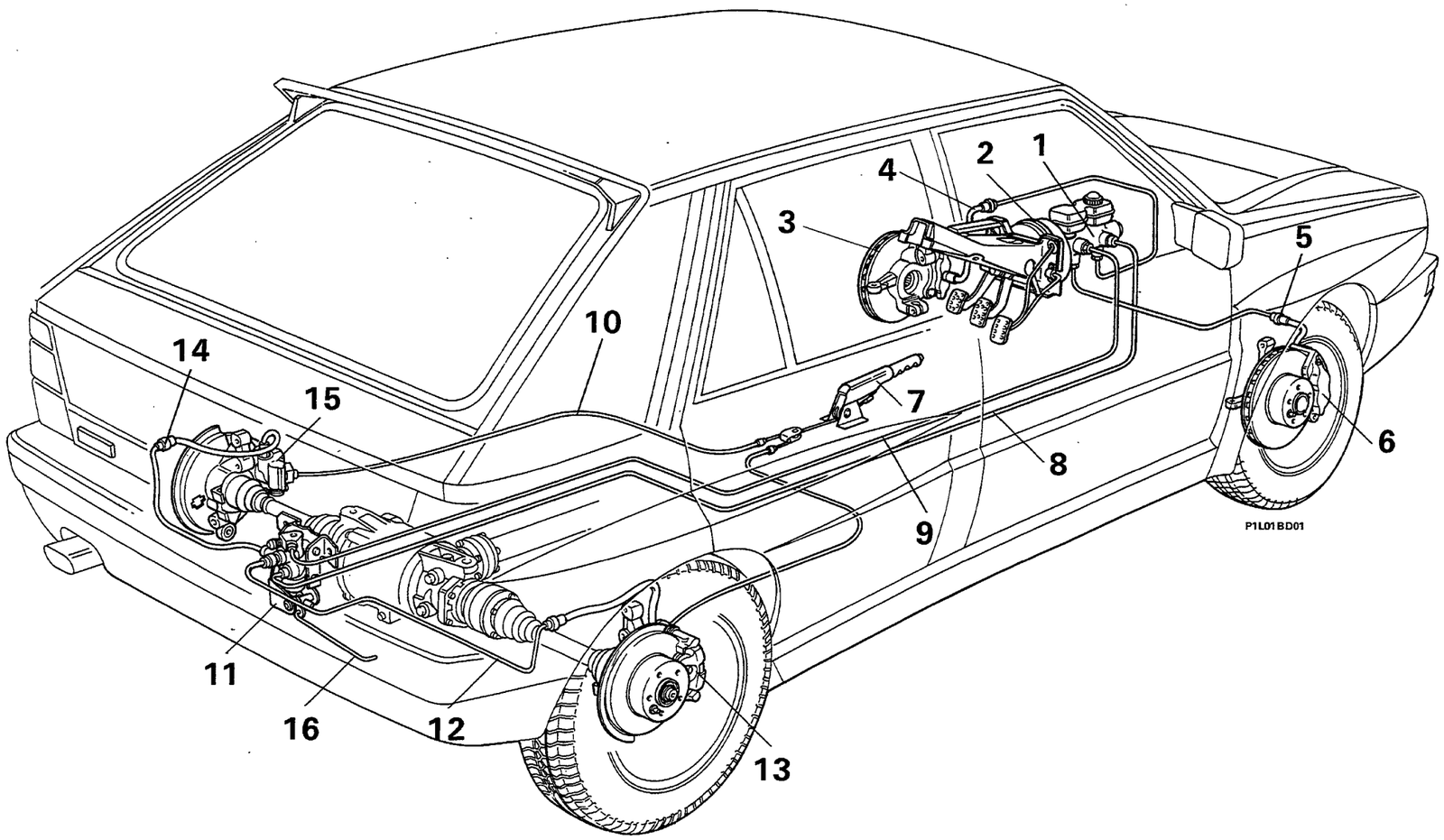
33.

DIAGRAM SHOWING BRAKING SYSTEM

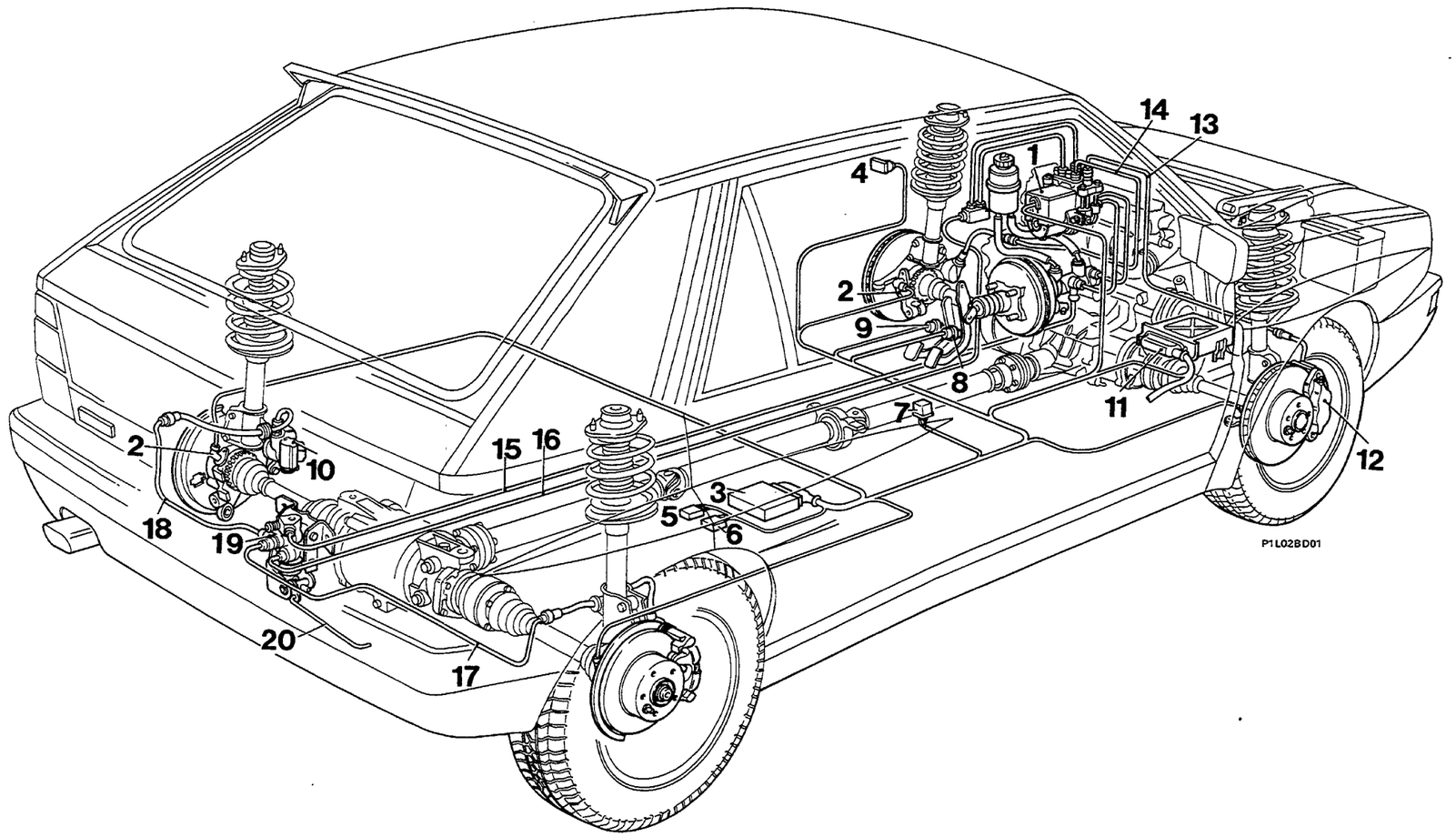


Key

1. Master cylinder
2. Vacuum servo brake
3. Ventilated front brake disc
4. Left front brake pipe
5. Right front brake pipe
6. Right front brake with 4 piston type fixed caliper (Brembo)
7. Handbrake lever
8. Pipe connecting left front brake to rear load proportioning valve
9. Pipe connecting right front brake to rear load proportioning valve
10. Handbrake flexible pipes
11. Load proportioning valve
12. Right rear brake pipe
13. Single piston floating caliper type right rear brake (Girling)
14. Left rear brake pipe
15. Single piston floating type caliper left rear brake (Girling)
16. Load proportioning valve control bar

33.

DIAGRAM SHOWING BRAKING SYSTEM WITH BOSCH ANTI-LOCK BRAKES (ABS) 4 channel, 2nd generation – See description of operation in print n° 504.787/11



Key

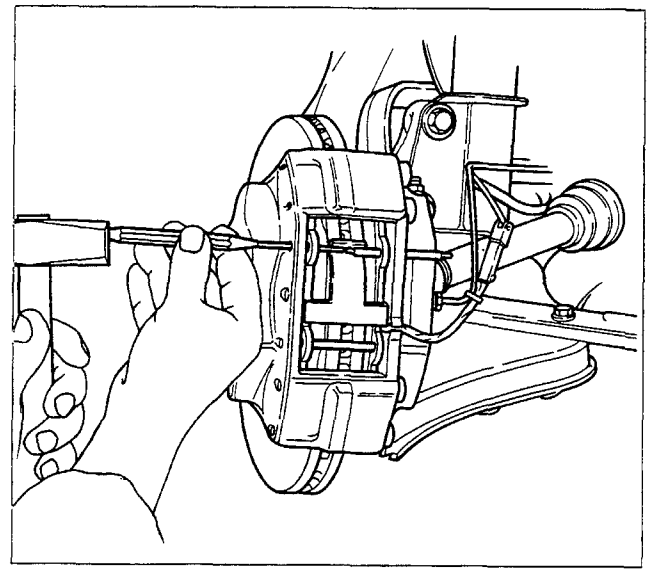
1. Anti-lock braking system hydraulic control unit
2. Rpm sensor
3. ABS electronic control unit
4. Warning light signalling device failure
5. Longitudinal accelerometer
6. Transverse accelerometer
7. Main control relay with protection against excess voltage
8. Brake lights and ABS system switch
9. Switch on clutch pedal
10. Flywheels
11. IAW injection/ignition control unit
12. 4 piston fixed caliper right front brake (Brembo)
13. Right front brake pipe from ABS hydraulic control unit
14. Left front brake pipe from ABS hydraulic control unit
15. Brake pipe to load proportioning valve from master cylinder
16. Brake pipe to load proportioning valve from ABS hydraulic control unit
17. Right rear brake pipe
18. Left rear brake pipe
19. Rear brake load proportioning valve
20. Load proportioning valve control bar

REPLACING 4 CYLINDER FIXED CALIPER BRAKE PADS (Brembo)

Removing brake pad support pins and retaining pins

- remove the two brake pad support pins using a drift and hammer as illustrated.
- remove the brake pad retaining spring.

NOTE *If only the brake pads are being replaced, the brake fluid connection pipe does not have to be disconnected.*



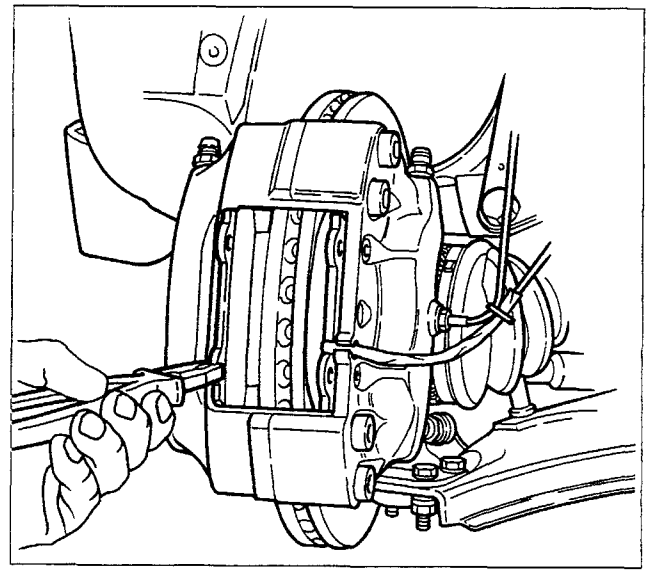
P1L03BD01

Removing brake pads from housings in brake caliper

- disconnect the brake pad wear sensor connector.
- using pliers, extract the brake pads from their housing in the brake caliper

Take great care not to damage the control piston protective boots. Ensure that the pistons go back into their housings using a wooden stick as a lever, making sure that the brake fluid does not spill out of the reservoir during this operation.

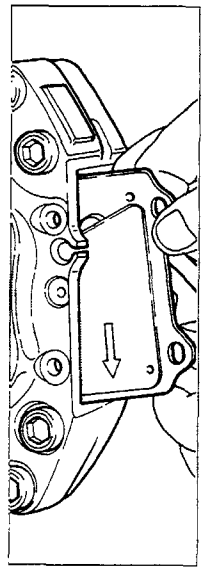
P1L03BD05



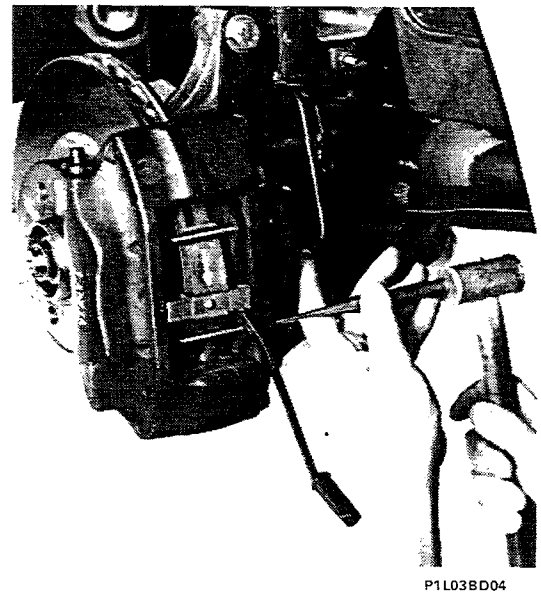
P1L03BD02

Refitting brake pads, spring and pad retaining pins

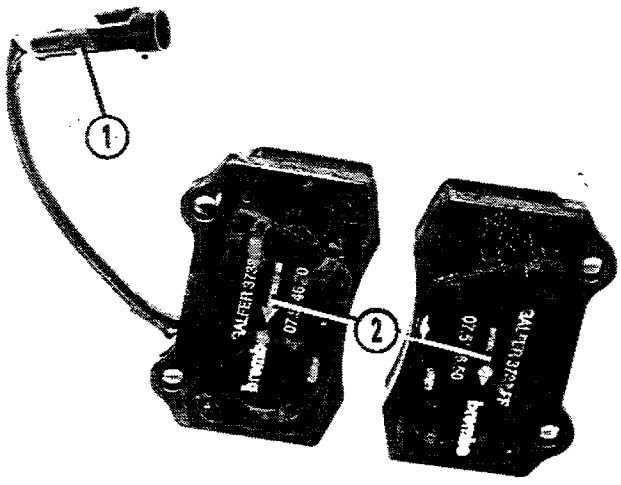
When refitting the pins are fitted with the springs retaining them to the caliper in the position illustrated in the diagram. The spring and the brake pads are fitted with the arrows facing downwards, as illustrated.



P1L03BD03



P1L03BD04

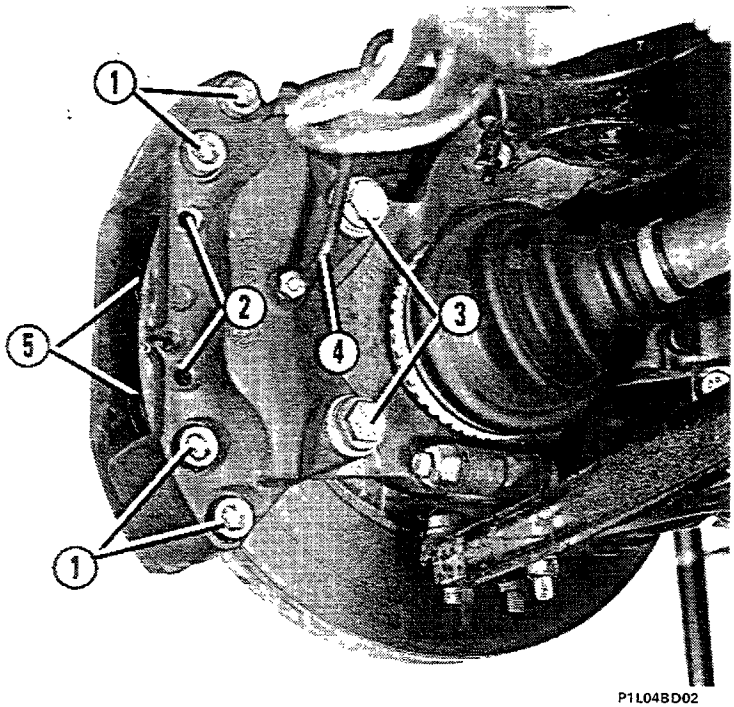


P1L04BD01

Front brake pads

Key

1. Front brake pad wear sensor connector (maximum thickness 1.5 mm).
2. Arrows showing correct fitting of brake pads in calper: they should be facing downwards (direction of rotation of the disc)



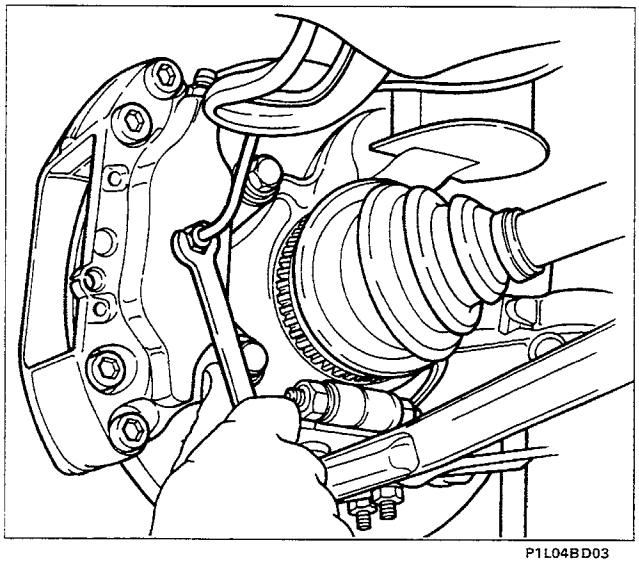
P1L04BD02

Front brake assembly fitted on vehicle

Key

1. Bolts fixing caliper half casings
2. Brake pad support pins
3. Bolts fixing brake caliper to steering knuckle
4. Brake fluid connecting pipe
5. Brake pistons

The bolts fixing the front brake caliper half casings (1) should not be tampered with for any reason whatsoever or else the complete caliper must be replaced



P1L04BD03

REMOVING-REFITTING BRAKE CALIPER

Removing bolts fixing brake fluid pipe to caliper

- To avoid draining the brake fluid reservoir it is advisable to keep the brake pedal depressed with a travel of between 10 and 20 mm during this operation.

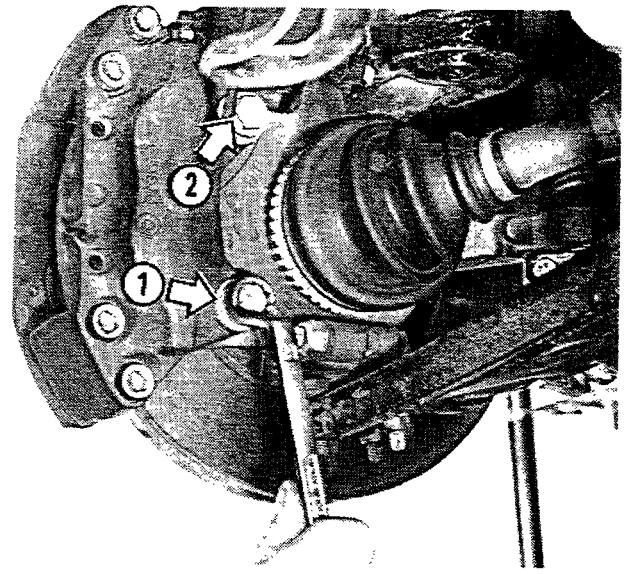
Bleeding air from hydraulic system

Removing bolts fixing brake caliper assembly to steering knuckle

- when refitting, tighten the two bolts fixing the caliper to the steering knuckle using a torque wrench to a torque of **10.5 daNm. There should be two washers under the head of each bolt.**

The bolts fixing the caliper casing to the steering knuckle are self-locking and should always be replaced each time they are undone or loosened.

Bleeding air from hydraulic system



P1L05BD01

BRAKE DISCS

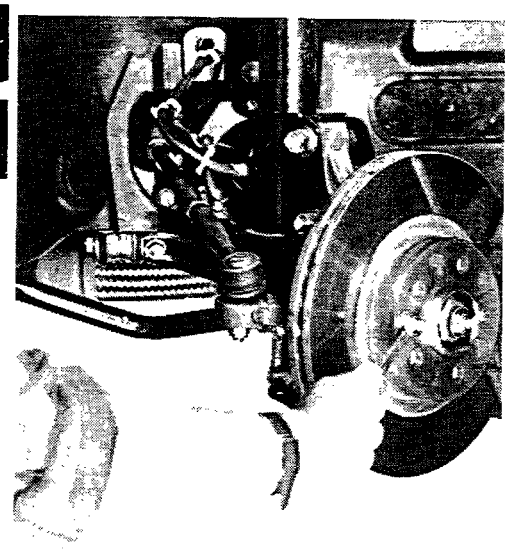
Removing and refitting brake disc

- this operation is carried out with the caliper disconnected from the steering knuckle.

When refitting remove any traces of rust to ensure that the disc is perfectly perpendicular in relation to the hub. The maximum permissible run out is 0.15 mm. See the instructions for checking the rear discs on page 7.

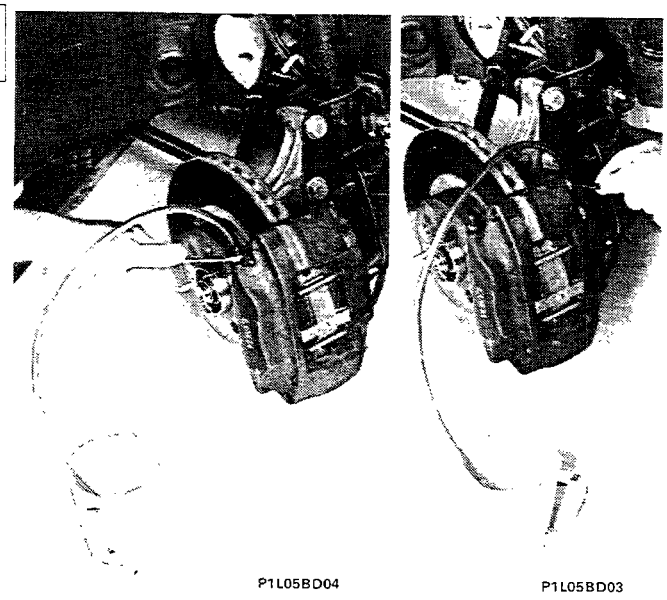
Checking and measuring disc

The thickness of a new disc is between 26.1 and 25.9 mm. whilst the minimum permissible thickness due to wear is **24.2 mm.**; if the disc measures less than this then it must be replaced.
In the case of deterioration or deep grooves, the surfaces of the disc may be skimmed using a grinder; after this operation the thickness of the brake disc must not be less than the figure given above.


P1L05BD02

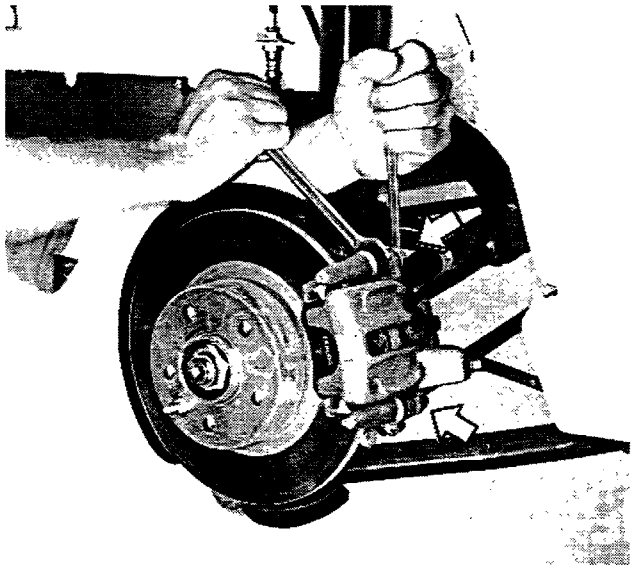
BLEEDING

The system is bled using the bleed screws on both the brake caliper half casings.


P1L05BD04

P1L05BD03

It is not advisable to re-use the fluid collected. The level should be topped up using new brake fluid.



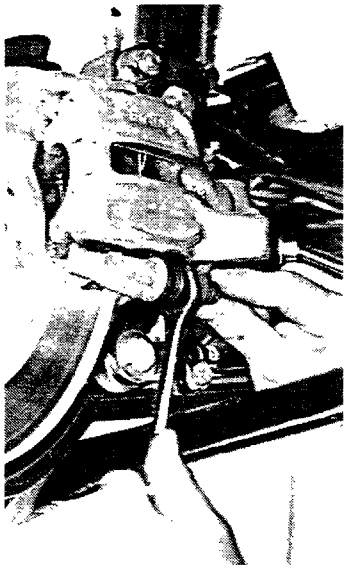
P1L06BD01

SINGLE PISTON BRAKE CALIPER SLIDING ON COLUMN TYPE GUIDES (GIRLING)

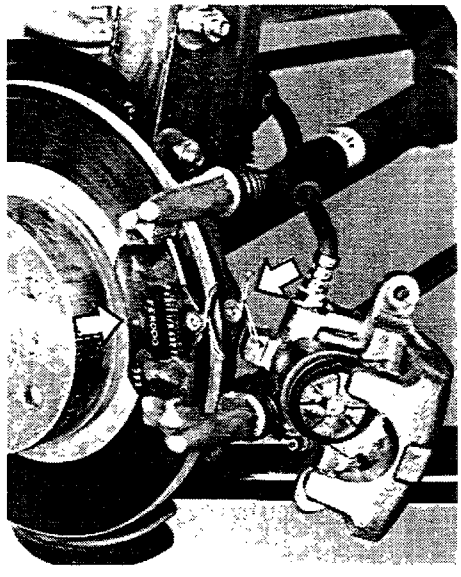
REPLACING BRAKE PADS

NOTE *The brake pads should be replaced if the thickness is less than 1.5 mm.*

Removing-refitting upper and lower bolts fixing brake caliper to mounting bracket



P1L06BD02

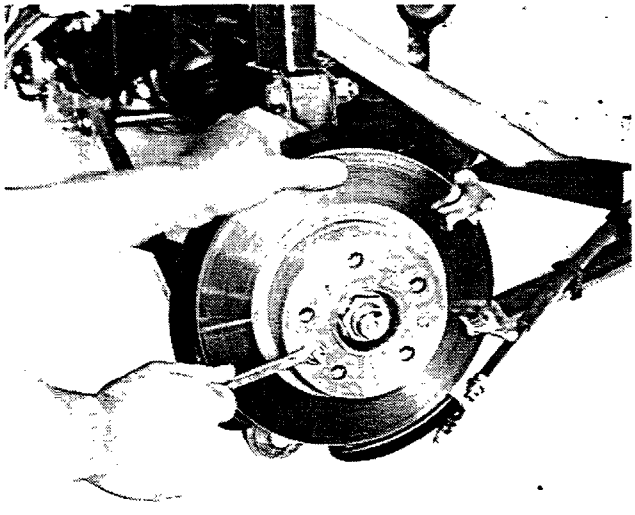


P1L06BD03

Extracting brake pads

- suitably position the brake caliper during this operation.

Before fitting the new brake pads, make sure that the caliper piston is fully retracted following the procedure illustrated on page 8.



P1L06BD04

If necessary, the disc may be ground if is excessively scored or worn; the brake back plate must be removed-refitted to carry out this operation

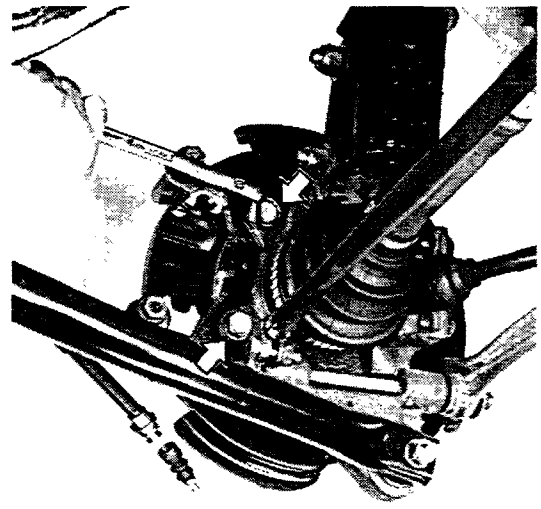
Removing-refitting bolt fixing brake disc to hub

REMOVING-ERFITTING BRAKE BACK PLATE FROM STUB AXLE

- undo the two bolts fixing the back plate to the stub axle using a polygonal spanner; when refitting tighten the bolts to a torque of **4.8 daNm.**

The bolts fixing the brake back plate are self-locking and should be replaced each time they are undone or loosened.

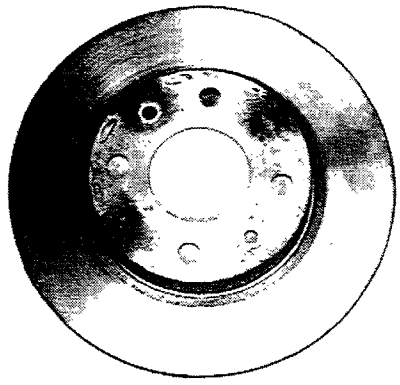
P1L07BD01



P1L07BD02

Checking and measuring disc

The minimum permissible thickness for a brake disc after wear is **9.0 mm**; if the thickness of the disc is less than this then it must be replaced. In the case of deterioration or deep grooves, the surfaces of the disc can be skimmed using a grinder; after this operation the thickness of the brake disc must not be less than **9.80 mm.**



P1L07BD05

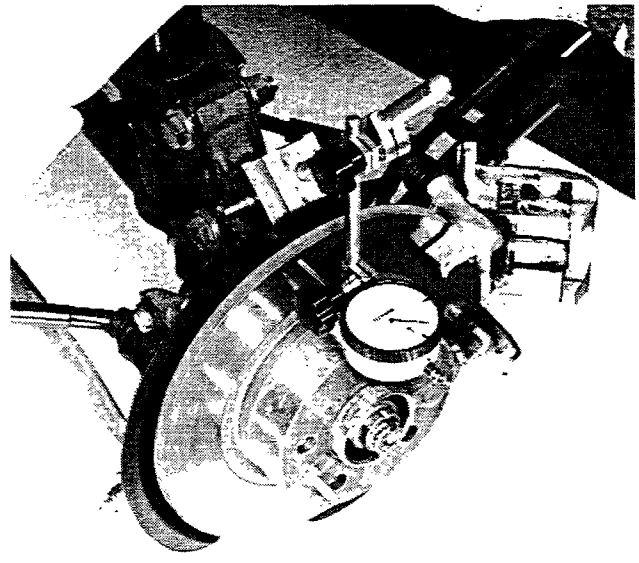
P1L07BD03

Refitting disc on hub

The operation is illustrated on page 6. When refitting remove any traces of rust to ensure that the disc is perfectly perpendicular in replace to the hub.

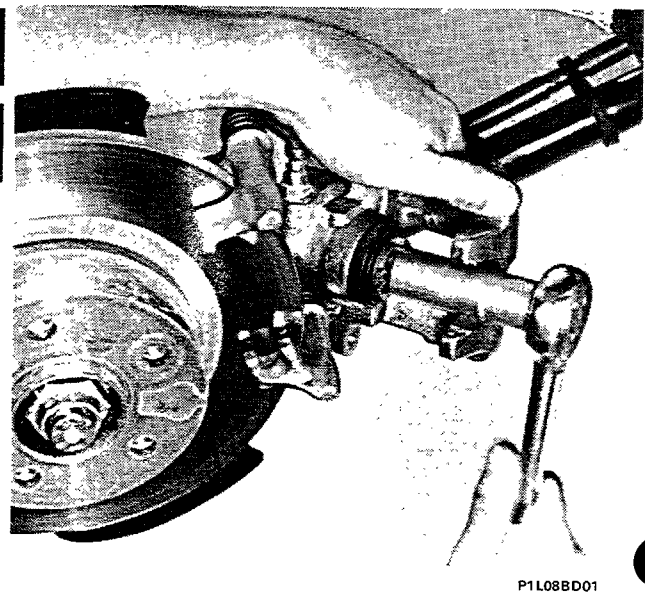
The maximum run out of the disc should not exceed 0.15 mm.
This figure is measured 2 mm from the external diameter of the disc.

Checking run out of brake disc using dial gauge fitted on magnetic base



P1L07BD04

Refitting brake caliper and pads on brake back plate



P1L08BD01

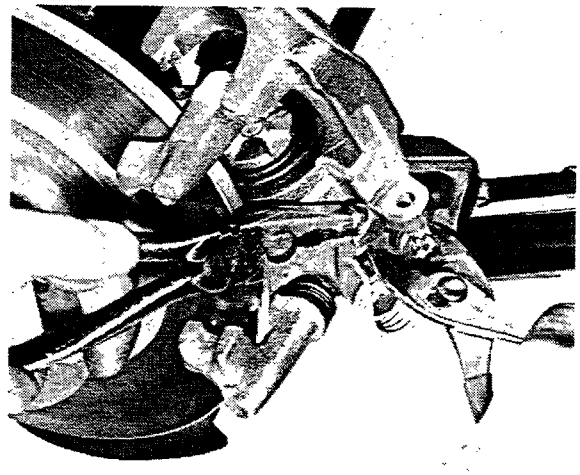
NOTE *Before placing the new brake pads in position the piston must be completely retracted by turning it in a clockwise direction with the help of tool 1856133000.*
Also carry out the adjustment of the handbrake.

Bleeding air from hydraulic system.

Removing-refitting brake pipe from bodyshell

Removing-refitting handbrake control cable from brake caliper

P1L08BD02

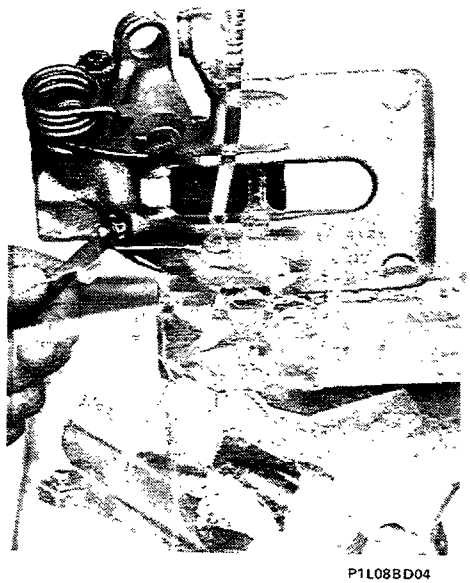


P1L08BD03

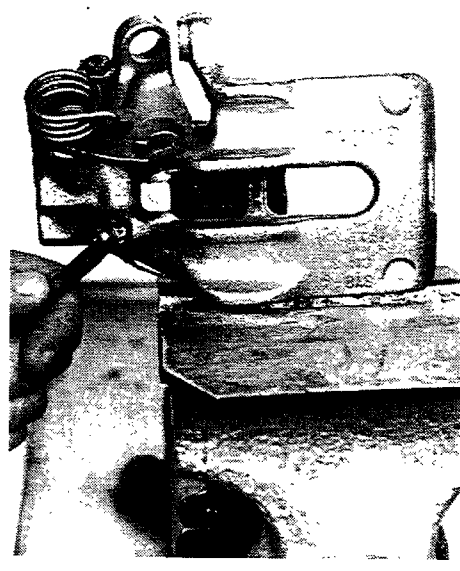
BRAKE CALIPER

Removing-refitting brake pipe and bleed screw from brake caliper

NOTE *The pipe should not be swollen or cracked or else it must be replaced. It is advisable to replace both pipes.*

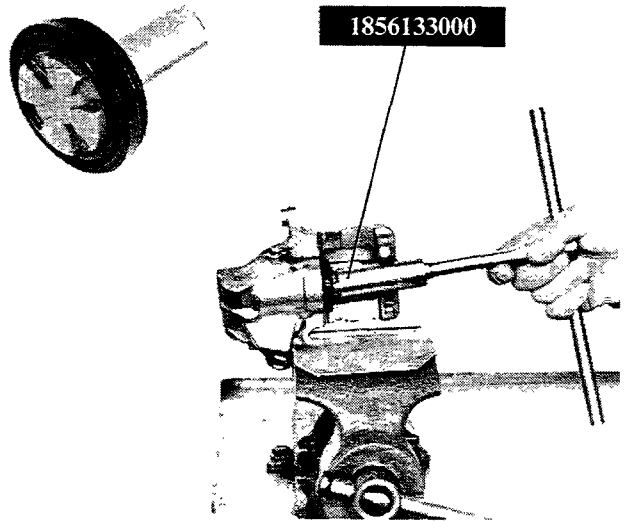


P1L08BD04



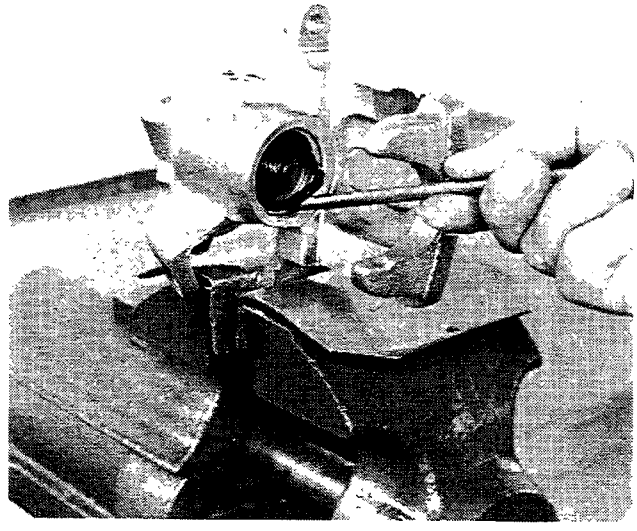
P1L08BD05

P1L09BD01



P1L09BD02

Removing piston and protective boot



PL09BDD03

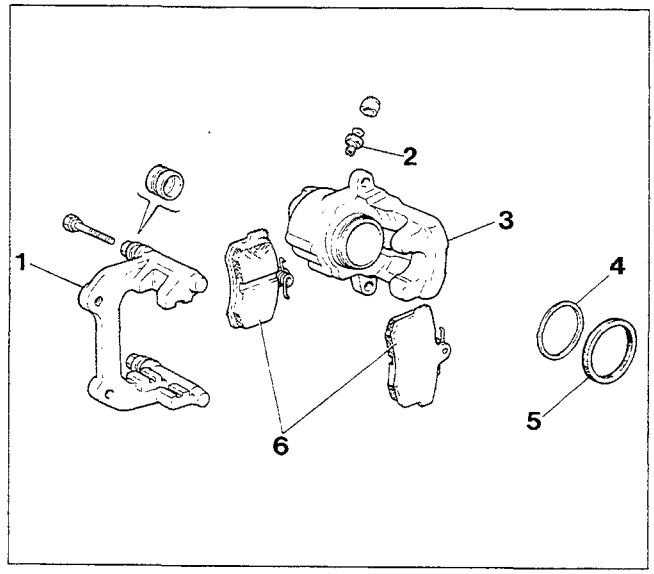
Removing seal

Checking caliper assembly components

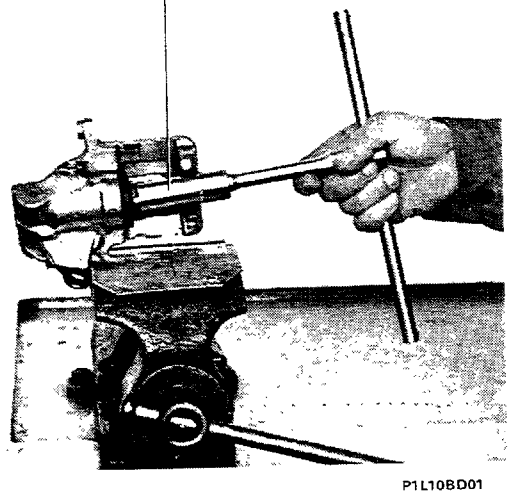
There should not be any traces of abrasion or seizing on the piston or the caliper casing or else the caliper complete with piston has to be replaced.
In any case the protective boot and the seal always have to be replaced; also make sure that the bleed screw is not obstructed.

Use a solution of warm water with FIAT LDC detergent to wash the metal components.

1. Caliper mounting bracket
2. Bleed screw
3. Caliper casing
4. Seal
5. Protective boot
6. Brake pads



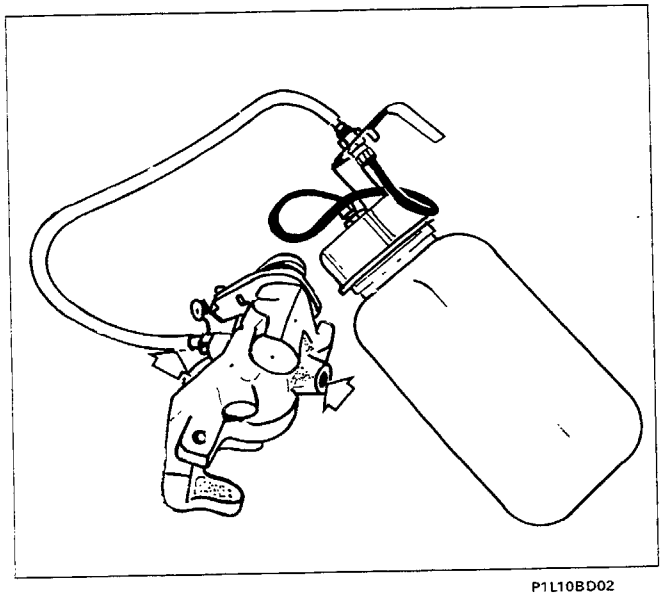
P1L09BD04



P1L10BD01

Refitting piston in caliper casing

Before fitting the piston in the caliper casing, position the protective boot in the rear part of the caliper.the parts concerned with brake fluid before fitting.



P1L10BD02

Refilling brake caliper

After having overhauled the brake caliper and before refitting it on the vehicle it should be refilled in the following way:

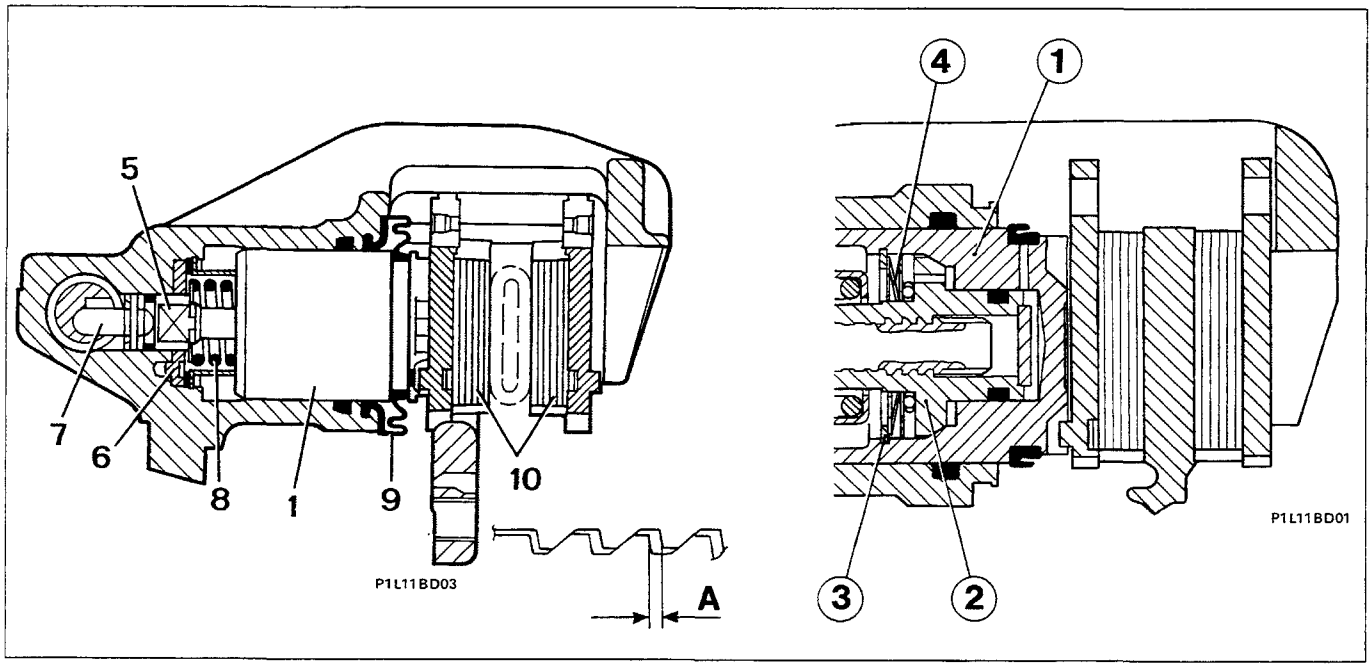
- loosen the bleed screw;
- insert the end of a transparent pipe in the opening in the bleed screw;
- using a regular container with brake fluid, introduce it into the caliper until air bubbles come out of the threaded opening where the flexible brake pipe is connected;
- lock the bleed screw.

AUTOMATIC DEVICE FOR ADJUSTING CLEARANCE BETWEEN REAR BRAKE PADS AND DISCS AND HANDBRAKE

In the rear brake calipres there is a device which allows the automatic adjustment of the distance bewteen the brake disc and the pads. This device comprises a female screw (2) which can rotate on a shaft (5) in one direction only; that which advances the action of a spring (4) and a shaft (5) on which the female screw (2) is bolted onto. This shaft cannot rotate as it is connected to the brake caliper casing (6).
There is a (4 way) threaded coupling bewteen the shaft and the female screw with a preset clearance (A).
During braking, the control piston (1), thrust by the hydraulic pressure, moves towards the brake pad with the female screw (2), as it is connected to the piston by the circlip (3) and the spring (4).

If the brake pad wear is excessive, the end float (A), even if recovered, is not sufficient, by itself, to absorb the entire control piston (1) travel. The female screw (2) distances itself momentarily from its contact point with the piston (1) but the intervention of the spring (4) causes the female screw (2) to rotation on the shaft (5) until it is in contact once again with the control piston (1).

When the handbrake is operated, the mechanical force is transmitted from the control lever to the rod (7) and therefore through the shaft/female screw coupling and reaches the control piston (1) and from there the brake pads (10).
The female screw (2) and therefore the control piston (1) fixed to it cannot rotate as the piston as during braking this is prevented by the brake pad plate.



Section of rear brake caliper cylinder

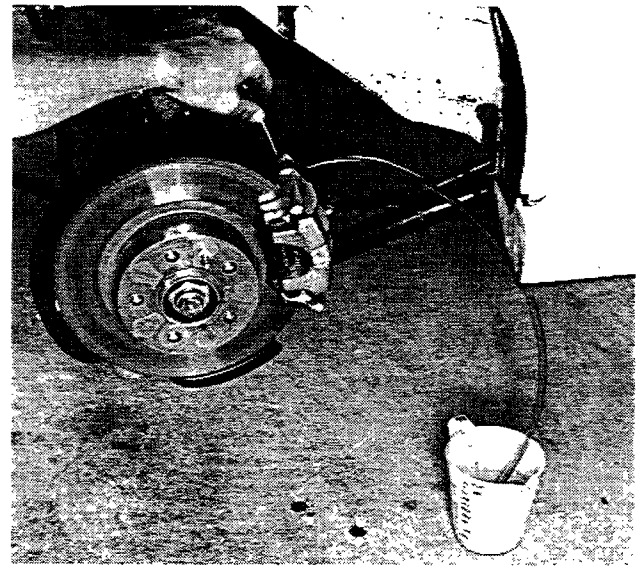
1. Piston - 2. Female screw - 3. Circlip - 4. Spring - 5. Shaft - 6. Circlip - 7. Rod - 8. Spring - 9. Protective boot - 10. Brake pads - A. Clearance between female screw and shaft

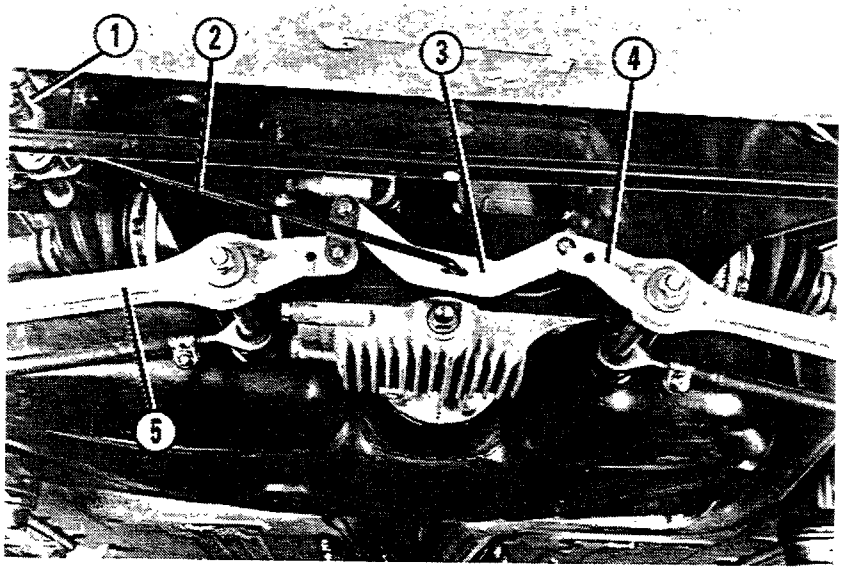
BLEEDING BRAKES

- after refitting the flexible brake pipes and the caliper the hydraulic brake circuit must be bled.

Compress the suspension during the bleeding to allow the load proportioning valve to operate and connect the front circuit with the rear circuit

It is not advisable to reuse the fluid collected. The level should be topped up with new brake fluid.

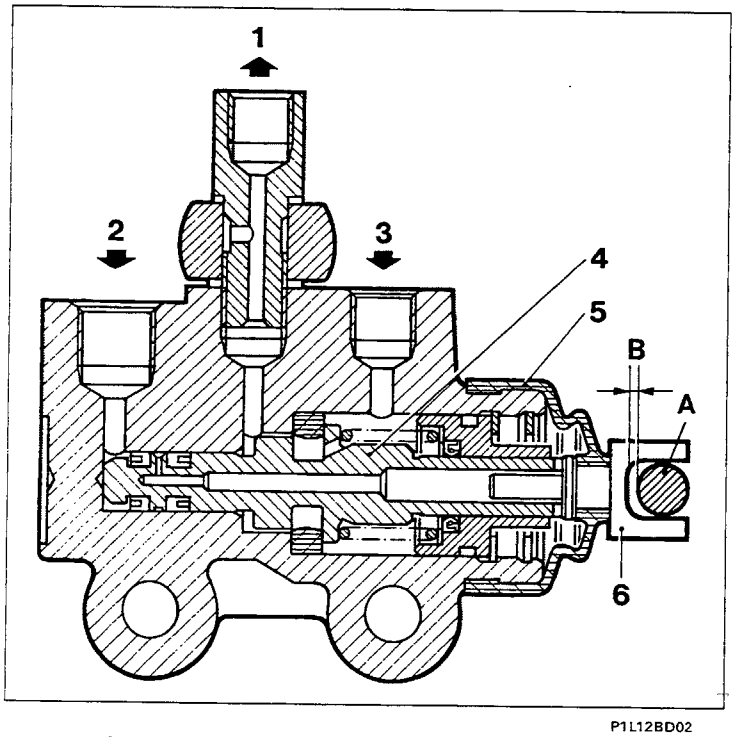

P1L11BD02



P1L12BD01

LOAD PROPORTIONING VALVE

The load proportioning valve (1) for the rear wheels, fixed to the bodyshell and controlled by a torsion bar (2) from the rear suspension lower transverse arms (4 and 5) connection rod (3), differentiates between the pressure in the rear brake circuit and the front circuit according to the vehicle load and deceleration conditions.
The variation in pressure is determined by the position of the bar connected to the rear suspension lower transverse arms which acts on the load proportioning valve piston.



P1L12BD02

Key to top photo

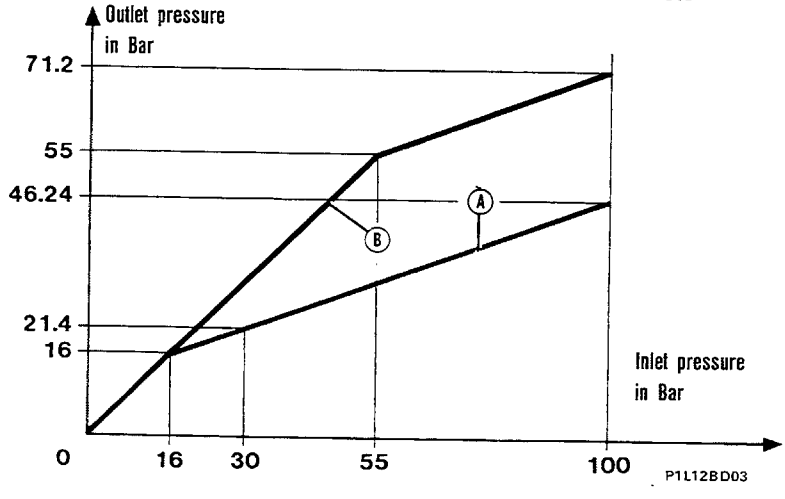
1. Load proportioning valve. - 2. Control bar. - 3. Connection rod. - 4. Right rear suspension transverse lower arm. - 5. Left rear suspension transverse lower arm.

Longitudinal section of load proportioning valve

Key

1. To the rear brake circuit
2. Pressure inlet from master cylinder to front brakes
3. Pressure inlet from master cylinder to rear brakes
4. Piston
5. Protective boot
6. Control fork

A. Control bar
B. Distance or gap for load proportioning valve adjustment (with no load on rear suspension) **1.1 ± 0.2 mm.**



P1L12BD03

Key

A. With the vehicle in running order and the driver
B. With the vehicle fully laden

Diagram showing pressures adjusted by the load proportioning valve

CHECKS AND ADJUSTMENTS TO THE LOAD PROPORTIONING VALVE

Removing-refitting load proportioning valve

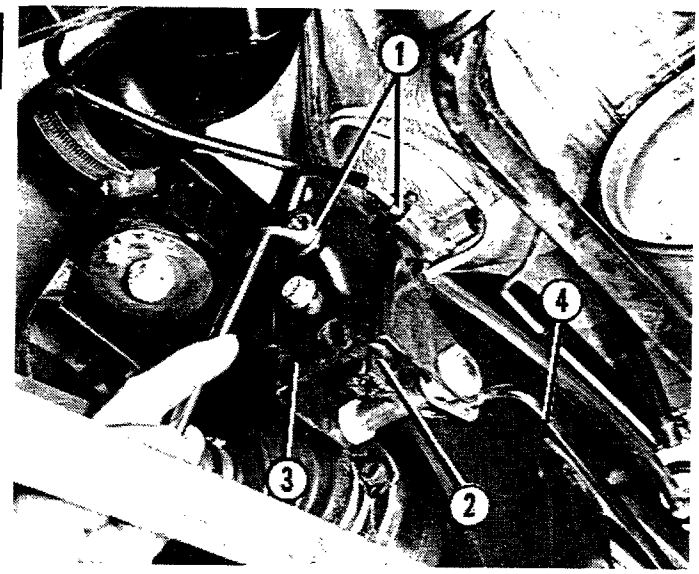
Take great care when loosening and tightening the pipe unions on the load proportioning valve casing in order not to damage them.

Bleeding air from hydraulic system

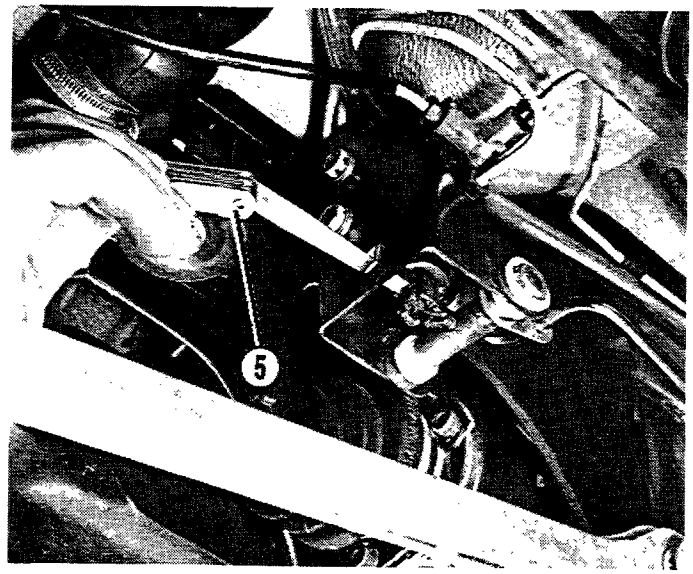
Adjusting the load proportioning valve

- During the adjustment the vehicle should be raised on a lift in such a way that **the rear suspension is not loaded.**
- loosen the bolts (1) fixing the load proportioning valve (2) to the plate (3);
- bring to distance B of **1.1 ± 0.2 mm.** (see also the second diagram on the previous page), which can be measured using a feeler gauge - which should not, however, be wider than 4 mm - by placing the latter between the load proportioning valve control bar and fork, as illustrated in the photo.
- then lock the bolts (1) fixing the load proportioning valve casing (2) to the plate (3) on the bodyshell.
- lubricate the end of the load proportioning valve control bar using SP 349 grease

Load proportioning valve adjustment 1.1 ± 0.2 mm.



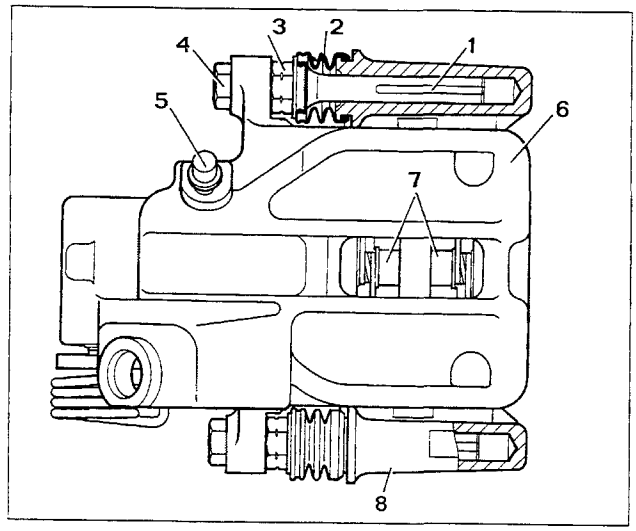
P1L13BD01



P1L13BD02

1. Bolts fixing load proportioning valve casing to plate on bodyshell. - 2. Load proportioning valve. - 3. Load proportioning valve support plate. - 4. Load proportioning valve control bar. - 5. 1.1 mm feeler gauge with a maximum width of 4 mm.

Partial cross section of rear brake caliper sliding on stud type guides (Girling).

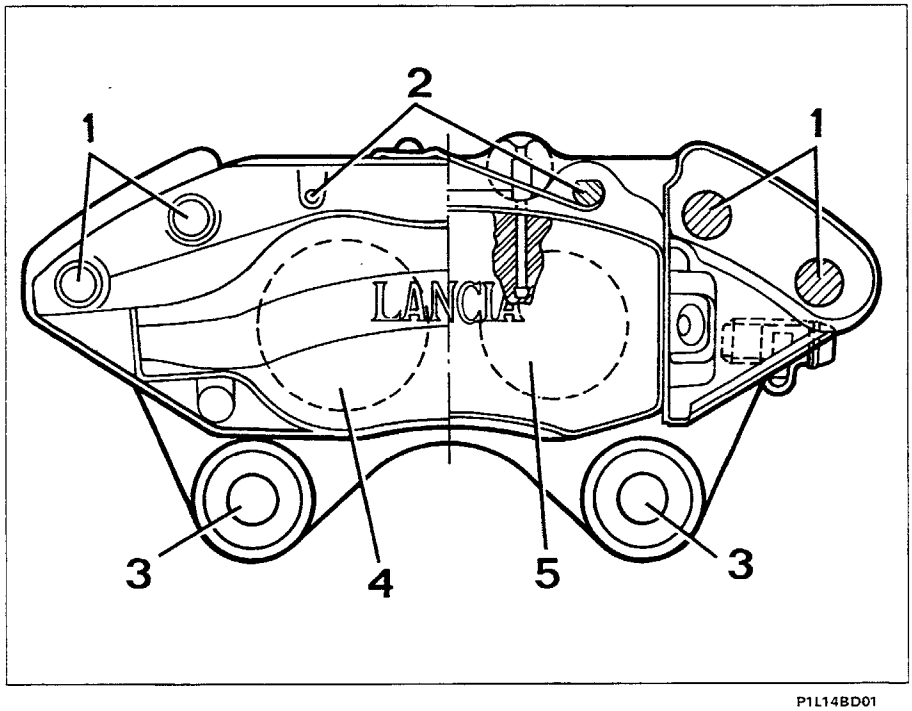


P1L13BD03

Key

1. Stud
2. Stud protective boot
3. Lock nut
4. Bolt fixing stud
5. Bleed screw
6. Piston type caliper
7. Brake pads
8. Bracket fixing caliper to stub axle

33.



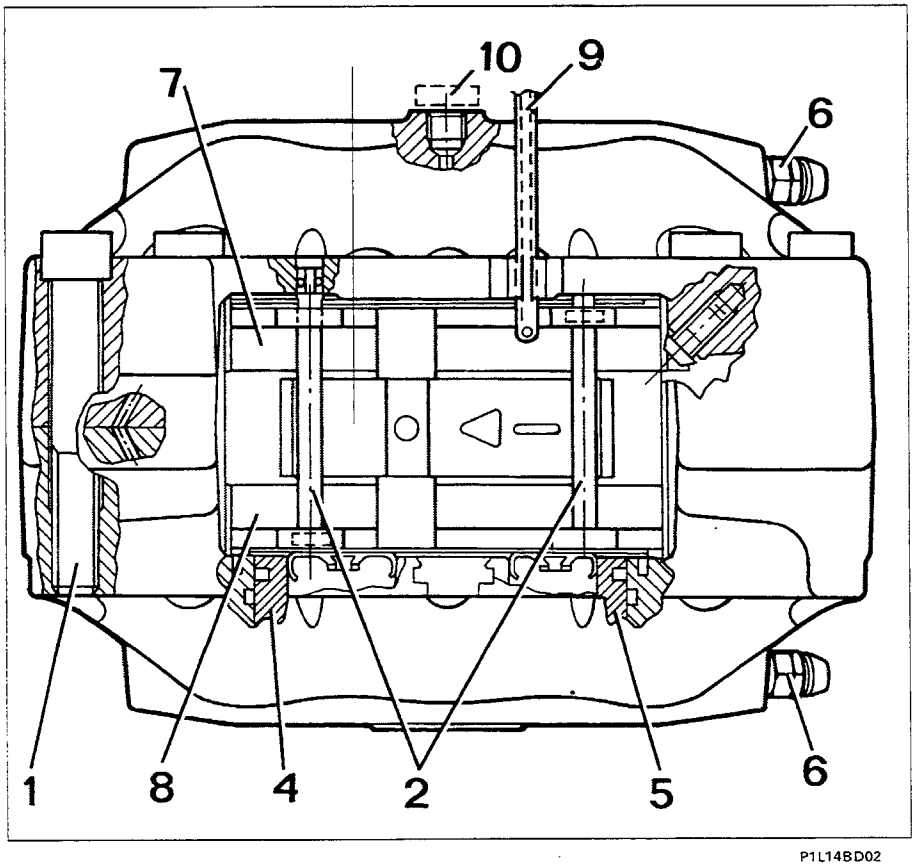
P1L14BD01

BRAKE CALIPER WITH FOUR PISTONS (Brembo)

Side view of complete front brake caliper

Key

1. Bolts fixing caliper half casings. - 2. Brake pad support pins. - 3. Bolts fixing brake caliper assembly to stub axle. - 4. Brake control piston ∅ 44 mm. - 5. Brake control piston ∅ 38 mm. - 6. Bleed screws. -- 7. Brake pad, inner side. - 8. Brake pad, outer side. - 9. Brake pad wear sensor cable. - 10. Bolt fixing brake fluid pipe. - 11. Brake pad retaining spring.



P1L14BD02

View of complete front brake caliper