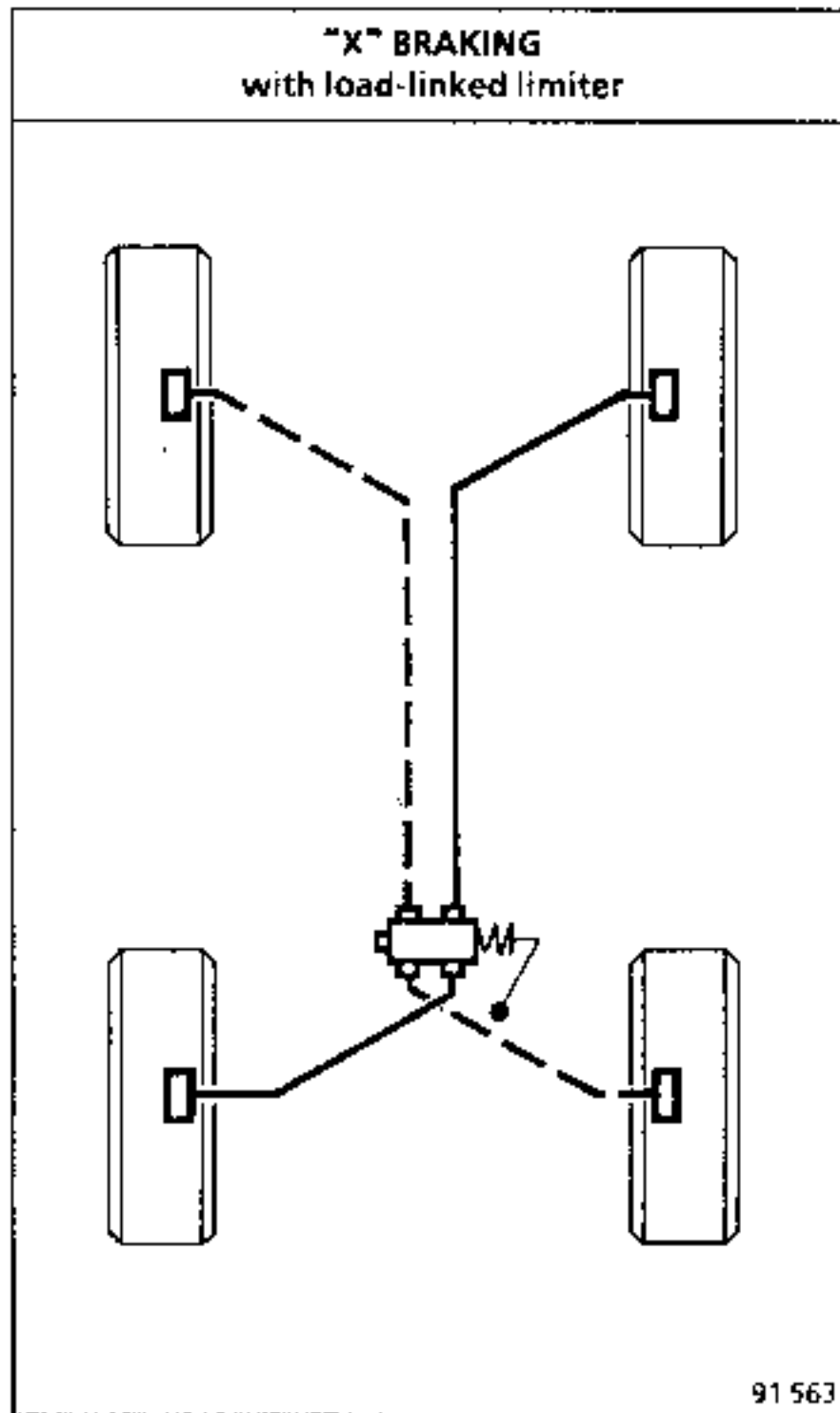


NOTE:

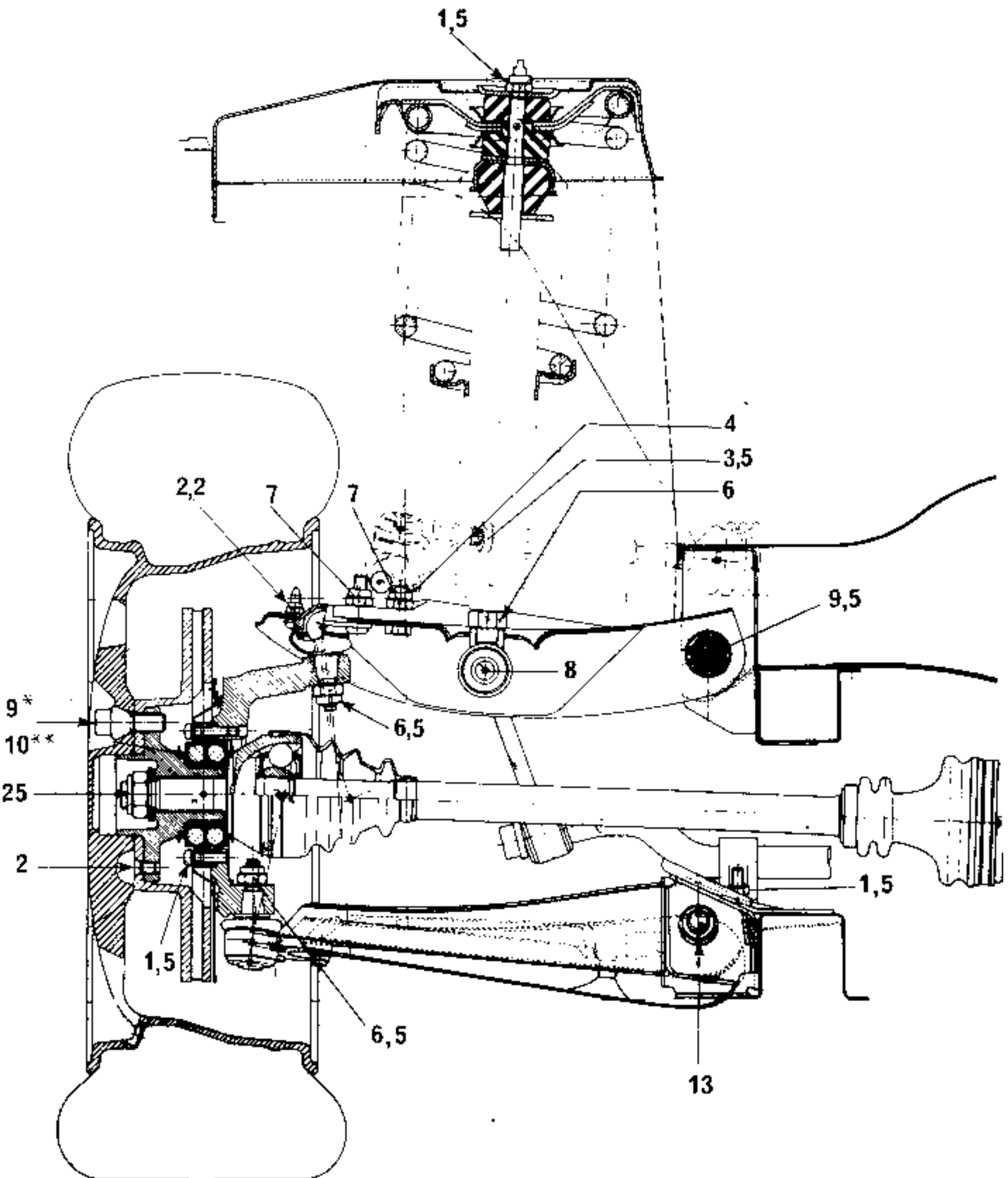
The following diagrams are general operating diagrams. On no account are they to be taken as a reference point for the connection and allocation of circuits. When replacing one of the components of a vehicle's braking system, always mark the pipes before dismantling them, in order to ensure that they are reconnected in their original positions.



	B 290 B 296 B 297 B 29E B 29H B 298 B 29W	B 293 B 298 B 29F B 29A	B 293 ABS B 29G B 295 B 298 ABS B 29F ABS B 29A ABS B 29B ABS →MOD87.05 B 29E ABS →MOD87.05	B 290 ABS B 296 ABS B 297 ABS B 29H ABS B 29W ABS B 29E ABS MOD 87.06 B 29B ABS → MOD 87.06 →	B 292 B 294
FRONT BRAKES (dimensions in mm)					
Wheel cylinder diameter	54	60	60	54	54
Disc diameter	259	280	280	259	259
Disc thickness	20	22	22	20	20
Minimum disc thickness*	18	20	20	18	18
Lining thickness (including support bracket)	18	18	18	18	18
Minimum lining thickness (including support bracket)	6	6	6	6	6
Maximum disc run-out	0.07	0.07	0.07	0.07	0.07
REAR BRAKES (distances in mm)					
Wheel cylinder diameter	22	36	36	36	36
Drum diameters	228.5	-	-	-	-
Maximum diameter of drums after machining	229.5	-	-	-	-
Disc diameter	-	254	254	254	254
Disc thickness	-	12	12	10.5	10.5
Minimum disc thickness*	-	10.5	10.5	9.5	9.5
Lining width	40	-	-	-	-
Lining thickness (including support bracket)	7	14	14	14	14
Minimum lining thickness (including support bracket)	2.5	6	6	6	6
MASTER CYLINDER (dimensions in mm)					
Diameter	20.6	23.8	23.8	20.6	22

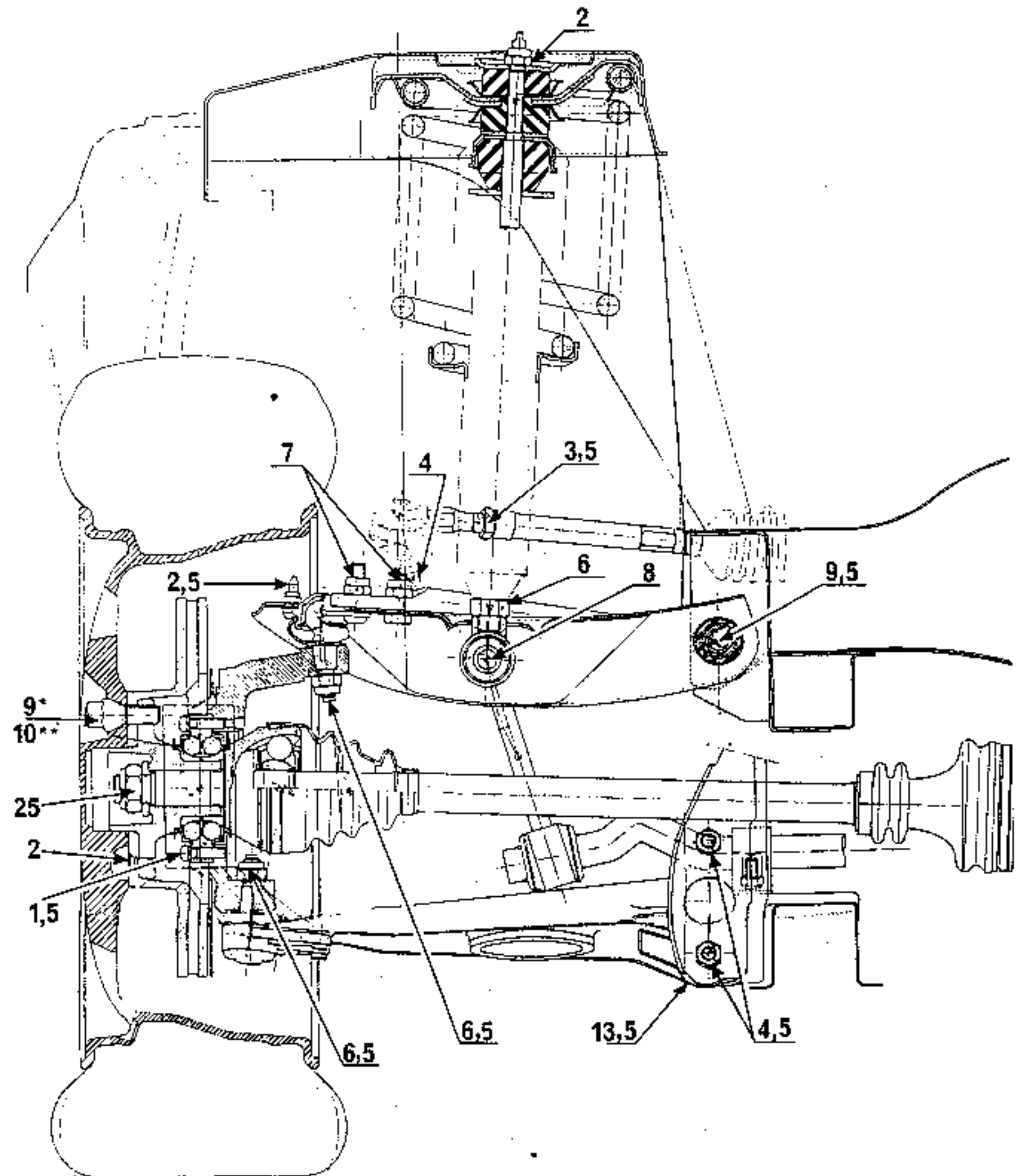
* Brake discs cannot be machined. They must be replaced if they are scored or excessively worn.

B29 X up to the end of the 1988 model



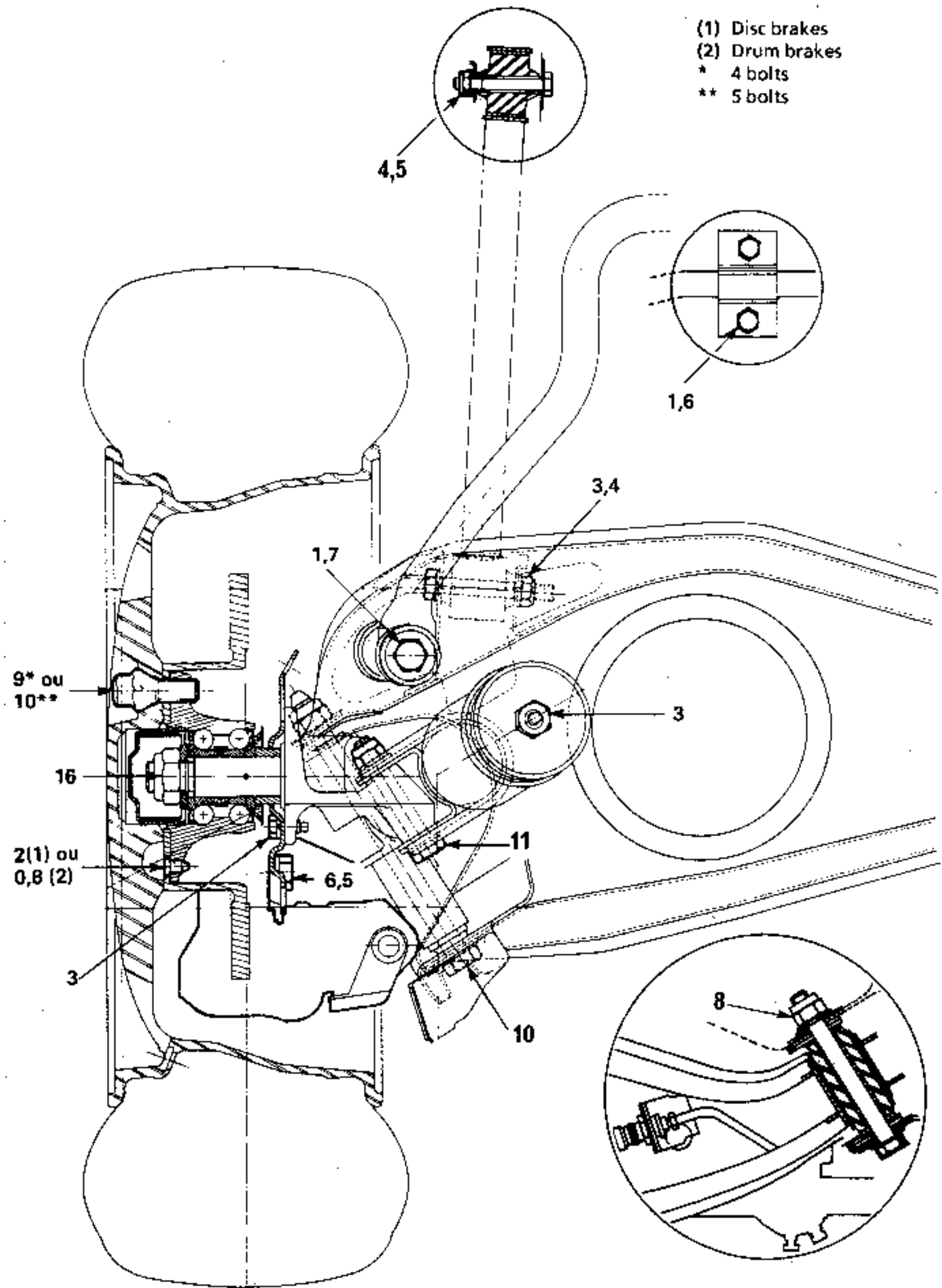
* 4 bolts
** 5 bolts

B29 X from 1989 model



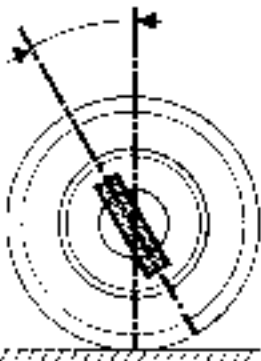
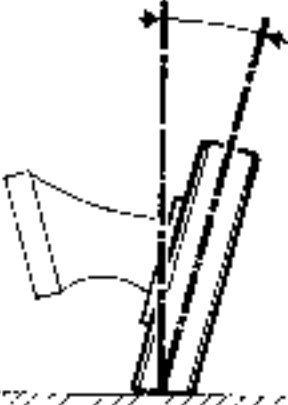
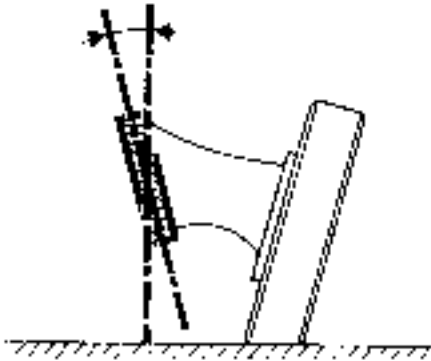
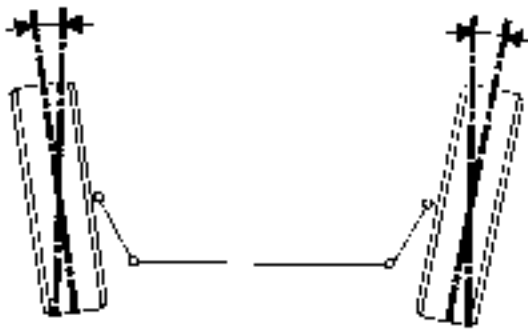
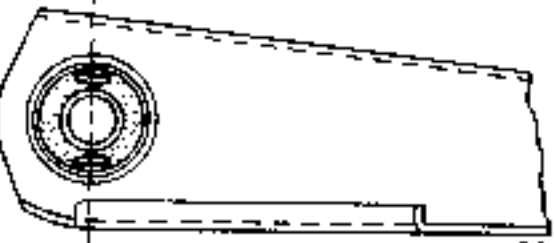
* 4 bolts

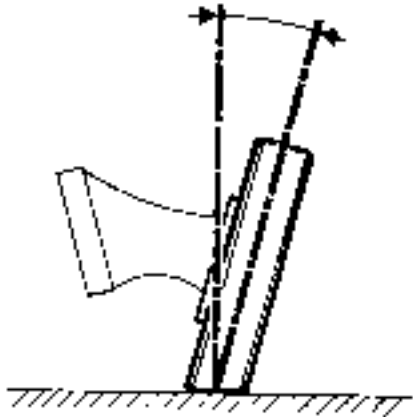
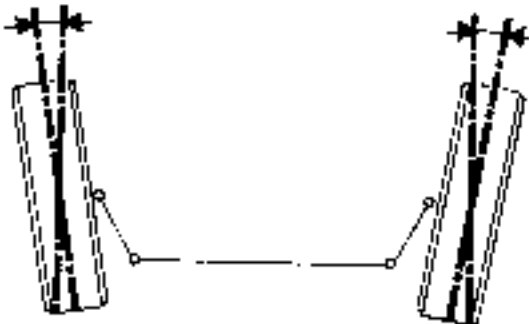
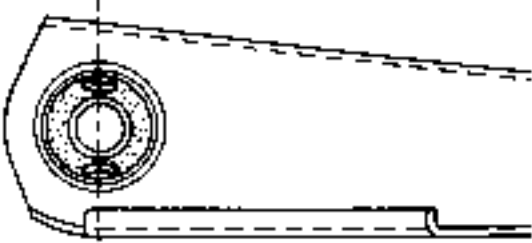
** 5 bolts

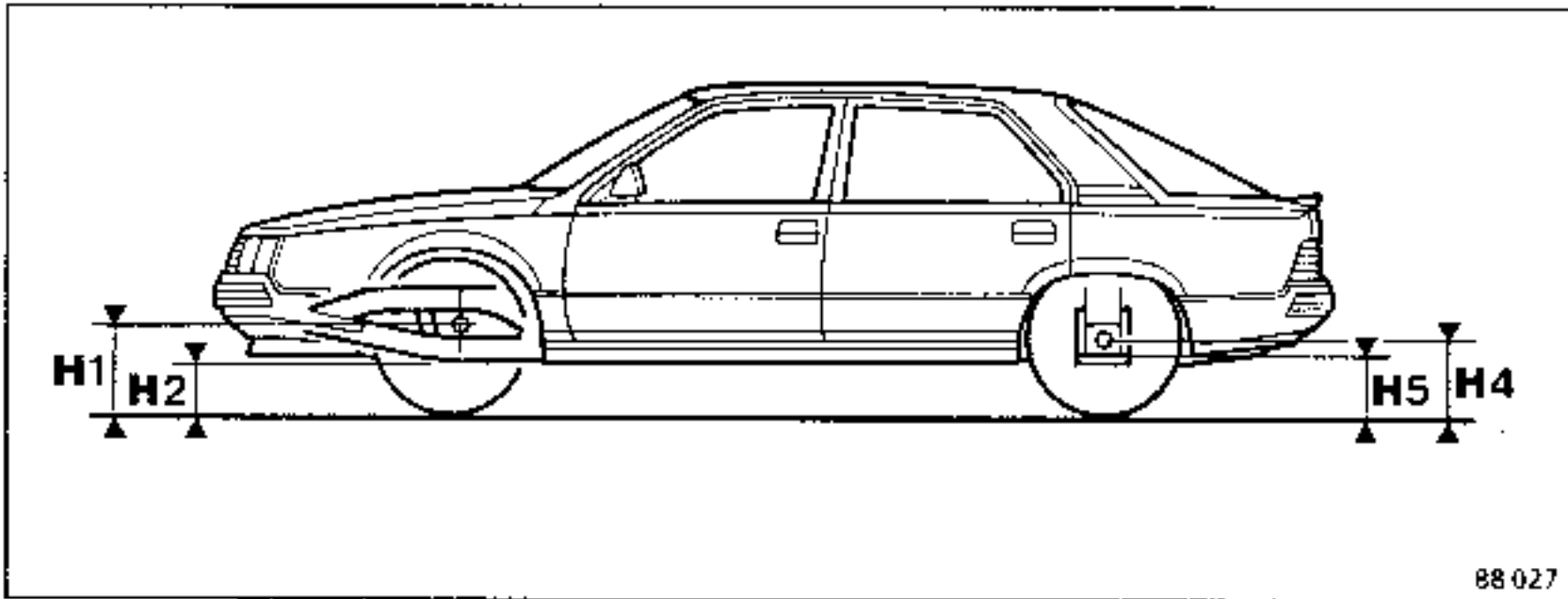




	DIMENSIONS	TIGHTENING TORQUE
Bleed screw	—	0.6 to 0.8
Front wheel cylinder hoses	M 10 × 100	1.3
Rear arm hoses	M 10 × 100	1.3
Rear wheel cylinder power supply	M 10 × 100	1.3
Master cylinder outlets	M 10 × 100 or M 12 × 100	1.3
Limiter inputs	M 10 × 100 or M 12 × 100	1.3
Limiter outputs	M 10 × 100 or M 12 × 100	1.3

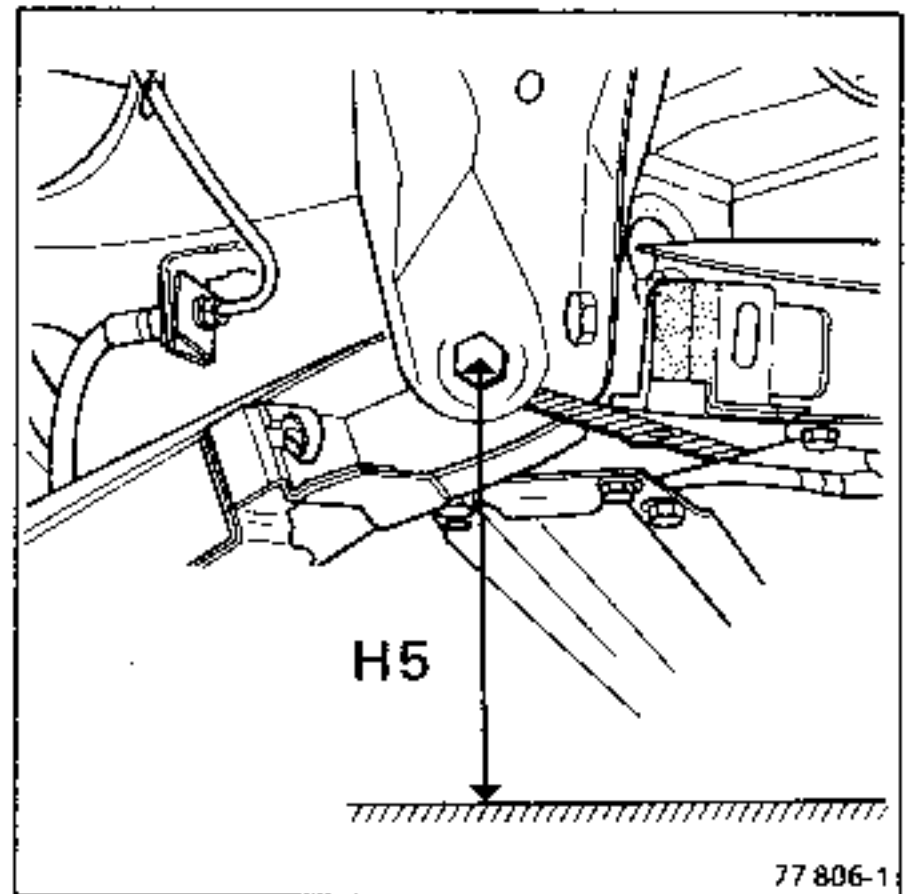
ANGLES	VALUES	FRONT AXLE POSITION	ADJUSTMENT
CASTER 	Manual steering 2° $1^{\circ} 30'$ 1° $0^{\circ} 30'$ 0° PAS 4° $3^{\circ} 30'$ 3° $2^{\circ} 30'$ 2° Max. right/left difference $= 1^{\circ}$	$H5 - H2 = 10 \text{ mm}$ $H5 - H2 = 35 \text{ mm}$ $H5 - H2 = 60 \text{ mm}$ $H5 - H2 = 85 \text{ mm}$ $H5 - H2 = 110 \text{ mm}$	ADJUSTABLE by pulling 1 turn = $15'$
CAMBER 	$0^{\circ} \pm 30'$ Max. right/left difference = 1° after caster adjustment	UNLADEN	NON ADJUSTABLE
KINGPIN 	$12^{\circ} 30' \pm 30'$ Max. right/left difference = 1° after caster adjustment	UNLADEN	NON ADJUSTABLE
PARALLELISM  78 423	For two wheels Toe-out $0^{\circ} 30' \pm 10'$ $(3 \text{ mm} \pm 1)$	UNLADEN	Adjustable by rotating the steering tie-rod sleeves 1 turn = $30'$ (3 mm)
POSITION FOR TIGHTENING RUBBER BUSHES  81 603		UNLADEN	

ANGLES	VALUES	POSITION	ADJUSTMENT
CASTER 	$-1^{\circ}15' \pm 30'$	UNLADEN	NON ADJUSTABLE
PARALLELISM  78 423	$-0^{\circ}10' \pm 10'$ $(-1\text{ mm} \pm 1)$	UNLADEN	Adjustment by shims on the bearing arm pivot.
POSITION FOR TIGHTENING RUBBER BUSHES  81 603		UNLADEN	



88 027

Distance H5 is measured between the ground and the centre of the central arm pivot.



77 806-1

TYPE	QUANTITY	UNITS CONCERNED
Elf-Multi	5 g Smear	Oil seal lips. Roadwheel bolt threads.
Molykote BR2	24 cm3 Smear	Steering box. Drive shaft splines at gearbox end.
CAF 4/60 THIXO	1 to 2 drops	Driveshaft rollpin holes.
Molykote 33 Medium	Smear	Anti-roll bar bearing bushes.
Loctite FRENBLOC	1 to 2 drops	Axial ball-joint threads. Rear brake plate fixing bolt.
Loctite "SCELBLOC"	5 to 6 drops	Transmission stub axle
SAE 80W Oil	Smear	Rear wheel stub axle

Parts to be replaced when dismantled

- Axial ball-joint retainer.
- Balance weight clips.
- Hub bearings.
- Bellows.
- LUCAS (Girling) caliper guide screws.
- Stub axle brake nut

FRONT AXLE

Independently sprung wheels.

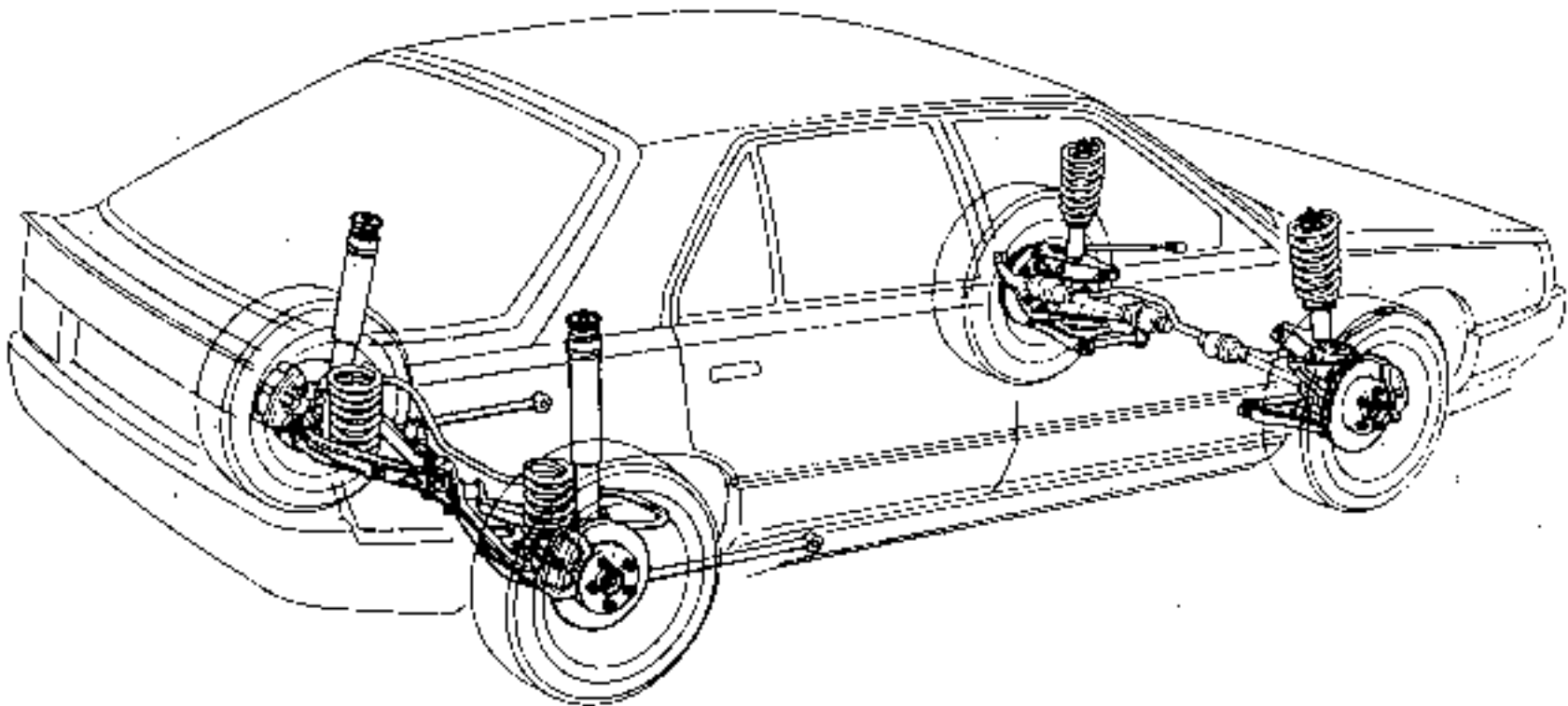
Suspension arm pivoting via :

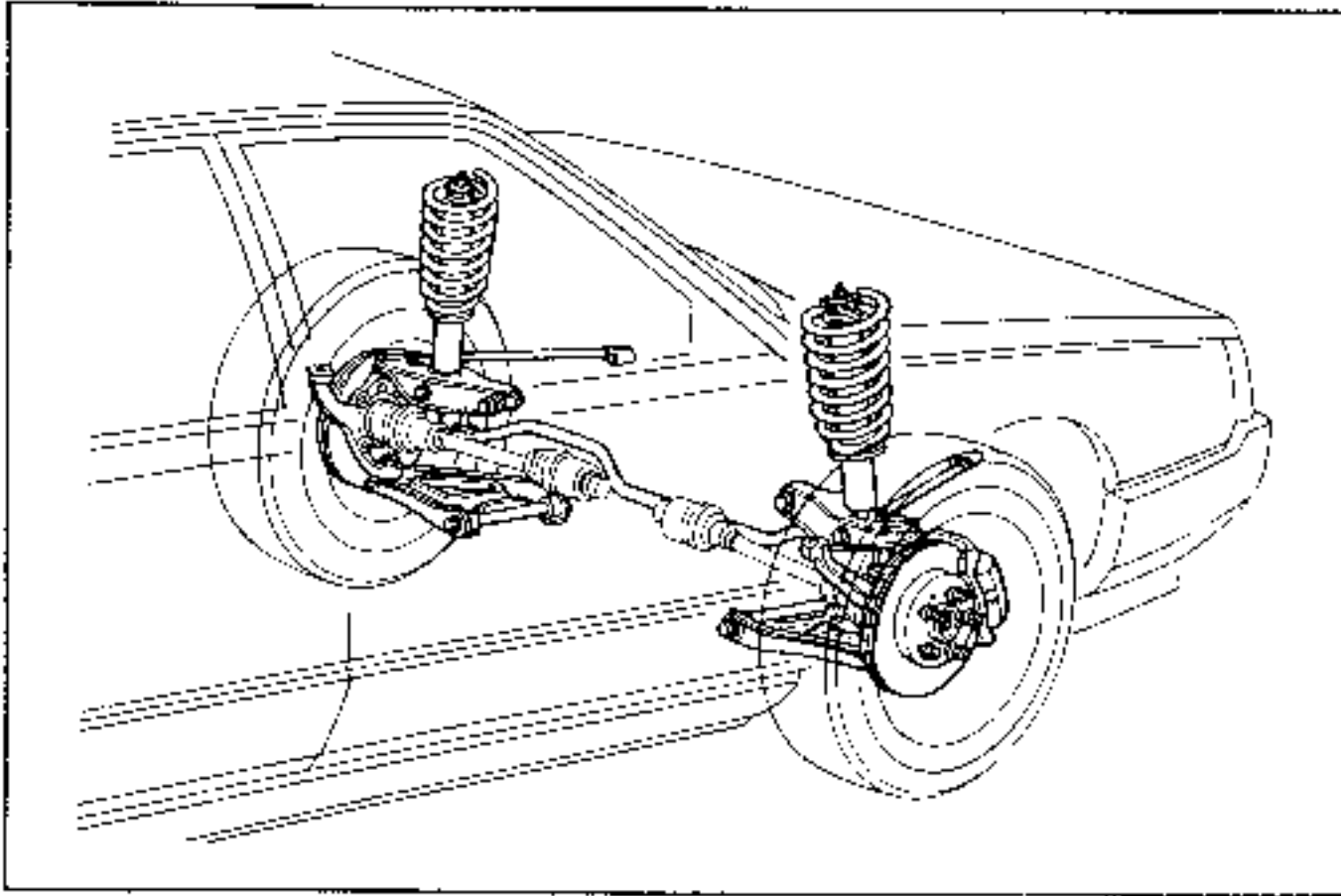
- chassis end, upper and lower arms on rubber bushings,
- (wheel end, stub axle carrier on sealed ball-joints) .

Rack and pinion steering and axial ball-joints.

Front wheel drive via two driveshafts incorporating constant velocity joints.

Front hubs mounted on dual row ball bearings.



FRONT AXLE - PURPOSE

The front axle must ensure constant contact between the wheels and the ground, as well as providing passenger and driver comfort.

Front axle geometry involves several angles and parameters which contribute to producing the results mentioned above.

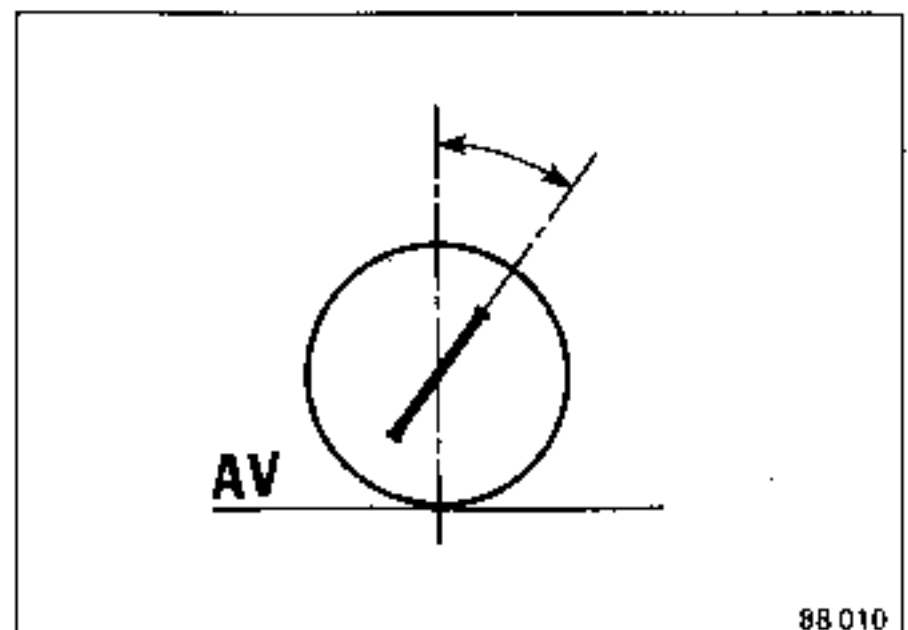
These various elements are:

The caster angle

This is the angle formed by the kingpin axis and the vertical axis, viewed from the side of the vehicle.

It ensures:

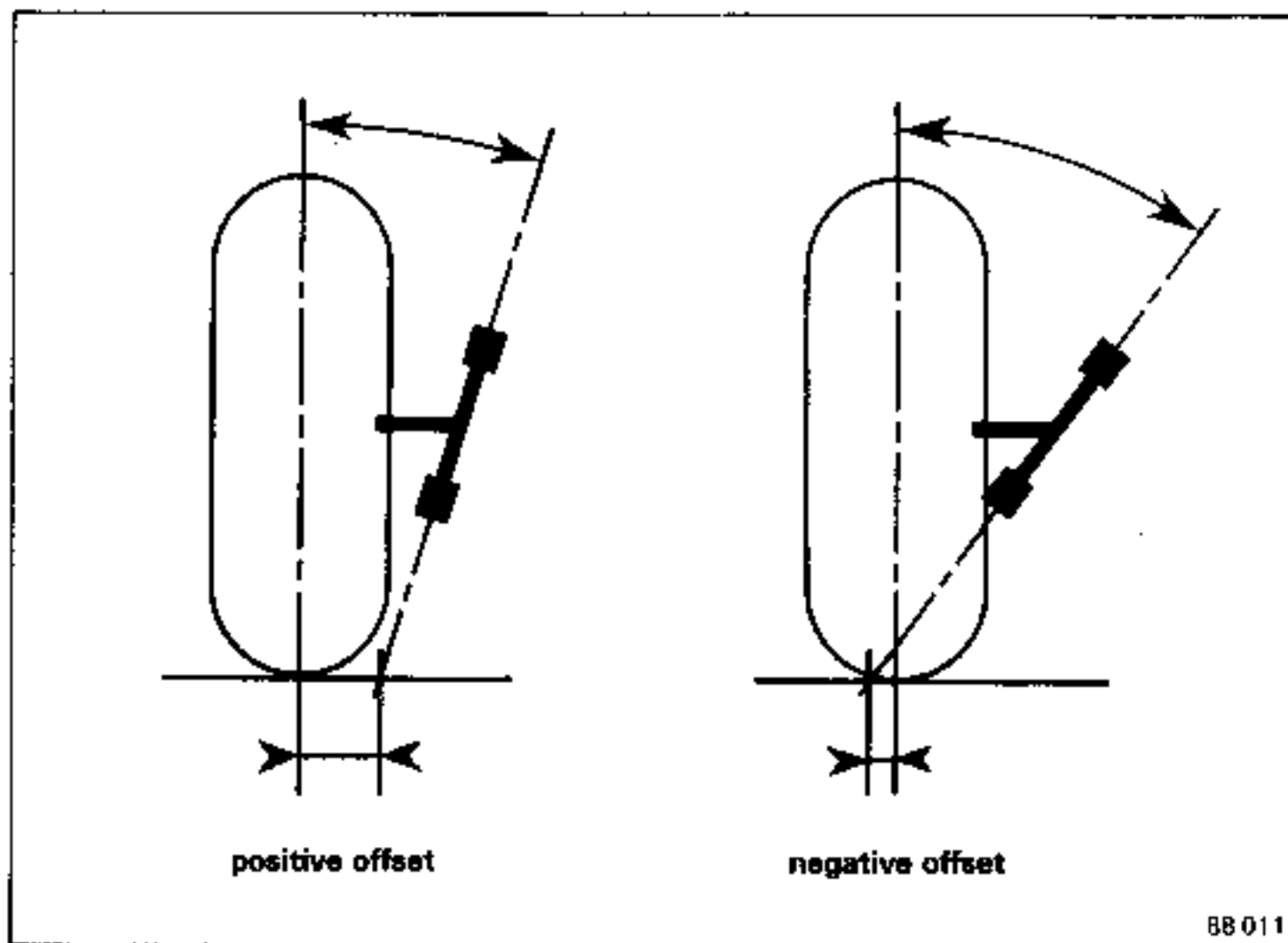
- steadiness of course straight ahead
- self-centring when cornering,
- a tendency to draw the wheels towards each other (balance is produced by the combined action of both wheels).



FRONT AXLE - KINGPIN INCLINATION (KPI)

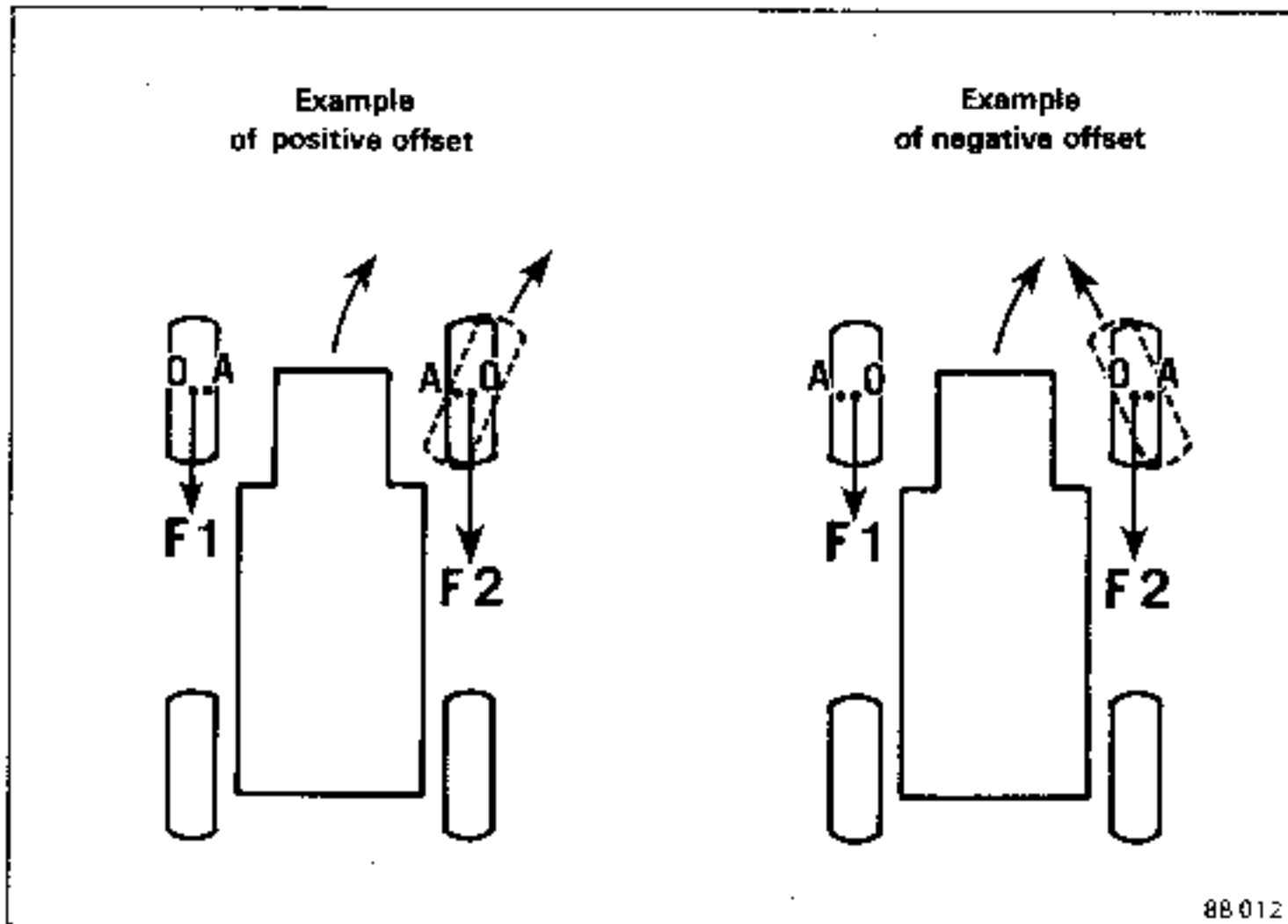
This is the angle formed by the kingpin axis and the vertical, viewed from the front of the vehicle;

- it reduces castor offset,
- together with the ground offset, it helps the wheels to self-centre.

**NOTE:**

Negative offset enables the vehicle to hold its course when braking is unequally distributed.

FRONT AXIS - KPI



8B 012

It is possible that the braking force on one front wheel may be stronger than the braking force on the other (caused by grip, brake condition, etc.); for example, the braking force on the left-hand front wheel may be (F1), while it is (F2) on the right-hand front wheel. In the latter case, the right-hand front wheel, which brakes harder, turns more slowly than the left-hand front wheel, pulling the vehicle to the right.

If the offset is positive, and since (F2) is greater than (F1), the right-hand front wheel tends to swerve to the right under the influence of torque $F2 \times OA$. This "toe-out" of the right-hand front wheel is added to the pulling to the right caused by the faulty braking.

On the other hand, if the offset is negative, the right-hand wheel tends to swerve to the left under the influence of torque $F2 \times OA$. This "toe-in" tends to counteract the effect of the pulling to the right caused by faulty braking.

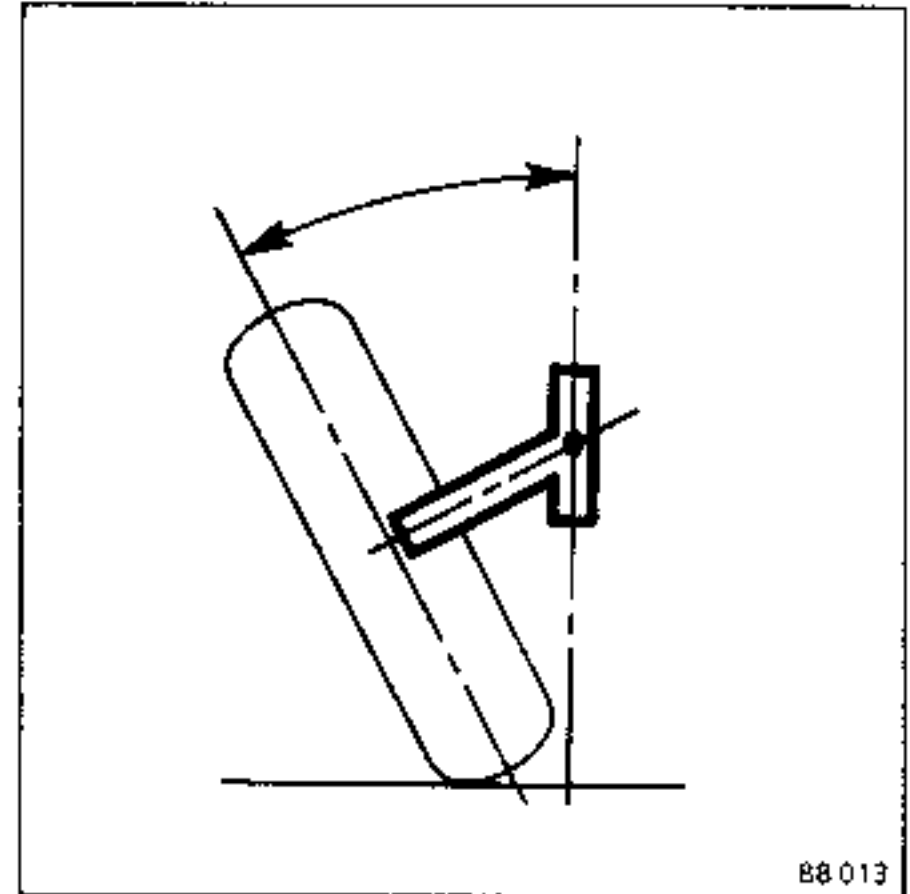
NOTE:

Front axle negative offset does not necessarily require an "X" braking layout. However, if such a layout is chosen, negative offset is essential.

FRONT AXLE - CAMBER ANGLE

This is the angle formed by the wheel and the vertical when viewed from the front of the vehicle.

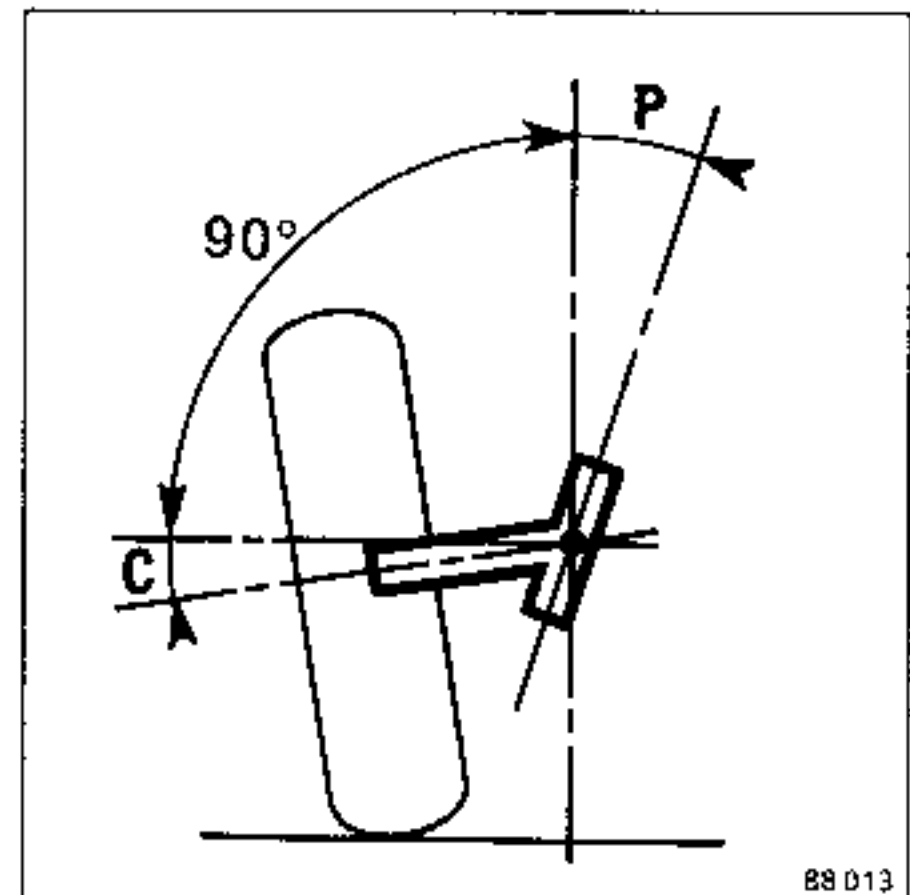
- It keeps the steering steady,
- It transfers the load to the inner bearing,
- It influences the offset.



Included angle

This is the sum of the KPI + 90° + the camber angle:

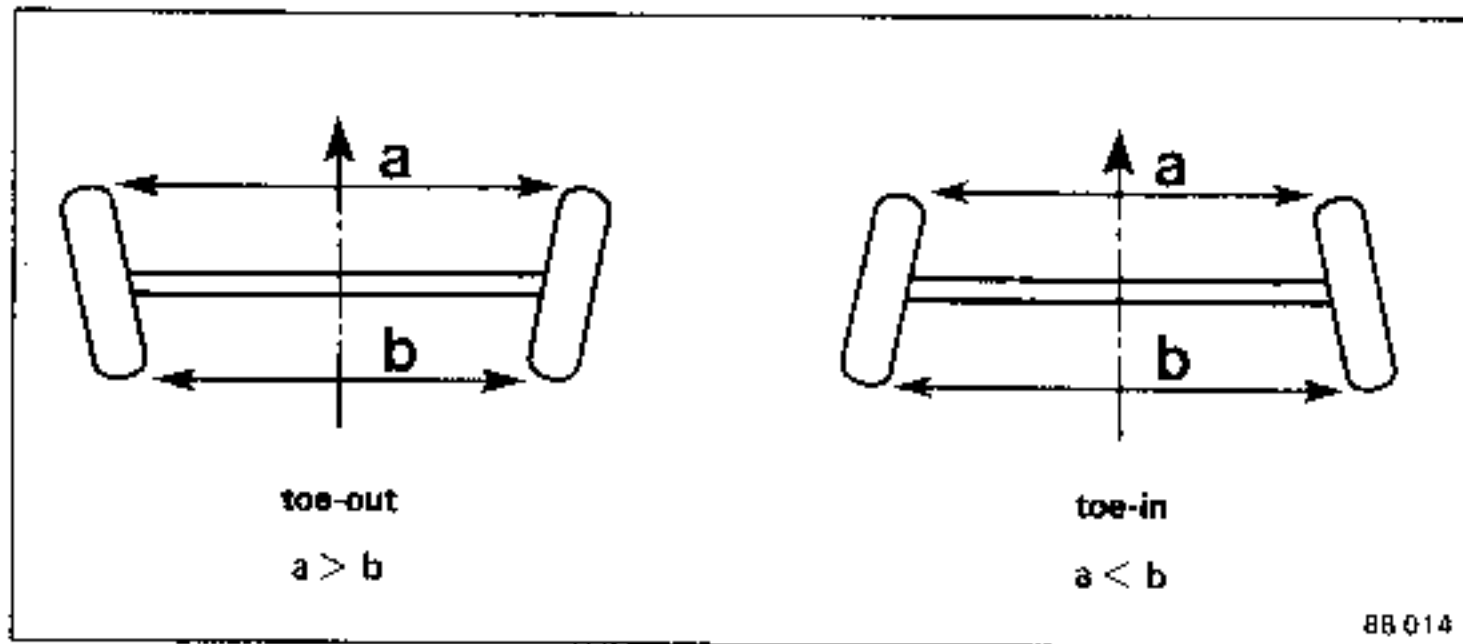
- It determines the stub angle geometry.



FRONT AXLE - PARALLELISM

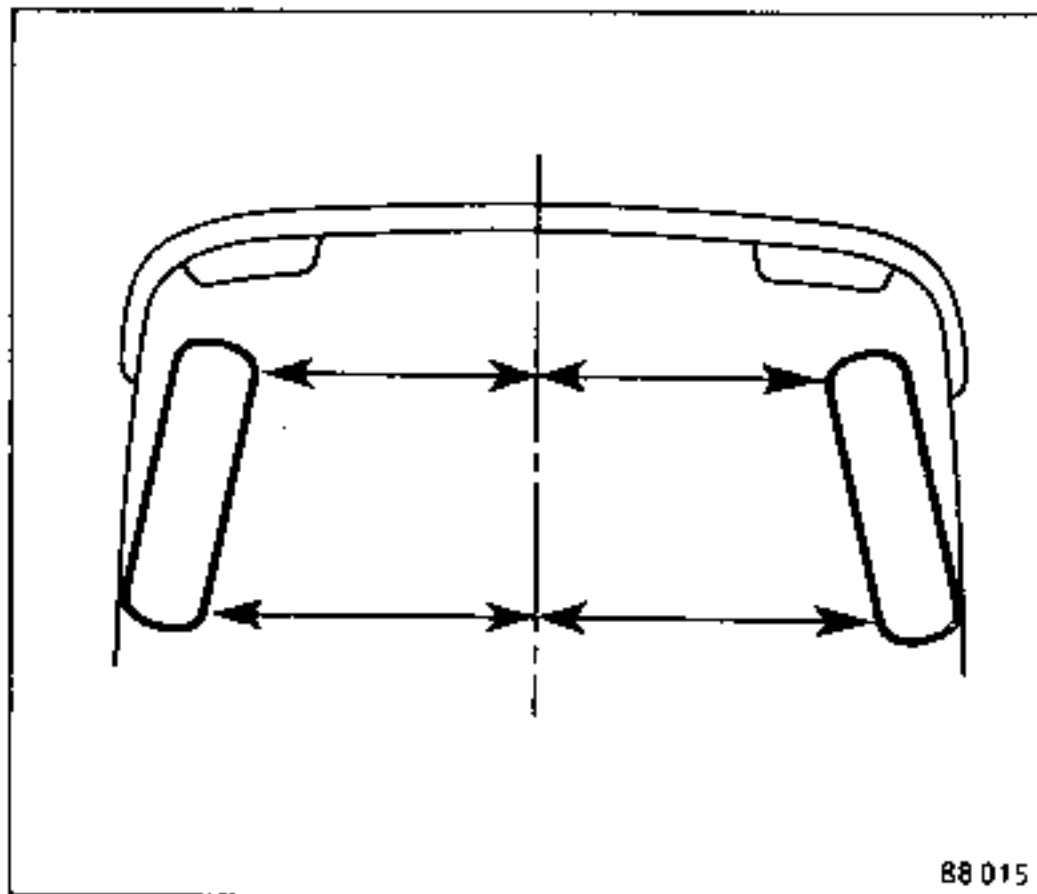
This is the difference in length between the front and the rear of the wheels of the same axle.

The purpose of the parallelism is to counteract the effects of the camber angle.



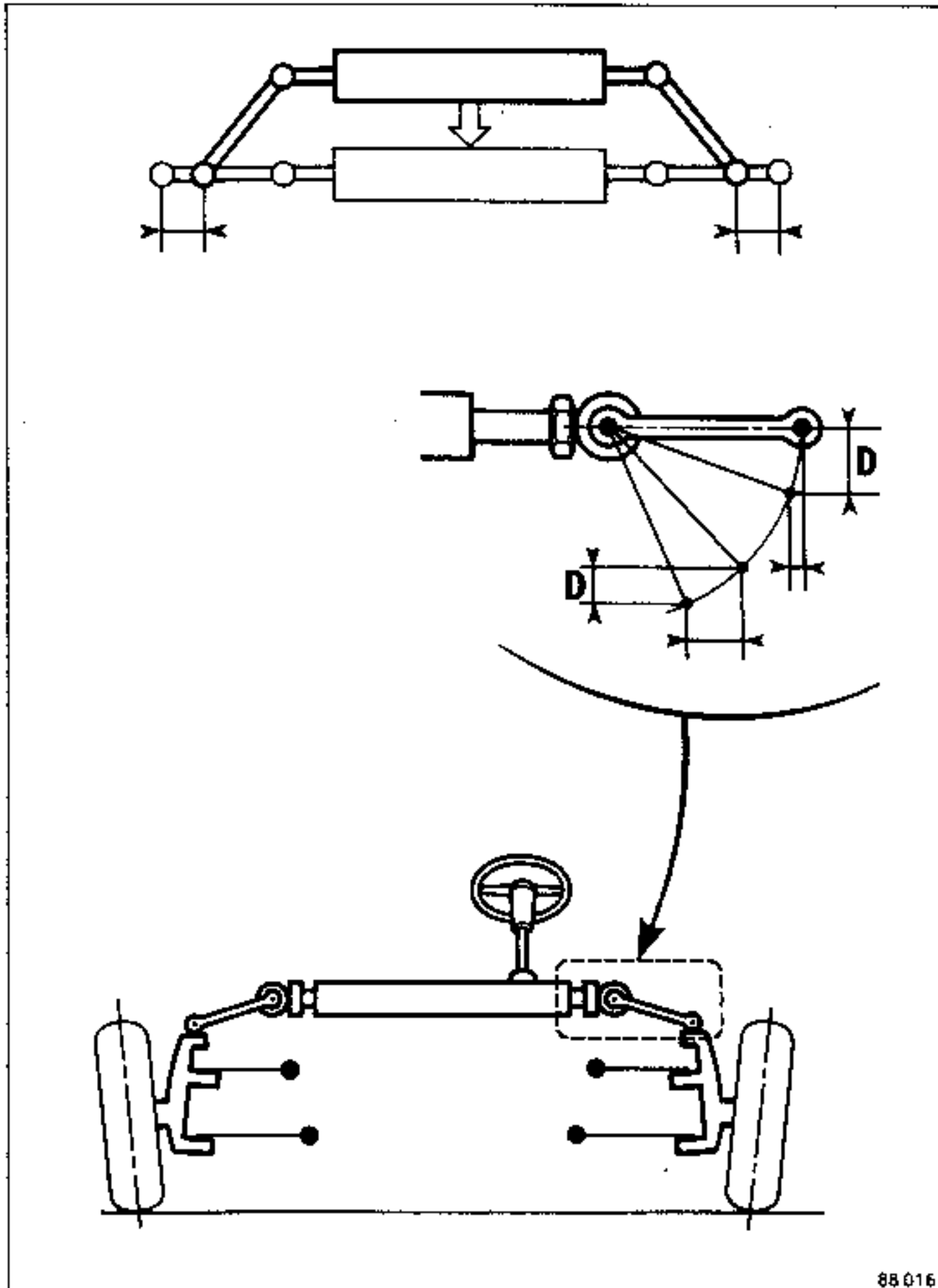
Distribution or alignment

This involves equally dividing the parallelism amongst all the wheels.



FRONT AXLE - STEERING BOX HEIGHT

Suspension with a large travel, together with a transverse arm front axle and relatively short steering arms produces a variation in parallelism.



For example:

The travel (D) in the suspension will cause the wheel parallelism to vary somewhat depending on the height of the steering box.

FRONT AXLE - INTERACTION

INTERACTION between the various parameters of the front axle. In vehicles in the **RENAULT** range which have one or more of these adjustable parameters:

- the caster influences the steering box position and the camber;
- the camber influences the caster;
- the KPI exerts the same influence as the camber;
- the steering box height position influences the parallelism and distribution.

Special system

The **RENAULT 25** is fitted with a specially designed front axle, the purpose of which is to reduce:

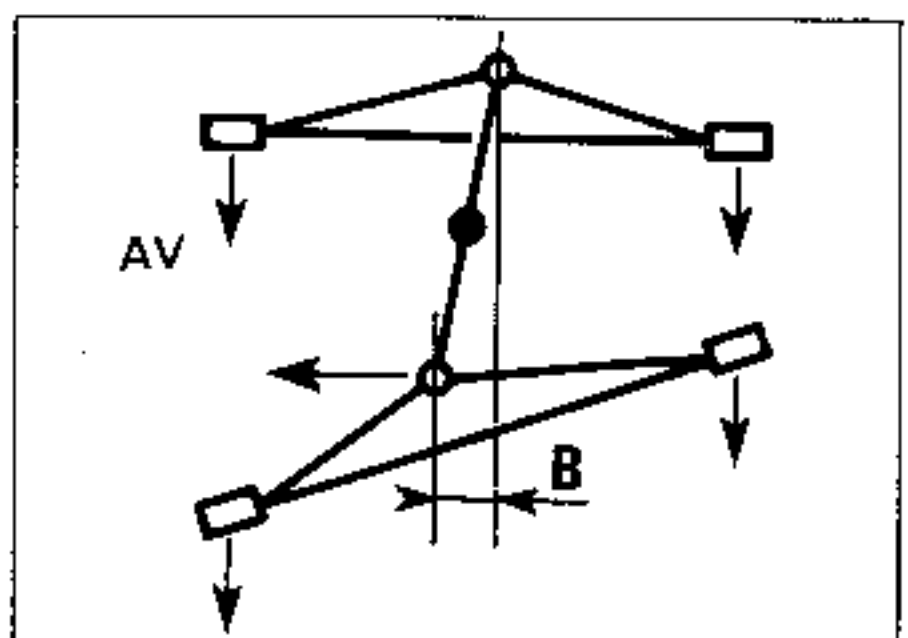
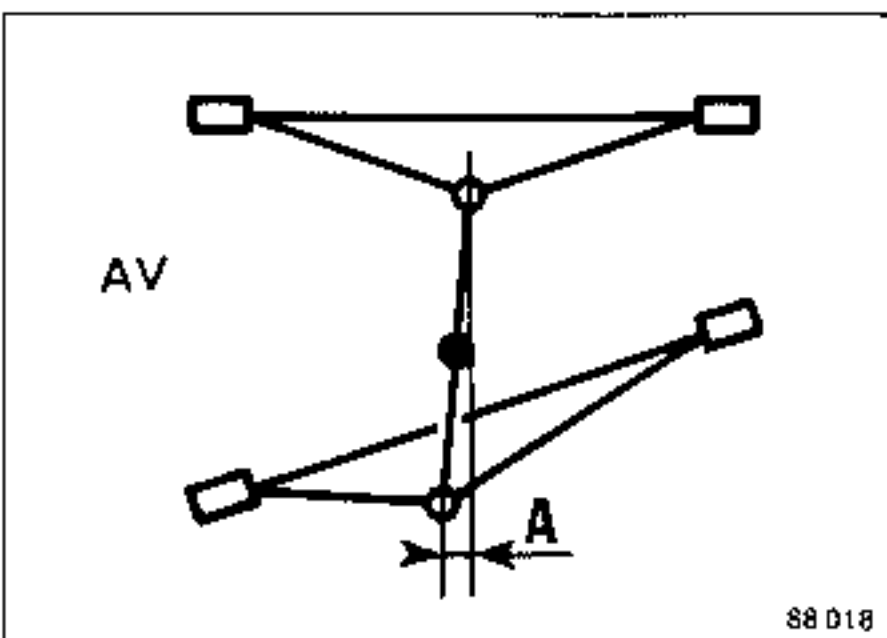
- the "nosedive" effect during hard braking;
- the "lifting" effect during acceleration.

This system is known as "anti-nosedive".

Anti-nosedive

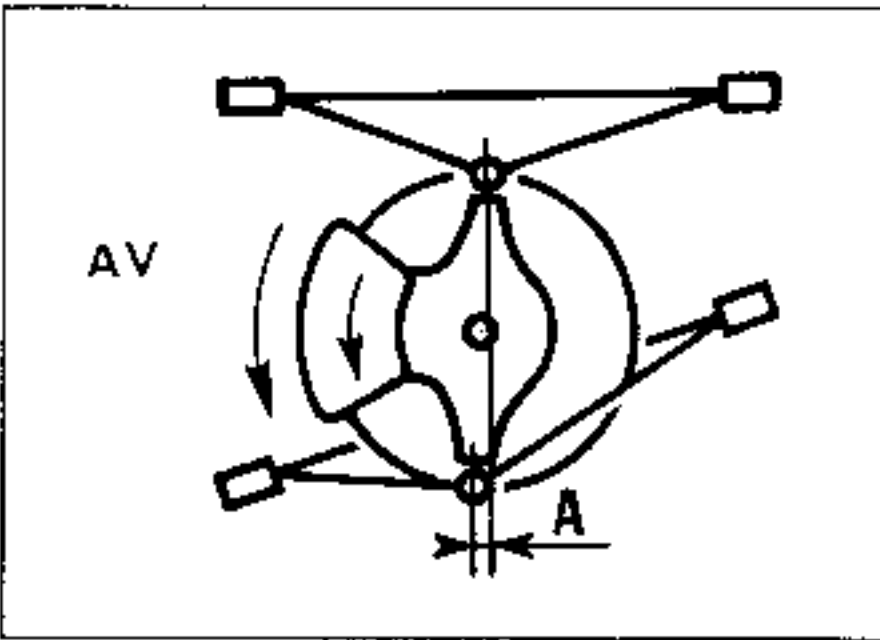
- the lower suspension arm is inclined forwards.

- The lower suspension arm ball-joint moves forward when the body "nosedives".

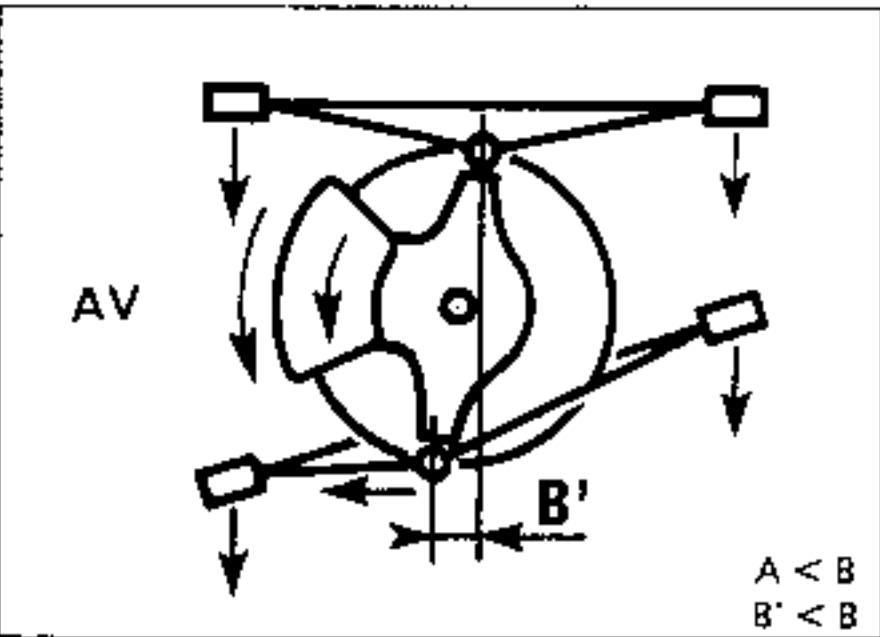


FRONT AXLE - SPECIAL SYSTEM

- When braking, the stub axle carrier is subjected to considerable force which tends to make it turn in the same direction as the wheel.

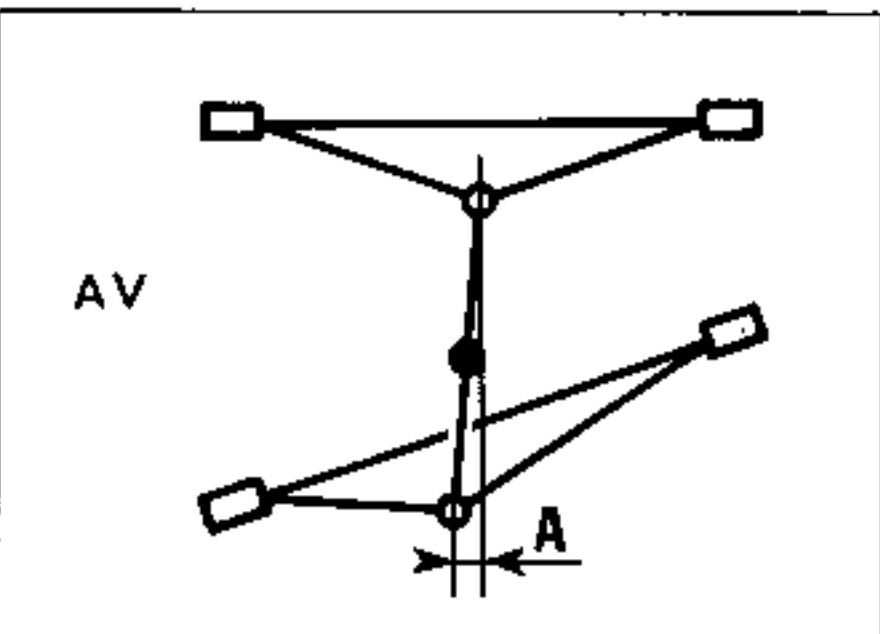


- The stub axle carrier opposes any forward movement of the lower ball-joint, thereby restricting the nosedive effect of the front of the vehicle.

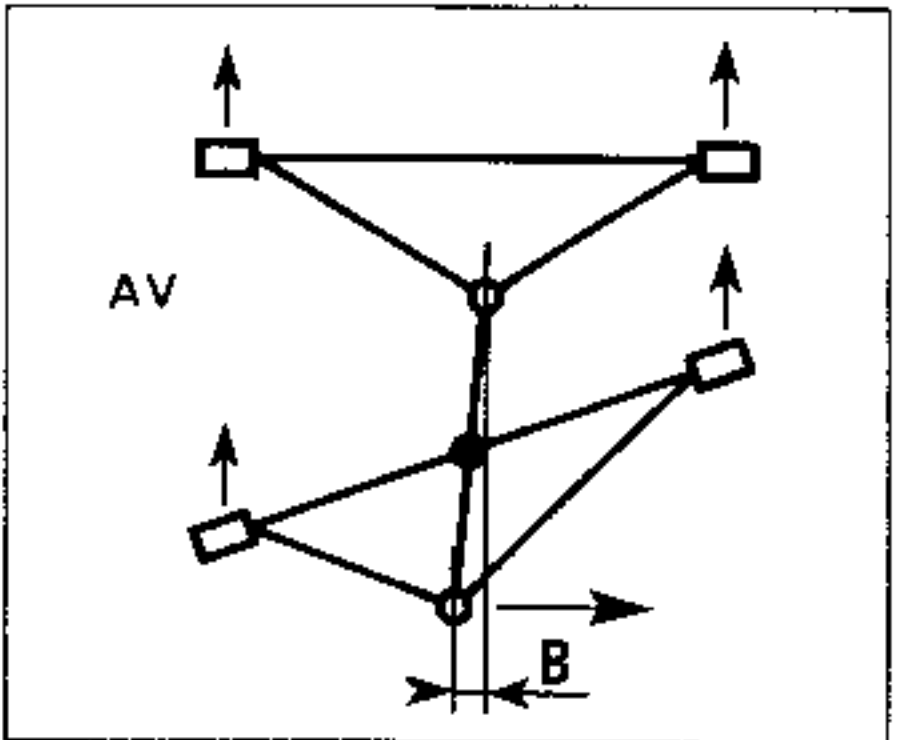


Anti-lifting

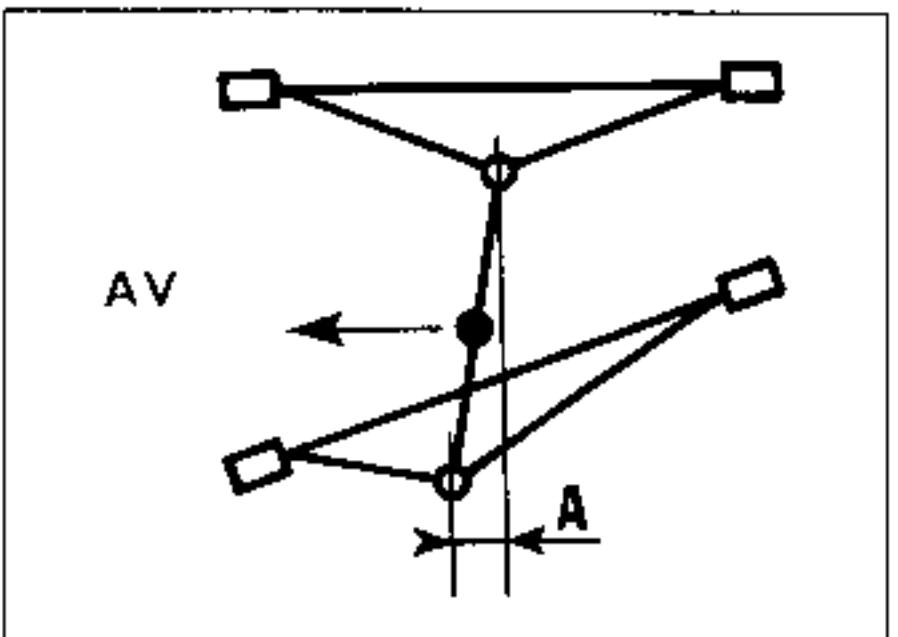
- the lower suspension arm is inclined forwards.



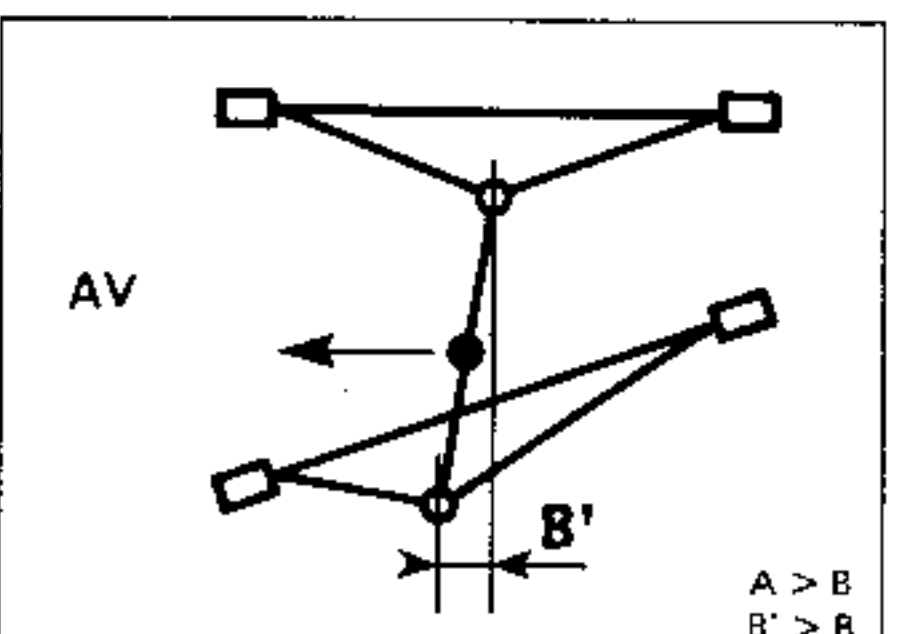
- The lower suspension arm ball-joint moves backwards when the front of the body lifts.



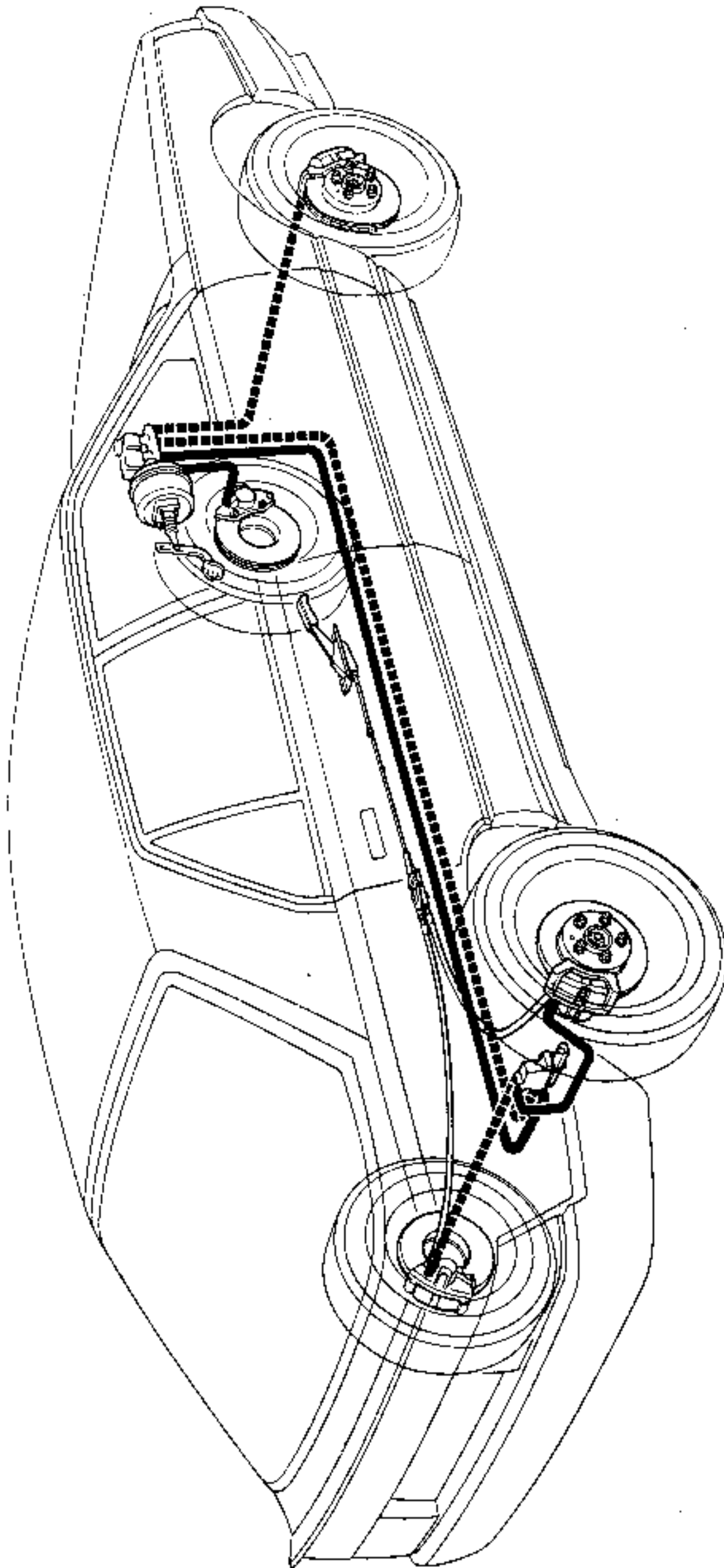
- When accelerating, the wheel pulls the stub axle carrier forwards.



- The stub axle carrier opposes any backward movement of the lower ball-joint, thereby restricting the lifting effect at the front of the vehicle.



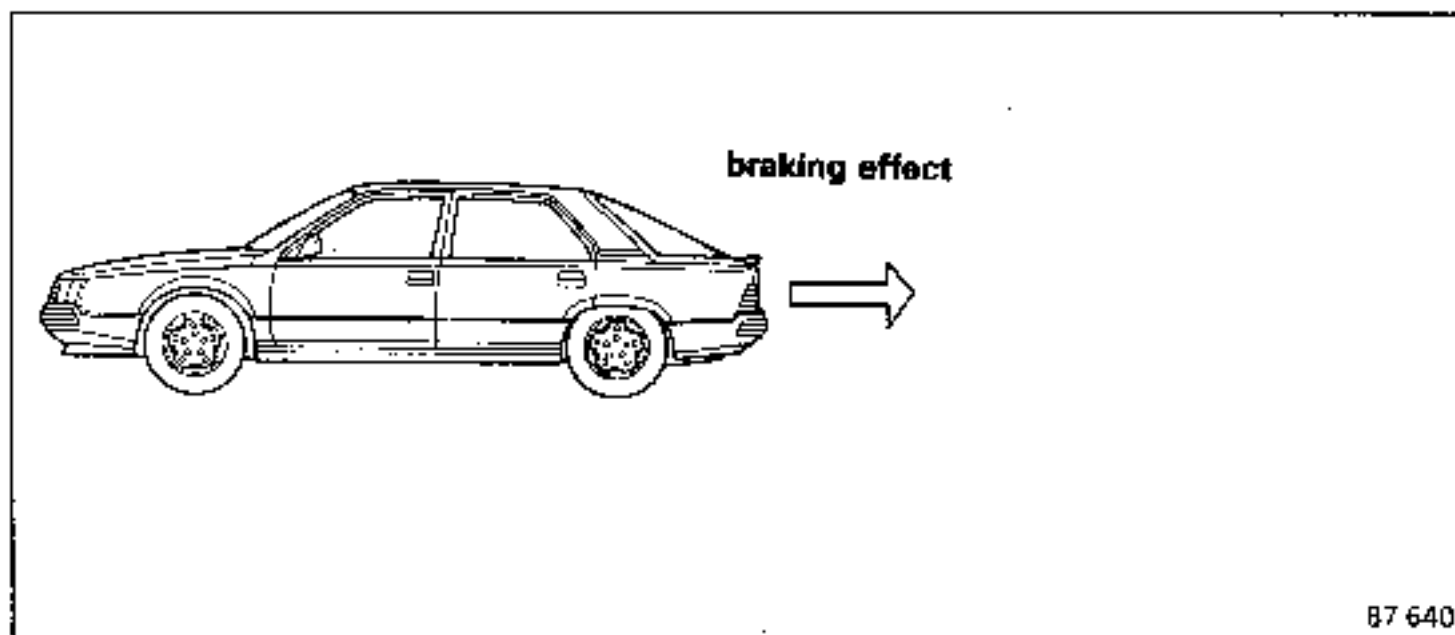
BRAKING SYSTEM



BRAKING SYSTEM

The purpose of the braking system is to **SLOW DOWN** and **STOP** the vehicle under the best possible conditions, i.e. with:

- **EFFICIENCY** - As quickly as possible and over the shortest possible distance.
- **STABILITY** - Maintaining the vehicle's course.
- **PROGRESSIVE** - With a braking effect proportional to the effort exerted by the driver.
- **COMFORT** - Requiring minimum effort by the driver.

BASIC PRINCIPLE

The wheels are slowed down by the **FRICTION** of a fixed chassis element against an integral part of the rotating wheel.

We now know that:

WEIGHT TRANSFER takes place during braking; the front axle is over-loaded while the rear axle is subjected to a reduction in load. This means that the front wheels are more likely to lock before the rear wheels.

On the other hand, if the wheels of the same axle do not brake equally, the vehicle will pull to the side of the wheel braking the harder.

We can therefore conclude that:

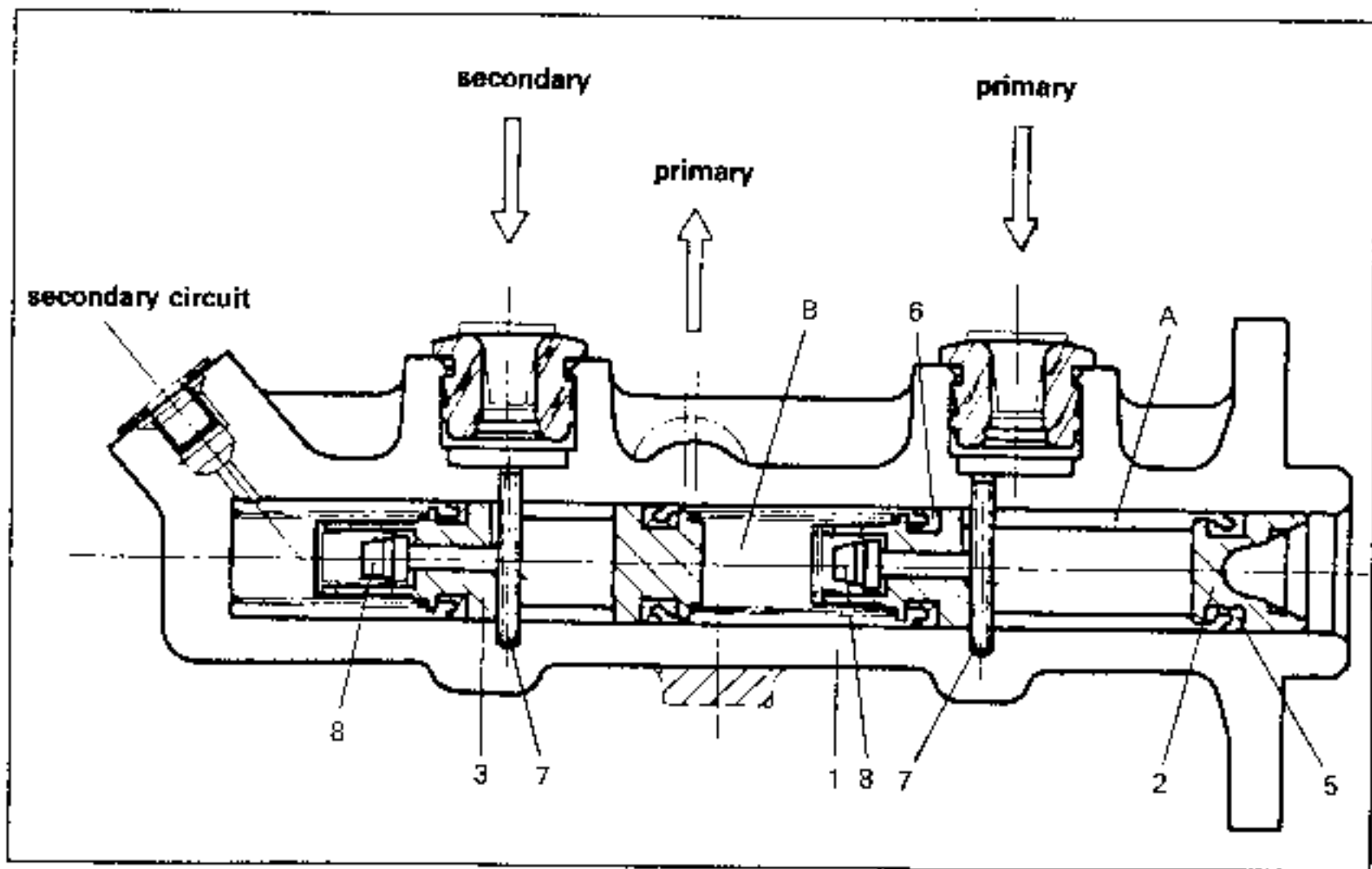
Braking must be **HARDER** on the front wheels than on the rear wheels and braking must be **EQUAL** for wheels of the same axle.

A braking circuit must therefore be designed which can achieve the results and characteristics described above.

BRAKING SYSTEM - MASTER CYLINDER**PURPOSE**

The master cylinder converts the mechanical pressure on the pedal into hydraulic pressure.

The driver causes the master cylinder pistons to move. During braking, these force brake fluid towards the wheel cylinders.

TANDEM MASTER CYLINDER

This comprises:

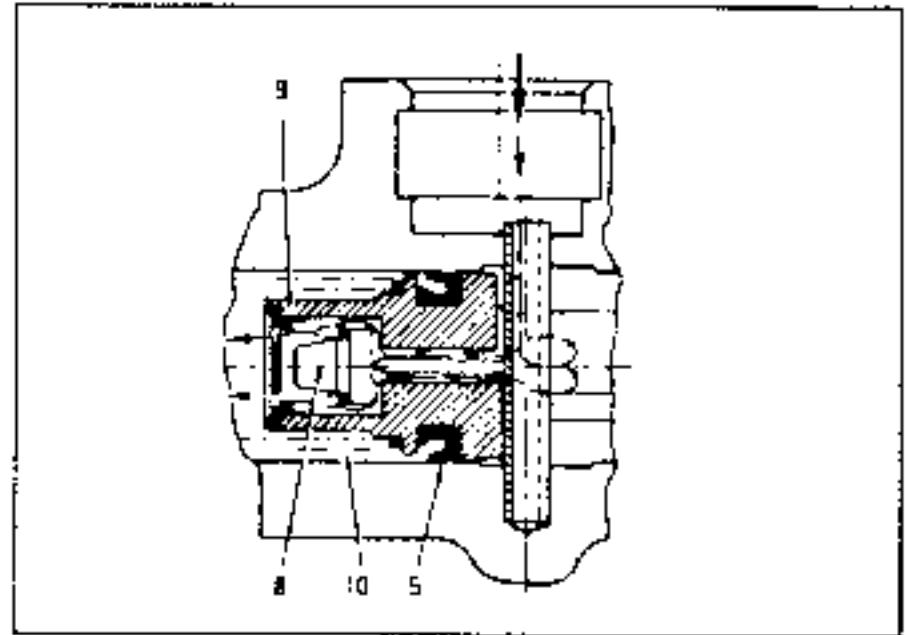
- A body (1), which is connected to the reservoir by two holes which ensure primary and secondary feed to the braking circuits and to the rollpins (7)
- Two pistons: a primary (2) and a secondary piston (3). Each piston has an axial, oblong aperture through which the rollpin passes during the piston's stroke. The head of each piston has a hole through which the valve (8) slides.
- Cup washers (5) and (6). These seal the feed chamber (A) and the pressure chamber (B).
- Two valves (8) which provide a link between the reservoir and the pressure chamber. To facilitate this, the stem of each valve has flats which enable the fluid to flow through the piston head, which is made of elastomer and provides a seal on the piston face.

BRAKING SYSTEM - OPERATION

The primary (2) and secondary (3) pistons slide within the body (1).

- **Rest position**

The pistons are held against the rollpin by their return spring (10). The valves, which are also held against the rollpin, do not come into contact with the cup washers. This therefore re-establishes the link between the reservoir and the pressure chambers.

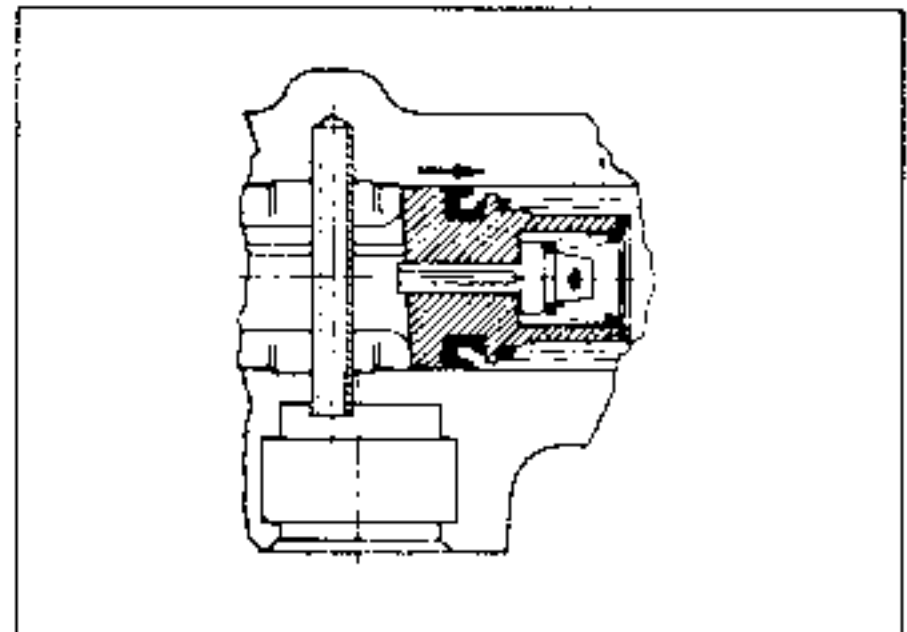


- **Braking position**

The pushrod pushes the piston and the primary cup washer forwards. The valve spring causes the valve to rest against the primary cup washer, thereby isolating the reservoir pressure chamber. The pressure of the fluid in the primary circuit therefore rises.

This pressure causes the secondary piston to move; the secondary valve rests against the secondary cup washer and the fluid pressure in the secondary circuit rises.

This increase in pressure only happens once all the pistons in the wheel cylinders have completed their stroke, in other words, when the braking linings have come into contact with the drum or disc.

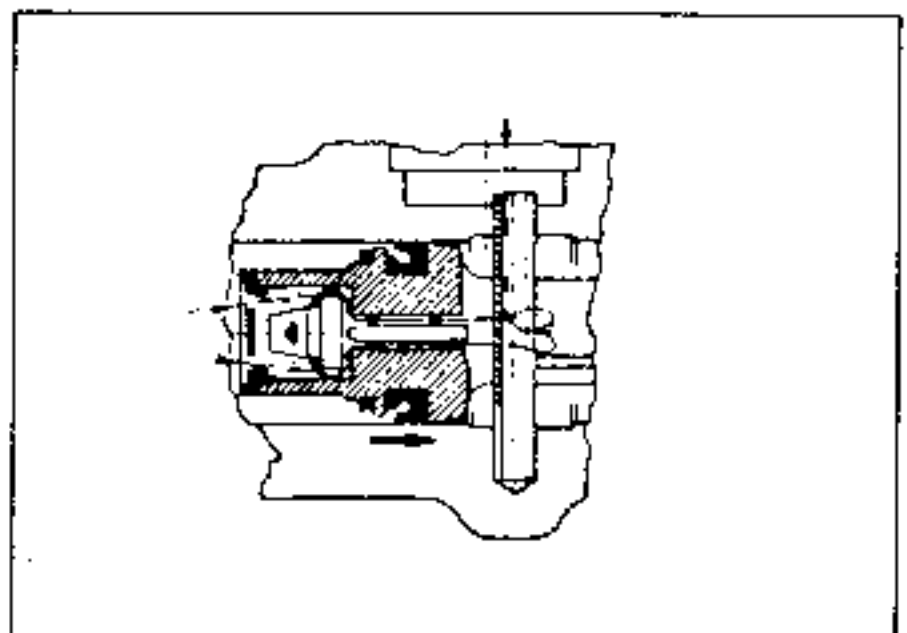


- **Braking release position**

Once the pressure has been released, the primary and secondary pistons return to their rest position under the influence of the return springs (10).

The hydraulic pressure in the circuits falls.

Since the pistons return more quickly than the fluid, a vacuum is created in the operating chamber: the valves are no longer in contact with the cup washers and the fluid is sucked from the reservoir.



BRAKING SYSTEM - SERVO ASSISTANCE**PURPOSE**

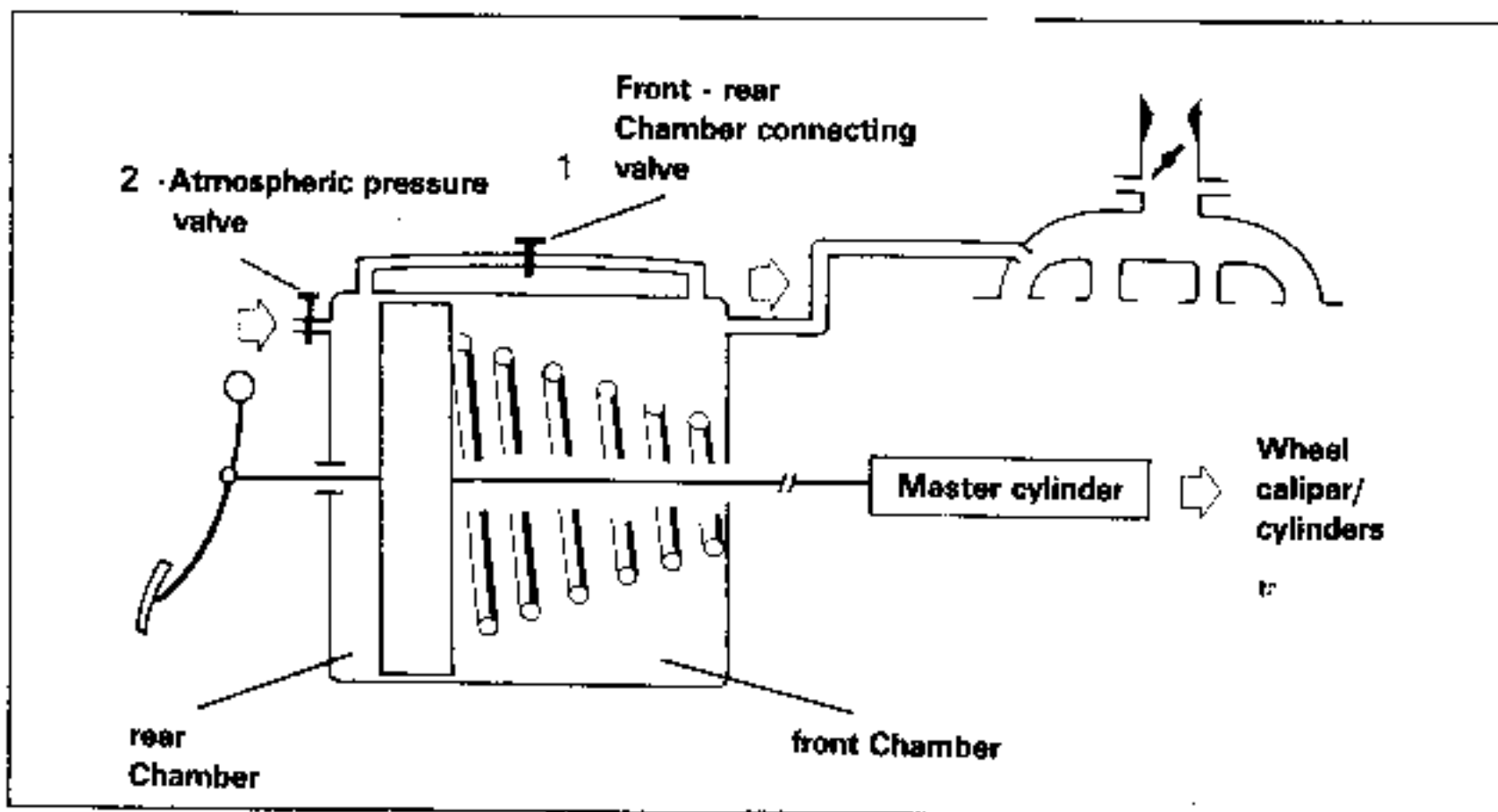
The servo-assistance (or brake servos) is intended to increase the effort exerted on the pedal, which allows the driver:

- either to achieve a given braking effect with less effort
- or to achieve harder braking using the same effort.

The brake servos draw their power either from the vacuum in the inlet manifold (in petrol engines) or from the vacuum created by a vacuum pump (in diesel engines).

The "Master-Vac"

This is a brake servo which acts on a master cylinder.

Operating diagram**In the rest phase**

Valve (1) is open, valve (2) is closed.

The front and rear chambers are subjected to the engine vacuum and the spring pushes the piston backwards.

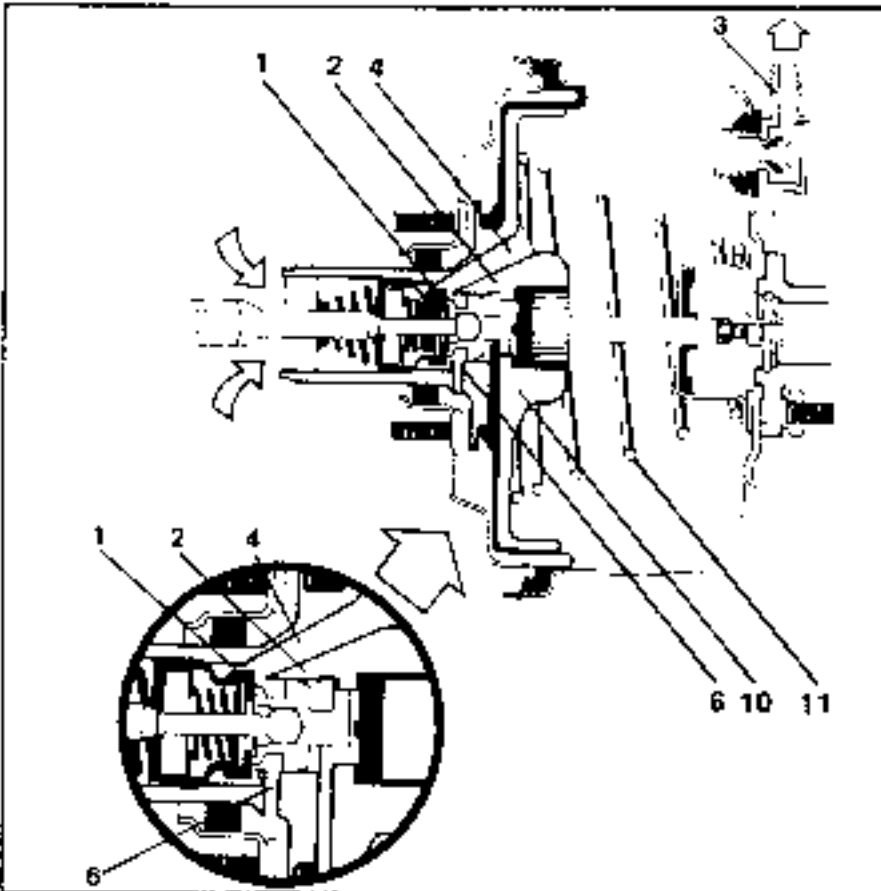
In the operating phase

Valve (1) is closed, valve (2) is open.

The rear chamber is subjected to atmospheric pressure, the front chamber to the engine vacuum, which produces piston imbalance and "assistance" to the effort exerted on the pedal.

BRAKING SYSTEM - THE MASTER-VAC

ACTUAL DIAGRAM



Rest phase

- The engine vacuum effect is transmitted to the front chamber via valve (3).
- The connecting valve (1) is lifted from its seat (2), which allows the vacuum to pass through to the rear chamber via channels (6) and (4).
- Since there is a vacuum in the front and rear chambers, the piston (10) is kept in its rest position by its spring (11).

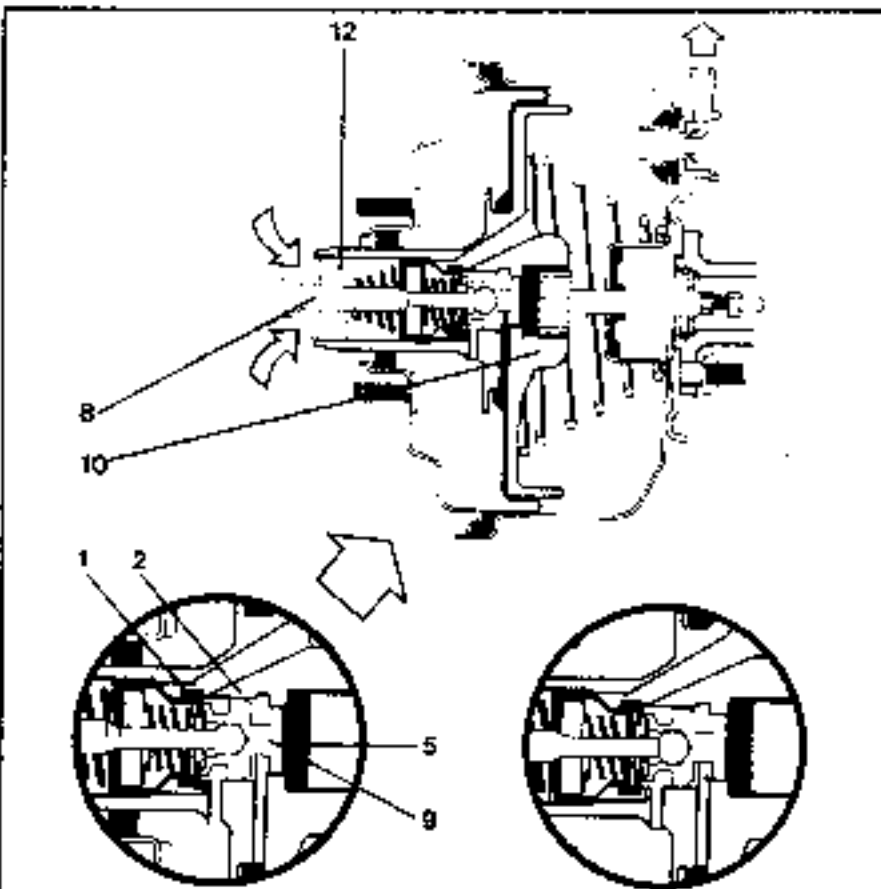
Operating phase

1st phase:

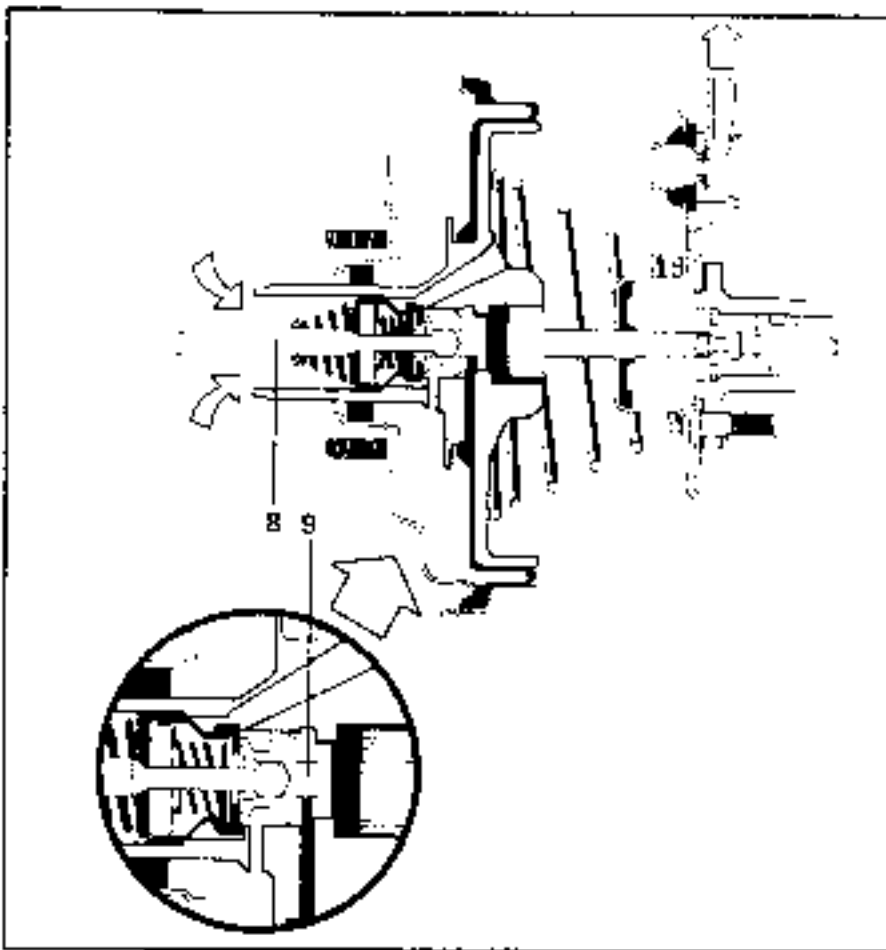
- The movement of the pushrod (8) causes the valve (1) to come to rest on its seat (2).
- The vacuum from the rear chamber is cut off.
- The plunger compresses the thrust washer (5).

2nd phase:

- The plunger (9) separates from valve (1).
- Air at atmospheric pressure enters the rear chamber after passing through filter (12).
- The pressure difference between the chambers induces movement of the piston (10).



BRAKING SYSTEM - THE MASTER-VAC



Braking maintained

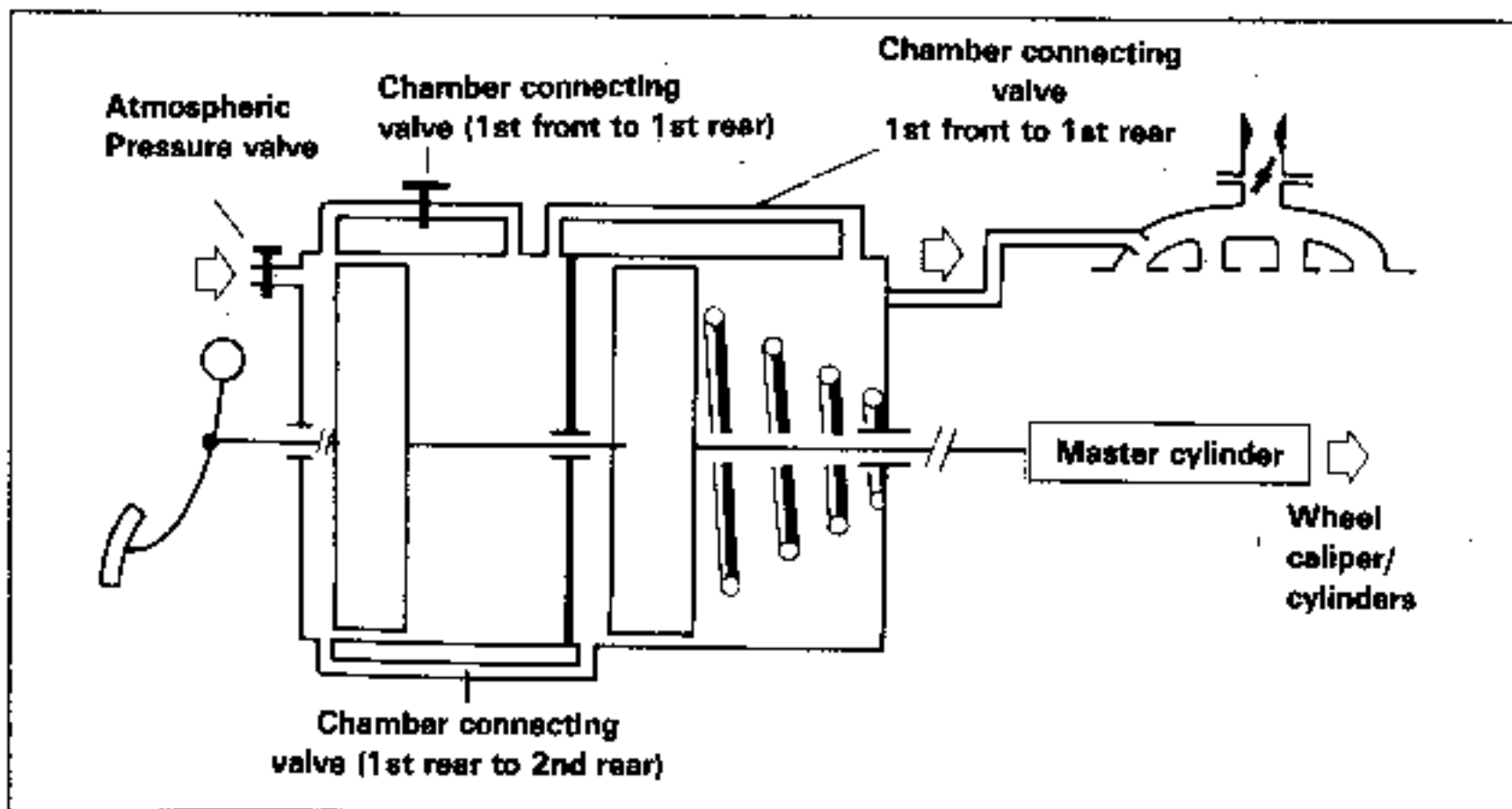
- Having achieved the required degree of deceleration, the driver maintains constant pressure on the pedal.
- The pushrod (8) and the plunger (9) remain stationary but the piston still moves a little.
- The central section of the thrust washer slackens.
- The plunger (9) once again comes to rest against the valve (1).
- The supply of air at atmospheric pressure is cut off.
- The brake servo assistance is held at this pressure.

Return to the rest position

- The rod (8) is pushed back by spring (7) and the valve (1) lifts from its seat.
- Both chambers are subjected to the engine vacuum.
- The piston (10) is pushed back by the spring (7).

THE TWIN MASTER-VAC

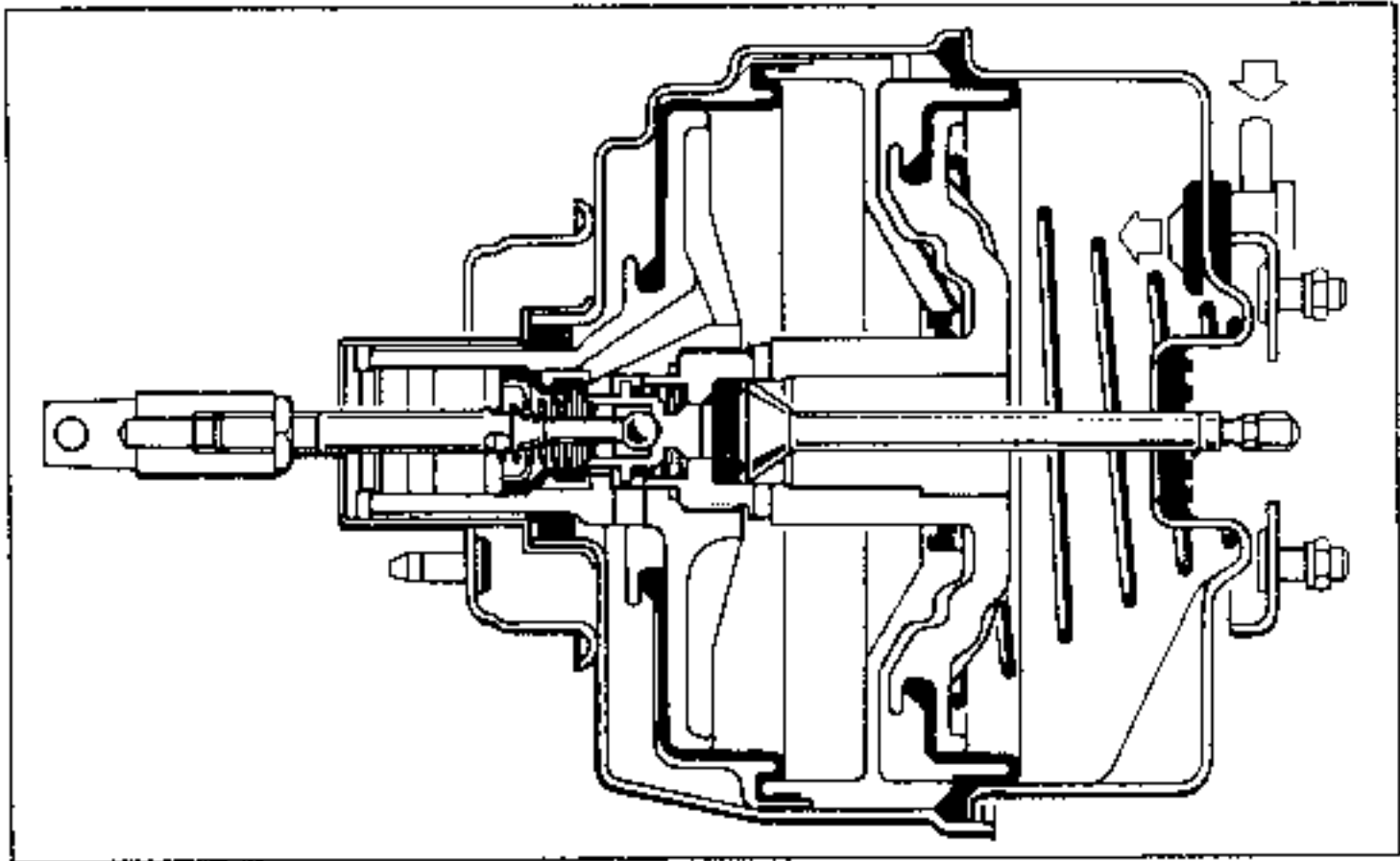
Basic principle



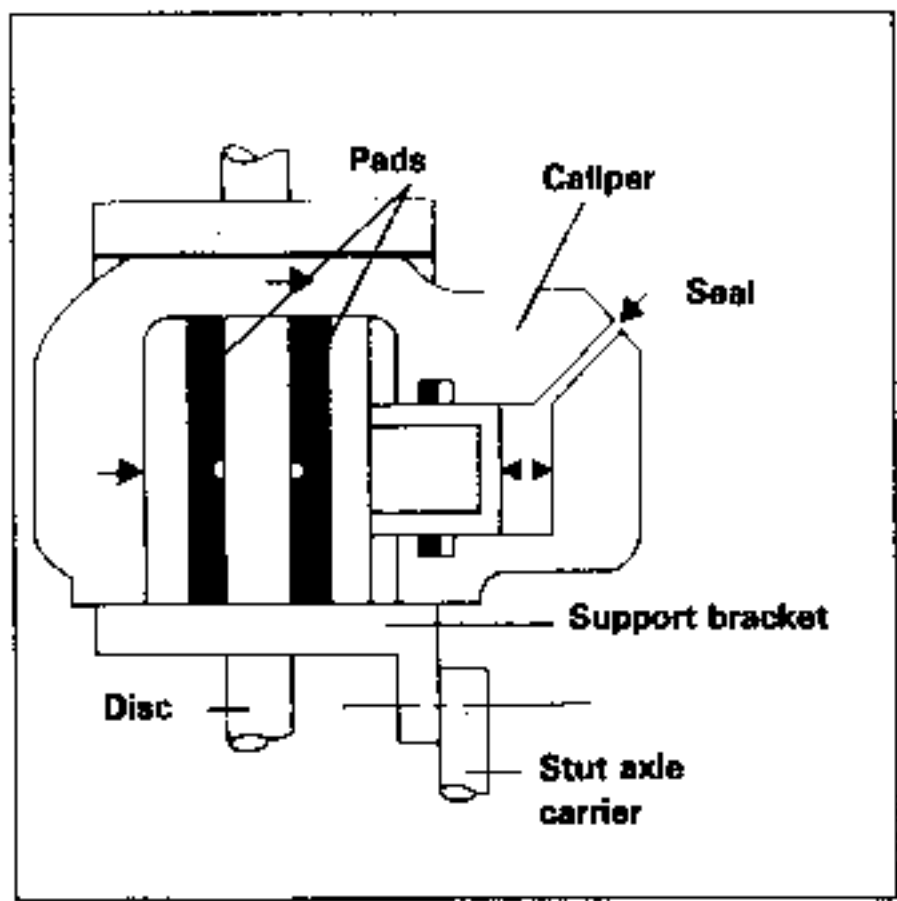
BRAKING SYSTEM - THE MASTER-VAC

This operates in a similar way to the single master-vac.

It has the advantage of providing greater servo assistance with the same diameter, since there are two pistons instead of one.



Disc brakes



Front wheel disc brakes

They are comprised of:

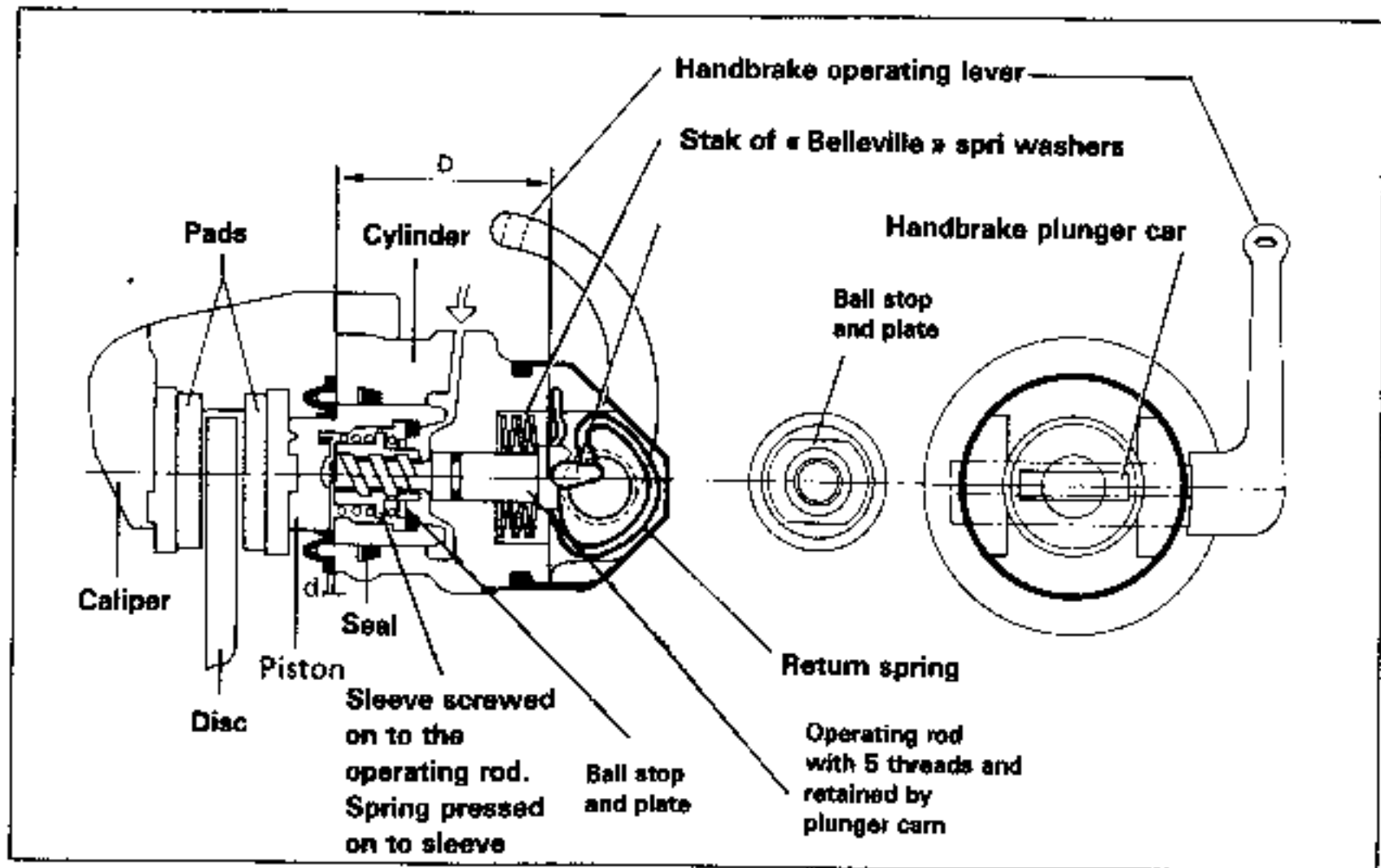
- the disc, which is an integral part of the wheel;
- integral parts of the chassis:
 - the caliper bracket,
 - the pads,
 - the caliper*.
- Releasing components:
 - the disc run-out,
 - the seal.

* The most widespread type is the floating caliper. Firstly, the pad is pushed against the disc by the piston. Then, since the piston can advance no further, the caliper moves with respect to the caliper bracket and pushes the second pad against the disc.

Braking SYSTEM - Disc BRAKES

Rear wheel disc brakes

With automatically adjusting handbrake system.



HANDBRAKE OPERATION

Applying the handbrake

- The handbrake lever moves the cam, which pushes the rod, compressing the flexible "Belleville" washers.
- the rod pushes the sleeve, which presses on the piston, which in turn pushes the pad.
- The sleeve tends to screw on to the rod but is prevented from doing so by the spring. In fact, in this direction of rotation, the spring, one end of which is in the piston, will tighten on to the sleeve.
- the movement of the rod will therefore cause the piston and the pad to move.

Handbrake released

- The "stack" of washers pulls on the control rod.
- The rod pulls on the sleeve.

- The sleeve, pressing on the thrust race, tends to unscrew, causing the spring (which is secured to the sleeve) to unscrew in the same direction.
- Distance (D) tends to increase.

Applying the footbrake

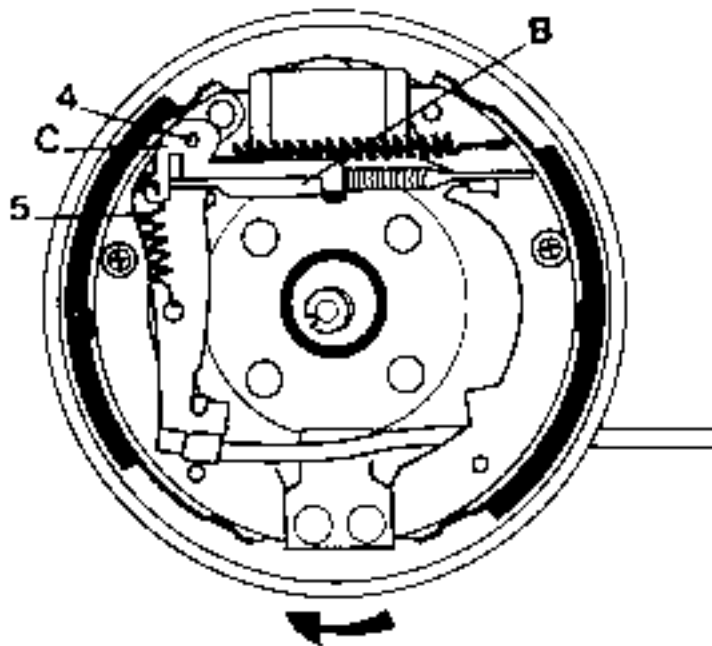
- The piston moves and the sleeve moves with it via the thrust race, the thrust washer and its retaining clip.
- The spring loosens and the sleeve unscrews.
- Distance (D) increase in proportion to the wear on the pads.

Footbrake released

- The seal pulls back the piston.
- The clearance of $\approx 0.5 \text{ mm}$ enables the piston to return.

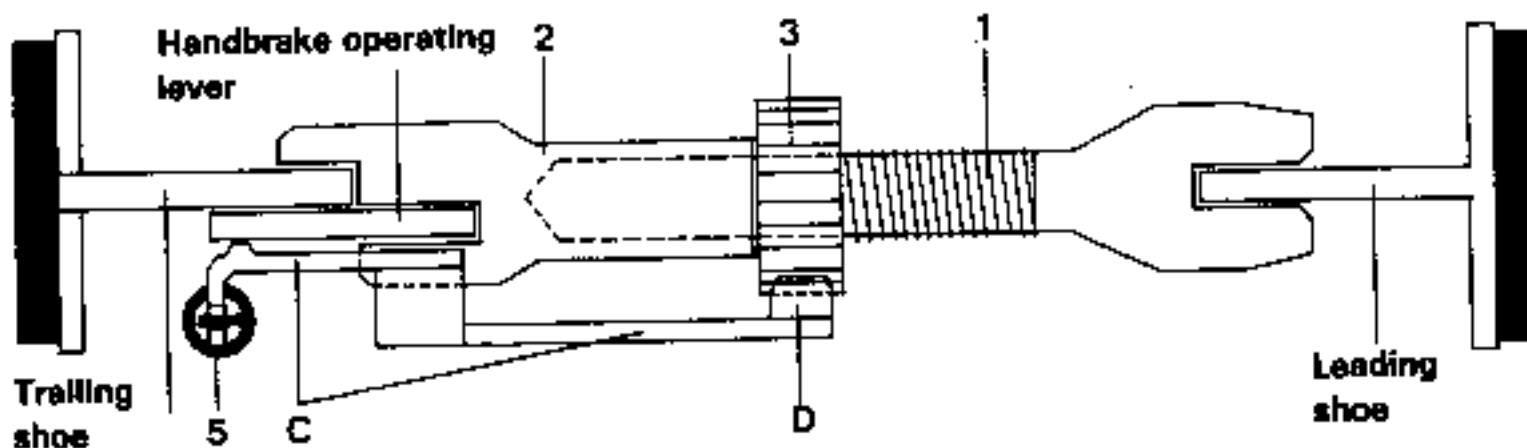
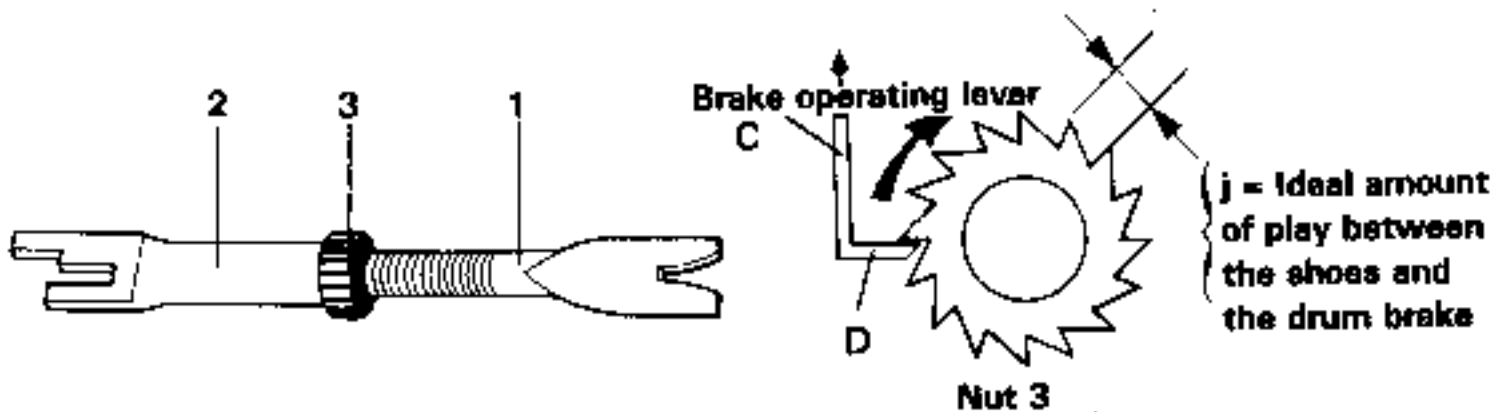
Braking SYSTEM - DRUM BRAKES (automatically adjusting)

GIRLING System



DESCRIPTION

- A link rod (B) of variable length, due to its toothed nut (3), threaded rod (1) and sleeve (2).
- An integral, jointed lever (C) at (4) on the handbrake lever, held against link rod (B) by a spring (5).
- Lever (C), plus finger (D) which engages toothed nut (3).
- The handbrake lever cable is attached to the secondary brake shoe.



OPERATION

Brakes applied:

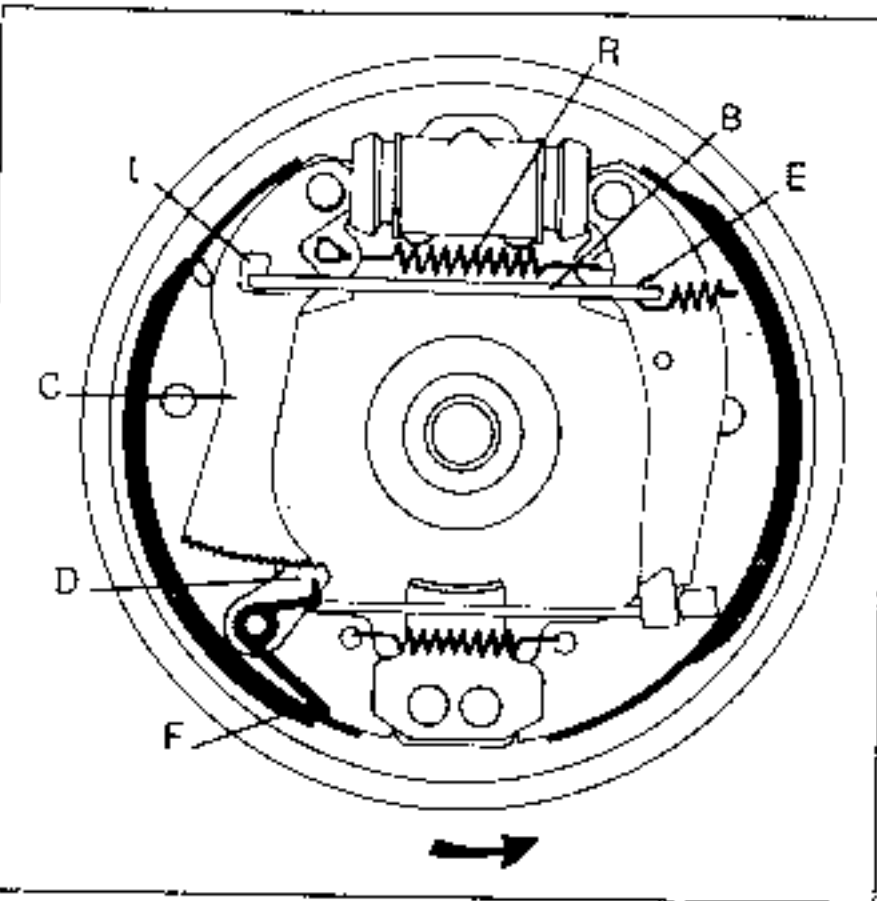
- The shoes separate, thereby freeing link rod (B) and enabling lever (C) to pivot around axis (4).
- Finger (D) on lever (C) rises and causes the nut (3) to rotate.
- The rotation of nut (3) lengthens the tie rod (B).

Brakes released:

- When the brake shoes return, lever (C) returns to its original position.
- Finger (D) can only engage the next tooth on nut (3) when the return movement of the brake shoes is adequate, i.e. when the clearance between the lining and the drum is significant.

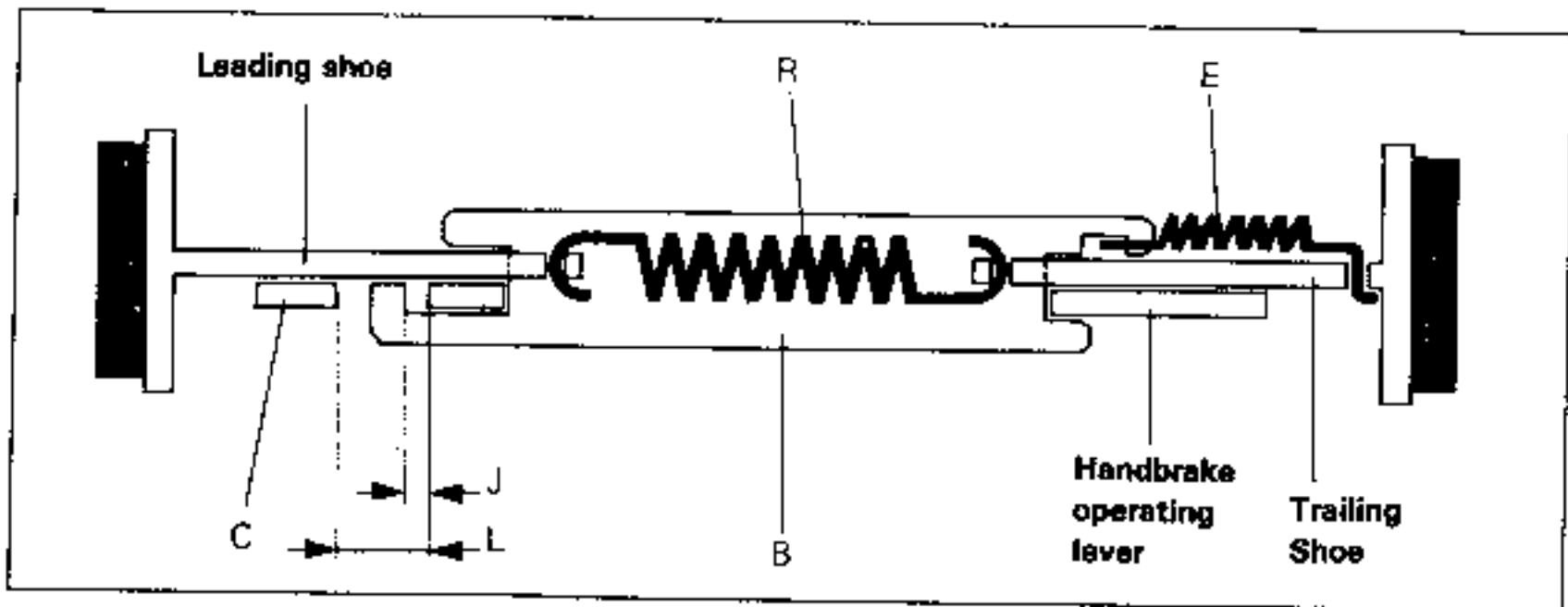
BRAKING SYSTEM - DRUM BRAKES

BENDIX SYSTEM



DESCRIPTION

- A lever (C), pivoting around the upper part of the primary brake shoe and toothed along its lower edge.
- A ratchet (D) which meshes with the readjusting lever (C) via spring (F).
- A link rod (B) attached to the secondary brake shoe by a spring (E) and which drives (C) via a hole (L).
- Clearance (J) defines the ideal clearance between brake shoes and drum.
- A spring (R) returns the brake shoes to their rest position.



OPERATION

Brakes applied:

- When the clearance between shoes and drum is greater than clearance (J); the brake shoes move apart, the secondary shoe moves the link rod (B) which in turn moves lever (C) (after taking up clearance (J)). Lever (C) moves and passes over the number of teeth in quadrant (D) which corresponds to the clearance to be taken up.

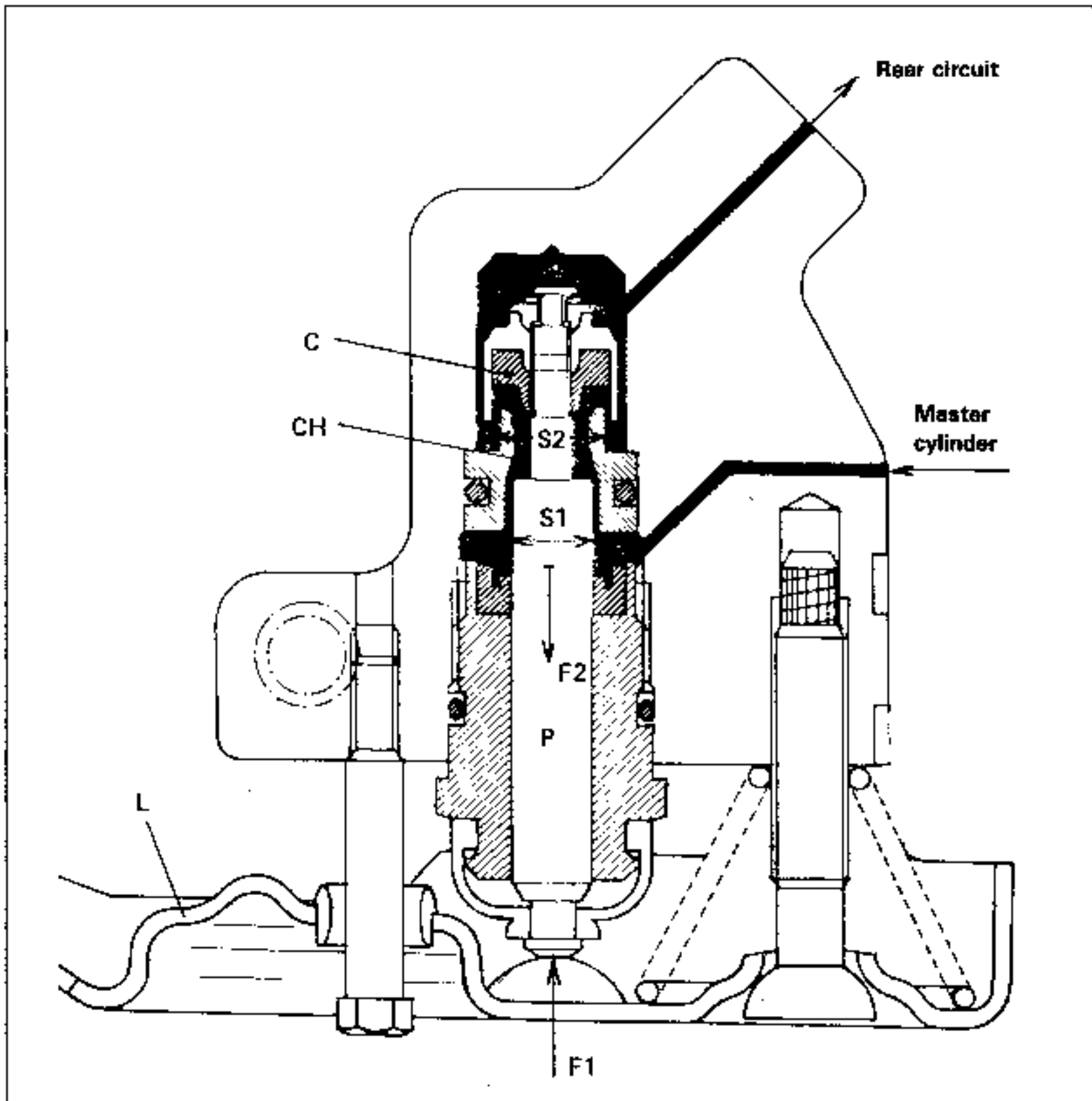
Brakes released:

- Lever (C) is prevented from returning by the ratchet (D).
- The spring (R) pulls back the brake shoes against the link rod (B) via lever (C) and the handbrake lever.
- Clearance (J) therefore defines the ideal clearance between brake shoes and drum.

BRAKING SYSTEM - BRAKE LIMITER

This allows the rear circuit pressure to be varied, with respect to two parameters:

- the pressure level in the front circuit;
- The rear axle load, as a result of the tension of the spring linked to the rear suspension.



Braking SYSTEM - BRAKE LIMITER

OPERATION

Rest position

Lever (L), linked to the suspension, exerts a force (F1) on the piston (P) in proportion to the rear axle load. Rubber cup washer (C) lifts from its seat, allowing the fluid into the rear circuit.

Brakes applied

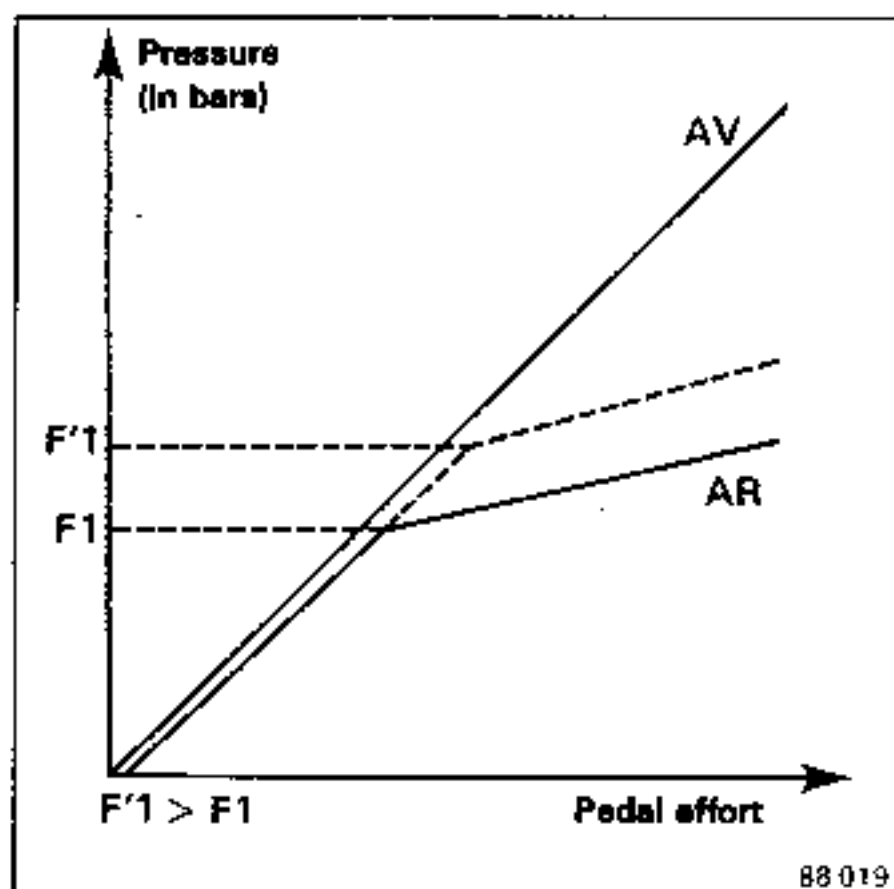
- **Phase 1:**
The pressure in the front and rear circuits increases equally, creating a force (F2) on the piston (caused by the pressure on section (S1)), which is opposed to (F1).
- **Phase 2**
When (F2) becomes greater than (F1), the piston moves, causing cup washer (C) to rest on its seat. The rear circuit is now cut off.
- **Phase 3**
As the pressure from the master cylinder continues to increase in the chamber (CH), it distorts the rubber cup washer and acts on the surface area (S2 > S1), causing the piston to move.

The link between the front and rear circuits is restored. The force resulting from this increase in pressure on (S1) is once again greater than (F1) and the piston once more cuts off the rear circuit.

Any further increase in pressure will restart the entire operation.

Brakes released

The drop in pressure from the master cylinder creates a "leak" between the rear circuit and the chamber (CH) since the interior of the cup washer, under these conditions, can no longer provide a seal on the gudgeon pin, causing it to return to its rest position.



PAS

PURPOSE

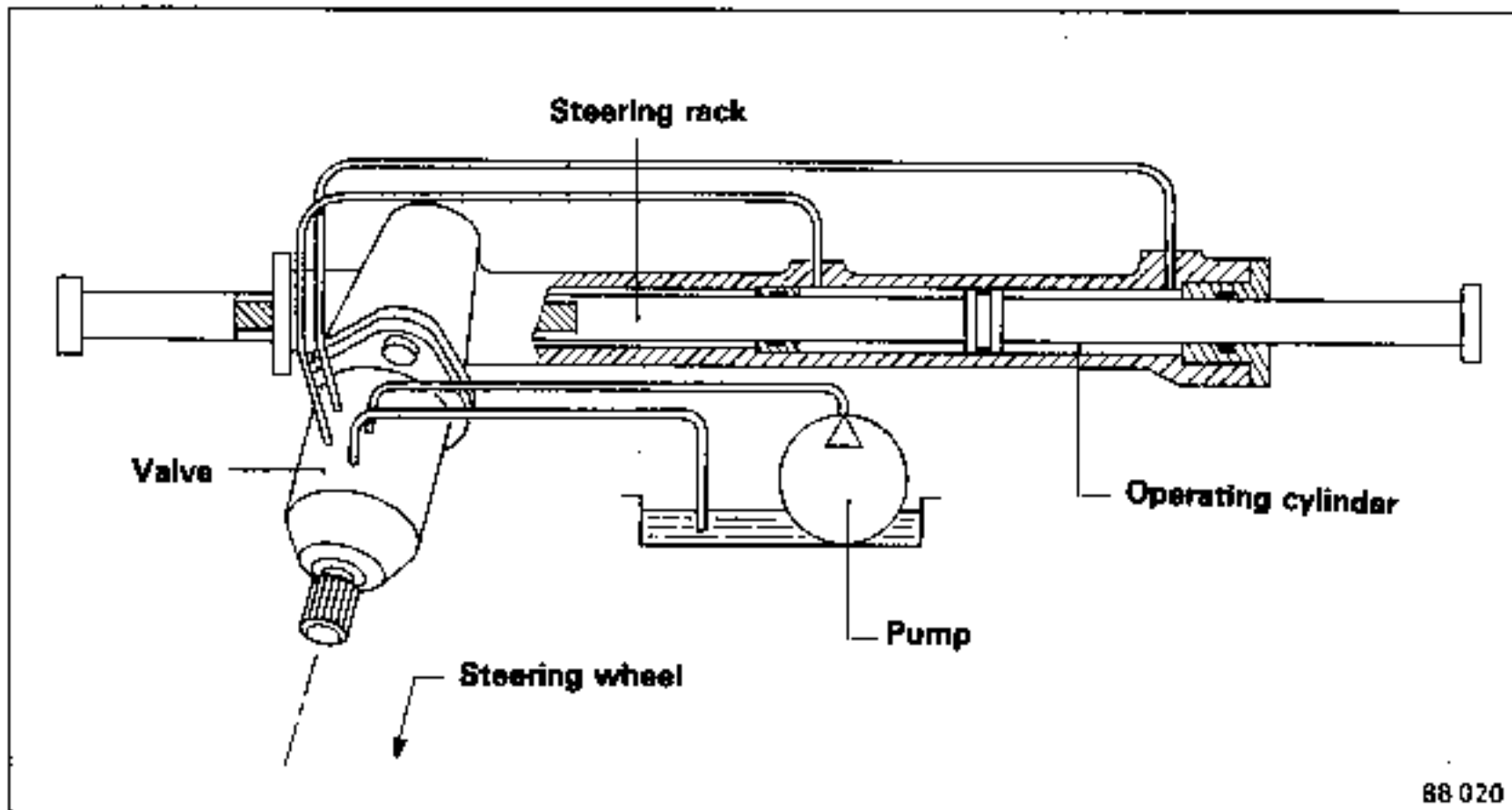
Power-assisted steering enables:

- less effort to be exerted on the steering wheel;
- a higher reduction ratio.

OPERATION

In addition to conventional mechanical components, the system includes:

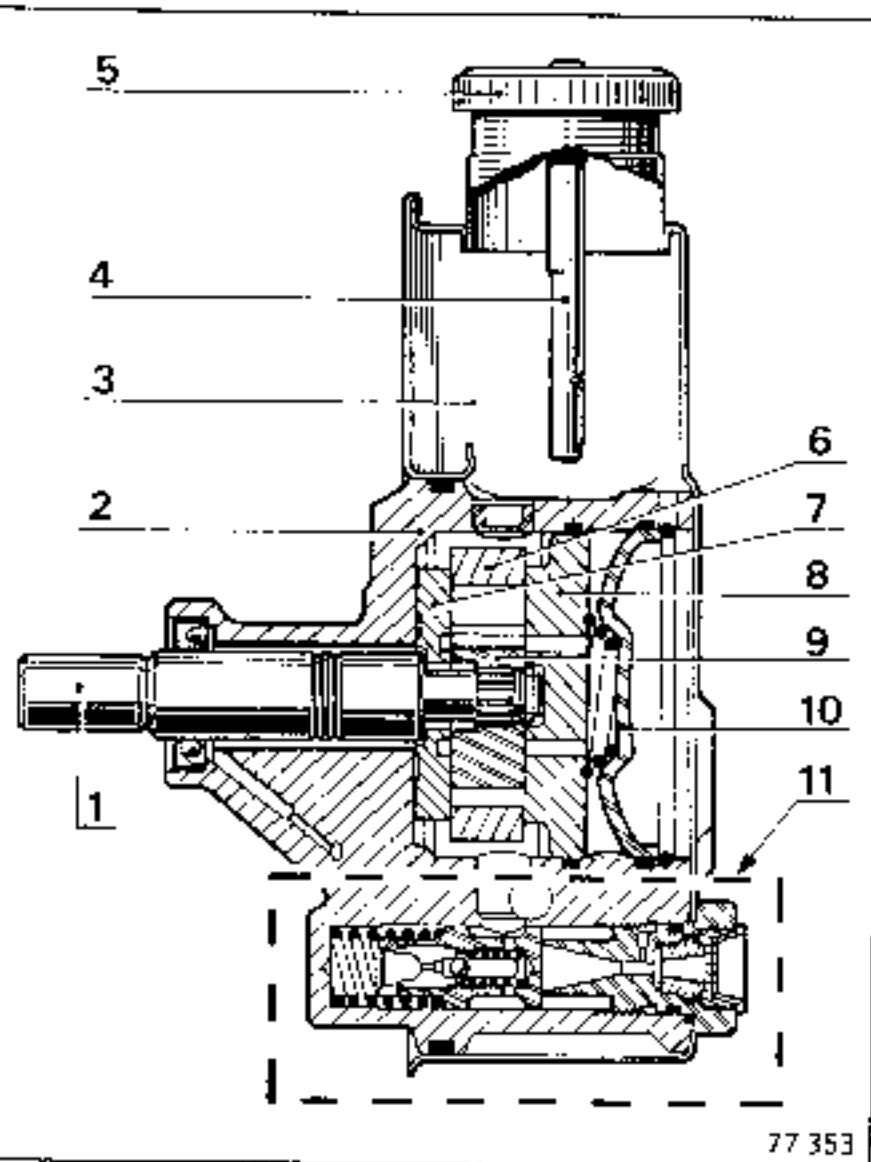
- a hydraulic pump driven by the engine, including the oil reservoir and the regulator
- a rotary valve integral with the rack and pinion at one end and with the steering wheel, via the steering column, at the other.
- a double-action jack built in to the steering box.
- a set of pipes and hoses linking the various components.



PAS

HIGH-PRESSURE PUMP

Description



- 1 - Driveshaft.
- 2 - Pump body.
- 3 - Reservoir.
- 4 - Dipstick.
- 5 - Cap.
- 6 - Stator.
- 7 - Front plate.
- 8 - Rear plate.
- 9 - Rotor.
- 10 - Cover plate.
- 11 - Regulator.

The pump flow is constant and equal to 10 l/minute (regulator outlet), regardless of its speed of rotation.

The flow regulator (11) is integral with the body of the pump.

It controls the pump flow and limits maximum pressure to 95 bar.

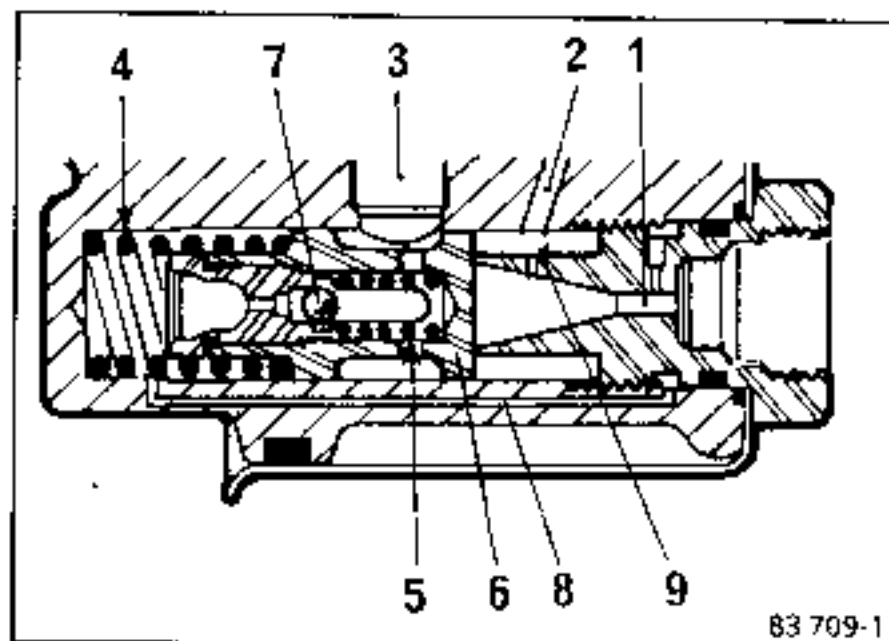
From the outside, the high-pressure pump looks identical to the one fitted until now, but its flow and pressure characteristics have developed significantly. Pumps are therefore not interchangeable.

PAS

FLOW REGULATOR

This is part of the pump body; it controls the pump flow and restricts the maximum pressure of the system.

- 1 - Valve feed hole.
- 2 - Oil input hole.
- 3 - Recycling hole.
- 4 - Flow regulator spring.
- 5 - Pressure limiter spring.
- 6 - Flow regulator valve.
- 7 - Pressure limiter ball valve.
- 8 - Connecting channel (transmits oil pressure to both sides of valve (6)).
- 9 - Oil flow hole when idling.



OPERATION

It adjusts the data from the pump to each particular phase of operation.

There are three phases of operation:

- parking manoeuvres;
- a straight course at all engine speeds;
- full lock manoeuvres (wheel against the kerb or in a pothole, rack at end of travel, etc.).

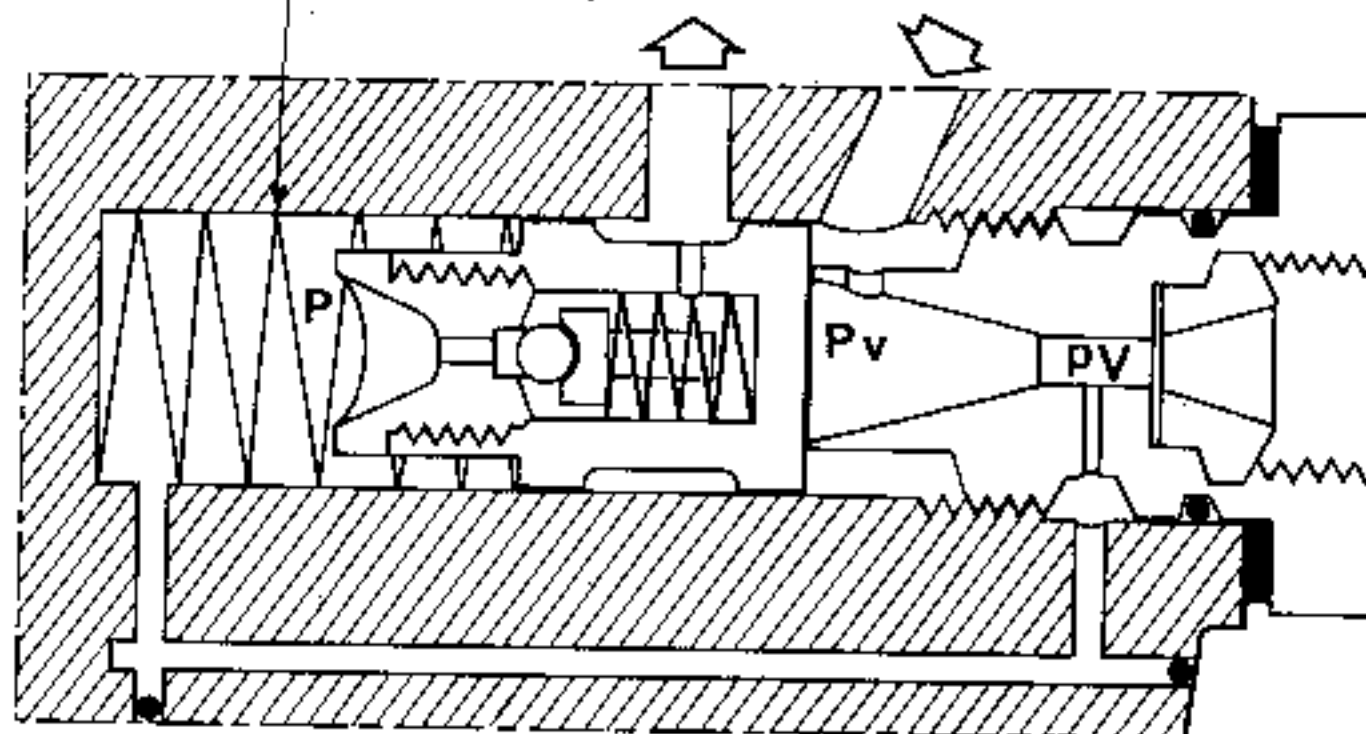
P = pump pressure
p = pressure at throat
v = oil speed (flow)

V = speed at throat
R = ball spring loading
r = piston spring loading

Piston spring

Reservoir

Pump pressure



Rotating
valve

PAS

Parking or low speed manoeuvres

Under these circumstances, the engine turns slowly, the oil flow and therefore the speed (v) and the pressure (P) supplied by the pump are not very high.

The difference between (P) and (p) is very small and can be expressed as: $p + r > P$.

The piston will therefore remain against the plug.

The jack will be fed by the pressure (P) issuing from the pump.

Travelling straight ahead

The pump rotates faster than the situation above, producing a faster flow and therefore a higher speed (v) and pressure (p).

As the flow, and therefore the speed, increases, the difference between pressures (P) and (p) increases (in fact, the difference in pressures depends on the difference in the squares of the speeds).

This therefore gives: $p + r < P$

The piston will move and allow oil to return to the reservoir. There will therefore be a run-out which will cause the pressure supply to the jack to fall.

There will therefore be reduced servo assistance at high engine speed.

Full lock manoeuvres

In this event, the rack and the jack are blocked.

It is no longer possible for oil to pass to the rotary valve or the jack.

It is as if the regulator output to the rotary valve were blocked.

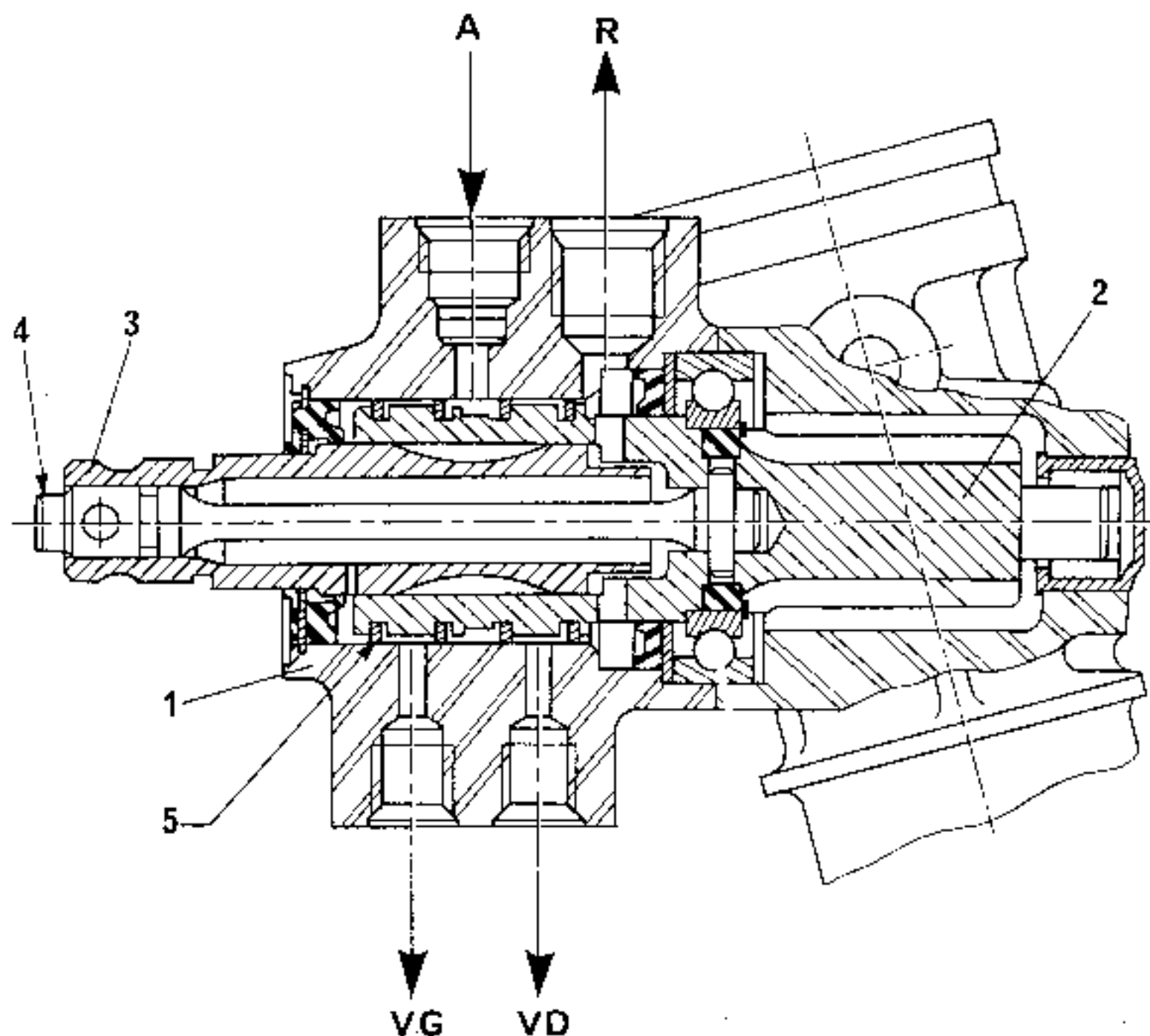
There is no flow and the pump pressure (P) prevails throughout the regulating zone.

The piston, which is subjected to pressure (P) on both sides, will come into contact with the plug as a result of the spring force (r).

Pressure (P) will be higher than spring (R) and the ball will rise, causing the pressure to fall.

PAS

DESCRIPTION OF THE ROTARY VALVE



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- 1 - Valve body.
- 2 - Pinion/distributor (rack connection).
- 3 - Rotor (steering wheel connection).
- 4 - Torsion bar.
- 5 - Brake shoes.
- A - Oil inlet.
- R - Oil return to reservoir.

- VG - Left jack supply.
- VD - Right jack supply.

OPERATION

The torque exerted at the valve inlet causes the rotor to turn through a given angle with respect to the pinion/distributor.

This rotor/pinion/distributor angle corresponds to a pressure which acts on the jack piston and applies a force to the rack.

Once this force becomes greater than the wheel resistance, the rack moves and the car can be steered.

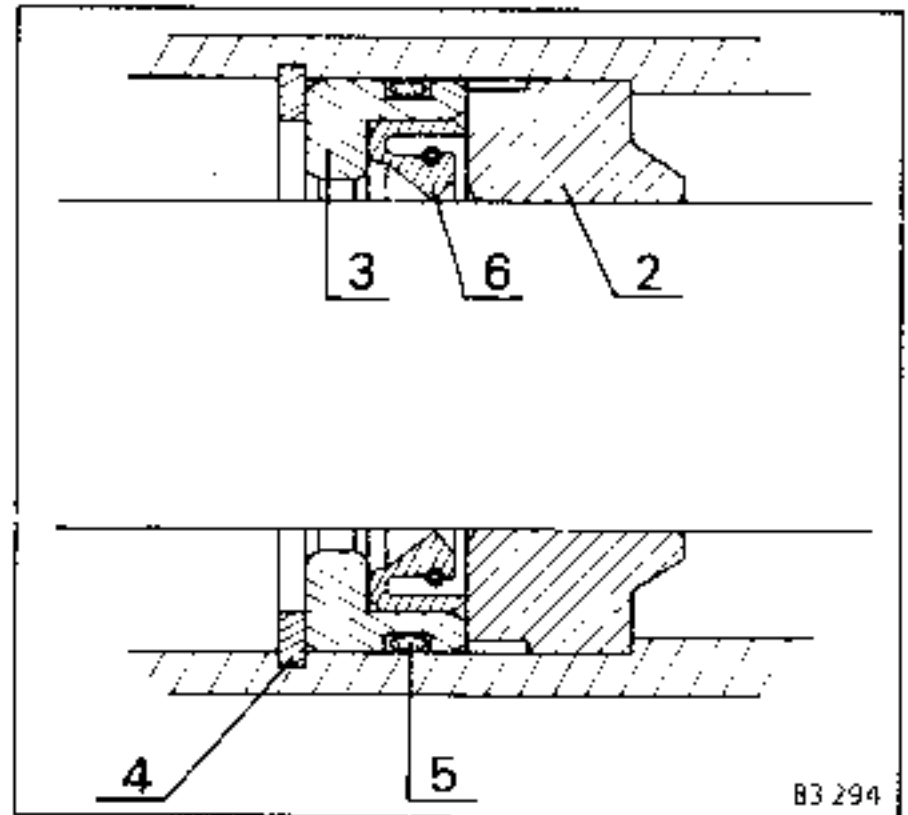
The movement of the rack causes the pinion to move also, therefore the distribution angle will be reduced and the steering wheel will have to be turned further to continue steering.

PAS

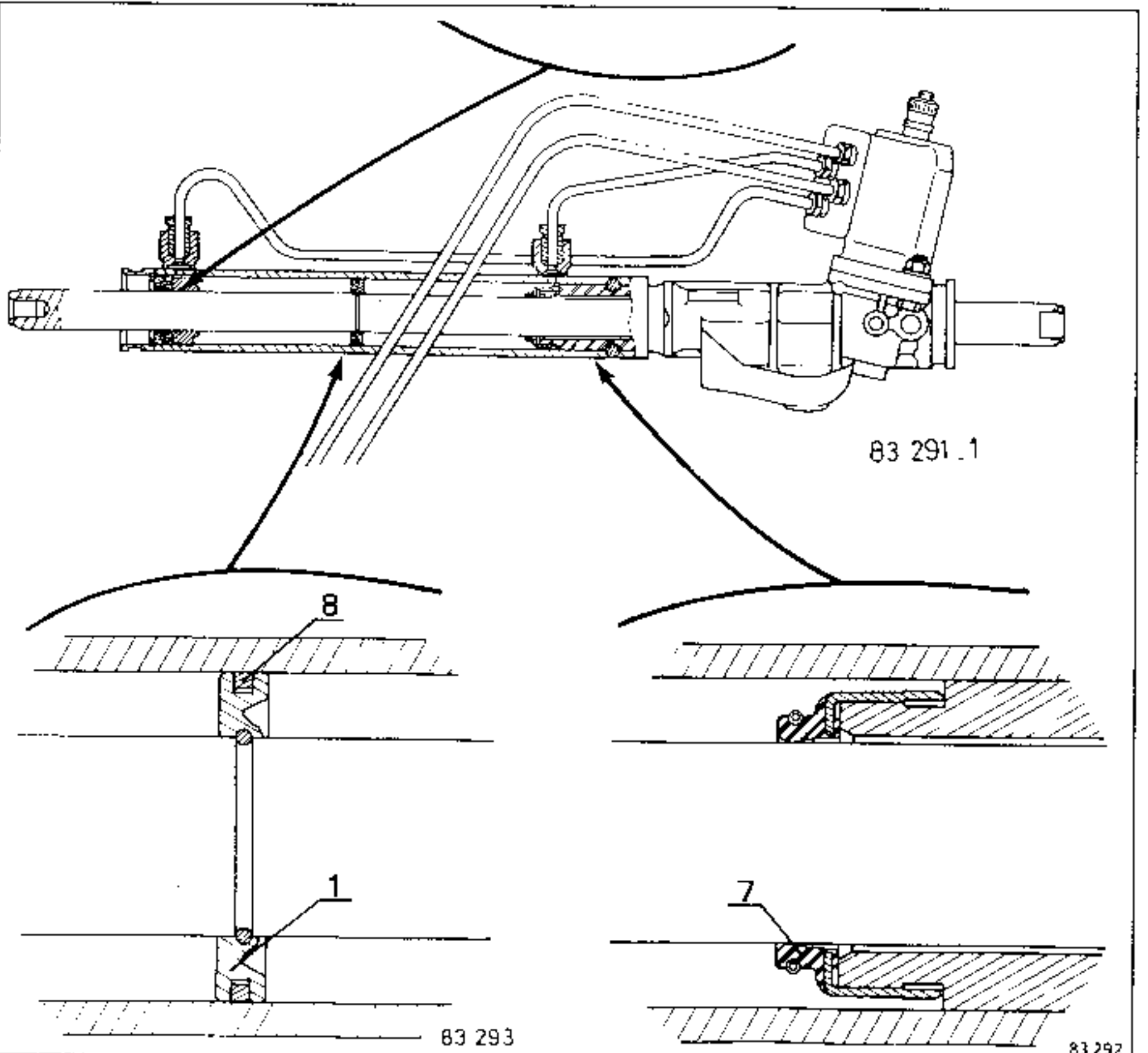
DUEL ACTION JACK

This power unit is an integral part of the rack and it alone is responsible for moving the rack.

- 1 - Piston.
- 2 - Rack bush.
- 3 - Seal bush.
- 4 - Locking ring.
- 5 - O-ring.
- 6 - Lip-type seal.
- 7 - Internal lip-type seal.
- 8 - Piston seal (square section).



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83 293

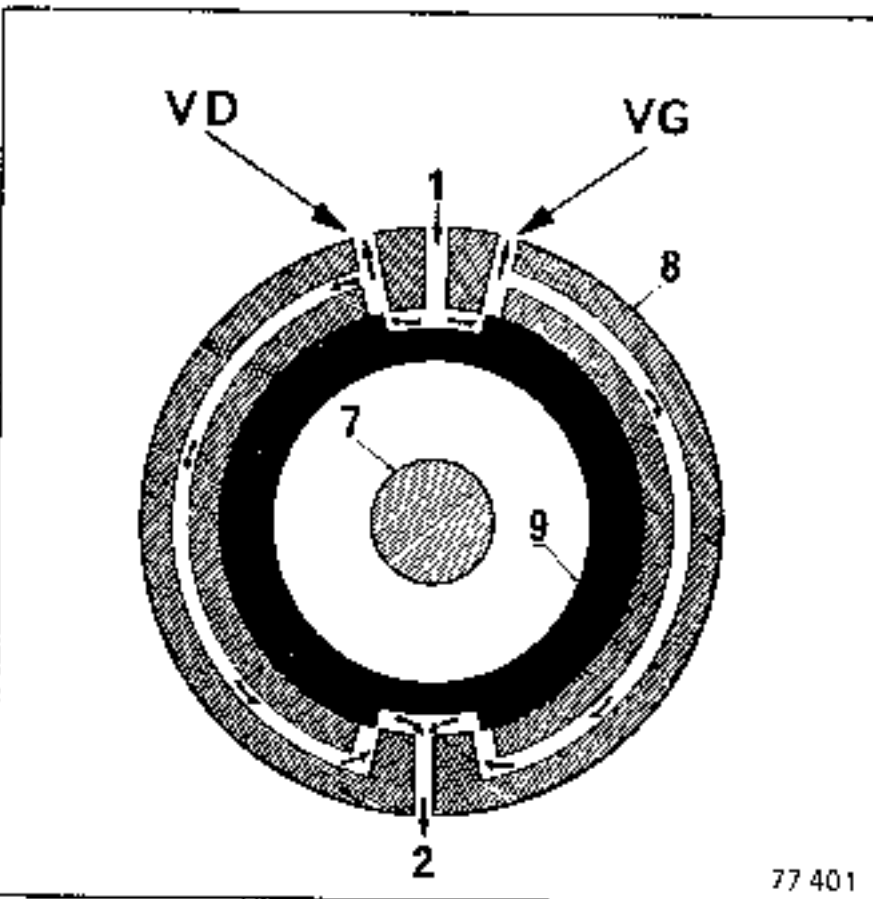
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PAS - ROTARY VALVE OPERATING PRINCIPLE

("Neutral" position).

Since no force is applied to the steering wheel, the torsion bar (7) keeps the rotor (9) and the distributor (8) in the "neutral" position.

The oil arriving from the pump via channel (1) feeds the jack on both sides and returns to the reservoir via channel (2).

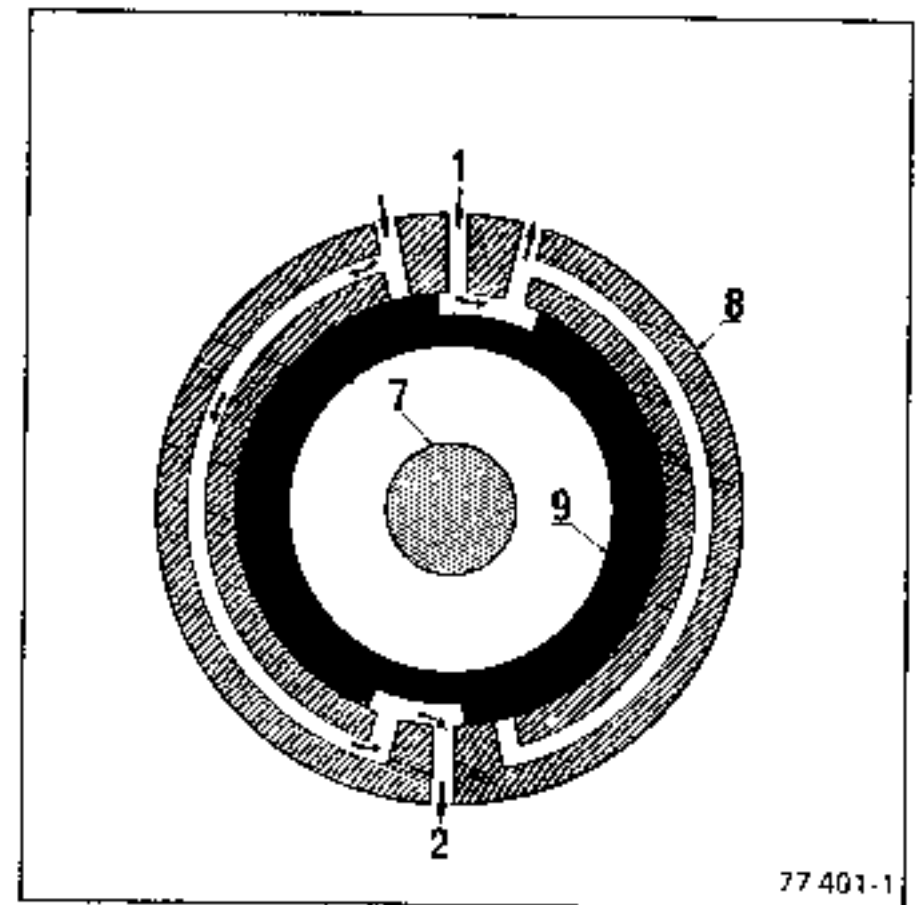


Wheels locked

By applying force to the steering wheel, the torsion bar is distorted, which moves the rotor with respect to the distributor.

This has the effect of cutting off the supply to one side of the jack and of feeding the other side.

The jack, which is fed asymmetrically, moves, taking the rack with it.



VD - Right jack
VG - Left jack

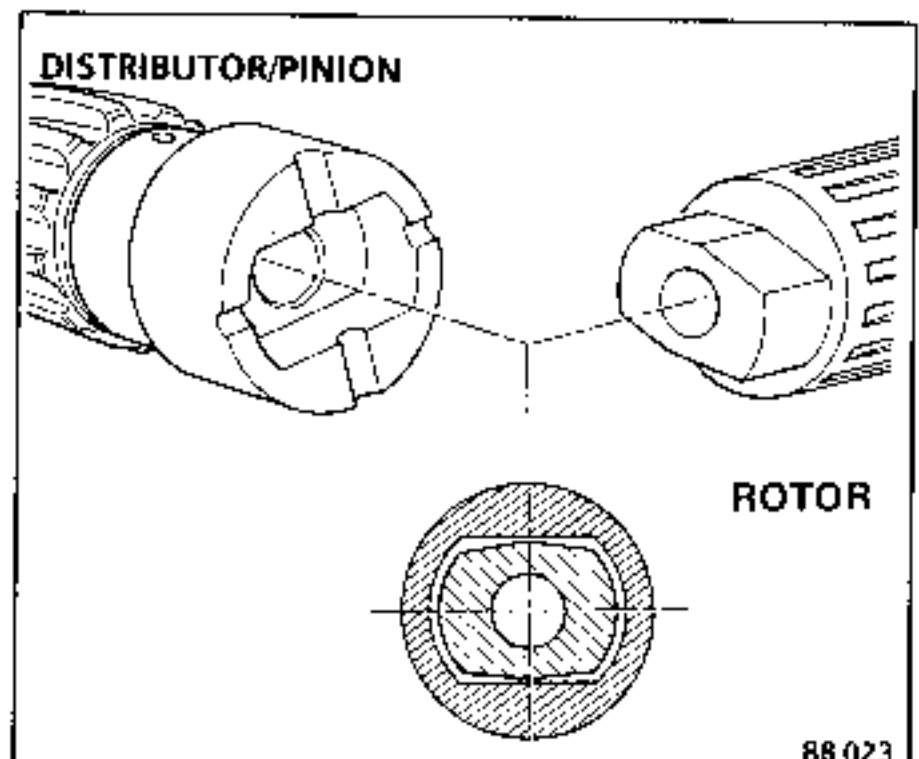
Safety device

The torsion bar (7) links the rotary distributor (8) the valve (9).

The movement of these two elements is restricted by a mechanical stop.

If servo assistance is not available (engine stopped or after a breakdown) this stop forms a mechanical link between the steering wheel and the steering pinion.

Mechanical safety device if servo assistance is lost.



PAS

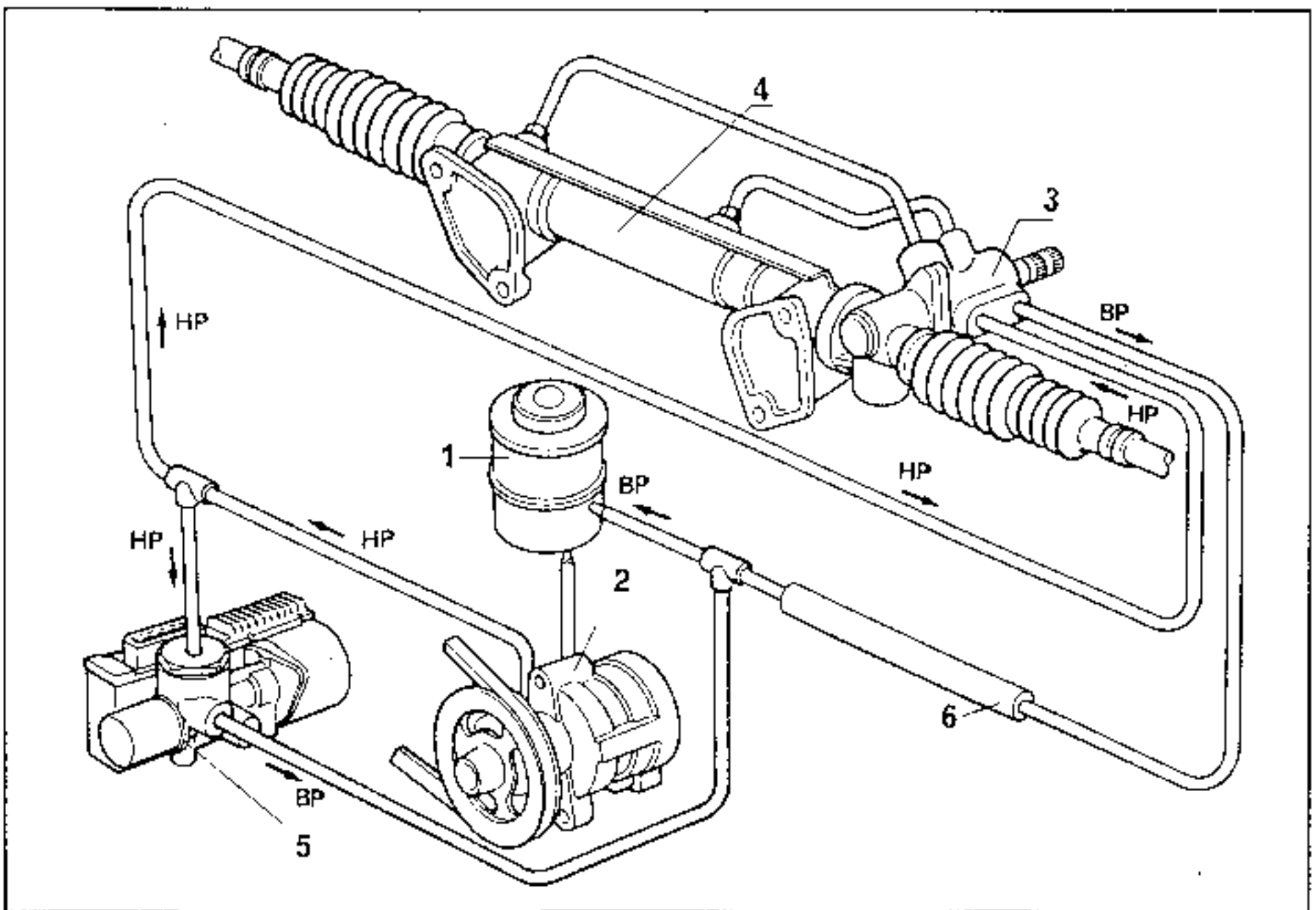
PRINCIPLE OF VARIABLE SERVO ASSISTED STEERING

HIGH-PRESSURE PUMP

Purpose:

- To provide better servo assistance during manoeuvres when the vehicle is stationary or at low speed.
- To increase the accuracy of the vehicle's course as it gathers speed, so as to achieve more controlled driving.

Operating diagram



- 1 - Oil reservoir.
- 2 - High-pressure pump.
- 3 - Rotary valve.
- 4 - Built-in jack.
- 5 - Servo controller.
- 6 - Cooler.

BP - Low pressure.

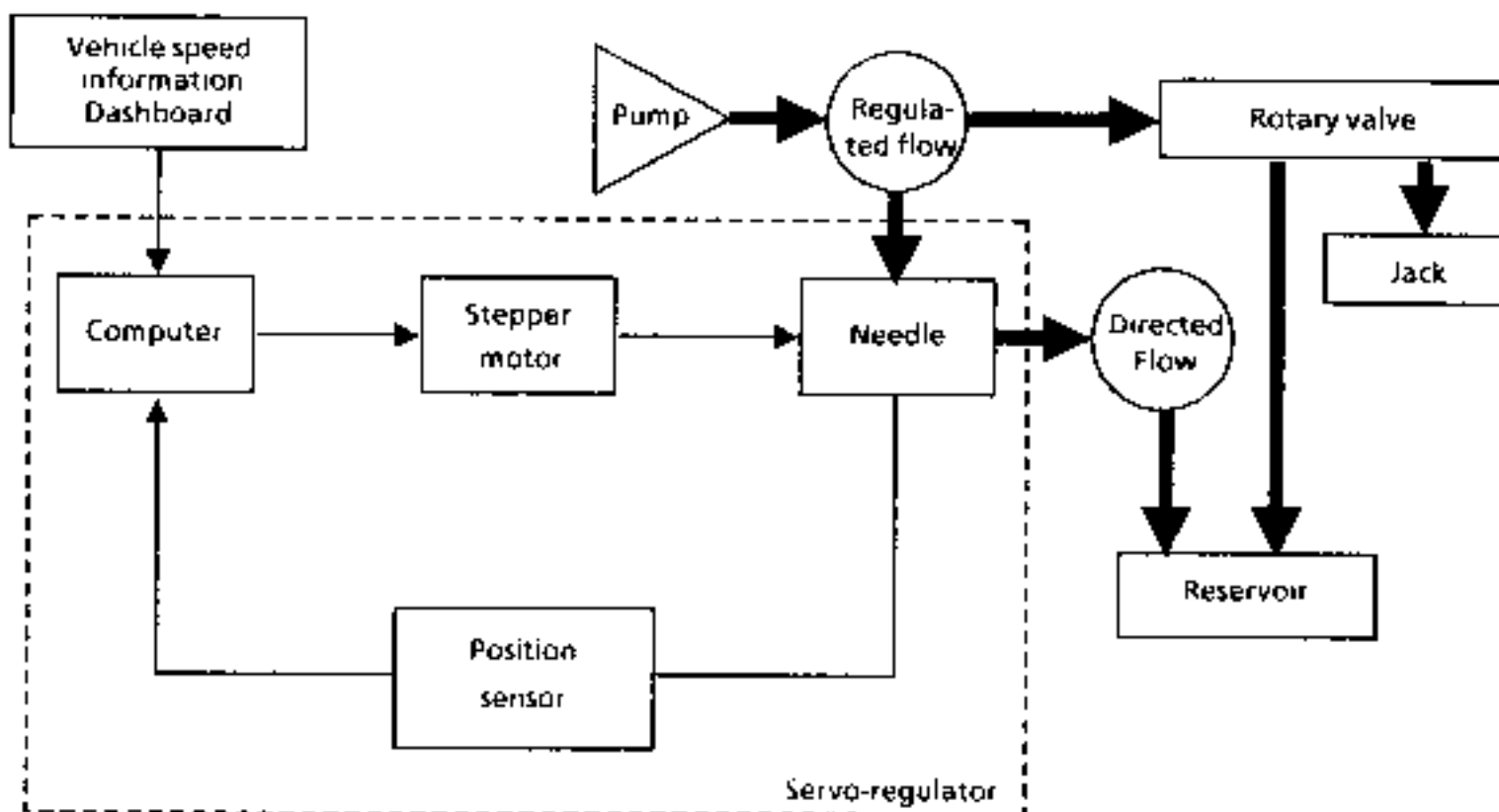
HP - High pressure.

PAS - THE SERVO CONTROLLER

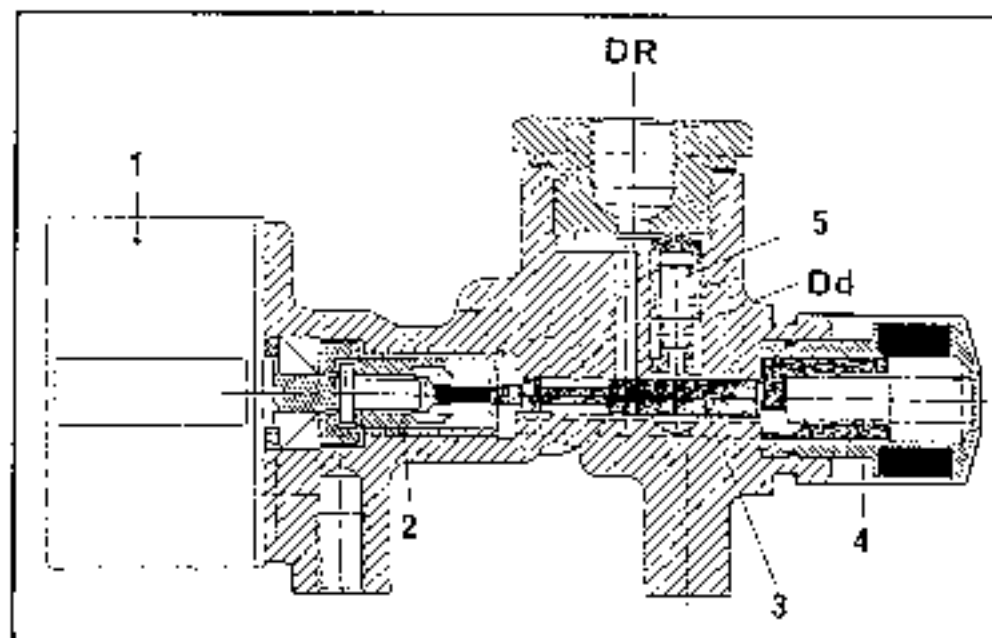
This is a flow regulator operated by a stepper motor which directs an oil flow to the reservoir according to the vehicle speed information.

The directed oil flow therefore varies according to the speed of the vehicle and has the effect of regulating the oil pressure which acts on the steering jack.

In fact, the higher the directed flow, the lower the servo assistance pressure.



SERVO-REGULATOR OPERATING PRINCIPLE



- 1 - Stepper motor.
- 2 - Screw drive??.
- 3 - Needle.
- 4 - Position sensor.
- 5 - Pressure regulator.

In accordance with the input received (vehicle speed, position sensor data, etc.), the computer determines the oil flow required to control the servo assistance pressure under driving conditions.

The stepper motor, controlled by the computer, determines the needle position by acting on the threaded drive.

As a result of the needle's tapered design??, part of the flow of oil to the reservoir corresponds to each position of the needle??.

DR = Regulated flow from the pump (high pressure)

Dd = Directed flow to the reservoir (low pressure).

BRAKE FLUID RENEWAL INTERVALS

The technical features of our brakes, particularly our disk brakes (low conductivity hollow pistons, small amount of fluid in the cylinder, sliding calipers, avoiding the presence of spare fluid in the warmest part of the wheel) have allowed us to reduce the risk of vapour lock to a minimum, even when the brakes are being used intensively (in mountainous regions).

Nonetheless, current brake fluids deteriorate slightly during their first few months of use as their humidity level gradually increases, which means that the recommended intervals for changing the fluid are:

- every 36,000 miles (50 000 km) on petrol vehicles,
- every 40,000 miles (60 000 km) on diesel vehicles.

Topping up the level:

The brake fluid level in the reservoir falls gradually as the pads and brake shoes wear. It is pointless topping up this level since the level will return to normal when the pads are next changed. Naturally, however, it must not be allowed to fall below the minimum level mark.

Approved brake fluids:

If two incompatible brake fluids are mixed together in the brake circuit, damage to the cup washers could lead to a serious risk of leakage. To avoid this happening, only fluids inspected and approved by our laboratories are to be used, which are in accordance with standard SAE J 1703.

Dot 3 or Dot 4	All types except Traffic and Master after 89.03
Dot 4 only	Traffic and Master after 89.03

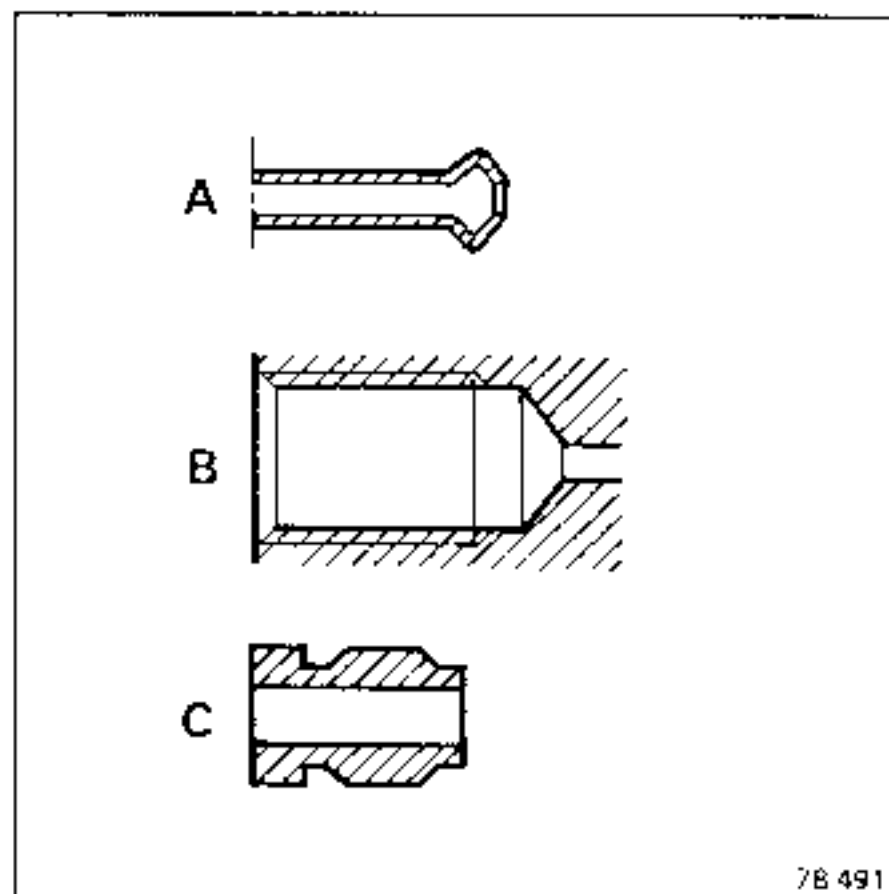


Connections between master cylinder, front calipers, brake limiter and rear wheel cylinders are made using **METRIC THREAD** pipe unions.

As a result, it is important to use only parts mentioned in the Parts Catalogue for this vehicle.

Identification of parts:

- **SHAPE** of the end of steel or copper **PIPES (A)**
- **SHAPE** of **THREADED BORES** in wheel cylinders **(B)**.
- **UNIONS** for **GREEN** or **BLACK** piping: 11 mm or 12 mm, hexagonal **(C)**.



Influence of angles

Influence of the various angles on course-holding and on vehicle tyre wear.

CAMBER

The important factor is the difference between left and right-hand angles. A difference greater than one degree between the two sides will produce offset, which will have to be corrected by the steering wheel, causing abnormal tyre wear.

CASTER

The important factor is the difference between left and right-hand angles. A difference greater than one degree between the two sides will produce offset, which will have to be corrected by the steering wheel, causing abnormal tyre wear.

This is characterised by pulling to the side with the smaller angle at constant speed.

STEERING BOX HEIGHT

This setting affects the variation in parallelism when the suspension is lifted or lowered.

Variations in parallelism between the right-hand and left-hand wheels lead to (without the steering wheel changing position):

- offset to one side on acceleration;
- offset to the other side on deceleration;
- difficulties in holding course on uneven road surfaces.

PARALLELISM

It is essential that this adjustment be made with the steering at its centre point so as to avoid any possible effect on road holding.

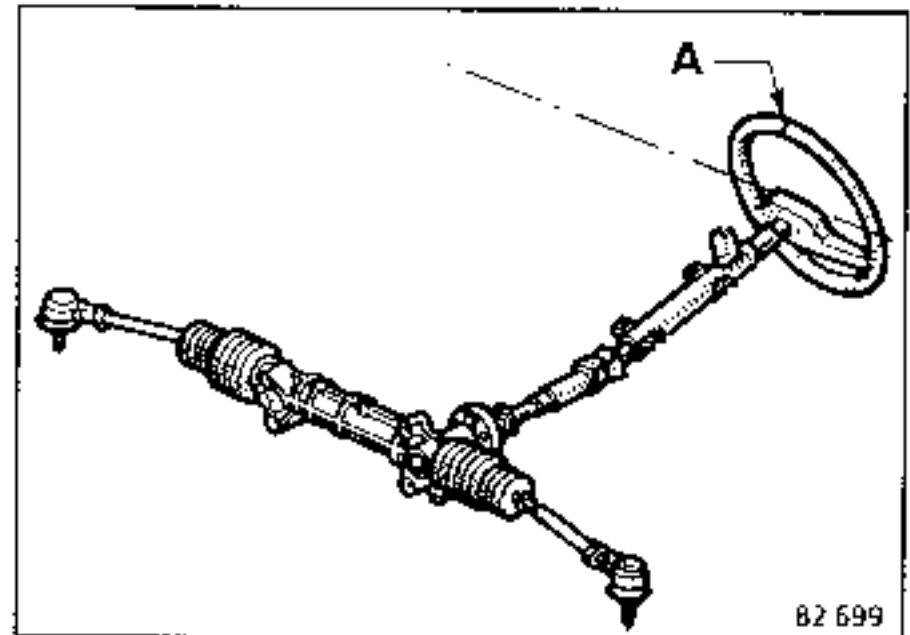
It should be noted that:

- excess toe-out leads to symmetrical wear on the internal edge of both tyres;
- excess toe-in leads to symmetrical wear on the external edge of both tyres.

PRELIMINARY CHECKS

Before checking the axle angles, it will be necessary to check and adjust, if necessary, the following points:

- Tyre symmetry on the same axle;
 - dimensions,
 - pressures,
 - amount of wear.
- Pivot points:
 - condition of flexible bushes,
 - ball joint play,
 - bearing play.
- Wheel run-out: this must not exceed 1.2 mm (the measuring instruments will compensate for this amount).
- Underbody height symmetry (condition of the suspension).



In this position, set up the measuring instruments and carry out the check.

When adjusting the parallelism, take care to observe the X length symmetry of the ball-joint housings on the steering tie-rods.

FINDING THE STEERING CENTRE POINT

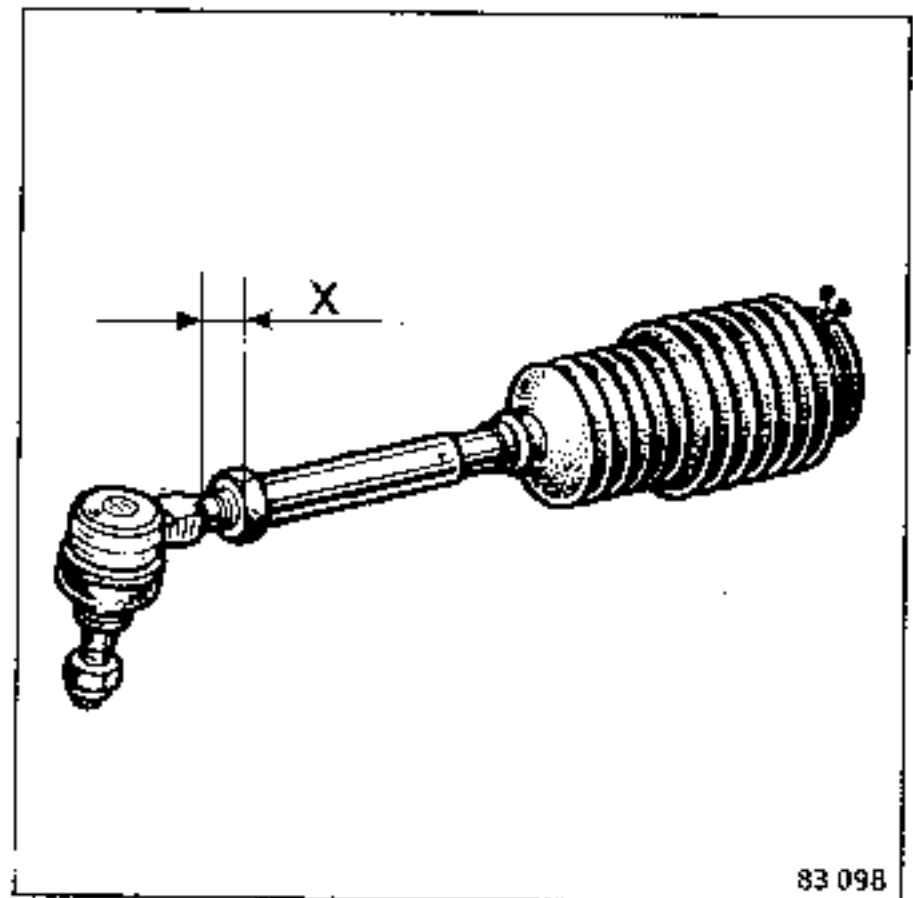
Checking and adjusting the front axle requires setting the steering centre point so as to avoid pulling to one side.

Turn the steering wheel to full lock in one direction.

Make a mark (A) at the top of the steering wheel rim.

Turn the steering wheel to full lock in the other direction, counting the number of revolutions and parts of revolutions.

Turn back half the revolutions (or fractions of a revolution) counted. This is the steering "centre point".

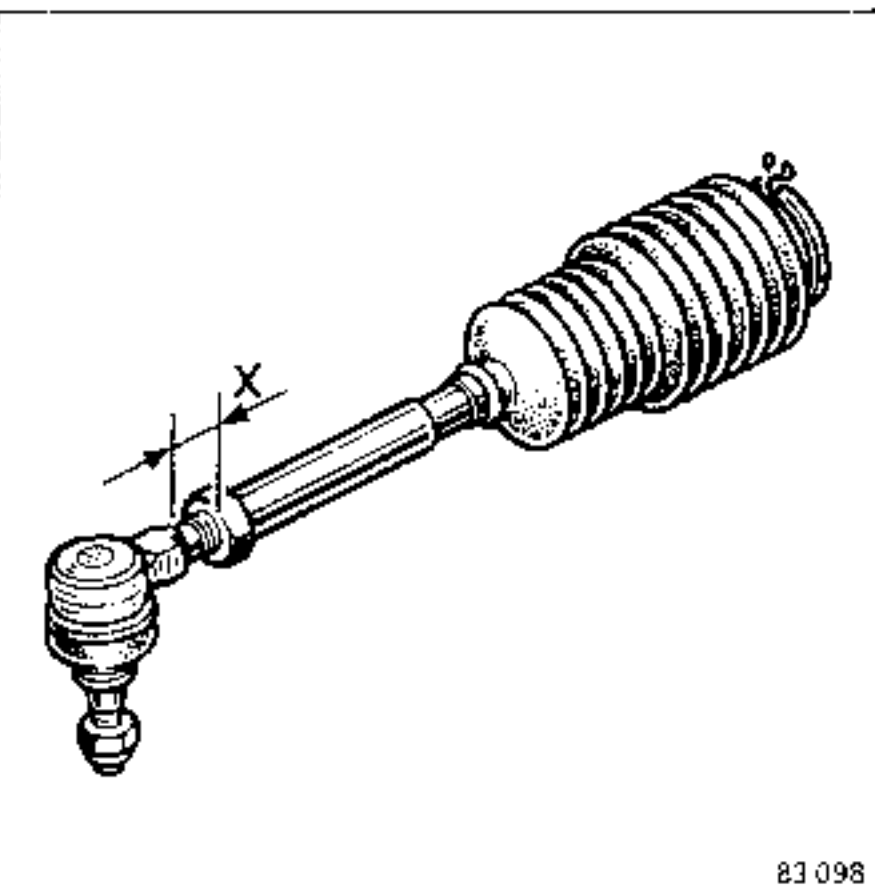


SEQUENCE OF OPERATIONS

As a result of the geometry of front axles, changing one of the angles (caster, camber, KPI, parallelism or distribution) will have fairly major consequences on the values of the other angles. (The caster angle will have the greatest effect.)

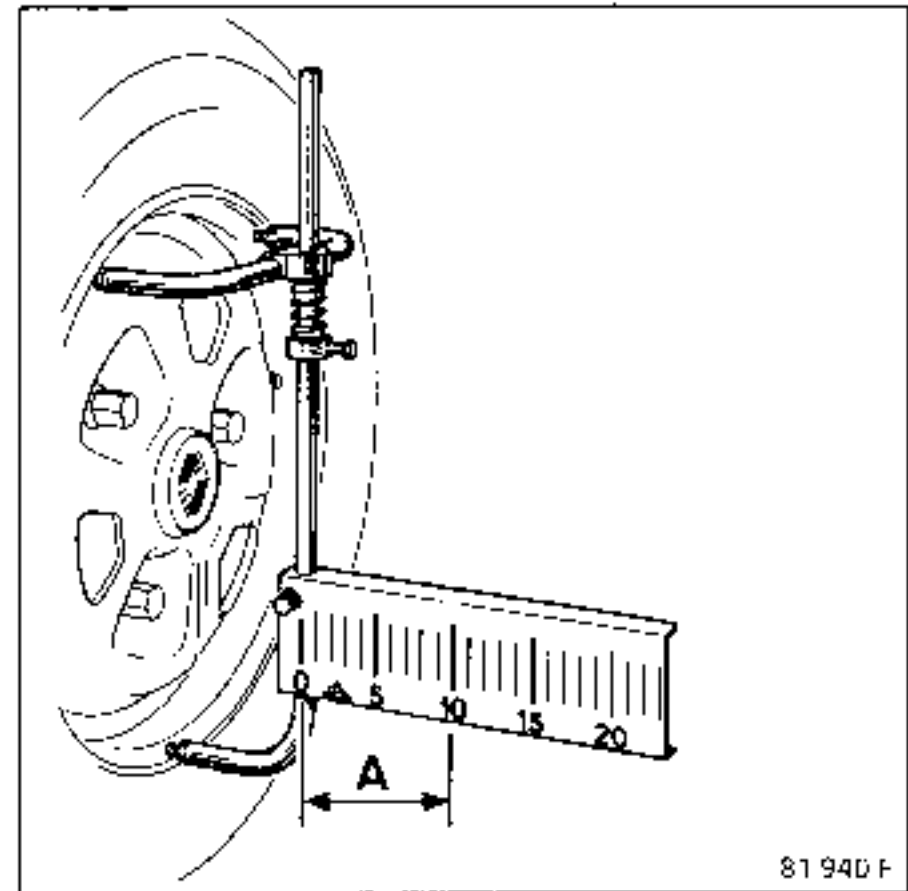
It is therefore extremely important to observe the following order:

- attach the equipment to the vehicle in accordance with the manufacturer's instructions;
- determine the steering centre point (see previous section) and lock the steering wheel;
- raise the underbody of the vehicle;
- cancel the rim run-out;
- reposition the vehicle on turntables;
- apply the brake pedal-press;
- Adjust the suspension until the vehicle settles;
- check the symmetry of the ball-joint housing X lengths on the steering tie-rods.



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- note the values (A) on the gauges,



1 Correct X length symmetry

- distance (A) must be equally divided.

2 Incorrect X length symmetry:

- measure distances (A) on right-hand and left-hand sides, subtract them and divide the result amongst both sides in equal halves.

For example :

Right-hand side reading : 16

Left-hand side reading : 10

$$16 - 10 = 6$$

$$6 \div 2 = 3$$

Use the steering tie-rods to balance distances (A) on both sides:

$$A = 13$$

- in this position, set the turntables to zero;
- in the following order, check;
 - the caster,
 - the KPI,
 - the camber,
 - the parallelism.

PARALLELISM ADJUSTMENT

The following are possibilities:

Parallelism	Distribution	Correction to be made
① CORRECT	INCORRECT	Turn the adjusting sleeve (or endpieces) the same number of revolutions, but in the opposite direction, to achieve the same value (A) on both sides.
② INCORRECT	CORRECT	Adjust the parallelism by the same value on the right-hand and left-hand side, making sure that the values (A) are always the same on both sides.
③ INCORRECT	INCORRECT	Distribute initially so as to balance the values (A) on both sides, then adjust the parallelism in the same way as under ②

Front axle fault-finding

INCIDENTS	POSSIBLE CAUSES
Incorrect caster	- Bent arm - Bent cross-member
Camber + KPI correct but camber incorrect KPI incorrect	- Bent arm - Bent cross-member
Camber correct but KPI incorrect	- Bent stub axle carrier
Camber correct but castor incorrect	- Bent stub axle carrier
Incorrect parallelism distribution	- See caster - Bent arm - Bent cross-member
Parallelism incorrect by more than 6 mm	- Bent right-hand or left-hand stub axle carrier

PRELIMINARY CHECKS

Before checking or adjusting the rear axle, check the following:

- Tyres : condition, pressures and dimensions
- Wheels : run-out, balance
- Pivot points : condition, tightness
- Suspension : condition of shock absorbers
- Hubs : bearing play

If any abnormalities are found during these checks, rectify them before performing any other work.

The rear axle must be checked in a specific order, on a level surface and using one of the approved instruments.

A fully equipped lift will make the operation easier. The following order must be observed:

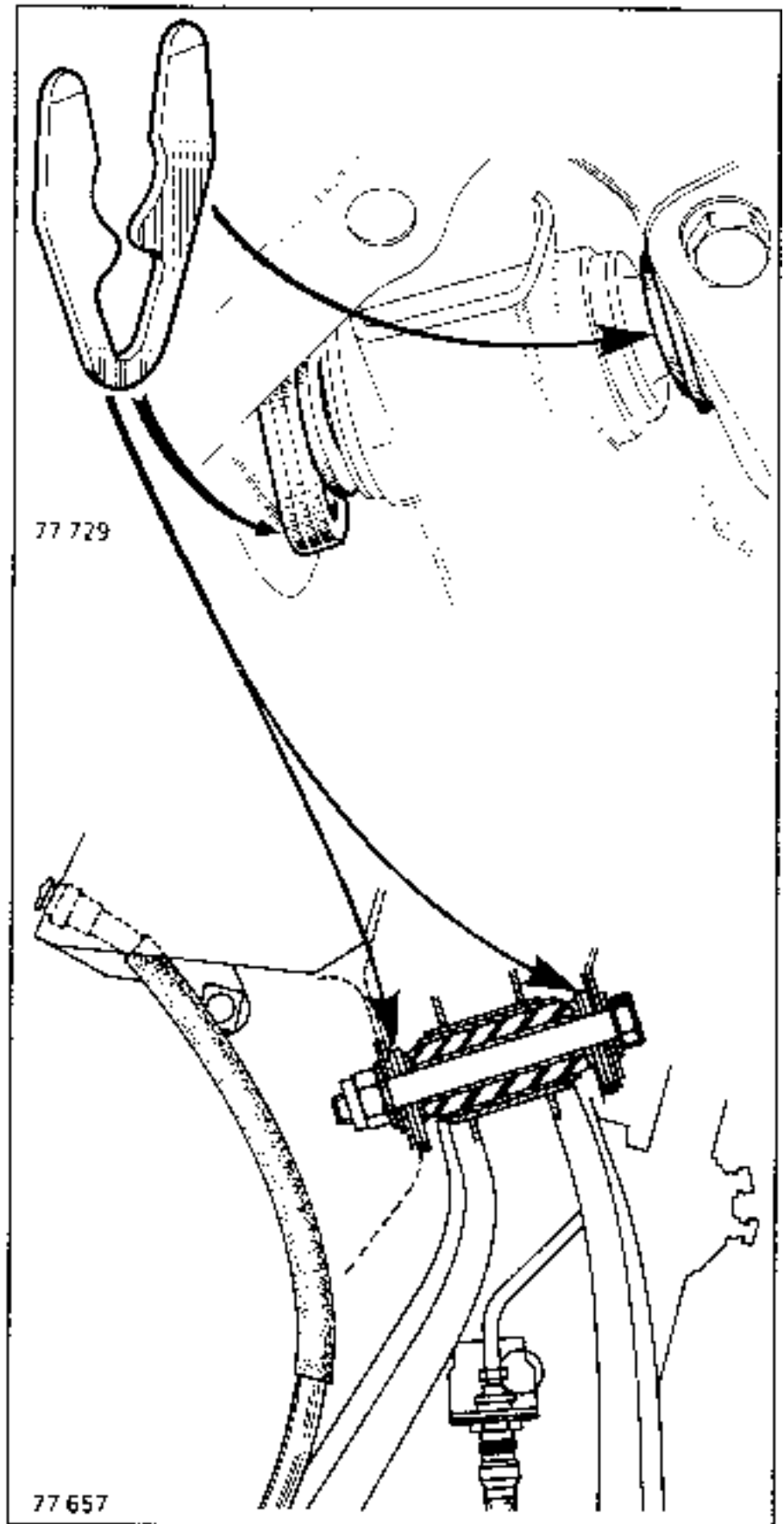
- parallelism check,
- distribution check,
- any necessary adjustments,
- camber check.

CHECKING AND ADJUSTING

Place the rear wheels of the vehicle on blocks to the same height as the front wheels.

Check the parallelism and the distribution.

Use shims on the centre pivot pin on the transverse arm for adjusting the parallelism and distribution.



To change the setting, unscrew the centre pivot pin on the transverse arm of the side in question.

Reduce the number of shims at the front of the bearing and increase correspondingly at the rear to provide toe-out - and vice versa to provide toe-in.

This fault-finding section includes all types of brake circuits and components used in the current vehicle range.

Only those components which are particular to the vehicle described in this Repair Manual will be used during fault-finding.

This fault-finding section is divided into two separate parts to make it easier to identify the fault.

- I - Faults noticed at the pedal
- II - Faults noticed in braking behaviour

I - FAULTS NOTICED AT THE PEDAL

INCIDENT	POSSIBLE CAUSES
"Hard" pedal: Increased power at low deceleration.	- Servo assistance fault - Lining: • oily, • glazed, non-standard, • heating, excessive braking with pedal permanently depressed (downhill), non-standard - Seized piston, - Pinched brake line, - Worn lining: virtually non-existent lining, beginning of metal on metal chafing (loud noise).
"Soft" pedal: NOTE: Since today's vehicles provide a high level of servo assistance, the pedal feels "soft". Two tests must be carried out to decide whether there is a fault or if the brakes are operating normally. 1 - While driving Judgment test: relationship between pedal travel and deceleration. 2 - Vehicle stationary, engine switched off Pedal travel supplementary test: press the brake pedal 5 times to empty the brake servo, before recording the result of the test.	- Air in the circuit: poor bleeding. - Internal leak in the brake circuit. - Insufficient fluid in the reservoir (external brake circuit leak).

Long pedal travel

Test to be performed on a stationary vehicle, engine switched off.

NOTE:

Depress the brake pedal 5 times to empty the brake servo, before recording the test result.

- Incorrect brake shoe adjustment

Drum brakes

- Manual adjustment: brake shoes too far from the drum surface.

Disc and drum brakes

- Automatic adjustment: handbrake cable too tight.

NOTE:

Automatic adjustment takes place via the brake pedal if the handbrake cable tension is correct in the rest position.

- Excessive, asymmetrical lining wear: (bevelled or crossed).
- Excessive master cylinder clearance.
- Boiling or overheated fluid.

Pedal "floors"

Test to be performed on a stationary vehicle, engine switched off.

NOTE:

Depress the brake pedal 5 times to empty the brake servo, before recording the test result.

- Hydraulic fluid leak (check seal).
- Faulty sealing cup between two master cylinder circuits.
- Fluid boiling.

2 - FAULTS NOTICED IN BRAKING BEHAVIOUR

INCIDENT	POSSIBLE CAUSES
Brakes picking up	- Linings require bevelling. - Linings slightly oily. - Springs need changing.
Brakes grabbing or juddering	- Oval drums. - Excessive disc run-out. - Disc thickness uneven. - Excessive deposit on discs (oxidation between lining and disc).

Front brakes pulling to one side	- Check front axle suspension and steering - Seized piston* - Tyres (wear/inflation pressures) - Pinched brake line* * ATTENTION : In vehicles with a negative front axle offset, pulling to one side is the result of a fault in the circuit on the opposite side.
Rear brakes pulling to one side	- Brake compensating system or limiter faulty (operational adjustment) - Seized piston. - Incorrect brake shoe adjustment. Manual adjustment: brake shoe too far from drum surface. Automatic adjustment: handbrake cable too tight. NOTE: Automatic adjustment takes place via the brake pedal if the handbrake cable tension is correct in the rest position. - Return spring faulty.
Brakes overheating	- Master cylinder clearance insufficient to enable master cylinder to return to rest position. - Piston seized or not returning correctly. - Pinched brake line. - Handbrake mechanism seized. - Handbrake mechanism incorrectly adjusted.

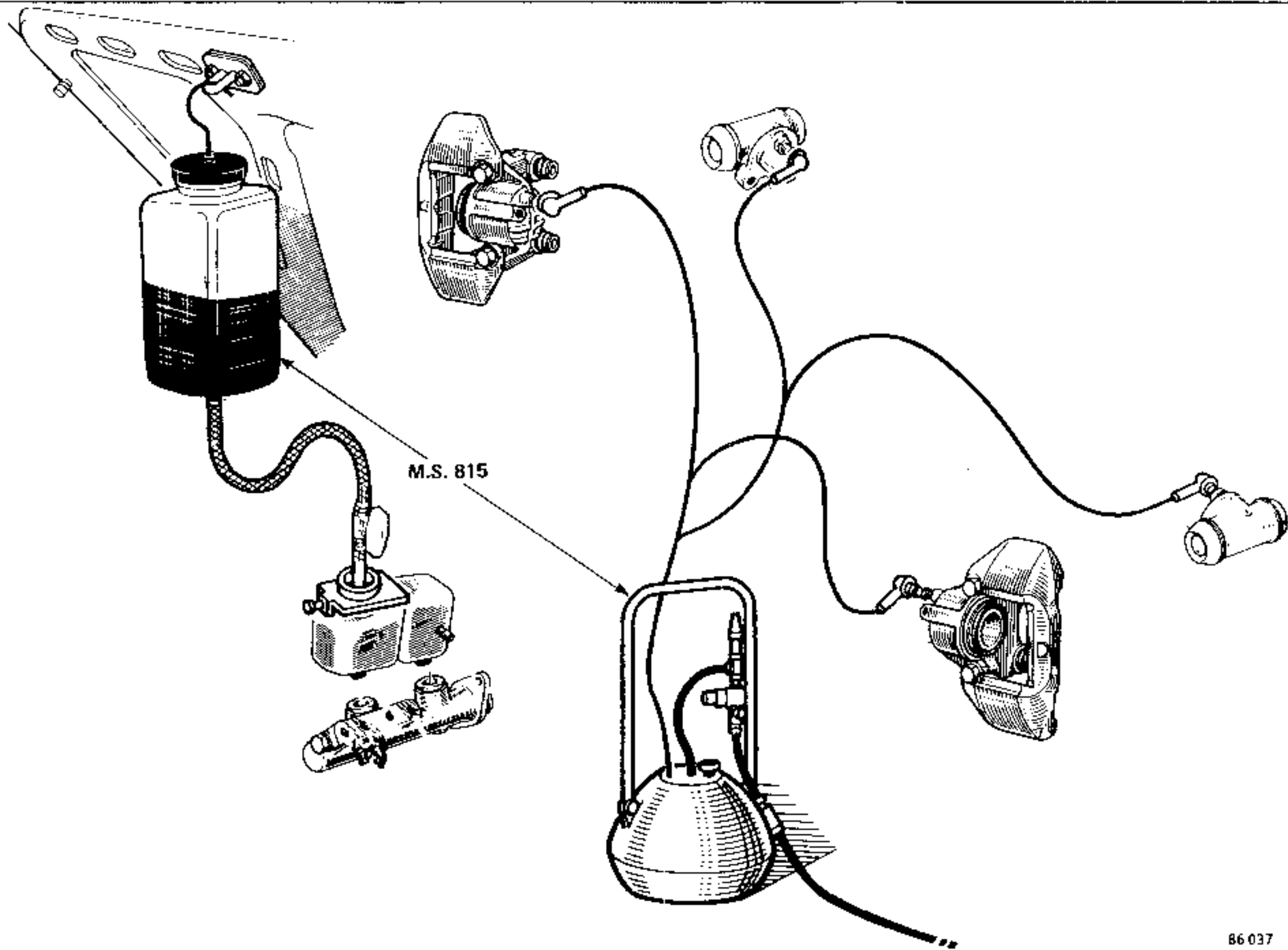
ESSENTIAL SPECIAL TOOLING**M.S. 815** Bleeding apparatus

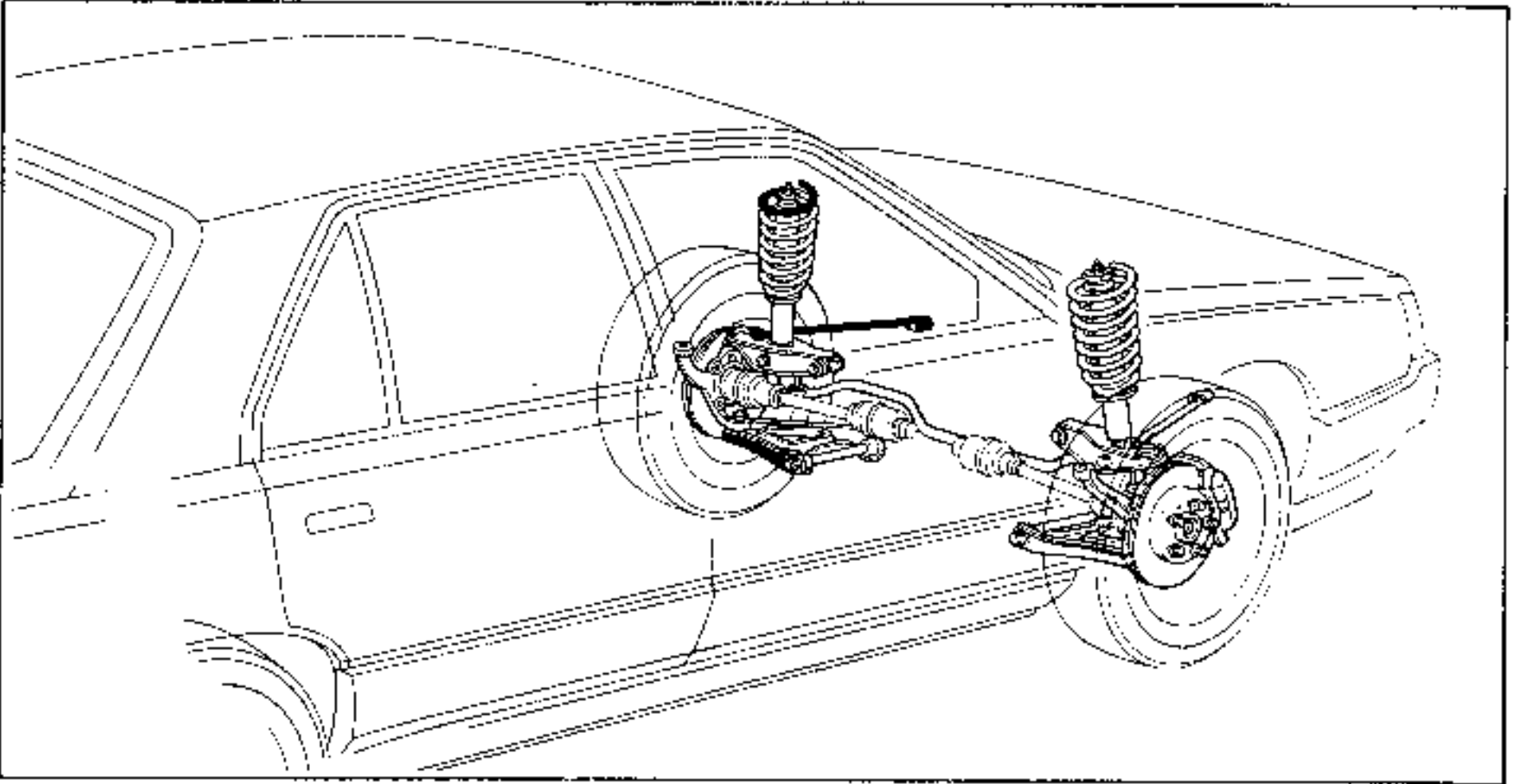
In vehicles fitted with a brake servo, it is important not to activate the servo assistance unit during the bleeding operation, whatever method is used.

- Bleeding is carried out using the **M.S. 815** on a 4-post lift, with the wheels on the ground.
- Connect the **M.S. 815** lines to the bleed screws of:
 - the master cylinder,
 - the wheel cylinder,
 - the brake limiter
- Connect the appliance to a compressed air power supply (min. 5 bar).
- Connect the fluid filling system to the brake fluid reservoir.
- Open the feed tap and wait until the reservoir is full (both compartments).
- Open the compressed air tap.

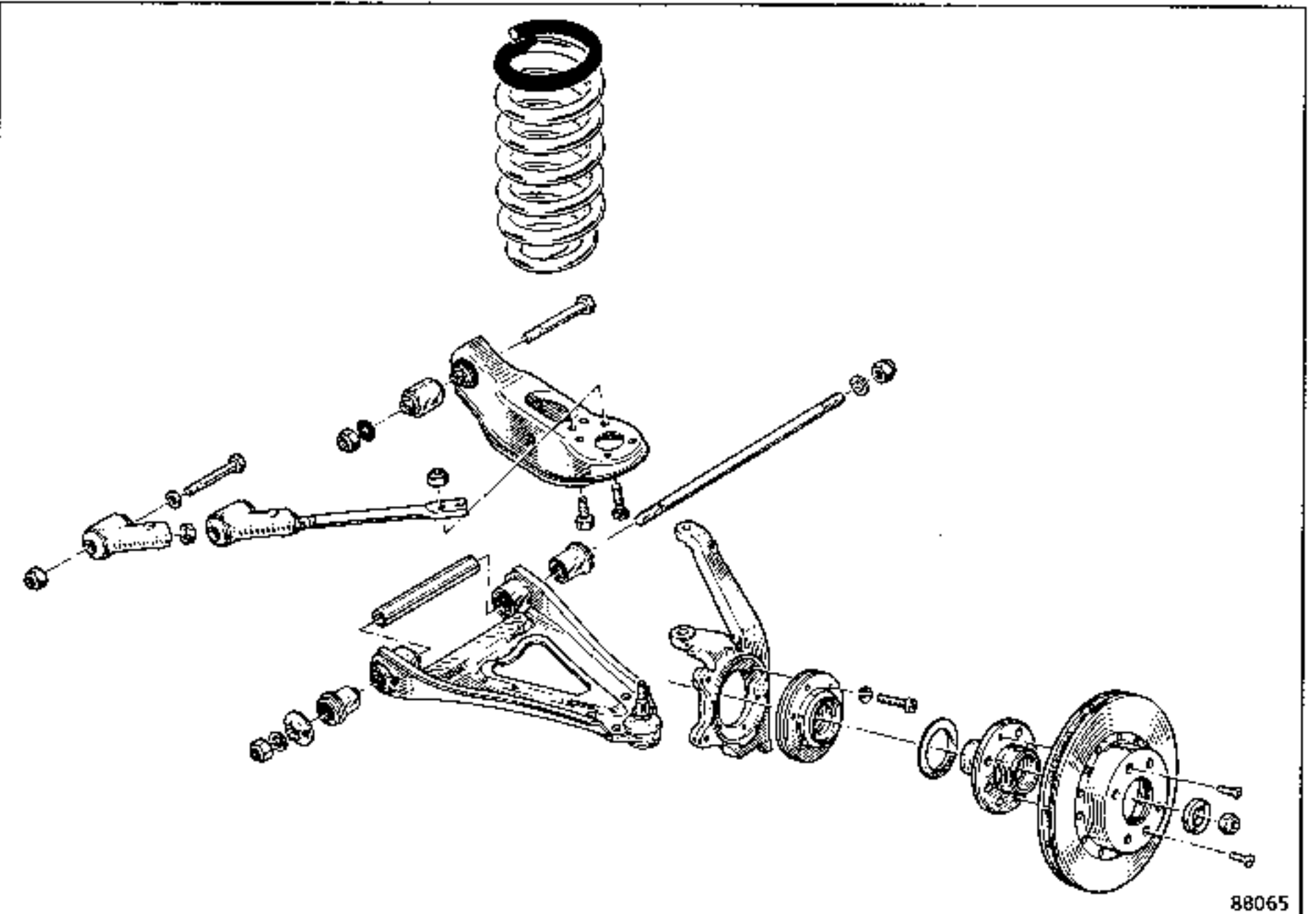
Since these vehicles are fitted with X brake circuits, continue as follows:

- Open:
 - the bleed screw on the right-hand rear wheel and wait approximately 20 seconds for the fluid to drain;
 - the bleed screw on the left-hand front wheel and wait approximately 20 seconds for the fluid to drain.
- Take no notice of any air bubbles in the bleeding apparatus hoses.
- Perform the same operations on the left-hand rear wheel and the right-hand front wheel.
- Check that there is firm resistance when the brake pedal is depressed (press several times).
- Repeat the bleed operation if necessary.
- Top up the brake fluid level in the reservoir, after having disconnected the apparatus.

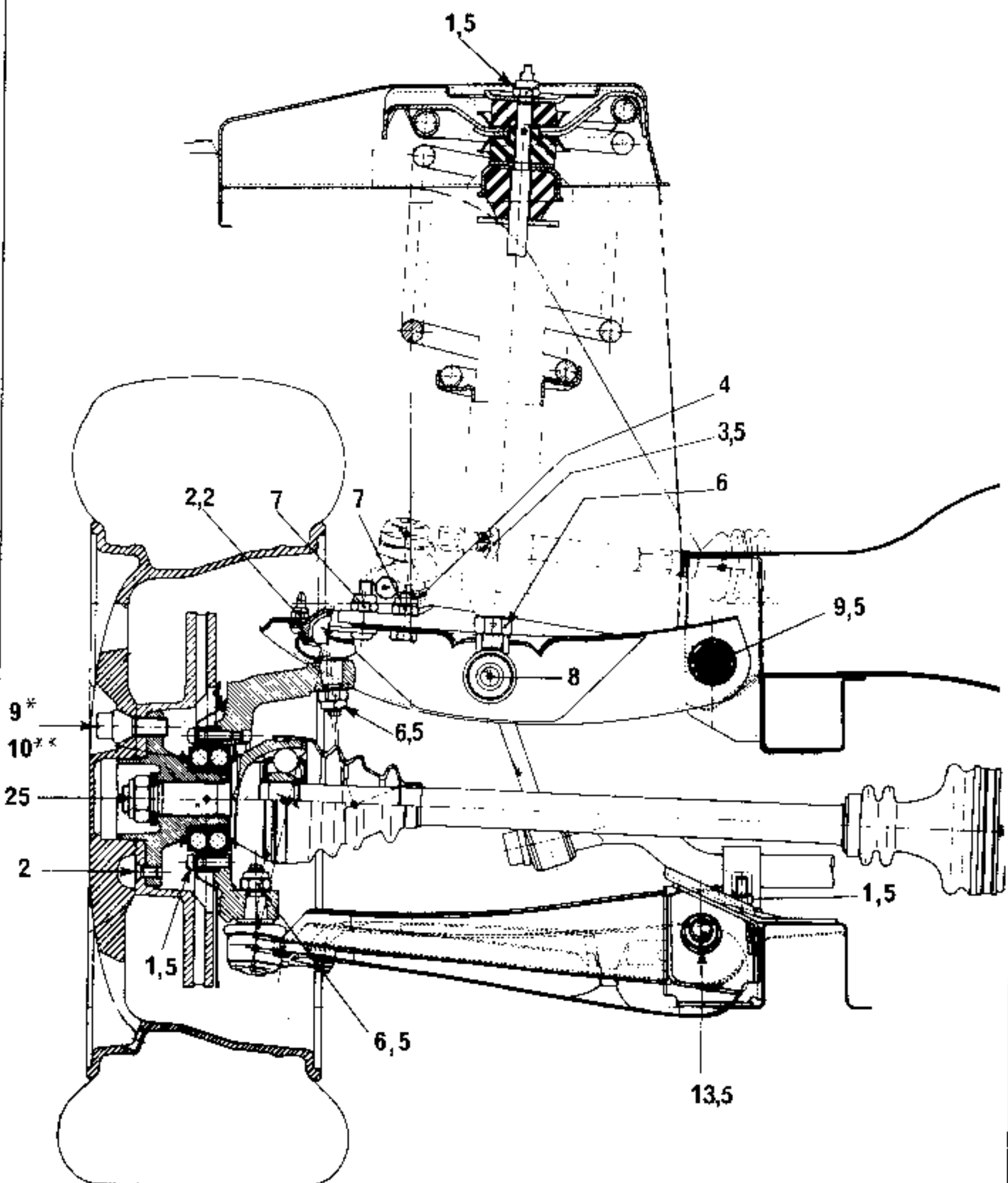




Exploded views



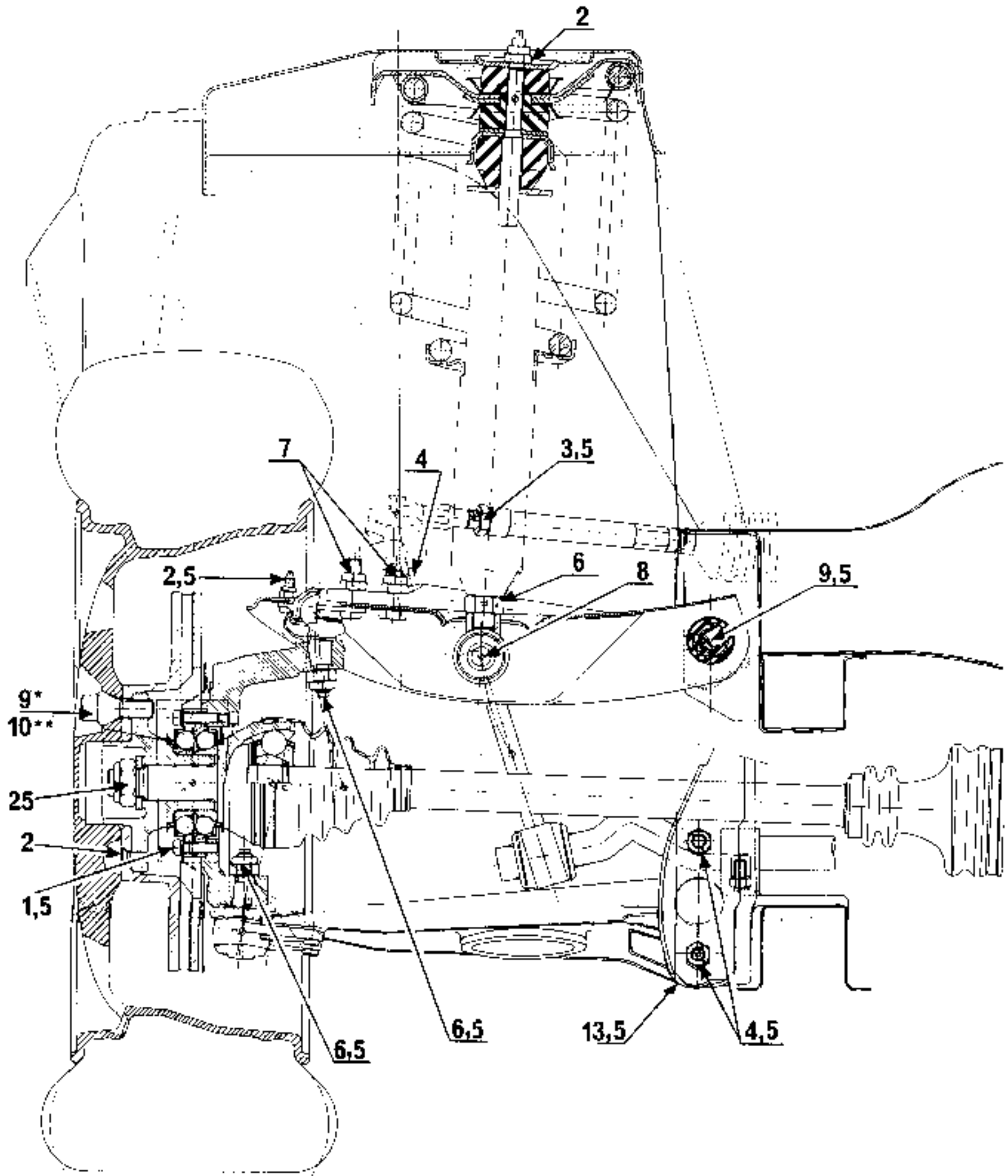
B29 X to end of model year 1988



* 4 wheel fixing bolts

** 5 wheel fixing bolts

B29 X from model year 1989



* 4 bolts
** 5 bolts

ESSENTIAL SPECIAL TOOLING

T. Av. 476

Ball joint extractor

TIGHTENING TORQUES (in daNm)



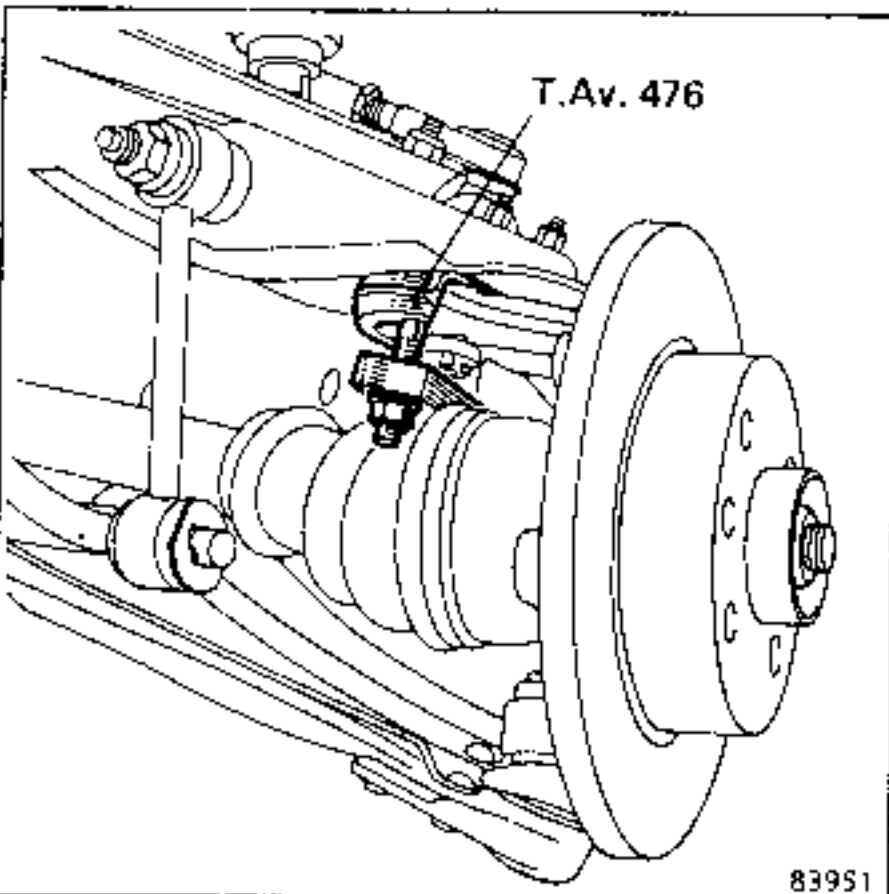
Upper arm pin	9.5
Shock absorber base pin	8
Caster tie-rod nut	9
Upper ball joint nut	6.5
Wheel bolts: 4 bolts	9
5 bolts	10
Shock absorber base locknut	6

REMOVING

Loosen the shock absorber base locknut.

Disconnect:

- the caster tie-rod at the suspension arm end,
- the upper ball joint using T. Av. 476

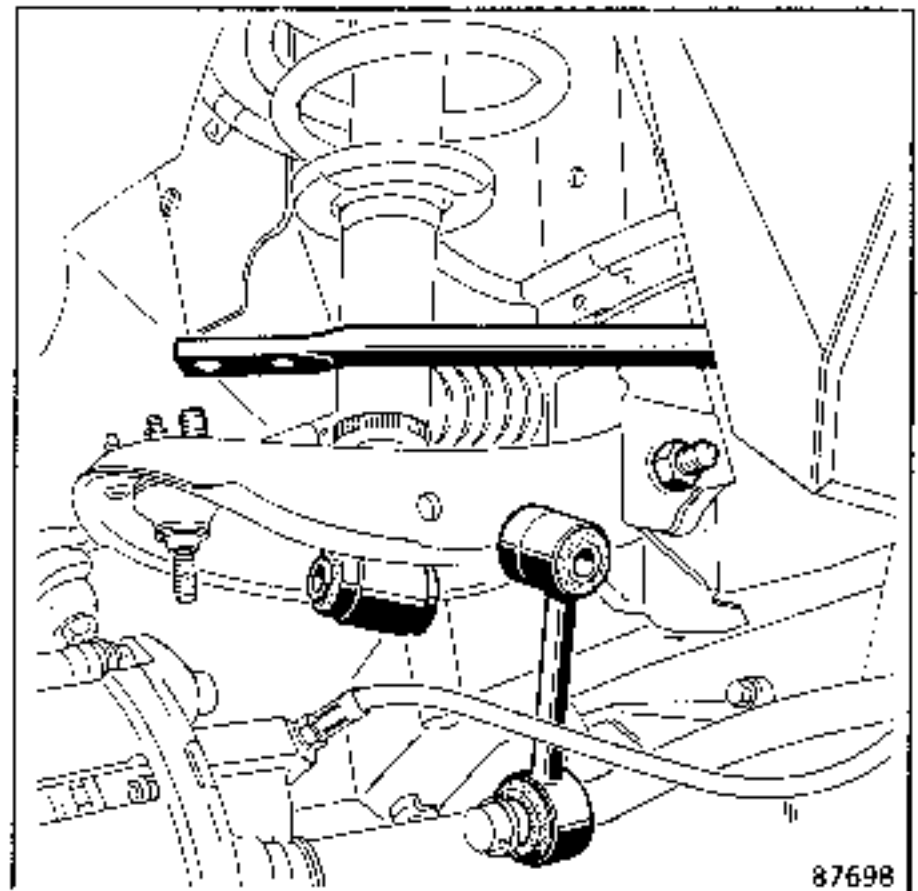


- the anti-roll bar.

Remove:

- the shock absorber base pin,
- the arm mounting pin.

Raise the arm and unscrew the shock absorber base



REFITTING

Position the arm and screw on the shock absorber base.

Refit, but do not tighten:

- the upper arm pin,
- the shock absorber base pin smeared with grease,
- the anti-roll bar.

Refit, and tighten to the correct torque:

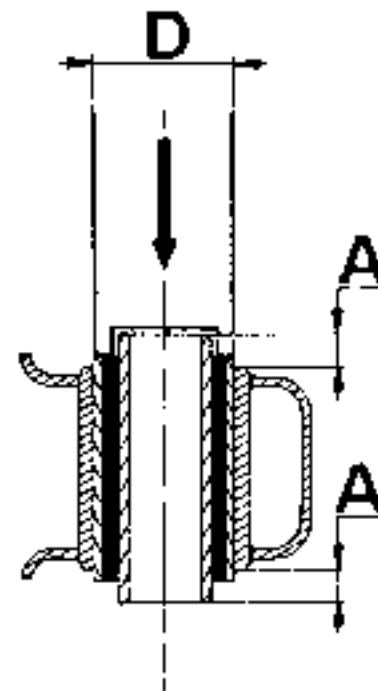
- the caster tie-rod,
- the shock absorber base nut,
- the upper ball joint.

Lower the vehicle onto its wheels and tighten to the correct torque:

- the upper arm pin,
- the shock absorber base pin.

With the upper arm removed:

- Press out the worn bush using a tube, external diameter:
D = 34.5mm
- Press in the new bush and centre it in the arm:
A = 7.5mm



72608

Upper arm ball joint

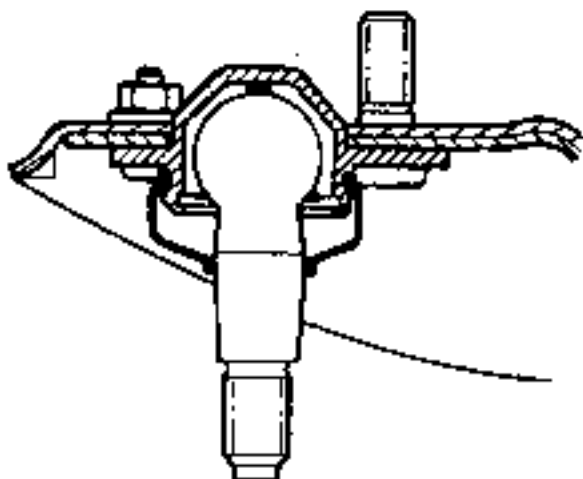
If the bellows are worn, the entire ball joint must be replaced.

REMOVING

Disconnect the upper ball joint using T. Av. 476

Remove:

- the caster tie-rod nut,
- the ball joint fixing bolts.



72610

REFITTING

Fit the ball joint to the arm.

Reconnect the caster tie-rod and the stub axle carrier.

Check and if necessary adjust:

- the caster and camber angles,
- the steering box height setting,
- the parallelism.

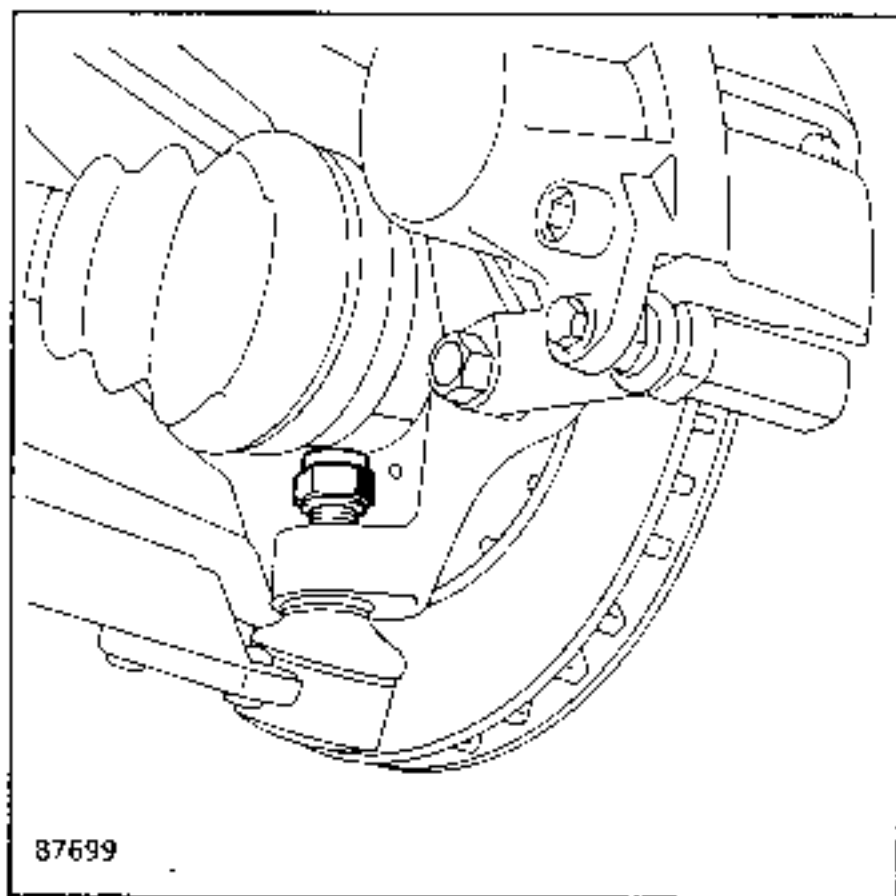
TIGHTENING TORQUES (in daNm)



Wheel bolts:	4 bolts	9
	5 bolts	10
Upper ball joint nut		6.5
Arm pin		13.5

REMOVING

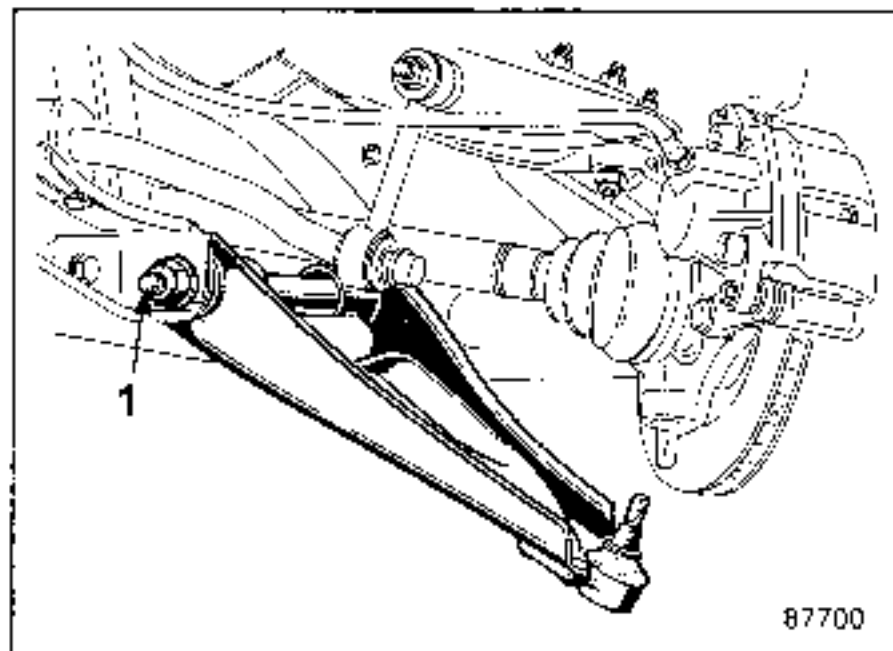
Loosen the ball joint nut and unscrew it until it comes into contact with the driveshaft joint casing. Continue to unscrew it to remove the ball joint; (the nut acts as an extractor and will have to be replaced during reassembly).



87699

Remove:

- pin (1) towards the front of the vehicle,
- the arm.



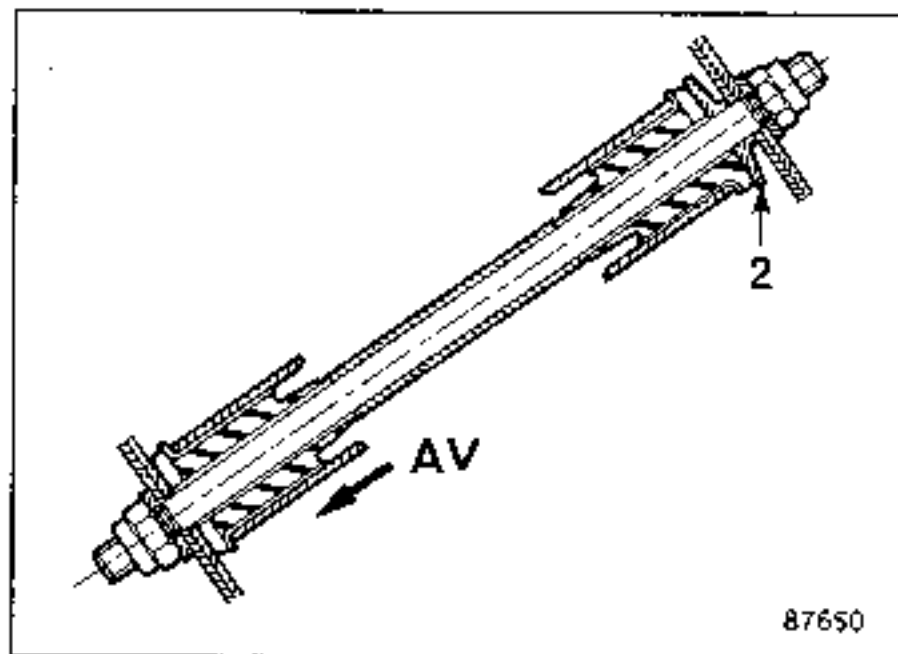
87700

REFITTING

Position the arm.

Smear the pin with grease.

Make sure that caster adjusting shim (2) is in the correct position (at the front for manual steering, at the rear for power-assisted steering).



87650

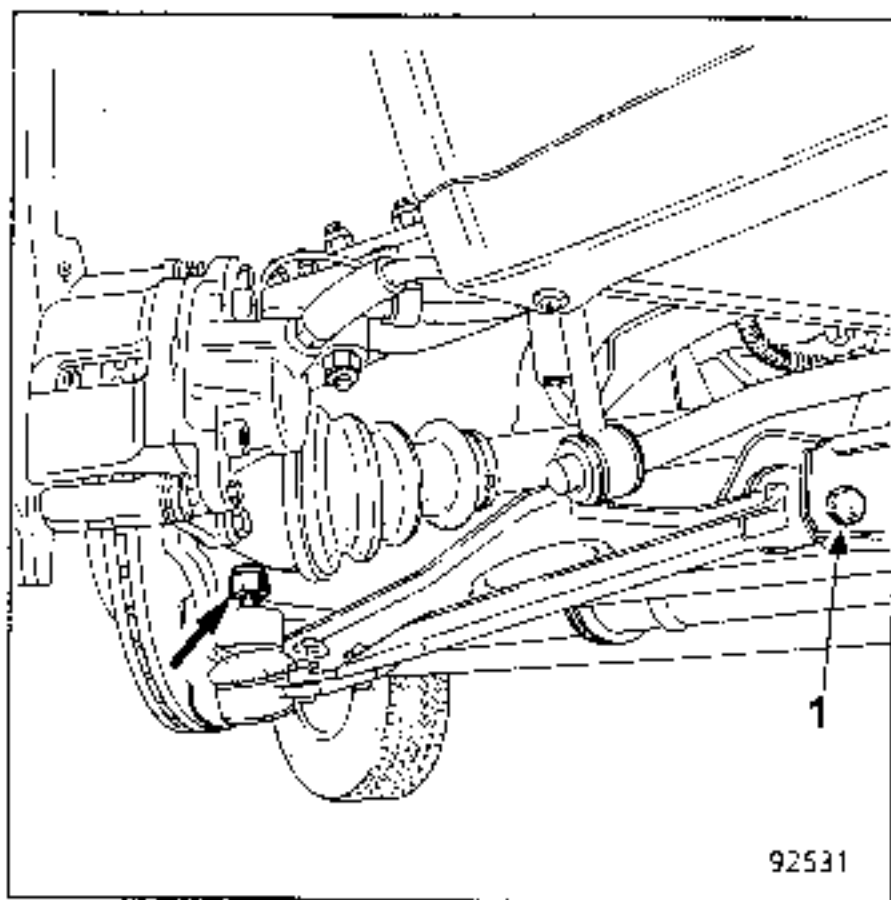
Refit and tighten the ball joint to the correct torque.

Lower the vehicle onto its wheels and tighten the arm pin to the correct torque.

TIGHTENING TORQUES (in daNm)		
Wheel bolts:	4 bolts	9
	5 bolts	10
Lower ball joint nut		6.5
Front fixing pin		13.5
Rear fixing bush pin		4.5

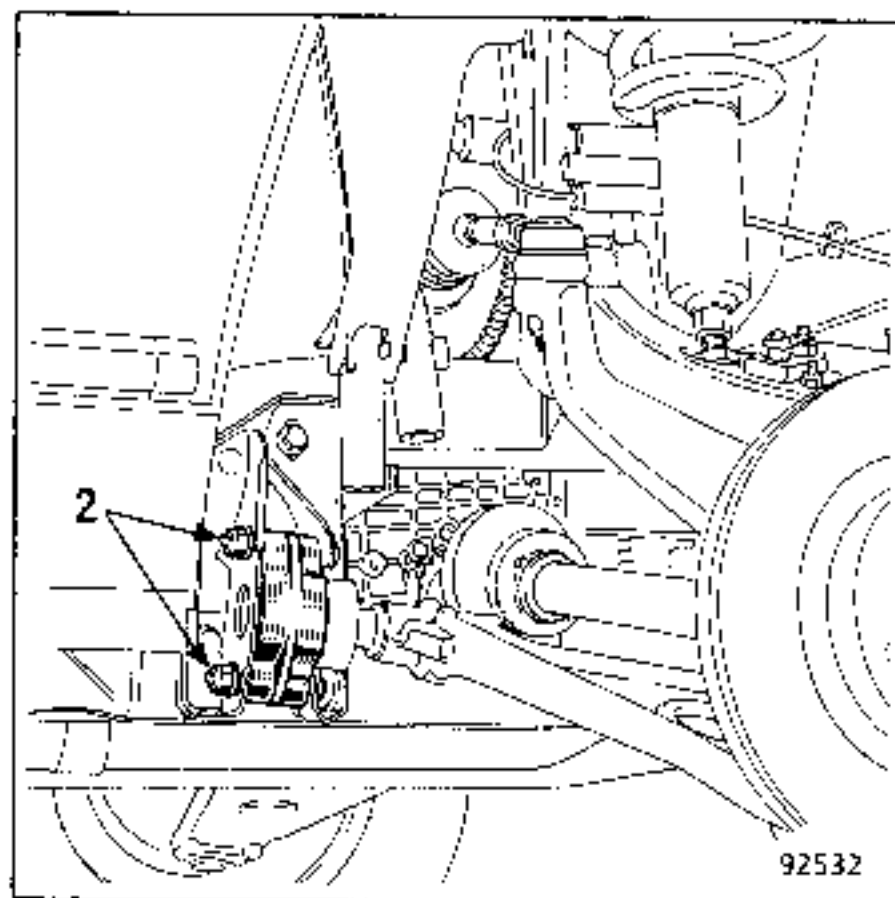
REMOVING

Loosen the ball joint nut and unscrew it until it comes into contact with the driveshaft joint casing. Continue to unscrew it to remove the ball joint; (the nut acts as an extractor and will have to be replaced during reassembly).



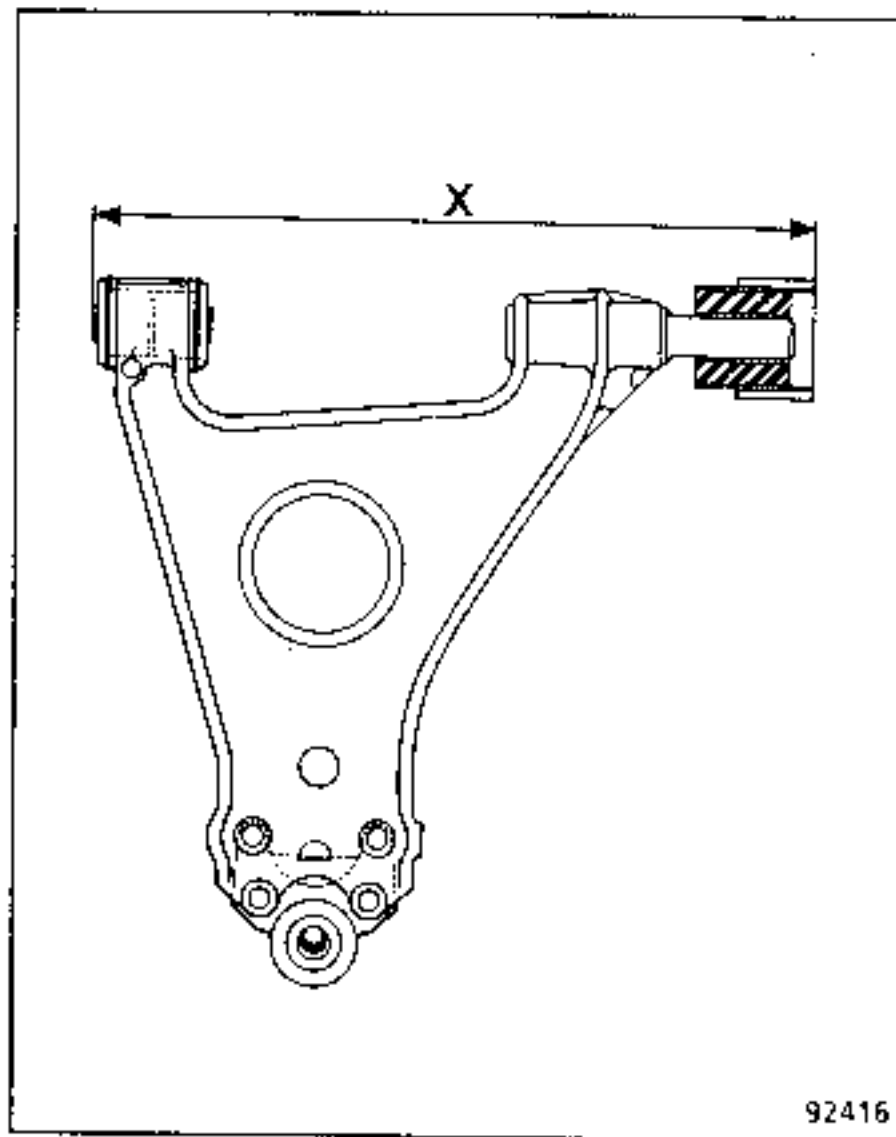
Remove:

- the pin (1),
- both rear bush pins (2).
- the arm.



The lower arms are delivered with the rear fixing bush fitted to size.

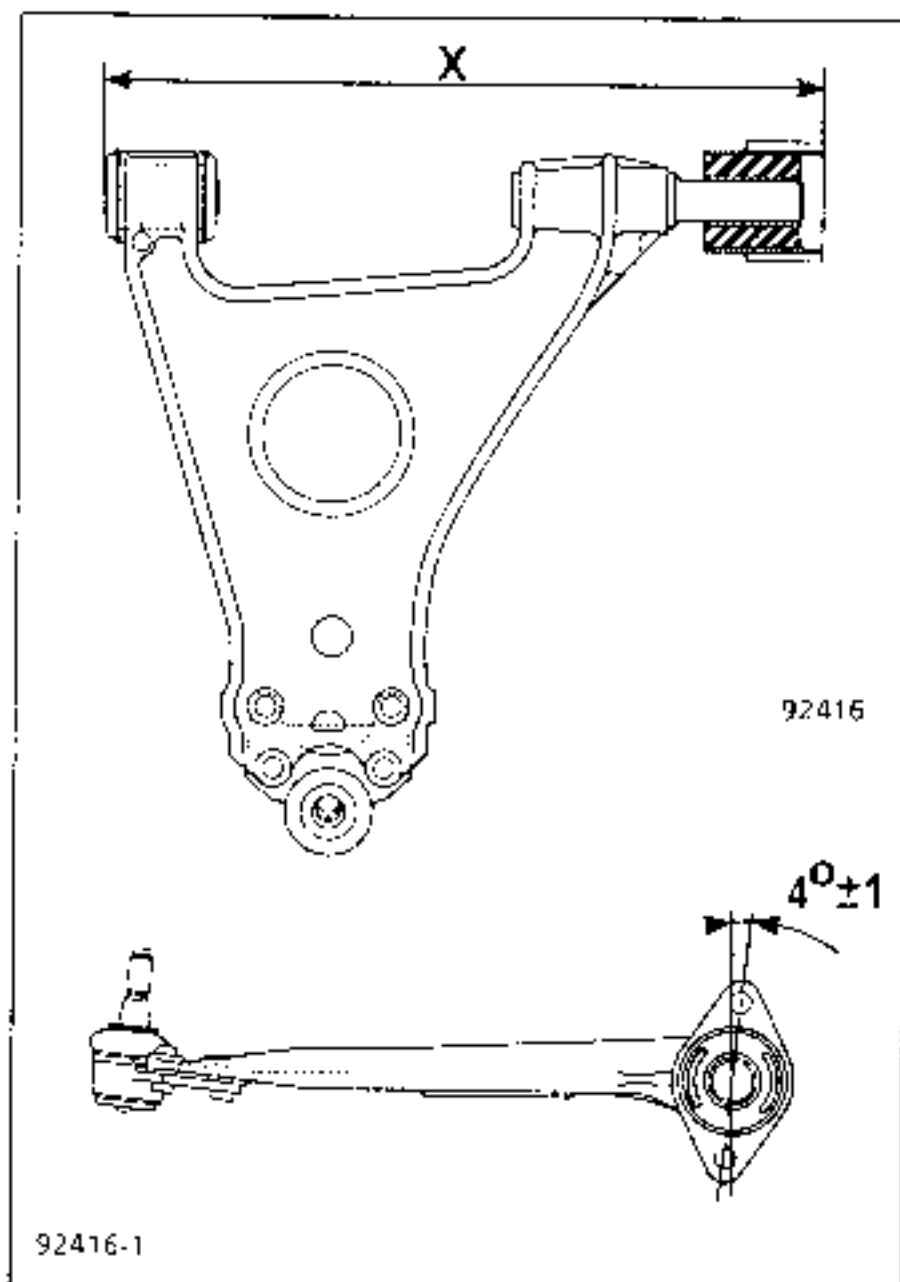
$X = 393 \pm \text{mm}$ for power-assisted steering.



The lower arm of vehicles with power-assisted steering can therefore be fitted as delivered.

In vehicles with manual steering, press in the rear fixing bush until the following distance is achieved:

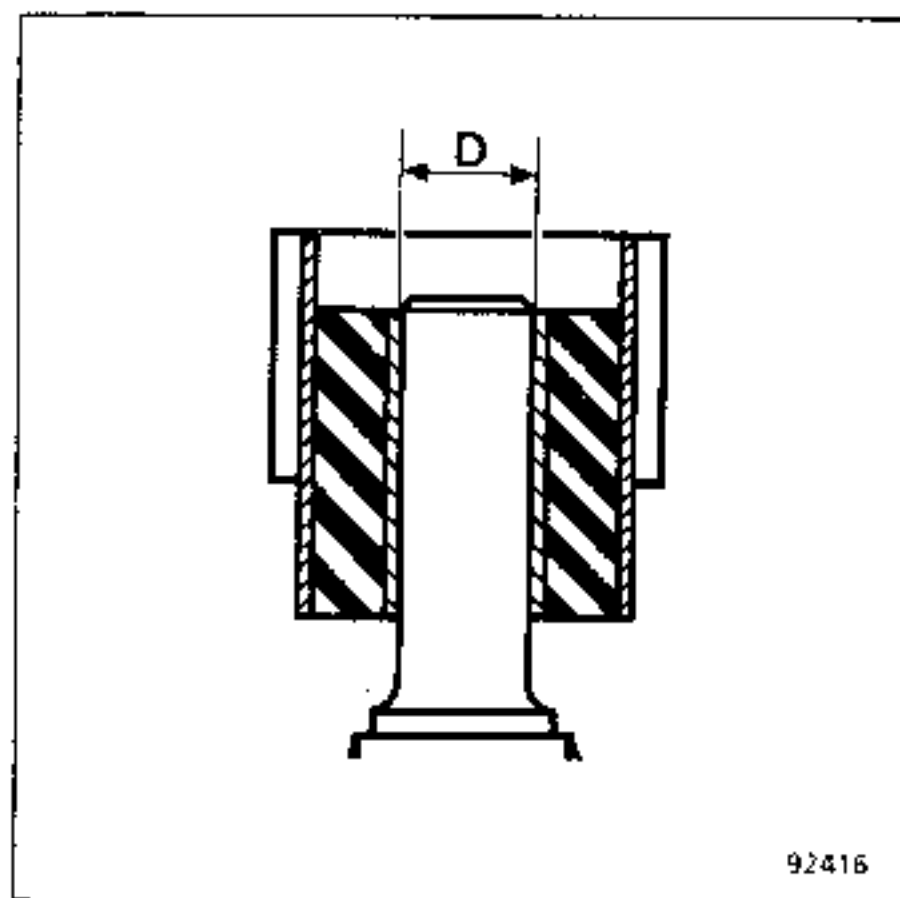
$$X = 382.4 \pm 0.5 \text{ mm.}$$



For manual steering only.

For this operation, press in the new bush/bearing assembly using a tube, internal diameter:

$$D = 24 \text{ mm}$$



IMPORTANT

Make sure that the caster adjusting shim (3) is correctly positioned. See the arm refitting method described below.

REFITTING

Position the arm and fit:

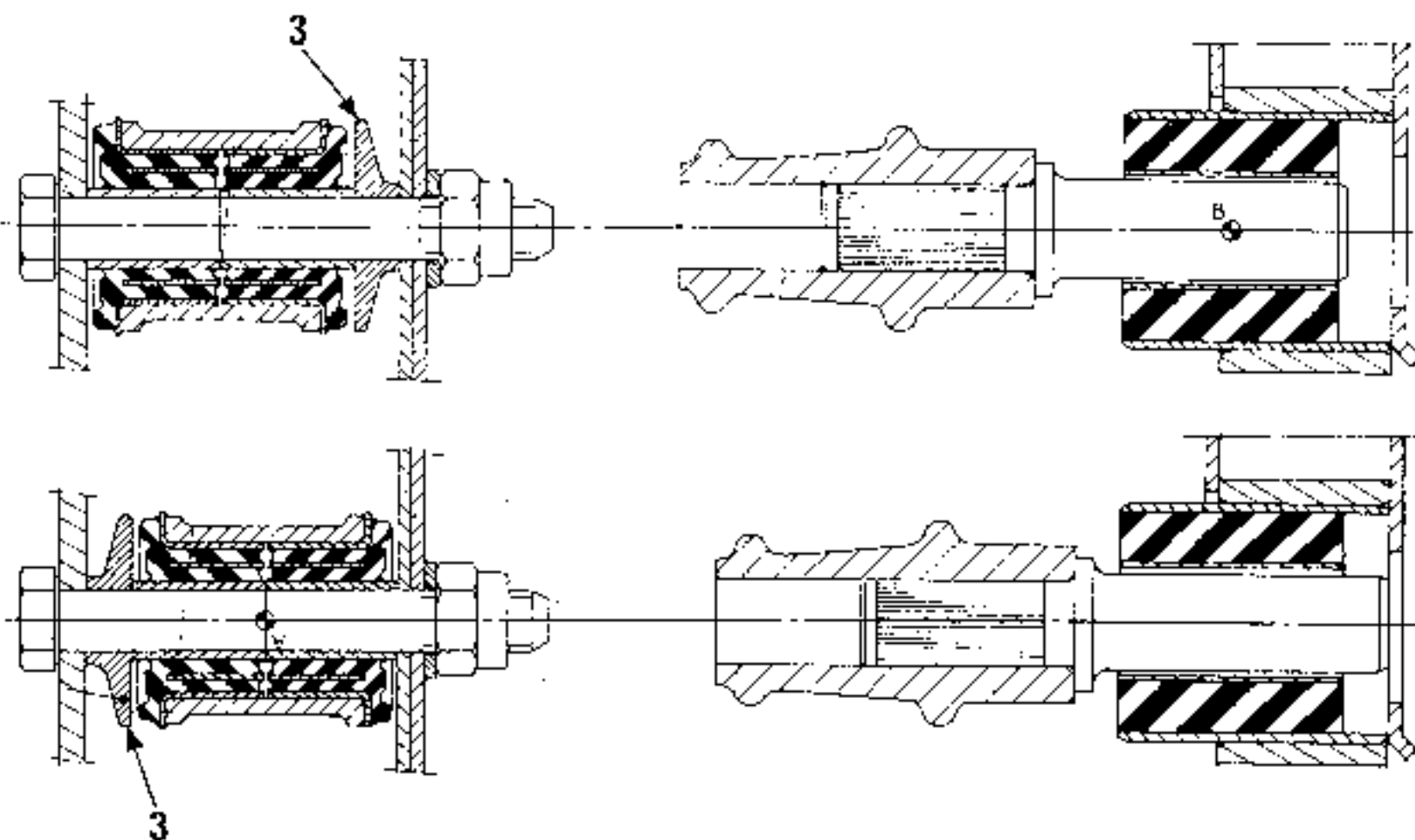
- the front fixing pin, previously smeared with "MOLYKOTE BR2" grease, making sure that the caster adjusting shim (3) is correctly positioned (at the front for manual steering, at the rear for power-assisted steering).

Tilt the rear fixing bush and insert the two pins, previously smeared with "MOLYKOTE BR2" grease.

Refit and tighten the ball joint to the correct torque.

Lower the vehicle onto its wheels and tighten to the correct torque:

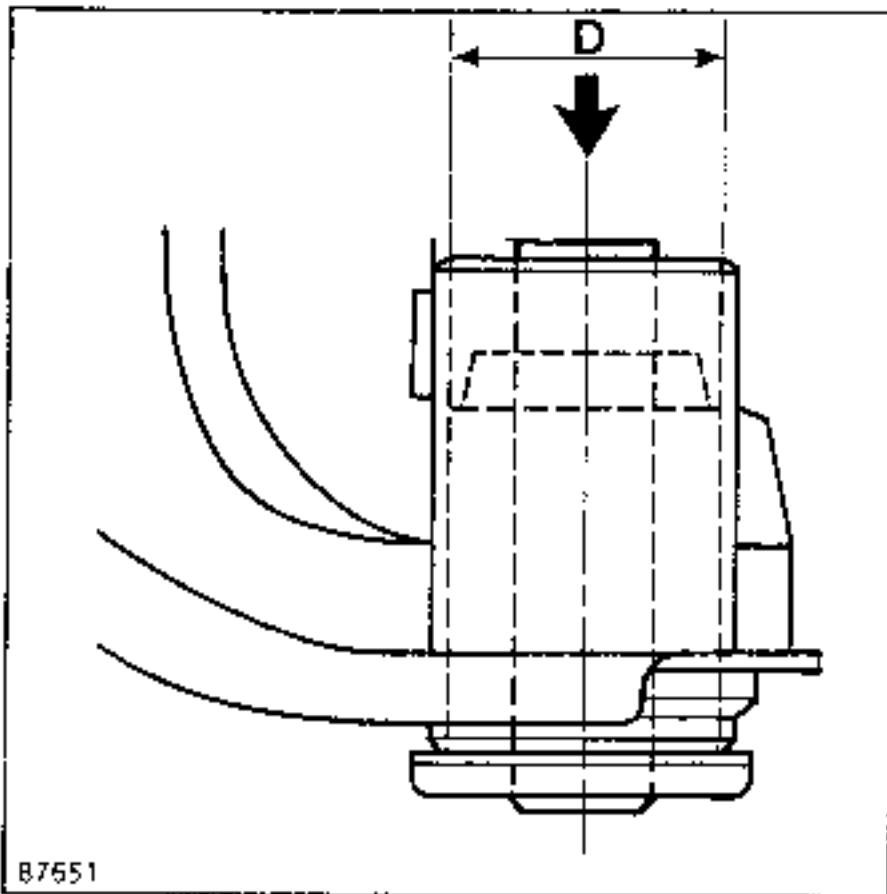
- the front fixing pin;
- both rear fixing pins.



To keep the bushes centred with respect to the arm pin, these must be changed one at a time.

With the lower arm removed:

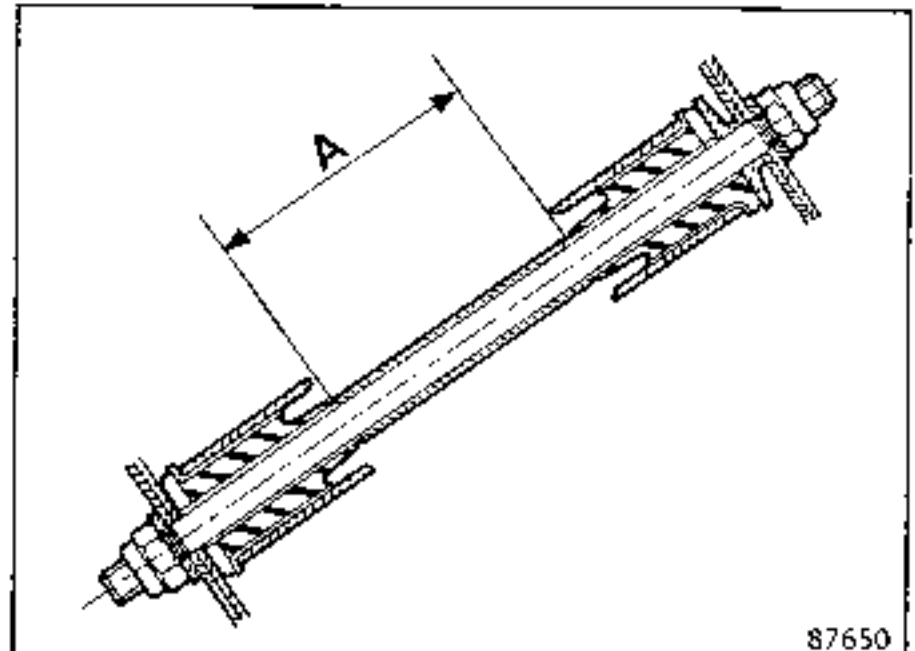
- Press out one worn bush using a tube, external diameter:
 $D = 39.5 \text{ mm}$



- Fit a new bush to achieve distance:
 $A = 112.6 \text{ mm}$

NOTE

When the rubber of both bushes is worn and can no longer be used as a reference point for measuring distance A, mark the position of the external bush tube with respect to the arm, and refit the new bush in the same place.



Press out the second bush and follow the same procedure to maintain the distance:

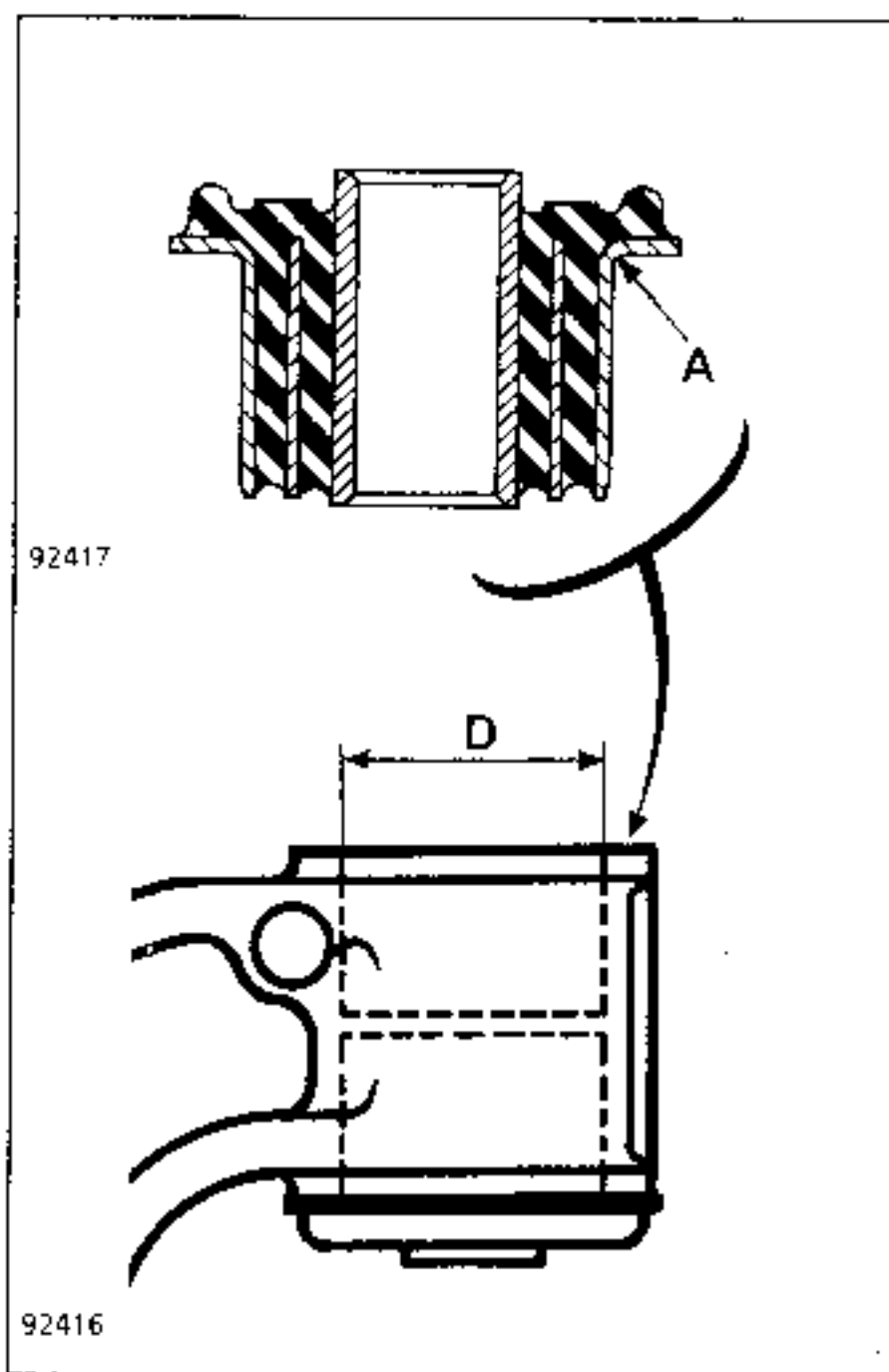
$$A = 112.6 \text{ mm}$$

THIS OPERATION IS PERFORMED WITH THE LOWER ARM REMOVED

I : FRONT BUSHES

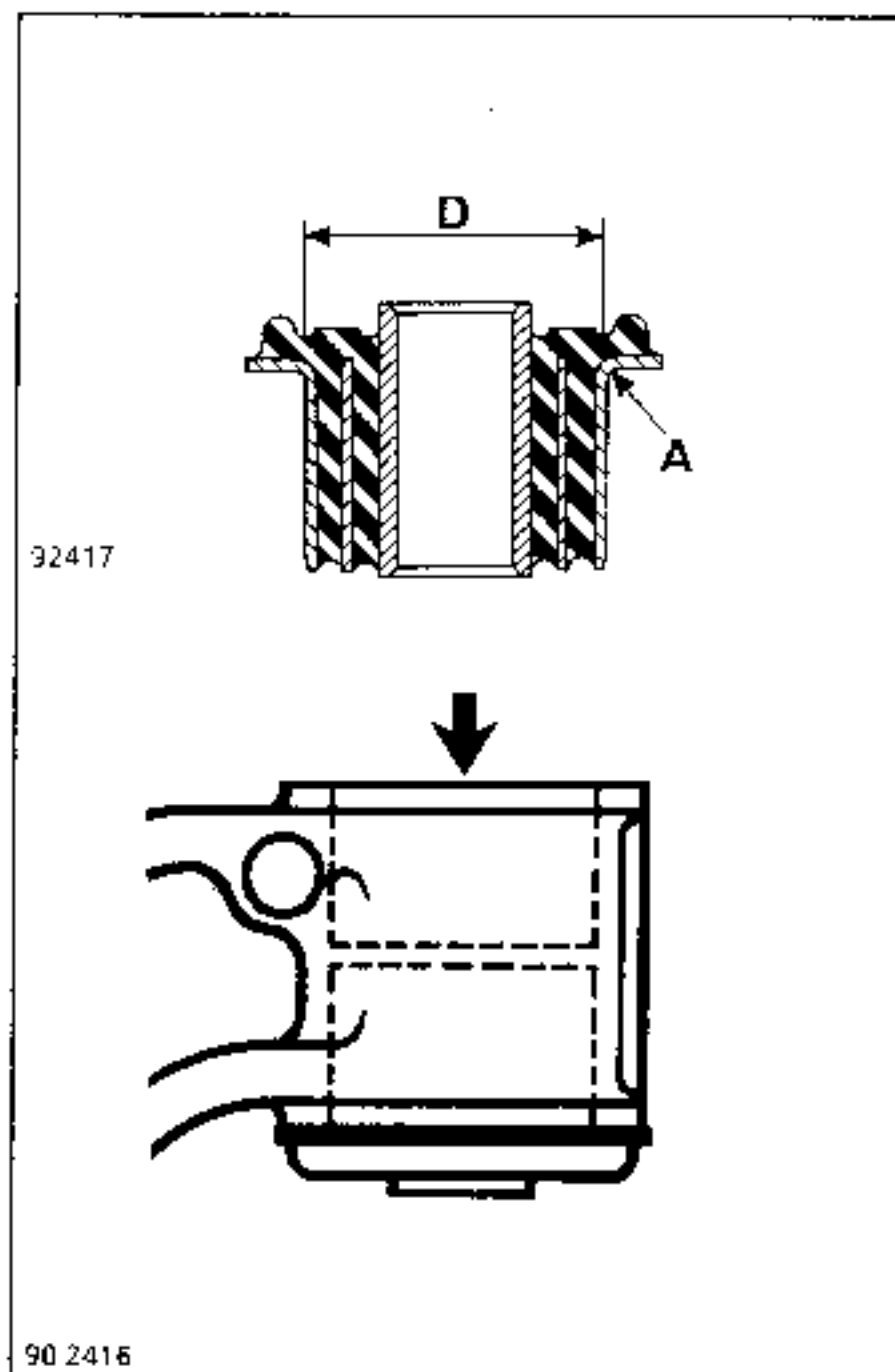
Saw the collar (A) of the external bush, then press out both bushes using a tube, external diameter:

$$D = 34 \text{ mm}$$

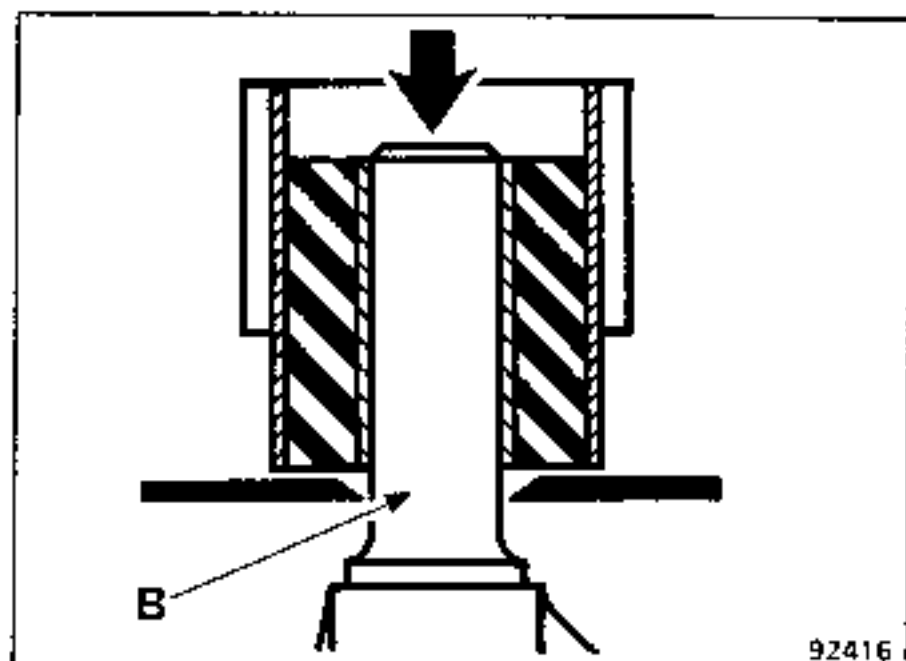


Refit two new bushes until collars (A) are resting on the arm, using a tube, external diameter:

$$D = 38 \text{ mm}$$

**II : REAR BUSH**

Press out the bush/bearing assembly, by pressing under the bush and pushing on the arm shaft (B).



Make sure the bearing position is in accordance with the drawing, as well as the insertion distance X , depending on the vehicle.

Manual steering:

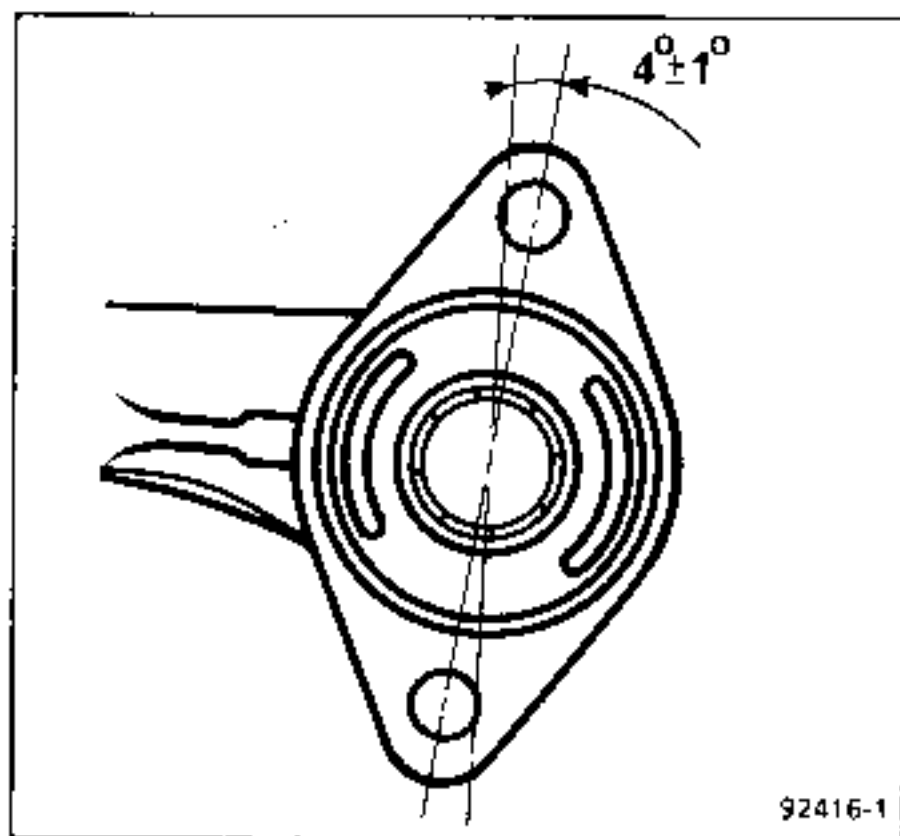
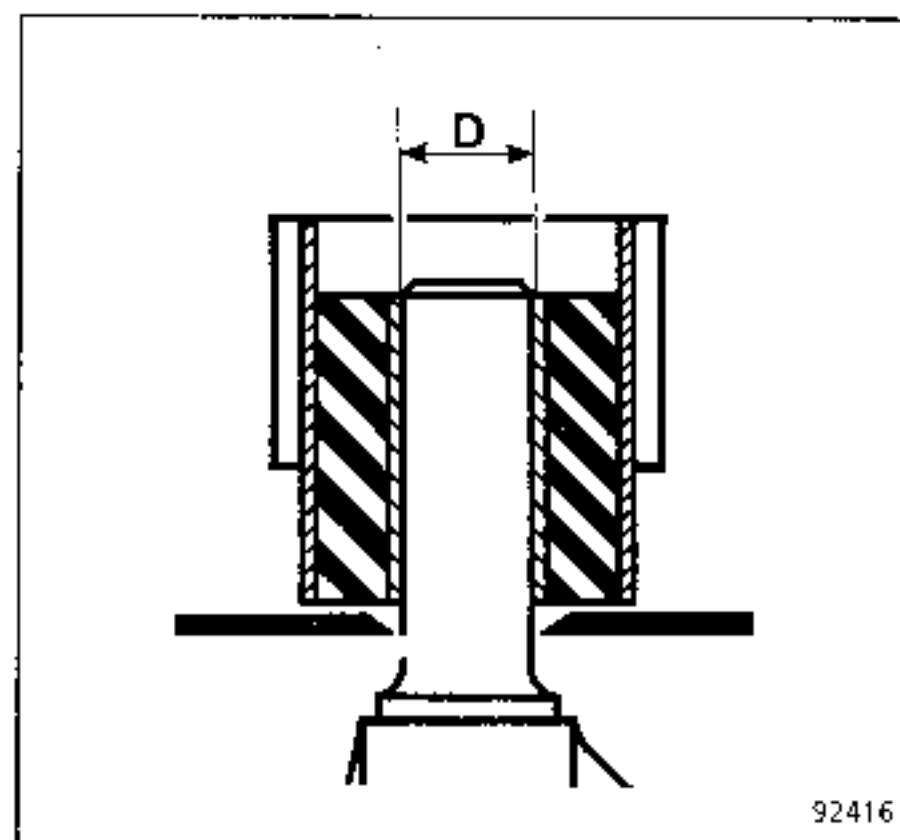
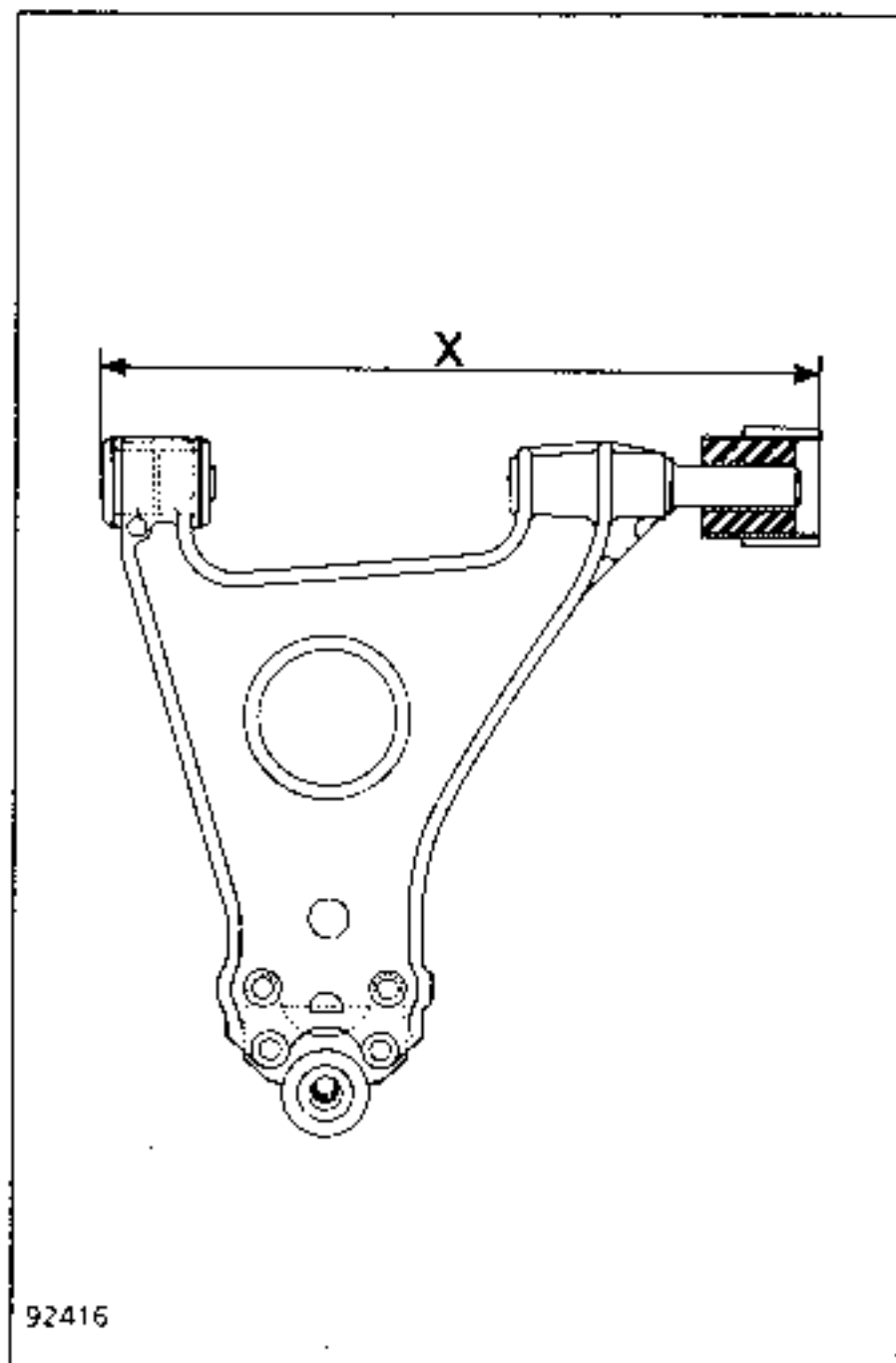
$$X = 382.4 \pm 0.5 \text{ mm}$$

Power-assisted steering:

$$X = 393 \pm 0.5 \text{ mm}$$

To perform this operation, fit the new bush/bearing assembly using a tube, internal diameter

$$D = 24 \text{ mm}$$



If the bellows are worn, the entire ball joint must be replaced.

The lower arm must be removed to perform this operation.

Drill out the ball joint fixing rivets and release the ball joint.

Fit the new ball joint using the fixing bolts delivered with it.

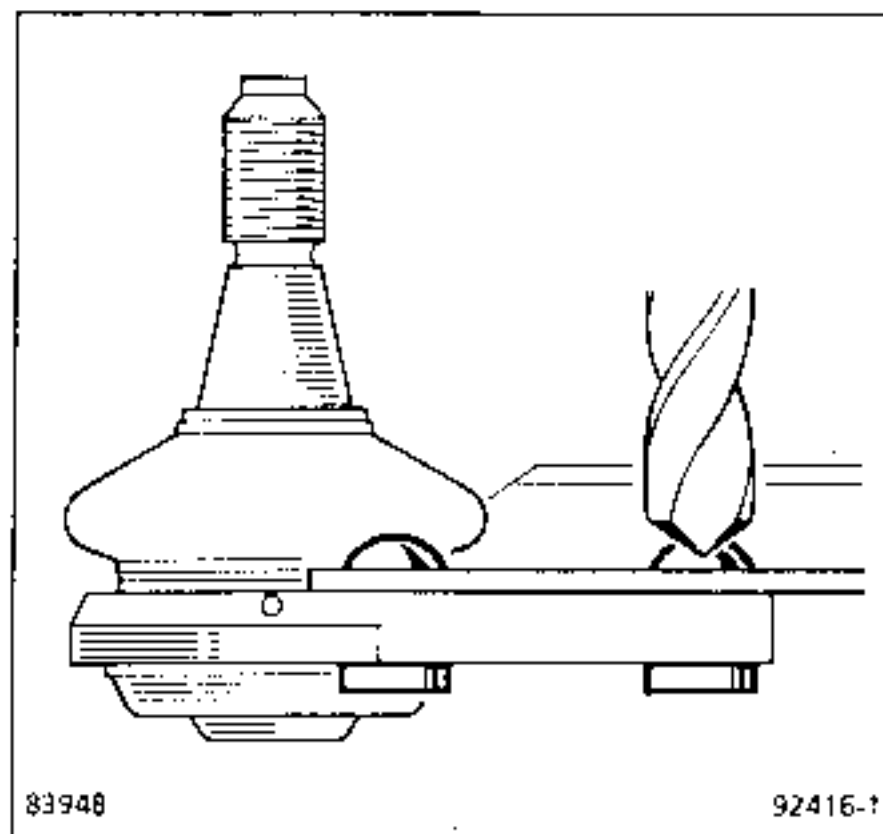
NOTE:

The ball joint is to be positioned under the lower arm.

The bolt heads should be on the bellows side.

Refit the lower arm.

Check and adjust, if necessary, the front axle angles.



ESSENTIAL SPECIAL TOOLING

Fre. 823

Piston retractor

TIGHTENING TORQUES (in daNm)

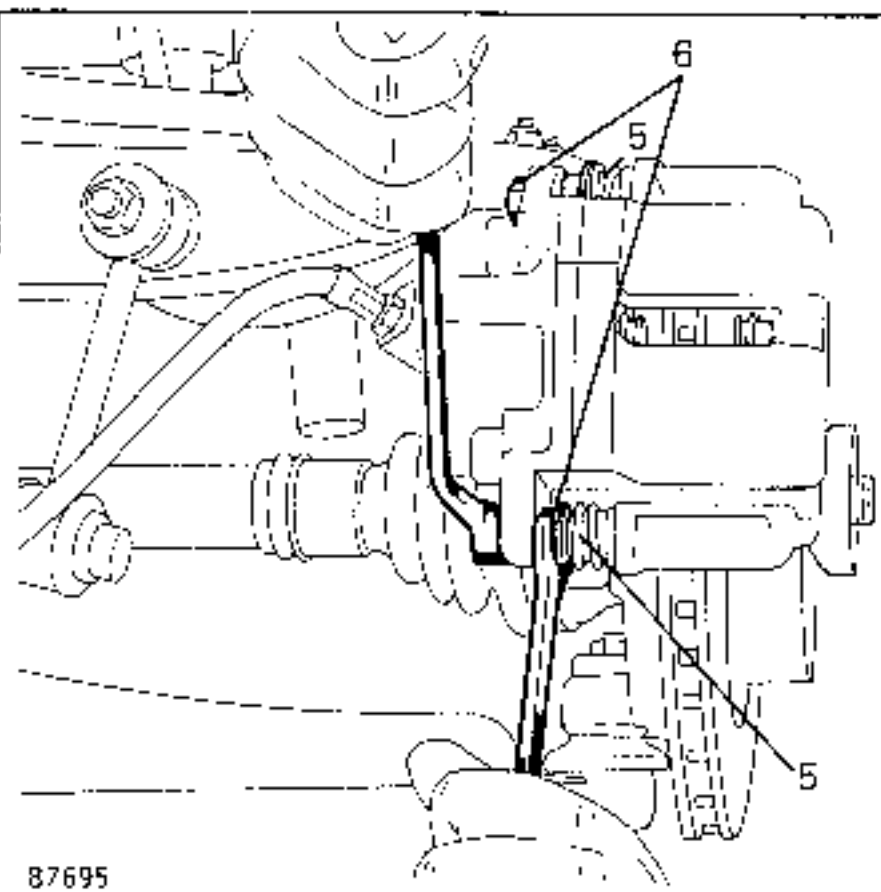


Wheel bolts:	4 bolts	9
	5 bolts	10
Brake caliper guide bolt		3.5

REMOVING

Disconnect the wear warning light wire.

Push in the piston by sliding the caliper outwards by hand



Using two spanners, remove the guide bolts (6).

Do not clean these bolts.

Release the sliding caliper.

Remove the linings.

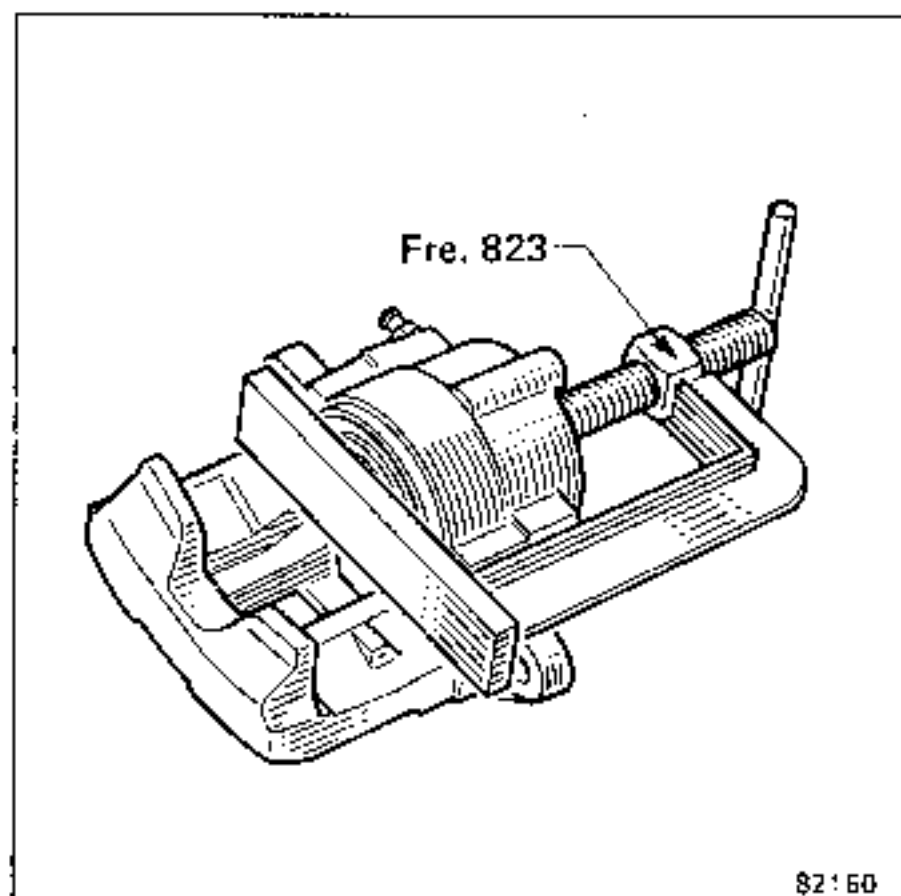
Checking

Check the condition and the fitting of the piston dust cover and its retaining ring.

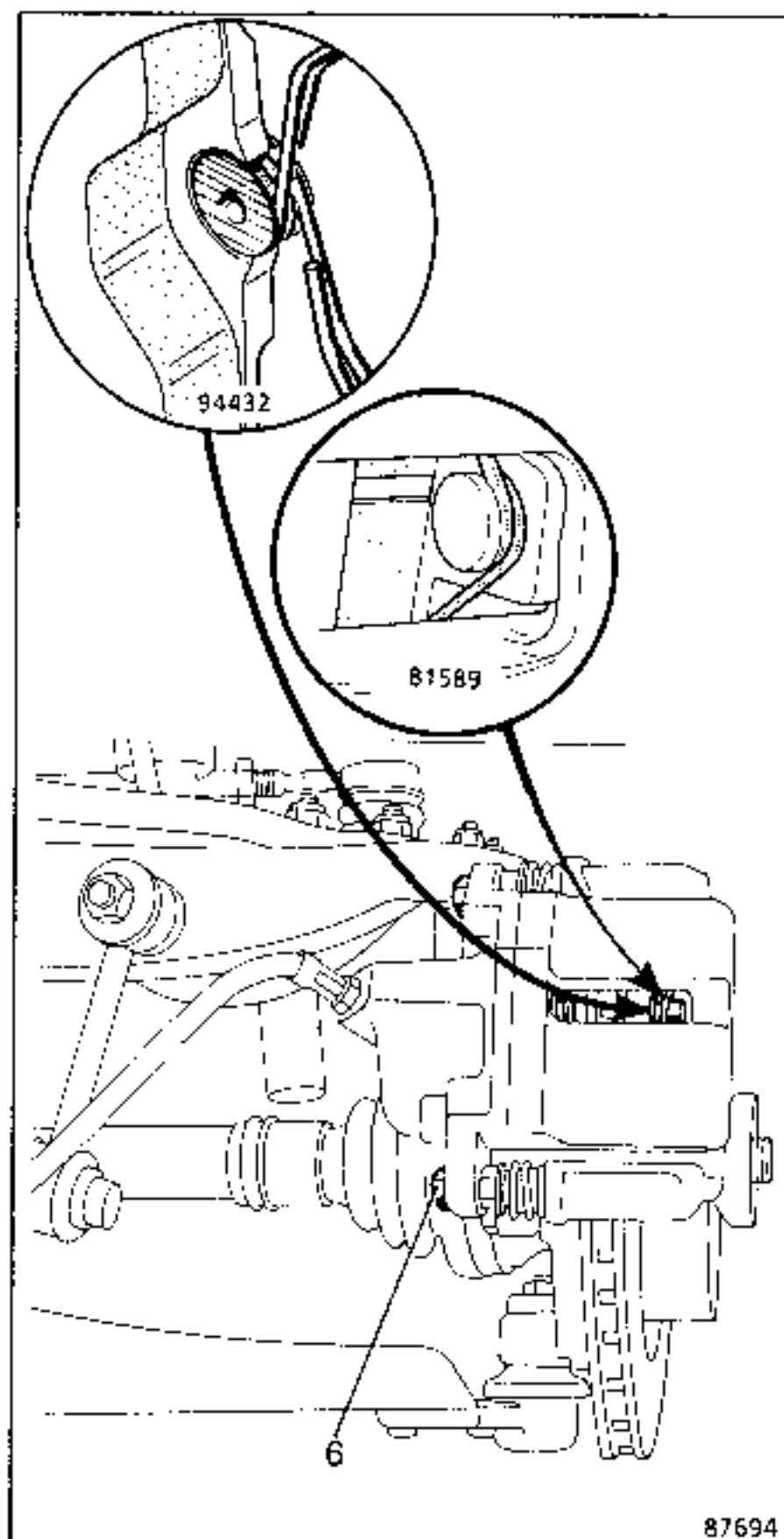
Check also the condition of the guide dust covers (5).

REFITTING

Push the piston back into its housing using Fre. 823.



Fit the new linings with their springs, taking care to fit them the correct way round.



The lining, with the wear warning light wire, is inserted on the inside.

Fit the caliper and insert the lower guide bolt (6), smeared with Loctite "FRENBLOC".

Press on the caliper and fit the upper guide bolt , smeared with Loctite "FRENBLOC".

Tighten the guide bolts to the correct torque, starting with the lower bolt.

Depress the brake pedal several times to create contact between the piston and the linings.

TIGHTENING TORQUES (in daNm)



Wheel bolts:	4 bolts	9
	5 bolts	10
Brake caliper guide bolts		3.5

REMOVING

Loosen the brake hose at the caliper end.

Remove:

- the brake linings (see appropriate section).

Unscrew the caliper from the hose (brake fluid will run out).

REFITTING

Screw the caliper back onto the hose.

Unscrew the bleed screw.

Check the condition of the linings and refit if necessary.

Partially bleed the circuit if the fluid reservoir has not drained completely during the operation. Otherwise, bleed completely:

- the braking circuit,
- the clutch circuit (depending on model).

Depress the brake pedal several times to create contact between the piston and the linings.

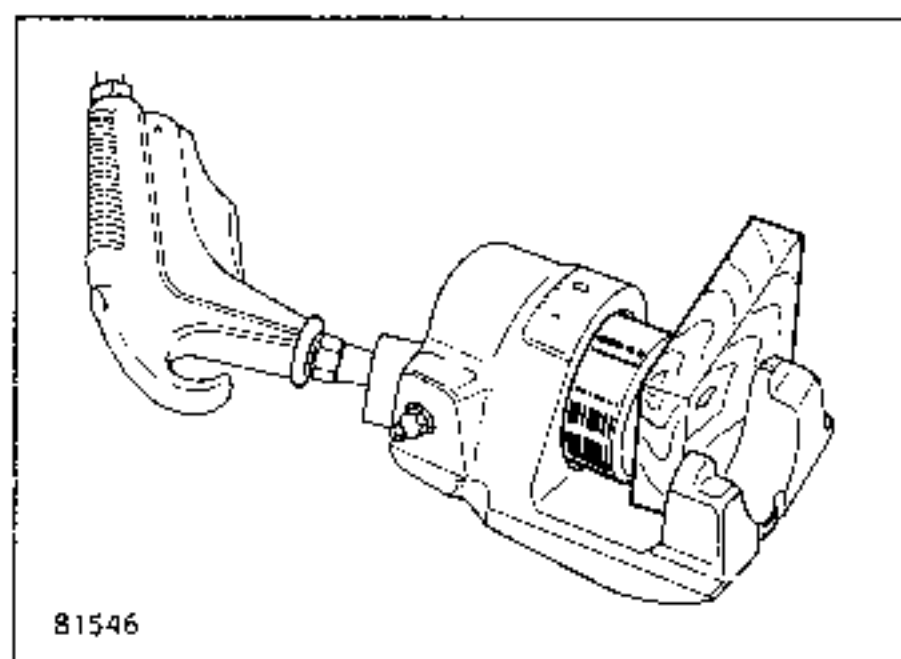
REPAIR

If the caliper bore is scored in any way, the entire caliper will have to be changed.

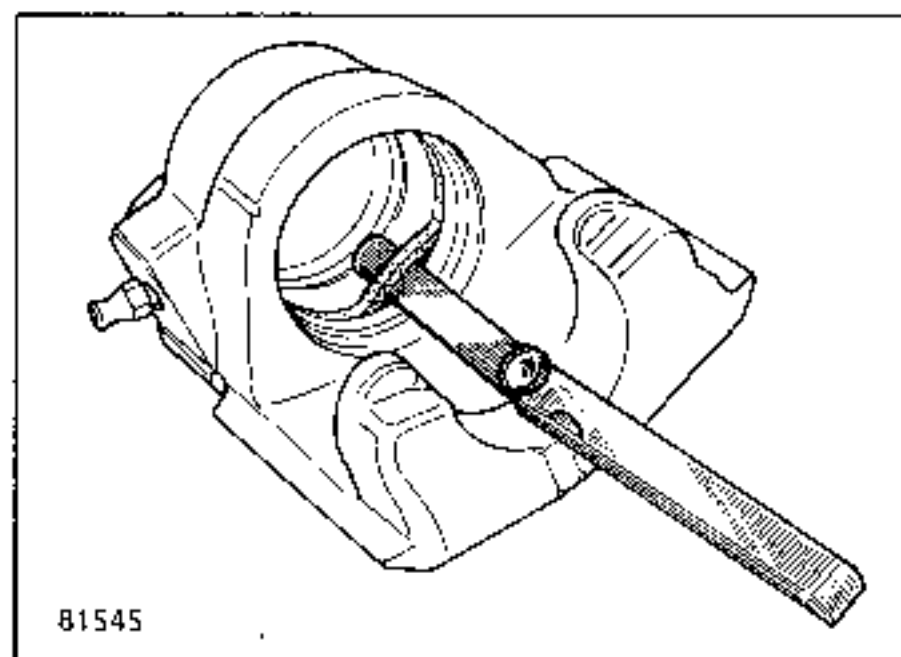
Remove the brake caliper, the rubber dust cover and its retaining ring.

Remove the piston using compressed air, making sure to insert a wooden shim between the caliper and the piston to prevent piston damage.

The skirt is useless if it shows any sign of impact.



Using a round-edged flexible blade (e.g. a feeler gauge), remove the rectangular-section seal from the caliper groove.



Clean the parts using methylated spirit.

Replace all faulty parts with genuine new parts and refit the seal, the piston, the dust-cover and its retaining ring.

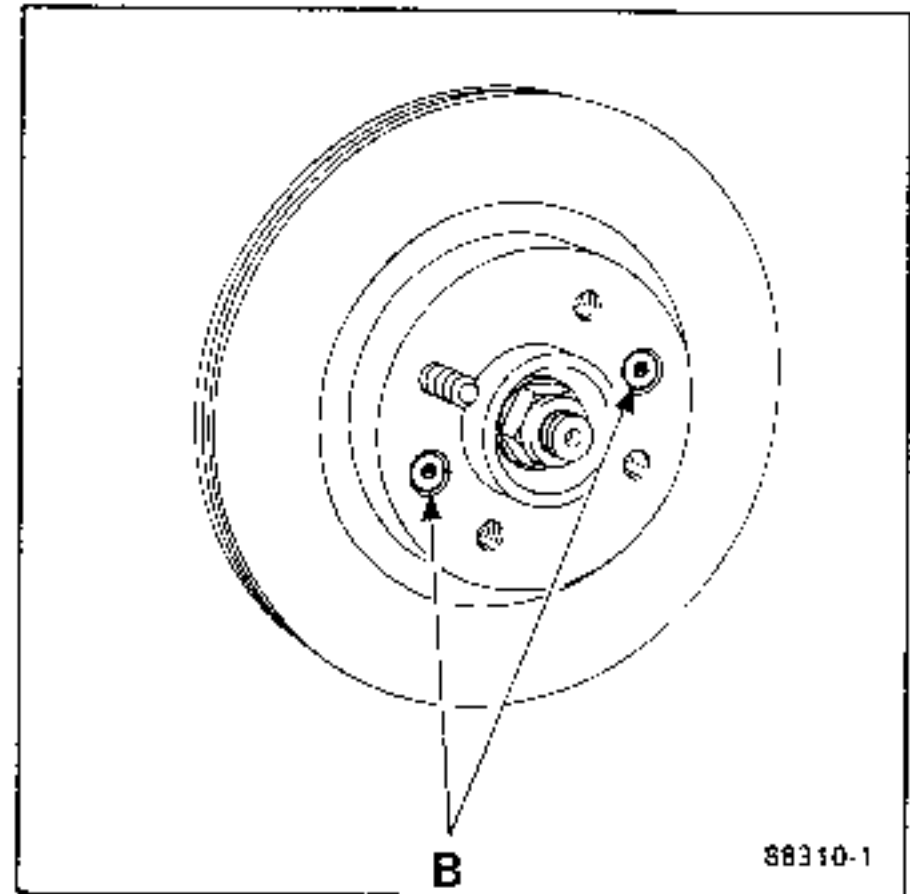
Brake discs cannot be machined. If there is major wear or scoring of the disc, it must be replaced.

TIGHTENING TORQUES (In daNm)			
Wheel bolts:	4 bolts	9	
	5 bolts	10	
Brake caliper guide bolt		10	

REMOVING

Remove:

- both caliper fixing bolts (A),
- both disc fixing bolts (B) (male hexagon key Torx T. 40 (e.g. Facom 89-40)),
- the disc.

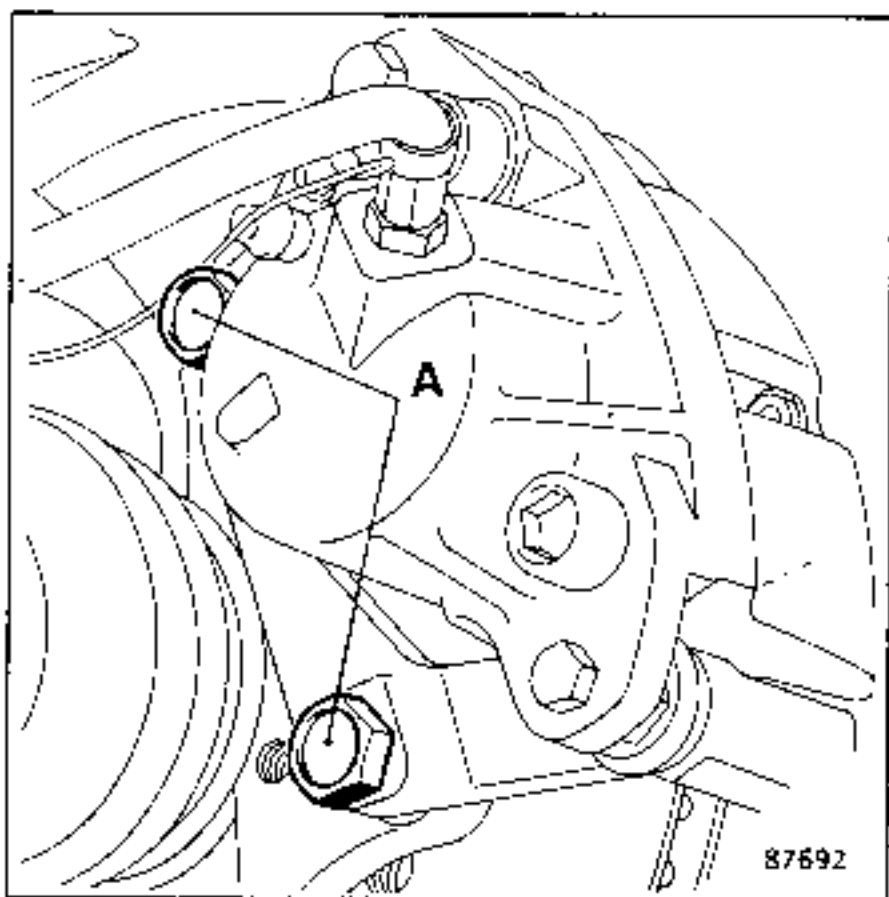


REFITTING

Position the disc on the hub and secure it using both bolts (B).

Refit the brake caliper and smear the bolts with Loctite "FRENBLOC" then tighten to the correct torque.

Depress the brake pedal several times to create contact between the piston and the linings.



ESSENTIAL SPECIAL TOOLING		
M.S.	580	Impact wrench
Rou.	15 -01	Protective end cup
Rou.	604 -01	Hub locking tool
T.Av.	1050	Hub extractor

TIGHTENING TORQUES (in daNm)

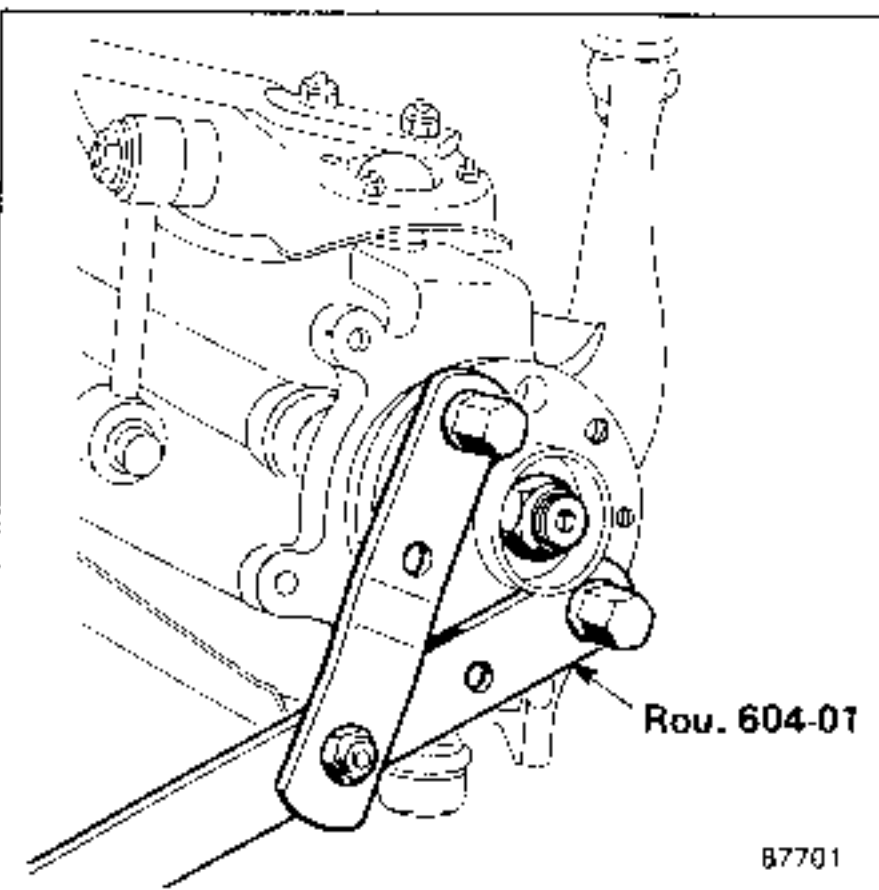


Driveshaft nut	25
Wheel bolts: 4 bolts	9
5 bolts	10
Brake caliper fixing bolt	10
Bearing fixing bolt	2

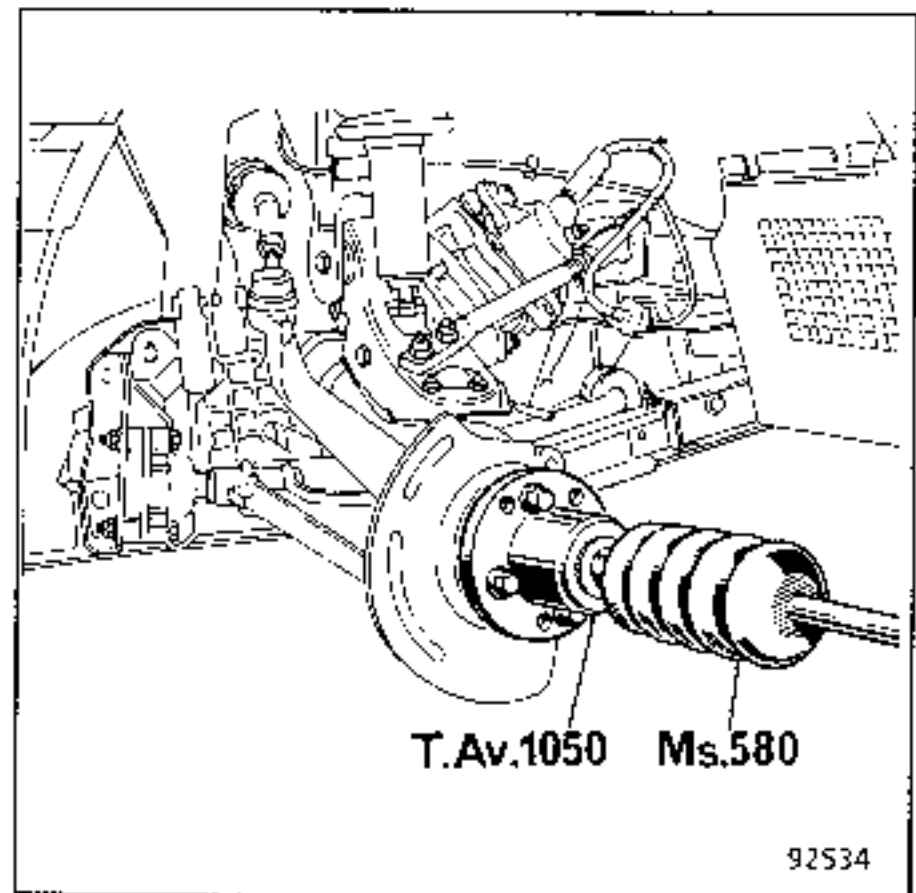
REMOVING

Remove:

- the brake disc (see previous page),
- the driveshaft nut using Rou. 604-01.

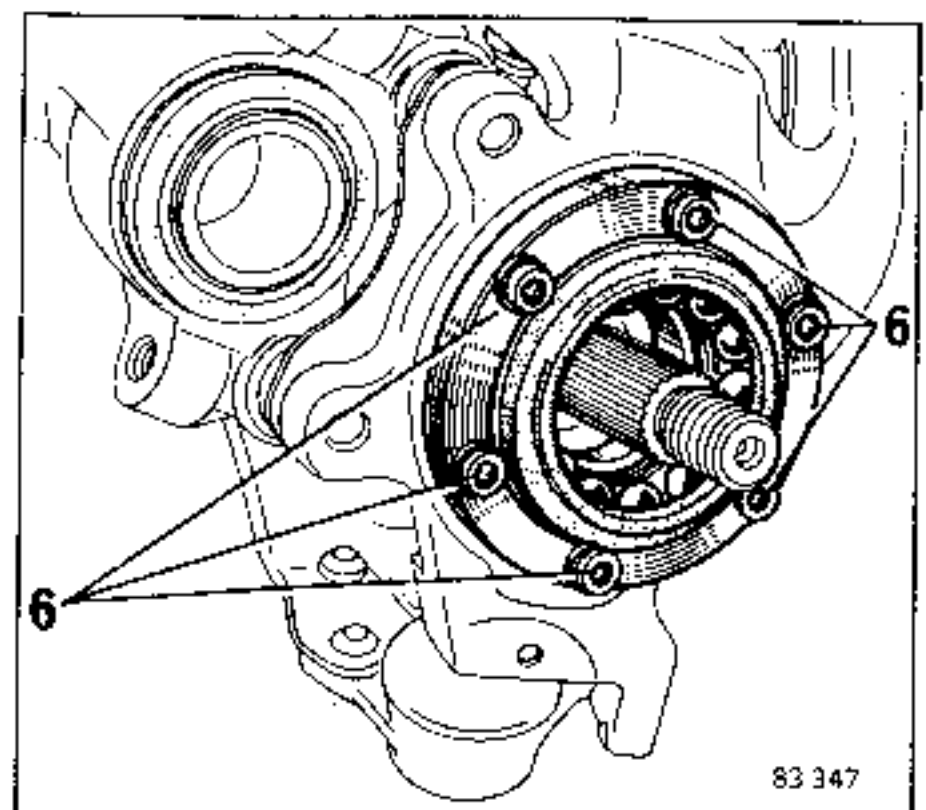


Extract the hub using T.Av. 1050 + M.S. 580.



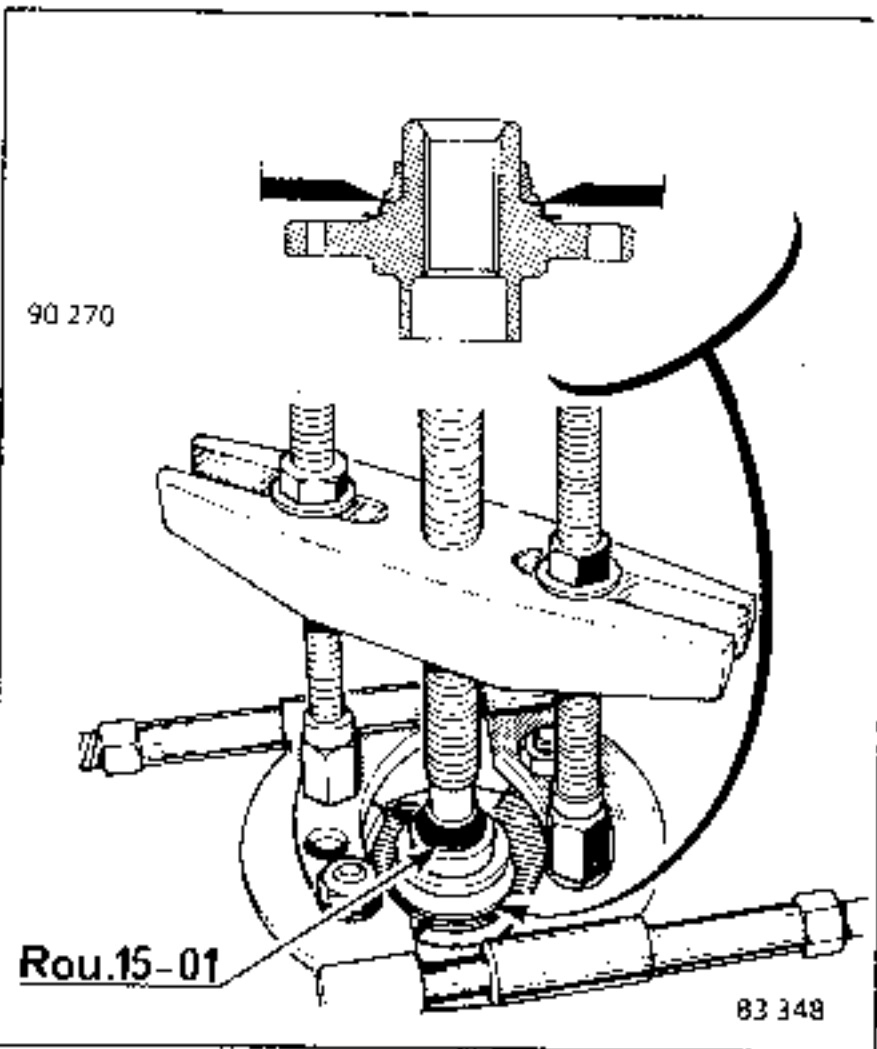
Remove:

- the bearing fixing bolts (6) using male hexagon key Torx T30 (e.g. : FACOM RX30 + adapter or 89-30).



- the bearing and its remaining internal inner track on the driveshaft stub axle.

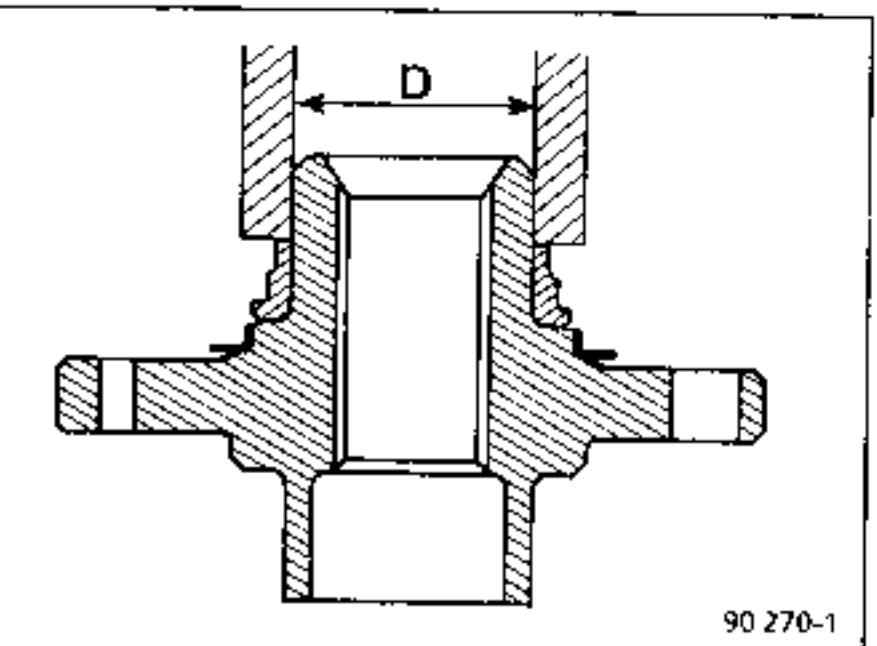
Extract the other bearing inner track from the hub using a jaw-type extractor such as **FACOM U53G + U53E** and **Rou. 15-01**.



REFITTING

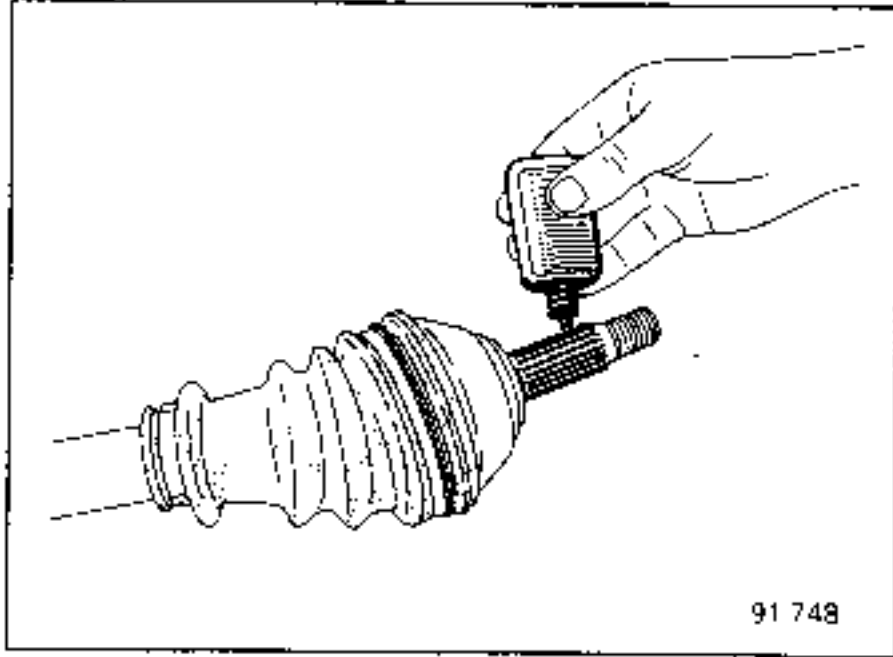
Fit the internal bearing inner track onto the driveshaft stub axle and attach the bearing to the stub axle carrier.

Press the other inner track onto the hub using a tube, internal diameter:
D = 41 mm.



Smear the balls, the ball races and the sealing lips with **ELF Multi grease**.

Smear the driveshaft stub axle with **LOCTITE SCELBLOC**.



Fit the hub to the driveshaft stub axle (using a mallet if necessary) until the nut can be screwed on by a few threads.

Fit the hub locking tool **Rou. 604-01** and tighten the driveshaft nut to the correct torque.

Refit the entire braking unit (see appropriate chapter).

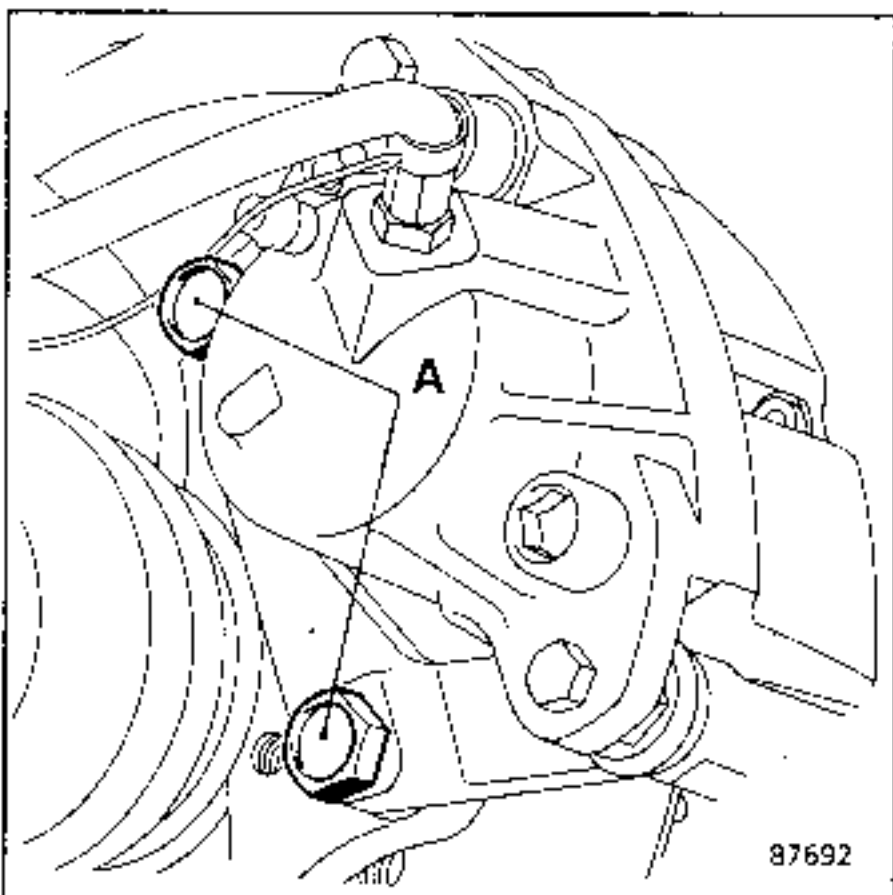
ESSENTIAL SPECIAL TOOLING			
Rou.	604 -01	Hub locking tool	
T.Av.	476	Ball joint extractor	

TIGHTENING TORQUES (in daNm)		
Driveshaft nut	25	
Wheel bolts: 4 bolts	9	
5 bolts	10	
Upper ball joint nut	6.5	
Lower ball joint nut	6.5	
Steering nut	4	
Brake caliper fixing bolt	10	
Bearing fixing bolt	1.5	

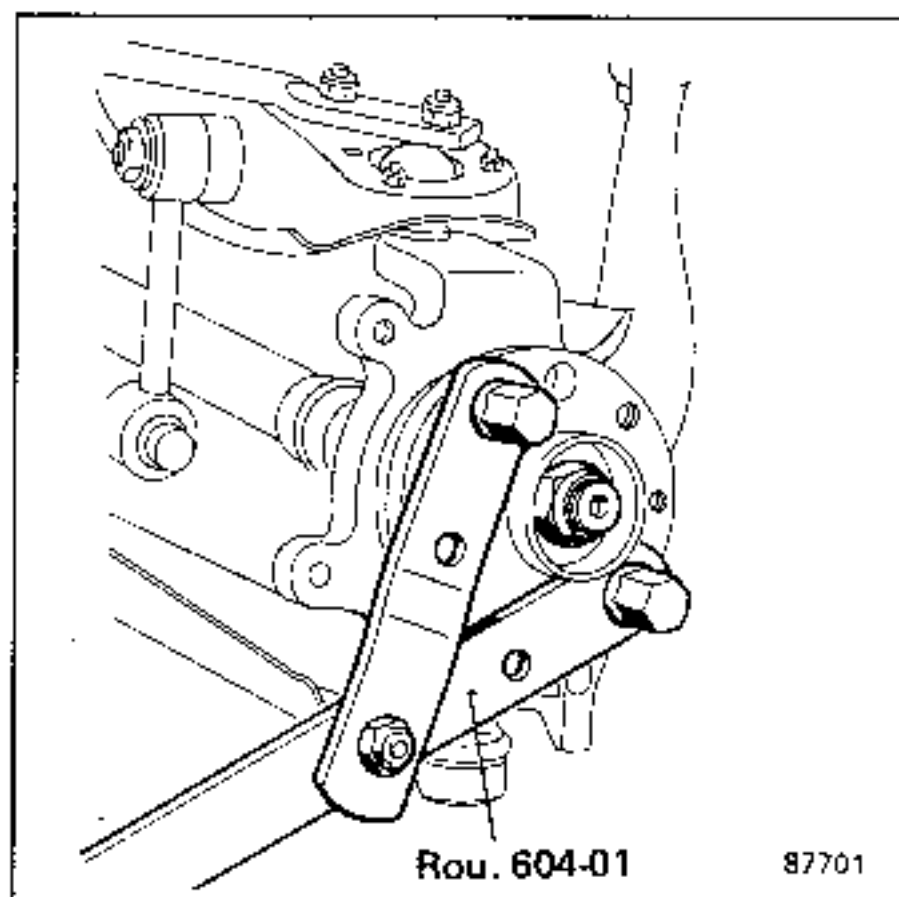
REMOVING

Remove:

- the braking assembly using the two bolts (A).

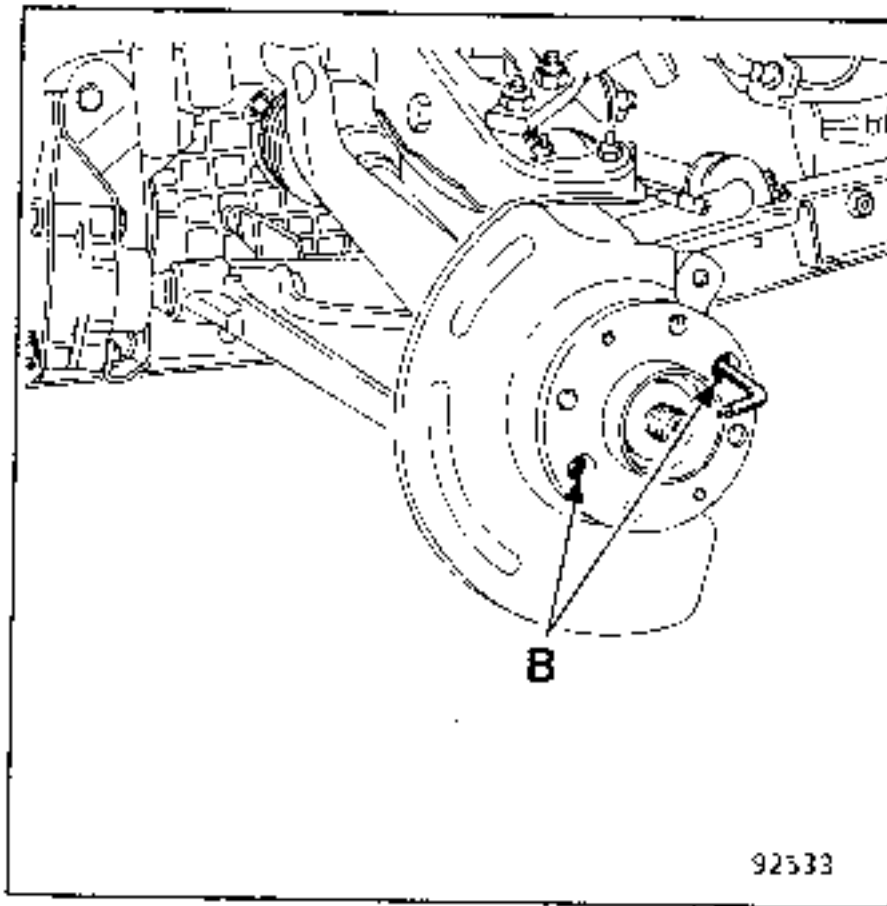


- the disc (see appropriate section),
- the driveshaft nut using Rou. 604-01.



Remove the bearing fixing bolts through the holes (B) in the hub, using a hexagon key, Torx T30

(e.g.: FACOM RX30 + adapter or 89-30)



Remove the hub/bearing assembly.

Disconnect the three stub axle carrier ball joints using T.Av. 476 and remove the stub axle carrier.

REFITTING

After having attached the stub axle carrier to its three ball joints, refit the hub and the braking system, taking care to fit only clean, serviceable parts.

Given the high tractive force of the springs, the tooling must be kept in perfect condition.

ESSENTIAL SPECIAL TOOLING	
Sus.513	Shock absorber piston rod location and insertion tool.
Sus.1012	Front spring and front shock absorber dismantling and reassembly tool.

TIGHTENING TORQUES (in daNm)



Setting control valve mounting	10
Upper fixing nut	2
Shock absorber base locknut	6
Shock absorber base pin	8
Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING (depending on version)

Remove:

- the expansion bottle;
- the earth (dephaser) located inside the shock absorber turret.
- the blanking cover.

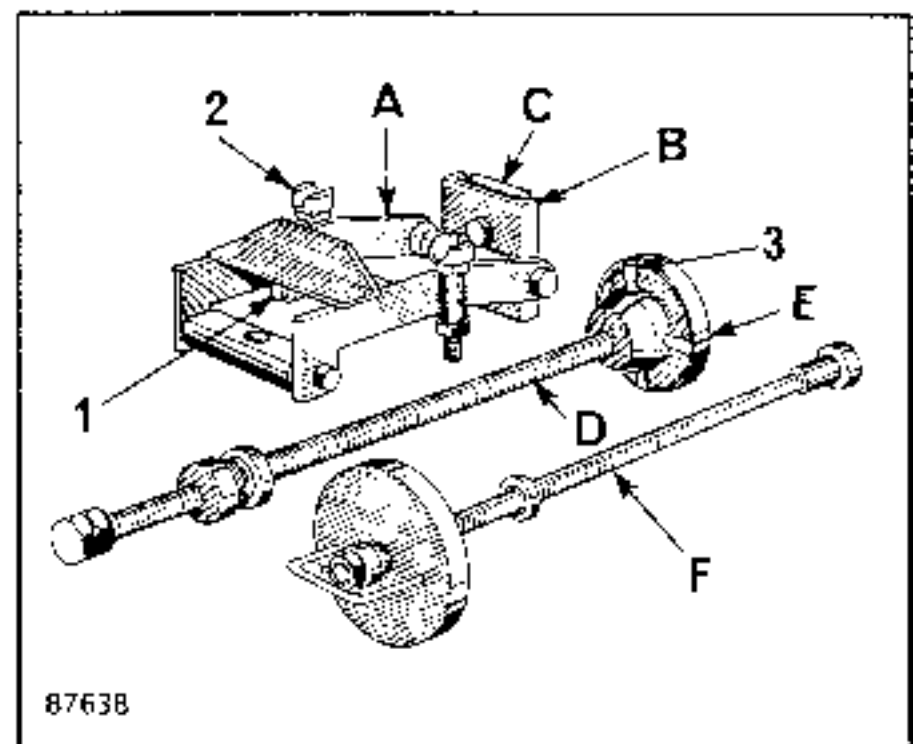
In the wheel arch

- disconnect the solenoid valve supply connector (driver-controlled shock absorber).

Remove:

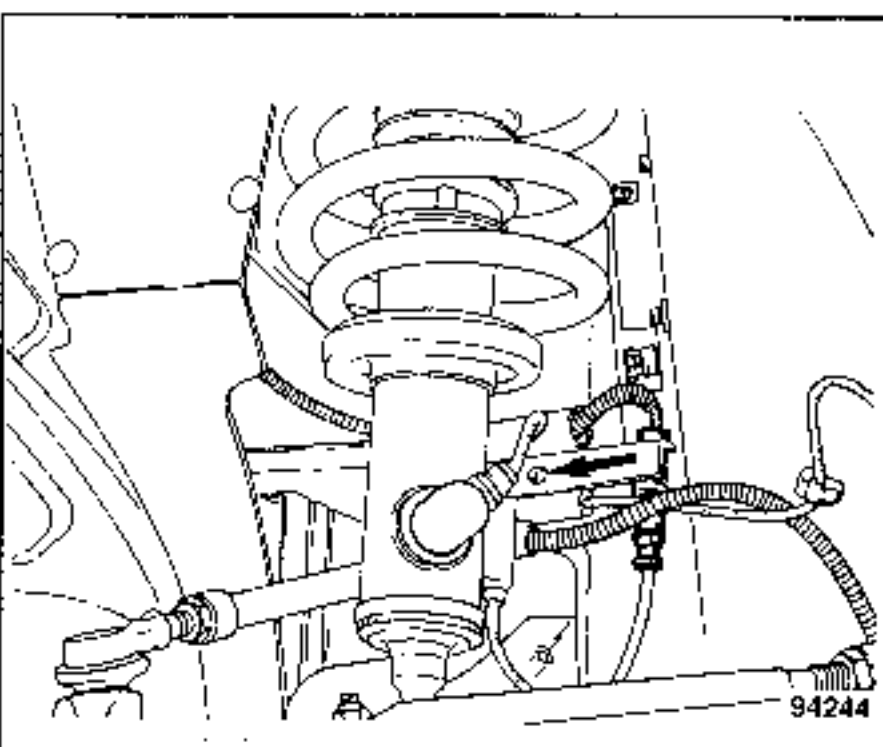
- the piping support bracket and the connector (blind rivet).

Use parts A, B, C and F of Sus. 1012

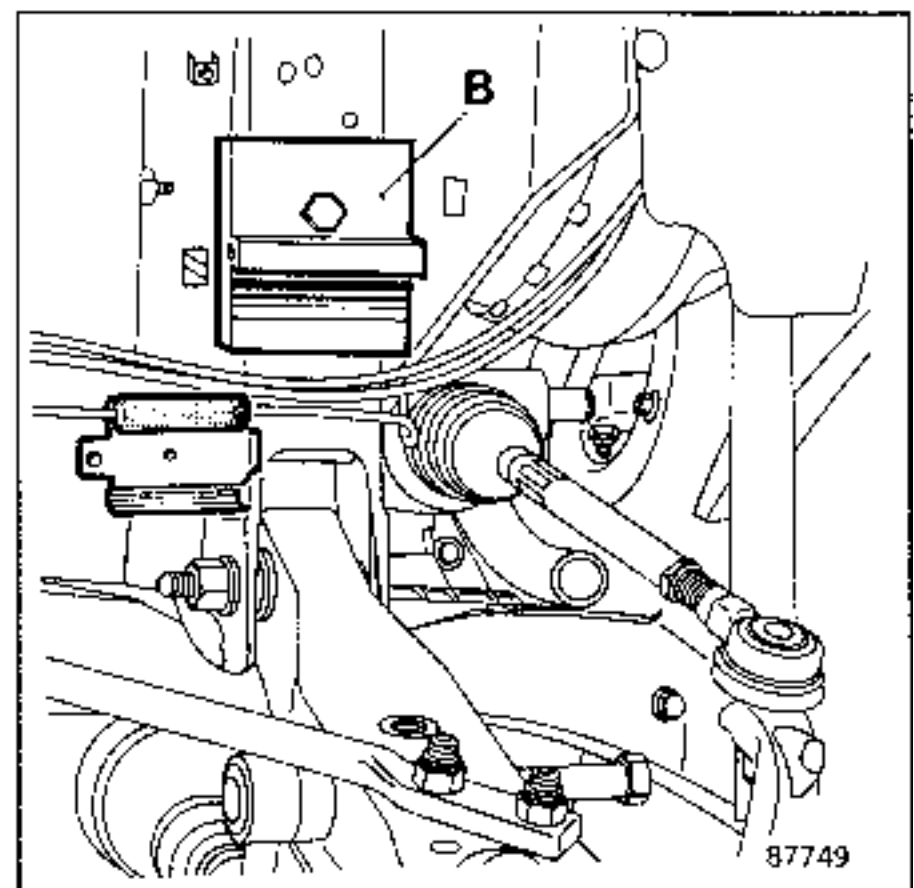


Place a jack under the lower ball joint and position:

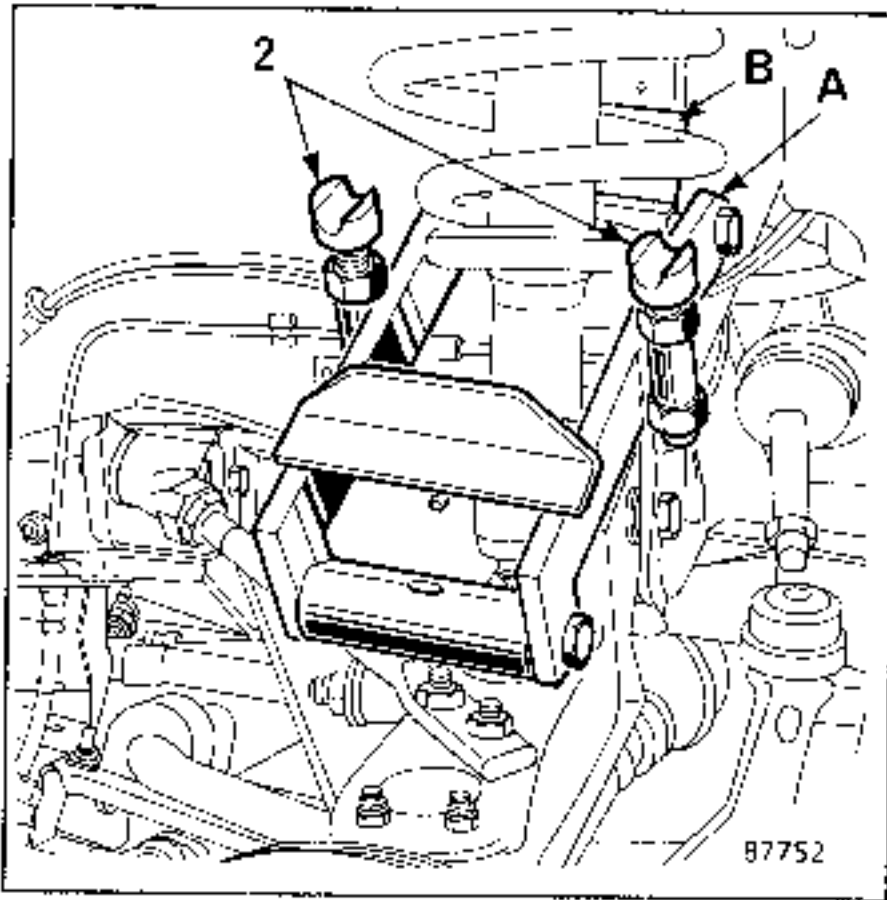
- the fixing plate (B) behind the shock absorber and the retaining plate (C); do not tighten them.



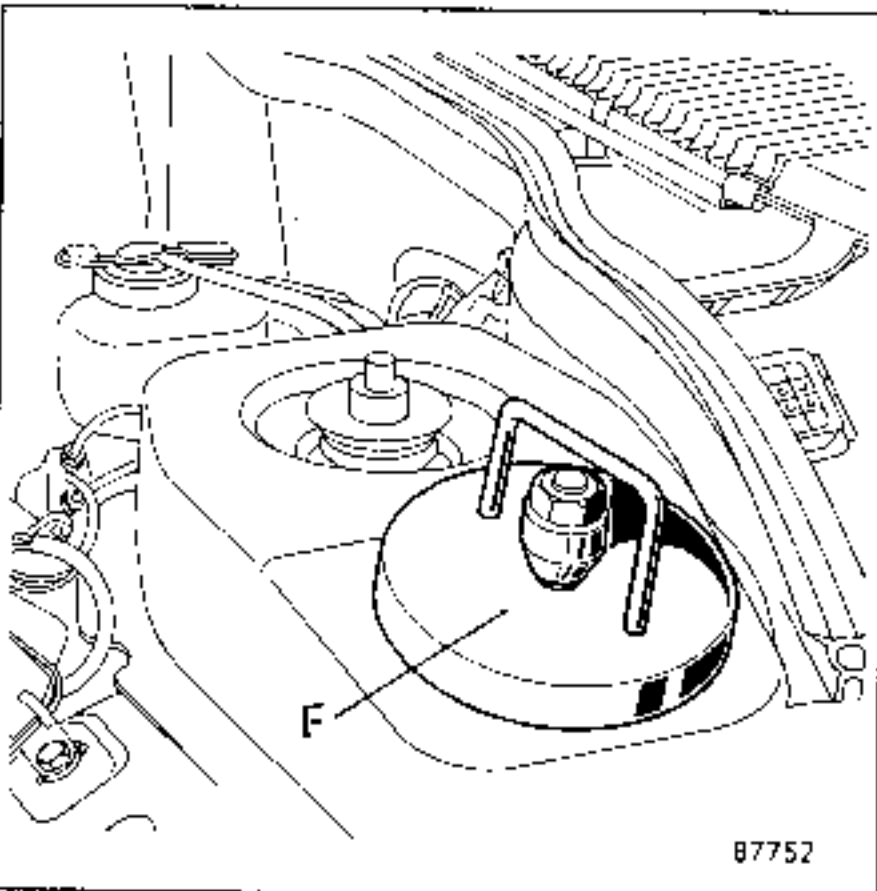
- A : spring compression baseplate
- B : fixing plate
- C : retaining plate
- D : retaining rod
- E : dummy cup washer
- F : compression rod.



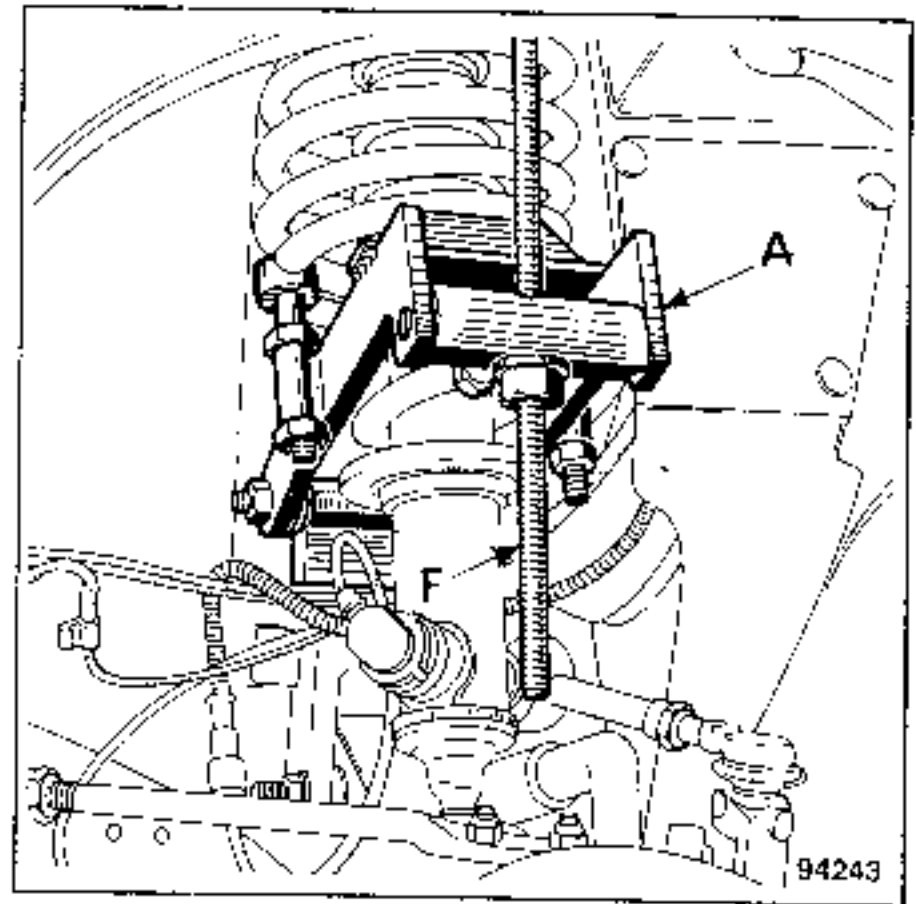
- the spring compression baseplate (A): position both spring supports (2).



- Centre and tighten assembly (B) and (C).
- Fit compression rod (F).



- Raise the driveshaft to horizontal
- Tighten the rod nut (F) so as to release the shock absorber sufficiently.
- Disconnect the anti-roll bar from the shock absorber base pin.



- Lower the half-axle.
- Unscrew the shock absorber and remove it.

REFITTING

Precautions to be taken before assembly:

Shock absorbers are stored horizontally in the spare parts warehouse.

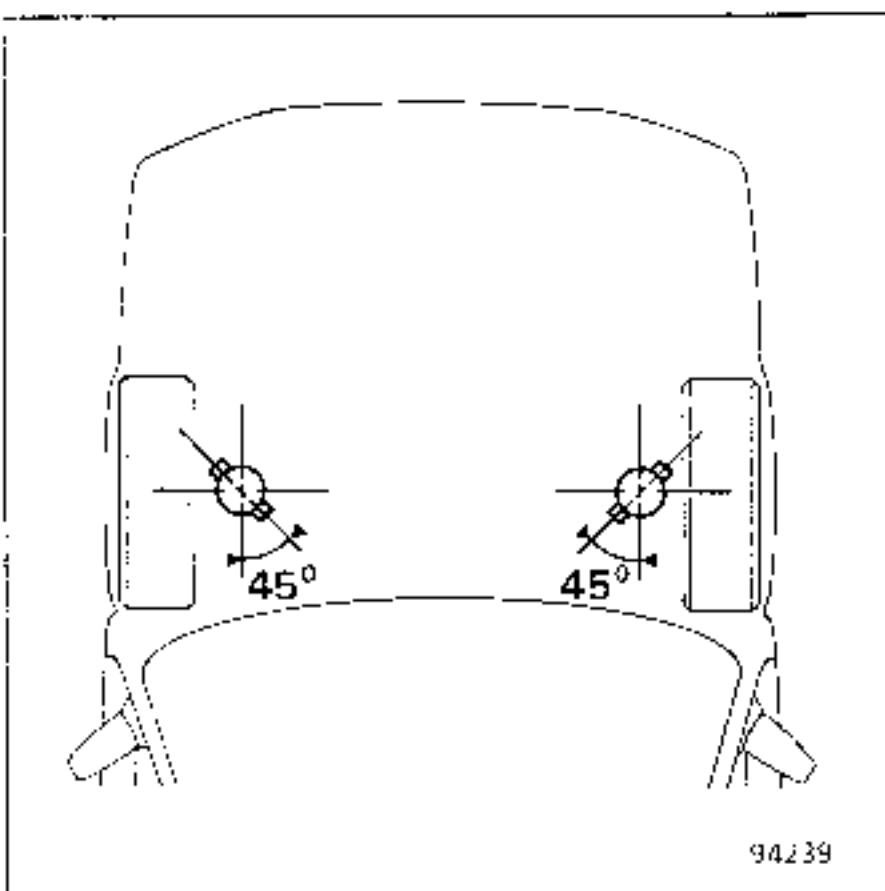
Under such conditions, it is possible that shock absorbers which have to operate in the vertical position may need priming.

The shock absorber should therefore be pumped manually several times in the vertical position, before being fitted to the vehicle.

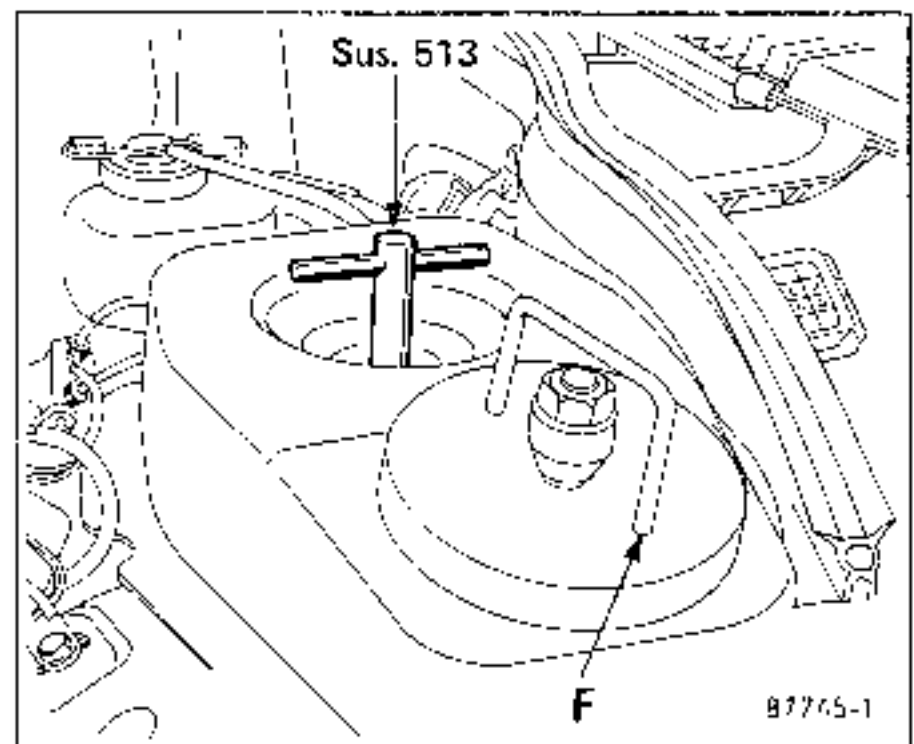
The shock absorber cup washer is fitted free. It is important to make sure that it slides easily.

Fit:

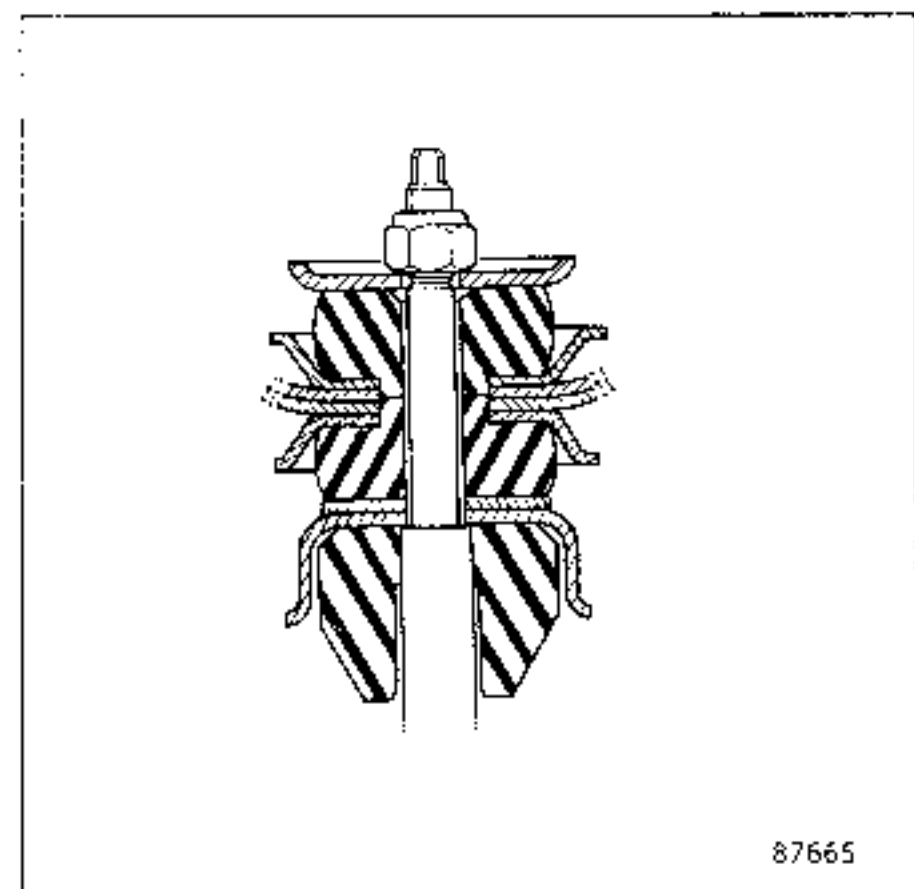
- • the shock absorber; screw it in place and position the cup washer and the shock absorber, making sure that the solenoid valves are the correct way round (master-controlled shock absorber suspension).



- the shock absorber piston rod using Sus. 513.



- Raise the driveshaft to horizontal.
- Attach the upper part of the shock absorber, making sure that the cup washers are fitted the correct way round.



NOTE: Suspension with master-controlled shock absorbers

The upper fixing pads are specific to these shock absorbers.

- Tighten the shock absorber base locknut to the correct torque.
- Reconnect the anti-roll bar.
- Loosen rod (F).

NOTE: If the spring does not locate correctly in the cup washer, turn bolt (1) of tool (A).

Lower the driveshaft.

Loosen assembly (B) and (C).

Remove:

- the baseplate (A);
- the fixing plate and retaining plate assembly (B) and (C).
- Rivet the piping/connector support bracket to the wheel arch.
- Reconnect and attach the solenoid valve connector.

Refit:

- the setting control valve.

Lower the vehicle onto its wheels and tighten to the correct torque:

- the shock absorber base pin;
- the upper shock absorber mounting.

Notes:

- Make sure that the correct wiring routing and electrical connections are used (otherwise the reliability of the master-controlled shock absorbers cannot be guaranteed).
- Do not use the wiring delivered with the shock absorber for fastening purposes.
- When disconnecting the 3-channel connector, do not use a sharp tool which may damage the retaining lugs on both sections of the connector.

Given the high tractive force of the springs, the tooling must be kept in perfect condition.

ESSENTIAL SPECIAL TOOLING	
Sus.513	Shock absorber piston rod location and insertion tool
Sus.1012	Front spring and front shock absorber dismantling and reassembly tool.

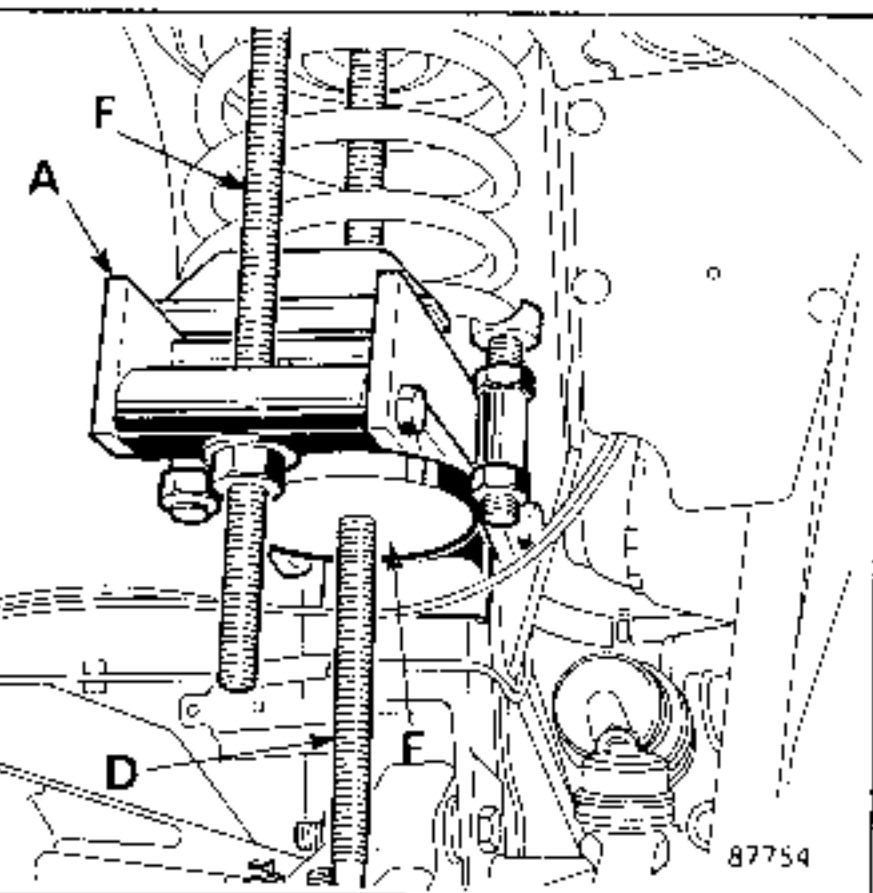
TIGHTENING TORQUES (in daNm)



Upper fixing nut	2
Shock absorber base locknut	6
Shock absorber base pin	8
Wheel bolts	9
4 bolts	9
5 bolts	10

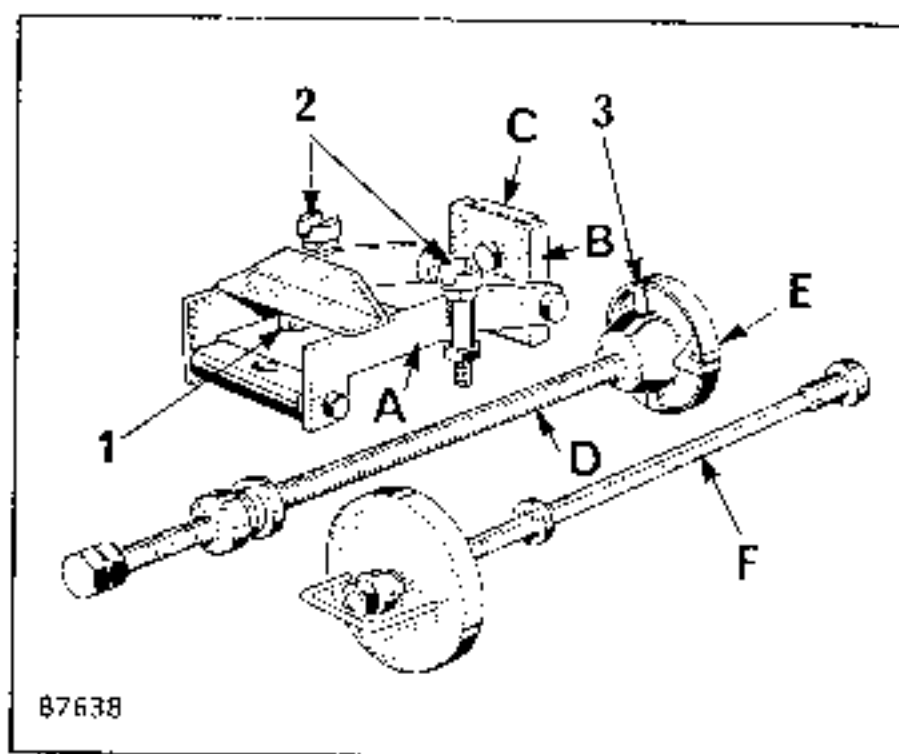
REMOVING

This operation is to be carried out after the shock absorber has been removed.



Fit the retaining rod (D).

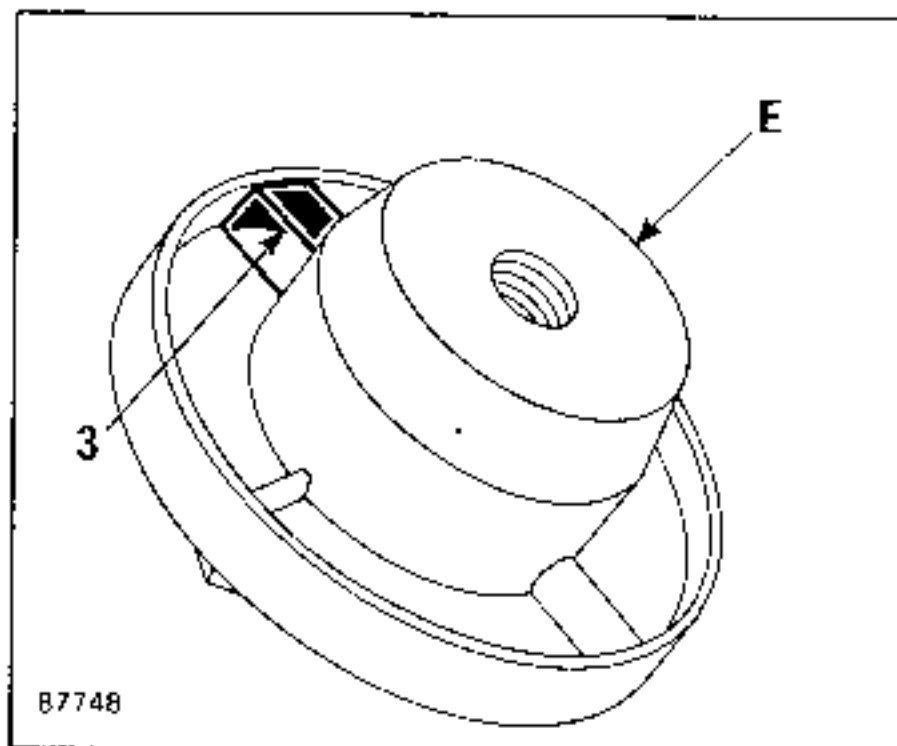
Use elements A,B,C,D,E and F of tool Sus. 1012



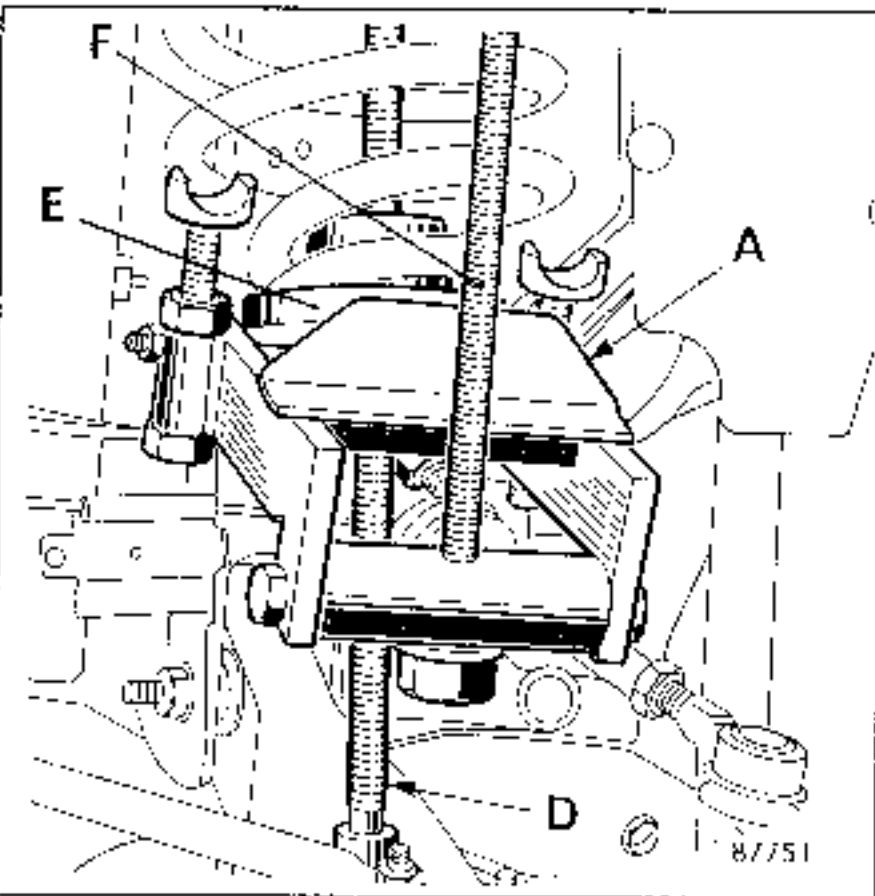
Screw on the dummy cup washer (E).

Centre rod (D) in the shock absorber base recess by raising the half-axle

Make sure the spring rests against the stop (3).



Compress the spring so as to free the baseplate (A).

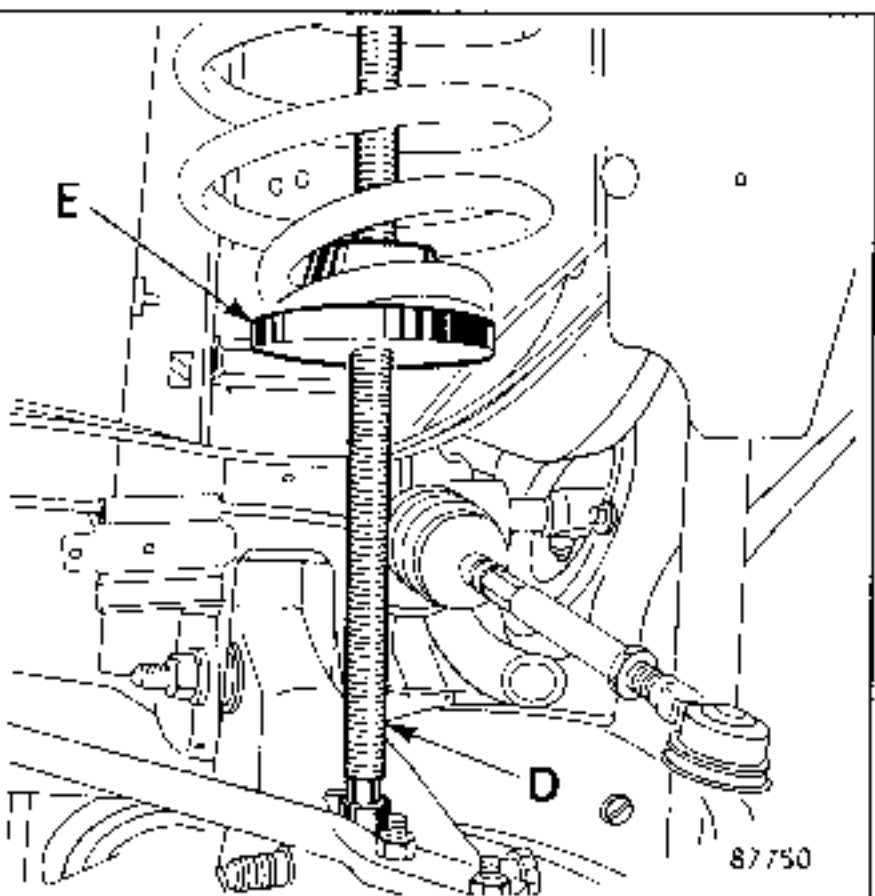


Remove the compression rod (I)

Loosen assembly (B) and (C).

Remove baseplate (A)

Decompress the spring.



Lower the driveshaft.

Remove the spring

REFITTING

Fit:

- the spring, position it against the stop in the shock absorber turret,
- the retaining rod (D),
- the dummy cup washer (E) (spring against stop)

Gently compress the spring.

Raise the driveshaft to centre the rod (D) in the shock absorber base support bracket.

Completely compress the spring.

Fit the compression baseplate (A); position both spring supports (2).

Tighten assembly (B) and (C).

Fit the rod (F).

Compress the spring so that baseplate (A) is horizontal.

Lower the driveshaft.

Remove rod (D) with the dummy cup washer (E).

Fit the shock absorber (see appropriate section).

TIGHTENING TORQUES (in daNm)		
Bearing fixing nut	1.5	
Nut fixing link rod to arm	8	
Wheel bolts: 4 bolts	9	
5 bolts	10	

REMOVING

On each side, unscrew:

- the bearing fixing nuts on the cross members,
- the anti-roll bar link rod nut.

Check the condition of the bearings and the bushes.

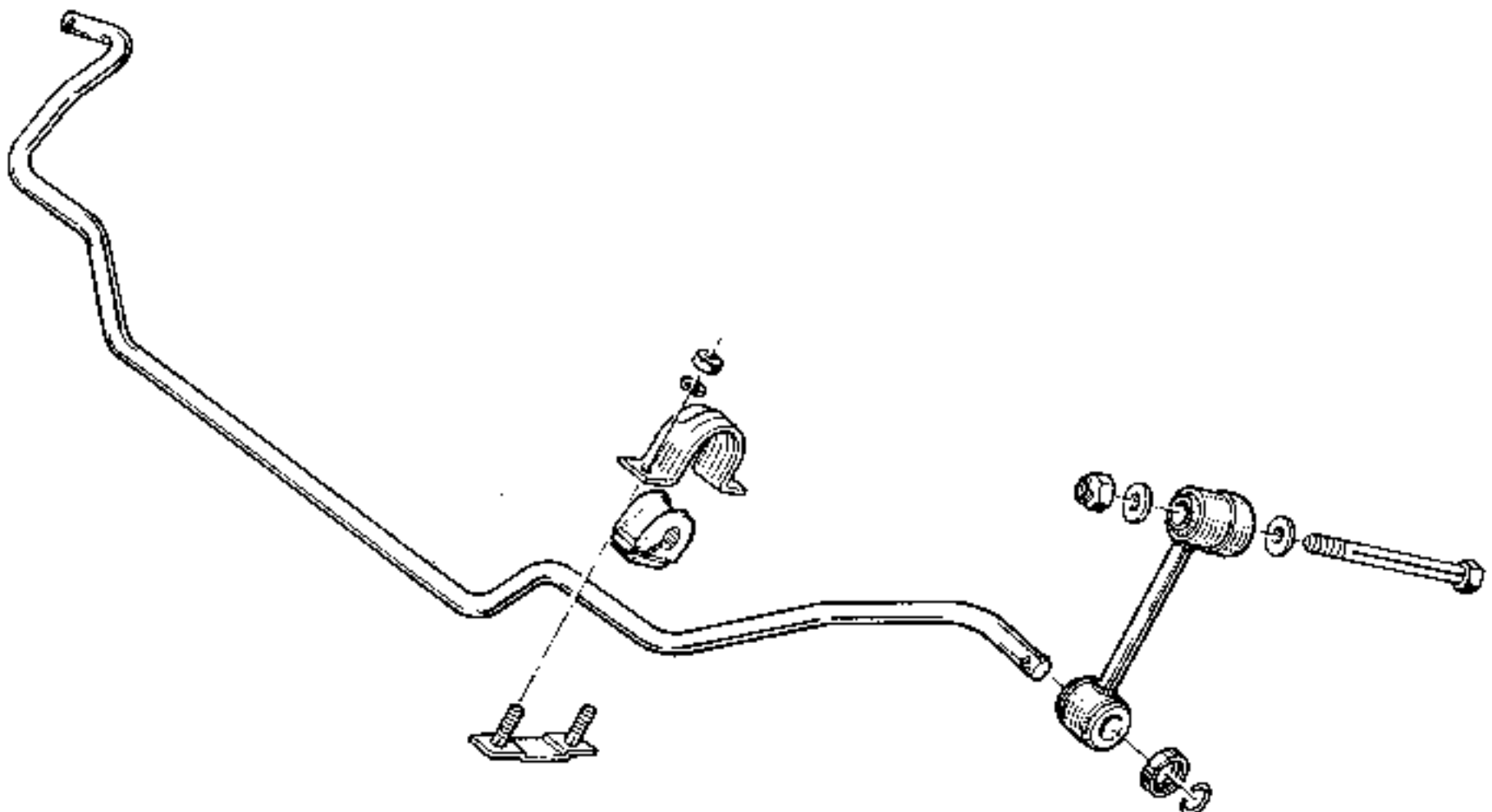
If necessary, separate the link rod from the bar.

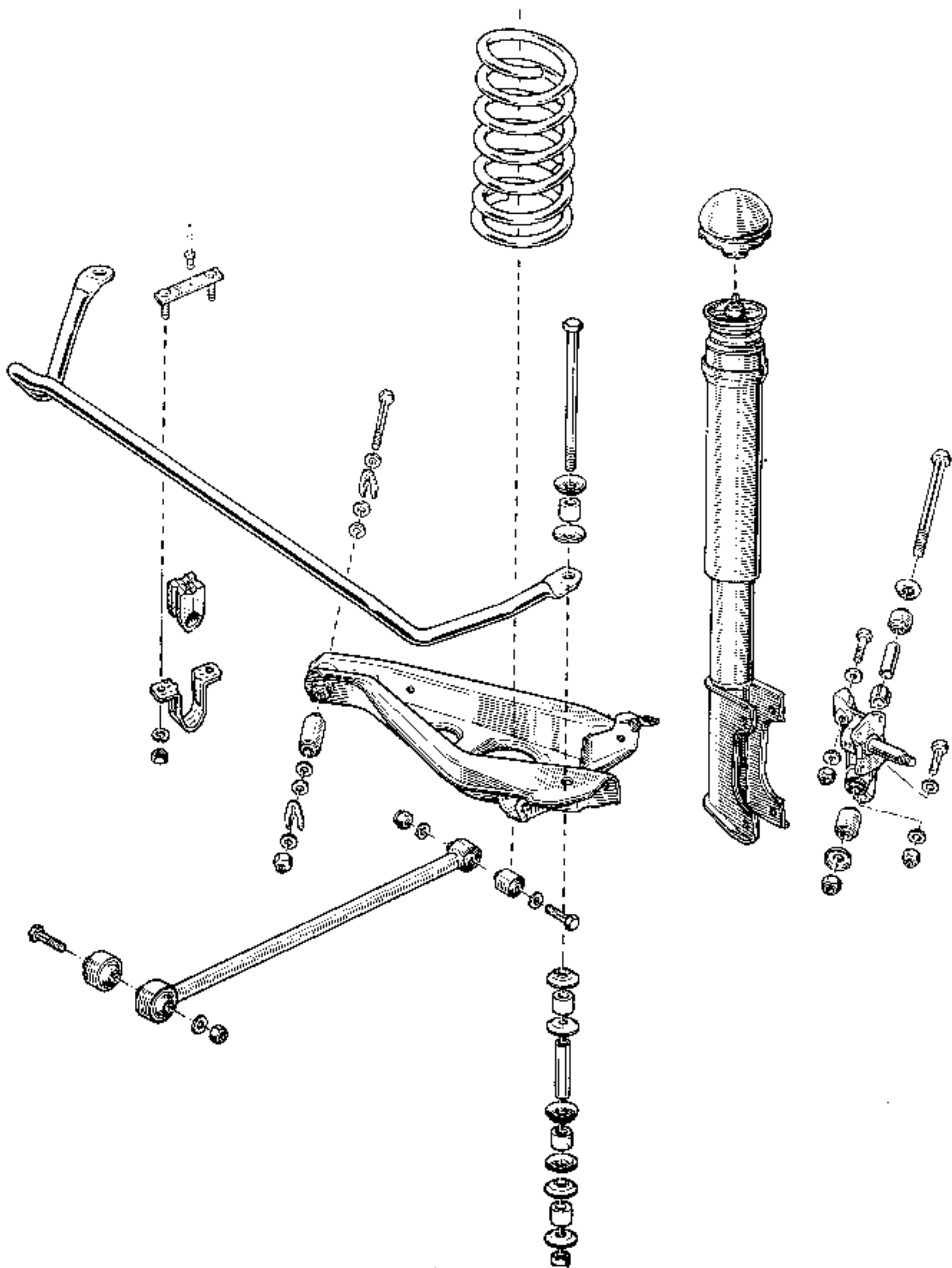
REFITTING

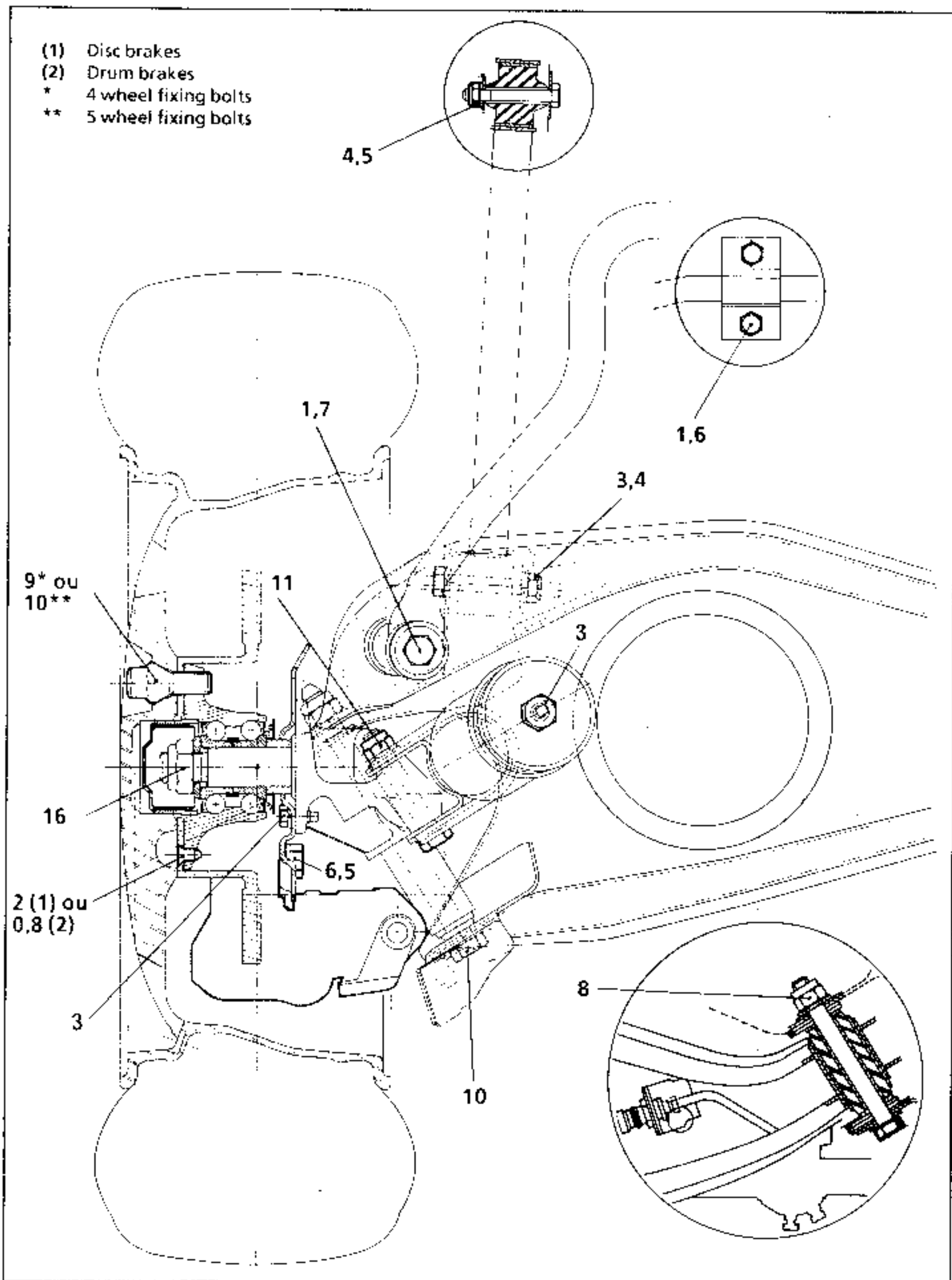
Take care to fit the parts in the correct order and the correct way round.

With the vehicle on its wheels, tighten to the correct torque:

- the bearing fixing nuts,
- the link rod fixing nuts on the shock absorber pin.







TIGHTENING TORQUES (in daNm)



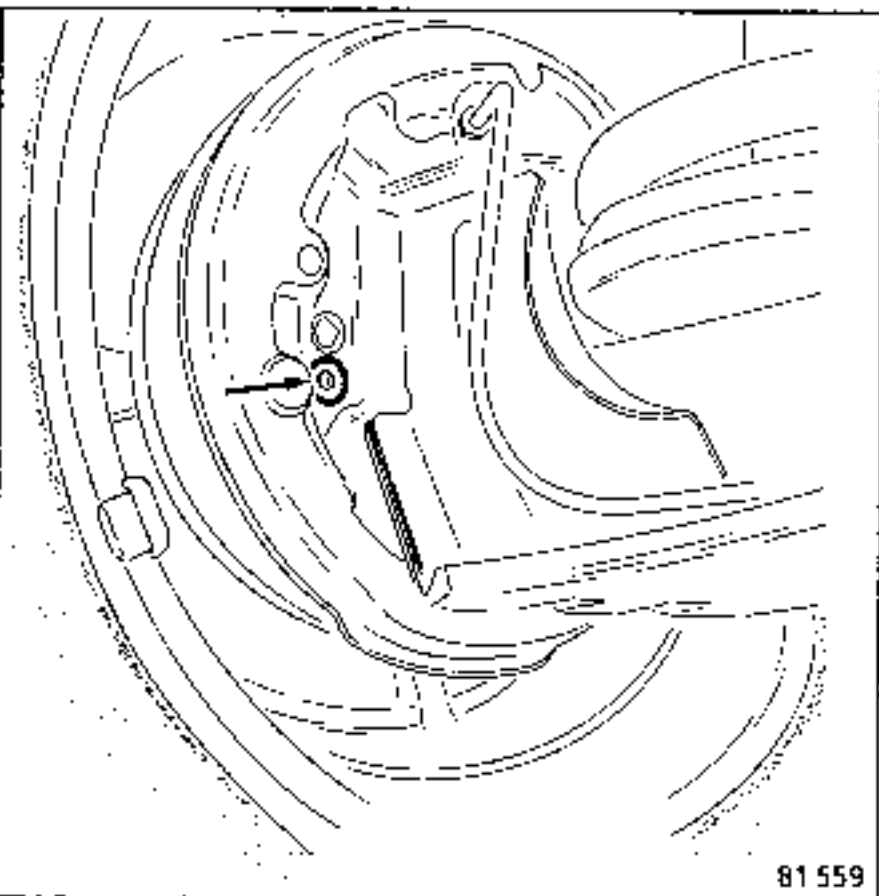
Wheel bolts: 4 bolts

9

REMOVING

Release the handbrake and loosen the secondary cables to allow the lever to move backwards.

Remove the blanking plug from the backplate to release the automatic adjustment mechanism.



81 559

Insert a screwdriver against the handbrake lever and push to free its lug (E) from the brake shoe.

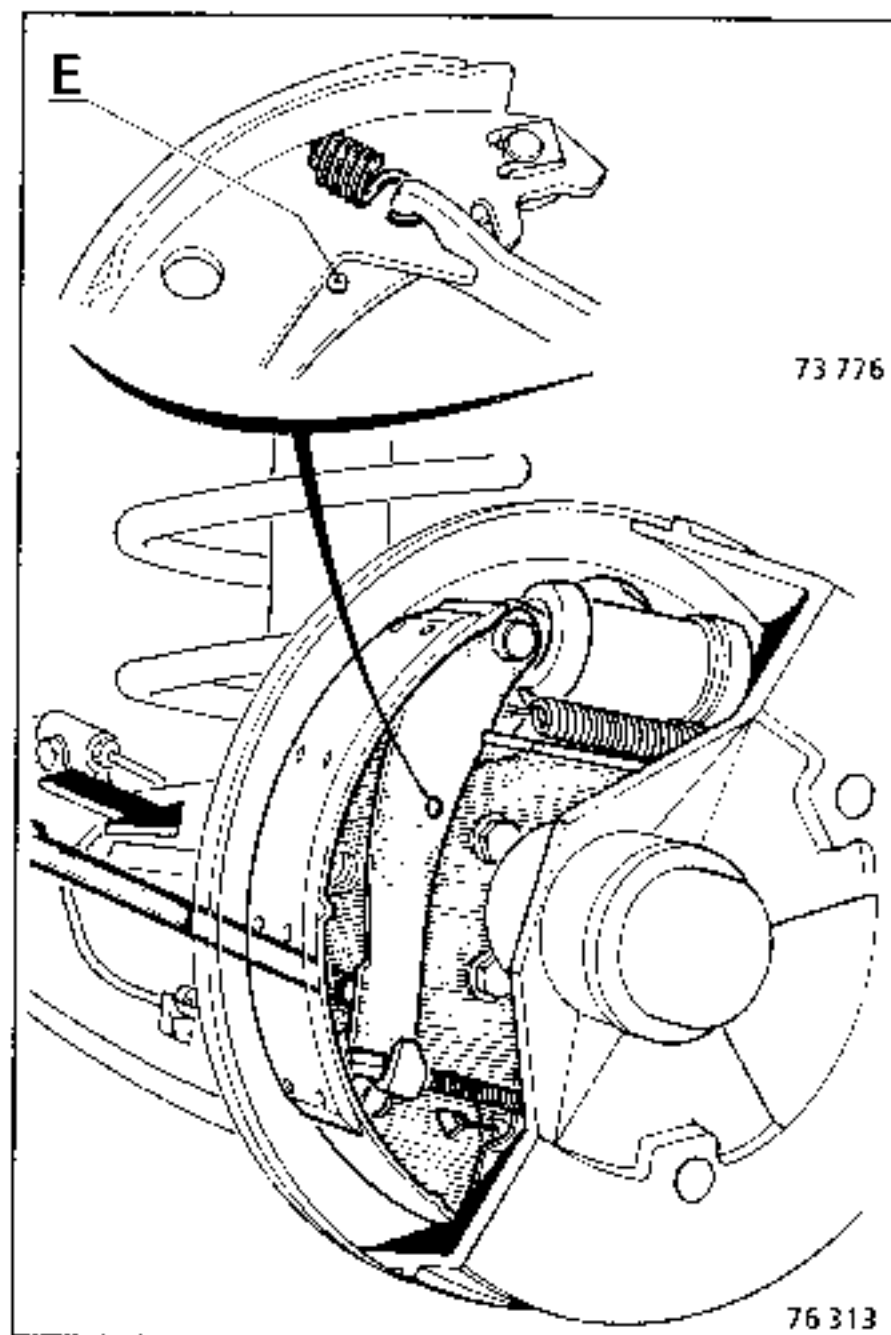
NOTE:

The backplate and the brake shoe have holes which provide access to the handbrake lever behind them.

After freeing the lug, push the lever backwards to loosen it.

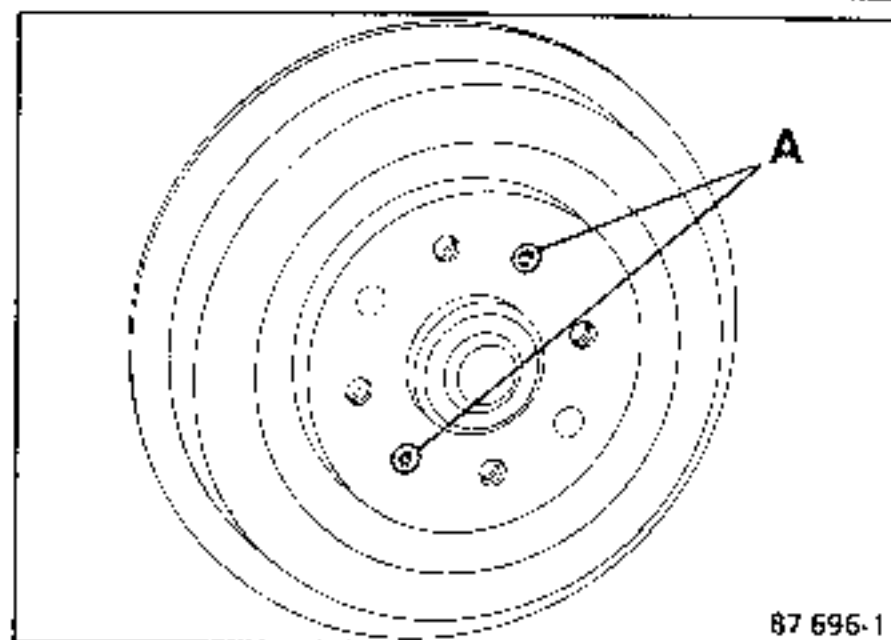
Remove:

- both drum fixing bolts (A) (using male hexagon key Torx T 30 (e.g. Facom 89-30)),
- the drum.



73 776

76 313



87 696-1

REFITTING

Fit the drum.

Adjust the linings by repeatedly depressing the brake pedal.

Adjust the handbrake.

Refit the backplate blanking plug.

TIGHTENING TORQUES (in daNm)

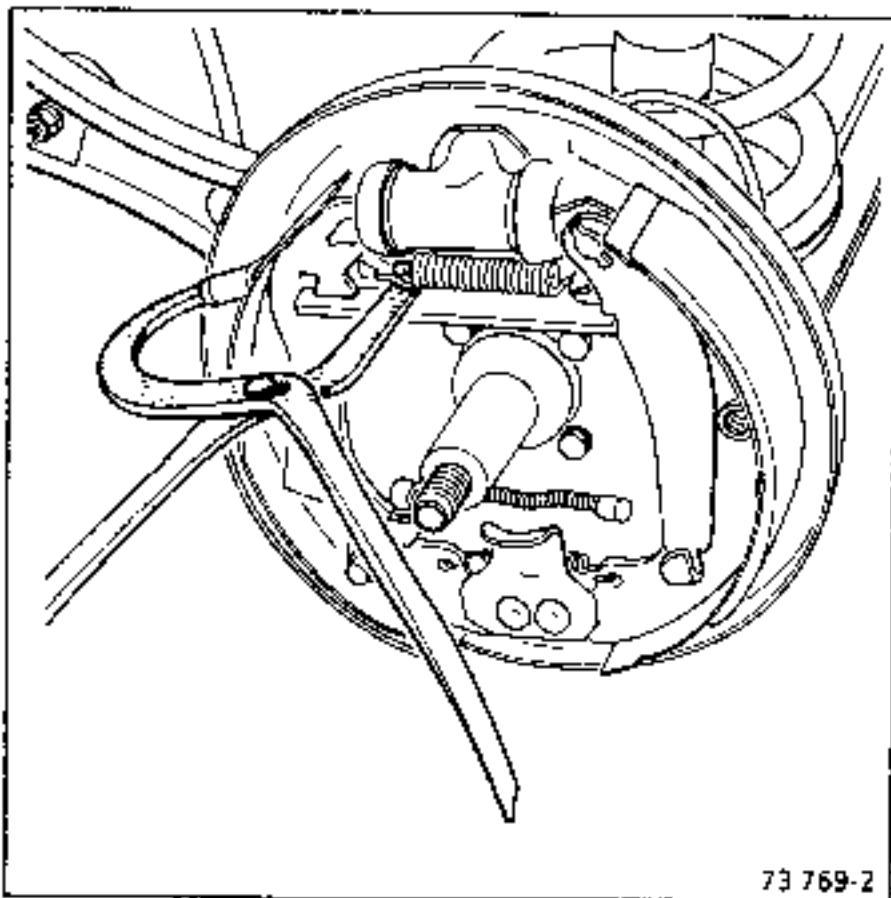


Wheel bolts	9
Bleed screw	0.6 to 0.8
Brake line unions	1.3

REMOVING

Remove:

- the drum (see appropriate section);
- the upper return spring, using brake shoe pliers.



Move the brake shoes away.

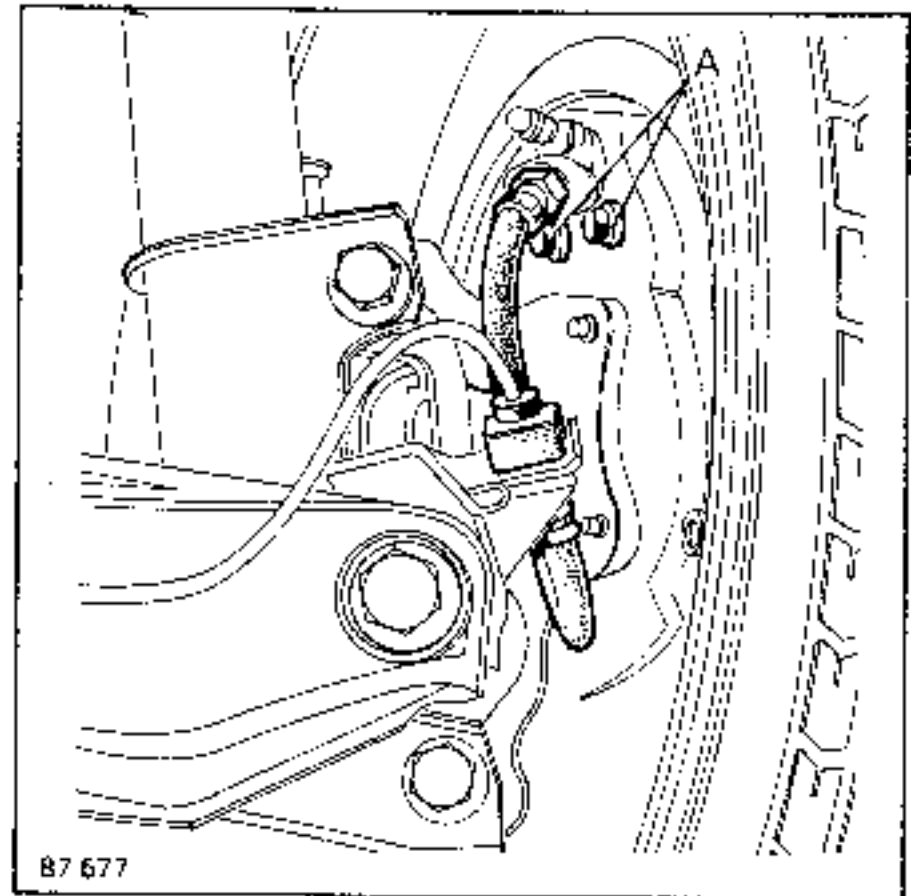
Unscrew:

- the brake line union from the brake hose.

Remove the hose retaining clip.

Unscrew:

- the hose from the cylinder;
- both fixing bolts (A).



Remove the wheel cylinder.

REFITTING

Check the condition of the shoes. Replace them if any traces of oil are visible.

Proceed as for removing but in reverse order.

Bleed the brake circuit.

Adjust the linings by repeatedly depressing the brake pedal.

REPAIR

Dismantle the wheel cylinder.

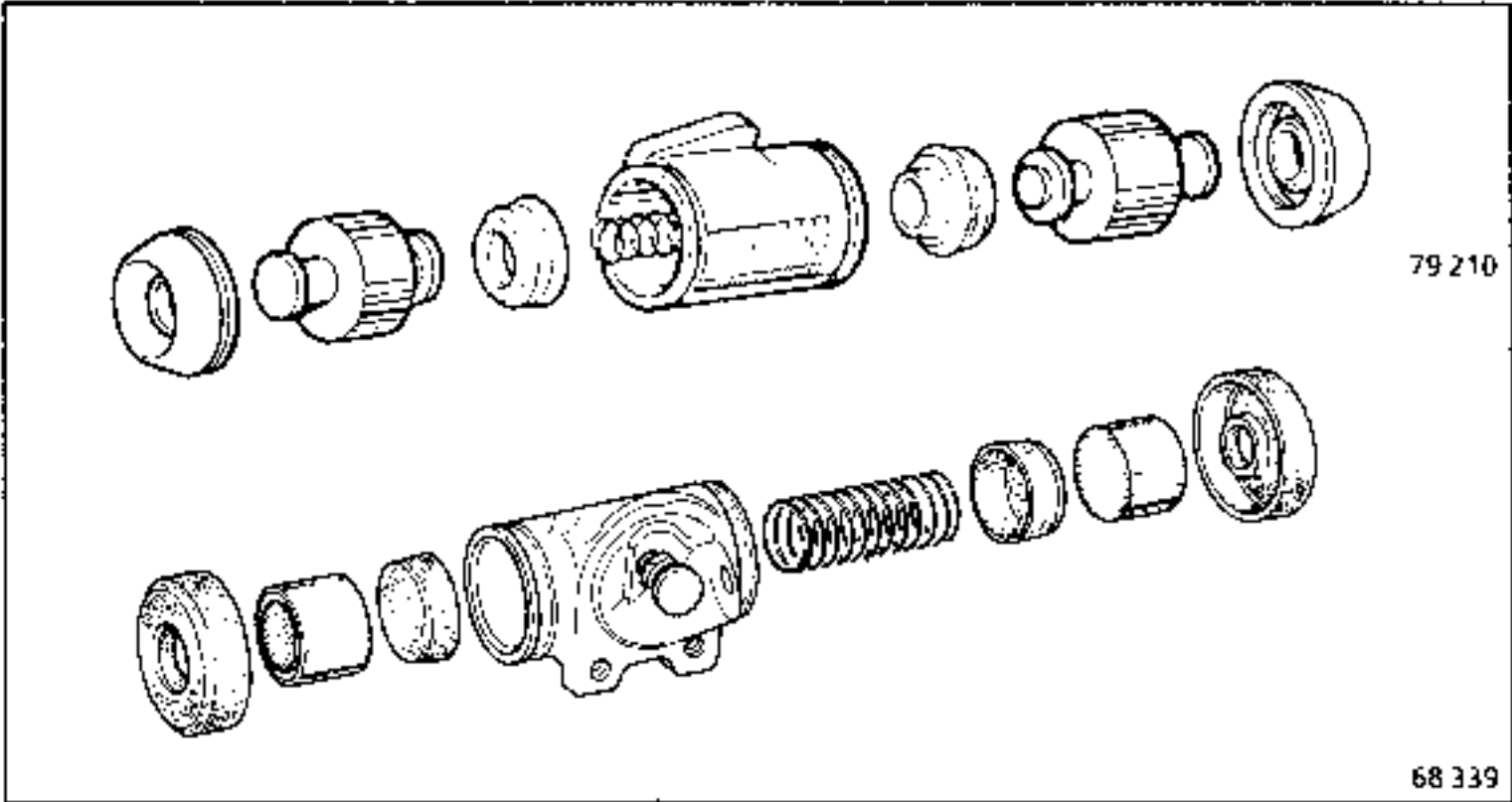
Before reassembling, check the condition of the cylinder and the piston. The entire cylinder must be replaced if there are any signs of scoring or oxidation

If the cylinder is in good condition, smear the sliding parts with brake fluid. Fit the bleed screw and its cap.

Fit the spring, the cup washers, pistons and protective caps.

Check that the parts slide freely.

Clamp the completed assembly together



ESSENTIAL SPECIAL TOOLING

Fre. 573-01	Handbrake cable pliers
Fre. 826	Brake lining retaining spring removal tool

TIGHTENING TORQUES (in daNm)

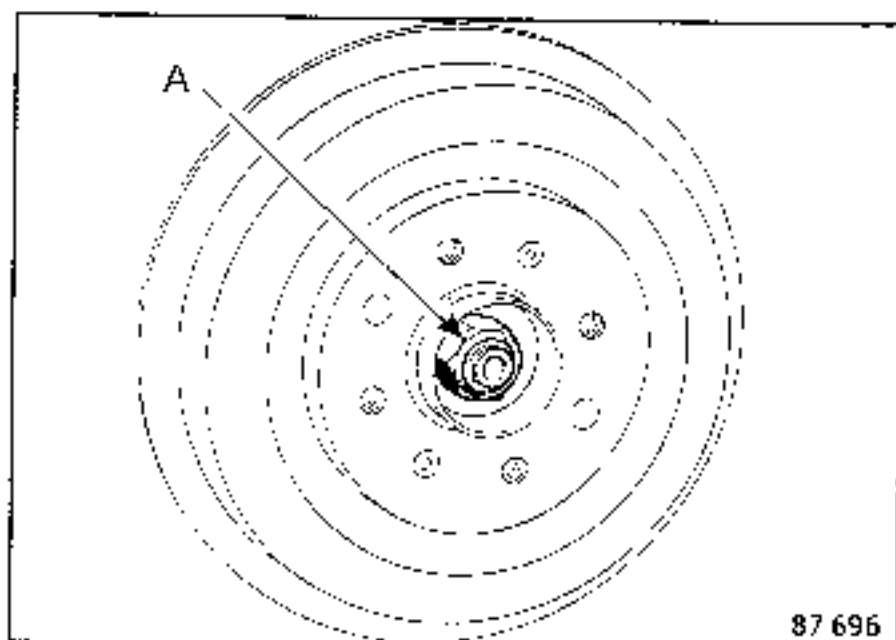


Wheel bolts	9
Stub axle nut	16

REMOVING

Remove:

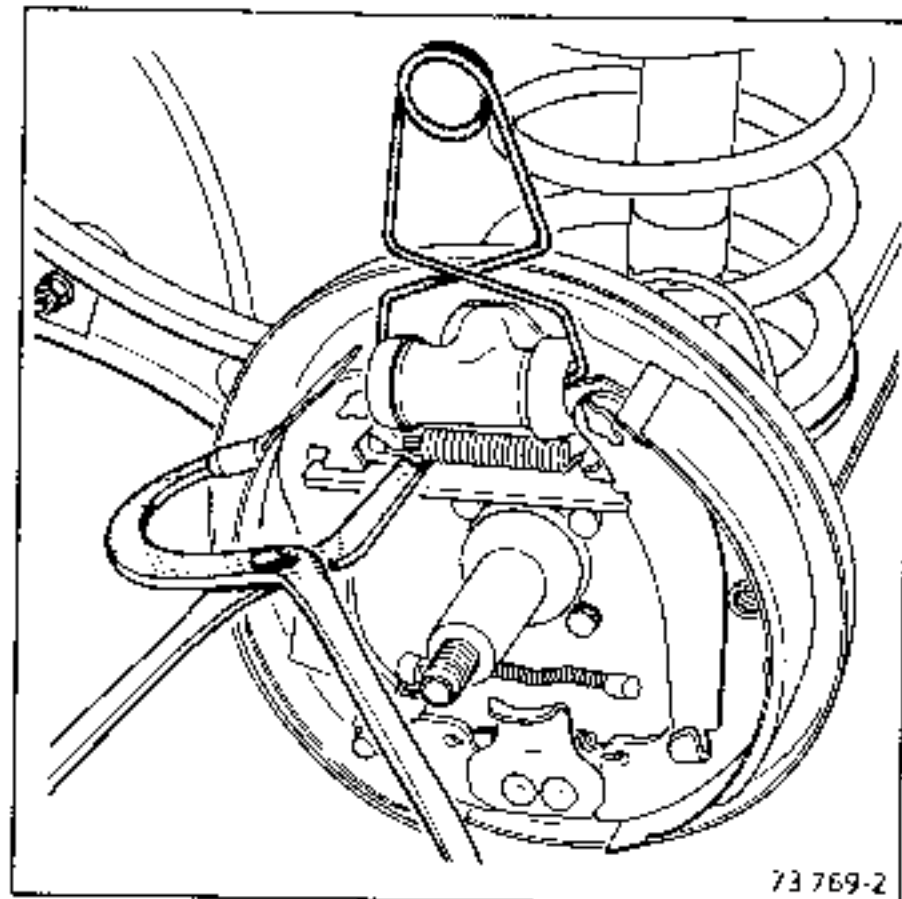
- the hub cap;
- the hub/drum/nut assembly (A) (see rear brake drum section).



The two front brake drums must always be the same diameter. If one drum requires machining, the other must always also be machined.

The diameter may be machined a maximum of 1 mm.

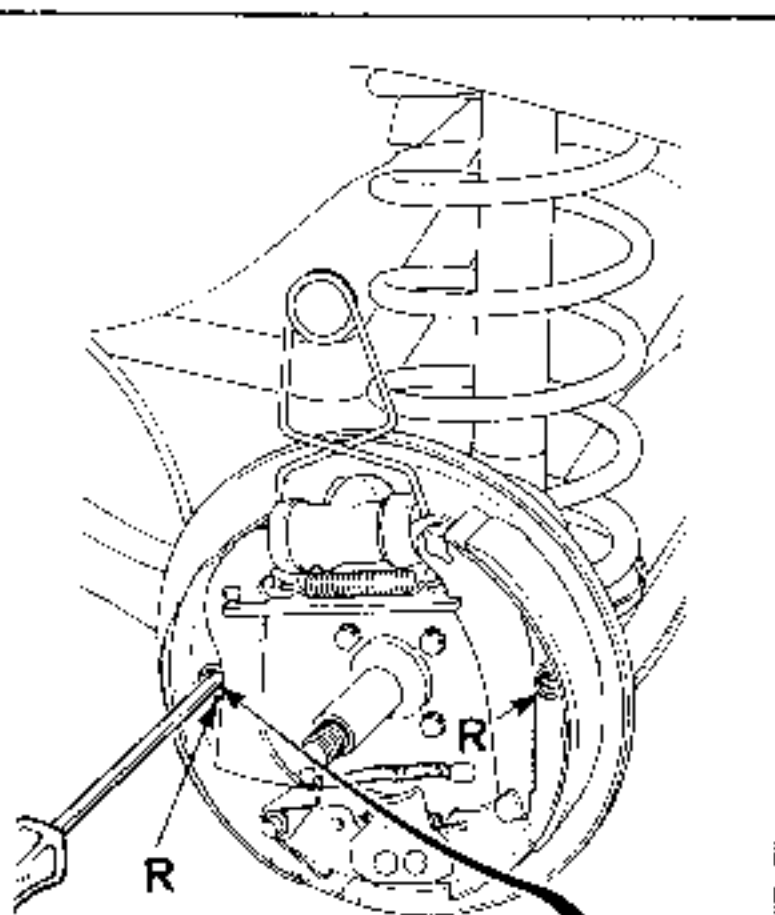
Fit the pliers to the wheel cylinder.



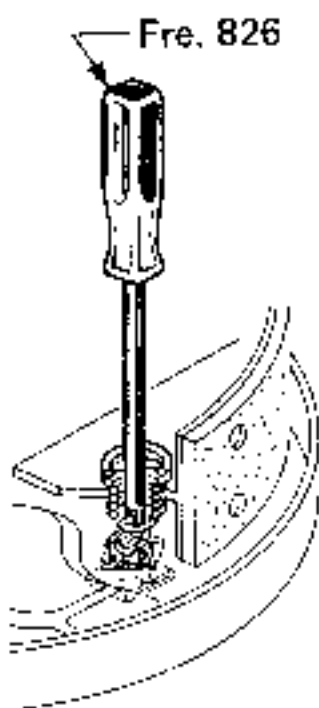
Remove the upper return spring using brake shoe pliers.

Disconnect the handbrake cable using Fre. 573-01.

Unhook the two brake shoe retaining springs (R) using Fre. 826.



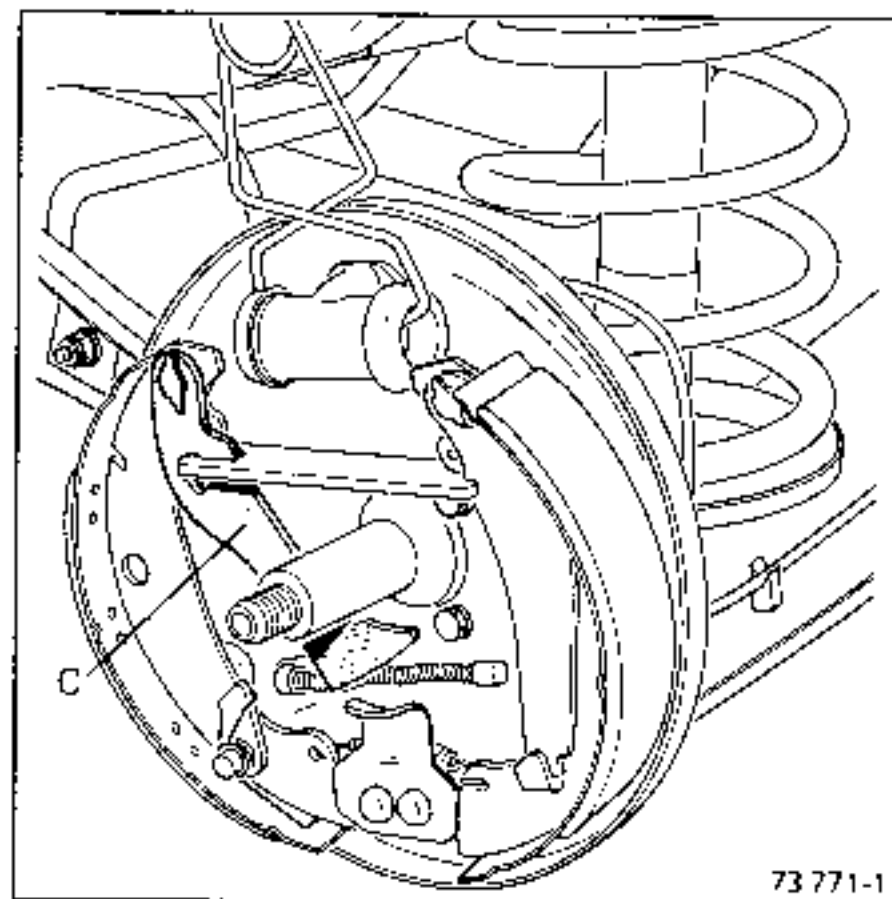
86 324



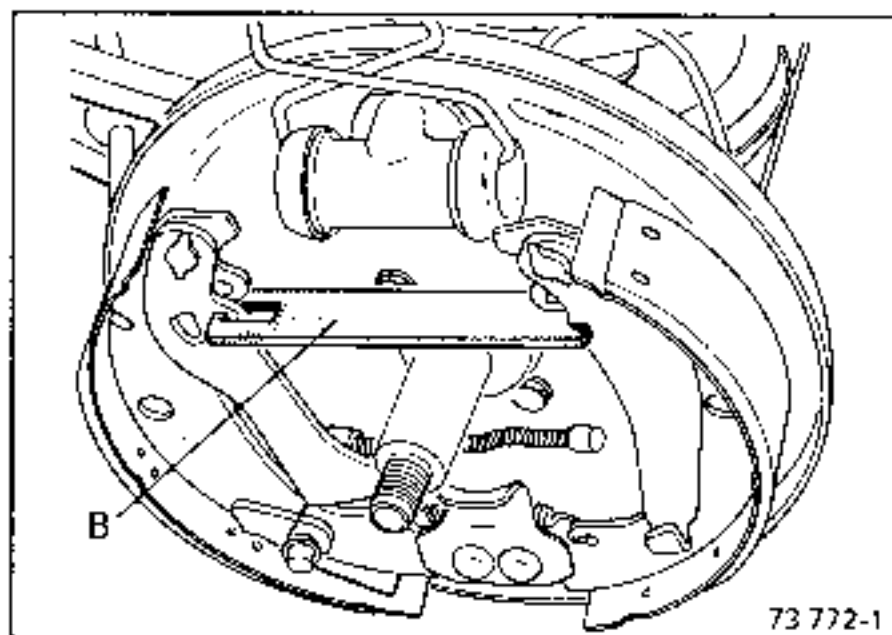
86 324-1

Tilt the toothed lever (C) as far as it will go towards the stub axle.

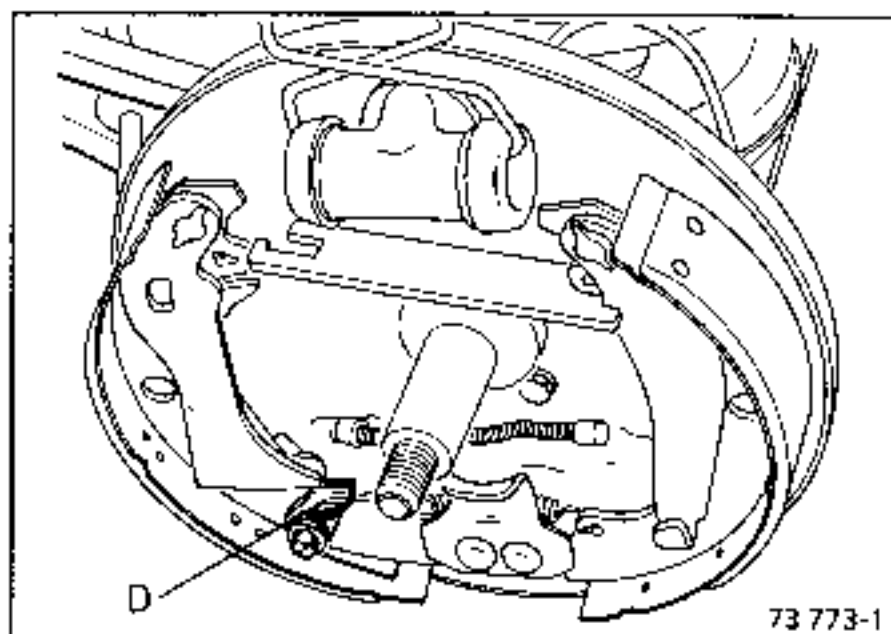
Move the brake shoes away from the backplate.



Pull link rod (B) outwards and remove it from the primary brake shoe.

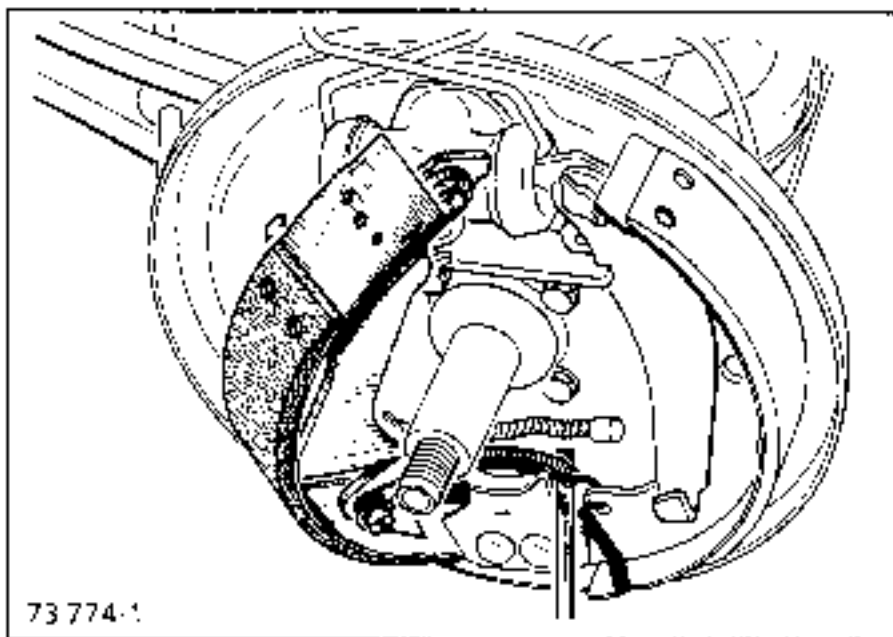


Position the toothed quadrant (D) in its original position.



Rotate the primary brake shoe through 90 °.

Remove the lower spring using a screwdriver



Release the primary brake shoe.

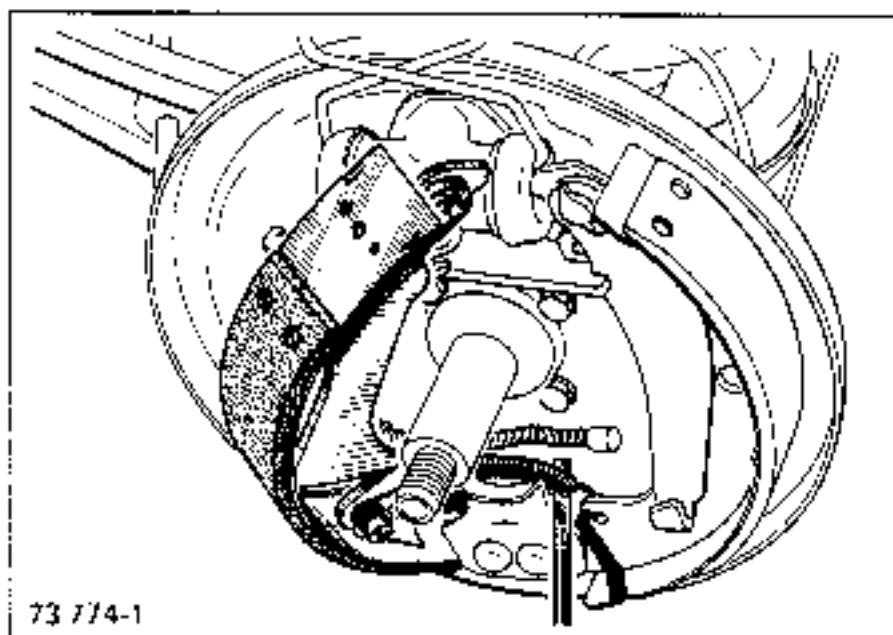
Remove the secondary shoe.

REFITTING

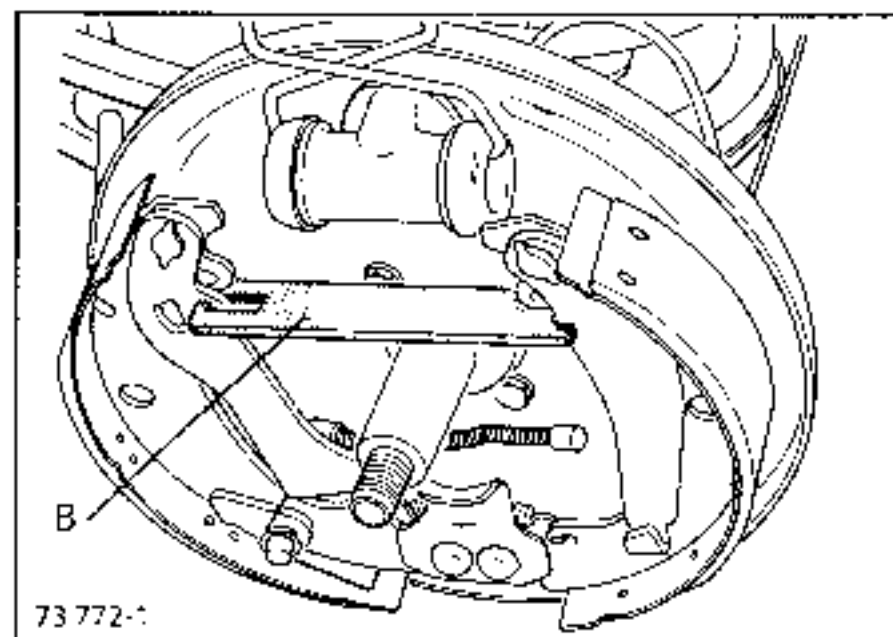
Check the condition of the drums and the hoses.

Hook the lower spring on to the brake shoes.

Place the brake shoes on the backplate by rotating the primary brake shoe through 90 °.



Tilt the toothed lever as far as it will go towards the stub axle and fit the link rod (B).



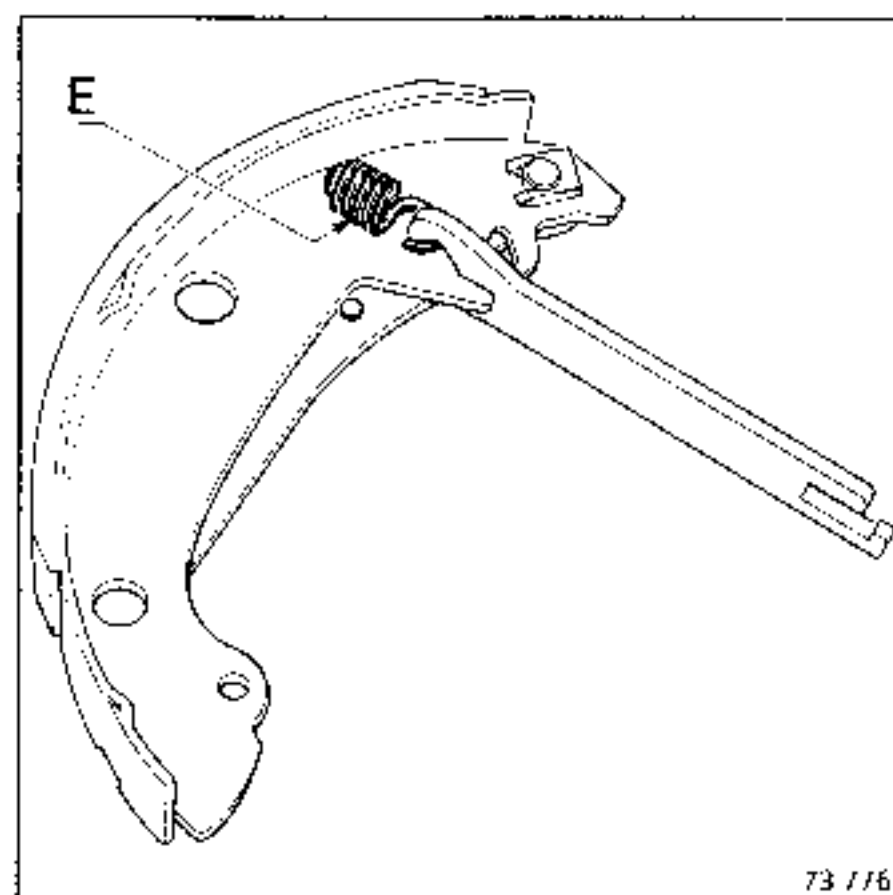
Fit the two brake shoe retaining springs using Fre. 826.

Connect the upper return spring.

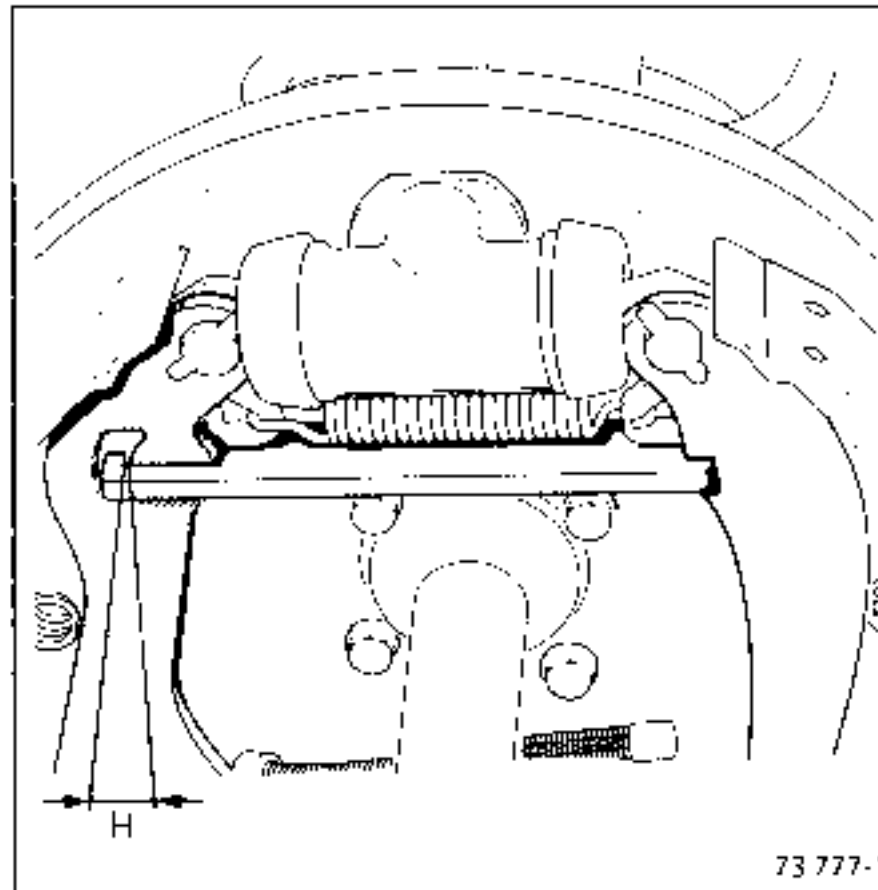
Fit the handbrake cable using Fre 573-01.

ADJUSTING THE AUTOMATIC SYSTEM

The setting depends on the tension of the spring (E) between the link rod and the secondary brake shoe



Adjusting involves measuring the distance H (which should be approximately 1 mm) between the link rod and the primary brake shoe, as shown below (the handbrake lever is hard against the brake shoe)



If this distance (H) is not correct, the link rod tension spring must be replaced, together with the two shoe return springs.

Refit the hub/drum assembly.

Tighten the stub axle nut to the correct torque.

Adjust the linings by repeatedly depressing the brake pedal.

Adjust the handbrake.

Refit the backplate blanking plug.

ESSENTIAL SPECIAL TOOLING

Brake shoe spring pliers

Fre. 573-01

Handbrake cable pliers

TIGHTENING TORQUES (in daNm)



Wheel bolts

9

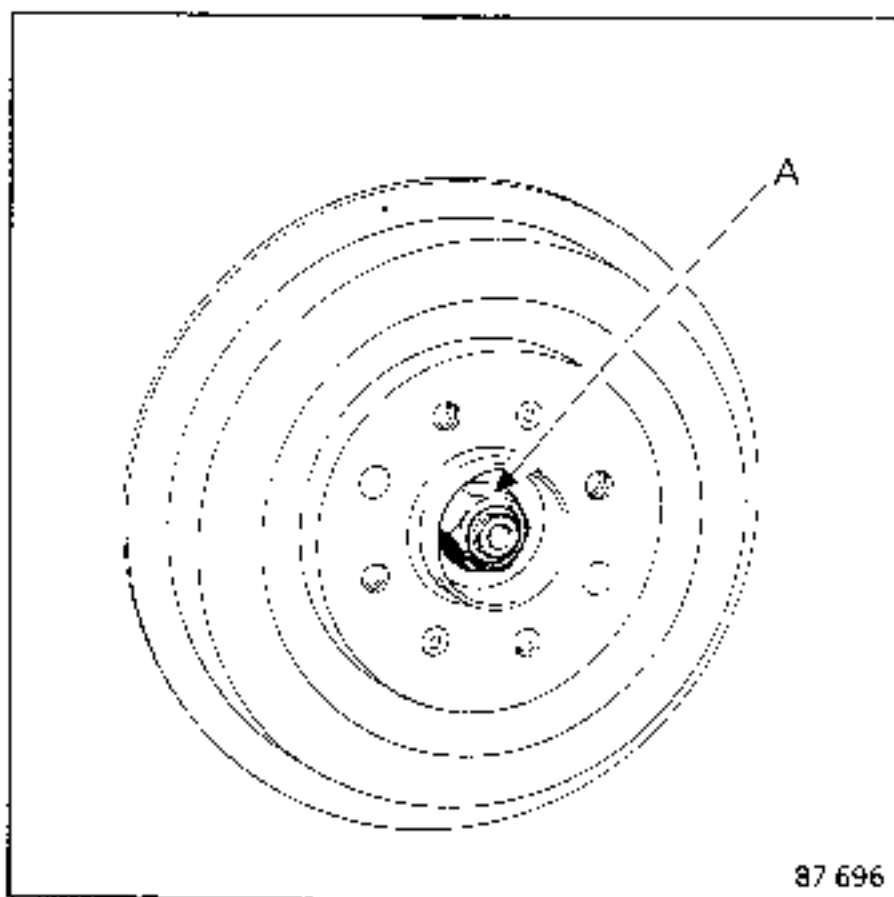
Stub axle nut

16

REMOVING

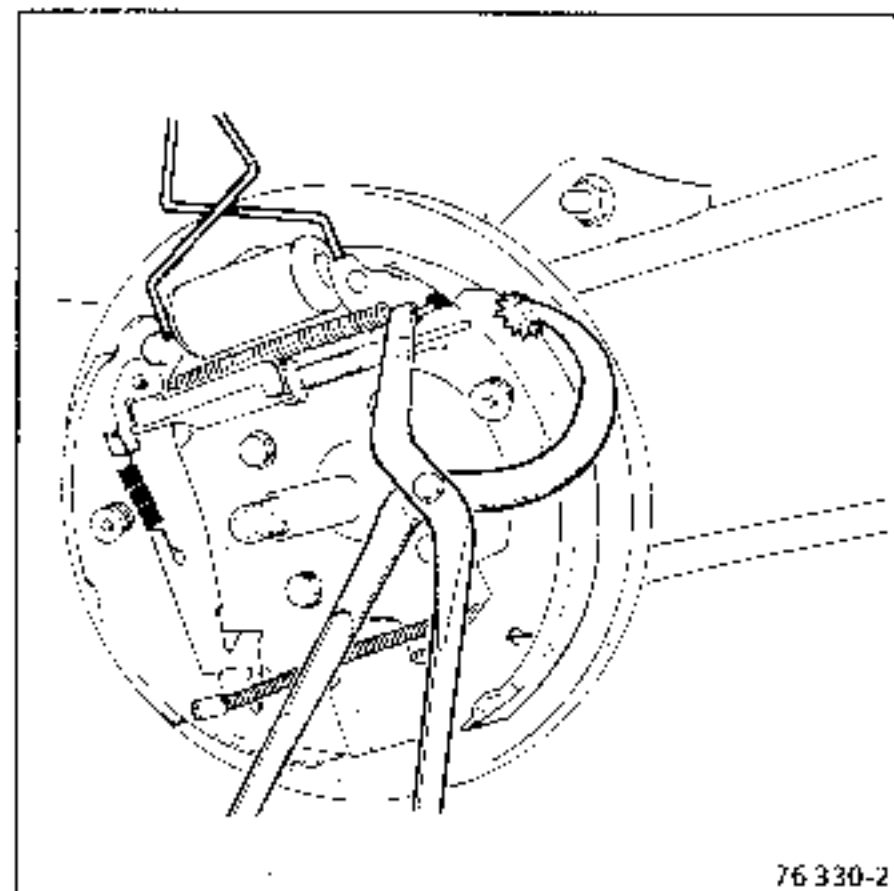
Remove:

- the hub cap;
- the hub/drum/nut assembly (A) (see section on "Rear brake shoe").



87 696

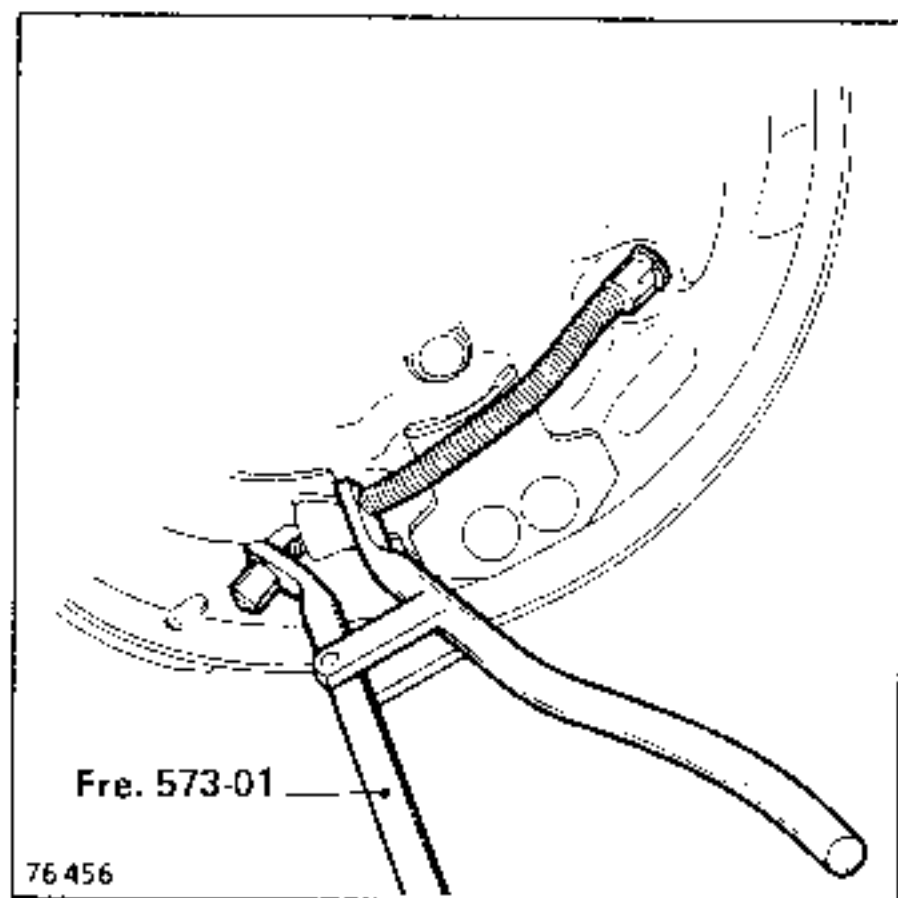
Fit the pliers to the wheel cylinder.



76 330-2

Remove:

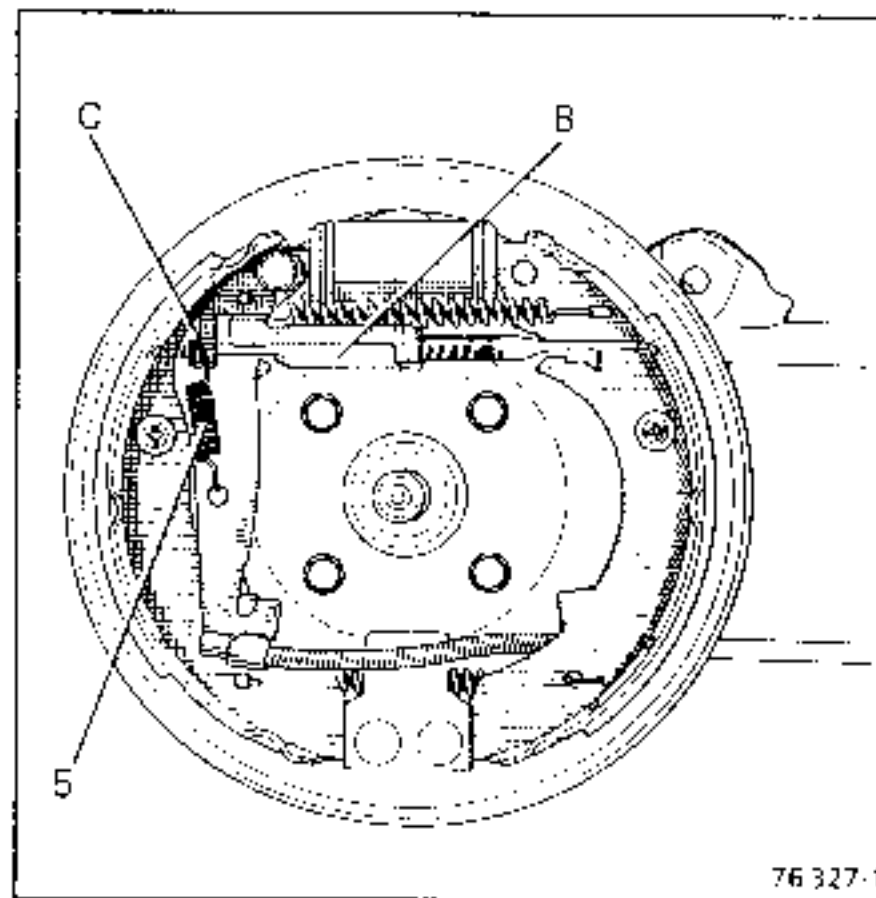
- the upper return spring;
- the handbrake cable using Fre. 573-01.



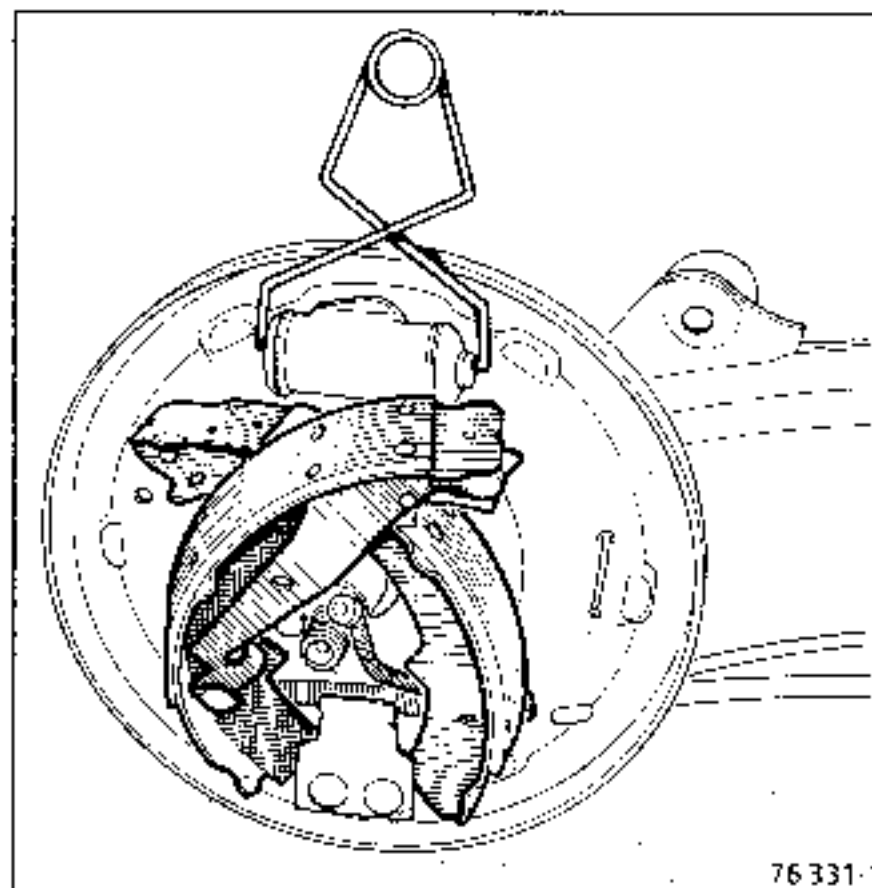
Fre. 573-01

76 456

- the adjusting lever (C) tension spring (5);
- the adjusting lever (C);



- the lining retainers (press and turn through 90 °);
- the adjustable link rod (B);



- the brake shoes, crossing them (as shown) so as to release the lower spring from behind the pivot point tongue.

REFITTING

Check the condition of the drums and the hoses.

Hook the lower spring on to the brake shoes

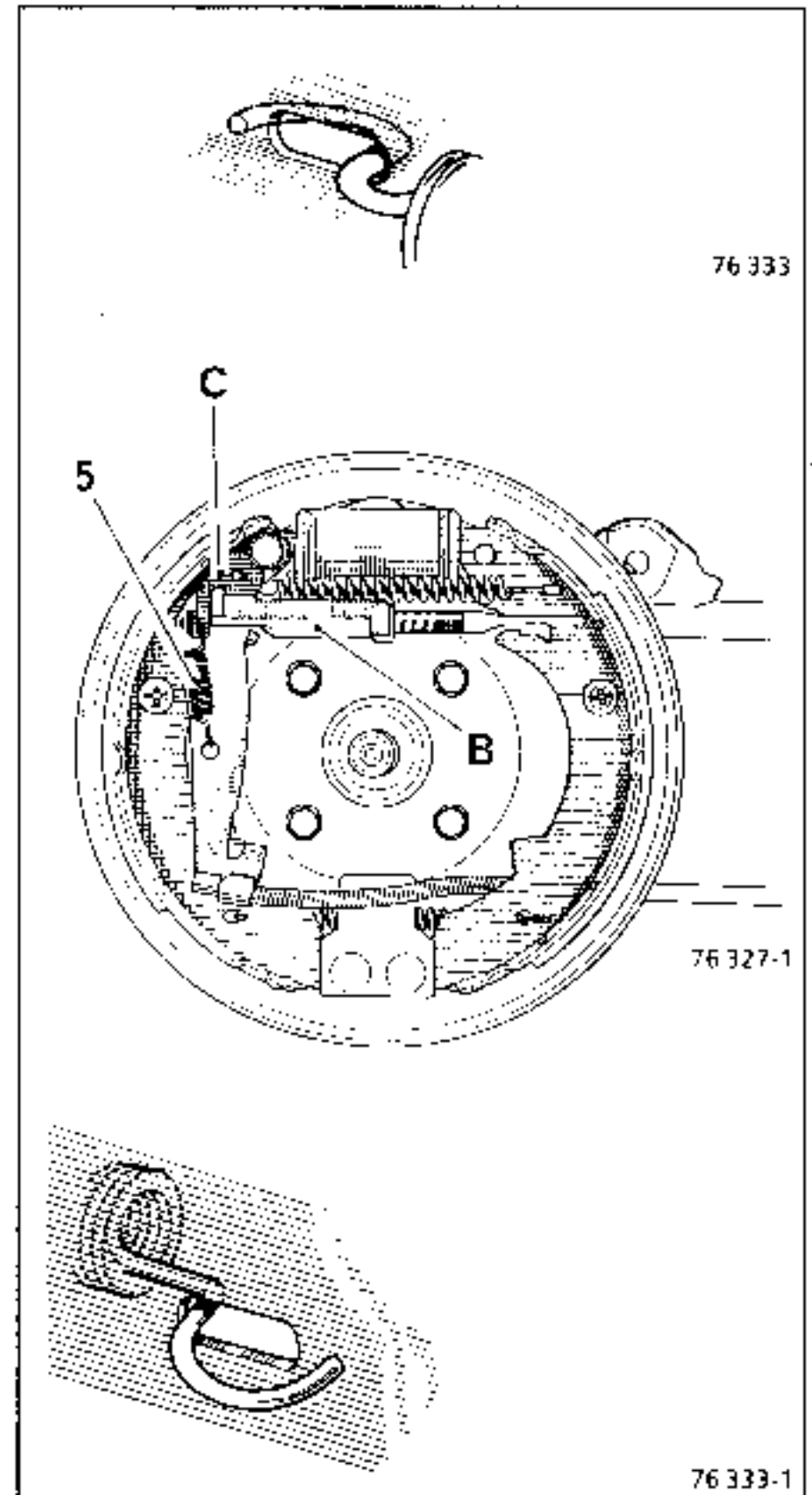
Cross the shoes over the stub axle.

Push the return spring behind the pivot point tongue.

Fit:

- the brake shoes;
- the adjustable link rod (B);
- the brake shoe retainers (press and turn through 90°);
- the lever (C) tension spring (5);
- the adjusting lever (C).

Before fitting the upper return spring, adjust the length of the link rod so that the lining diameter is approximately 228 mm



Fit the handbrake cable using Fre. 573-01 and push the lever hard against the brake shoe

Check that the ends of the lower and upper springs are in the correct position on the brake shoes.

Refit the hub/drum assembly.

Tighten the stub axle nut to the correct torque.

Adjust the linings by repeatedly depressing the brake pedal.

Adjust the handbrake

Refit the backplate blanking plug.

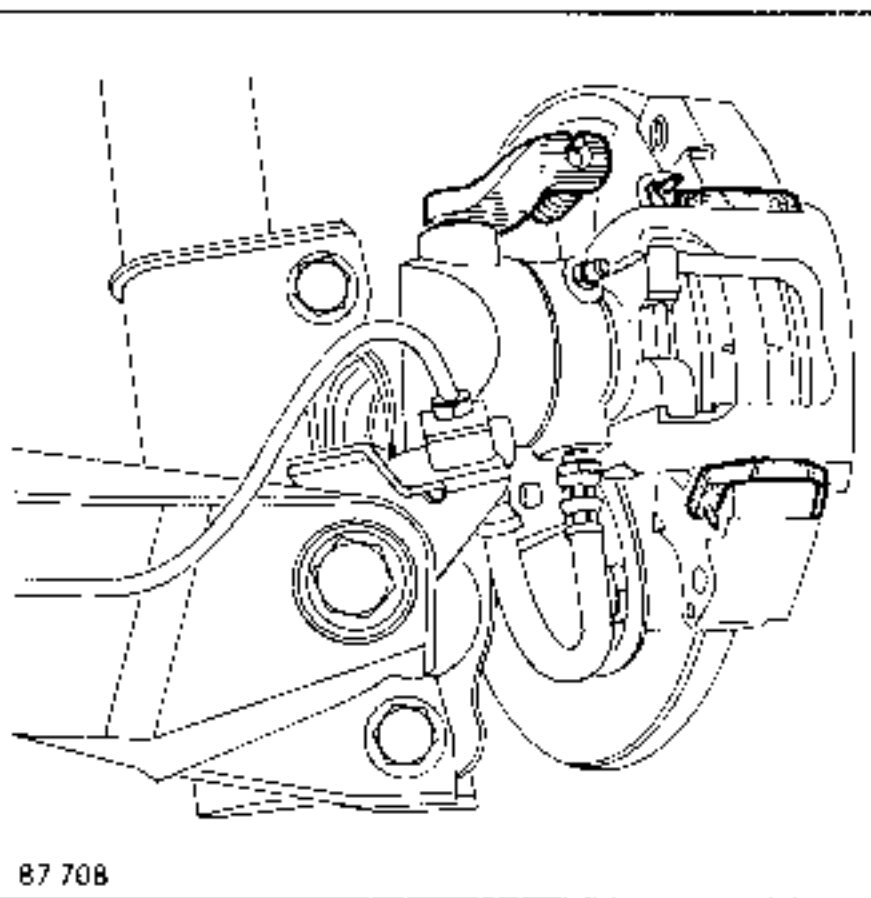
TIGHTENING TORQUES (in daNm)



Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING

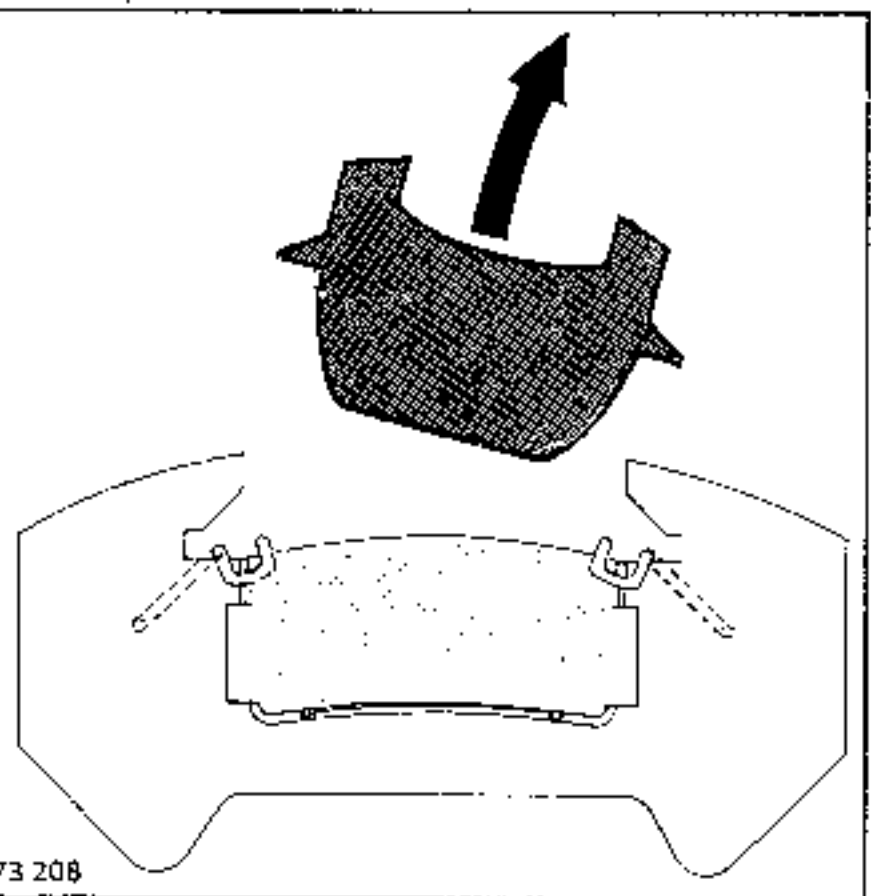
Disconnect the handbrake cable.



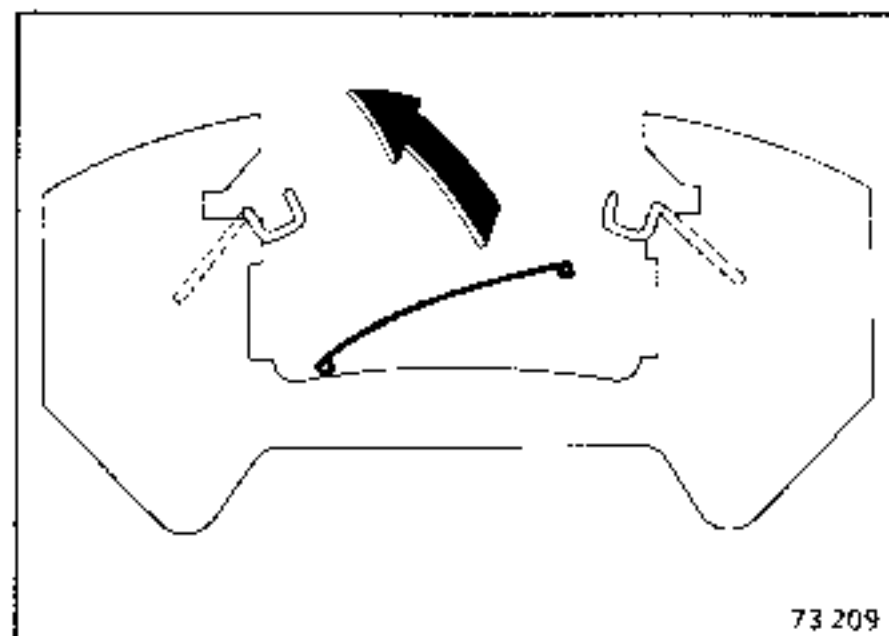
Remove:

- both pins;
- both keys using a pin drift;

the caliper;



- the linings;
- the springs under the linings.



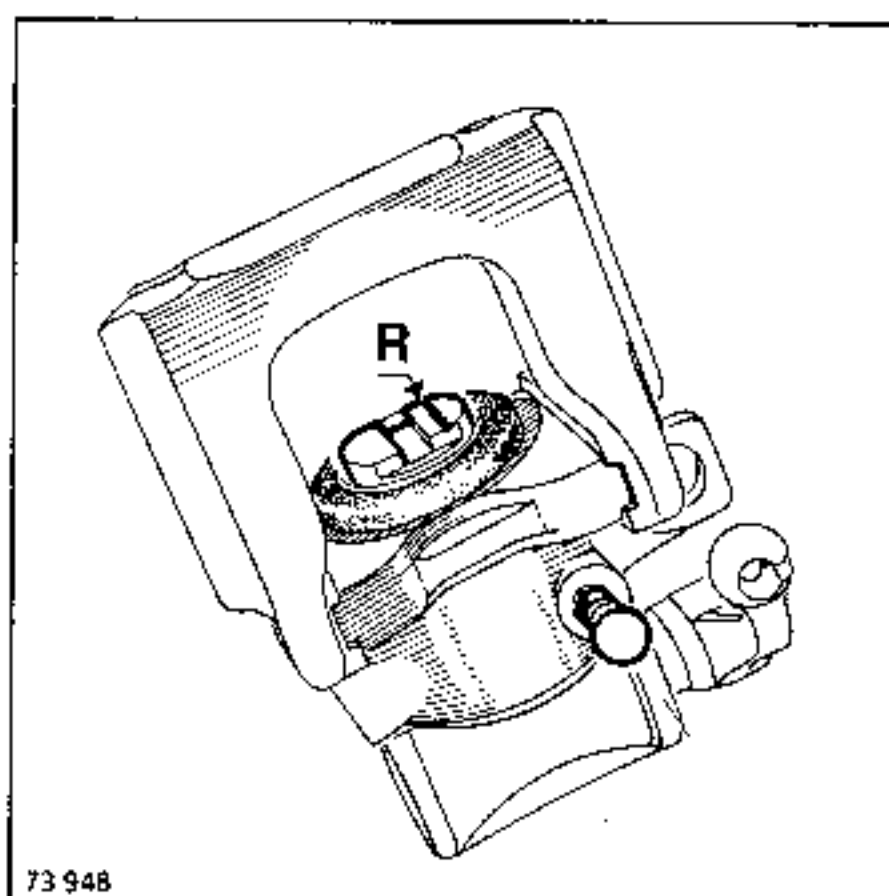
Checking:

Check the condition and fit of the piston dust cover.

REFITTING

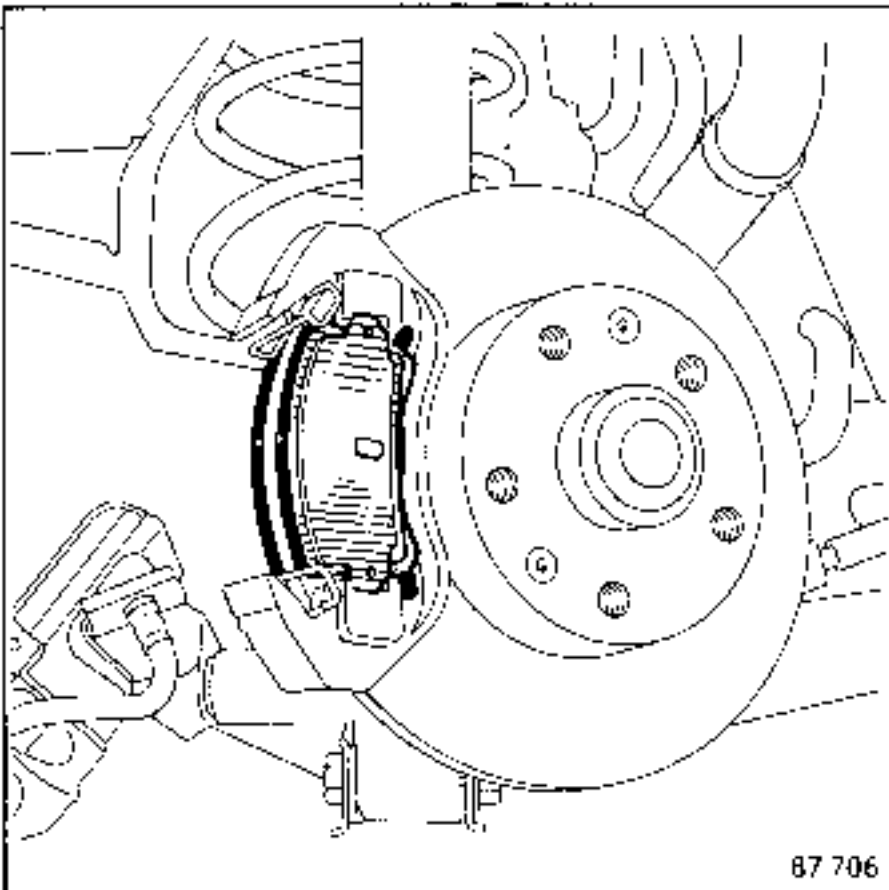
Push in the piston, screwing it with a square section screwdriver until it turns but goes in no further

Rotate the piston so that the groove (R) on its outer face is towards the bleed screw.

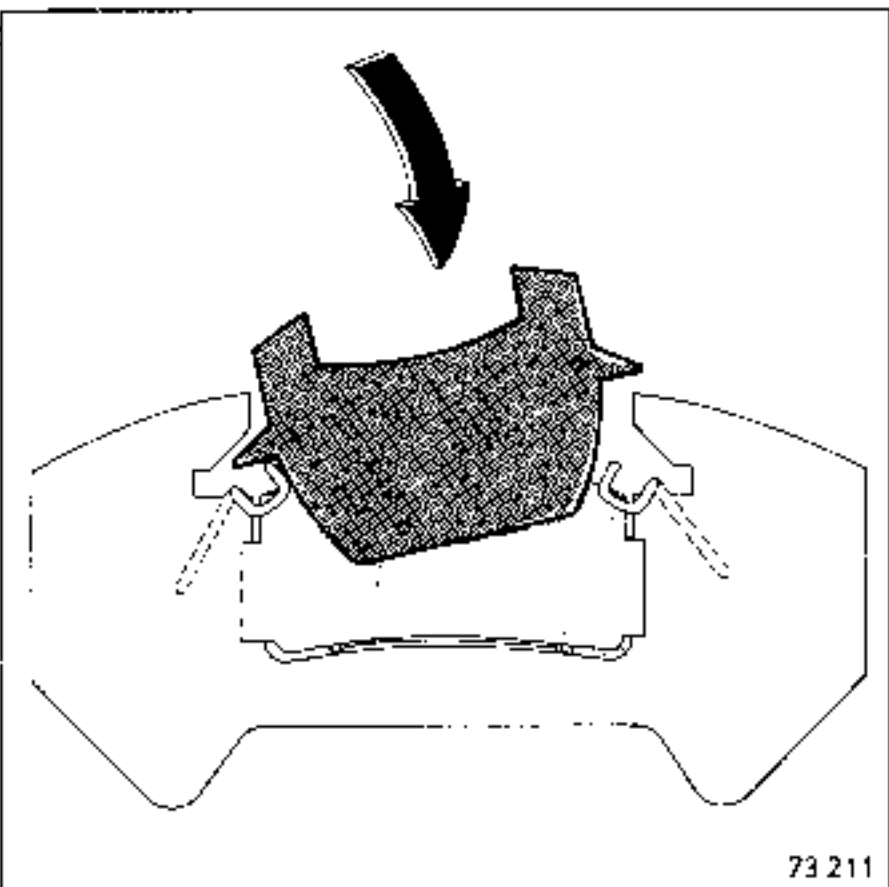


Fit:

- the springs under the linings;
- the linings;



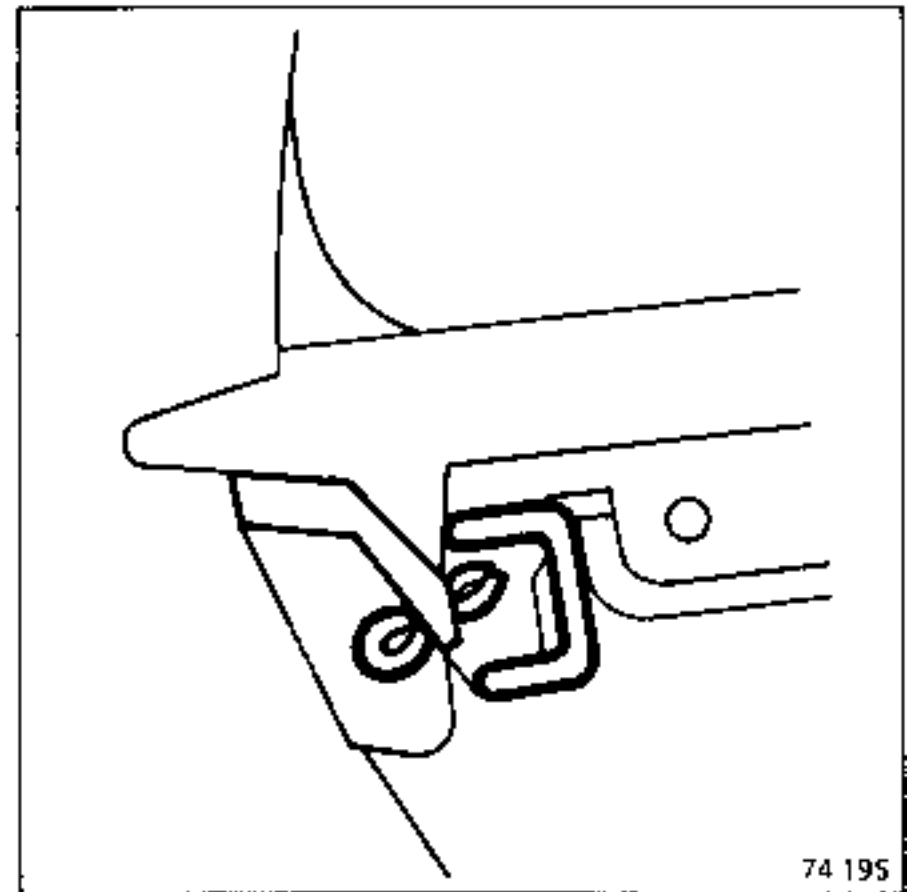
- one end of the caliper between the wire spring and the keyway on the support;



- the other end of the caliper by compressing the two springs.

Fit the first key, insert a screwdriver into the slot of the second and insert this by pressing down on the screwdriver.

Fit two new key retaining clips.



Reconnect the handbrake cables.

Depress the brake pedal several times to create contact between the piston and the linings.

TIGHTENING TORQUES (in daNm)



Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING

Loosen the brake hose at the wheel cylinder end.

Remove:

- the brake linings (see appropriate section)

Unscrew the wheel cylinder from the hose (brake fluid will flow out).

Check the condition of the hose and replace if necessary (see section on replacing a hose).

REFITTING

Screw the wheel cylinder back on to the hose.

Unscrew the wheel cylinder bleed screw and allow the brake fluid to run out (check that there is sufficient fluid in the reservoir).

Retighten the bleed screw.

Check the condition of the linings and refit them.

Partially bleed the circuit if the fluid reservoir has not been completely bled during the operation. If it has, completely bleed;

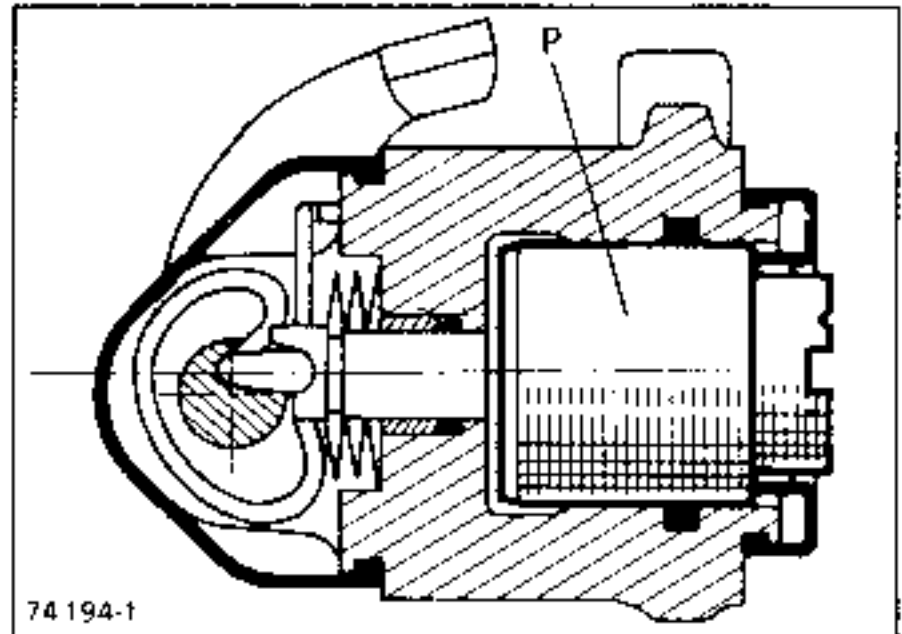
- the braking circuit;
- the clutch circuit.

Depress the brake pedal several times to create contact between the piston and the linings.

REPAIR

Remove the brake caliper.

The interior of the piston (P) must not be dismantled.

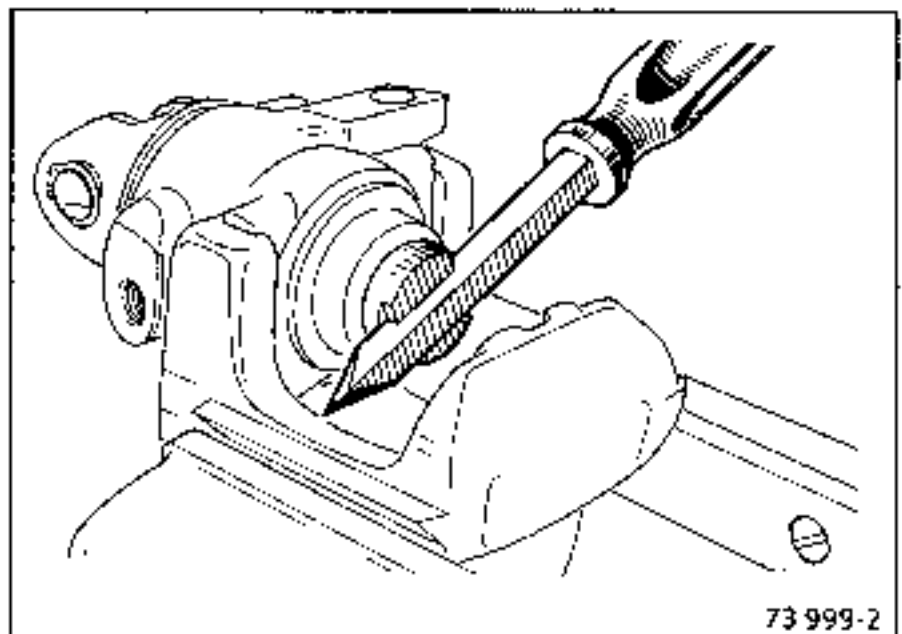


DISMANTLING

Place the caliper in a vice with protective jaws.

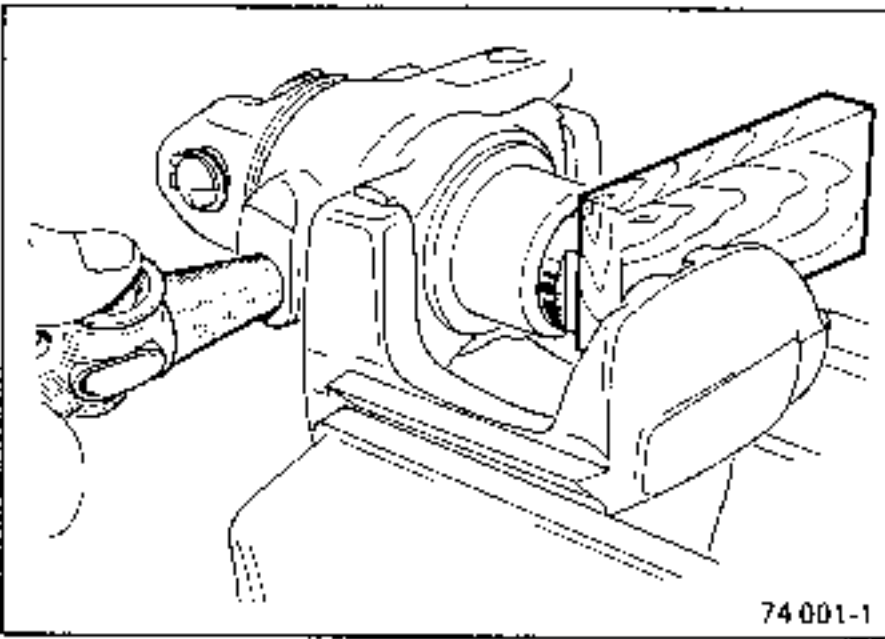
Remove the rubber dust cover.

Take out the piston by unscrewing it using a square section screwdriver.



When the piston is turning freely, gradually inject compressed air into the cylinder, taking care not to eject the piston violently. Insert a block of wood between the caliper and the piston to prevent damage to the piston.

The piston is useless if it shows any signs of impact damage or scoring.



Take the sealing ring from its groove using a round-edged flexible blade.

Clean the parts using methylated spirit, and reassemble.

The wheel cylinder is useless if the groove shows any signs of scoring.

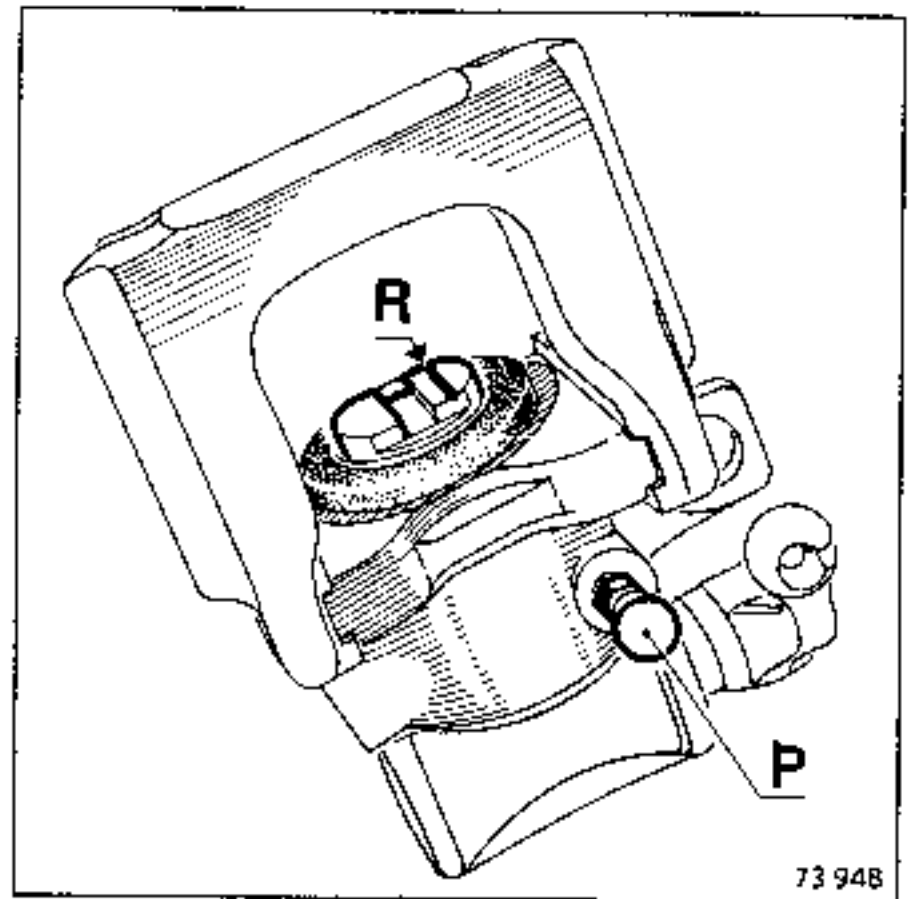
REASSEMBLY

Lubricate the seal and the piston with brake fluid.

Gradually push the piston in by hand so as not to damage the seal.

Finish pushing in the piston by screwing it with a screwdriver until the piston turns but goes in no further.

Turn the piston so that the groove (R) on its outer face is on the bleed screw side (P), and so that the caliper can be correctly bled and the lining fits correctly into the central piston groove.



Smear the piston rim with grease the provided in the repair kit.

Fit a new rubber protective cap.

ESSENTIAL SPECIAL TOOLING

B.Vi. 39

Drift

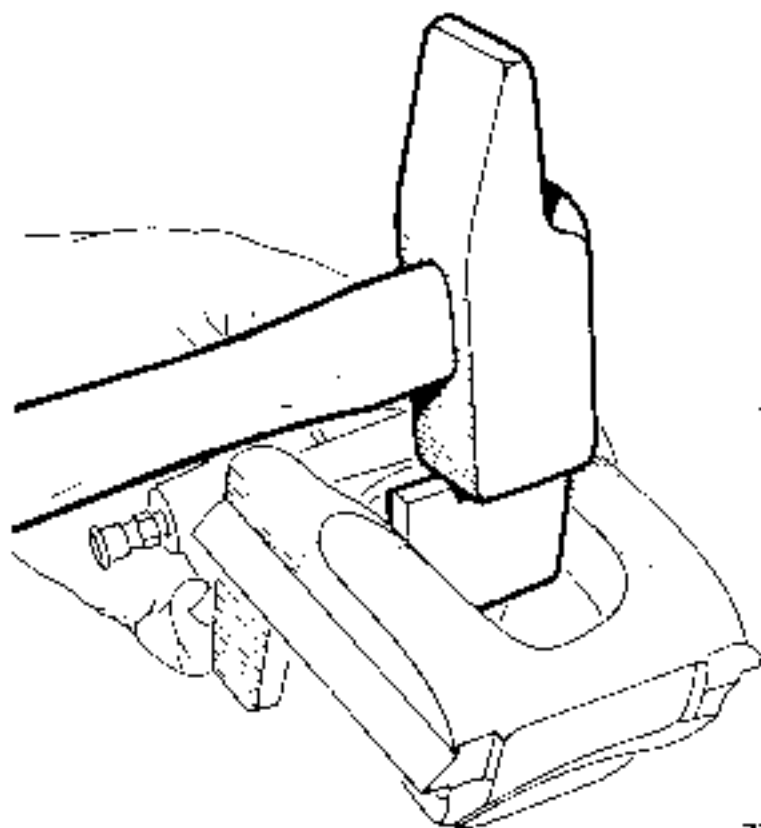
REPLACING THE WHEEL CYLINDER

Remove the brake caliper before carrying out this operation.

The caliper is made up of two parts : the support bracket and the cylinder. These have to be separated in order to replace the hydraulic cylinder

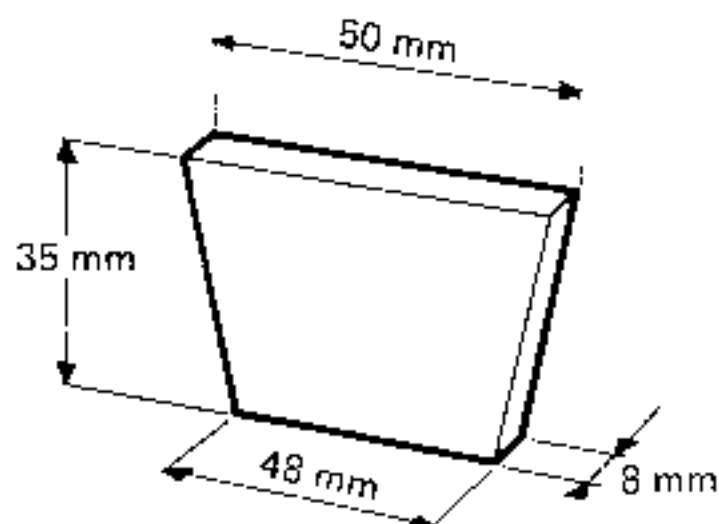
DISMANTLING

Using a wedge, slightly separate the two arms of the support bracket, so that the hydraulic cylinder can be slid out.



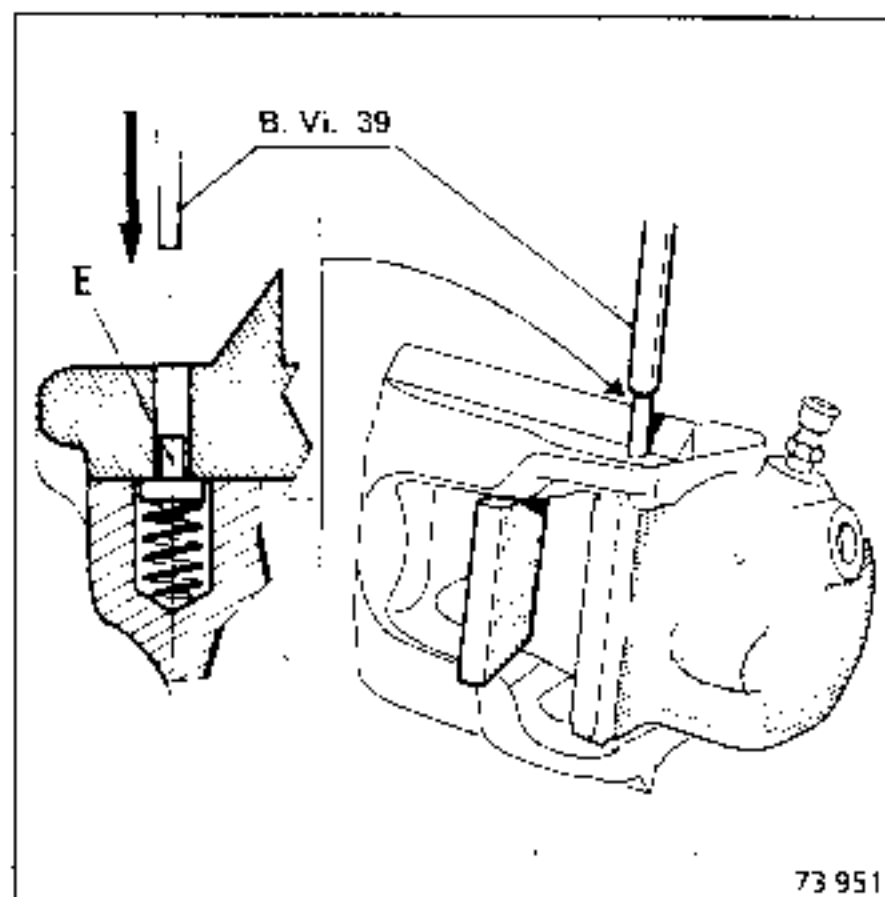
73 950

The wedge is to be made locally, as shown:



74 176-1

Push in the peg (E) using B.Vi. 39.



73 951

Remove the support bracket.

REASSEMBLY

With the wedge in place in the support bracket, position and slide the hydraulic cylinder in the support bracket channels, after having pushed in the peg/spring assembly.

Position the cylinder so as to insert the peg in the relevant cylinder support bracket hole.

Remove the separating wedge.

ESSENTIAL SPECIAL TOOLING

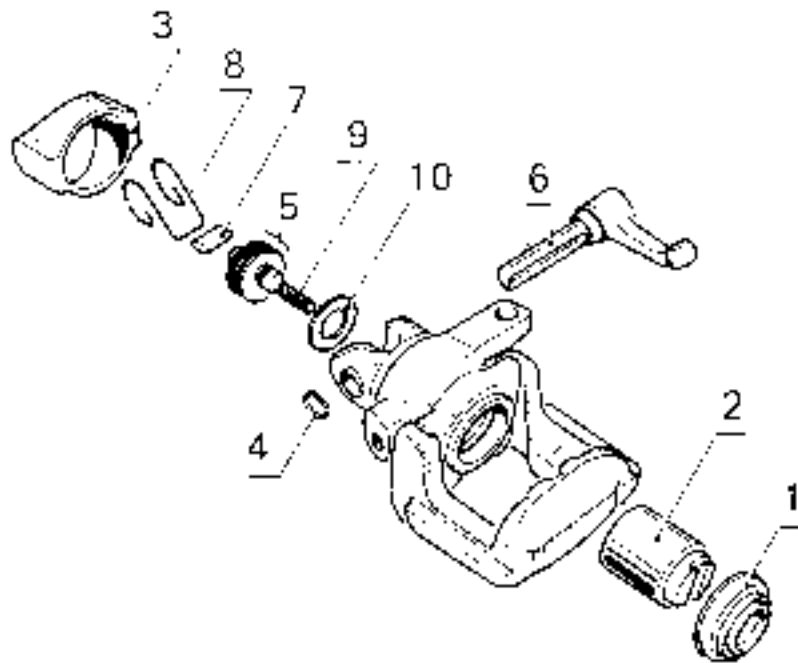
Fre.514 Tool for dismantling handbrake mechanism

DISMANTLING

Place the caliper in a vice fitted with protective jaws, without removing the cylinder from the support bracket.

Remove:

- the sealing cap (1);
- the piston (2) by unscrewing it;
- the dust cover cap (3);
- the circlip (4).

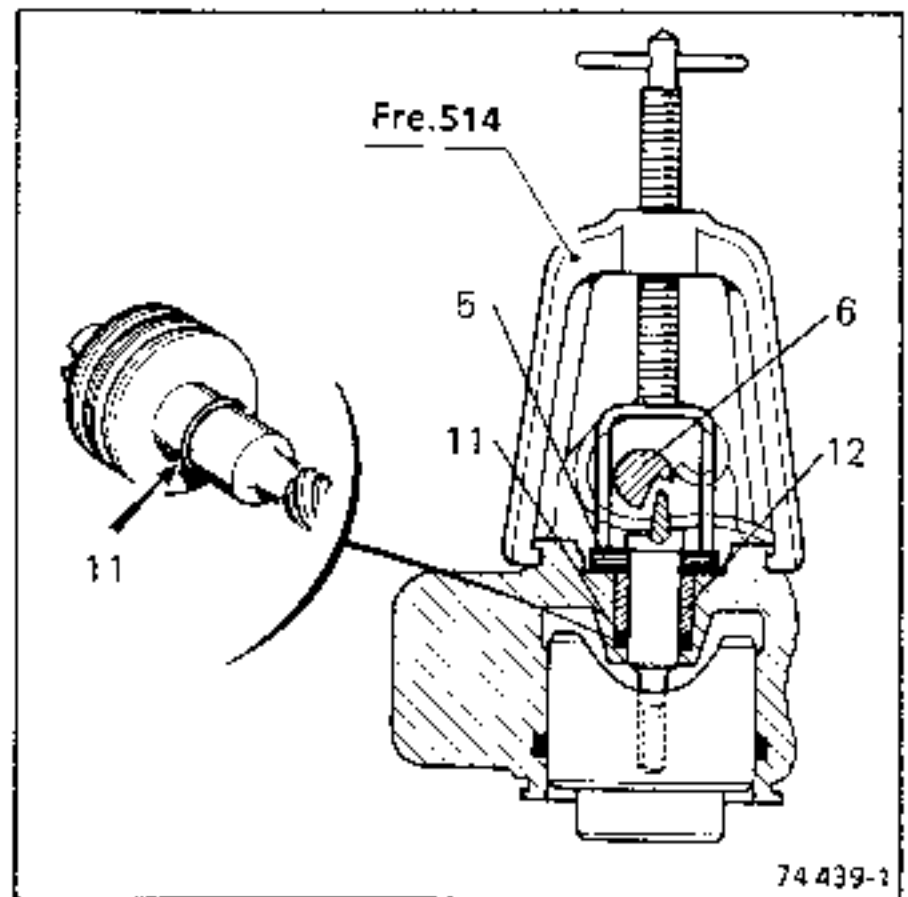


74 002-1

Compress the spring washers (5) using Fre.514.

Remove:

- the shaft (6), by pulling on the lever;
- the plunger cam (7);
- the spring (8);



74 439-1

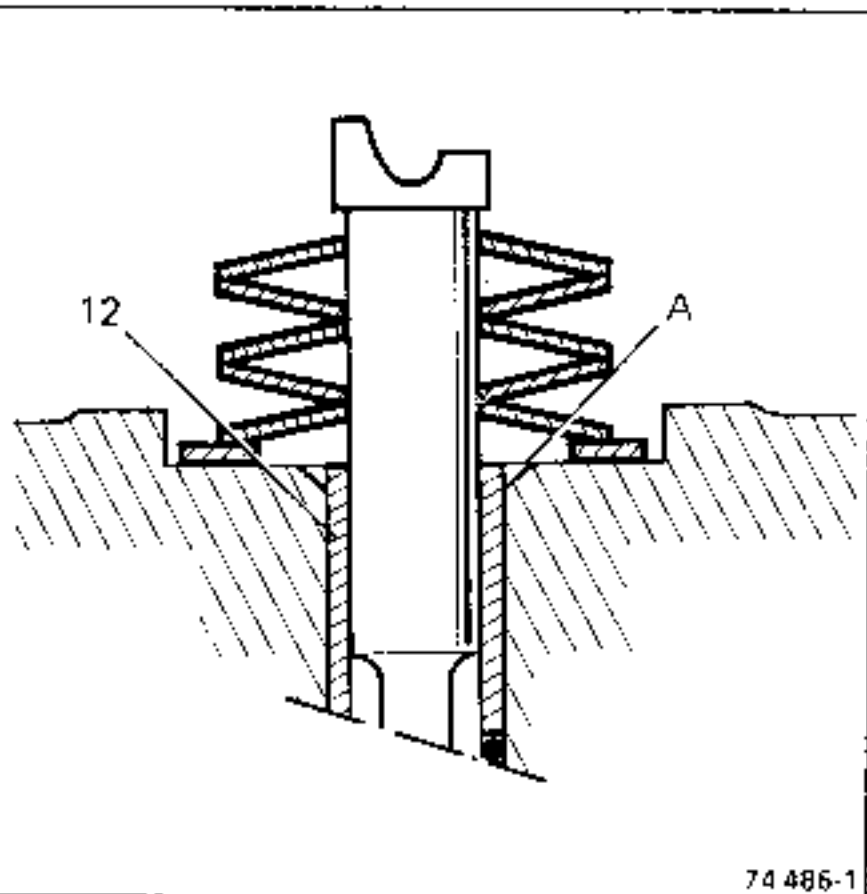
- the adjusting screw (9);
- the washer (10);
- the spring washers (5);
- the sleeve (12) using a pin drift;
- the O-ring (11).

Clean all the parts with methylated spirit.

REFITTING

Fit:

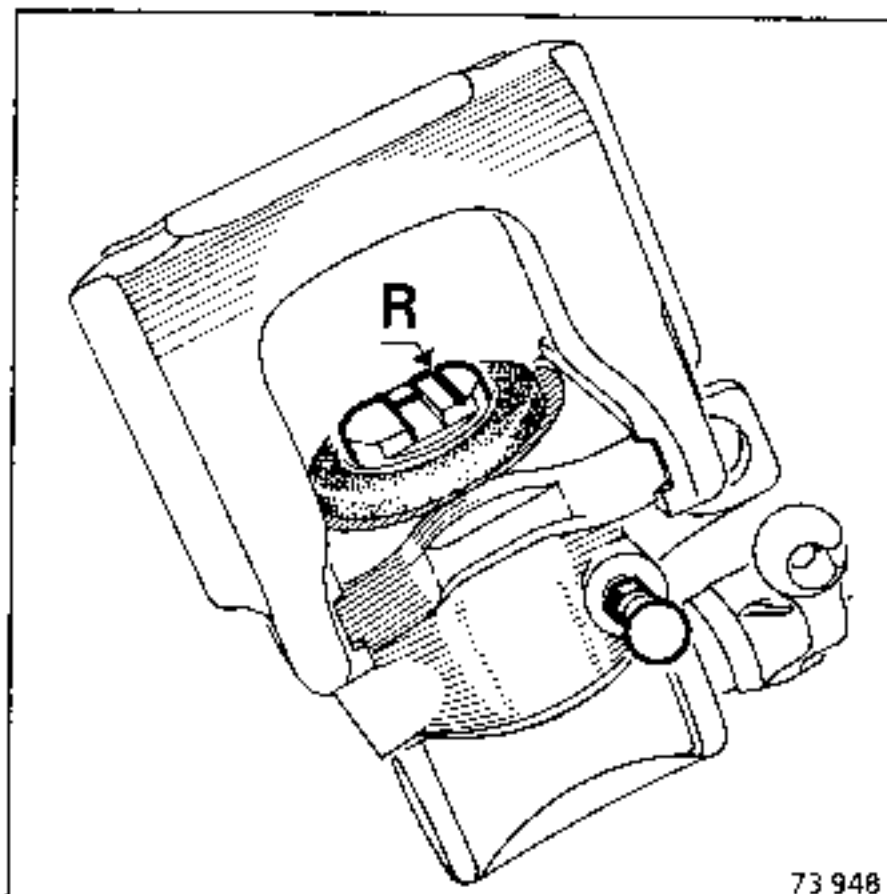
- the O-ring (11);
- the sleeve (12) until it is flush with surface A, using a tube of the appropriate diameter.



Check the location of the spring washers. These must be fitted in accordance with the diagram so that the handbrake lever is in the correct "rest" position.

Proceed as for dismantling, but in reverse order.

Rotate the piston so that the groove (R) on its outer face is towards the bleed screw.



TIGHTENING TORQUES (in daNm)



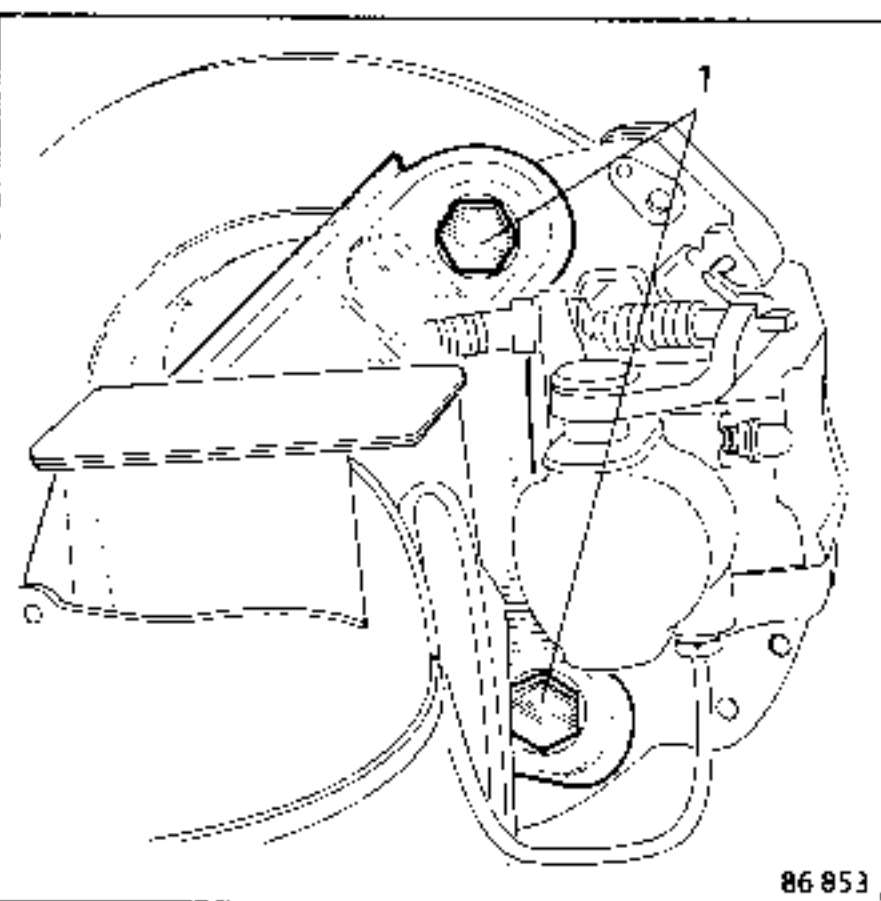
Wheel bolts: 4 bolts	9
5 bolts	10
Caliper support screws	6.5

Brake discs cannot be machined. If they are badly worn or uneven, the entire part must be replaced.

REMOVING

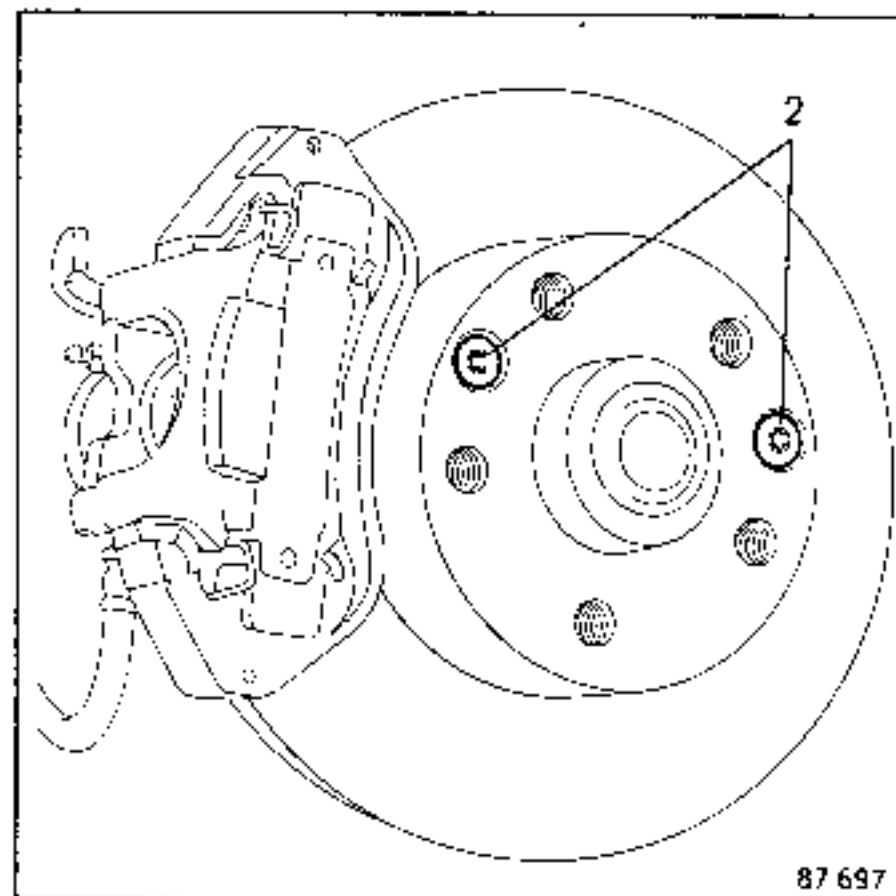
Remove:

- the brake linings (see appropriate section);
- the two support fixing screws (1);
- the support;



86 853

- the two fixing screws (2) on the hub (using male hexagon key Torx T 40 (e.g. Facom 89-40);



87 697

- the disc.

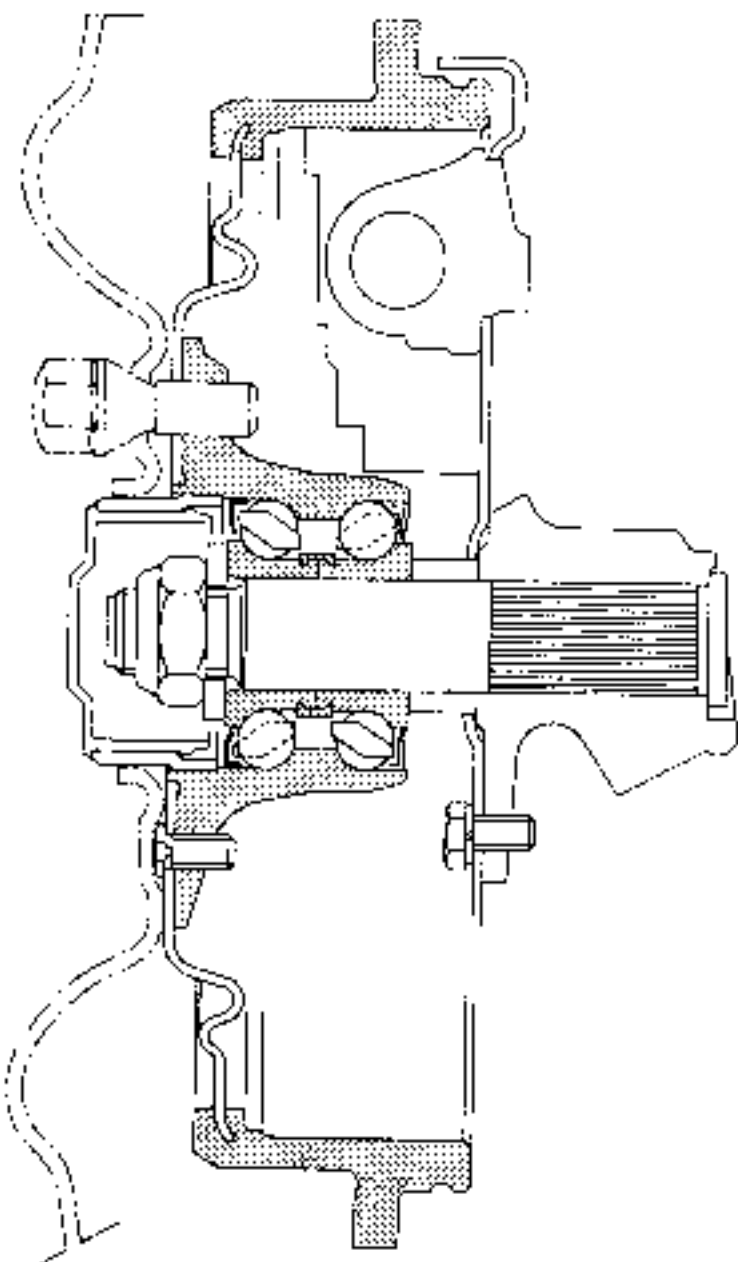
REFITTING

Proceed as for removing, but in reverse order.

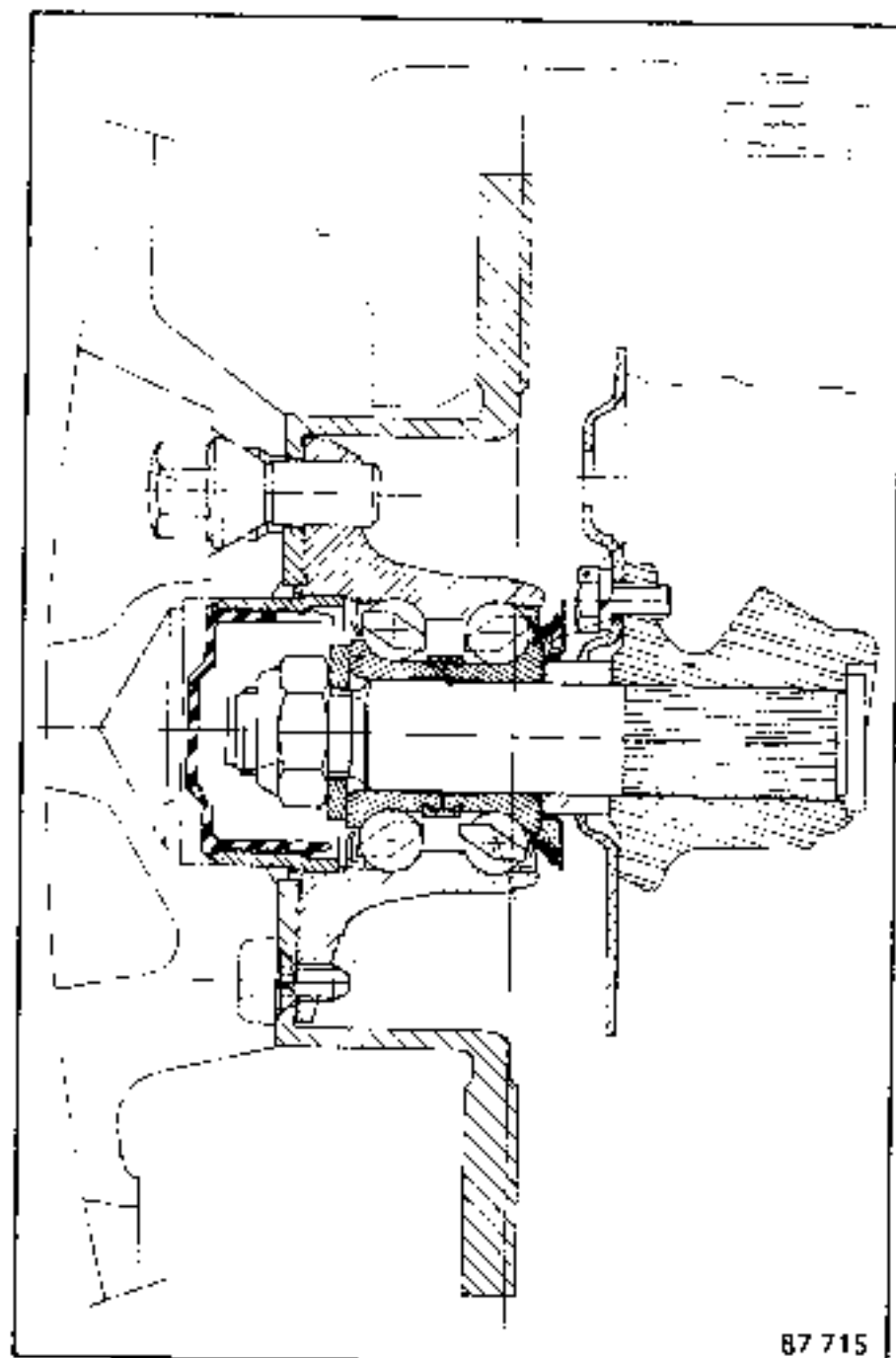
Smear the support screws with Loctite "FRENBLOC" and tighten to the correct torque.

Depress the brake pedal several times to create contact between the piston and the linings.

These vehicles have rear hubs with built-in bearings. Since the bearing and the hub cannot be separated, if either is faulty, the whole assembly will have to be replaced.



87 396



87 715

Since this vehicle has hubs with built-in bearings, if either part is faulty, the whole assembly will have to be replaced.

TIGHTENING TORQUES (in daNm)		
Wheel bolts: 4 bolts		9
	5 bolts	10
Stub axle nut		16
Support screw (disc)		6.5

REMOVAL

Remove:

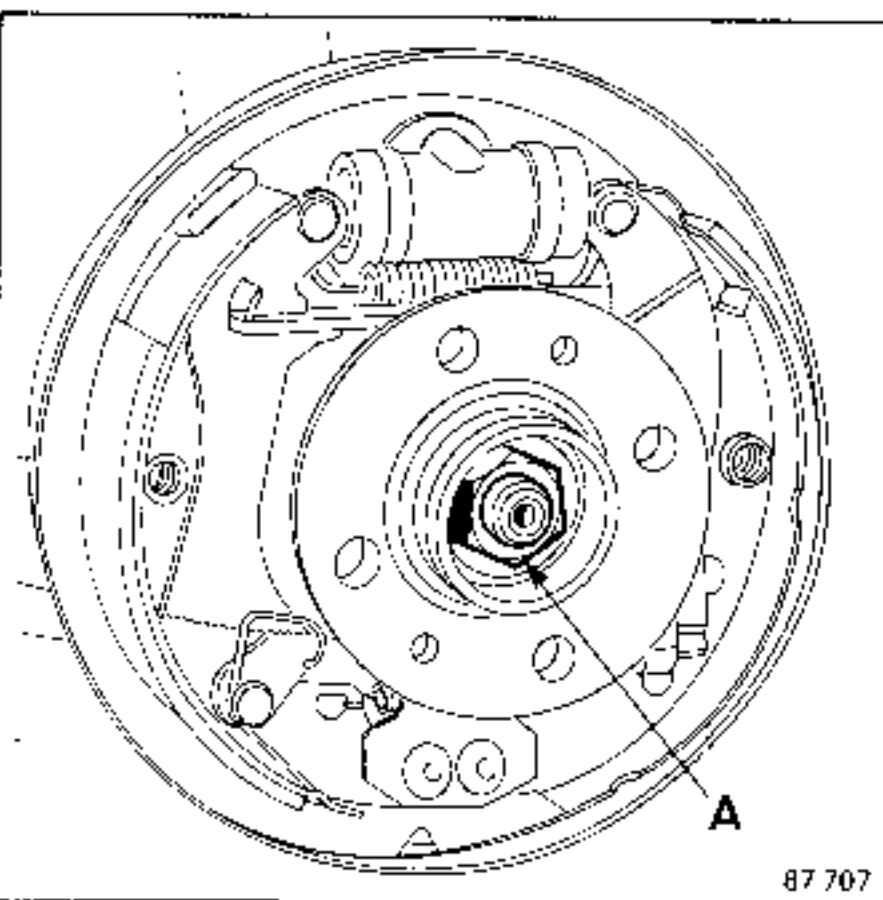
- the hub cap;
- the drum or the disc (see appropriate section);
- the hub (nut A).

REFITTING

Oil the stub axle with SAE 80 W.

Fit:

- the hub and tighten to the correct torque;
- the drum or disc (see appropriate section);
- the hub cap.



87 707

ESSENTIAL SPECIAL TOOLING

- T. Ar. 659-01 Caliper
T. Ar. 659-02 Rear spring removal tooling

TIGHTENING TORQUES (in daNm)



Lower shock absorber fixing arm	11
Upper shock absorber fixing	3
Anti-roll bar fixing	1.7
Lateral arm pivot pin nut	3.4
Transverse arm pivot pin nut	7
Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING

Remove:

- the shock absorber (see appropriate section);
- the spring (see appropriate section);
- the protective housing.

Disconnect:

- the handbrake cable at the primary/secondary yoke connection;
- the limiter control rod;
- the brake hose;
- the lateral arm pivot pin.

Remove the inner pivot pin.

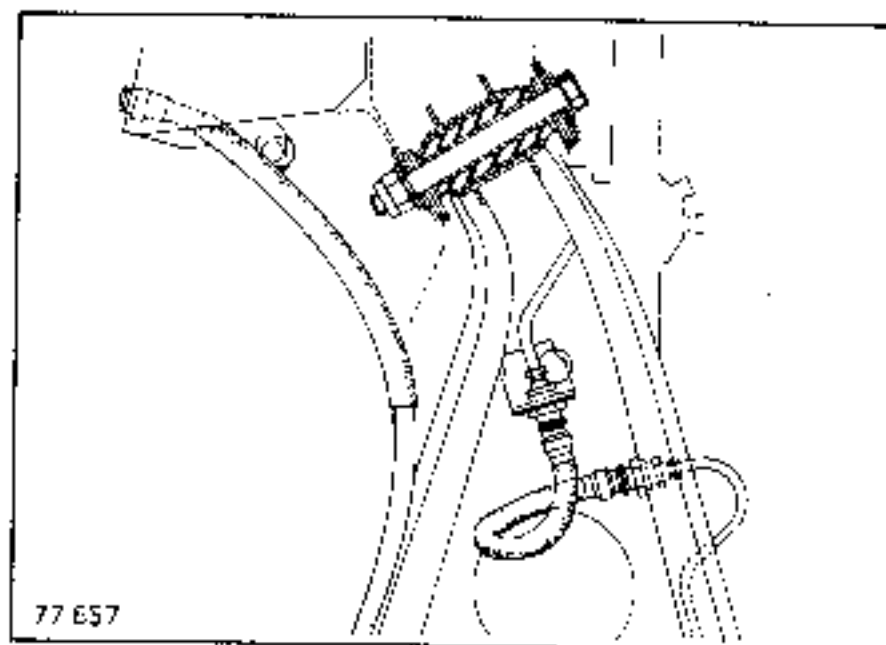
Retrieve the adjusting shims and note their position.

Remove the transverse arm.

REFITTING

Fit:

- the transverse arm into the inner bearing;
- the inner pivot pin, making sure to fit the shims and the washers in the correct order.



NOTE:

If the arm has been replaced, temporarily place an adjusting shim on either side.

Then proceed in the same way as for removing, but in reverse order.

Place the vehicle on its wheels.

Tighten to the correct torque:

- the lateral arm pivot pin;
- the transverse arm pivot pin.

Bleed the braking circuit.

Check and if necessary adjust;

- the parallelism;
- the brake limiter.

TIGHTENING TORQUES (in daNm)		
Lateral arm pivot pin nut:	body	4.5
	arm	3.4
Wheel bolts: 4 bolts		9
	5 bolts	10

REMOVING

- Remove the protective housing.
- Disconnect the reservoir support member.
- Remove the two pivot pins (1) and (2).
- Push back the transverse arm and free the lateral arm.

REFITTING

- Smear the pivot pins with grease.
- Fit new locknuts.
- Tighten the pivot pins to the correct torque (with the vehicle on its wheels).



TIGHTENING TORQUES (in daNm)



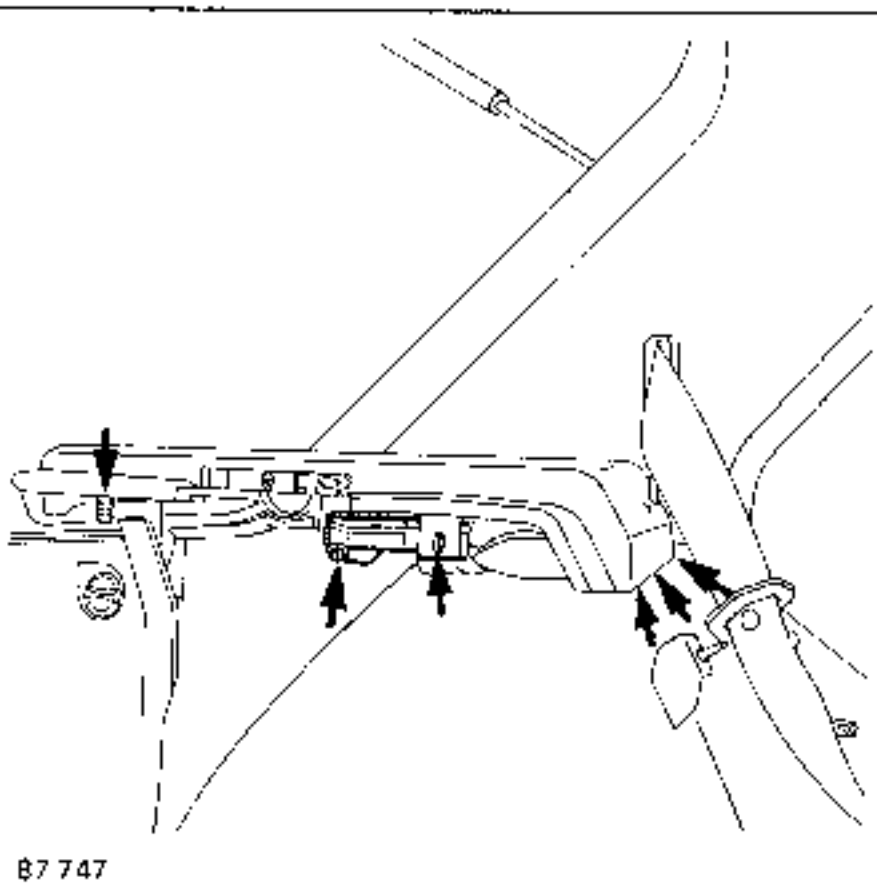
Lower fixing pin	11
Upper fixing	3
Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING

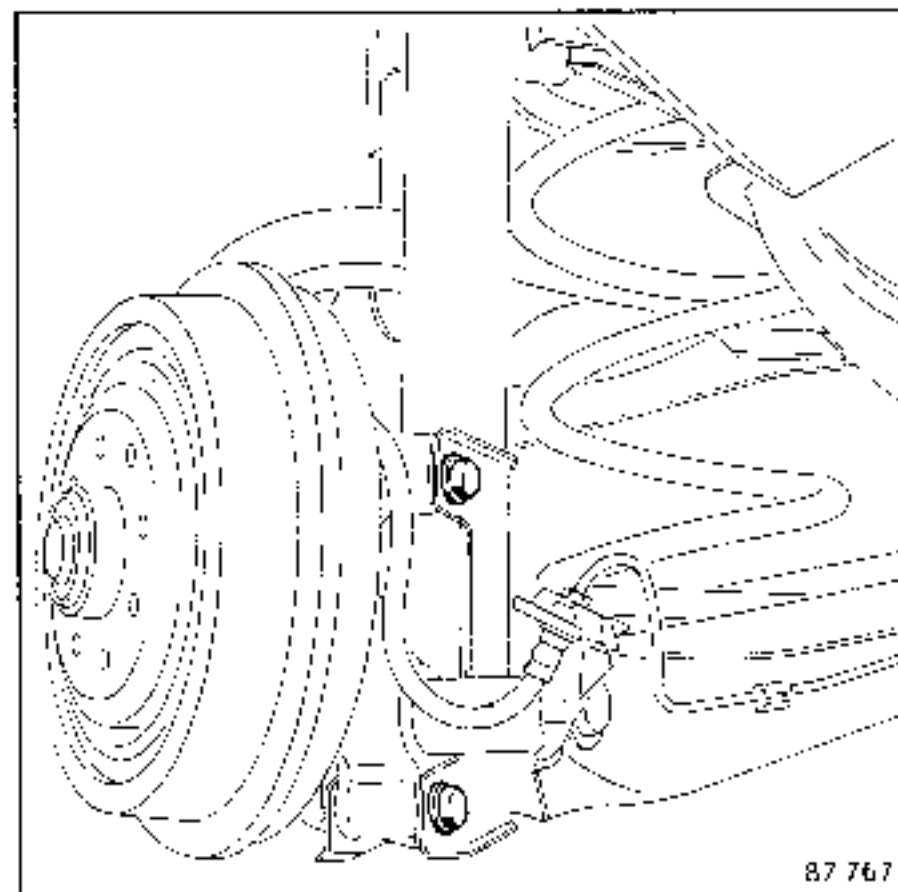
Support the suspension arm with a prop.

Remove:

- the rear side shelf (6 screws);
- the upper shock absorber fixing;
- the two lower shock absorber pivot pins.



Compress the shock absorber and release it outwards.

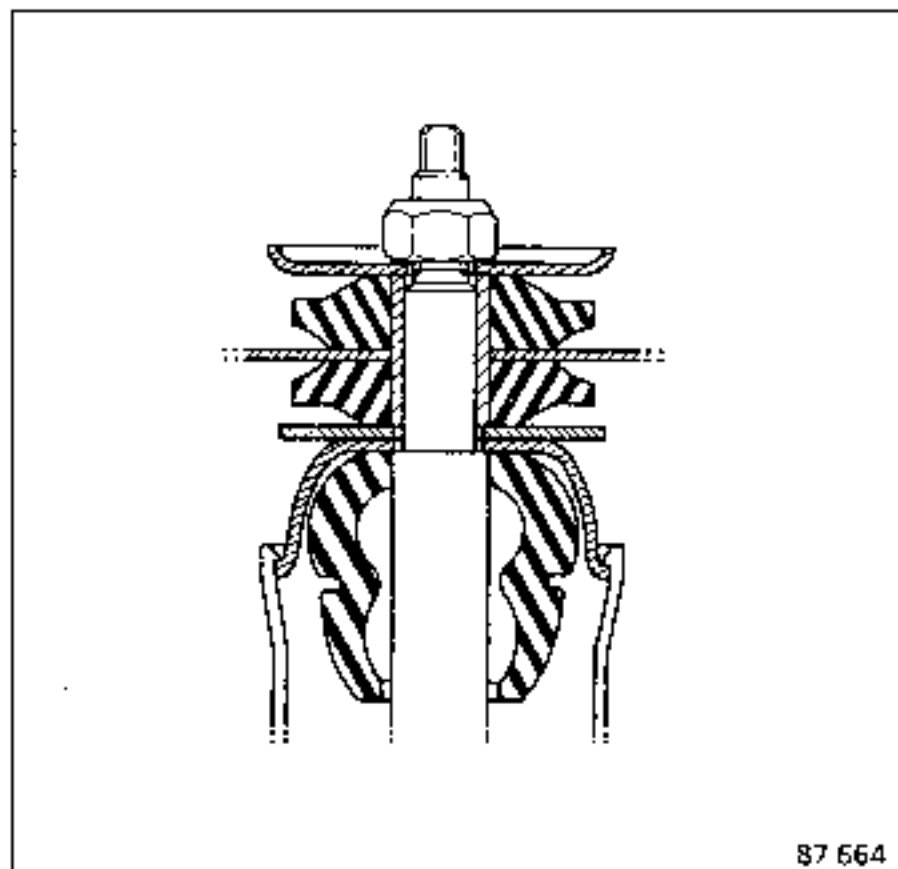


REFITTING

Fit:

- the shock absorber;
- the two lower mounting bolts (smeared with grease);
- the shock absorber rod using a tool made locally.

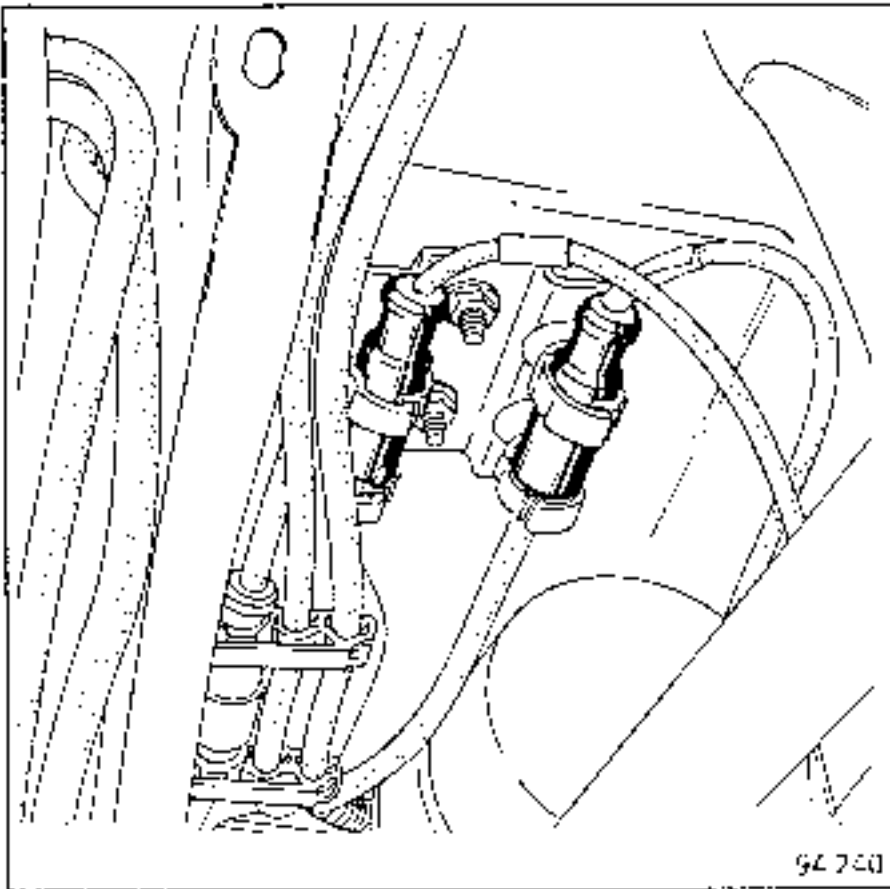
Make sure the cup washers are fitted the correct way round.



Lower the vehicle on its wheels and tighten the upper and lower shock absorber fixings to the correct torque.

DRIVER-CONTROLLED SHOCK ABSORBER SUSPENSION??: SPECIAL FEATURES

The solenoid valve connector supply wires are to the rear right, near the petrol pump.



NOTE;

the solenoid valve supply wires are different lengths;

- rear left-hand shock absorber (2 metres, orange mark);
- rear right-hand shock absorber (1.4 metres, black mark).

When connecting the connectors make sure that the marks match. Mixing them up could cause a fault-finding error.

NOTES:

- Make sure that the correct wiring routing and electrical connections are used (otherwise the reliability of the master-controlled shock absorbers cannot be guaranteed).
- Do not use the wiring delivered with the shock absorber for fastening purposes.
- When disconnecting the 3-channel connector, do not use a sharp tool which may damage the retaining lugs on both sections of the connector.

ESSENTIAL SPECIAL TOOLING

T. Ar. 659-01 Caliper

T. Ar. 659-02 Rear spring removing/refitting tooling

TIGHTENING TORQUES (in daNm)



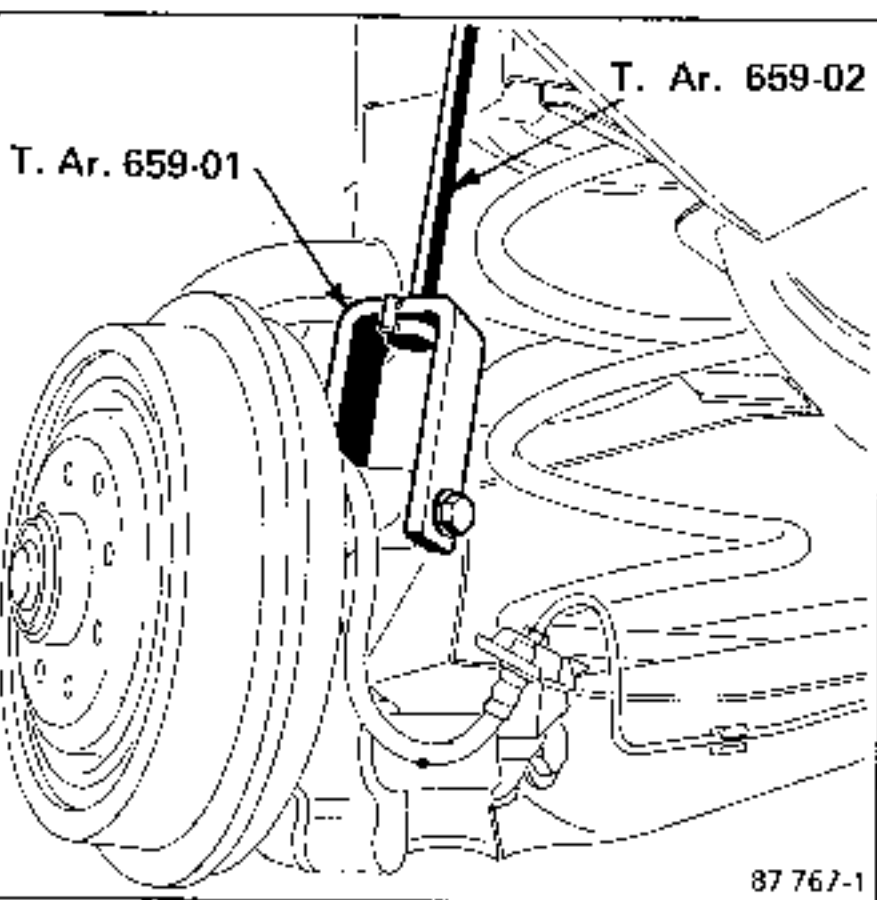
Lower fixing pins	11
Upper fixings	3
Anti-roll bar fixing	1.7
Wheel bolts: 4 bolts	9
5 bolts	10

REMOVING

Remove the shock absorber (see appropriate section).

Position the threaded rod of tool:

T. Ar. 659-02 fitted with caliper T. Ar. 659-01.



Gently compress the spring to loosen the anti-roll bar.

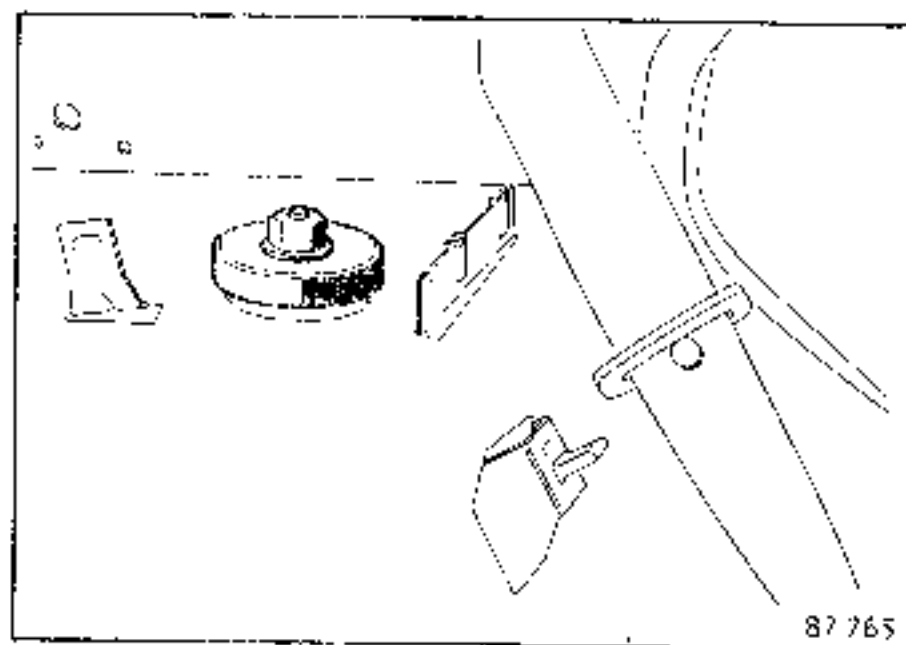
Disconnect:

- the anti-roll bar;
- the limiter control.

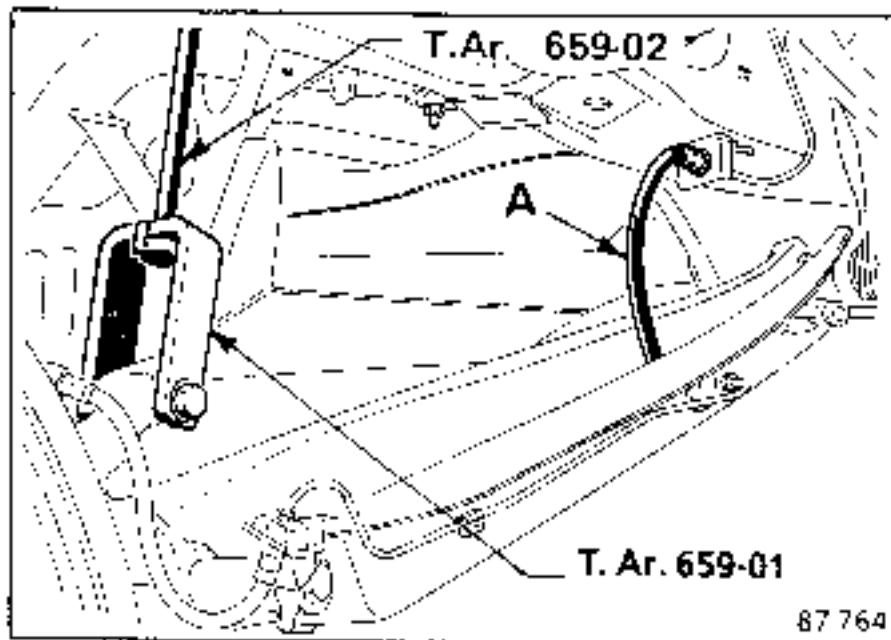
Decompress the arm.

NOTE:

If the longest type of spring is in use, the nut of the tool reaches the last thread.



The tool must not be removed, so as to avoid damaging the brake hose (A).



Remove the spring without removing the tool.

REFITTING

Fit:

- the spring, wedge it against the upper plate and make sure that it is correctly positioned in the lower spring mounting.

Compress the assembly.

Connect:

- the anti-roll bar;
- the limiter control.

Remove the tool.

Fit the shock absorber (see appropriate section).

Lower the vehicle onto its wheels and tighten the anti-roll bar to the correct torque.

TIGHTENING TORQUES (in daNm)		
Wheel bolts: 4 bolts		9
	5 bolts	10
Eye bolt nuts 1.7		
Bearing fixing nut		1.5

REMOVAL

Remove the protective housing.

On each side, unscrew:

- the bearing fixing nuts on the cross members;
- the mounting pin nuts.

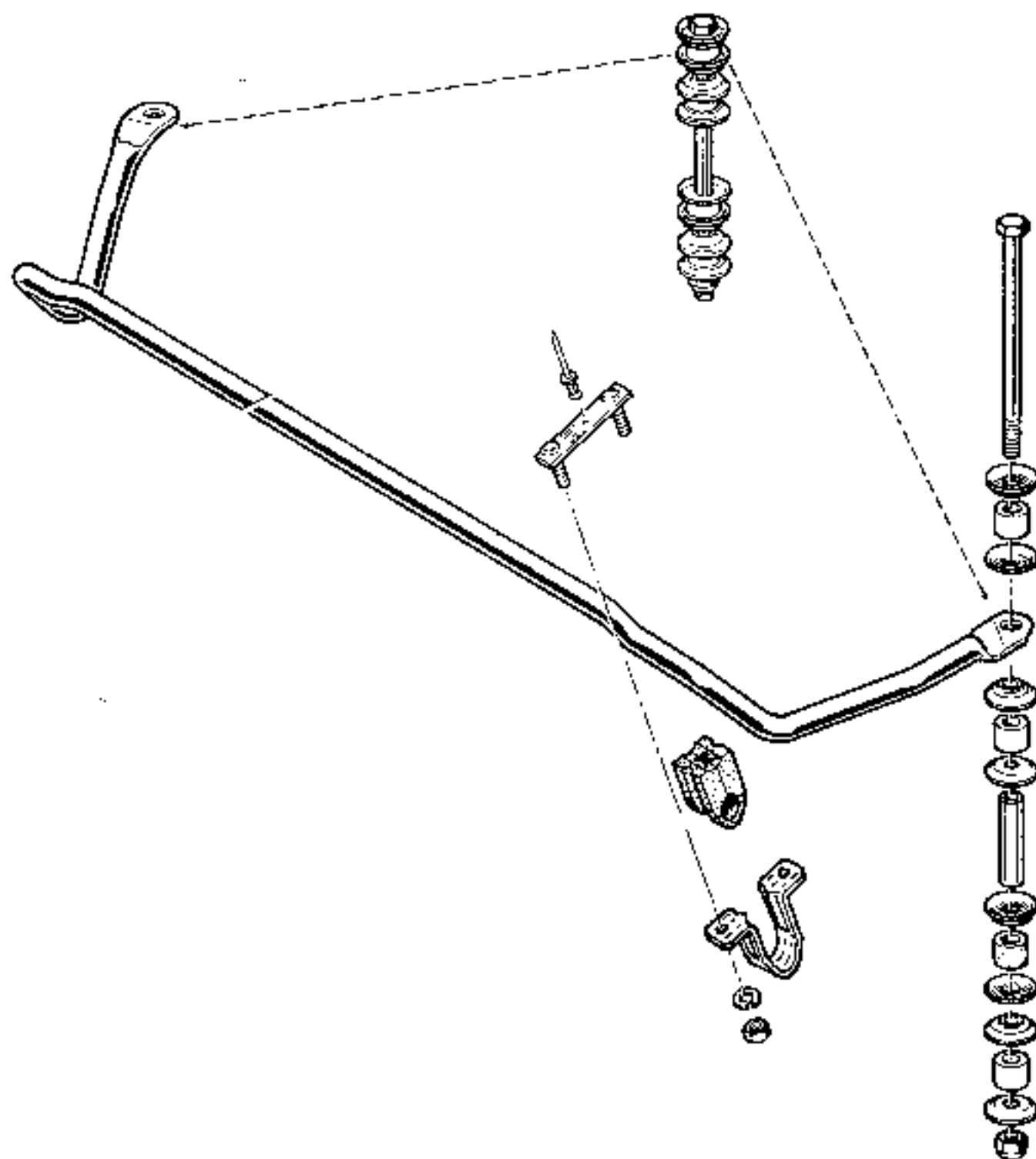
Remove the bearings.

REFITTING

Take care to fit the parts in the correct order and the correct way round.

With the vehicle on its wheels, tighten to the correct torque:

- the bearing fixing nuts;
- the mounting pin nuts.



WHEELS

Wheels can be identified in one of two ways:

- engraved marking on steel rims;
- cast marking on aluminium rims.

This marking identifies the main dimensional properties of the wheel. It may be in full:

e.g.: 5 1/2 J 14 4 CH 36

or simplified:

e.g.: 5 1/2 J 14

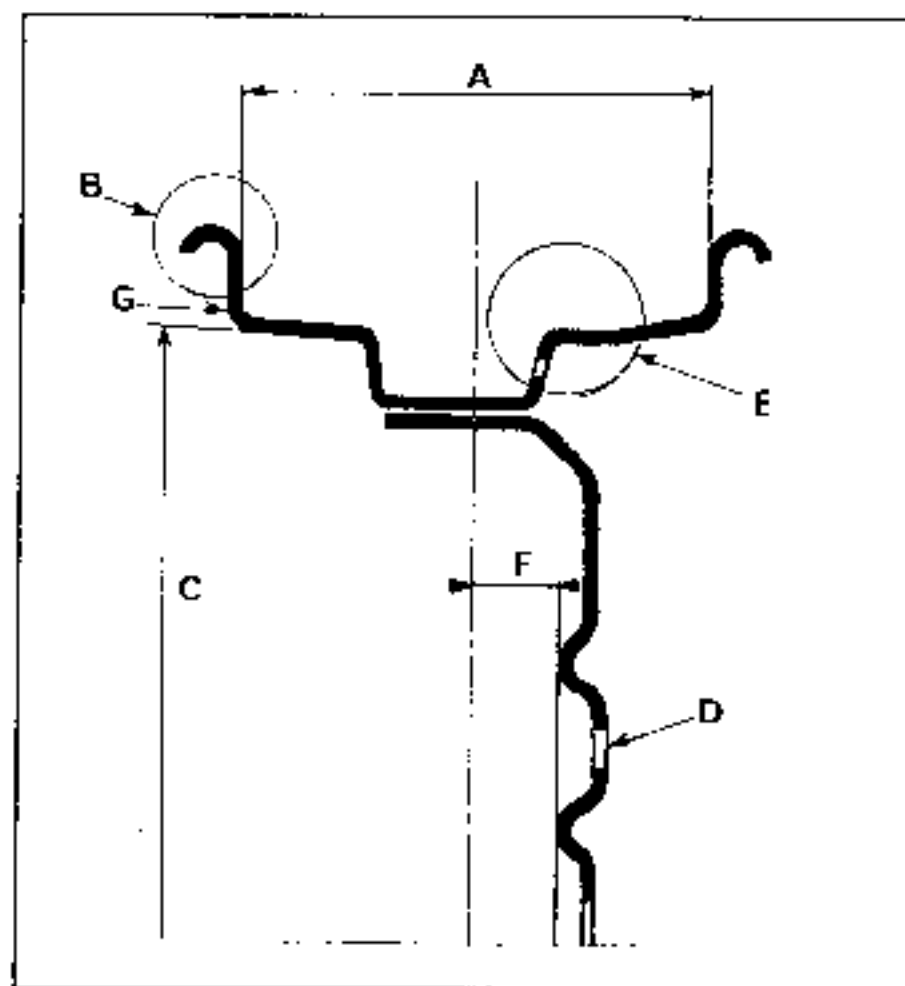
	A	B	C	D	E	F
TYPE OF WHEEL	WIDTH (in inches)	RIM EDGE PROFILE	NOMINAL ϕ (in inches) under tyre bead	Number of holes	Tyre locating profile	Offset in mm
5 1/2 J 14 4 CH 36	5 1/2	J	14	4	CH	36

The wheel bolts have a pitch circle diameter of

- 4 fixing bolts: 100 mm
- 5 fixing bolts: 108 mm

Maximum run-out: 1.2 mm measured at the rim edge (at G).

Maximum eccentricity: 0.8 mm measured at the tyre bead (surface B).

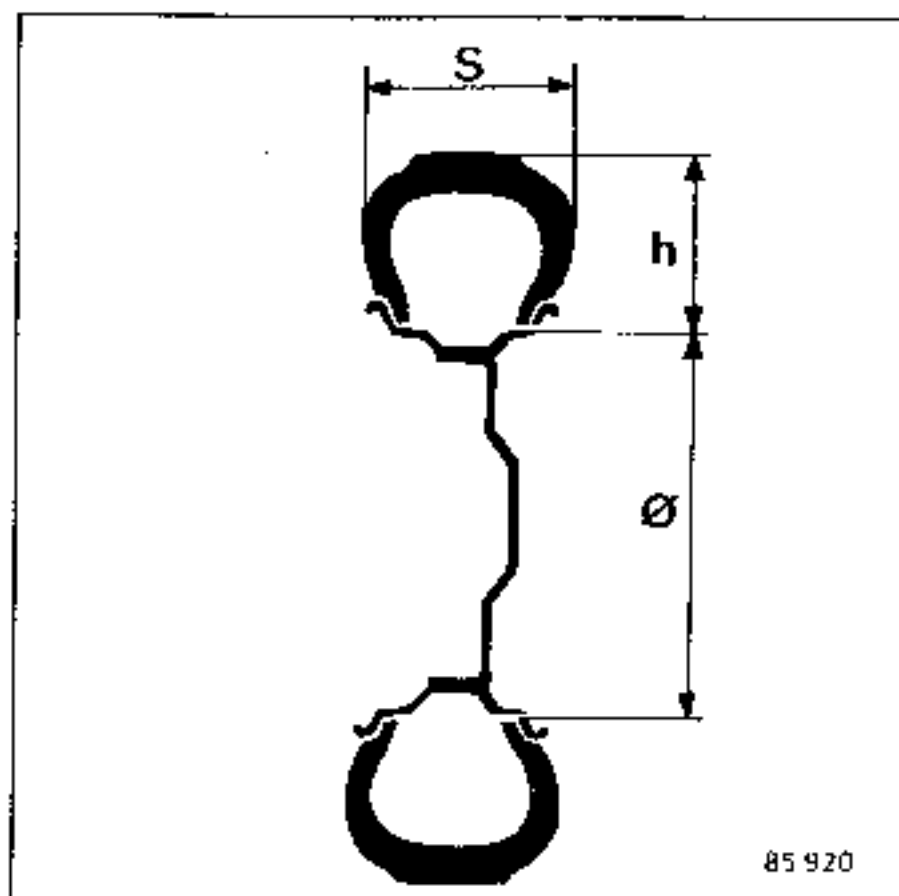


TYRES

The same type of tyre may have two different identification markings.

E.g.: 185/70 H R 14
or 185/70 R 14 88 H

185	/	70	H	R	14	
1		2	3	4	5	
185	/	70	R	14	88	H
1		2	4	5	6	3



85 920

1 185 Width of tyre wall in mm (S)

2 70 H/S ratio: $\frac{\text{Height}}{\text{Width}}$

4 R Radial structure

5 14 Internal diameter in inches, corresponding to the rim diameter.

6 88 Load indicator 88 (560 kg)

3 H Maximum speed indicator 210 km/h

Some of the speed symbols:		Max. speed in km/h
R		170
S		180
T		190
U		200
H		210
V		240
Z		+ than 240

Structure type :	Cross-ply	no marking
	Radial	R
	Bias belted	B

Type	Rim	Rim Run-out (mm)	Wheel nut tightening torques (daNm)	Tyres	Inflation pressure (bar)	
					FRONT	REAR
B29E B29E (1)	6 x 15	1.2	9 10 (1)	195/60R15H	2.0	2.2
B296 B297	5 1/2 x 14 6 x 14	1.2	9	165R14T 185/70R14T 185/70R14H	2.0	2.2
B29B	5 1/2 x 14 6 x 15	1.2	9	185/70R14H 195/60/R15H	2.0	2.2
B290 B29W B29H	6 x 15 6 x 14	1.2	9 10	185/70R14H 195/60R15H	2.0	2.2
B292 B294	6 x 15	1.2	10	195/65R15H 195/60R15V	2.5	2.3
B298	6 x 15	1.2	10	195/60R15H	2.3	2.5
B293 B29A B29F	6 x 15	1.2	10	195/60R15V	2.5	2.3
B295	6 x 15	1.2	10	205/60R15V	2.5	2.3
B296	6 x 15	1.2	10	205/55R16Z	2.5	2.3

Increase the pressure by 0.1 bar at the front on vehicles with automatic transmission.

(1) Vehicle with **ABS MOD. 1986-1987** brakes.

Tyres are Tubeless (without inner tube).

Inflation pressures should be checked when tyres are cold. Driving causes a rise in temperature and increases the pressure by 0.2 - 0.3 bar.

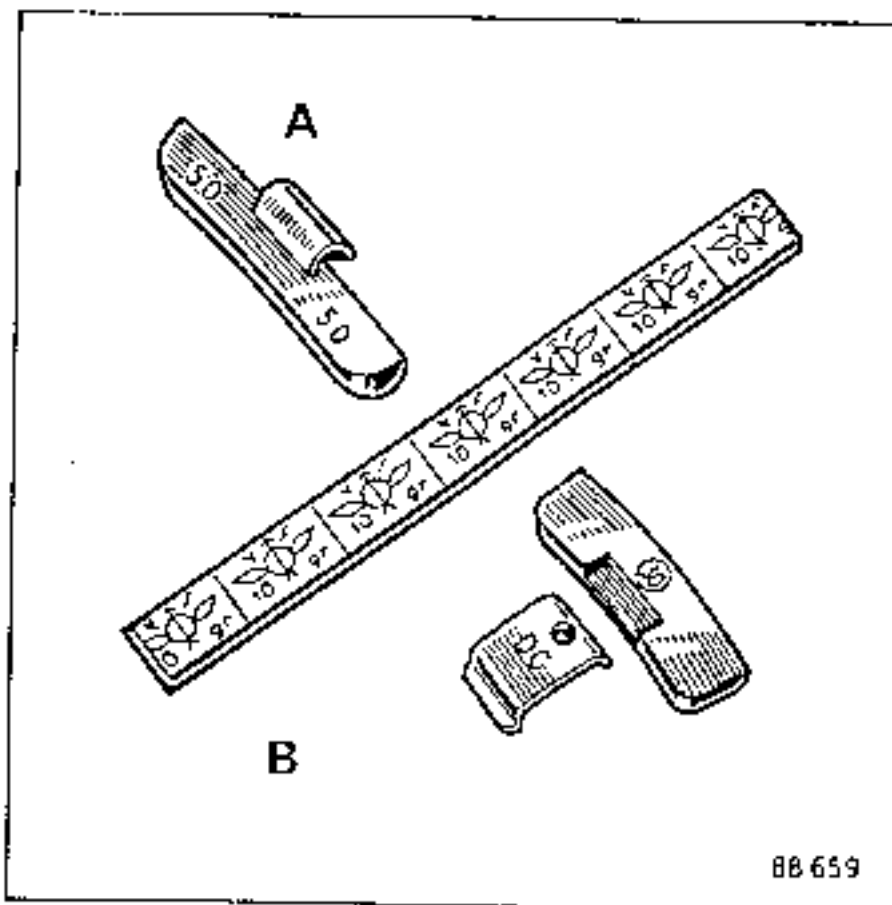
If checking the pressure when tyres are hot, take this increase in pressure into account and **never deflate tyres.**

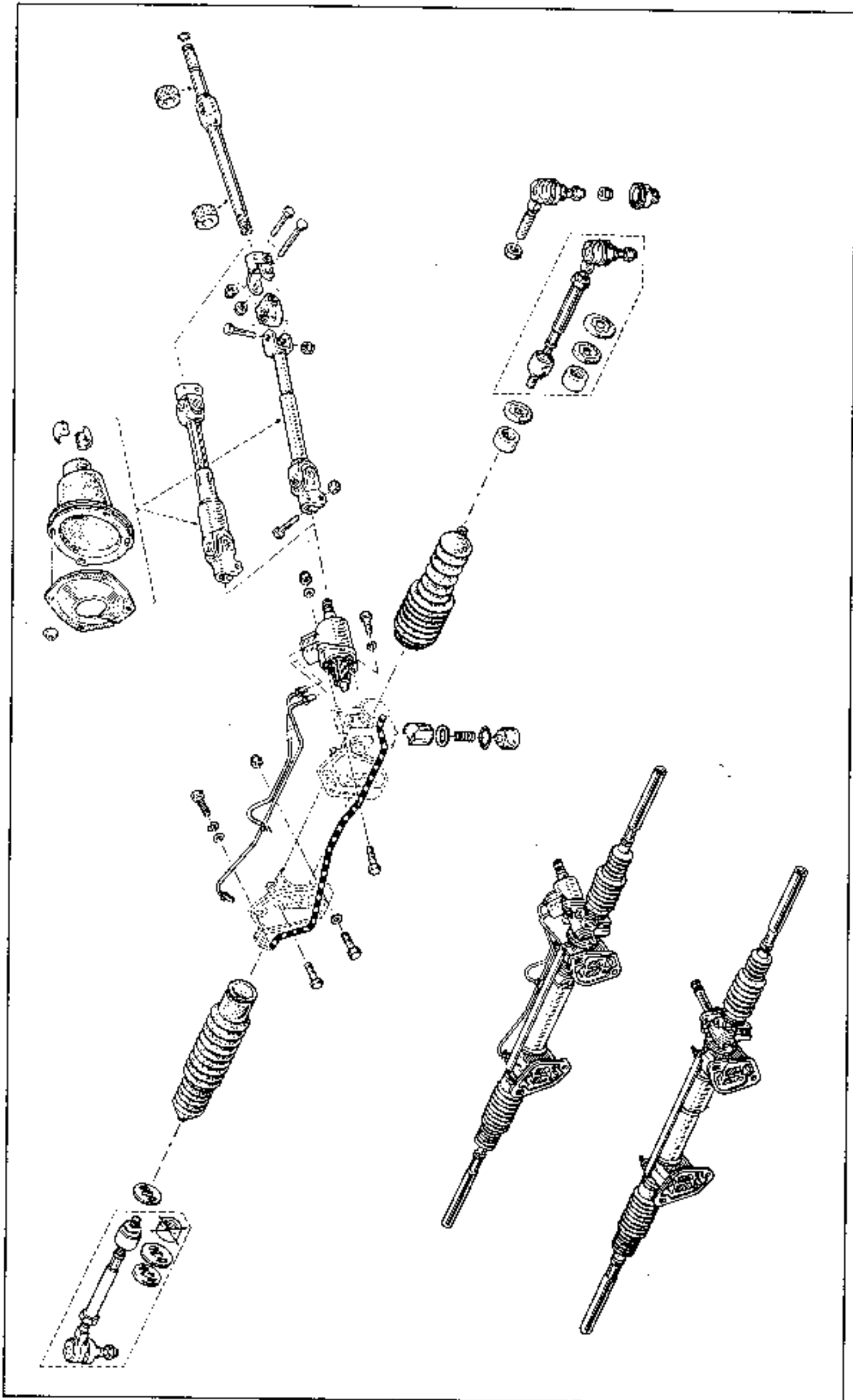
BALANCING WEIGHTS

Use only the weights supplied as spare parts:

- fastened by hooks to steel rims (hooks built into weights);
- fastened by hooks (flat hooks) or self-adhesive to aluminium alloy rims.

- A Steel rim
B Aluminium rim





ESSENTIAL SPECIAL TOOLING

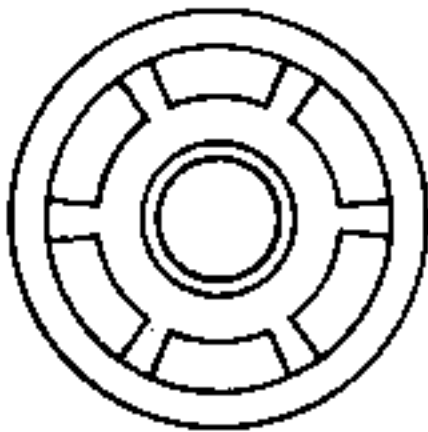
Dir. 812-01 or Dir. 832-01	Axial ball joint wrenches
T. Av. 476	Ball joint extractor
Dir. 812-02	Tap 12/100



TIGHTENING TORQUES (in daNm)

Ball joint nut	4
Steering tie rod nut	3.5
Axial ball joint	5

Axial ball joint with flat lockwasher



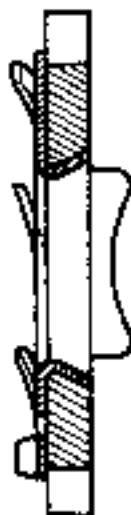
1

86 111



3

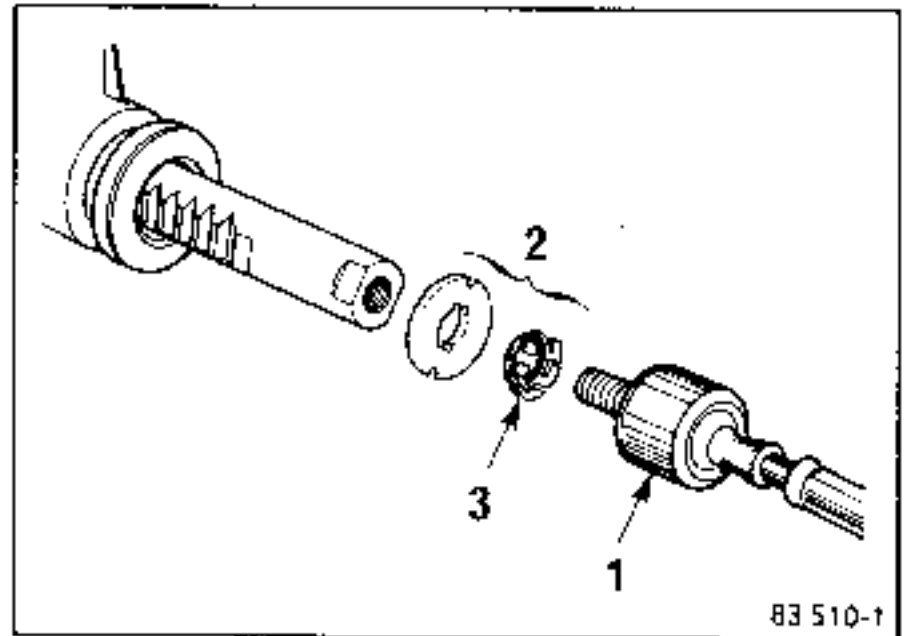
86 114



2

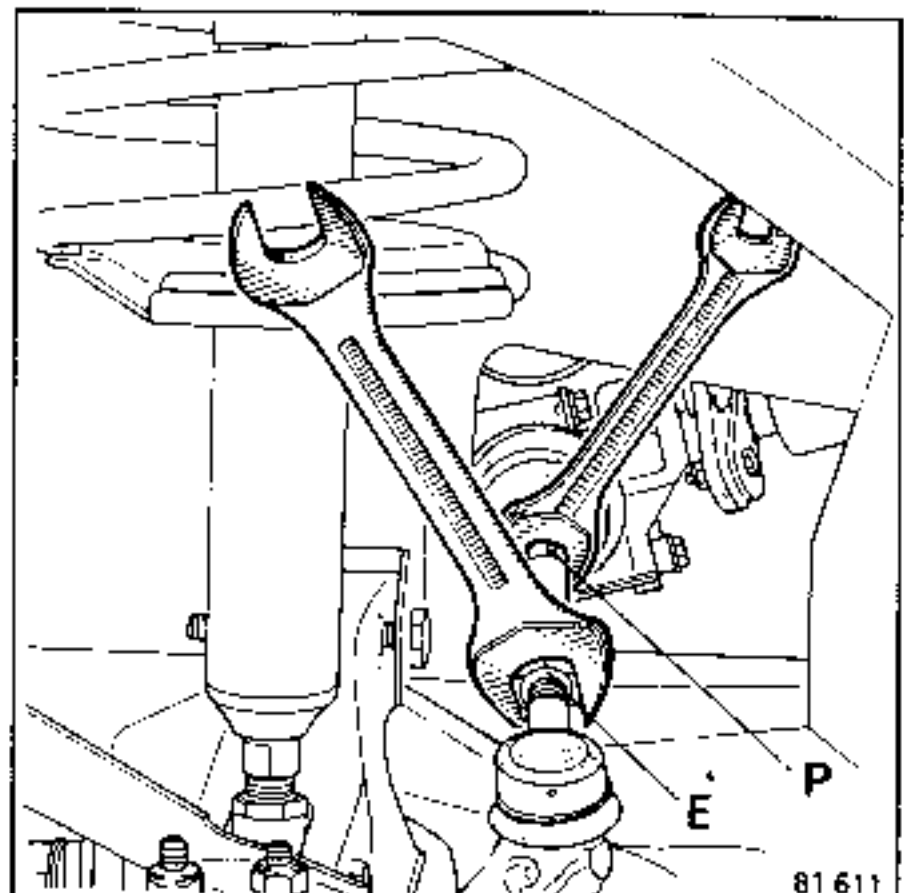
86 112

REMOVING THE BALL JOINT: Replace assembly (2) systematically. If the ball joint (1) teeth are not damaged, the joint may be reused.



83 510-1

Loosen locknut (E), holding the axial ball joint with an open end wrench at (P).



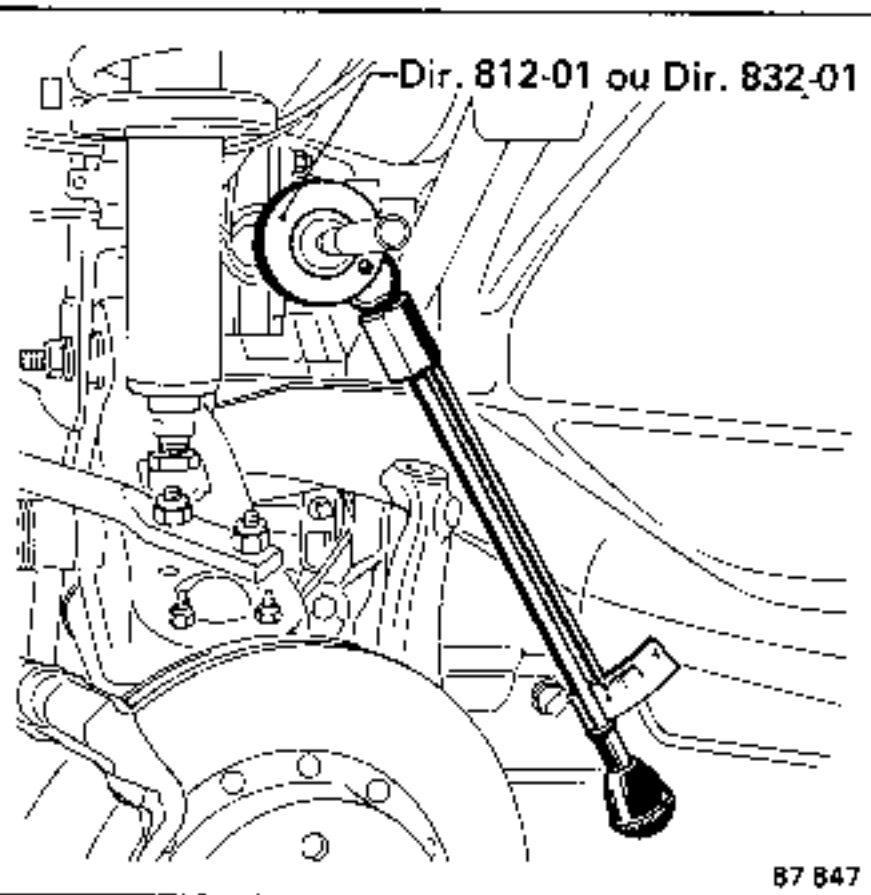
81 611

Disconnect the steering ball joint using T. Av. 476.

Remove:

- the ball joint housing, counting the number of threads engaged so that the parallelism can be pre-adjusted for refitting;
- the rack bellows.

Loosen the axial ball joint using Dir. 812-01 or Dir. 832-01, holding the stop washer (2) with a pair of vicegrips to stop the rack rotating.



NOTE:

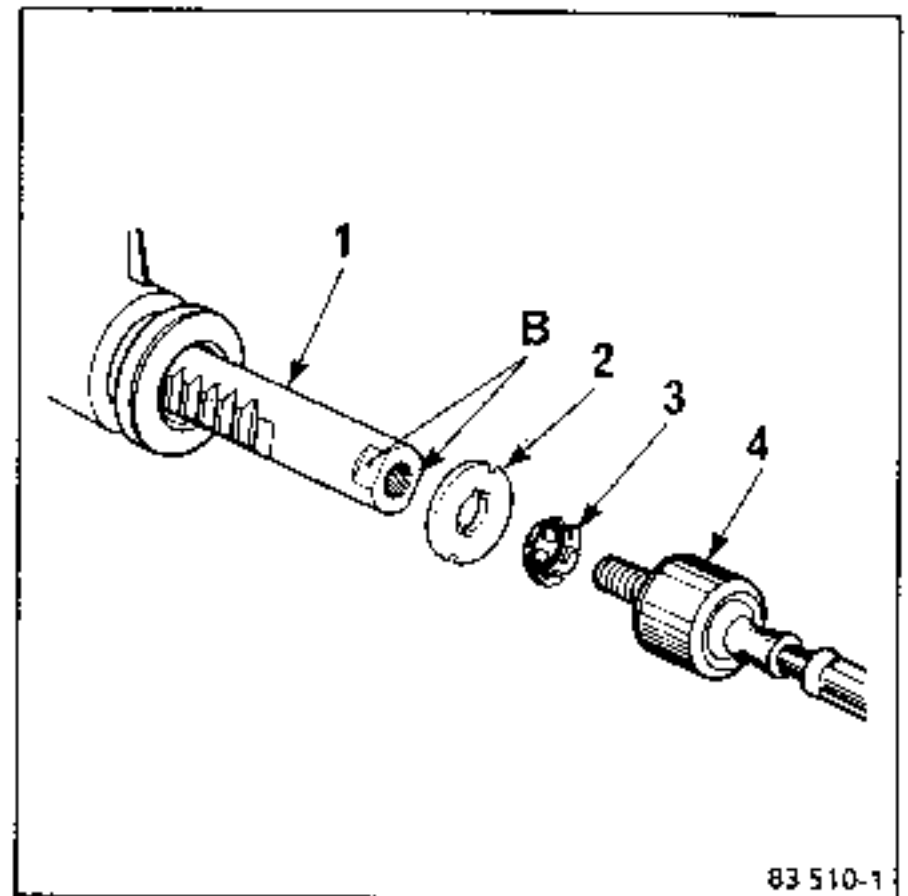
Before refitting new steering tie rods, run a 12 x 100 tap along the threads at the ends of the rack to remove any Loctite left over from the original fitting and to stop the threads seizing during refitting.

Refit to the rack (1):

- the stop washer (2);
- the lockwasher (3);
- the axial ball joint (4), having previously smeared its threads with Loctite "FRENBLOC".

NOTE:

Before tightening the ball joint using Dir. 812-01 or Dir. 832-01, check that the two lockwasher tabs (2) line up with the rack flats (B).



Refit the bellows and their clip.

Screw the ball joint back into the sleeve by the same number of turns as were counted during dismantling.

Reconnect the tie rod to the stub axle carrier.

Check and if necessary adjust the parallelism, then tighten the sleeve locknut.

ESSENTIAL SPECIAL TOOLING

Mot. 453-01	Flexible hose clamp
T. Av. 476	Ball joint extractor



TIGHTENING TORQUES (in daNm)

Steering ball joint nut	4
Steering tie rod nut	3.5
Axial ball joint	5

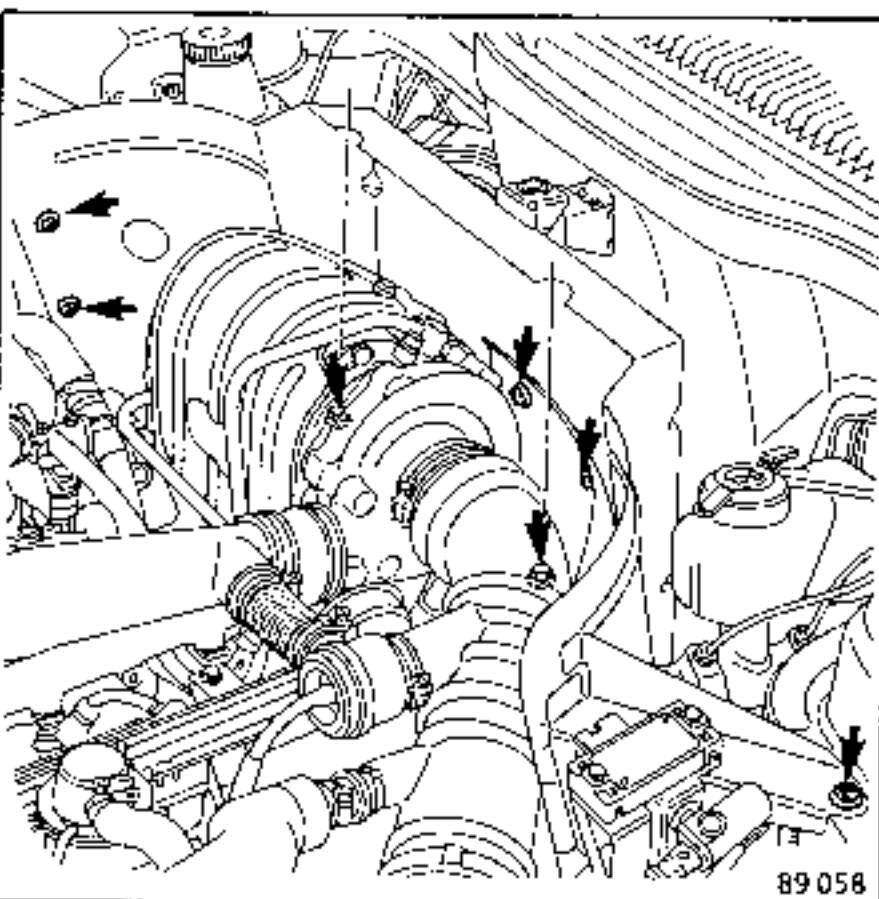
REMOVING

With the front of the vehicle on stands, remove:

- the wheels;
- the stub axle carrier steering ball joints using T.Av. 476.

B 295, B29G;

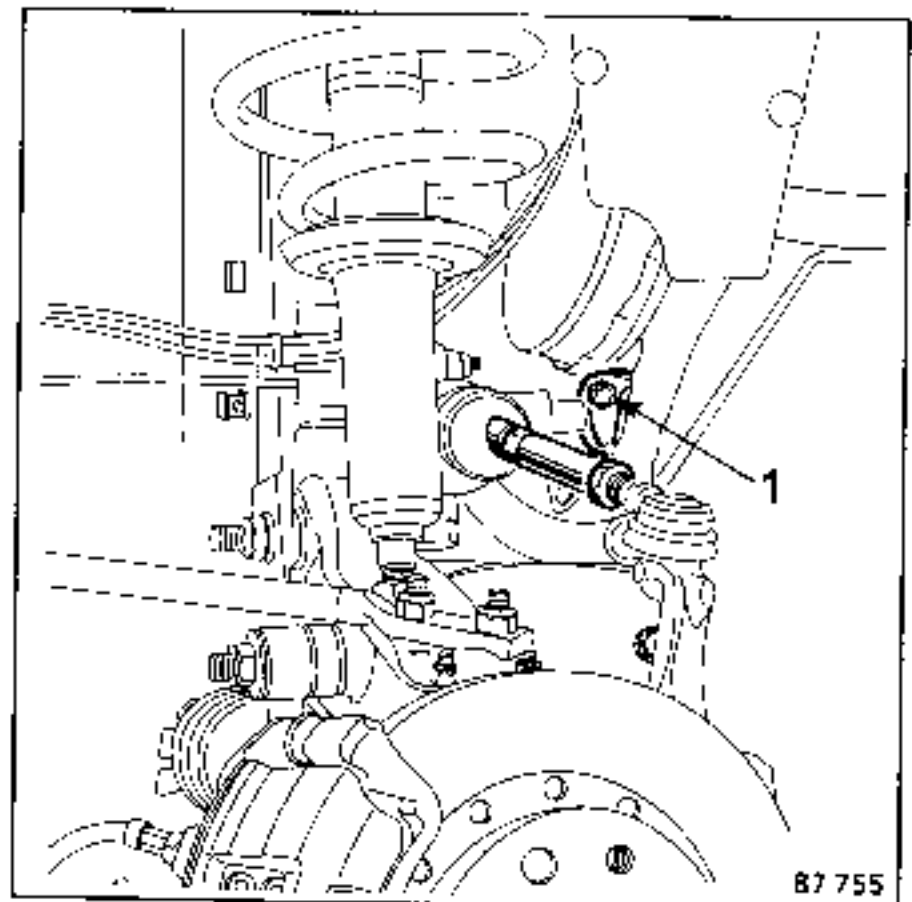
- the heat shield;
- the fixing nuts from the intermediate steering shaft heat shield.



89 058

Move the rack to the right.

Remove the key bolt (1) from the steering universal joint; disconnect the universal joint and note its position with respect to the steering pinion splines.



87 755

Power-assisted steering:

Fit clamps Mot. 453-01 to each of the hoses leading from the oil reservoir.

Remove:

The pipe bracket.

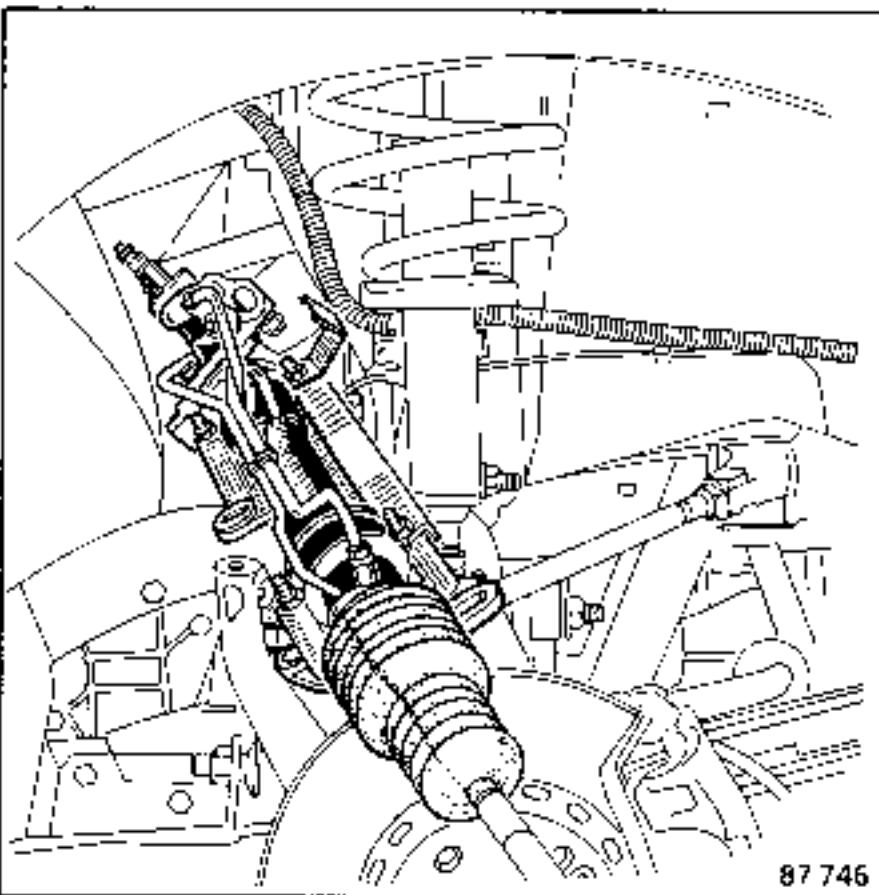
Disconnect the piping from the reservoir and from the high-pressure pump to the rotary valve. Be ready to catch the oil which will run out.

"ABS" Equipment

- the ABS hydraulic unit support bracket mountings;
- the hydraulic unit from its support bracket without disconnecting the piping;
- the four fixing bolts holding the steering box to the cross member.

Move the steering box to the rights and remove:

- the intermediate steering shaft heat shield;
- the box assembly, plus the tie rods through the hole in the right-hand scuttle side, raising the ABS hydraulic unit and its support bracket.

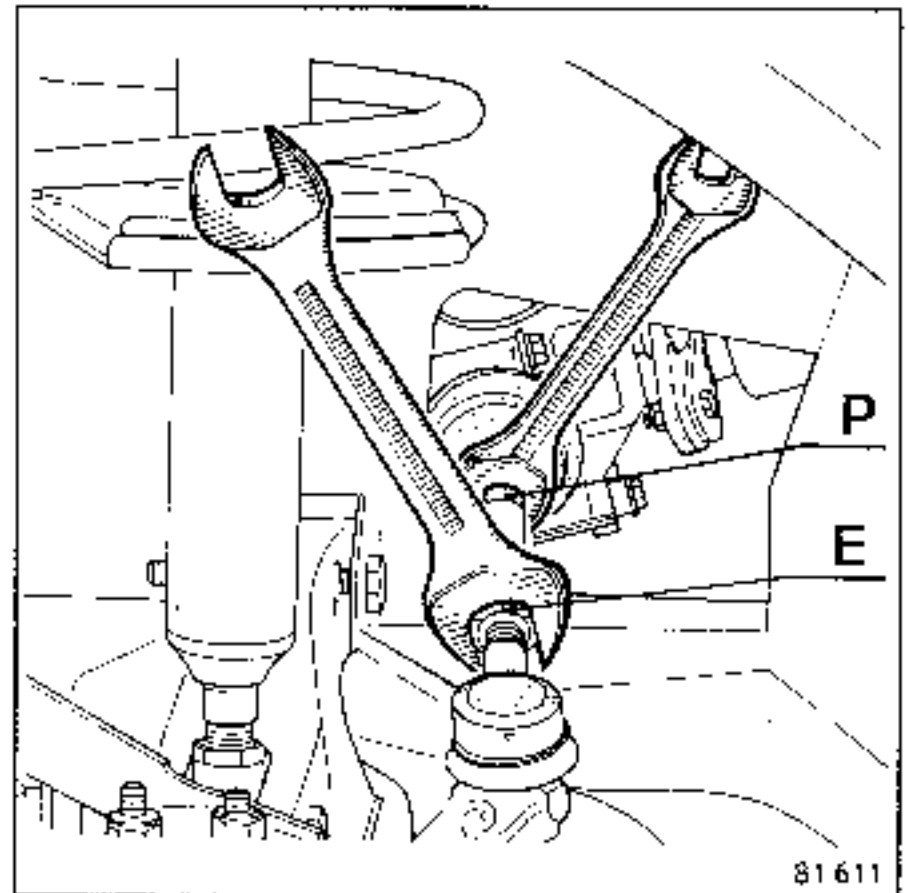


Never unscrew the rack axial ball joints except to replace them.

If the steering box is being replaced, the ball joint housings on the stub axle carrier end will have to be retained.

In order to do this:

- Loosen locknut (E), holding the axial ball joint with an open end wrench at (P);
- Unscrew the ball joint housings, counting the number of threads engaged.



REFITTING

ATTENTION: When handling:

- do not hold the steering assembly by the bellows;
- do not carry the steering assembly by the piping;
- do not jolt the support bracket at the tube end;
- do not jolt the tie rods.

Proceed as for removing, but in reverse order.

If a new steering box is being fitted, fit the ball joint housings in the position noted during dismantling.

NOTE:

If it is impossible to fit the steering universal joint, disconnect the collapsible steering wheel shaft.

Bleed the power-assisted steering circuit (see section on "Power-assisted steering pump").

Check and adjust the parallelism, then secure the locknut to torque 3.5 daNm.

REMOVING

Remove the plastic clips on the bulkhead and push the rubber (3) towards the vehicle's passenger compartment.

Remove the plastic trim under the steering column.

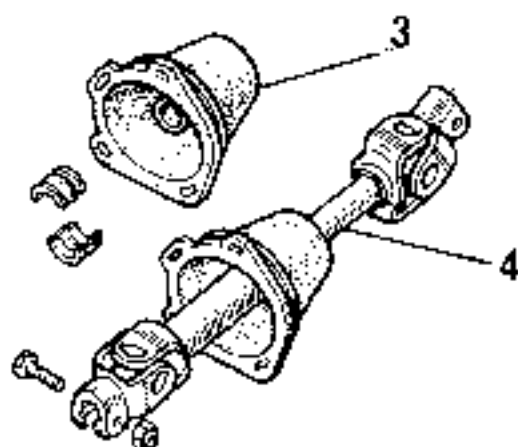
Uncouple the intermediate shaft (4) and free it from its aperture in the bulkhead.

Remove the pipes from the rotary valve and the jack.

Under the vehicle, loosen the steering plunger adjusting nut (1) without removing it.

Remove the two valve fixing bolts.

Remove the valve from the housing (fitted quite tightly).



83 989

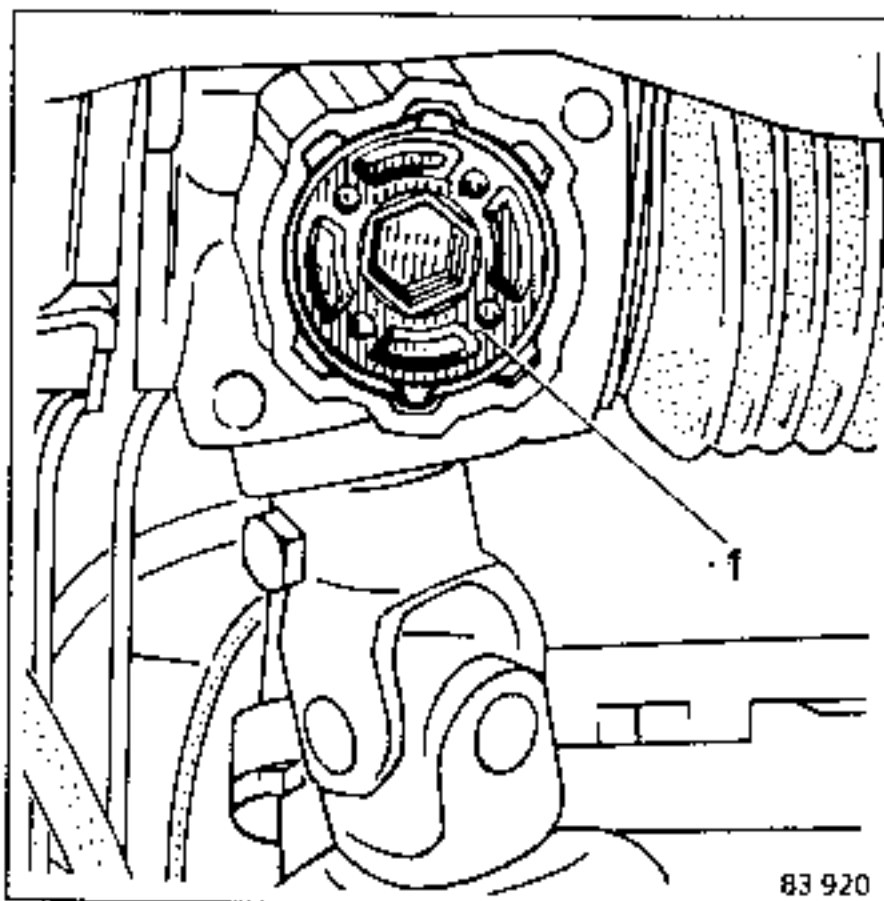
REFITTING

Remove as much grease as possible from the housing.

Fit a new valve after having smeared the pinion and the rack with **Molykote BR2** grease.

Reconnect the intermediate steering shaft to the valve and reattach the rubber (3).

Adjust the plunger clearance (see next page).



83 920

This operation is carried out on the vehicle

ADJUSTMENT

If the plunger is rattling, before replacing the steering box, it is essential to make sure that the plunger is correctly adjusted.

Place the vehicle on a hydraulic lift with the wheels free and remove the wheels.

1. Identifying the rattle

Hold the rack bar by the plunger end and check the side play. Play followed by a rattle indicates that the damper is loose.

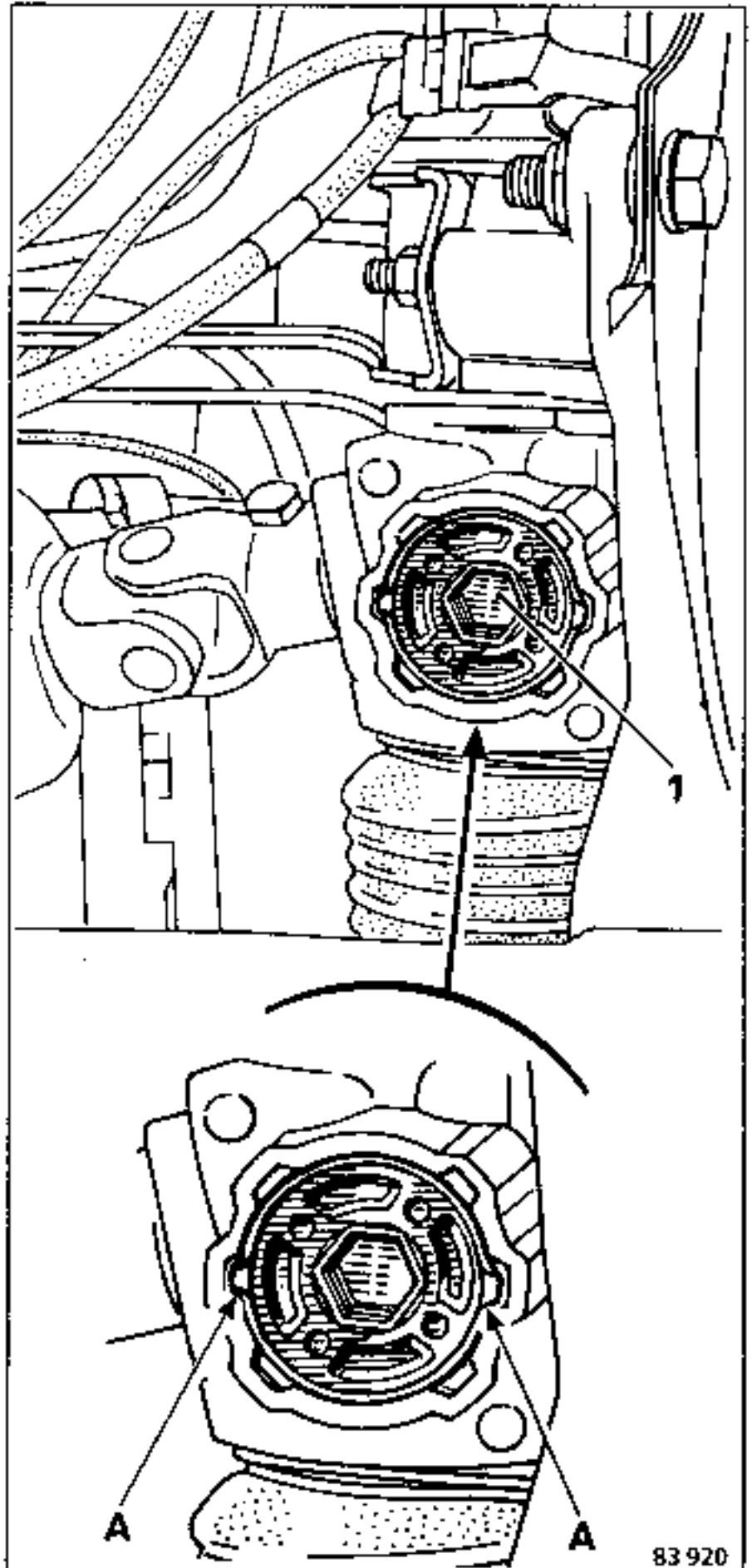
2. Adjustment

Unlock the adjusting nut (1) by pushing back the nut collar lock tabs (A).

Tighten the adjusting nut by two notches using a 10 mm male hexagon key and check that the clearance has disappeared.

Maximum permitted adjustment: 3 notches.

Relock the nut using two opposing recesses in the housing by turning down the nut collar.



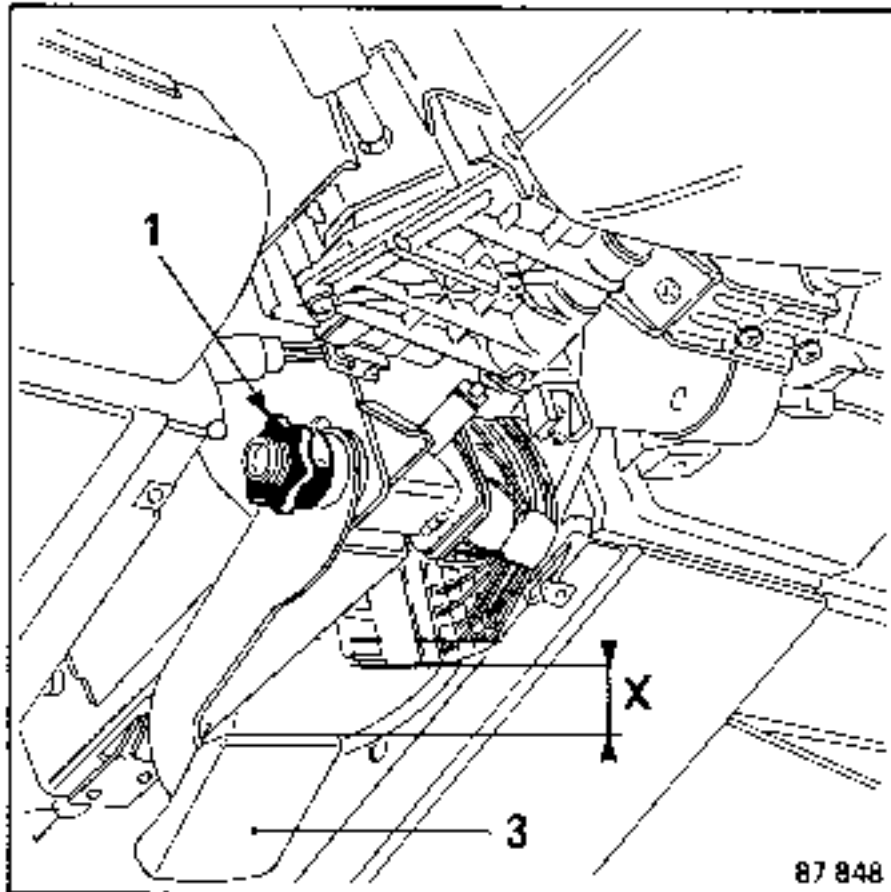
A locking lever under the steering column enables the height of the steering wheel to be adjusted to suit the driver. In some cases, it will be necessary to adjust the degree of tightness.

ADJUSTING THE DEGREE OF TIGHTNESS

Remove:

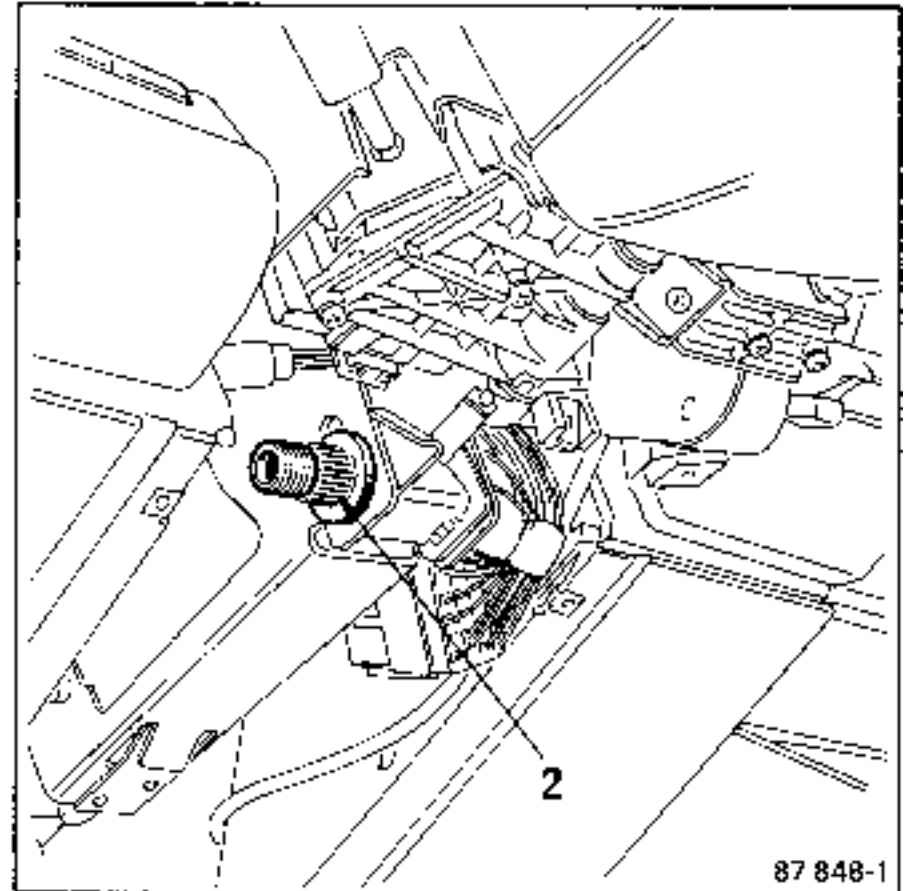
- the lower steering wheel half-casing;
- the lower protective cover.

Loosen the lever locking nut (1).



Lower the steering wheel shaft to its low position.

Lock the column by tightening nut (2) using the locking lever (3).

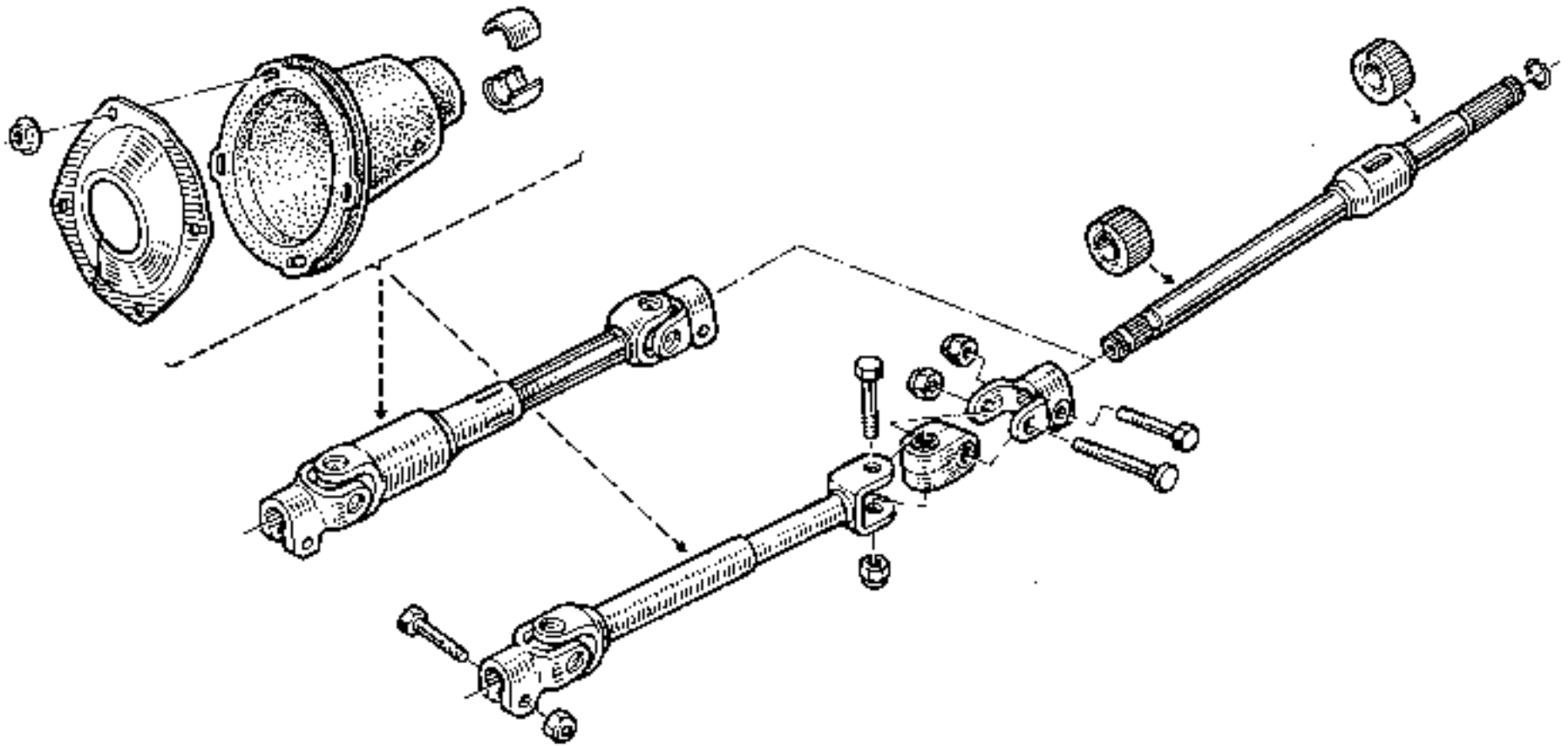


Position the locking lever (3) so that $X = 30$ mm from the steering support bracket.

Refit:

- the nut (1);
- the lower cover;
- the lower steering wheel half-casing.

Check that the lever is accessible; if not, increase or decrease the distance by 10 mm.



TIGHTENING TORQUES (in daNm)

Steering wheel bolts	1.5
----------------------	-----

Remove:

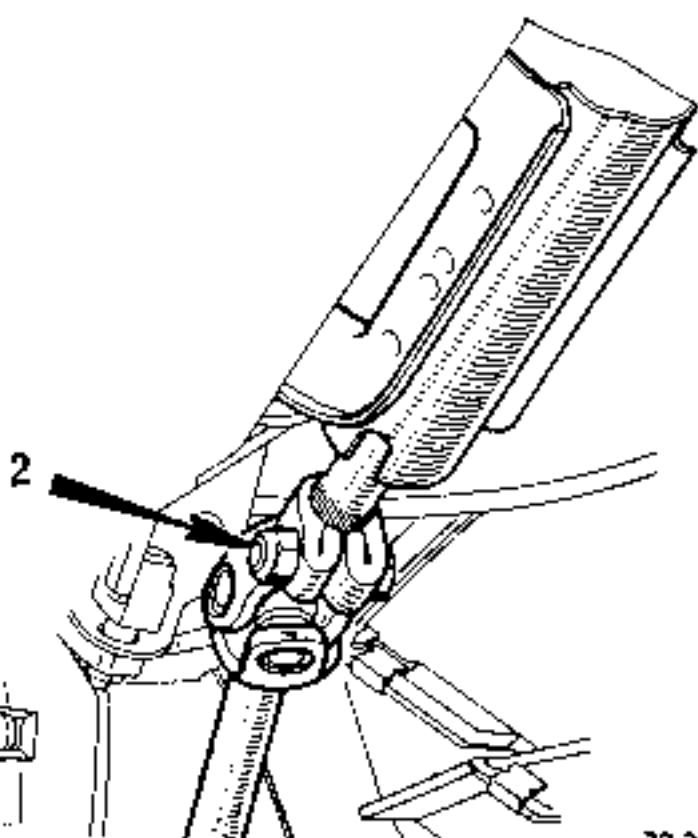
- the lower protective cover;
- the key bolt (2).

Manual steering:

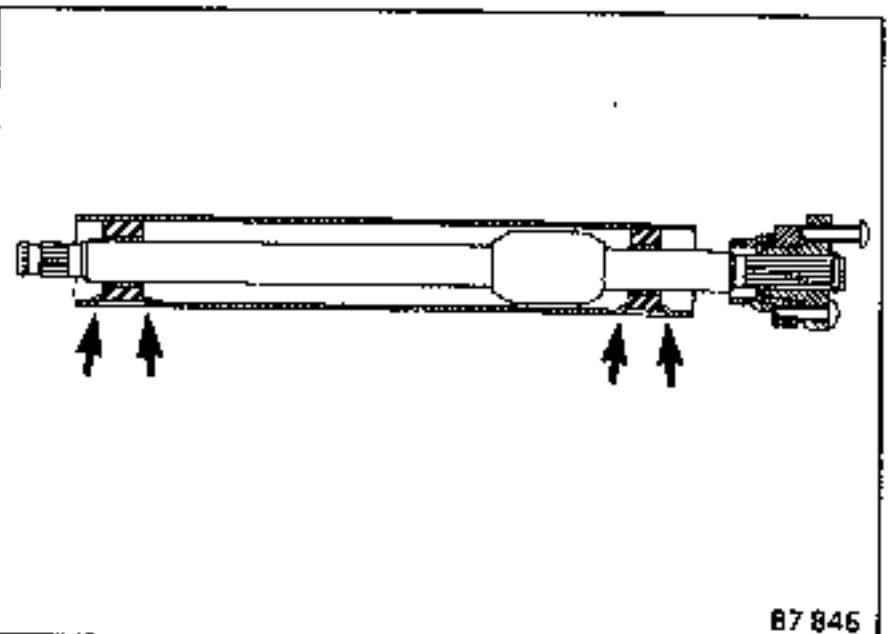
- the steering universal joint.

Pull the steering wheel to free the shaft and the upper bush (make sure that the steering anti-theft switch has been unlocked).

Push out the lower bush using a tube, external diameter 35 mm.



79 296-1



87 846

REFITTING

Fit the new lower bush using a tube, external diameter 35 mm, after having smeared it with grease.

Uncouple the steering wheel from the shaft.

Fit the steering wheel shaft, insert it in the universal joint and refit the key bolt (2).

Insert the new upper bush using a tube, external diameter 35 mm, after having smeared it with grease.

Refit:

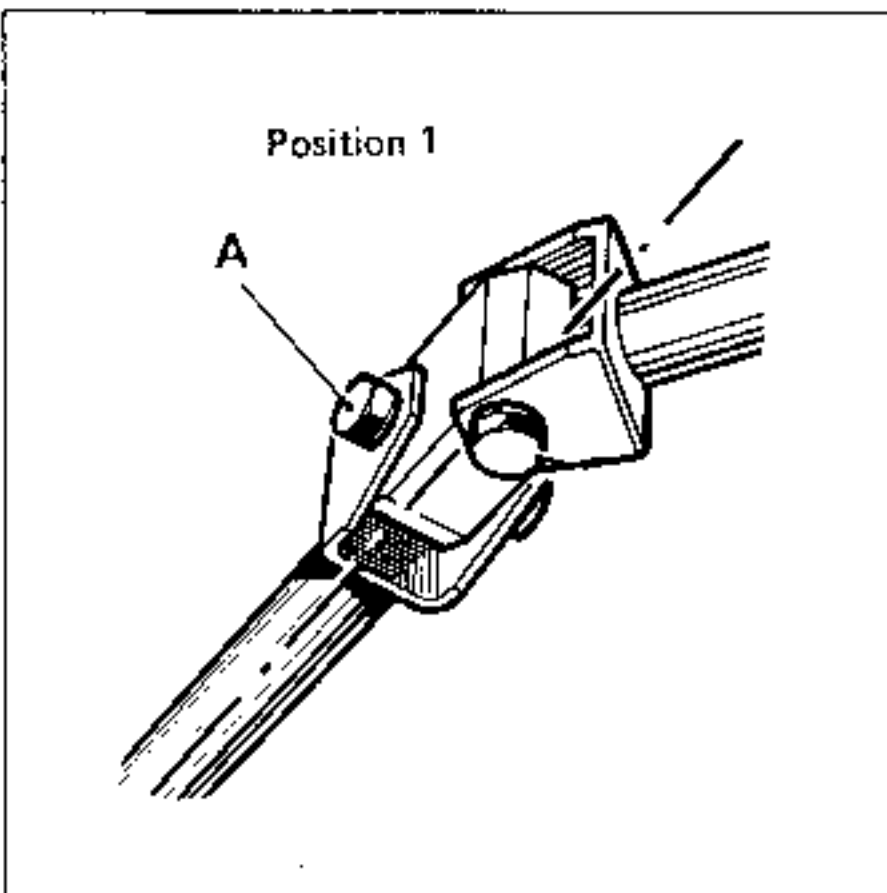
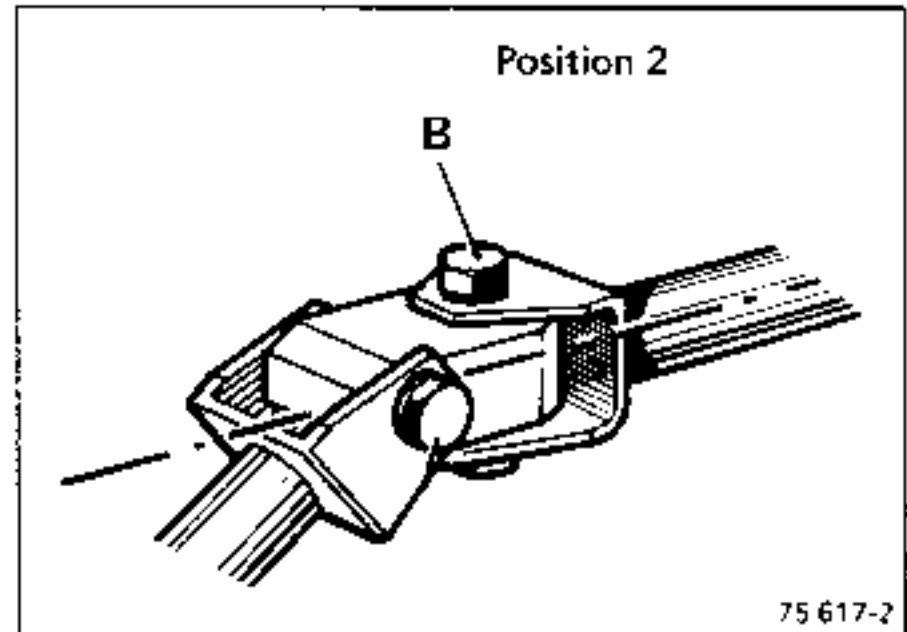
- the steering wheel and tighten the fixing bolts to the specified torque;
- the lower protective cover

Tightening the universal joint:

Each bolt (A and B) must be tightened when the corresponding end is in line (as shown) :

- turn the shaft to position (1) and tighten bolt (A).

- Turn the steering wheel a quarter of a turn to the right or to the left until it is in position (2) and tighten the bolt (B).



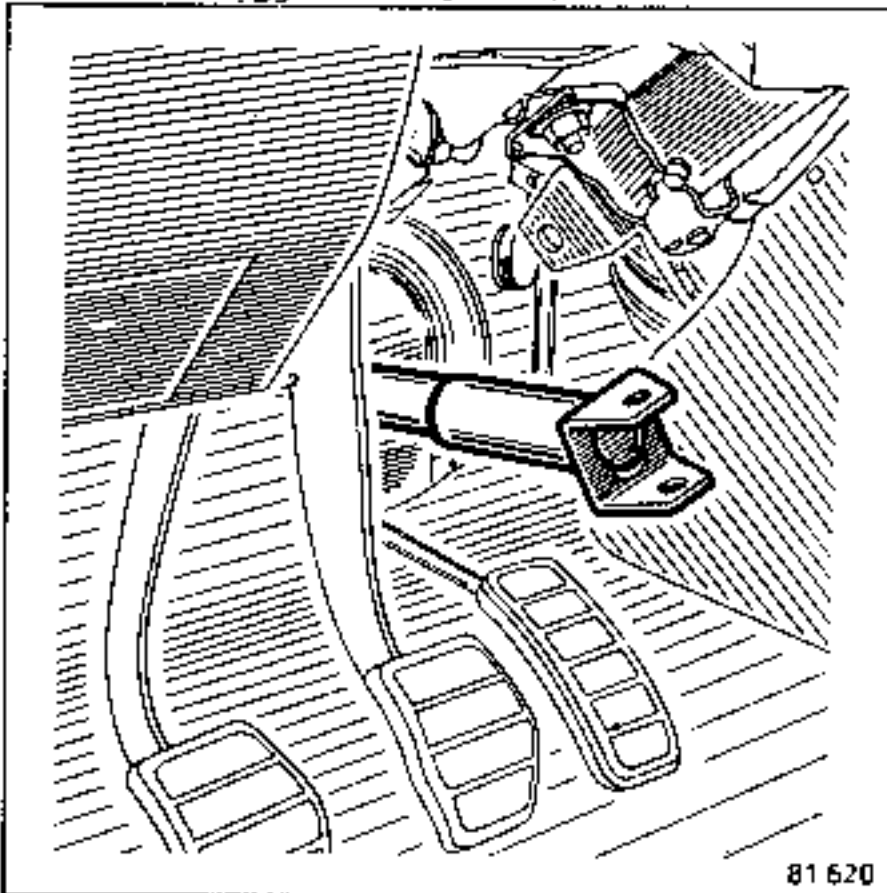
REMOVING

Remove the plastic clips from the bulkhead and push back the rubber towards the vehicle's passenger compartment.

Manual steering:

Remove:

- the universal joint;
- the steering pinion key bolt ;

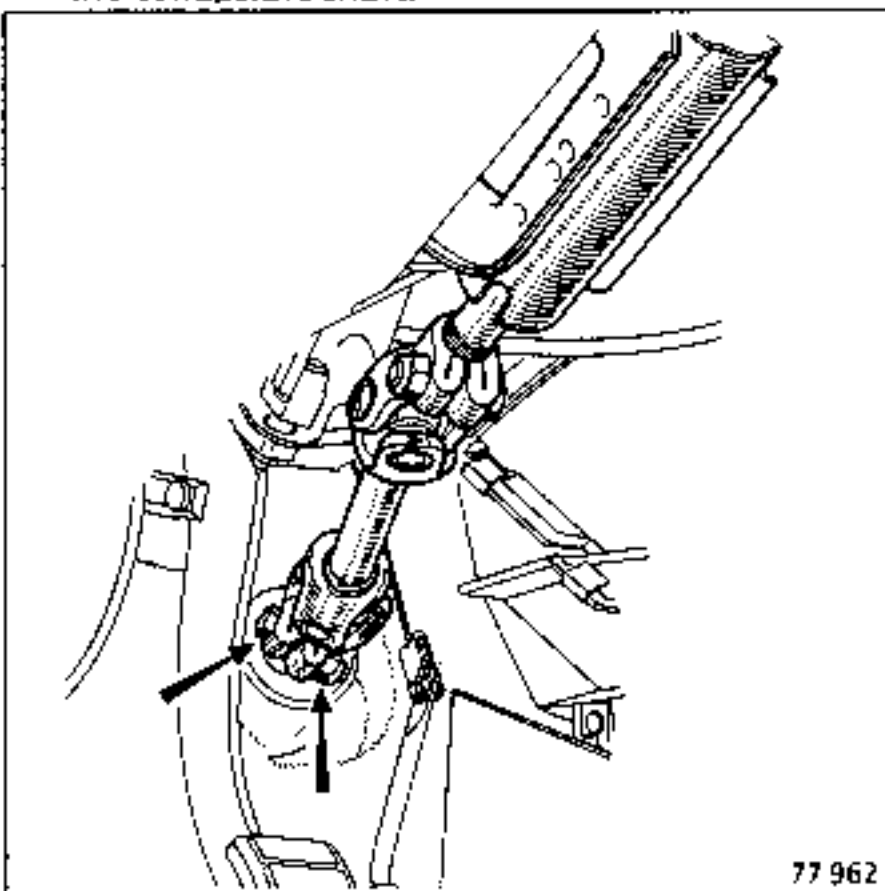


- the collapsible shaft.

Power-assisted steering:

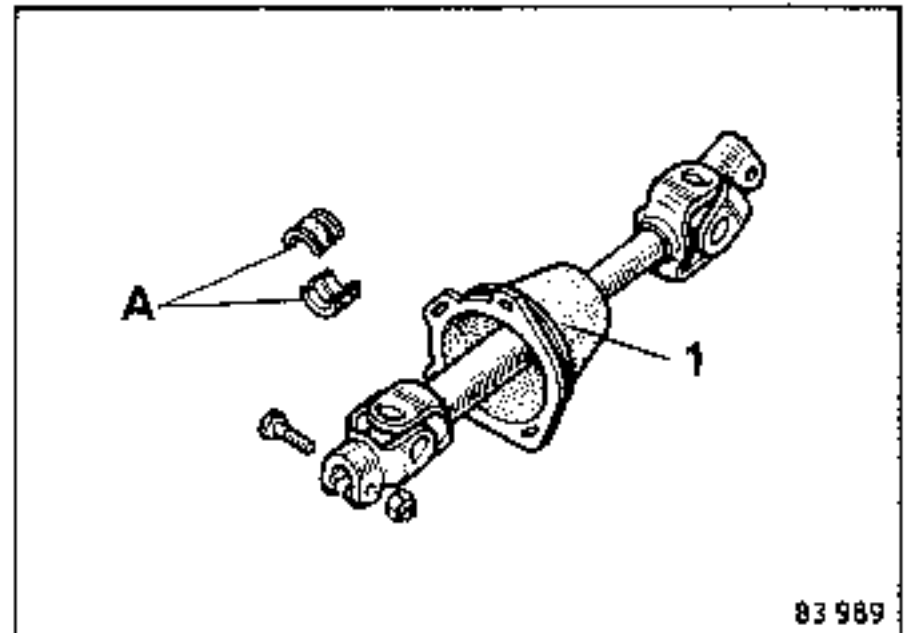
Remove:

- both fixing key bolts;
- the collapsible shaft.



REFITTING

If necessary, fit the rubber (1) on the shaft.



Fit the assembly to the vehicle.

Power-assisted steering:

Couple the key bolt to the steering pinion and the steering shaft.

Manual steering:

Couple the key bolt to the steering pinion.

Fit the universal joint and tighten (see previous page, "Tightening the universal joint").

All types

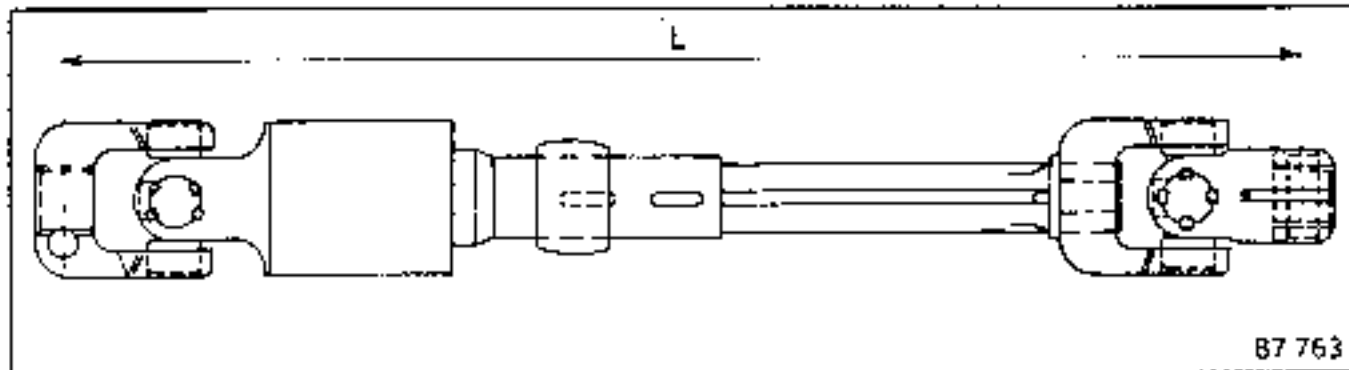
Position the rubber (1) over the spherical sleeve of the shaft and insert the two plastic half-bushes (A).

CHECKING

If it is impossible to fully engage the splines, check that the shaft length is correct; if not, replace it.

Power-assisted steering:

$L = 341 \pm 1 \text{ mm}$

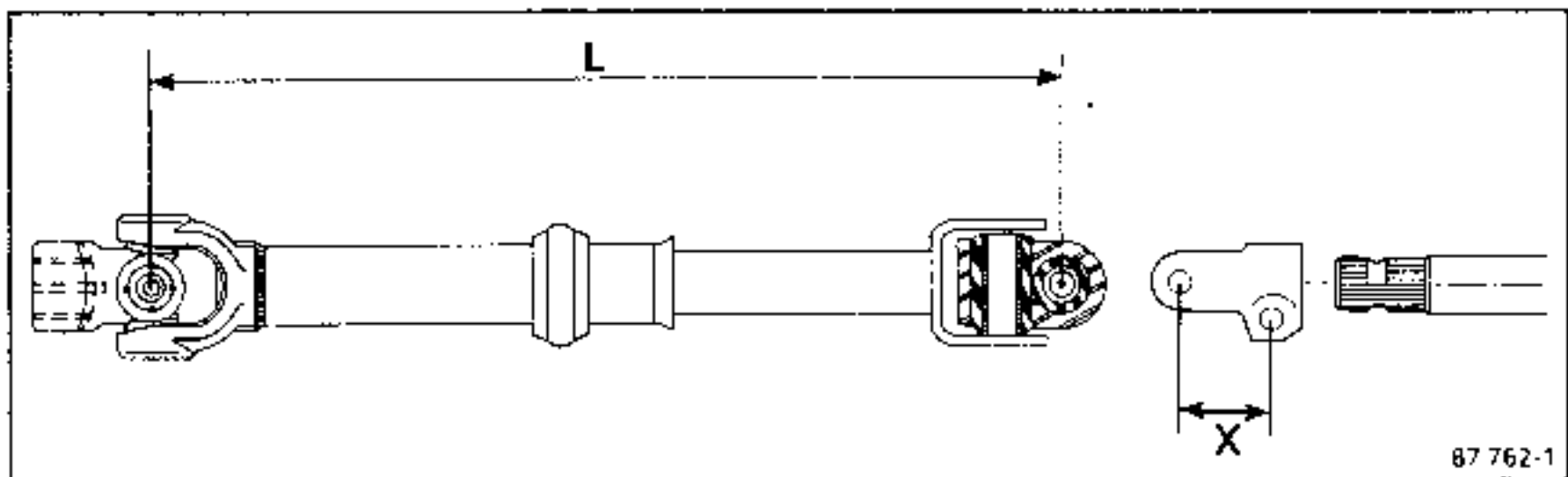


Manual steering

First assembly

$L = 303 \pm 1 \text{ mm}$

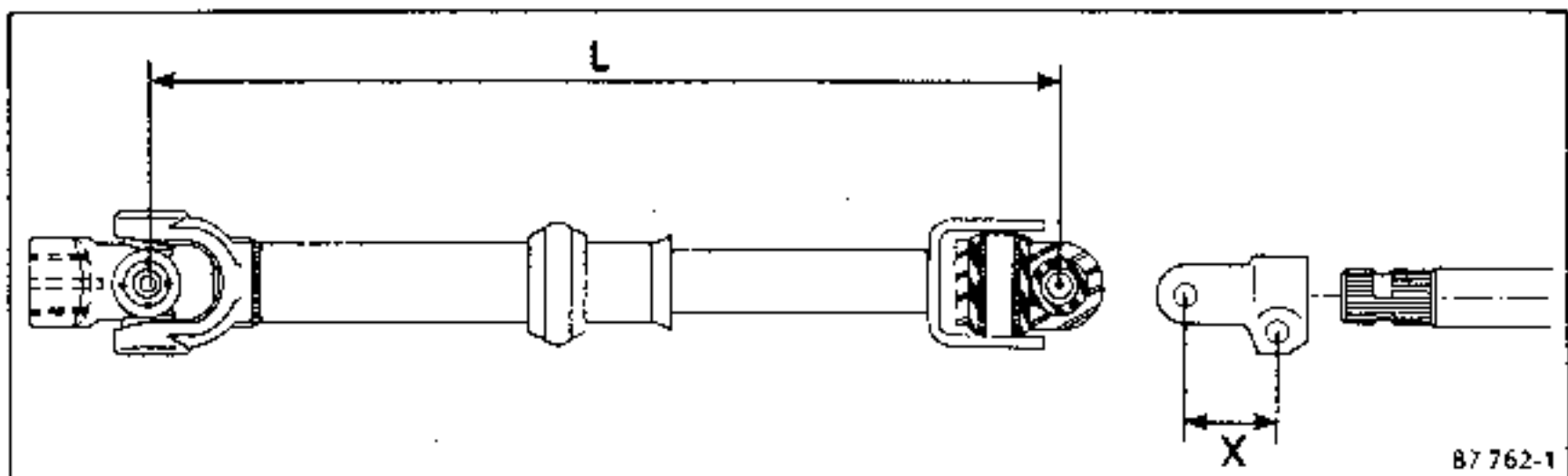
$X = 33 \text{ mm}$



Second assembly

$L = 306 \pm 1 \text{ mm}$

$X = 33 \text{ mm}$



NOTE: The 1st and 2nd assembly methods must not be combined.

TIGHTENING TORQUES (in daNm)



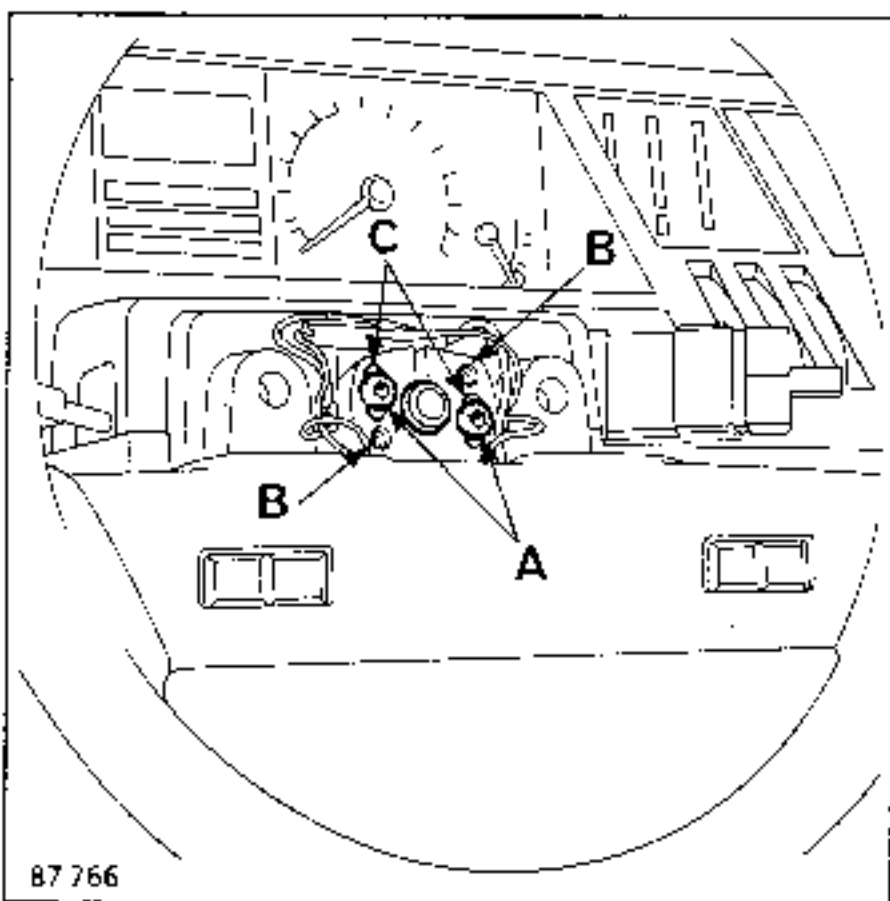
Steering wheel bolt

1.5

REMOVING

Remove:

- the plastic embellisher in the centre of the steering wheel;
- the two bolts (A) using a Torx T30 screwdriver (e.g. Facom 89/30);
- the steering wheel shaft clip.



Fit the two bolts (A) in the threaded holes (B) and tighten them to extract the mounting bracket.

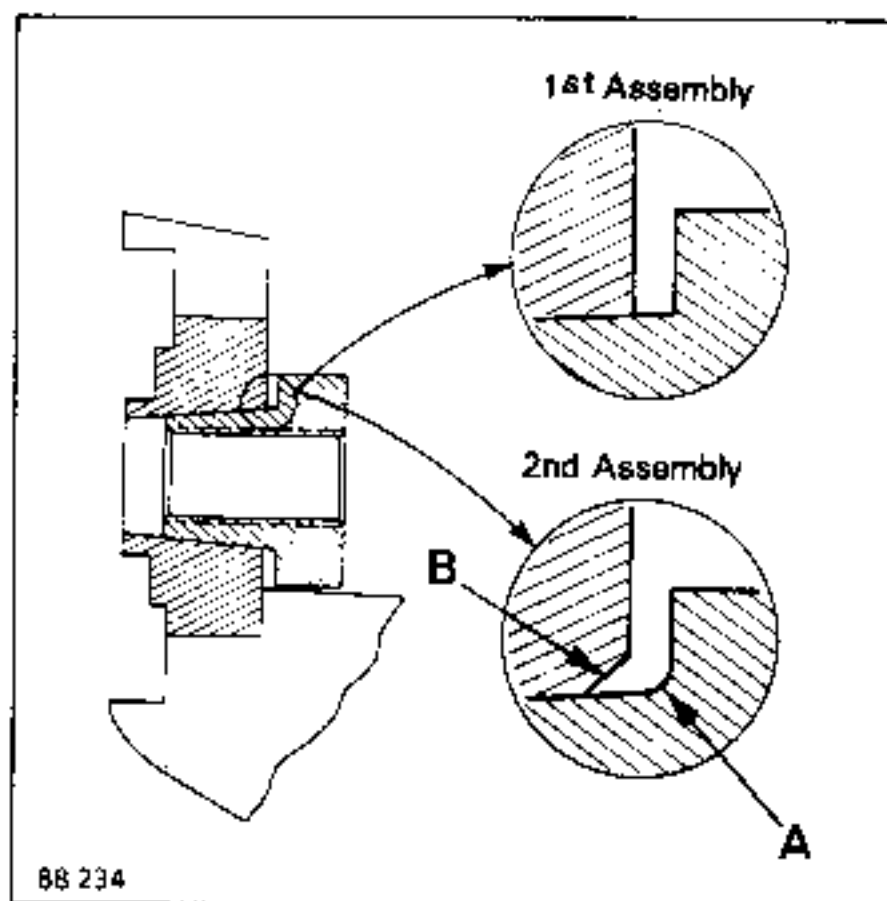
Remove the steering wheel, noting the position of the bush with respect to the shaft.

REFITTING

Fit the steering wheel on its shaft, position it flush with the clip in line with the position marked during dismantling.

Complete the adjustment using the oblong slots (C).

FLEXIBLE STEERING WHEEL CONES: Development



As the result of a material change, the MPR only delivers 2nd type flexible cones.

This cone has a fillet A and must be fitted to a steering wheel with a groove B.

If only the cone is being replaced on a 1st phase?? steering wheel, a 1.5 mm groove will have to be made at 45°.

This can be done using a NEWAY cutter, part no. 100, used for machining valve seats.



TIGHTENING TORQUES (in daNm)

M 10 x 100	1.3
M 12 x 100	1.3
Brake servo fixing bolt	1.3

REMOVING

Drain the brake fluid reservoir and remove it by pulling upwards.

Remove the pipes and note their position.

Remove the two brake servo fixing nuts.

REFITTING

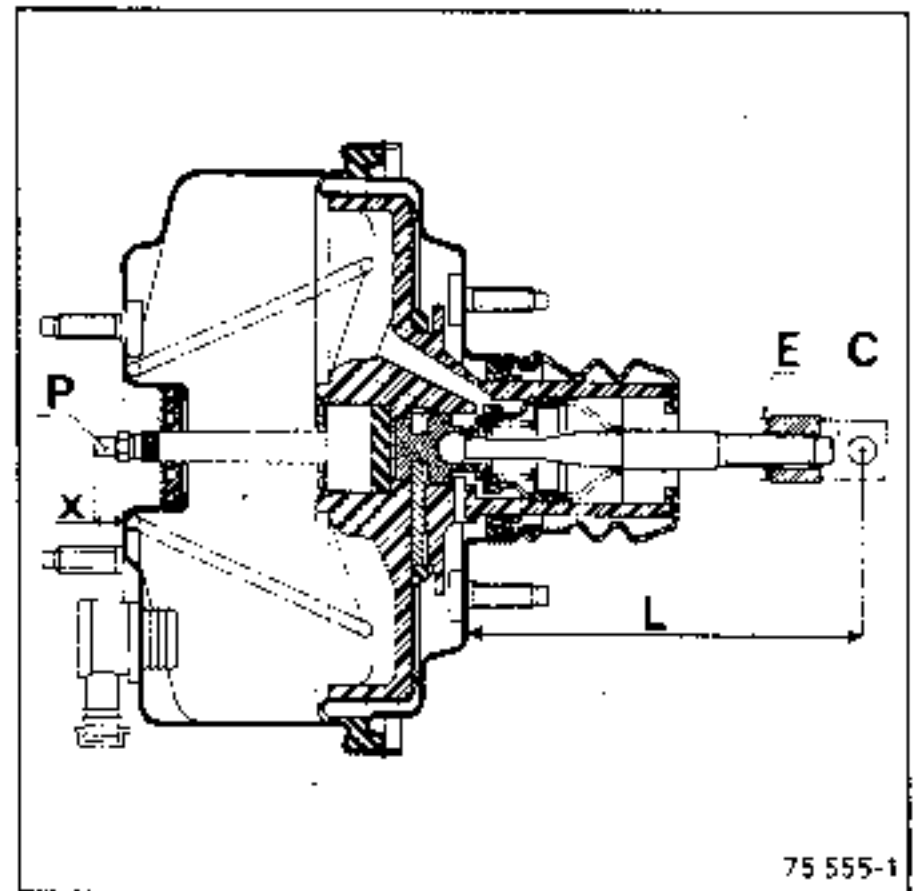
Check the length of the pushrod
 $X = 9 \text{ mm}$

Reconnect:

- the pipes in the correct position;
- the brake fluid reservoir, pressing it down until it clicks into place in the master cylinder.

Bleed the braking circuit.

Check that distance $L = 128.5 \text{ mm}$.





TIGHTENING TORQUES (in daNm)

Master cylinder to brake servo	1.3
Brake servo to bulkhead	2

The brake servo cannot be repaired.
The only operations permitted are on:

- the air filter;
- the check valve.

REMOVING

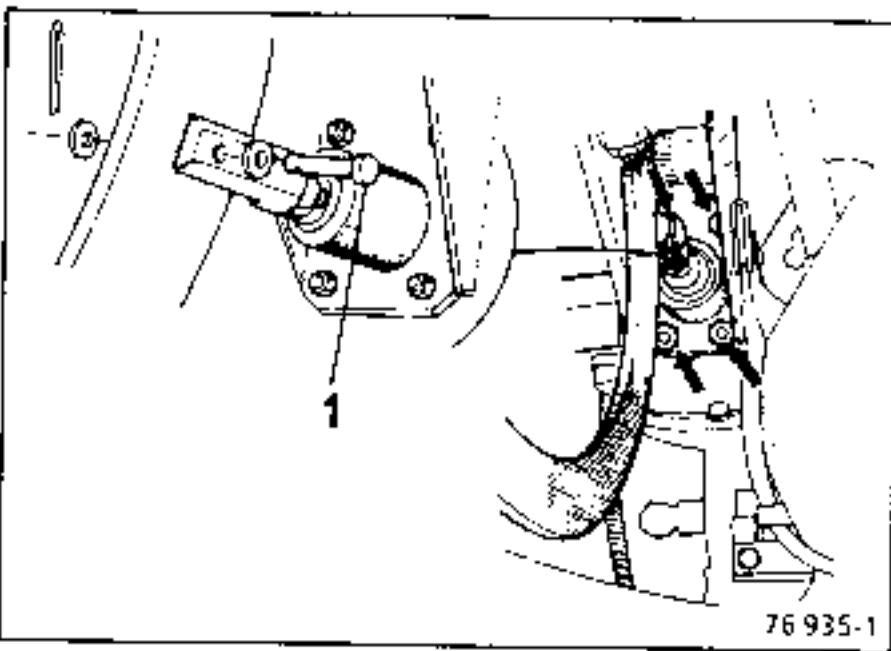
Disconnect the battery.

Remove the master cylinder

Disconnect the flexible vacuum hose from the brake servo.

Withdraw the clevis pin (1) linking the brake pedal to the pushrod.

Unscrew the brake servo fixing nuts.



REFITTING

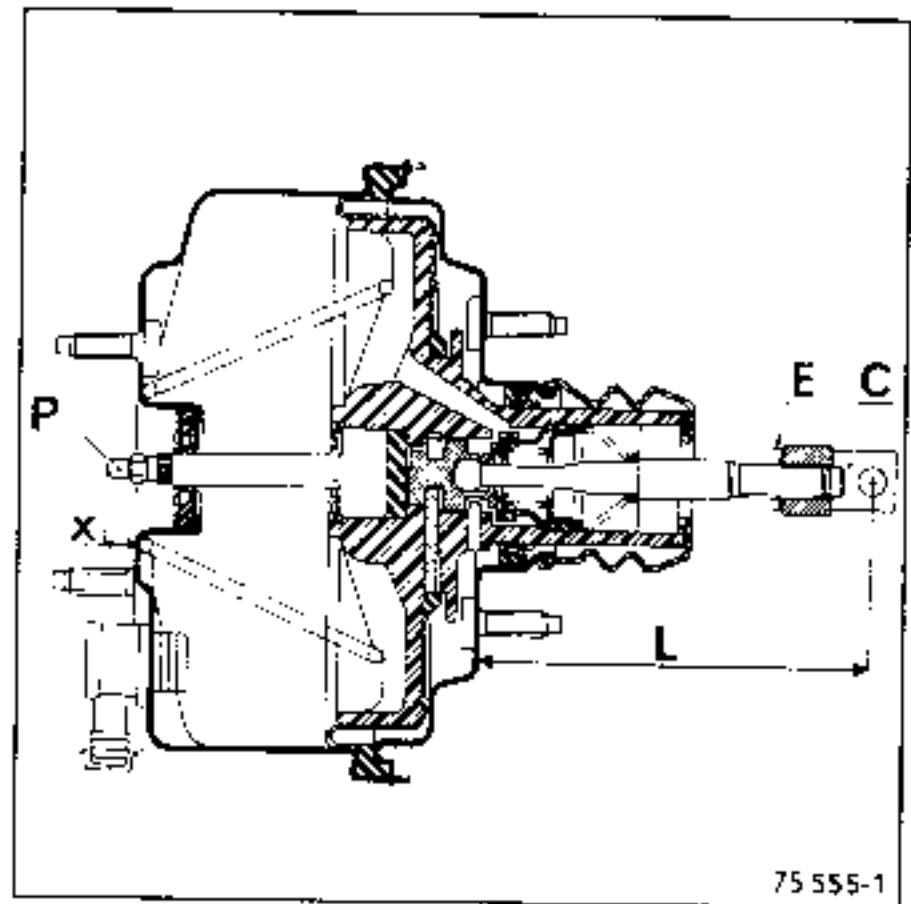
Before refitting the brake servo, check:

- distances:

$X = 9 \text{ mm}$
adjustable by rod (P)

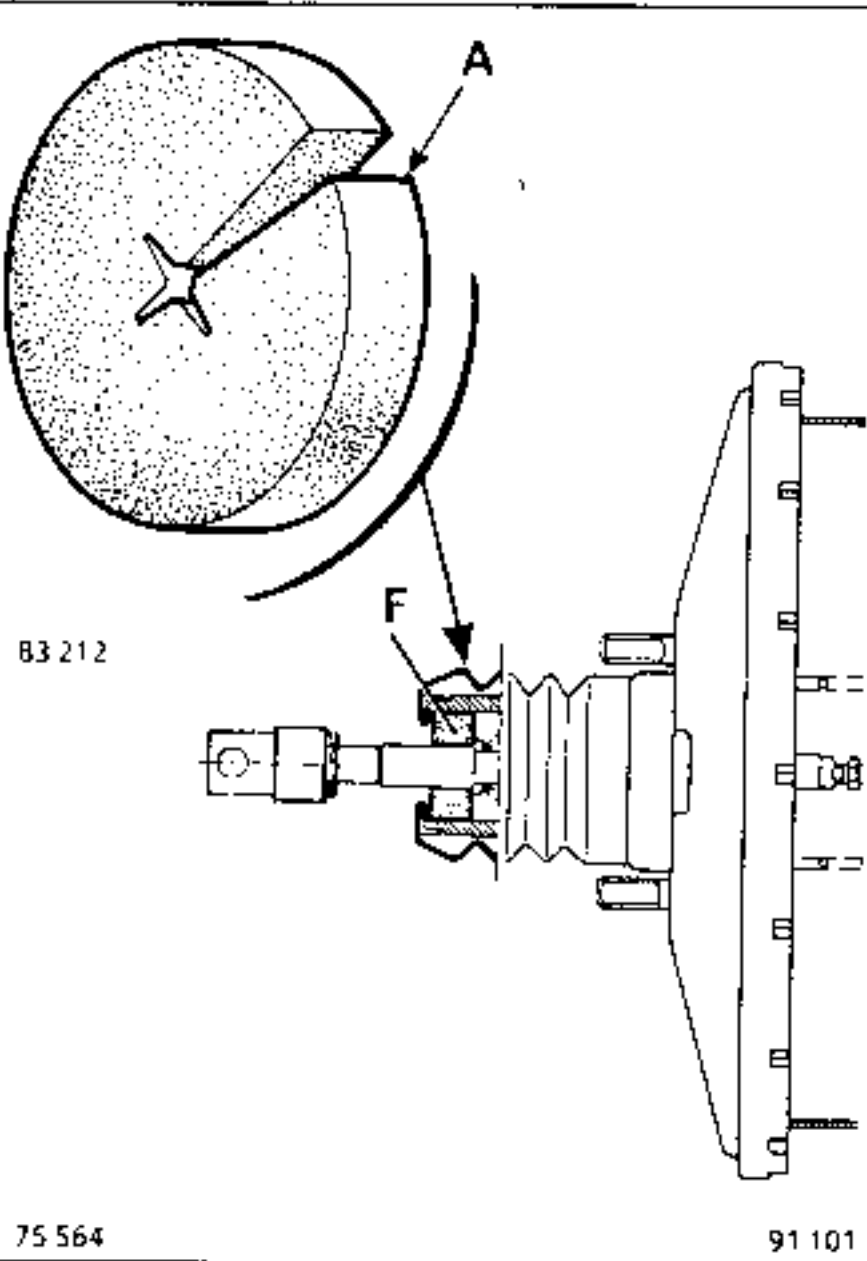
$L = 128.5 \text{ mm}$
adjustable by rod (C)

Bleed the braking circuit.





REPLACING THE AIR FILTER



It is not necessary to remove the brake servo in order to replace the air filter (F).

Extract the used filter (F) from under the brake pedal, using a screwdriver or a metal hook.

Cut the new filter at (A) (see diagram) and fit it around the rod. Then push it into its location, taking care to spread it around the entire bore to prevent unfiltered air entering the unit.

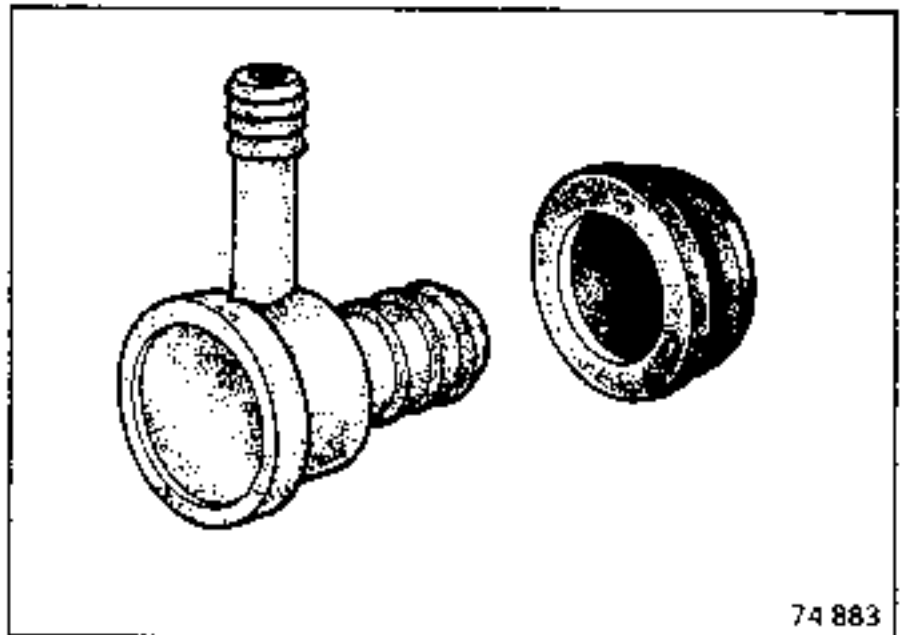
REPLACING THE CHECK VALVE

This operation may be performed on the vehicle.

REMOVING

Disconnect the vacuum inlet pipe from the brake servo.

Pull and turn check valve to free it from the rubber sealing washer.



REFITTING

Check the condition of the sealing washer and the check valve.

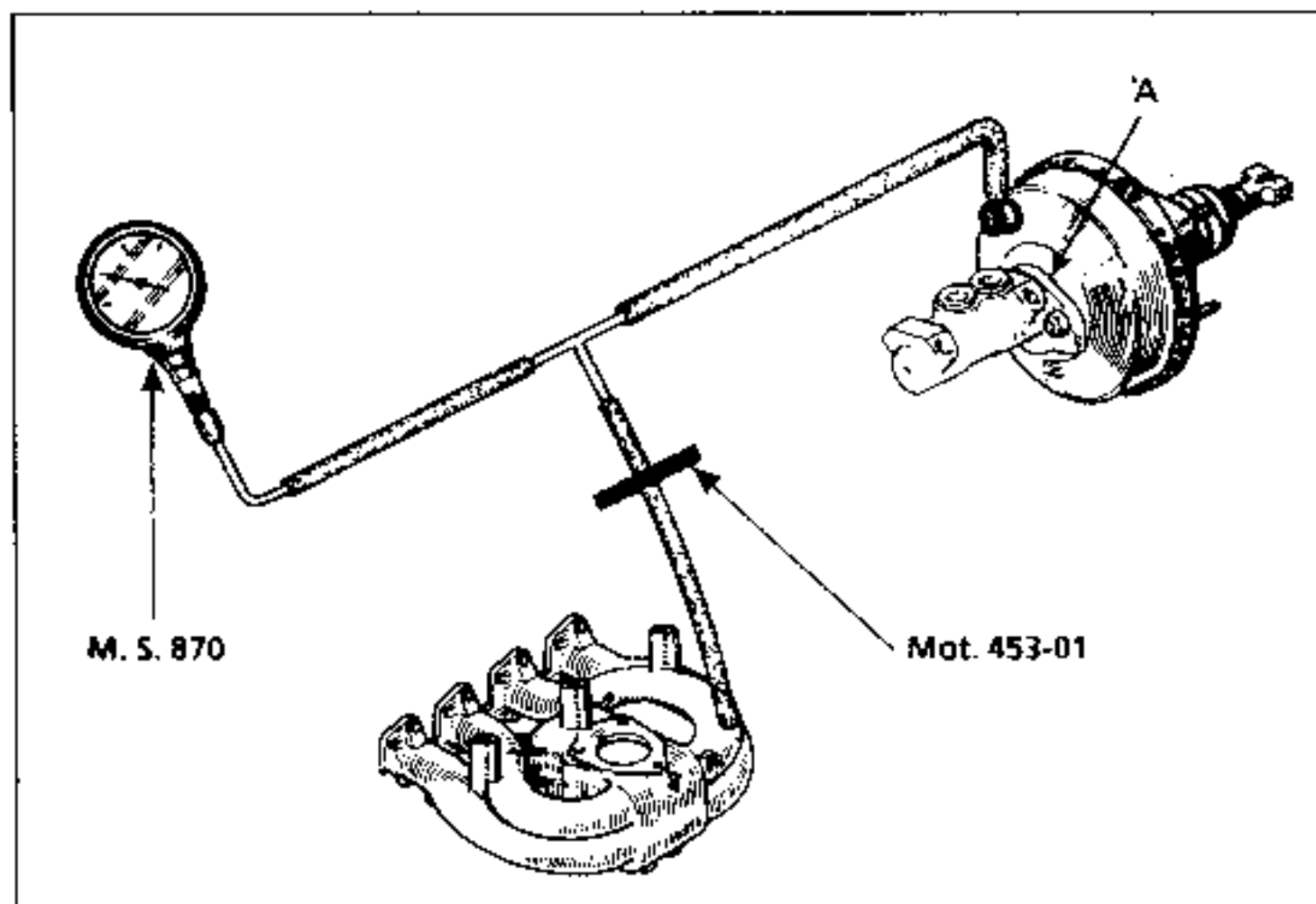
Replace any faulty parts.

Refit the assembly.

ESSENTIAL SPECIAL TOOLING		
Mot.	453-01	Hose clamp
M.S.	870	Vacuum test gauge

CHECKING THE SEALING

When checking the brake servo sealing, make sure that there is perfect sealing between the brake servo and the master cylinder. If there is a leak at this level, replace the seal (A).



The brake servo sealing must be checked on the vehicle with the hydraulic circuit functioning correctly.

Connect the vacuum test gauge M.S. 870 between the brake servo and the vacuum source (inlet manifold) using a "T" junction and as short a tube as possible.

Allow the engine to idle for one minute.

Clamp the tube (using Mot. 453-01) between the "T" junction and the vacuum source.

Stop the engine.

If the vacuum drops by more than 33 mbar (25 mm/hg) in 15 seconds, there is a leak which may be either:

- in the check valve (replace it), or;
- in the pushrod diaphragm (in this case, replace the brake servo).

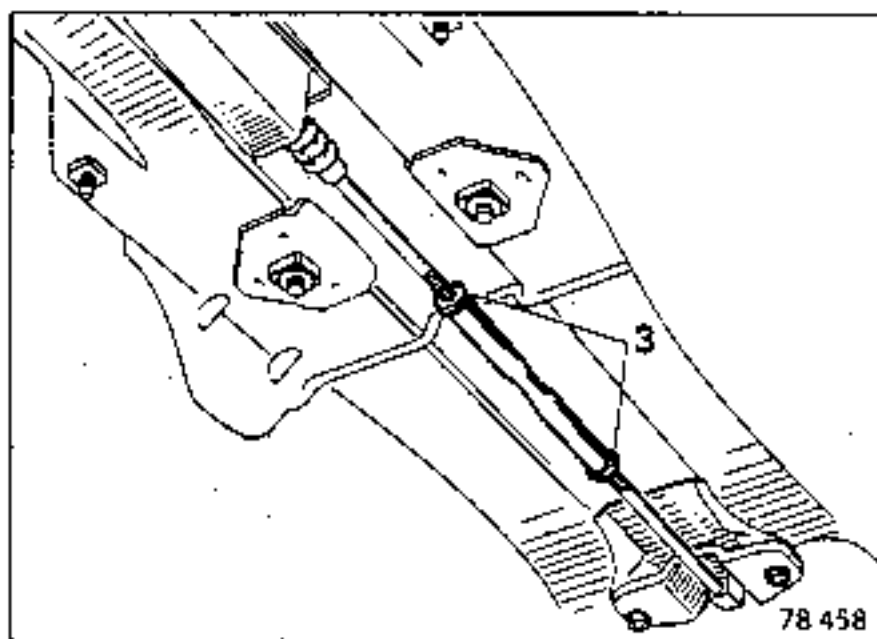
If the brake servo is not working, the braking system works but the effort required at the pedal to produce deceleration equivalent to servo-assisted braking is much greater.

REMOVING

Under the vehicle:

Remove the centre protective cover.

Disconnect the sleeve, after having unscrewed the adjusting nuts (3).

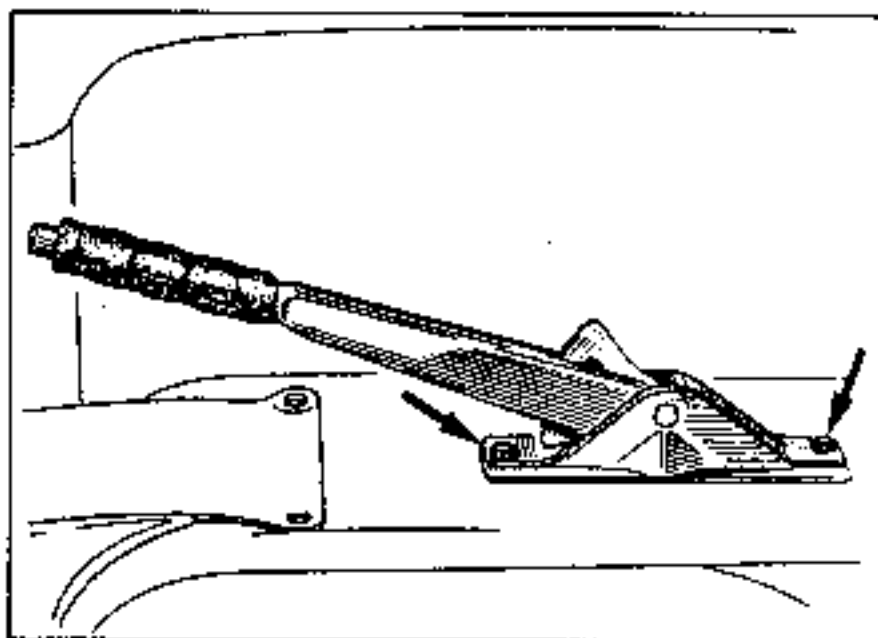


In the vehicle:

Remove:

- the centre console (see electrical section, "Dashboard")
- the 2 floor fixing bolts.

Free the lever/primary rod assembly.



REFITTING - SPECIAL FEATURES

Adjust the lever's travel (see section on control adjustment).

Adjustment:



If the handbrake is incorrectly adjusted and the cable is too tight:

- the automatic brake shoe clearance adjustment system will not operate correctly;
- the brake pedal will have a long travel.

On no account are the cables to be retightened to rectify this fault - the problem will soon reappear.

The handbrake is not a means of adjusting the clearance. It must be adjusted only when replacing:

- linings;
- cables
- the control lever.

Any adjustment other than these operations is forbidden.

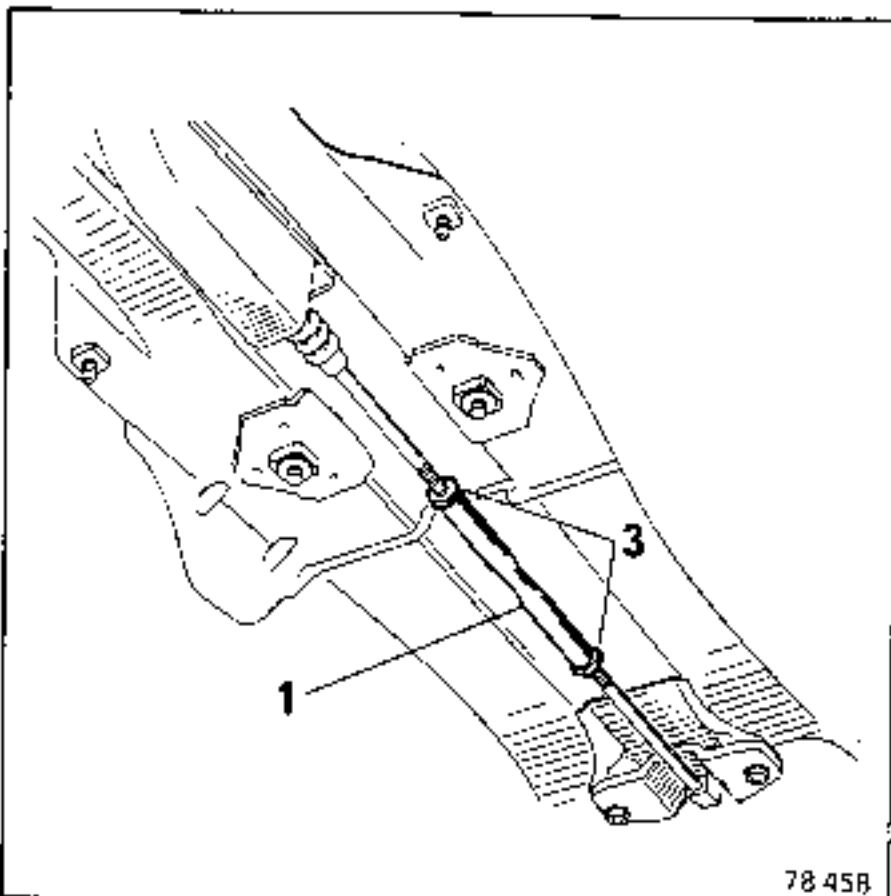
1. ADJUSTING DRUM BRAKES

With the vehicle on a lift and the wheels free:

Remove the centre protective cover.

Loosen the handbrake.

Loosen the sleeve (1) locknuts (3).



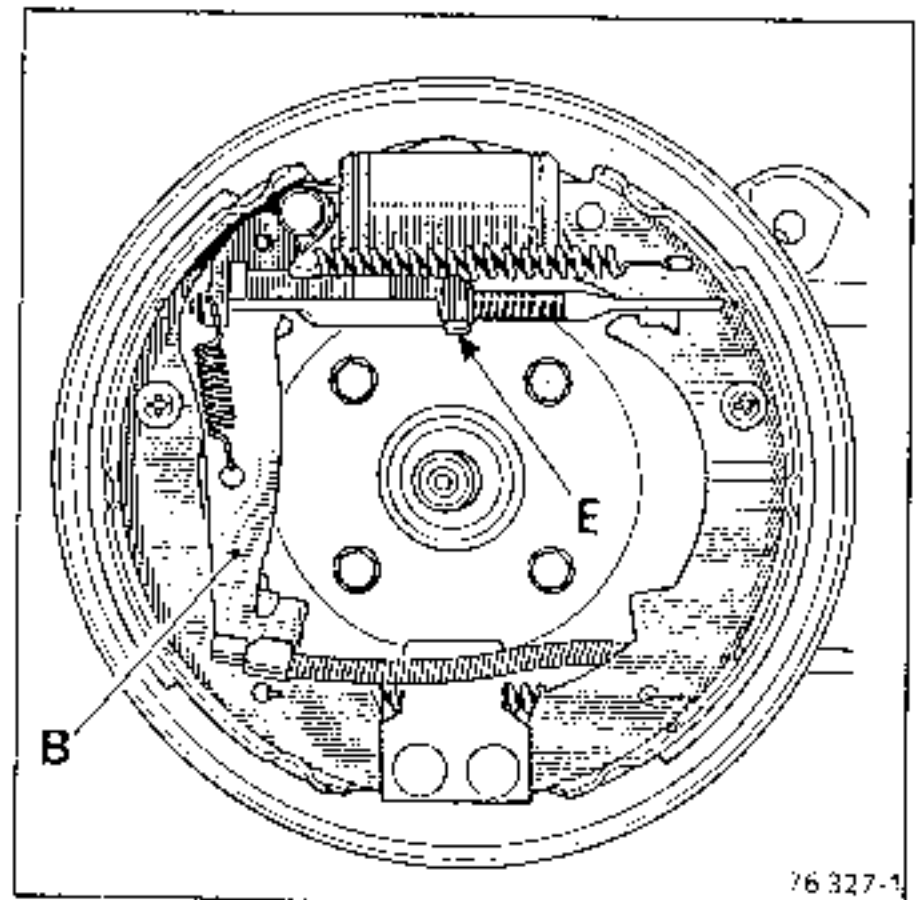
78 45B

Loosen the cable completely.

Remove:

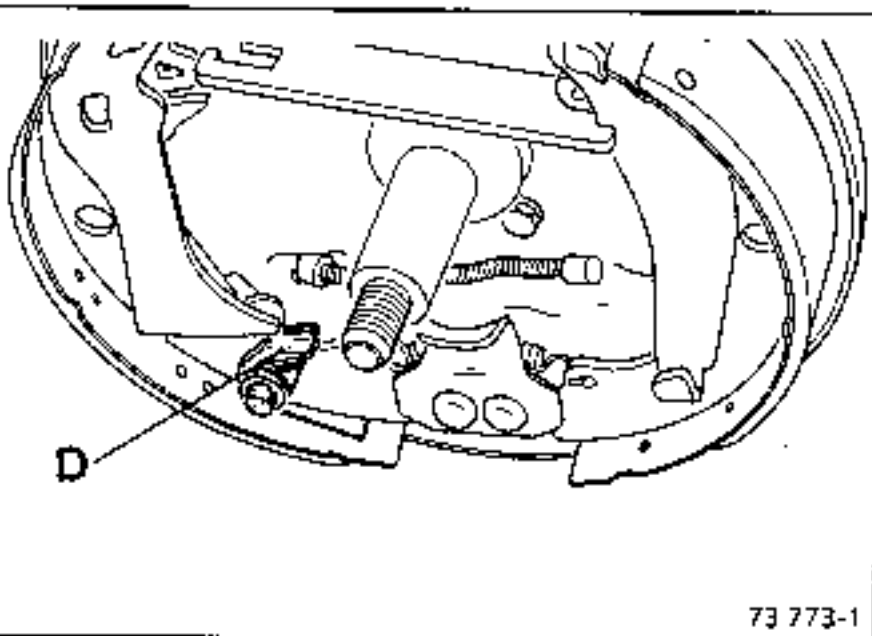
- both rear wheels;
- both drums.

Check the operation of the automatic clearance adjusting system by rotating the toothed quadrant (E) (make sure it turns freely in both directions), then loosen it by 5 or 6 teeth.



Bendix :

Place the toothed quadrant (D) in its original position.



Check:

- that the cables slide freely;
- that the handbrake levers (B) rest correctly on the brake shoes.

ADJUSTMENT:

Gradually tighten the cables centrally so that the levers (B) are free between the 1st and 2nd notch of the control lever's travel and remain free at the 2nd notch.

Tighten the locknuts (3).

Fit the drums.

With the vehicle on its wheels:

Adjust the linings by repeatedly depressing the brake pedal firmly, listening to the operation of the automatic adjusting system.

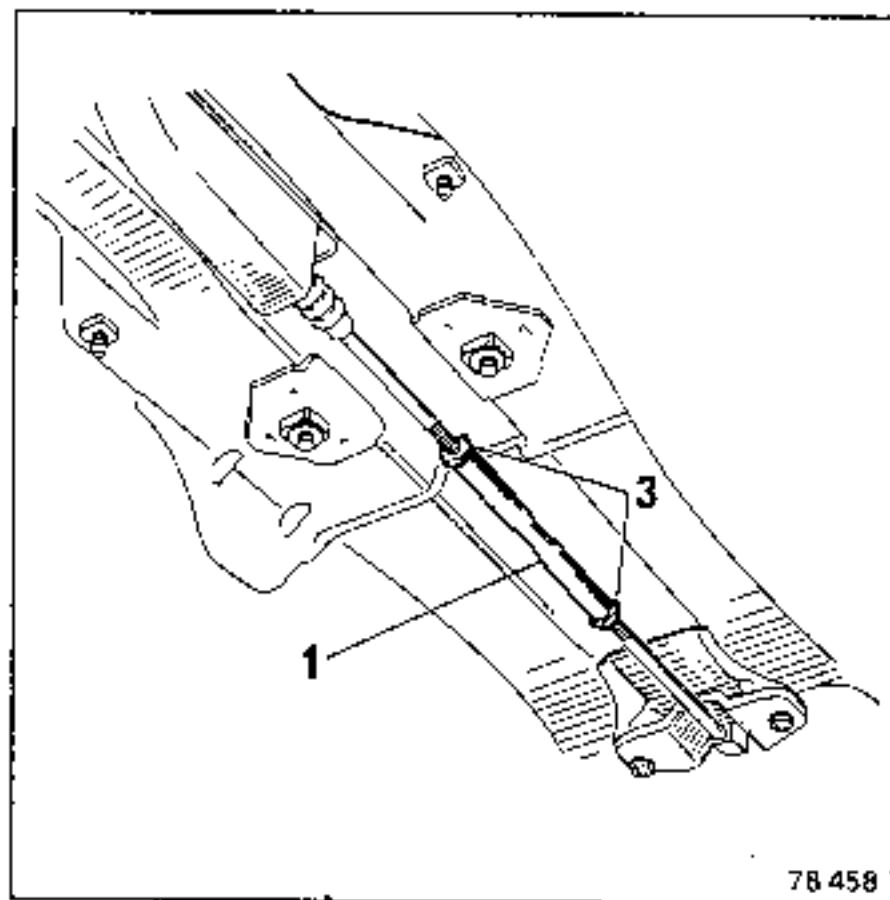
2. ADJUSTING DISC BRAKES

With the vehicle on a lift and the wheels free:

Remove the centre protective cover.

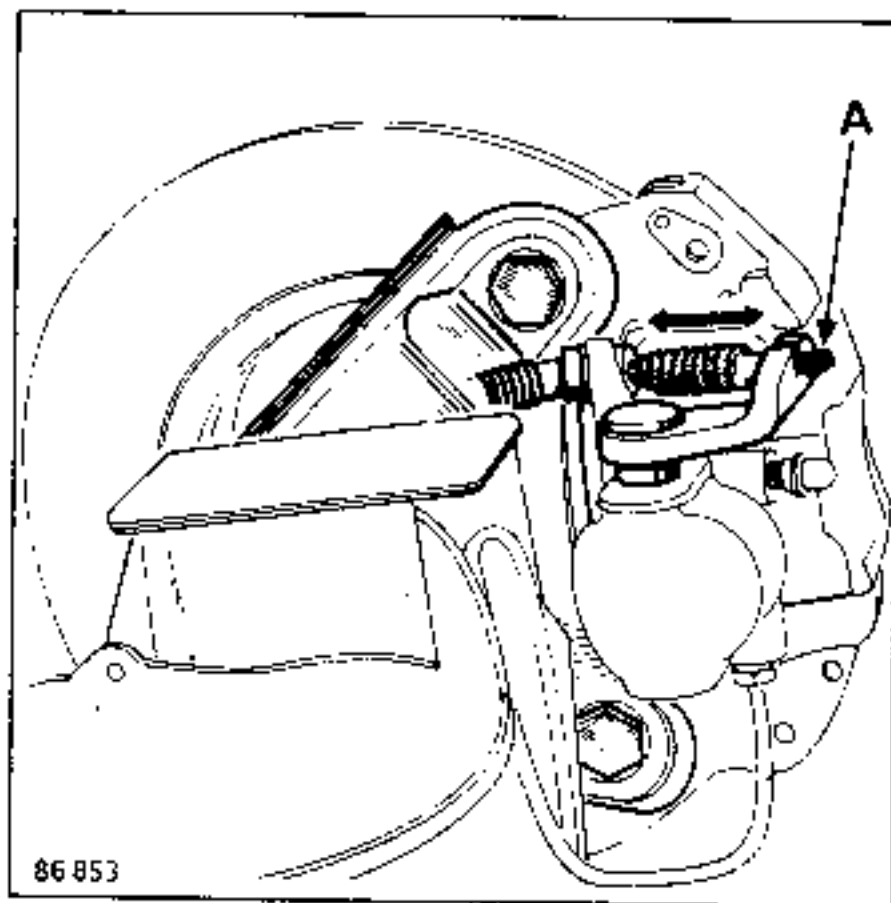
Loosen the handbrake.

Unlock the sleeve (1) locknuts (3) and slacken off the cable completely.



Check:

- that the cables slide freely;
- the travel of handbrake levers and push them as far as they will go towards the rear of the vehicle.



Gradually tighten the cables centrally so as to create contact between the end (A) and the lever without moving the lever.

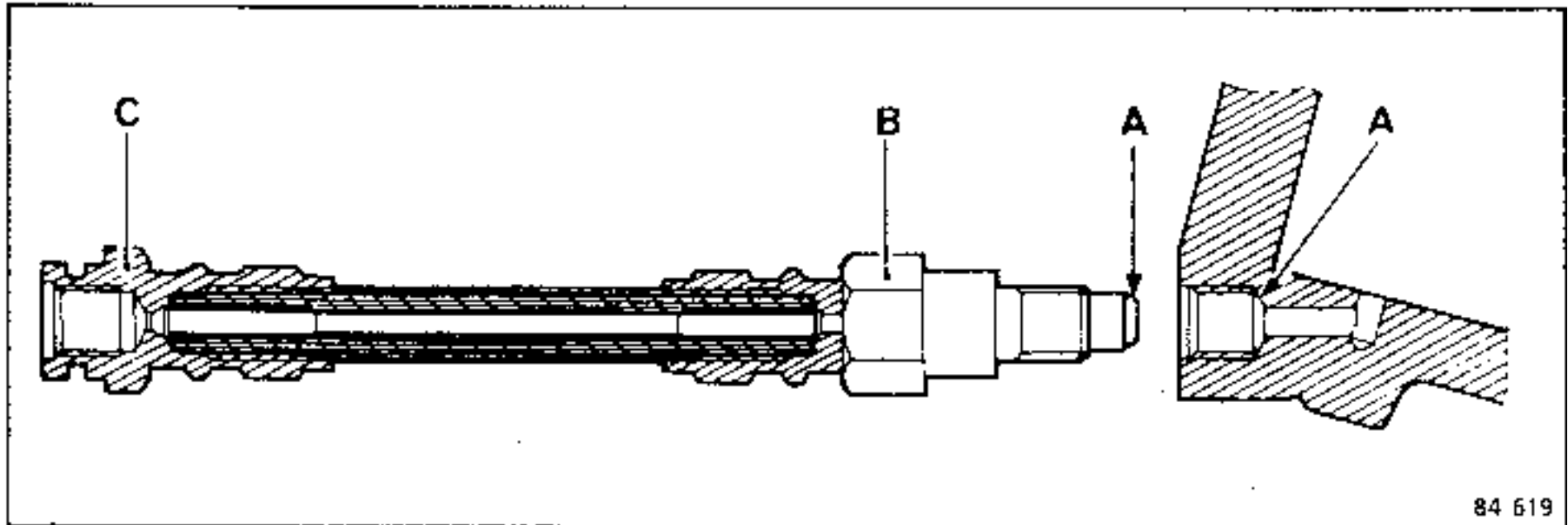
Finish off the adjustment so that the levers are free between the 1st and 2nd notch of the control lever's course and remain free at the 2nd notch.

Tighten the locknuts (3).

These vehicles have brake hoses whose sealings do not have copper seals.
Sealing is provided by contact with the hose tapered face (A) and the cylinder tapered face.



TIGHTENING TORQUES (in daNm)
B = 1.3
C = 1.3



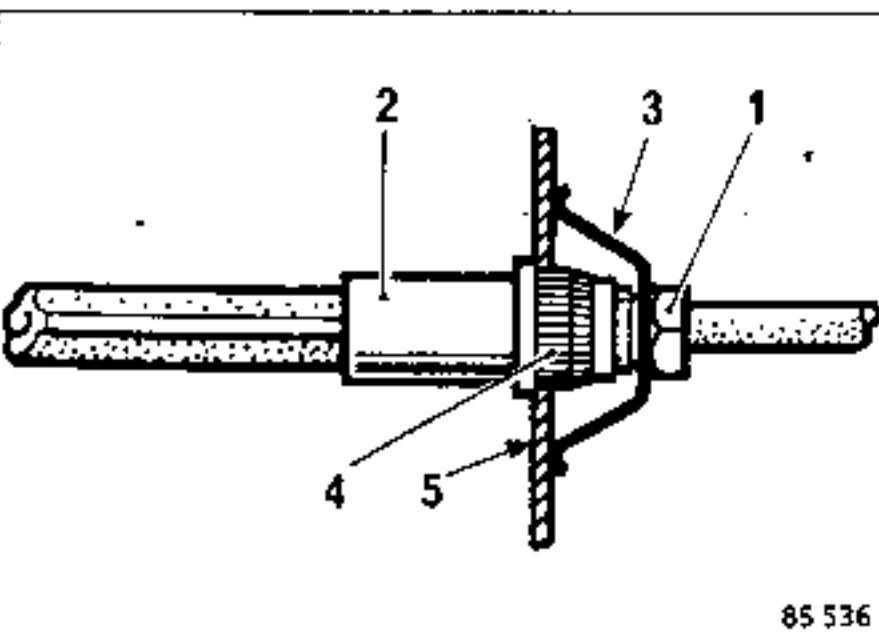
84 619

PRECAUTIONS TO BE TAKEN WHEN REMOVING AND REFITTING A BRAKE WHEEL CYLINDER OR HOSE

In the interests of safety and to prevent the brake hose from becoming twisted and possibly coming into contact with part of the suspension, the following operations must be carried out in the following sequence:

REMOVING

Unscrew the piping union (1) from hose (2) until the spring (3) is loose enough to free the hose from the splines (4).



85 536

Unscrew the hose from the caliper and possibly the caliper as well.

REFITTING

Fit the caliper to the brake and screw the hose to it. Then tighten to torque 1.3 daNm.

With the wheels hanging free and pointing straight ahead, locate the female end of the hose on the retaining lug (5) (it must not be twisted) and fit:

- the spring (3);
- the brake pipe to the hose, making sure that the hose does not rotate during tightening.

Bleed the braking circuit.

CHECKING PRINCIPLE

These vehicles are fitted with a load-controlled brake limiter.

The pressure is controlled at X by comparing the rear wheel pressure with a given front wheel pressure.

These dual pressure cylinders have two chambers entirely separate from one another, which act at X on one front wheel and one rear wheel.

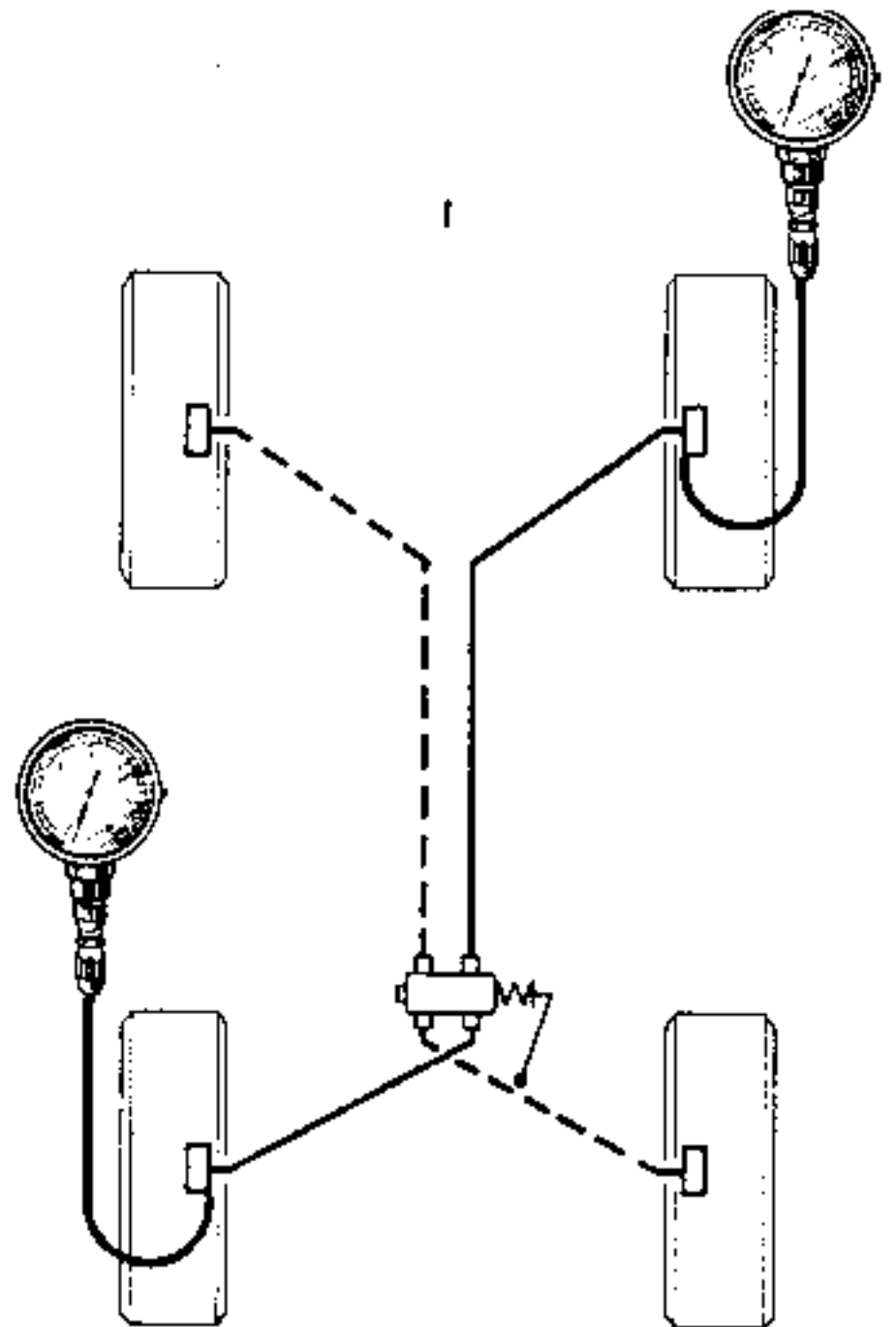
It is essential to check both circuits.

- I : right-hand front/left-hand rear
- II : left-hand front/right-hand rear.

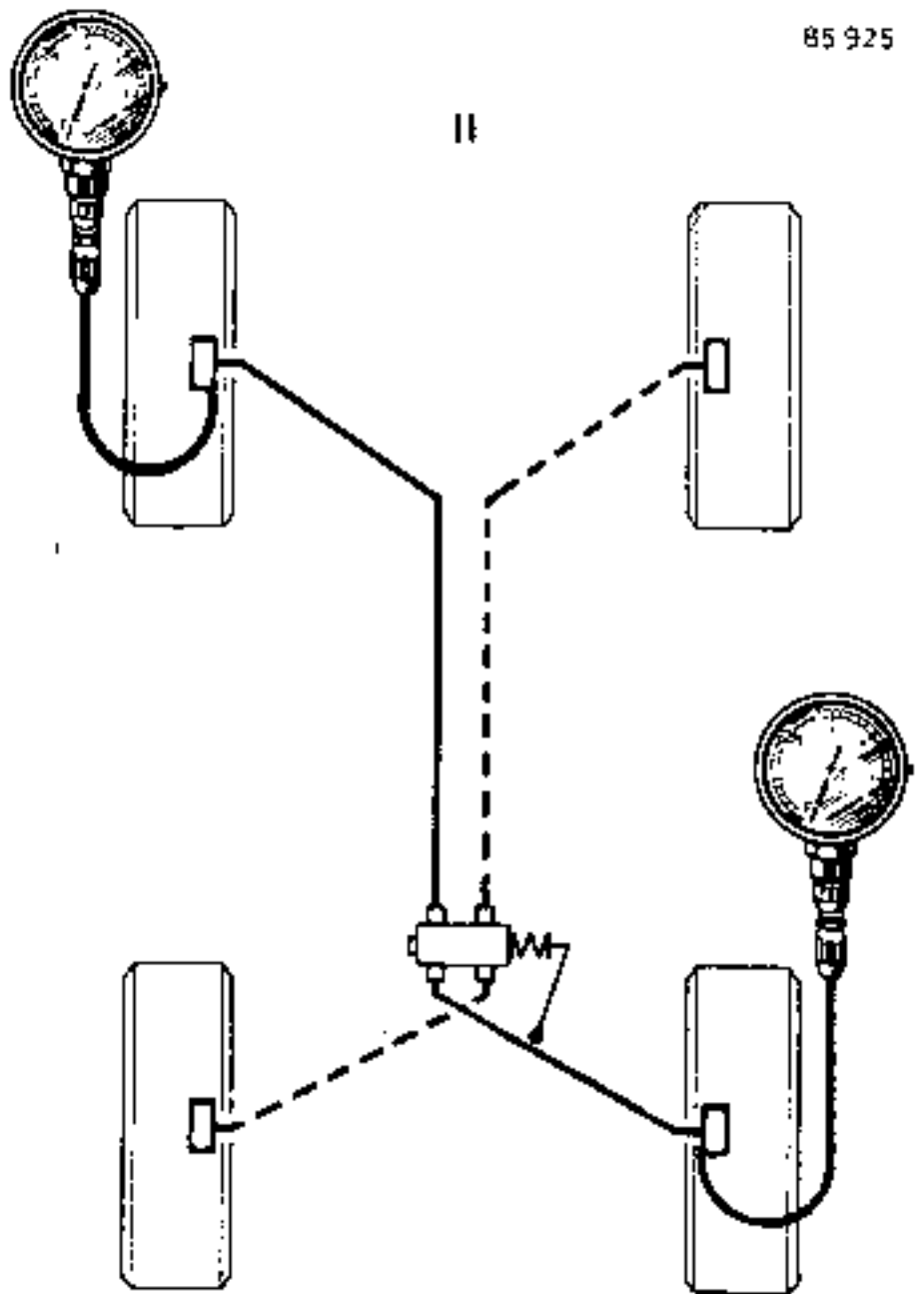
Load-controlled limiter.

The adjustment of load-controlled limiters enables the rear pressure to be adjusted as a function of the front pressure.

Adjustment is made simultaneously to both chambers. If the pressure is incorrect in one of the two chambers, replace the limiter



85 925





These vehicles are fitted with load-controlled limiters. Checking and adjustment take place on an unloaded vehicle, with the fuel reservoir full and the driver in the car.

Vehicle type	Amount of fuel in reservoir	Checking pressure (bar)	
		FRONT	REAR
B 290 B 292 B 293 B 294 B 295 B 296 B 297 B 298 B 29A B 29B B 29E B 29F B 29G B 29H B 29W	90 966	100	→ 40 $\begin{smallmatrix} +0 \\ -8 \end{smallmatrix}$

ESSENTIAL SPECIAL TOOLING

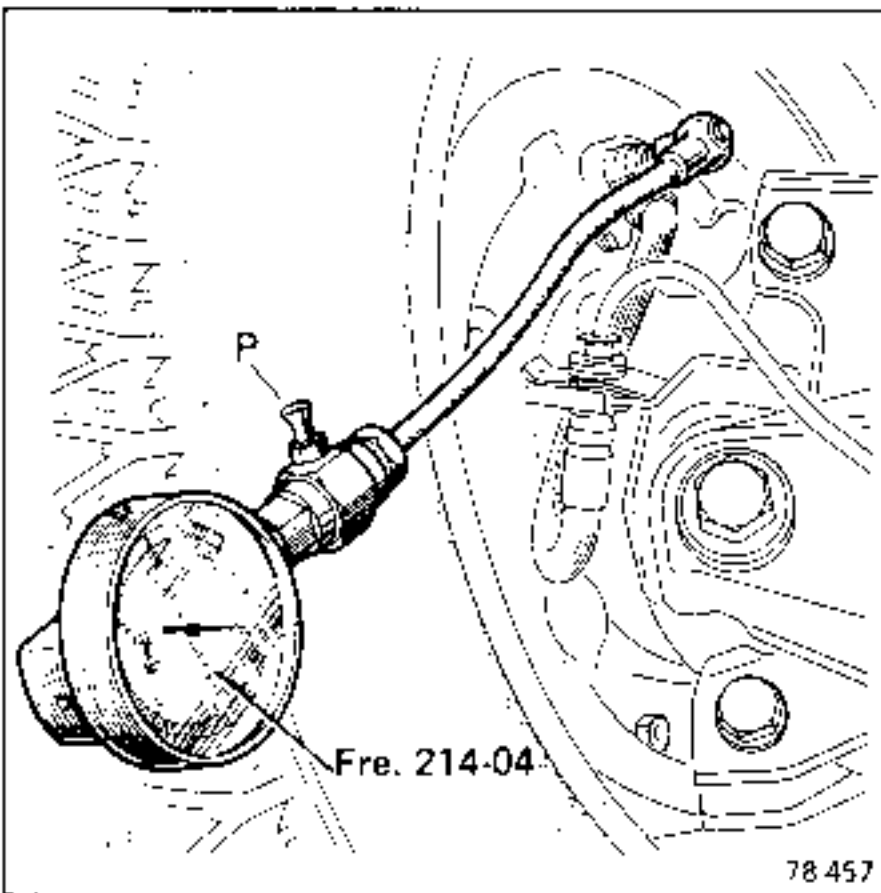
Fre. 244-04	Limiter calibration pressure
or	gauge
Fre. 1085	

CHECKING

Connect two pressure gauges (A) Fre. 244-04 or Fre. 1085:

- one on the right-hand front
- one on the left-hand rear.

Bleed the pressure gauges: screw P.



Depress the brake pedal gradually until the adjusting pressure is obtained on the front wheels (see table of values). Then read off the relevant pressure on the rear wheels and correct if necessary.

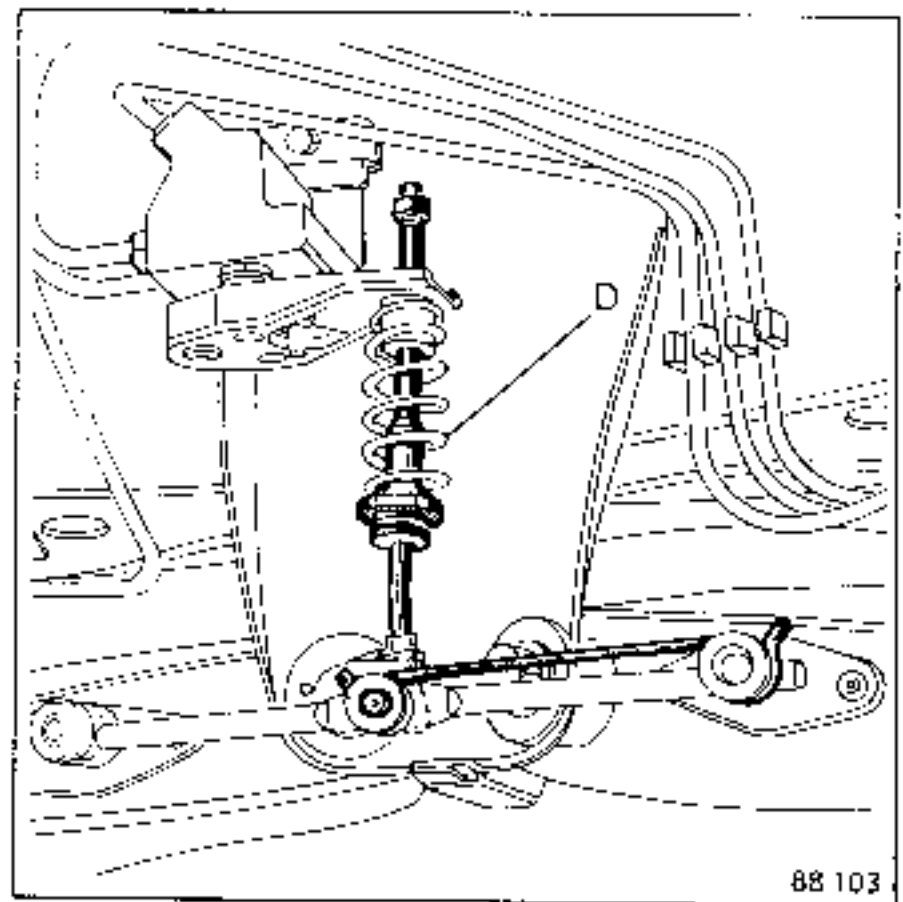
Perform the same operation on the other circuit; i.e.:

- one on the left-hand front
- one on the right-hand rear.

If there is a major difference (values outside tolerances), replace the limiter. No operations may be performed on the limiter.

ADJUSTMENT

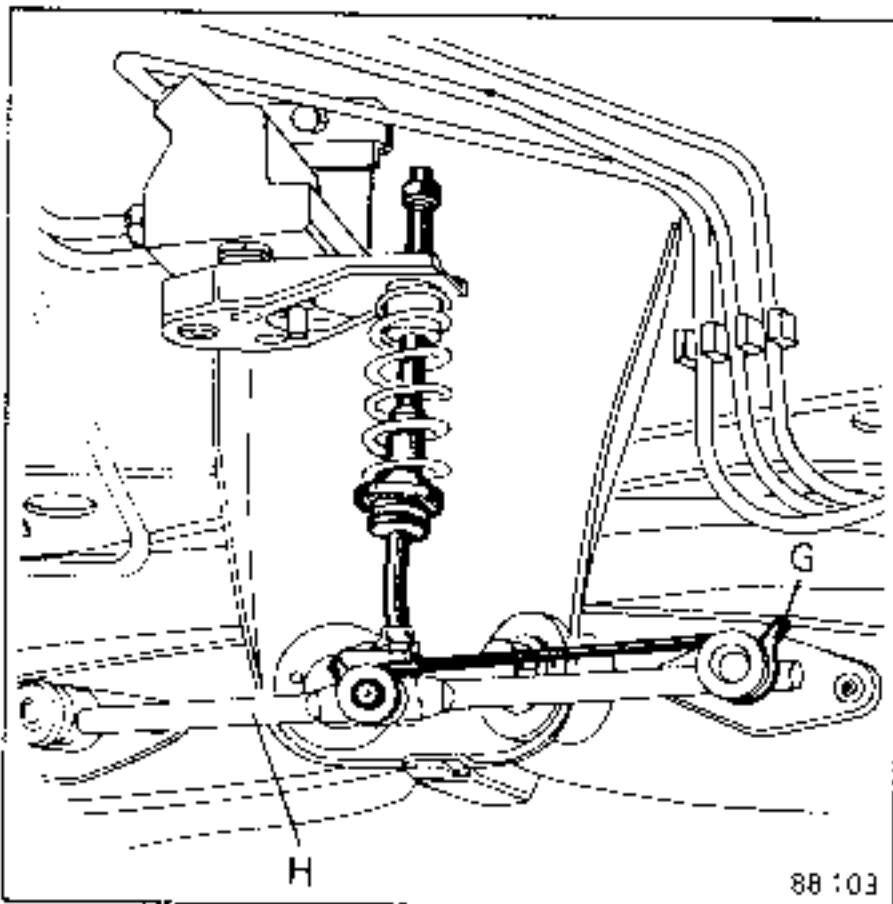
Adjustment is achieved by altering the spring compression (D).



REMOVAL:

Disconnect:

- the clip (G);
- the suspension arm link rods (H);
- the piping.

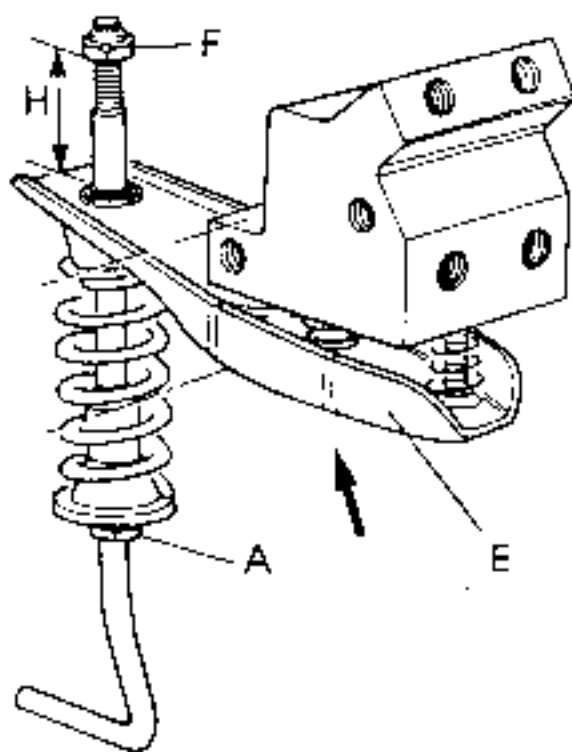


Remove the 3 support bracket bolts

Uncouple the limiter from the support bracket.

REFITTING: Preadjustment:

With lever (E) in the direction of the arrow, height (H) should be approximately 32 mm.

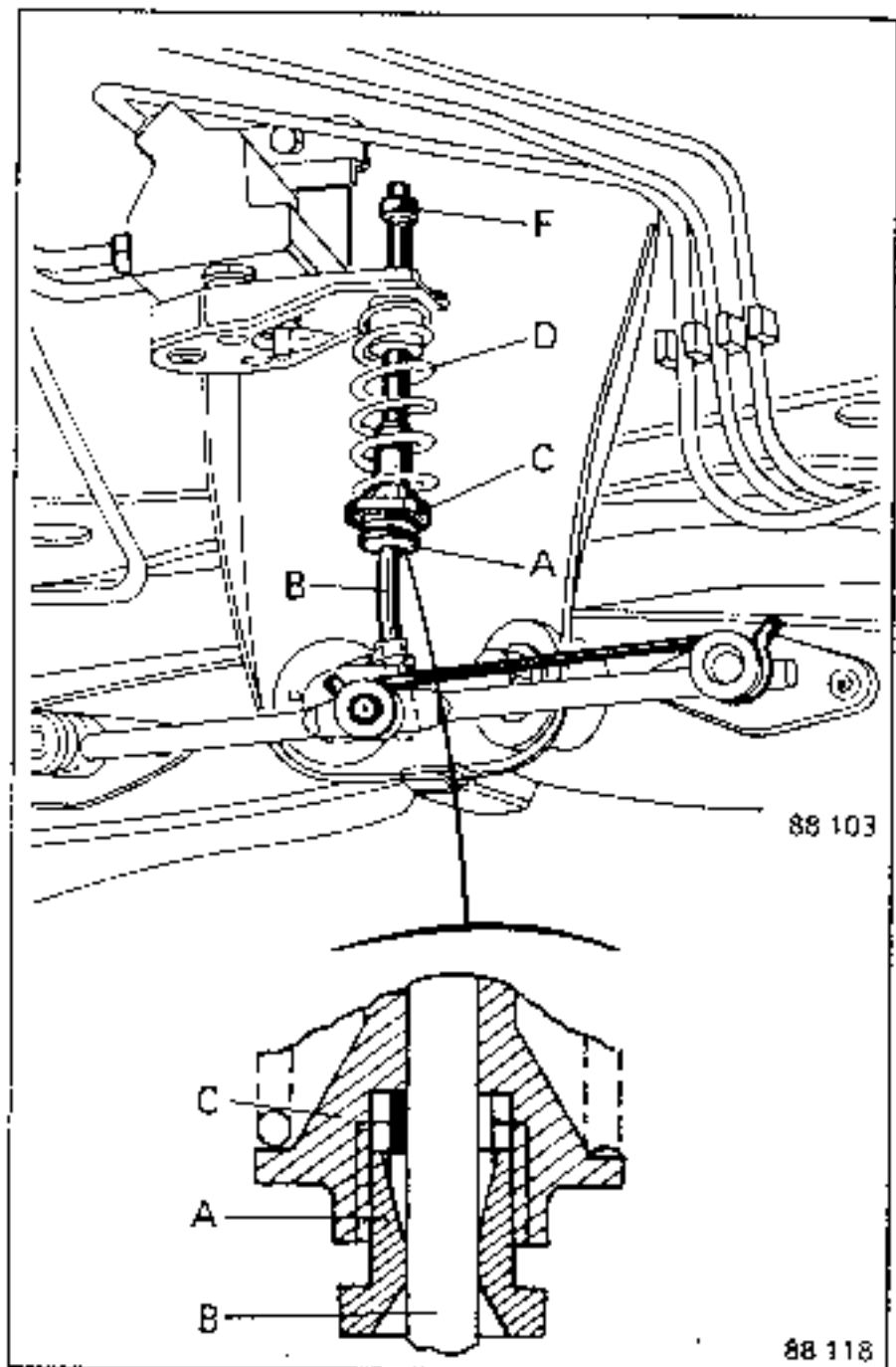


88 109

To obtain this distance, loosen nut (A) and move the rod (B) in the sleeve (C).

NOTE:

The position of nut (F) must not be altered.



Bleed the braking circuit.

Check and if necessary adjust the pressure (see section on "Checking and Adjusting").

ADJUSTING

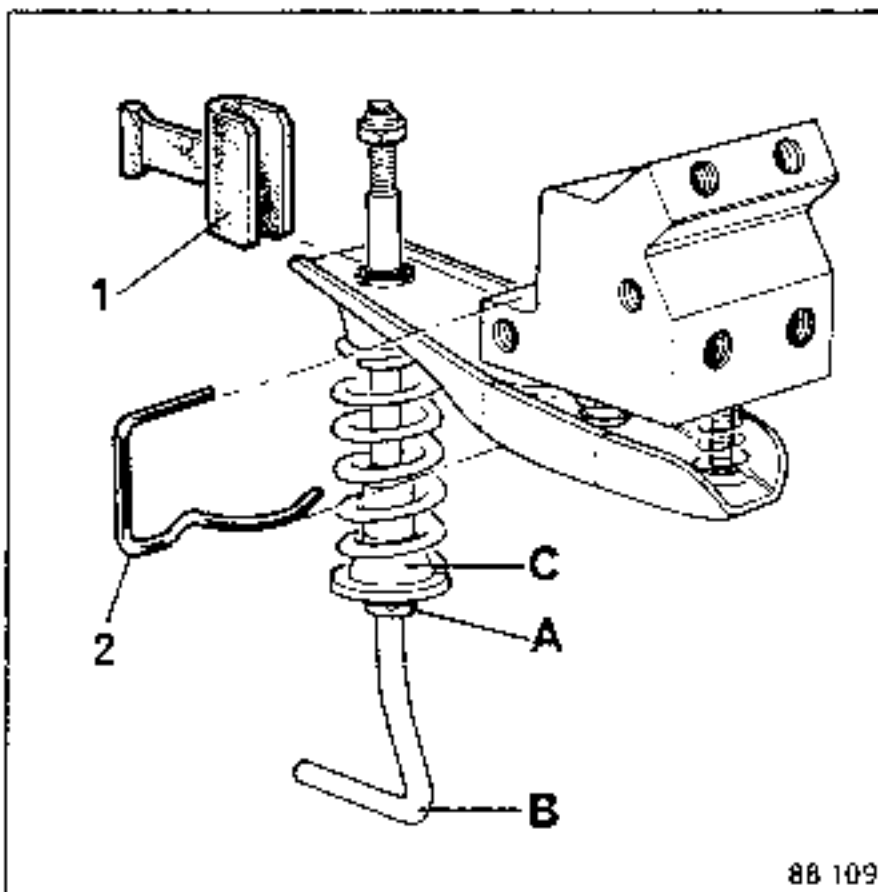
If the recommended values are not obtained, adjust distance (H).

REPLACING

The MPR supplies replacement pre-adjusted limiters fitted with two clips (1) and (2).

Set up the vehicle as for adjustment.

Fit the new limiter fitted with clips (1) and (2).



Loosen nut (A).

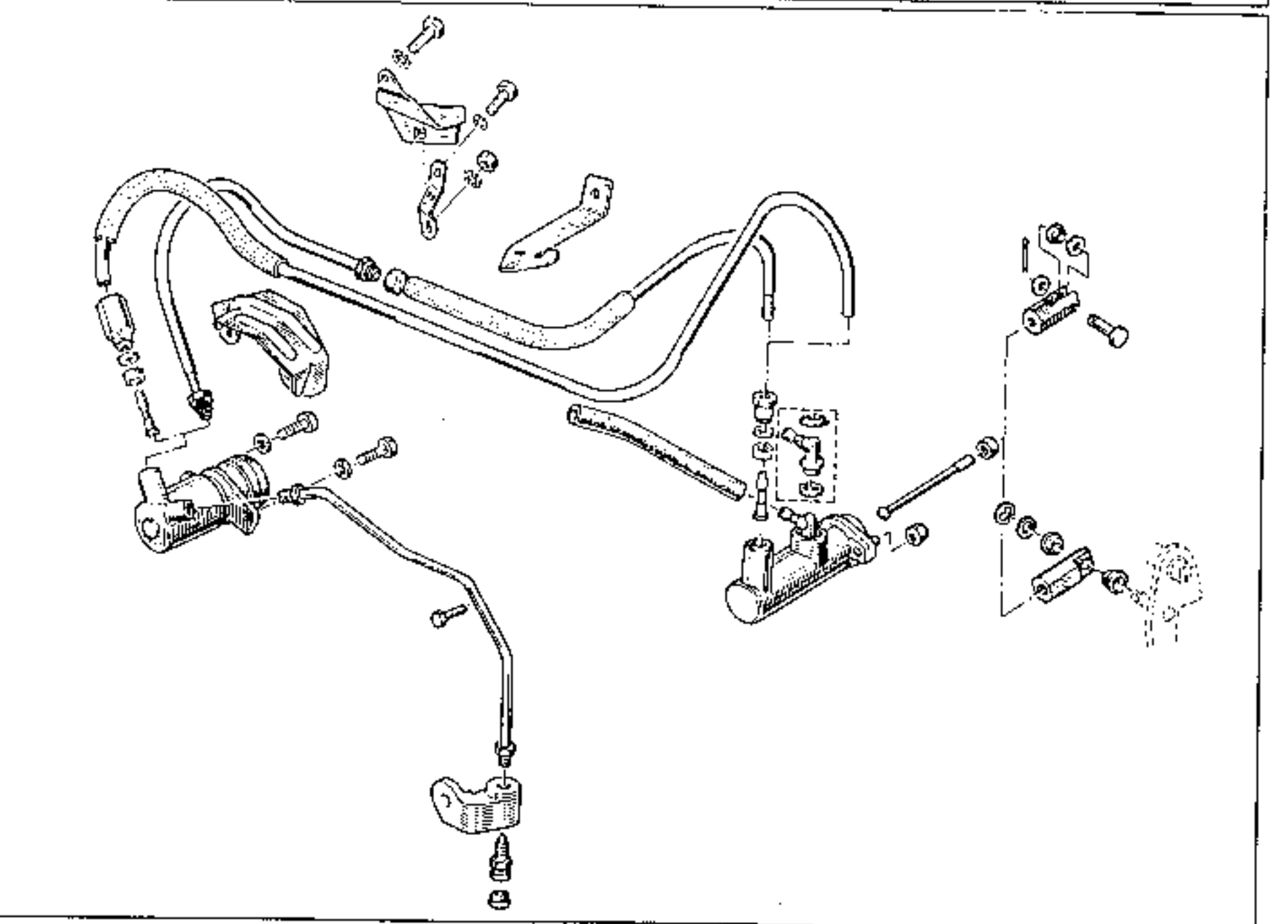
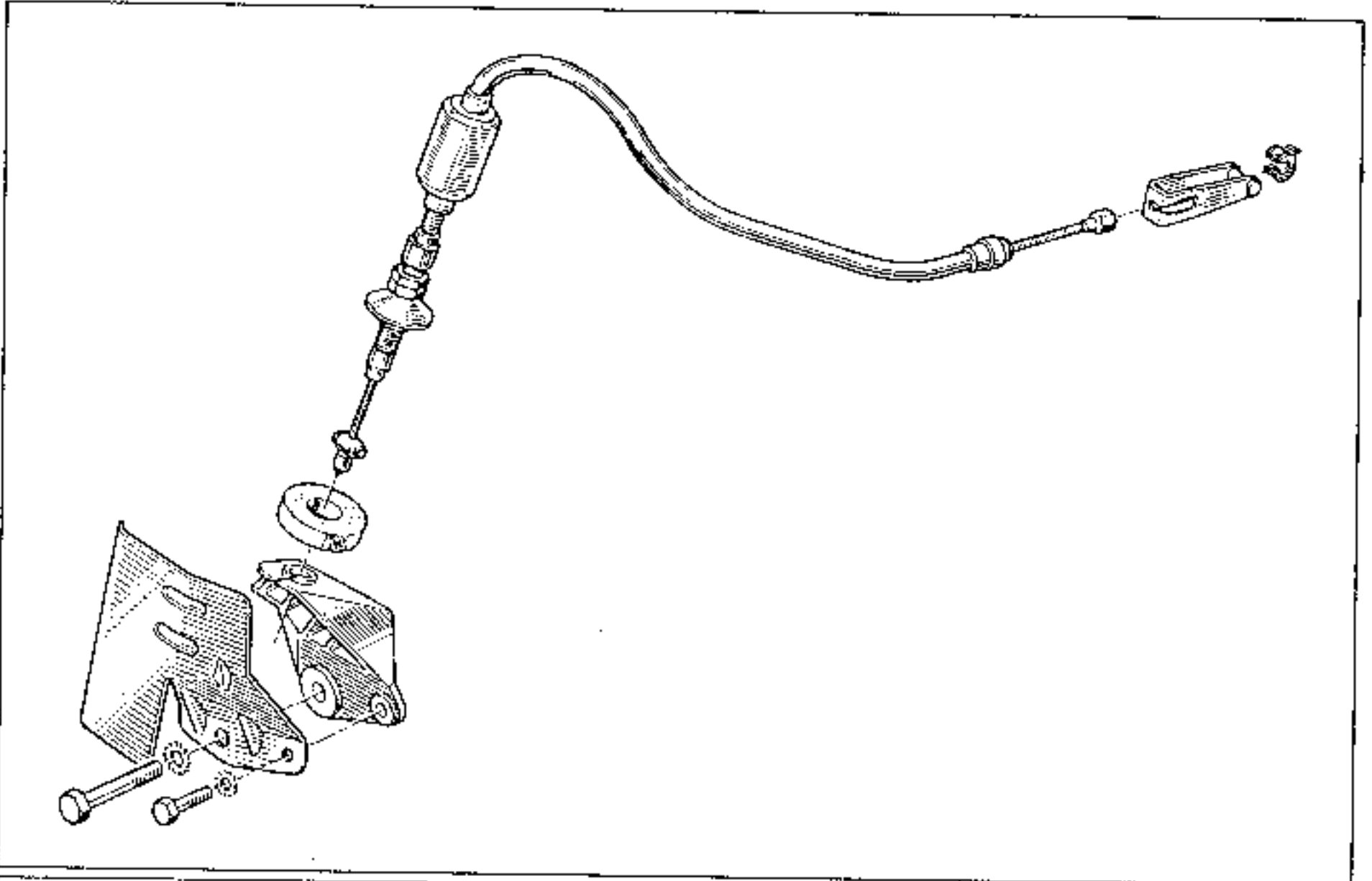
Position rod (B) in the link rod (H)

Tighten nut (A), holding sleeve (C).

Remove clips (1) and (2).

Bleed the check the circuit (see section on "Checking and Adjustment").

EXPLODED VIEW



CLEARANCE ADJUSTMENT

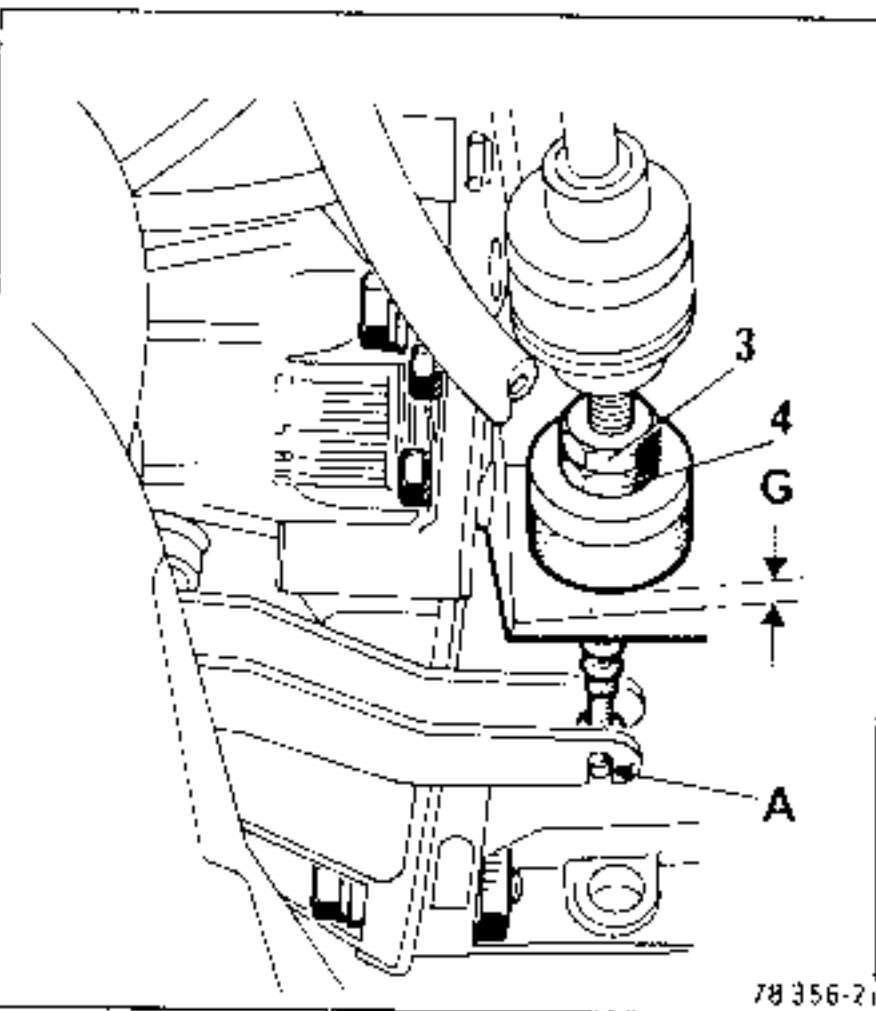
Cable control:

Hold the clutch pedal up.

Raise the cable until resistance is felt and check the clearance (G):

G = 3 to 4 mm at the end of the damping block.

Adjust, if necessary, by turning nuts (3) and (4).

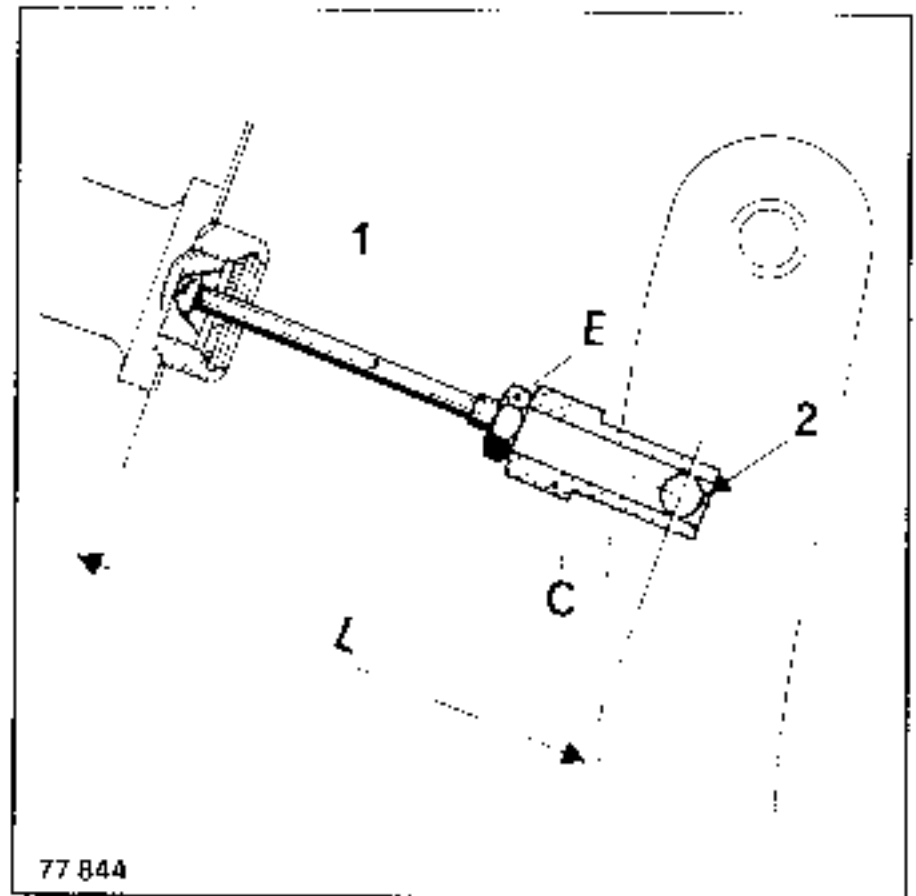


The yoke and the clevis pin of all cable clutch controls will have to be lubricated with "Molykote BR2" grease.

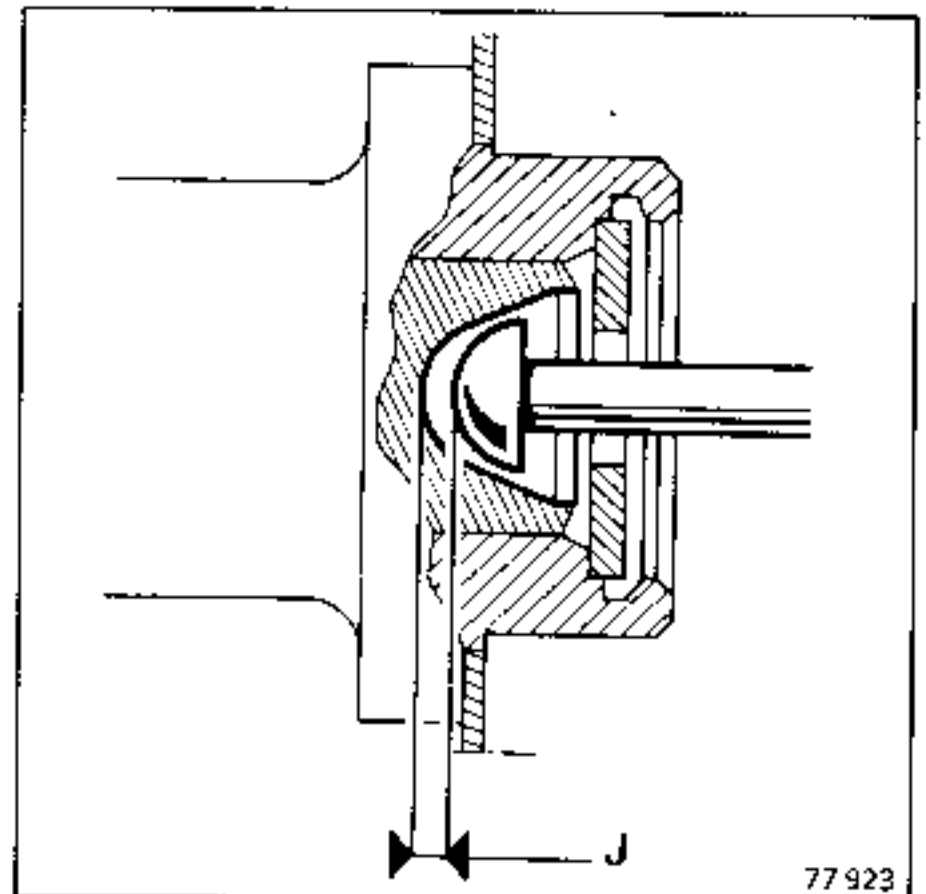
A: parts to be lubricated.

Hydraulic control:

Check the length of the pushrod distance L = 129.5 ± 0.5 mm



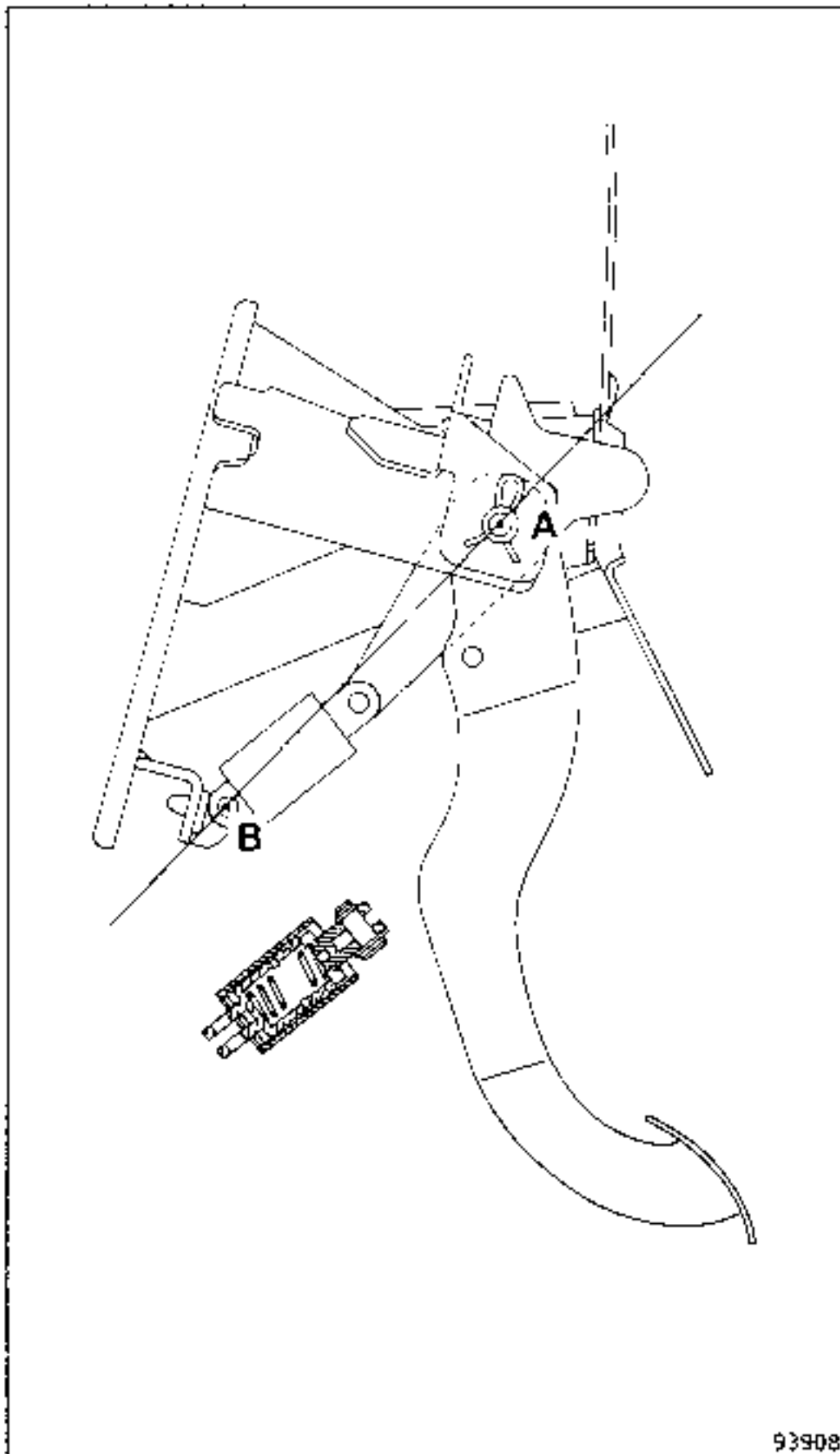
There must be a clearance (J) of 0.2 - 0.5 mm between the pushrod and the master cylinder piston, i.e. approximately 1 - 2.5 mm at the pedal pad.



If this clearance is incorrect, adjust the length of the pushrod.

Check the travel of the wheel cylinder, which must be 11 mm minimum.

This device is made up of a capsule-spring assembly located between the clutch pedal and the pedal support bracket.



OPERATION

In the rest position, the compressed spring pushes the pedal to its stop.

After having crossed the pivot (straight line AB), the spring extends and reduces the effort exerted by the driver.

Remark: Replacing the clutch master cylinder does not necessarily involve removing the spring-activating capsule assembly.

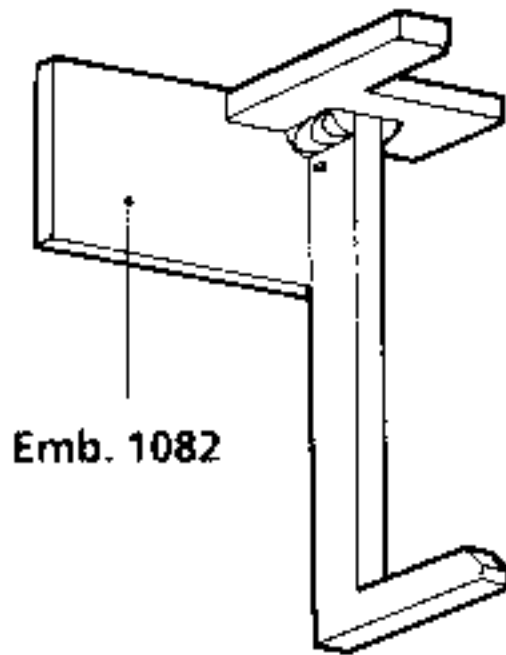
Replacing

ESSENTIAL SPECIAL TOOLING

Emb. 1082 Tool for removing-refitting clutch control
spring-activating capsule

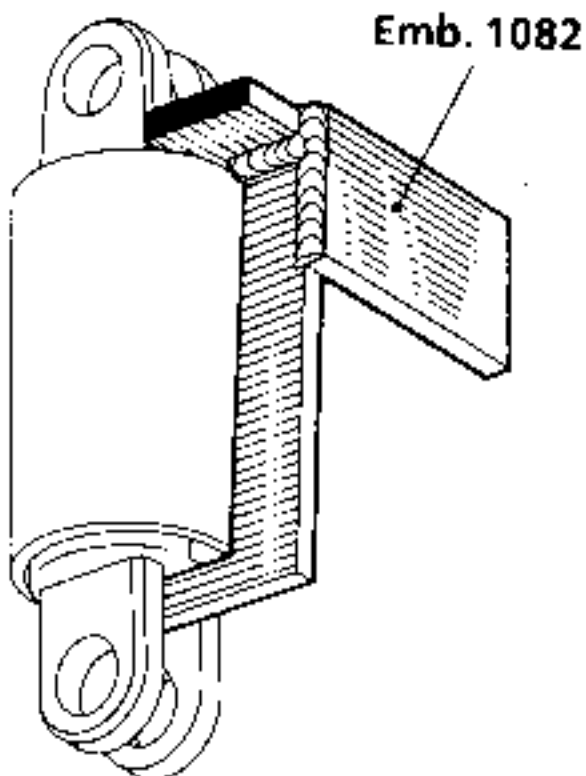
REMOVING

To remove-refit the spring-activating capsule, it is essential to lock it in the compressed position, using Emb. 1082.



92512

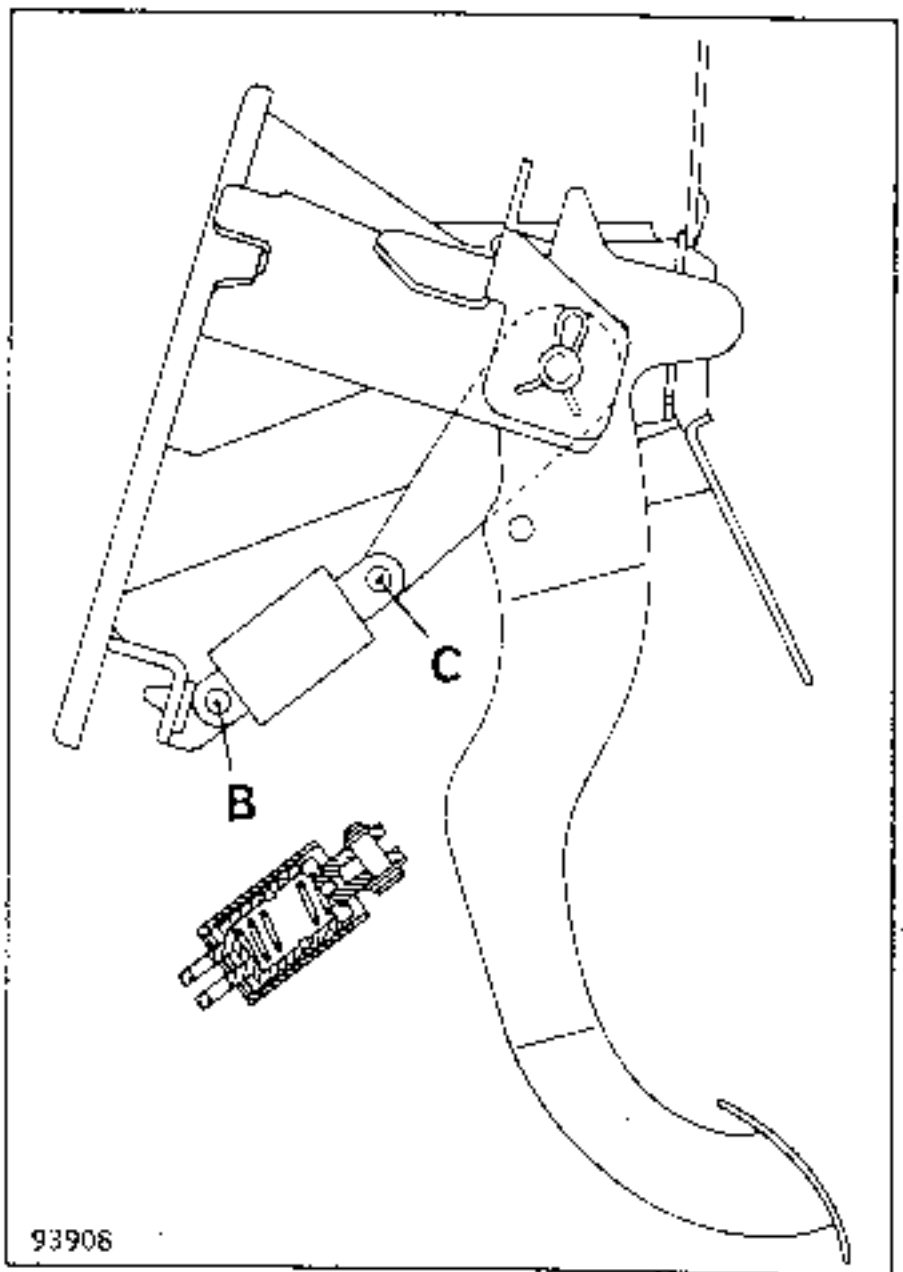
Fit the tool to the spring-activating capsule.



92511

Remove the circlips from shafts (B) and (C).

Depress the pedal gently to extract shaft (B).



93908

Release the capsule.

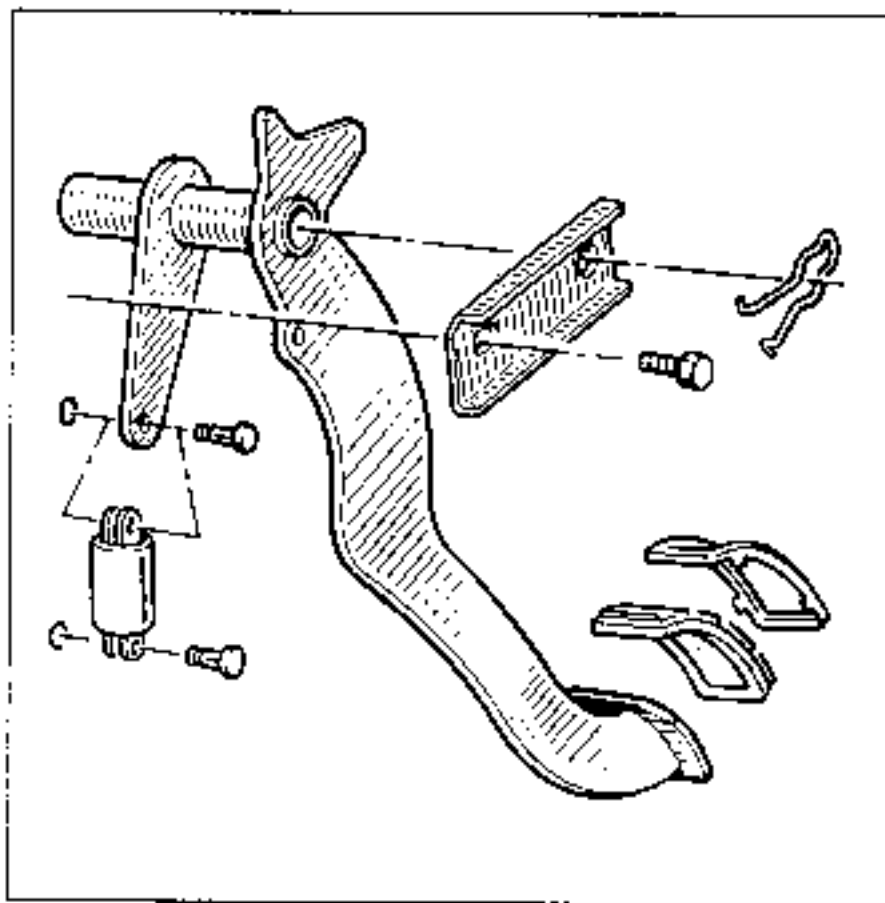
Take out the shaft (C) and remove the spring-activating capsule-tool assembly.

REFITTING (Special features).

When fitting a new part, compress the spring-capsule assembly in a vice and fit tool Emb. 1082.

Make sure the capsule is fitted the correct way round: large diameter to pedal end.

Smear the shafts with "ELF MULTI" grease.



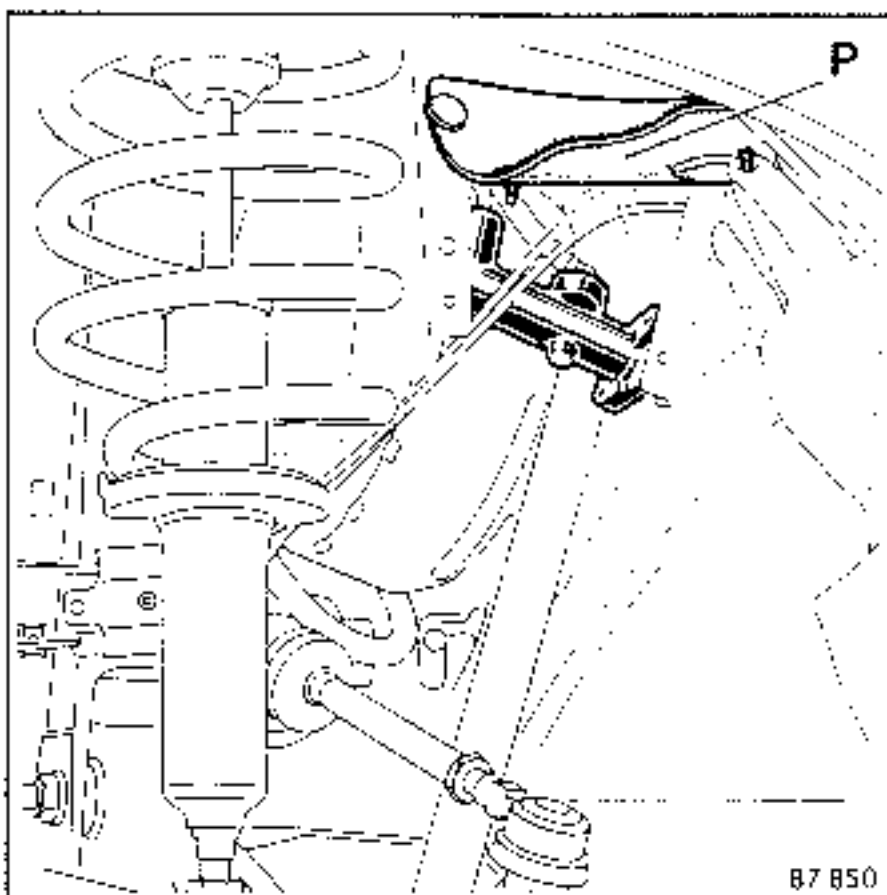
TIGHTENING TORQUES (in daNm)

Cylinder fixing nut	1.5
Connecting bolt	1.8

REMOVING

Remove the left-hand front wheel.

Remove the plastic cover (P).



Partly drain the brake fluid reservoir and disconnect the clutch master cylinder feed pipe.

Disconnect the piping at the wheel cylinder end, linking it to the master cylinder.

Remove the clutch pedal pushrod.

Unscrew the two master cylinder fixing bolts from inside the vehicle.

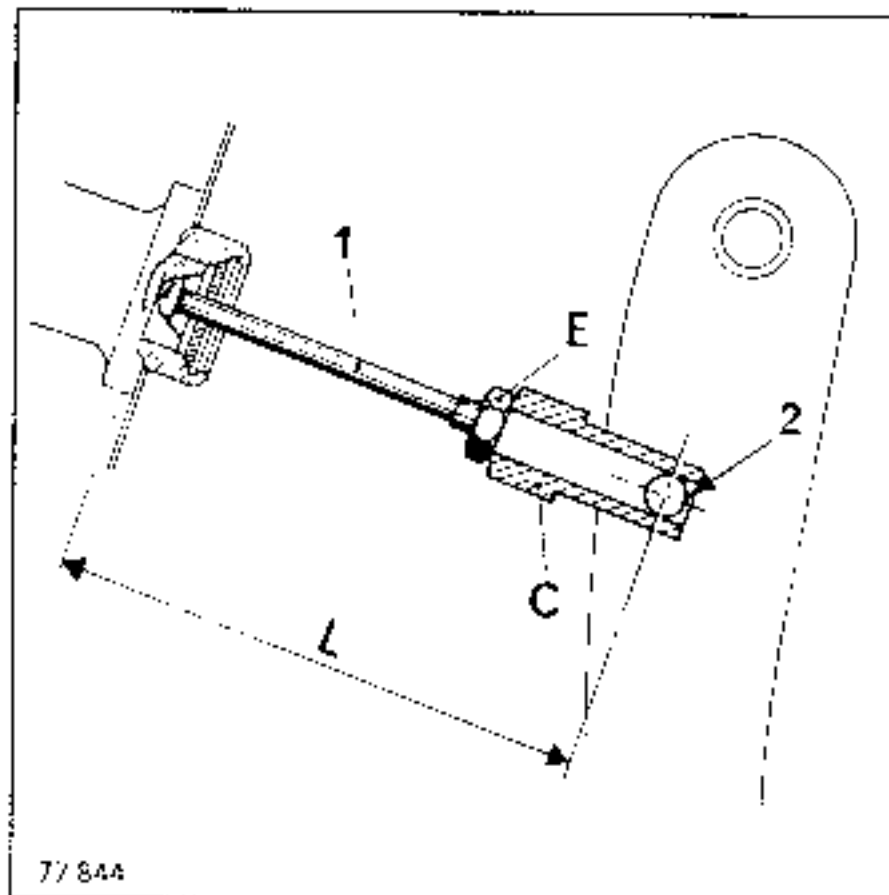
REFITTING (Special features)

Preadjusting the pushrod

Remove the pushrod (1) by taking out pin (2).

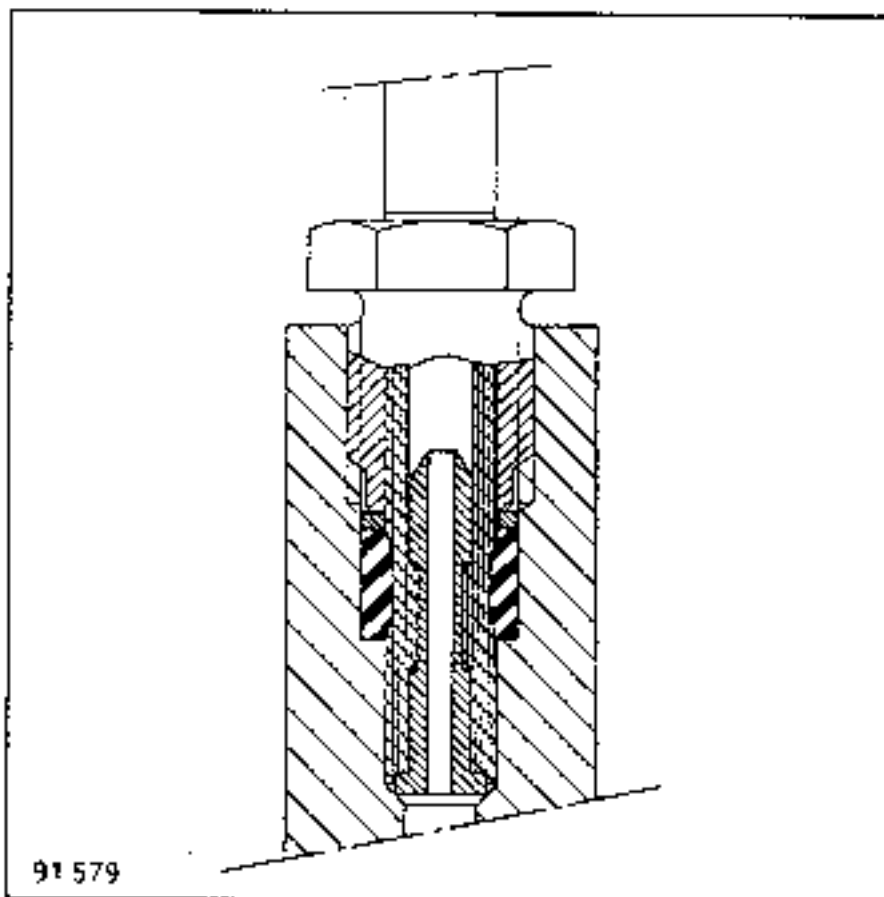
Loosen locknut (E) from the yoke (C).

Turn the pushrod (1) to obtain distance:
 $L = 129.5 \pm 0.5$ mm.



Fit the master cylinder and tighten its two fixing bolts, after having checked the seal of the master cylinder joint face with the bulkhead, using mastic tape **CAF 4/60 THIXO**

Connect the output pipe fitted with the washer and a new seal.

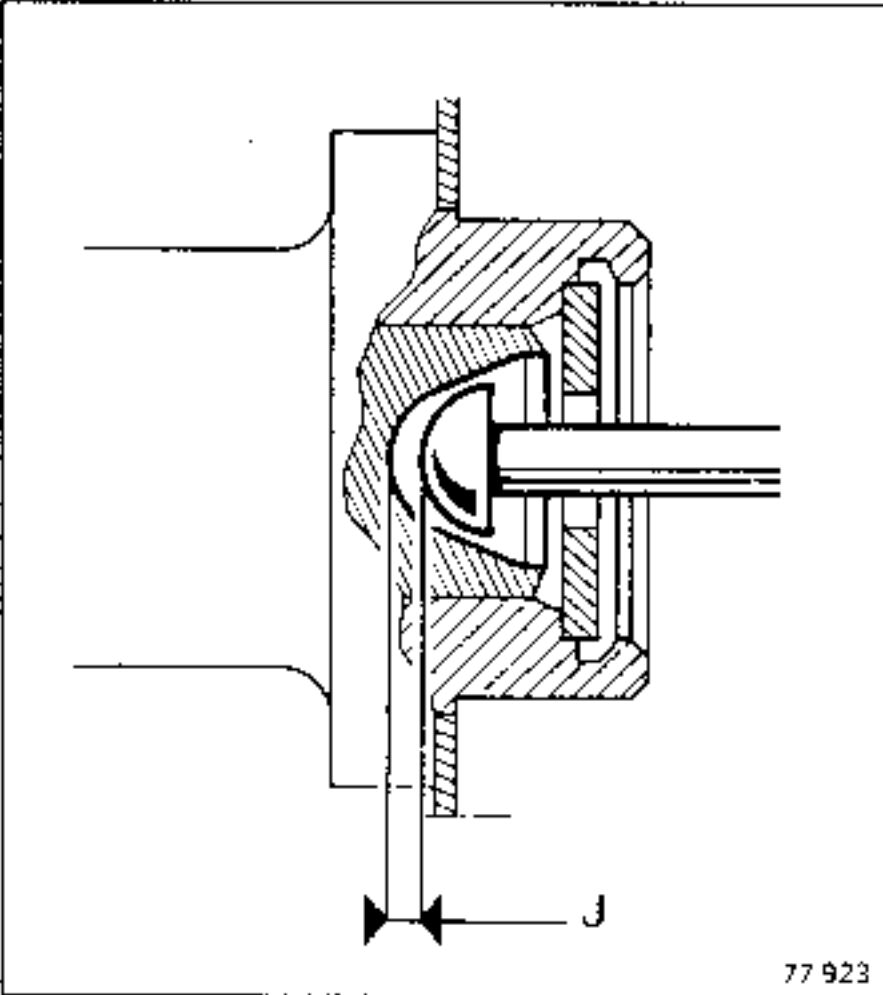


CHECK AND ADJUST IF NECESSARY:

- the position of the seal and the flat washer;
- the tightening torques.

Adjusting the clearance:

There must be a clearance (J) of 0.2 - 0.5 mm between the pushrod and the master cylinder piston, i.e. approximately 1 - 2.5 mm at the pedal pad.

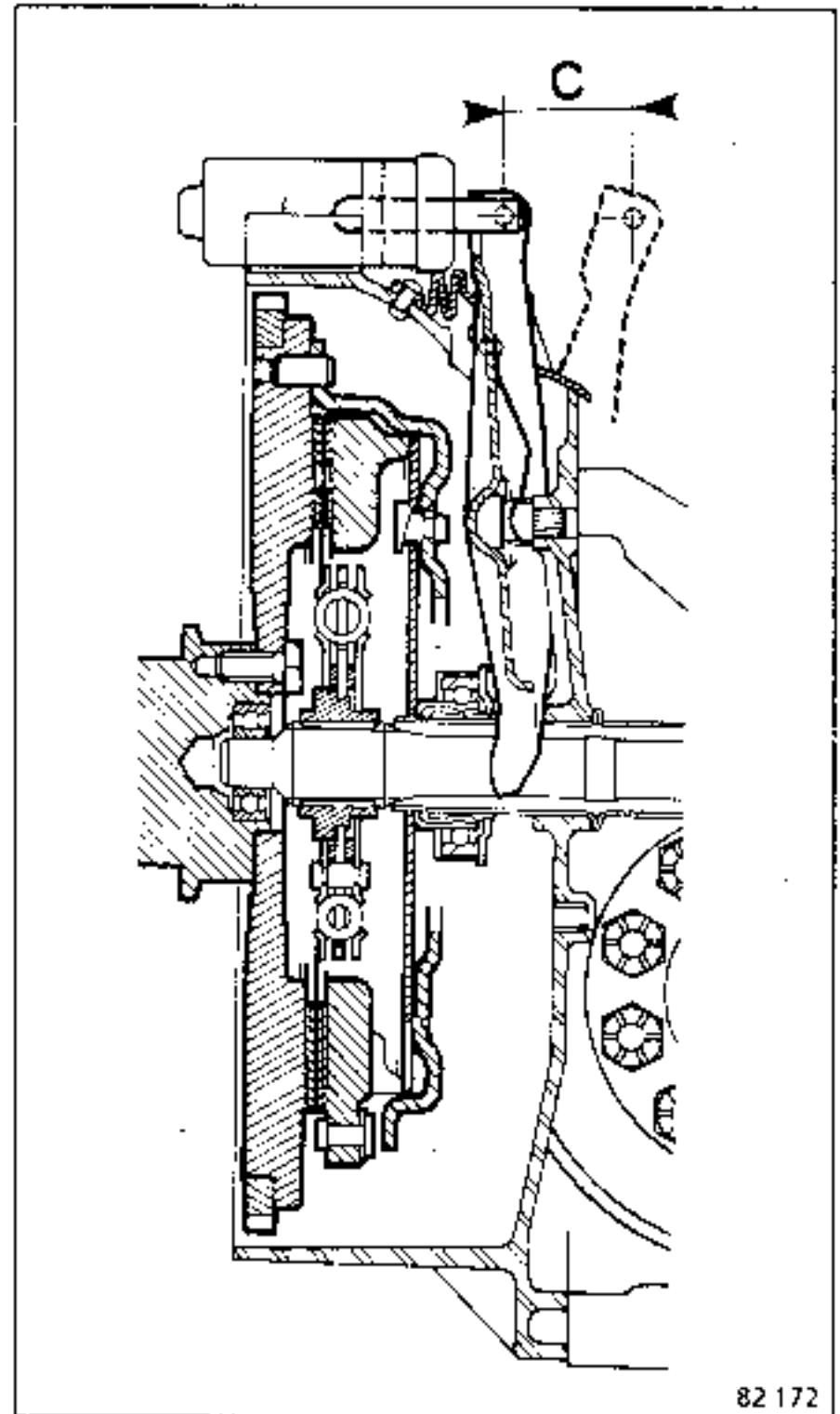


If this clearance is not correct, adjust the length of the pushrod.

Bleed the circuit.

Check the travel of the slave cylinder: it should be at least: $C = 11$ mm.

Top up the level of brake fluid in the reservoir.



TIGHTENING TORQUES (in daNm)

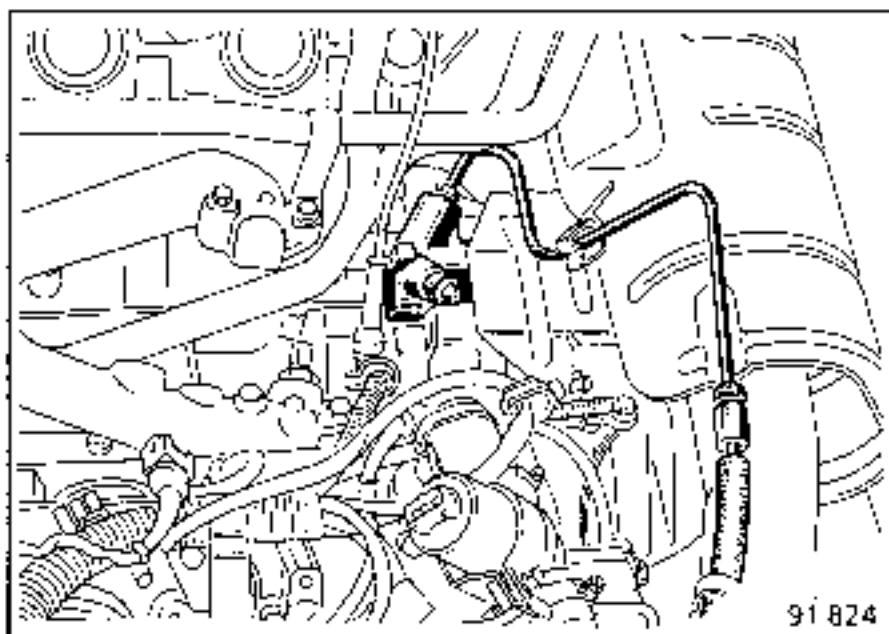
Cylinder fixing bolt	1.5
Connecting bolt	1.8

REMOVING

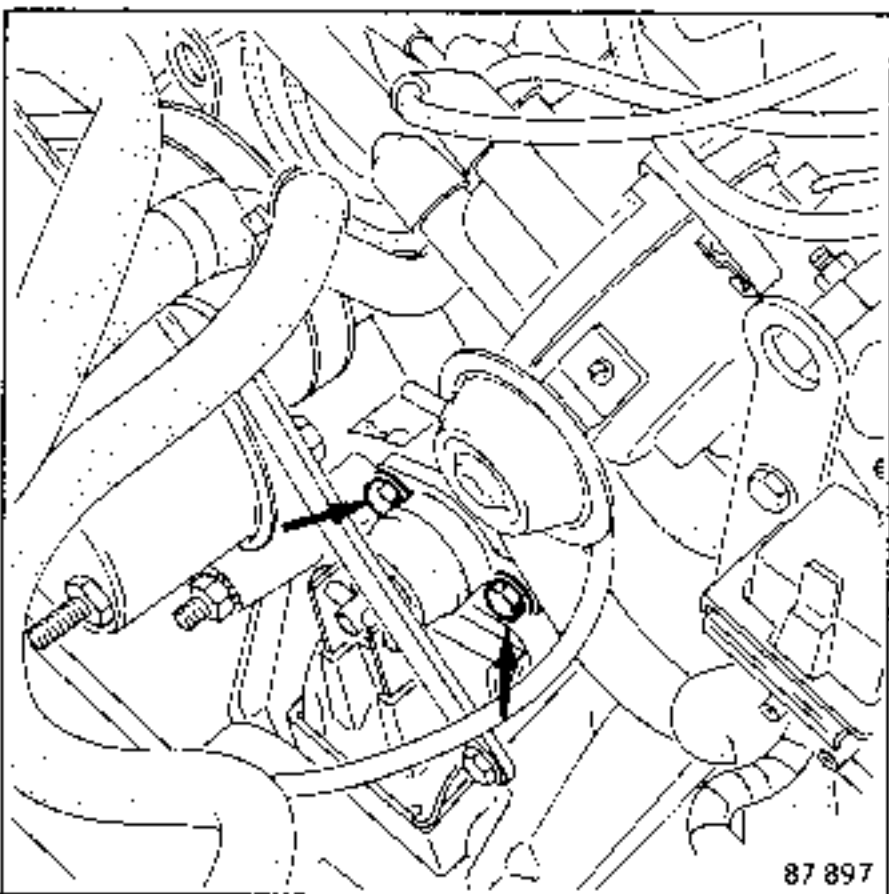
Partially drain the brake fluid reservoir.

Remove the slave cylinder heat shield.

Disconnect the slave cylinder feed pipe.

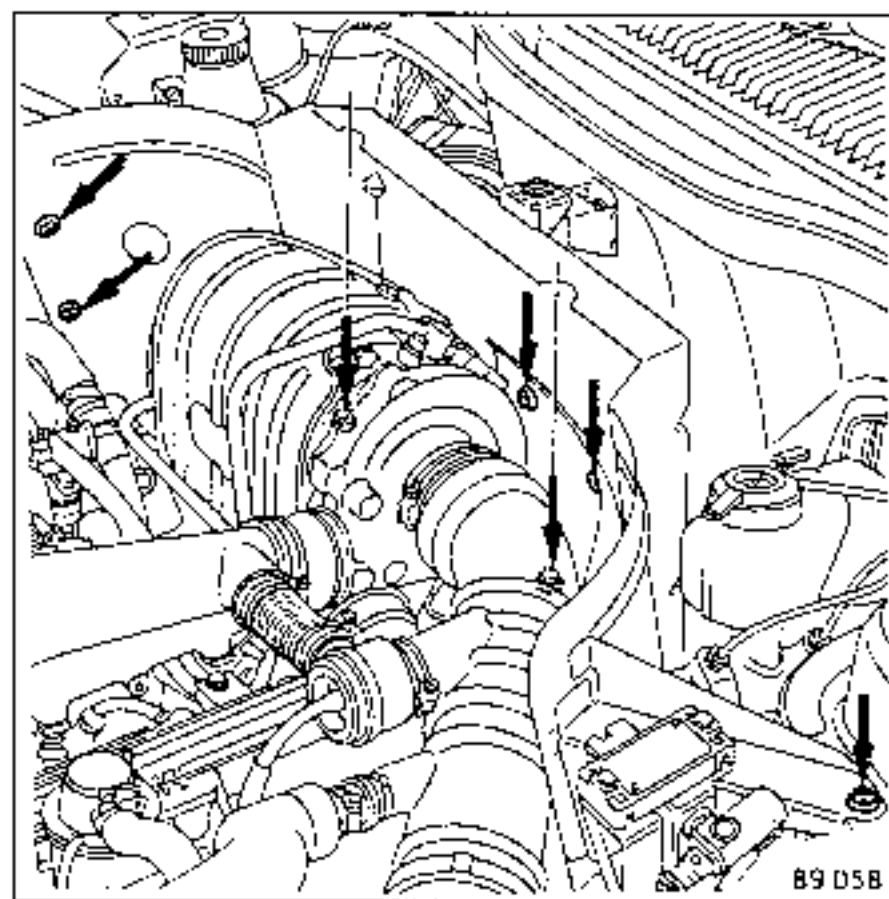


Take out the two slave cylinder fixing bolts and remove the cylinder.

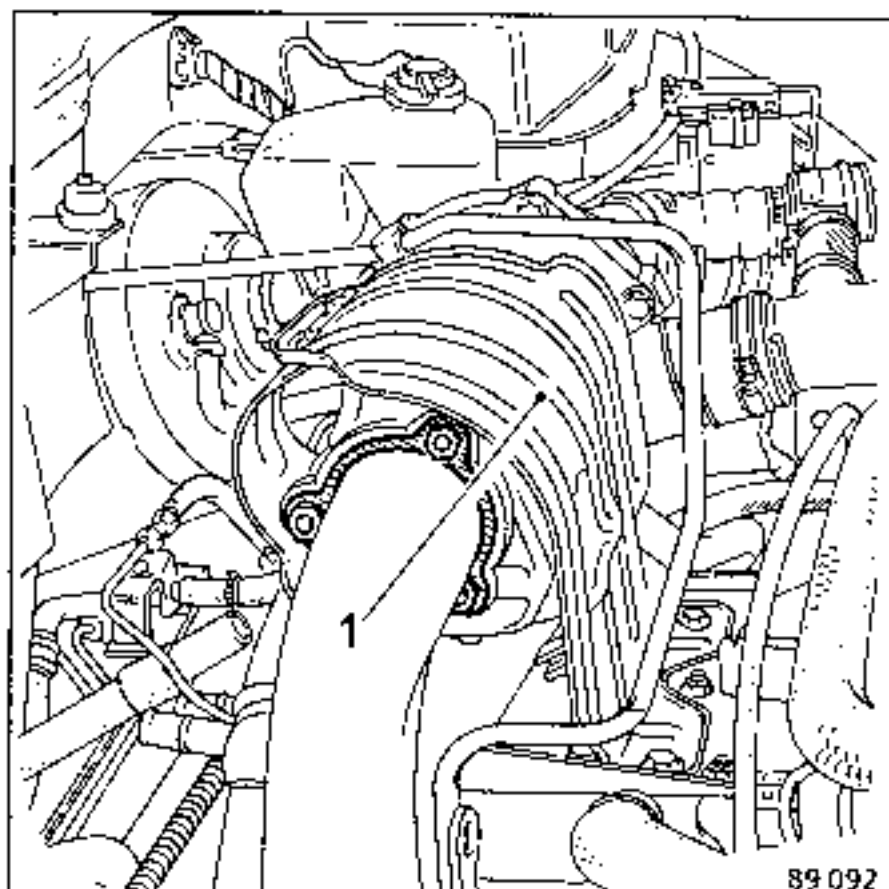


(V6 Turbo) Special features:

Remove the heat shield and its scoop as well as the cool air fan scoop and pipe.

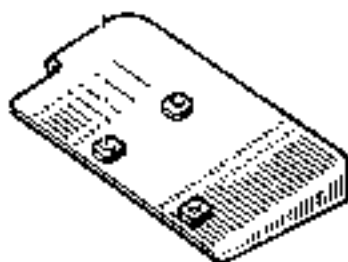


Remove: the heat shield (1).



Remove:

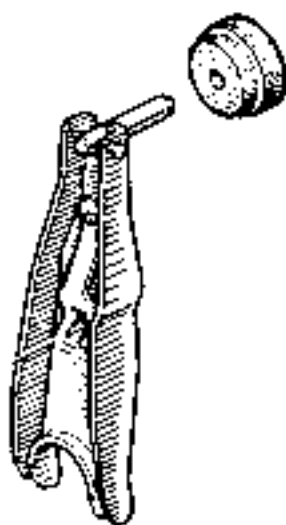
- the heat shield from the clutch slave cylinder;
- the shield cover under the turbocharger support bracket.



Disconnect the clutch slave cylinder piping and remove the cylinder.

REFITTING:

For refitting, fit the rubber clutch slave cylinder cup washer on the pushrod.



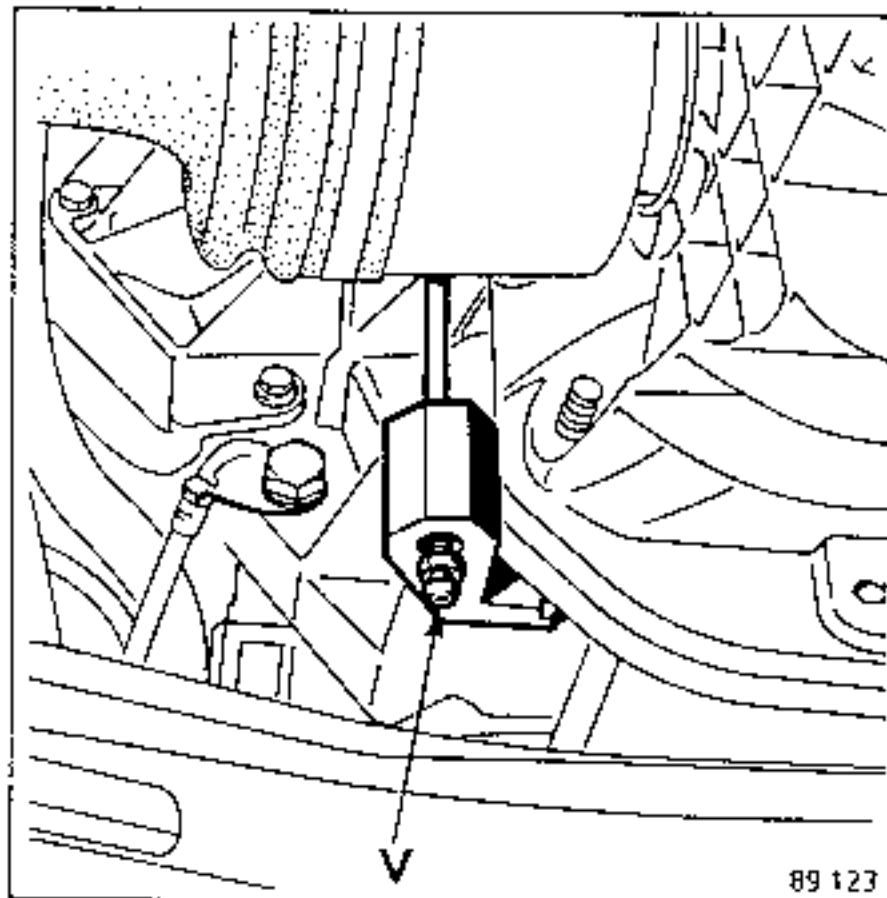
Fit the wheel cylinder by inserting the pushrod into the cylinder, while compressing the cup washer and the spring inside the wheel cylinder.

Attach the slave cylinder and reconnect its feed pipe.

Check and if necessary adjust the clutch clearance.

Bleeding the hydraulic circuit (V6 Turbo) : Special features

Bleed the clutch hydraulic circuit via screw (V) attached to the left-hand front base of the gearbox.

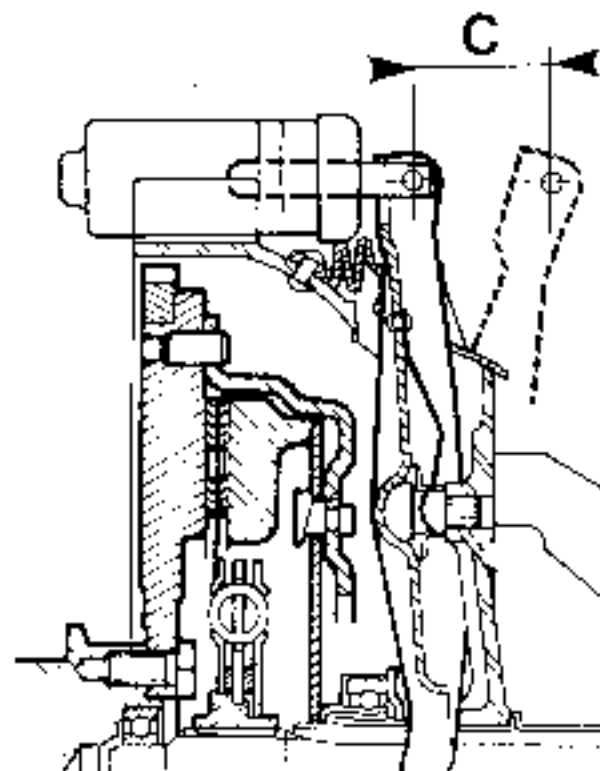


Dedutch using the pedal to separate the clutch fork from the slave cylinder.

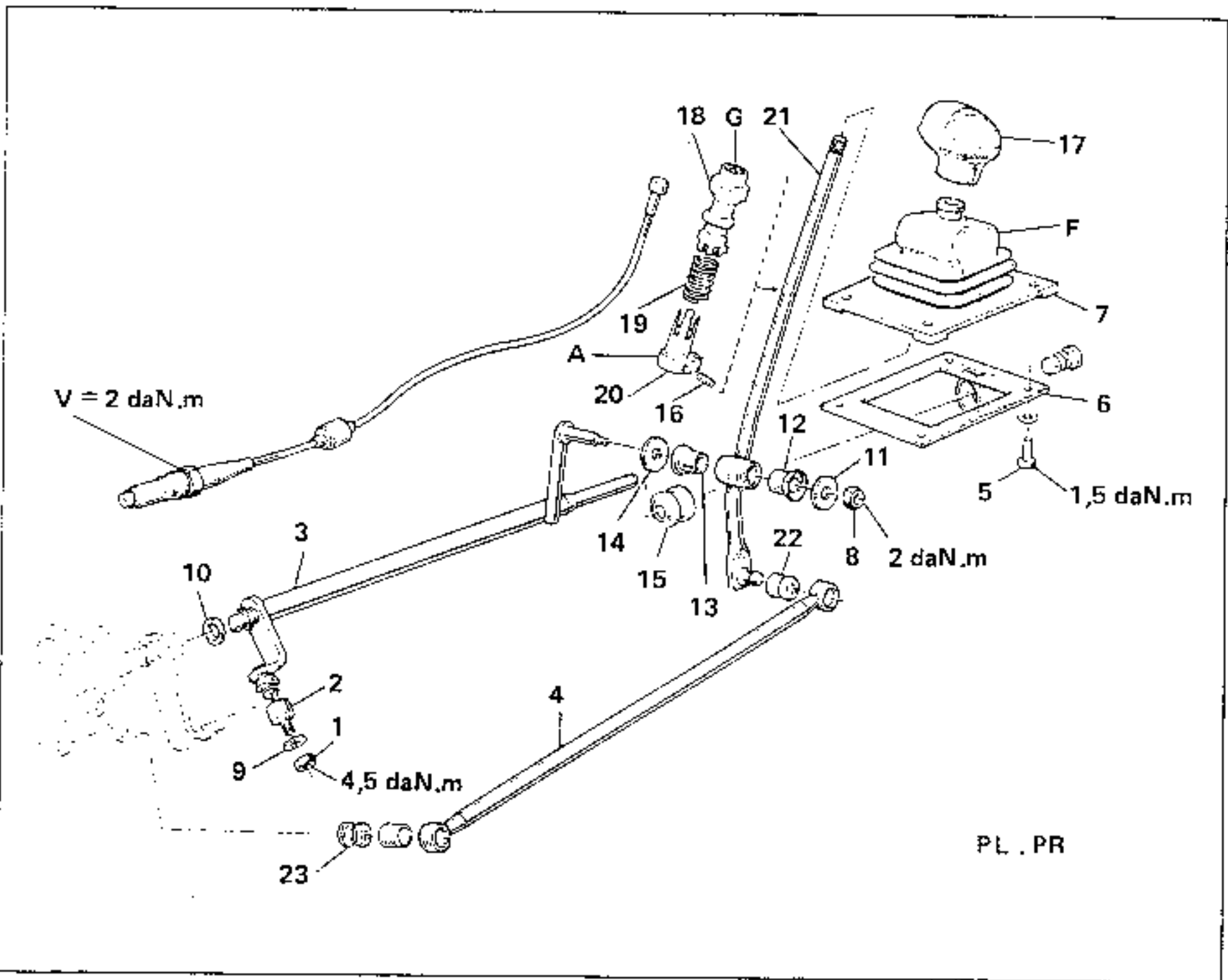
Fit the rubber cup washer to the slave cylinder.

Check the travel of the slave cylinder: it should be at least $C = 11$ mm.

Top up the level of brake fluid in the reservoir.



DUAL LEVER CONTROL



REMOVING

- Remove the parts in sequence, (1) to (8).
- Retain parts (9) to (14).
- Remove (15) from (6).
- Remove the pin from (16).
- Remove the parts in sequence, (17) to (20).
- Retain (21).
- If necessary, replace (22) and (23).
Green fitted on the gearbox end.
Neutral fitted on the lever end.

REFITTING - Special features.

- Stick (17) to lever (21).
- Lightly grease inside (15), (22) and (23) with 33 Medium.
- Tighten the nuts to the specified torque.

NOTE:

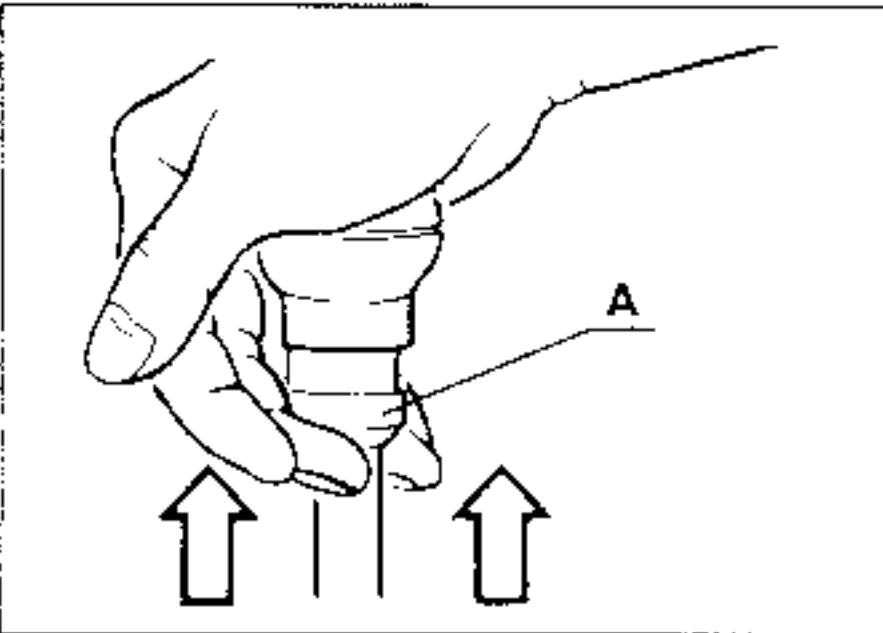
No adjustment is to be made to this type of control.

REVERSE POSITIVE LOCKING

This system prevents accidentally selecting reverse gear when changing quickly from 3rd to 2nd gear.

Operation:

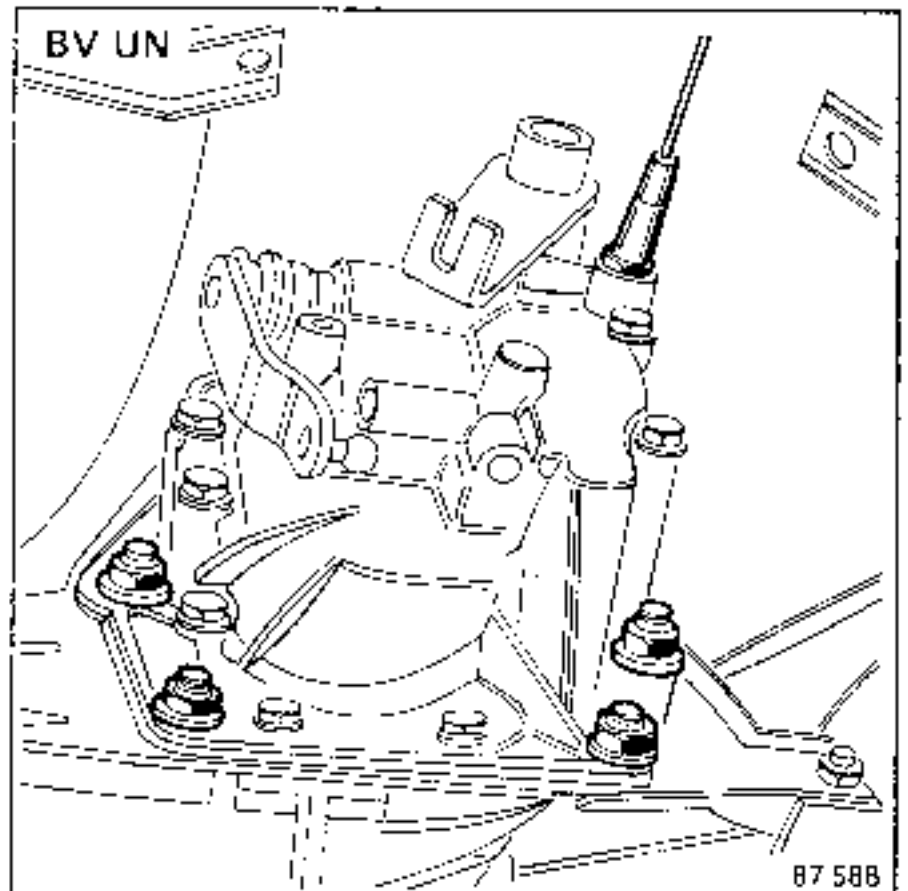
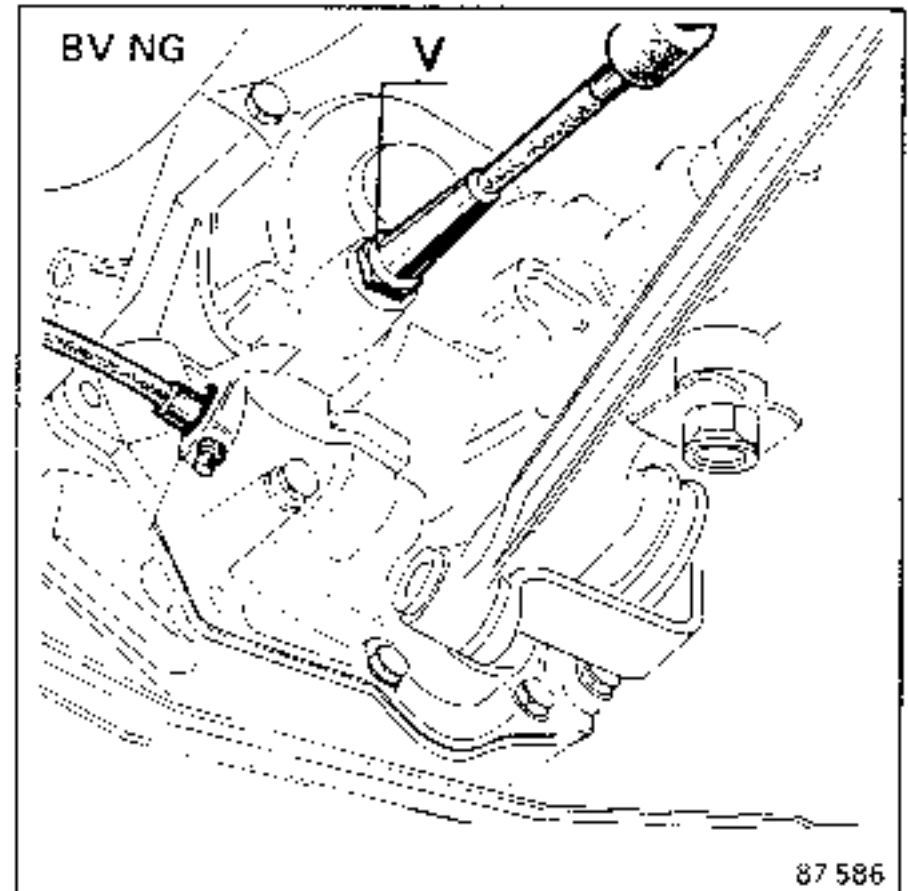
To select reverse, lift ring (A) and move the lever. The ring activates a cable which operates a lock finger fitted to the rear gearbox housing. The operation of this finger enables reverse gear to be selected.



REMOVING (the locking cable)

The gearbox does not have to be drained.

Unscrew and remove the lock on the gearbox.



Raise the bellows (F).

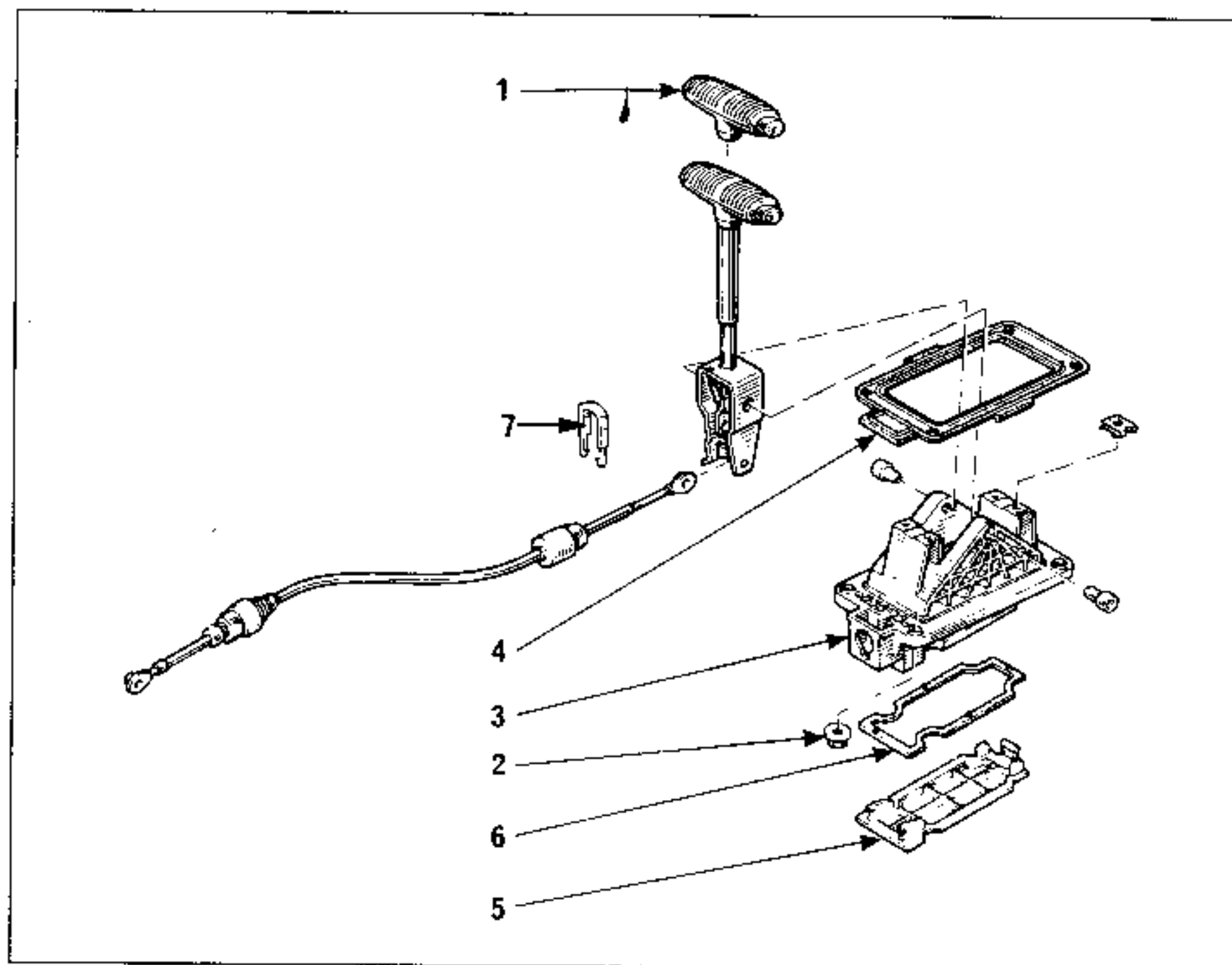
Unclip the ring cable stop (G).

Remove the cable sleeve from the sleeve stop (A).

REFITTING:

Spread a strip of **CAF 4/60 THIXO** paste on the lock threads and tighten to torque **2 daNm**.

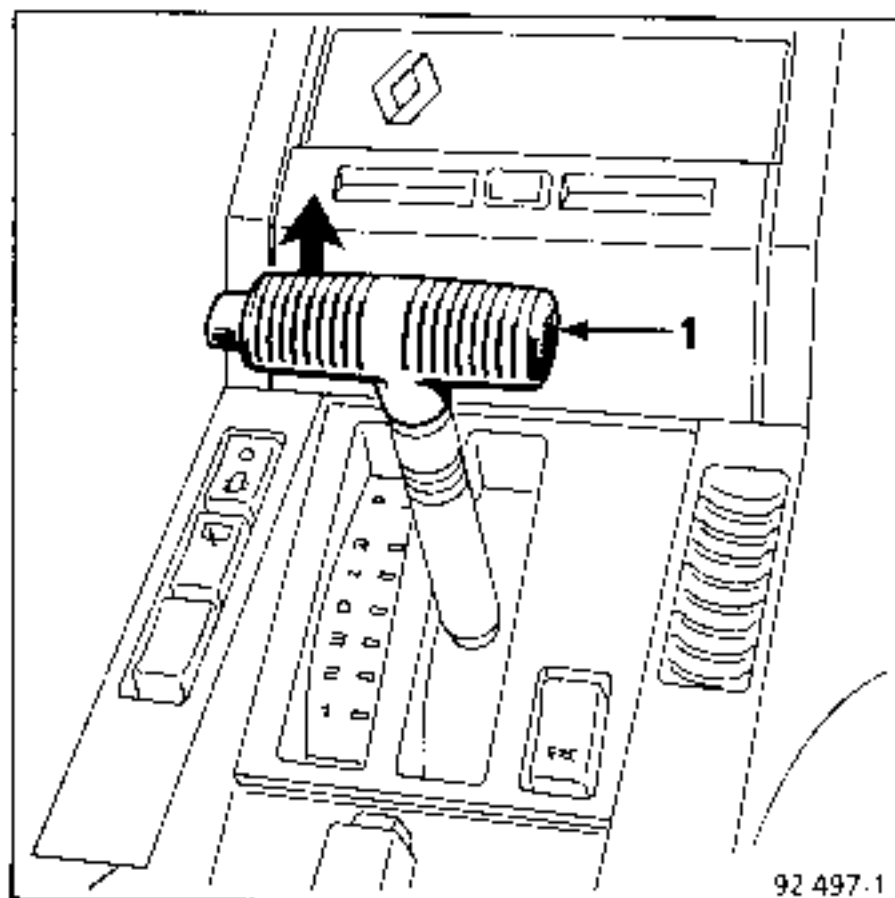
EXPLODED VIEW



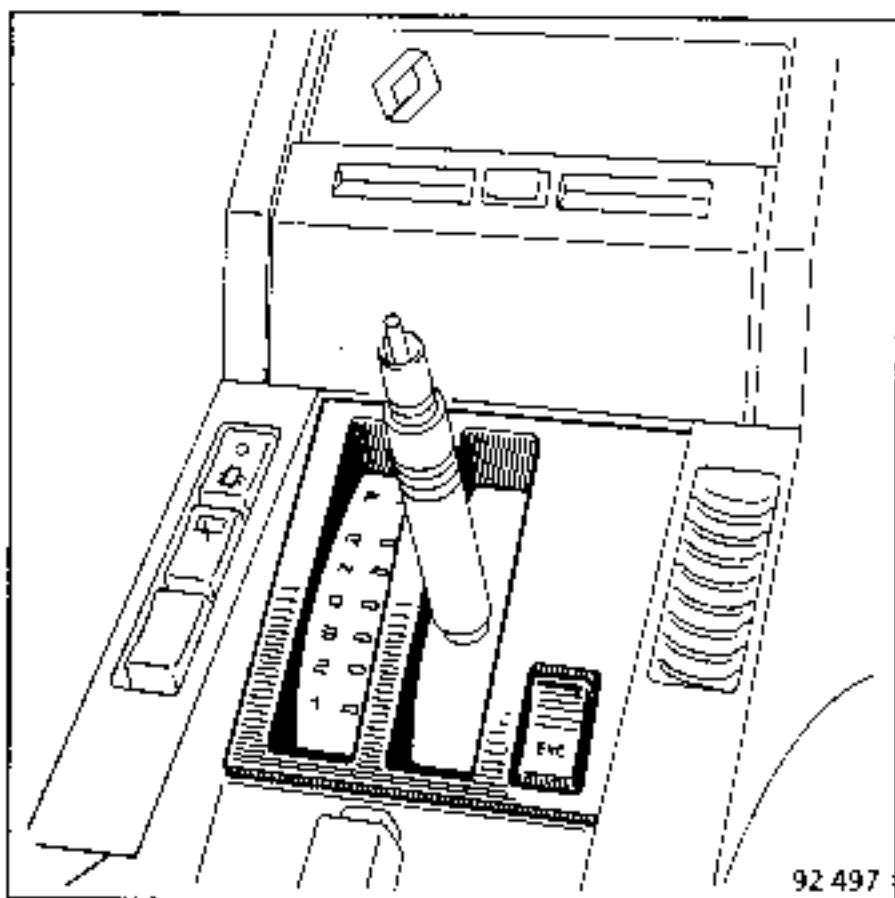
- 1 - Gear change lever handle.
- 2 - Gear change lever retaining nut under floor.
- 3 - Control module.
- 4 - Control module seal under floor.
- 5 - Lower cover.
- 6 - Seal.
- 7 - Locking key.

REMOVING

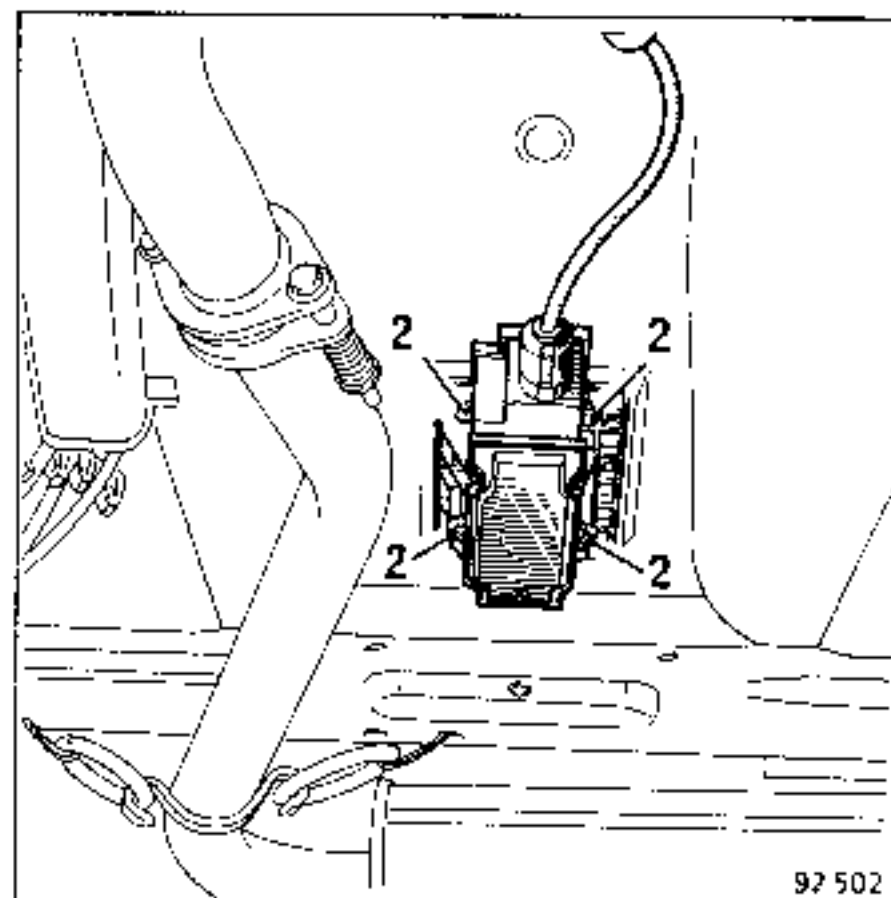
Remove the gear change lever handle (1) by lifting it upwards.



Remove the console trim by pressing to the left and releasing the retaining lugs as you raise it.



Remove the 4 gear change lever retaining nuts under the floor (2).



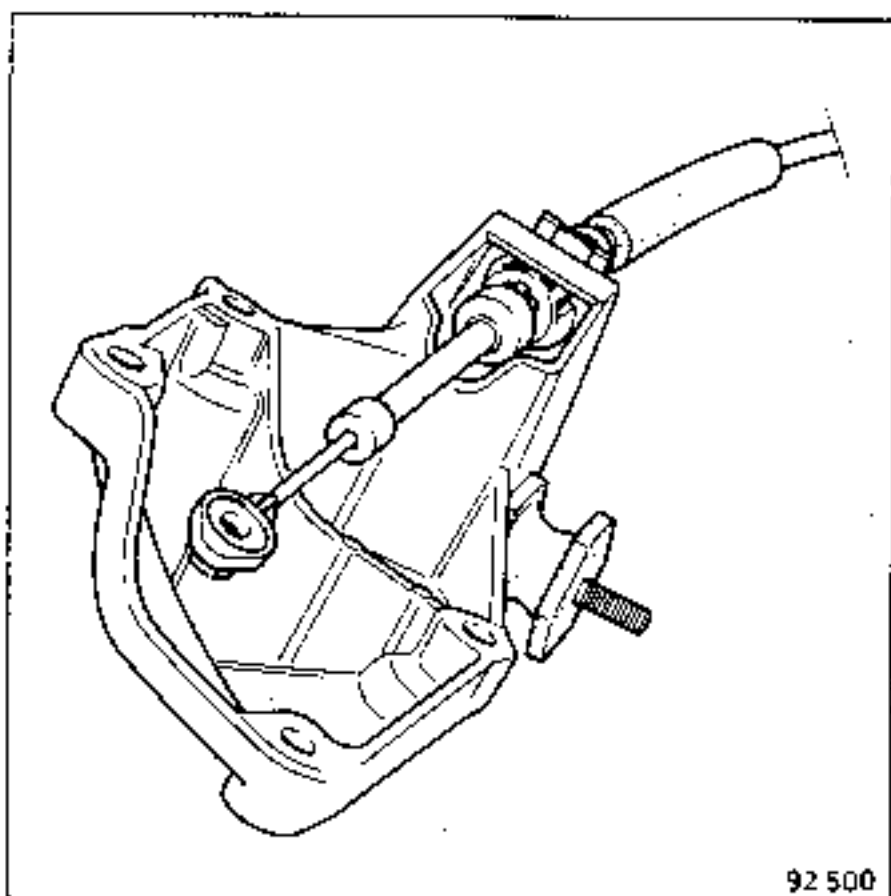
Disconnect the wire to the light.

Unclip the lever balljoint control cable from the gearbox selector lever.

Remove the right-hand automatic transmission support bracket.

Release the complete control assembly (support bracket, cable and lever).

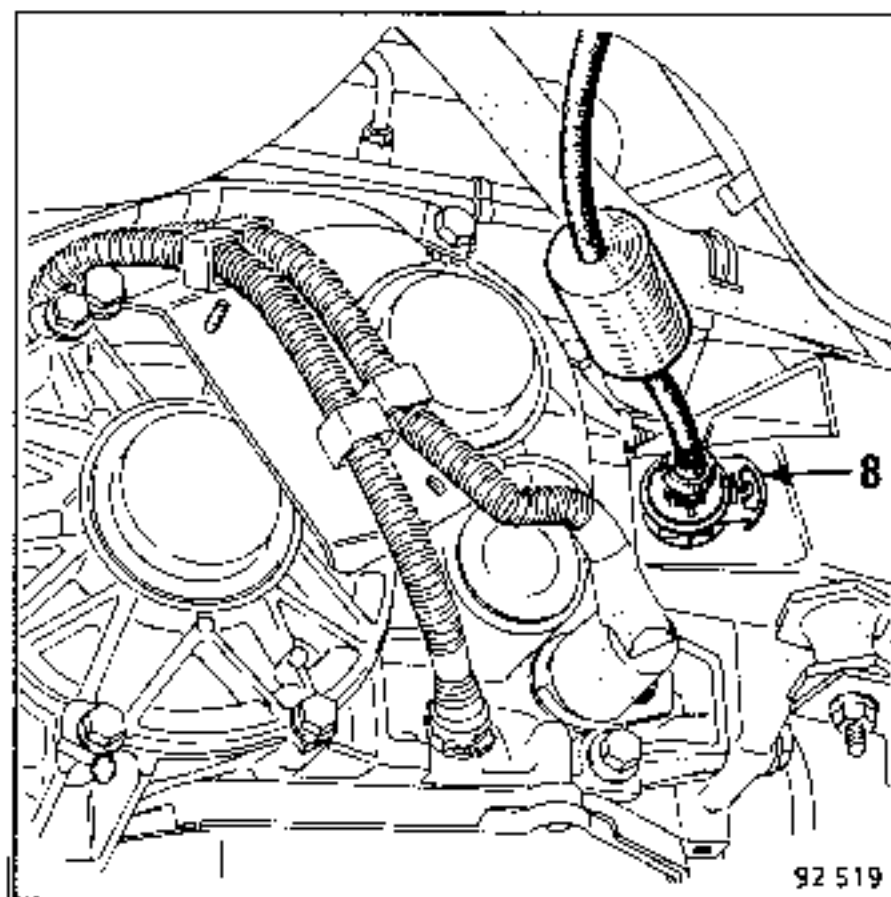
Separate the control section from the right-hand transmission support bracket.



REMOVING-ADJUSTING

Fit the right-hand transmission support bracket, coupled to the control cable.

Unlock the control cable adjuster and free it enough to release the adjustment??.



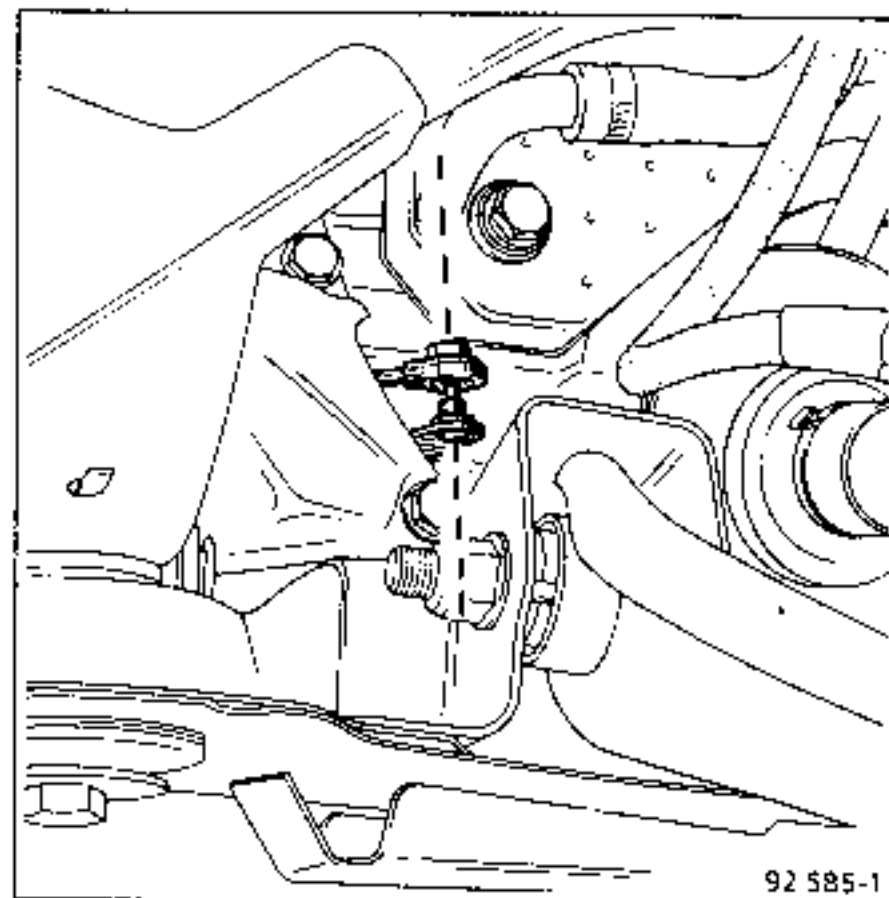
Fit the control module (3) fitted with its seal (4), from under the floor.

Connect the wire to the light.

Screw in and tighten the 4 underbody fixing nuts (2).

Clip on the console trim and the gear change lever handle.

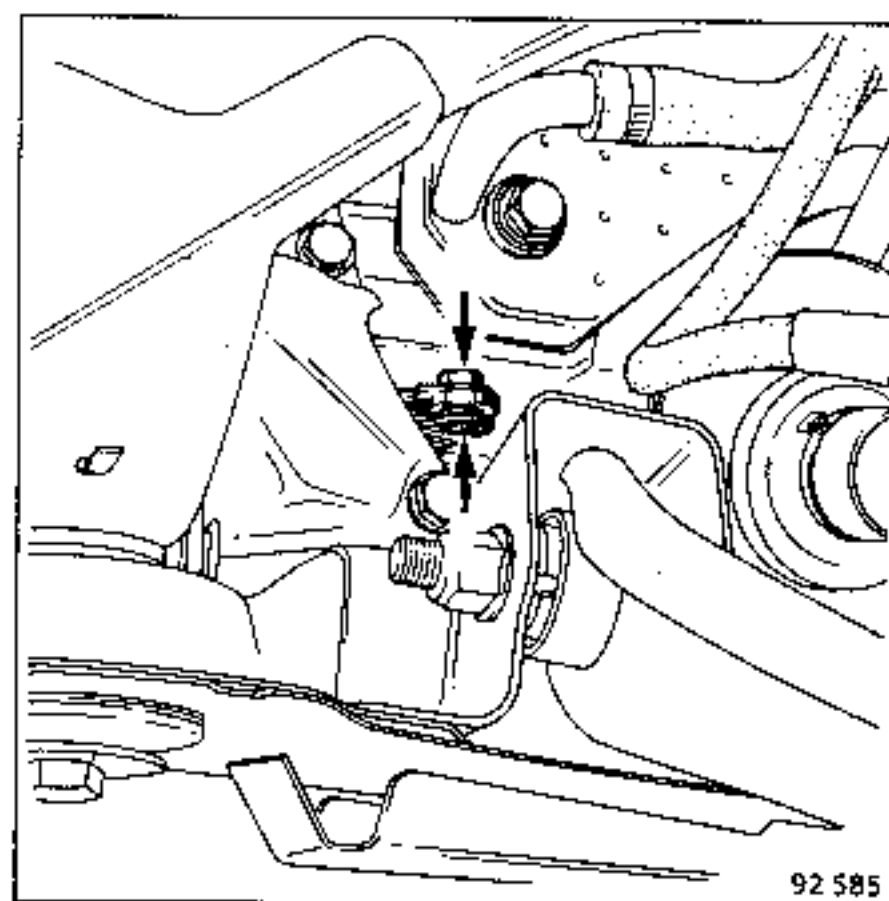
Move the gear change lever and the automatic transmission into 1st gear "hold" (lever on gearbox fully towards rear of transmission).



Line up the cable ball joint with the transmission lever ball joint by adjusting the position of the sleeve.

Lock by pushing in the clip (8).

Clip the control cable ball joint to the transmission lever using multi-grip pliers.

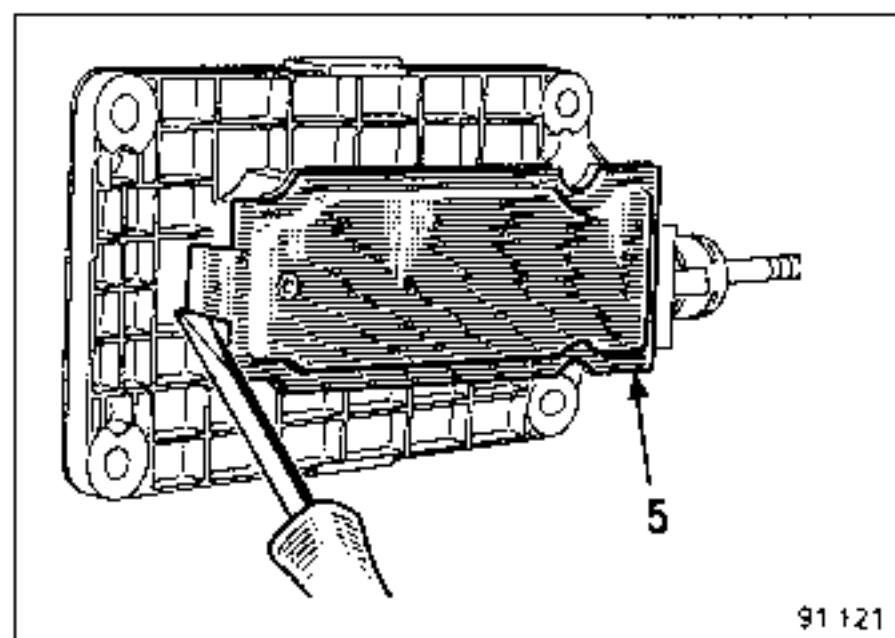
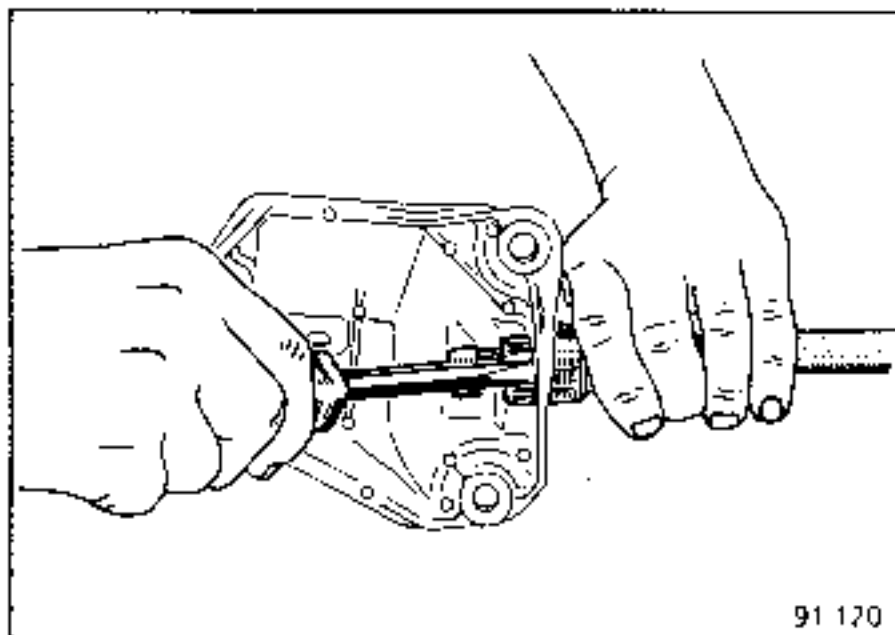


REPLACING

The control cable can only be removed after having removed the control assembly (see section on removing the control assembly).

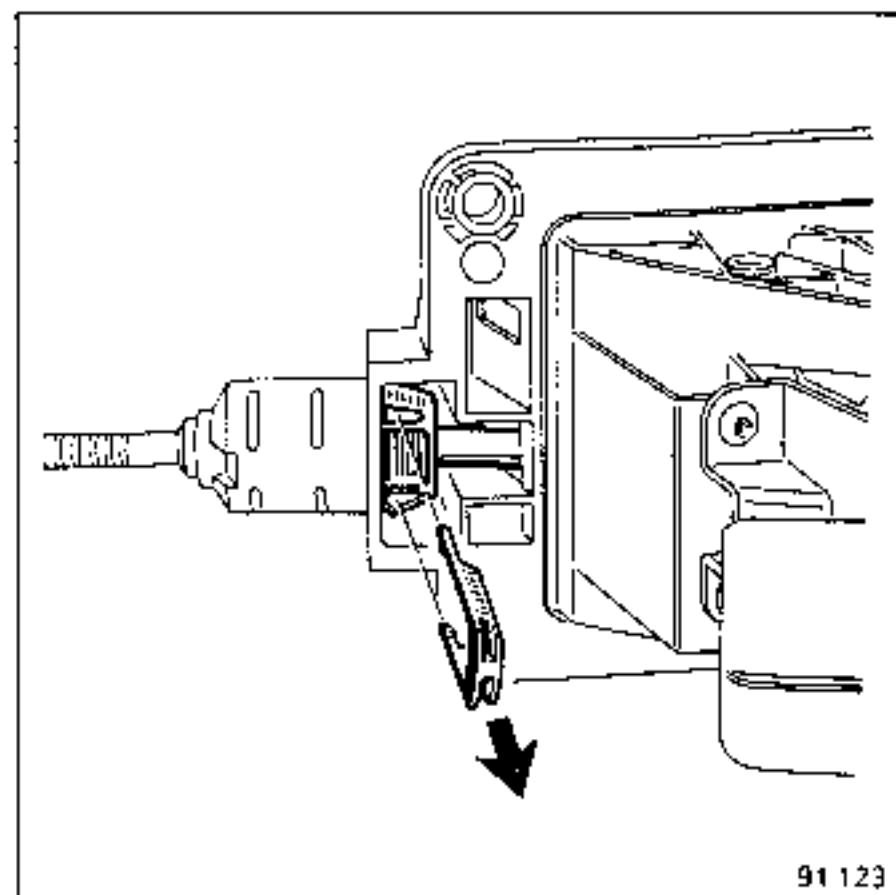
Unbolt the right-hand transmission support bracket.

Open the lower cover (5) of the control module using a screwdriver.

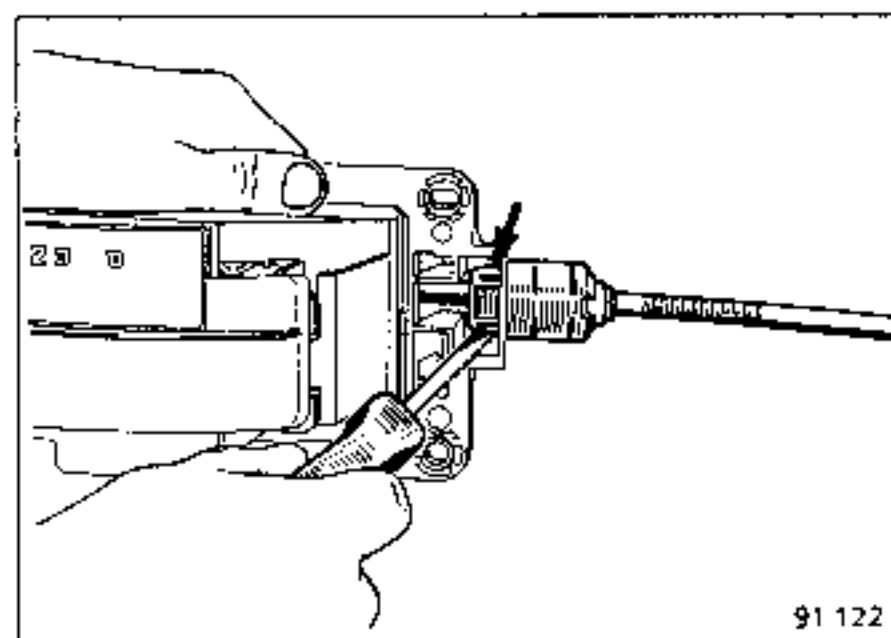


Unclip the balljoint from the base of the lever.

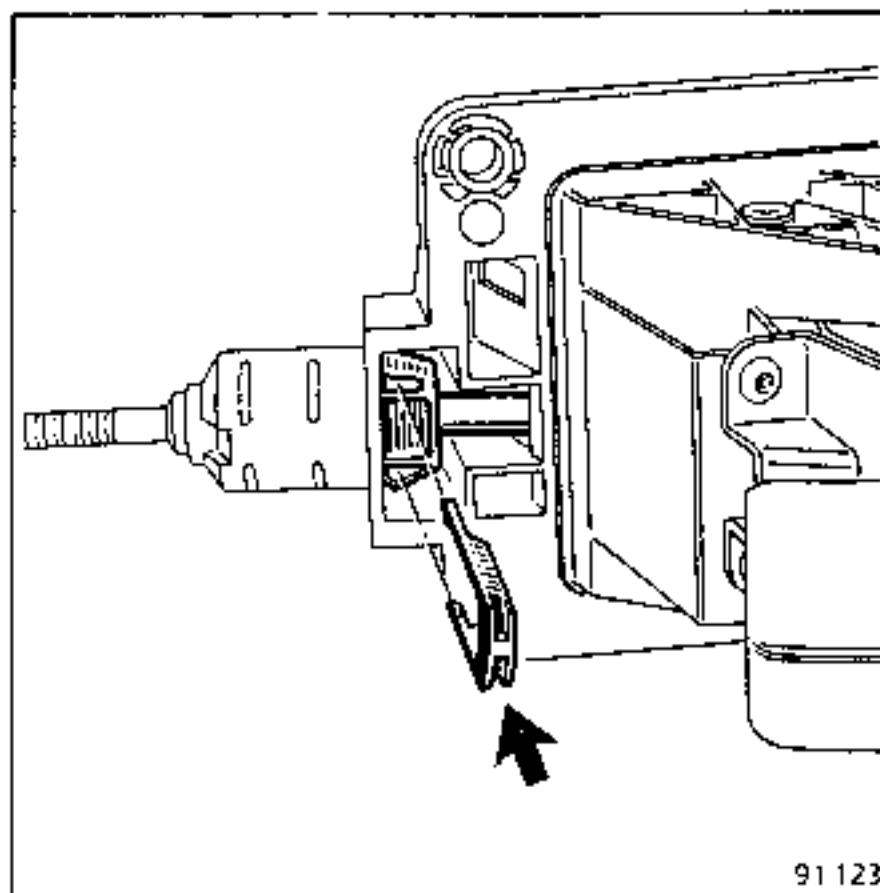
Remove the cable locking key from the housing.



Free the cable by pressing on the 2 locking lugs in the housing.



When refitting, fit the cable to the housing (fit the key the correct way round).



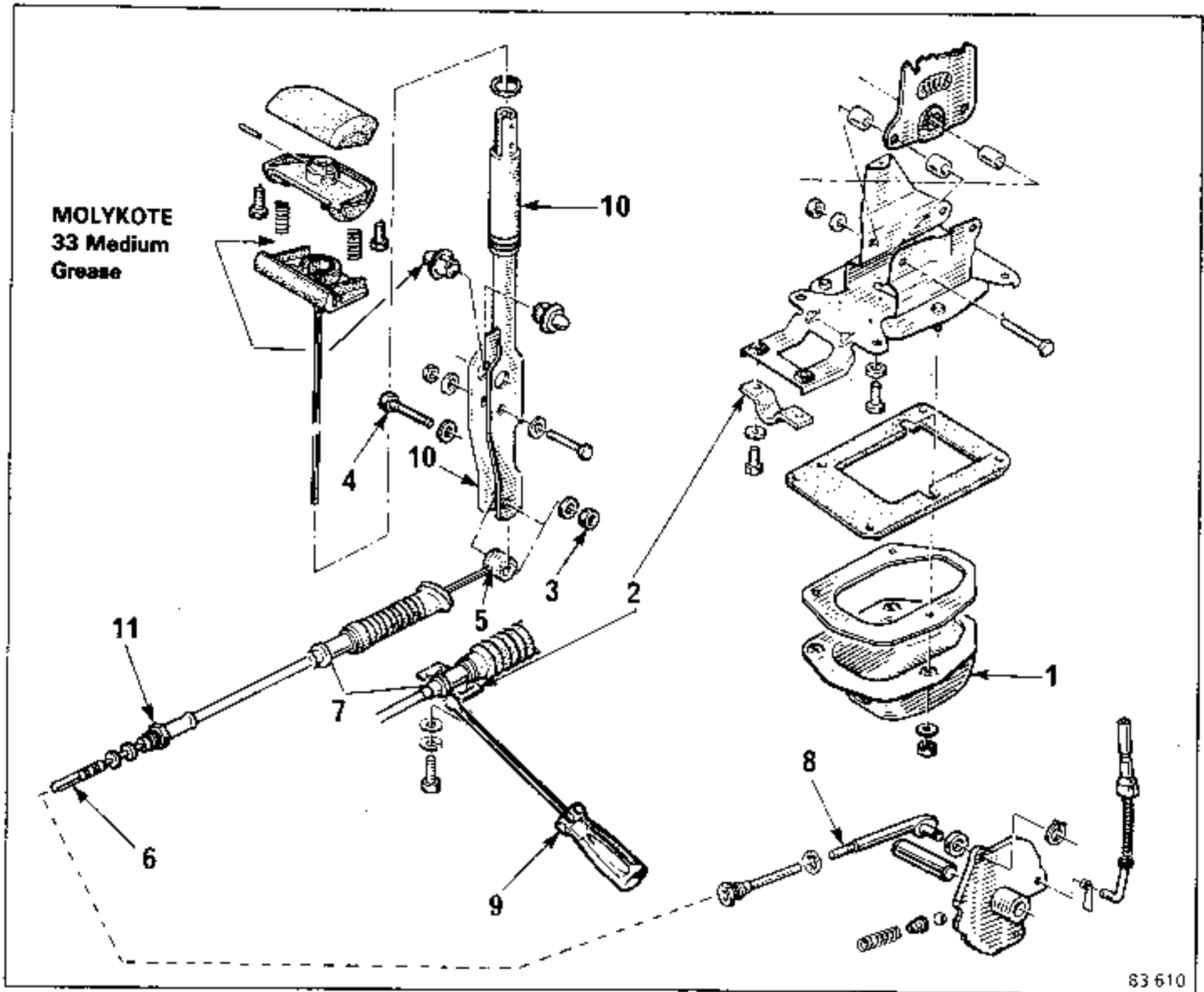
Clip the balljoint at the base of the lever.

Close the base of the housing using the seal (6) and the cover (5).

Clip the cable to the transmission support bracket.

Follow the instructions in the section on refitting and adjusting the control assembly.

EXPLODED VIEW



See "Removing and refitting" on next page.

ESSENTIAL SPECIAL TOOLING

B. Vi. 868

Locknut wrench

Move the selector lever to N.

REMOVING

Lever end:

Remove:

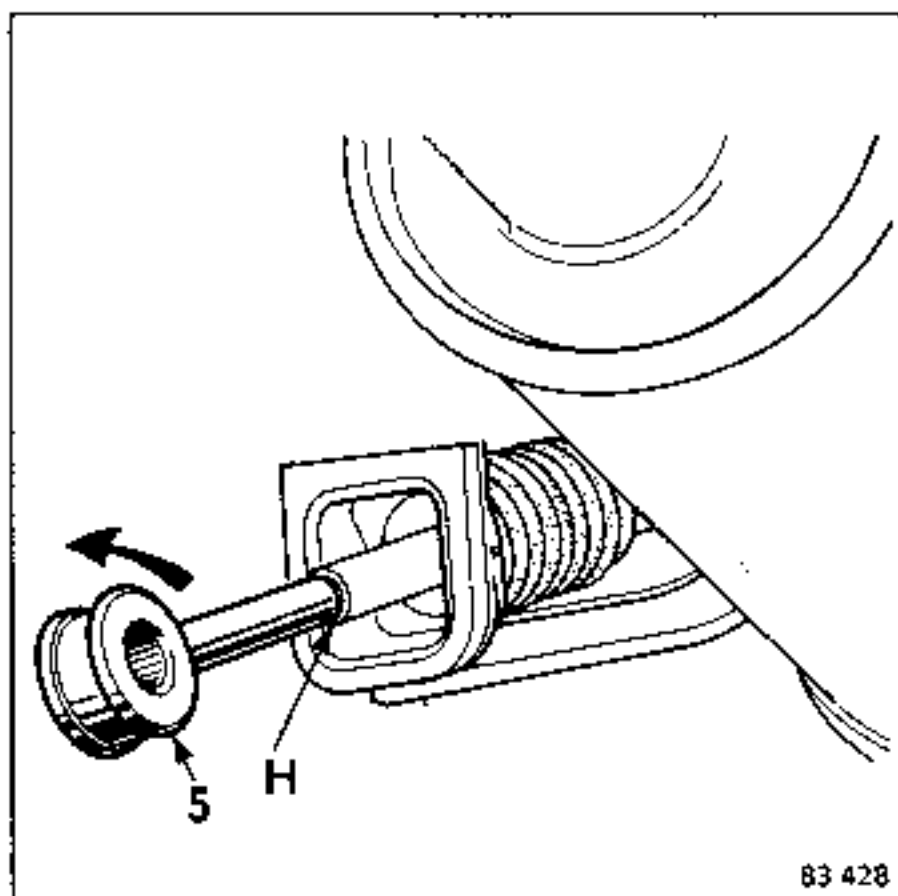
- the protective plate (1) under the lever;
- the clip (2)
- the nut (3) and its pin (4).

Disconnect the control cable (5) from the lever (10).

Automatic transmission end:

Using wrench B.Vi. 868 unlock the sleeve end bolt (11) in order to free it from the housing.

Turn the cable at the lever end to unscrew it from the automatic transmission between (8) and (6).



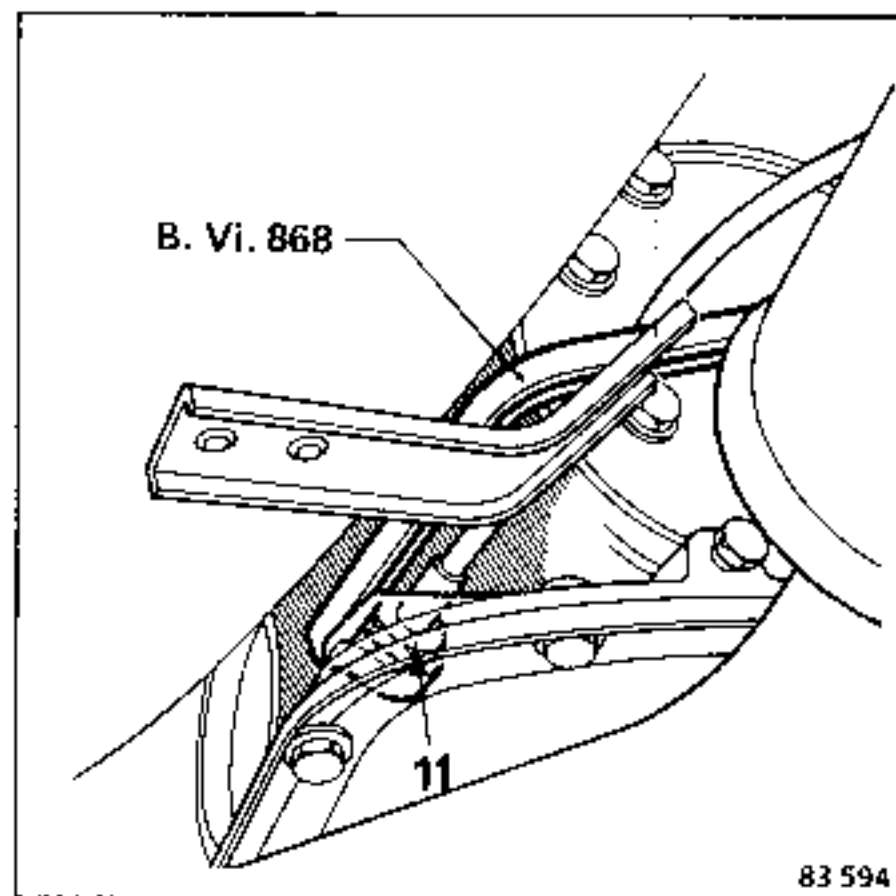
Pull hard on the cable to free it and its two sealing washers.

REFITTING

Move the selector lever to "P".

Automatic transmission in position "N".

Screw in the sleeve stop (11) and lock it using wrench B.Vi. 868.

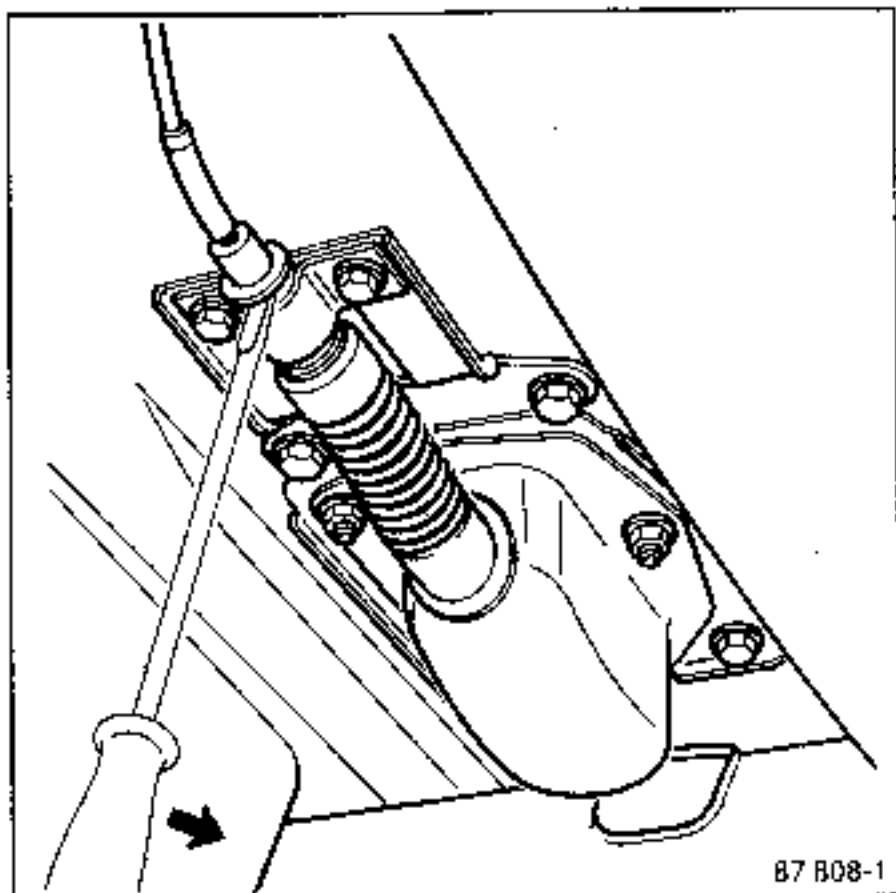


Screw in the cable until the end (5) is flush with the sleeve at (H).

Pull on the cable until it moves to position "P".

Connect the cable to the lever.

Preload the cable sleeve using a screwdriver (9) between the clip (2) and the sleeve stop (7) and tighten the clip bolts.



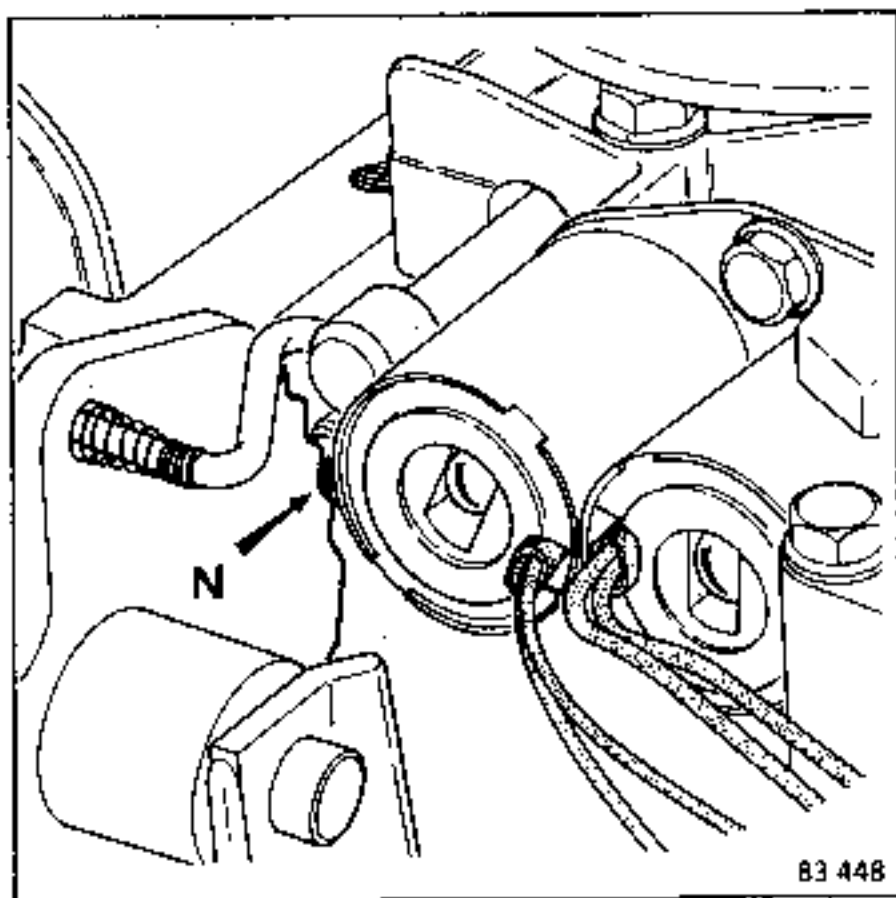
Check gear changing with the lever, the starter activation in positions "P" and "N" and the Park function.

SPECIAL CIRCUMSTANCES - BROKEN OR SEIZED CABLE

Cut the sleeve and the cable as close to the automatic transmission as possible.

Remove the lower housing.

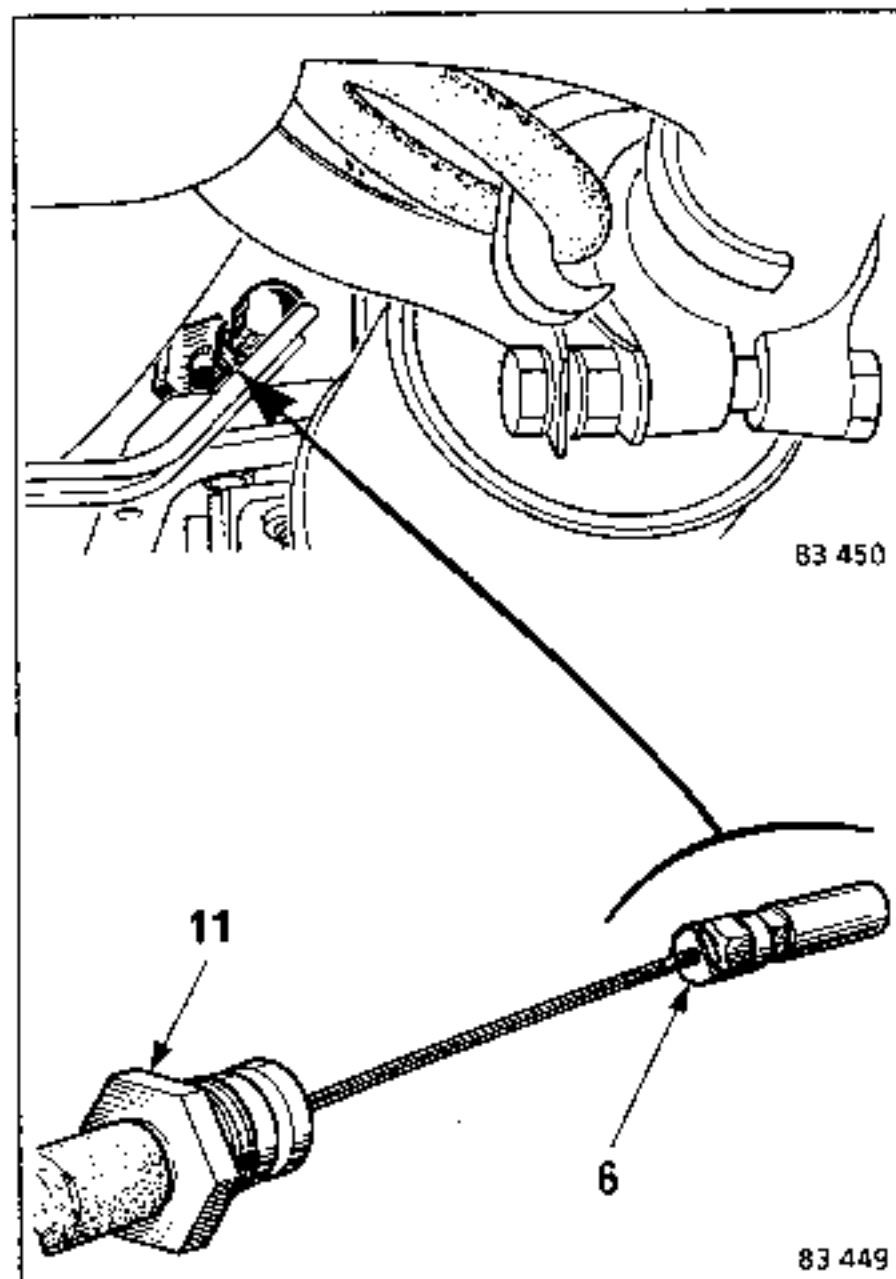
Move the quadrant to position N.



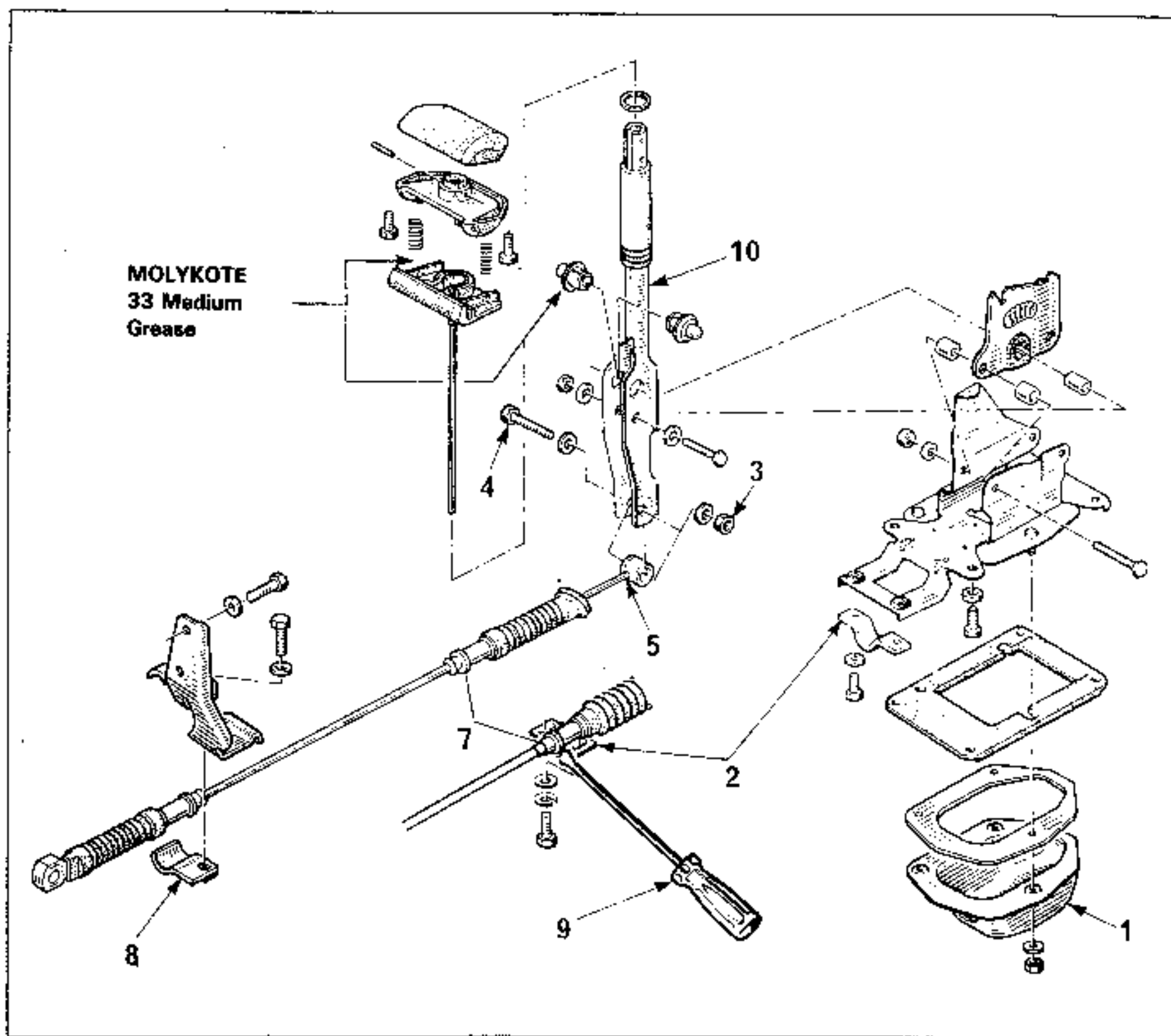
Remove the sleeve bolts (11) using B.Vi. 868.

Remove the two sealing washers using a gimlet.

Unscrew the crimped end (6) still in the transmission, and remove it.



Fit a new cable.



See Removing-Refitting and Adjusting on the next page.

REMOVING THE SELECTOR CABLE

Lever end:

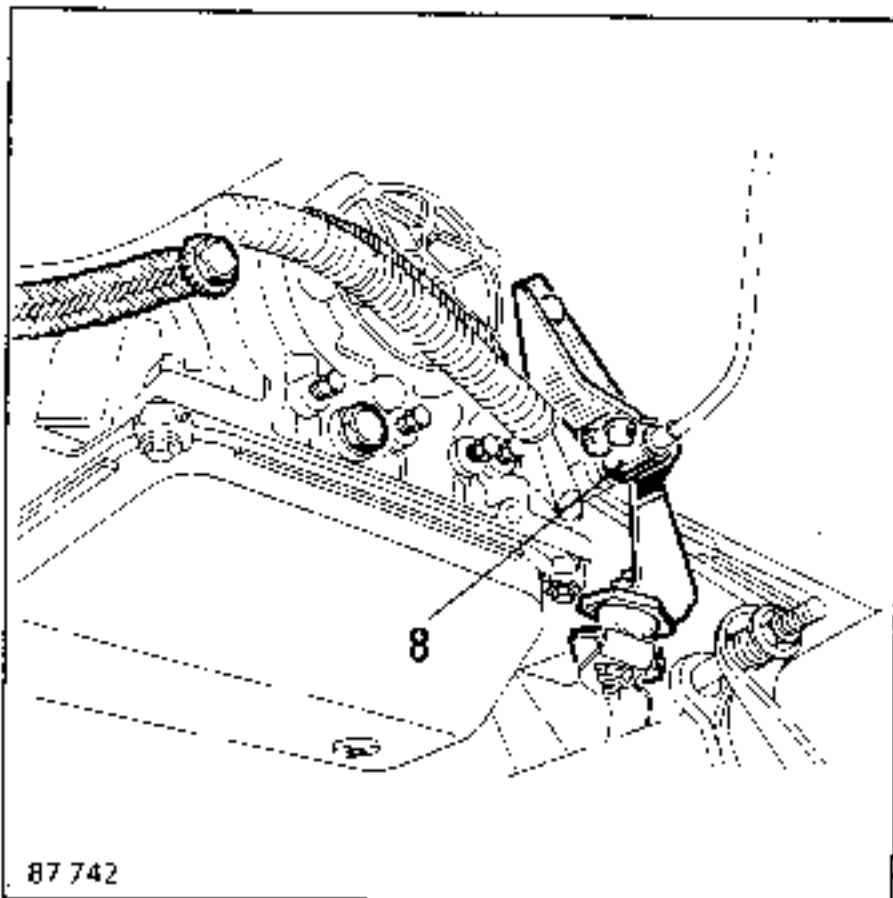
Remove:

- the protective plate (1) under the lever;
- the clip (2);
- the nut (3) and its pin (4).

Disconnect the control cable (5) from the lever (10).

Transmission end:

Remove the clip (8) and disconnect the cable from the input shaft.

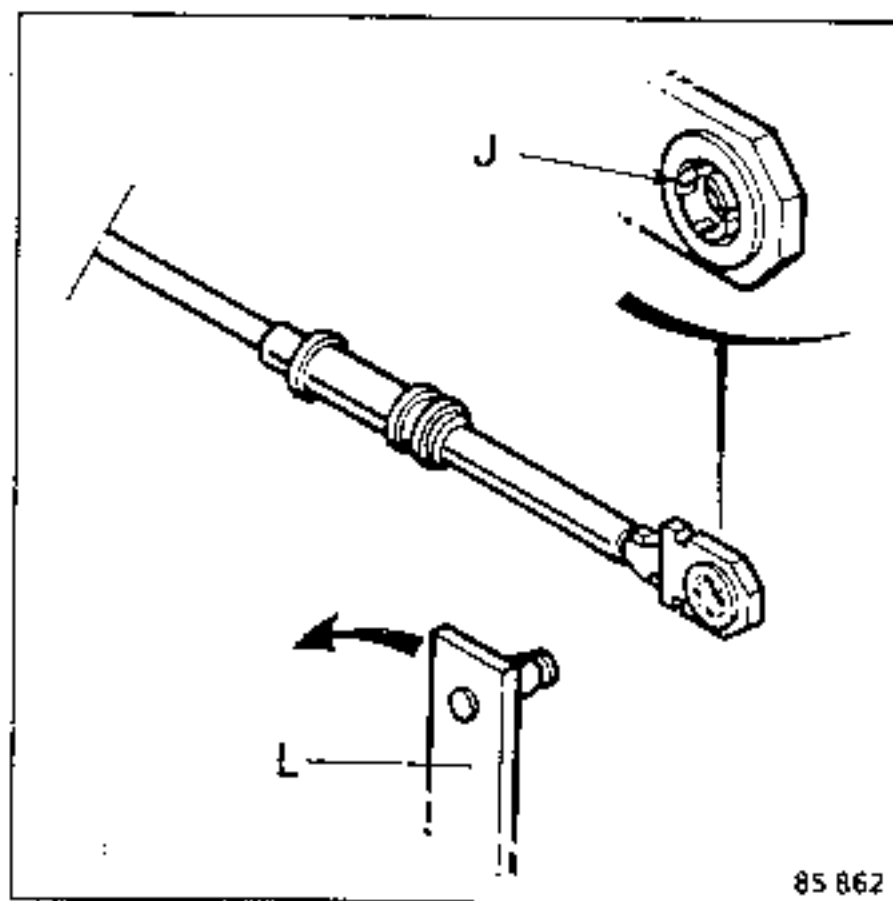
**REFITTING-ADJUSTING**

Move the selector lever to "P".

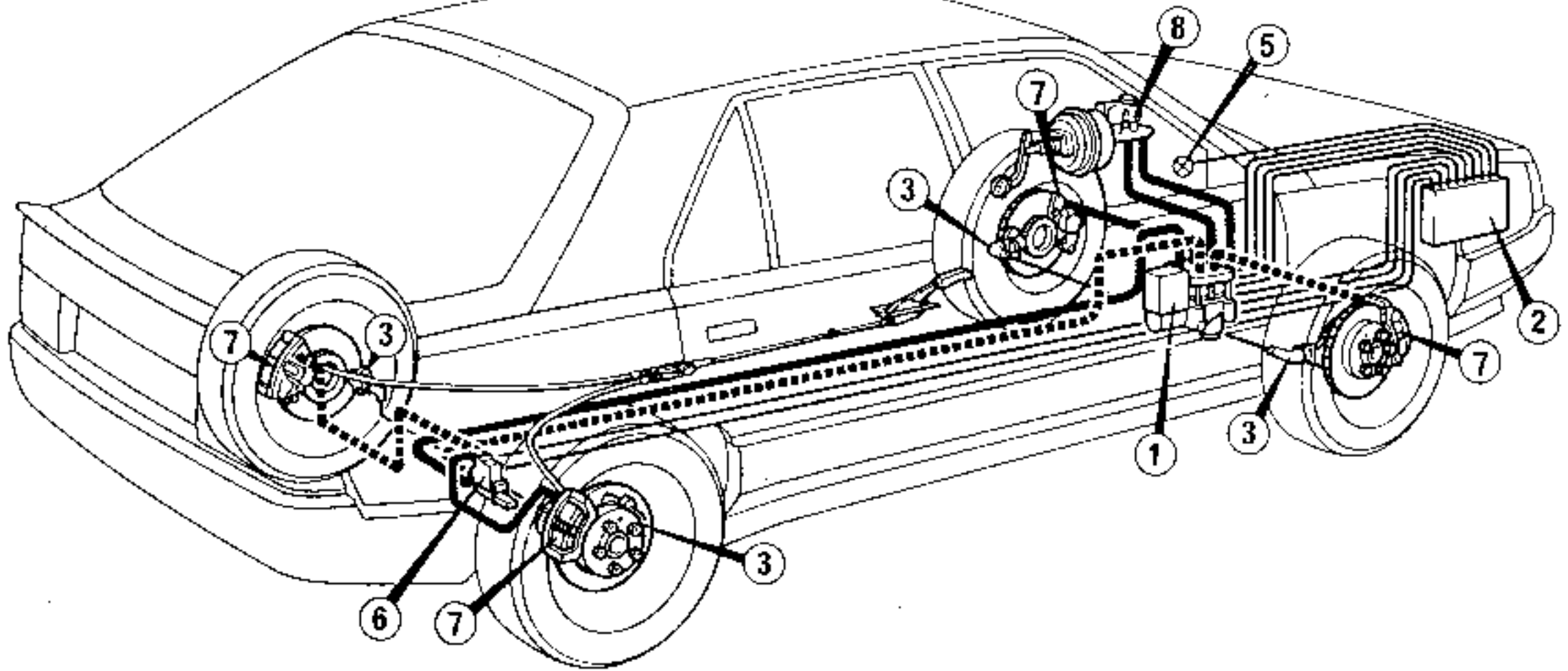
Connect the cable, with notches (J) on the balljoint end and set the selector lever (L) to Park.

Preload the cable sleeve using a screwdriver (9) between the clip (2) and the sleeve stop (7) and tighten the clip bolts (2).

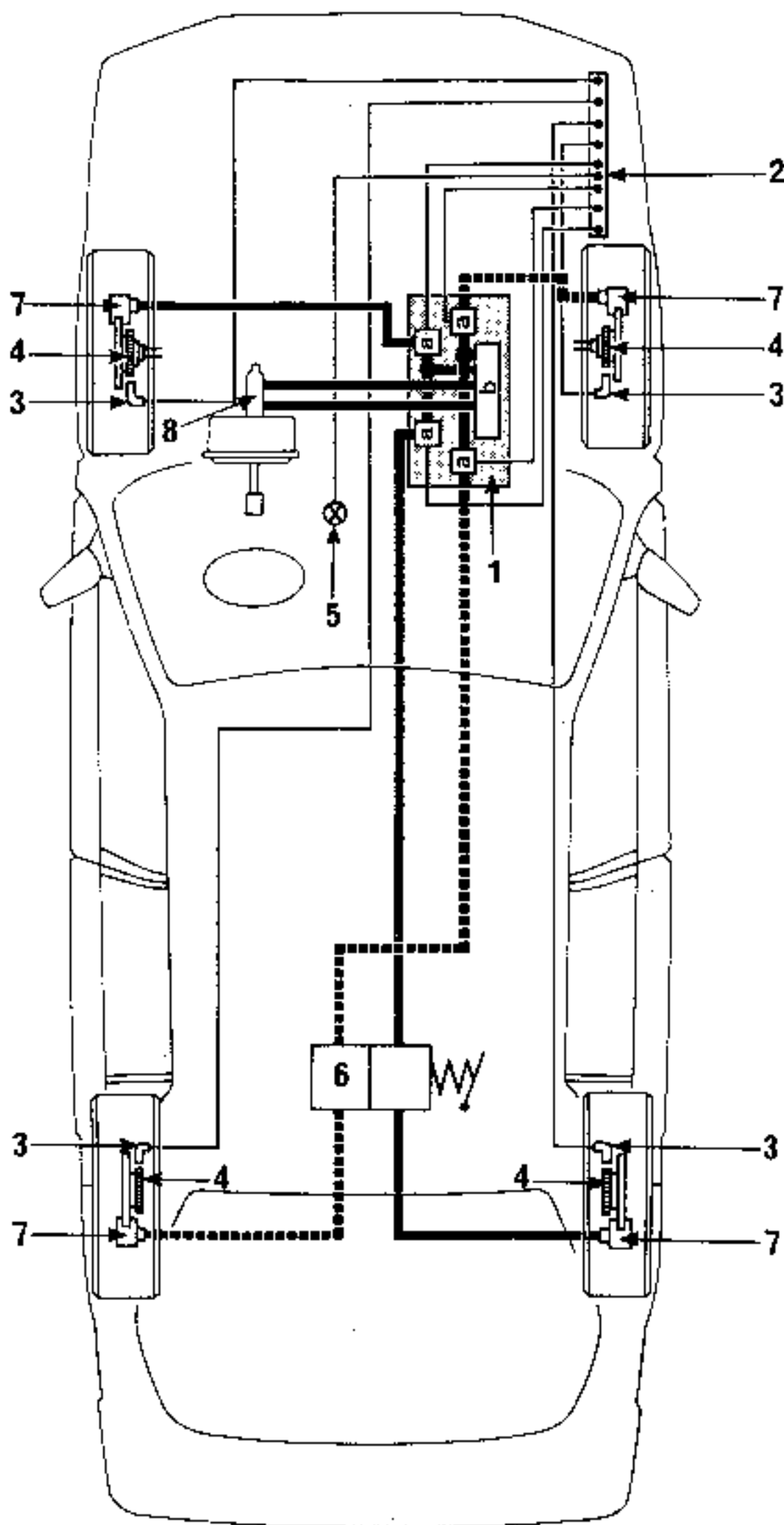
Check gear changing with the lever, the starter activation in positions "P" and "N" and the Park function.



INSTALLATION AND LAYOUT



INSTALLATION AND LAYOUT



The **ABS** system comprises:

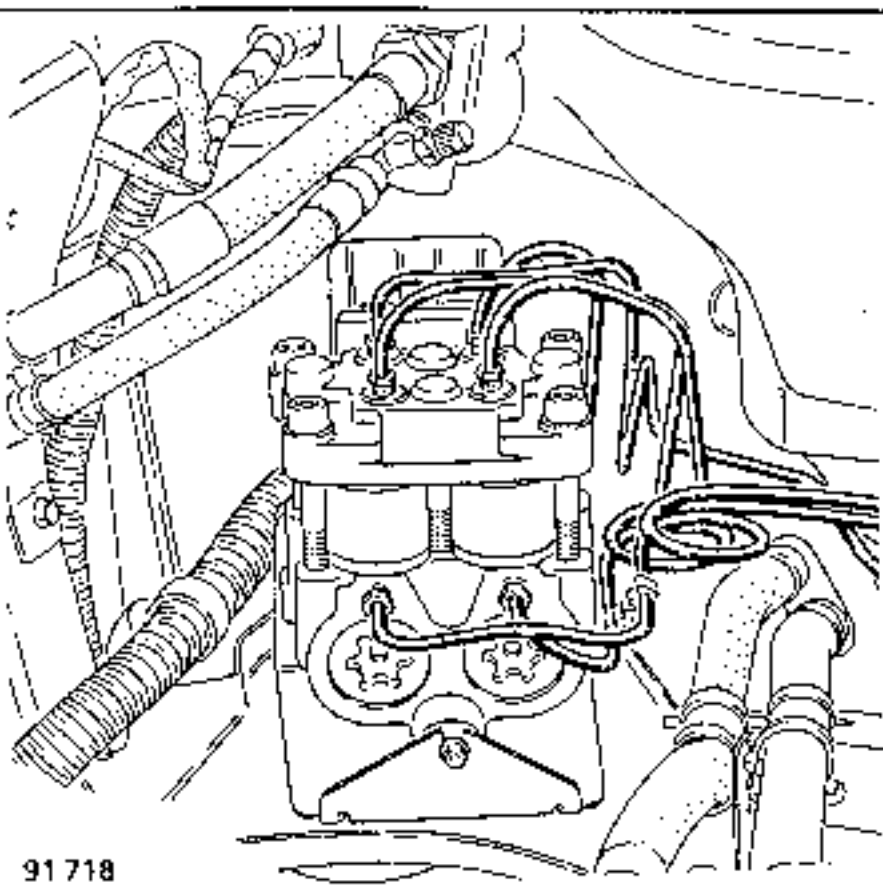
- a hydraulic unit (1) comprising an electric pump (b) and four solenoid valves (a);
- an electronic computer (2) including a self-monitoring system;
- one wheel rotation speed sensor per wheel (3);
- four mounted targets (4): on the driveshafts at the front and on the hubs at the rear;
- a warning lamp on the dashboard (5).

The rest of the circuit comprises:

- a double brake limiter (6);
- four brake calipers (7);
- a tandem master cylinder (8).

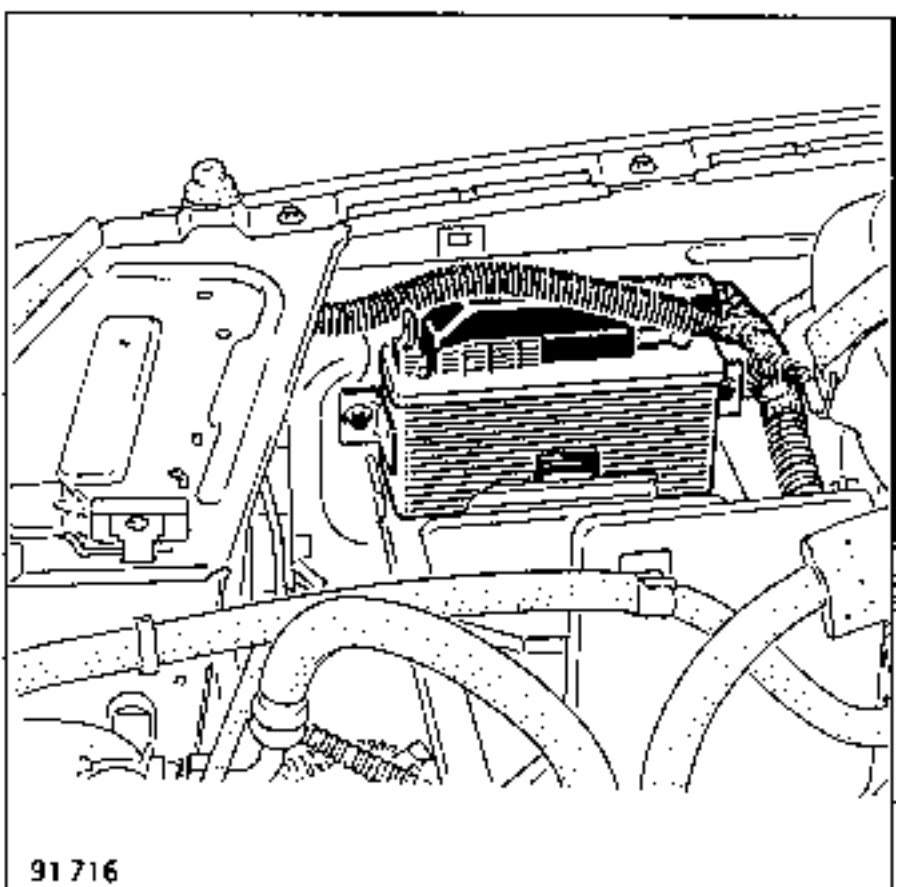
Hydraulic unit (1)

This comprises an electric pump and four solenoid valves (one for each wheel). It is located on the steering cross member at the front left-hand side of the vehicle.



Electronic computer (2)

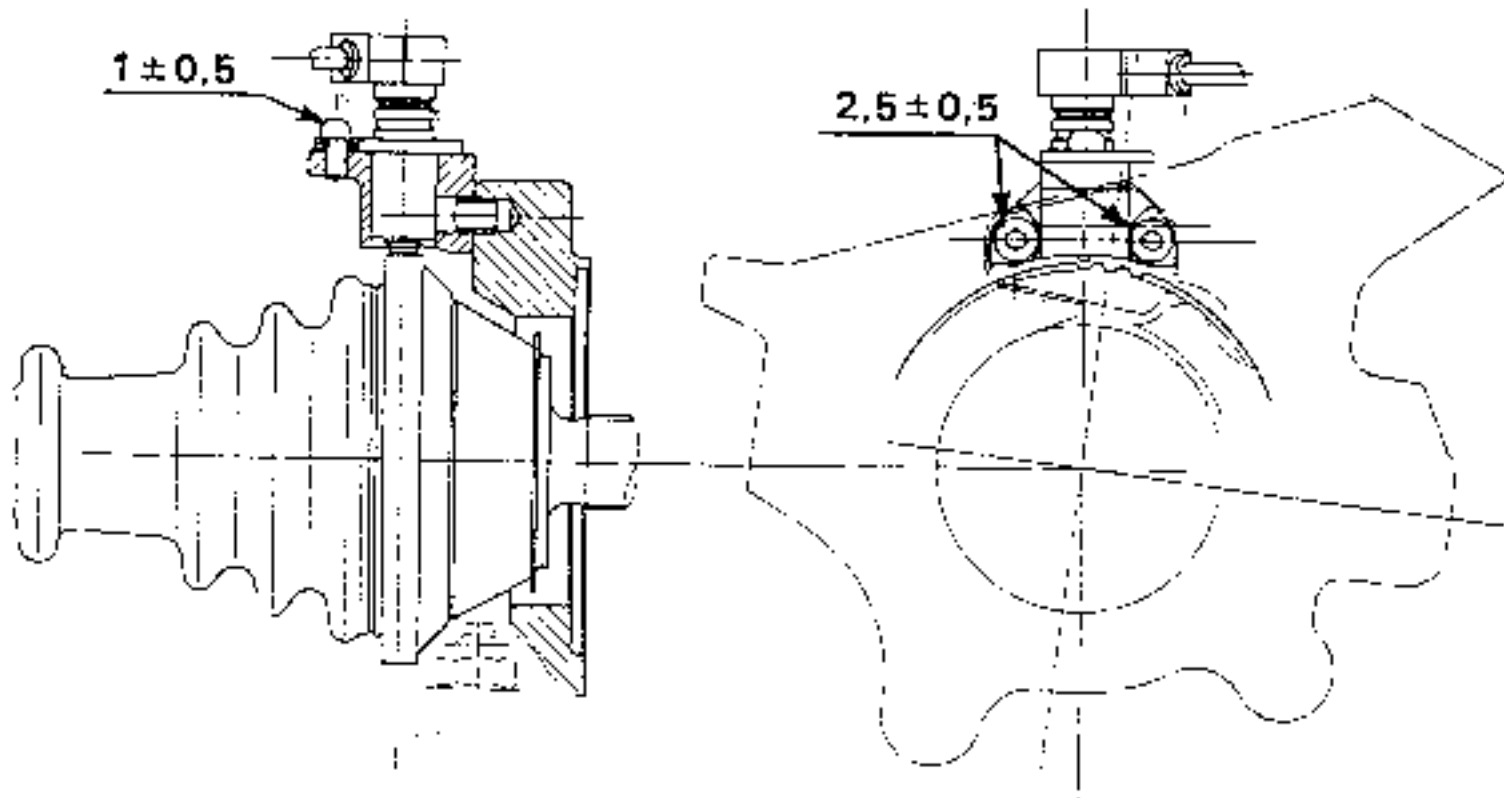
This is located between the battery and the front right-hand wheel arch.



It analyses the information from the wheel sensors and controls the solenoid valves in accordance with this information.

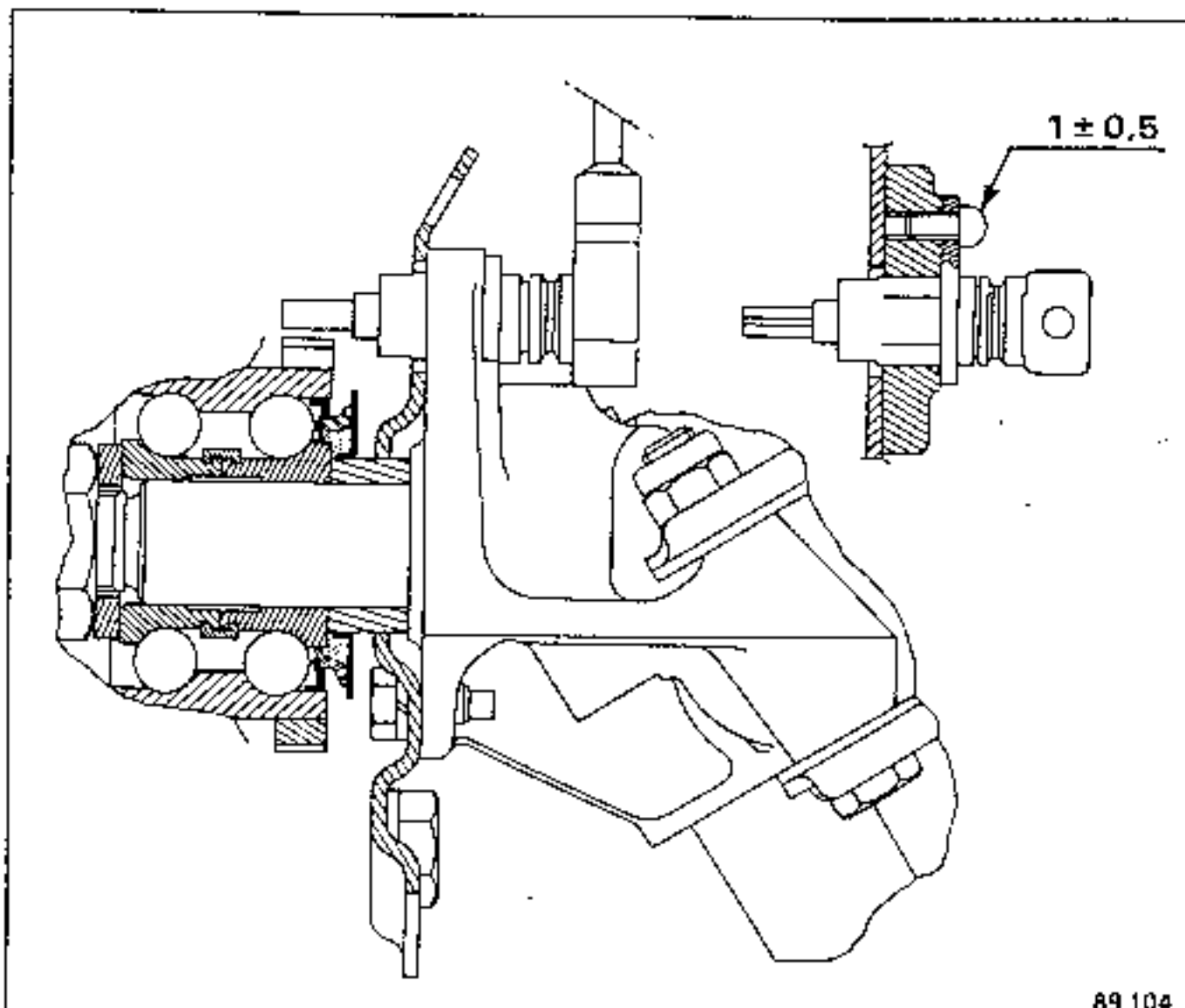
TIGHTENING TORQUE (in daNm) OF SPEED SENSORS

Front sensor



89 126

Rear sensor

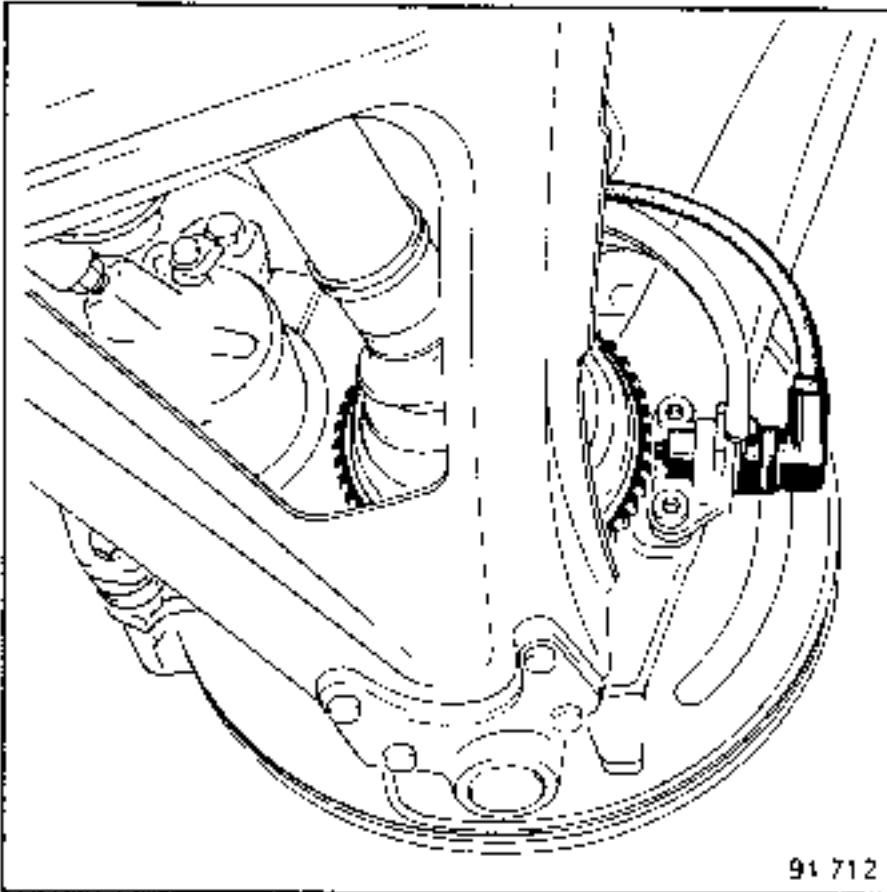


89 104

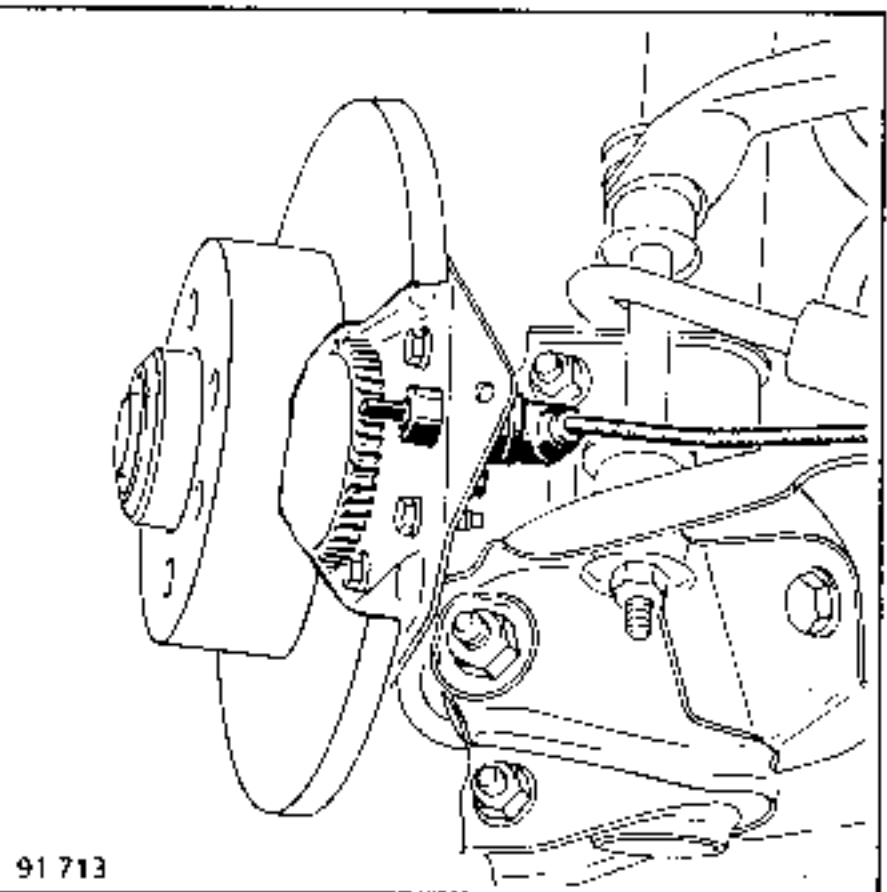
Speed sensors (3) and targets (4)

The speed sensors are mounted on the stub axle carriers and receive information from the toothed target wheels.

Targets mounted on the driveshafts for the front wheels.

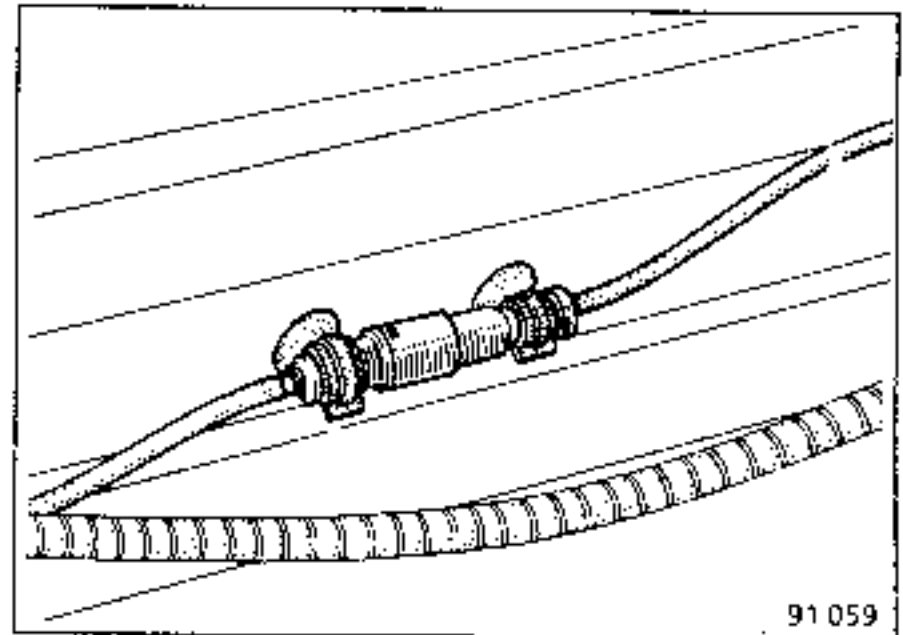


Targets mounted on the hubs (non removable) at the rear.



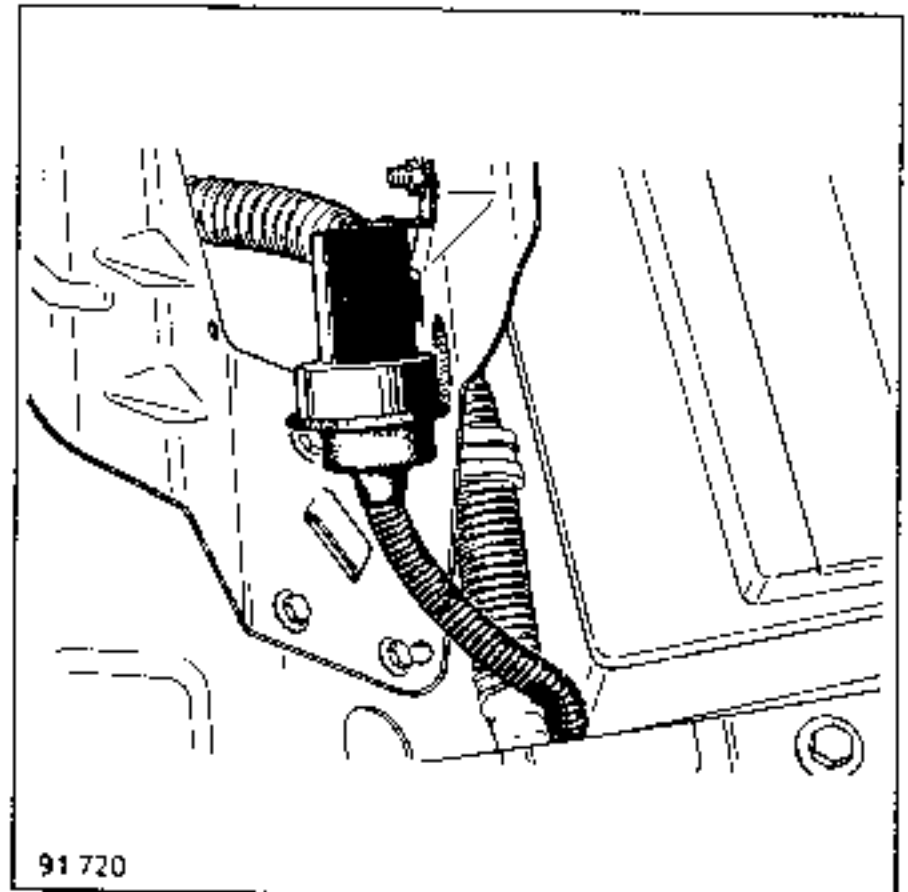
The speed sensors are linked to the electronic computer wiring by connectors located:

- in the wheel arches at the front;
- under the vehicle at the rear.

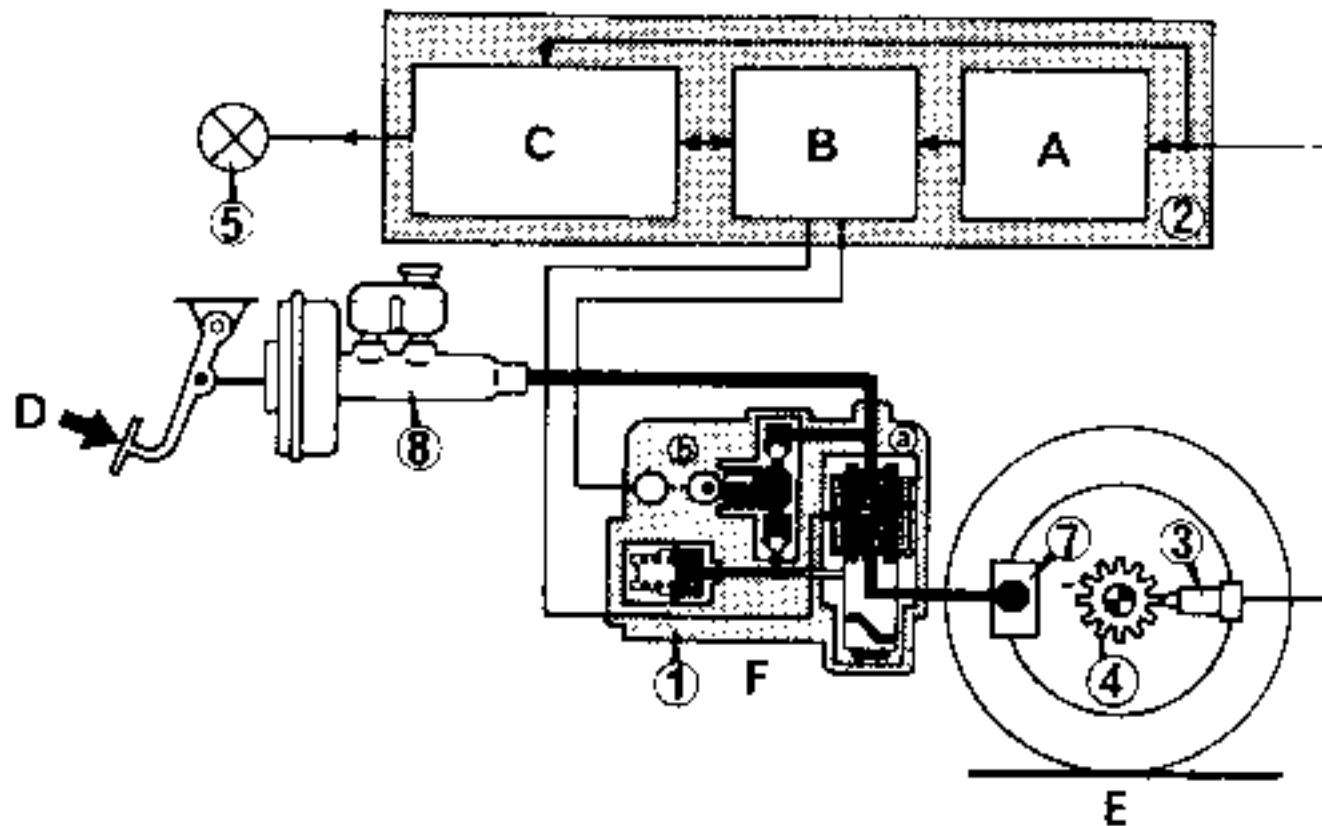


Main control relay for ABS system (5).

This is located under the cooling system expansion bottle.



OPERATION



1 - Hydraulic unit

a : solenoid valve

b : pump

2 - Electronic computer

3 - Wheel sensor

4 - Toothed targets

5 - Warning lamp

7 - Brake caliper

8 - Master cylinder

A - Computer

B - Adjustment

C - Alarm monitoring check

D - Braking pressure

E - Road surface condition

F - Braking pressure modulation

OPERATION

Once the speed of the vehicle reaches 2 - 4 mph (5 - 6 km/h), the ABS system performs a self-monitoring operation and is ready for use.

When the brakes are applied, if the computer receives information from one or more wheel sensors that the speed of the wheel is falling rapidly and that these wheels are starting to lock, it operates the corresponding regulator valve to prevent any increase in pressure or even to reduce pressure. This continues until the wheel or wheels reach normal deceleration speed.

Once this level of deceleration is reached, the reverse phase commences. The pressure is restored by direct communication between the master cylinder and the wheel cylinder or cylinders.

The ABS controlled braking cycle can be repeated between 4 and 10 times per second.

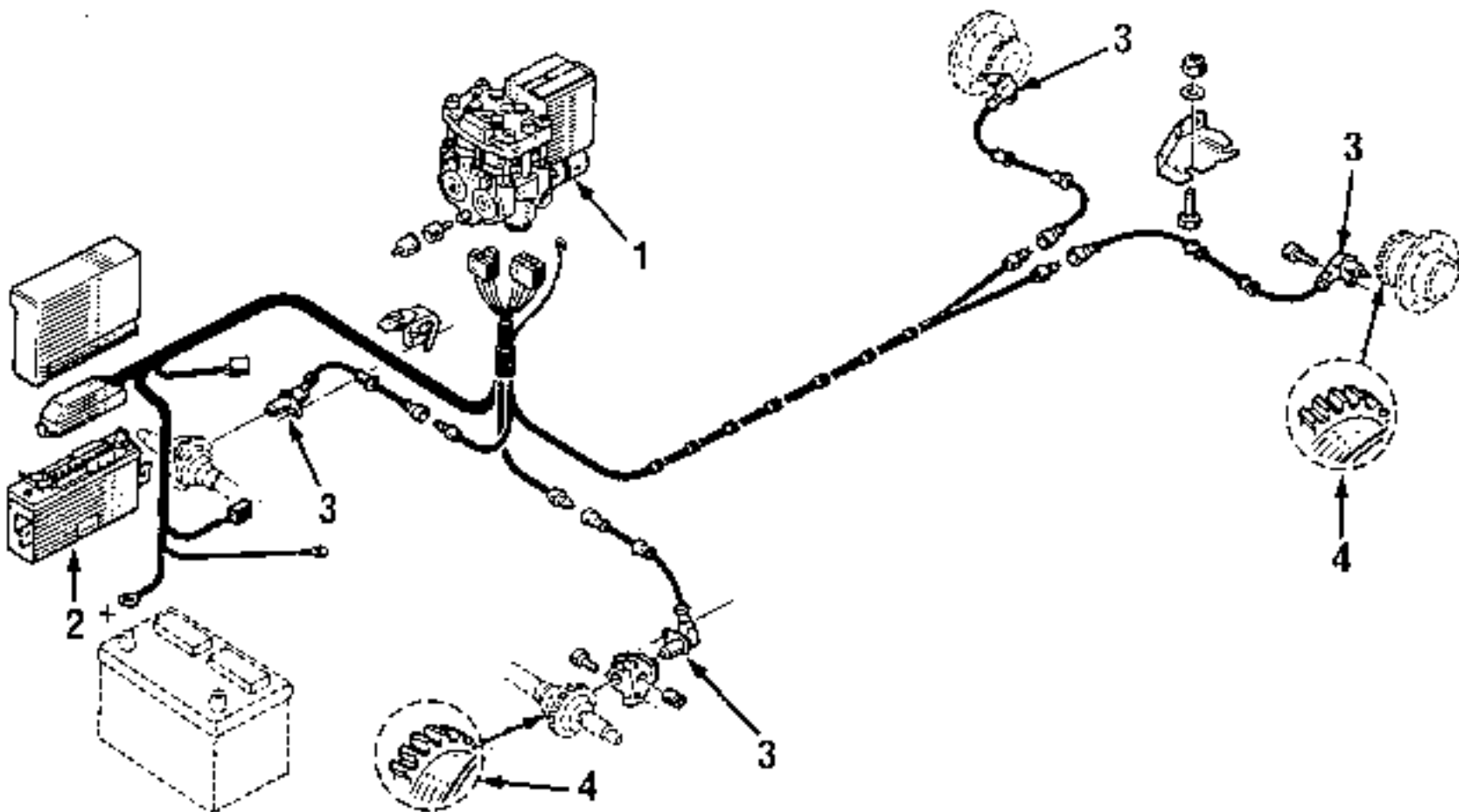
OPERATION (continued)

The rear axle is regulated by the "Select low" system, which means that both valves on both rear wheels supply identical pressures. The wheel which has the least road-holding governs the same regulation for both rear wheels. Any fault affecting the operation of the regulator is indicated by a warning lamp which illuminates on the dashboard.

In this case, braking takes place conventionally, without the use of the ABS system.

SPECIAL FEATURE

When the brakes are applied on uneven ground, sideways torque is produced which tends to turn the vehicle towards the side with a high adhesion coefficient. The driver must therefore turn the steering wheel. To avoid this phenomenon, these vehicles have a sideways torque delay time. In such an event, the braking pressure on the high adhesion wheel increases gradually until it reaches its maximum. This reduces the effort required to maintain the vehicle's course and allows the driver to stay in control of the situation.

Components:

1 - Hydraulic unit

2 - Computer

3 - Sensors

4 - Targets

REMOVING-REFITTING COMPONENTS

I : FRONT WHEEL SENSORS



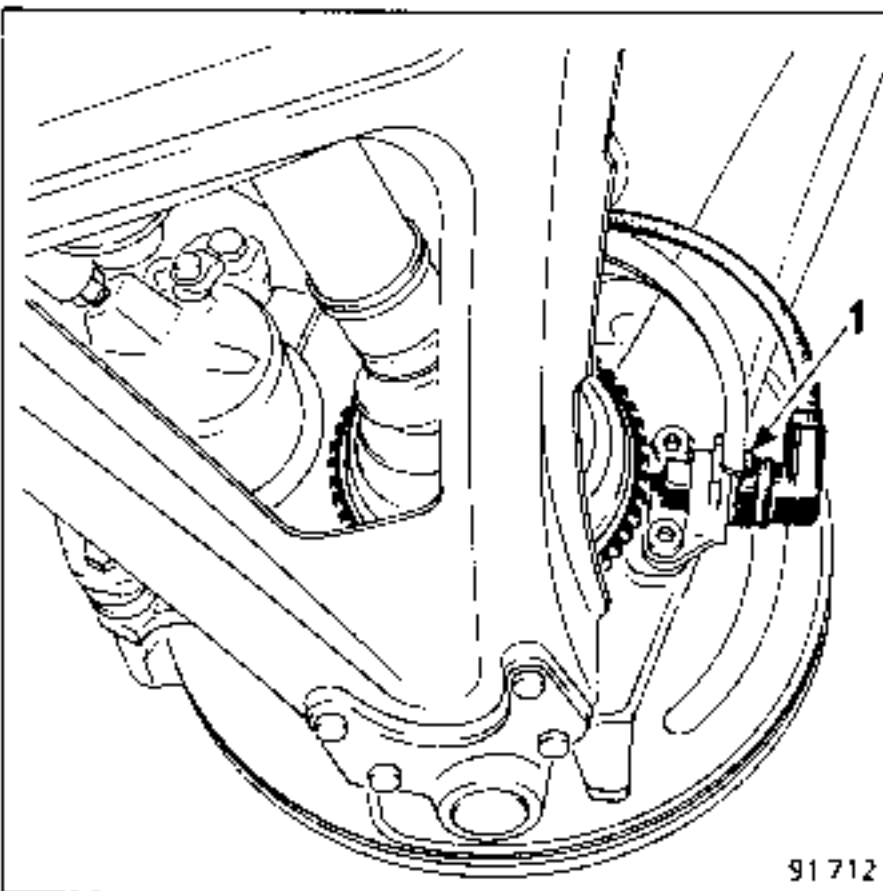
TIGHTENING TORQUES (in daNm)

Sensor fixing bolt	1
Sensor support bracket bolt	2.5

REMOVING

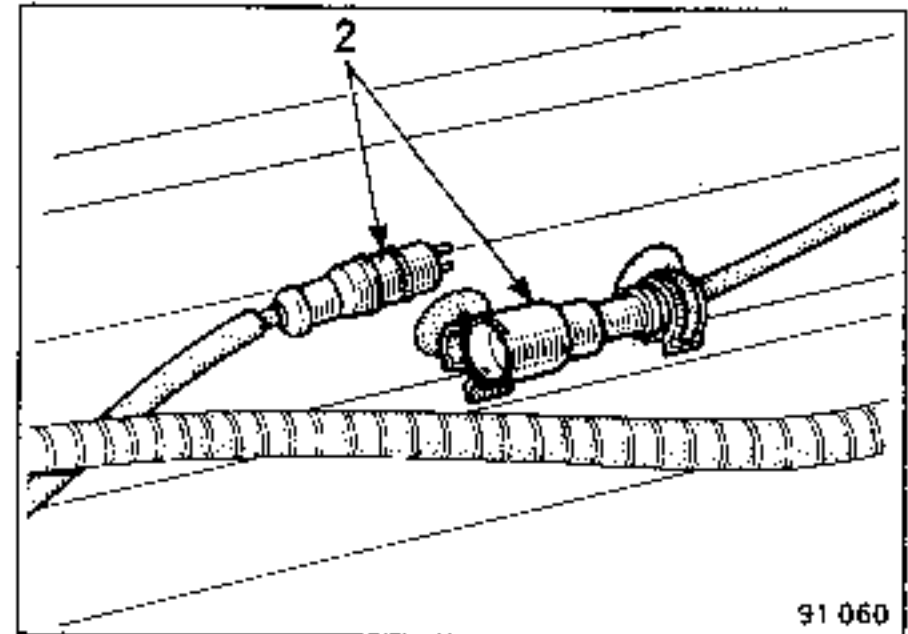
Remove:

- the sensor fixing bolt (1);
- the sensor.



Unclip the lead from its support bracket.

Disconnect the sensor from its connector (2) in the wheel arch.



Remove the assembly

REFITTING

Fit the sensor, already smeared with Multifunction grease, part no. 77 01 422 308, and then reconnect it.

NOTE: To avoid any risk of malfunction, it is essential to make sure the connector is correctly connected.

II : FRONT WHEEL TARGETS



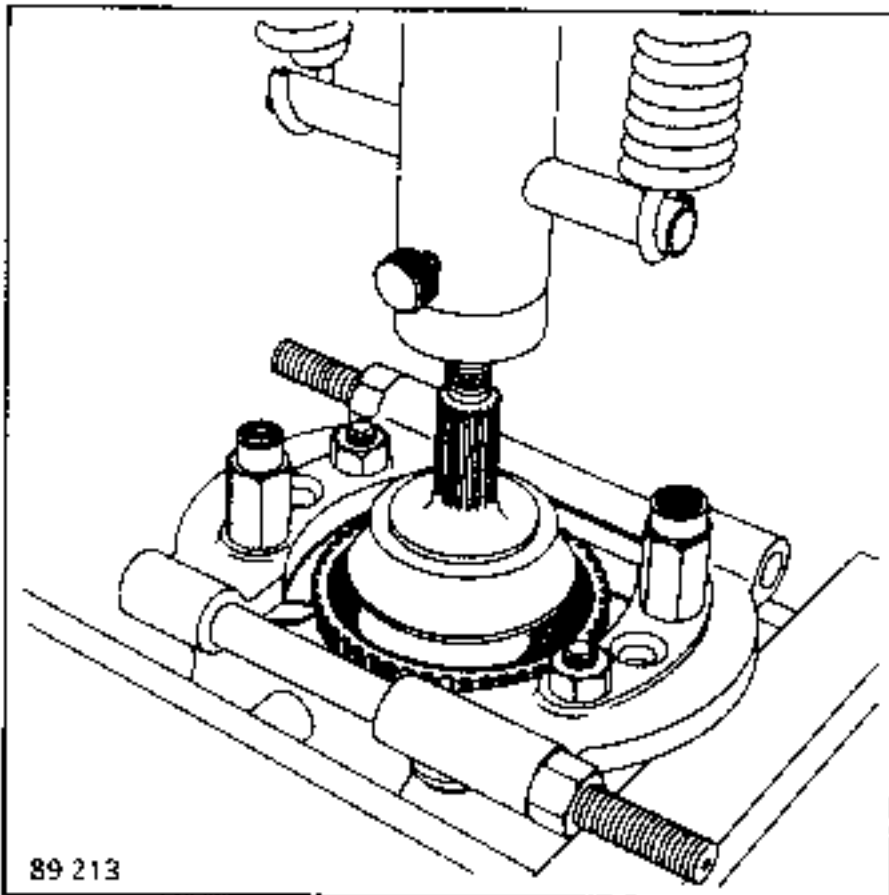
TIGHTENING TORQUES (in daNm)

Wheel bolt: 4 bolts	9
5 bolts	10
Driveshaft nut	25

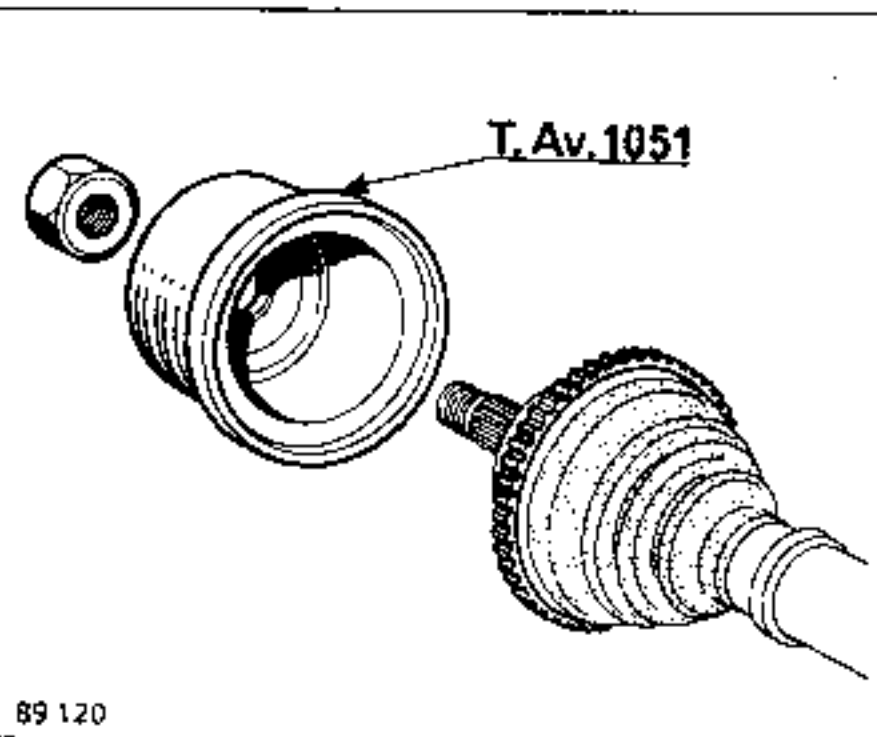
Since the target is mounted on the driveshaft, this operation is to be carried out after removing the driveshaft.

REMOVING

Press out the target using an extractor such as FACOM U53G

**REFITTING**

Smear the target with Loctite SCELBLOC and refit it using T.Av. 1051, reusing the old driveshaft nut.

**NOTE:**

The MPR will now supply replacement machined driveshafts not fitted with ABS targets. It will therefore be necessary to keep the target to rebuild the driveshafts. However, the target is available on its own from the MPR.

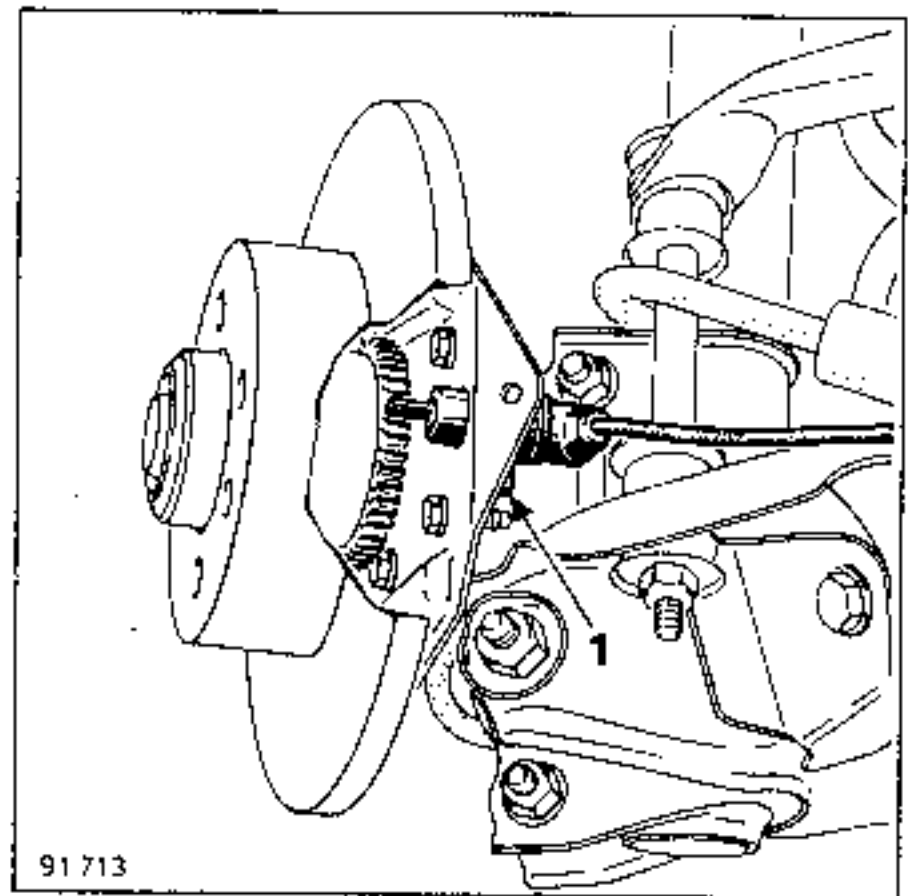
III : REAR WHEEL SENSORS**TIGHTENING TORQUES (in daNm)**

Wheel bolt: 4 bolts	9
5 bolts	10
Sensor fixing bolt	1

REMOVING

Remove:

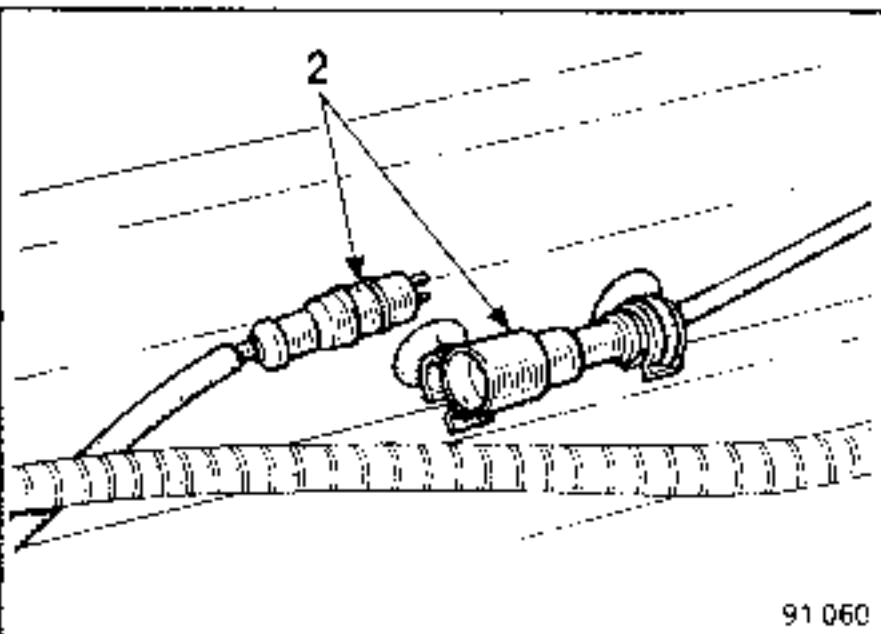
- the wheel
- the sensor fixing bolt (1)
- the sensor from its support bracket.



Unclip the lead from its support brackets.

Disconnect the sensor from its connector (2) under the vehicle.

Remove the assembly.



REFITTING

Fit the sensor, already smeared with Multifunction grease, part no. 77 01 422 308, and then reconnect it.

NOTE: To avoid any risk of malfunction, it is essential to make sure the connector is correctly connected.

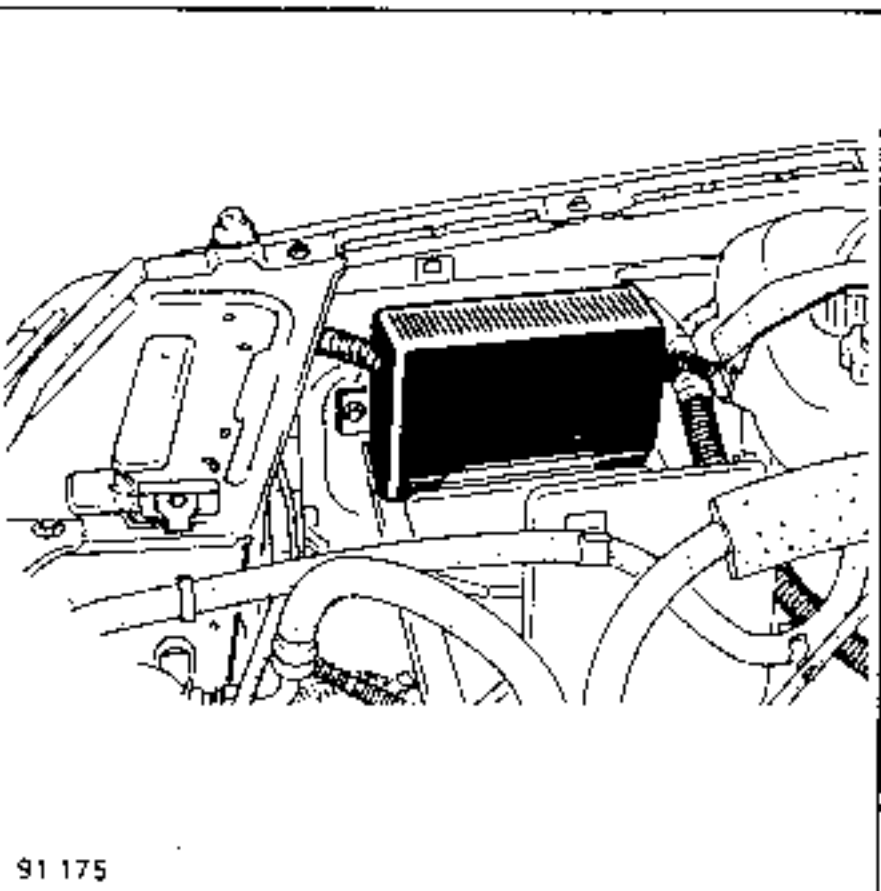
IV: ELECTRONIC COMPUTER

This is located between the battery and the front right-hand wheel arch.

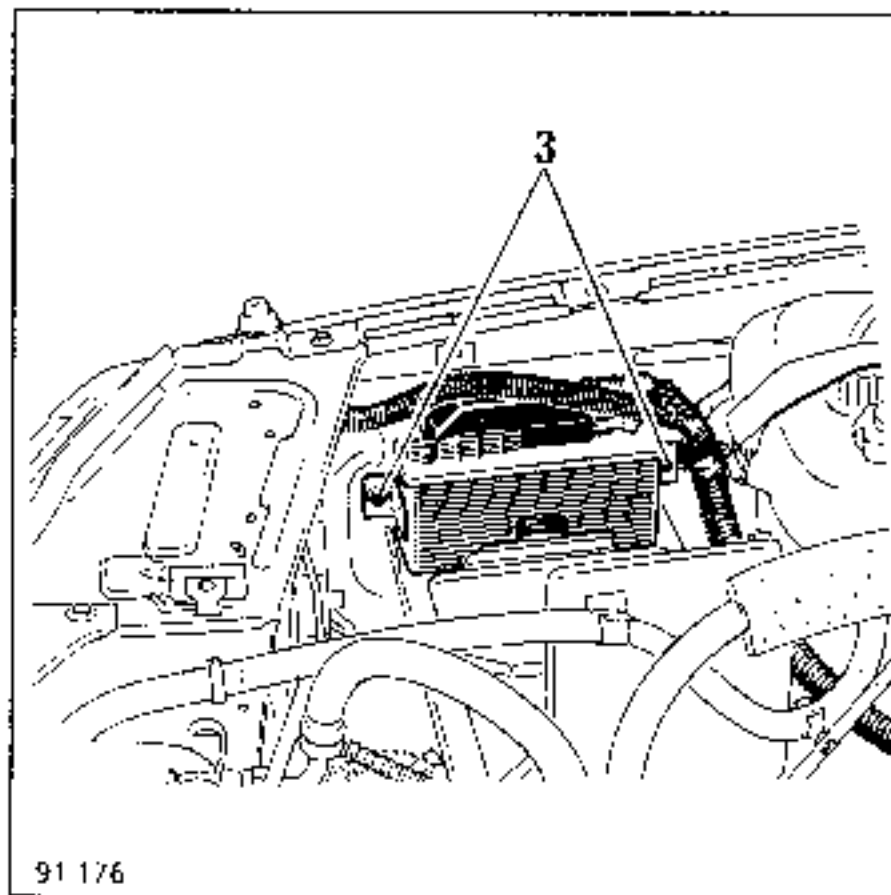
REMOVING

Remove:

- the battery;



- the plastic cover;
- the two bolts (3);



- the computer, then disconnect it.

REFITTING

Fit the computer, making sure that the 35-pin connector is correctly connected.

V: HYDRAULIC UNIT



TIGHTENING TORQUES (in daNm)

Piping bolts

1.3

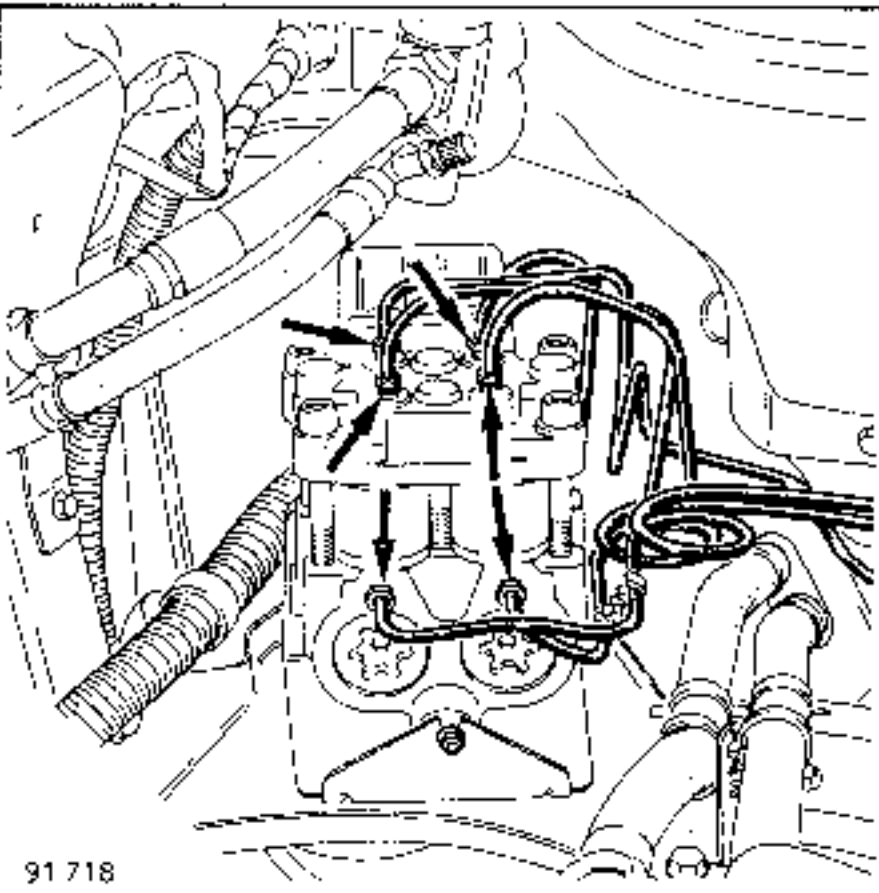
REMOVING

Disconnect the battery:

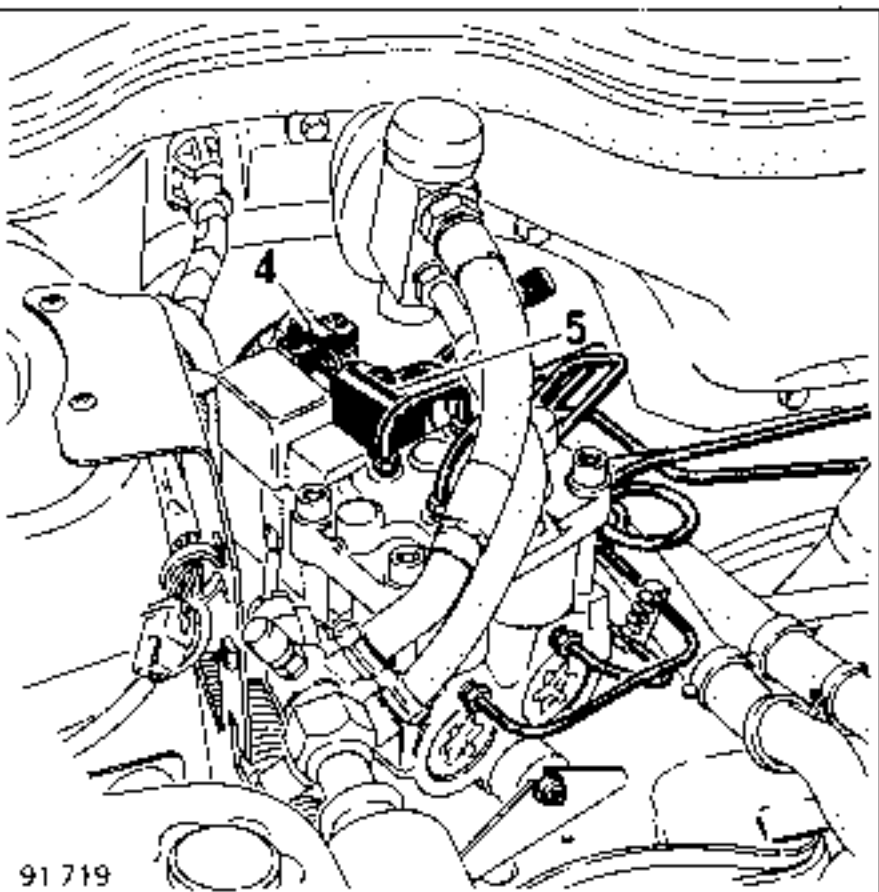
Remove:

- the three nuts holding the hydraulic unit to its support bracket;

- the pipes, marking their position;



- the electric connections cover;
- the wiring clip (4);
- the connector (5);

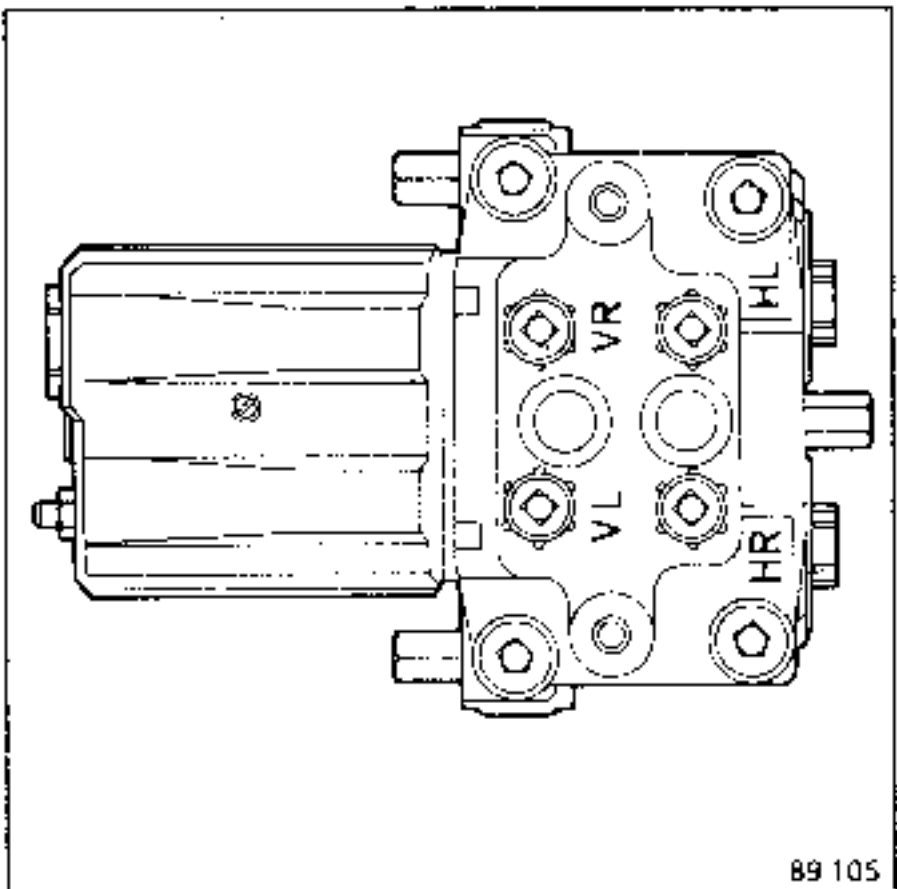


- the hydraulic unit.

NOTE: Always plug all piping outlets to prevent impurities entering and damaging the hydraulic unit.

REFITTING

Fit the hydraulic unit. The position of the pipes must be adhered to: the hydraulic unit is engraved with letters which correspond to the various circuits.



VL : Front left
VR : Front right
HL : Rear left
HR : Rear right

- Connect the connector (5)

Fit:

- the retaining clip (4);
- the electric connections cover.

Bleed the braking circuit.

NOTE: do not switch on the ignition to ensure that the hydraulic unit pump is not activated. This would involve the possible risk of air bubbles forming in the hydraulic unit.

In the interests of absolute safety, never reverse the sensor connectors or the hydraulic unit ducting.

FAULT-FINDING

ESSENTIAL SPECIAL TOOLING	
M.S. 1048	Bornier for checking the wiring using XR 25 or multimeter.

This comprises a 35 contact base identical to the ABS computer contact and integral with a circuit board with numbered electrical contacts: (1) to (35).

Each number corresponds to an electrical connection in the vehicle wiring and is shown on the operating diagram on page (38-20).

It enables all incoming electrical connections to the ABS main connector to be checked quickly and faultlessly.

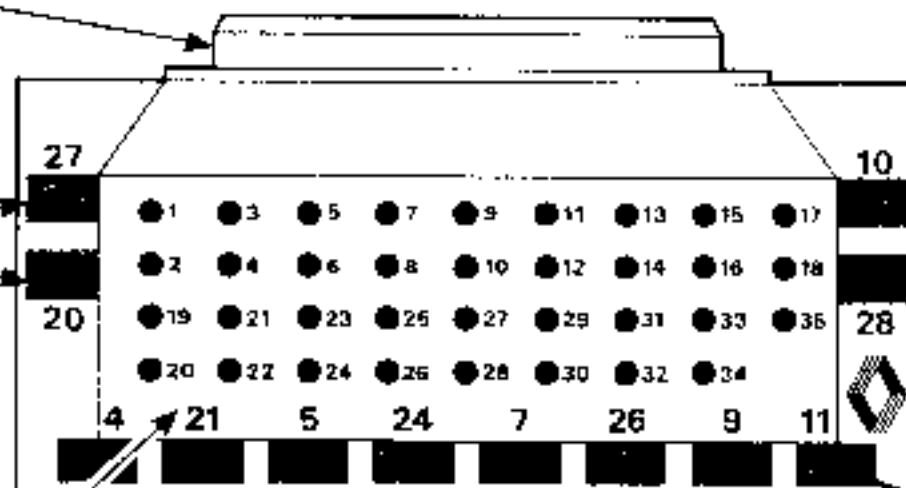
CABLAGE VEHICULE

Terminals enabling
the solenoid valve
feed relay to be
checked

Terminals
enabling the hydrau
pump unit to be
checked

Switches enabling
quick access to
check points

Terminals enabling the
wheel sensors to be
checked

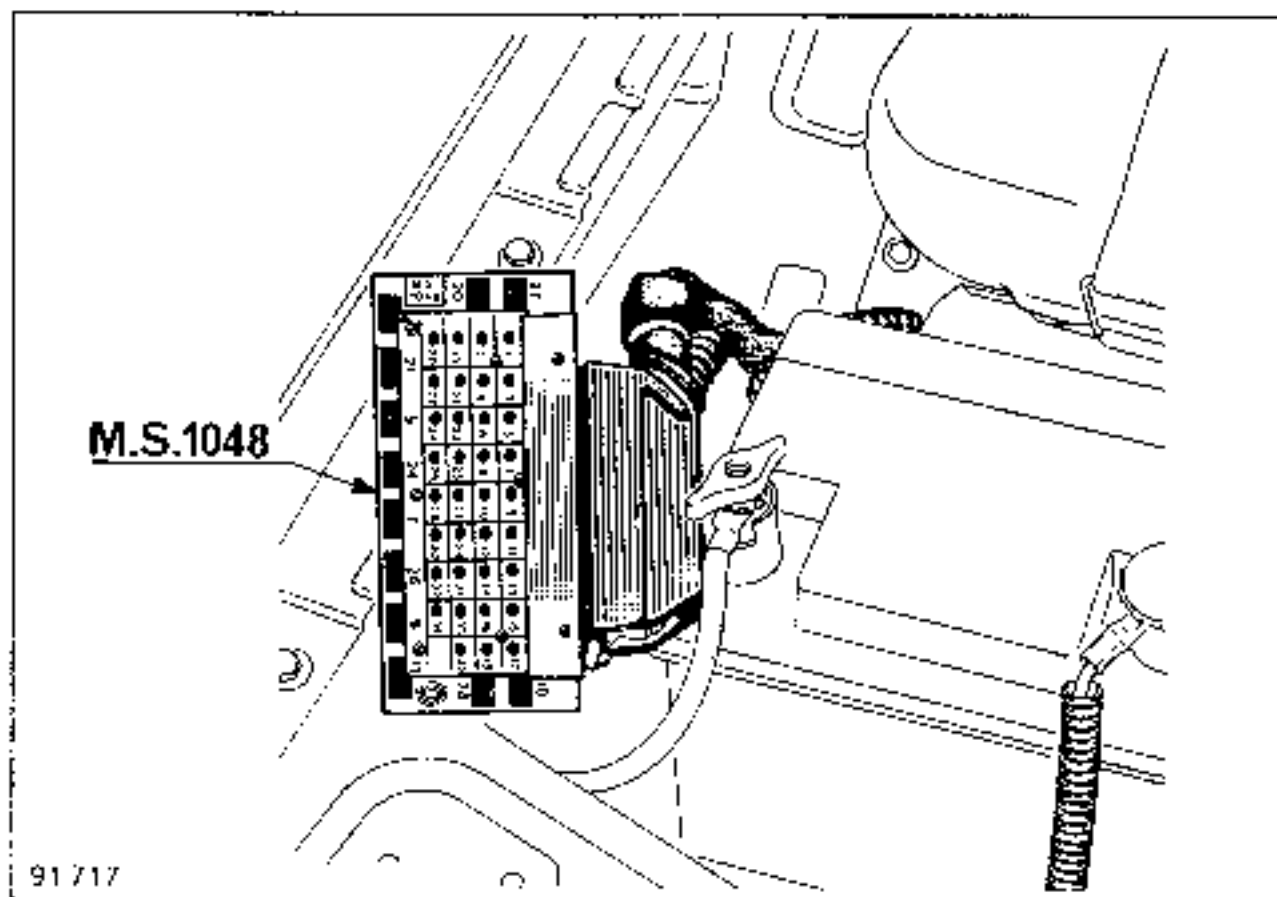


89 024

CONNECTION TO VEHICLE

Ignition off:

Disconnect the **ABS** computer from its base and connect the bornier in its place.

**Checking method principle :**

Connect the numbers on the bornier with either the **XR 25** or the multimeter connector, corresponding to the letters **DIAG A → B → C** through to **Y** on the bornier. For each measurement, observe the conditions given in the left-hand column of these tables, on pages (38-16 and 38-17).

Permissible checking equipment

- **XR 25** : Continuity measurement, using the buzzer.
: Voltage measurement, using the voltmeter.
- **Multimeter** : Resistance measurement.
: Voltage measurements.

FAULT-FINDING USING THE DASHBOARD WARNING LIGHTS

NOTE: Possible particular operating circumstances

Observation:

Braking fault without illumination of warning lamp.

Check the braking system without **ABS** (road test).

Check:

Disconnect the main relay.

If the fault continues in the road test: the **ABS** system is not at fault.

If the fault has disappeared: check the entire wiring.

Intermittent faults:

A faulty electrical contact may cause the lamp either to flash or to be permanently illuminated under various vehicle use conditions (either when stationary or during a road test).

If the faulty component is not found after checking the wiring, visually check the general condition of the wiring and clean the wheel sensor link connectors, the various **ABS** wiring connectors and the connector for the two relay bases located on the hydraulic unit and the **35-pin** computer connector.

For this operation, use: **ELECTRONEX** part no. **77 01 403 517**.

Perform the road test once more; if the fault continues: replace the computer.

FAULT-FINDING USING DASHBOARD WARNING LIGHT

TEST CONDITIONS	WARNING LAMP CONDITION		FAULT-FINDING
	Correct	Incorrect	
			Checks pages 16 / 17 / 18
Ignition off	●	X	Checks lines A to X (except wheel sensors)
Switch on ignition without starting	X see note page 17	Illuminates for 0.5 seconds X → ●	Checks lines R and X
		●	Checks lines A to X (except wheel sensors)
Start the engine	●	Illuminates after 20 seconds ● → X	Checks lines I / Q / W
		X	Checks lines A to X (except wheel sensors)
		Flashes	Checks lines C/N / O/R/X
Road test with emergency braking	●	● → X	Checks lines A to Y4
		X	Checks lines A to Y4
		Flashes	Checks lines A to Y4 and see: intermittent faults.

KEY:

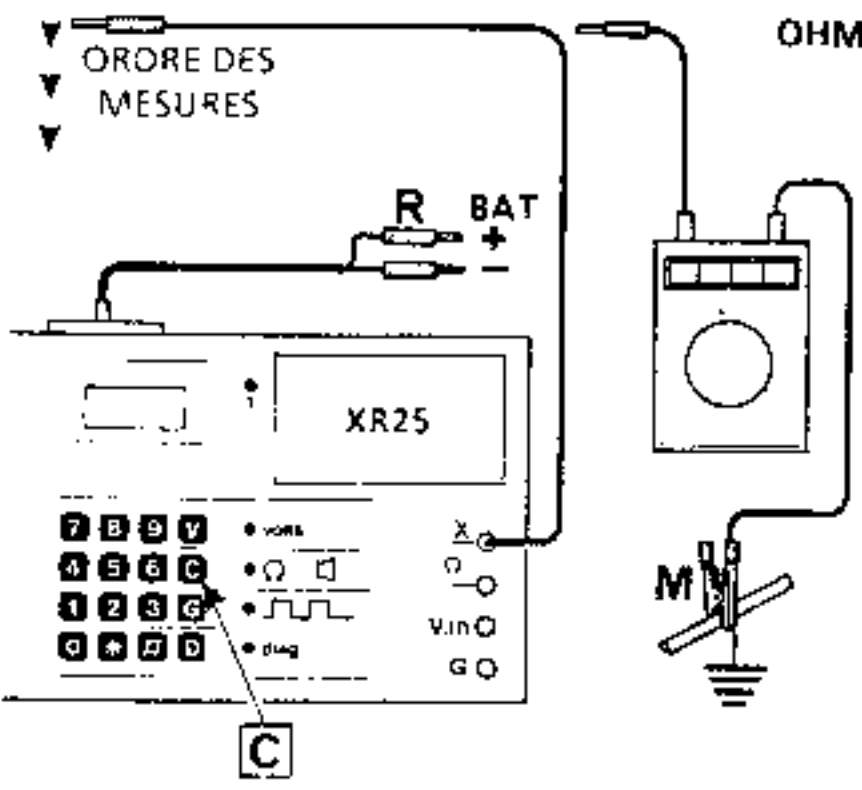
● Lamp not illuminated

X Lamp illuminated

X → ● The lamp goes out

● → X The lamp illuminates

CONTINUITY CHECKS

TEST CONDITIONS	F-F	TEST EQUIPMENT		N° OF JCN HOLDER	CONNECTIONS	
		XR25	OHM-METER		XR25	MULTIMETERS
VEHICLE IGNITION OFF Key: *  THE BUZZER SOUNDS *  DOES NOT SOUND	A	* 	0 to 0.5 Ω	(20)		OHMS
	B			(34)		
	C			(10)		
	D			(32)		
	E	* 	0.5 to 2 Ω	(2)		
	F			(35)		
	G			(18)		
	H			(19)		
	I	* 	> 20 k Ω	(14)		
	J			(5)		
	K			(11)		
	L			(7)		
	M			(24)		

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VOLTAGE CHECKS

TEST CONDITIONS		XR25/ VOLTMETER		XR25	CONNECTIONS	MULTIMETERS
IGNITION OFF	N	< 5 V	(1)			VOLTS
IGNITION ON	O	> 10.5 V	(1)			
	P		(27)			
ENGINE STOPPED	Q		(28)			
	R	< 2.5 V	(15)			
	S	0.3 to 1.5 V	(29)			
	T	< 10,5 V	(25)			
BRAKE DEPRESSED	U	> 10.5 V	(25)			
CONNECT TERMINALS 20 AND 27	V	If: V1 = V32: Corr.	(1)			
	V	If: V1 > V 32 Incorrect	(32)			
Pump check See note	W	No check with equipment		If the pump does not turn: see DIAG W		
ENGINE RUNNING	X	> 10.5 V	(15)	V = Key pressed R = Red terminal connected to + battery M = Pliers linked to brake piping		

Key: > 10.5 V = Correct if value measured is greater than 10.5 volts.

NOTE (W):

Checking the operation of the hydraulic unit pump:

For this test, make sure that the vehicle's braking system is correctly bled, since an air pocket could form in the hydraulic unit when the pump is activated.

Pump tests:

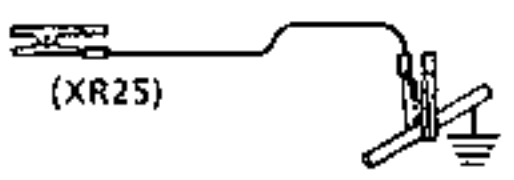
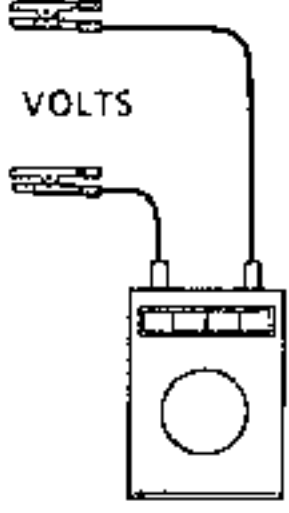
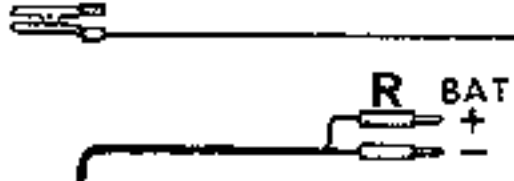
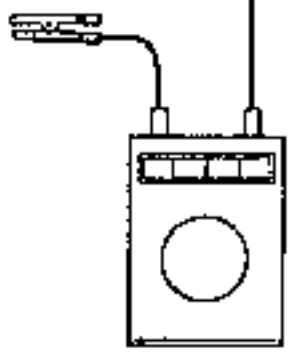
Connect terminals 10 and 28 of the junction holder and listen to make sure that the pump is working: short-term tests (1 to 2 seconds).

WHEEL SENSOR CHECKS

Voltage measurements

* Turn the wheel sharply, at the same time watching the voltmeter.

Key: - multimeter on alternating current.

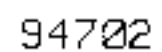
TEST CONDITIONS	XR 25 / VOLTMETER		CONNECTIONS	
			XR25	MULTIMETER
TURN THE LEFT- HAND FRONT WHEEL	Y1	$V > 0.1 V \approx$ $R = 0.6 \text{ to } 1.6 \text{ k}\Omega$	4 5 	
TURN THE RIGHT- HAND FRONT WHEEL	Y2	$V > 0.1 V \approx$ $R = 0.6 \text{ to } 1.6 \text{ k}\Omega$	21 11 	
TURN THE LEFT- HAND REAR WHEEL	Y3	$V > 0.1 V \approx$ $R = 0.6 \text{ to } 1.6 \text{ k}\Omega$	9 7 	
TURN THE RIGHT- HAND REAR WHEEL	Y4	$V > 0.1 V \approx$ $R = 0.6 \text{ to } 1.6 \text{ k}\Omega$	26 24 	

Key ☐ V depressed:

R : Red terminal connected to + battery

BB 158-5

Components tested		Fault-finding	
Earth	A	Check terminal (20) wiring to earth (M4)	If A/B/C are incorrect Check the earthing of the test equipment (pliers).
Earth	B	Check terminal (34) wiring to earth (M4)	
Earth	C	Check terminal (10) wiring to earth (M4)	
Solenoid valve relays Break contact	D	Terminal wiring (32) to earth (M4) see appendix 2 (page 38-23)	
Solenoid valve circuit Left-hand front wheel	E	Terminal wiring (2) to earth (M4) Coil cut / see appendix 2 (page 38-23)	
Solenoid valve circuit Right-hand front wheel	F	Terminal wiring (35) to earth (M4) Coil cut / see appendix 2 (page 38-23)	
Solenoid valve circuit Left-hand rear wheel	G	Terminal wiring (18) to earth (M4) Coil cut / see appendix 2 (page 38-23)	
Solenoid valve circuit Right-hand rear wheel	H	Terminal wiring (19) to earth (M4) Coil cut / see appendix 2 (page 38-23)	
Pump motor circuit	I	Terminal wiring (14) to engine earth (M4) or coil cut see check (W) / see appendix 2 (page 38-23)	
Sensor insulation Left-hand front wheel	J	Faulty wiring insulation / chassis short circuit	
Sensor insulation Right-hand rear wheel	K	Faulty wiring insulation / chassis short circuit	
Sensor insulation Left-hand rear wheel	L	Faulty wiring insulation / chassis short circuit	
Sensor insulation Right-hand rear wheel	M	Faulty wiring insulation / chassis short circuit	
Current supply relay (461)	N	If > 5 volts : the relay sticks: disconnect the relay from its support bracket. The voltage must be zero: otherwise the wiring will short-circuit	
Current supply relay (461) make contact	O	Check battery charging/condition of contacts If < 10.5 volts (0 volts): Relay not supplied or cut: see appendix 1 (page 38-23)	
Solenoid valve relay coil circuit	P	If < 10.5 volts: Coil or wiring cut / see appendix 2 (page 38-23)	If checks (P and Q) are incorrect: check the link to terminal (5) of relay support bracket (461). See appendix 1 (page 38-23)
Pump motor relay coil circuit	Q	If < 10.5 volts: Coil or wiring cut / see appendix 2 (page 38-23)	
Oil pressure sensor circuit	R	If > 2.5 volts: Check oil pressure switch	
Diode check (short circuit)	S	If the voltage < 0.3 volts and if the warning lamp illuminates: diode short circuit If the voltage < 0.3 volts and if the warning lamp does not illuminate: check warning light and its wiring. If the voltage > 1.5 volts: diode burnt out (replace the hydraulic unit).	
Diode check (burnt out)			
Stop switch pedal raised	T	If > 10.5 volts: Faulty stop switch	
Stop switch pedal depressed	U	If < 10.5 volts and stop illuminated: wiring cut	
Solenoid valve relays Make contact	V	Terminals (20) and (27) linked (the relay closes). If V1 is greater than V32 the make contact is faulty (see appendix 2) (page 38-23) If V1 = V32: the relay is OK	
Pump motor relay Make contact	W	Terminals 10 and 28 linked (the relay closes) Note: tests I and Q must be correct. 1) If the pump motor turns: Correct 2) If the pump motor does not turn: Incorrect/Check relay/current supply: see appendix 2 (page 38-23)	
Oil detector circuit	X	Engine running: if < 10.5 volts and oil lamp illuminated: wiring (15) cut Engine running: if < 10.5 volts and oil lamp not illuminated: wiring short circuit	
Wheel sensor signal	Y1 Y2 Y3 Y4	If the voltage is not greater than 0.1 volts when the wheel corresponding to the measuring points is turned sharply, check the condition of the connectors/play in the wheel hubs.	



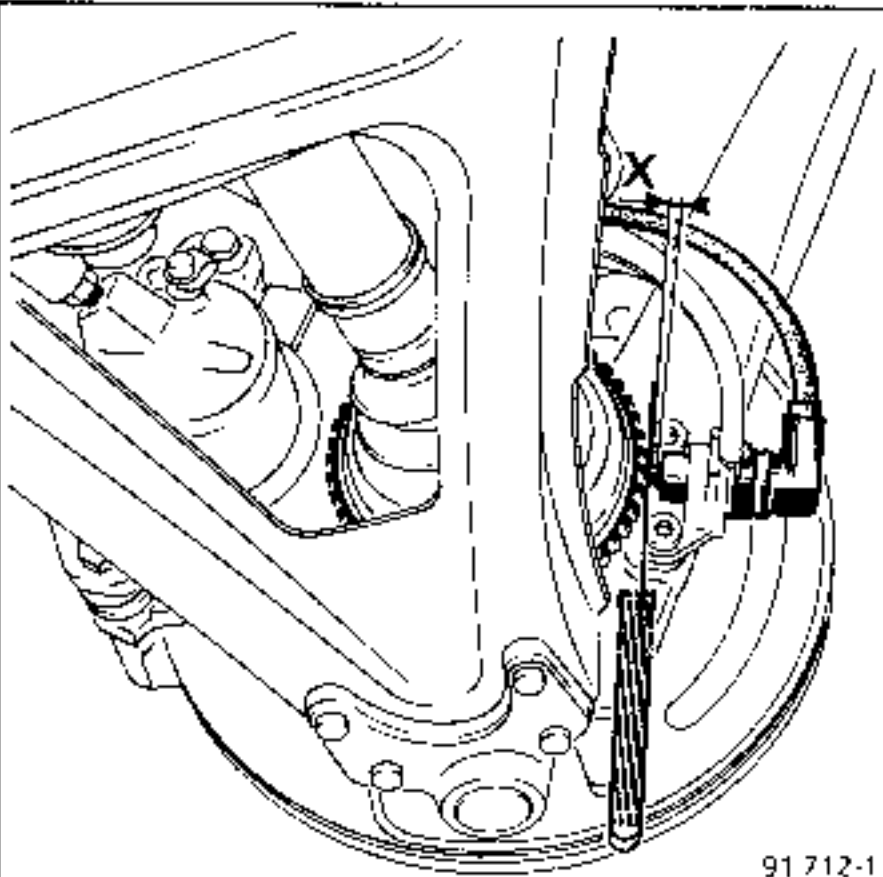
- 104** : Anti-theft switch.
- 107** : Battery.
- 118** : ABS Computer.
- 150** : Right-hand rear wheel sensor.
- 151** : Left-hand rear wheel sensor.
- 152** : Right-hand front wheel sensor.
- 153** : Left-hand front wheel sensor.
- 205** : Pressure sensor.
- 247** : Dashboard ABS warning light.
- 361** : ABS hydraulic unit.
- 461** : ABS main relay.
- M4** : Bodywork earth.
- R2** : Instrument panel/left-hand rear wiring connection.
- R10** : Instrument panel/right-hand cross member connection
- R27** : Engine/right-hand cross member connection.
- R60** : ABS/right-hand cross member connection .

ADDITIONAL CHECKS

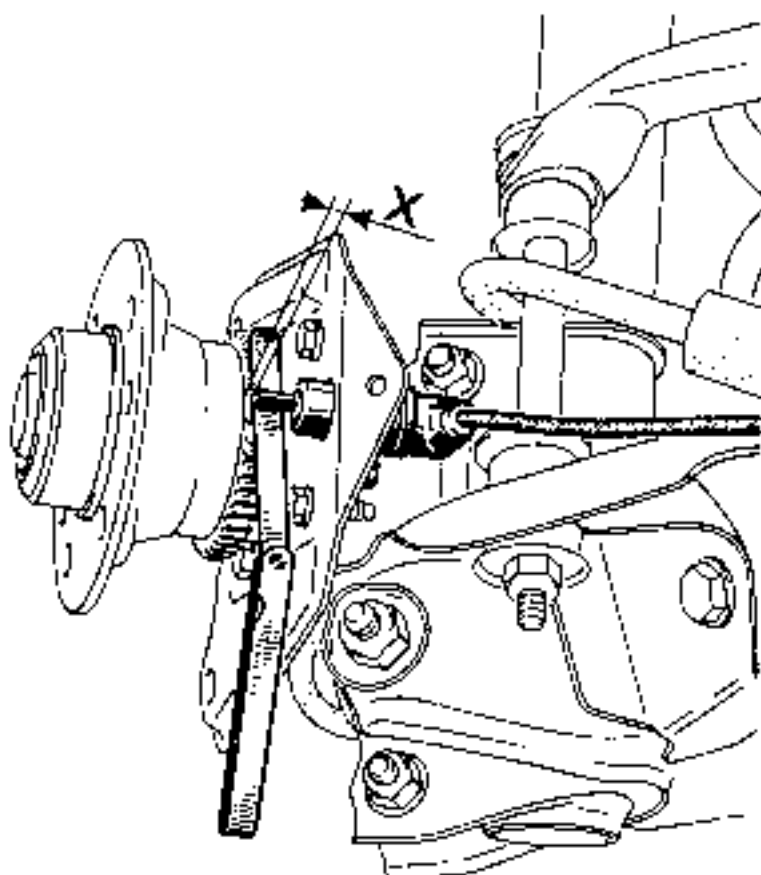
I: SENSOR AIR GAP CHECKS

Target/sensor air gap;

$X = 0.6 \text{ mm}$

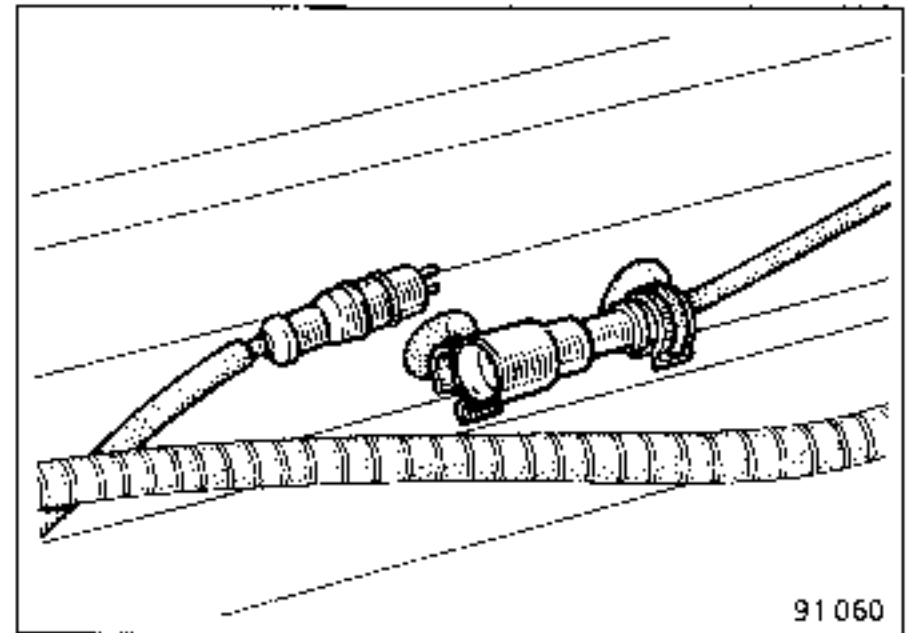


91 712-1



92 533

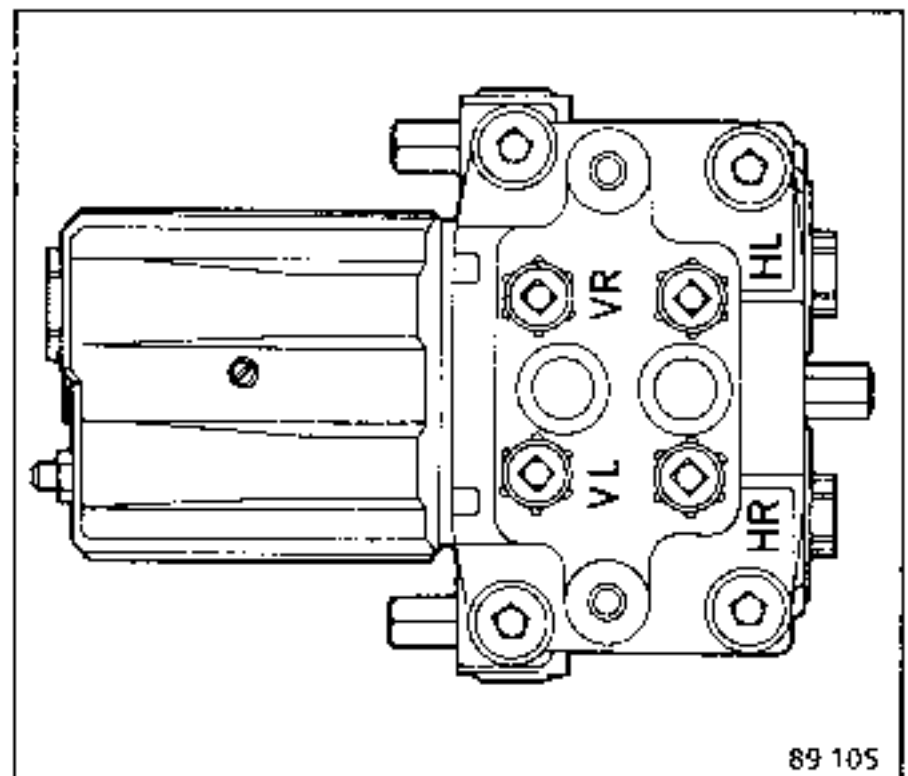
II: WHEEL SENSOR CONNECTOR CHECKS



91 060

If the ABS warning light illuminates intermittently, check first the wheel sensor connectors and clean them using ELECTRONEX part no. 77 01 403 517.

III: HYDRAULIC UNIT PIPING MARKINGS



89 105

VL : Front left
VR : Front right
HL : Rear left
HR : Rear right

IV : ELECTRICAL CHECK

Checks to be performed only if there are faults during checks D/E/F/G/H/I/O/P/Q/V/W

Appendix 1 :

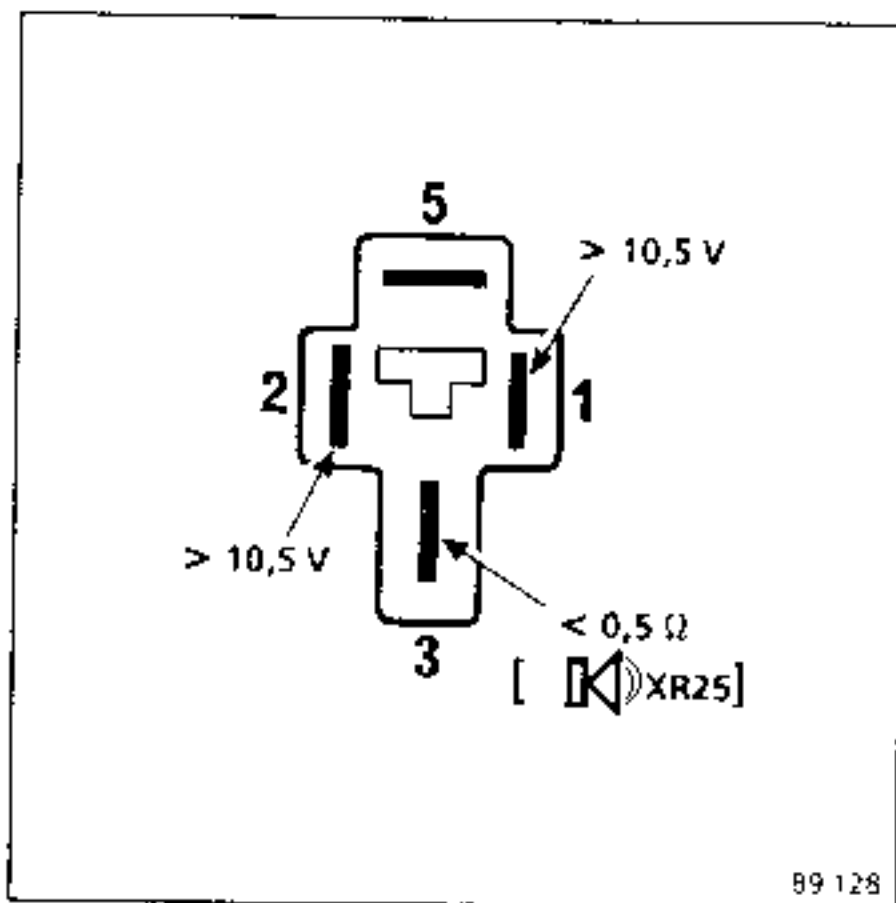
Only if there is a fault during test O/P/Q.

Disconnect the main relay.

Switch on the ignition:

- measure the voltage at the points shown on the drawing.

Front view



461 relay support bracket

Switch off the ignition:

- measure the resistance at the points shown on the drawing.

If the checked points are correct:

- replace the relay.

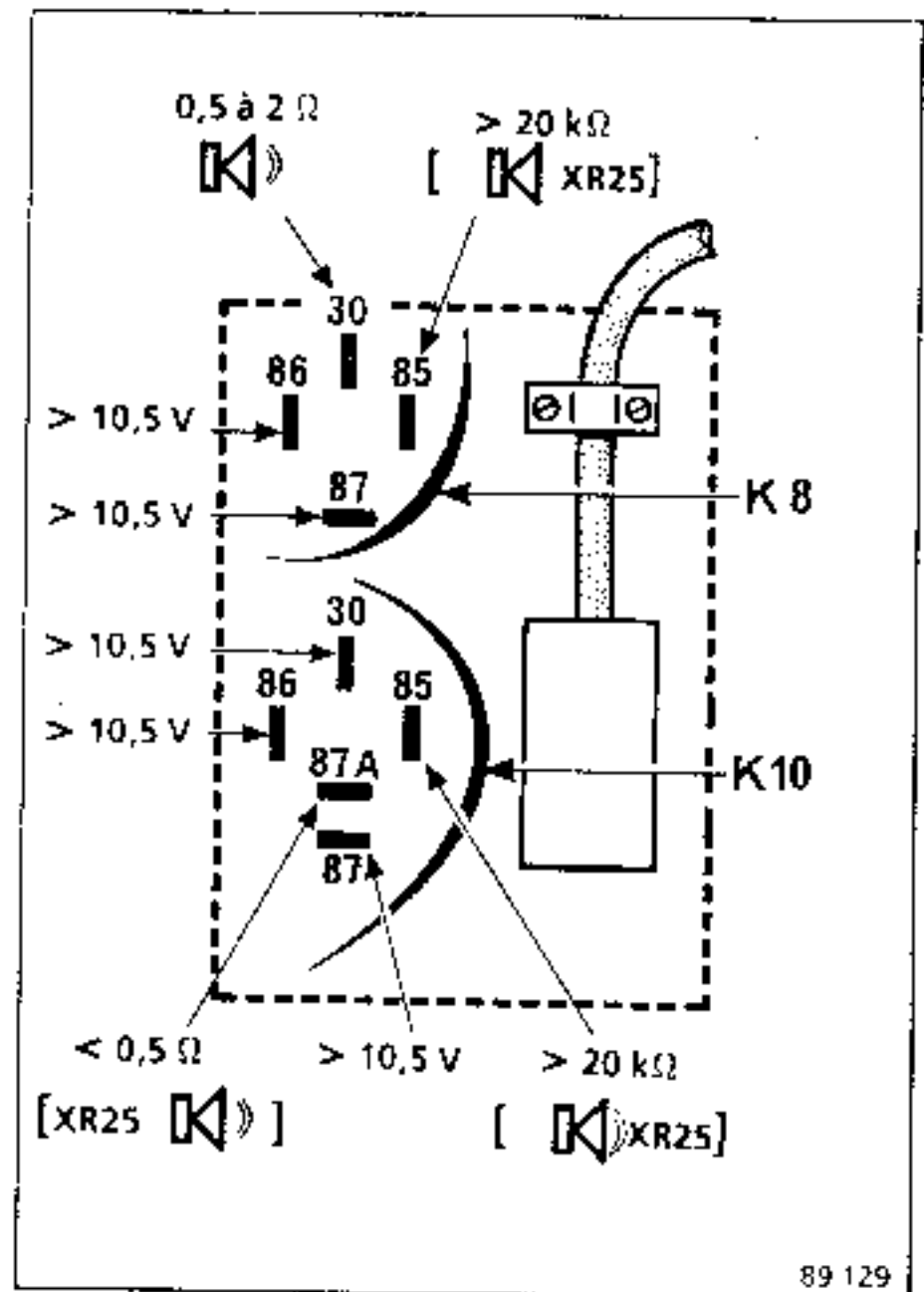
Appendix 2:

Hydraulic unit checks

Remove the protective cover from the hydraulic unit and take out the two relays.

Switch on the ignition:

- measure the voltage at the points shown on the drawing.



K 8 = Pump relay

K 10 = Solenoid valve relay

Switch off the ignition:

- measure the resistance at the points shown.

If there are any faults, see the operational diagram and check the corresponding continuities at the points where there is a fault:

- either to the battery;
- or to the junction holder or the earth.

Purpose:

- To provide better steering assistance when the vehicle is stationary or travelling at low speed;
- To make the vehicle steering more responsive as the vehicle speed increases, to achieve better driving accuracy.

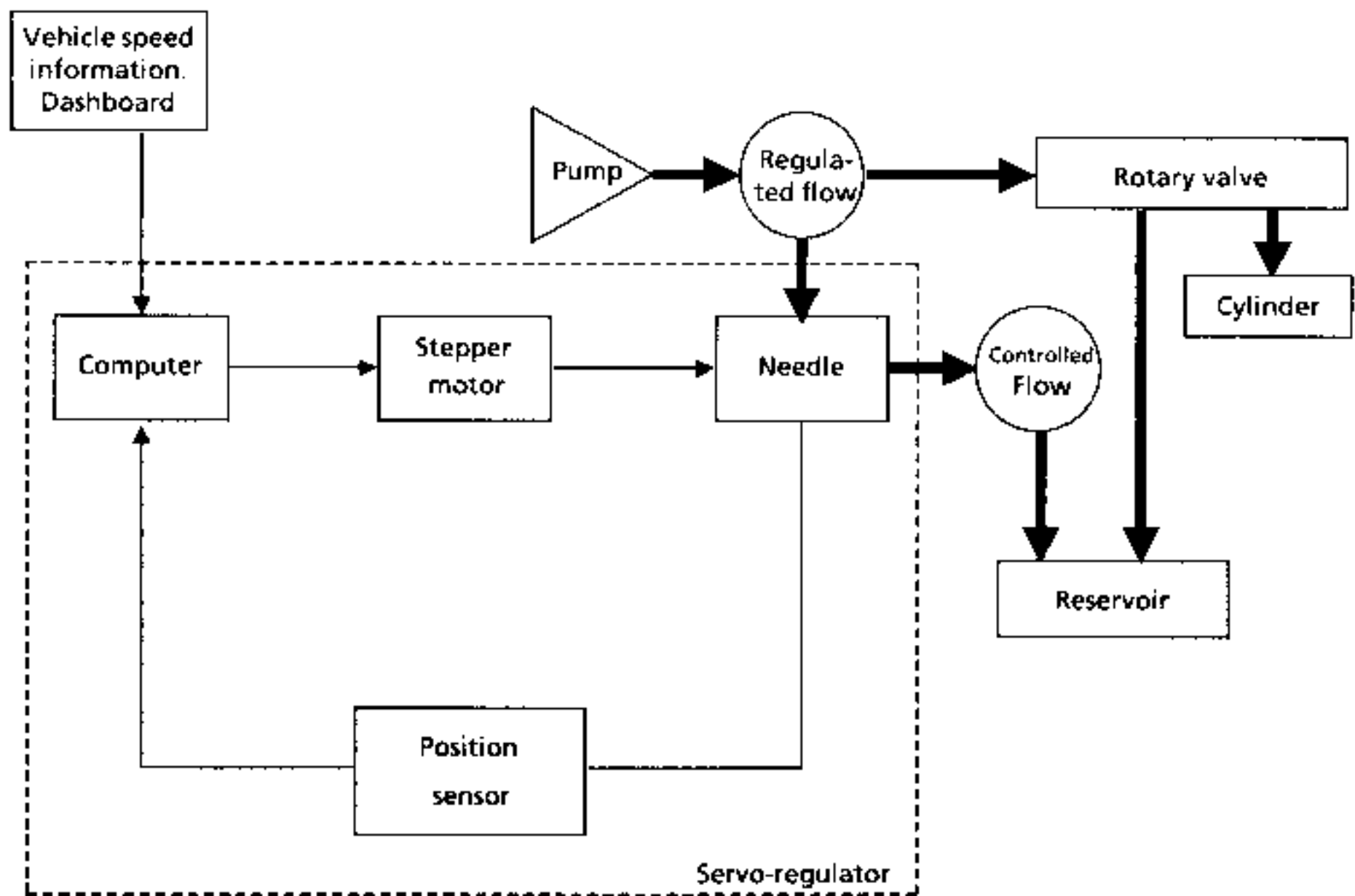
PRINCIPLE OF VARIABLE ASSISTANCE STEERING

The servo-regulator is fitted in parallel with the rotary valve.

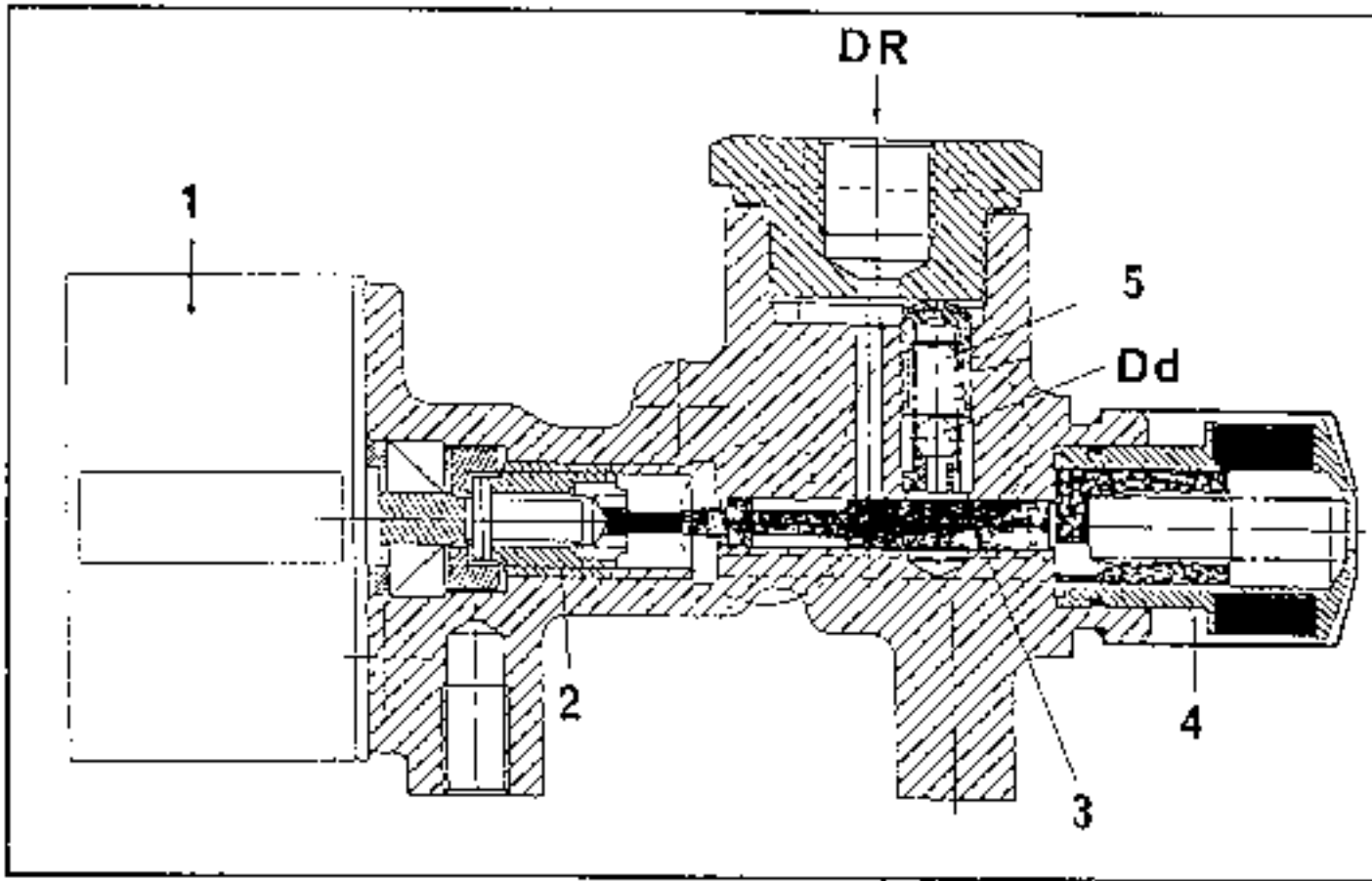
This is a flow regulator activated by a stepper motor which controls a flow of oil to the reservoir, in accordance with the vehicle speed information.

The directed oil flow therefore varies depending on the speed of the vehicle and has the effect of regulating the oil pressure on the steering cylinder.

In fact, the greater the directed flow, the lower the assistance pressure.



SERVO-REGULATOR OPERATING PRINCIPLE



- 1 - Stepper motor.
- 2 - Screw drive.
- 3 - Needle.
- 4 - Position sensor.
- 5 - Pressure regulator.

DR = Regulated flow from the pump (high pressure)

Dd = Directed flow to the reservoir (low pressure).

Depending on the input received (vehicle speed, position sensor information), the computer determines the flow required to adjust the assistance pressure to the driving conditions.

The stepper motor, controlled by the computer, determines the position of the needle by acting on the screw drive.

As a result of the conical needle configuration, part of the oil flow to the reservoir corresponds to each position of the needle.

During return, the computer is informed of the needle's position by the position sensor, and therefore of the volume of oil flow created.

Note:

- the pressure regulating valve (5) enables a constant difference between high and low pressure to be maintained.

This means that the pressure influencing the needle is constant so that the flow created is purely as a result of the area of the needle.

- When the vehicle is stationary or at speeds slower than 3 mph (5 km/h), the computer controls the stepper motor which closes the regulator valve?? aperture completely.
- The range of activity of the assistance is between 3 and 125 mph (5 and 200 km/h).
- Inputs and outputs are permanently monitored by the computer, the speed input lead continuity, the speed dynamics (the signal must not suddenly fall to zero), the position sensor information, the consistency of needle movements and the voltage regulated with engine speeds. In addition, each time the ignition is switched on, the computer performs a self-monitoring operation. Temporary faults are not stored. If a fault is found, the system provides progressive assistance up to that corresponding to 68 mph (120 km/h), i.e., with the wheels pointing straight ahead, an assistance pressure of 3 - 5 bar.

FAULT-FINDING - GENERAL

In the logical fault-finding process, it should always be borne in mind that variable assistance steering is above all based on conventional power-assisted steering.

For correct fault-finding, it will be necessary to distinguish a conventional power-assisted steering incident (pump, regulator, rotary valve, cylinder) from an incident relating to the electronic assistance module (speed sensor, module current supply, servo-regulator).

For this reason, using tool Dir. 1197 and pressure gauge Fre. 244-03, it is possible initially to cut the high pressure supply to the servo-regulator to check the conventional power-assisted steering assembly and then reconnect the servo-regulator supply to check its operation.

Furthermore, the use of the XR 25 test box will allow us to simulate a vehicle speed and, using cassette N°. 9, to perform fault-finding operations for the operation of and current supply to the servo-regulator module computer.

Note:

If the operator does not have tool Dir. 1197, it is still possible to check the assistance pressure using tool Dir. 803, but this tool can only be fitted to the high-pressure pump output , involving removing and refitting the battery and its support bracket.

FAULT-FINDING

Fault troubleshooting

The two main faults may be:

- Lack of assistance during parking manoeuvres;
- Over-assistance at high speed.

Checking the variable assistance steering

1st Test

Conditions:

- engine idling;
- Pressure gauge connected to servo-regulator HP input;
- Servo-regulator isolated.

A) Wheels pointing straight ahead

Irrespective of engine speed, the pressure must not exceed 10 bar or fall below 8 bar

- Idling: if the pressure is too high

→ faulty rotary valve.

- Accelerating: if the pressure is too low

→ faulty regulator.

B) Wheels fully locked

This operation must not take too long, otherwise the oil temperature will rise excessively.

When turning the steering wheel, the pressure must reach at least 90 bar and not exceed 95 bar.

When turning to one side then the other, the difference in pressure must not be greater than 5 bar.

- Pressure too low, pressure gauge needle oscillating:
 - regulator faulty.
- Pressure too low, pressure gauge needle not oscillating:
 - belt slack;
 - valve faulty;
 - internal cylinder leak.
- Pressure difference when turning on both sides:
 - valve faulty;
 - cylinder faulty.

2nd Test

Conditions:

- Same conditions as above, but the HP pipe to the servo-regulator is open.

If the checks above were correct, the pressures should not vary (wait 30 seconds for the pressure to stabilise).

Then, using the XR 25, transmit a frequency to the servo-regulator module through the brown lead from the wiring to pin 11 on the computer (frequency = vehicle speed image).

The frequencies which should be transmitted on pin 11 are G1, G2, G3 and G4, corresponding to a vehicle speed of approximately 75 mph (120 km/h). (It is important to increase the frequency generated gradually since the computer switches to fault mode if the difference in speed is too great.)

In this case, there will be a gradual fall in pressure to approximately 3 - 5 bar.

If these checks have not been validated, check the electrical current supply of this module before replacing the servo-regulator module.

NOTE:

To generate a frequency using the XR 25, simply:

- connect terminal G of the XR 25 to the brown lead from the wiring to pin 11 on the computer;
- press keys G and 1, 2, 3, 4.

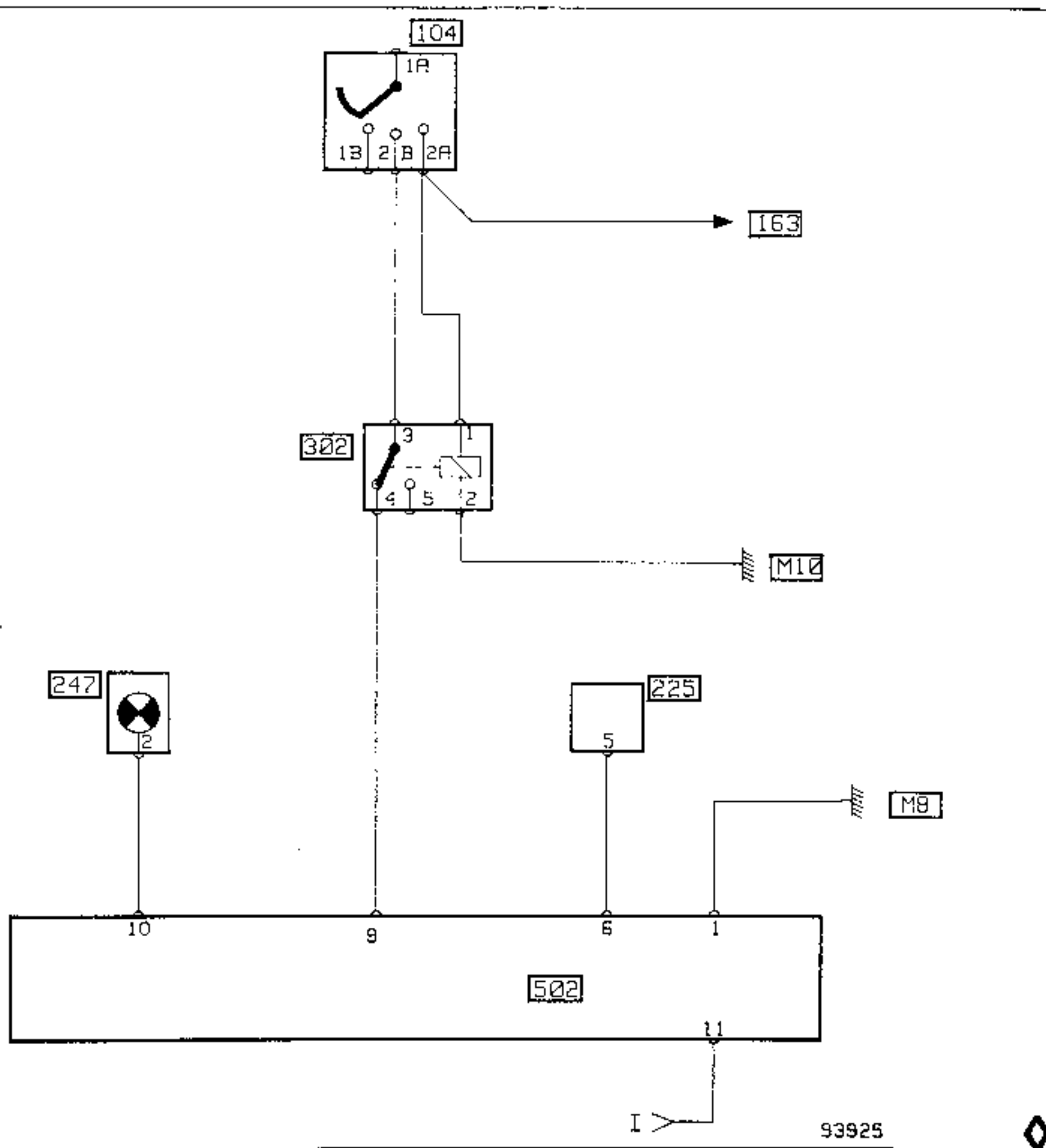
The assistance pressure will then gradually fall with the engine idling and the wheels pointing straight ahead.

REMOVE-REFIT

The system is automatically bled after any operation on the power-assisted steering hydraulic system; however, after removing-refitting the servo-regulator module the vehicle's engine must be run for at least 1 minute with the wheels pointing straight ahead, before turning the wheels.

Furthermore, at the end of this bleeding phase, it is possible to turn from one stop to the other with the vehicle raised and the wheels hanging free.

FAULT-FINDING - OPERATING DIAGRAM



104 - Anti-theft.

163 - Starter.

225 - Diagnostic socket.

M8 ; M10 - Earth.

I - Brown lead with round terminal for vehicle speed simulation through XR 25 test box.

247 - Dashboard.

302 - Variable assistance steering relay.

502 - Variable assistance steering computer.

SERVO-REGULATOR OPERATION ANALYSIS USING CASSETTE NO. 9

Using the XR 25 and cassette no. 9 (connector 90 D)

- With the vehicle stationary and the ignition switched on:

- Enter the code

D

0

9

The servo-regulator module code appears on the centre display.

282.9

Bar graph illumination

- Must always be illuminated. If not, no dialogue with the computer.
- Computer fault diagnosis; if lit at G and at D, replace servo-regulator module.
- Speed information line continuity diagnosis. If lit at G, check wiring continuity.
- Speed sensor signal fault diagnosis, moving vehicle. If lit at D and G, check wiring and signal source.

CONNECTOR 90 D		
1	CODE PRESENT 	
3		COMPUTER FAULT
6		WIRING FAULT (SPEED INFORMATION)
9		SPEED CONSISTENCY CHECK DURING ROAD TEST
VARIABLE ASSISTANCE STEERING		KEY # 19 :VEHICLE SPEED KM/H
12		1
13		2
14		3
15		4
16		5
17		6
18		7
19		8
20	MEMORY FUNCTION: 0 	

Assistance threshold selection must be illuminated, line 19 left.

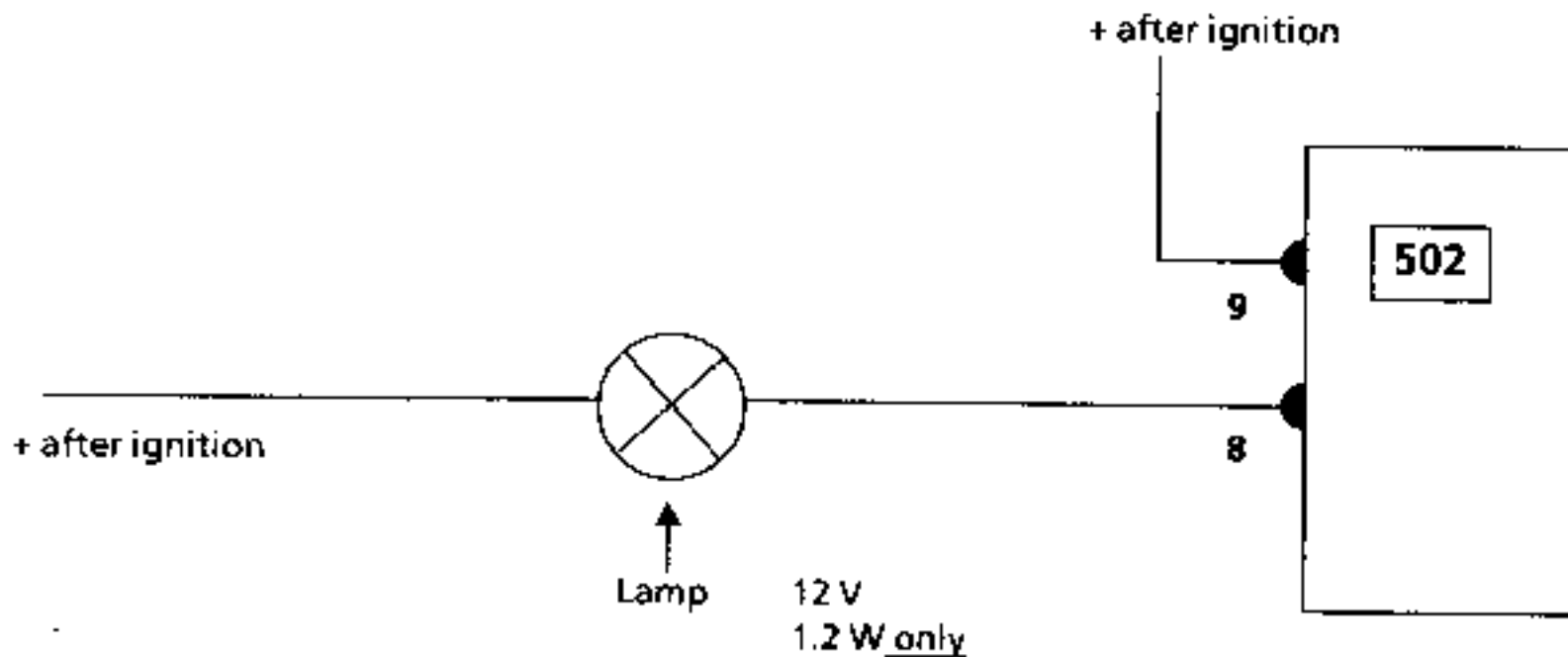
NOTE: This check must be carried out at the same time as the steering oil pressure check.

BRIEF ANALYSIS OF THE OPERATION OF THE SERVO-REGULATOR MODULE COMPUTER

If the operator does not have the XR 25 test box, with cassette N°. 9, It is nevertheless possible to diagnose a computer malfunction.

In fact, this can be done by connecting a locally made harness to computer pin No. 8.

Harness:



+ after ignition which can be substituted on pin N°. 9 of the connector (connected).

Fault-finding sequence

When the ignition is switched on, the computer performs a self-monitoring operation.

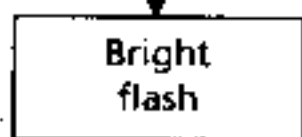
It tests:

- 1 - the electro-hydraulic assembly;
- 2 - the speed sensor and its computer link.

Fault-finding sequence

After ignition:

(Wait 5 - 6 s)



If the lamp illuminates: electro-hydraulic assembly test.

(Wait 1 s)



If the lamp illuminates: speed sensor assembly test.

END

These bright flashes enable rapid fault-finding of the servo-regulator module operation.

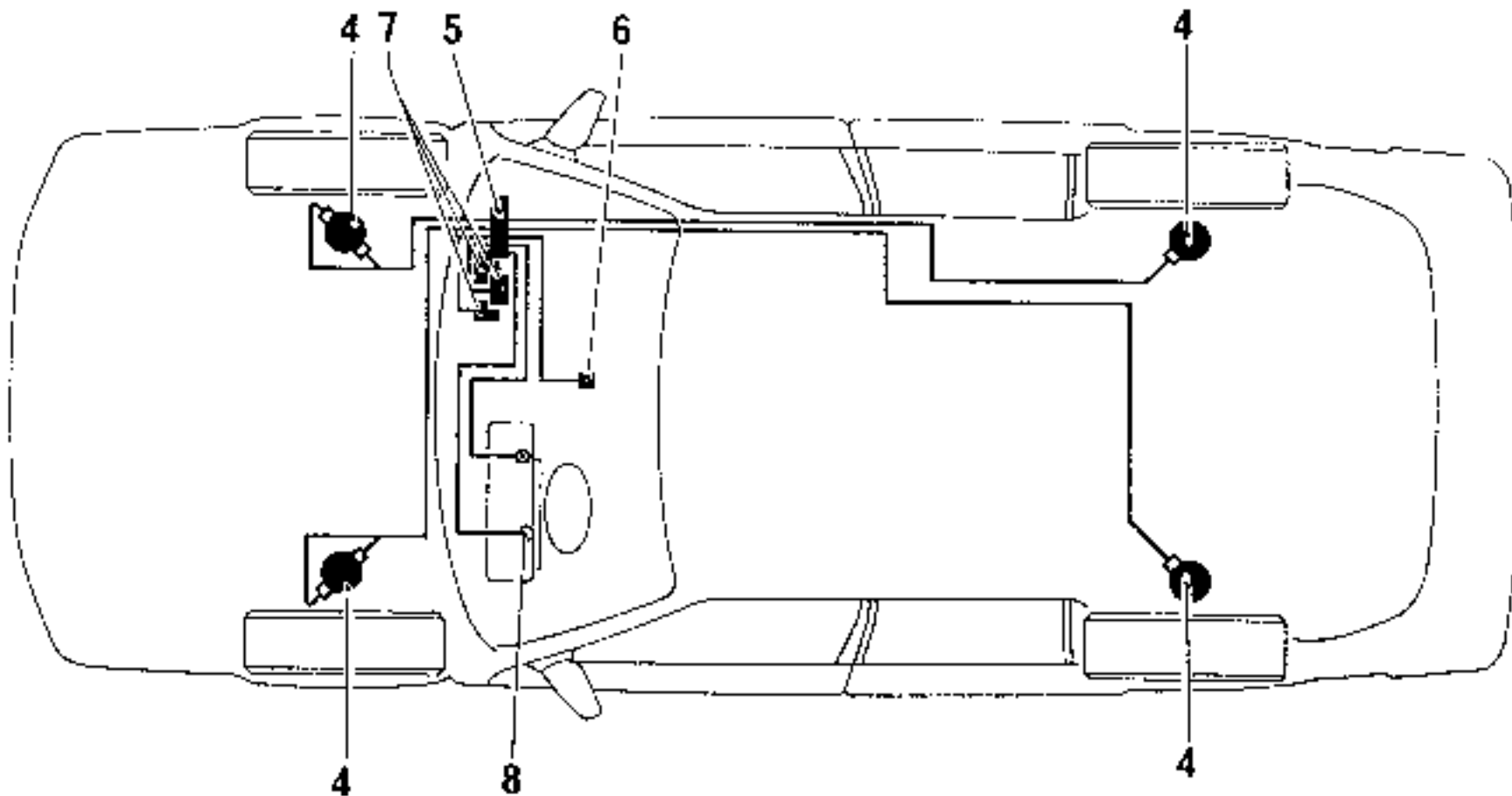
Variable rate shock absorption?? is a system which allows the degree of comfort and the suspension behaviour of the vehicle to be controlled in accordance with the driving conditions.

However, it is possible to engage permanent "SPORT" position.

The device comprises:

- four special shock absorbers;
- an electronic computer controlling the shock absorbers in accordance with the information received:
 - vehicle speed information;
 - stop lights switch;
 - accelerometers (longitudinal, vertical, transverse);
 - a driver/vehicle interface: control and signalling module.

INSTALLATION AND LAYOUT



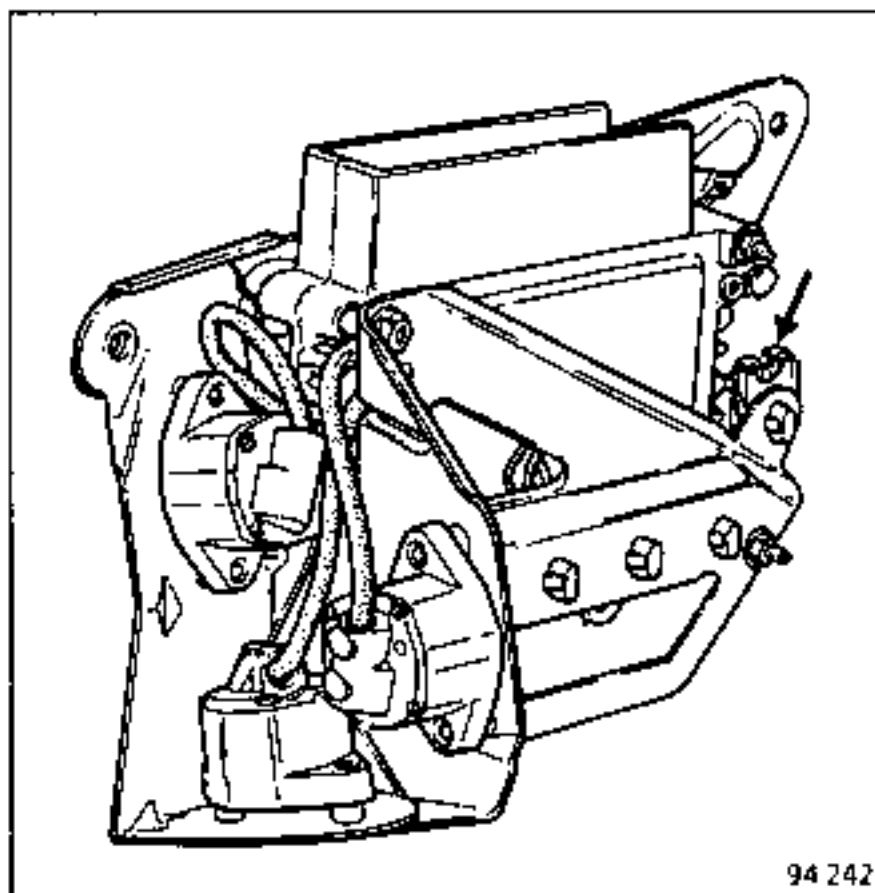
INSTALLATION AND LAYOUT

Components:

- 4 special hydraulic shock absorbers (4) (each shock absorber has two solenoid valves);
- 1 electronic module (5) for checking and controlling the shock absorbers, in accordance with the information sent to it;
- three acceleration sensors (7):
 - longitudinal accelerometer;
 - vertical accelerometer;
 - transverse accelerometer;
- vehicle speed information (8);
- a brake pedal contact;
- a control and signalling module (6) comprising:
 - a green sport warning lamp;
 - an amber fault warning lamp (in // with the dashboard service warning lamp);
 - a pushbutton for setting the automatic or sport "hold" position;
 - a sidelight illumination lamp;
 - a system comprising a resistor and a diode for extinguishing and illuminating the sport warning lamp when the sidelights are switched on.

Electric power supply

The computer is supplied by + 12 V after ignition via a 15 A fuse attached to the right-hand part of the computer/accelerometer support plate.



OPERATIONAL PRINCIPLE

This system can be used in one of two ways:

- in "automatic" mode;
- in "SPORT" mode.

The driver selects a mode of operation using the control switch.

- Only the "SPORT" mode is displayed by the illumination of warning lamp (1) (green).
- When the ignition is switched on, the system is in "automatic" mode.

Automatic mode of operation

- This mode is the most frequently used and therefore has no operating tell-tale.
- The electronic module will control 3 shock absorption levels known as "COMFORT", "MEDIUM" and "SPORT", which will be selected automatically in accordance with a strategy taking into account the parameters of vehicle speed, longitudinal acceleration, transverse acceleration, vertical acceleration and "stop" lights contact.

"SPORT" mode of operation

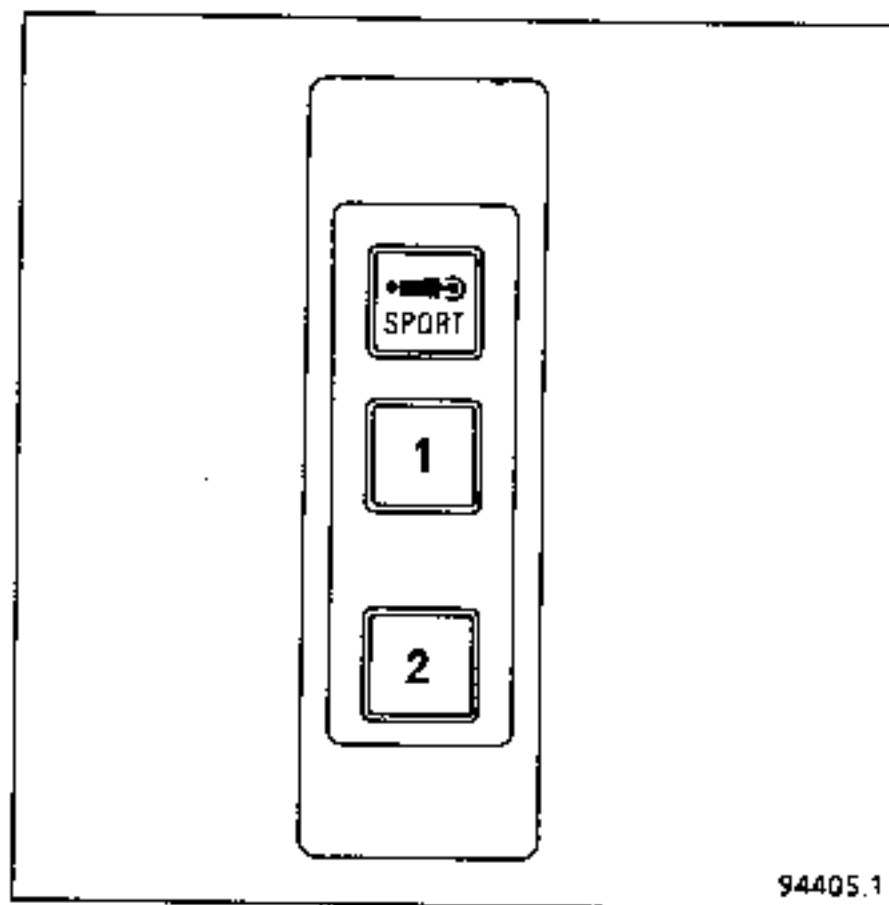
- This is engaged by briefly depressing the pushbutton and is displayed by the illumination of warning lamp (1) (green).
- Depress the button again to return to the "Automatic" mode.
- When the ignition is switched on, if the pushbutton is not depressed, the system is in "automatic" mode.

OPERATION

"Failure" tell-tale

When the ignition is switched on, the computer automatically starts a self-monitoring sequence, displayed by the illumination (for three seconds) of the failure tell-tale (2) (amber), linked to the dashboard "SERVICE" tell-tale.

- The "failure" tell-tale (2) should go out after 3 seconds and not illuminate again, unless the system malfunctions in any way.



Any system failure is indicated by:

- illumination of the test warning lamp and the "Service" warning lamp on the dashboard;
- the computer locks the system in an irreversible "degraded mode".

The fault which caused the warning lamp to illuminate can be displayed via the diagnostic socket using the XR 25 test box and cassette N°. 9 (connector 90 A).

OPERATION

Failures:

Any system failure is indicated by:

- illumination of the failure warning lamp (2);
- simultaneous illumination of the "SERVICE" warning lamp on the dashboard;
- the "SPORT" warning lamp (1) goes out if this position was engaged when the failure occurred.

A - Shock absorber electrical section failure:

- The computer sets the system in "SPORT" mode.

B - Failure of the speed sensor and the accelerometer sensors:

- The computer sets the system in "Medium" mode.

In all known cases of failure, the computer locks the system in an irreversible "degraded" mode of operation.

The fault which caused the warning light to illuminate can be displayed via the diagnostic socket using the XR 25 test box and the appropriate cassette.

When there is a fault, after the ignition has been switched off the fault is stored in the "non volatile" memory of the electronic computer. This memory can be accessed at any time, also using the XR 25 and the appropriate cassette.

Important recommendations

- 1) When the repair is complete, it is important to erase the fault memory by entering the command **GO**** on the XR 25.
- 2) When working on the mounting plate under the glove box (replacing accelerometers, changing the computer or removing the board assembly), it is very important to recalibrate the accelerometer values (see page 38-54).
- 3) It is important to remember that the accelerometer sensors are very fragile components. Take care not to jolt them.

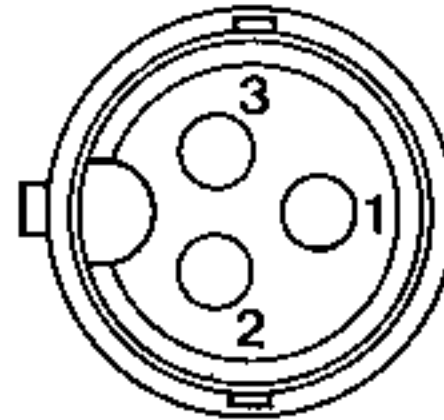
OPERATION**Shock absorbers**

Each shock absorber has two solenoid valves. Depending on the position selected, the current supply is as follows:

	COMFORT	MEDIUM	SPORT
ELECTRO. COMFORT	Supplied	Not supplied	Not supplied
ELECTRO. MEDIUM	Not supplied	Supplied	Not supplied

- Mechanical shock absorber faults cannot be "seen" electrically. A shock absorber without electric current supply is in the "SPORT" condition, which is a safety condition.
- Connectors (3-pin): shock absorber cable connector end view

- 1 : + (Medium and Comfort)
- 2 : - Comfort
- 3 : - Medium



94 439

Value of the solenoid valve coil resistance when cold (temperature 20 °C): 3.2 - 3.5 Ω .

REMOVING-REFITTING COMPONENTS

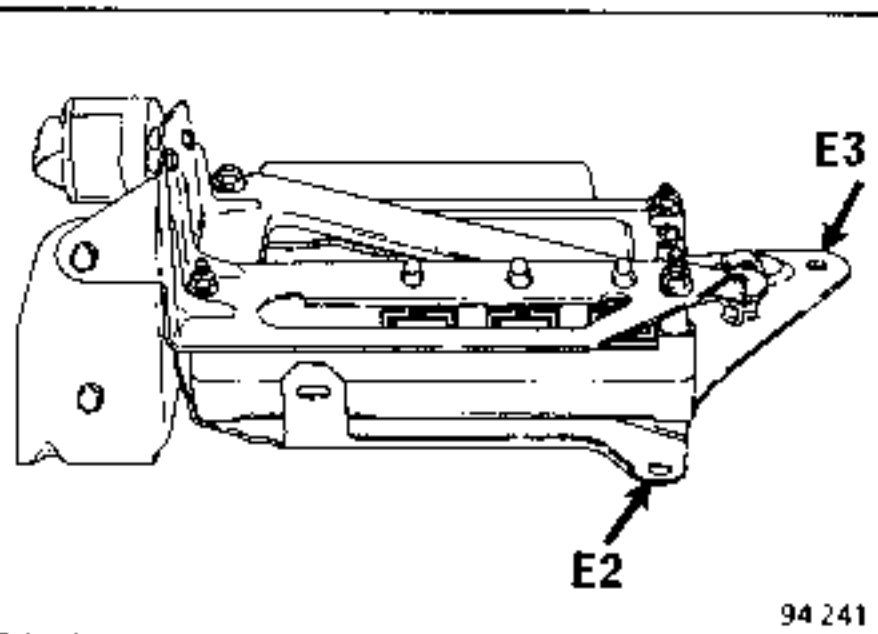


TIGHTENING TORQUES (in daNm)

Plate fixing nut	0.6 - 0.8
Accelerometer fixing bolt	0.5

Computer:

- Remove the glove box (two pins).
- Disconnect:
 - the 9-pin connector;
 - the accelerometer connectors.
- Free the wiring.
- Remove the mounting plate assembly, the computer and the accelerometers (3 nuts: arrows E1, E2 and E3).



Disconnect the 35-pin connector.

Remove the computer.

Refitting:

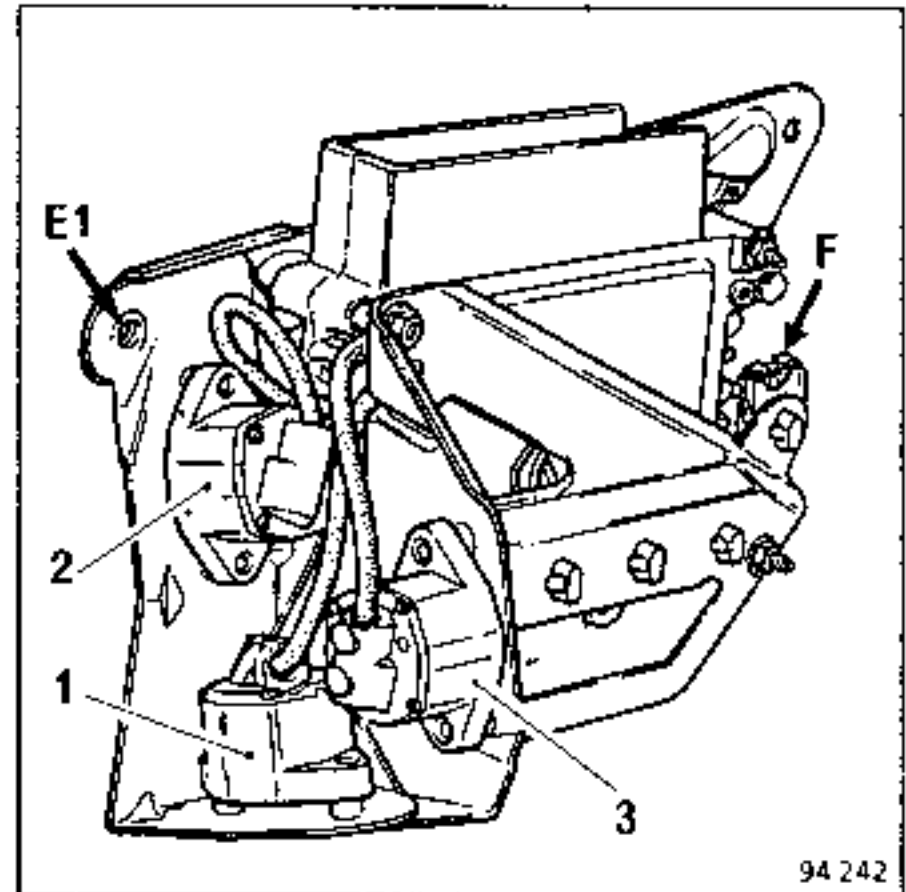
- Fit the computer, then attach it, making sure it connects perfectly with the 35-pin connector.

Precautions:

- Take care not to impose stress on the mounting plate in any way which would distort it.
- Observe the position of the spacers and the wiring (without overlapping the wiring).

Accelerometers:

In the same way as for the computer, remove the glove box and the support plate assembly, the computer and the accelerometers.



F - Fuse holder.

1 - Vertical accelerometer.

2 - Longitudinal accelerometer.

3 - Transverse accelerometer.

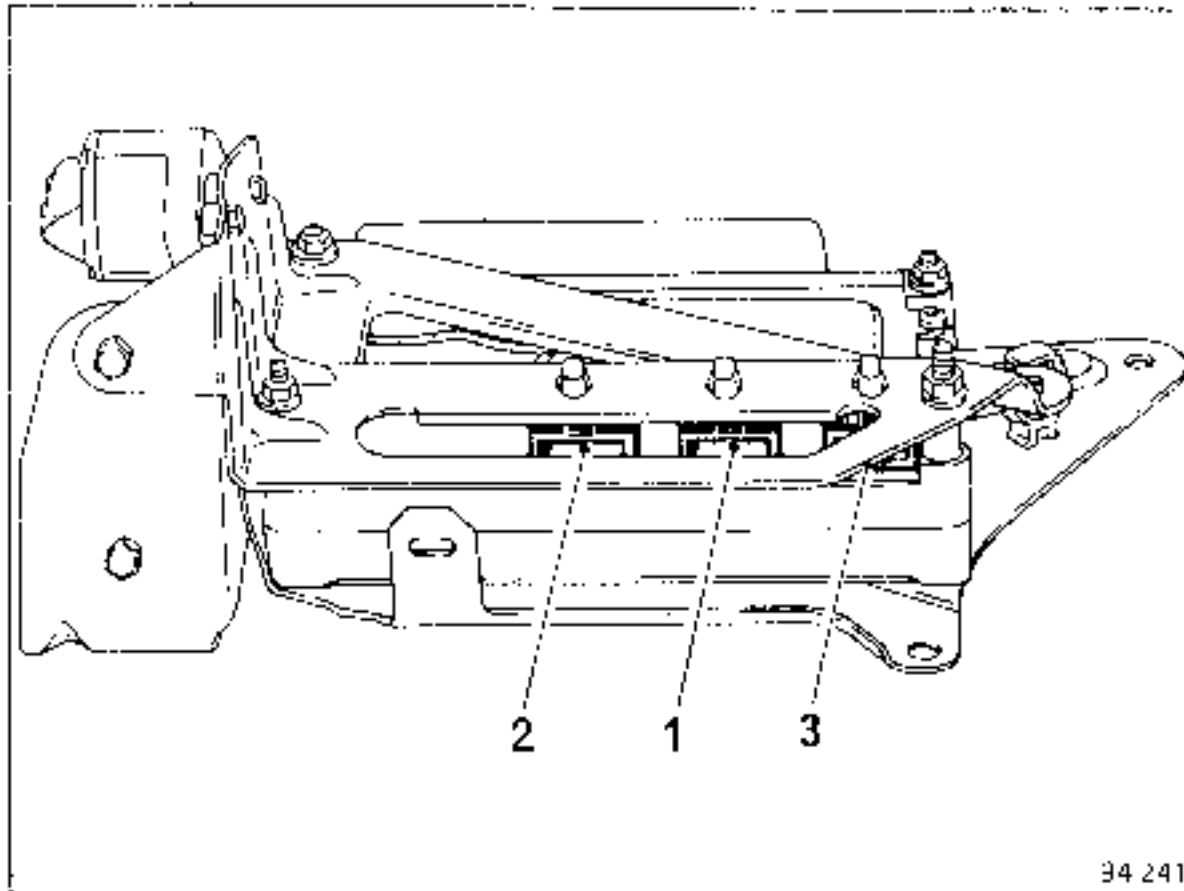
Replace the faulty element and observe the position of the accelerometers and connectors.

ATTENTION

- Handle the sensors with care.
- Do not jolt the plate to which the computers and accelerometers are fitted.

REMOVING-REFITTING COMPONENTS

Allocation of connectors:



- 1 - Vertical accelerometer (crystal).
- 2 - Longitudinal accelerometer (black).
- 3 - Transverse accelerometer (grey).

Note:

Replacing the computer and one or more accelerometers involves "calibrating the accelerometers" (see page 38-54).

REMOVING REFITTING COMPONENTS

Shock absorbers;

- Given the compressive load of the spring, it is essential to make sure that the tooling is in perfect condition.

ESSENTIAL SPECIAL TOOLING	
Sus. 513	Shock absorber piston rod locating and insertion tool
Sus. 1012	Tooling for operating on front spring and front shock absorber



TIGHTENING TORQUES (in daNm)

Solenoid valve mounting	10
Upper fixing nut	2
Shock absorber base locknut	6
Shock absorber base pin	8
Wheel bolts	10

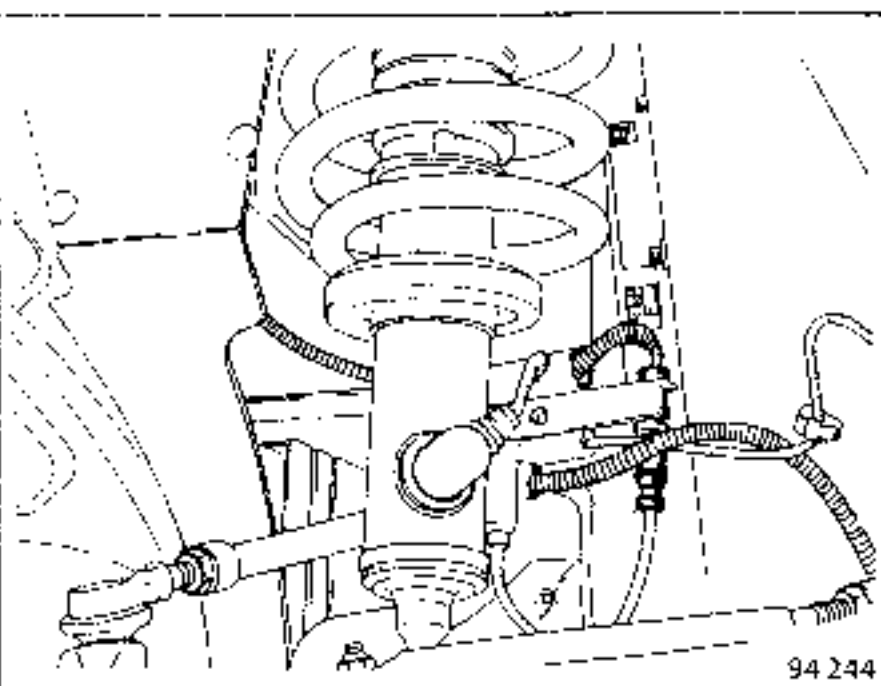
Removing:

Remove:

The earth (solenoid valve) located inside the shock absorber turret.

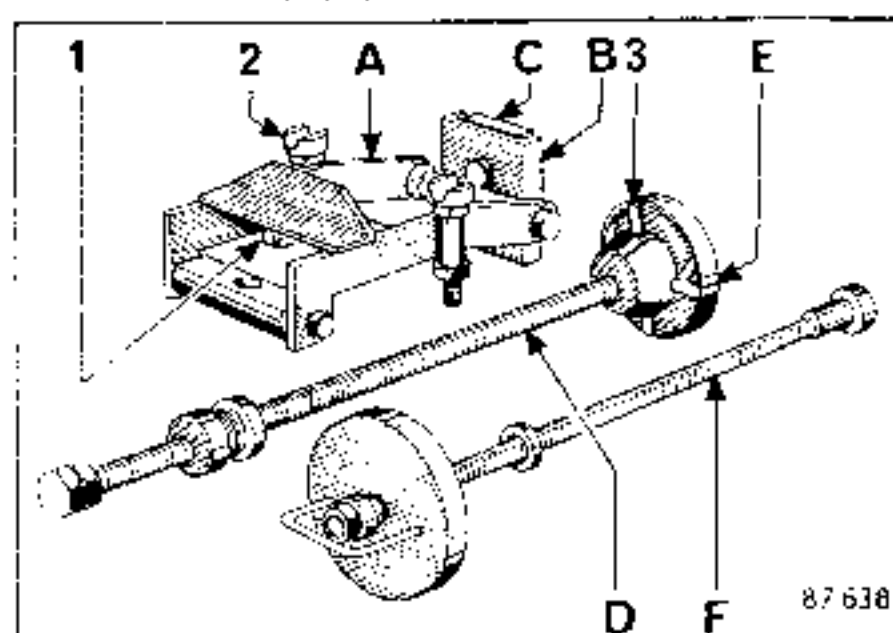
In the wheel arch: disconnect the solenoid valve current supply connector.

Remove: the ducting and connector support bracket (blind rivet).



94 244

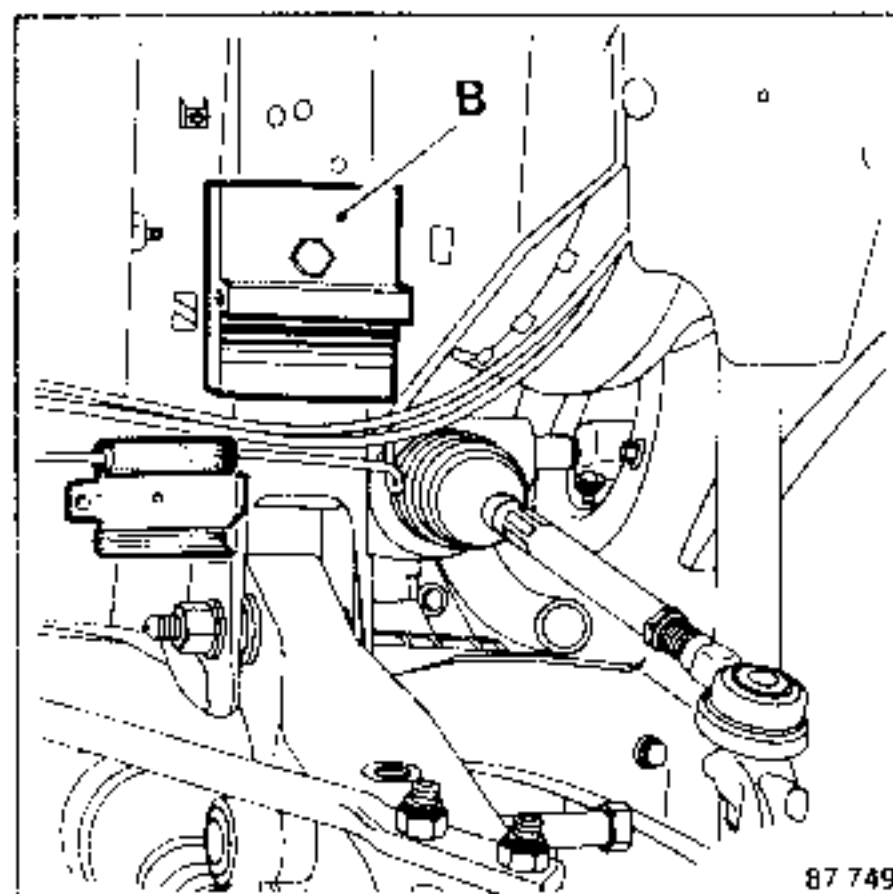
Use elements A, B, C, F of tool Sus. 1012



87 638

Place a jack until the lower balljoint and position:

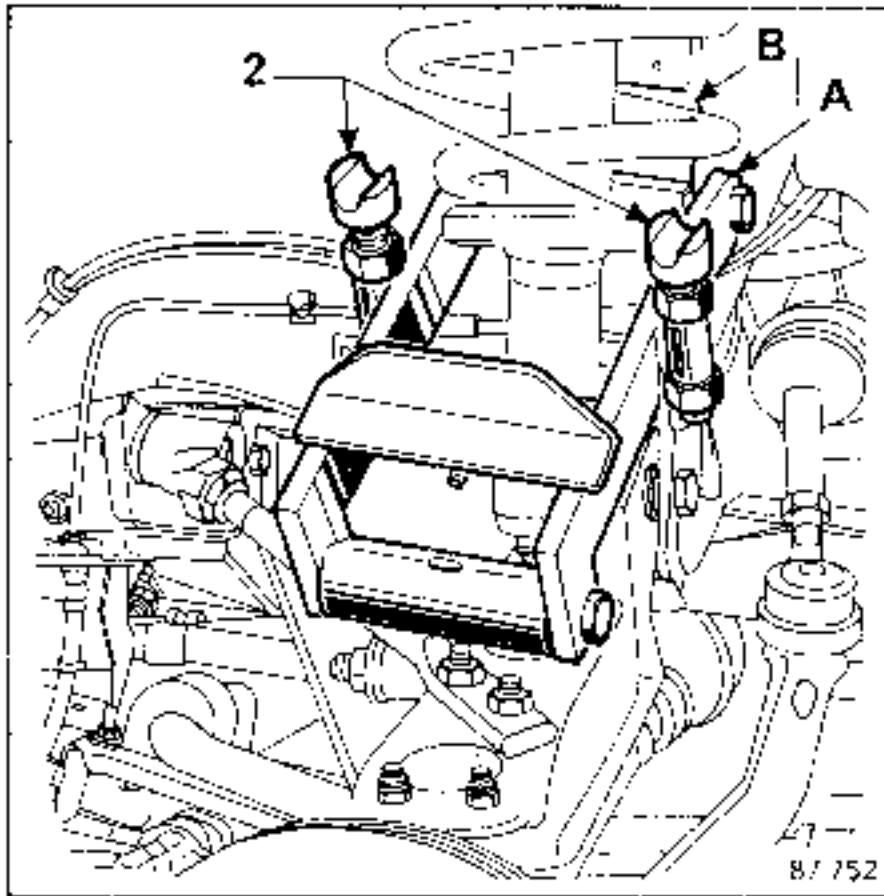
- the fixing plate (B) behind the shock absorber and the retaining plate (C). Do not tighten.



87 749

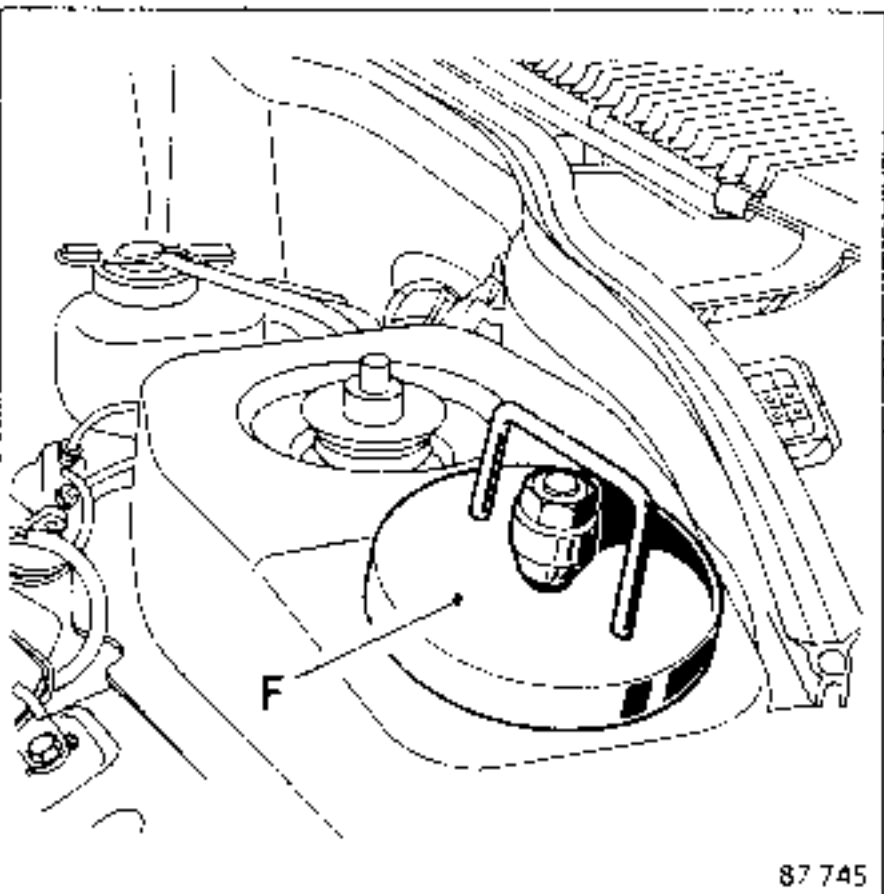
REMOVING-REFITTING COMPONENTS

- The compression baseplate (A); locate the two spring support pins (2).



Centre and tighten assembly (B) and (C).

Fit the compression rod (F).

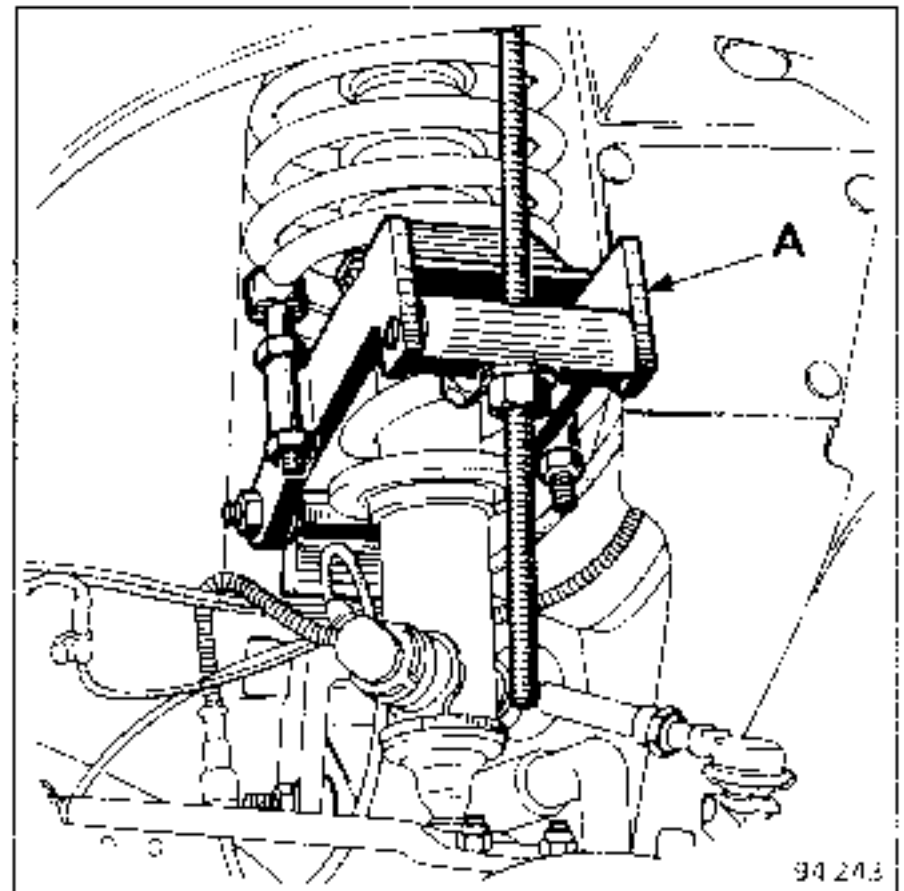


Raise the half-axle to horizontal.

Tighten the nut of rod (F) so as to free the shock absorber sufficiently.

Loosen the upper cup washers and the shock absorber base locknut.

Disconnect the anti-roll bar from the shock absorber base pin.



Lower the half-axle.

Unscrew and remove the shock absorber.

REMOVING-REFITTING COMPONENTS

Refitting:

Precautions to be taken before assembly:

Shock absorbers are stored horizontally in the spare parts warehouse.

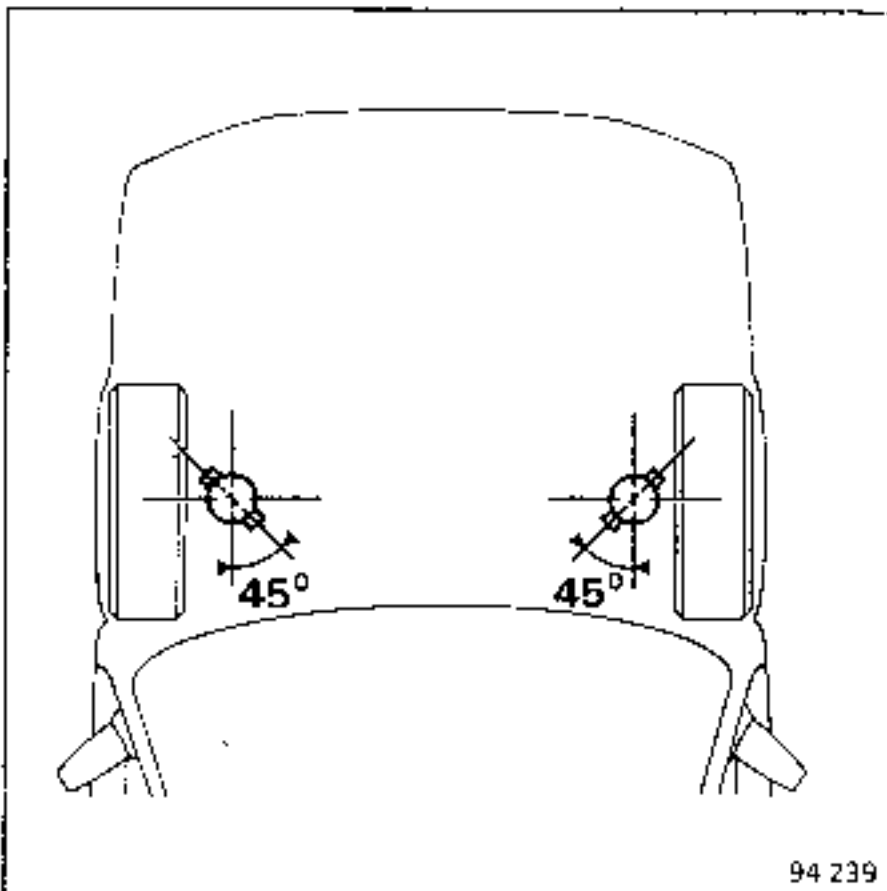
Under such conditions, it is possible that shock absorbers which have to operate in the vertical position may "deprime".

The shock absorber should therefore be pumped manually several times in the vertical position, before being fitted to the vehicle.

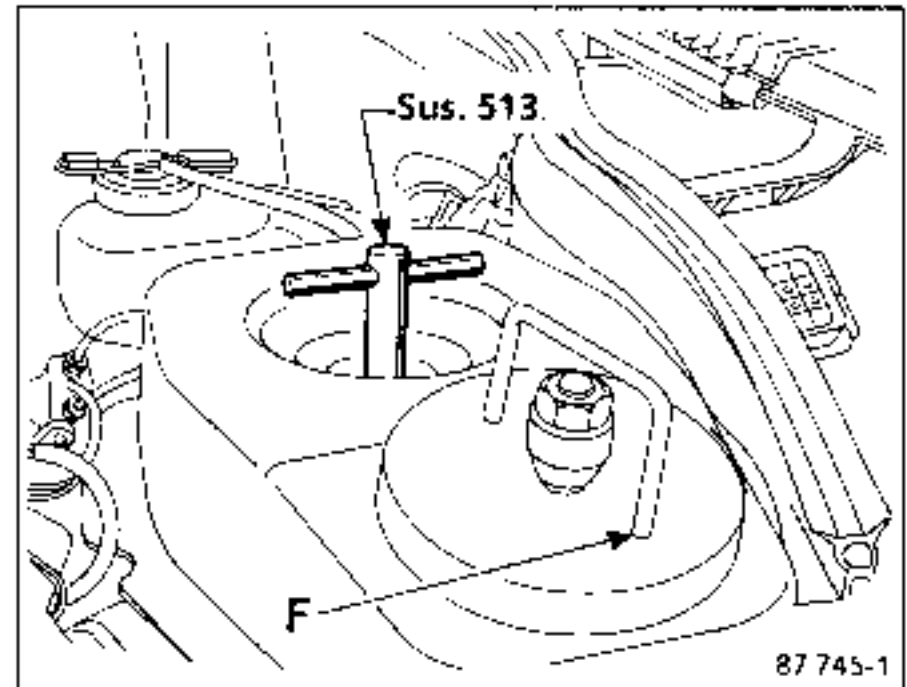
The shock absorber cup washer is fitted free. It is important to make sure that it slides easily.

Fit:

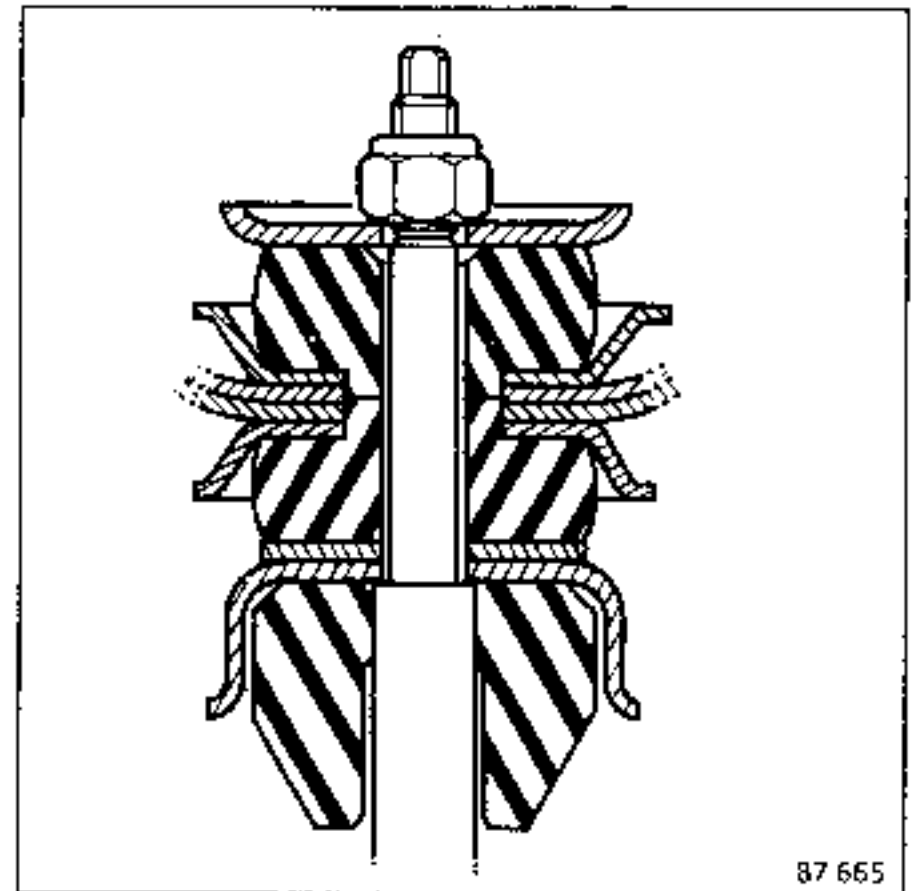
- the shock absorber; screw it in place and position the cup washer and the shock absorber, making sure that the solenoid valves are the correct way round.



- the shock absorber piston rod using Sus. 513.



- Raise the half-axle to horizontal.
- Attach the upper part of the shock absorber, making sure that the cup washers are fitted the correct way round.



NOTE:

The upper fixing pads are specific to these shock absorbers.

Tighten the shock absorber base locknut to the specified torque.

Reconnect the anti-roll bar.

Loosen rod (F).

NOTE: If the spring does not locate correctly in the cup washer, turn bolt (1) of tool (A).

REMOVING-REFITTING COMPONENTS

Lower the half-axle.

Loosen assembly (B) and (C)

Remove:

- the baseplate (A);
- the fixing plate and retaining plate assembly (B) and (C).
- Rivet the ducting/connector support bracket to the wheel arch.
- Reconnect and attach the solenoid valve connectors.

Refit:

- the solenoid valves

Lower the vehicle onto its wheels and tighten to the specified torque:

- the shock absorber base pin;
- the upper shock absorber mounting.

Note:

- Make sure that the correct wiring routing and electrical connections are used (otherwise the reliability of the controlled shock absorption cannot be guaranteed).
- Do not use the wiring delivered with the shock absorber for suspending purposes.
- When disconnecting the 3-pin connector, do not use a sharp tool which may damage the retaining lugs on both sections of the connector.

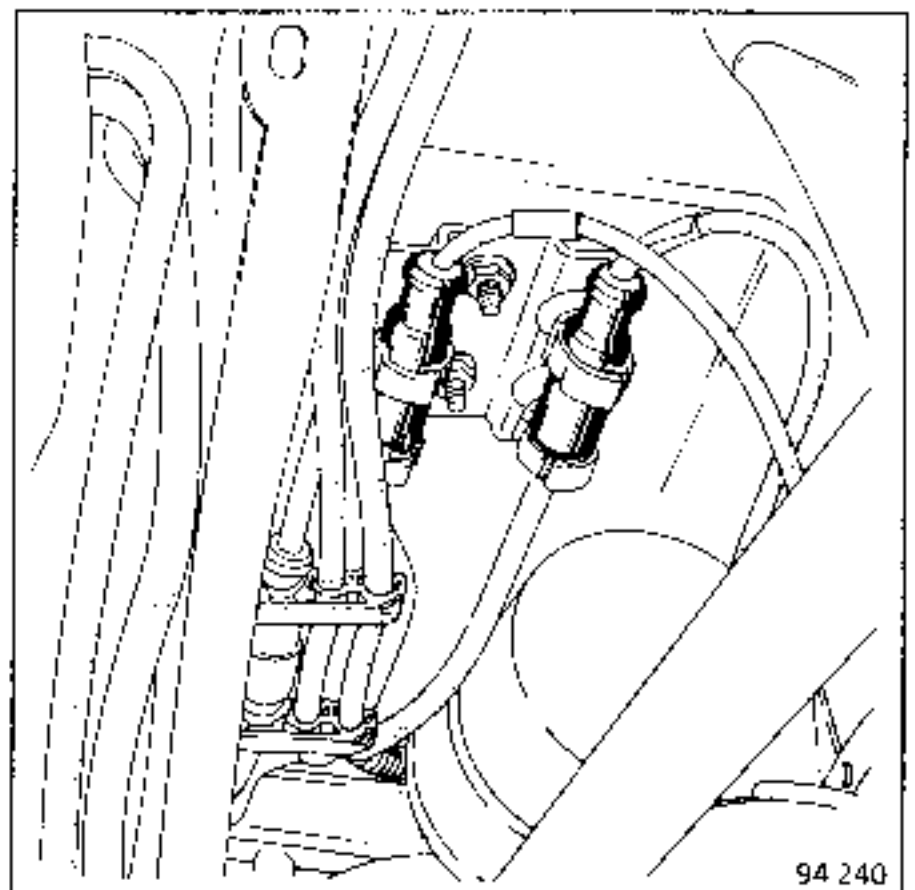
Rear shock absorbers

The removing-refitting method is identical to the method for conventional shock absorbers

**TIGHTENING TORQUES (in daNm)**

Lower fixing pin	10
Upper mounting	3
Wheel bolts: 5 bolts	10

The solenoid valve current supply lead connectors are located to the rear right, near the petrol pump.

**NOTE:**

The solenoid valve supply leads are different lengths;

- rear left-hand shock absorber (2 metres, orange mark);
- rear right-hand shock absorber (1.4 metres, black mark).

When connecting the connectors make sure that the marks line up. Mixing them up could cause a fault-finding error.

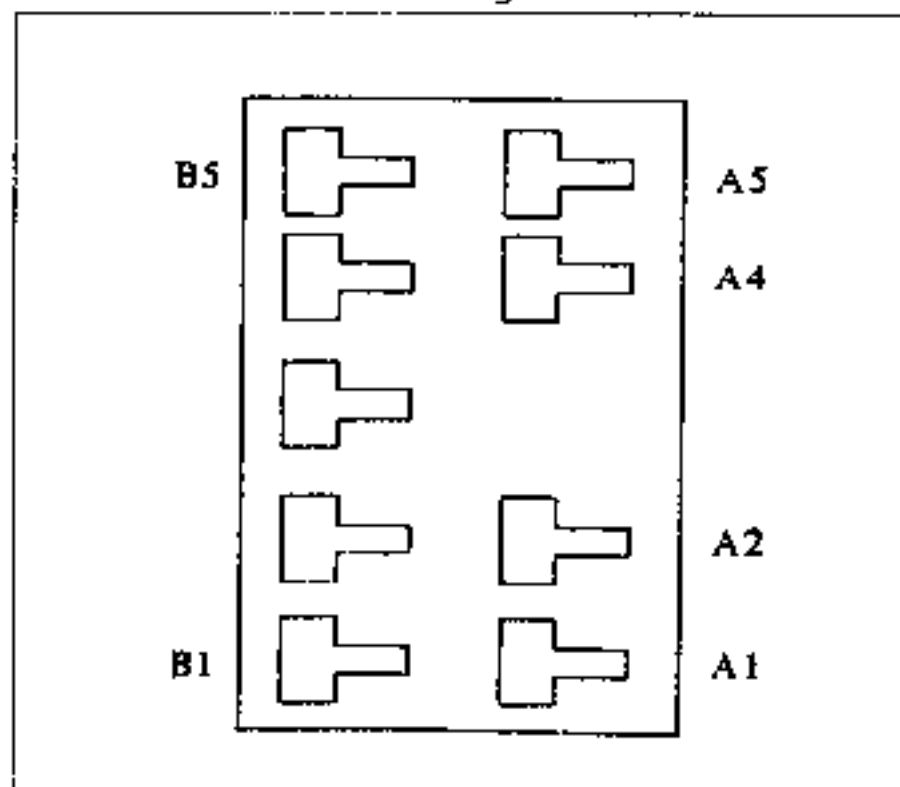
59448

WIRING DIAGRAM KEY

- 225** - Diagnostic socket.
- 247** - Dashboard.
- 260** - Fuse.
- 498** - Vertical accelerometer.
- 499** - Longitudinal accelerometer.
- 500** - Transverse accelerometer.
- 534** - Variable shock absorption control module.
- 543** - Variable shock absorption computer.
- 547** - Left-hand rear shock absorber solenoid valves.
- 548** - Right-hand rear shock absorber solenoid valves.
- 549** - Left-hand front shock absorber solenoid valves.
- 550** - Right-hand front shock absorber solenoid valves.

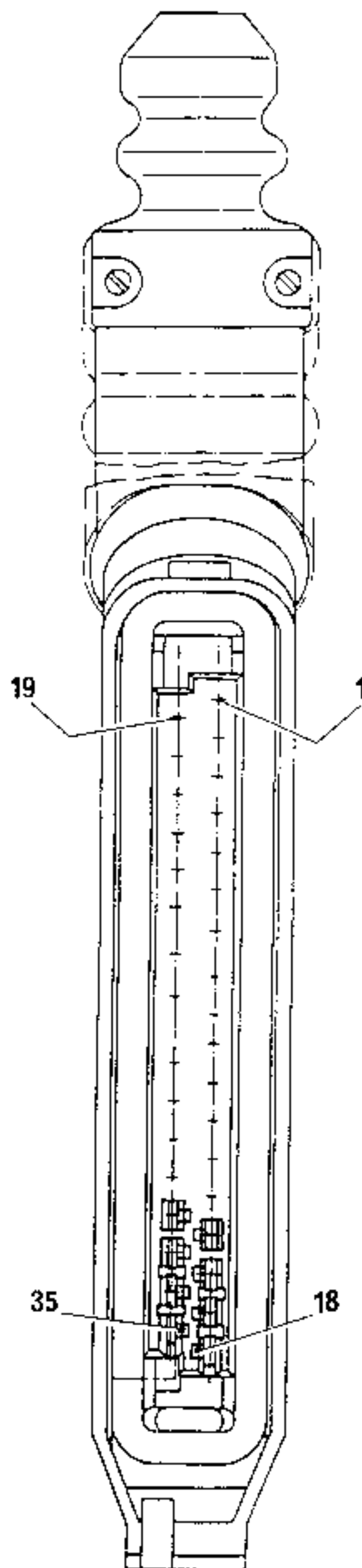
9-pin MIC connector fitted to mounting plate:

- A1** - Sport warning lamp control.
- A2** - Sport button.
- A4** - Fault warning lamp control.
- A5** - + 12 volts sidelights.
- B1** - Earth.
- B5** - + 12 volts after ignition.



Allocation of computer connector pins

PIN N°	DESCRIPTION
1	REAR L- H COMFORT solenoid valve output
2	REAR R- H COMFORT solenoid valve output
3	FRONT L- H COMFORT solenoid valve output
4	FRONT R- H COMFORT solenoid valve output
5	REAR L- H NORMAL solenoid valve output
6	REAR R- H NORMAL solenoid valve output
7	FRONT L- H NORMAL solenoid valve output
8	FRONT R- H NORMAL solenoid valve output
9	Electric earth
10	Electric earth
11	Input + 12 V after ignition
12	Input + 12 V after ignition
13	Not connected
14	Not connected
15	Fr. R-H shock absorber connector
16	Fr. L-H shock absorber connector
17	R. R-H shock absorber connector
18	R. L-H shock absorber connector
19	Diagnostic line L
20	Diagnostic line K
21	FAULT warning light output
22	Stop lights contact input
23	Vehicle speed input
24	SPORT warning lamp output
25	Not connected
26	SPORT / AUTO button input
27	Vert. accelero. sensor signal input
28	Transverse accelero. sensor signal input
29	Transverse and longitudinal accelero. sensors analog earth
30	Vert. accelero. sensor analog earth
31	Not connected
32	Longit. accelero. sensor signal input
33	Not connected
34	Longit. and trans. accelero. + 5 V sensor power supply output
35	Vert. accelero. + 5 V sensor power supply output

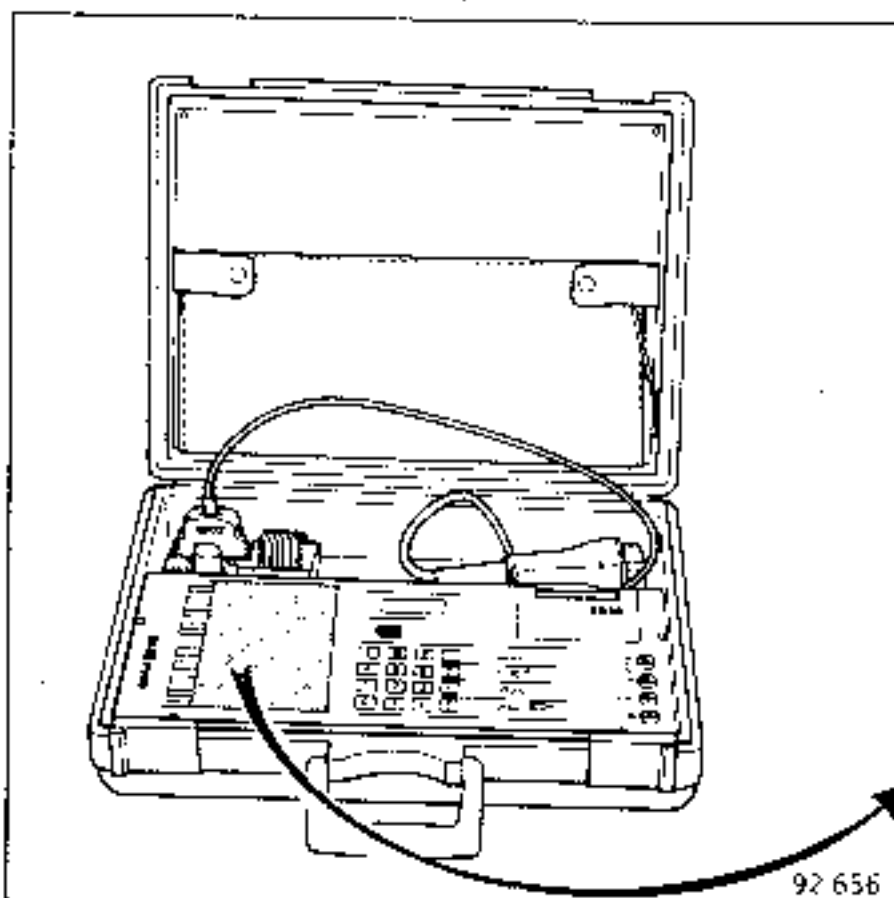


FAULT-FINDING

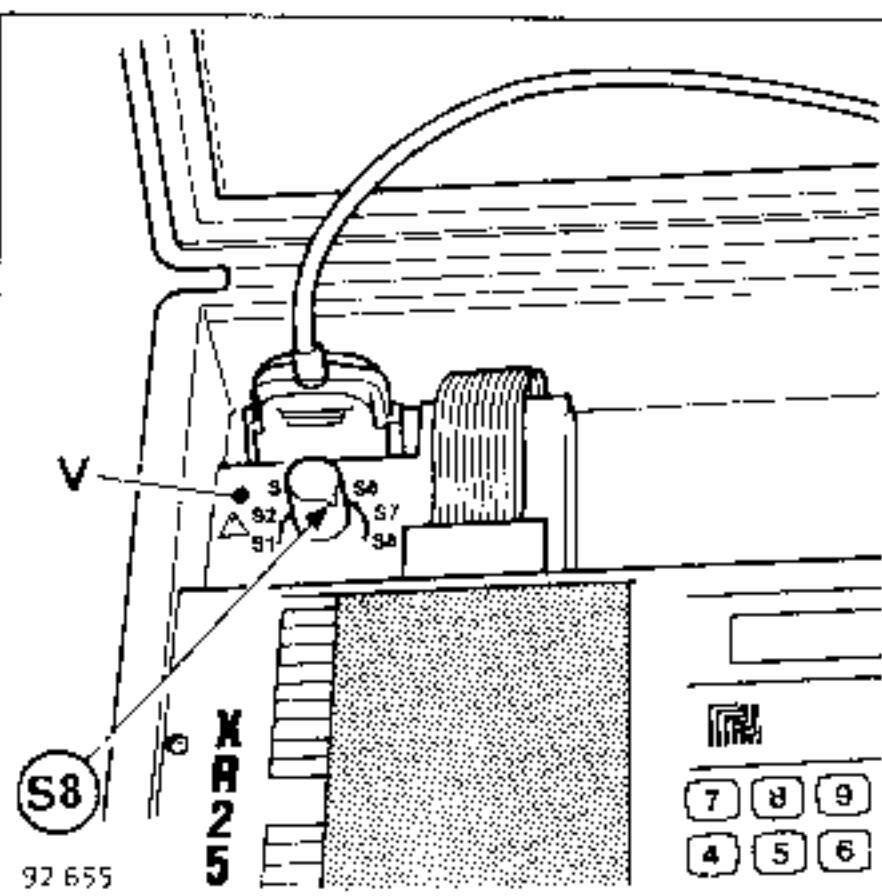
The XR 25 test box is essential for any repairs to the controlled shock absorption suspension, whatever the origin of the incidents.

It is fitted with a microprocessor, providing access to all the information supplied by the various sensors, and making it possible to read the diagnostic message generated by the electronic module

It also enables the "non volatile memory", contained in the electronic module, to be erased each time work on the suspension is completed.



Connect the XR 25 to the vehicle's diagnostic socket.
Set the selector to S8.



Connector 90 A		4XX.8
1	CODE PRESENT	
2	DEPRESSED ← --- BRAKE --- →	RAISED
3	DEPRESSED ← --- SELECTION KEY --- →	RAISED
4	SPEED CIRC. CO??	FAULT WARNING LAMP SC
5	CO VERTICAL ACCELEROMETER (1)	SC
6	CO LONGITUDINAL ACCELEROMETER (2)	SC
7	CO TRANSVERSE ACCELEROMETER (3)	SC
8	M ACCEL DRIFT 1	HSV? (!) M
9	M ACCEL DRIFT 2	
10	M ACCEL DRIFT 3	
AMV VDO CODE : D08 (S8) (ERASE MEMORY: GO**) (END OF FAULT-FINDING: G 13*)		KEYS #
11	EV1 FR-H	01 ACCELEROMETER 1 (VERTICAL)
12	EV2 FR-H	02 ACCELEROMETER 2 (LONGITUDINAL)
13	EV3 FL-H	03 ACCELEROMETER 3 (TRANSVERSE)
14	EV4 FL-H	05 VEHICLE SPEED
15	EV5 RR-H	COMMAND MODES G1 * SPORT POSITION G2 * MEDIUM POSITION G3 * COMFORT POSITION
16	EV6 RR-H	
17	EV7 RL-H	
18	EV8 RL-H	SHOCK ABSORBER POSITIONS
19	SPORT MEDIUM COMFORT	
20	XR 25 STORAGE REQUEST (0)	
(1) SEE TEST CONDITIONS IN WORKSHOP MANUAL		FRA

NOTE: Warning light V must be out. If it is illuminated, disconnect and reconnect the diagnostic socket. If it remains illuminated, check the XR 25 wiring.

FAULT-FINDING

Analysis of the operation of the system using the XR 25 and cassette N° 9 (Connector 90A).

- With the vehicle stationary and the ignition switched on:

Enter the code

D 0 8

- The centre display shows;

5 4 5

(1 second) then

4 X X 8

or

— — — —

4: Mark (V.D.O)

XX: Computer number

8: The product tested (controlled shock absorption suspension)

Dialogue has not been established.

Must be illuminated; goes out during solenoid valve dynamic checks (key G ● *).

Manipulate the tested element, there should be a change in condition on the bar graphs.

If one or more bar graphs are illuminated, there is a fault.

If flashing, a fault has been memorised.

In automatic mode, vehicle stationary: position "Medium".

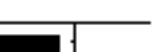
Connector 90 A		4XX.B	
1	CODE PRESENT		
2	DEPRESSED BRAKE RAISED		
3	DEPRESSED KEY SELECTION RAISED		
4	SPEED CIRC. DEFECT	FAULT WARNING LAMP SC	
5	DEFECT VERTICAL ACCELEROMETER (1)	SC	
6	DEFECT LONGITUDINAL ACCELEROMETER (2)	SC	
7	DEFECT TRANSVERSE ACCELEROMETER (3)	SC	
8	M ACCEL ADJ. DEFECT 1 HSVF (?) M		
9	M ACCEL ADJ. DEFECT 2		
10	M ACCEL ADJ. DEFECT 3		
AMV VDO CODE : D08 (S8) (ERASE MEMORY: G0**) (END OF FAULT-FINDING: G 13*)			
11	EV1 FR-H	SOLENOID VALVE CIRCUIT CO SC	
12	EV2 FR-H		
13	EV3 FL-H		
14	EV4 FL-H		
15	EV5 RR-H		
16	EV6 RR-H		
17	EV7 RL-H		
18	EV8 RL-H		
19	SPORT MEDIUM COMFORT	KEYS # 01 ACCELEROMETER 1 (VERTICAL) 02 ACCELEROMETER 2 (LONGITUDINAL) 03 ACCELEROMETER 3 (TRANSVERSE) 05 VEHICLE SPEED COMMAND MODES G1 * SPORT POSITION G2 * MEDIUM POSITION G3 * COMFORT POSITION SHOCK ABSORBER POSITIONS	
20	XR 25 STORAGE REQUEST (0)		

(?) SEE TEST CONDITIONS IN WORKSHOP MANUAL FRA

IMPORTANT :

If D08 is entered when the computer is in the test sequence, the diagnosis may appear up to 40 seconds later. To reduce this time, enter: G13 * (bleep), then D08.

FAULT-FINDING

 1	Illuminated: correct - goes out if key G is used because computer is in fault-finding reception instead of transmission mode. If not illuminated after entering D08: - Check diagnostic socket link to computer (lines 10 and 11 of the socket to pins 19 and 20 of the computer) - Check earth of pins 9 and 10 of computer, 12 V current supply of pins 11 and 12 of computer → if incorrect: starting relay/fuse (check correct operation of XR 25 if necessary).	
 2	- Illuminated, brake pedal raised	Attention: this bar graph is not a fault, it is a "STOP" light switch function display.
 2	- Illuminated, brake pedal depressed	
 3	- Illuminated, button released	Attention: this bar graph is not a fault, it is a control button switch function display.
 3	- Illuminated, button depressed	
 4	- Warning lamp short circuit	Check wiring and control module. Check illumination of warning light when ignition is switched on.
 4	- No speed signal	Check speed sensor harness and sensor # 05 which can display the vehicle speed in km/h.
 5	- Vertical accelerometer	These bar graphs (left and right) indicate a problem linked to the accelerometer sensor. Check: - the electrical connection and the 3-pin connector; - the accelerometer value by entering $\times$ and the corresponding figure in the XR 25 (see page 38-54).
 5		
 6	- Longitudinal accelerometer	
 6		
 7	- Transverse accelerometer	
 7		
 8	HSVF: Hidden Solenoid Valve Fault: Illumination as a result of three successive intermittent faults not visible from bar graphs 11 to 18 (delay time less than one minute). This is the forerunner of a distinct permanent fault. Check condition of wiring, connectors, continuities and connector mountings.	

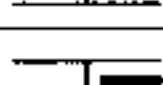
FAULT-FINDING

 8	- Vertical accelerometer adjustment.	The fault could be due to: 1) The vehicle not being on a horizontal surface when the accelerometers are calibrated. 2) Incorrect plate position on bulkhead or plate distorted. 3) Incorrect accelerometer position on plate. 4) Faulty accelerometer.
 9	- Longitudinal accelerometer adjustment.	
 10	- Transverse accelerometer adjustment.	

			Corresponding 35-pin positive terminal
 11	- Front right-hand Comfort solenoid valve terminal 4 (35-pin)		15
 11	- Front right-hand Comfort solenoid valve terminal 4 (35-pin)		
 12	- Front right-hand Medium solenoid valve terminal 8 (35-pin)		
 12	- Front right-hand Medium solenoid valve terminal 8 (35-pin)		
 13	- Front left-hand Comfort solenoid valve terminal 3 (35-pin)	Illuminated on right, solenoid valve coil short circuited.	16
 13	- Front left-hand Comfort solenoid valve terminal 3 (35-pin)		
 14	- Front left-hand Medium solenoid valve terminal 7 (35-pin)		
 14	- Front left-hand Medium solenoid valve terminal 7 (35-pin)		
 15	- Rear right-hand Comfort solenoid valve terminal 2 (35-pin)	Illuminated on left, solenoid valve coil or wiring cut.	17
 15	- Rear right-hand Comfort solenoid valve terminal 2 (35-pin)		
 16	- Rear right-hand Medium solenoid valve terminal 6 (35-pin)		
 16	- Rear right-hand Medium solenoid valve terminal 6 (35-pin)		

FAULT-FINDING

FAULT-FINDING

			Corresponding 35-pin positive terminal
 17	- Rear left-hand Comfort solenoid valve terminal 1 (35-pin)	Illuminated on right, solenoid valve coil short circuited. Illuminated on left, solenoid valve coil or wiring cut.	18
 17	- Rear left-hand Comfort solenoid valve terminal 1 (35-pin)		
 18	- Rear left-hand Medium solenoid valve terminal 5 (35-pin)		
 18	- Rear left-hand Medium solenoid valve terminal 5 (35-pin)		
 19	- Shock absorber position: SPORT	Attention: these bar graphs do not indicate faults, they show the condition of the controlled suspension.	
 19	- Shock absorber position: MEDIUM		
 19	- Shock absorber position: COMFORT		
 20	- Present if using the store function on the XR 25.		

The memorise function on the XR 25 enables the values of the various parameters which can be accessed using key # (followed by two figures) to be fixed and stored for future reference.

Once communication between the XR 25 and the electronic module has been established, enter

0

This memorisation can be erased by entering

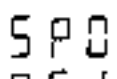
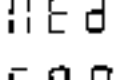
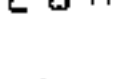
D

0

8

Hydraulic shock absorber check: (Key G) control mode

Touching key G followed by a figure and * makes the computer engage a shock absorption position.

G1 *	"SPORT"	  	} remains illuminated for two seconds.
G2 *	"MEDIUM"		
G3 *	"COMFORT"		

NOTE:

- This key does not enable bar graphs 1 to 18 (none illuminated) to be read simultaneously; bar graphs 19 show the position engaged.
- To perform this test, there must be a power supply to the shock absorber solenoid valves: check beforehand that there are no faults from 11 to 18.
- To avoid damaging the suspension elements and endangering the driver:
The XR 25 prevents:
 - the "COMFORT" position being engaged at vehicle speeds above 3.5 mph (6 km/h)
 - the "MEDIUM" position being engaged at vehicle speeds above 62 mph (100 km/h).
- During the road test, the change in shock absorption condition (bar graphs 19) cannot be displayed.

Checking the efficiency of changing shock absorption modes: (vehicle stationary).

- Change from position "SPORT" to "COMFORT" and from "SPORT" to "MEDIUM" to appreciate the efficiency of changing modes.

This enables shock absorption mode changing to be better evaluated.

FAULT-FINDING

Checking the accelerometers and speed sensors: Keys#

Function to be checked	Test box selection	Screen display	Conditions
Vertical accelerometer	# 01	The value on the centre display must be between - 1.49 ms ² and 1.49 ms ²	Place the vehicle on a flat surface
Longitudinal accelerometer	# 02	The value on the centre display must be between - 4.49 ms ² and 4.49 ms ²	
Transverse accelerometer	# 03	The value on the centre display must be between - 1.87 ms ² and 1.87 ms ²	
Vertical accelerometer	# 01	The value must vary in accordance with the corresponding vehicle movement	Vehicle (stationary) Activate the suspension
Longitudinal accelerometer	# 02		Move the vehicle slightly
Transverse accelerometer	# 03		Tilt the vehicle sideways (stationary)
Speed sensor	# 05	Check and compare the speed value in km/h with that on the dashboard	Road test

Calibrating the accelerometers:

- Before giving this command, the vehicle must be on a horizontal surface (gradient error < 0.5%), vehicle unladen and fuel tank full.
- This command must be given only when replacing one or more accelerometers or the calculator or when working on the support plate of either of these parts.

Enter G 99* → read

	0	F	F
--	---	---	---

 then enter * to validate

The result is given by:

- bleep (no fault)
- bleep + illumination of bar graphs 8, 9 or 10 depending on the circumstances, indicating that the sensor or sensors is/are incorrectly adjusted.

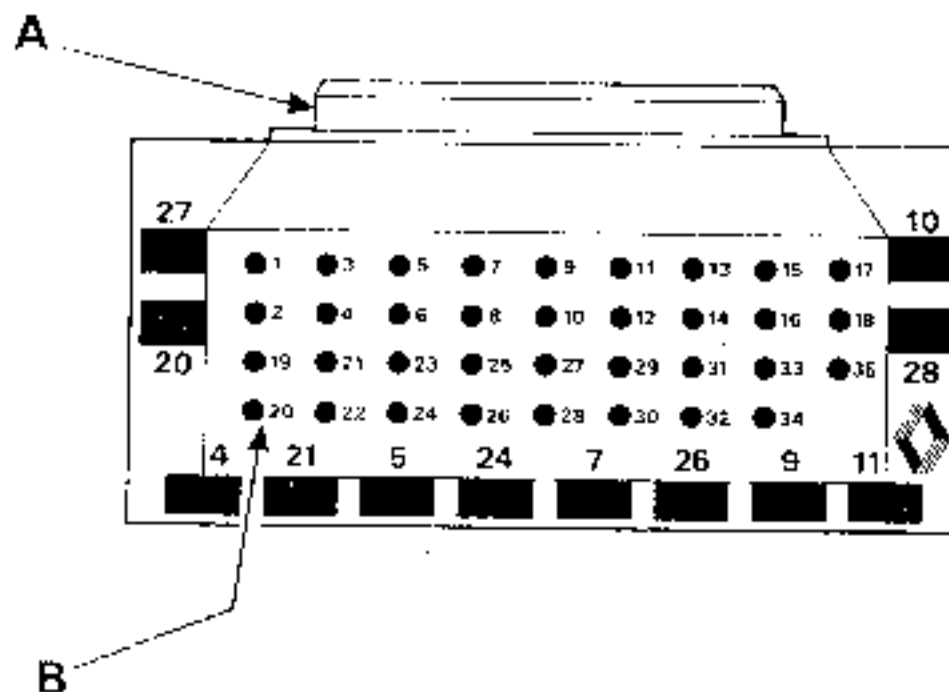
FAULT-FINDING

ESSENTIAL SPECIAL TOOLING	
M.S. 1048	Junction holder for checking the wiring using XR 25 or multimeter

This comprises a base of 35 contacts identical to the computer contact and integral with a circuit board with numbered electrical contacts: (1) to (35).

Each number corresponds to an electrical connection in the vehicle wiring and is indicated on the operating diagram on page (38-46).

It enables all incoming electrical connections to the main connector to be checked quickly and faultlessly.



89 024

A = Vehicle wiring.

B = Contacts for access to the control points key.

Connection to vehicle.

Ignition off: remove the computer from its base and connect the junction holder in its place.

Checking method principle

Touch the numbers on the junction holder with the XR 25 or multimeter contact point.

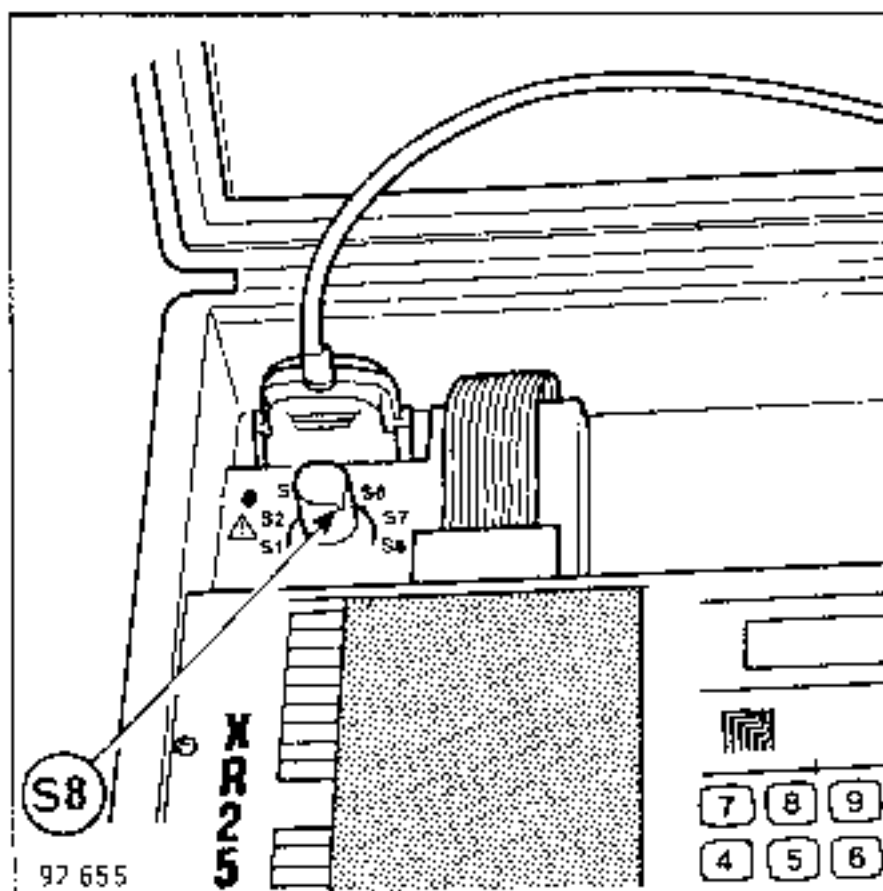
Potential checking equipment

- XR 25: Measuring continuity using the buzzer.
Measuring voltage using the voltmeter.
- Multimeter: Measuring the solenoid valve resistance.
Measuring voltages.
- Solenoid valve resistances: 3.2 to 3.5 Ω

This measurement must be carried out with the shock absorbers cold: temperature 20 °C.

ERASING THE NON-VOLATILE MEMORY USING CASSETTE N° 9

Connect the XR 25 test box to the vehicle's diagnostic socket.
Set the selector to S8.



Switch on the ignition without starting the engine

On the keyboard enter code:

D 0 8

The centre display shows:

5 U 5

Then

4 x x 8

On the keyboard enter

G 0 *

The centre display shows:

8 E F F

Check the erase request on

The centre display then shows:

E E 5

The memory has been erased.