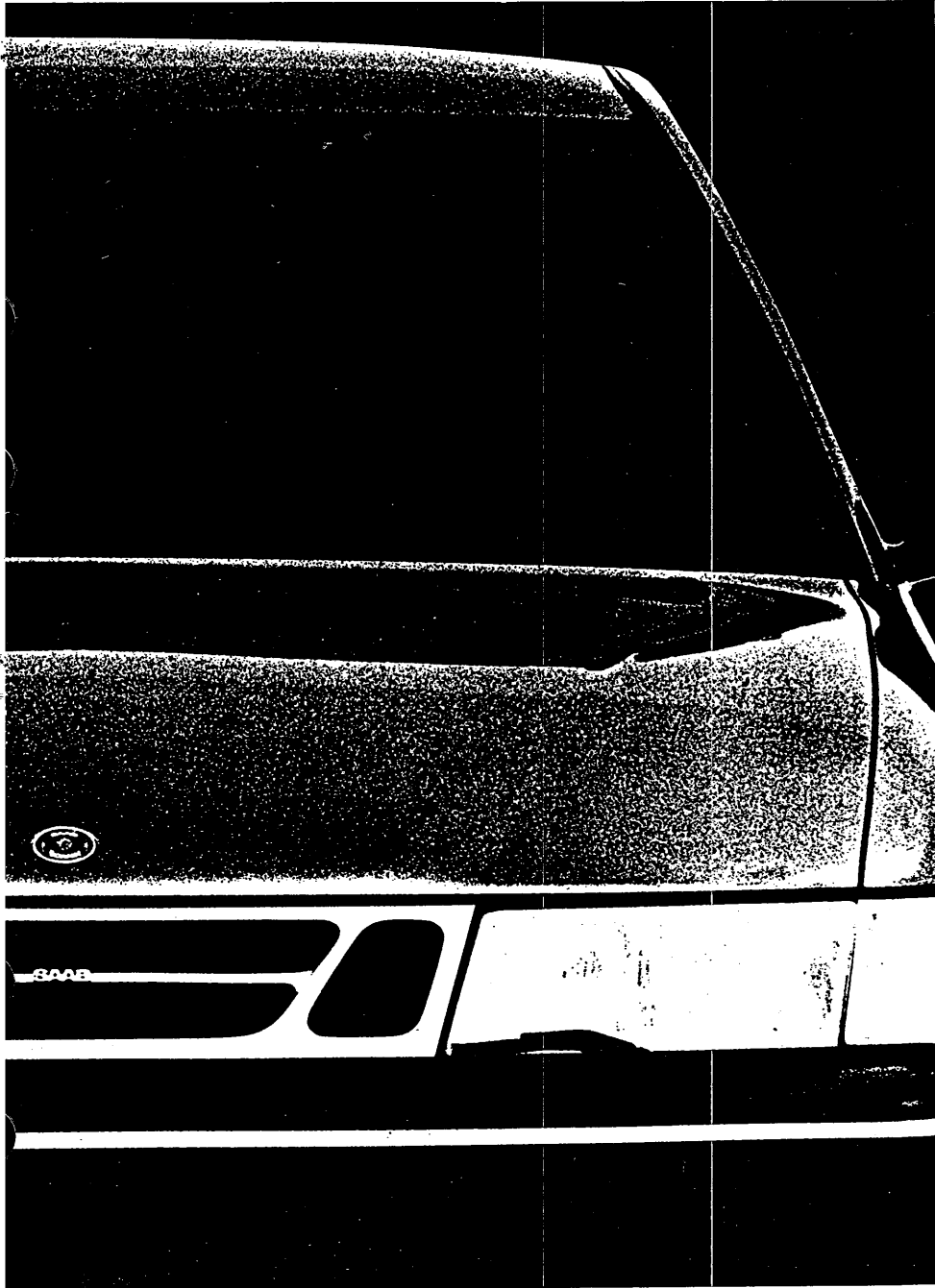


Saab 9000

Service Manual



M 1985-96

ENG

5:1 Brakes

Warning, Important and Note

The headings "Warning", "Important" and "Note" occur from time to time in the Service Manual. They are used to draw the attention of the reader to information of special interest and seriousness. The importance of the information is indicated by the three different headings and the difference between them is explained below.

WARNING

Warns of the risk of material damage and grave injury to mechanics and the driver, as well as serious damage to the car.

Important

Points out the risk of minor damage to the car and also warns the mechanic of difficulties and time-wasting mistakes.

Note

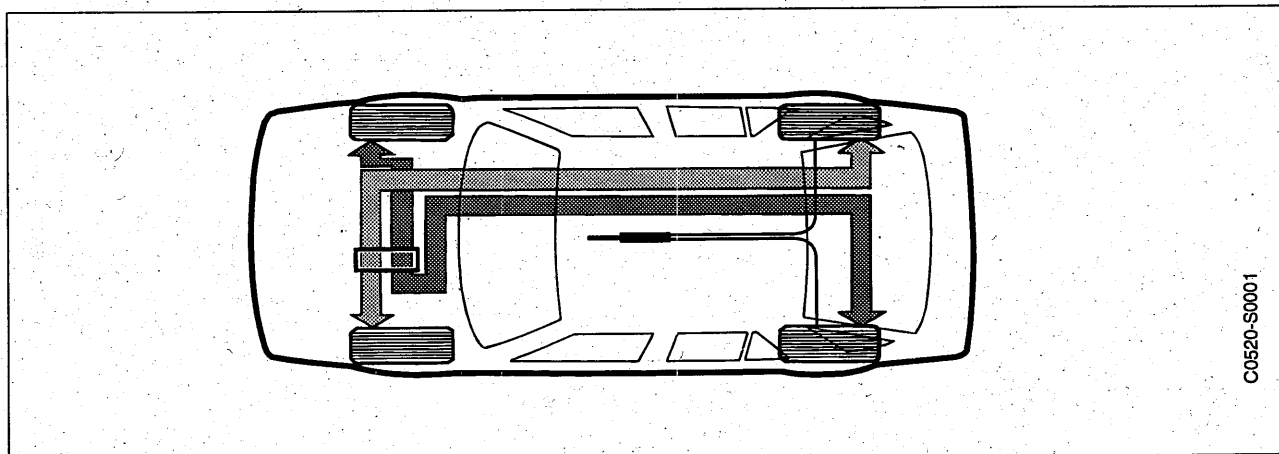
Hints and tips on how the work can be done in a way that saves time and labour. This information is not supplied for reasons of safety.

Market codes

The codes refer to market specifications

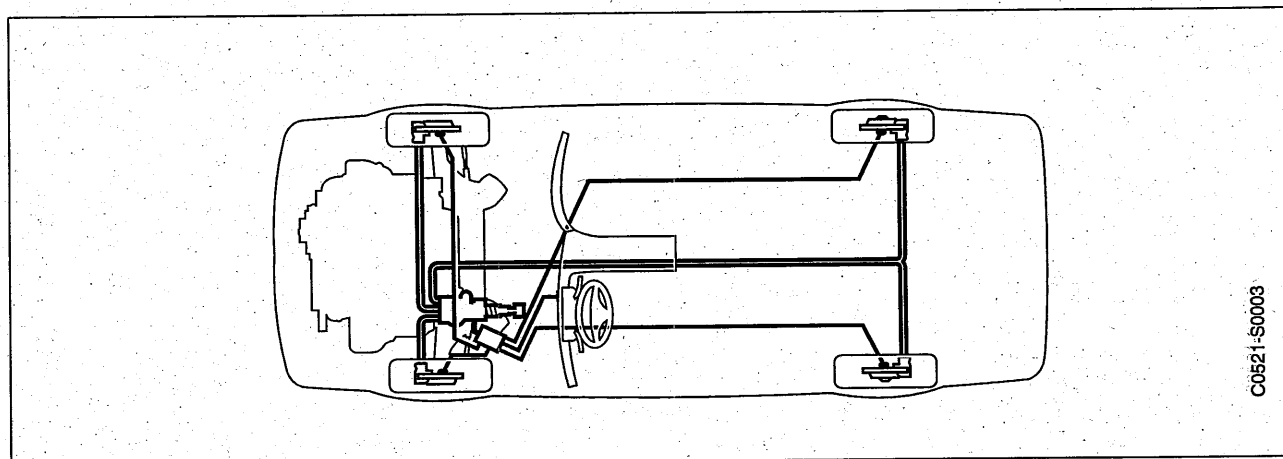
AT	Austria	GB	Great Britain
AU	Australia	GR	Greece
BE	Belgium	IS	Iceland
CA	Canada	IT	Italy
CH	Switzerland	JP	Japan
DE	Germany	ME	Middle East
DK	Denmark	NL	Netherlands
ES	Spain	NO	Norway
EU	Europe	SE	Sweden
FE	Far East	US	USA
FI	Finland	UC	US California
FR	France		

Technical data



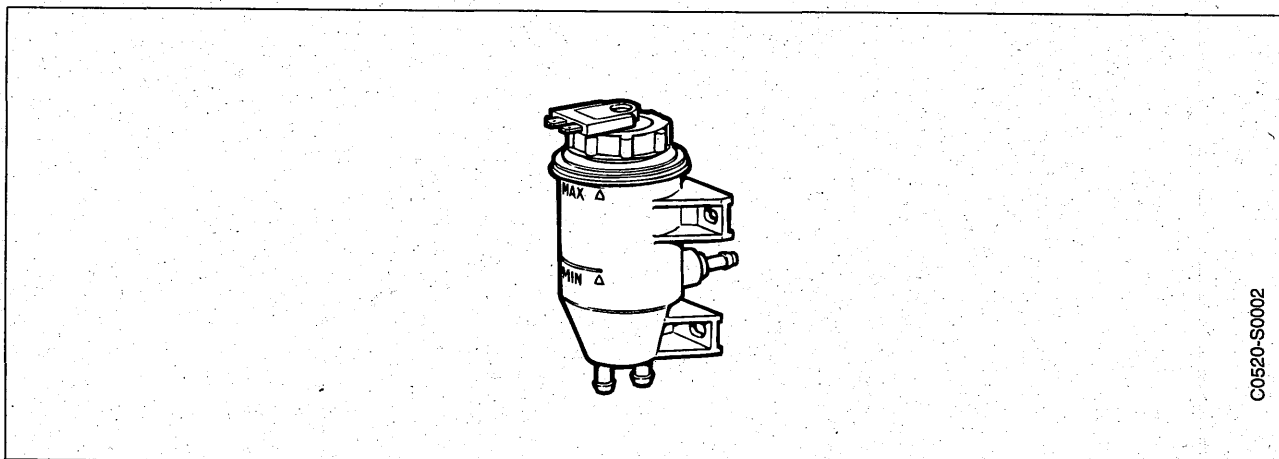
Brake system (cars without ABS and cars with ABS Mk IV)

Type	Two separate diagonal brake circuits
Hydraulic brake system	Acts hydraulically on all wheels
Handbrake system	Acts mechanically on rear wheels



Brake system (cars with ABS Mk II)

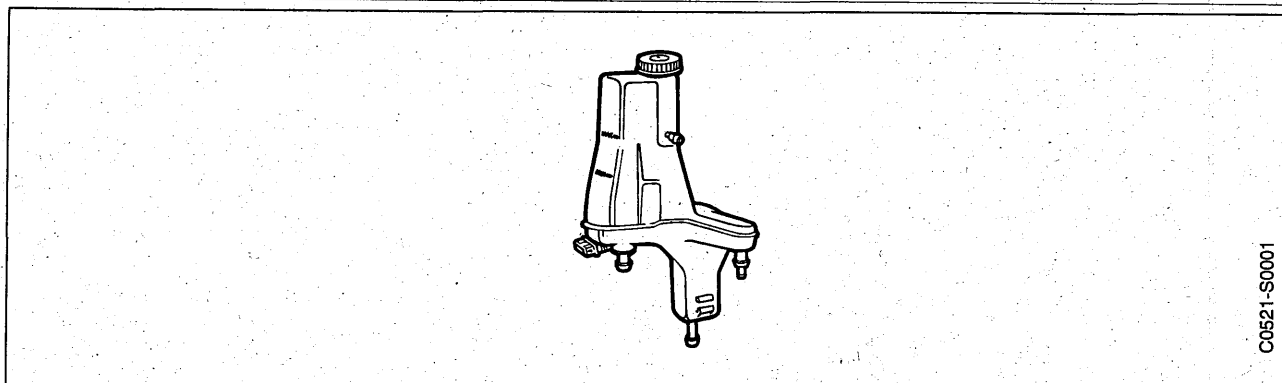
Type	Three separate brake circuits
Hydraulic brake system	Acts hydraulically on all wheels
Handbrake system	Acts mechanically on rear wheels



C0520-S0002

Brake fluid reservoir (cars without ABS)

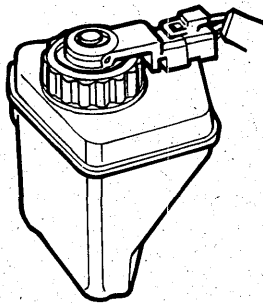
Capacity	litres	0.5
Total brake system capacity	litres	0.58
Brake fluid specification		DOT 4
Number of chambers	quantity	1
Chamber 1		To primary circuit
Chamber 2		to secondary circuit
Chamber 3		to clutch cylinder



C0521-S0001

Brake fluid reservoir (ABS Mk II)

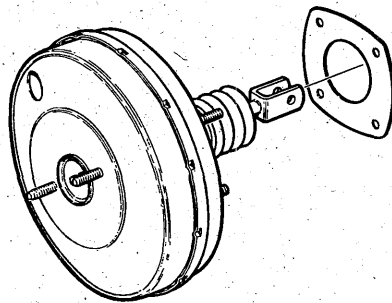
Capacity	litres	0.8
Total brake system capacity	litres	1.2
Brake fluid specification		DOT 4
Number of chambers		3
chamber 1		static circuit
chamber 2		dynamic circuit (to high pressure pump)
chamber 3		dynamic circuit (from servo cylinder)
Flow rate, filter	litres/minute	0.5
Resistance, level warning switch	Ohms	10 (float at bottom)
Resistance, ABS warning switch	Ohms	1 (float at top)



C0521-S0002

Brake fluid reservoir (ABS Mk IV)

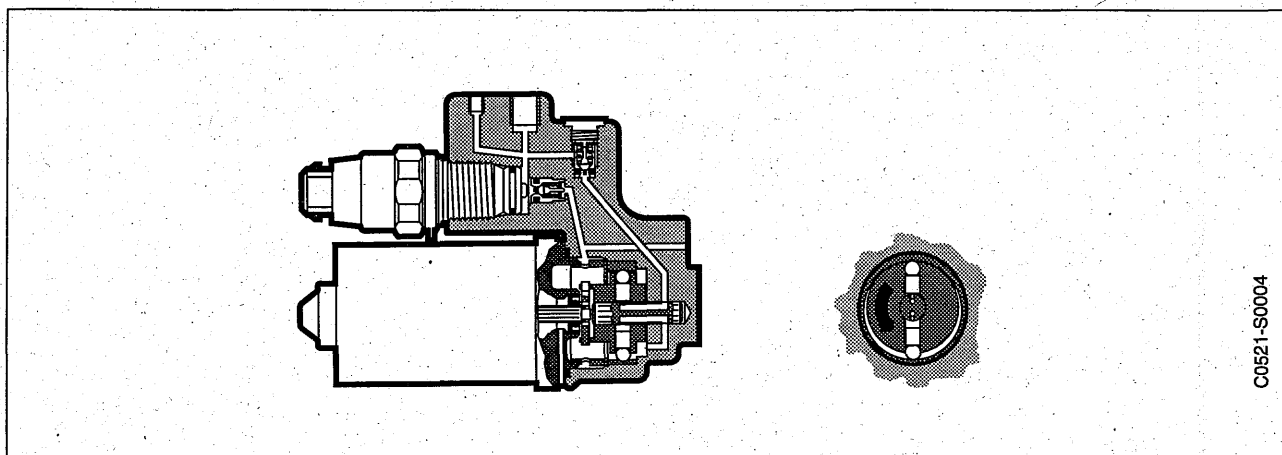
Capacity	litres	0.36
Brake fluid specification		DOT 4
Number of chambers		5
Chambers 1 and 2		Primary circuit
Chambers 3 and 4		Secondary circuit
Chamber 5		Hydraulic clutch
Flow rate, filter	litres/minute	0.5 for both brake circuits



C0520-S0003

Brake servo unit (not ABS Mk II)

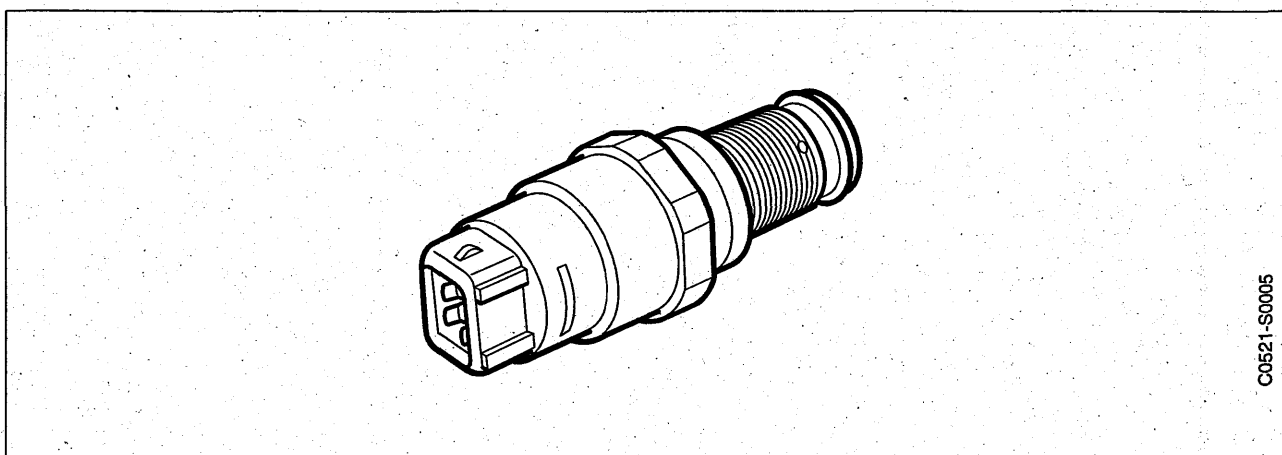
Manufacturer		Girling (Ate/Teves on ABS MK IV)
Type		Vacuum assisted
Diameter	mm (in)	203 mm (8)
Power amplification		4:1 (at 300 N (66 lbf) pedal pressure)



C0521-S0004

High-pressure pump (ABS Mk II only)

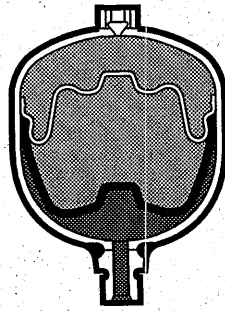
Type		ball-valve pump
Pressure, suction side	bar (psi)	0.1–1.0 (1.45–14.5)
Pressure, delivery side	bar (psi)	140–180 (2030–2610)
Opening pressure, relief valve	bar (psi)	210 (3045)
Rating	W	180 (at 160 bar)
Maximum operating time	minutes	2, then a 10-minute rest period (the pump must not be run dry)



C0521-S0005

Pressure switch (ABS Mk II only)

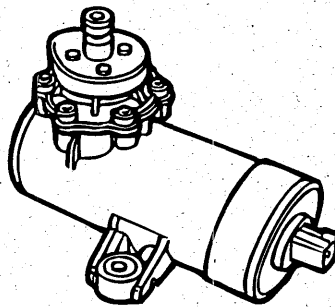
Upper breakpoint, pressure switch	bar (psi)	180 ± 4 (2610 ± 58)
Lower breakpoint, pressure switch	bar (psi)	140 ± 4 (2030 ± 58)
Upper breakpoint, warning switch	bar (psi)	134 ± 2 (1943 ± 29)
Lower breakpoint, warning switch	bar (psi)	150 ± 2 (1523 ± 29)



C0521-S0006

Pressure accumulator (ABS Mk II only)

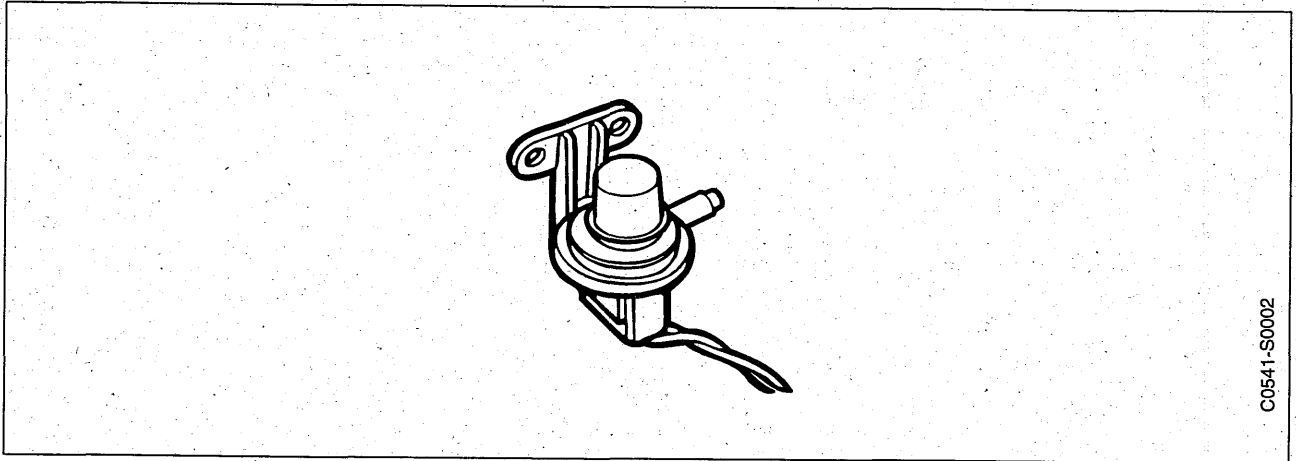
Type, gas		nitrogen
Gas pressure	bar (psi)	80 (1160) (at 20°C)
Minimum gas pressure	bar (psi)	40 (580)
Capacity	litres	0.25
Pressure range, operating pressure	bar (psi)	135–190 (1958–2755)
Maximum pressure loss	bar (psi)/10 min	10 (145)



C0541-S0001

Vacuum pump (2.0 LPT aut. M1996– only)

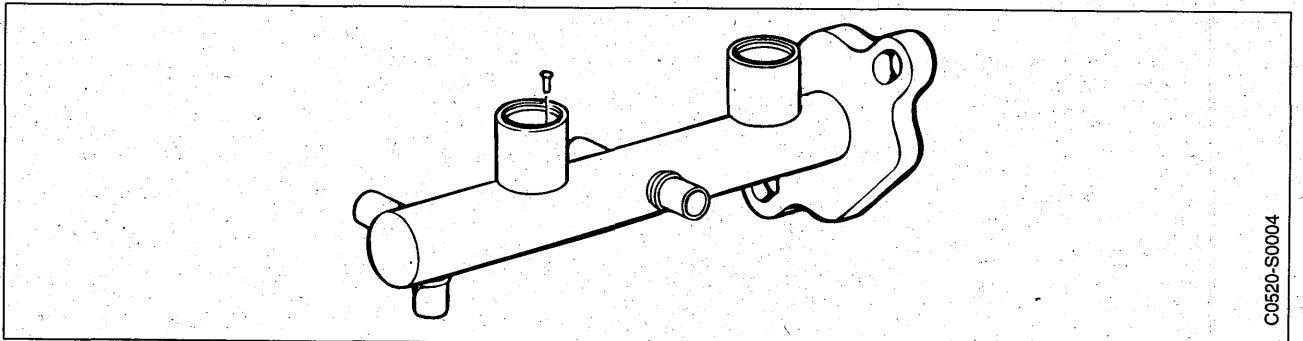
Manufacturer		Pierburg PA66 GF30
Maximum speed	rpm	4400
Maximum vacuum	bar	0.8
Resistance	Ohms	1,45
Operating voltage	V	12
Current consumption	A	2.3



C0541-S0002

Pressure switch, vacuum pump (2.0 LPT aut. M1996- only)

Manufacturer		TRW
Starts at	bar	0.35
Stops at	bar	0.4



C0520-S0004

Master cylinder

cars with ABS:

Manufacturer		Girling
Type		Tandem cylinder
Diameter	mm (in)	22.2 (0.87)

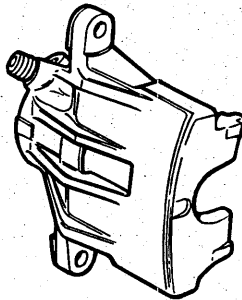
ABS MK IV:

Manufacturer		Ate
Type		Tandem cylinder
Diameter	mm (in)	22.2 (0.87)

ABS MK II:

Manufacturer		Ate
Type		Tandem cylinder
Diameter	mm (in)	23.81 (0.937)

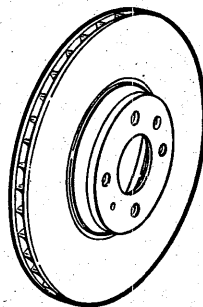
9000 Turbo M1985–1987
9000i M1985–1989



C0520-S0005

Brake caliper, front wheel

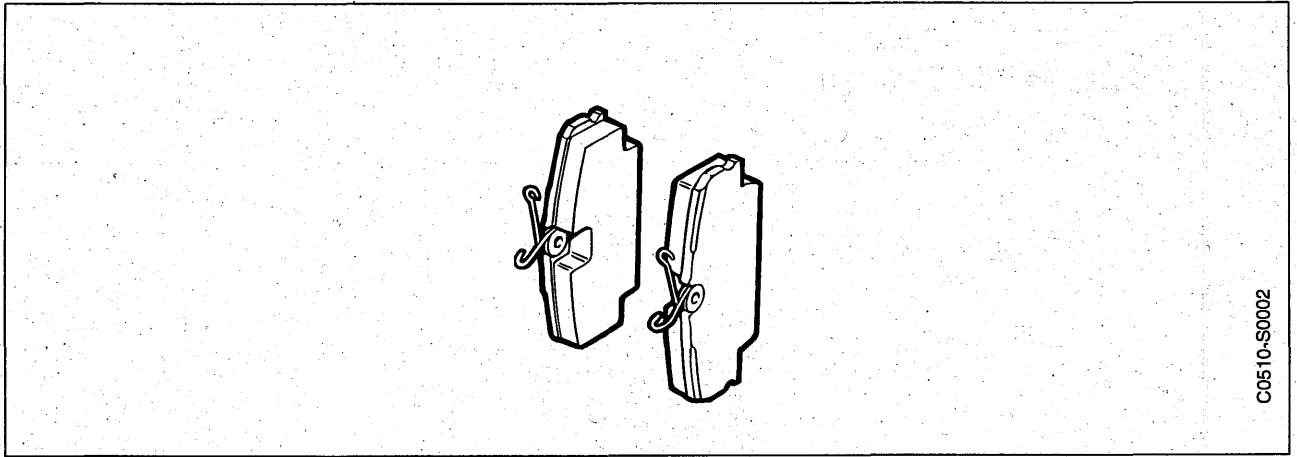
Manufacturer	Girling
Type designation	Colette 54
Type	Disc brake with sliding hydraulic body
Piston diameter	mm (in) 54 (2.13)



C0510-S0001

Brake disc, front wheel

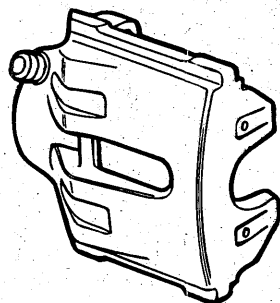
Type	Ventilated	
Outside diameter	mm (in)	278 (10.95)
Thickness (new)	mm (in)	23.5 ±0.2 (0.87 ±0.01)
Minimum thickness after grinding	mm (in)	21.5 (0.79)
Grinding depth each side	mm (in)	1.0 (0.04)
Max. runout (fitted)	mm (in)	0.08 (0.003)
Max. variation in thickness	mm (in)	0.015 (0.0006)



Brake pads, front wheel

Friction pad thickness (new)	mm (in)	16.7 (0.66)
Friction pad thickness (minimum)	mm (in)	4.0 (0.16)
Friction pad area	cm ³ (in ³)	35 (5.4)

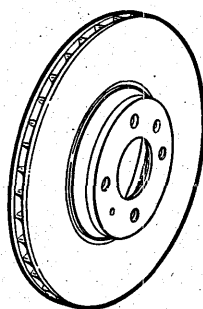
9000 Turbo M1988– 9000i M1990–



C0520-S0006

Brake caliper, front wheel

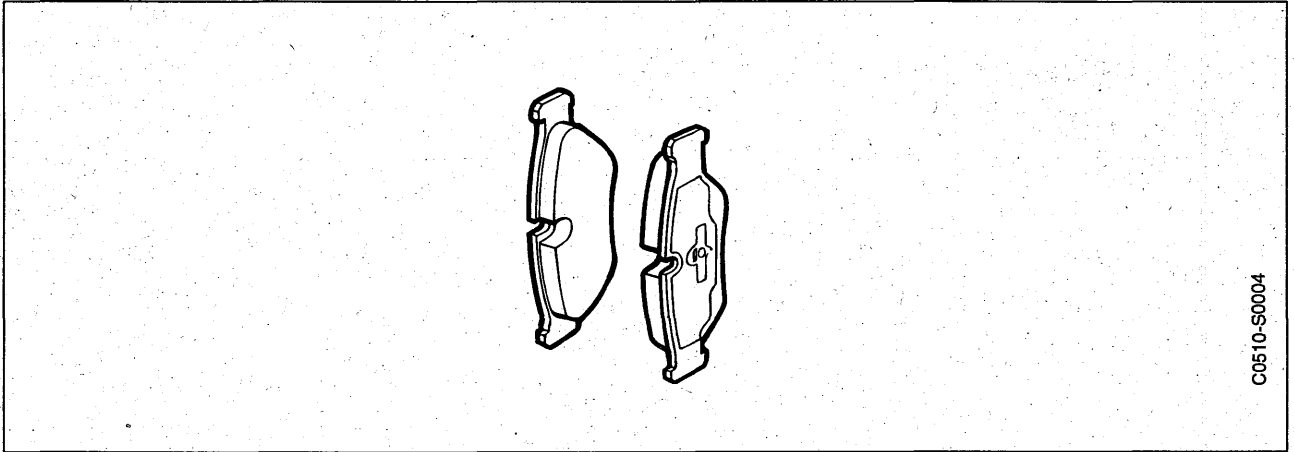
Manufacturer	Ate	
Type designation	FN 57	
Type	Disc brake with sliding hydraulic body	
Piston diameter	mm (in)	57 (2.24)



C0510-S0003

Brake disc, front wheel

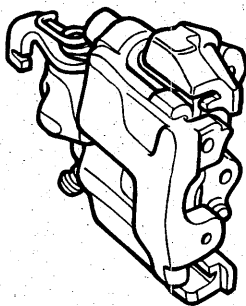
Type	Ventilated	
Outside diameter	mm (in)	278 (10.95)
Thickness (new)	mm (in)	25.0 ±0.2 (0.98 ±0.01)
Minimum thickness after grinding	mm (in)	23.5 (0.91)
Grinding depth each side	mm (in)	1.0 (0.04)
Max. runout (fitted)	mm (in)	0.08 (0.003)
Max. variation in thickness	mm (in)	0.015 (0.0006)



Brake pads, front wheel

Friction pad thickness (new)	mm (in)	19.5 (0.77)
Friction pad thickness (minimum)	mm (in)	4.0 (0.16)
Friction pad area	cm ³ (in ³)	48 (7.4)

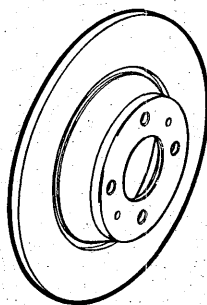
Saab 9000 M1985-



C0520-S0007

Brake caliper, rear wheels

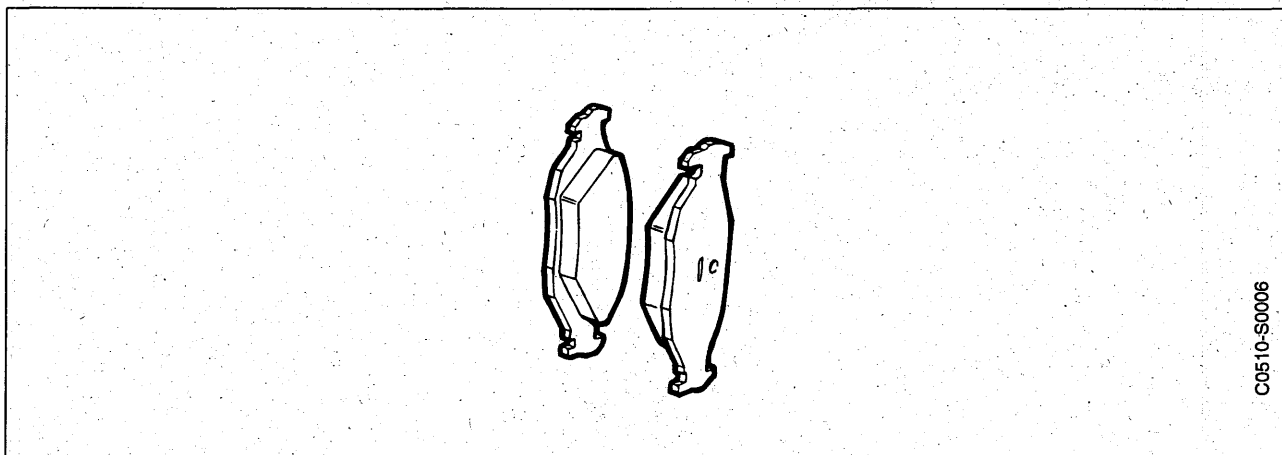
Manufacturer	Ate	
Type	Disc brake with sliding hydraulic body	
Piston diameter	mm (in)	33 (1.26)



C0510-S0005

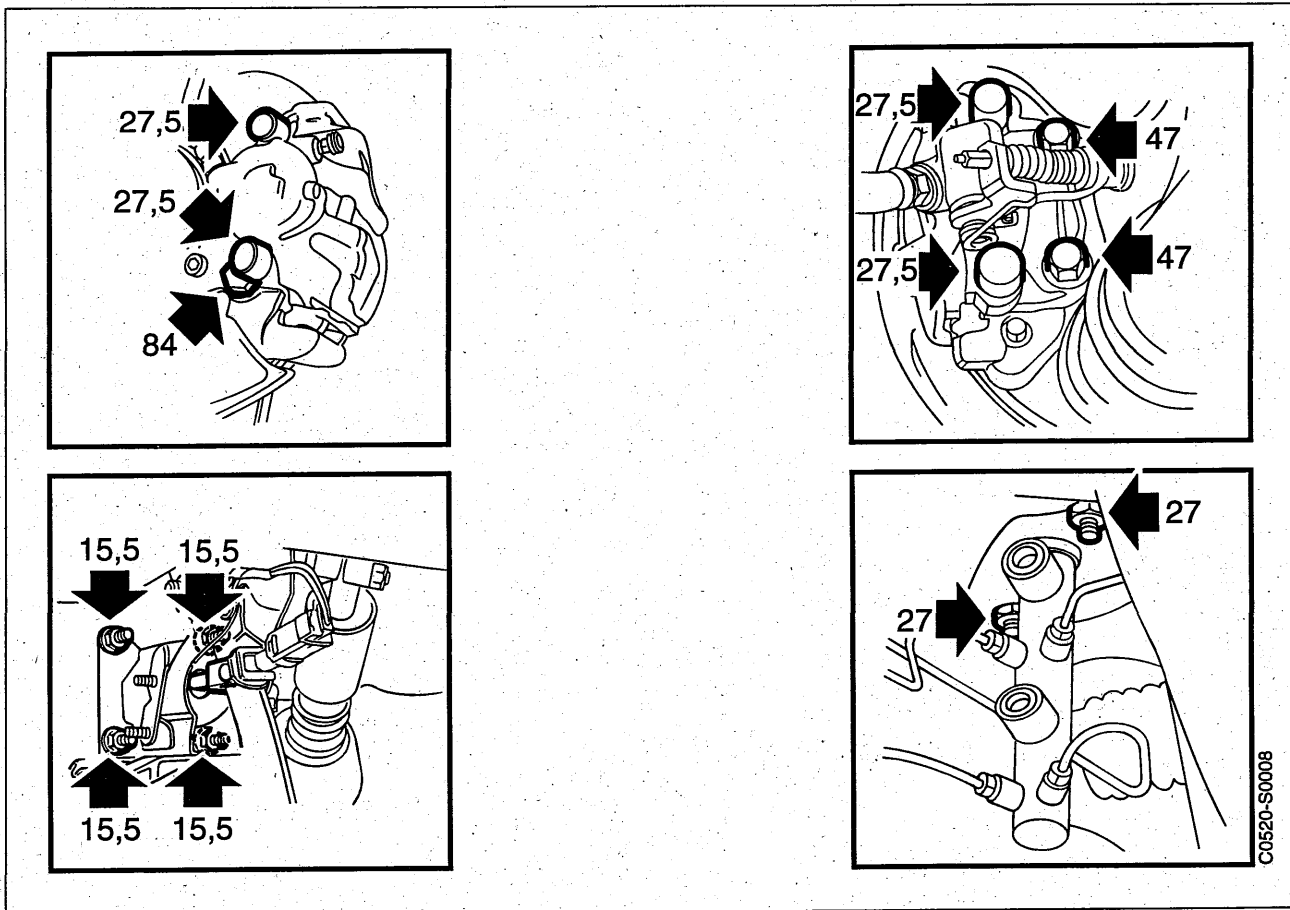
Brake disc, rear wheels

Type	"Solid" (not ventilated)	
Outside diameter	mm (in)	258 (10.16)
Thickness (new)	mm (in)	9.0 ±0.1 (0.35 ±0.004)
Minimum thickness after grinding	mm (in)	7.5 (0.29)
Grinding depth each side	mm (in)	0.7 (0.03)
Max. runout (fitted)	mm (in)	0.08 (0.003)
Max. variation in thickness	mm (in)	0.015 (0.0006)



Brake pads, rear wheels

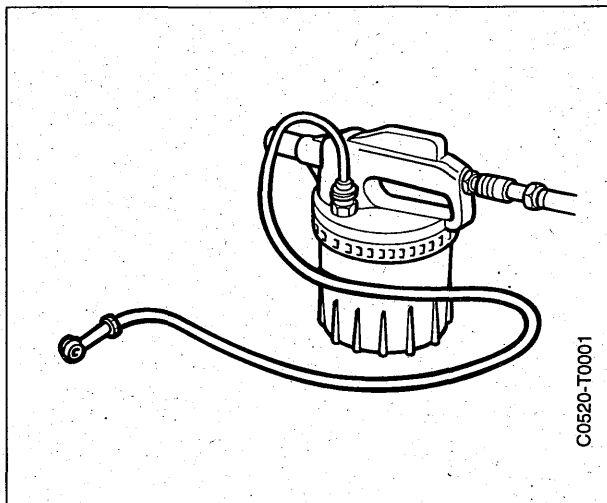
Friction pad thickness (new)	mm (in)	11.0 (0.43)
Friction pad thickness (minimum)	mm (in)	4.0 (0.16)
Friction pad area	cm ³ (in ³)	18.4 (2.8)



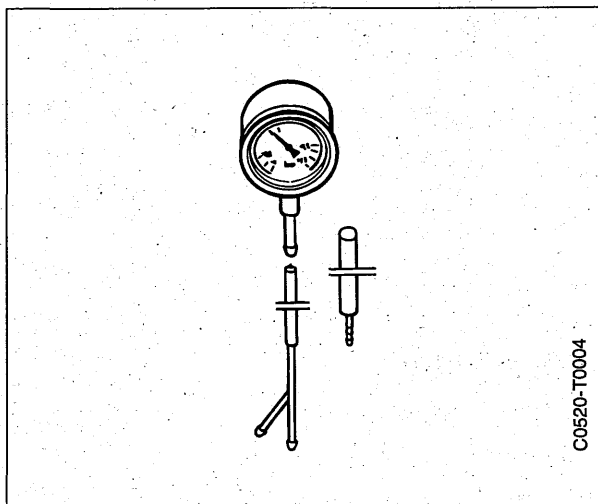
Tightening torques

Front caliper's carrier to steering swivel member	Nm (lbf ft)	84 (62)
Rear caliper carrier to rear axle hub	Nm (lbf ft)	47 (35)
Guide pins, front	Nm (lbf ft)	27.5 (20.5)
Guide pins, rear	Nm (lbf ft)	27.5 (20.5)
Brake servo retaining nuts	Nm (lbf ft)	15.5 (11.5)
Master cylinder retaining nuts	Nm (lbf ft)	27 (20)

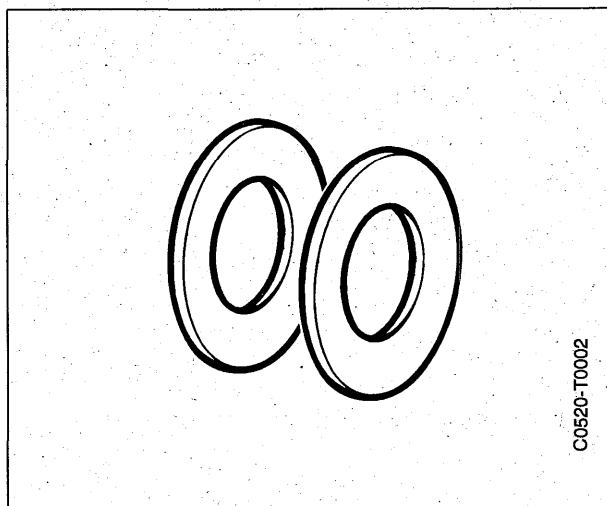
Special tools



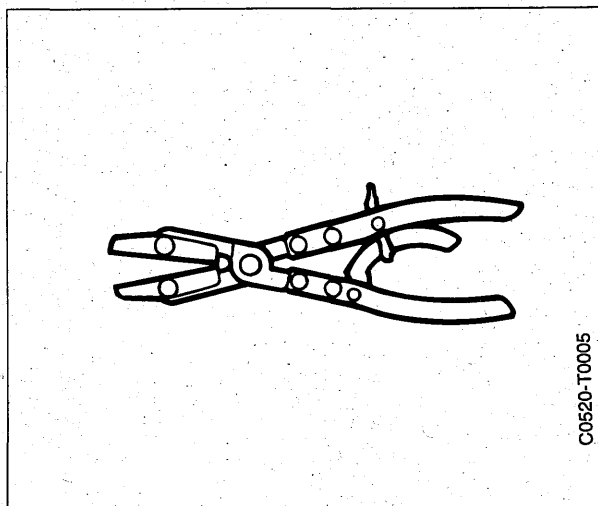
(16) 88 19 096 Brake system bleeder unit



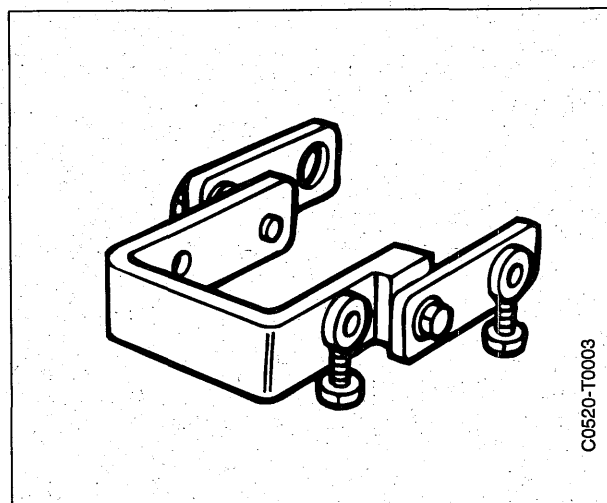
(16) 83 93 514 Boost pressure meter



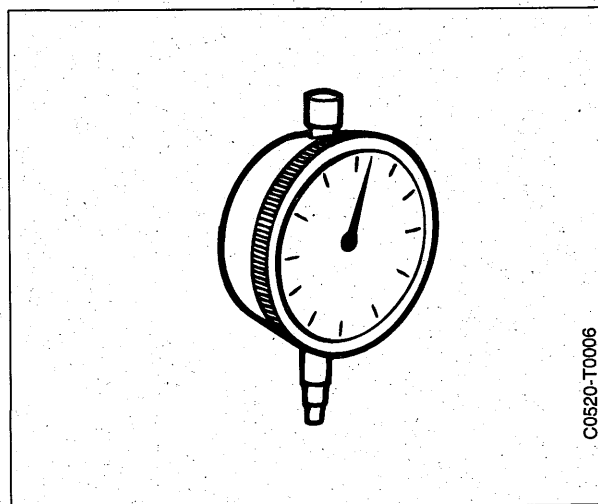
(10) 80 73 124 Washer



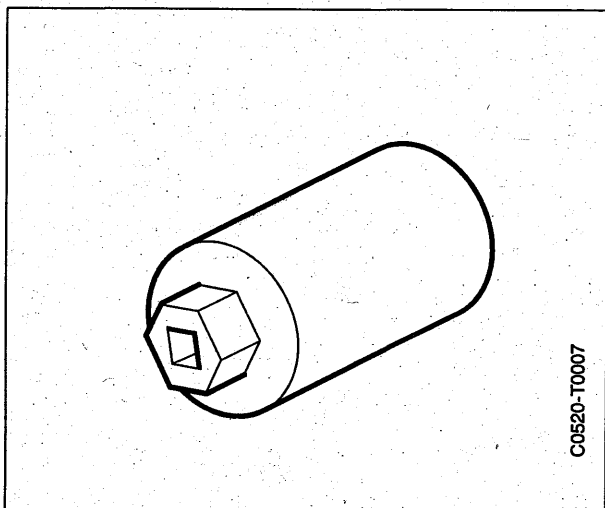
(16) 30 07 739 Hose pinch-off pliers



(16) 89 96 639 Brake disc measuring tool



(16) 78 40 622 Dial gauge

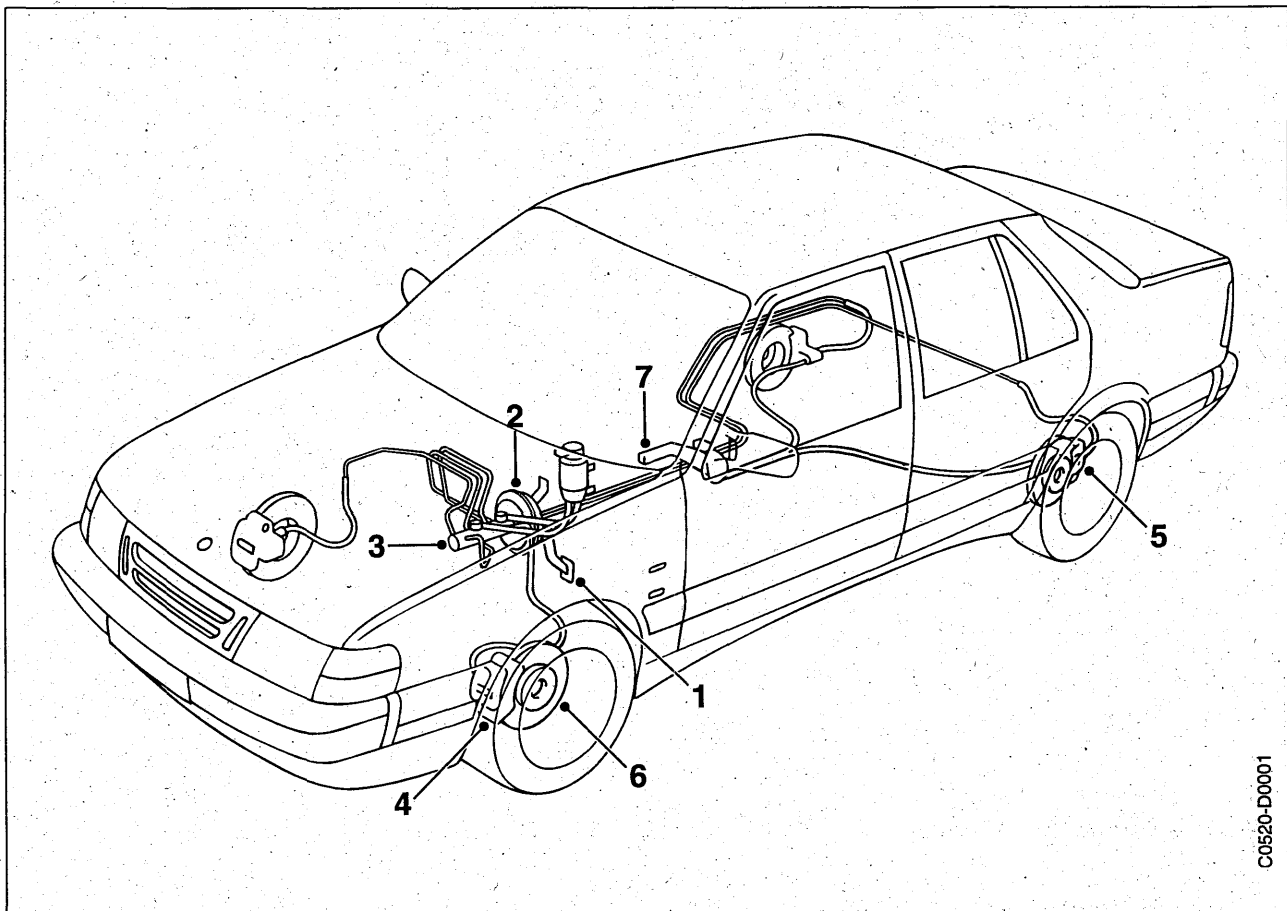


(16) 89 96 571 Sleeve

Technical description

General	17	Pressure accumulator	34
Brake fluid reservoir	20	Pressure switch	35
Hydraulic brake system	23	Master cylinder	36
Brake servo unit	25	Brake caliper, front wheel	44
Vacuum pump	32	Brake caliper, rear wheel	45
High-pressure pump	33	Handbrake system	46

General



C0520-D0001

Brake system

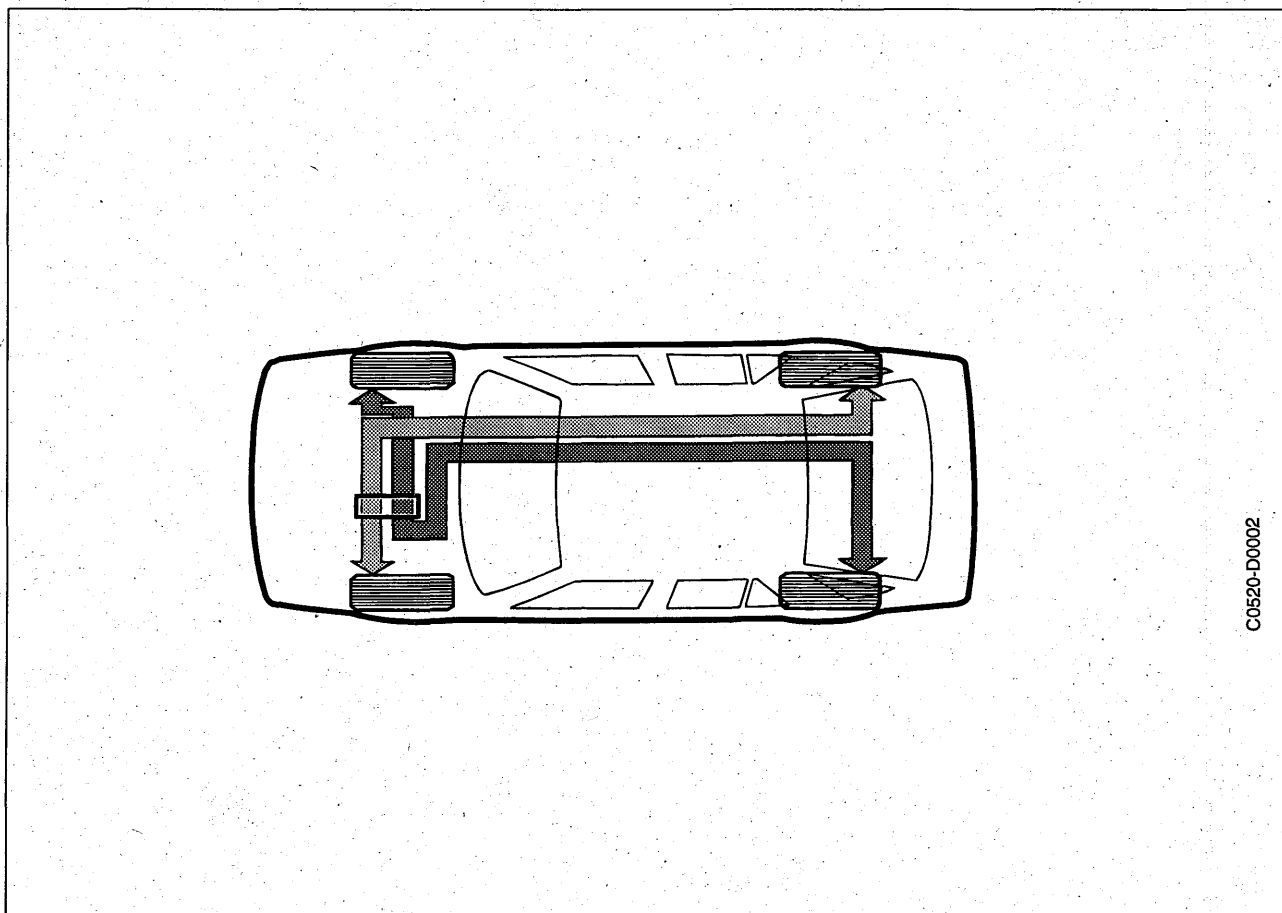
- 1 Brake pedal
- 2 Brake servo unit
- 3 Master cylinder
- 4 Brake caliper, front wheel
- 5 Brake caliper, rear wheel
- 6 Brake disc
- 7 Handbrake lever

The car is equipped with two independent brake systems:

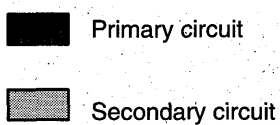
- Hydraulic brake system
- Handbrake system

The hydraulic brake system is operated by the brake pedal and acts hydraulically on all the wheels. The handbrake system is operated by the handbrake lever and acts mechanically on the rear wheels.

General (contd.)



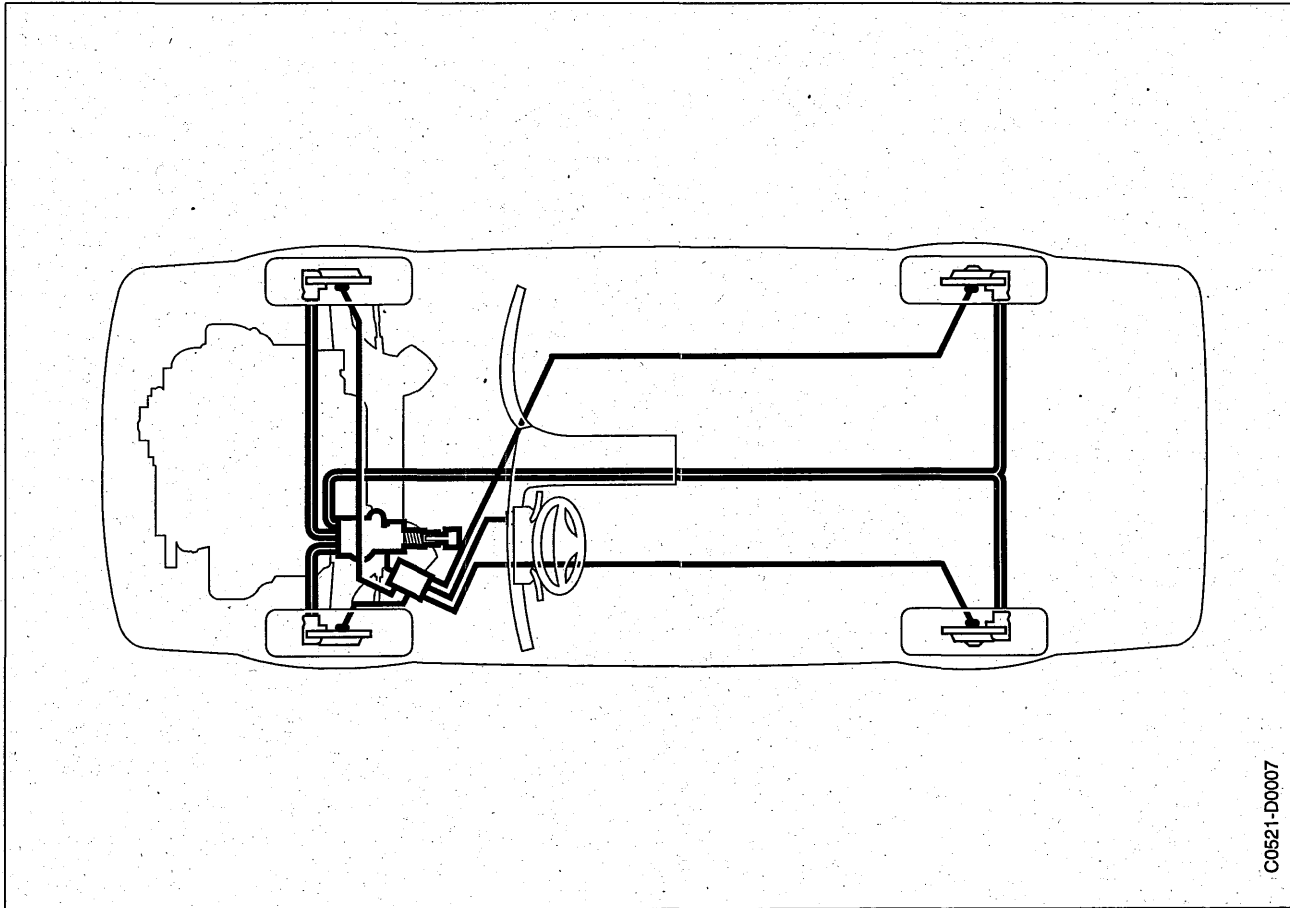
C0520-D0002



Cars without ABS and cars with ABS MK IV

The hydraulic brake system consists of two separate diagonal brake circuits. One circuit is for the right-hand front wheel and left-hand rear wheel (primary circuit) and the other circuit is for the left-hand front wheel and right-hand rear wheel (secondary circuit). With the circuits split in this way, if one circuit should fail because of leakage; for instance, the other circuit still remains operative and always provides at least 50% of the total braking power.

General (contd.)

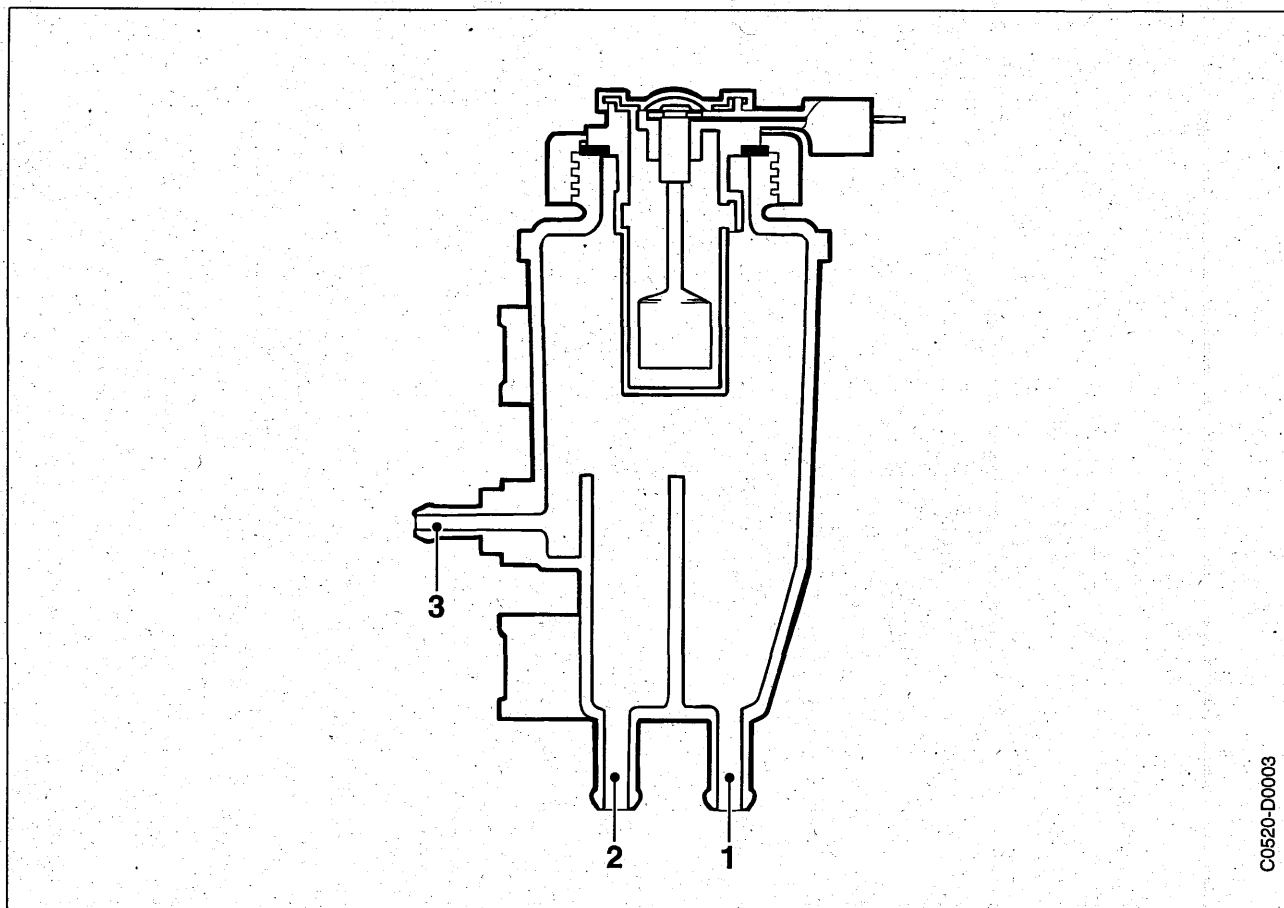


Cars with ABS MK II

The ABS MK II is a 3-circuit brake system with individual control of two circuits (one for each front wheel) and common control of the third circuit (for the rear wheels).

Instead of a conventional vacuum servo unit, the ABS MK II uses hydraulic pressure provided by a high-pressure pump.

Brake fluid reservoir (cars without ABS)



Brake fluid reservoir

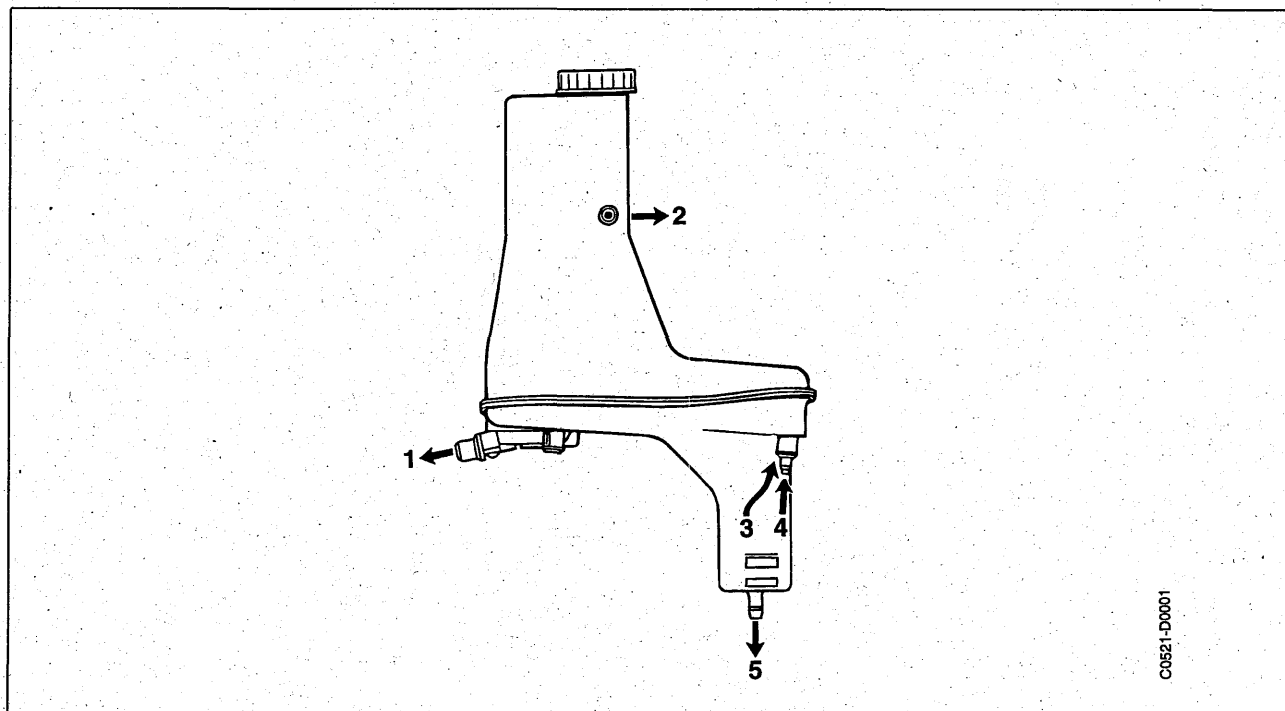
- 1 To primary circuit
- 2 To secondary circuit
- 3 To clutch cylinder

The brake fluid reservoir is divided into three chambers:

- one chamber for the right/hand front wheel and left-hand rear wheel (primary circuit)
- one chamber for the left-hand front wheel and right-hand rear wheel (secondary circuit)
- one chamber for the clutch cylinder (manual gear-box).

A level switch is built into the brake fluid reservoir filler cap. This switch consists of a float and two contacts. If the level of the brake fluid drops, the float sinks, the two contacts close and the brake fluid warning lamp on the dashboard lights up.

Brake fluid reservoir (ABS MK II)



Brake fluid reservoir

- 1 To master cylinder
- 2 To clutch cylinder
- 3 From servo cylinder
- 4 From valve block
- 5 To high-pressure pump

The brake fluid reservoir is divided into three chambers:

- one chamber for the master cylinder feeding the front-wheel circuits
- one chamber for the high-pressure pump feeding the rear-wheel circuit and servo cylinder
- one chamber for the clutch cylinder (cars with manual gearbox only).

These chambers have a safety function. In the event of leakage in the front wheel circuits the brake fluid reservoir will always retain a sufficient amount of fluid for the rear wheel circuit so that the rear wheels can be braked. In the event of leakage in the rear wheel circuit the front wheels can be braked, although without servo assistance and consequently requiring higher pedal pressure.

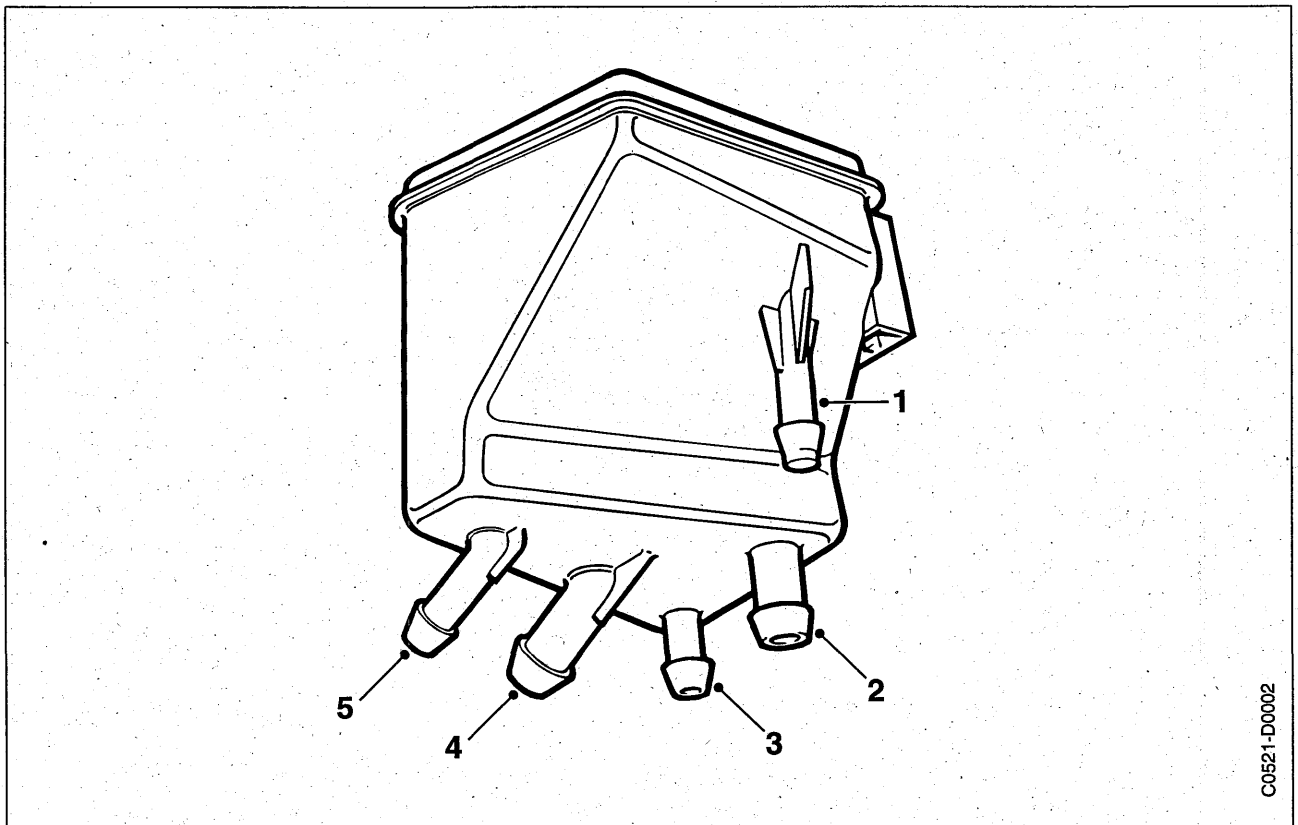
The return flow from the valve block, servo cylinder and master cylinder goes to the second chamber so that movement of the brake fluid is damped. This prevents brake fluid mixed with air bubbles from being sucked into the brake system.

The brake fluid reservoir holds about 0.8 litres and has MIN and MAX marks to indicate the fluid level. The reservoir is mounted beside the hydraulic unit

and is connected to it via two "push-in" rubber bushes. A hose for feeding the high-pressure pump is also connected to the reservoir. The filter in the reservoir cannot be changed separately.

A level switch is mounted in the reservoir. If the fluid level drops too low a warning lamp first lights up. If the fluid level drops still further, this will be registered by the control module which disconnects the ABS and switches the ABS warning lamp on.

Brake fluid reservoir (ABS MK IV)



C0521-D0002

- 1 To clutch
- 2 To master cylinder, primary
- 3 To master cylinder, secondary
- 4 To pump, primary
- 5 To pump, secondary

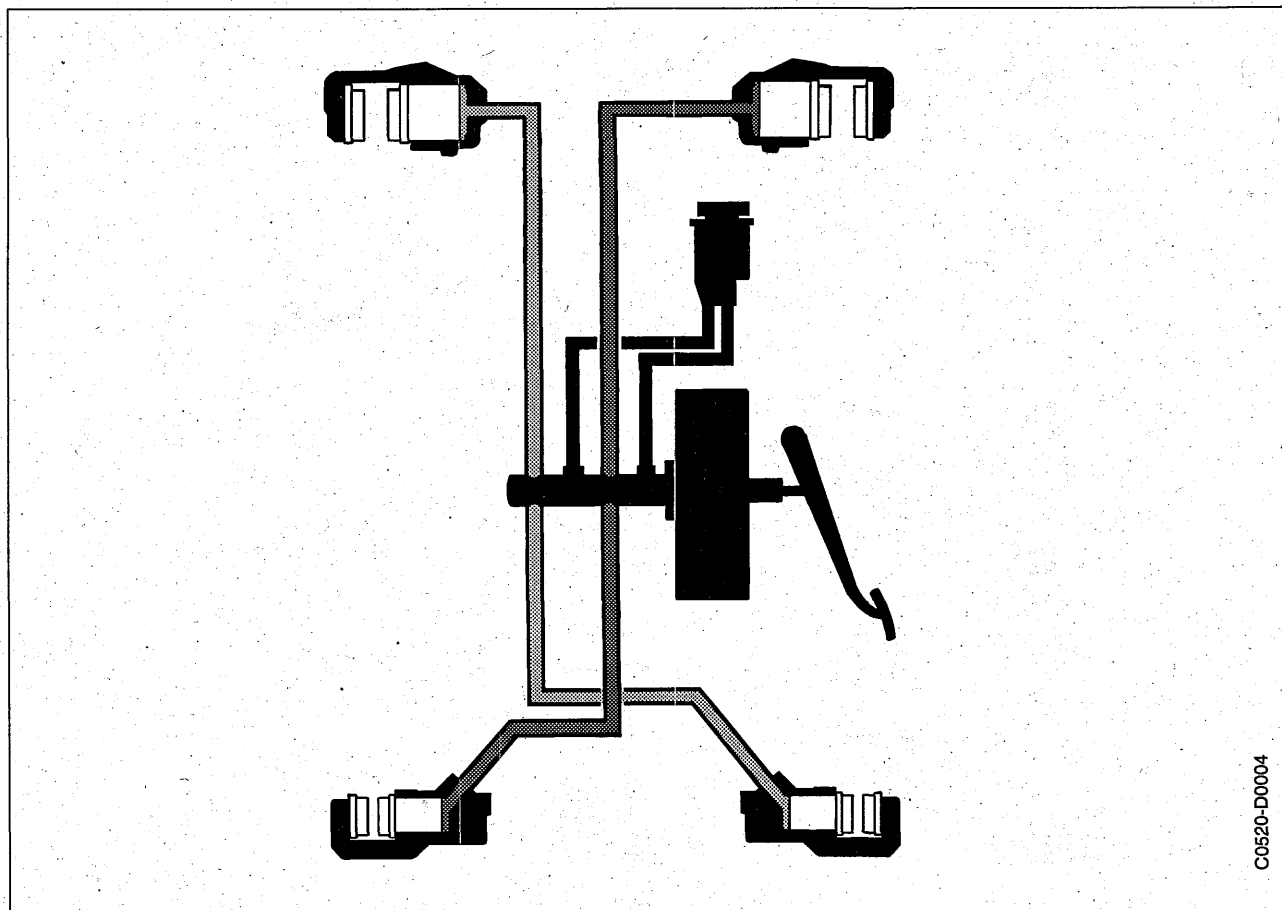
The brake fluid reservoir is divided into five chambers:

- one chamber for the clutch (only cars with a manual gearbox). On cars with automatic transmission this chamber is plugged.
- two chambers for the primary circuit – one for the master cylinder and one for feeding the pump.
- two chambers for the secondary circuit – one for the master cylinder and one for feeding the pump. These chambers have a safety function. Should leakage occur in the primary circuit, for instance, the reservoir will still contain sufficient brake fluid for the secondary circuit. Consequently, full braking power will be available for the secondary circuit's diagonal system, that is to say the left-hand front wheel and right-hand rear wheel. In other words, two wheels can still be braked.

The brake fluid reservoir holds 0.36 litres and has MIN and MAX marks to indicate the fluid level. The reservoir is mounted on the bulkhead partition beside the main fuse box for the ABS and is connected to the hydraulic unit by means of four supply hoses.

A level switch is built into the brake fluid reservoir filler cap. This switch consists of a float and two contacts. If the level of the brake fluid drops, the float sinks, the two contacts close and the brake fluid warning lamp on the dashboard lights up.

Hydraulic brake system

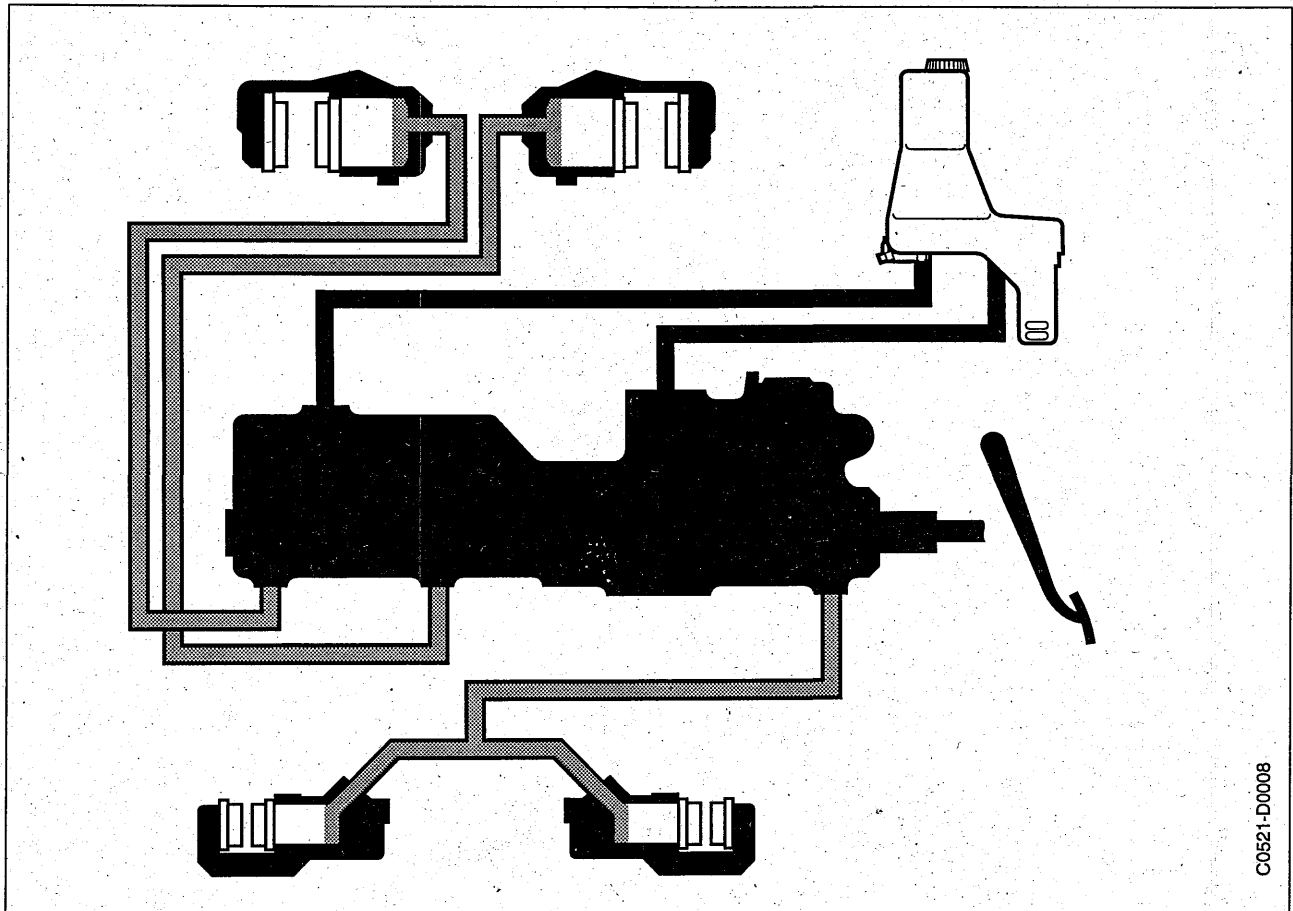


Cars without ABS and cars with ABS MK IV

When the brake pedal is depressed, pedal force is boosted by the brake servo unit and pressure builds up in the master cylinder. The pressure on the pistons in the master cylinder is propagated in the brake system and acts on the brake piston in each caliper. The brake piston presses the brake pads against the brake disc.

When the brake pedal is released, the pistons in the master cylinder return to their original positions and the return passage is opened. Pressure is relieved and the brake pistons are retracted to the rest (brakes off) position by means of the piston sealing ring in the brake cylinder.

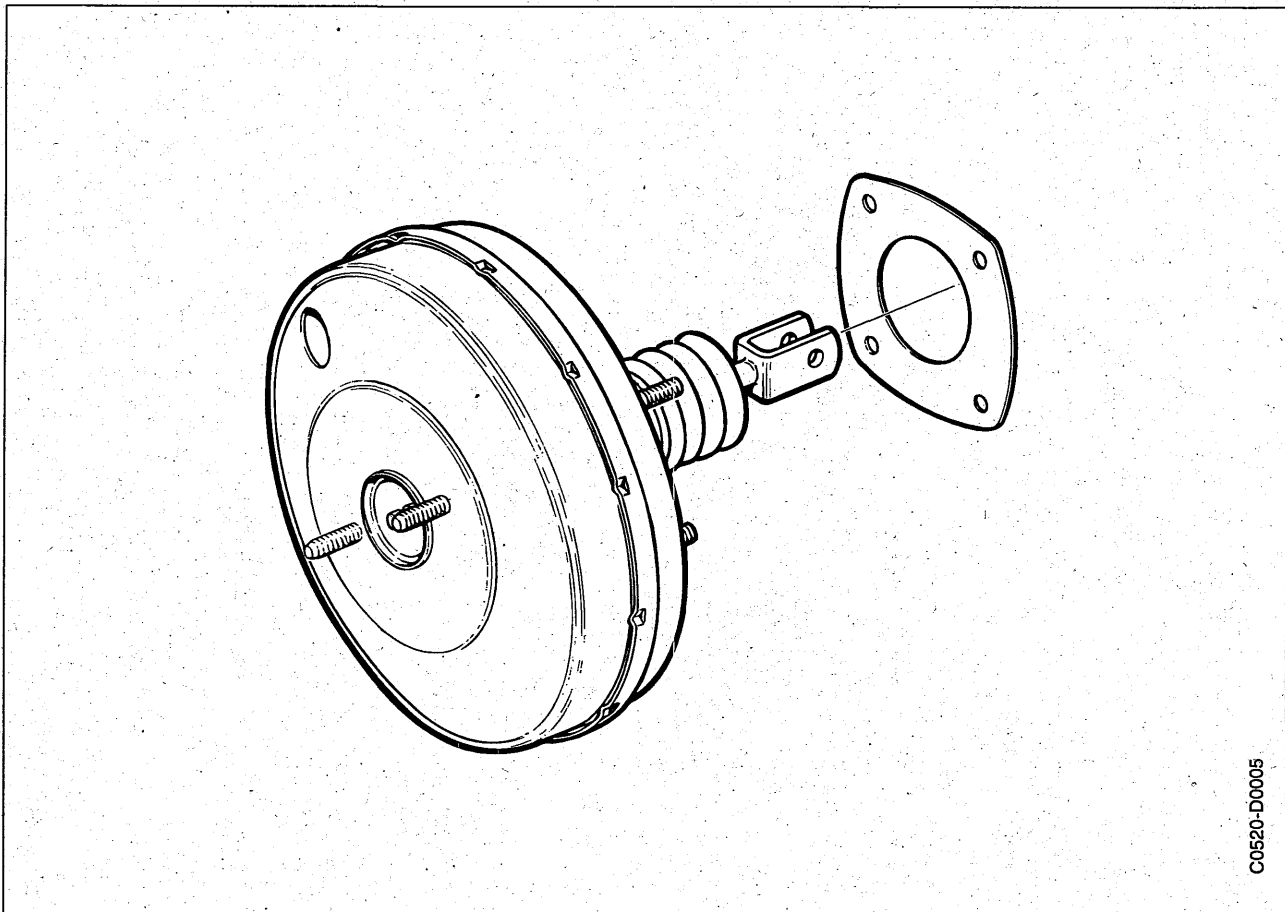
Hydraulic brake system (contd.)



Cars with ABS MK II

When the brake pedal is depressed, pedal force is boosted by a servo cylinder which is supplied with brake fluid under pressure from the pressure accumulator. Pressure builds up in the master cylinder. The pressure on the pistons in the master cylinder is propagated in the brake system and acts on the brake piston in each hydraulic body. The brake piston presses the brake pads against the brake disc. When the brake pedal is released, the pistons in the master cylinder return to their original positions and the return passage is opened. Pressure is relieved and the brake pistons are retracted to the rest (brakes off) position by means of the piston sealing ring in the brake cylinder.

Brake servo unit (cars without ABS and cars with ABS MK IV)



C0520-D0005

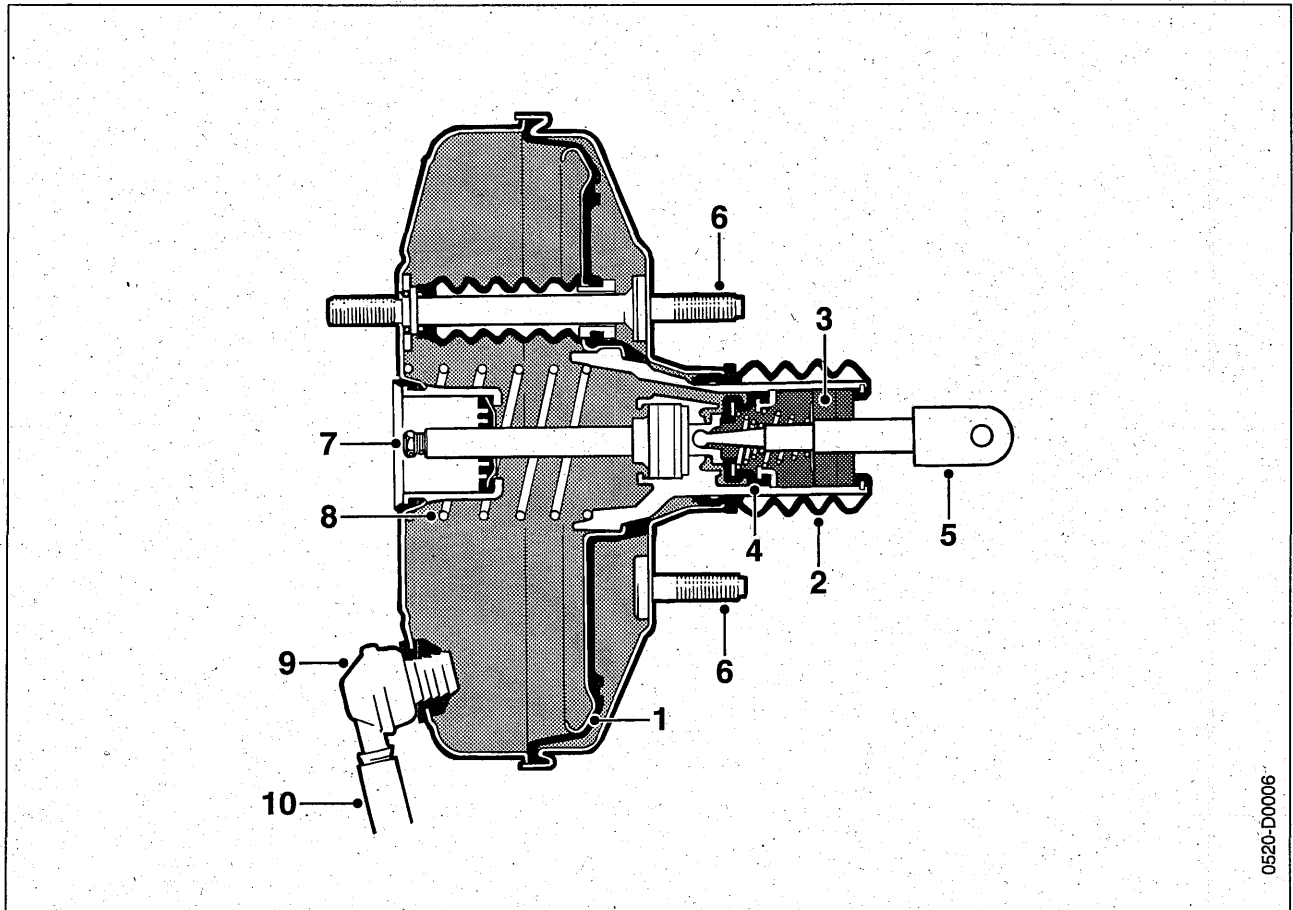
The brake servo unit boosts the pressure on the brake pedal exerted by the driver when the brakes are applied. The power supplied by the servo unit is obtained from the vacuum formed in the engine intake manifold and provides assistance in the ratio of about 4:1. A hose connects the servo unit to the intake manifold.

The servo unit consists of a metal casing mounted between the brake pedal and the master cylinder and connected to them by pushrods. In the event of a leak in the servo unit, the two pushrods act as a single pushrod.

The brakes will then work conventionally without servo assistance but much greater pedal force will be required.

The ABS MK IV has a pedal position sensor mounted on the servo unit.

Brake servo unit (cars without ABS and cars with ABS MK IV) (contd.)



Brake servo unit, rest (brakes off) position (cars without ABS)

■ Vacuum

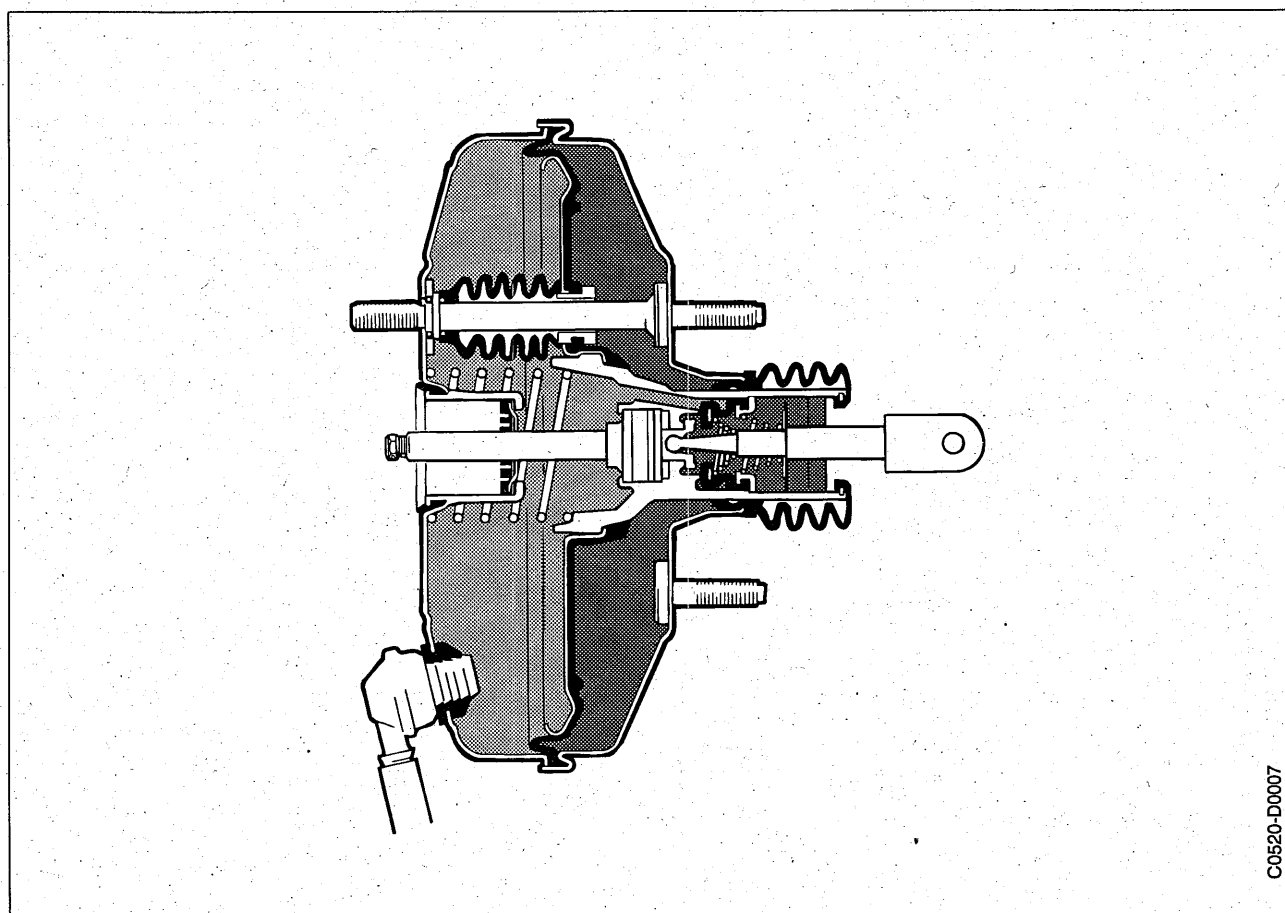
■ Barometric pressure

- 1 Diaphragm
- 2 Dust excluder
- 3 Filter
- 4 Sealing ring
- 5 Pushrod (from brake pedal)
- 6 Retaining stud
- 7 Pushrod (to master cylinder)
- 8 Return spring
- 9 Non-return valve
- 10 Hose (to intake manifold)

Rest (brakes off) position

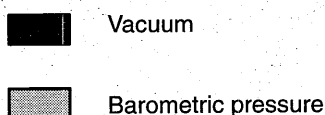
In the rest (brakes off) position, the diaphragm and valve control piston are held in the fully returned position by the return spring. Equal vacuum obtains on both sides of the diaphragm since a bypass valve in the diaphragm is open.

Brake servo unit (cars without ABS and cars with ABS MK IV) (contd.)



C0520-D0007

Brake servo unit, brakes applied (cars without ABS)



Brakes applied

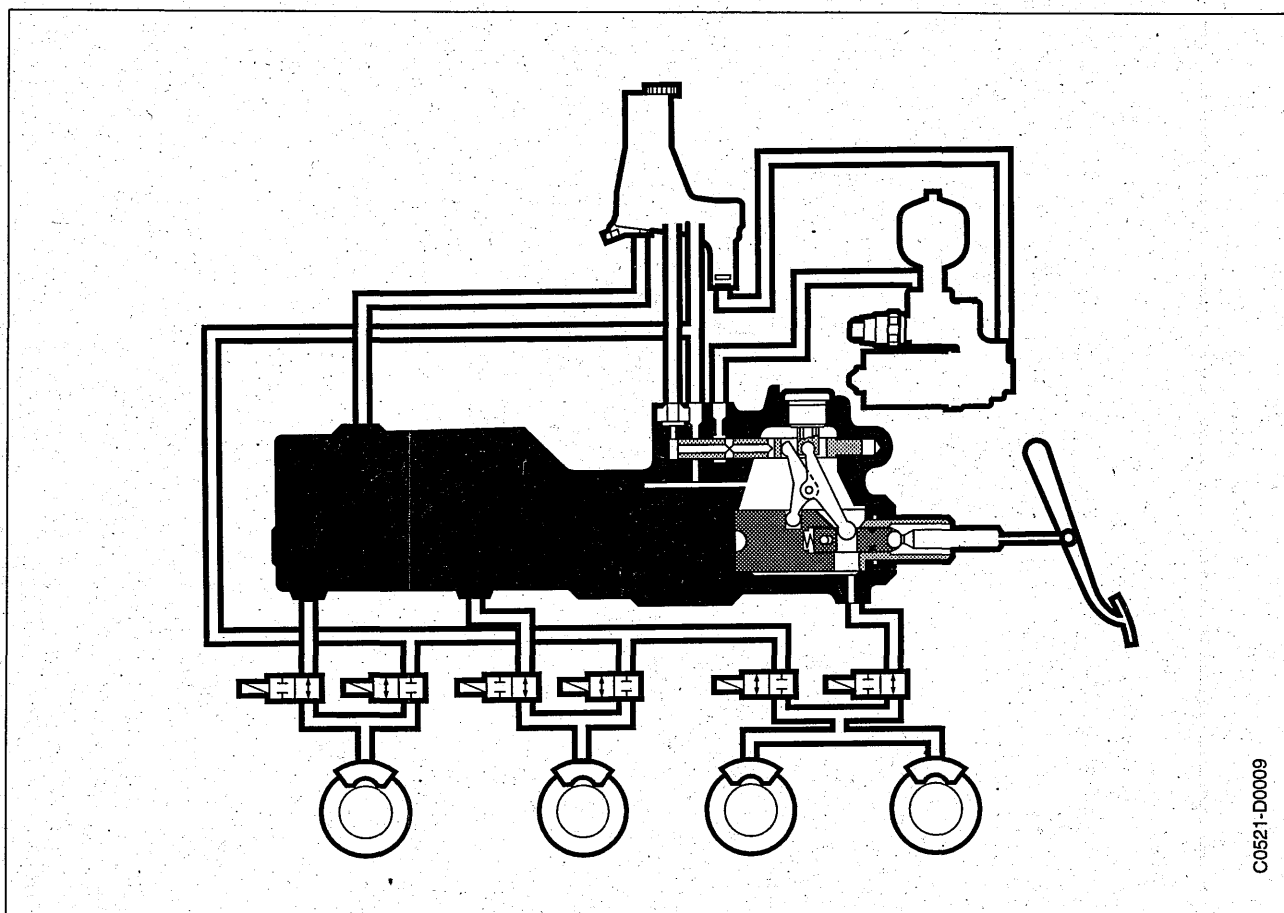
When the brake pedal is depressed the pushrod presses the valve control piston and diaphragm forwards, closing the bypass valve. As the pushrod continues to move forwards, the valve control piston opens a passage enabling air at barometric pressure to flow through the filter and into the servo unit behind the diaphragm.

Since vacuum from the intake manifold acts in front of the diaphragm, the pressure difference assists the pushrod from the brake pedal in moving the diaphragm and the pushrod to the master cylinder forwards, thus boosting the effort applied by the driver.

When the pedal is released, the bypass valve opens and air at barometric pressure at the rear of the diaphragm flows across to the front and then through the non-return valve to the intake manifold. The opening for air at barometric pressure closes and the

return spring presses the diaphragm, valve control piston and pushrod from the brake pedal back to the rest (brakes off) position. The non-return valve prevents air at barometric pressure from flowing back from the intake manifold to the servo unit. The non-return valve opens only when the vacuum in the intake manifold is greater than in the servo unit.

Master cylinder (ABS MK II)



C0521-D0009

The hydraulic master cylinder replaces the conventional vacuum servo and has three tasks to perform:

- boost the pedal force applied by the driver
- supply brake fluid to the rear axle circuit
- supply brake fluid via the main valve to the front wheel circuits when braking with the ABS engaged.

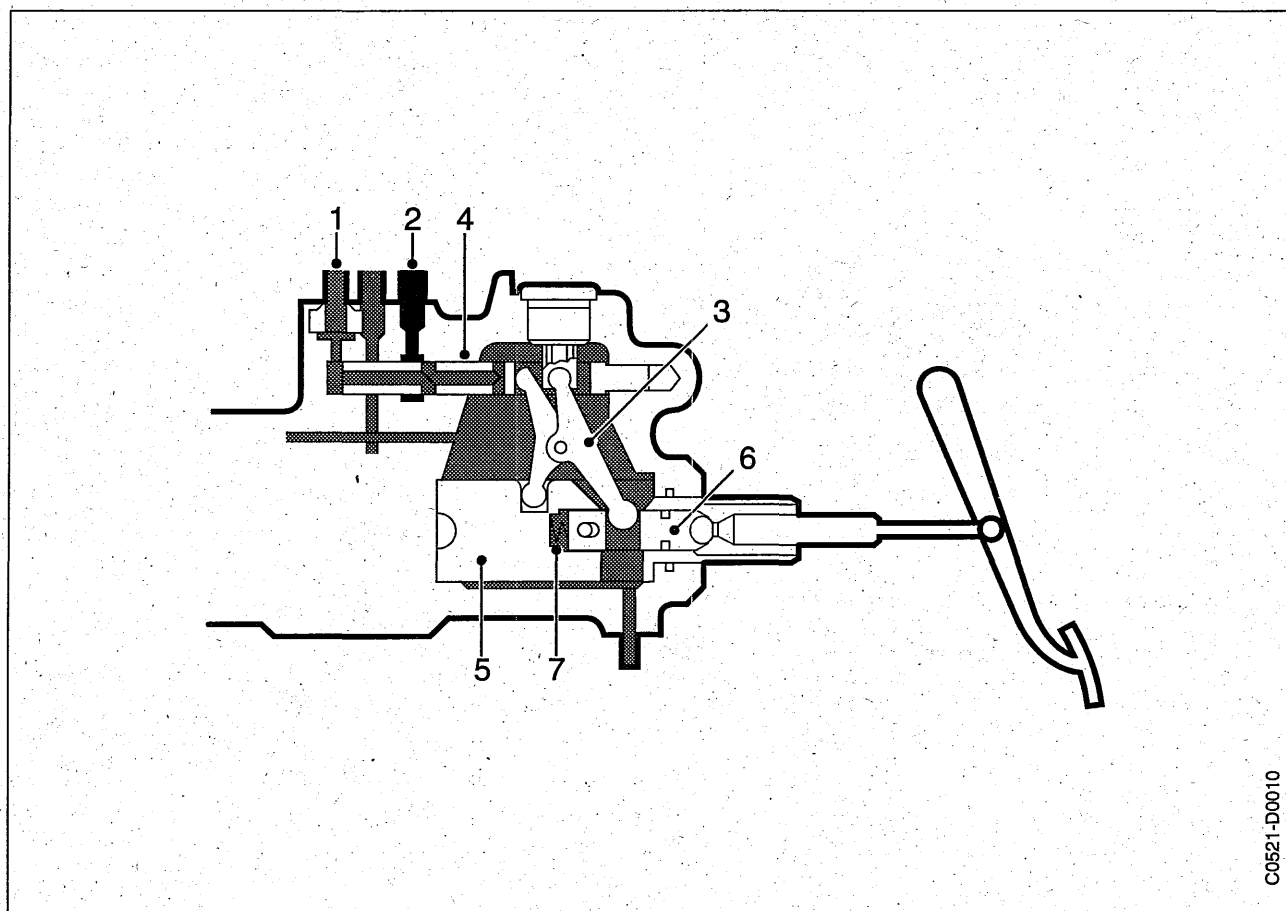
Via the control valve, the master cylinder is supplied with brake fluid under pressure from the pressure accumulator. This boosts the pressure in the master cylinder by an amount which is proportional to the pedal force. The control valve is actuated by the pedal force and also by the pressure in the master cylinder.

The rear axle circuit is connected to the master cylinder. Consequently, the rear wheels are braked with the assistance of that portion of the accumulator pressure that was built up in the master cylinder via the control valve.



Pressure line

The pressure line that connects the pump body to the master cylinder is under the same pressure as the pressure accumulator.

Master cylinder (ABS MK II) (contd.)



Master cylinder, rest (brakes off) position

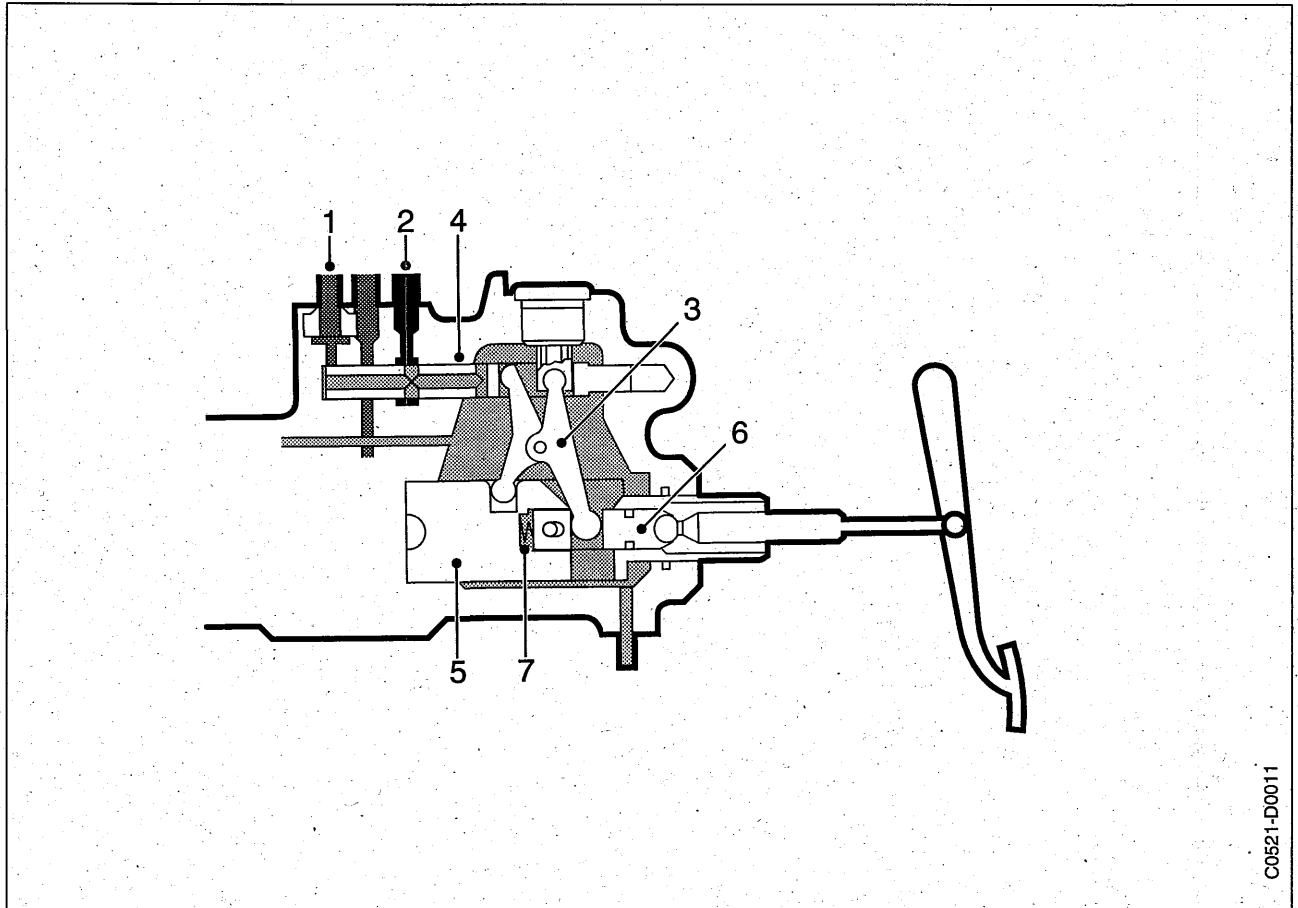
-  Accumulator pressure
-  Zero pressure

- 1 Return passage (to brake fluid reservoir)
- 2 Inlet passage (from pressure accumulator)
- 3 Compound lever
- 4 Control valve
- 5 Servo piston
- 6 Differential piston
- 7 Spring

Rest (brakes off) position




In the rest (brakes off) position, the supply of pressure from the pressure accumulator is closed by the control valve and the return passage to the brake fluid reservoir is open.

Master cylinder (ABS MK II) (contd.)



C0521-D0011

Master cylinder, brake position 1

-  Accumulator pressure
-  Servo pressure
-  Zero pressure

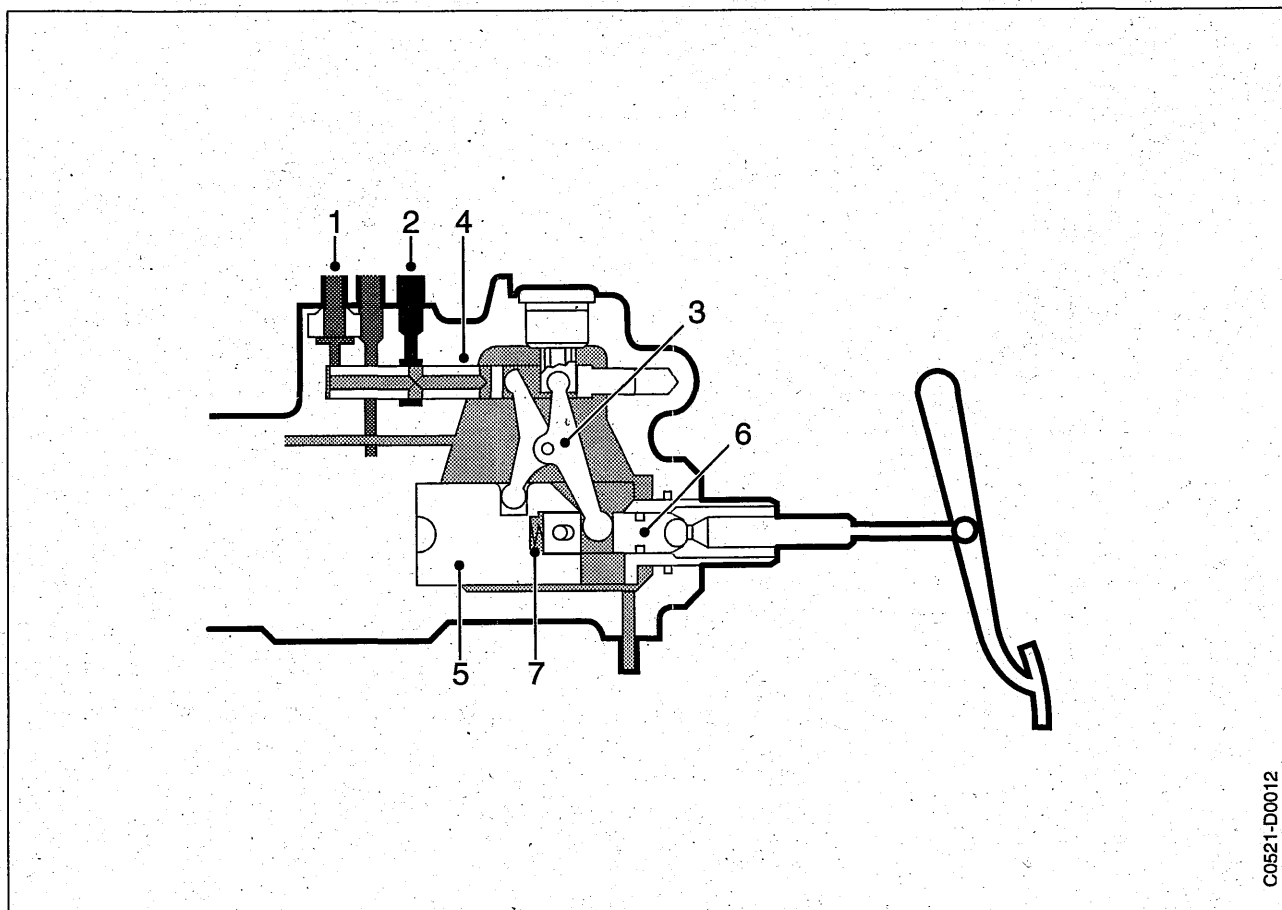
- 1 Return passage (to brake fluid reservoir)
- 2 Inlet passage (from pressure accumulator)
- 3 Compound lever
- 4 Control valve
- 5 Servo piston
- 6 Differential piston
- 7 Spring

Brake position 1




When the brake pedal is depressed the differential piston (6) will move forwards together with the compound lever (3). The two lower balls move towards each other while the two upper ones move away from each other. This movement causes the control valve (4) to open the inlet passage (2) from the pressure accumulator at the same time as it closes the return passage (1).

Pressure builds up in the master cylinder and this pressure moves the servo piston (5) forwards, reinforcing the effort applied to the brake pedal by the driver.

Master cylinder (ABS MK II) (contd.)



Master cylinder, brake position 2

-  Accumulator pressure
-  Servo pressure
-  Zero pressure

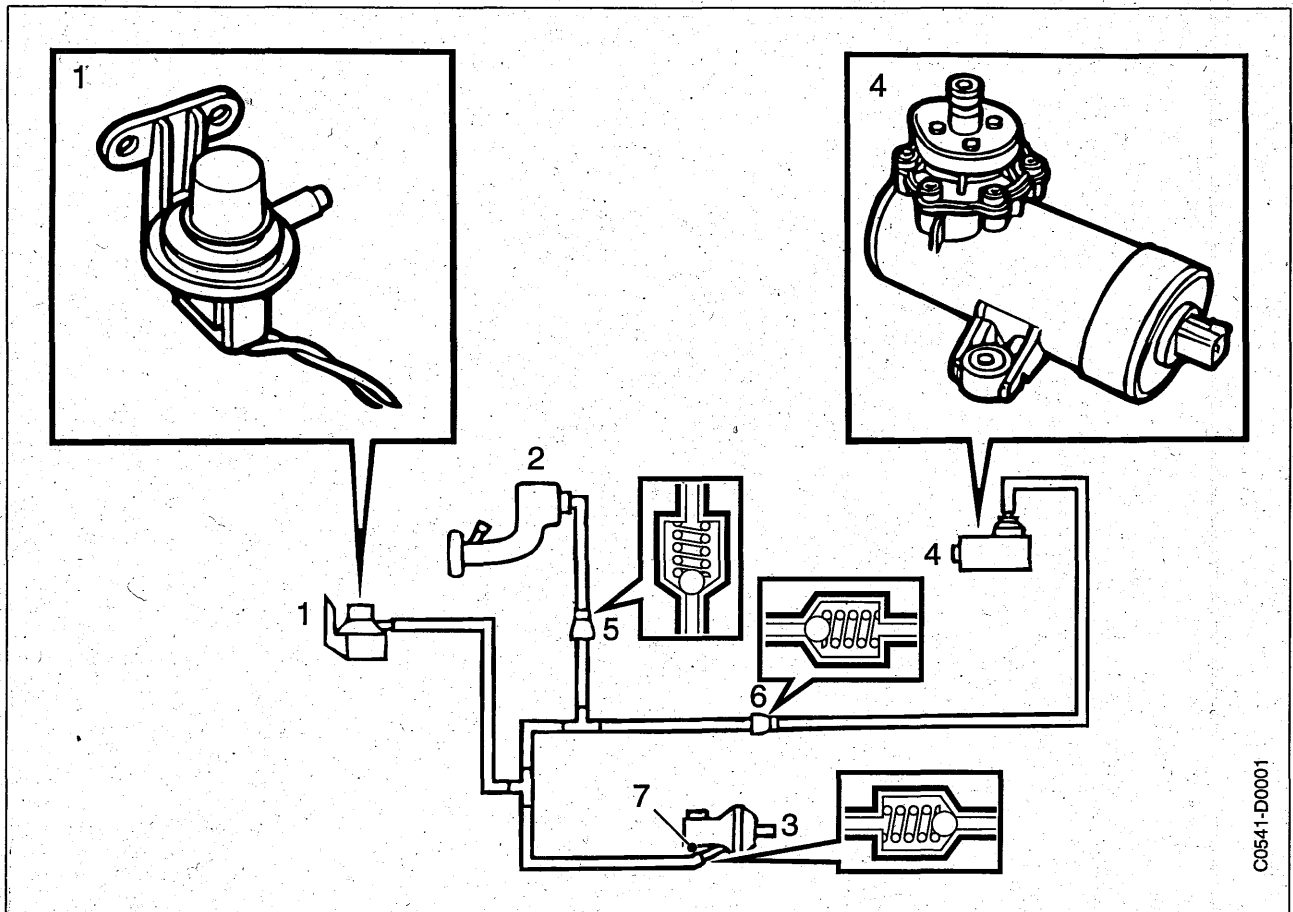
- 1 Return passage (to brake fluid reservoir)
- 2 Inlet passage (from pressure accumulator)
- 3 Compound lever
- 4 Control valve
- 5 Servo piston
- 6 Differential piston
- 7 Spring

Brake position 2

The pressure acts simultaneously between the servo piston (5) and the differential piston (6) and moves both these components away from each other. The two lower balls are moved apart while the upper ones are moved towards each other. As a result of this movement, the inlet passage (2) is closed by the control valve (4) while the return passage (1) to the brake fluid reservoir remains closed.

The control valve closes when the pressure on the differential piston generates a force which is equal to the force applied to the pedal and the pressure in the master cylinder is proportional to the pedal force.

Vacuum pump (2.0 LPT aut. M1996- only)



- 1 Pressure switch
- 2 Intake manifold
- 3 Brake servo
- 4 Vacuum pump
- 5 Non-return valve near intake manifold
- 6 Non-return valve near vacuum pump
- 7 Non-return valve near brake servo

The purpose of the vacuum pump is to increase the vacuum for the brake servo at times when engine vacuum is insufficient.

The system consists of vacuum pipes and hoses as well as an electrical system for controlling the vacuum pump.

The vacuum system consists of a pressure switch (1) which is connected pneumatically to the vacuum circuit that is formed between non-return valves 5, 6 and 7.

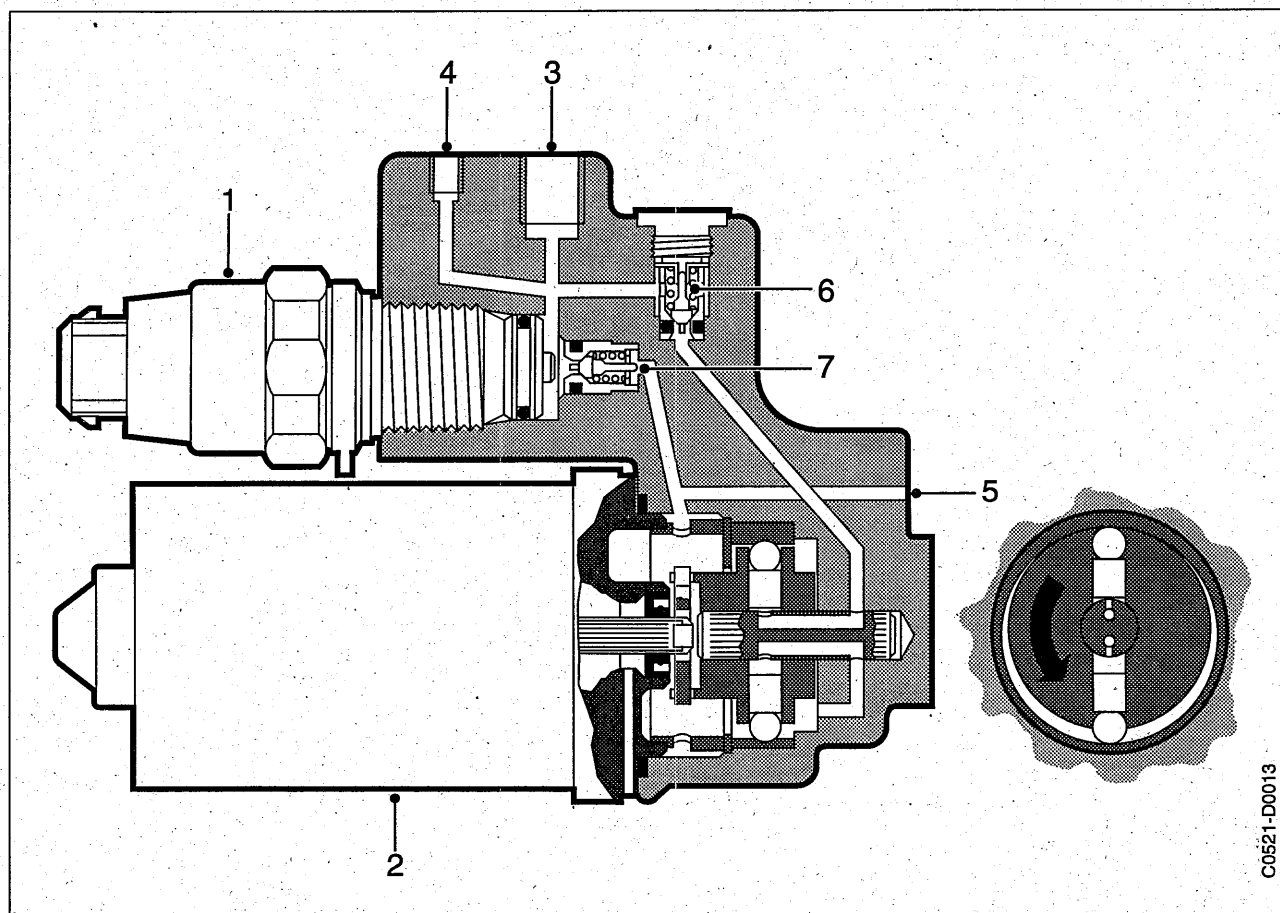
When the vacuum in the vacuum circuit is less than 0.35 bar negative pressure, the contacts in the pressure switch close and relay pin 85 is grounded. The relay operates and the vacuum pump starts.

When the vacuum pump has reduced the pressure in the vacuum circuit to 0.4 bar, the pressure switch contacts open and the vacuum pump stops.

For the vacuum pump to work, the ignition must be on and pressure in the vacuum circuit must be higher than -0.35 bar.

The vacuum pump is bolted to a bracket mounted on the engine between the engine and the bulkhead partition. The pressure switch is fitted in a holder at the top of the bulkhead partition. The relay is plugged into a relay/fuse board in the engine bay.

High-pressure pump (ABS MK II)



C0521-D0013

The high-pressure pump's electric motor

- 1 Pressure switch
- 2 Electric motor
- 3 To pressure accumulator
- 4 To master cylinder
- 5 From brake fluid reservoir
- 6 Non-return valve
- 7 Relief valve

High-pressure pump

The high-pressure pump pumps brake fluid from the brake fluid reservoir through the supply hose to the bottom part of the pressure accumulator. The pump, which is resiliently mounted in the hydraulic unit, operates at a pressure of between 140 bar (2030 psi) and 180 bar (2610 psi).

As a safety feature, the pump incorporates a relief valve having an opening pressure of 210 bar (3045 psi) which dumps the pressure to the suction side of the pump.

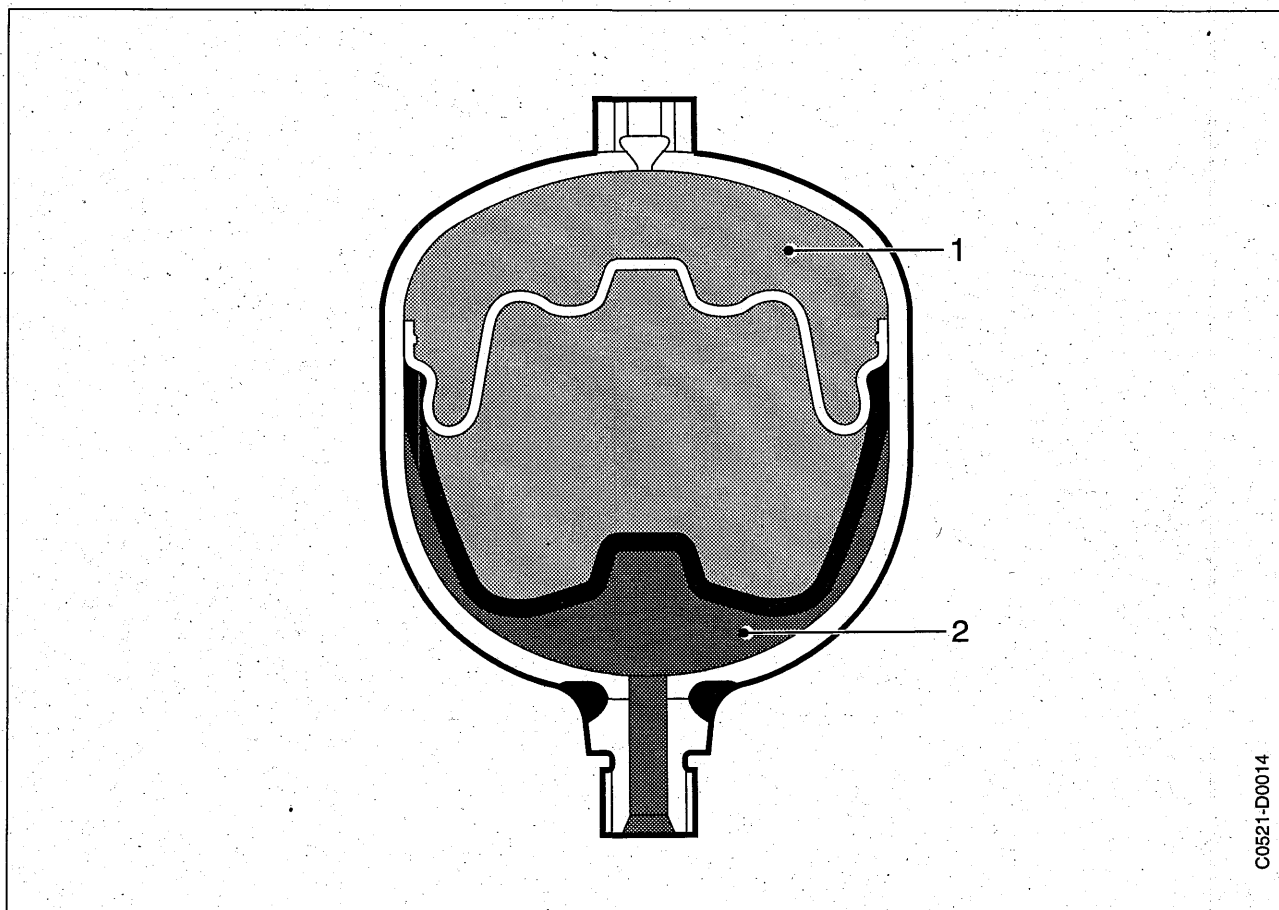
Electric motor

The electric motor which drives the high-pressure pump is turned on and off by the pressure switch and is connected by means of a 2-pin connector.

Supply hose

The supply hose connects the brake fluid reservoir to the high-pressure pump. At the pump the hose is connected to an angled plastic union.

Pressure accumulator (ABS MK II)



C0521-D0014

Pressure accumulator

- 1 Chamber (filled with nitrogen)
- 2 Chamber (filled with brake fluid)

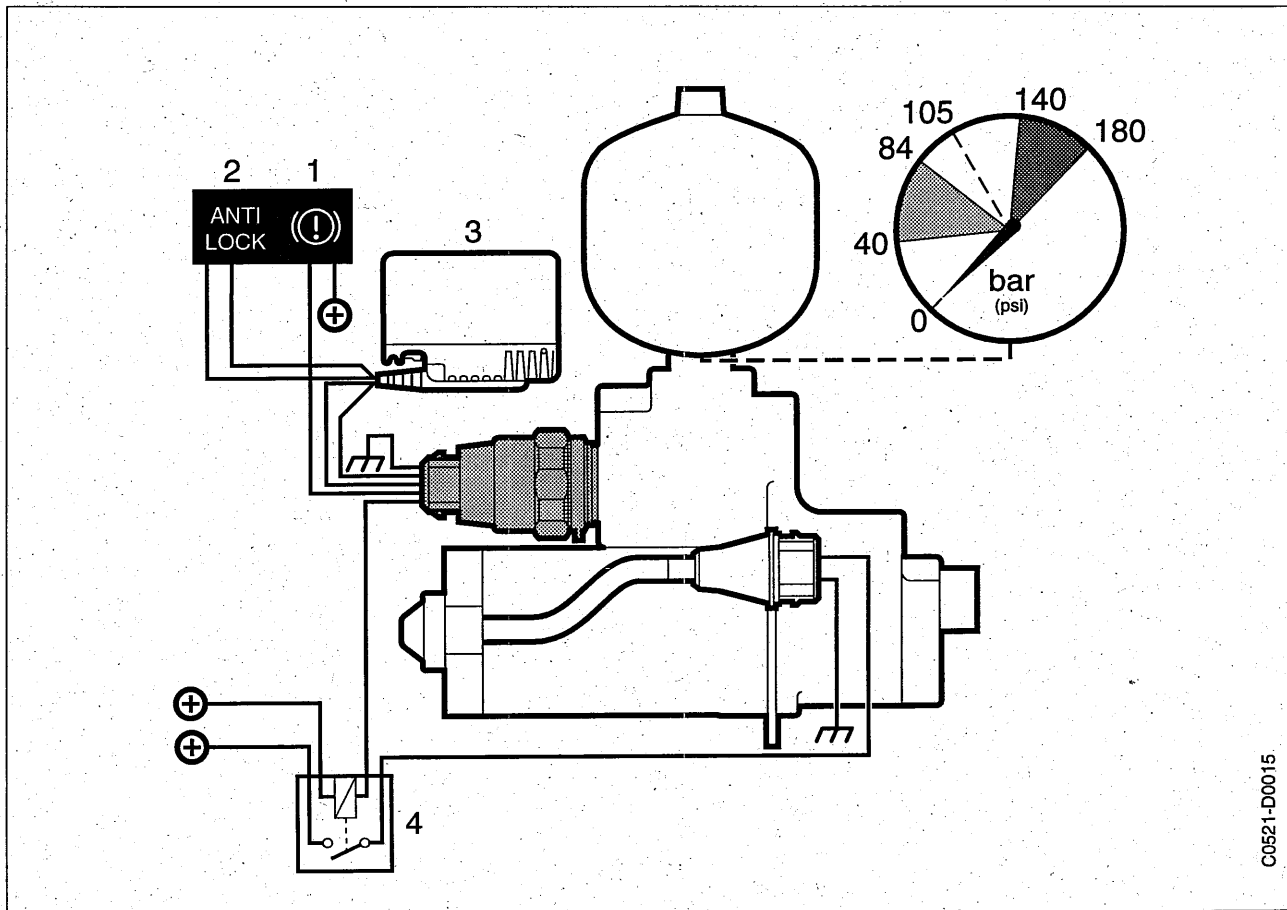
The pressure accumulator, which is screwed to the pump housing, is divided into two spaces by a rubber diaphragm.

One of the chambers is sealed and filled with nitrogen at a basic pressure of 80 bar (1160 psi) at 20°C (68°F). The minimum permissible pressure is 40 bar (580 psi). If the pressure drops below this the pressure accumulator must be changed.

Brake fluid is pumped to the other chamber from the high-pressure pump via the non-return valve. This compresses the nitrogen and the space containing brake fluid grows larger. This increase in volume makes it possible to store large amounts of brake fluid under high pressure for immediate use.

The high-pressure pump is switched on only for as long as necessary to maintain the pressure between 140 bar (2030 psi) and 180 bar (2610 psi).

Pressure switch (ABS MK II)

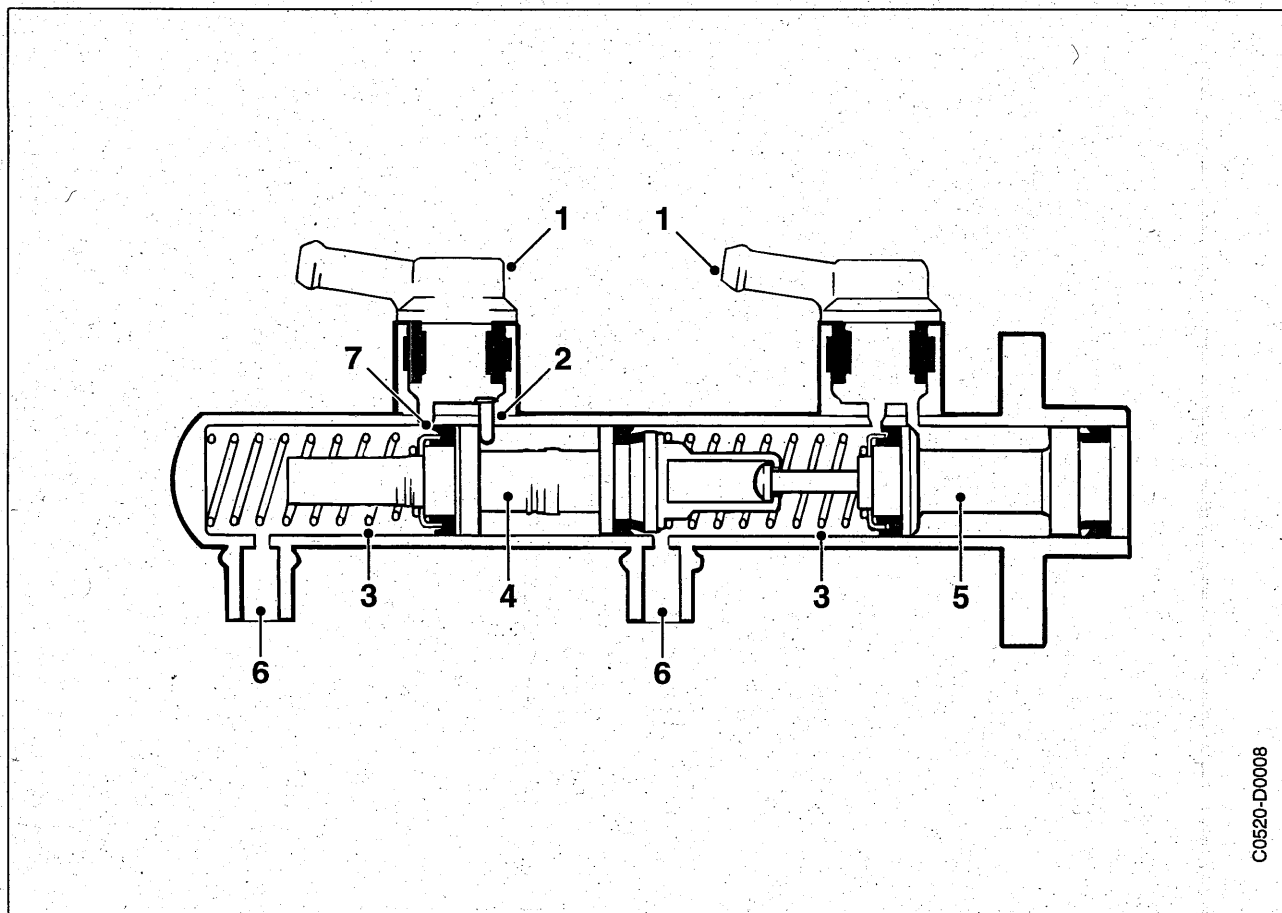


- 1 Brake warning lamp
- 2 ABS warning lamp
- 3 Electronic control unit
- 4 Relay, high-pressure pump's electric motor

The pressure switch is mounted in the pump housing and has two functions:

- to start and stop the electric motor at 140 bar (2030 psi) and 180 bar (2610 psi)
- to switch on the brake warning lamp when accumulator pressure drops below 105 bar (1523 psi) and at the same time disconnect ABS control and indicate this by switching on the ABS warning lamp.

Master cylinder (cars without ABS)



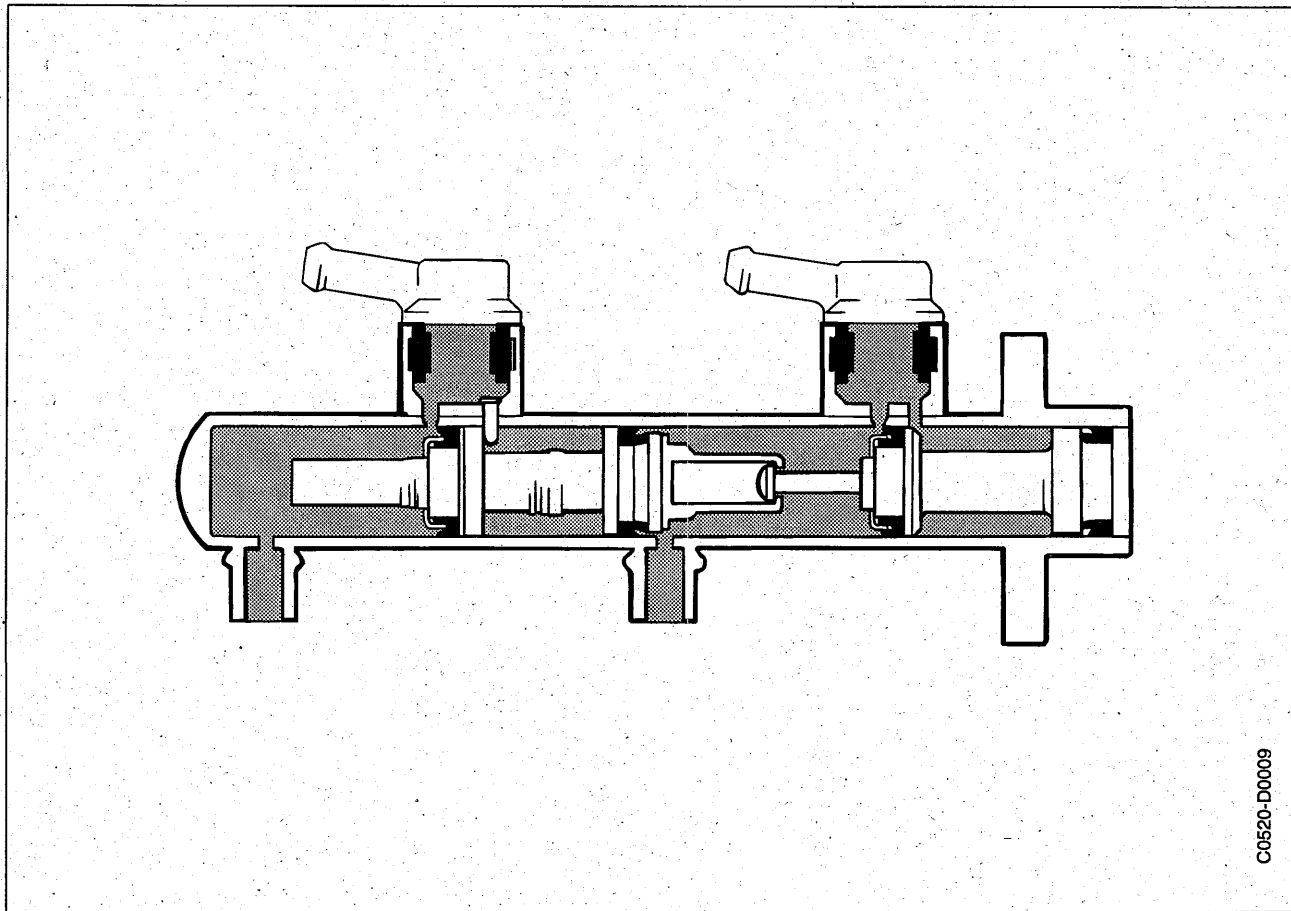
C0520-D0008

Master cylinder


- 1 Connection, brake fluid reservoir
- 2 Stop pin
- 3 Return spring
- 4 Secondary piston
- 5 Primary piston
- 6 Connection, brake line
- 7 Return passage

The master cylinder consists of a tandem cylinder and is made of steel. Inside the cylinder are two pistons: a primary piston (nearest the brake pedal) and a secondary piston (nearest the brake servo unit). There is also a return spring for each of these pistons. The master cylinder has connections for four brake lines and two hoses from the brake fluid reservoir.

Master cylinder (cars without ABS) (contd.)



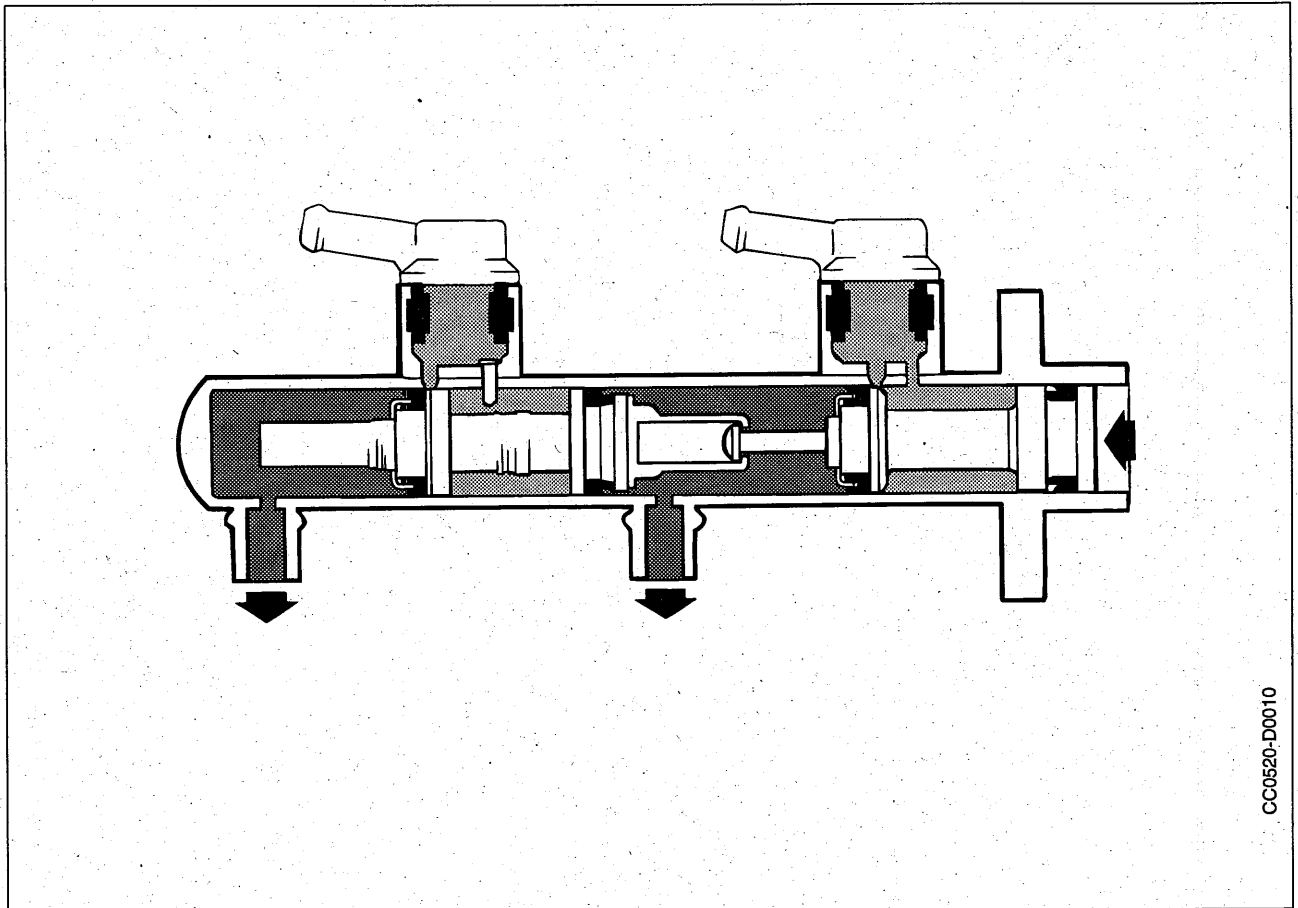
Master cylinder, rest (brakes off) position

 Zero pressure



Rest (brakes off) position

In the rest (brakes off) position the return springs press the pistons to the rear end position. In this position, both return passages are open and the brake system is without pressure. Rearward movement is limited by a stop pin.

Master cylinder (cars without ABS) (contd.)



*Master cylinder, brakes applied
(both circuits in operation)*

-  Zero pressure
-  Servo pressure

Brakes applied (both circuits in operation)

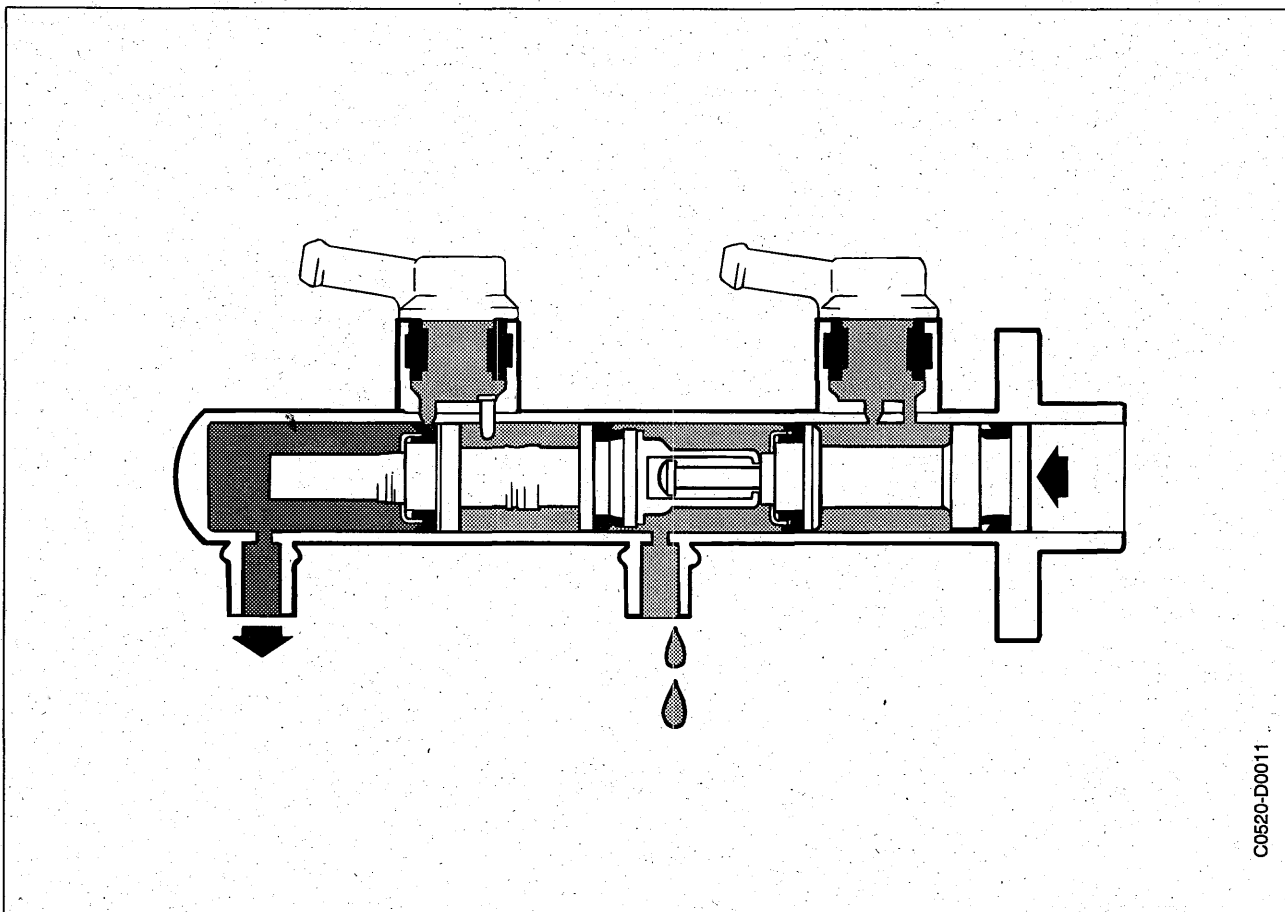
When the brake pedal is pressed down, the primary piston is pushed forwards by the pushrod.

The return passage to the brake fluid reservoir is closed and the pressure in front of the primary piston increases. The pressure also acts on the secondary piston, pushing it forwards and so closing its return passage also. The hydraulic pressure in the two brake circuits increases and since the pistons are equally large in area, the pressure in both brake circuits is also equal. The pressure is propagated in the brake system and acts on the brake piston in each hydraulic body. The brake pistons press the friction pads against the brake discs.


When the brake pedal is released the pistons in the master cylinder return to their rest (brakes off) position and the return passage is opened. The pressure

is relieved and the brake piston in each brake cylinder is returned to the rest (brake off) position by the piston sealing ring.

Master cylinder (cars without ABS) (contd.)



*Master cylinder, brakes applied
(one circuit inoperative)*

 Zero pressure

 Servo pressure

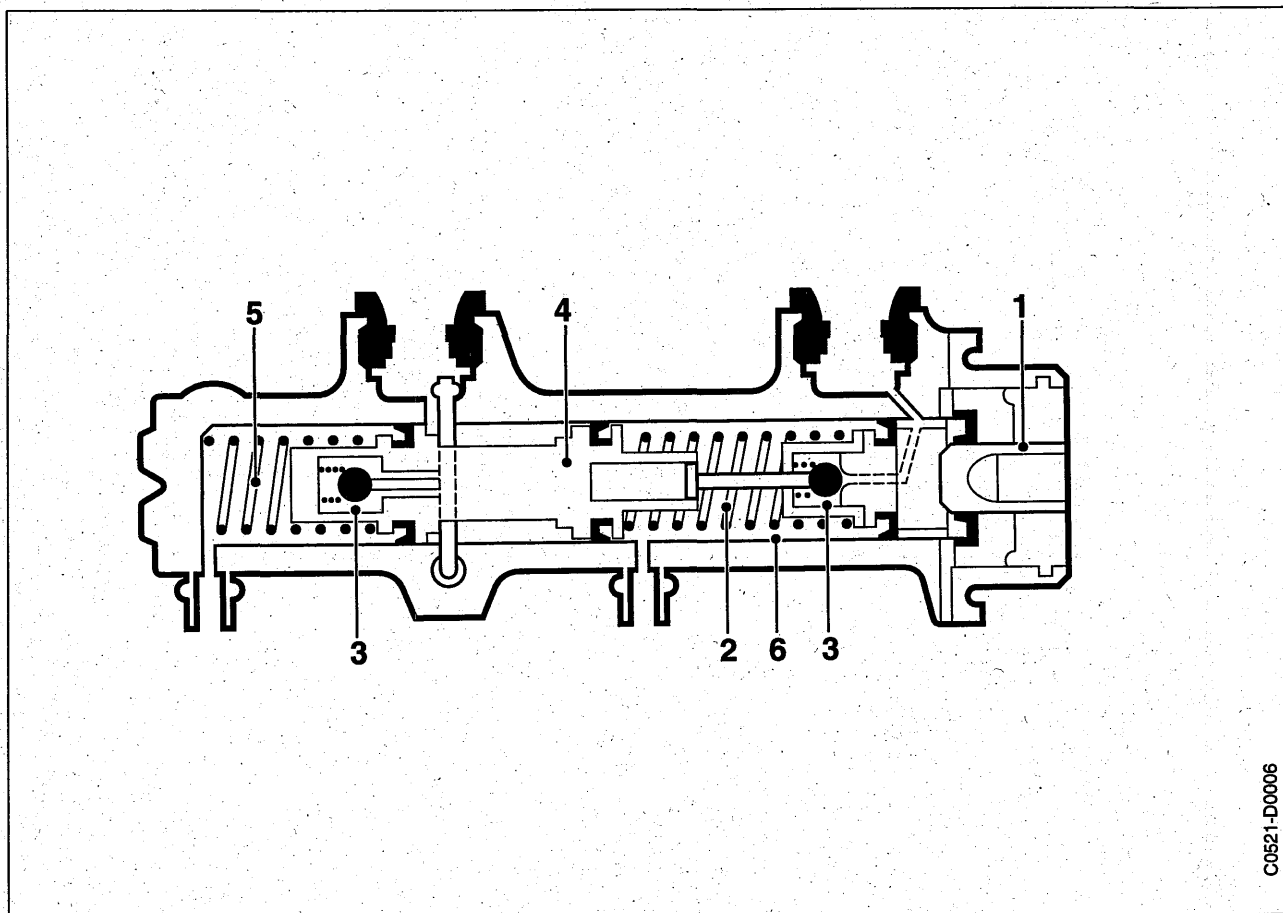
Brakes applied (one circuit inoperative)

When the brake pedal is depressed and leakage occurs in the primary circuit, for instance, the primary piston is pushed forwards by the pushrod until it acts mechanically on the secondary piston. The secondary piston closes the return passage and hydraulic pressure builds up in the secondary circuit only.

If there is a leak in the secondary circuit, the secondary piston will be pushed forwards until it bottoms in the master cylinder.

In both cases, longer pedal travel is required to accomplish the desired braking power.

Master cylinder (cars with ABS)



Master cylinder, ABS MK IV

- 1 Pushrod with primary piston
- 2 Pressure chamber (primary circuit)
- 3 Central steel valves
- 4 Secondary piston
- 5 Pressure chamber (secondary circuit)
- 6 Compression spring

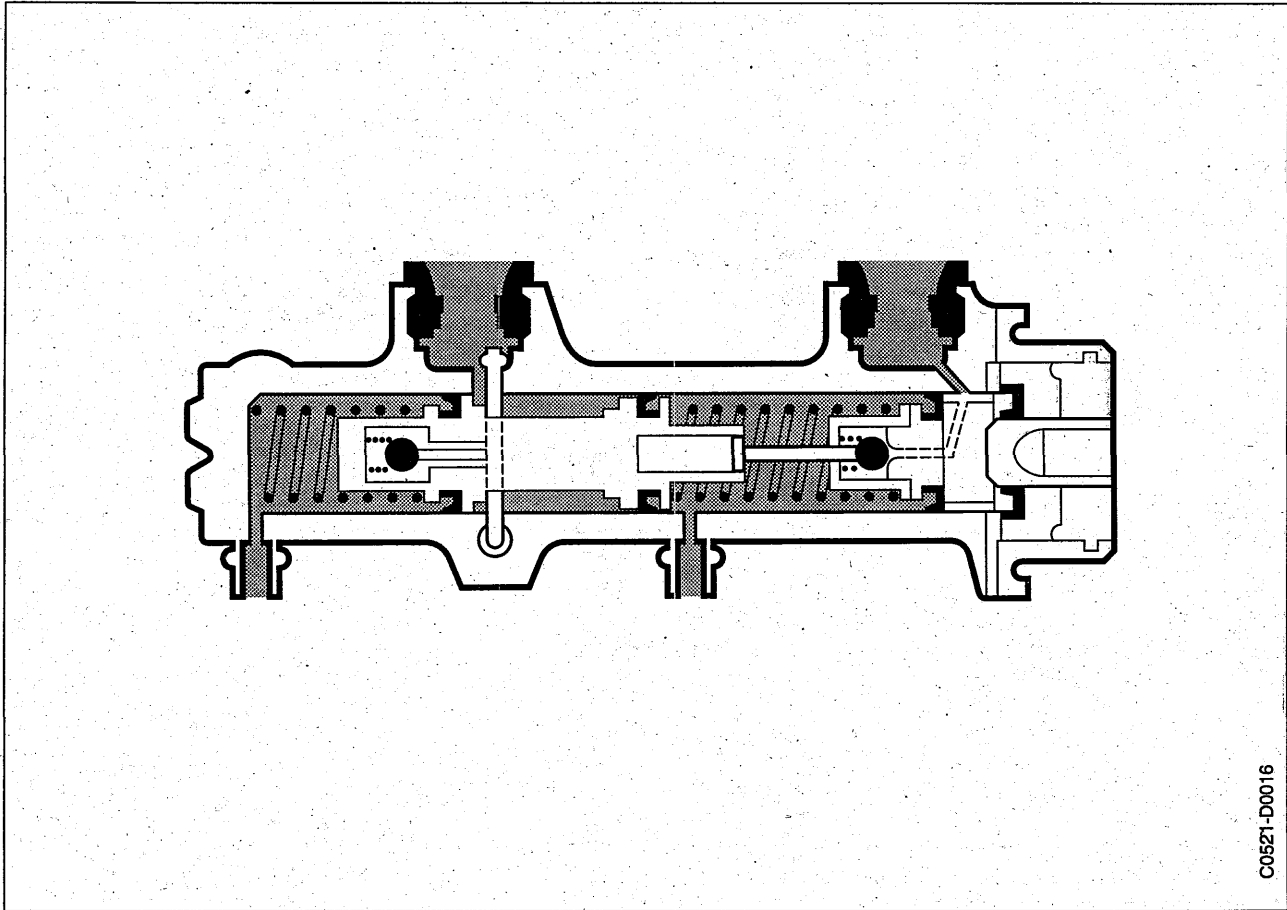
The master cylinder on cars with ABS MK IV and ABS MK II works on the same principle but is somewhat different in design.

The master cylinder consists of a tandem cylinder which is made of aluminium.

Inside the cylinder are two pistons, a primary piston (nearest the brake pedal) and a secondary piston. There is also a return spring for these pistons with connections to two brake lines and two hoses from the brake fluid reservoir.

Two central valves made of steel to resist the high pressure in the master cylinder open the passage to the brake fluid reservoir in the rest (brakes off) position to avoid damaging the sealing rings on braking when the ABS is activated.

Master cylinder (cars with ABS) (contd.)

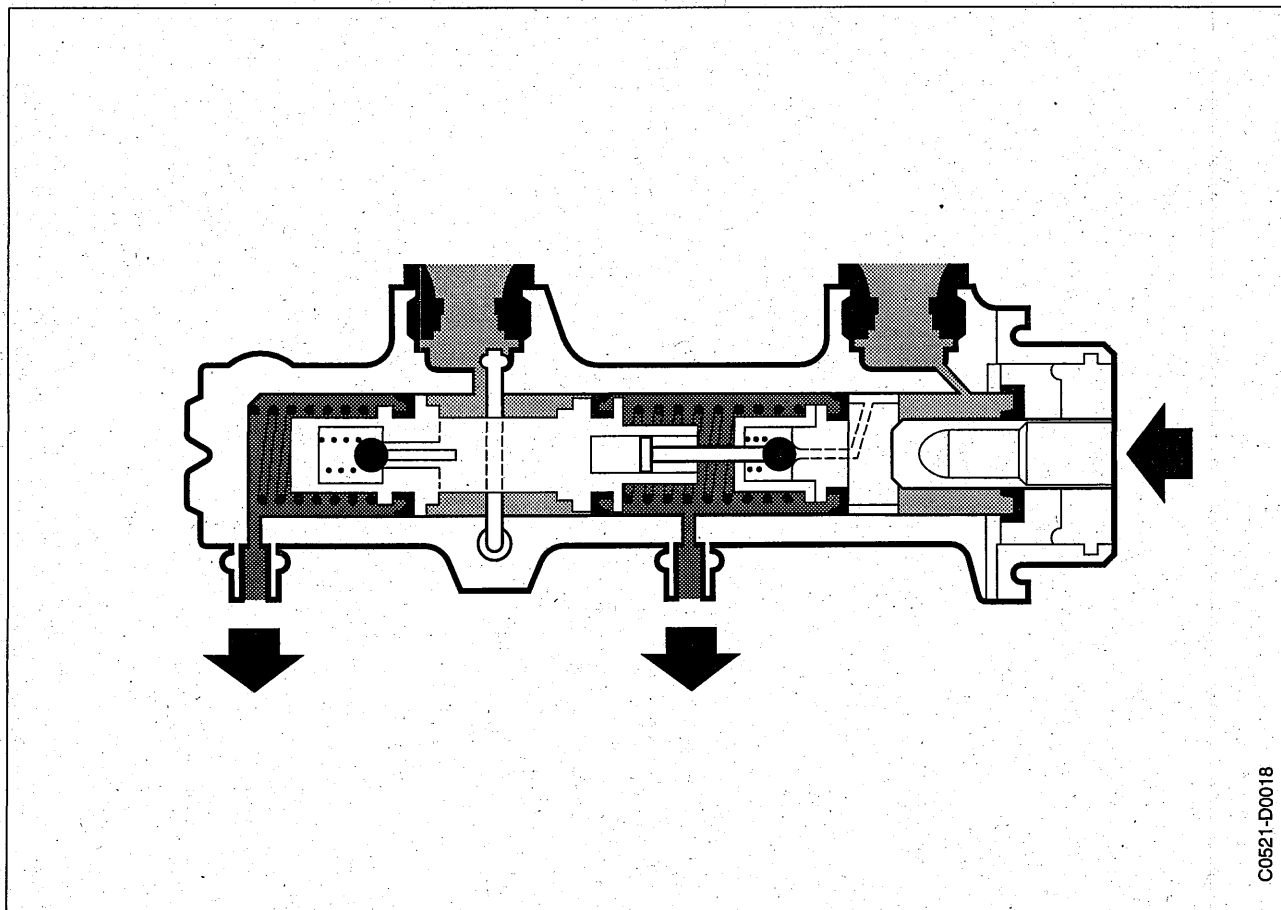


Rest (brakes off) position

In the rest (brakes off) position the return springs press the pistons to the rear end position. In this position, both return passages are open and the brake system is without pressure. Rearward movement of the pistons is prevented by a stop pin. The master cylinder and other hydraulic components are filled with brake fluid under zero pressure.

In the valve block the inlet and outlet valves are in their rest (brakes off) positions and the central valves are also open.

Master cylinder (cars with ABS) (contd.)



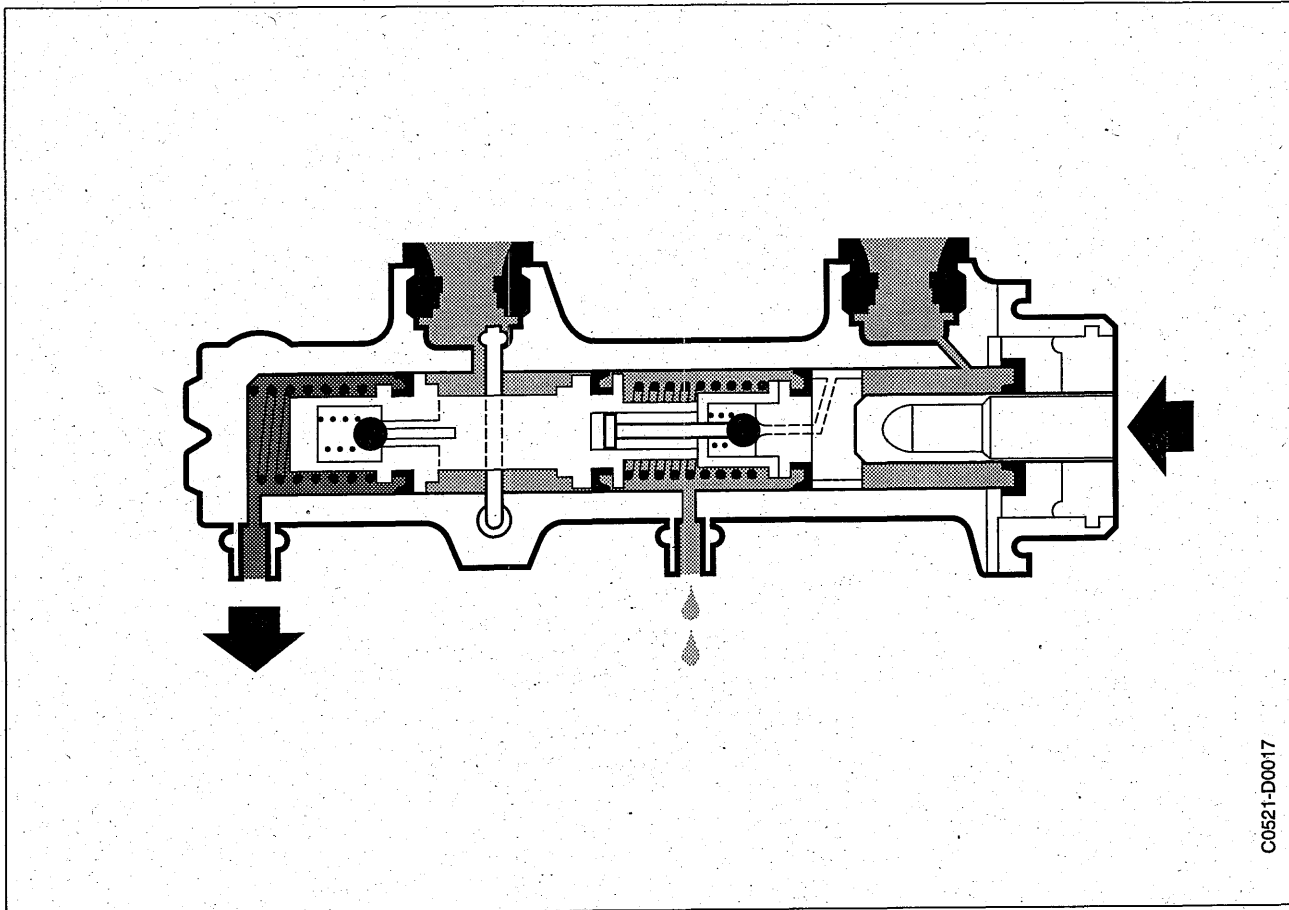
Brakes applied (both circuits operative) without ABS control

The primary piston's central valve to the brake fluid reservoir closes the return flow and the pressure in front of the primary piston increases. The pressure also acts on the secondary piston which is pushed forwards with the result that its central valve is also closed.

The hydraulic pressure in both circuits increases, and since the pistons have the same area the pressure through the valve block is equal in both brake circuits.

The pressure is propagated in the brake system and acts on the brake piston in each hydraulic body. The brake pistons press the friction pads against the brake discs. When the brake pedal is released the pistons in the master cylinder return to their rest (brakes off) position and the central valves open. The pressure is relieved and the brake piston in each brake cylinder is returned to the rest (brake off) position by the piston sealing ring.

Master cylinder (cars with ABS) (contd.)



Brakes applied (one circuit inoperative)

When the brake pedal is depressed and leakage occurs in the primary circuit, for instance, the primary piston is pushed forwards by the pushrod until it acts mechanically on the secondary piston. The secondary piston closes the central valve and hydraulic pressure builds up in the secondary circuit. Braking power is obtained in the secondary circuit only.

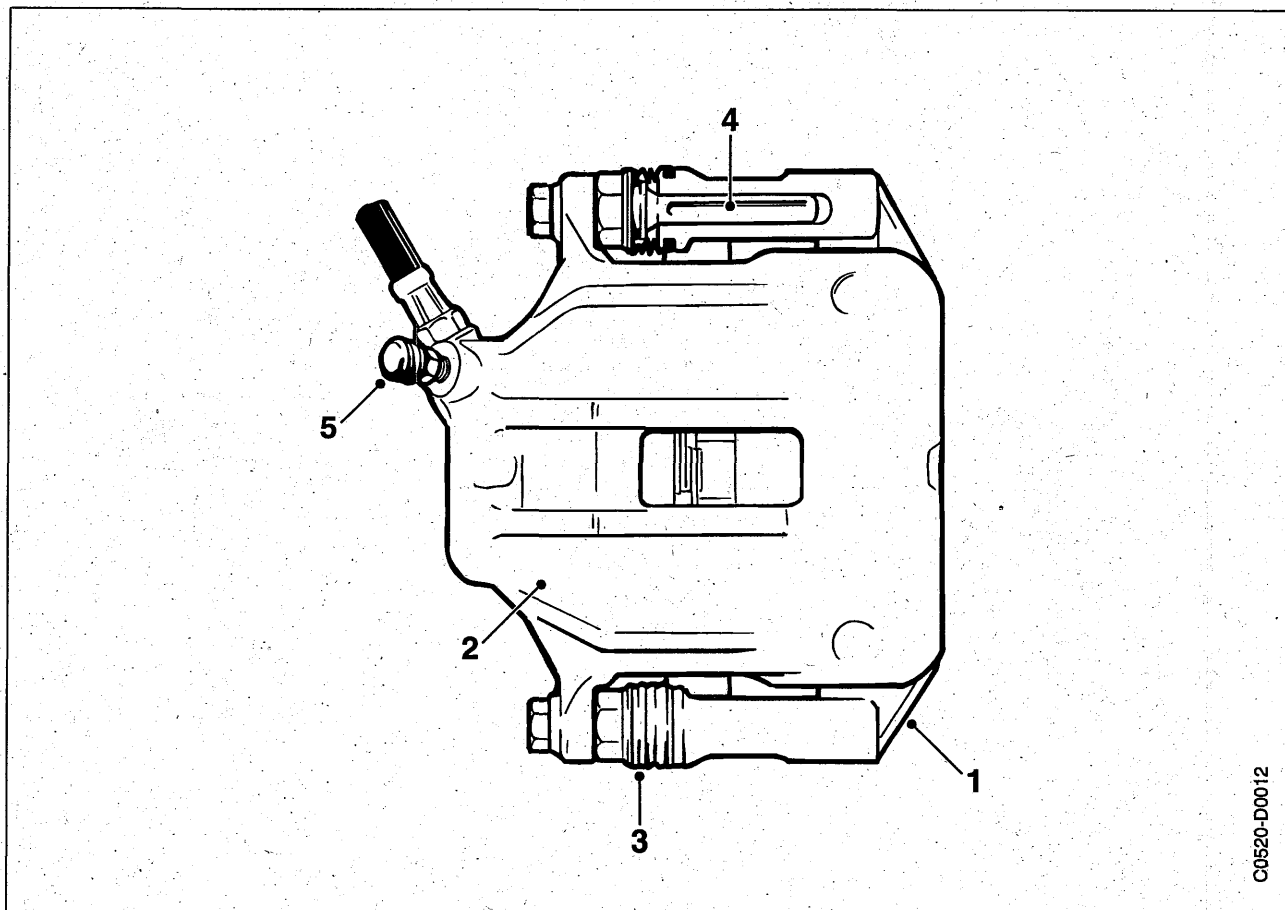
If leakage occurs in the secondary circuit:

The primary piston closes the central valve and hydraulic pressure builds up in the primary circuit. Braking power is obtained in the primary circuit only. The secondary piston is pushed forwards until it bottoms in the master cylinder.

In both cases, longer pedal travel is required to accomplish the desired braking power.

ABS braking power can be obtained but only on the operative circuit and the brake fluid warning lamp will come on.

Brake caliper, front wheel



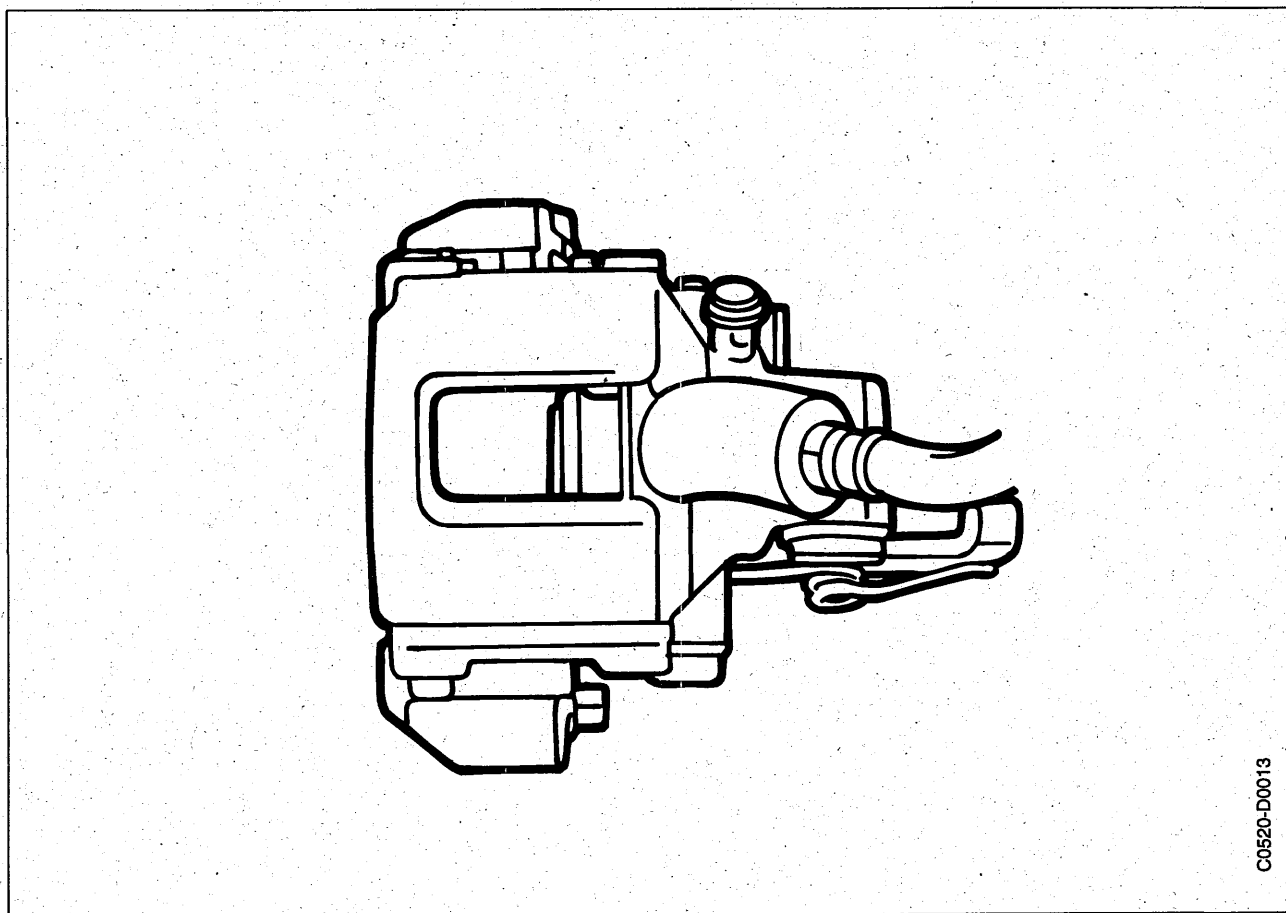
Brake caliper, front wheel (early version)

- 1 Carrier
- 2 Hydraulic body
- 3 Dust excluder
- 4 Guide pin
- 5 Bleed nipple

The brake caliper for each wheel consists of a hydraulic body with a brake piston, two brake pads and a carrier. The hydraulic body slides on two guide pins mounted in this carrier. One version of the hydraulic body has a single brake piston and a characteristic of this design is that only a small amount of heat is transferred to the brake fluid. The brakes are therefore able to withstand a high thermal load.

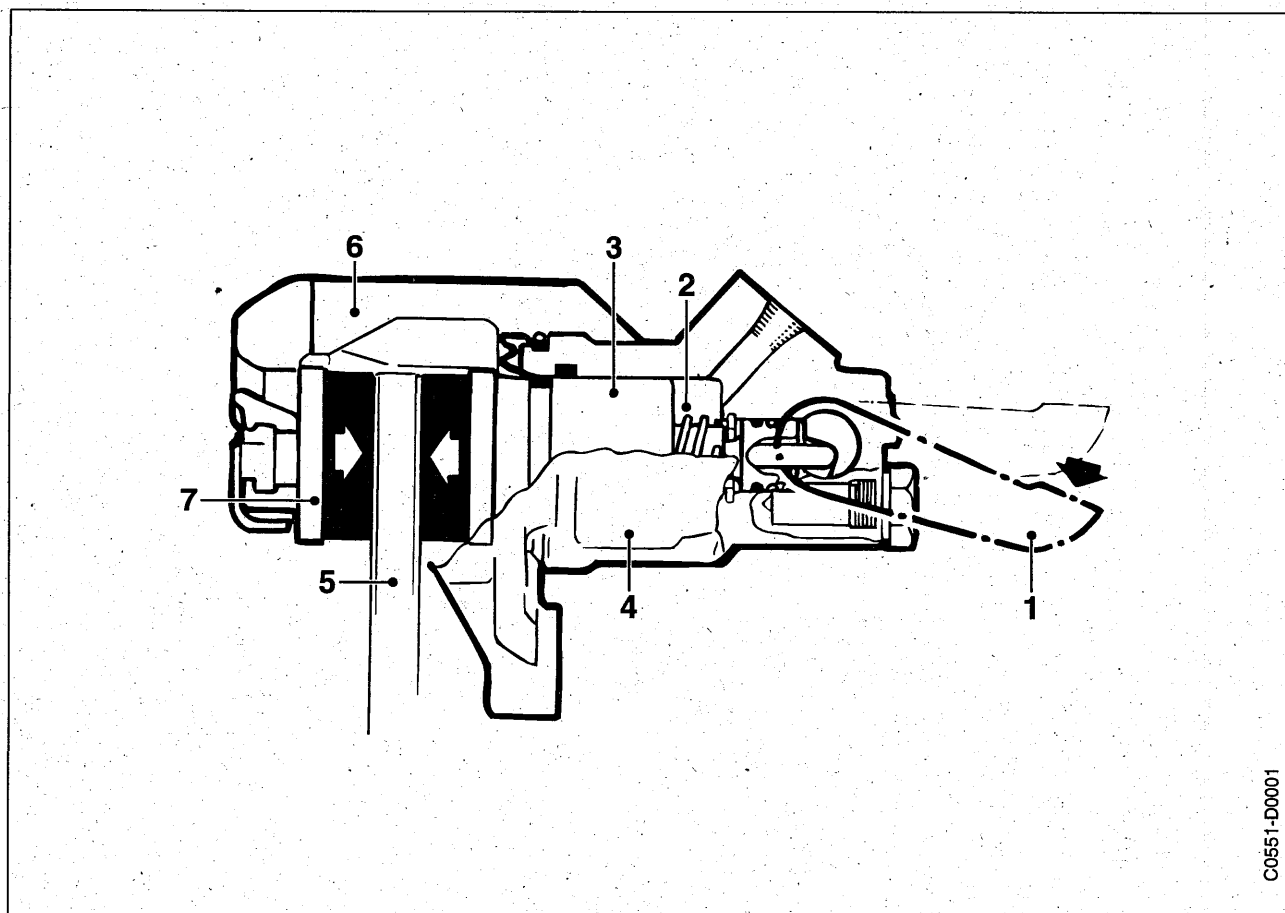
When the brakes are applied, the hydraulic pressure acts directly on the brake piston and also on the walls of the brake cylinder. The brake piston presses the inboard brake pad against the brake disc while at the same time the hydraulic body slides sideways and presses the outboard brake pad also against the brake disc. When the hydraulic pressure is released, the piston sealing ring retracts the brake piston in each brake cylinder to the rest (brake off) position.

Brake caliper, rear wheels



The design of the brake caliper for the rear wheels is the same as that for the front wheels but with the addition of a mechanical device for the handbrake system (see description under "Handbrake system").

Handbrake system



C0551-D0001

Handbrake system

- 1 Lever
- 2 Return spring
- 3 Brake piston
- 4 Carrier
- 5 Brake disc
- 6 Hydraulic body
- 7 Brake pad

When the handbrake is applied, the effort required is transferred via cables to the lever of each brake unit (caliper) on the rear wheels. This lever is fixed to an eccentric shaft that presses on a stud when it is rotated. Via the adjusting mechanism, the stud presses on the brake piston and the inboard brake pad. Simultaneously, the entire hydraulic body slides sideways and also presses the outboard brake pad against the brake disc.

When the handbrake is released, the lever on the brake unit (caliper) is returned by the spring and the piston sealing ring in the brake cylinder retracts the brake pads to the rest (brake off) position.

The handbrake system is self-adjusting. As the brake pads wear, the clearance between pads and brake disc is adjusted automatically so that it is kept constant at all times. The adjusting mechanism con-

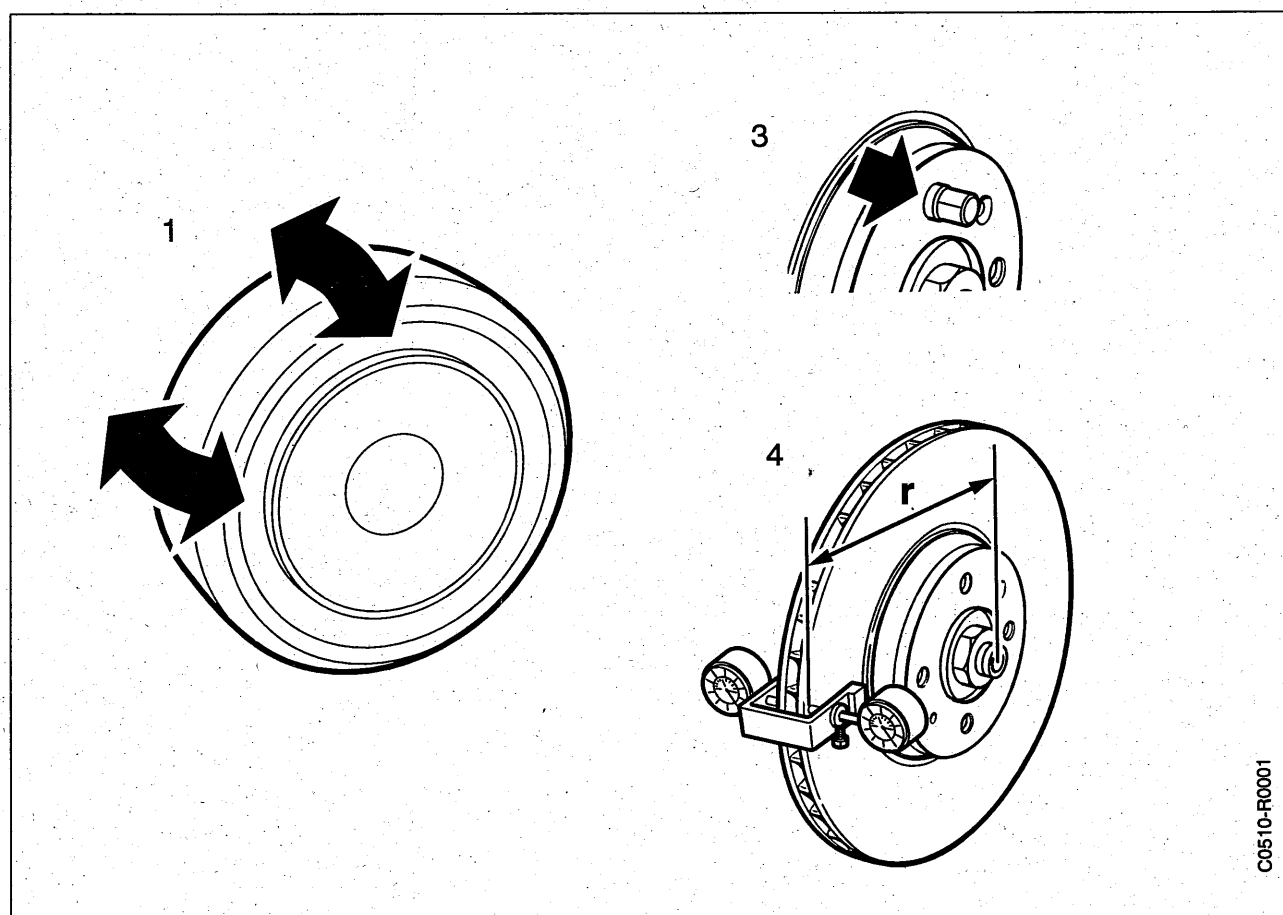
sists of an adjusting screw and a threaded sleeve. When the clearance reaches a certain limit, the adjusting screw backs off slightly. Self-adjustment is therefore carried out in small steps.

When working on the brake system, adjustment should be carried out manually as described in section 551 "Handbrake adjustment".

Brake discs

Checking for lateral runout and variation in thickness	47	Brake disc, front wheels	50
Checking wheel hub runout	49	Brake disc, rear wheels	52

Checking for lateral runout and variation in thickness

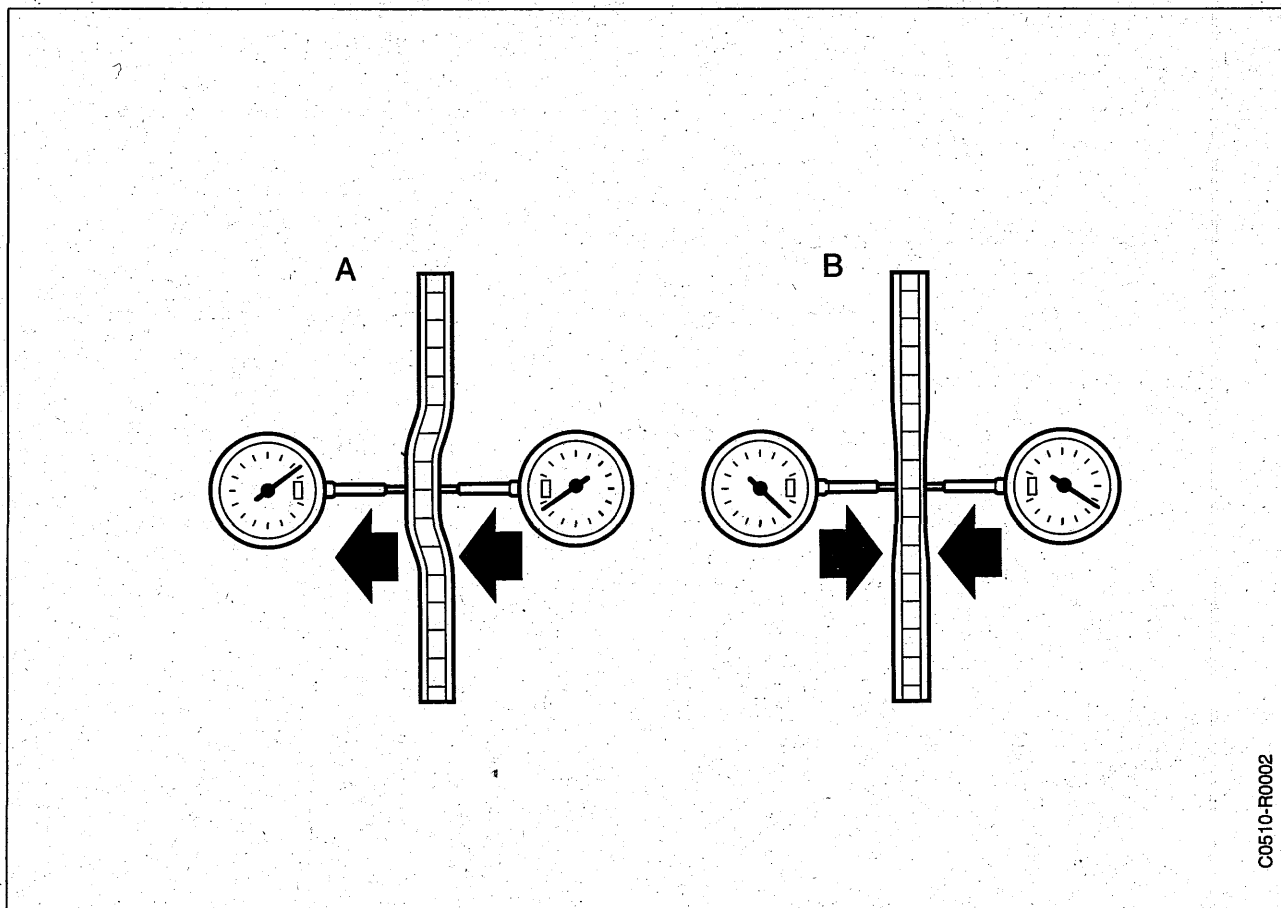


To check

- 1 Check for free play in the wheel bearing by grasping opposite sides of the wheel and rocking it to and fro. Rotate the wheel through 90 degrees and repeat. Change the wheel bearing if free play is detected.
- 2 Remove the wheel and brake caliper from the wheels causing vibration. Hang up the caliper with a cable tie.
- 3 Tighten the brake disc. Fit 4 washers, part No. (10) 80 73 124, under the wheel bolts. The washers protect the wheel bolt's taper and prevent the bolt from touching the bearing housing.
- 4 Mount a brake disc measuring tool, part No. (16) 89 96 639, on the lower retaining lug for the brake caliper and fit the dial gauges, part

No. (16) 78 40 622, on the measuring tool. Adjust the measuring tool so that the tips of the dial gauges are $r=130$ mm from the wheel centre (front discs) and $r=120$ mm from the wheel centre (rear discs).

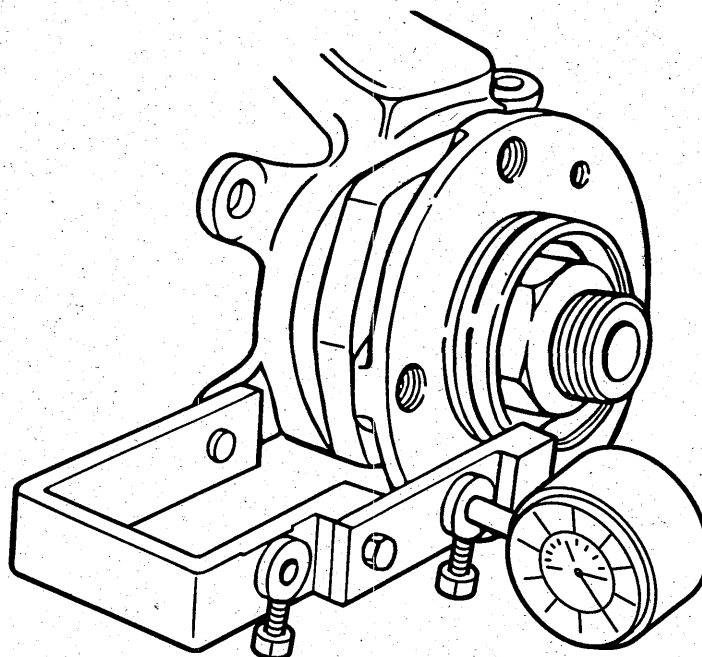
Checking for lateral runout and variation in thickness (contd.)



C0510-R0002

- 5 Rotate the brake disc while observing the out-board dial gauge. Zeroize both gauges when the negative reading obtained on the outboard one is at maximum.
- 6 Rotate the disc and read the gauges. Note the runout (A) and variation in thickness (B).
If the runout exceeds the tolerance limits, check the wheel hub (see next page).
If the hub is OK then the brake disc is defective and should be changed or reground. For measurement details, see group 0 "Technical Data".
If variation in thickness exceeds the maximum permissible limit, the disc should be changed.
- 7 Remove the dial gauges, brake disc measuring tool and wheel bolts with washers.
- 8 Fit the brake caliper.
- 9 Fit the wheels and tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)
- 10 When the measurements have been completed, lower the car and depress the brake pedal to press out the brake pads.

Checking wheel hub runout



C0510-R0003

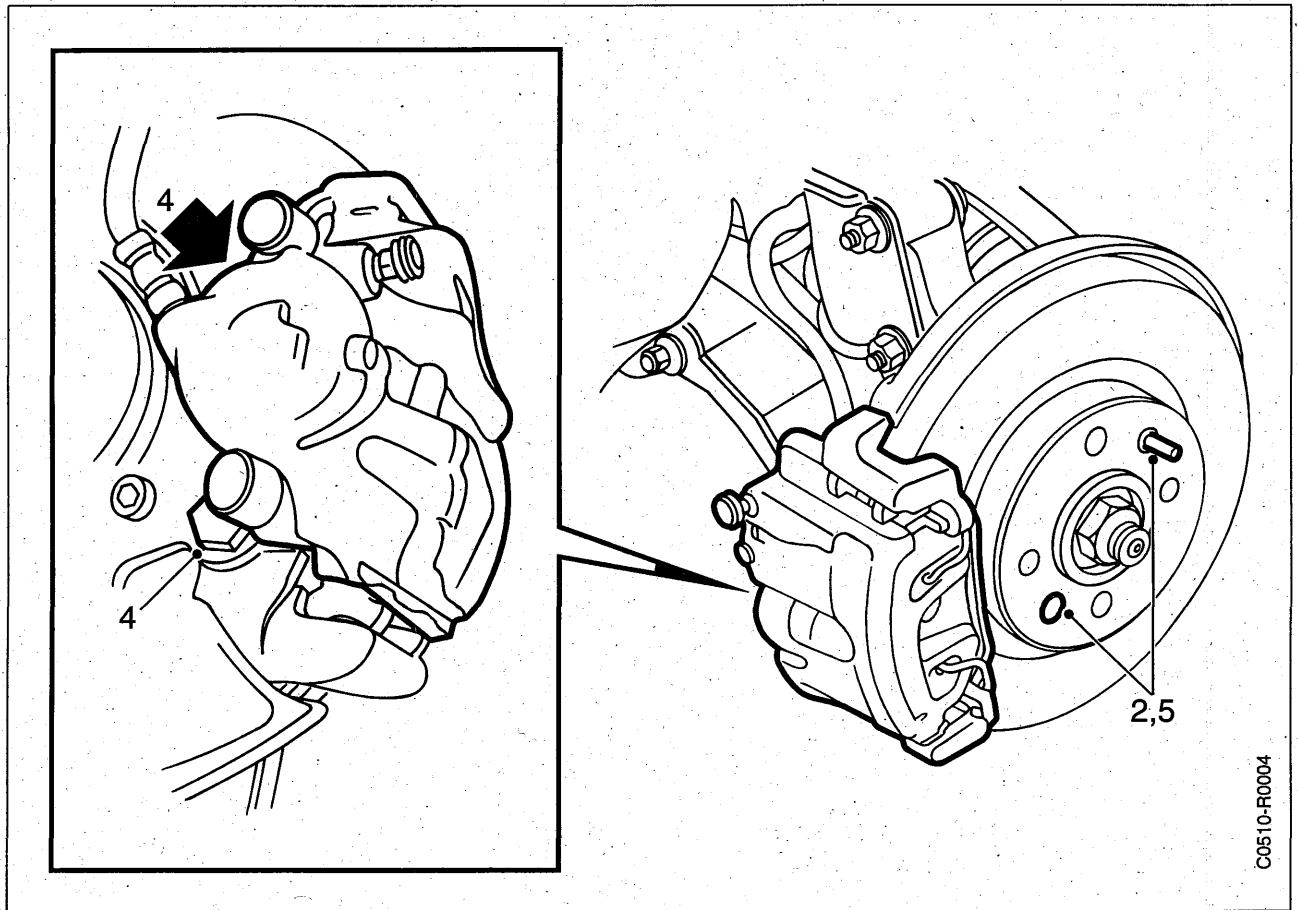
- 1 Remove the wheel, brake caliper and brake disc.
- 2 Make sure the hub is clean and free from impurities. Use the extension arm on the brake disc measuring tool to adjust its position so that gauge readings will be taken outside the bolt holes. Only one dial gauge need be used.
- 3 Rotate the hub and check the runout (the mean of the maximum and minimum readings). If runout exceeds 0.05 mm the hub should be changed.

Important

The dial gauge will fluctuate about 0.03–0.05 mm at every bolt hole. This is perfectly normal.

- 4 Fit the brake disc, brake caliper and wheel. Tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)

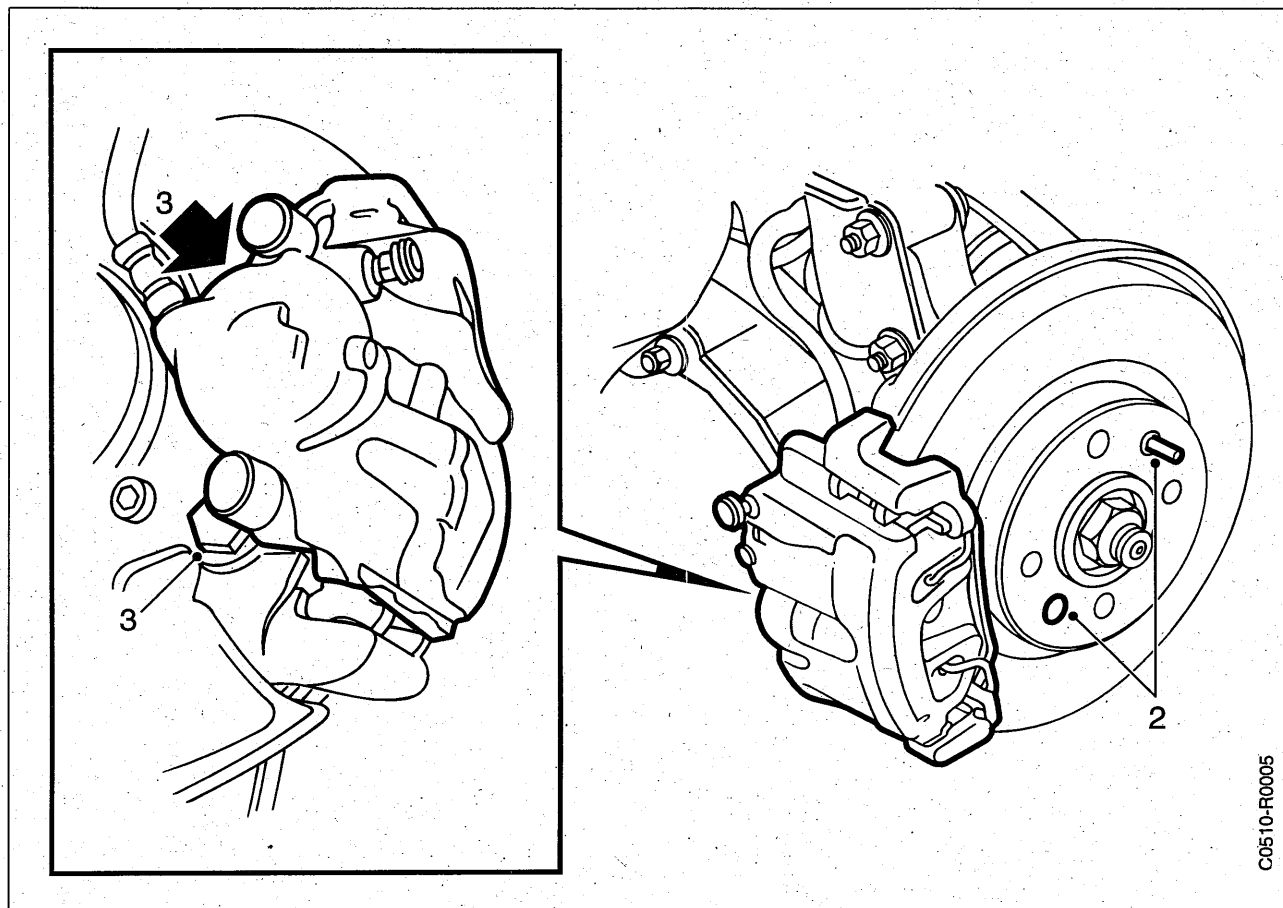
Brake disc, front wheel



To remove

- 1 Raise the car and remove the front wheel.
- 2 Slacken the locating stud and retaining bolt in the brake disc.
- 3 Press back the piston and remove the brake pads. See section 517.
- 4 Remove the carrier's retaining bolts.
- 5 Unscrew the locating stud and retaining bolt and remove the brake disc.

Brake disc, front wheel (contd.)



To fit

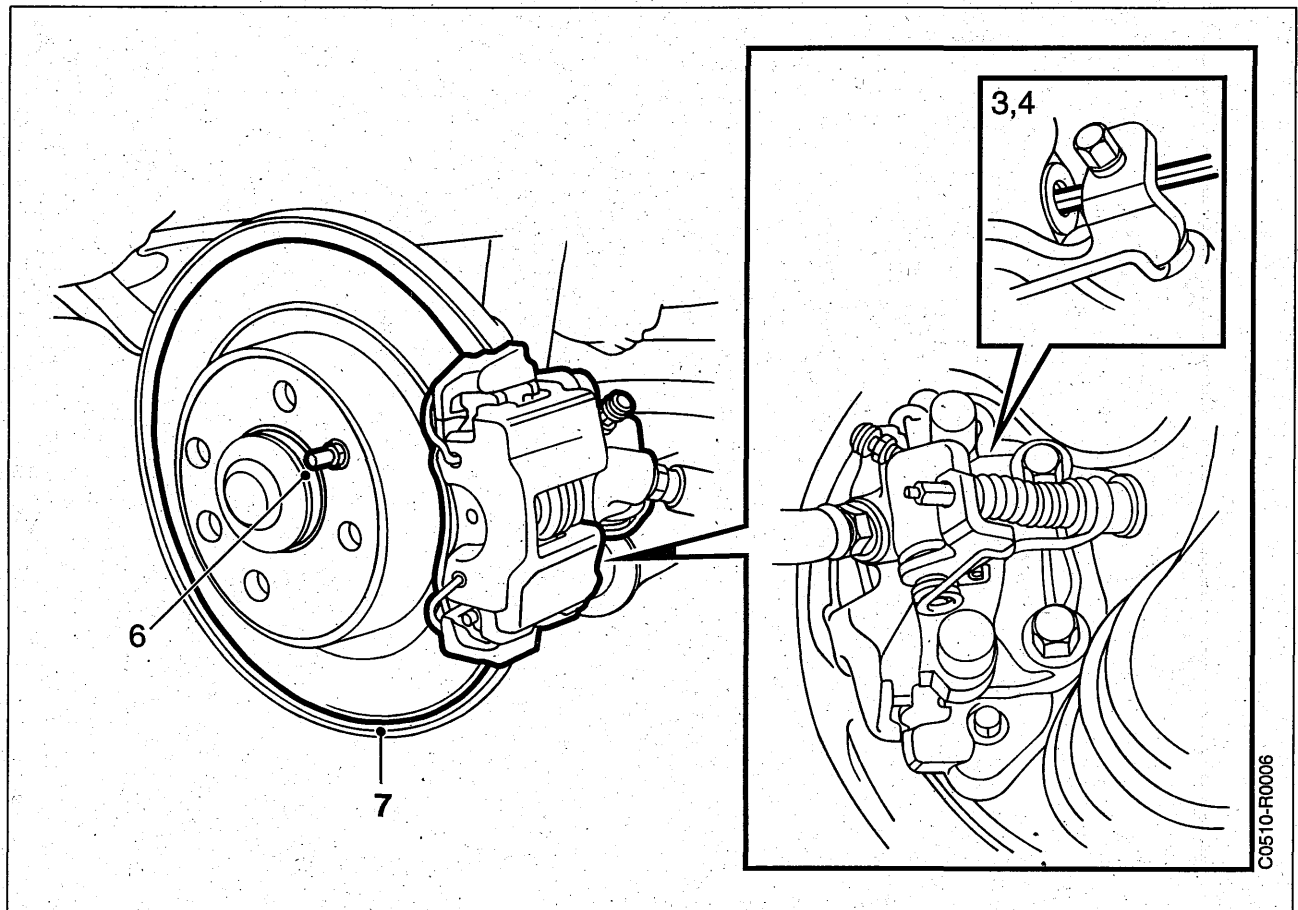
Before refitting the brake disc, check that its surface in contact with the hub is free from rust, burrs and the like. Use a scraper, chisel, file or the like to clean the brake pad contact surfaces in the carrier frame.

- 1 Wash the brake disc to clean it.
- 2 Fit the brake disc and screw the locating stud in place.
- 3 Fit the carrier.
Tightening torque, carrier-steering swivel member: 84 Nm (62 lbf ft)
- 4 Fit the brake pads. See section 517.
- 5 Fit the wheels and tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)

Important

Depress the brake pedal to press out the brake pads towards the disc.

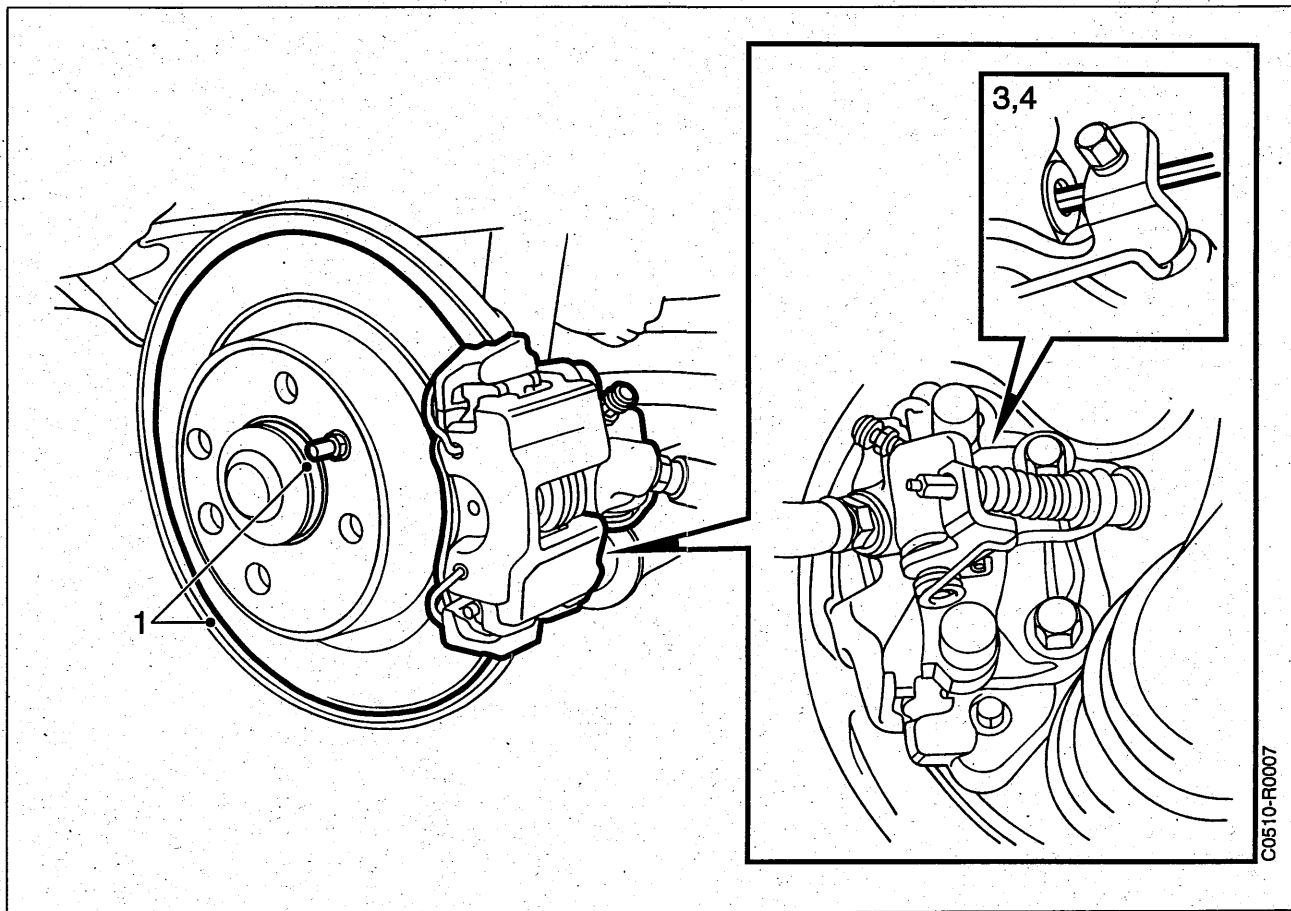
Brake disc, rear wheels



To remove

- 1 Make sure that the handbrake is not applied.
- 2 Jack up the car and remove the wheel.
- 3 Remove the adjusting screw's threaded plug.
- 4 Unscrew the adjusting screw.
- 5 Remove the brake pads. See section 517.
- 6 Remove the locating stud.
- 7 Lift off the brake disc.

Brake disc, rear wheels (contd.)



To fit

Before refitting the brake disc, check that its surface in contact with the hub is free from rust, burrs and the like. Use a scraper, chisel, file or the like to clean the brake pad contact surfaces in the carrier frame. Wash the brake disc to clean it.

- 1 Position the brake disc and fit the locating stud.
- 2 Fit the brake pads. See section 517.
- 3 Remove the adjusting screw's threaded plug. Tighten the adjusting screw all the way in and then back it off a 1/4-1/2 turn. Check that the brake disc can rotate freely.
- 4 Fit the adjusting screw's threaded plug.
- 5 Fit the wheels and tighten the wheel bolts, using a torque wrench.

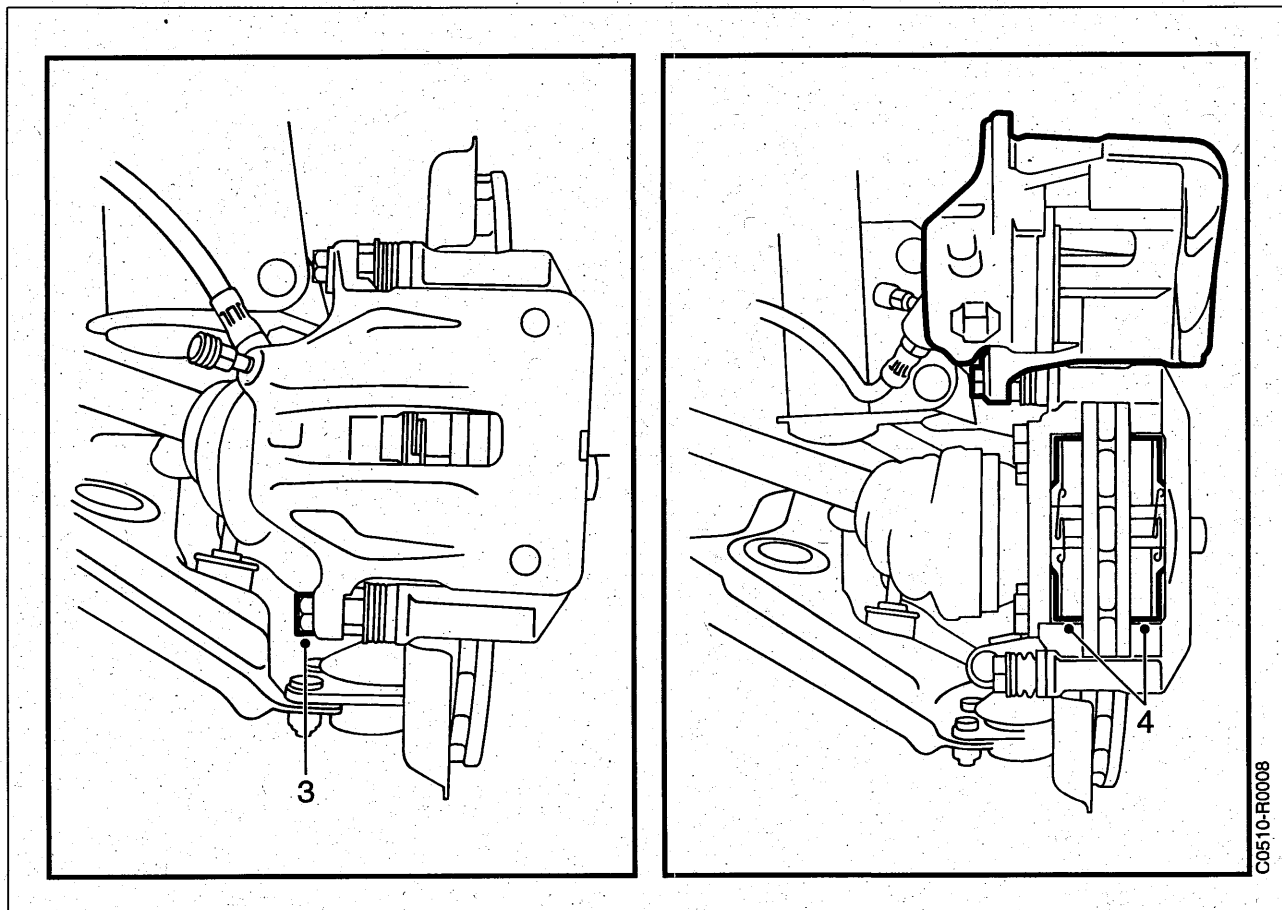
Tightening torque: 120 Nm (89 lbf ft)

Brake pads

Brake pads, front wheels 55

Brake pads, back wheels 59

Brake pads, front wheels (9000 Turbo M1985-87 and 9000i M1985-88)



To check

Since both the footbrake and handbrake are self-adjusting, it is not possible to judge whether the brake pads are worn from the amount of pedal or handbrake lever travel. It is therefore essential to remove the wheels and inspect the thickness of the pads at regular intervals as specified in the service programme.

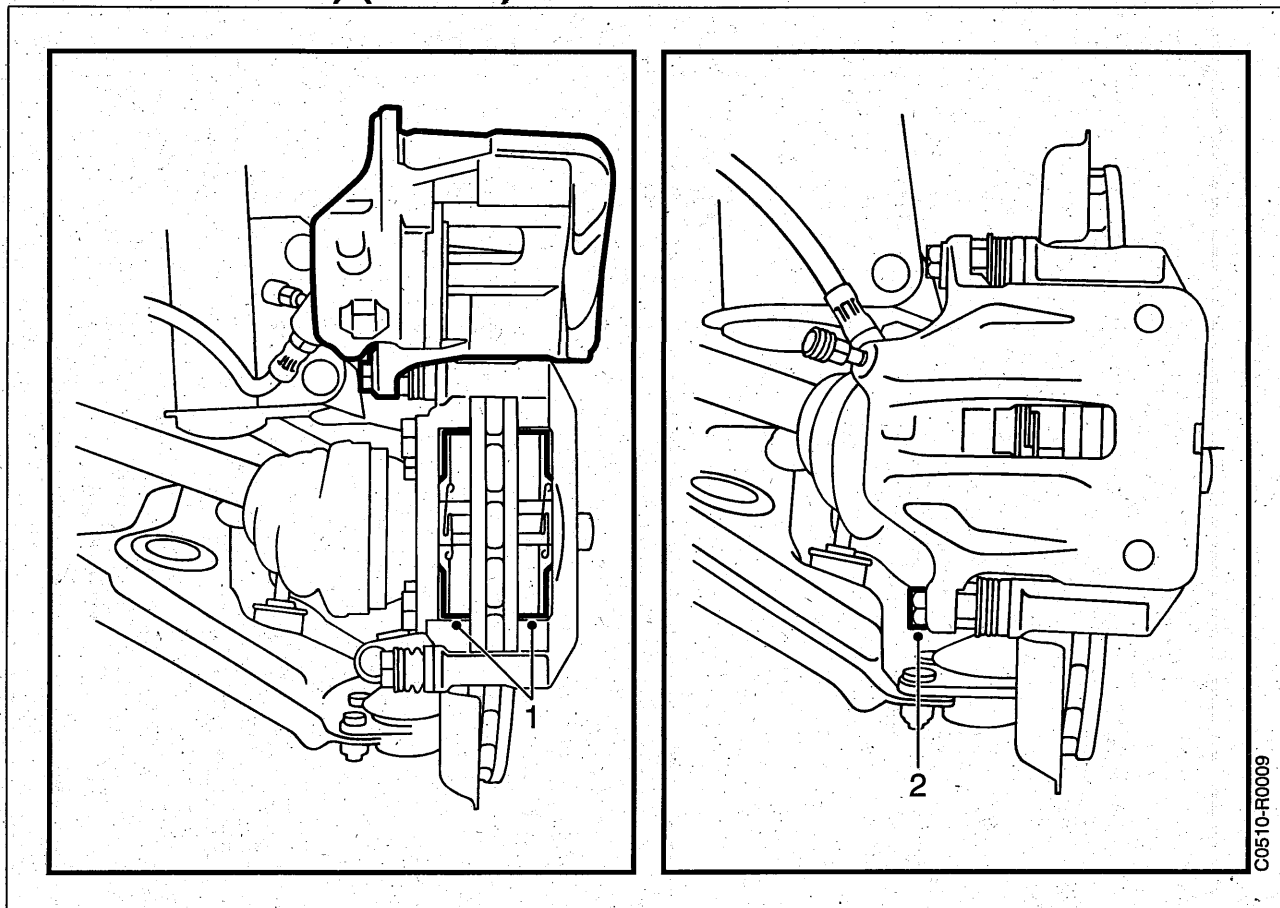
The brake pads should be changed when the thickness of the friction material is down to 4 mm (0.16 in).

To remove

- 1 Raise the car and remove the front wheel.
- 2 Press back the piston.
- 3 Remove the bolt in the lower guide pin.

- 4 Pivot the hydraulic body upwards to avoid stretching the brake hose and extract the brake pads.

Brake pads, front wheels (9000 Turbo M1985-87 and 9000i M1985-88) (contd.)



To fit

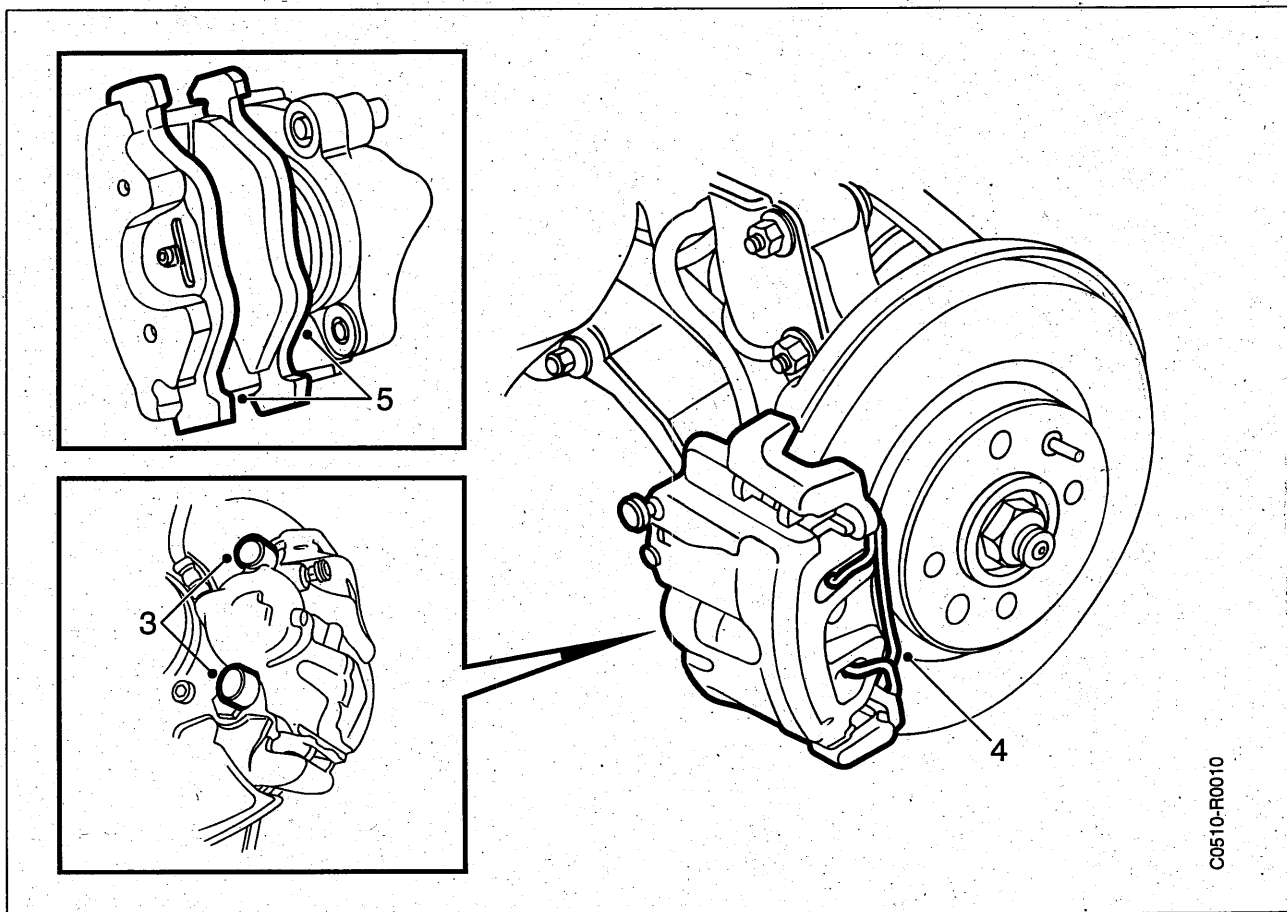
Before refitting, thoroughly clean the contact surfaces between the carrier and the pads.

- 1 Fit the brake pads and lower the hydraulic body into place.
- 2 Tighten the bolt in the lower guide pin. Use a new bolt when refitting.
Tightening torque: 27.5 Nm (20.5 lbf ft)
- 3 Fit the front wheel and tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)

Important

Depress the brake pedal to press out the brake pads towards the disc.

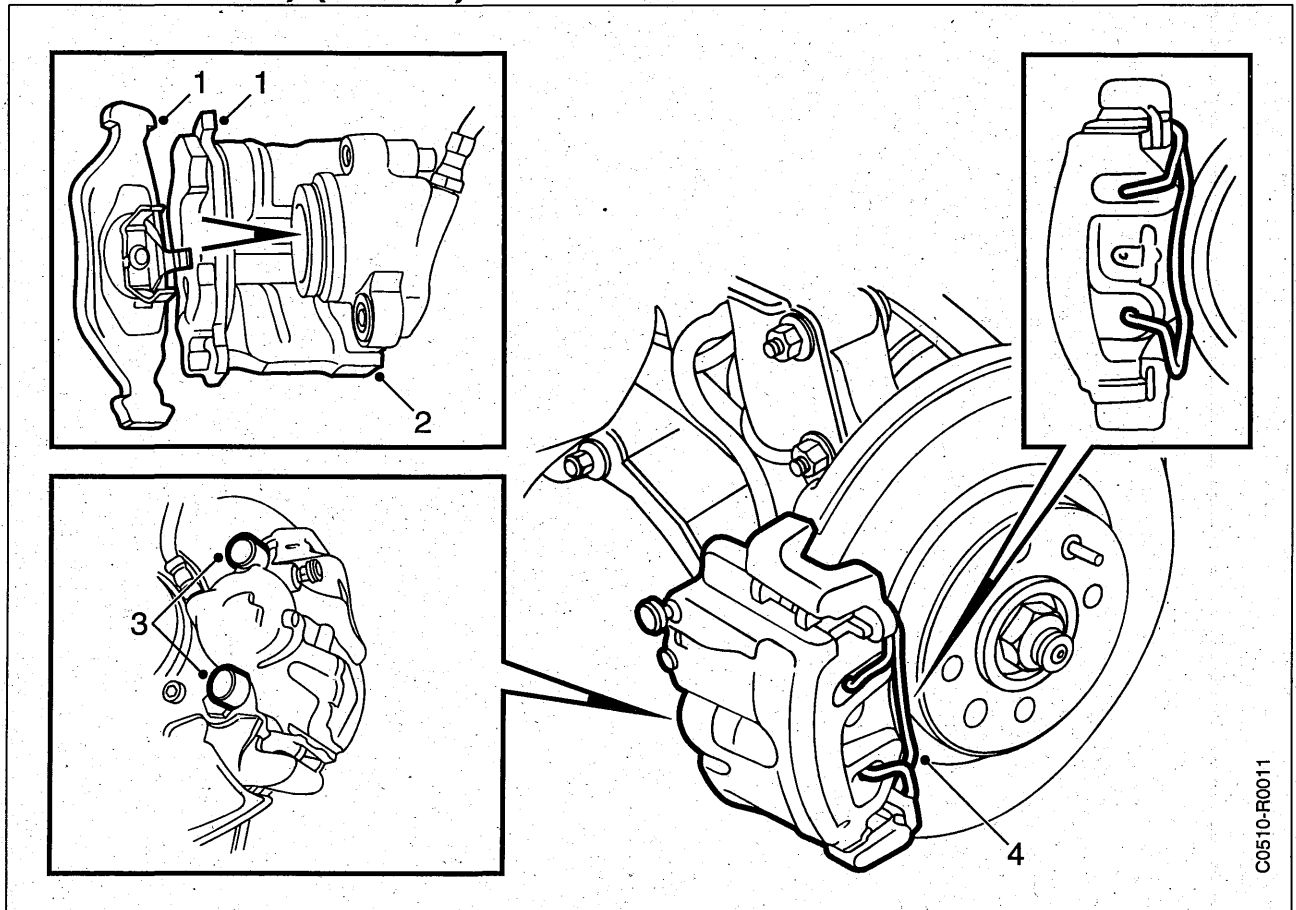
Brake pads, front wheels (9000 Turbo M1988- and 9000i M1990-)



To remove

- 1 Raise the car and remove the front wheel.
- 2 Press back the piston.
- 3 Remove the covers from the guide pins and unscrew the pins.
Use a 7 mm Allen key.
- 4 Remove the retaining clip.
- 5 Lift off the hydraulic body and remove the brake pads.
- 6 Suspend the hydraulic body from the steering swivel member with a cable tie or the like.

Brake pads, front wheels (9000 Turbo M1988- and 9000i M1990-) (contd.)



C0510-R0011

To fit

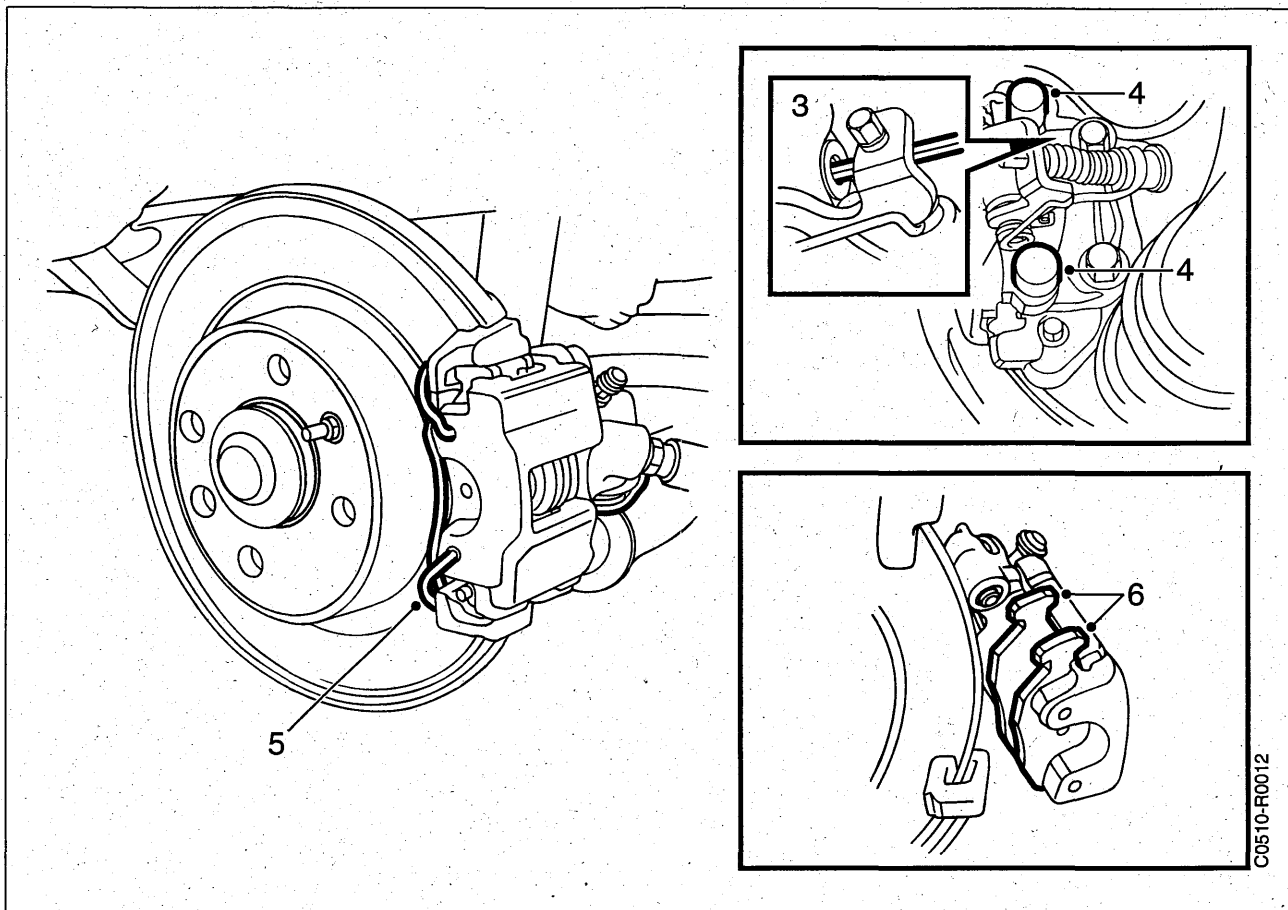
Before refitting, thoroughly clean the contact surfaces between the carrier and the pads.

- 1 Refit the outboard brake pad. Then fit the inboard pad, locating the 3 centring springs in the brake piston.
- 2 Refit the hydraulic body.
- 3 Fit the guide pins and tighten them.
Tightening torque 27 Nm (20.5 lbf ft)
Fit the covers in place.
- 4 Fit the retaining clip.
- 5 Fit the front wheel and tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)

Important

Depress the brake pedal to press out the brake pads towards the disc.

Brake pads, rear wheels

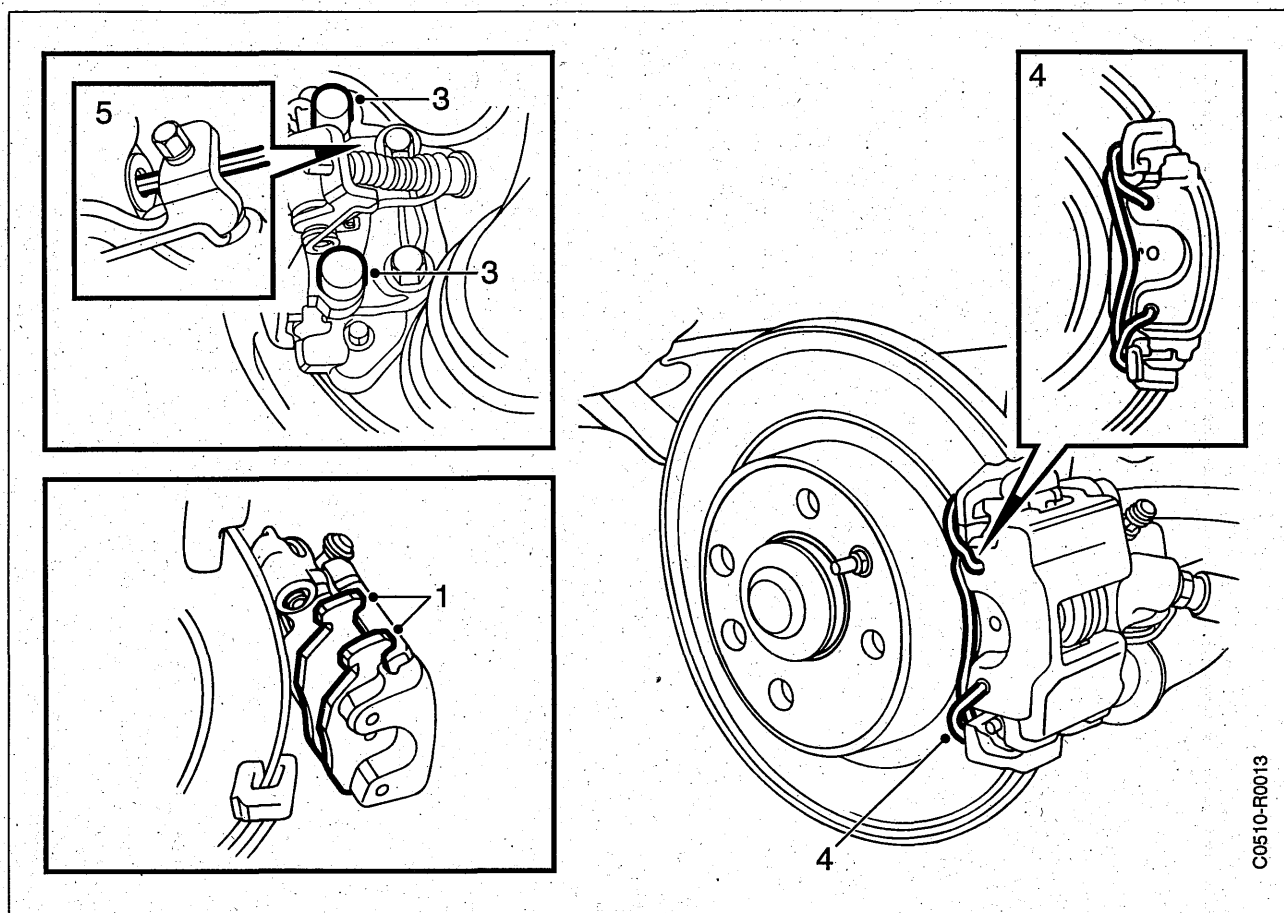


C0510-R0012

To remove

- 1 Release the handbrake.
- 2 Lift the car and remove the rear wheel.
- 3 Remove the adjusting screw's threaded plug.
Unscrew the adjusting screw.
- 4 Remove the covers from the guide pins and
unscrew the pins.
Use a 7 mm Allen key.
- 5 Remove the retaining clip.
- 6 Lift off the hydraulic body and remove the brake
pads.

Brake pads, rear wheels (contd.)



To fit

Before refitting, thoroughly clean the contact surfaces between the carrier and the pads.

- 1 Fit new brake pads.
- 2 Refit the hydraulic body.
- 3 Fit the guide pins and tighten them.
Tightening torque 27.5 Nm (20.5 lbf ft)
Fit the covers in place.
- 4 Fit the retaining clip.
- 5 Adjust the handbrake:
Remove the adjusting screw's threaded plug.
Tighten the adjusting screw all the way in and then back it off a 1/4-1/2 turn.
Check that the brake disc can rotate freely.
Screw the threaded plug back in place.
- 6 Fit the rear wheel.
Tightening torque: 120 Nm (89 lbf ft)

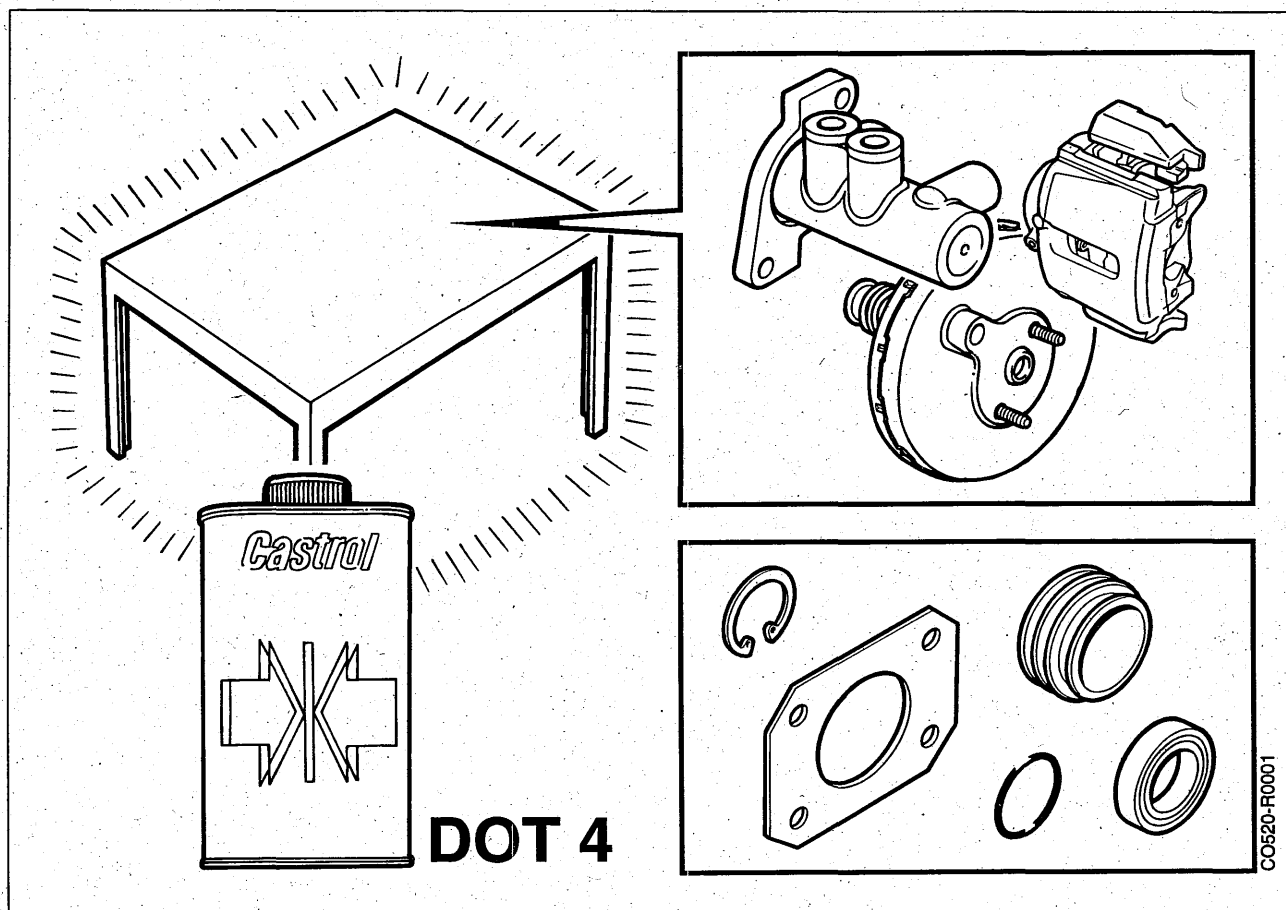
Important

Depress the brake pedal to press out the brake pads towards the disc.

Hydraulic brake system

General instructions 61

General instructions



Scrupulous cleanliness is essential when removing, dismantling, assembling and fitting components forming part of the hydraulic brake system. Clean removed and dismantled components in clean brake fluid or a special cleaning fluid for hydraulic brake components. Wipe the parts dry using clean, lint-free paper or cloth. Gaskets, circlips and rubber parts are available as repair kits and old ones should be discarded.

Before assembly, the components should be generously lubricated with clean, unused brake fluid of the recommended specification.

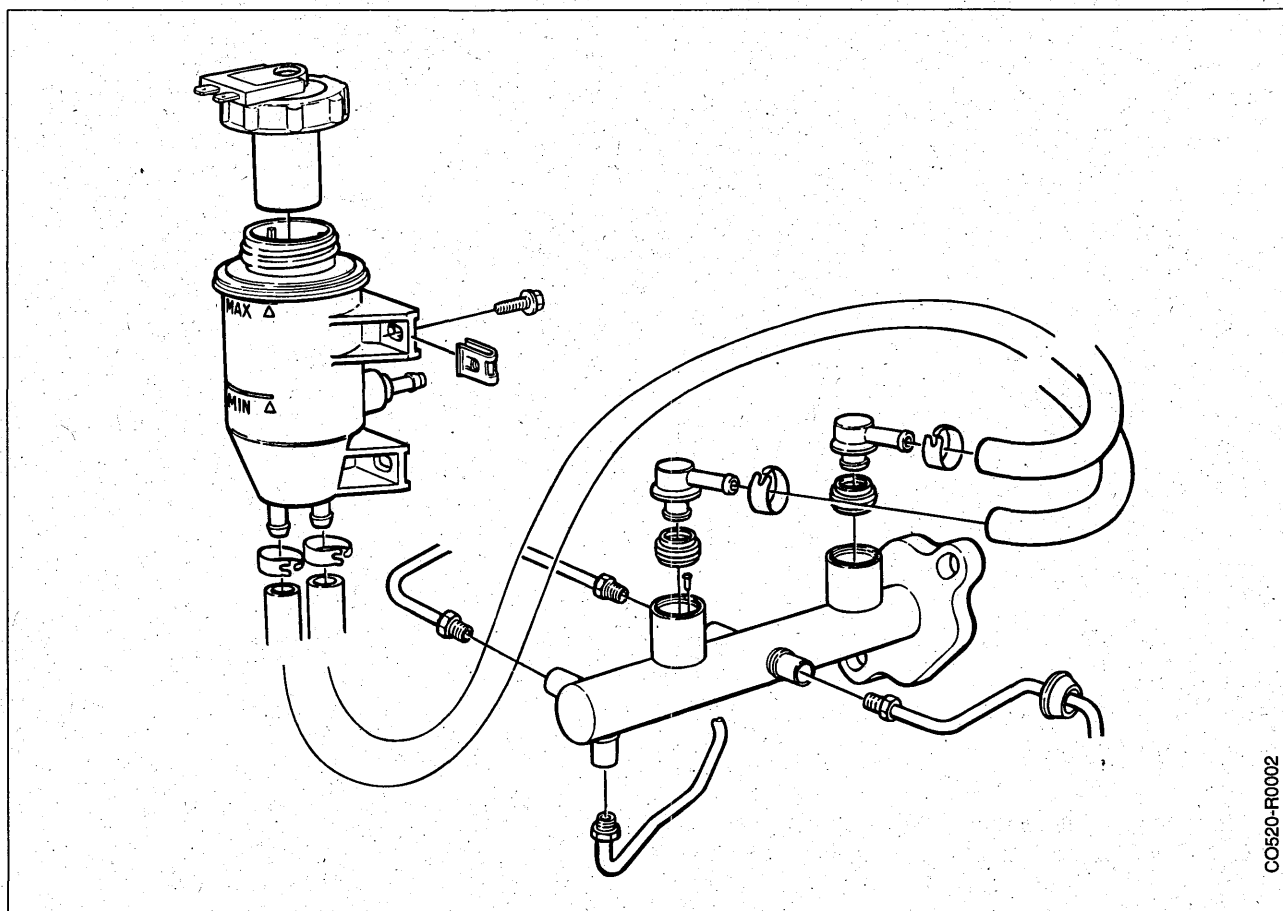
Important

Brake fluid can damage painted surfaces. Take care to ensure that the brake fluid does not come into contact with the car's paintwork.

Master cylinder

General instructions	63	Brake fluid reservoir, cars without ABS	72
Master cylinder, cars without ABS	64	Brake fluid reservoir, ABS MK II	74
Master cylinder, ABS MK II	68	Brake fluid reservoir, ABS MK IV	76
Master cylinder, ABS MK IV	70		

General instructions



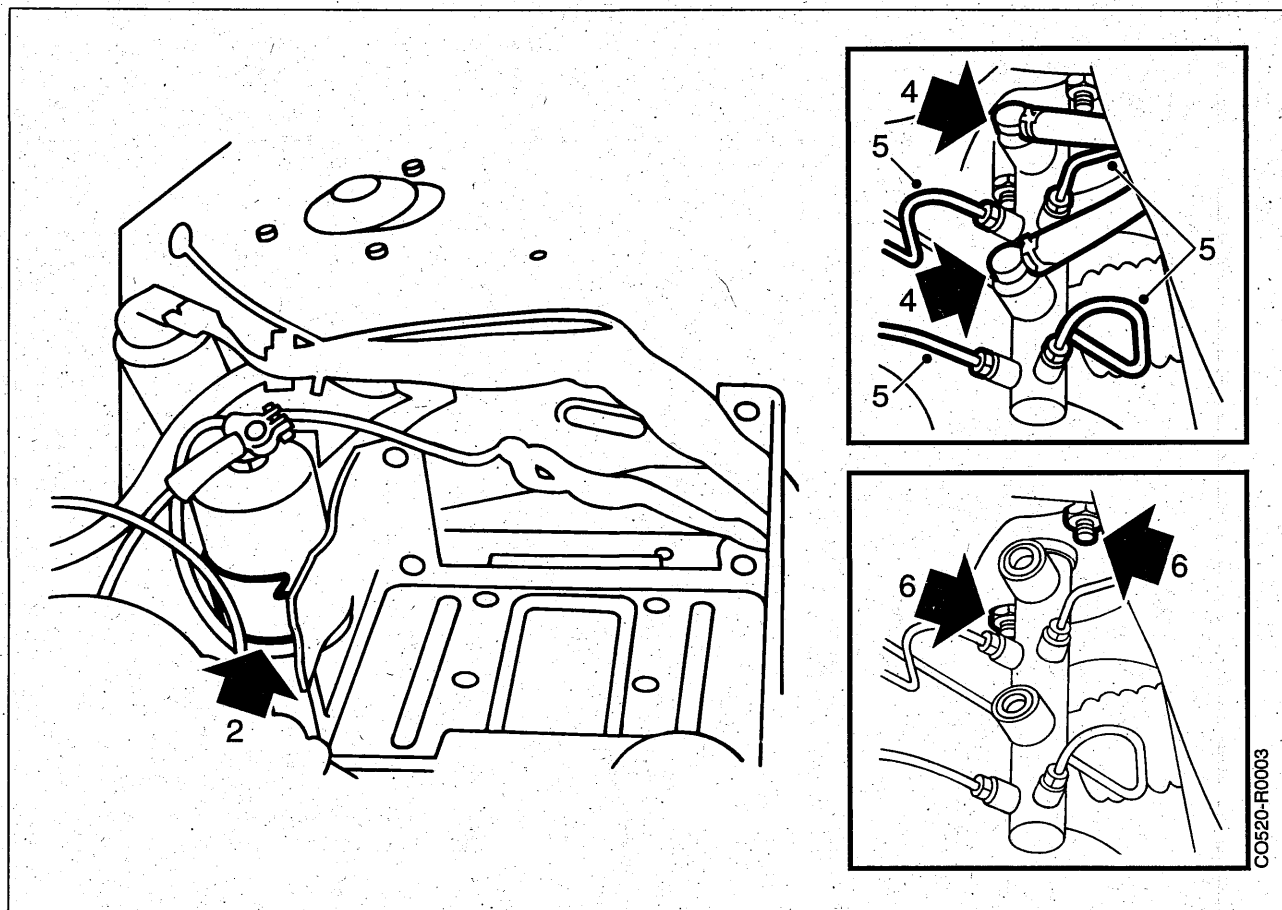
Master cylinder with brake fluid reservoir (cars without ABS)

Scrupulous cleanliness is essential when removing, dismantling, assembling and fitting components forming part of the hydraulic brake system.

Clean removed and dismantled components in clean brake fluid or a special cleaning fluid for hydraulic brake components. Wipe the parts dry using clean, lint-free paper or cloth. Gaskets, circlips and rubber parts are available as repair kits and old ones should be discarded.

Before assembly, the components should be generously lubricated with clean, unused brake fluid of the recommended specification.

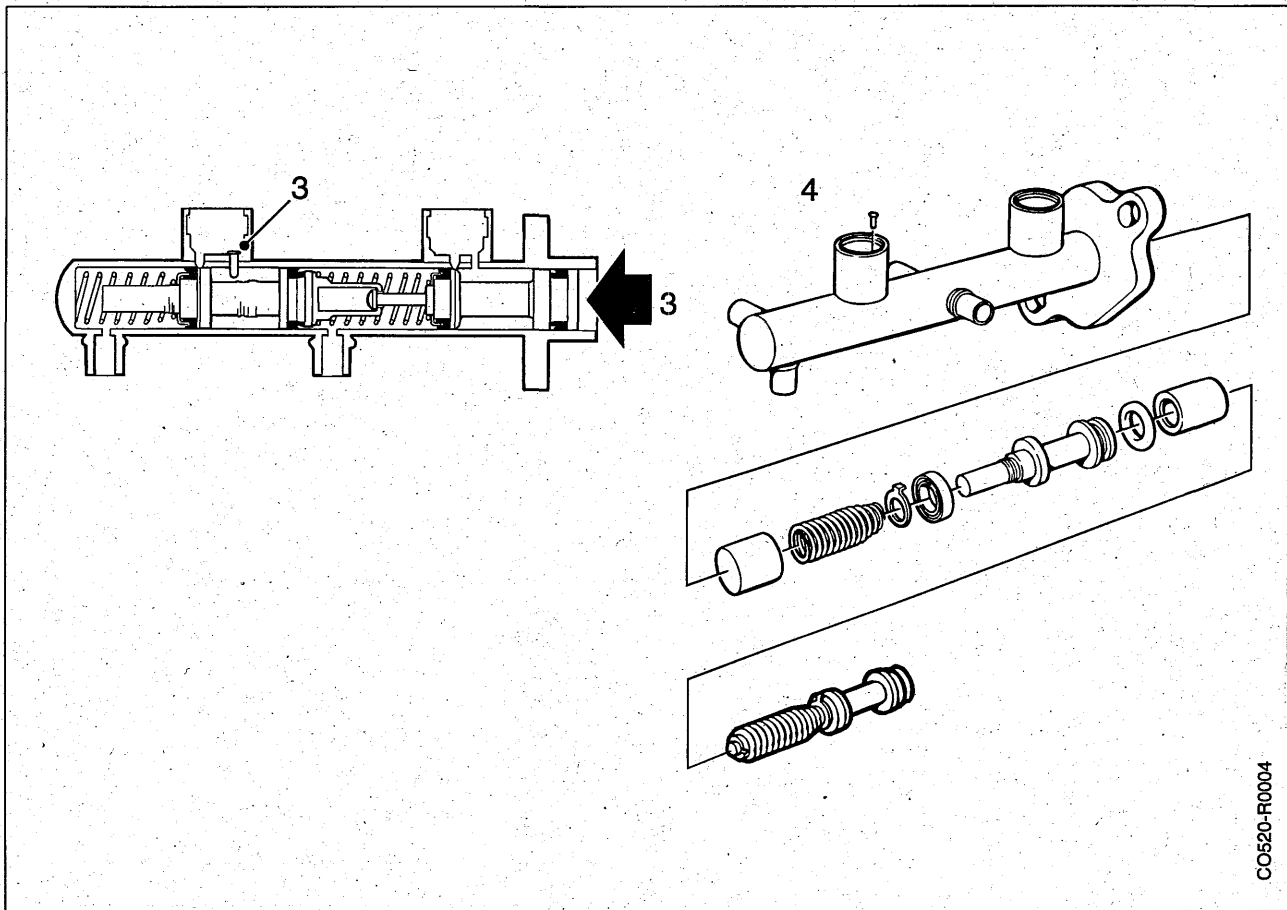
Master cylinder (cars without ABS)



To remove

- 1 Disconnect the battery cables and lift out the battery.
- 2 Undo the fuel filter and move it aside.
(Not model year 1990 and later cars.)
- 3 Empty the brake fluid reservoir.
- 4 Disconnect the hoses from the master cylinder and bend them up out of the way beside the brake fluid reservoir.
- 5 Undo the pipe connections.
- 6 Unbolt the master cylinder from the brake servo unit.

Master cylinder (cars without ABS) (contd.)

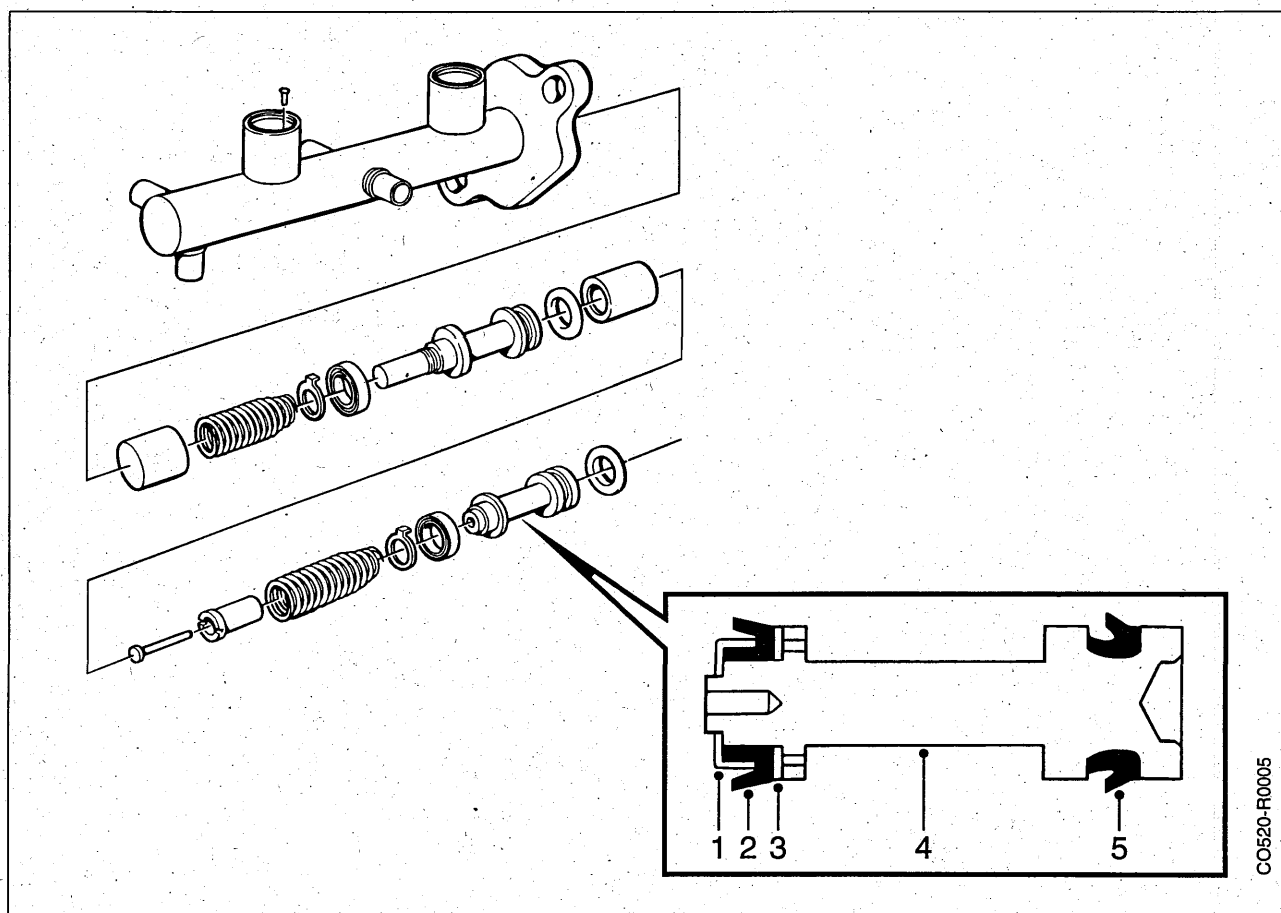


CO520-R0004

To dismantle

- 1 Clamp the master cylinder in a vice fitted with soft jaws.
- 2 Remove the rubber seals from the brake hose connections.
- 3 Press in the primary piston (nearest the bulk-head partition) and remove the secondary piston's stop pin.
- 4 Remove the pistons and plastic sleeves from the cylinder bore.
- 5 Inspect the parts and replace any that are damaged. Also check that the cylinder bore is not scored.

Master cylinder (cars without ABS) (contd.)



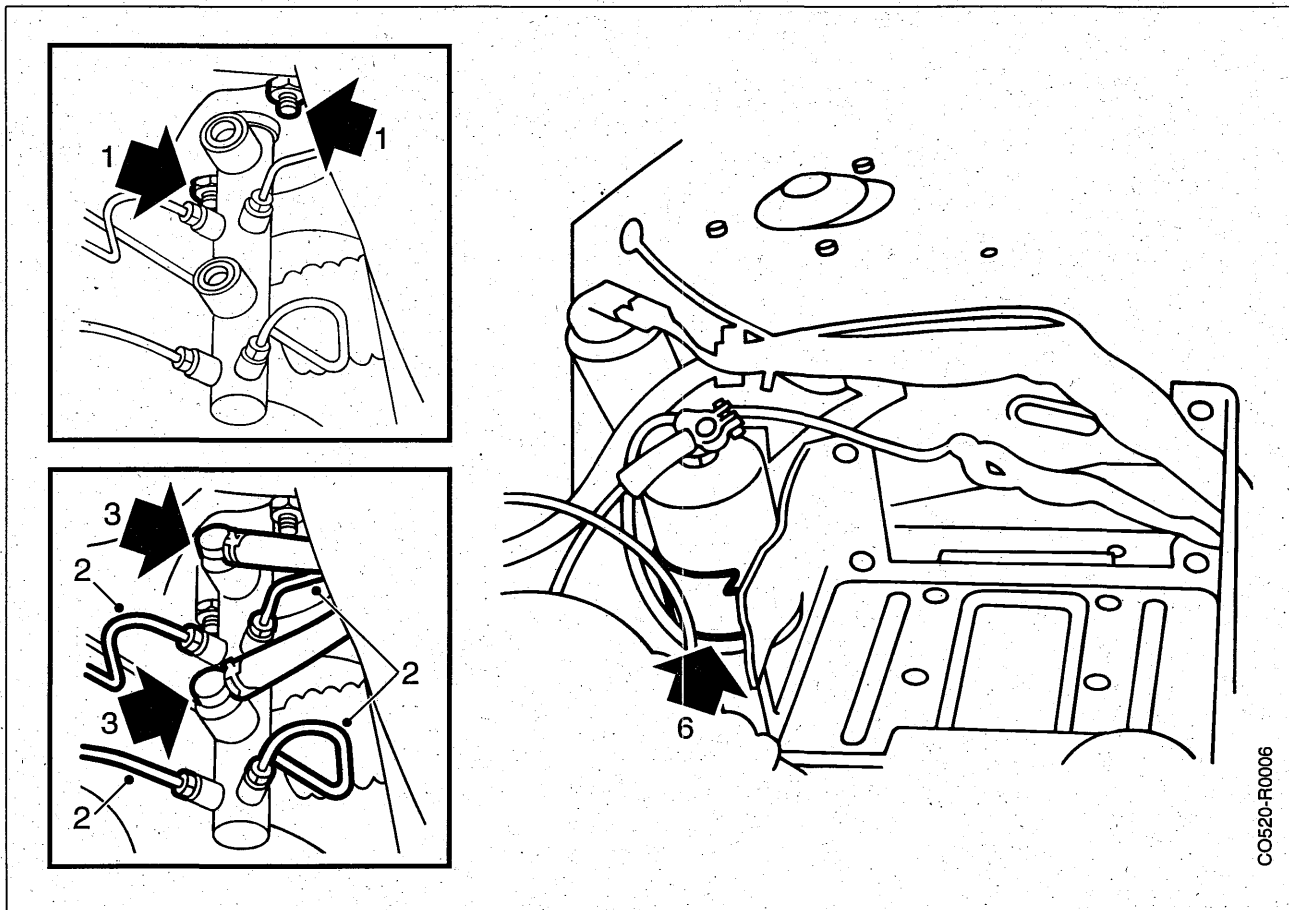
Secondary piston with seals

- 1 Spring seat
- 2 Piston seal
- 3 Washer
- 4 Secondary piston
- 5 Piston seal

To assemble

- 1 Fit the secondary piston with new seals, if necessary.
Since the primary piston's front seal cannot be changed, it will be necessary to change the entire piston assembly if the seal is damaged.
- 2 Fit the secondary piston's spring and retaining ring.
- 3 Lubricate the seals and cylinder bore with brake fluid.
- 4 Fit the secondary piston's plastic sleeve.
Insert the secondary piston into the cylinder bore.
Take care not to damage the seals.
- 5 Insert the primary piston into the cylinder bore.
Take care not to damage the seals.
- 6 Press in the primary piston and fit the secondary piston's stop pin back in place.

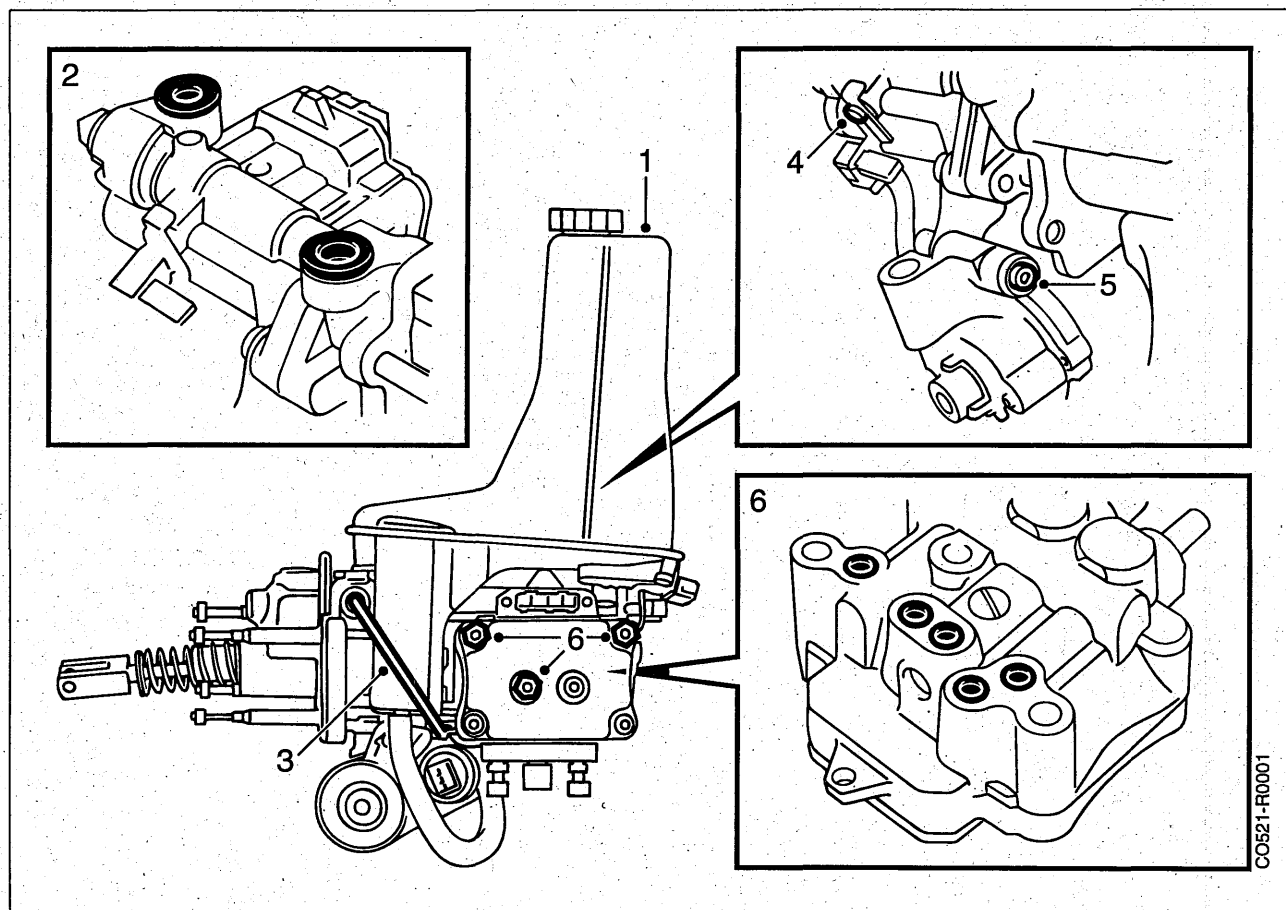
Master cylinder (cars without ABS) (contd.)



To fit

- 1 Refit the master cylinder.
Tighten the master cylinder's nuts securing it to the brake servo unit.
Tightening torque: 27 Nm (20 lbf ft)
- 2 Reconnect the brake pipes and tighten the connections.
- 3 Reconnect the hoses from the brake fluid reservoir.
Take care to ensure that the sealing rings are not pressed out of position.
- 4 Fill up with brake fluid, DOT 4 specification.
- 5 Bleed the brake system.
See section 529, "Bleeding the brake system".
- 6 Refit the fuel filter.
(Not model year 1990 and later cars.)
- 7 Put the battery back in place and reconnect the cables.

Master cylinder (ABS MK II)



To remove

To change master cylinder, the hydraulic unit should first be removed. To remove the hydraulic unit, see Service Manual 5:2 ABS braking system M1987-.



WARNING

When carrying out any work on the brake system's hydraulic circuits the system must first be depressurized. Depress the brake pedal about 20 times or until noticeable resistance is felt in the pedal.

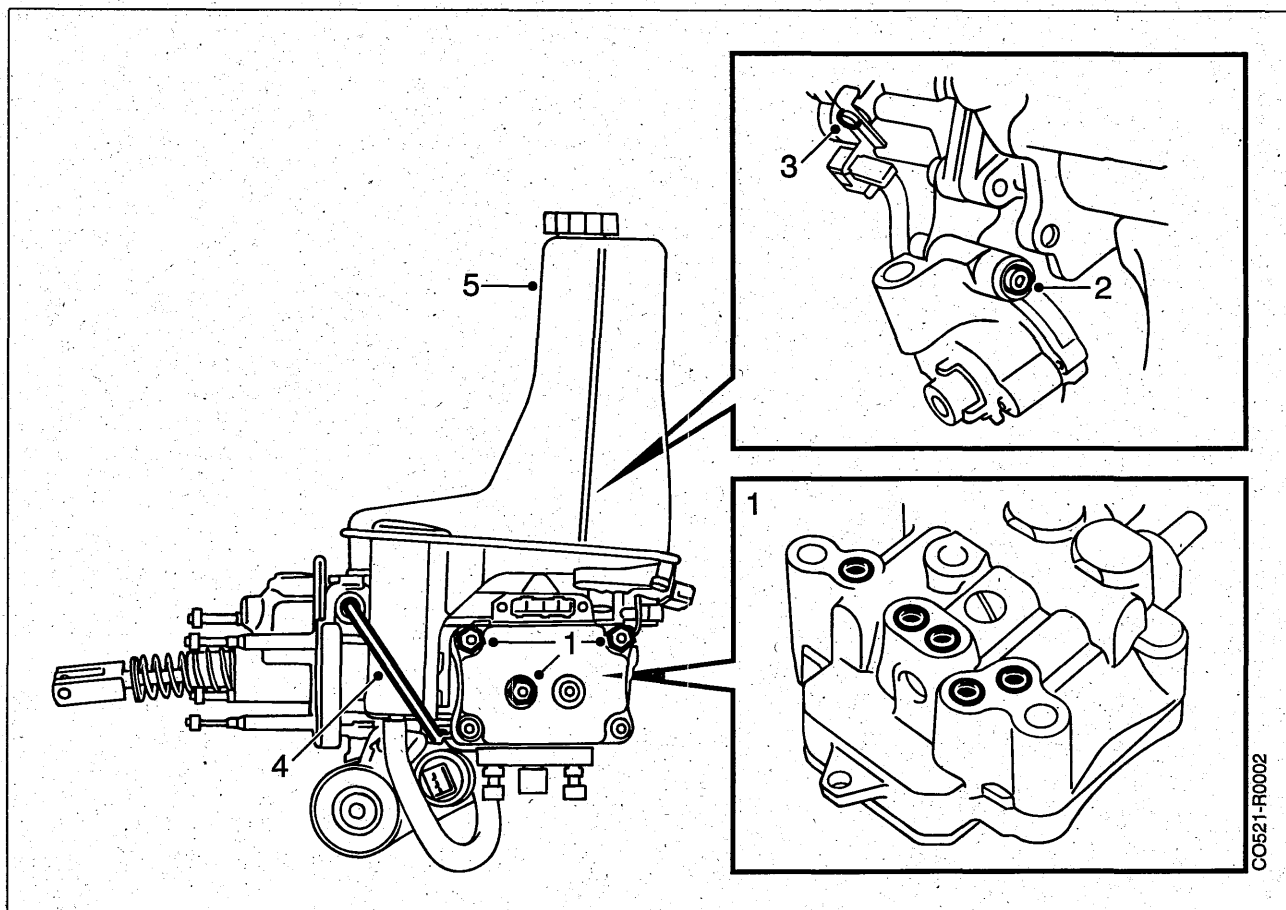
- 1 Remove the brake fluid reservoir (see page 74).
- 2 Transfer the rubber seals to the new master cylinder. If they are damaged, fit new ones.
- 3 Disconnect the delivery pipe between the pump and master cylinder.
- 4 Remove the bracket for the pump's electrical connector (1 bolt).
- 5 Undo the pump retaining bolt and lift out the pump.

- 6 Remove the valve block's three retaining nuts.

Important

Take care to ensure that the five small O-rings on the side of the valve block are not lost.

Master cylinder (ABS MK II) (contd.)



To fit

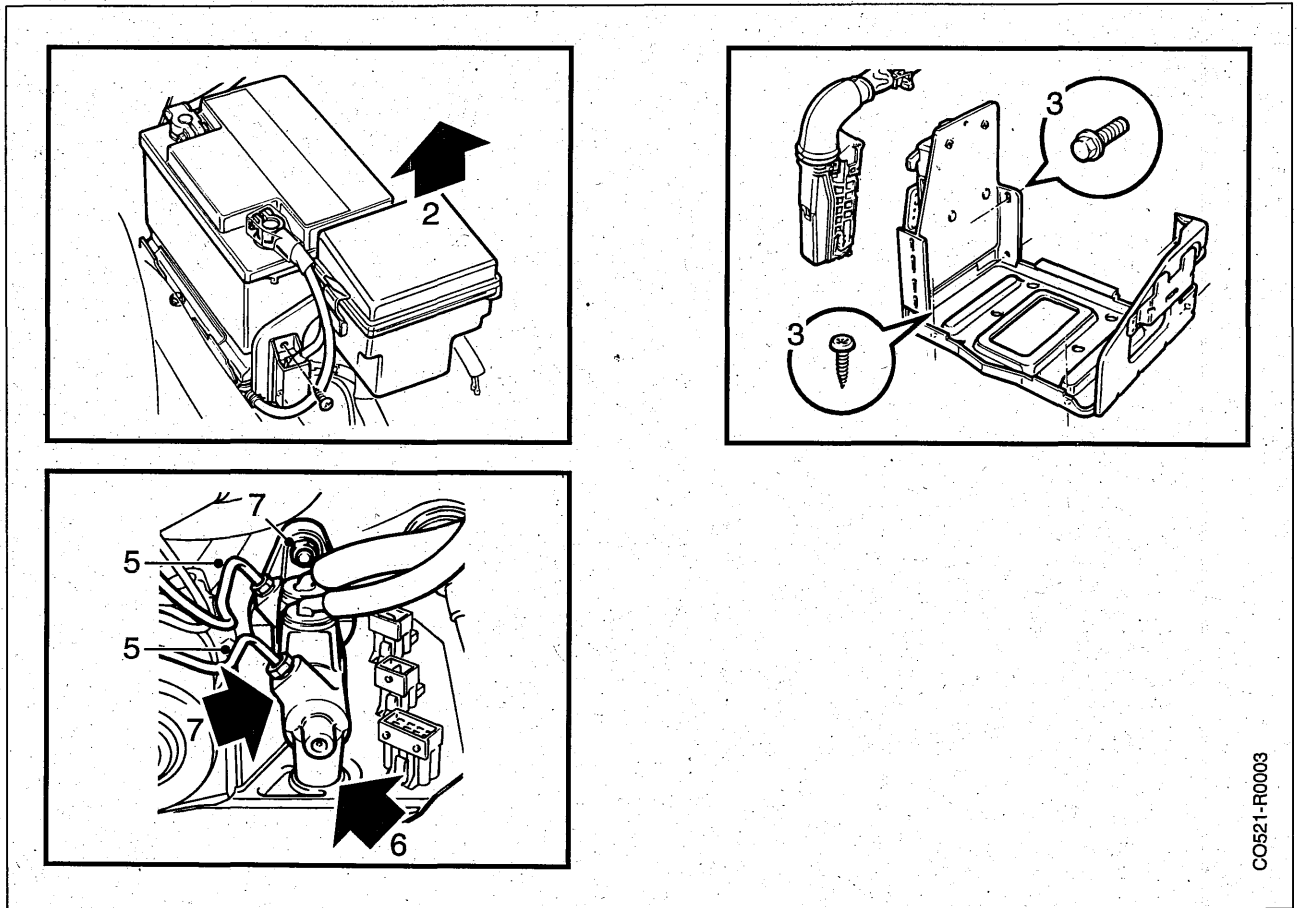
- 1 Fit the valve block.

Important

Make sure that the five small O-rings are in place.

- 2 Fit the pump and tighten the retaining bolt.
- 3 Fit the bracket for the pump's electrical connector (1 bolt).
- 4 Fit the delivery pipe between the pump and master cylinder.
- 5 Fit the brake fluid reservoir (see page 75).
- 6 Refit the complete hydraulic unit. See Service Manual 5:2 ABS braking system M1987-.

Master cylinder (ABS MK IV)

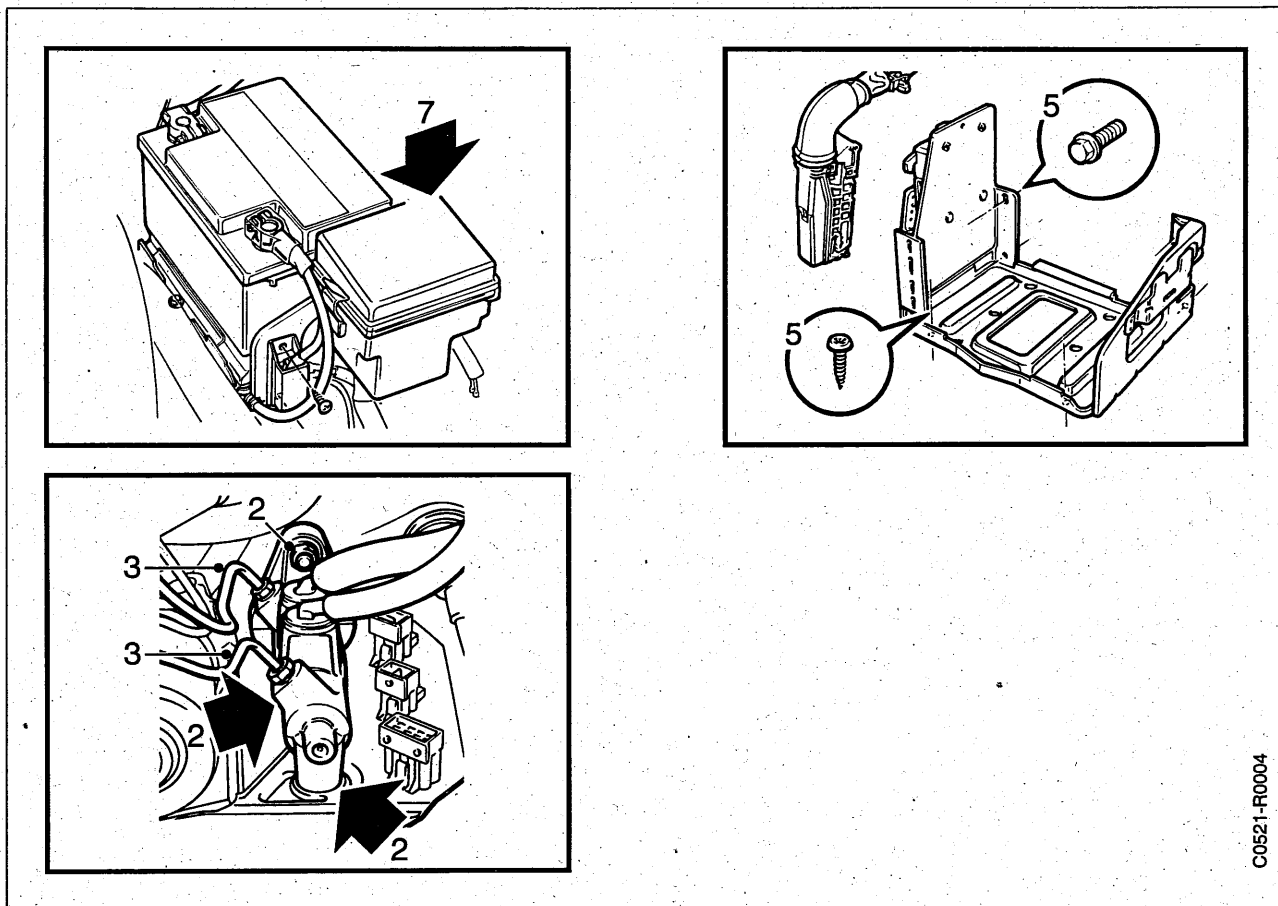


CC521-R0003

To remove

- 1 Wash the area round the brake pipe connections.
- 2 Disconnect the battery cables and undo the bolt retaining the bracket holding the battery in place.
Lift out the battery.
Also remove the main fuse box by lifting it straight up.
- 3 Remove the battery tray by unscrewing the eight screws and bolts.
- 4 Empty the brake fluid reservoir and move the cap aside.
- 5 Disconnect the master cylinder's primary and secondary pipes.
- 6 Remove the retaining bolt on the underside of the master cylinder.
- 7 Remove the two nuts securing the master cylinder to the vacuum servo unit.
- 8 Lift out the master cylinder and brake fluid reservoir.
Disconnect the hoses from the master cylinder.

Master cylinder (ABS MK IV)

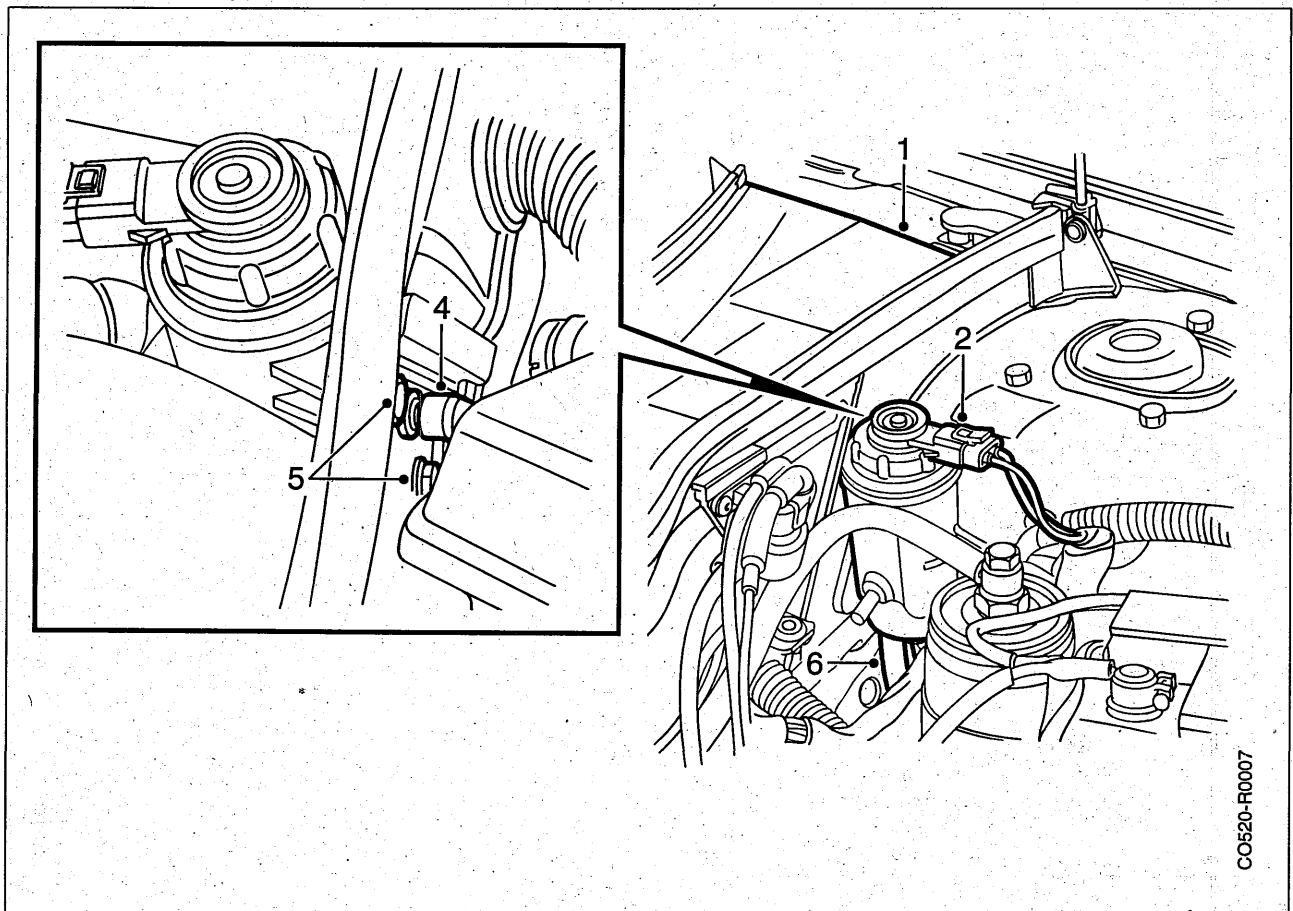


C0521-FR0004

To fit

- 1 Connect the hoses to the new master cylinder. Press the brake fluid reservoir in place and position the master cylinder.
- 2 Tighten the two nuts securing the master cylinder to the vacuum servo unit.
Tightening torque 27 Nm (20 lbf ft)
Tighten the retaining bolt on the underside of the master cylinder.
- 3 Connect the master cylinder's primary and secondary pipes.
- 4 Fill up with brake fluid, DOT 4 specification.
- 5 Fit the battery tray.
Attach the ABS wiring harness to the battery tray.
- 6 Fit the battery and tighten the nut retaining the bracket holding the battery in place.
- 7 Press the main fuse box in place on its bracket.
- 8 Bleed the brake system.
Drive the car on test and check the brakes.

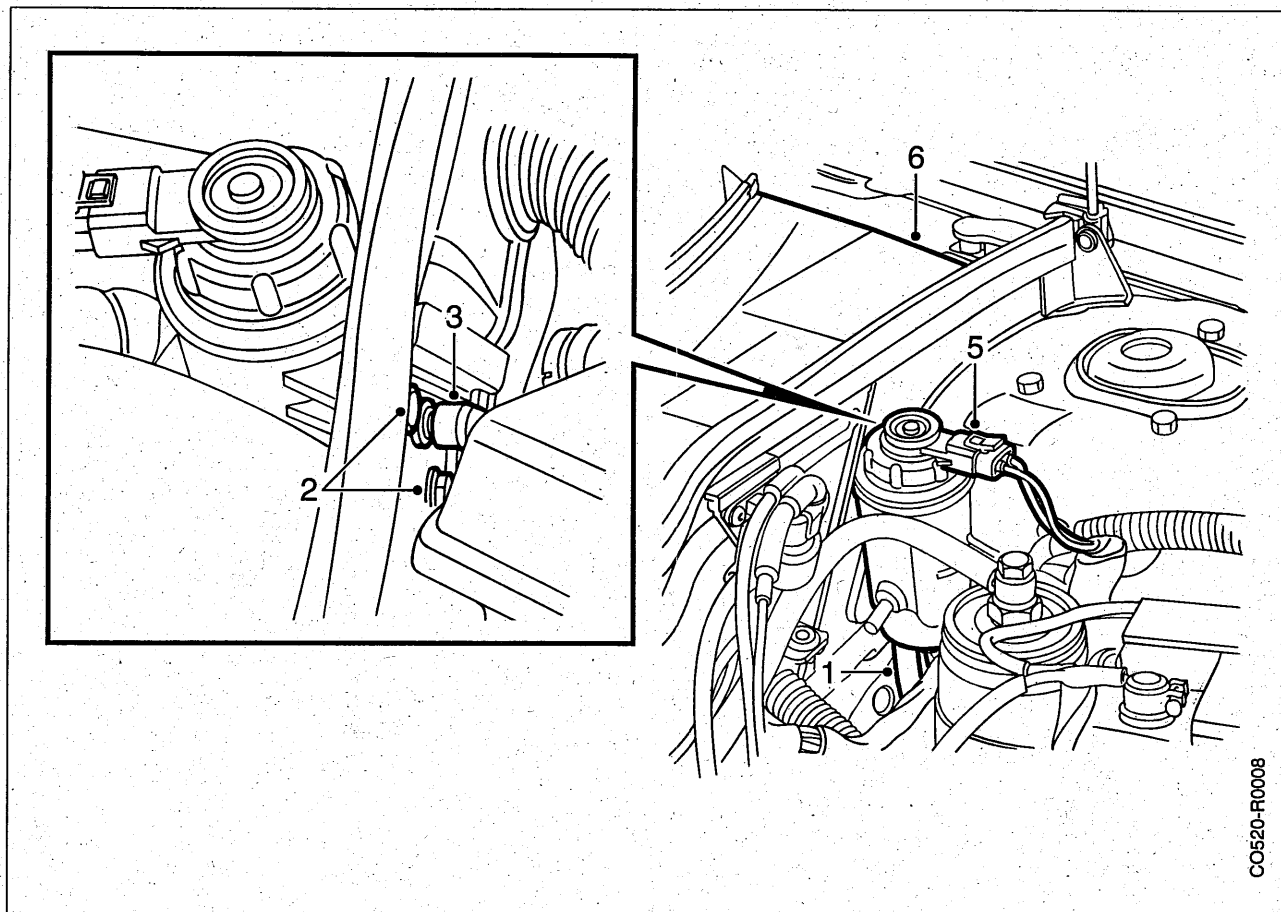
Brake fluid reservoir (cars without ABS)



To remove

- 1 Remove the cover panel.
- 2 Unplug the connector from the brake fluid reservoir's filler cap.
- 3 Empty the brake fluid reservoir. The easiest way to do this is to remove the brake fluid by suction using the brake system bleeder unit, part No. (16) 88 19 096.
- 4 Disconnect and plug the hose to the clutch.
- 5 Undo the two retaining bolts.
- 6 Remove and plug the hoses between the master cylinder and brake fluid reservoir.

Brake fluid reservoir (cars without ABS) (contd.)



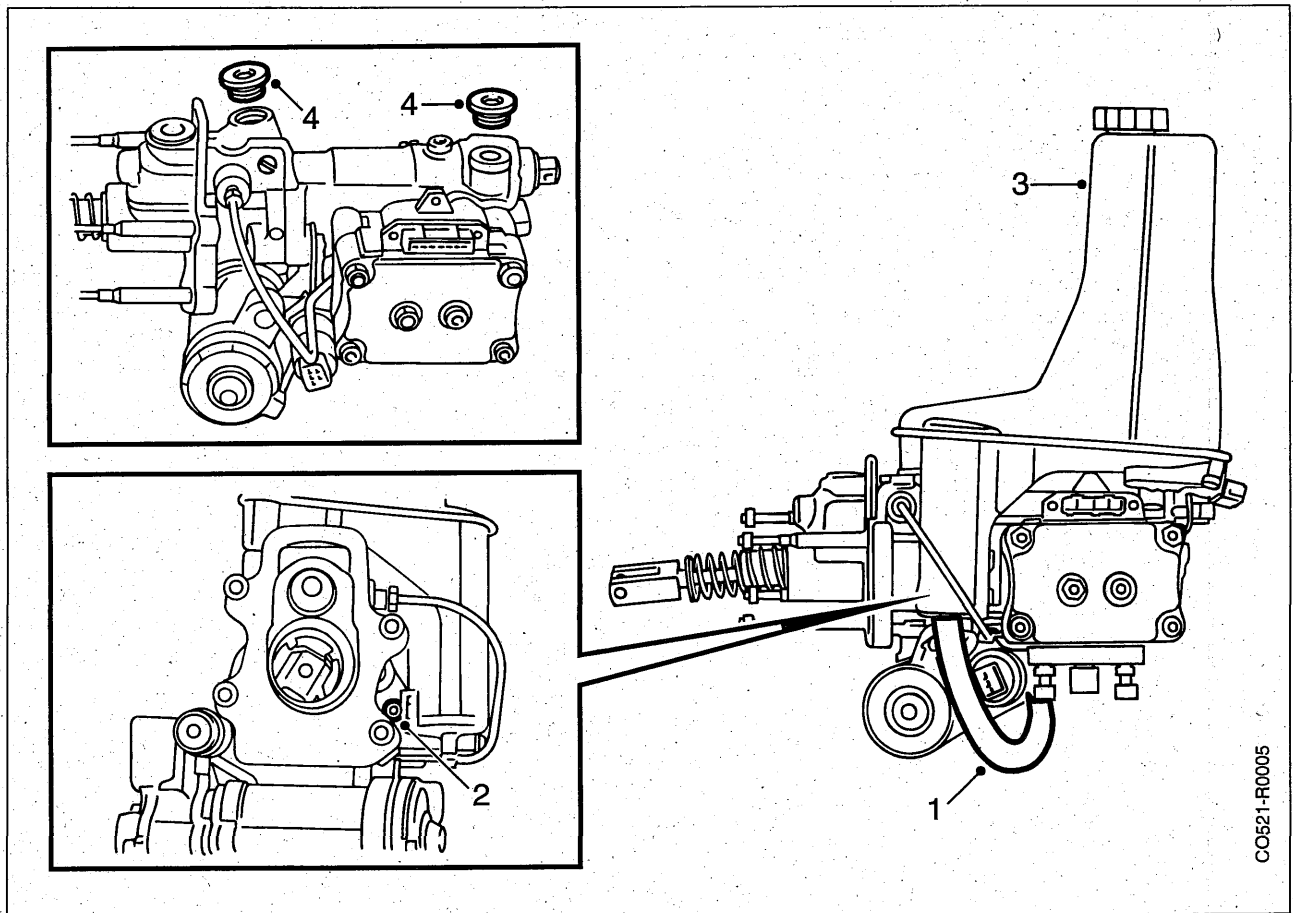
To fit

Important

On new brake fluid reservoirs the outlet for the clutch is plugged so that the reservoir can be used on cars with automatic transmission. If the reservoir is to be fitted to a car with a manual gearbox, the plug must be cut away.

- 1 Remove the plugs and fit the hoses between the master cylinder and brake fluid reservoir.
- 2 Fit the two retaining bolts and tighten them.
- 3 Remove the plug and connect the hose to the clutch.
- 4 Fill up with brake fluid.
- 5 Plug in the connector on the brake fluid reservoir's filler cap.
- 6 Fit the cover panel in place.

Brake fluid reservoir (ABS MK II)



CO521-F0005

This work can only be performed on a hydraulic unit that has first been removed. To remove the hydraulic unit, see Service Manual 5:2 ABS braking system M1987-.

WARNING

When carrying out any work on the brake system's hydraulic circuits the system must first be depressurized.

Depress the brake pedal about 20 times or until noticeable resistance is felt in the pedal.

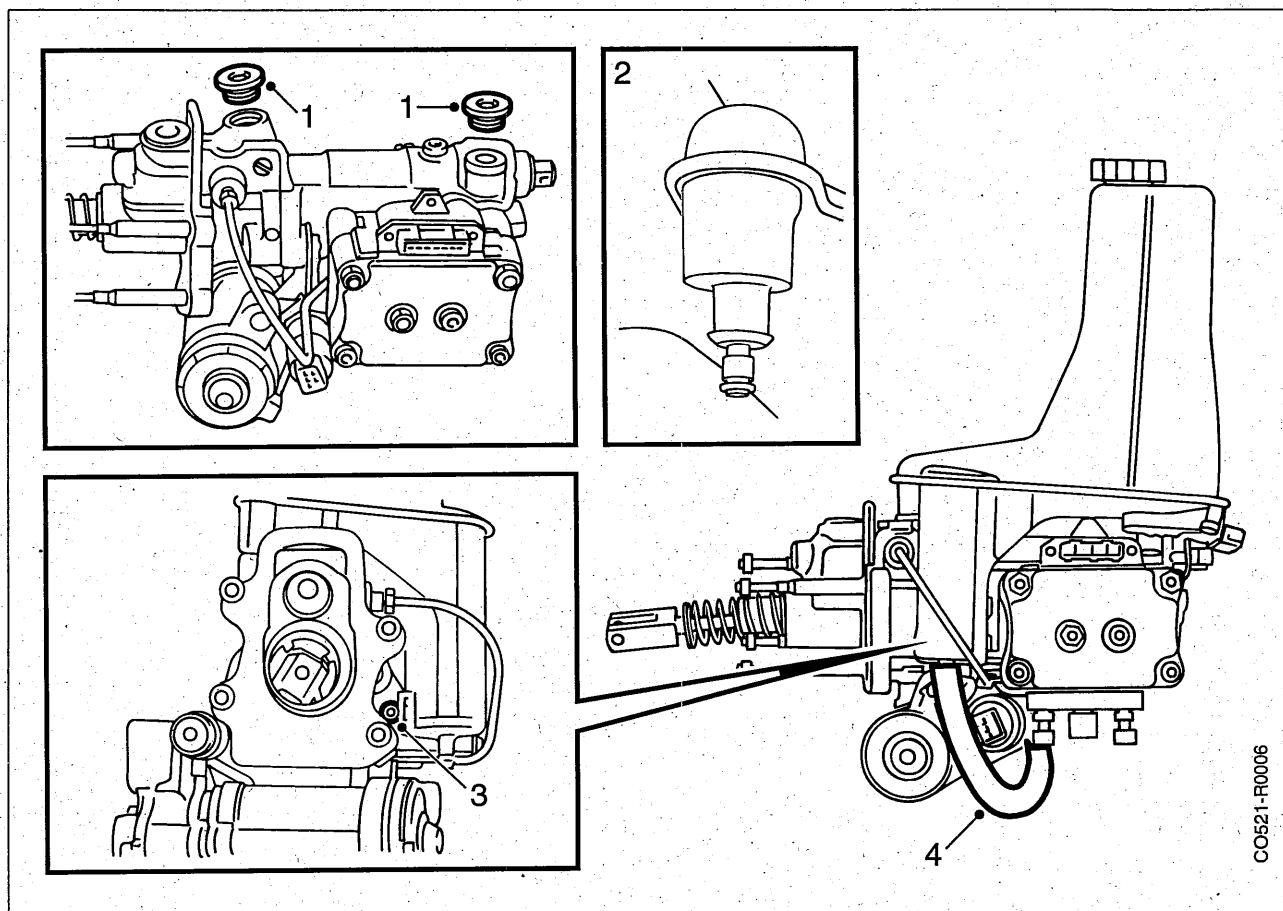
Note

In connection with replacement of the brake fluid reservoir, the pressure accumulator should preferably be removed before the hydraulic unit is removed from the car. Plug the connections on the pump body.

To remove

- 1 Disconnect the high-pressure pump's supply hose from the brake fluid reservoir.
- 2 Unscrew the brake fluid reservoir's retaining bolt.
- 3 Lift up the brake fluid reservoir by withdrawing the hydraulic unit's rubber seals.
Note the spacer sleeve and O-ring on the rear connection.
- 4 Remove the rubber seals from the hydraulic unit.

Brake fluid reservoir (ABS MK II) (contd.)



CO521-FR006

To fit

Important

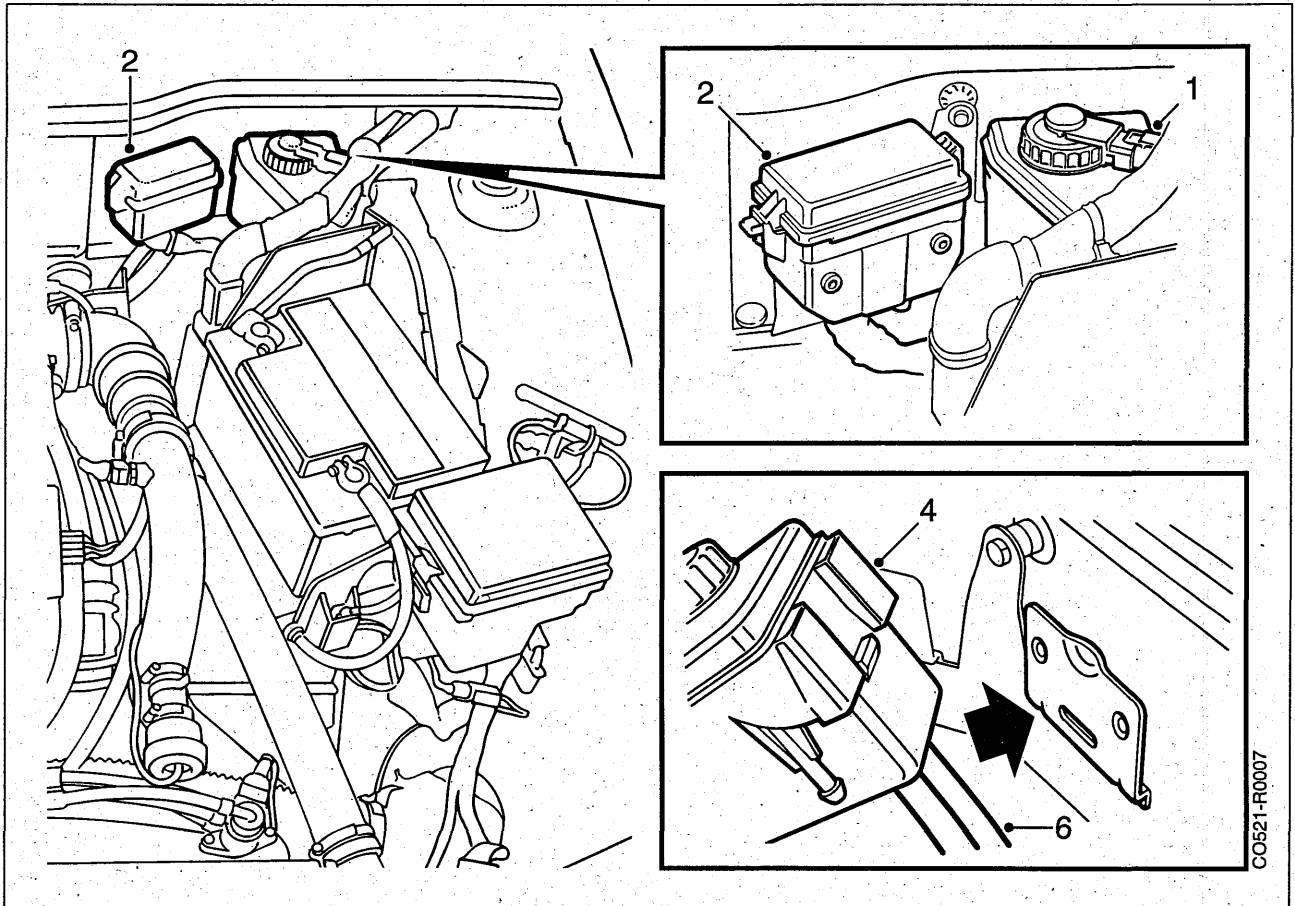
On new brake fluid reservoirs the outlet for the clutch is plugged so that the reservoir can be used on cars with automatic transmission. If the reservoir is to be fitted to a car with a manual gearbox, the plug must be cut away.

- 1 Fit the hydraulic unit with two new rubber seals.
- 2 Fit the spacer sleeve and O-ring on the brake fluid reservoir's rear connection.
Fit the brake fluid reservoir by pressing the connections down into the hydraulic unit's rubber seals.
- 3 Tighten the brake fluid reservoir's retaining bolt.
- 4 Connect the high-pressure pump's supply hose to the brake fluid reservoir.
Fit the pressure accumulator after fitting the hydraulic unit in the car.
Tightening torque: 40 Nm (29.6 lbf ft)
- 5 Fill up with brake fluid, DOT 4 specification.
- 6 Bleed the brake system.
See section 529 "Bleeding the brake system".

7 Switch on the ignition and check that the brake and ABS warning lamps go out.

8 Drive the car on test and check that the brake and clutch systems are in perfect working order.

Brake fluid reservoir (ABS MK IV)



To remove

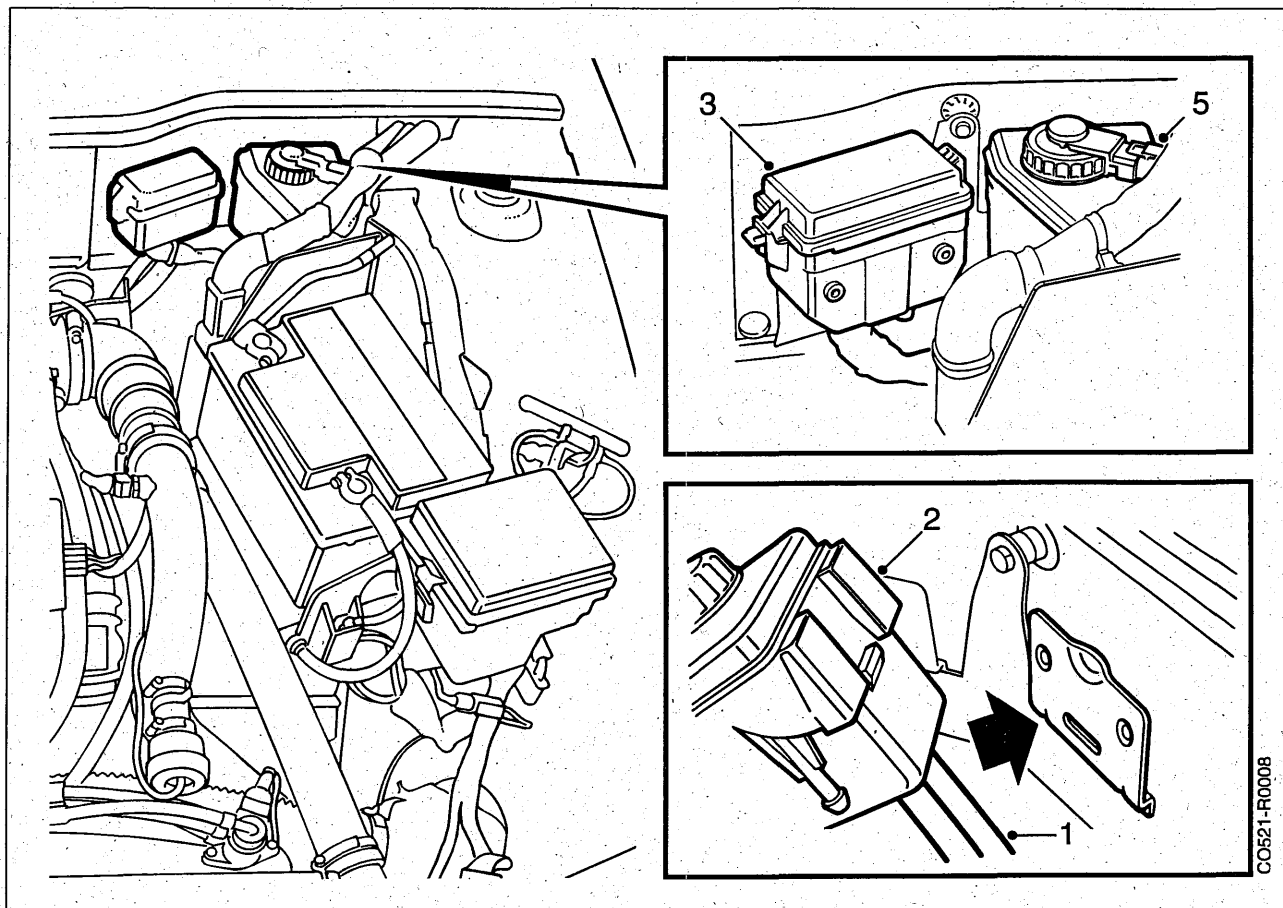
- 1 Unplug the connector from the brake fluid reservoir's filler cap.
- 2 Lift off the main fuse box for the ABS and move it aside.
- 3 Empty the reservoir. The easiest way to do this is to remove the brake fluid by suction using the brake system bleeder unit, part No. (16) 88 19 096.

Note

It will only be possible to siphon off the brake fluid from one of the chambers.

- 4 Lift the brake fluid reservoir diagonally upwards to detach it from its mounting.
- 5 Tilt the reservoir so that the brake fluid in the other chamber runs over to the chamber from which it is possible to siphon off the brake fluid. Use the brake system bleeder unit to suck out the rest of the brake fluid.
- 6 Disconnect the hoses and plug them.

Brake fluid reservoir (ABS MK IV) (contd.)



To fit

Important

On new brake fluid reservoirs the outlet for the clutch is plugged so that the reservoir can be used on cars with automatic transmission. If the reservoir is to be fitted to a car with a manual gearbox, the plug must be cut away.

- 1 Cut off the plugs and fit the hoses to the new brake fluid reservoir.
- 2 Press the reservoir into its mounting.
- 3 Fit the main fuse box for the ABS.
- 4 Fill up with fresh brake fluid to the correct level.
- 5 Plug in the connector on the brake fluid reservoir's filler cap.

Brake lines

Changing a brake pipe 79

Changing a brake hose 80

Inspection

For reasons of safety, all brake pipes, hoses, connections and fittings must always be maintained in perfect condition. All these components must therefore be carefully inspected periodically as stipulated in the service schedule. Brake pipes that are secured to the body with metal or plastic clamps or clips must not display any corrosion or pitting nor must they be mounted in such a way that they can chafe against other components. Inspect the brake hoses carefully for signs of visible damage and make sure that all pipe and hose connections and fittings are properly tightened and do not leak. Change any damaged parts.

Changing a brake hose

To remove

- 1 Clean the connections of the damaged brake pipe.
- 2 Unscrew the brake pipe's union nuts and other retaining clips, if any.
- 3 Insert plastic plugs into the open connections and remove the damaged brake pipe.

To fit



WARNING

Brake pipes should not be bent or strained after installation.

- 1 Clean the inside of the new brake pipe by blowing compressed air through it.
- 2 Position the pipe, remove the plastic plugs and tighten the connecting nuts.
- 3 Bleed the brake system.
See section 529, "Bleeding the brake system".

Changing a brake hose



WARNING

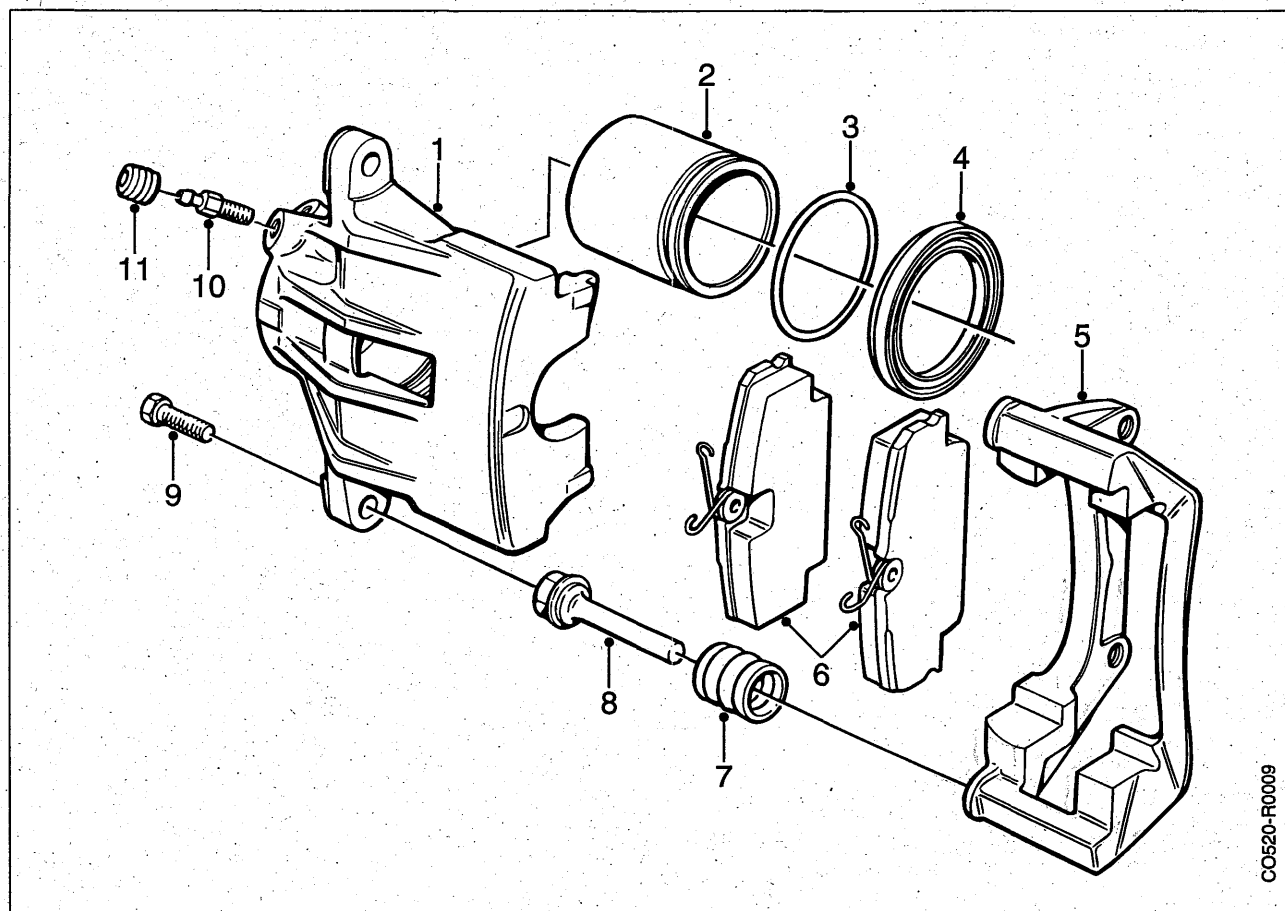
When fitting a new brake hose it is extremely important to ensure that it is positioned correctly so that it does not come into contact with other parts of the car as a result of suspension and steering movements. Also take care not to twist the hose. The front brake hoses should be fitted when the wheels are freely suspended and in the straight-ahead position. Refit the chafing guards in the correct position.

The procedure for changing brake hoses is the same as for changing brake pipes.

Brake caliper

Brake caliper, front wheel	81, 84	Brake caliper, rear wheel	89
Hydraulic body, front wheel	82, 85	Hydraulic body, rear wheel	90

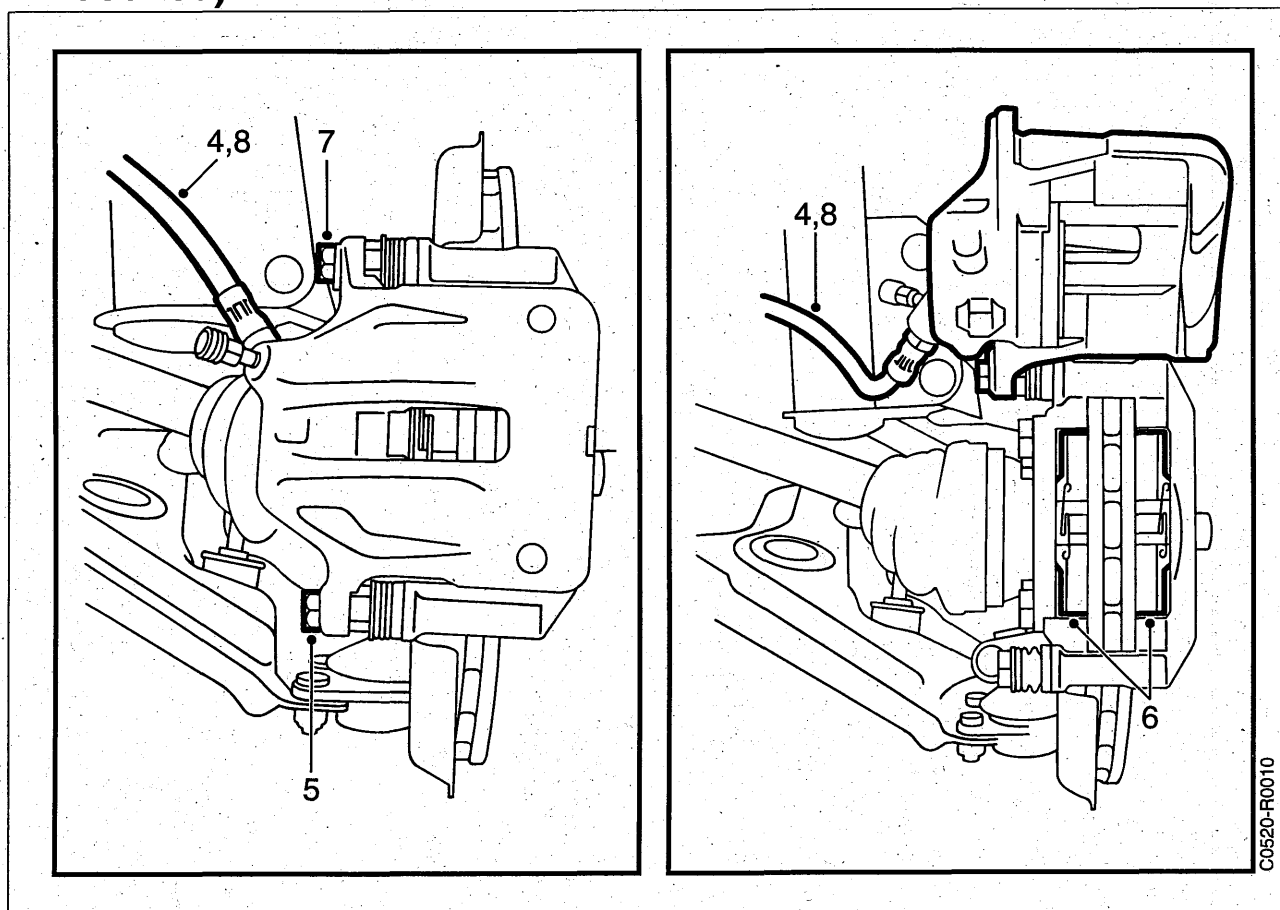
Brake caliper, front wheel (9000 Turbo M1985-87 and 9000i M1985-89)



Brake caliper, front wheel

- 1 Hydraulic body
- 2 Brake piston
- 3 Piston sealing ring
- 4 Dust excluder (on brake piston)
- 5 Carrier
- 6 Brake pad
- 7 Dust excluder (on guide pin)
- 8 Guide pin
- 9 Retaining bolt
- 10 Bleed nipple
- 11 Dust cap

Hydraulic body, front wheel (9000 Turbo M1985-87 and 9000i M1985-89)

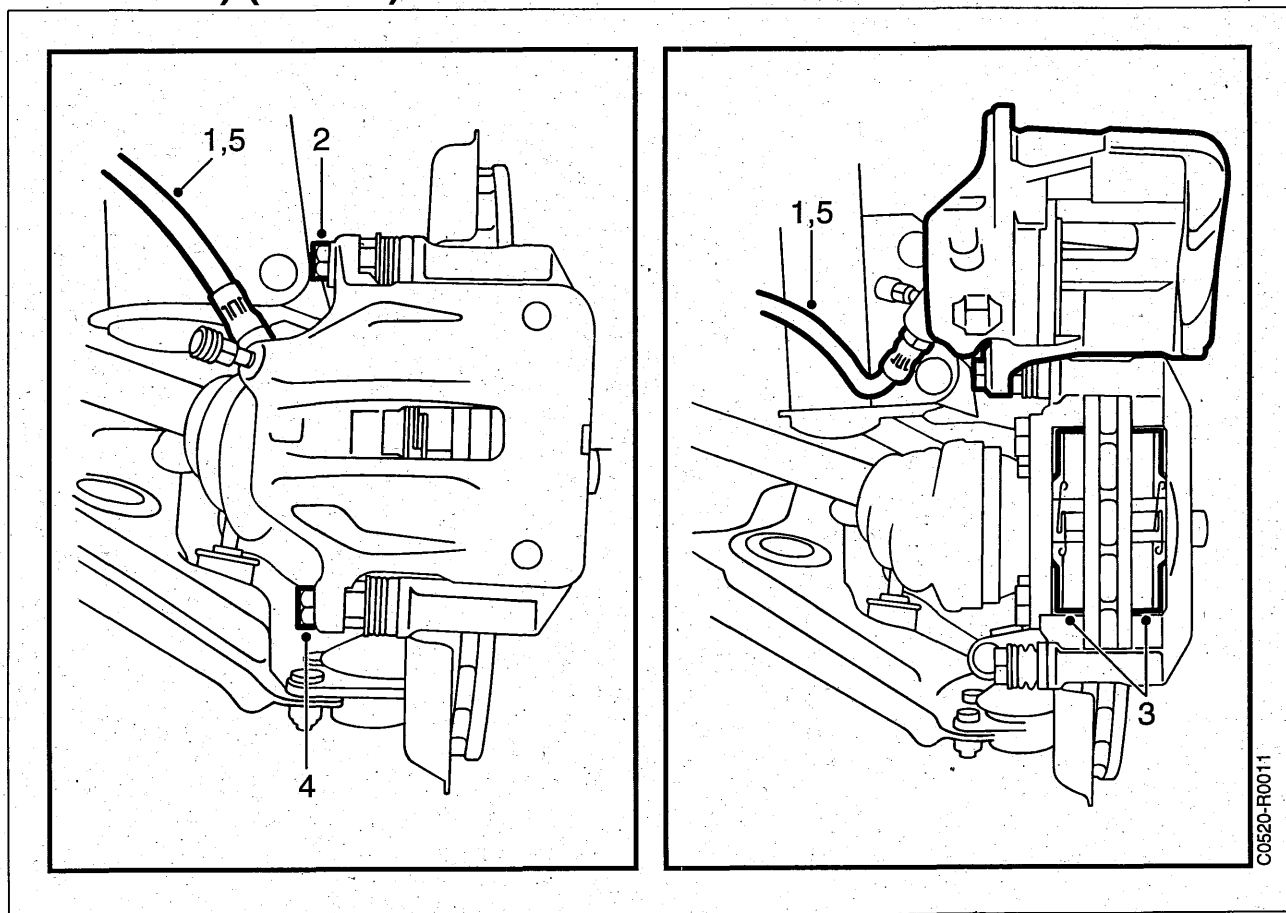


To remove

- 1 Raise the car and remove the front wheel.
- 2 Press the piston back.
- 3 Depress the pedal slightly by means of a brake pedal clamp to prevent brake fluid from running out.
- 4 Slacken the brake hose union on the hydraulic body.
- 5 Remove the bolt in the lower guide pin.
- 6 Pivot the hydraulic body upwards and remove the brake pads.
- 7 Remove the bolt from the upper guide pin.
- 8 Rotate the hydraulic body to unscrew the brake hose from it.
Fit a dust cap on the brake hose and on the hose fitting on the hydraulic body.

For dismantling and assembly of the hydraulic body, refer to pages 523-87 and 523-88.

Hydraulic body, front wheel (9000 Turbo M1985-87 and 9000i M1985-89) (contd.)

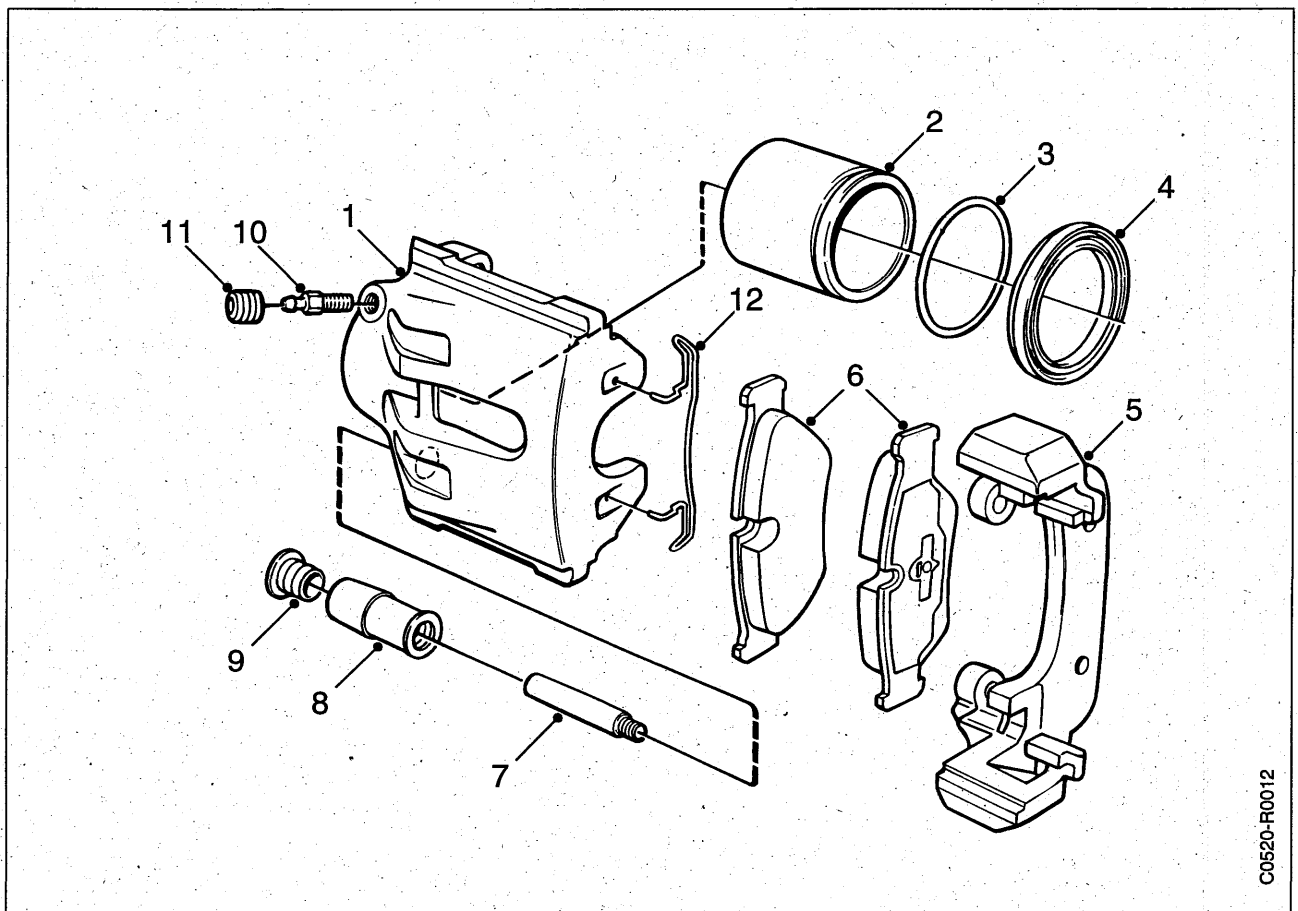


To fit

Before starting assembly, check that the guide pins do not bind and that the dust excluder is intact. If necessary, lubricate with Girling Special Grease.

- 1 Connect the brake hose to the hydraulic body.
- 2 Position the hydraulic body and tighten the bolt in the upper guide pin.
Tightening torque: 27.5 Nm (20.5 lbf ft)
Make sure that the brake hose does not twist.
- 3 Fit the brake pads.
- 4 Tighten the bolt in the lower guide pin.
Tightening torque: 27.5 (20.5 lbf ft)
- 5 Tighten the brake hose connected to the hydraulic unit. Then remove the brake pedal clamp.
- 6 Bleed the brake system.
See section 529, "Bleeding the brake system".
- 7 Fit the front wheel.
Tightening torque: 120 Nm (89 lbf ft)
- 8 Pump the brake pedal to press out the brake pads towards the disc.

Brake caliper, front wheel (9000 Turbo M1988- and 9000i M1990-)

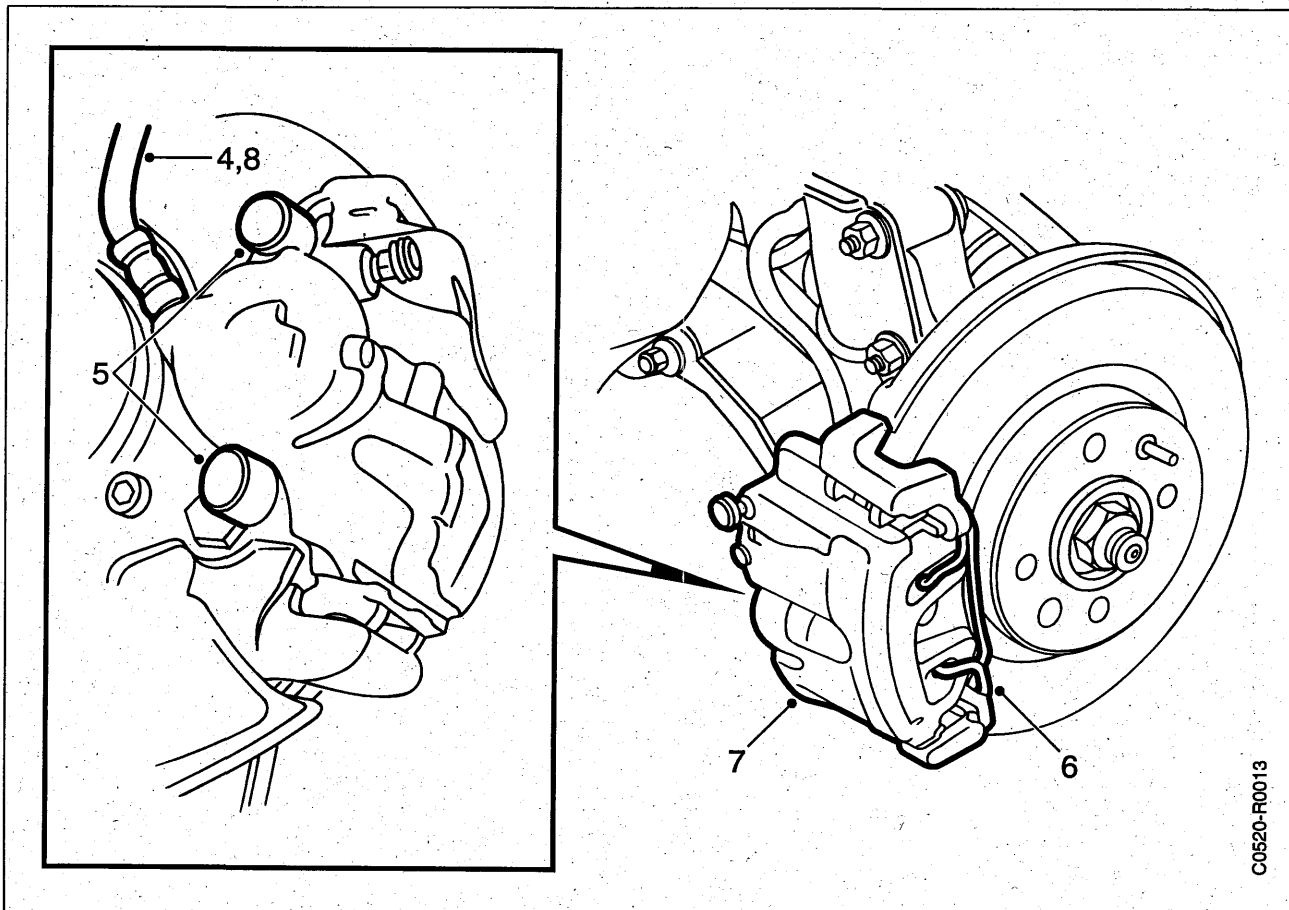


C0520-F0012

Brake caliper, front wheel

- 1 Hydraulic body
- 2 Brake piston
- 3 Piston sealing ring
- 4 Dust excluder
- 5 Carrier
- 6 Brake pad
- 7 Guide pin
- 8 Spacer sleeve
- 9 Dust cap
- 10 Bleed nipple
- 11 Dust cap
- 12 Retaining clip

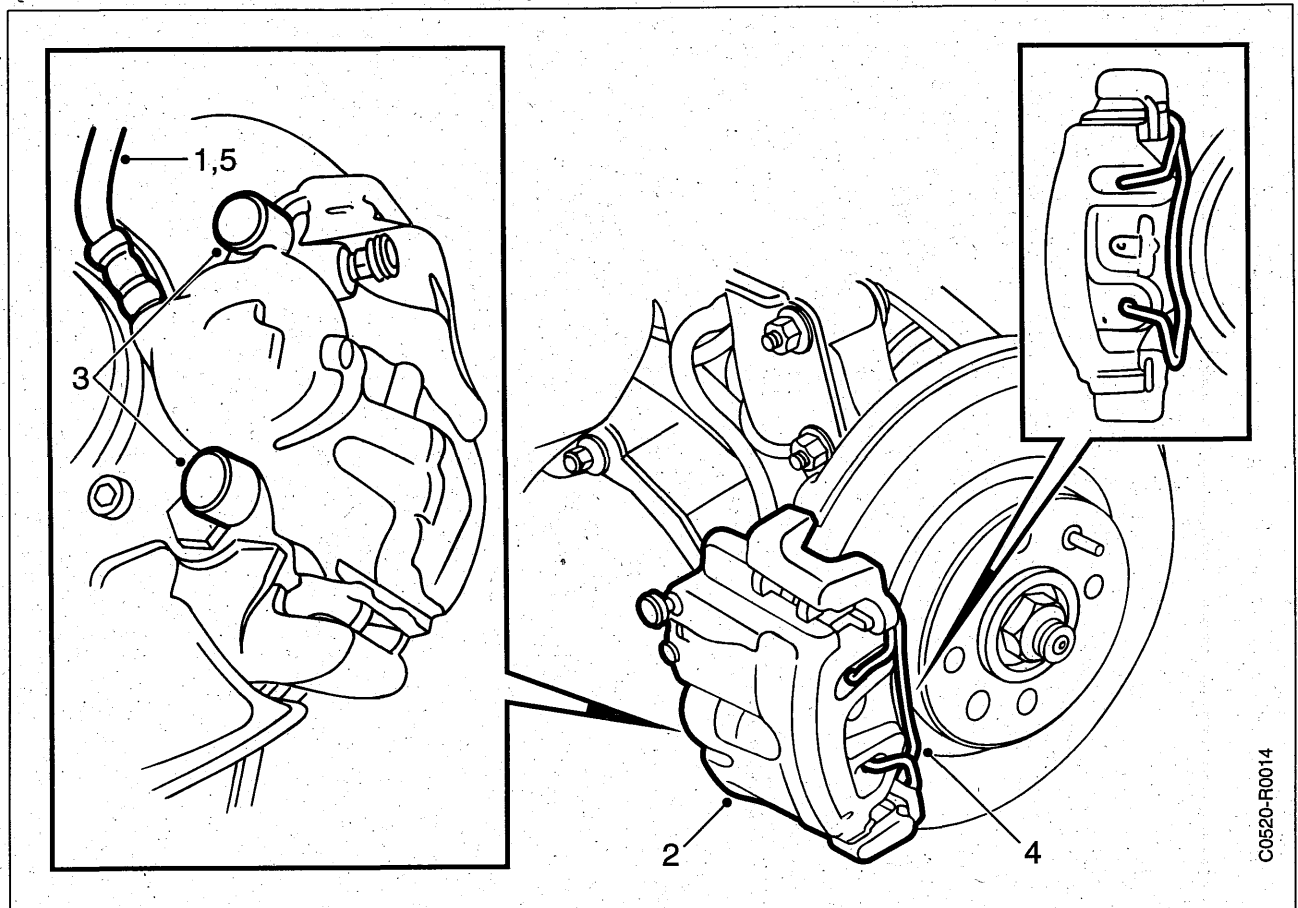
Brake caliper, front wheel (9000 Turbo M1988- and 9000i M1990-) (contd.)



To remove

- 1 Raise the car and remove the front wheel.
- 2 Press back the piston.
- 3 Depress the pedal slightly by means of a brake pedal clamp to prevent brake fluid from running out.
- 4 Slacken the brake hose union on the hydraulic body.
- 5 Remove the dust caps from the guide pins and unscrew the guide pins, using a 7 mm Allen key.
- 6 Remove the retaining clip.
- 7 Remove the hydraulic body.
- 8 Rotate the hydraulic body to unscrew the brake hose from it.
Fit a dust cap on the brake hose and on the hose fitting on the hydraulic body.

Brake caliper, front wheel (9000 Turbo M1988- and 9000i M1990-) (contd.)



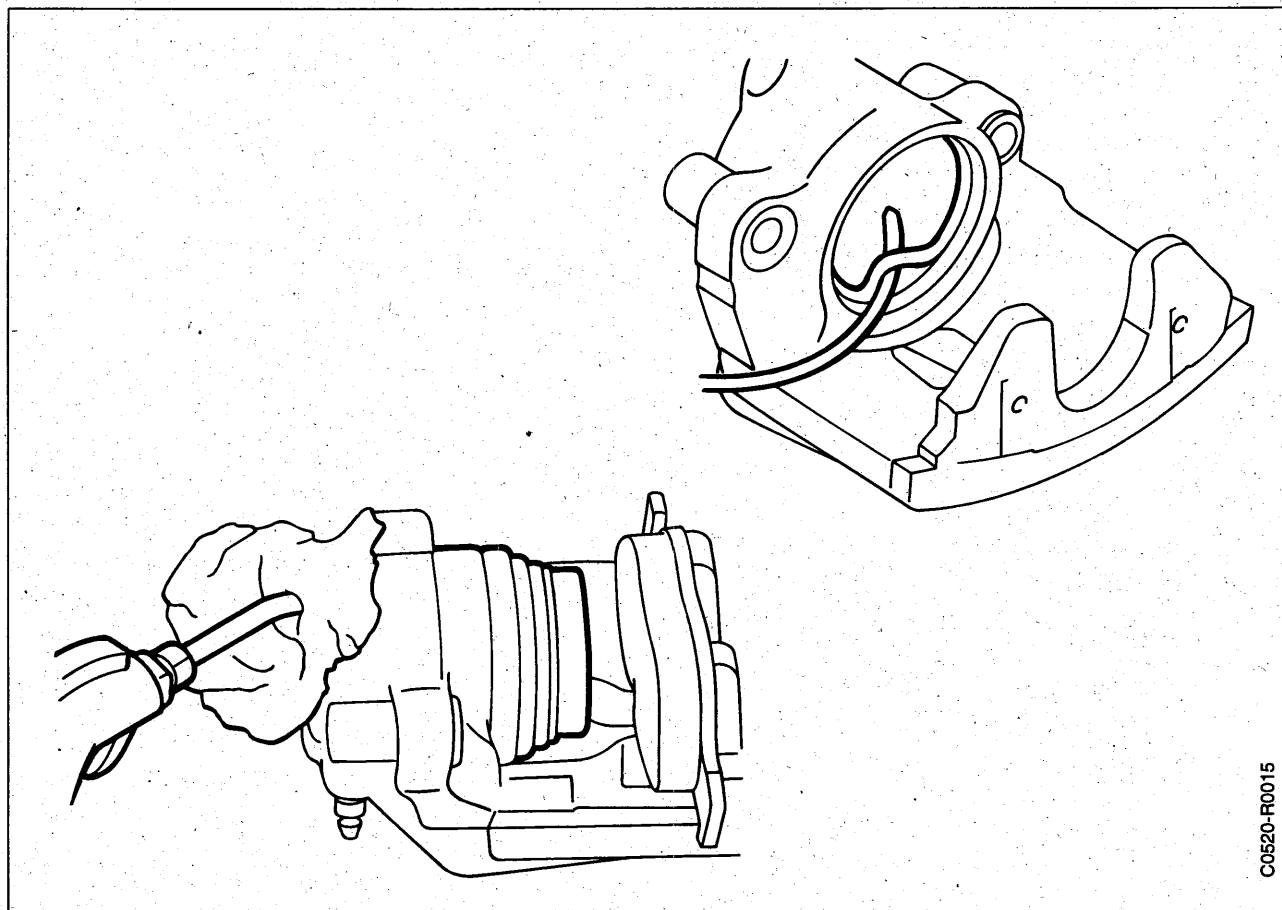
To fit

Before starting assembly, check that the guide pins do not bind and that the dust excluder is intact. If necessary, lubricate with Girling Special Grease.

- 1 Connect the brake hose to the hydraulic body.
- 2 Position the hydraulic body. Make sure that the brake hose is not twisted.
- 3 Fit the guide pins and tighten them.
Tightening torque: 27.5 (20.5 lbf ft)
Refit the dust caps.
- 4 Fit the retaining clip.
- 5 Tighten the brake hose connected to the hydraulic unit. Then remove the brake pedal clamp.
- 6 Bleed the brake system.
See section 529, "Bleeding the brake system".
- 7 Fit the front wheel.
Tightening torque: 120 Nm (89 lbf ft)
- 8 Pump the brake pedal to press out the brake pads towards the disc.

C0520-R0014

Hydraulic body, front wheel (all 9000 M1985-)



To dismantle

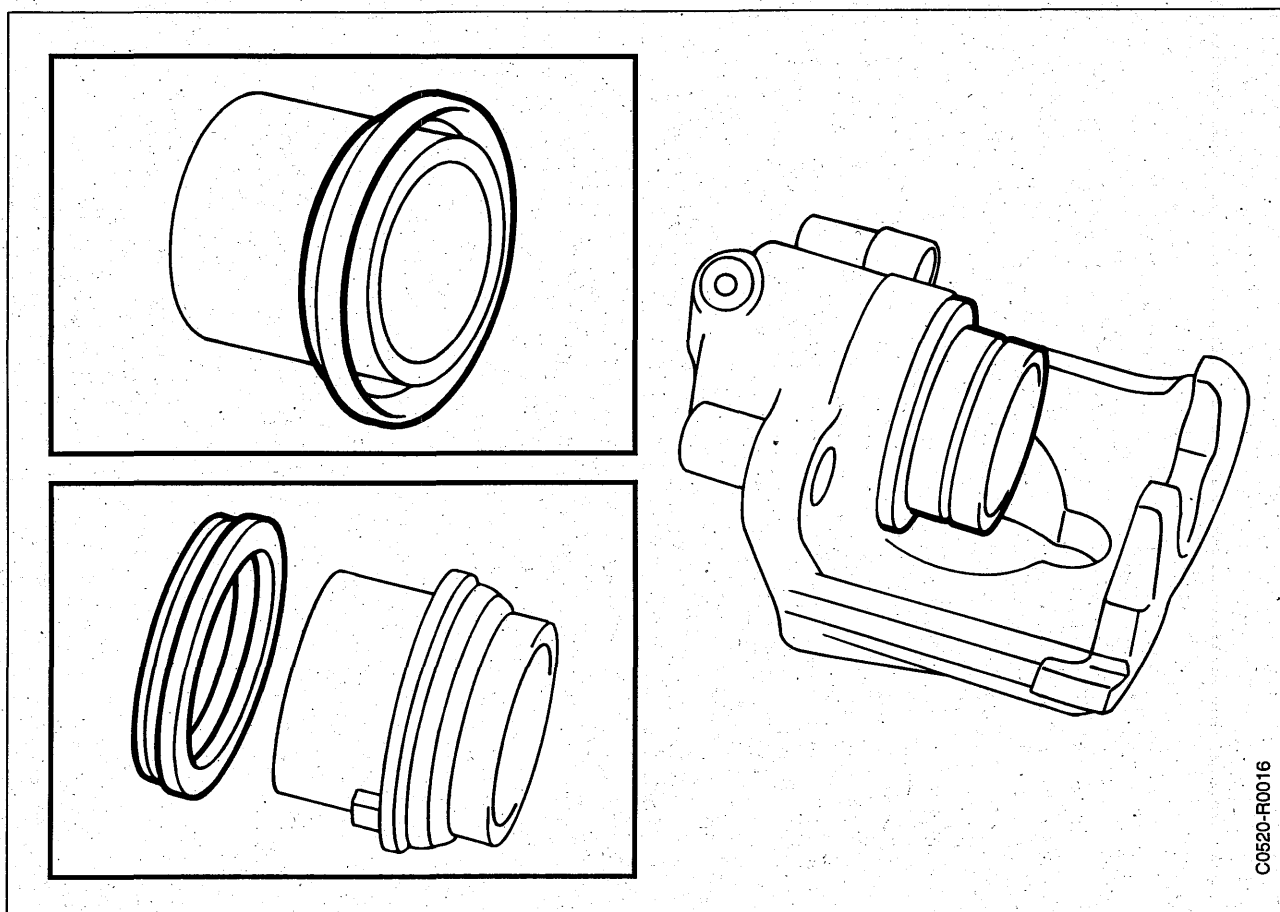
- 1 Remove the hydraulic body.
- 2 Clean the hydraulic body and press out the brake piston with compressed air. Position a brake pad or block of wood as protection when the piston is pressed out.

 **WARNING**

Take care not to damage the cone in the hydraulic body as oil leakage could otherwise occur. Use a piece of paper or a cloth.

- 3 Remove the dust excluder.
- 4 Remove the piston sealing ring.
Use a plastic cable tie or the like.

Hydraulic body, front wheel (all 9000 M1985-) (contd.)



To assemble

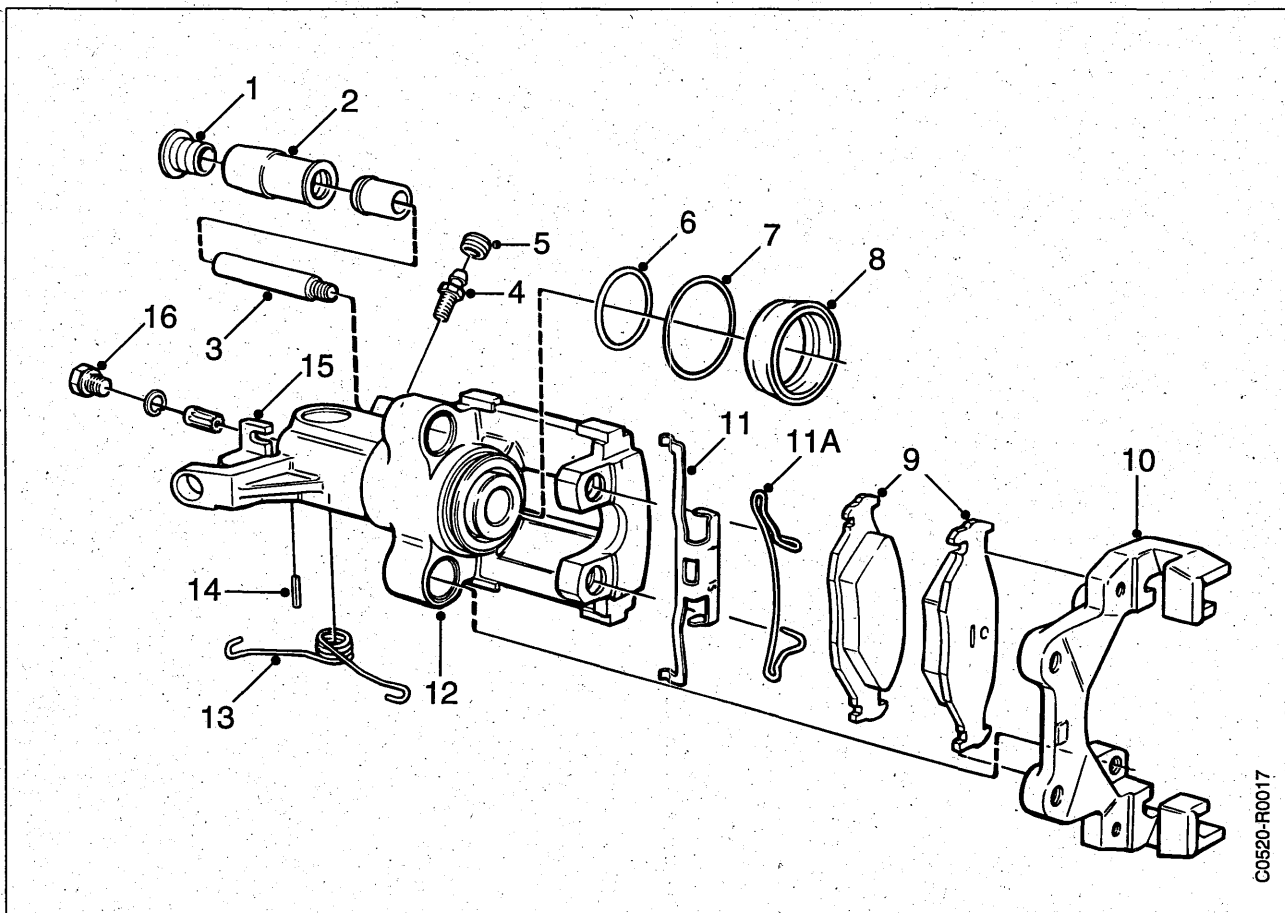
Inspect the components and change any that are damaged.

Lubricate the piston sealing ring, using the grease supplied with the set of seals.

Also lubricate the dust excluder with grease.

- 1 Fit the new piston sealing ring in the groove in the brake cylinder.
- 2 Fit the new dust excluder on the piston as follows:
 - a) Fit the dust excluder over the brake piston from the brake pad's friction lining side.
 - b) Slide the dust excluder to the other end of the piston.
- 3 Press the dust excluder's collar into the groove in the brake cylinder, starting at the bottom.
- 4 Press the piston into the brake cylinder.
- 5 Fit the hydraulic body.

Brake caliper, rear wheel

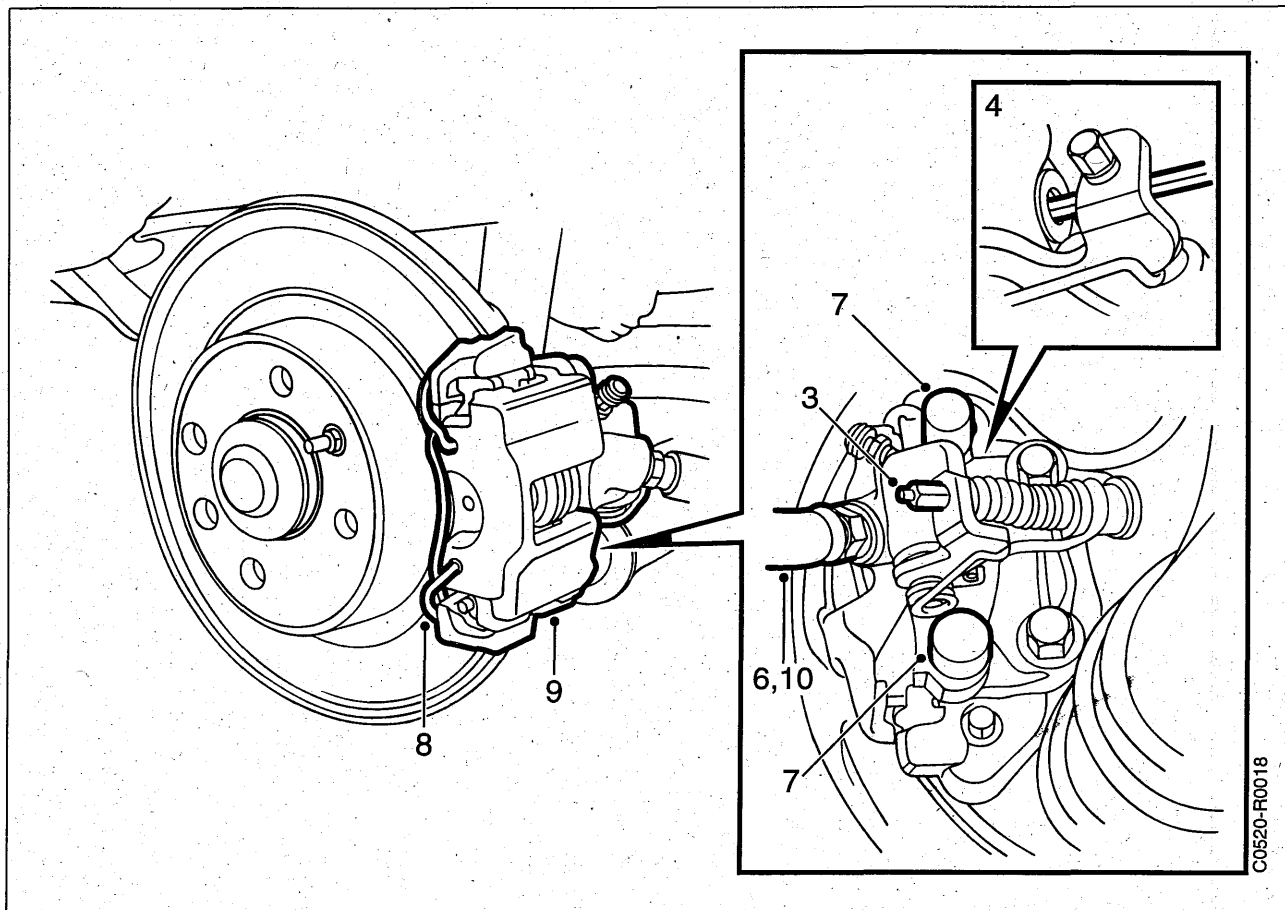


C0520-F0017

Brake caliper, rear wheel

- 1 Dust cap
- 2 Spacer sleeve
- 3 Guide pin
- 4 Bleed nipple
- 5 Dust cap
- 6 Piston sealing ring
- 7 Retaining ring
- 8 Dust excluder
- 9 Brake pad
- 10 Carrier
- 11 Retaining clip (early version),
11A Retaining clip (later version)
- 12 Hydraulic body
- 13 Return spring
- 14 Stop pin
- 15 Lever
- 16 Threaded plug (for adjusting screw)

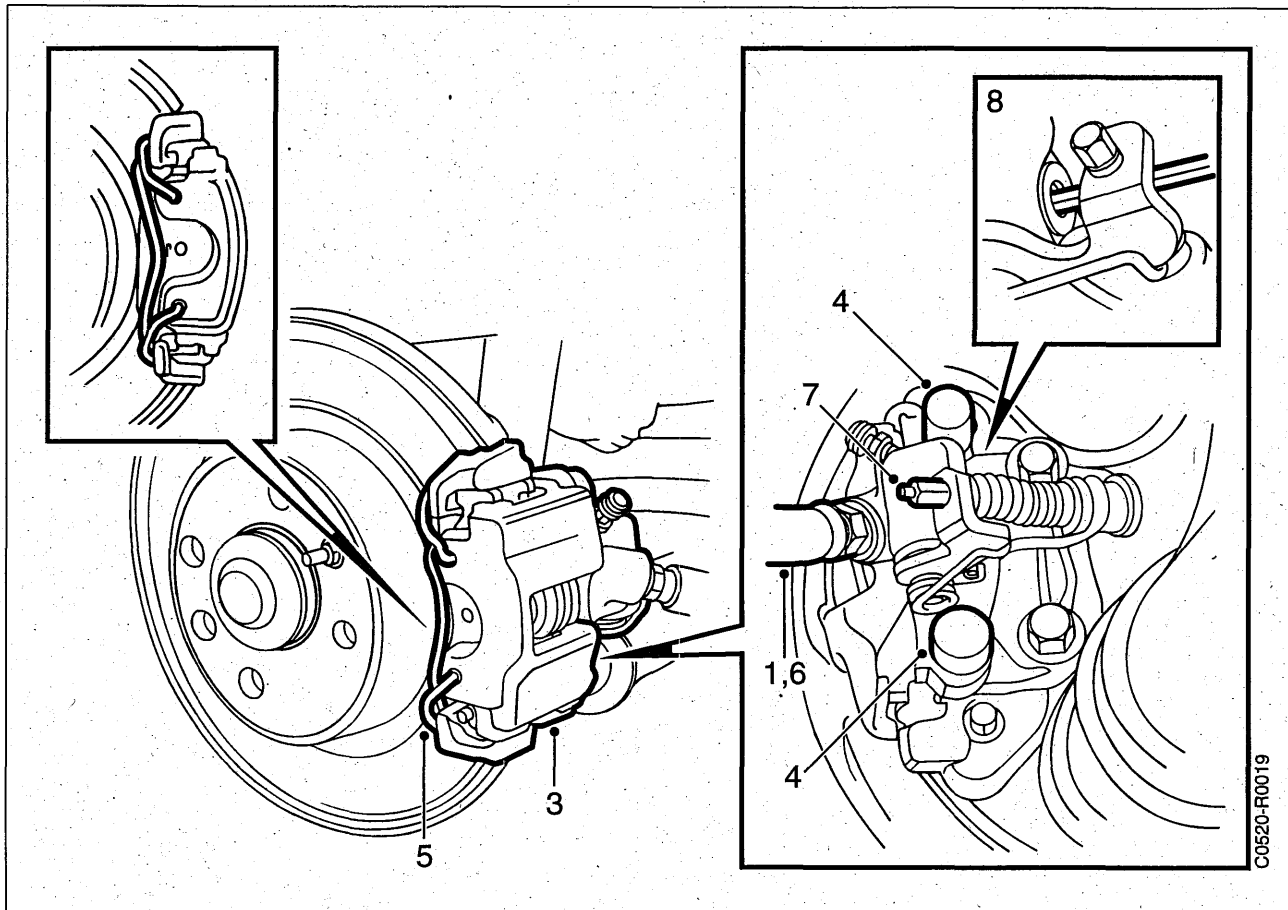
Hydraulic body, rear wheel



To remove

- 1 Lift the car and remove the rear wheel.
- 2 Release the handbrake.
- 3 Disconnect the handbrake cable from the lever on the hydraulic body.
- 4 Remove the adjusting screw's threaded plug. Unscrew the adjusting screw.
- 5 Depress the brake pedal slightly by means of a brake pedal clamp to prevent brake fluid from running out.
- 6 Slacken the brake hose union on the hydraulic body.
- 7 Remove the covers from the guide pins and unscrew the pins. Use a 7 mm Allen key.
- 8 Remove the retaining clip.
- 9 Lift off the hydraulic body and remove the brake pads.
- 10 Rotate the hydraulic body to unscrew the brake hose from it. Fit a dust cap on the brake hose and on the hose fitting on the hydraulic body.

Hydraulic body, rear wheel (contd.)



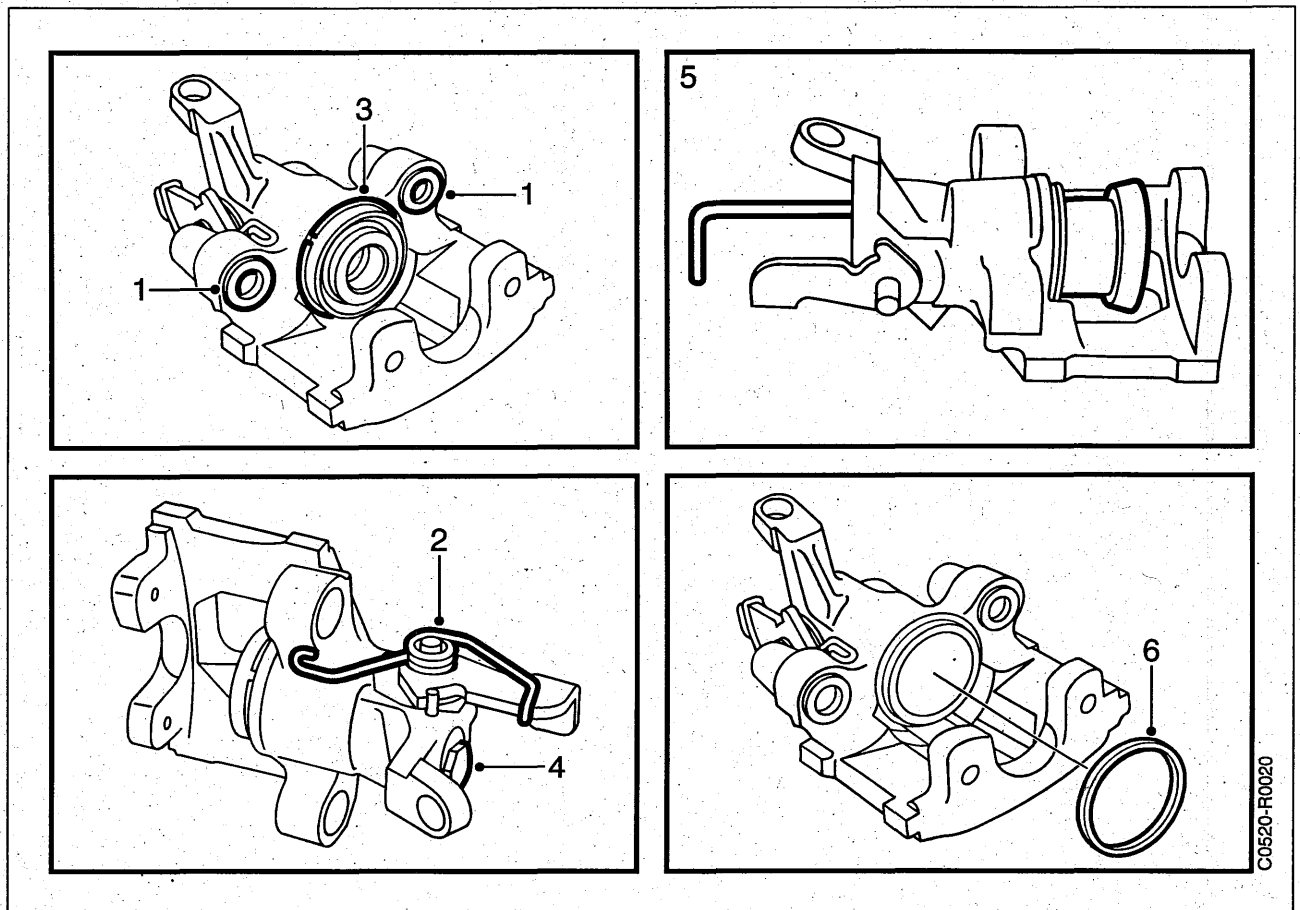
To fit

Before starting assembly, check that the guide pins do not bind. Lubricate with Girling Special Grease as necessary.

- 1 Connect the brake hose to the hydraulic body.
- 2 Fit the brake pads.
- 3 Refit the hydraulic body.
- 4 Fit the guide pins and tighten them.
Tightening torque 27.5 Nm (20.5 lbf ft)
Fit the covers in place.
- 5 Fit the retaining clip.
- 6 Tighten the brake hose on the hydraulic body.
Then remove the brake pedal clamp.
- 7 Fit the end of the handbrake cable to the lever.
- 8 Adjust the handbrake as follows:
Remove the adjusting screw's threaded plug.
Screw the adjusting screw all the way in and then back it off a 1/4–1/2 turn.
- 9 Bleed the brake system.
See section 529, "Bleeding the brake system".
- 10 Fit the rear wheel and tighten the wheel bolts, using a torque wrench.
Tightening torque: 120 Nm (89 lbf ft)

- 11 Pump the brake pedal to press out the brake pads towards the disc.

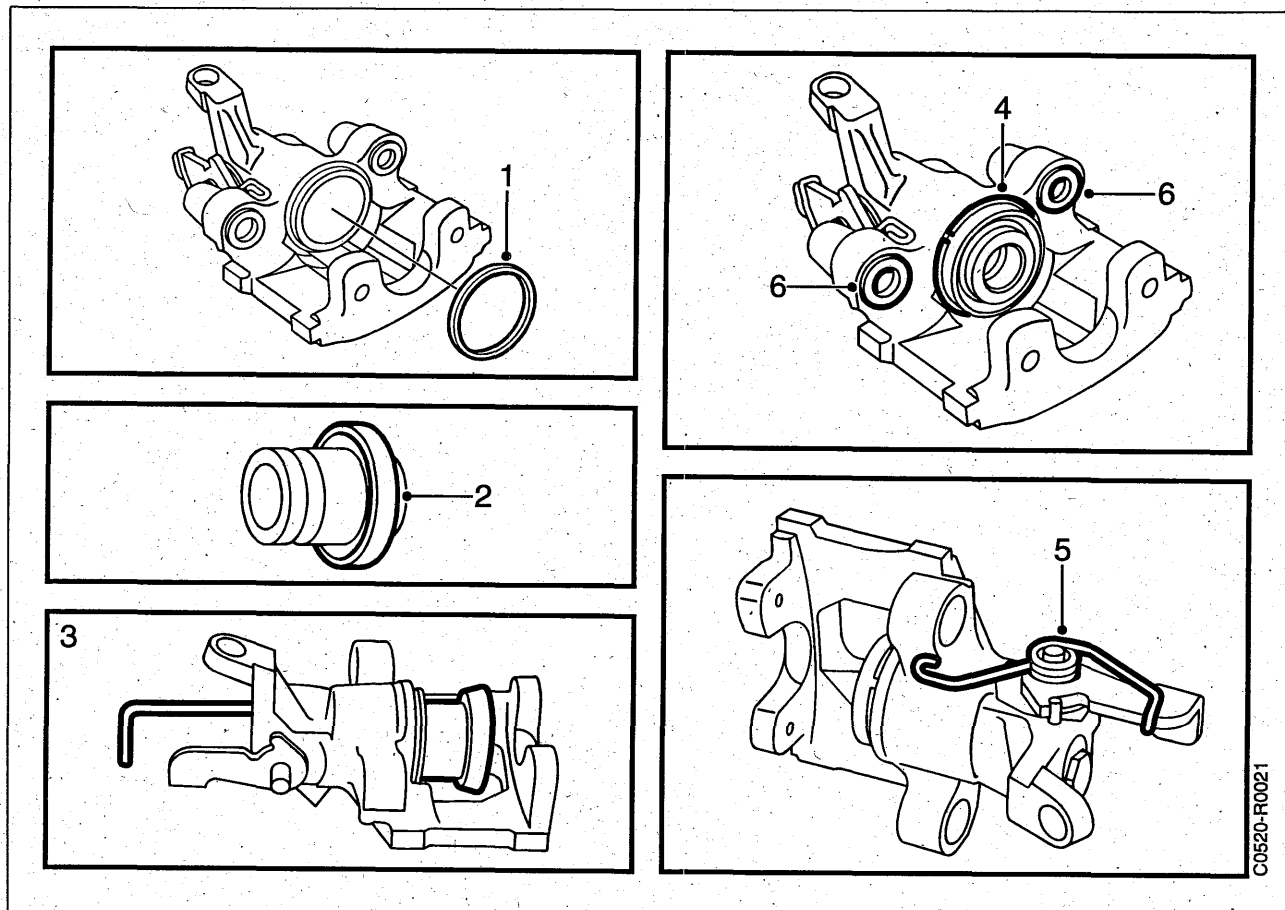
Hydraulic body, rear wheel (contd.)



To dismantle

- 1 Remove the rubber sleeve with bush.
- 2 Remove the lever's return spring.
- 3 Remove the dust excluder retaining ring and remove the dust excluder.
- 4 Remove the adjusting screw's threaded plug.
- 5 Unscrew the brake piston by means of the adjusting screw.
Use a 4 mm Allen key.
- 6 Remove the sealing ring.

Hydraulic body, rear wheel (contd.)



To assemble

Inspect the components and change any that are damaged.

Lubricate the piston sealing ring, using the grease supplied with the set of seals.

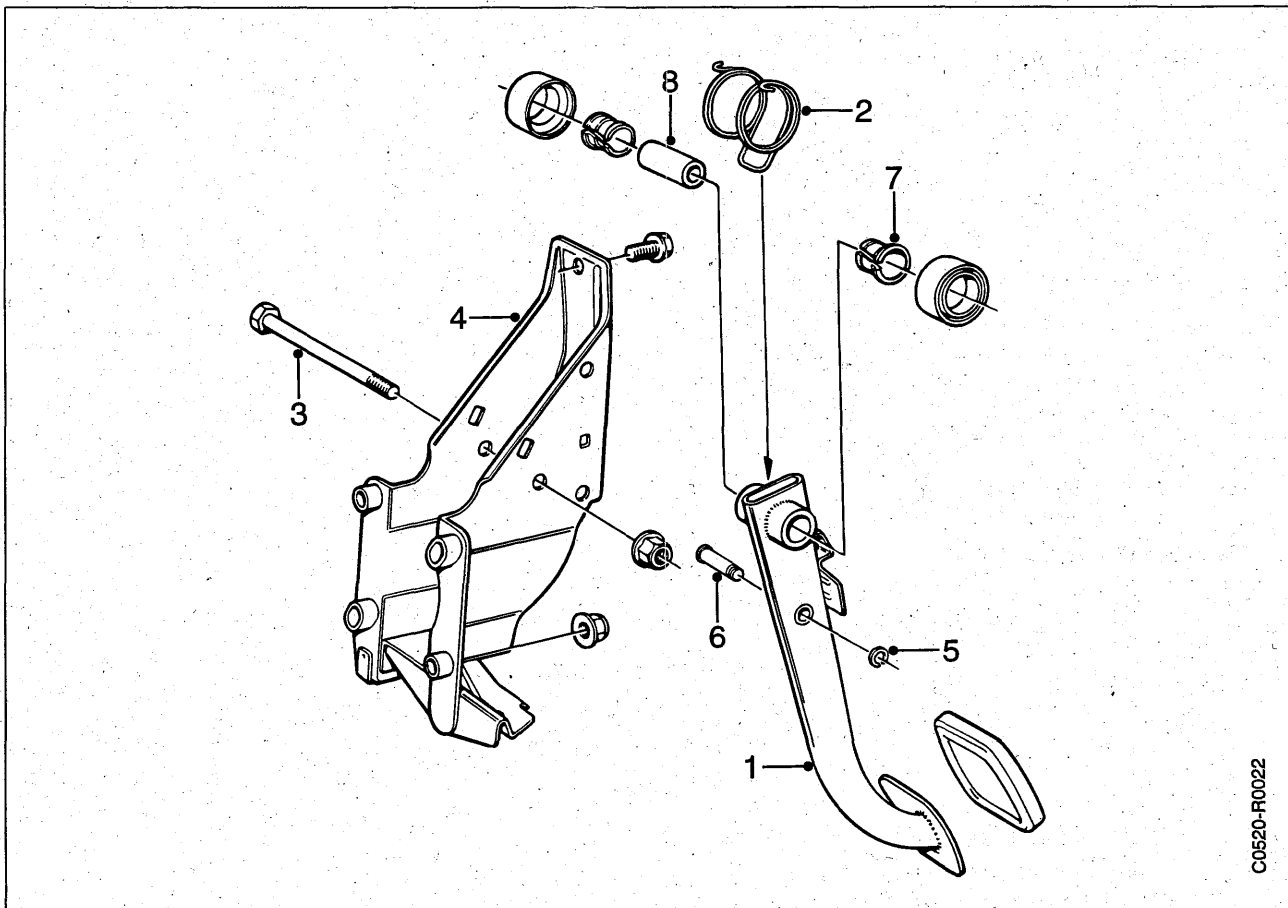
Also lubricate the dust excluder with grease.

- 1 Fit the new piston sealing ring in the groove in the brake cylinder.
- 2 Fit the new dust excluder on the brake piston as follows:
 - a) Fit the dust excluder over the brake piston from the brake pad's friction lining side.
 - b) Slide the dust excluder to the other end of the piston.
- 3 Screw the piston into the hydraulic body by means of the adjusting screw.
- 4 Make sure that the dust excluder is correctly fitted on the hydraulic body and piston and then fit the dust excluder's retaining ring.
- 5 Fit the lever's return spring.
- 6 Fit the two rubber sleeves with bushes.

Brake pedal assembly

Brake pedal 95

Brake pedal

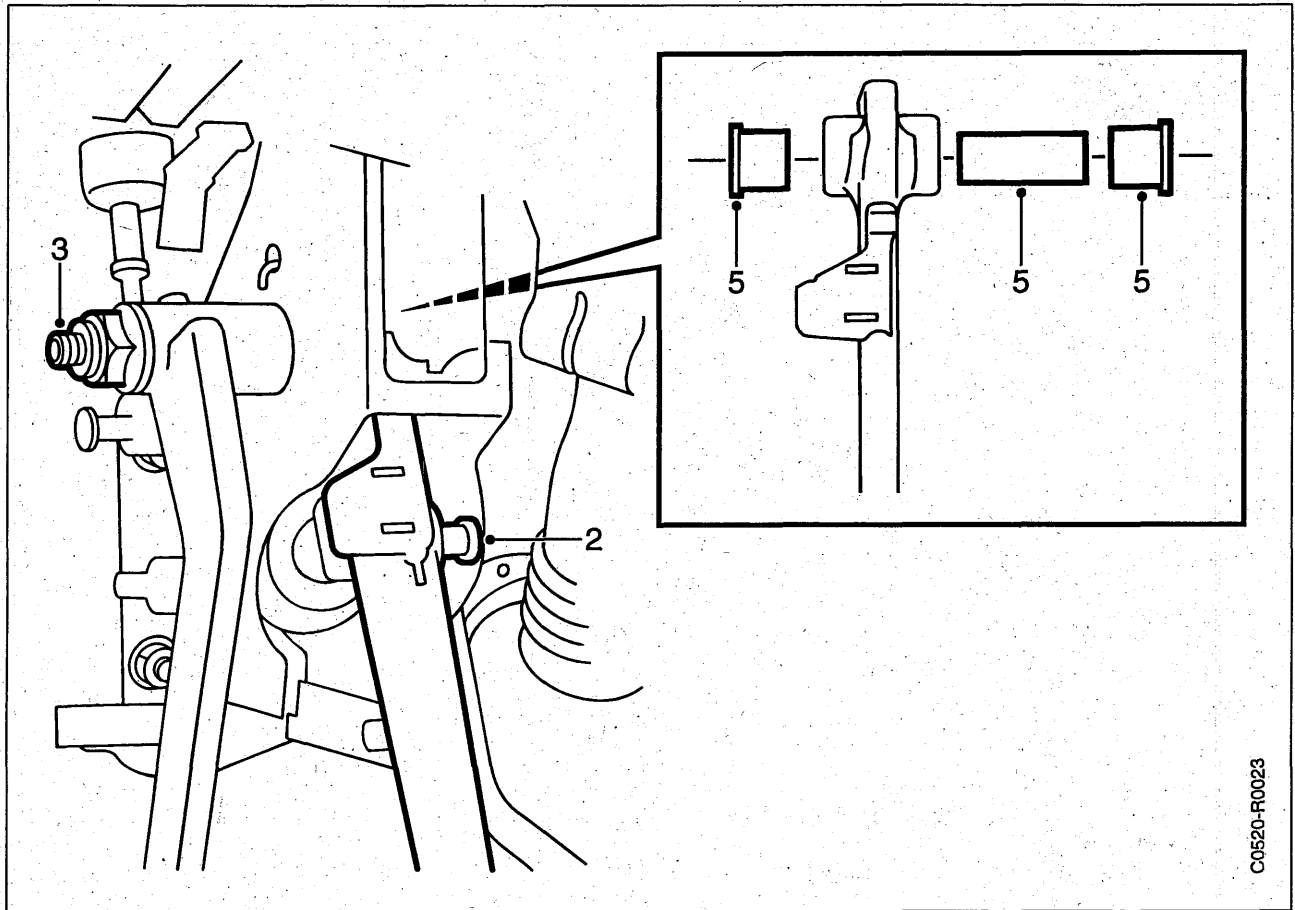


C0520-R0022

Pedal assembly

- 1 Brake pedal
- 2 Return spring
- 3 Pedal pivot bolt
- 4 Pedal bracket
- 5 Circlip
- 6 Clevis pin
- 7 Bush
- 8 Spacer sleeve

Brake pedal (contd.)

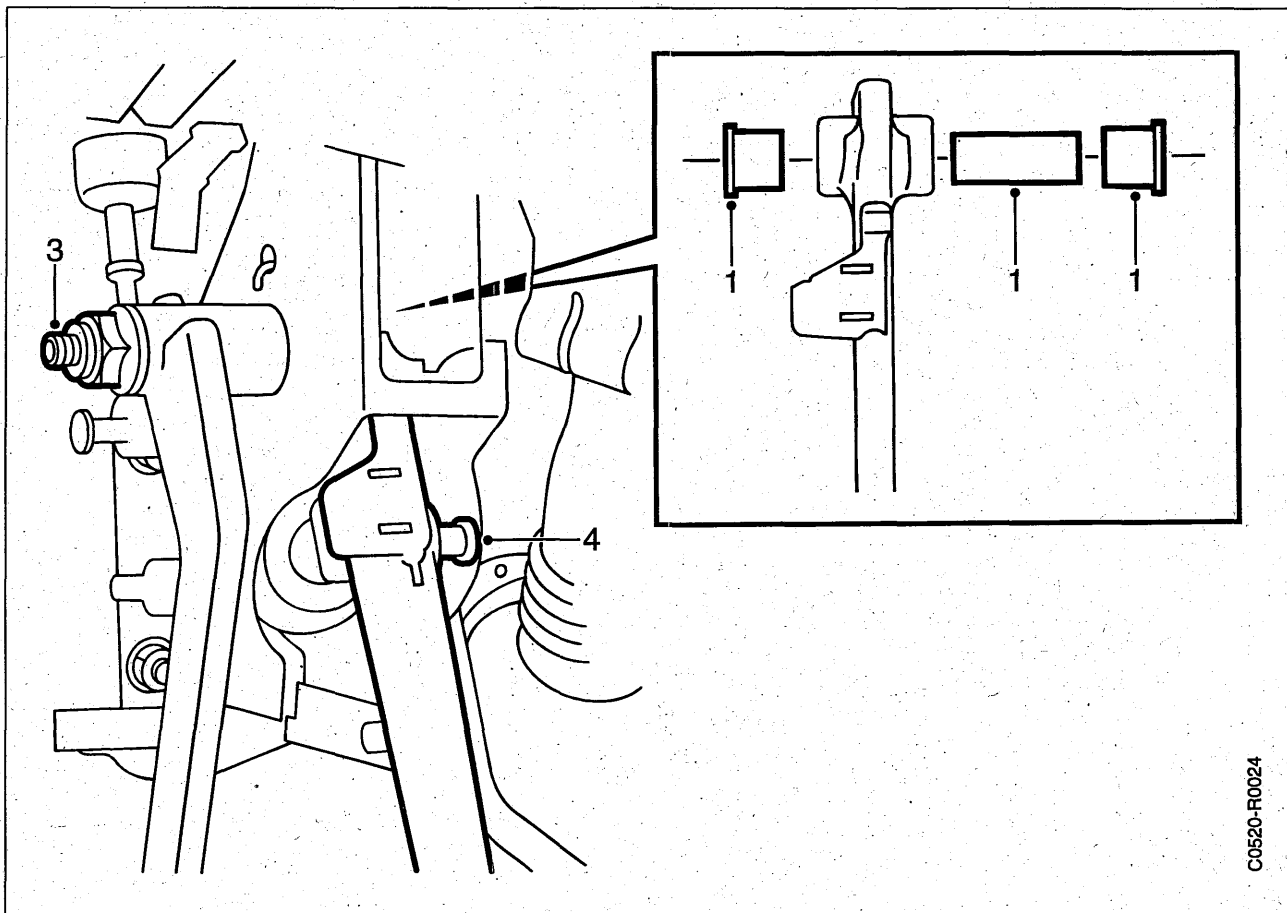


C0620-R0023

To remove

- 1 Remove the lower section of the dashboard.
- 2 Remove the circlip and clevis pin from the brake servo unit's pushrod.
- 3 Remove the pedal pivot bolt together with the clutch pedal.
- 4 Press in the ends of the brake pedal return spring and remove the pedal.
Note the position of the return spring.
- 5 Remove the plastic bushes and spacer sleeve from the pedal.

Brake pedal (contd.)



To fit

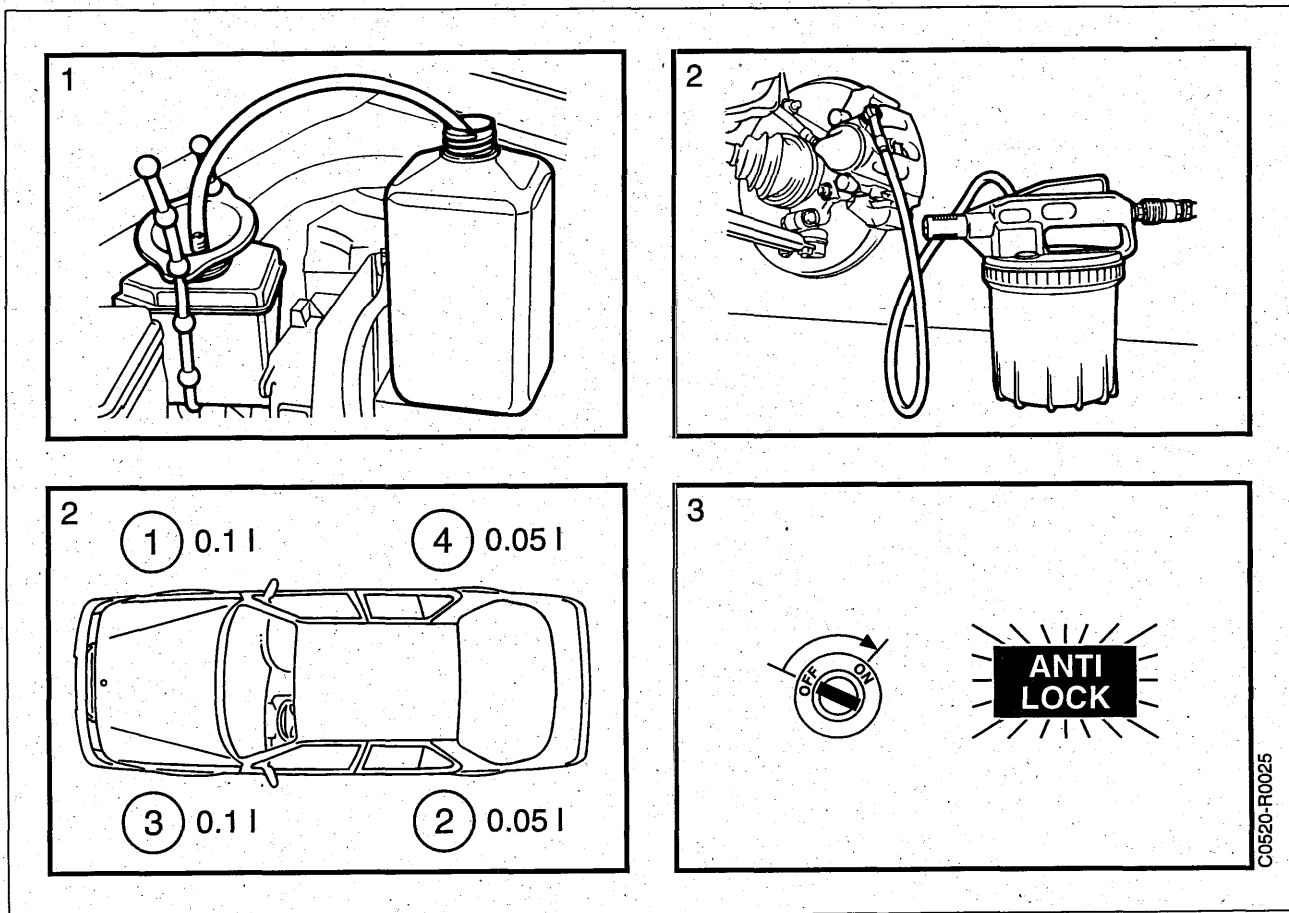
- 1 Fit the plastic bushes and spacer sleeve in the pedal.
- 2 Fit the return spring.
- 3 Position the pedal and fit the pedal pivot bolt.
- 4 Fit the clevis pin and circlip to the brake servo unit's pushrod.
- 5 Fit the lower section of the dashboard.

Bleeding the brake system

Using the brake system bleeder unit (not ABS MK II)	99
Bleeding the brake system manually (not ABS MK II)	100

Bleeding the brake system (ABS MK II)	101
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Using the brake system bleeder unit (not cars with ABS MK II)



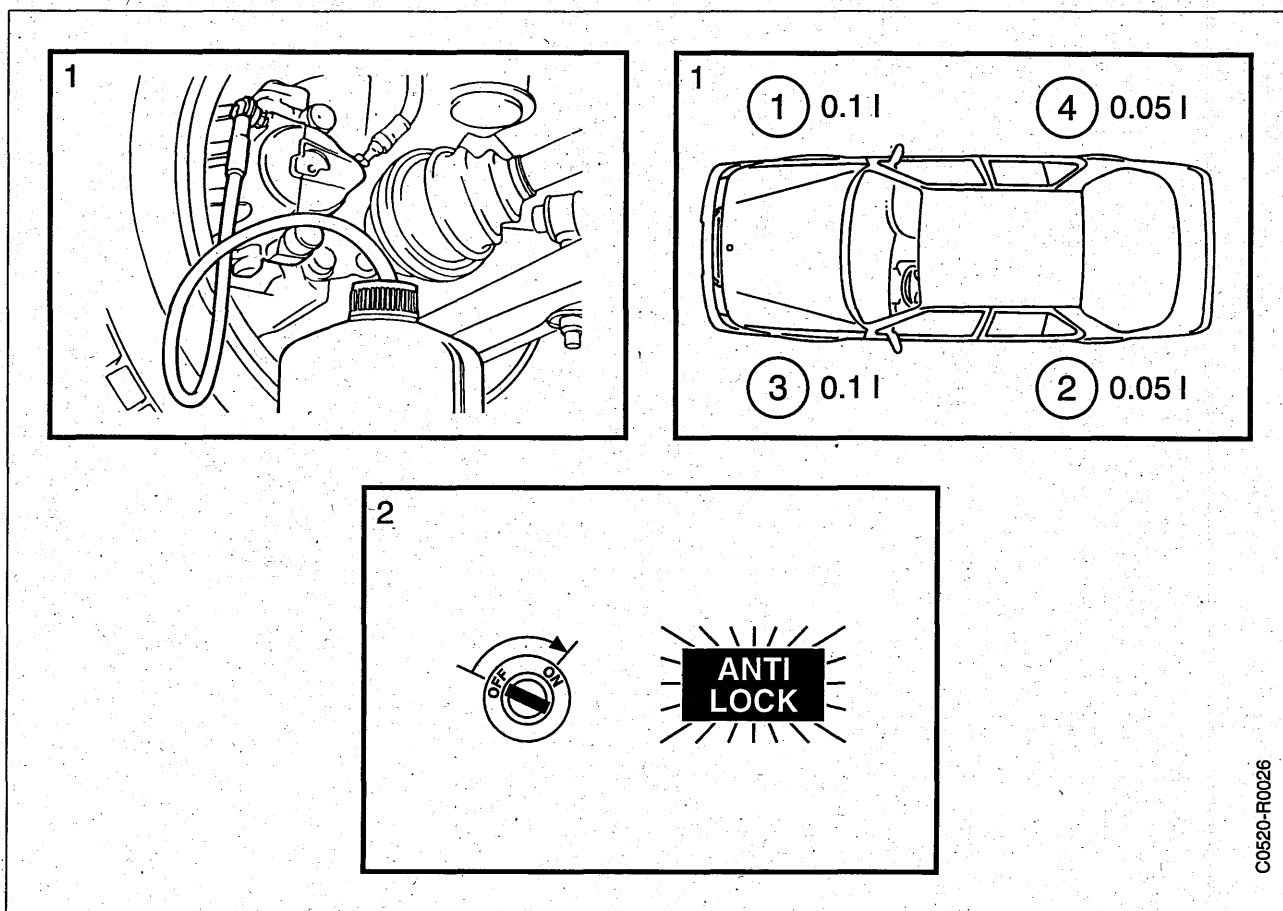
C0520-R0025

- 1 Unscrew the brake fluid reservoir filler cap. Using a length of hose, connect the container of brake fluid to the filler funnel (supplied with the brake system bleeder unit (16) 88 19 096) and strap the filler funnel to the brake fluid reservoir to avoid the risk of emptying the reservoir.
- 2 Bleed the system by means of the bleeder unit, part No. (16) 88 19 096. Bleed the brake system in the following order: RH front wheel, LH rear wheel, LH front wheel and RH rear wheel. When changing the brake fluid, the contents of the reservoir should first be removed by suction. The reservoir should then be filled with fresh brake fluid. The amount of fluid drained

from each brake caliper should be as indicated in the figure above.

- 3 Switch on the ignition and check that the ABS warning lamp on the dashboard goes out (cars with ABS). Drive the car and test the brake system, braking normally and also braking with ABS if the car is so fitted. Check the level of the brake fluid.

Bleeding the brake system manually (not cars with ABS MK II)



1 Connect a brake bleeder hose to the bleed nipple.

Get a helper to depress the brake pedal at least ten times for each brake caliper until the brake fluid visible in the transparent plastic hose is free from air bubbles.

The bleed nipple must be opened before the brakes can be bled.

Bleed the brake system in the following order: RH front wheel, LH rear wheel, LH front wheel and RH rear wheel.

When changing the brake fluid, the contents of the reservoir should first be removed by suction. The reservoir should then be filled with fresh brake fluid. The amount of fluid drained from each brake caliper should be as indicated in the figure above.

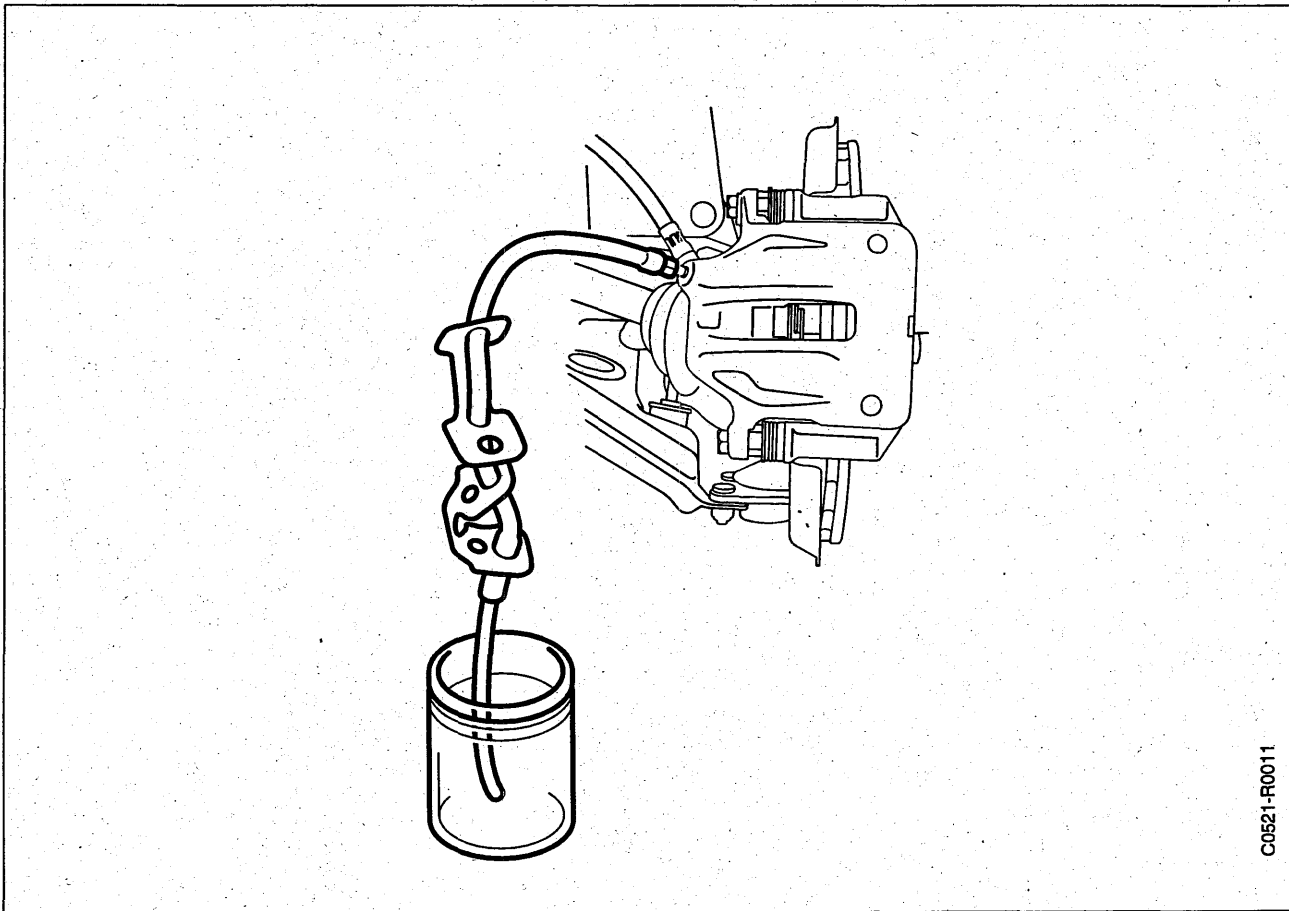
Check the level of the brake fluid in the reservoir to ensure that the reservoir is not emptied.

2 Switch on the ignition and check that the ABS warning lamp on the dashboard goes out (cars with ABS).

Drive the car and test the brake system, braking normally and also braking with ABS if the car is so fitted.

Check the level of the brake fluid.

Bleeding the brake system (cars with ABS MK II)



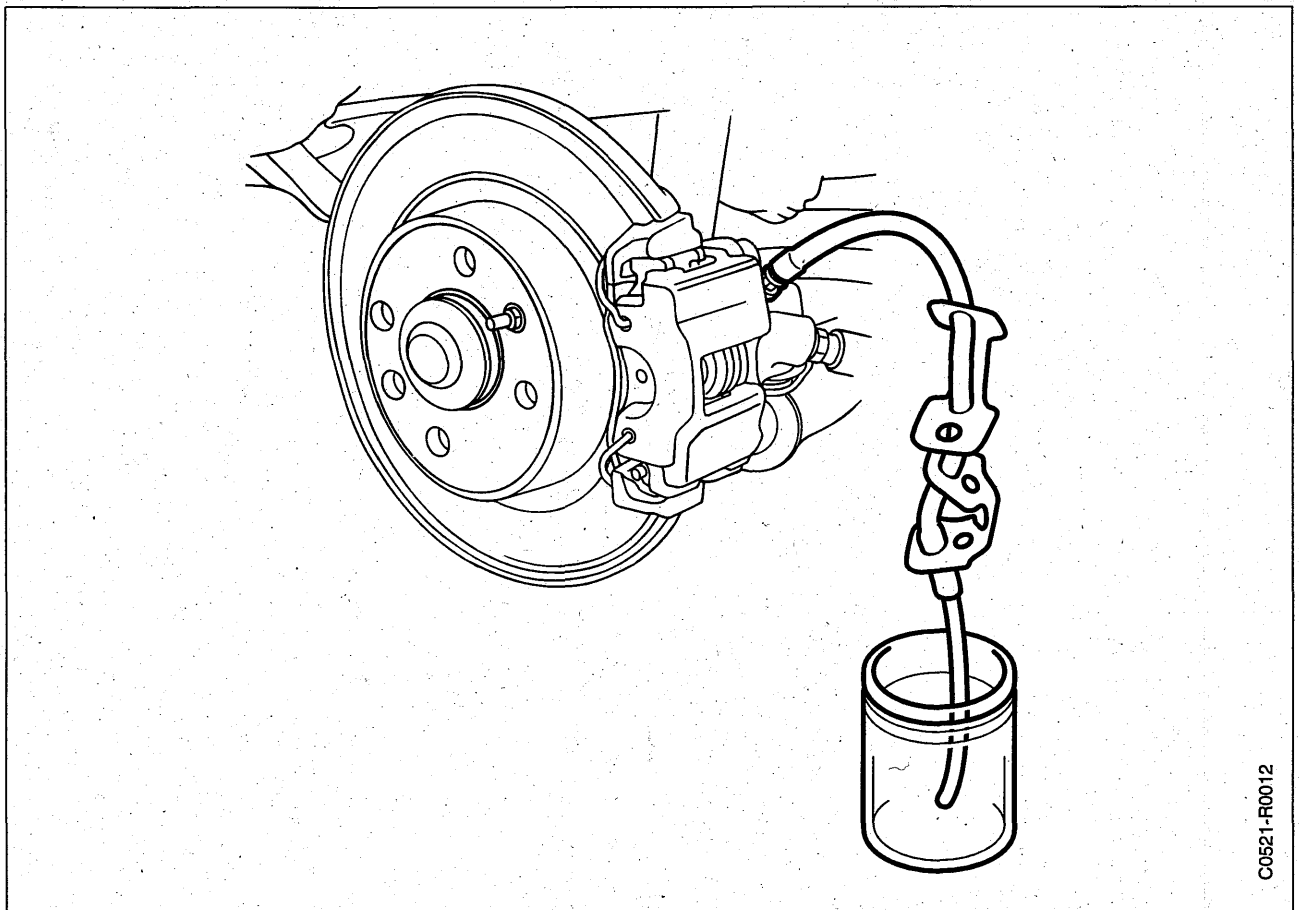
C0521-R0011

Brake circuits, front wheels

A brake system bleeder unit can be used for the front wheel brake circuits.

- 1 Top up with brake fluid, DOT 4 specification, as necessary.
- 2 Connect a length of transparent plastic tubing to the bleed nipple on the right-hand front wheel brake caliper.
Place the other end of the tubing in a suitable receptacle.
- 3 Get a helper to depress the brake pedal at the same time as you open the bleed nipple. Close the nipple when the brake pedal is fully depressed and then tell the helper to release the pedal.
Repeat this procedure until the brake fluid in the transparent hose is free from air bubbles.
To bleed the other brake circuit for the left-hand front wheel: repeat points 2 and 3.

Bleeding the brake system (cars with ABS MK II) (contd.)



Brake circuit, rear wheels

- 1 Check the level of fluid in the reservoir and top up as necessary.
- 2 Connect a length of transparent plastic tubing to the bleed nipple on the rear wheel's brake caliper (either rear wheel). Place the other end of the tubing in a suitable receptacle.
- 3 Get a helper to switch on the ignition and depress the brake pedal.

 **WARNING**

The high-pressure pump's electric motor should not be run for more than 2 minutes at a time. It should then be allowed to cool down for 10 minutes.

- 4 Open the nipple until the brake fluid in the transparent hose is free from air bubbles.

To bleed the same brake circuit for the other rear wheel: repeat points 2, 3 and 4.

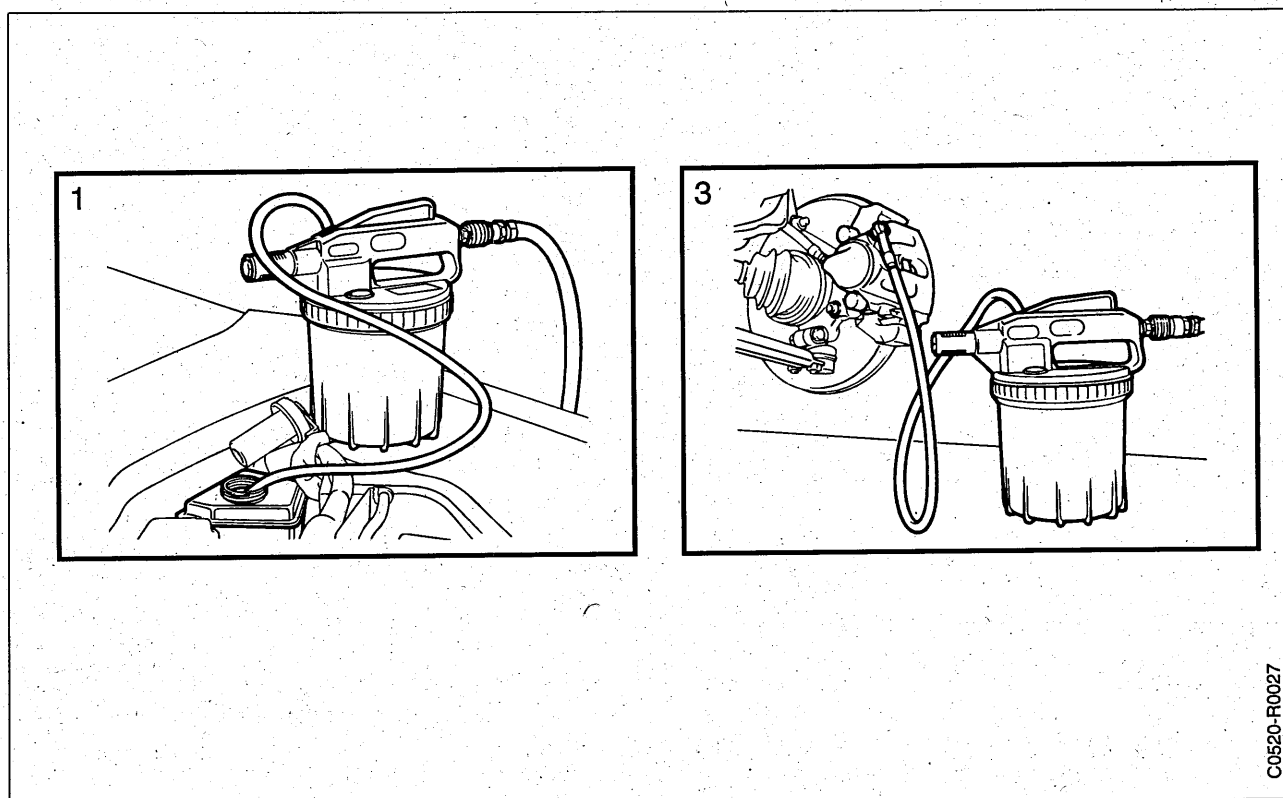
- 5 Top up with brake fluid to the MAX mark on the brake fluid reservoir.

Changing the brake fluid

Changing the brake fluid (not ABS MK IV) .. 103

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Changing the brake fluid (not cars with ABS MK II)



All brake fluid deteriorates after a time due to oxidation and absorption of water.

This process lowers its boiling point and makes it more likely to vaporize during prolonged or repeated heavy braking, with brake failure as a result. Brake fluid must therefore be changed at regular intervals.

Important

It is essential to change all the brake fluid as the brake system could otherwise malfunction. There should be no old brake fluid left in the reservoir when it is filled up with fresh brake fluid.

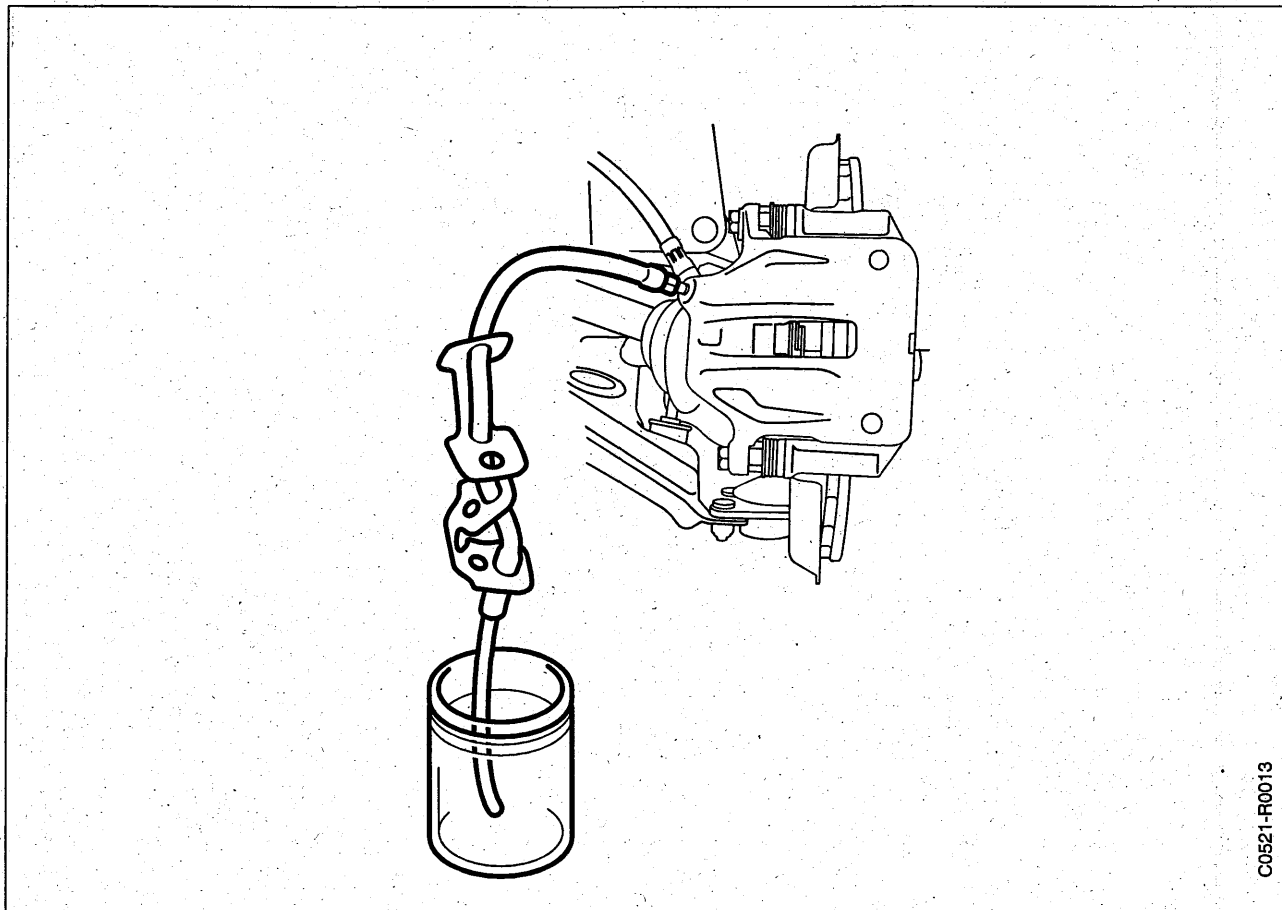
1 Suck the brake fluid out of the reservoir (using the brake system bleeder unit, part No. (16) 88 19 096). On cars with ABS MK IV the reservoir must be removed from its bracket and tilted so that the brake fluid in the other chamber runs over to the chamber from which it can be sucked out.

2 Fill up with brake fluid, DOT 4 specification.

3 Suck out the old brake fluid from each individual wheel until fresh brake fluid is visible. Use the brake system bleeder unit, part No. (16) 88 19 096.

4 Adjust the brake fluid level to the MAX mark on the brake fluid reservoir.

Changing the brake fluid (cars with ABS MK II)



C0521-R0013

All brake fluid deteriorates after a time due to oxidation and absorption of water. This process lowers its boiling point and makes it more likely to vaporize during prolonged or repeated heavy braking, with brake failure as a result. Brake fluid must therefore be changed at regular intervals. See the "Maintenance schedule" section in Service Manual 1:2 "Service".

Important

It is essential to change all the brake fluid as the brake system could otherwise malfunction. The total amount of brake fluid in the brake system is about 1.2 litres.

A brake system bleeder unit can be used for the front wheel brake circuits.

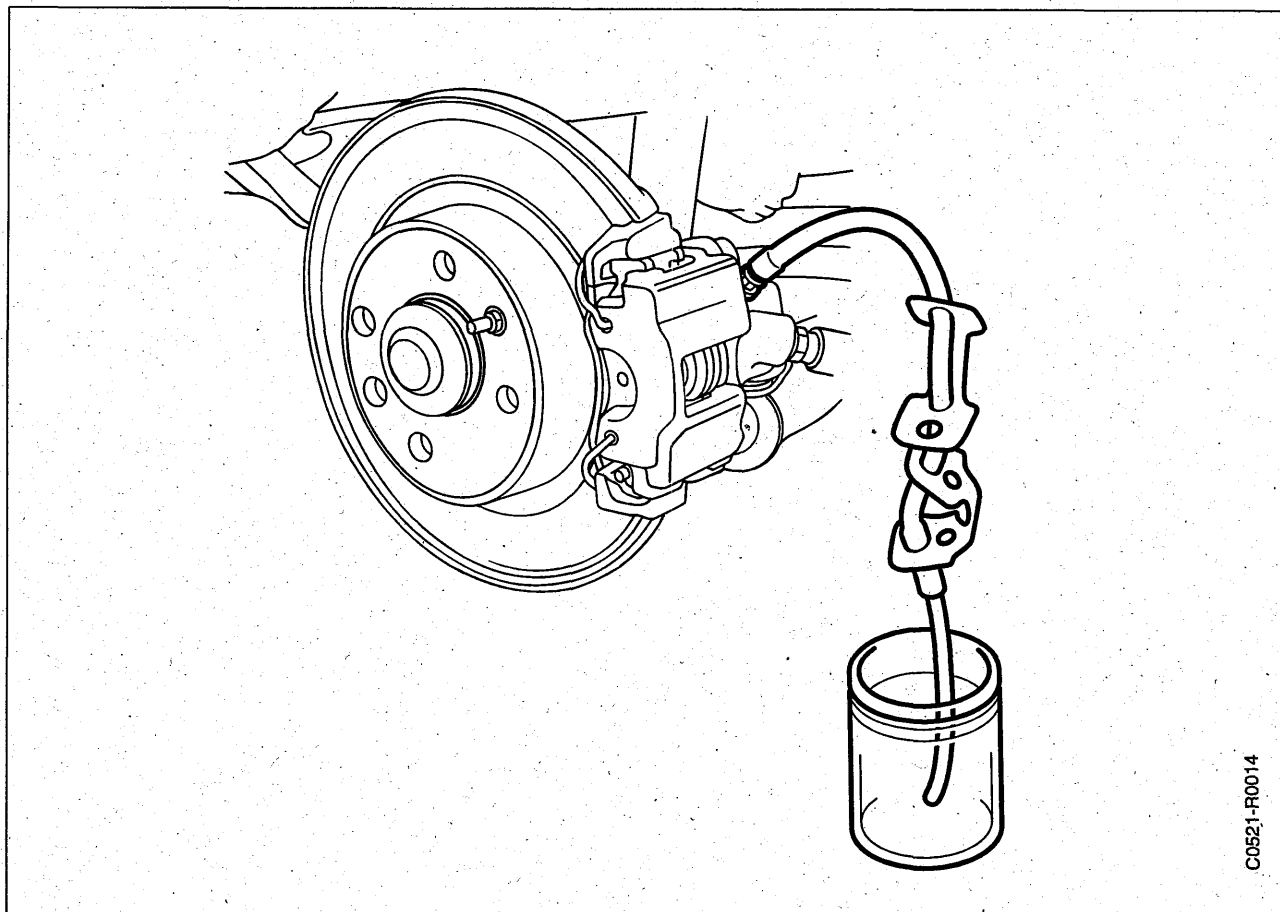
- 1 Suck the brake fluid out of the fluid reservoir.
- 2 Fill up with brake fluid, DOT 4 specification.
- 3 Connect a length of transparent plastic tubing to the bleed nipple on the right-hand front wheel brake caliper.
Place the other end of the tubing in a suitable receptacle, such as a 1-litre measuring flask.
- 4 Get a helper to depress the brake pedal at the same time as you open the bleed nipple. Close

the nipple when the brake pedal is fully depressed and then tell the helper to release the pedal.

Repeat this procedure until about 0.5 litres of brake fluid has been sucked out.

To drain the other brake circuit for the left-hand front wheel: repeat points 3 and 4 (but drain off about 0.1 litres of brake fluid).

Changing the brake fluid (cars with ABS MK II) (contd.)



- 5 Connect a length of transparent plastic tubing to the bleed nipple on the rear wheel's brake caliper (either rear wheel). Place the other end of the tubing in a suitable receptacle.
- 6 Get a helper to switch on the ignition and depress the brake pedal.

 **WARNING**

The high-pressure pump's electric motor should not be run for more than 2 minutes at a time. It should then be allowed to cool down for 10 minutes.

- 7 Open the nipple until about 0.1 litres of brake fluid has been drained off.

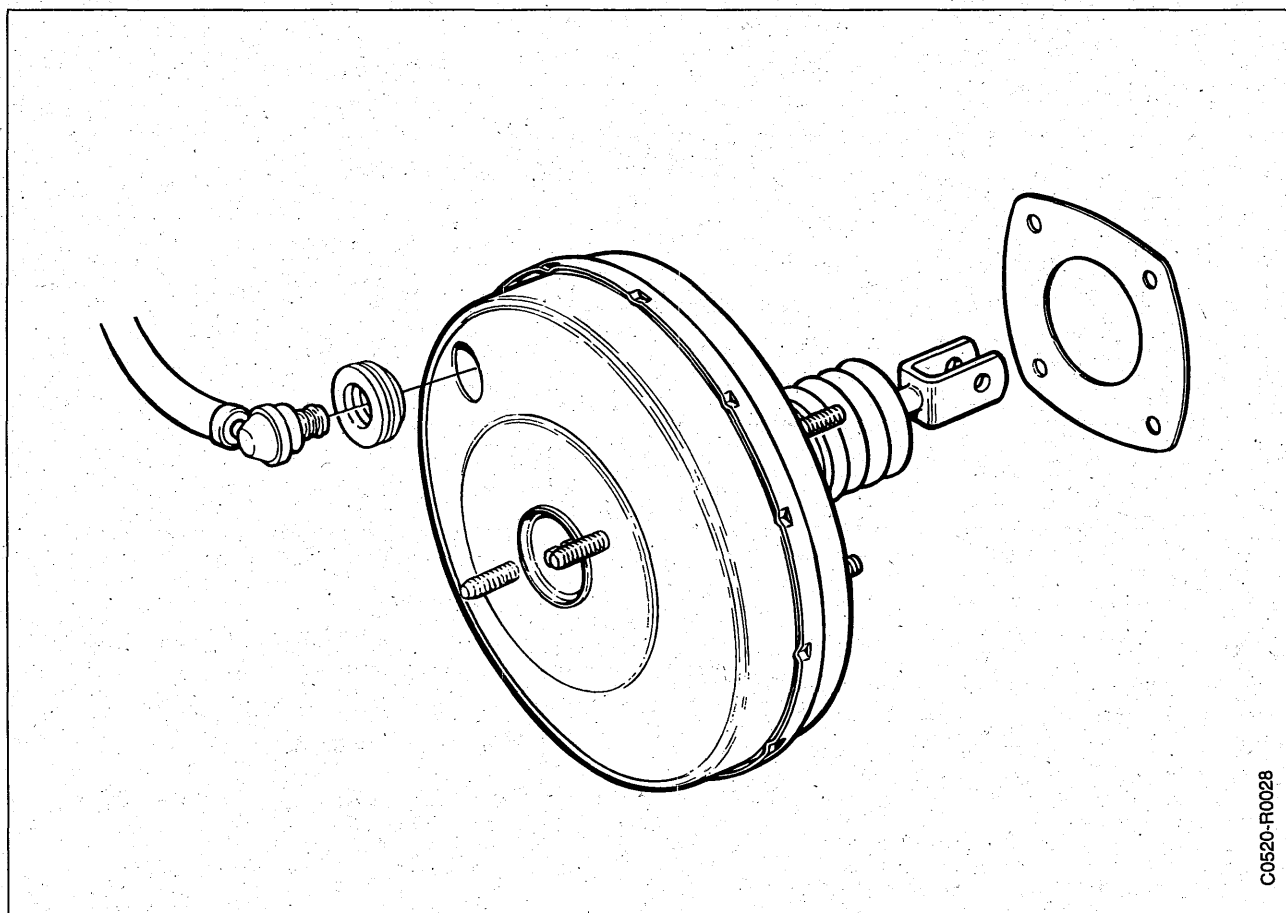
To drain the same brake circuit for the other rear wheel: repeat points 5, 6 and 7.

- 8 Top up with brake fluid to the MAX mark on the brake fluid reservoir.

Brake servo unit

General instructions	107	Vacuum pump	127
Brake servo unit (cars without ABS)	108	Pressure switch, vacuum pump	129
Brake servo unit (ABS MK IV)	110	Fault diagnosis, vacuum pump	131
Pressure accumulator (ABS MK II)	112	List of components, vacuum pump	135
Pressure switch (ABS MK II)	114	Wiring diagram, vacuum pump	136
Pressure line (ABS MK II)	118		
High-pressure pump/electric motor (ABS MK II)	122		

General instructions



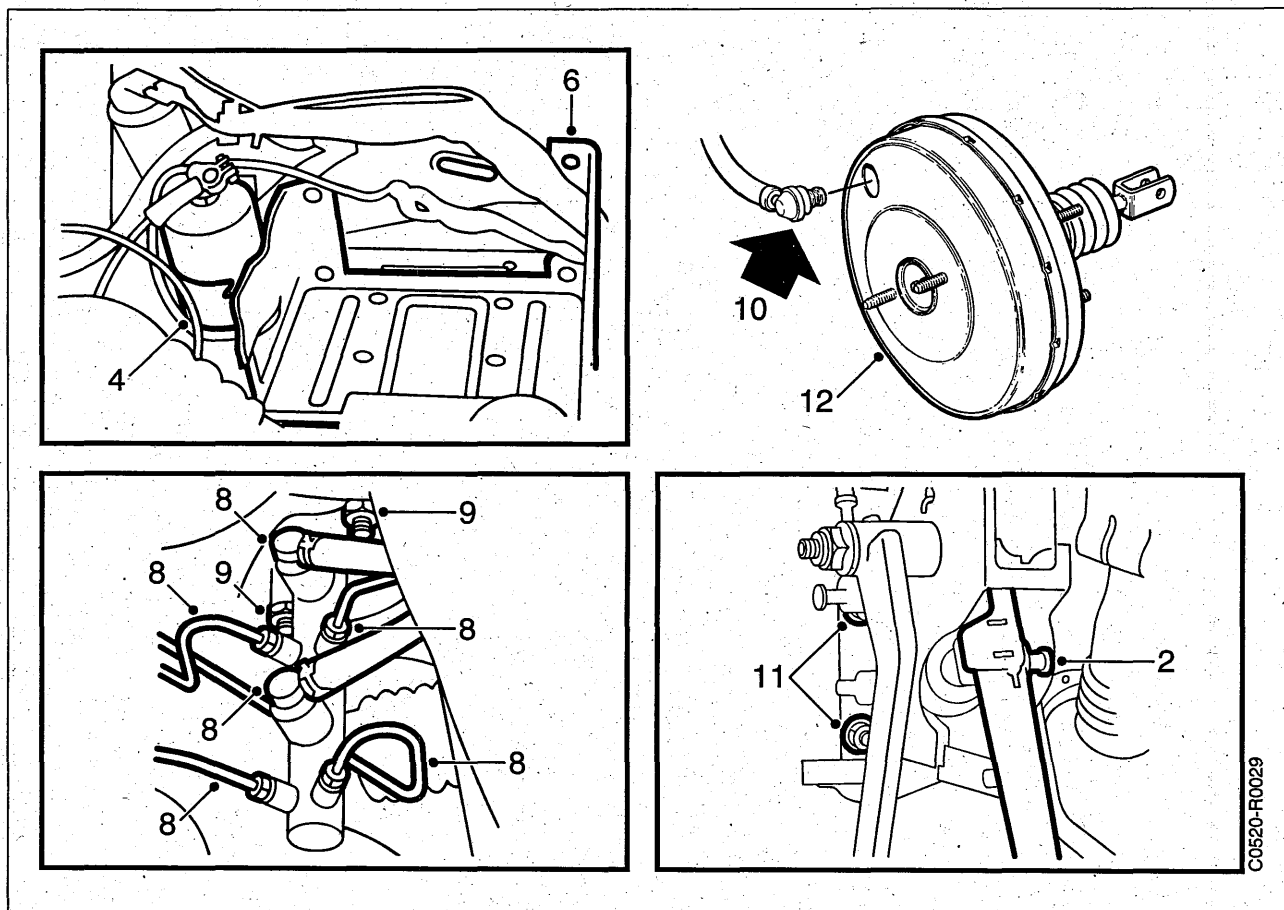
C0520-F0028

Scrupulous cleanliness is essential when removing, dismantling, assembling and fitting components forming part of the hydraulic brake system.

Clean removed and dismantled components in clean brake fluid or a special cleaning fluid for hydraulic brake components. Wipe the parts dry using clean, lint-free paper or cloth. Gaskets, circlips and rubber parts are available as repair kits and old ones should be discarded.

Before assembly, the components should be generously lubricated with clean, unused brake fluid of the recommended specification.

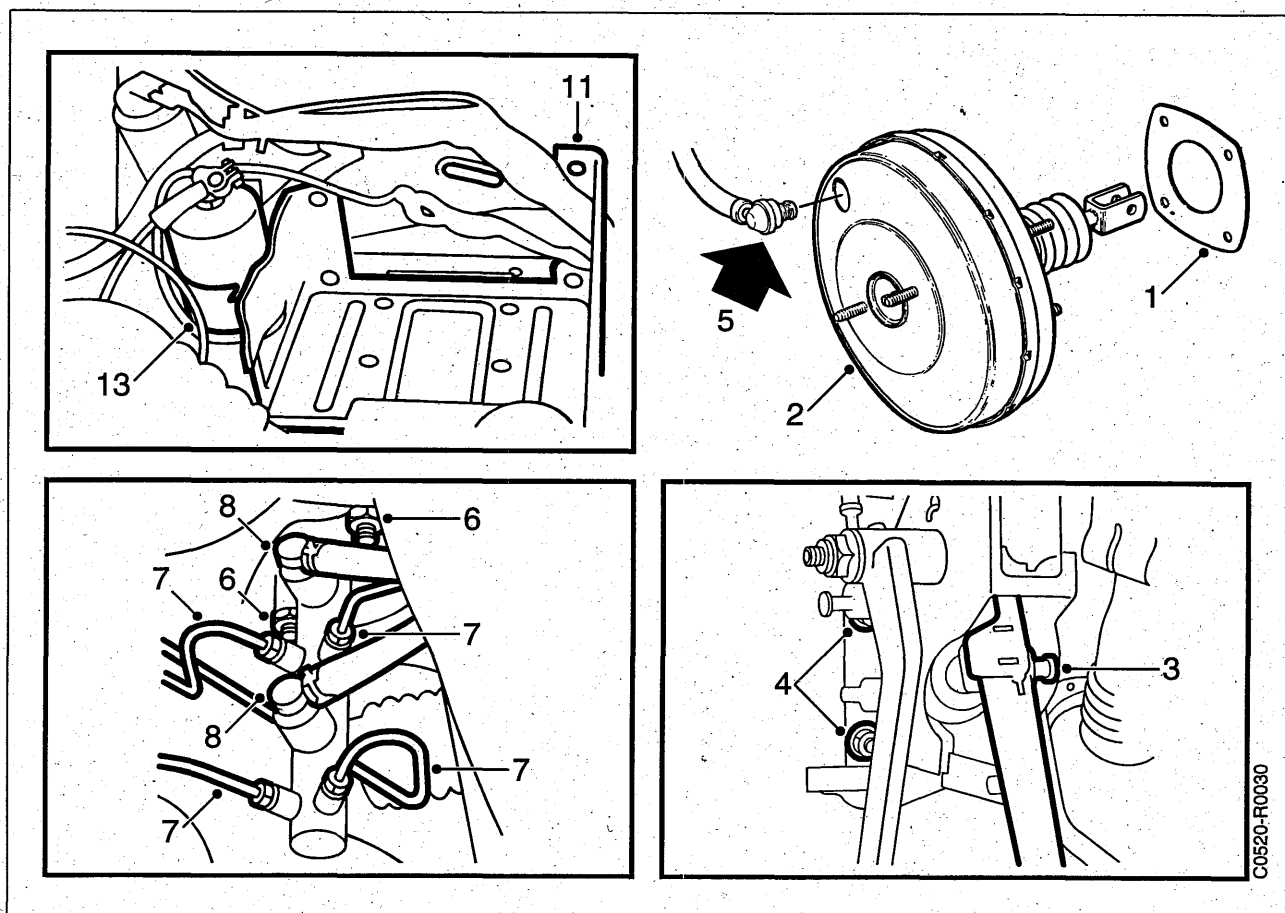
Brake servo unit (cars without ABS)



To remove

- 1 Remove the lower section of the dashboard by the pedal assembly.
- 2 Remove the circlip and clevis pin from the brake servo unit's pushrod.
- 3 Disconnect the battery cables and lift out the battery.
- 4 Undo the fuel filter and move it aside.
(Not model year 1990 and later cars)
- 5 Remove the terminal blocks from the battery tray.
- 6 Remove the battery tray.
- 7 Suck the brake fluid out of the reservoir (use the brake system bleeder unit, part No (16) 88 19 096).
- 8 Disconnect the hoses from the master cylinder and tuck them up out of the way by the brake fluid reservoir.
Undo the pipe connections.
- 9 Unbolt the master cylinder from the brake servo unit.
- 10 Disconnect the vacuum hose with non-return valve from the servo unit.
- 11 Undo the brake servo unit's four retaining nuts on the bulkhead partition by the pedal assembly.
- 12 Lift out the brake servo unit.

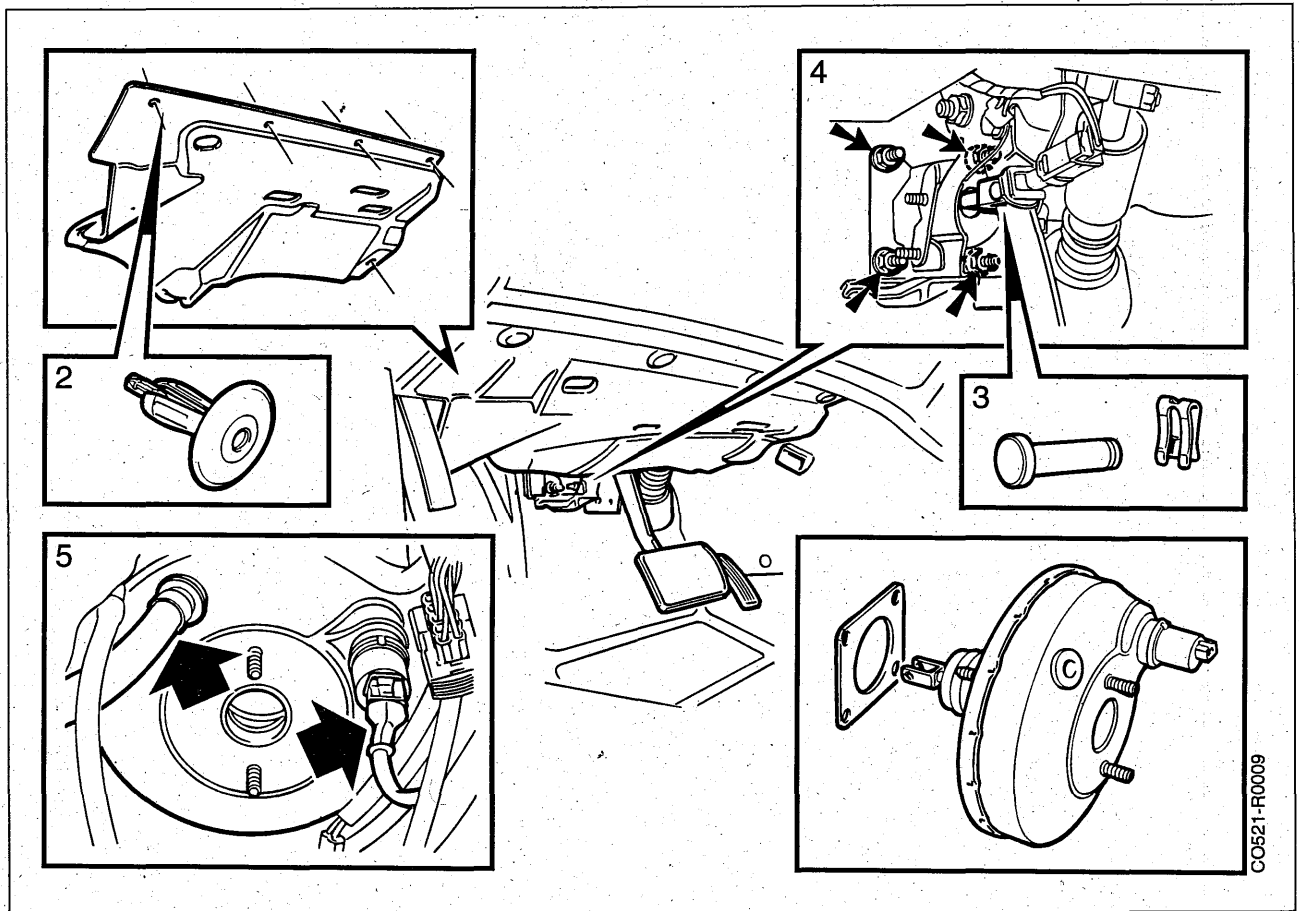
Brake servo unit (cars without ABS) (contd.)



To fit

- 1 Fit a new gasket on the brake servo unit.
- 2 Lift the brake servo unit into position and make sure the pushrod is correctly aligned with the pedal assembly.
- 3 Fit the clevis pin and circlip to the brake servo unit's pushrod.
- 4 Tighten the brake servo unit's four retaining nuts on the bulkhead partition by the pedal assembly.
Tightening torque: 15.5 Nm (11.5 lbf ft)
Check the positions of the pedal switches and adjust if necessary.
- 5 Fit the vacuum hose with non-return valve on the servo unit.
- 6 Refit the master cylinder.
Tighten the nuts securing the master cylinder to the brake servo unit.
Tightening torque: 27 Nm (20 lbf ft)
- 7 Reconnect the brake pipes and tighten the connections.
- 8 Reconnect the hoses from the brake fluid reservoir.
Take care not to displace the seals from their seats.
- 9 Fill up with brake fluid, DOT 4 specification.
- 10 Bleed the brake system.
See section 529, "Bleeding the brake system".
- 11 Fit the battery tray.
- 12 Fit the terminal blocks on the battery tray.
- 13 Refit the fuel filter.
(Not model year 1990 and later cars.)
- 14 Put the battery back in place and reconnect the cables.
- 15 Refit the lower section of the dashboard by the pedal assembly.

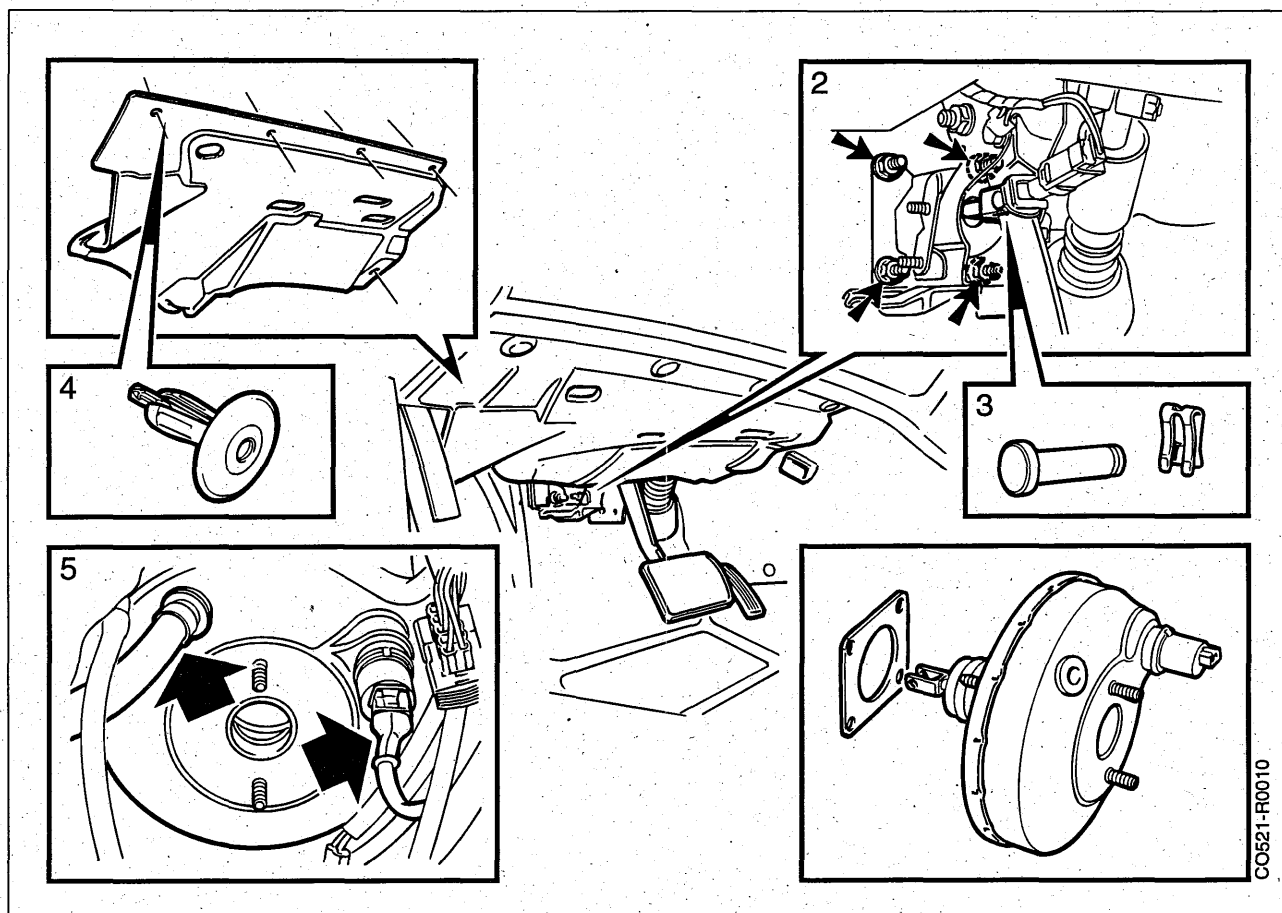
Brake servo unit (ABS MK IV)



To remove

- 1 Remove the ABS unit. See Service Manual 5:2 ABS braking system (ABS MK IV), section 510.
- 2 Remove the lower section of the dashboard adjacent to the pedal assembly by pressing in the locking pin 4 mm on the five plastic clips.
- 3 Remove the clips and clevis pin from the push-rod.
- 4 Undo the four retaining nuts securing the vacuum servo.
- 5 Disconnect the vacuum hose and unplug the pedal position sensor connector from the vacuum servo.
- 6 Lift out the vacuum servo unit.
- 7 When changing the vacuum servo unit, the pedal position sensor should be transferred to the vacuum servo. The adjusting sleeve having the same colour as the colour marking on the vacuum servo unit should be mounted on the pedal position sensor. See Service Manual 5:2 ABS braking system (ABS MK IV).

Brake servo unit (ABS MK IV) (contd.)

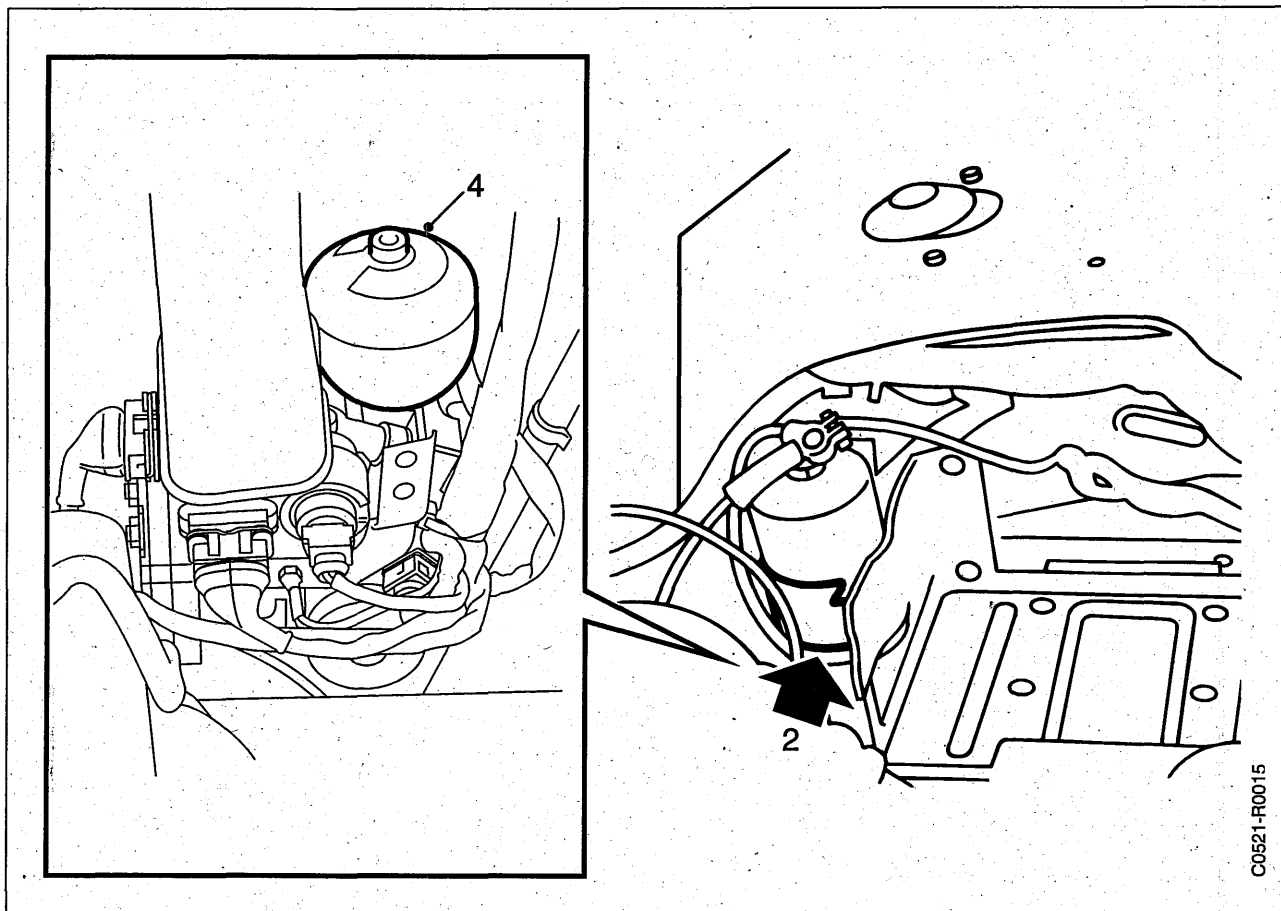


CO521-F0010

To fit

- 1 Get a helper to hold the pedal assembly so that its holes and the holes in the bulkhead partition are in alignment when the vacuum servo is fitted in place.
- 2 Screw on the four vacuum servo retaining nuts and tighten them.
Tightening torque: 15.5 Nm (11.5 lbf ft)
- 3 Fit the clevis pin and clip on the pushrod.
- 4 Fit the lower section of the dashboard by pressing the five plastic clips into place.
Check the pedal switches and adjust them if necessary.
- 5 Plug in the pedal position sensor connector and reconnect the vacuum hose.
- 6 Fit the ABS unit. See Service Manual 5:2 ABS braking system (ABS MK IV).

Pressure accumulator (only cars with ABS MK IV)



⚠ WARNING

When carrying out any work on the brake system's hydraulic circuits the system must first be depressurized. Depress the brake pedal about 20 times or until noticeable resistance is felt in the pedal.

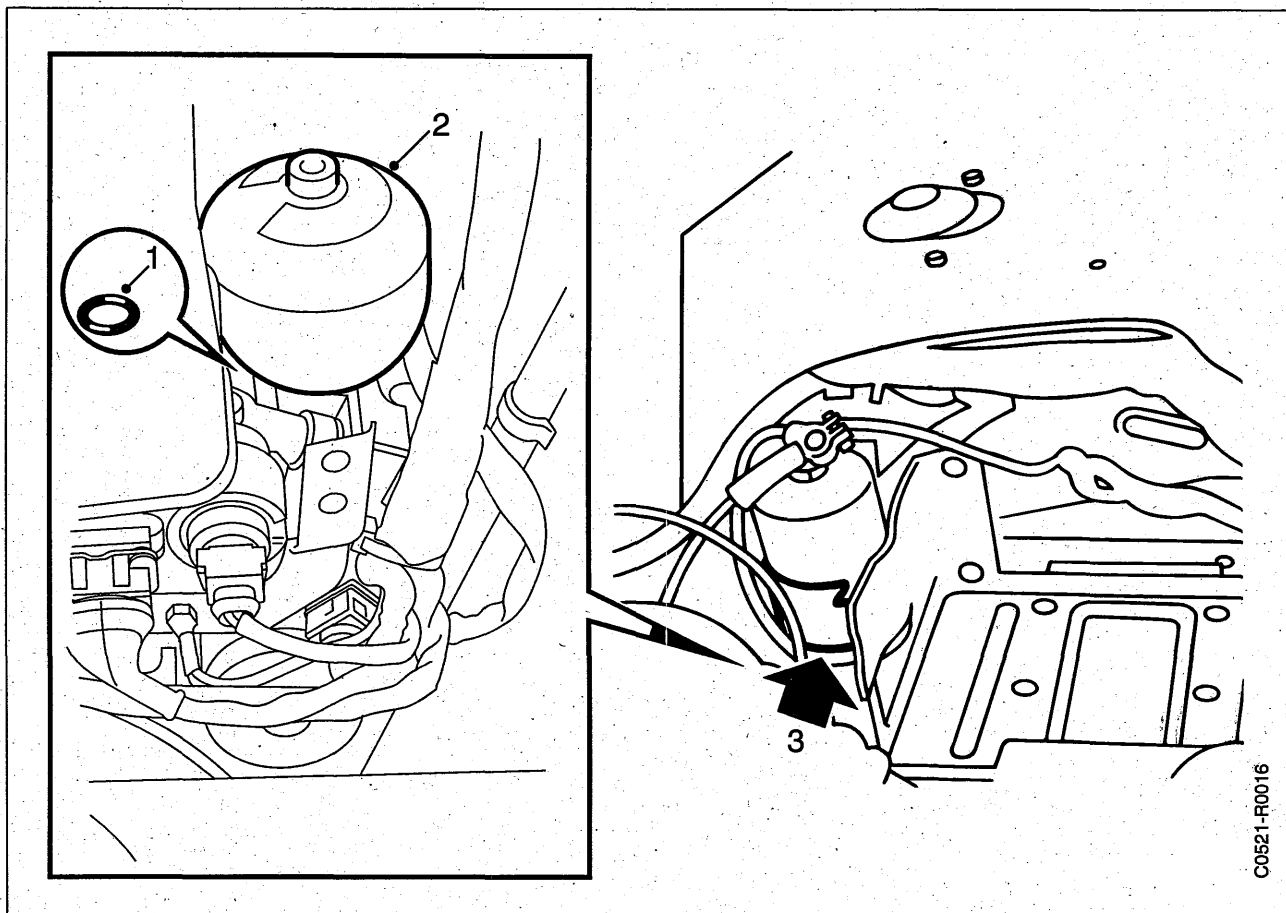
⚠ WARNING

Before starting any work on the pressure accumulator, thoroughly clean the area adjacent to it so that the risk of dirt getting into the brake system is eliminated.

To remove

- 1 Disconnect the battery cables and lift out the battery.
- 2 Remove the fuel filter from the battery tray.
- 3 Move the fuel filter aside.
- 4 Remove the pressure accumulator.
Use an 8 mm Allen key.

Pressure accumulator (only cars with ABS MK IV) (contd.)



To fit

- 1 Fit a new O-ring on the pressure accumulator.
- 2 Fit the pressure accumulator.
Tightening torque: 40 Nm (29.6 lbf ft)
- 3 Secure the fuel filter to the battery tray.
- 4 Refit the battery and connect the battery cables.
- 5 Switch on the ignition and check that the brake and ABS warning lamps go out.
- 6 Drive the car on test to check that the brake system is in perfect working order.

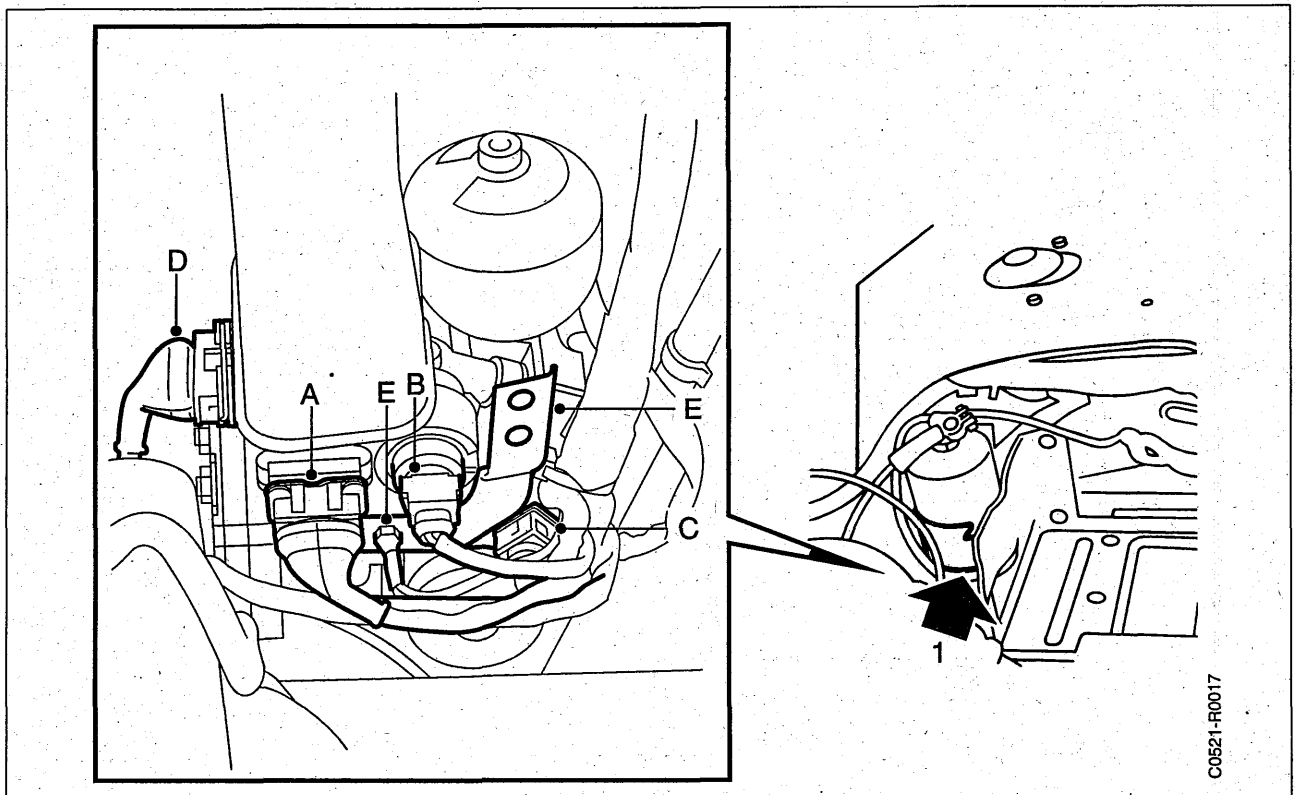
Pressure switch (only cars with ABS MK II)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



WARNING

When carrying out any work on the brake system's hydraulic circuits the system must first be depressurized. Depress the brake pedal about 20 times or until noticeable resistance is felt in the pedal.

WARNING

Before starting any work on the pressure switch, thoroughly clean the area adjacent to it so that the risk of dirt getting into the brake system is eliminated.

2 Unplug all the hydraulic unit's electrical connectors:

- level switch on the brake fluid reservoir (A)
- main valve (B)
- pressure switch (C)
- valve block (D)

3 Remove the bracket from the mounting point on the master cylinder and the ground connection (E).

4 Fit special tool (16) 89 96 571 and unscrew the pressure switch.

To remove

1 Remove the battery, fuel filter and battery tray to expose the hydraulic unit.

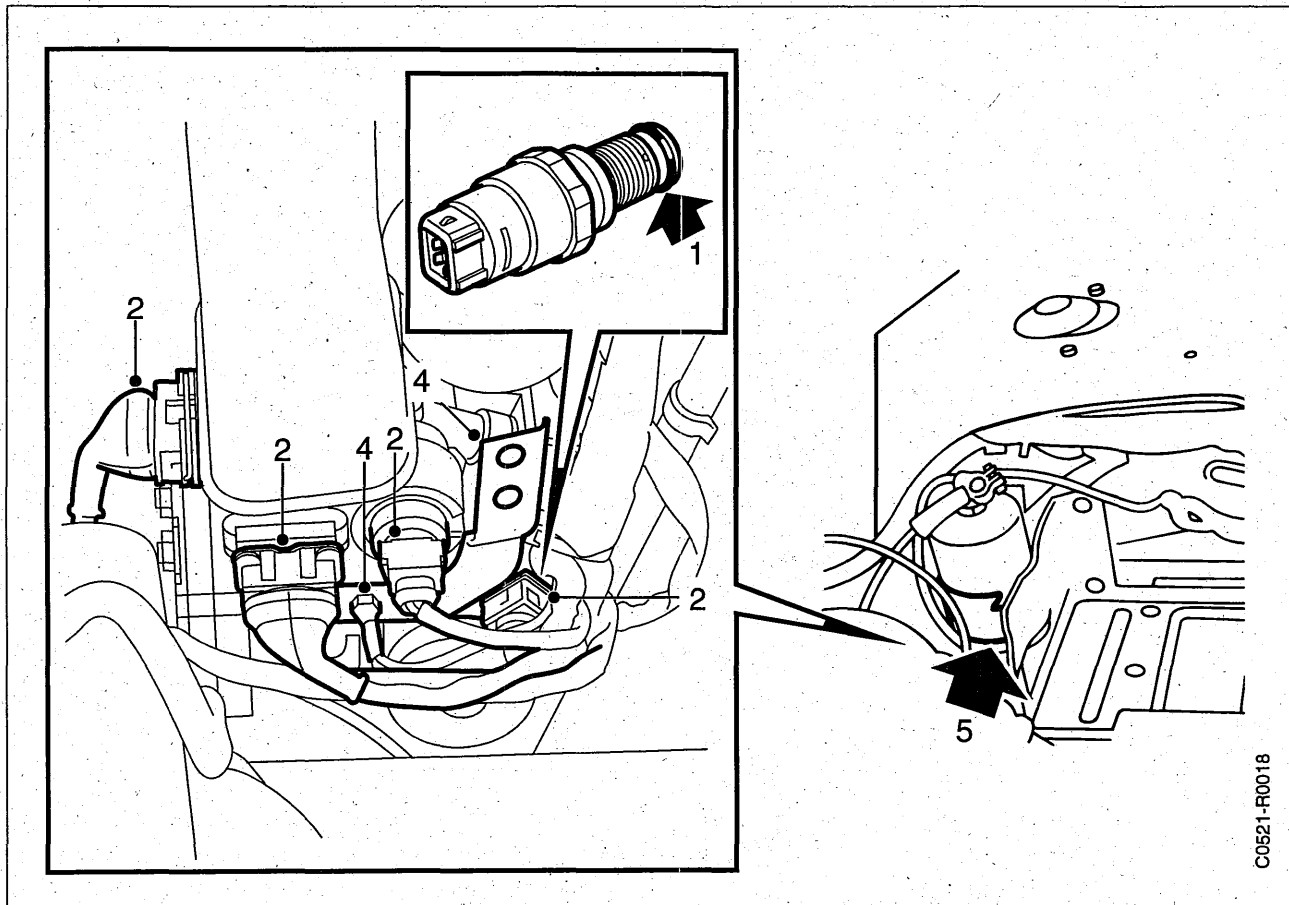
Pressure switch (only cars with ABS MK II) (contd.)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



To fit

1 Fit a new O-ring and screw in the pressure switch.

Tightening torque: 23 Nm (17 lbf ft)

2 Plug in all the hydraulic unit's electrical connectors.

- pressure switch
- main valve
- level switch on the brake fluid reservoir
- valve block.

3 Fit the bracket to the mounting point on the master cylinder and the ground connection.

4 Fit the battery tray, fuel filter and battery.

5 Switch on the ignition and check that the brake and ABS warning lamps go out.

6 Check that there are no leaks in the brake system.

7 Drive the car on test to check that the brake system is in perfect working order.

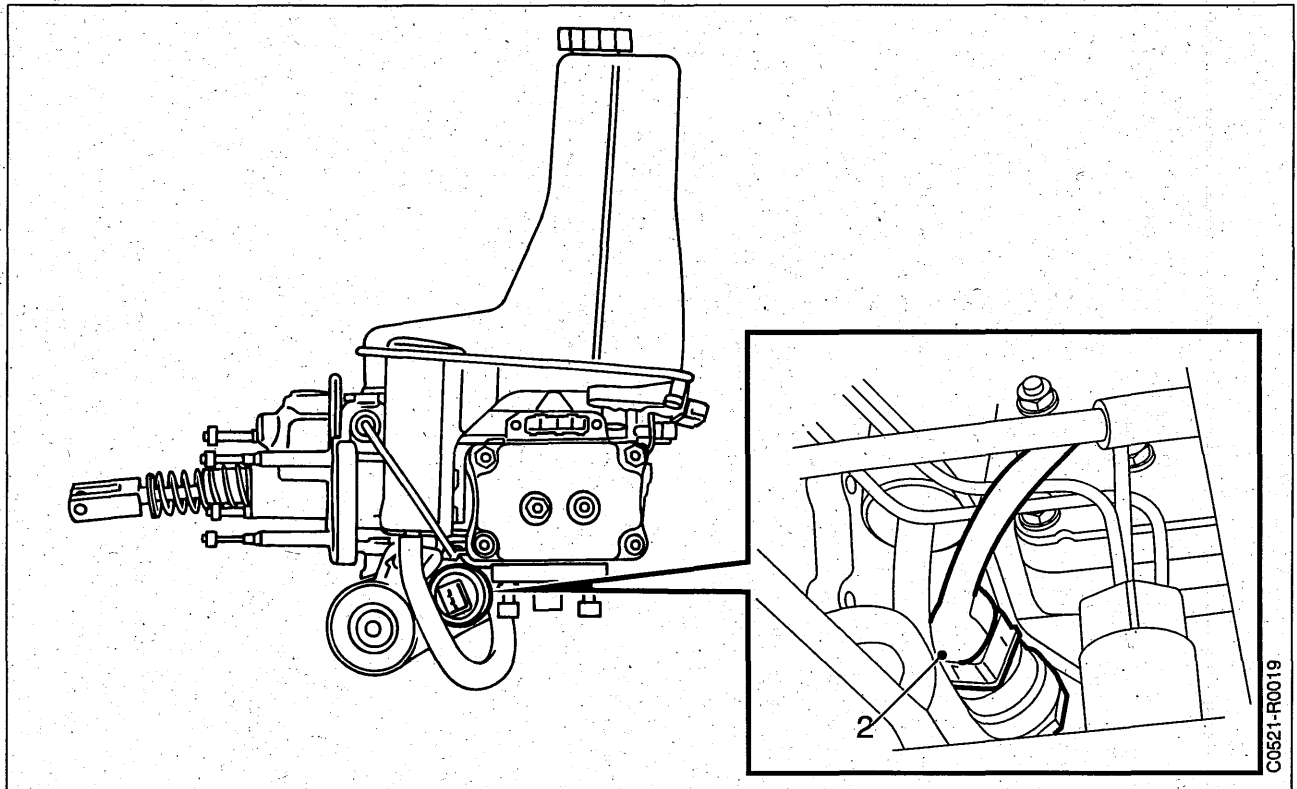
Pressure switch (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



WARNING

When carrying out any work on the brake system's hydraulic circuits the system must first be depressurized. Depress the brake pedal about 20 times or until noticeable resistance is felt in the pedal.

- 2 Unplug the connector from the pressure switch.
- 3 Fit an extension piece on special tool (16) 89 96 571 and unscrew the pressure switch.

Note

If the pressure switch is tightened down hard, a suitable counterstay can be placed between the pump body and the hydraulic unit.

WARNING

Before starting any work on the pressure switch, thoroughly clean the area adjacent to it so that the risk of dirt getting into the brake system is eliminated.

To remove

- 1 Remove the damping rubber on the pressure pipe.

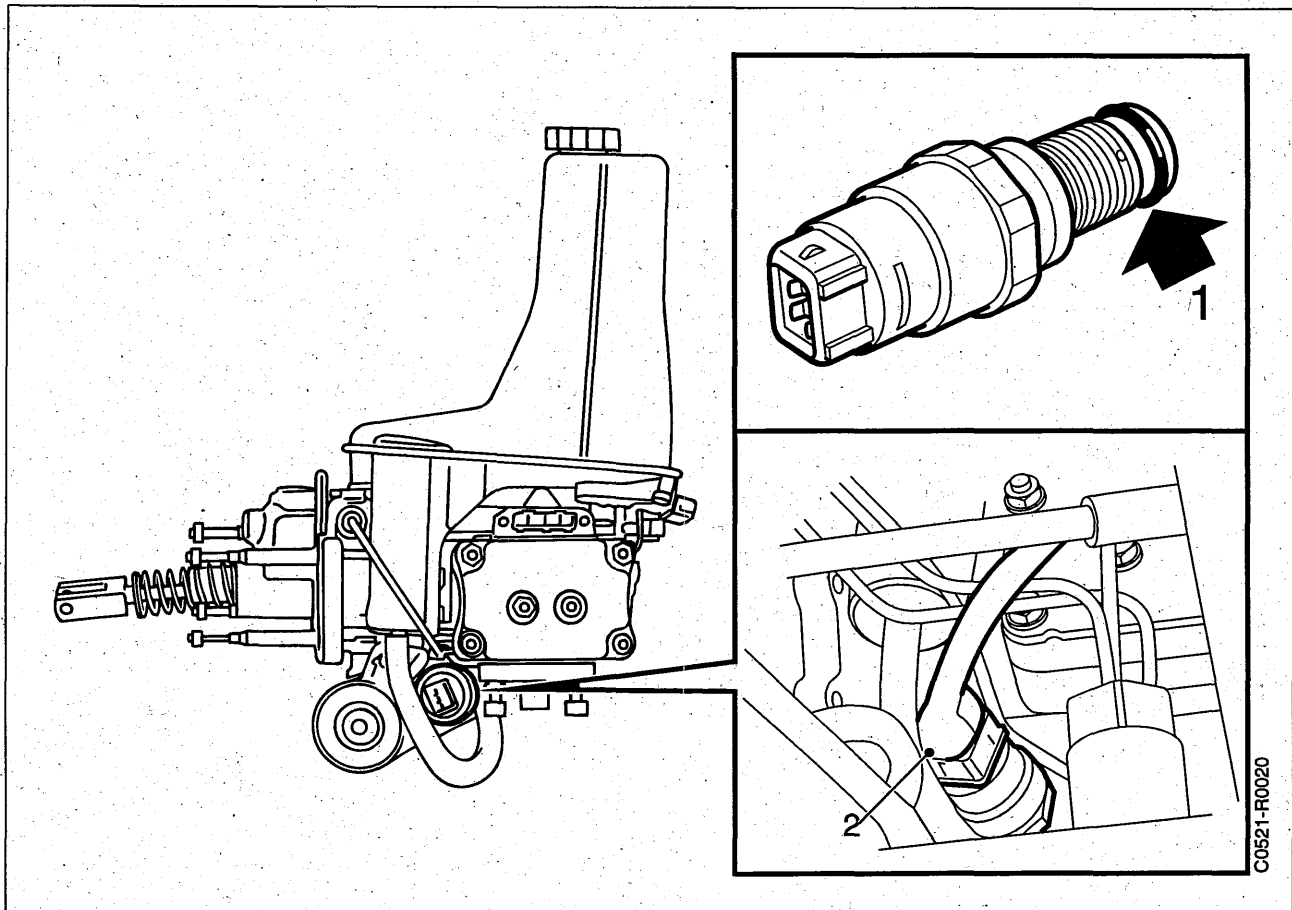
Pressure switch (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



To fit

- 1 Fit a new O-ring and screw in the pressure switch.
Tightening torque: 23 Nm (17 lbf ft)
- 2 Plug the electrical connector into the pressure switch.
- 3 Fit the damping rubber on the pressure pipe.
- 4 Switch on the ignition and check that the brake and ABS warning lamps go out.
- 5 Check that there are no leaks in the brake system.
- 6 Drive the car on test to check that the brake system is in perfect working order.

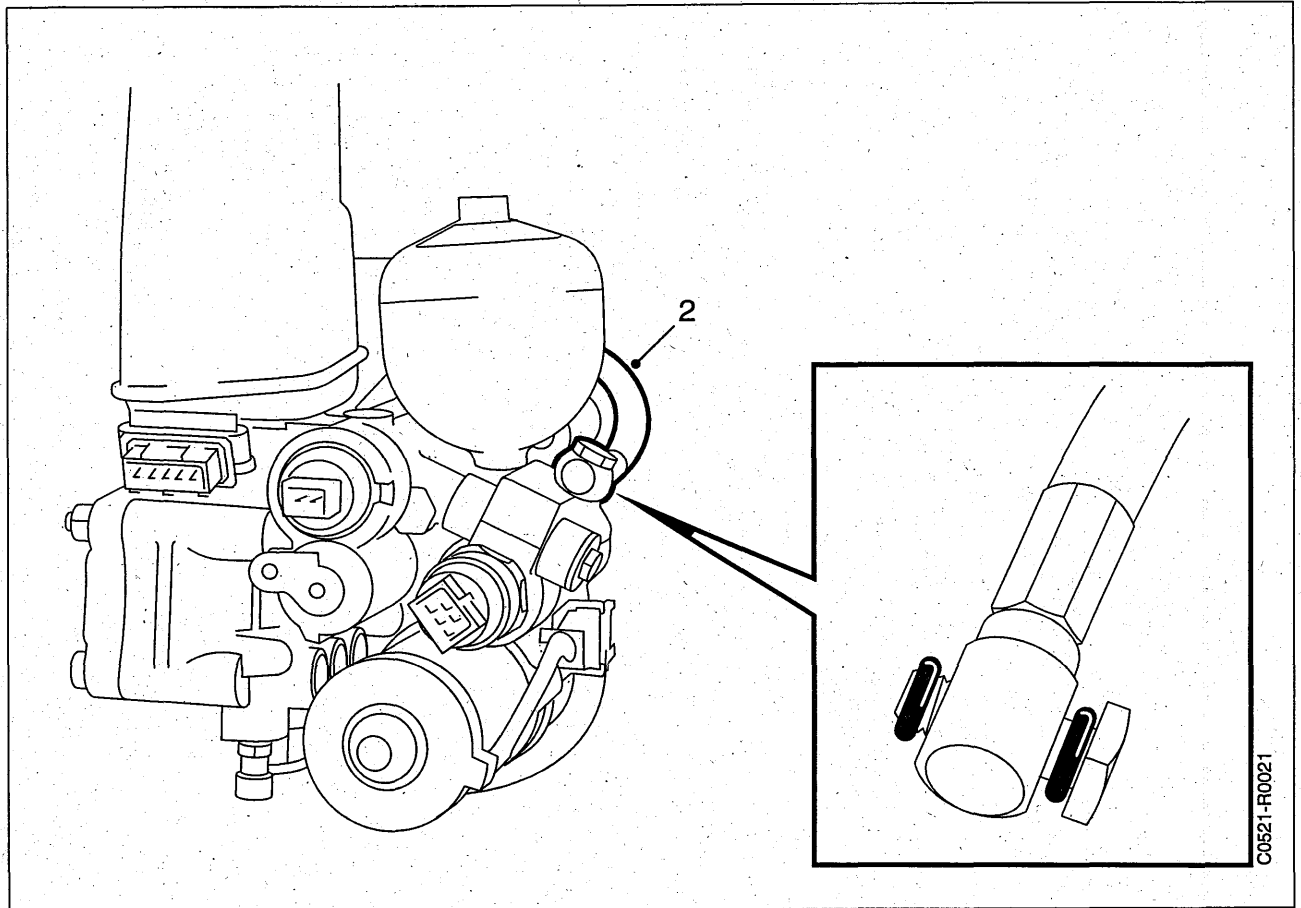
Pressure line (only cars with ABS MK II)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



Note

When changing the pressure line, it is advisable to remove the pressure accumulator before the hydraulic unit is removed from the car. Plug the connections on the pump body.

To remove

- 1 Remove the hydraulic unit. See Service Manual 5:2 "ABS braking system" M1987-.
- 2 Remove the pressure hose.
Plug both pressure hose connections on the hydraulic unit.

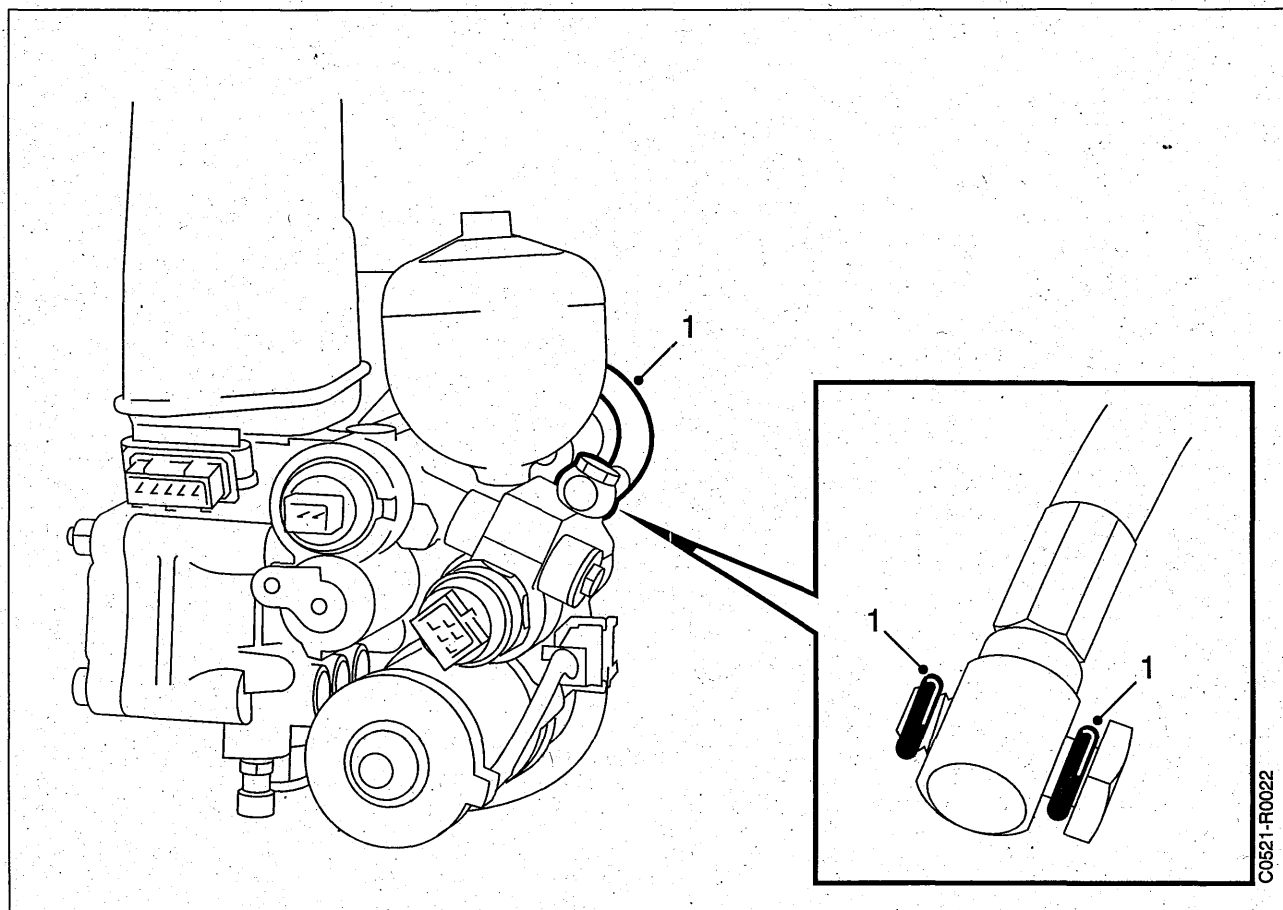
Pressure line (only cars with ABS MK II) (contd.)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



To fit

1 Fit new O-rings (2 on each banjo fitting) on the connecting nipples and fit the hose.
Fit the pressure accumulator after fitting the hydraulic unit in the car.

Tightening torque: 40 Nm (29.6 lbf ft)

2 Fill up with brake fluid, DOT 4 specification.

3 Bleed the brake system.

See section 529 "Bleeding the brake system".

4 Switch on the ignition and check that the brake and ABS warning lamps go out.

5 Drive the car on test and check that the brake and clutch systems are in perfect working order.

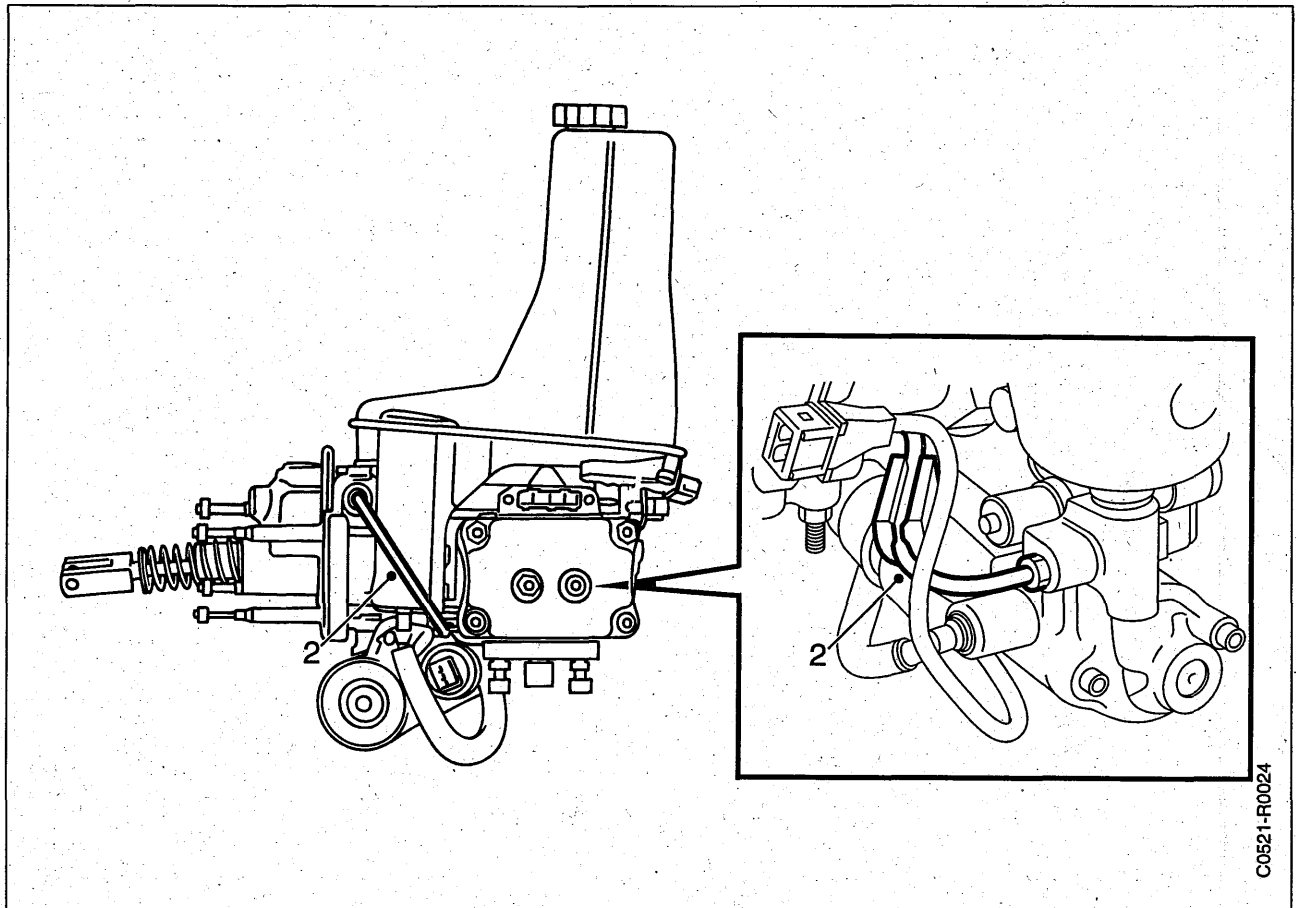
Pressure line (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



Note

When changing the pressure line, it is advisable to remove the pressure accumulator before the hydraulic unit is removed from the car. Plug the connections on the pump body.

To remove

- 1 Remove the hydraulic unit. See Service Manual 5:2 "ABS braking system" M1987-.
- 2 Remove the pressure pipe.
Plug both pipe connections on the hydraulic unit.

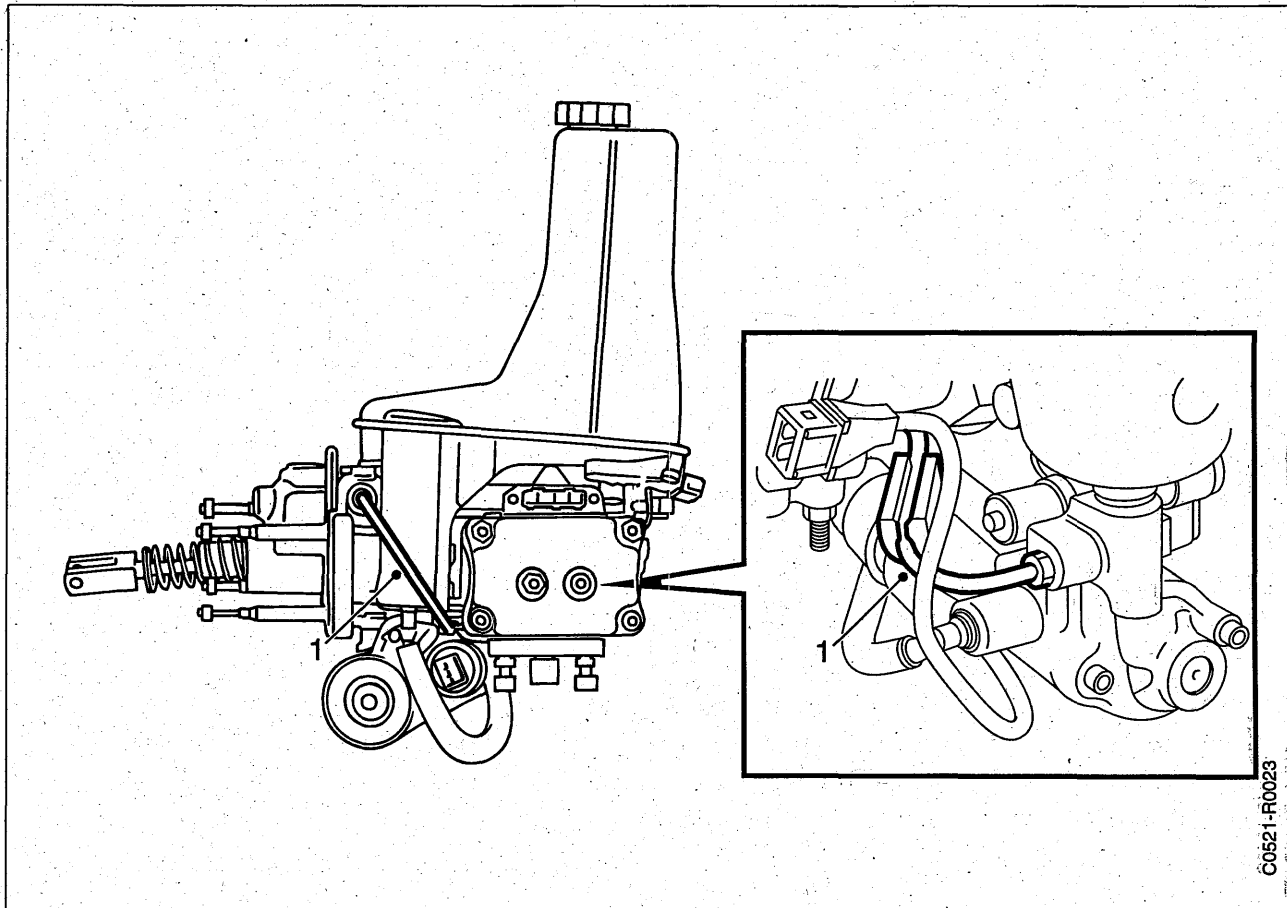
Pressure line (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



C0521-R0023

To fit

- 1 Fit the pressure pipe.
Fit the pressure accumulator after fitting the hydraulic unit in the car.
Tightening torque: 40 Nm (29.6 lbf ft)
- 2 Fill up with brake fluid, DOT 4 specification.
- 3 Bleed the brake system.
See section 529 "Bleeding the brake system".
- 4 Switch on the ignition and check that the brake and ABS warning lamps go out.
- 5 Drive the car on test and check that the brake and clutch systems are in perfect working order.

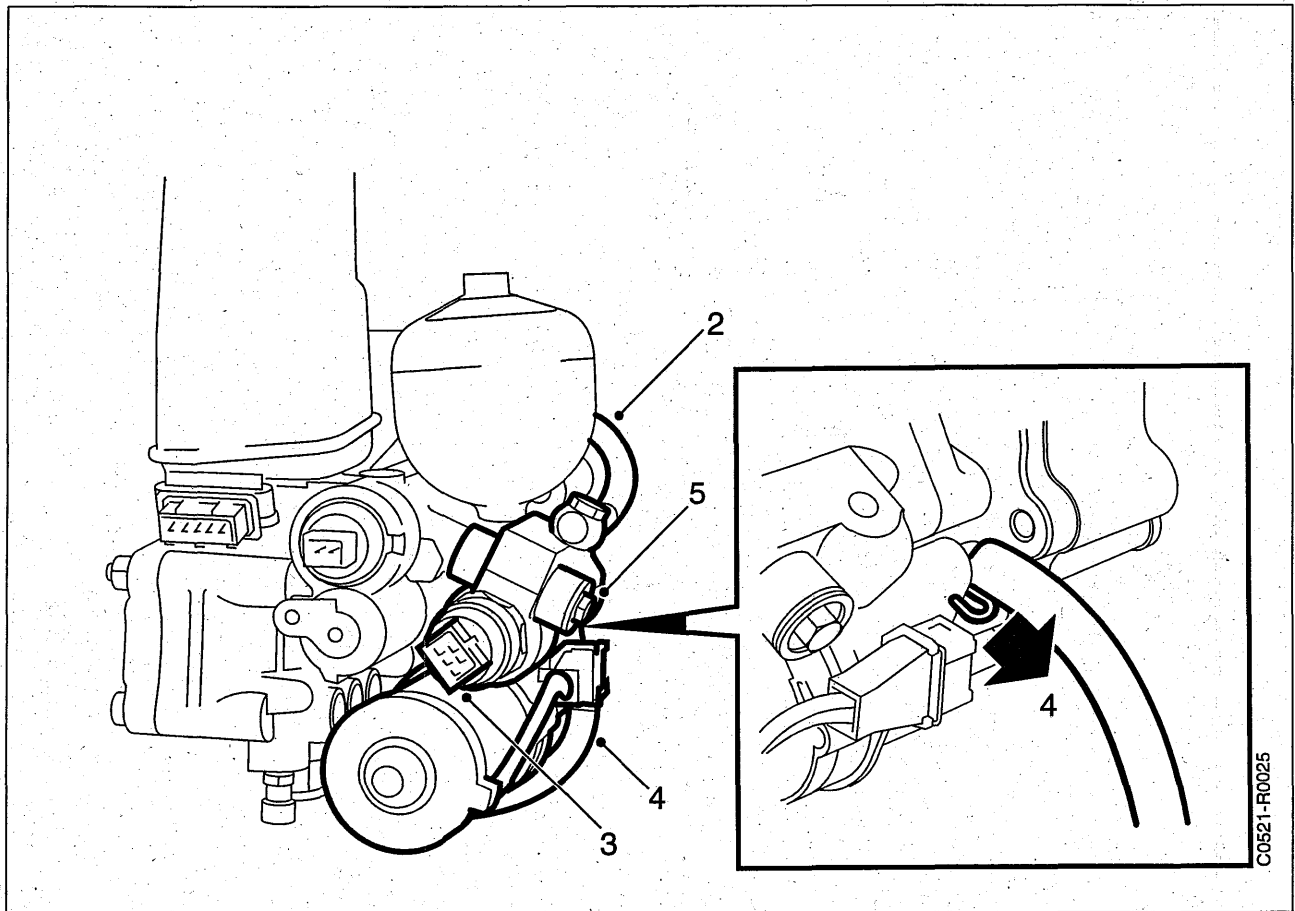
High-pressure pump/electric motor (only cars with ABS MK II)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



Note

When changing the high-pressure pump/electric motor, it is advisable to remove the pressure accumulator before the hydraulic unit is removed from the car. Plug the connections on the pump body.

5 Remove the retaining bolt and lift out the pump unit.

To remove

- 1 Remove the hydraulic unit. See Service Manual 5:2 "ABS braking system" M1987-.
- 2 Remove the high-pressure hose's pump unit connection.
- 3 Remove the pressure switch.
Use special tool (16) 89 96 571.
- 4 Remove the clip securing the supply hose's connecting nipple to the pump unit.

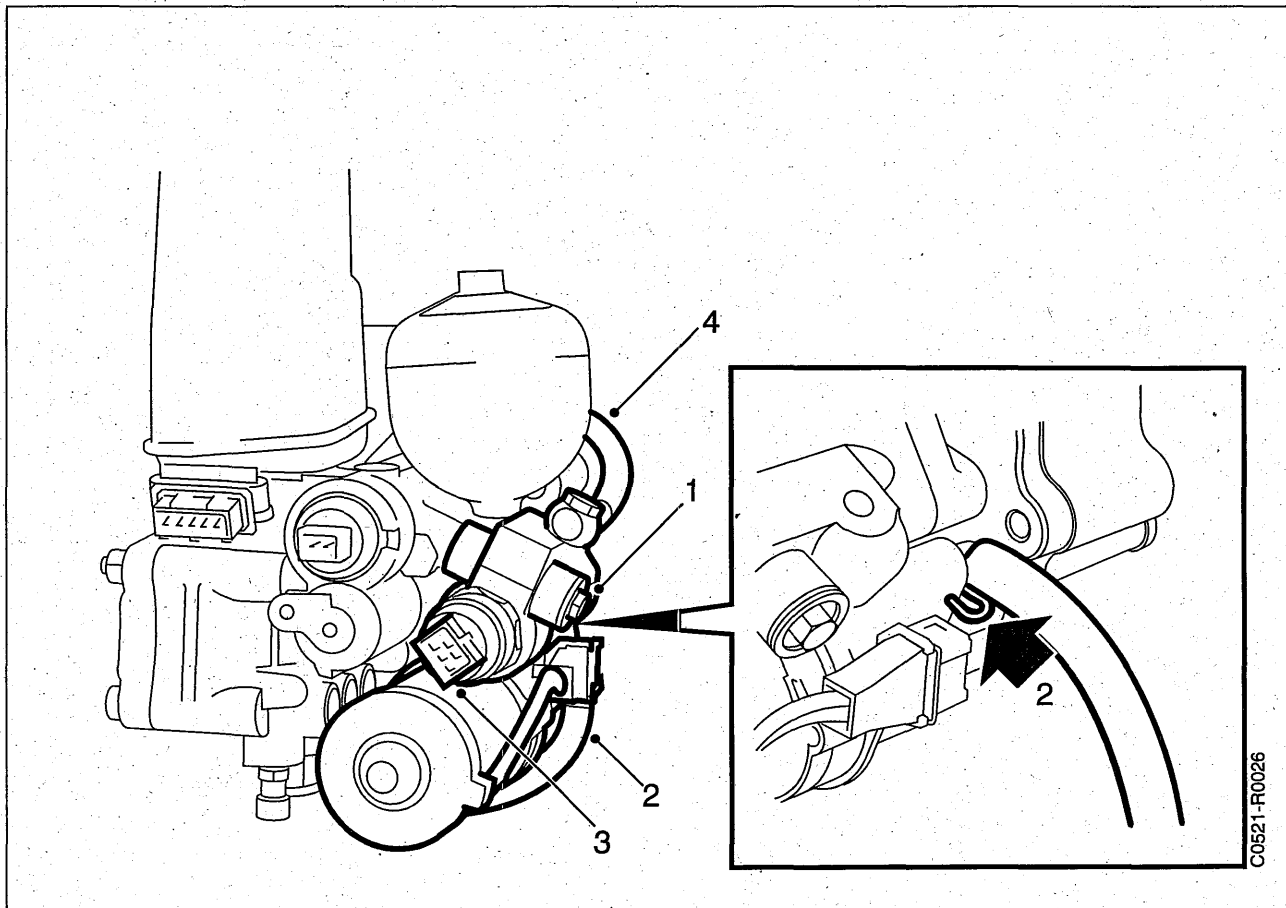
High-pressure pump/electric motor (only cars with ABS MK II) (contd.)

M1989 and earlier cars up to and including chassis numbers:

K1009731

K2004996

K8000276



To fit

- 1 Fit the pump unit and tighten the retaining bolt.
- 2 Fit a new O-ring on the supply hose's connecting nipple. Connect the nipple to the pump unit and refit the retaining clip.
- 3 Fit the pressure switch.
Tightening torque: 23 Nm (17 lbf ft)
- 4 Fit the high-pressure hose.
Tightening torque: 20 Nm (14.8)
Fit the pressure accumulator when the hydraulic unit has been fitted in the car.
Tightening torque: 40 Nm (29.6)
- 5 Fill up with brake fluid, DOT 4 specification.
- 6 Bleed the brake system.
See section 529 "Bleeding the brake system".
- 7 Switch on the ignition and check that the brake and ABS warning lamps go out.

- 8 Drive the car on test to check that the brake system is in perfect working order.

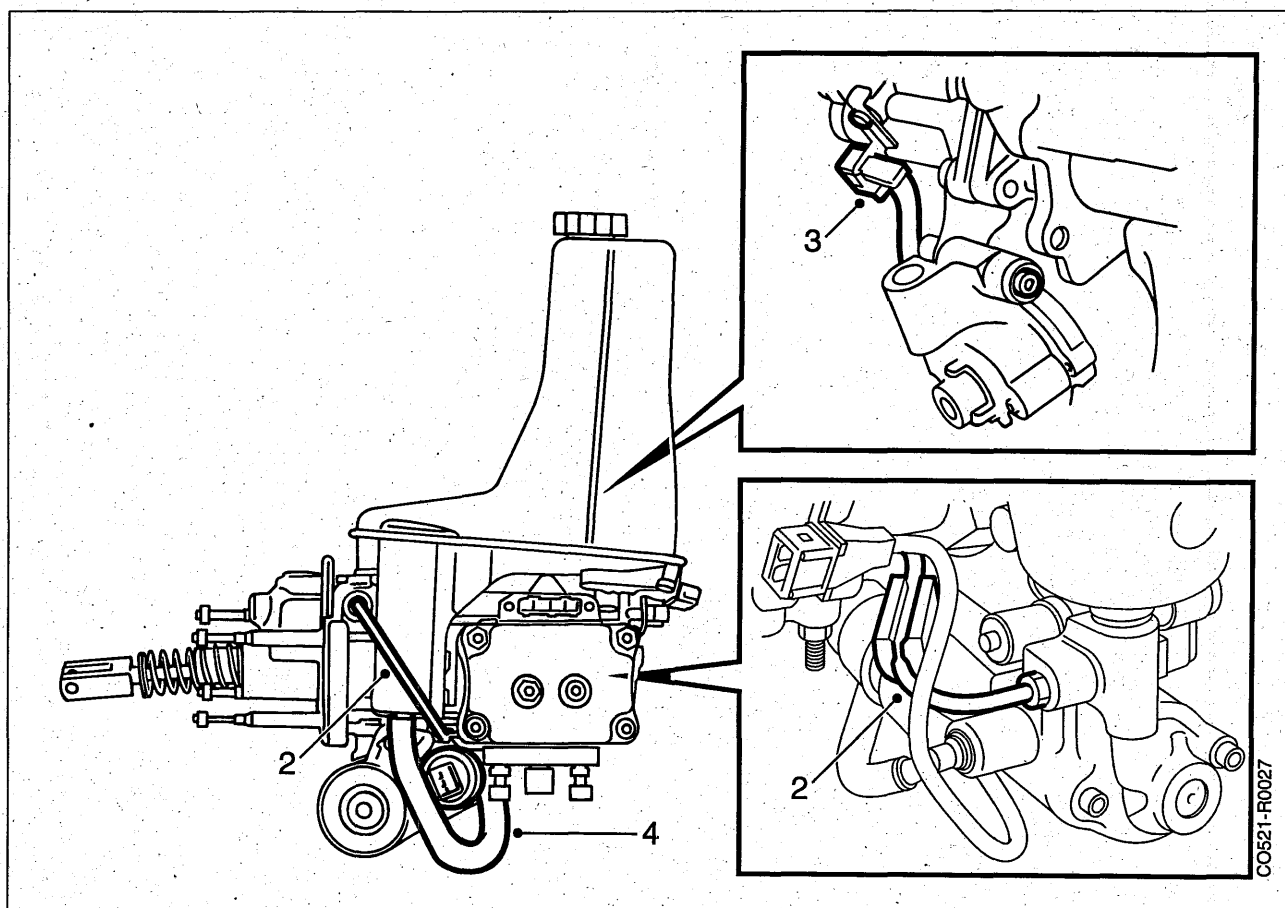
High-pressure pump/electric motor (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



Note

When changing the high-pressure pump/electric motor, it is advisable to remove the pressure accumulator before the hydraulic unit is removed from the car. Plug the connections on the pump body.

To remove

- 1 Remove the hydraulic unit. See Service Manual 5:2 "ABS braking system" M1987-.
- 2 Disconnect the pressure pipe from the pump body.
Plug the pressure pipe's connection.
- 3 Unplug the connector from the terminal block by pressing the catch aside.
- 4 Remove the supply hose from the pump body.

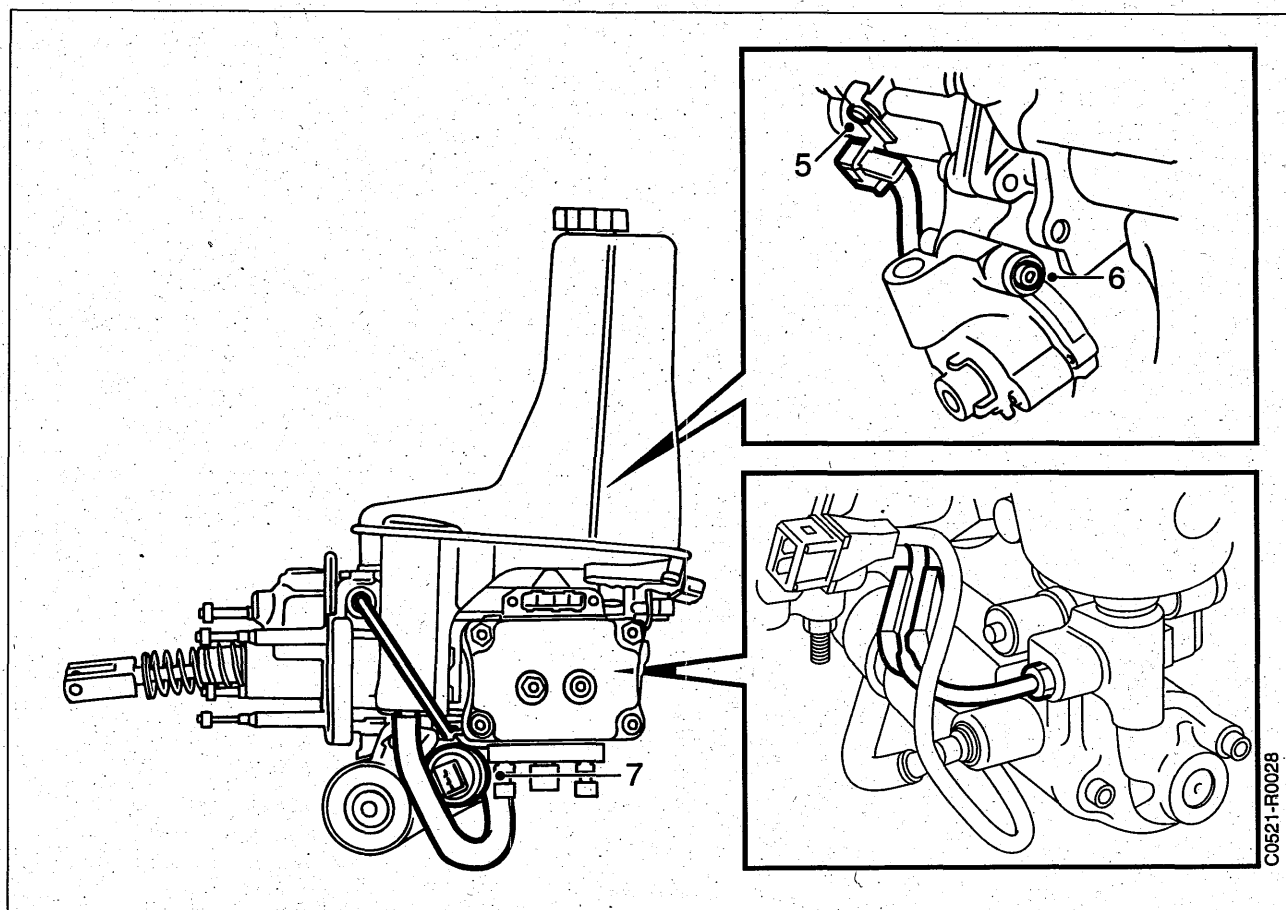
High-pressure pump/electric motor (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



5 Unscrew the high-pressure pump/electric motor's retaining bolt in the front mounting point.

Important

Note the order in which the damping sleeves and washer should be fitted.

6 Unhook the high-pressure/electric motor from the rear mounting point.

7 Remove the pressure switch.
Use special tool (16) 89 96 571.

Note

If the pressure switch is tightened down hard, a suitable counterstay can be placed between the pump body and the hydraulic unit.

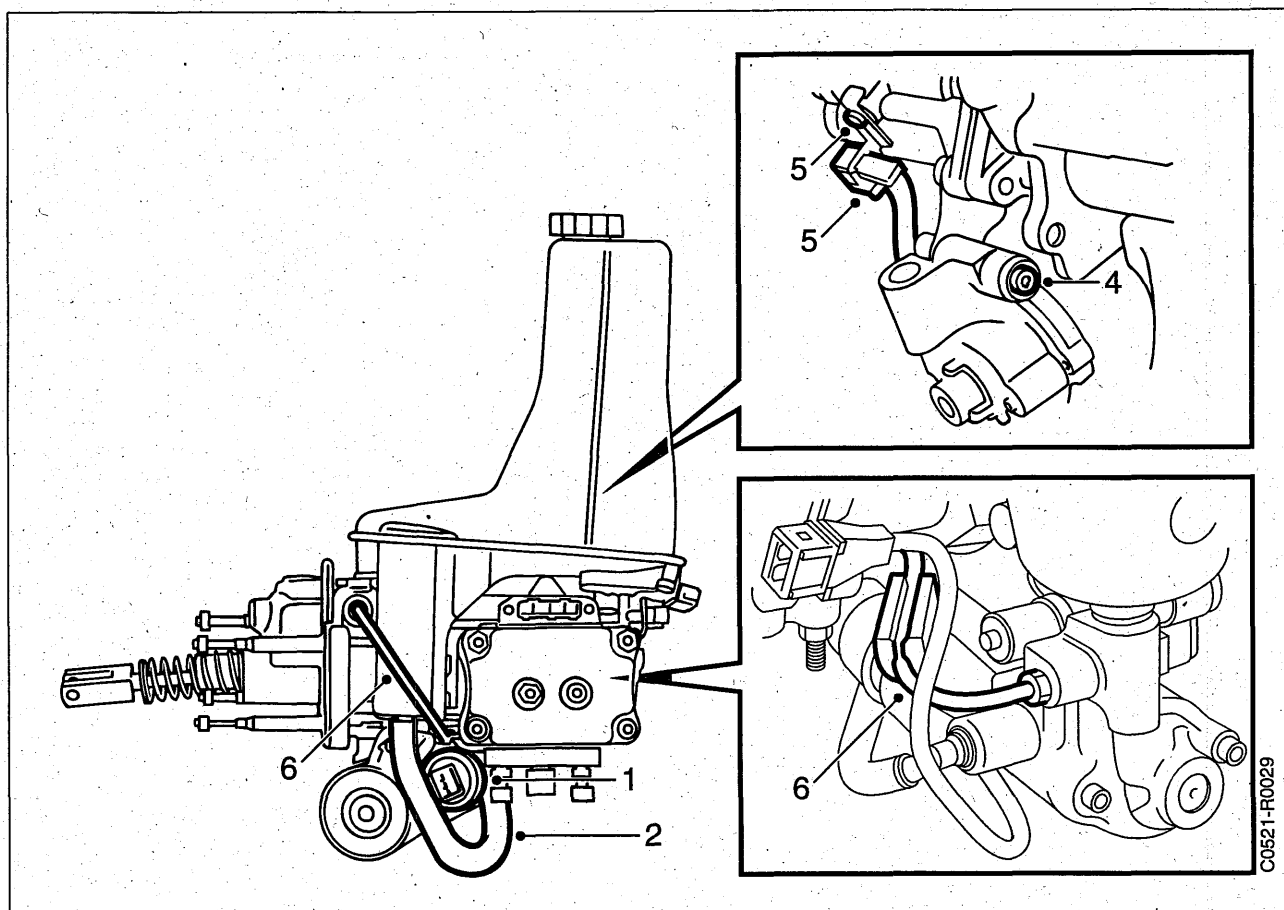
High-pressure pump/electric motor (only cars with ABS MK II) (contd.)

M1989 and later cars from the following chassis numbers, inclusive:

K1009732

K2004997

K8000277



To fit

1 Fit a new O-ring and screw in the pressure switch.

Tightening torque: 23 (17 lbf ft)

2 Connect the supply hose to the pump body.

3 Fit the high-pressure pump/electric motor to the rear mounting point.

4 Fit the damping sleeves and washer.

Tighten the high-pressure pump/electric motor's retaining bolt.

5 Plug the connector into the terminal block.

6 Connect the pressure pipe to the pump body. Fit the pressure accumulator after fitting the hydraulic unit in the car.

Tightening torque: 40 Nm (29.6 lbf ft)

7 Fill up with brake fluid, DOT 4 specification.

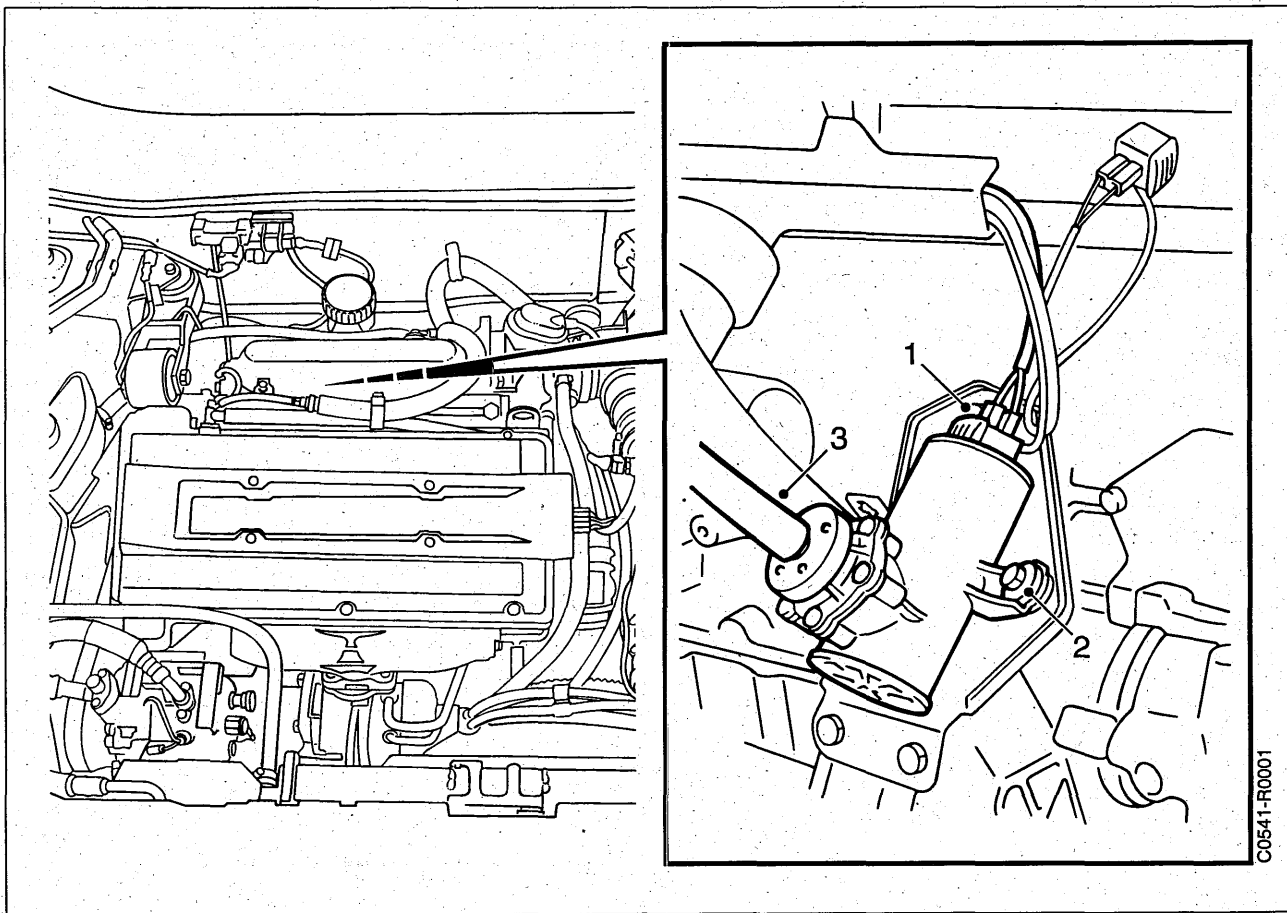
8 Bleed the brake system.

See section 529 "Bleeding the brake system".

9 Switch on the ignition and check that the brake and ABS warning lamps go out.

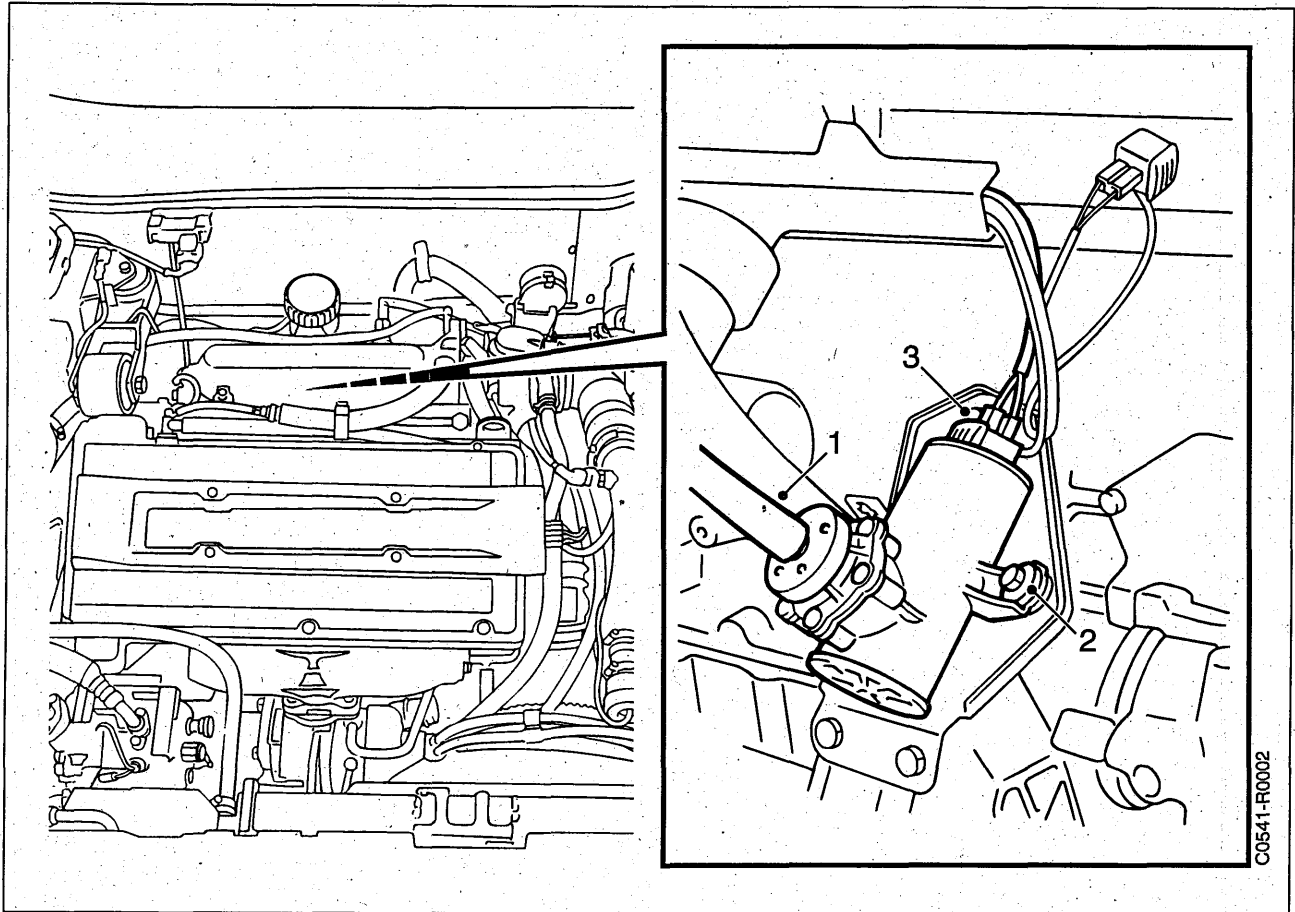
10 Drive the car on test and check that the brake and clutch systems are in perfect working order.

Vacuum pump (2.0 LPT aut. M1996- only)



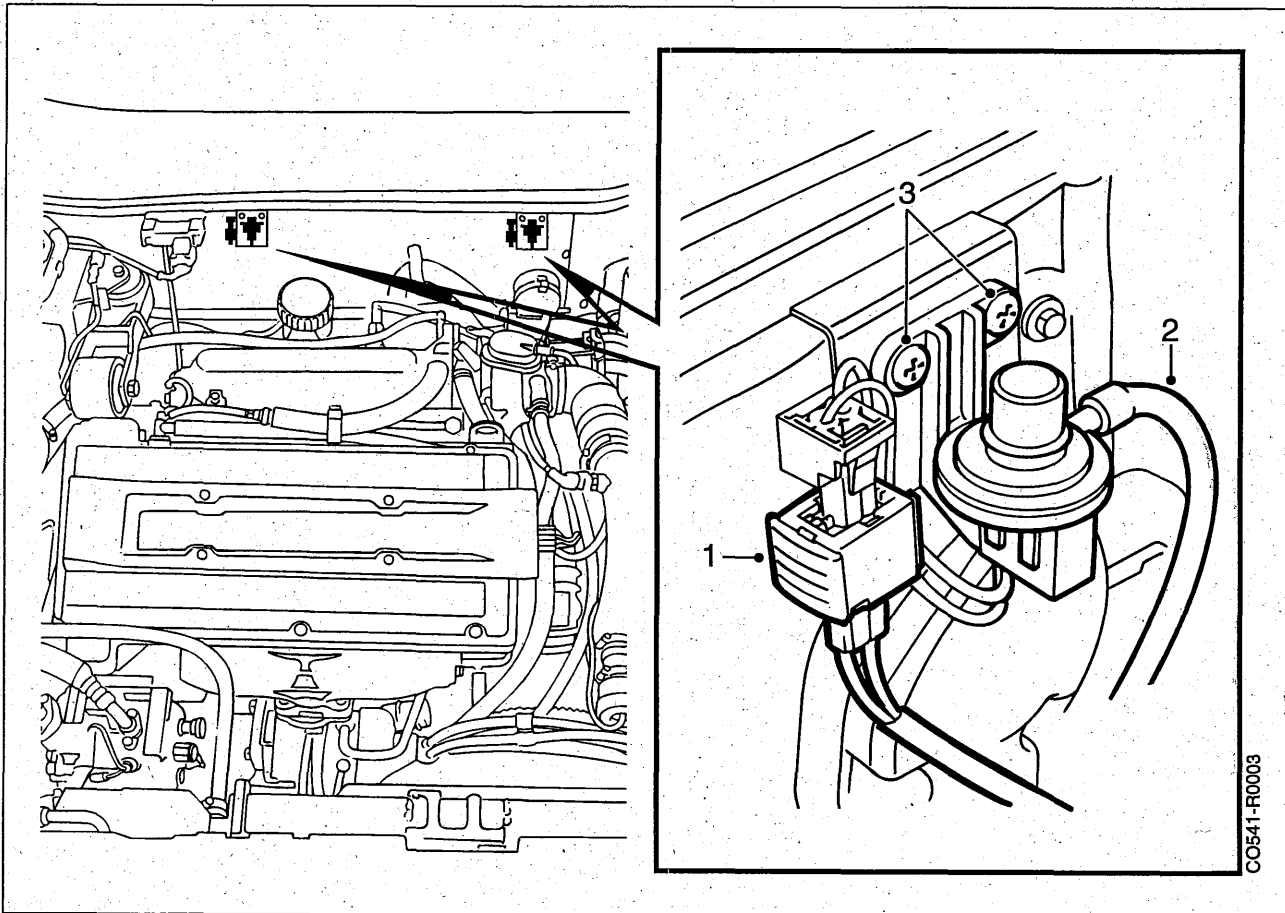
To remove

- 1 Unplug the vacuum pump's connector.
- 2 Undo the three bolts securing the pump to the bracket.
- 3 Lift up the vacuum pump and remove the hose.
Use a pair of pliers to undo the hose clip.

Vacuum pump (2.0 LPT aut. M1996- only)**To fit**

- 1 Connect the hose to the pump and fit the hose clip, using a pair of pliers.
- 2 Bolt the vacuum pump to the bracket in the following order:
 - 1) Right-hand bolt
 - 2) Bottom left-hand bolt
 - 3) Upper bolt.
- 3 Plug in the connector.

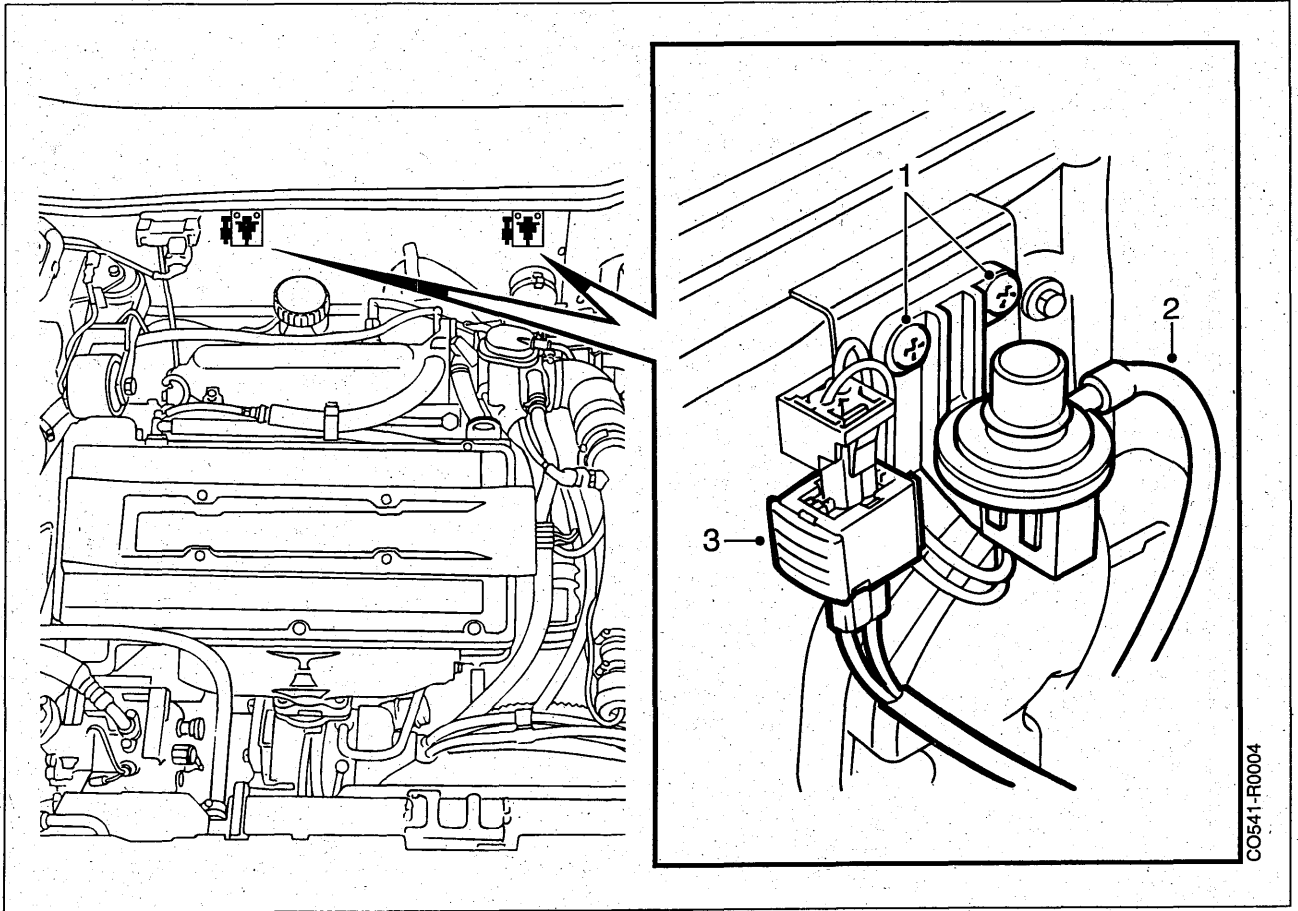
Pressure switch



To remove

- 1 Unplug the connector.
- 2 Disconnect the hose.
- 3 Lift the connector away from the bracket and undo the two pressure switch retaining screws.

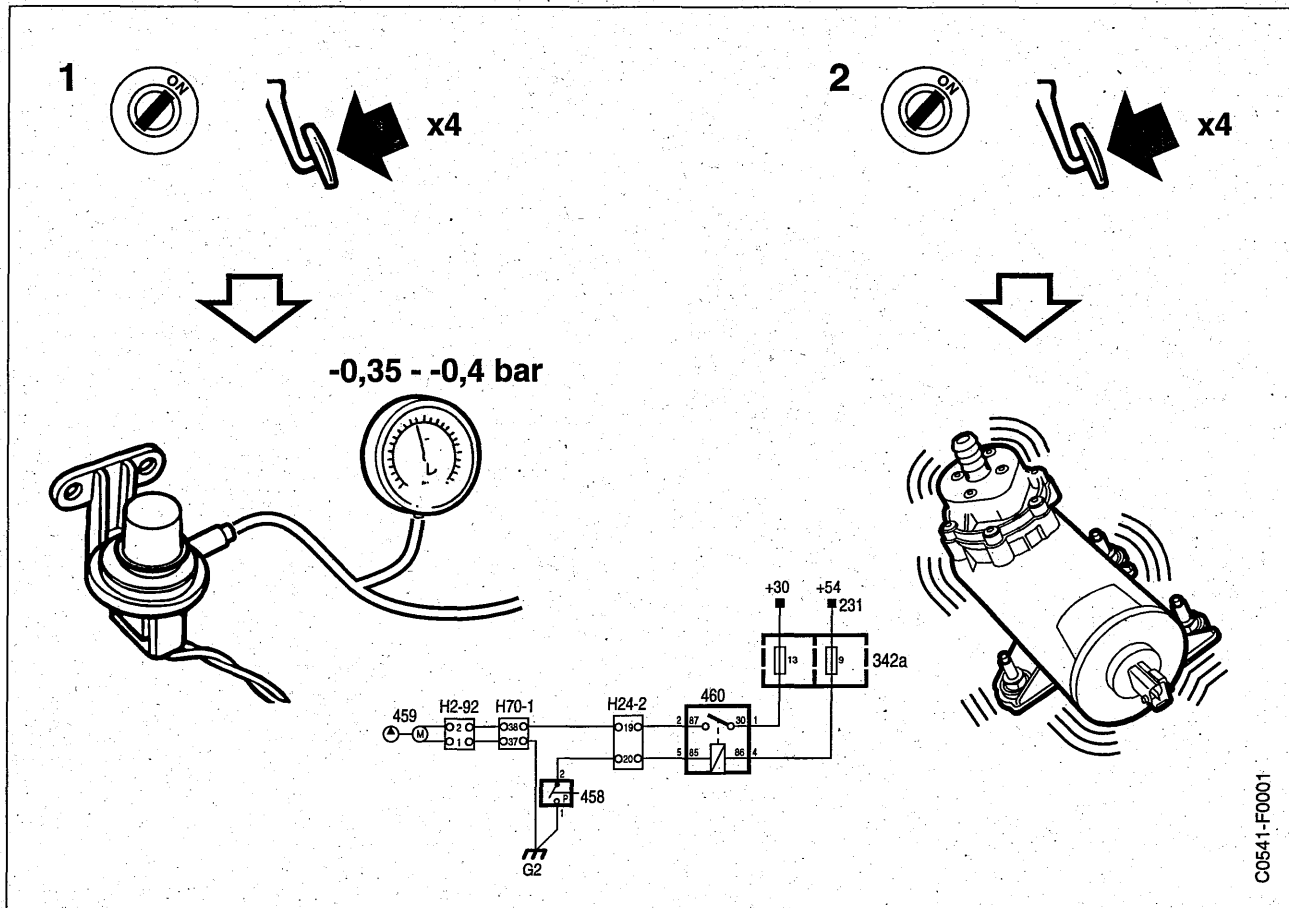
Pressure switch (contd.)



To fit

- 1 Screw the pressure switch in place and press the connector half into its holder.
- 2 Connect the hose.
- 3 Plug in the connector.

Fault diagnosis, vacuum pump (only 2.0 LPT aut. M1996-)



Fault symptom

Sluggish brakes, particularly when idling and in stop-and-go traffic.

Diagnostic procedure

- 1 Check the performance of the vacuum pump by connecting a boost pressure meter, part No. (16) 83 93 514, with a branch outlet for the hose to the vacuum pump's pressure switch. With the ignition switched on and the engine not running, pump the brake pedal 3-4 times. Note the meter reading.

Does the meter indicate a vacuum of between 0.35 and 0.4 bar?

YES The vacuum system is OK.

NO Go to point 2.

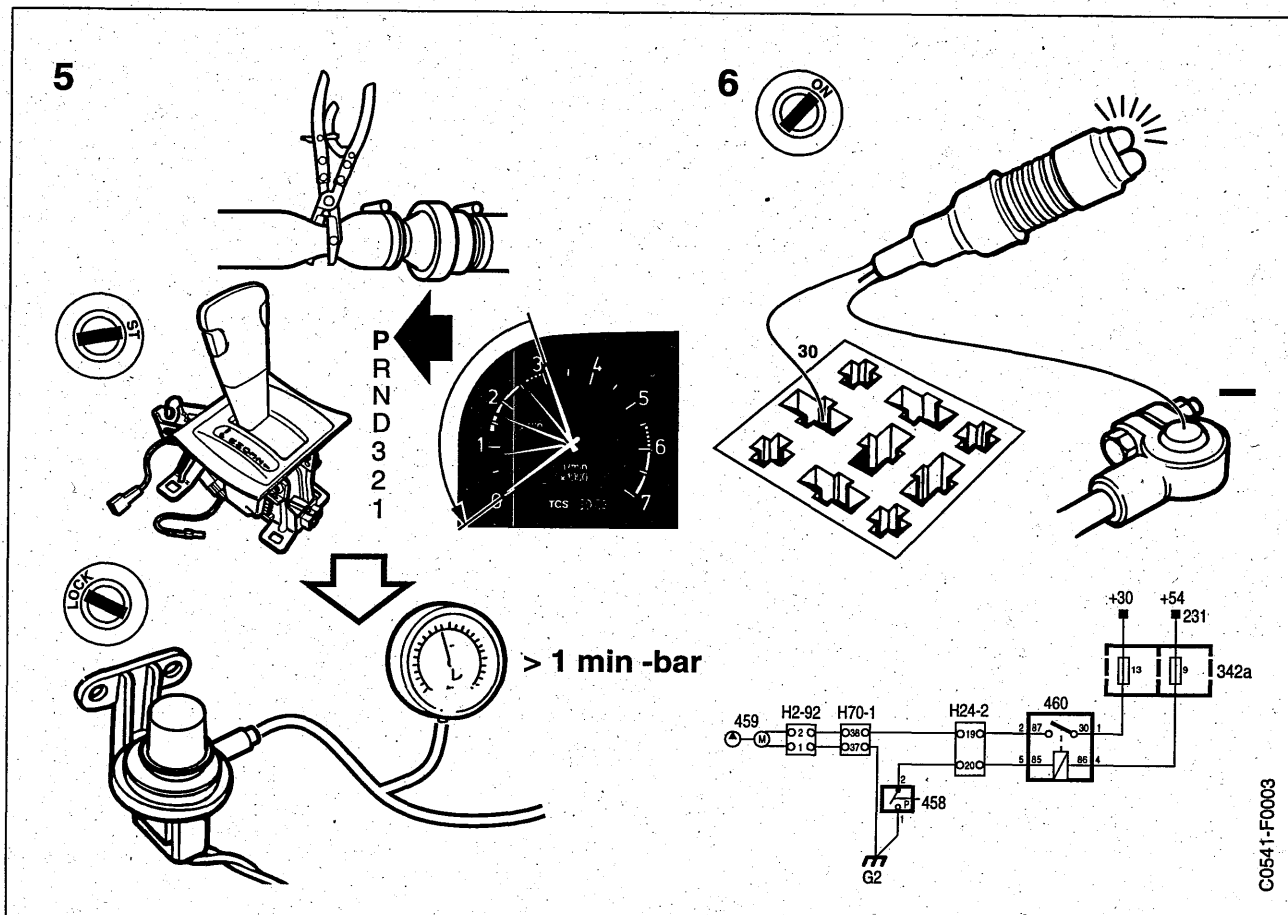
- 2 With the ignition switched on and the engine not running, pump the brake pedal 3-4 times.

Can you hear the pump working?

YES Go to point 3.

NO Go to point 6.

Fault diagnosis, vacuum pump (only 2.0 LPT aut. M1996-) (contd.)



5 Pinch off the hose between the vacuum pump and non-return valve, using a pair of hose clamp pliers, part No. (16) 30 07 739. Repeat the test described in point 3.

6 With the ignition switched on, remove the vacuum pump relay from the relay board. Connect the test lamp to pin 30 of the relay board and a good ground.

With the vacuum pump's hose connection blocked, is a vacuum maintained in the pipe system?

- YES** The non-return valve nearest the vacuum pump is defective.
- NO** Remove the pipe connection from the brake servo and plug it. Repeat the test described in point 3.

With the brake servo's hose connection blocked, is a vacuum maintained in the pipe system?

- YES** The brake servo is defective.
- NO** The non-return valve between the intake manifold and T-piece on the vacuum pipe is faulty.

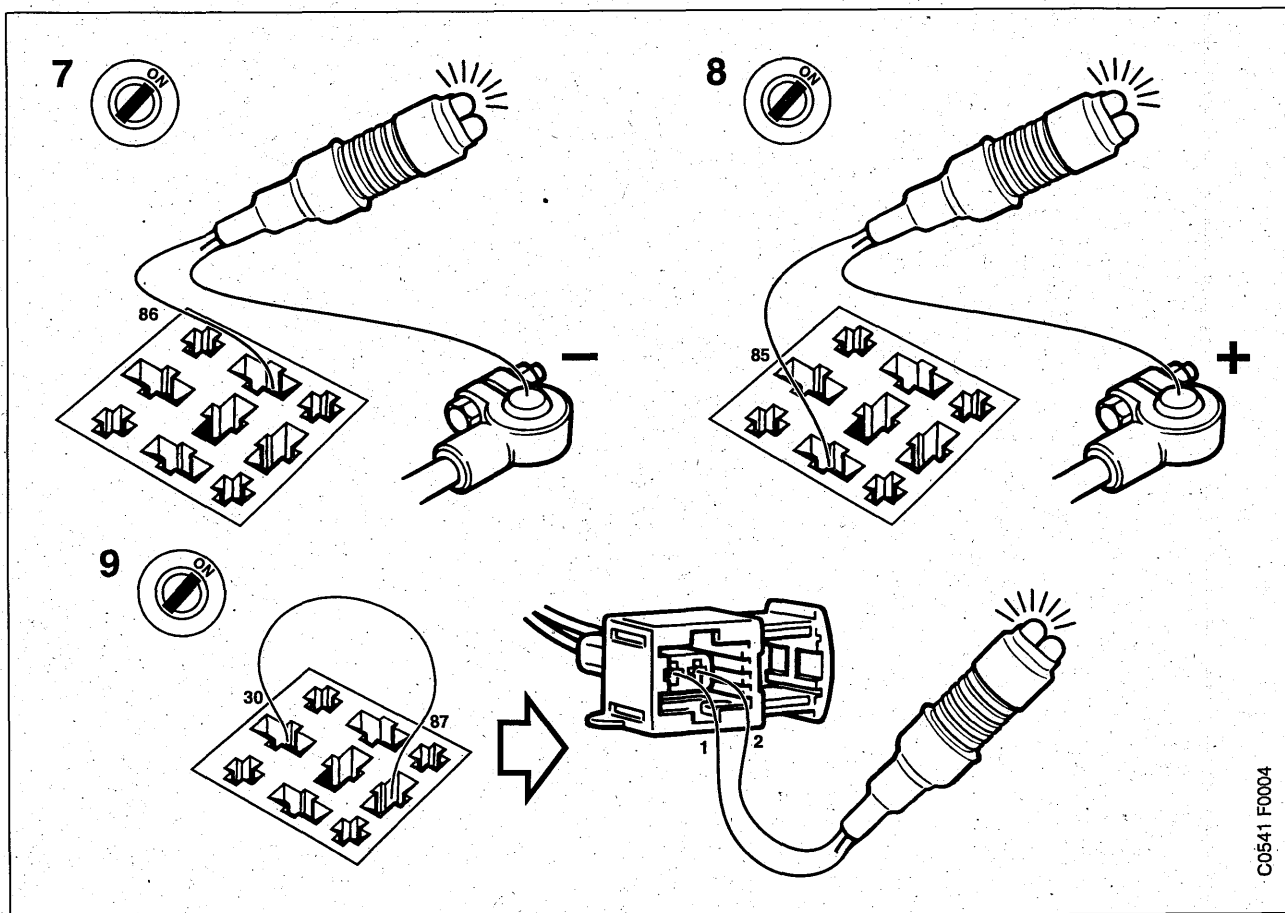
Did the lamp light up?

- NO** Restore the supply of current (+30 circuit) to the relay.
- YES** Connect a jumper lead between pins 30 and 87B of the relay board.

Did the vacuum pump start?

- YES** Go to point 7.
- NO** Go to point 9.

Fault diagnosis, vacuum pump (only 2.0 LPT aut. M1996-) (contd.)



7 With the ignition switched on and the pressure switch hose removed, connect the test lamp to a good ground and pin 86.

Did the lamp light up?

- YES** Go to point 8.
- NO** Restore the supply of positive current to the relay coil.

8 With the ignition switched on, the engine not running and the pressure valve's hose removed, connect the test lamp to battery positive and pin 85.

Did the lamp light up?

- YES** The relay is defective.
- NO** Restore the relay's ground connection via the pressure switch, which should be closed.

9 Connect the test lamp to pins 1 and 2 of the vacuum motor's connector in the car's wiring harness.

Connect a jumper lead between pins 30 and 87 of the relay board.

Did the lamp light up?

- YES** The vacuum pump is defective.
- NO** Connect the test lamp to pin 2 of the car's connector and ground.

Did the lamp light up?

- YES** Restore the vacuum motor's ground connection.
- NO** Rectify the wiring between pin 87 of the relay and pin 2 of the connector.

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List of components, vacuum pump

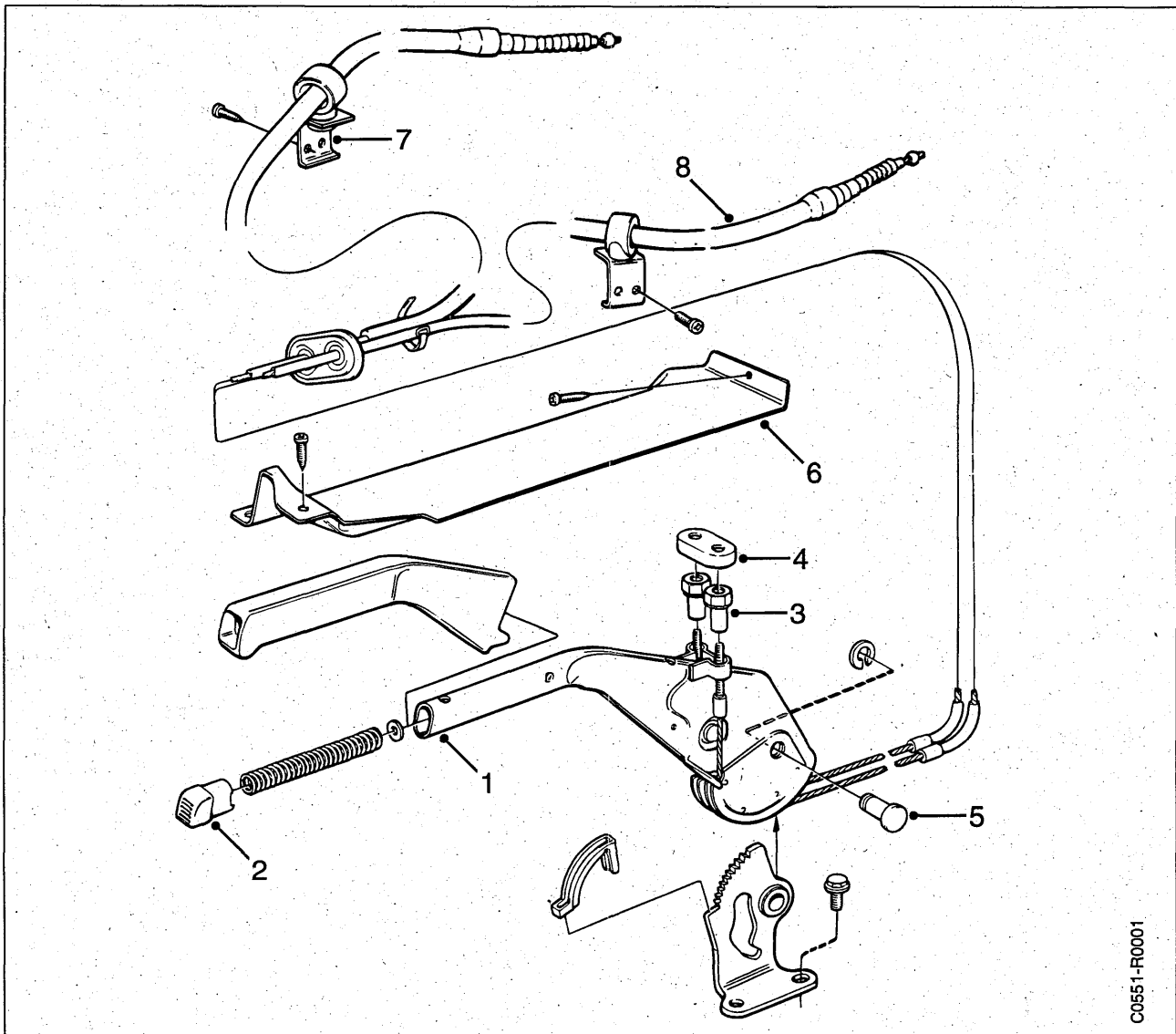
1	Battery.
75	Distribution block, battery positive.
231	Distribution terminal (+54 circuit).
342a	Main fuse board, engine bay.
458	Pressure switch, vacuum, on left-hand side of bulkhead partition.
459	Vacuum pump, below starter motor.
460	Relay, vacuum pump. On relay board in engine bay.
H2-92	2-pin connector, vacuum pump.
H10-15	10-pin connector, behind left-hand headlamp.
H24-2	24-pin connector, behind left-hand headlamp.
H70-1	70-pin connector. In engine bay behind the bulkhead partition.
J116	+30 circuit, in front main fuse box.
G2	Grounding point, battery tray.
G25	Grounding point, gearbox.

Handbrake system

Handbrake cables 137

Handbrake adjustment 142

Handbrake cables

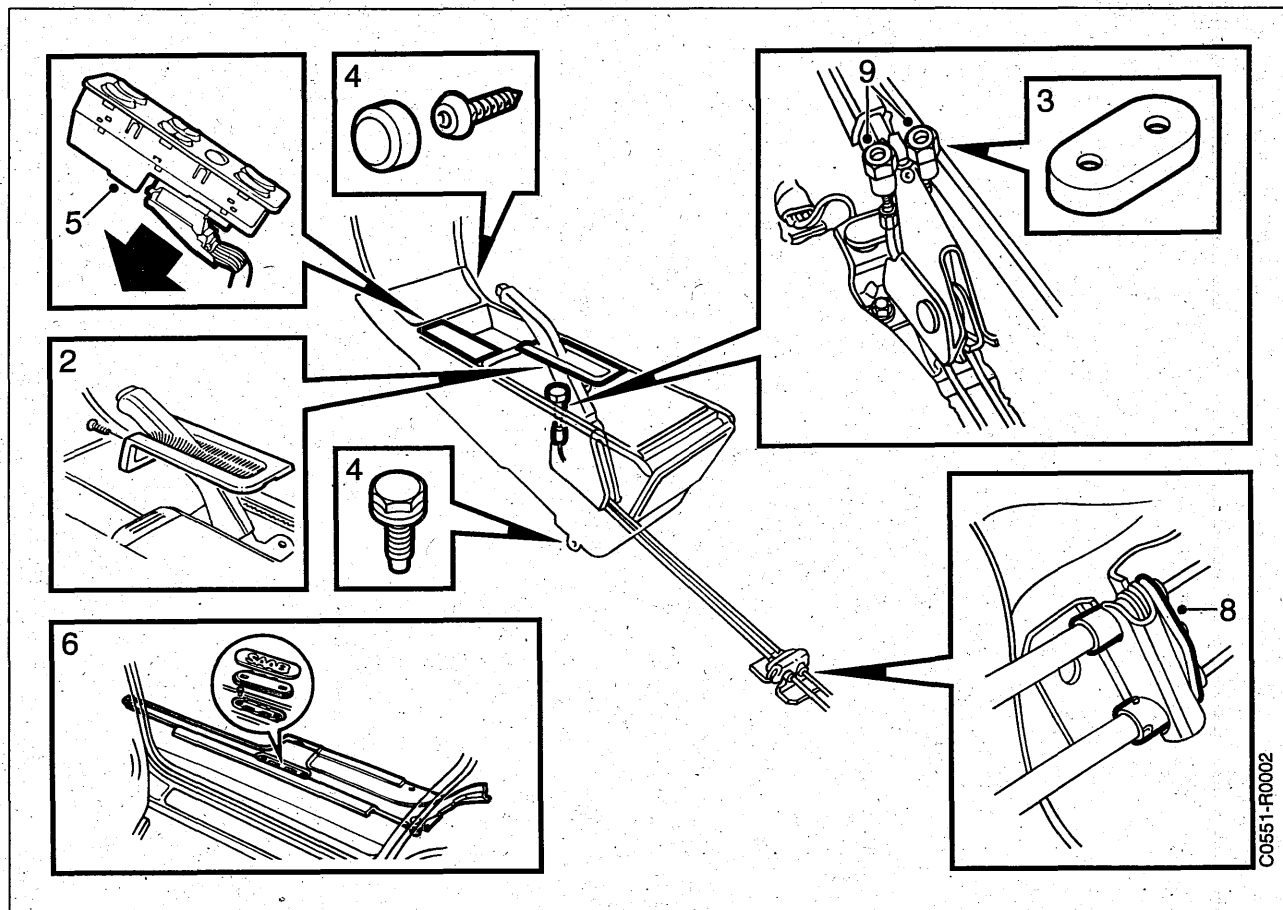


Handbrake

- 1 Handbrake lever
- 2 Release button
- 3 Adjusting nut
- 4 Locking plate
- 5 Pivot pin
- 6 Cover panel
- 7 Bracket
- 8 Cable

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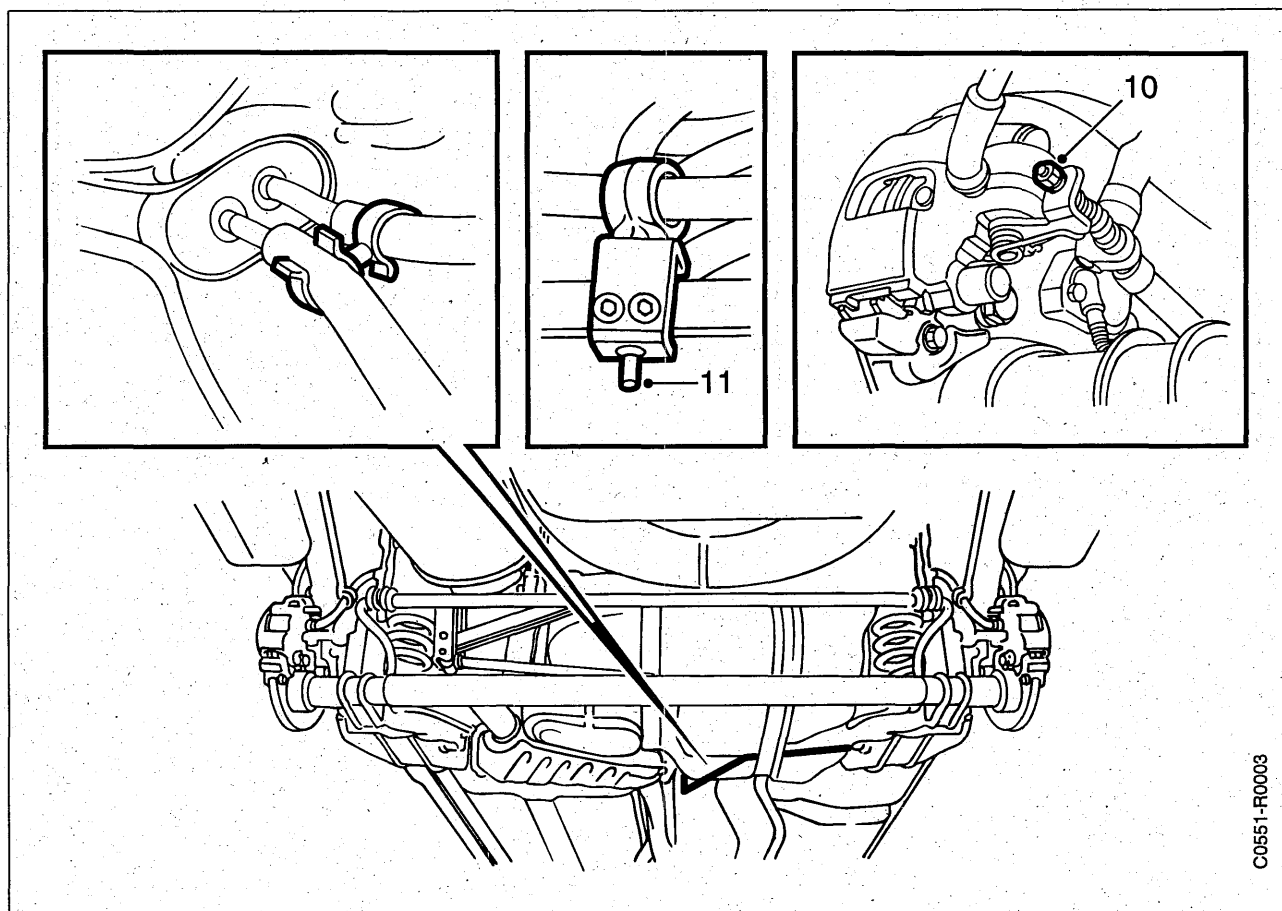
Handbrake cables (contd.)



To remove

- 1 Remove the front passenger seat.
- 2 Remove the brush seal from the handbrake lever console.
- 3 Remove the locking plate from the adjusting nuts.
- 4 Remove the rear section of the centre console by undoing the two screws at the rear and one on each side at the front. Remove the ring and slide the gaiter over the gear lever. Remove the selector lever on cars with automatic transmission.
- 5 Unplug the connector from the control panel for the electric window lifts.
- 6 Remove the sill scuff plates and fold back the carpet.
- 7 Remove the three screws securing the cover panel over the cables.
- 8 Remove the plastic clip.
- 9 Unscrew the adjusting nuts from the ends of the cables at the handbrake lever.

Handbrake cables (contd.)

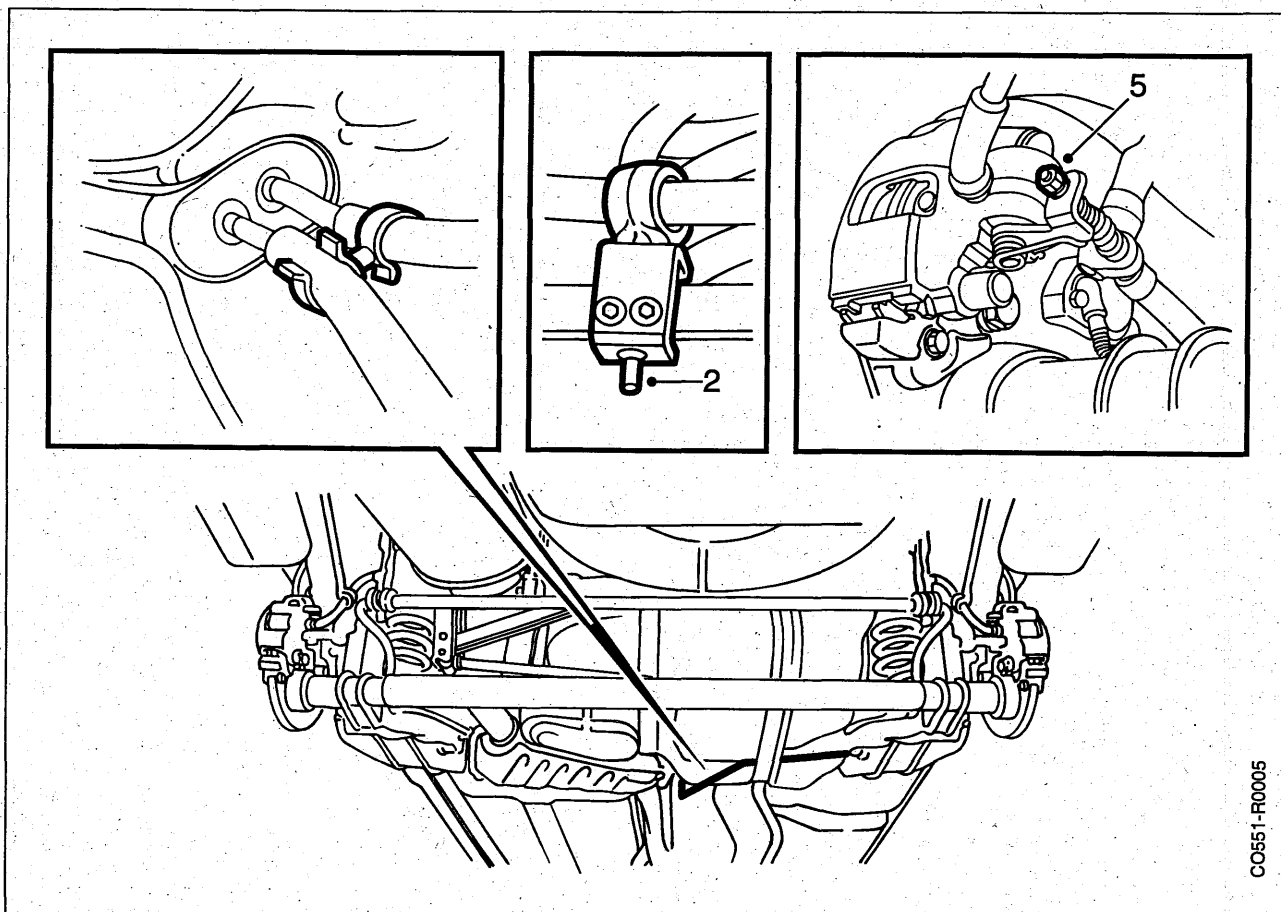


10 Unhook the cable from the lever on the brake unit (caliper). Remove the gaiter and withdraw the cable.

11 Remove the bracket from the spring link.

12 Withdraw the cable.

Handbrake cables (contd.)



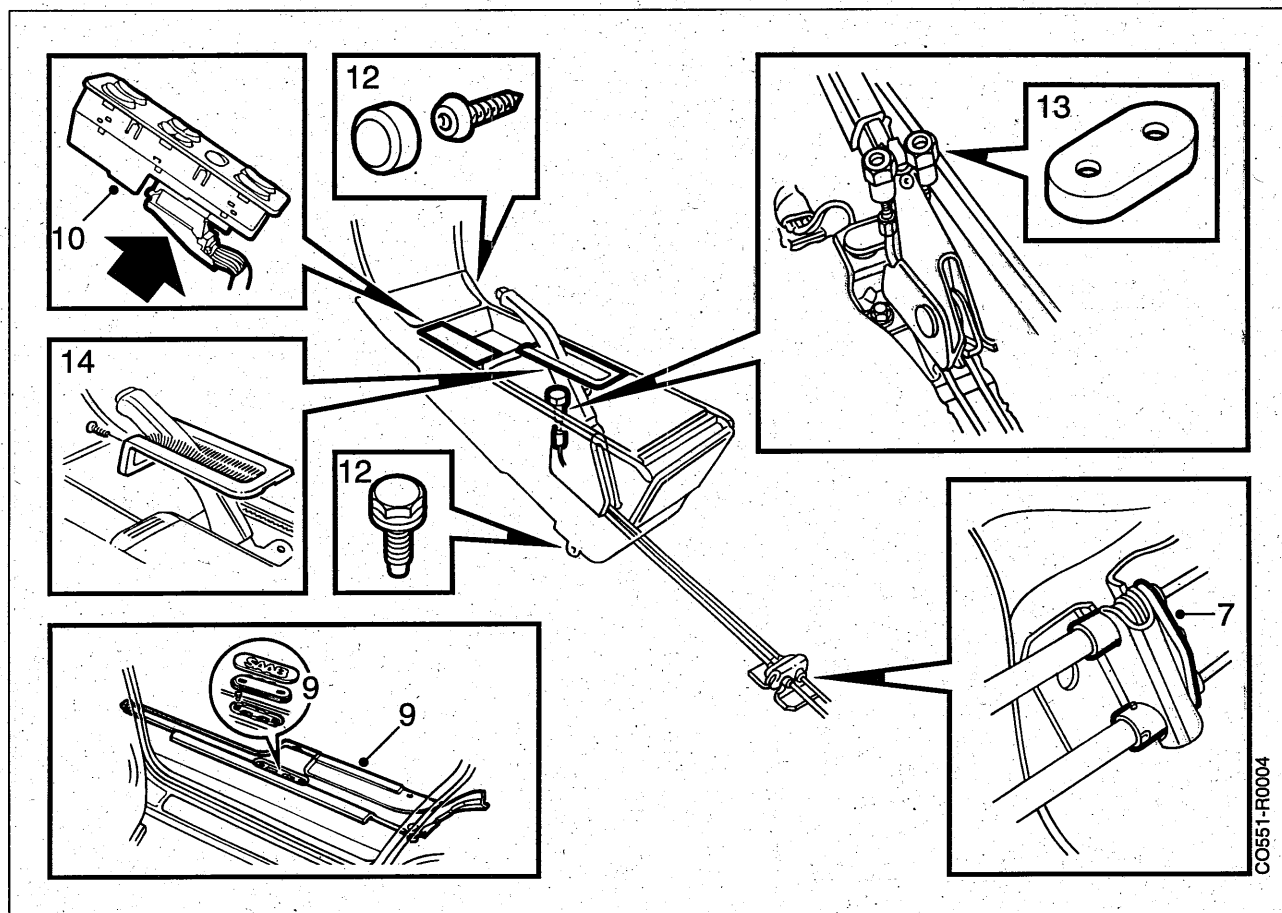
To fit

Important

On model year 1988 and later cars the cable is run differently. This makes it necessary to lower the fuel tank slightly.

- 1 Feed the new cable through the grommet in the body.
- 2 Mount the bracket on the spring link.
- 3 Run the cable to the handbrake lever. Pull up the threaded end and fit the adjusting nut.
- 4 Pack the gaiter with grease and slide it onto the cable.
- 5 Hook the end of the cable onto the lever and apply the handbrake to tension the cable.

Handbrake cables (contd.)



6 Adjust the handbrake.

See under "Handbrake adjustment" in this section.

7 Fit the plastic clip.

8 Fit the cover panel over the cables.

9 Fold back the carpet and fit the sill scuff plates.

10 Plug the connector into the control panel for the electric window lifts.

11 Fit the gear lever gaiter (on cars with automatic transmission, fit the selector lever).

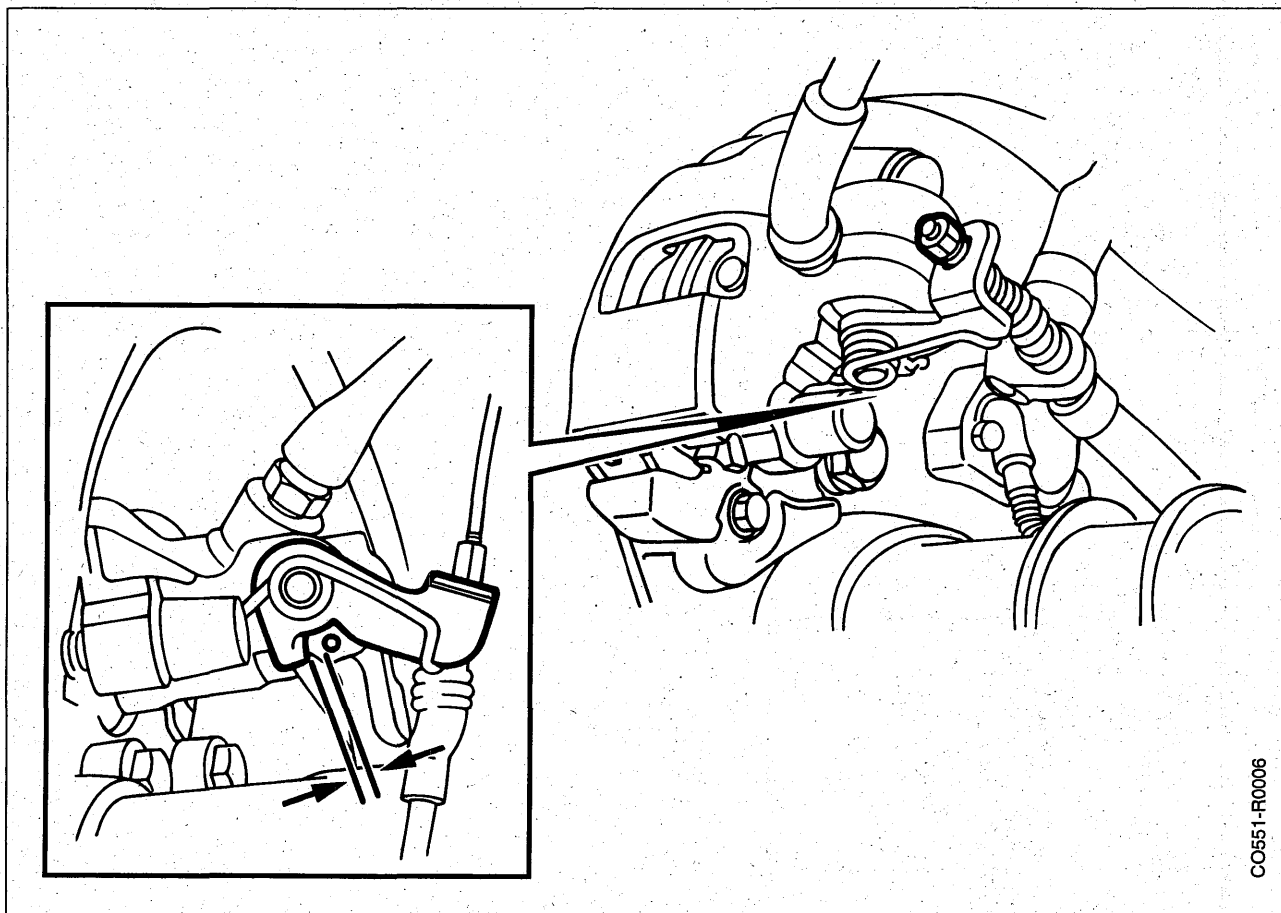
12 Refit the rear section of the centre console.

13 Fit the locking plate over the adjusting nuts.

14 Slide the brush seal over the handbrake lever and into place on the handbrake console.

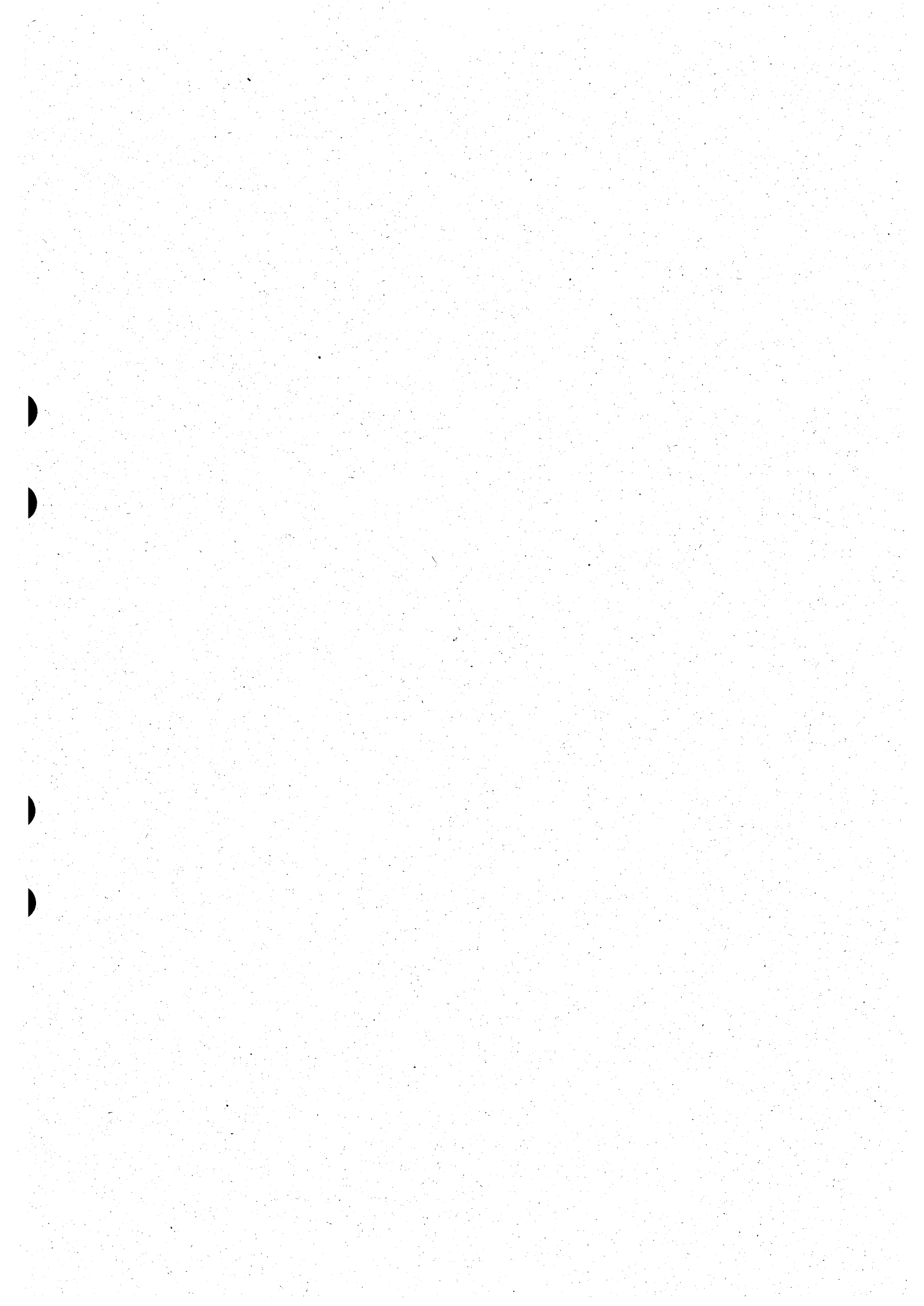
15 Refit the front passenger seat.

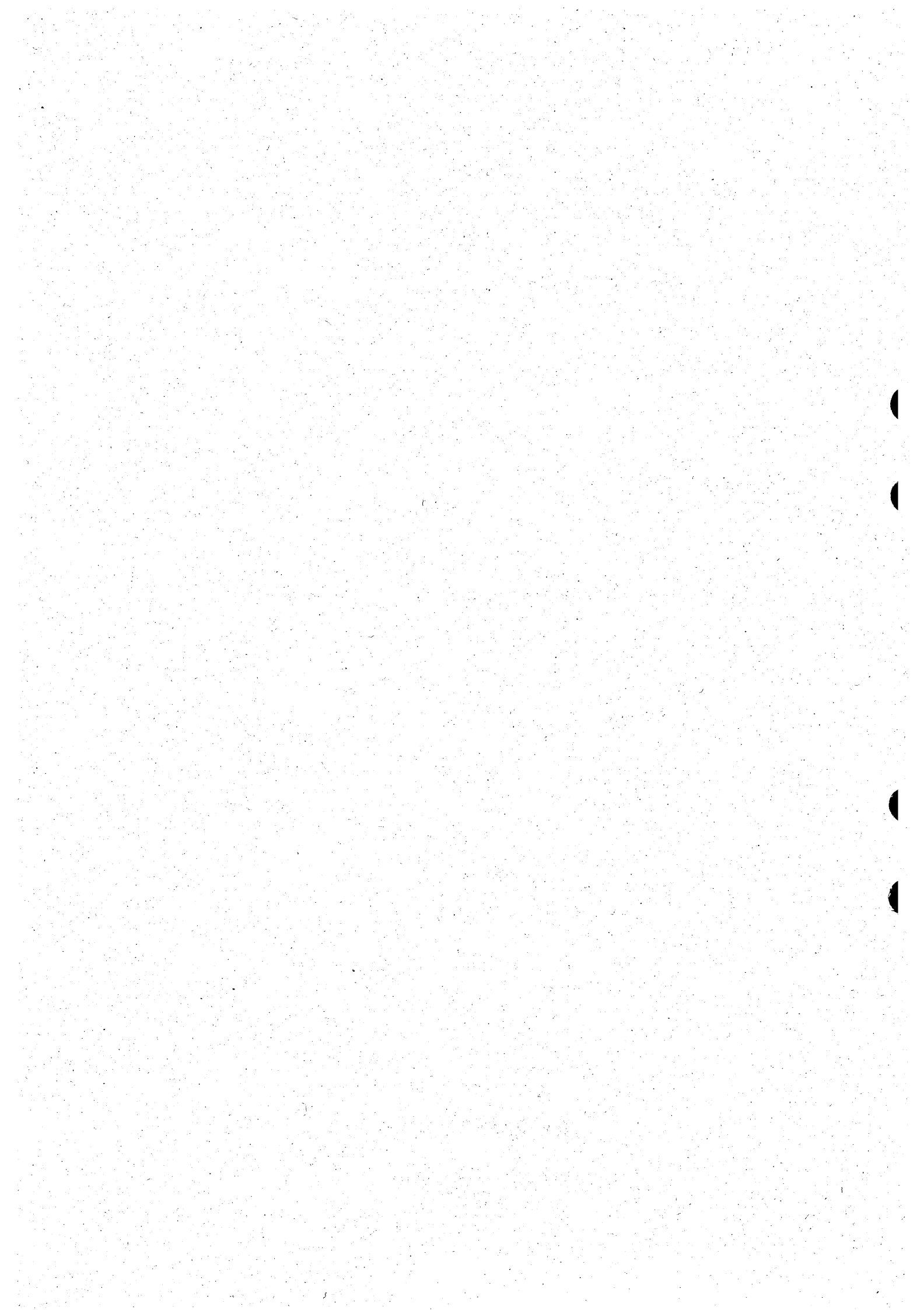
Handbrake adjustment



CO551-R0006

- 1 Remove the brush seal from the handbrake lever console.
- 2 Remove the locking plate from the adjusting nuts.
- 3 Remove the threaded plug from the adjusting screw.
Tighten the adjusting screw all the way in and then back it off a 1/4–1/2 turn.
Check that the brake disc can rotate freely.
Screw the threaded plug back in place.
- 4 Adjust the cable as follows:
 - a) Insert a 1.0 mm feeler gauge between the lever and stop.
 - b) Screw the adjusting nut (under the handbrake lever) until the feeler gauge slips out.
Correct clearance: 1.0 ± 0.5 mm
(0.04 ± 0.02 in).
- 5 Fit the locking plate over the adjusting nuts.
- 6 Slide the brush seal over the handbrake lever and into place on the handbrake console.







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Saab Automobile AB
Trollhättan, Sweden



Ordering No. 364521 English edition. Printed in Sweden. © Saab Automobile AB, 1995.

