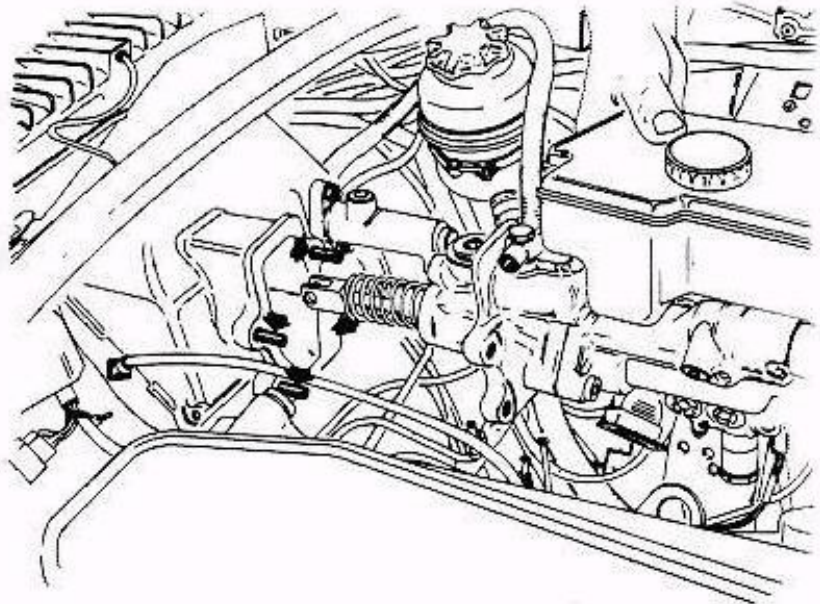
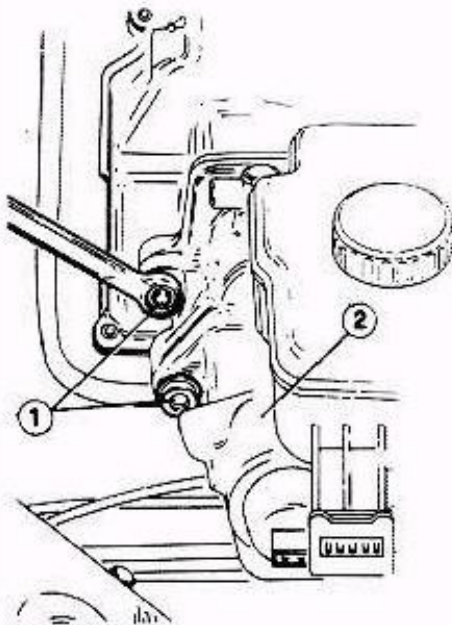
8. Working from within the passenger compartment, disconnect the brake pedal **1** from the piston of the master cylinder **3** by acting on the cotter pin **2**.



- 1 Union
- 2 Union
- 3 Union

- 1 Brake pedal
- 2 Cotter pin
- 3 Master cylinder piston

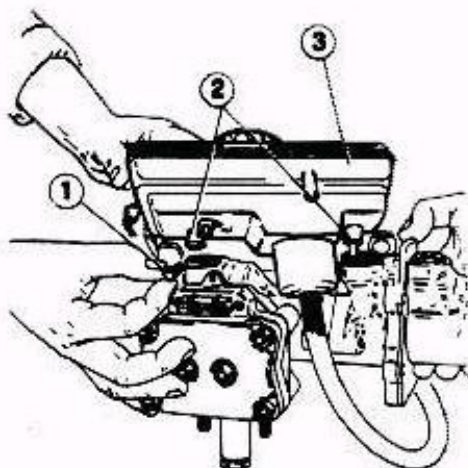
9. Back off the four units **1** connecting the hydraulic assy **2** to the pedal assy and remove the former by extracting it from the four studs.



- 1 Nuts connecting the hydraulic pedal assy
- 2 Hydraulic assy

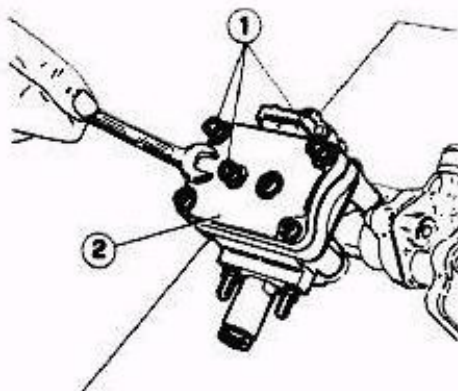
DISASSEMBLY

1. Unscrew screw ① and with the aid of a lever, free the brake fluid tank ③ from the two unions ②.



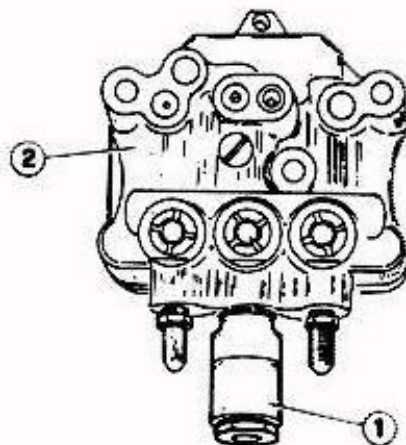
- 1 Screw connecting the brake fluid tank - hydraulic assy
- 2 Unions
- 3 Brake fluid tank

2. Back off the three nuts ①, separate the electrovalve unit ② from the hydraulic assy and retrieve the O-Rings.



- 1 Nuts connecting the electrovalve unit - master cylinder
- 2 Electrovalve unit

3. If necessary unscrew the brake pressure adjusting valve ① and remove it from the electrovalve unit ②.



- 1 Brake pressure adjusting valve
- 2 Electrovalve unit

CAUTION:

Do not disassemble the electrovalve unit and brake pressure adjusting valve components; do not separate the brake master cylinder from the hydraulic operating cylinder.

REASSEMBLY

Reassemble the hydraulic assembly in reverse order of removal, making sure to tighten the various connections to the specified torques.

WARNING:

The circuit is a high pressure one and correct reassembly is extremely important for the safety of the vehicle during braking; adhere strictly to instructions.

- Replace the O-Rings.
- Observe the following tightening torques.

Ⓣ : Tightening torques

Brake pressure adjusting valve-electrovalve unit connection

35 thru 40 N·m
(25.8 thru 29.5 ft·lb)
(3.6 thru 4.1 kg·m)

Nuts securing the electrovalve unit - hydraulic assy

21.4 thru 29.4 N·m
(15.8 thru 21.7 ft·lb)
(2.2 thru 3 kg·m)

Screw locking union on hydraulic assy

16 thru 20 N·m
(11.8 thru 14.8 ft·lb)
(1.6 thru 2 kg·m)

INSTALLATION

Install in reverse order of removal, adhering to these instructions.

1. Apply Lowac Perfect Seal to the hydraulic assy - pedal assy joining surfaces.
2. Observe the following tightening torques.

Ⓣ : Tightening torques

Nuts connecting the hydraulic assembly - pedal assy

11.3 thru 14 N·m
(8.3 thru 10.3 ft·lb)
(1.1 thru 1.4 kg·m)

Unions connecting the hydraulic assy - pipes carrying pressurized fluid to the brake callipers

12 thru 16 N·m
(8.9 thru 11.8 ft·lb)
(1.2 thru 1.6 kg·m)

Screw securing the square connecting the front left hand wheel impulse pick-up to the hydraulic assy

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Union connecting pipe ("from" electropump) - hydraulic assy

16 thru 20 N·m
(11.8 thru 14.8 ft·lb)
(1.6 thru 2 kg·m)

3. Fill the tank with recommended fluid (see: Service Data and Specifications) then bleed (see: (ABS) MARK II Braking System with Wheel Antilock - Braking System Bleeding).

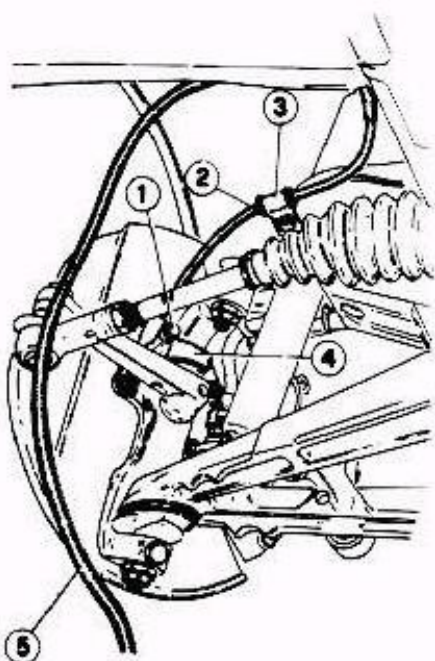
IMPULSE PICK-UPS AND IMPULSE EMITTING WHEELS

FRONT IMPULSE PICK-UPS

Removal

1. Disconnect the battery.
2. Working in the engine compartment, disconnect the electrical connection of the cable of the front impulse pick-up in question.
3. Place the car on a lift, put on the parking brake and raise the car.
4. Back off the screw (2) securing the cable plate (3) to the suspension upper link.

Back off the screw (1) securing the impulse pick-up to the support (4); retrieve the impulse pick-up.



- 1 Screw securing impulse pick-up support
- 2 Screw
- 3 Cable plate
- 4 Impulse pick-up support
- 5 Impulse pick-up cable

5. If necessary, remove the support of the impulse pick-up by unscrewing the two nuts securing it to the steering knuckle.

Installation

Re-install by operating in reverse order of removal and adhering to the following instructions.

CAUTION:

The impulse pick-ups are not interchangeable (neither front with rear nor left with right).

When re-installing take great pains to ensure that the impulse pick-ups, new or used, are installed in the correct position.

- Observe the following tightening torques.

Tightening torques

Screw securing cable plate - suspension upper link

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Screw securing impulse pick-up - support

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Nuts securing support - steering knuckle

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

- Ensure that the impulse pick-up cables are secure in their anchor points on the body and secured to the suspension assemblies to prevent damage when the vehicle is running.
- Adjust the air gap between the impulse pick-up and the impulse emitting wheel by operating as follows.

Adjustment of the air gap between the front impulse pick-up and impulse emitting wheel.

- If installing a new impulse pick-up
 - a. Loosen the air gap adjusting screw (1).
 - b. Drive the impulse pick-up home against the impulse emitting wheel (there

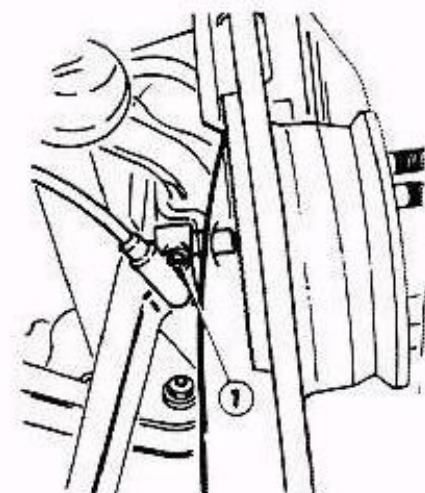
is a plastic spacer on the impulse pick-up head of the same thickness as the air gap required).

- c. Keeping the impulse pick-up against the impulse emitting wheel, tighten the air gap adjusting screw (1) to the specified torque.

Tightening torque

Screw adjusting the air gap between the impulse pick-up and impulse emitting wheel

2.4 thru 3 N·m
(1.77 thru 2.21 ft·lb)
(0.24 thru 0.3 kg·m)

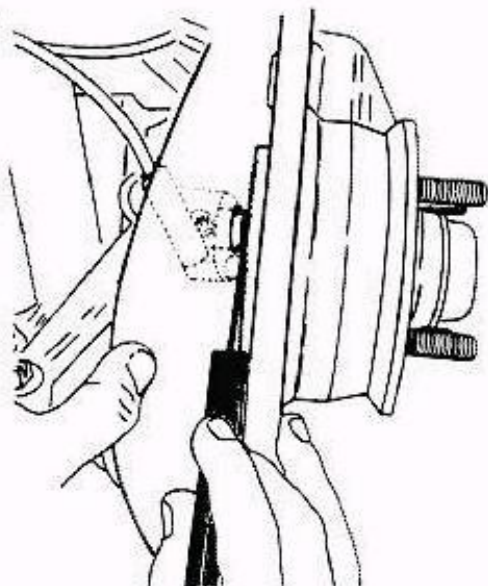


- 1 Screw adjusting air gap between the impulse pick-up and impulse emitting wheel

- If the impulse pick-up is re-used.
 - a. Using a thickness gauge, check that the air gap between the impulse pick-up and impulse emitting wheel is as specified. Make the same test in two or three other positions of the impulse emitting wheel.

Air gap between front impulse pick-up and impulse emitting wheel:

$t = 0.7 \text{ mm}$
(0.03 in)

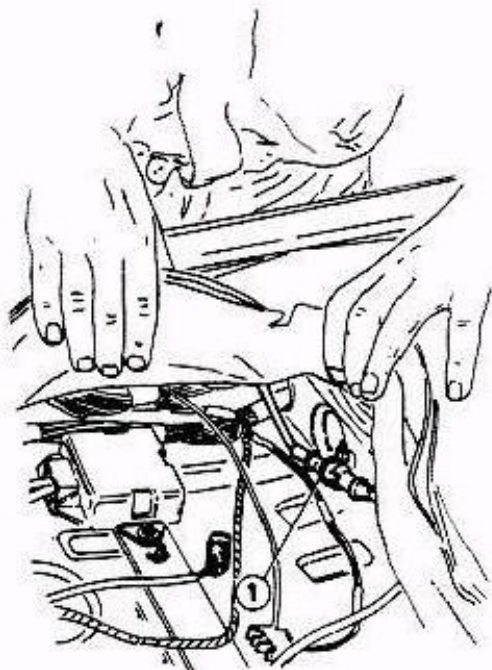


d. Check that the air gap remains as specified in two or three further positions of the impulse emitting wheel.

REAR IMPULSE PICK-UPS

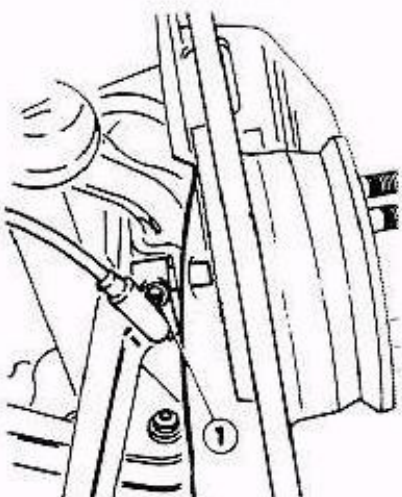
Removal

1. Disconnect the battery.
2. Working in the passenger compartment, remove the rear seat, raise the sound proof upholstery then disconnect the electrical connection ① of the rear impulse pick-up cable concerned, sliding it off from outside the car.



1 Rear impulse pick-up connection

b. Failing to find such a value, loosen the air gap adjusting screw ①.



1 Screw adjusting air gap between impulse pick-up and impulse emitting wheel

c. Put a spacer equivalent to the specified air gap between the impulse pick-up and the impulse emitting wheel (0.7 mm; 0.03 in).

Keeping the impulse pick-up in contact with the spacer and impulse emitting wheel, tighten the adjusting screw to the specified torque.

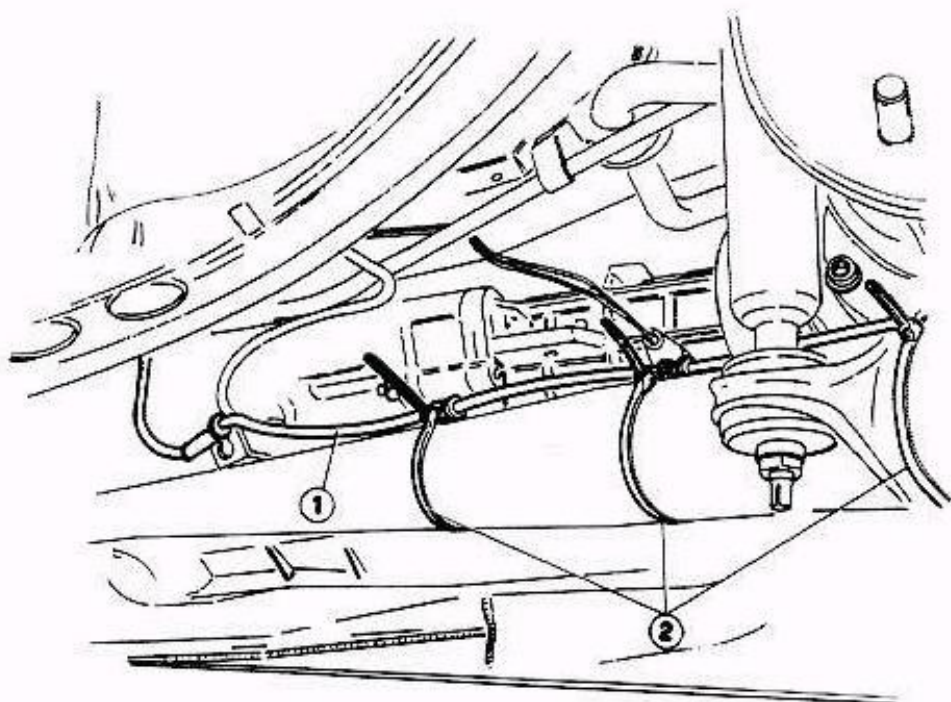
T : Tightening torque

Screw adjusting the air gap between the impulse pick-up - impulse emitting wheel

- 2.4 thru 3 N·m
- (1.77 thru 2.21 ft·lb)
- (0.24 thru 0.3 kg·m)

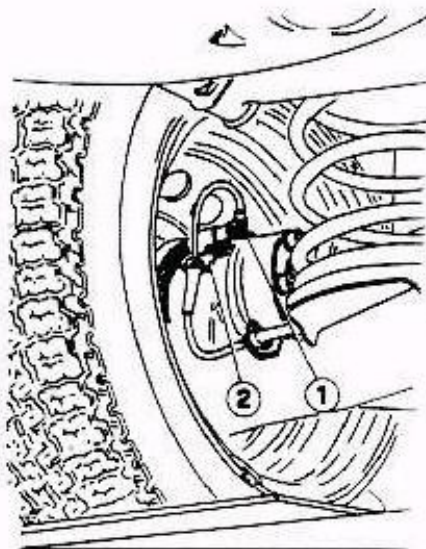
3. Place the vehicle on the lift, activate the parking brake and raise the car.

4. Free the impulse pick-up cable ① from the three clips ② securing it to the De Dion axle.



1 Rear impulse pick-up cable
2 Clips

5. Unscrew the screw ① securing the impulse pick-up to the support ② and get hold of the impulse pick-up.



- 1 Screw securing impulse pick-up - support
2 Support

6. If necessary, remove the support by unscrewing the two nuts holding it to the wheel hub.

Installation

Reinstall by operating in reverse order of removal and adhering to the following instructions.

CAUTION:

The impulse pick-ups are not interchangeable (neither front with rear nor left with right).

When re-installing take great care to ensure that the impulse pick-ups, new or used, are installed in the correct position.

- Observe the following tightening torques.

- Ⓣ: Tightening torques
Screw securing impulse pick-up - support

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

Nuts securing support - wheel hub

9 thru 10 N·m
(6.6 thru 7.4 ft·lb)
(0.9 thru 1 kg·m)

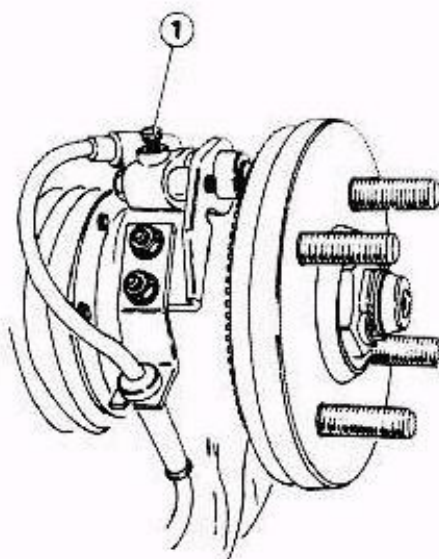
- Ensure that the impulse pick-up cables are secure in their anchor points on the body and secured to the suspension assemblies to prevent damage when the vehicle is running.
- Adjust the air gap between the impulse pick-up and the impulse emitting wheel by operating as follows.

Adjustment of the air gap between the rear impulse pick-up and impulse emitting wheel.

- If installing a new impulse pick-up
 - Loosen the air gap adjusting screw ①.
 - Drive the impulse pick-up home against the impulse emitting wheel (there is a plastic spacer on the impulse pick-up head of the same thickness as the air gap required).
 - Keeping the impulse pick-up against the impulse emitting wheel, tighten the air gap adjusting screw ① to the specified torque.

- Ⓣ: Tightening torque
Screw adjusting the air gap between the impulse pick-up and impulse emitting wheel

2.4 thru 3 N·m
(1.77 thru 2.21 ft·lb)
(0.24 thru 0.3 kg·m)

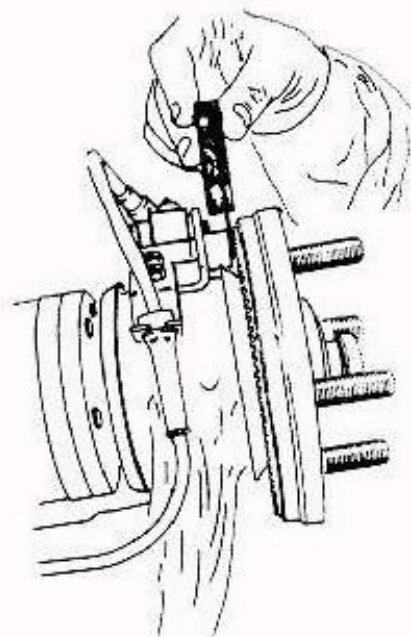


- 1 Screw adjusting air gap between the impulse pick-up and the impulse emitting wheel

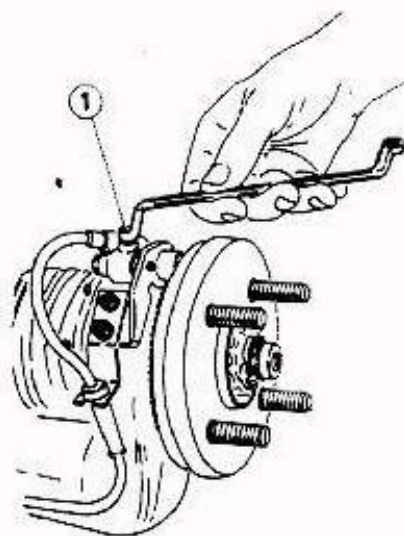
- If the impulse pick-up is re-used.
 - Using a thickness gauge, check that the air gap between the impulse pick-up and impulse emitting wheel is as specified. Make the same test in two or three other positions of the impulse emitting wheel.

Air gap between rear impulse pick-up and impulse emitting wheel:

t = 1.1 mm
(0.04 in)



- b. Failing to find such a value, loosen the air gap adjusting screw ①.



- 1 Screw adjusting air gap between the impulse pick-up and the impulse emitting wheel

c. Put a spacer equivalent to the specified air gap between the impulse pick-up and the impulse emitting wheel (1.1 mm; 0.04 in).

Keeping the impulse pick-up in contact with the spacer and impulse emitting wheel, tighten the adjusting screw to the specified torque.

Tightening torque

Screw adjusting the air gap between the impulse pick-up - impulse emitting wheel

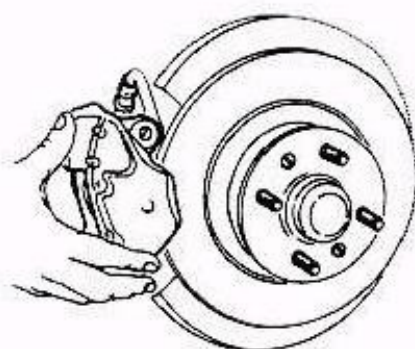
2.4 thru 3 N·m
(1.77 thru 2.21 ft·lb)
(0.24 thru 0.3 kg·m)

d. Check that the air gap remains as specified in two or three further positions of the impulse emitting wheel.

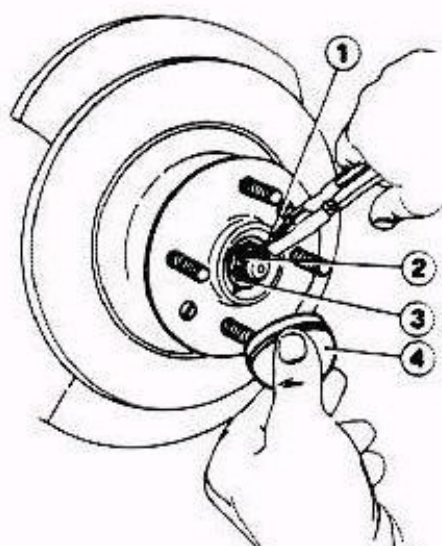
FRONT IMPULSE EMITTING WHEELS

Removal

1. Place car on lift, activate the parking brake, raise the car at the front using a column type jack secure with stands and remove the wheel.
2. Remove the pads.
3. Unlock and back off the two screws, securing the brake caliper to the steering knuckle, without disconnecting it from the brake hose.
4. Remove the brake caliper unit, secure the brake caliper on one of the suspension links.

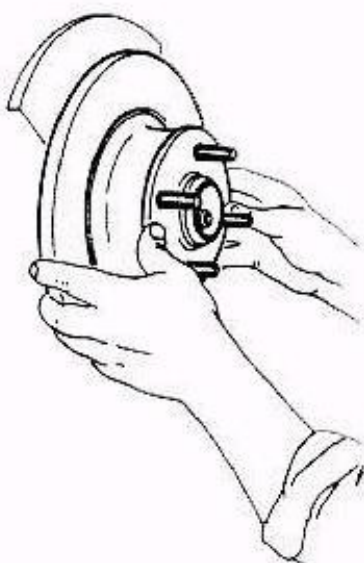


5. Extract the hub cover (4) and cotter pin (1).
6. Back off nut (2) and extract together with washer (3).

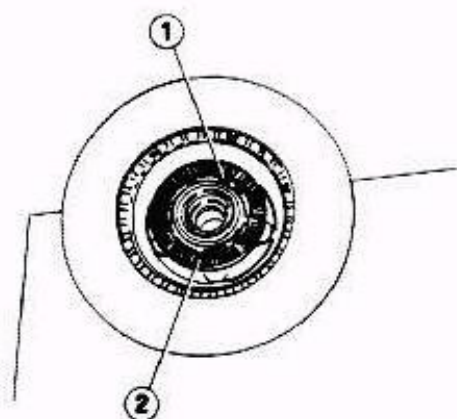


- 1 Cotter pin
- 2 Nut
- 3 Washer
- 4 Hub cover

7. Remove the hub complete with brake disc and place on bench.



8. Using pliers, remove the retainer ring (1) and separate the impulse emitting wheel (2) from hub.



- 1 Retainer ring
- 2 Front impulse emitting wheel

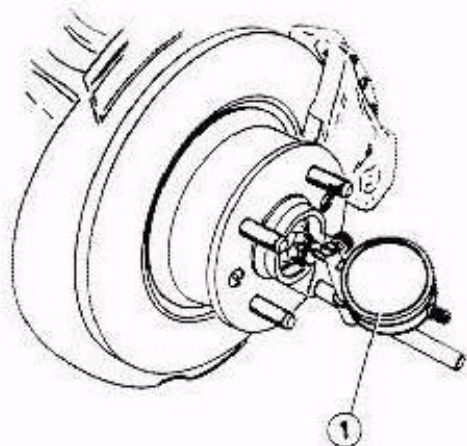
Installation

Re-install by operating in reverse order of removal, adhering to the following instructions.

- Clean the impulse emitting wheel thoroughly, checking that there are no signs of damage.
- Put the impulse emitting wheel into place and secure it to the hub with the retainer ring.
- Re-install the hub on the steering knuckle but do not insert the cotter pin.
- Check the clearance of the front hub bearings by operating as follows.

Front hub bearing clearance check

a. Install a comparator on a magnetic base (or suitable tool) so that it touches the steering knuckle axis (pre load the comparator to 1 mm (0.04 in)).



1 Comparator

b. Move the wheel hub axially (back and forth) and read the clearance indicated on the comparator. This clearance should come within specified values.

Front hub bearing clearance:
 $G = 0.02$ thru 0.12 mm
 (0.0008 thru 0.005 in)

c. Re-position the cotter pin thus. If the clearance value is 0.02 to 0.06 mm (0.0008 thru 0.002 in), back off nut until cotter pin is inserted.

— If the clearance value is 0.06 to 0.12 mm (0.002 thru 0.005 in), screw on the nut until cotter pin is inserted.

d. Bend the cotter pin back and reassemble the hub cover.

• Observe the following tightening torque.

Tightening torque
 Screw securing the brake caliper to the steering knuckle

74 thru 83 N·m
 (54.6 thru 61.2 ft·lb)
 (7.5 thru 8.5 kg·m)

- Check the air gap between the impulse pick-up and the impulse emitting wheel (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Pick-ups - Adjustment of the Air Gap between the Front Impulse Pick-up and the Impulse Emitting Wheel).

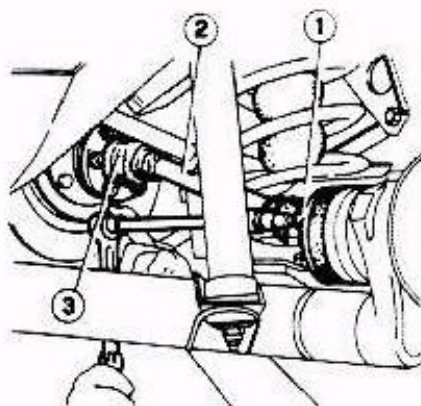
REAR IMPULSE EMITTING WHEELS

Removal

1. Place car on lift, chock front wheels, raise rear using a column type jack secure on stands and remove the wheel.
2. Back off screws (1), get hold of washers and plates then uncouple the outer axle shaft (2).

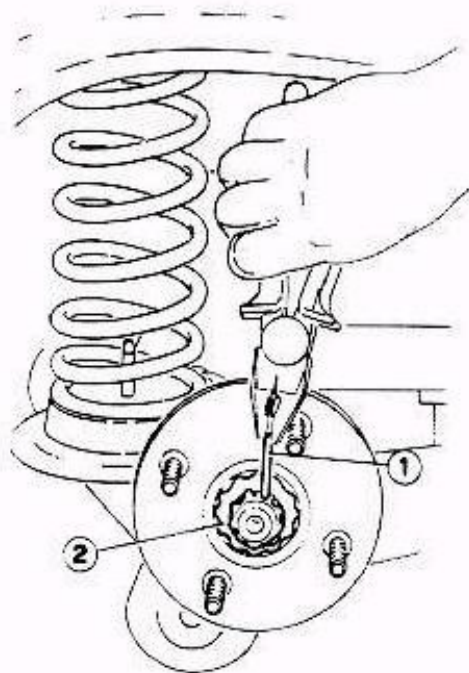
CAUTION:

During operations take care to avoid damage to the boot (3) protecting the joints.



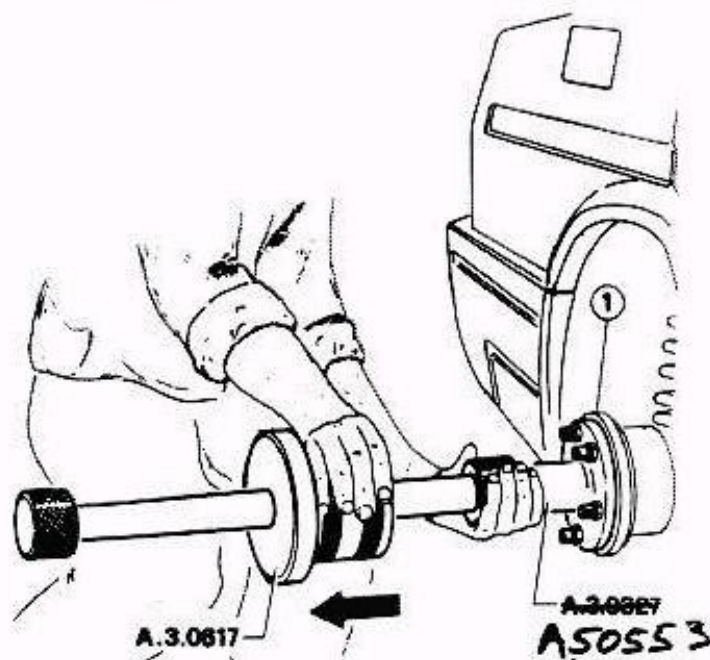
1 Screw securing outer axle shafts
 2 Outer axle shaft
 3 Boot protecting joint

3. Extract the cotter pin (1) from the wheel shaft and slide off the lock nut (2).



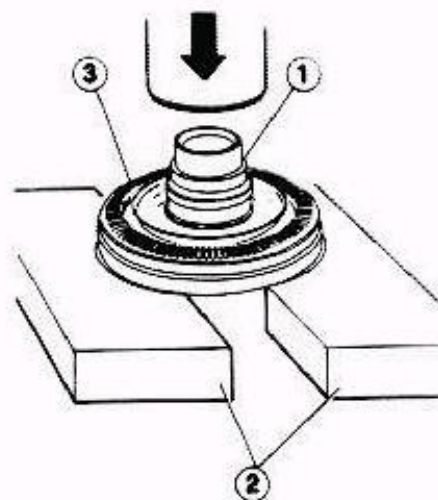
1 Cotter pin
 2 Lock nut

4. Having installed a suitable tool to prevent wheel shaft from turning, back off the nut securing the hub to the wheel shaft and slide off the associated washer.
5. Assemble percussion tool A.3.0617 on tool A.3.0527, then, operating as illustrated hereafter, extract the wheel hub (1) and retrieve equipment.



1 Wheel hub

6. Using two suitable half-plates (2) and with the aid of a press, divide the impulse emitting wheel (3) and hub (1).



1 Wheel hub
2 Half plate
3 Impulse emitting wheel

- Clean the impulse emitting wheel thoroughly, checking that there are no signs of damage.
- Using a press, slip the impulse emitting wheel onto the hub and check correct installation (see: Service Data and Specifications - Checks and Adjustments).
- Lock the wheel hub securing nut to the following tightening torque.

T : Tightening torque
Nut securing wheel hub

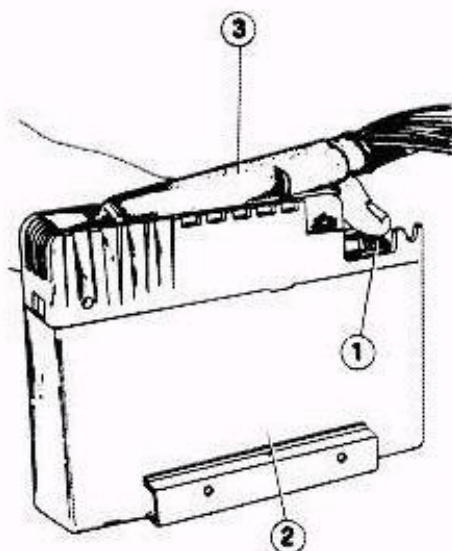
265 thru 324 N·m
(195.5 thru 239 ft·lb)
(27 thru 33 kg·m)

ANTILOCK SYSTEM CONTROL UNIT

WARNING:
The electronic unit is situated in the luggage compartment.

REMOVAL AND INSTALLATION

1. Disconnect the battery.
 2. Remove protective casing by acting on associated nails.
- Back off screws and remove the control unit from the support.
3. Disconnect the connector (3) from the control unit (2) by pressing the release lever (1).



1 Release lever
2 Electronic unit
3 Connector

CAUTION:
Avoid knocks to the electronic unit

4. Re-install in reverse order of removal.

Installation

Install in reverse order of removal, adhering to these instructions.

FRONT BRAKES

PAD REPLACEMENT

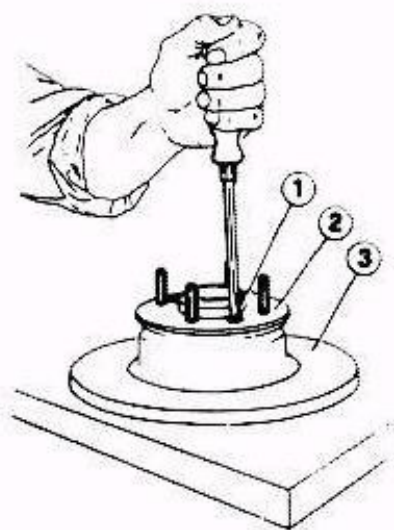
BRAKE CALIPER

Components given are structurally similar to those of the vehicle **(GV6/25)** and consequently the overhaul procedures remain the same.

BRAKE DISC

Removal

1. Remove pads, applying suitable reference marks to facilitate subsequent installation.
2. Back off two brake caliper/steering knuckle screws without disconnecting from system. Secure brake caliper to a suspension link.
3. Carry out the operations described in steps 5., 6., 7. and 8. - Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Emitting Wheels.
4. Back off two screws **(1)** securing the wheel hub **(2)** to the brake disc **(3)** and separate the two parts.



- 1 Screw
2 Wheel hub
3 Brake disc

Inspection

1. Clean brake discs and check that working surfaces are free from score marks and porosity. Replace or grind as necessary.
2. Should working surfaces need grinding, adhere to the following instructions.
 - a. Always grind off the same amount of material on both surfaces.
 - b. Dimensions and tolerances as per "Service Data and Specifications", "Checks and Adjustments" are compulsory.

Installation

Install in reverse order of removal, adhering to these instructions.

- Lubricate wheel hub nut thread using recommended grease (AGIP Grease 33 FD; IP Autogrease - FD; SHEEL Retinax Ax; ESSO Norva 275).
- Check front wheel hub bearing clearance (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Emitting Wheels - Installation).
- Observe the following tightening torque.

Ⓣ: Tightening torque

Screw securing brake caliper to steering knuckle

74 thru 83 N·m
(54.6 thru 61.2 ft·lb)
(7.5 thru 8.5 kg·m)

- Check the air gap between the impulse pick-up and the impulse emitting wheel (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Pick-ups - Adjustment of the Air Gap between the Front Impulse Pick-up and the Impulse Emitting Wheel).

REAR BRAKES

PAD REPLACEMENT

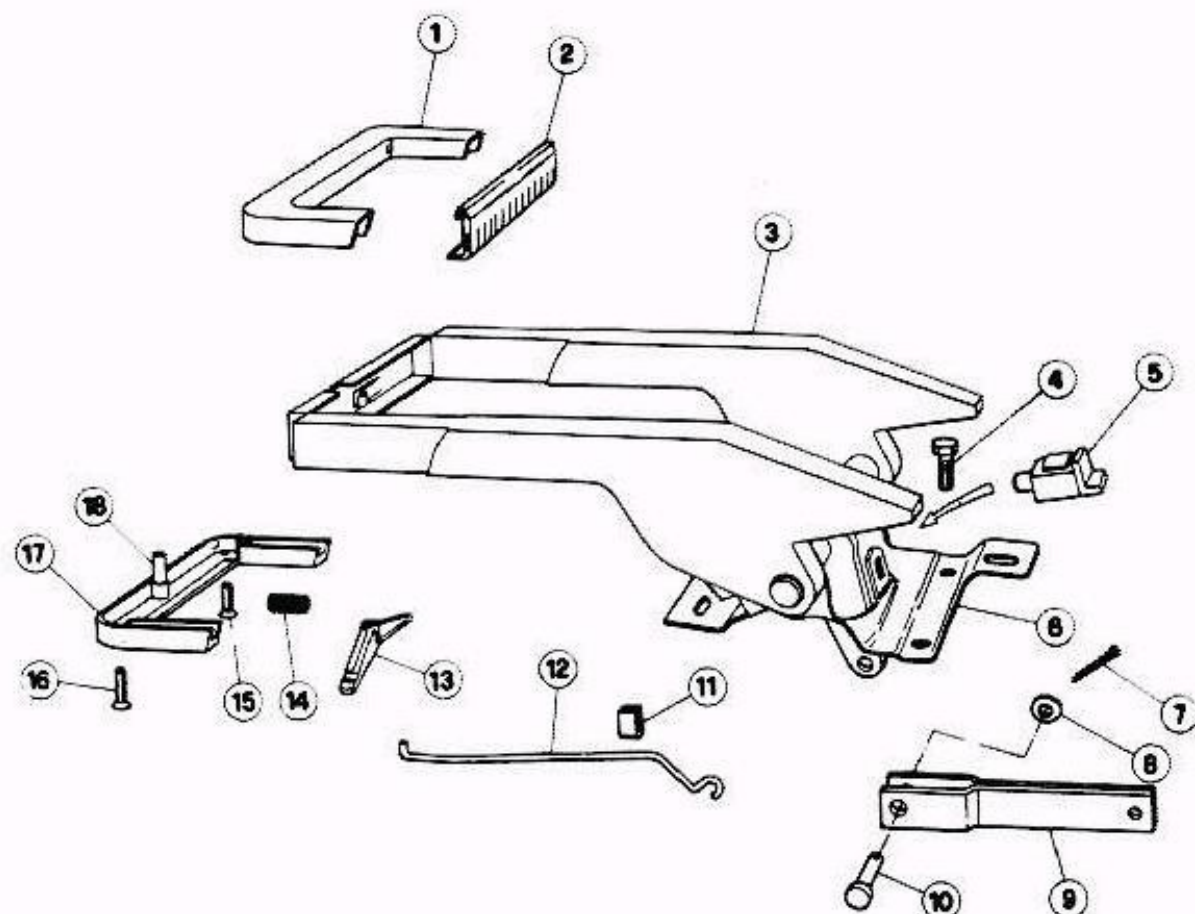
BRAKE CALIPERS

BRAKE DISC

Components given are structurally similar to those of the vehicle **(GV6/25)** and consequently the overhaul procedures remain the same.

PARKING BRAKE

CONTROL LEVER

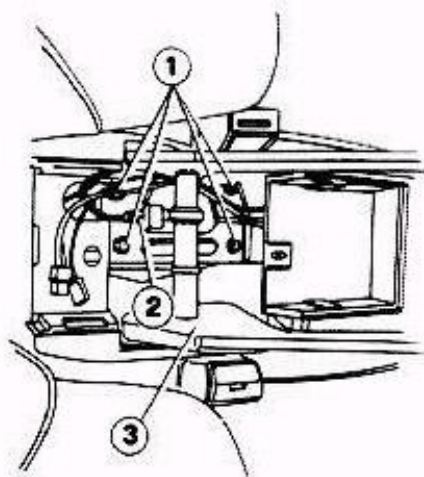
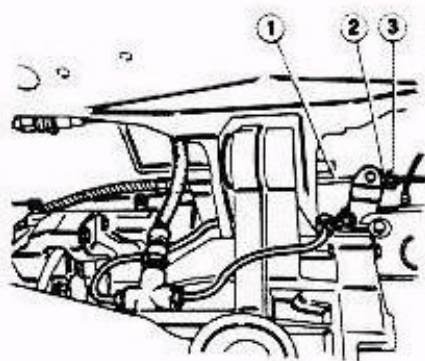


- 1 Upper grip
- 2 Control bar
- 3 Control lever body
- 4 Support/body retaining screw
- 5 Parking brake on indicator sending unit
- 6 Lever support
- 7 Cotter
- 8 Washer
- 9 Actuating fork

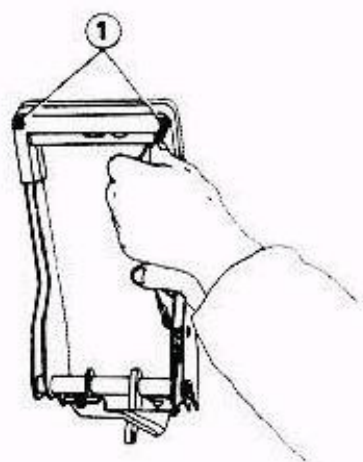
- 10 Pin
- 11 Guide
- 12 Push rod
- 13 Bracket
- 14 Spring
- 15 Screw
- 16 Screw
- 17 Lower grip
- 18 Bracket pin

REMOVAL

1. Raise car on a platform lift.
2. Back off locknut (3) and nut (2) and disconnect cable (1).



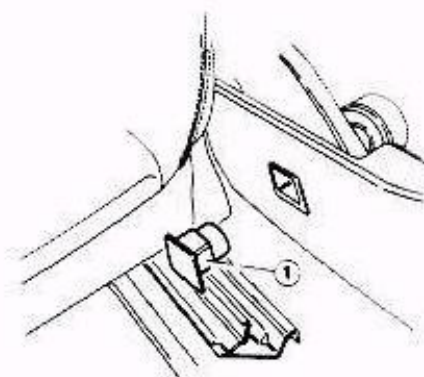
- 1 Lever support/body retaining screws
- 2 Parking brake on indicator sending unit
- 3 Parking brake control lever



- 1 Handle screws

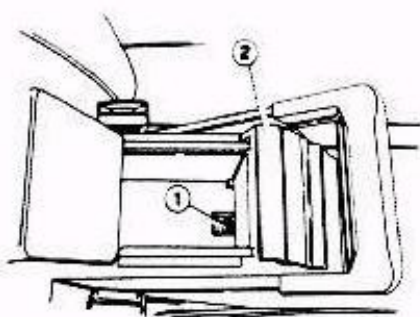
- 1 Parking brake control cable
- 2 Parking brake adjusting nut
- 3 Locknut

5. Move front seats fully forward, re-move plugs (1).



- 1 Rear console plug

3. Back off screw (1) from car interior, disconnect rear cigar lighter wiring and remove console (2).



- 1 Console screw
- 2 Rear console

4. Back off four screws (1) and disconnect sending unit lead (2).

6. Move lever to gain access to lever/control cable conn. rod connection.
7. Remove cotter and lever/conn. rod pin; remove control lever.
8. If necessary, back off 2 control lever grip screws (1), disassemble lever and take off indicator sending unit.

INSPECTION

1. Visually check that components are not excessively worn or damaged. In particular, check ratchet and pawl are not worn or damaged; if necessary replace lever assembly.
2. Check that parking brake on indicator sending unit is working properly.

INSTALLATION

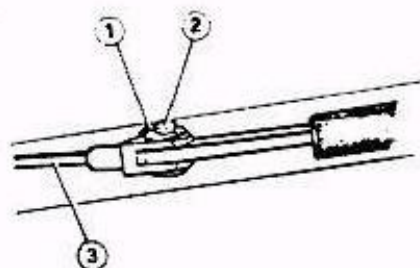
If previously disassembled, assemble lever and install adopting a reversal of the removal sequence, and adhering to the instructions given below.

- Coat cable sliding surfaces with the recommended grease (AGIP Grease 15; SHELL RETINAX G11).
- Adjust parking brake (see Parking Brake Lever Travel Adjustment).

CONTROL CABLE

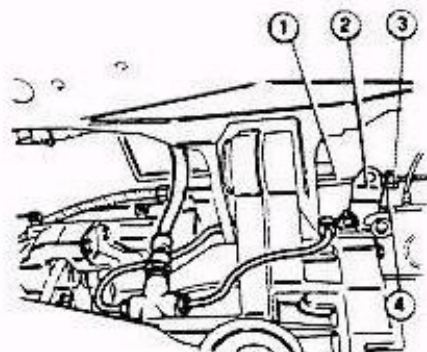
REMOVAL

1. Raise car on platform lift.
2. Remove exhaust pipe center section and front end (see: Group 04 - Exhaust System - Manifolds, Mufflers and Catalytic Converter).
3. Disconnect remote control rod from gear lever and move out of the way to gain access to parking brake control lever/cable connection.
4. Remove cotter (1) and take out pin (2) thereby releasing cable (3).



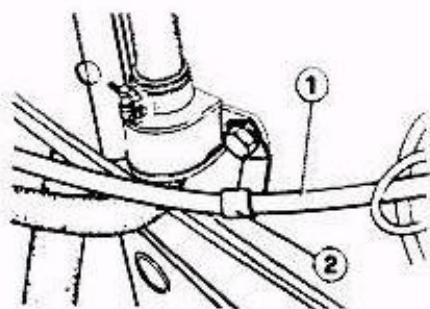
- 1 Cotter
- 2 Pin
- 3 Parking brake control cable

5. Back off locknut (3) and nut (4) remove cable (1) from levers (2) and take off together with sheath.



- 1 Parking brake cable
- 2 Brake pad actuating lever
- 3 Locknut
- 4 Hand parking brake adjusting nut

6. Release sheath (1) from retaining brackets (2).



- 1 Cable sheath
- 2 Retaining bracket

INSTALLATION

Install by adopting a reversal of the removal sequence and adhering to the instructions given below.

- Adjust parking brake cable as per "Parking Brake Lever Travel Adjustment".

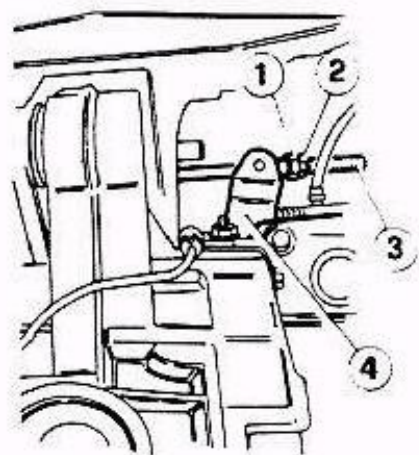
PARKING BRAKE LEVER TRAVEL ADJUSTMENT

1. Check that parking brake lever is in rest position.
2. Adjust rear brakes pad clearance operating as for vehicles **0TV623**.
3. Tighten nut (1) on threaded terminal (3) until cable end float is nil.

CAUTION:

Tighten nut without moving levers (4) from rest position (levers abutting limit travel pin) to avoid a reduction in clearance between inner pads and brake disc, as this would cause binding, even with parking brake released.

4. Tighten locknut (2).



- 1 Parking brake adjusting nut
- 2 Locknut
- 3 Cable threaded terminal
- 4 Brake pad actuating lever

5. Operate parking brake lever and check that rear wheels are locked after 4 to 6 clicks.

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

BRAKE CALIPERS

| | |
|--------|------|
| Front | Rear |
| BREMBO | ATE |

Cylinder dia.

| | |
|-------|-----------------|
| Front | 48 mm (1.89 in) |
| Rear | 38 mm (1.50 in) |

TRADITIONAL BRAKING SYSTEM

BRAKE BOOSTER

| | |
|--|------|
| Type: ATE or BENDITALIA Vacuum cylinder dia | 6 in |
|--|------|

BRAKE MASTER CYLINDER

| | | |
|-------------------------|-------------------|-------------------|
| Type: ATE or BENDITALIA | | |
| Diameter | 22.2 mm (0.87 in) | |
| Stroke | front | 16.5 mm (0.65 in) |
| | rear | 10 mm (0.394 in) |

BRAKING SYSTEM WITH (ABS) MARK II WHEEL ANTILOCK SYSTEM

| | |
|---|--|
| ANTILOCK SYSTEM | ATE ABS MARK II |
| BRAKE BOOSTER | High pressure hydraulic |
| Operating pressure | 140 thru 180 bar (11970 thru 12960 KPa) (142.5 thru 183.2 Kg/cm ²) |
| Maximum pressure (prior to safety valve activation) | 210 bar (20954 KPa) (213.7 Kg/cm ²) |

FRONT AND REAR BRAKES

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

| Description | Type | Recommended product |
|--------------------------------------|--------|---|
| Hydraulic brake system | FLUID | ATE: S AGIP: Brake Fluid Super HD IP: Auto Fluid FR Part no.: 3681-69903 |
| Brake caliper bellows | GREASE | ATE: Bremszylinder Paste |
| Pedal pivot | GREASE | ISECO: Molykote Longterm n. 2 Part no.: 3671-69831 |
| Parking brake cable sliding surfaces | GREASE | AGIP Grease 15 Part no.: 3671-69810 SHELL RETINAX G 11 Part no: 3671-69811 |
| Wheel hub nut thread | GREASE | AGIP: Grease 33 FD IP: Autogrease FD SHELL: Retinax AX ESSO: Norva 275 |

SEALANTS

| Description | Type | Recommended product |
|---|----------------------|--|
| Brake booster-shim and pedal support contact surfaces (1) | JOINTING COMPOUND | LOWAC: Perfect Seal Part no. 3522-00011 |
| Hydraulic assy - pedal assy adjoining surfaces (2) | | |

(1) Vehicles equipped with traditional braking system

(2) Vehicles equipped with (ABS) MARK II antilock braking system

CHECKS AND ADJUSTMENTS

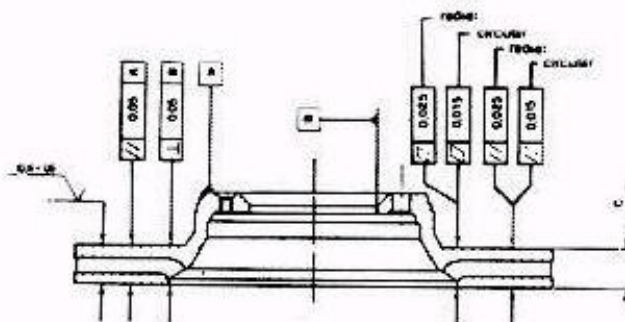
DISC REGRINDING DATA ⁽¹⁾

Front disc

Cars with selfventilated front discs

| Brake disc thickness C mm (in) | |
|--------------------------------|------------|
| New | 22 (0.866) |
| Min. thickness after grinding | 21 (0.827) |
| Max. wear thickness | 20 (0.787) |

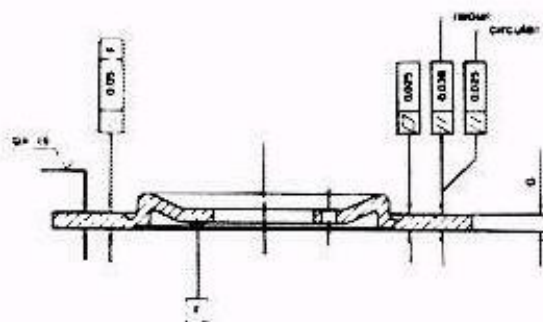
Note: The same amount of material must be removed from both sides of the disc.



Rear disc

| Brake disc thickness G mm (in) | |
|--------------------------------|-----------|
| New | 10 (0.39) |
| Min. thickness after grinding | 9 (0.35) |
| Max. wear thickness | 8 (0.315) |

Note: The same amount of material must be removed from both sides of the disc.



(1) Symbols $\sqrt{\quad}$ Roughness [μ] // Parallelism [mm] \perp Flatness [mm] --- Squareness [mm]

REAR BRAKE PAD CLEARANCE

On assembly 0.1 to 0.15 mm (0.004 to 0.006 in)

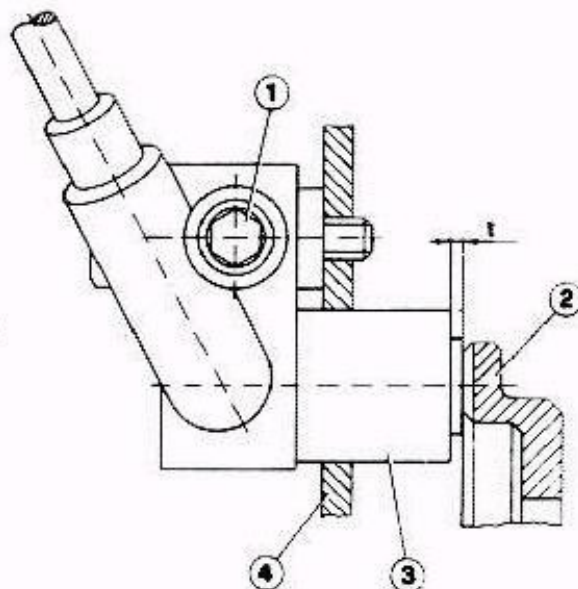
BRAKE PAD THICKNESS mm (in)

| FRONT | | REAR | |
|-------------|---------------------|-----------|---------------------|
| New | Max. wear thickness | New | Max. wear thickness |
| 16.5 (0.65) | (1) | 15 (0.59) | (1) |

(1) On cars provided with brake pad wear indicator, replace pads when indicator lights up

PARKING BRAKE LEVER TRAVEL ADJUSTMENT

Number of free notches on ratchet before wheel locking: 4 to 6

ADJUSTMENT OF THE AIR GAP BETWEEN THE IMPULSE PICK-UPS AND THE IMPULSE EMITTING WHEELS (*)


- 1 Air gap (t) adjustment screw between the impulse pick-up and impulse emitting wheel
- 2 Impulse emitting wheel
- 3 Impulse pick-up
- 4 Impulse pick-up support

CAUTION:

The impulse pick-ups are not interchangeable (neither front with rear nor left with right).

When re-installing make sure that the impulse pick-ups, new or re-used, are installed in their correct position.

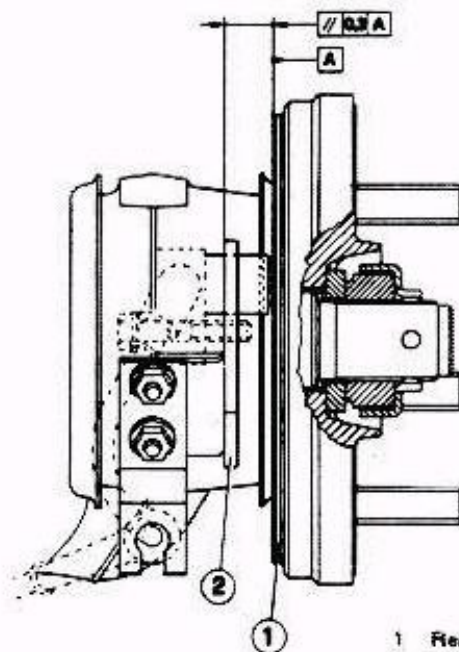
(*) Vehicles equipped with (ABS) MARK II antilock braking system

REAR IMPULSE EMITTING WHEELS (*)

Assembly tolerance

Parallelism error between the impulse emitting wheel ① and impulse pick-up support ②:

0,3 mm
(0.01 in)



- 1 Rear impulse emitting wheel
- 2 Impulse pick-up support

(*) Vehicles equipped with (ABS) MARK II antilock braking system

TIGHTENING TORQUES

| Measurement unit | |
|--|---|
| Description | N·m (ft·lb, kg·m) |
| Screws front brake caliper to steering knuckle | 74 thru 83 (54.6 thru 61.2; 7.5 thru 8.5) |
| Nuts, rear brake caliper to gearbox/differential housing | 46 thru 52 (33.9 thru 38.4; 4.7 thru 5.3) |
| Screws, spacer and rear brake disc to inner axle shaft | 49 thru 54 (36.1 thru 39.8; 5 thru 5.5) |
| Screws, spacer to outer axle shaft | 44 thru 54 (32.5 to 39.8; 4.5 thru 5.5) |
| Locknut, rear brake disc clearance adjusting screw (torque for guidance only, to be obtained by means of a wrench) | 7 thru 10 (5.2 thru 7.4; 07 thru 1) |

FRONT AND REAR BRAKES

TRADITIONAL BRAKING SYSTEM data

| Description | Measurement unit | N-m (ft-lb; kg-m) |
|--|------------------|--|
| Fittings, hydraulic brake system piping | | 10 thru 12 (7.4 thru 8.9; 1 thru 1.2) |
| Fittings, hydraulic brake system hoses | | 10 thru 15 (7.4 thru 11.1; 1 thru 1.5) |
| Nuts, brake servo to pedal support | | 12 thru 15 (8.9 thru 11.1; 1.2 thru 1.5) |
| Nuts, brake master cylinder to brake servo | | 12 thru 15 (8.9 thru 11.1; 1.2 thru 1.5) |

(ABS) MARK II WHEEL ANTILOCK BRAKING SYSTEM data



| Description | Measurement unit | N-m (ft-lb; kg-m) |
|---|------------------|---|
| Pressure switch - electropump unit connection | | 20 thru 26 (14.8 thru 19.2; 2 thru 2.7) |
| Accumulator - electropump unit connection | | 40 thru 46 (29.5 thru 33.9; 4.1 thru 4.7) |
| Screw connecting hose - electropump unit (union) | | 16 thru 20 (11.8 thru 14.8; 1.6 thru 2) |
| Screw securing electropump unit - support | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Hose (on electropump unit)-pressurized fluid delivery pipe connection | | 16 thru 20 (11.8 thru 14.8; 1.6 thru 2) |
| Screws securing electropump unit support - body | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Nuts securing coil and electropump unit support - body | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Brake adjusting valve - braking pressure modulation electrovalve unit connection | | 35 thru 40 (25.8 thru 29.5; 3.6 thru 4.1) |
| Nuts securing electrovalve unit - hydraulic assy | | 21.4 thru 29.4 (15.8 thru 21.7; 2.2 thru 3) |
| Screw tightening union on hydraulic assy | | 16 thru 20 (11.8 thru 14.8; 1.6 thru 2) |
| Nuts connecting hydraulic - pedal assies | | 11.3 thru 14 (8.3 thru 10.3; 1.1 thru 1.4) |
| Unions connecting hydraulic assy - pipes carrying pressurized fluid to brake calipers | | 12 thru 16 (8.9 thru 11.8; 1.2 thru 1.6) |
| Screw securing hydraulic assy-bracket for connection of front left hand wheel impulse pick-up | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Union connecting pipe ("from" electropump unit) - hydraulic assy | | 16 thru 20 (11.8 thru 14.8; 1.6 thru 2) |
| Screw securing front impulse pick-up cable plate - suspension upper link | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Screw securing impulse pick-up (front and rear) - support | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Nuts securing front impulse pick-up steering knuckle | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Nuts securing rear impulse pick-up - wheel hub | | 9 thru 10 (6.6 thru 7.4; 0.9 thru 1) |
| Screw adjusting air gap, impulse pick-up impulse emitting wheel (front and rear) | | 2.4 thru 3 (1.77 thru 2.21; 0.24 thru 0.3) |


TROUBLESHOOTING FOR THE (ABS) MARK II WHEEL ANTILOCK BRAKING SYSTEM


For correct brake system troubleshooting check:

- Tires for wear
- Tire inflation pressure
- Brake fluid and compliance with scheduled maintenance instructions.



NOTE:

The  warning light is indicated in the text with the symbol .

The correct operation of the "BRAKE" warning light on the A.R. CONTROL and of the "ABS MARK II System" warning light  on the instrument panel is the following:

- On turning the key to IGNITION, both lights illuminate and extinguish (not at the same time) after approximately two seconds.
- On starting the engine, the  light only will illuminate again, to extinguish about two seconds after the key has returned from the START position to IGNITION.
- In motion, both lights are off.

WARNING:

If ABS control is disconnected, indicated by the illumination of the  light on the instrument panel, the servo assisted braking system still continues to operate; the simultaneous illumination of the  light on the instrument panel and the "BRAKE" warning light on the A.R. CONTROL, on the other hand indicates an effectively hazardous situation on account of an excessive reduction in hydraulic circuit pressure and the lack of servo assistance.

NOTE:

Reference should be made to the wiring diagram in Group 00 and cabling in Group 40 for electrical testing and component location.

For "Diagnosis Procedure of the (ABS) MARK II Antilock System" refer to Group 00 - Maintenance of Mechanical Components and Body

FRONT AND REAR BRAKES

| Condition | Cause | Corrective action |
|---|--|--|
| A.L. light fails to illuminate with key to IGNITION | <ul style="list-style-type: none"> • Blown bulb • Diode N29a (see Wiring Diagram) is cut off and ABS unit not supplied at same time | <p>Replace bulb or check wiring</p> <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |
| A.L. lights but remains so with key to IGNITION | <ul style="list-style-type: none"> • ABS unit not supplied or inefficient • Brake fluid tank switch H34 or N28 pressure switch (see Wiring Diagram) inefficient | <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |
| With key to IGNITION, the A.L. light and the "BRAKE" light on the A.R. CONTROL light up but both remain so | <ul style="list-style-type: none"> • Insufficient brake fluid • The pressure in the high pressure circuit has not overtaken the minimum safety value (105 bar) • N28 pressure switch (see Wiring Diagram) inefficient | <p>Top up</p> <p>Wait 30 seconds</p> <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |
| With key to IGNITION, the "BRAKE" on A.R. CONTROL lights up but remains so | <ul style="list-style-type: none"> • Worn pads • Insufficient brake fluid • Brake fluid tank switch H34 (see Wiring Diagram) inefficient • N28 pressure switch (see Wiring Diagram) inefficient | <p>Replace</p> <p>Top up</p> <p>Carry out electrical diagnosis of the brake fluid tank for the (ABS) MARK II antilock braking system</p> <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |
| With key to IGNITION, A.L. light illuminates and extinguishes duly after 2 seconds but fails to light up again on starting | <ul style="list-style-type: none"> • Relay I38 (see Wiring Diagram) inefficient | <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |
| With the key to IGNITION, the A.L. light illuminates and duly extinguishes after 2 seconds, but on starting lights up again and remains so | <ul style="list-style-type: none"> • ABS unit inefficient | <p>Replace</p> |
| When running, the A.L. light illuminates or both the A.L. light and the "BRAKE" on A.R. CONTROL light up | <ul style="list-style-type: none"> • Multiple causes | <p>Carry out diagnosis procedure of the (ABS) MARK II antilock system</p> |

| Condition | Cause | Corrective action |
|---|---|--|
| <p>When running the A.L. light illuminates now and again due to causes unknown (and not shown by the diagnosis of the (ABS) MARK II antilock system)</p> | <ul style="list-style-type: none"> • Badly connected or rusty connections • Clearance of the front wheel hub bearings not within specified tolerance limits • Diode N29b (see Wiring Diagram) cut off • Relay 140 (see Wiring Diagram) inefficient • ABS control unit occasionally inefficient | <p>Verify and rectify</p> <p>Return clearance to within specified values (see: Group 21 - Front Suspension Service Data and Specifications - Checks and Adjustment)</p> <p>Replace</p> <p>Replace</p> <p>Replace</p> |
| <p>Insufficient braking power</p> | <ul style="list-style-type: none"> • Brake line leakage • Air in brake system • Grease, oil, mud or water on pad surfaces • Pad deterioration • Worn or seized pad actuating pistons • Brake master cylinder/hydraulic operating cylinder inefficient due to internal leakage | <p>Repair or replace faulty parts</p> <p>Bleed system</p> <p>Clean and detect cause of trouble. Replace pads</p> <p>Replace pads and grind discs as necessary</p> <p>Replace calipers</p> <p>Verify presumed cause thus:</p> <ul style="list-style-type: none"> - Connect two 100 bar pressure gauges (A.2.0440) to the front caliper bleed screws - Turn the key to IGNITION and wait for the electropump to come to a halt - Remove key - Press brake pedal with suitable tool (A.2.0442) until 100 bar is reached on front caliper pressure gauges - Wait about 3 minutes for the pressure to settle then check that the loss of pressure is no greater than 5 bar in 5 minutes. <p>If pressure loss is greater, replace master cylinder with hydraulic operating cylinder</p> |
| <p>Excessive pedal travel</p> | <ul style="list-style-type: none"> • Brake master cylinder and/or hydraulic operating cylinder leakage • Fluid leakage from brake pressure adjusting valve • Brake system union leakage • Air in brake system • Gaskets inside master cylinder and/or hydraulic operating cylinder inefficient | <p>Replace master cylinder with hydraulic operating cylinder</p> <p>Replace</p> <p>Tighten unions to specified torque. Replace</p> <p>Bleed</p> <p>Replace brake master cylinder with hydraulic operating cylinder</p> |

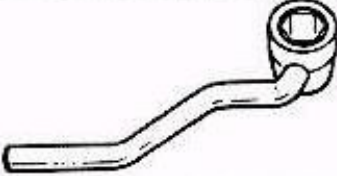
FRONT AND REAR BRAKES

| Condition | Cause | Corrective action |
|--|--|---|
| Pedal sponginess | <ul style="list-style-type: none"> • Air in brake system • Clogged air vent on brake fluid tank • Use of unsuitable brake fluid | <p>Bleed</p> <p>Clean and possibly replace</p> <p>Change to recommended brake fluid and bleed system</p> |
| Uneven braking | <ul style="list-style-type: none"> • Incorrect tyre pressure • Grease, oil, mud or water on pad surfaces • Pad surfaces unevenly worn or deteriorated • Inefficient brake pressure adjusting valve • Incorrect wheel trim | <p>Inflate to correct pressure</p> <p>Clean components and detect cause of trouble. Replace pads</p> <p>Detect cause of trouble and replace pads</p> <p>Replace</p> <p>Adjust</p> |
| Vibration on brake application | <ul style="list-style-type: none"> • Unevenly worn pads • Grease or brake fluid on braking surfaces • Distorted discs | <p>Detect cause and replace pads</p> <p>Detect cause and replace pads</p> <p>Grind or replace</p> |
| Brakes squeal | <ul style="list-style-type: none"> • Unsuitable pads • Rusty discs | <p>Replace</p> <p>Grind or replace</p> |
| Brakes binding | <ul style="list-style-type: none"> • Pedal fails to return to rest position • Calipers stay partially closed • Parking brake stuck | <p>Check pedal motion and repair fault. Replace master cylinder with hydraulic operating cylinder</p> <p>Check and possibly replace</p> <p>Check and repair</p> |
| Rear wheels tend to brake more than front ones | Inefficient brake pressure adjusting valve | Replace |
| Parking brake inoperative | <ul style="list-style-type: none"> • Pads not adjusted • Parking brake travel adjustment incorrect • Control cable damaged or broken • Parking brake control on calipers defective | <p>Adjust</p> <p>Adjust</p> <p>Replace cable</p> <p>Replace calipers</p> |
| Car still braking with parking brake off | Binding in cable return travel | Remove obstacles or replace cable |

FRONT AND REAR BRAKES

| Fault | Cause | Remedy |
|-------------------------------------|--|---|
| Parking brake struck | Lever pushbutton stuck | Disassemble and release or replace lever |
| Park on indicator fails to light up | <ul style="list-style-type: none"> • Open circuit • Defective switch • Defective A.R. CONTROL | Restore circuit continuity Replace Check and possibly replace |

SPECIAL SERVICE TOOLS

| Part No. | Description | Page |
|-------------------------------|--|--|
| A.5.0194 | Wrench, wheel cylinder, 17 |  |
| A.3.0327 A30553 | Hub puller (to be used, without screw, with tool A.3.0617) | 22-24 22-25 |
| A.3.0617 | Percussion tool for rear wheel hub pulling (to be used with tool A.3.0327 without screw) | 22-24 22-25 |
| A.2.0440 | Front and rear brake calipers 100 bar pressure gauges | 22-39 |
| A.2.0442 | Brake pedal operating tool | 22-39 |