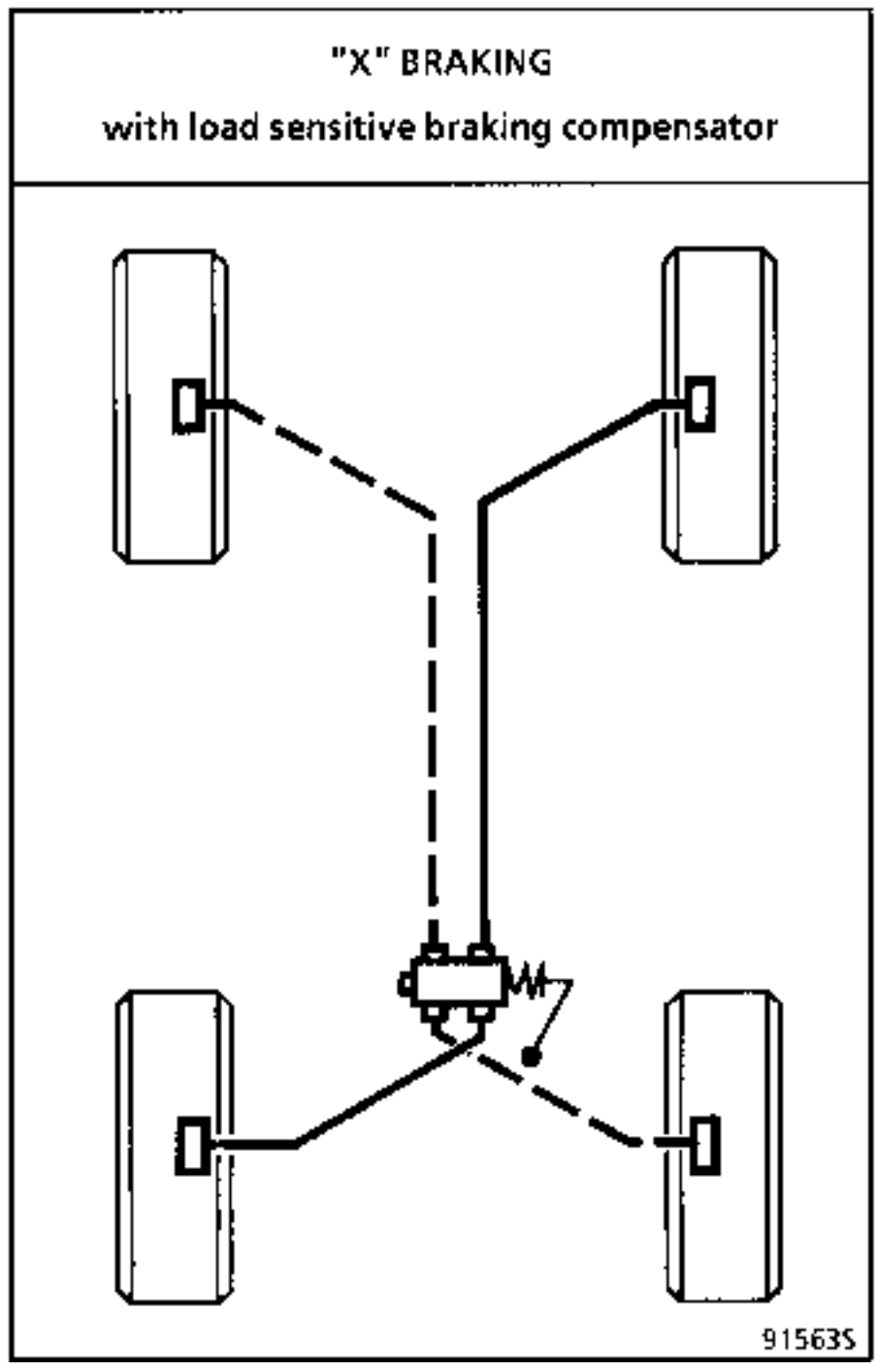
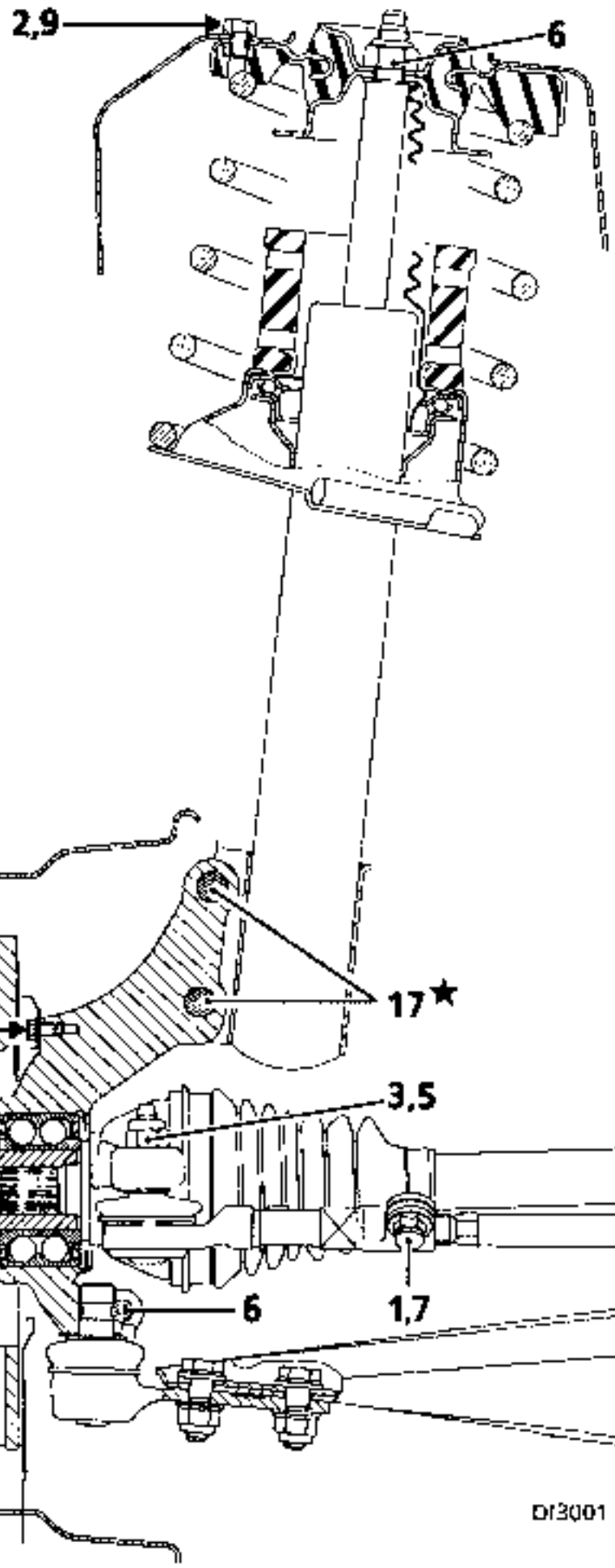
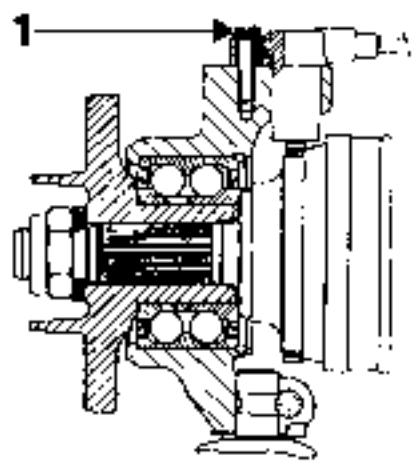
NOTE : the diagram below shows the general principle ; in no case should it be taken as reference for the circuit connections and allocations. When replacing one of the components of the brake circuit on a vehicle, always mark the pipes before removing them so that they can be connected back in their original positions.



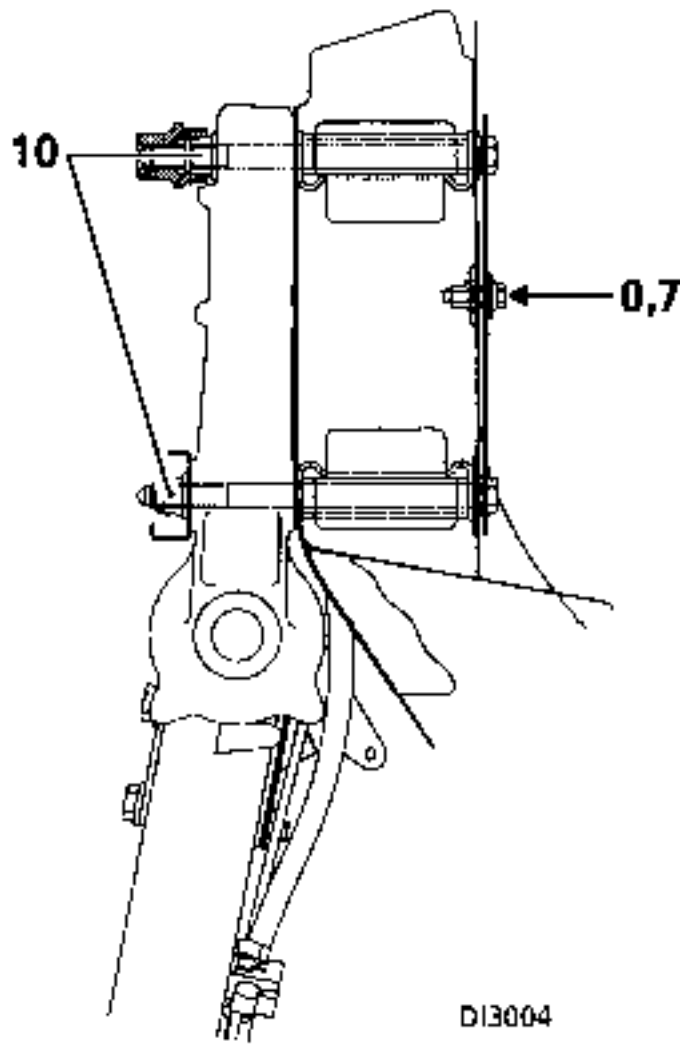


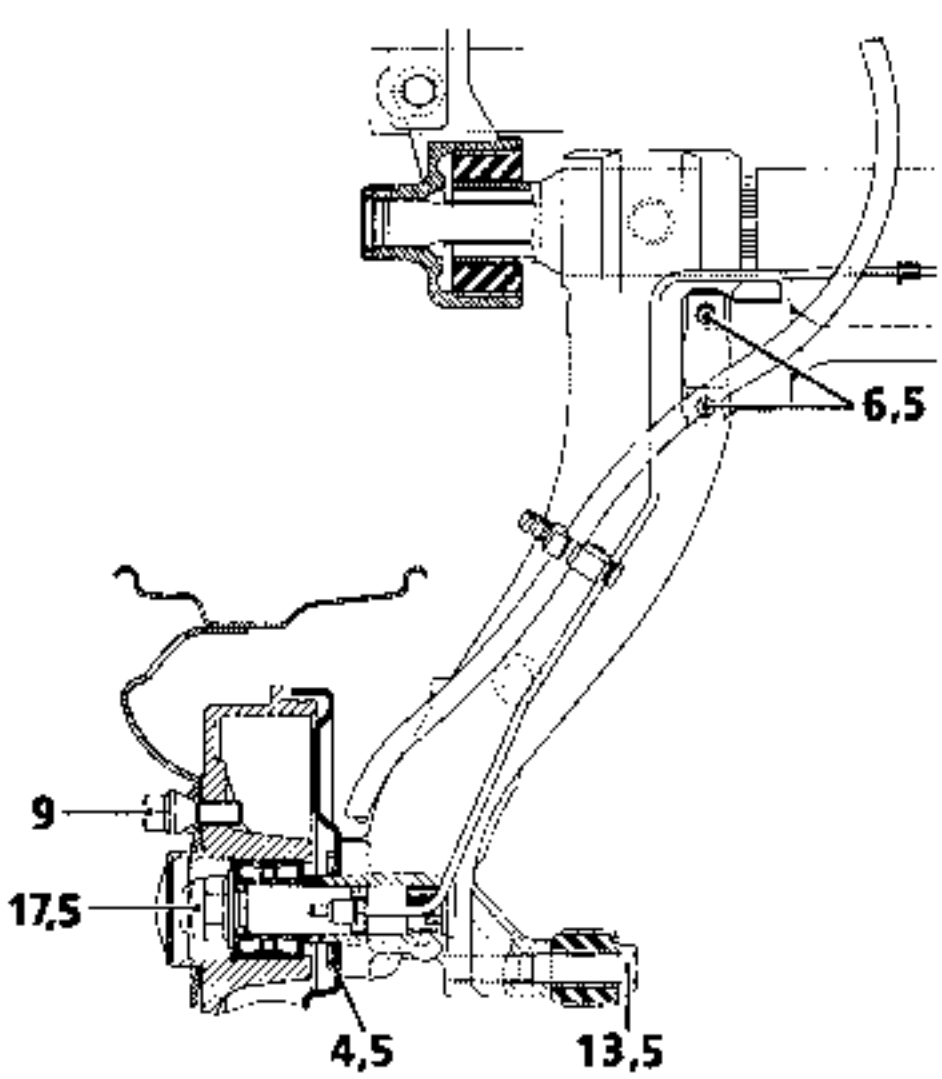
For vehicles fitted with an ABS system



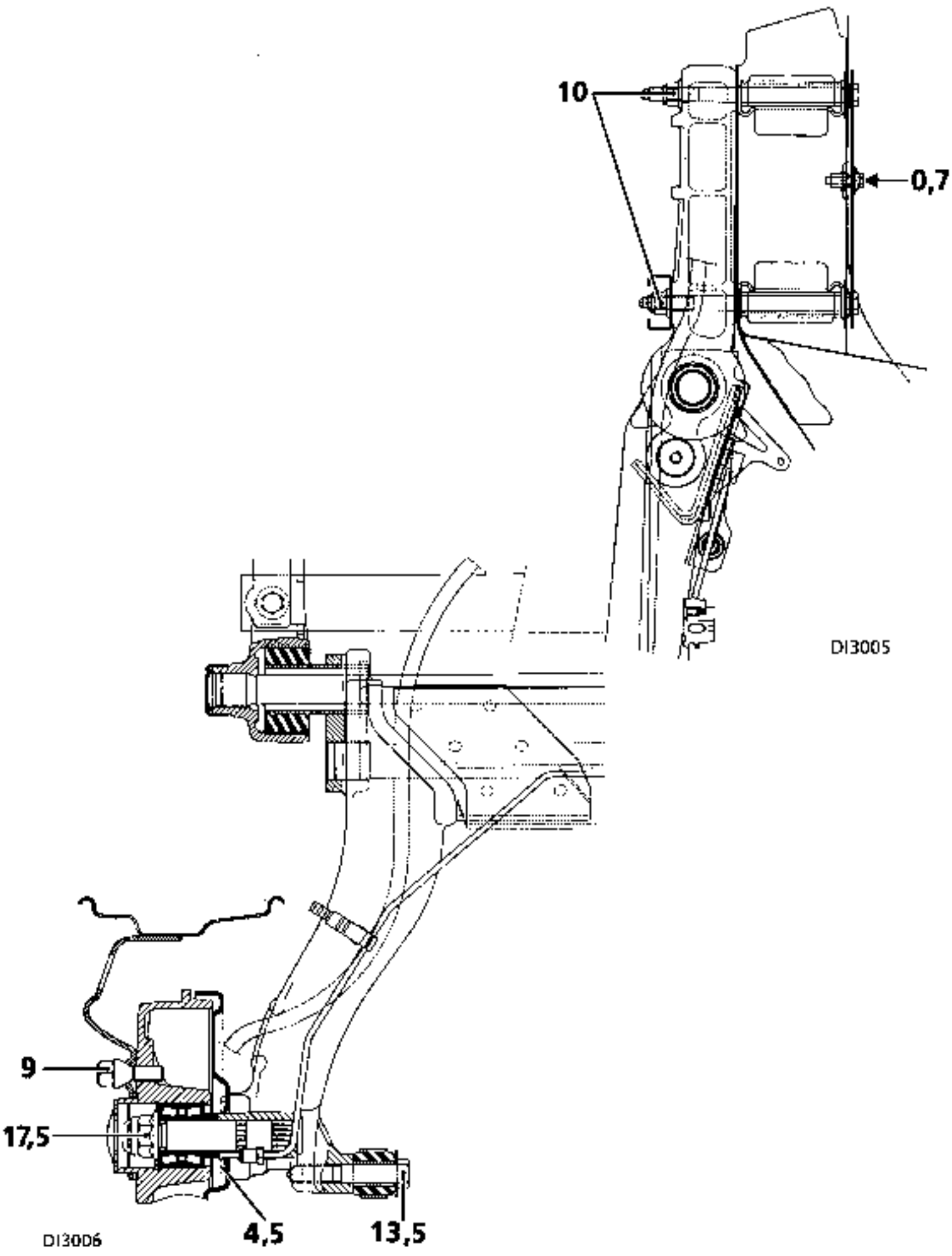
★ Fitting direction must be observed (head of bolt on brake caliper side).

GENERAL
Tightening torques (in daN.m)

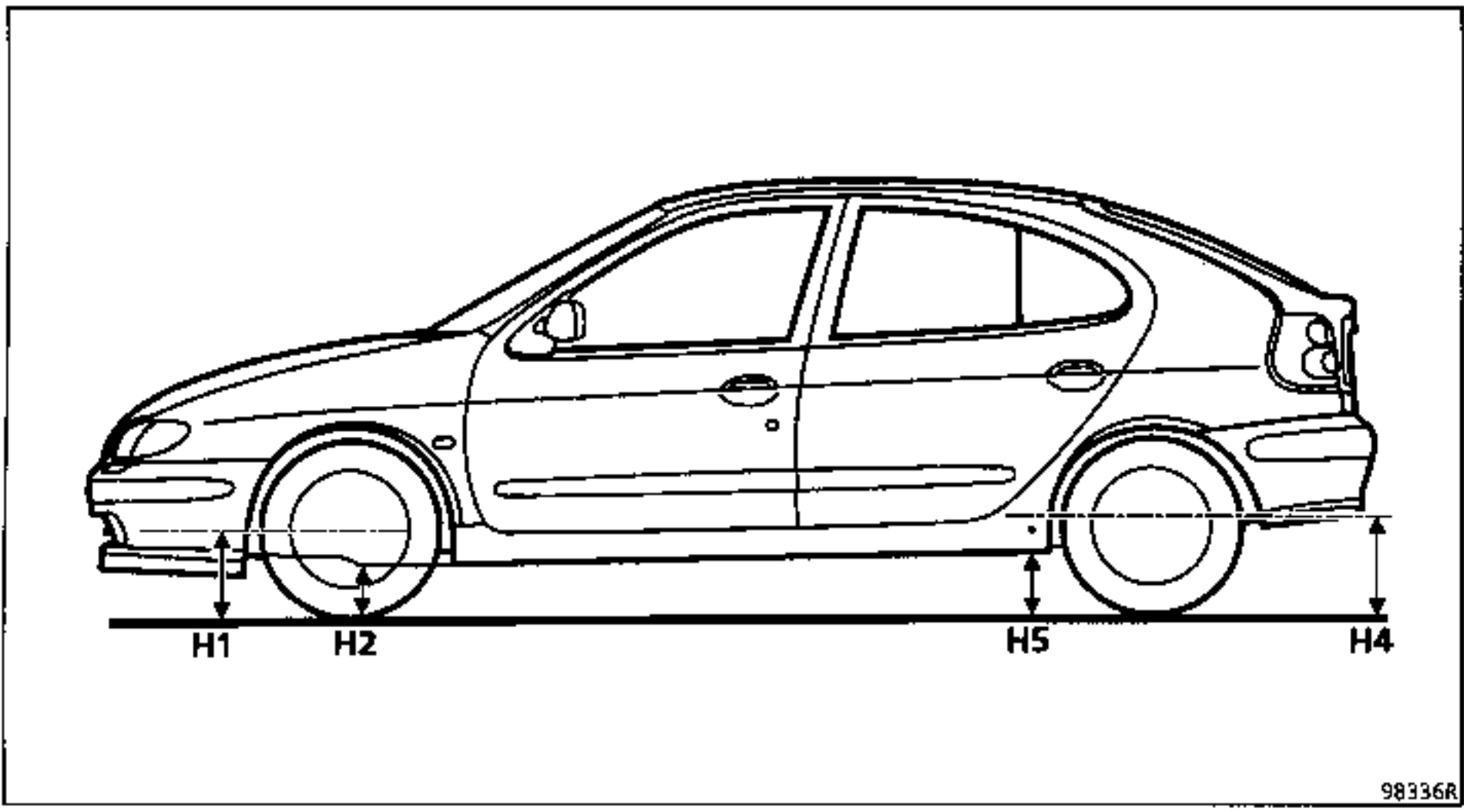




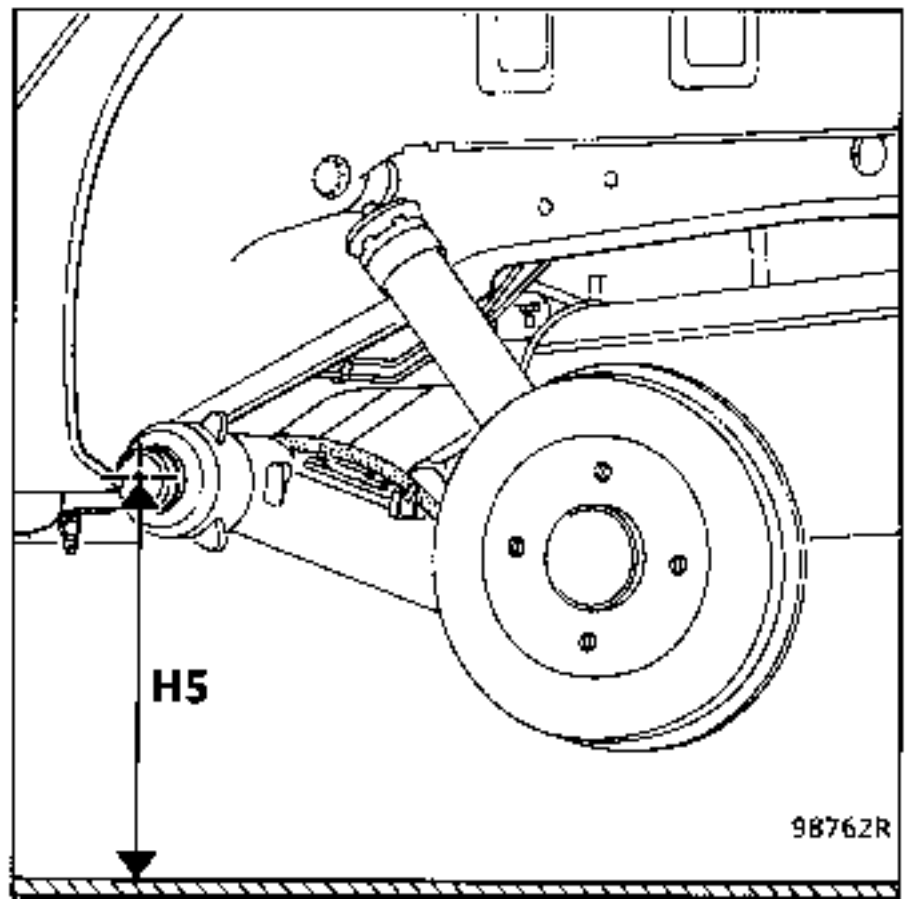
GENERAL
Tightening torques (in daN.m)



	DIMENSIONS	TIGHTENING TORQUES
Bleed screw	-	0.5 to 0.8
Hoses for front calipers	M 10 × 100	1.3
Hoses on rear arm	M 10 × 100	1.3
Rear cylinder supply	M 10 × 100	1.3
Master cylinder outlets	M 10 × 100	1.3
Compensator inlet	M 12 × 100	1.3
Compensator outlets	M 10 × 100	1.3
ABS hydraulic assembly inlets and outlets	M 10 × 100 M12 × 100	1.3



Dimension H5 is taken from the suspension arm axis.



Underbody heights are measured with the vehicle unladen on a flat surface (preferably on a 4 post lift) :
- fuel tank full,
- correct tyre inflation pressures.

H1 and H4 : wheel axis to ground

H2 : front side member to ground in the wheel axis

H5 : suspension bar axis to ground

Measure the dimensions:
H1 and H2 at the front
H4 and H5 at the rear
and subtract.

See the values given in the section on values and adjustments.

Consumables

TYPE	QUANTITY	COMPONENTS
Loctite FRENBLOC	1 to 2 drops	Axial ball joint threads Rear brake backing plate mounting bolt
Loctite SCELBLOC	5 to 6 drops	Stub axle
SAE 80W oil	Coat	Rear stub axle

- Axial ball joint stop.
- Balance weight hook.
- Hub bearing.
- Driveshaft bearing gaiter.
- Girling caliper guide bolts
- Stub axle lock nut.
- Mounting bolts for:
  - steering rack,
  - front axle assembly mounting,
  - rear axle assembly.

Brake fluid

BRAKE FLUID RENEWAL FREQUENCY

Braking technology, in particular for disc brakes (hollow pistons which transmit little heat, low volume of fluid in the cylinder, sliding calipers avoiding the need for a fluid reservoir in the least cooled area of the wheel), has allowed us to avoid the risk of vapour lock as far as possible, even if the brakes are used intensively (in mountainous areas).

Modern brake fluids still degrade slightly during the first few months of use due to a small uptake of humidity (refer to vehicle's Warranty and Servicing Handbook for fluid replacement frequency).

Topping up the level:

Wear of the brake pads and shoes will cause a gradual drop in the fluid level in the reservoir. This drop should not be compensated for since the level will rise again when the pads are changed. The level should not however be allowed to fall below the minimum mark.

Approved brake fluids:

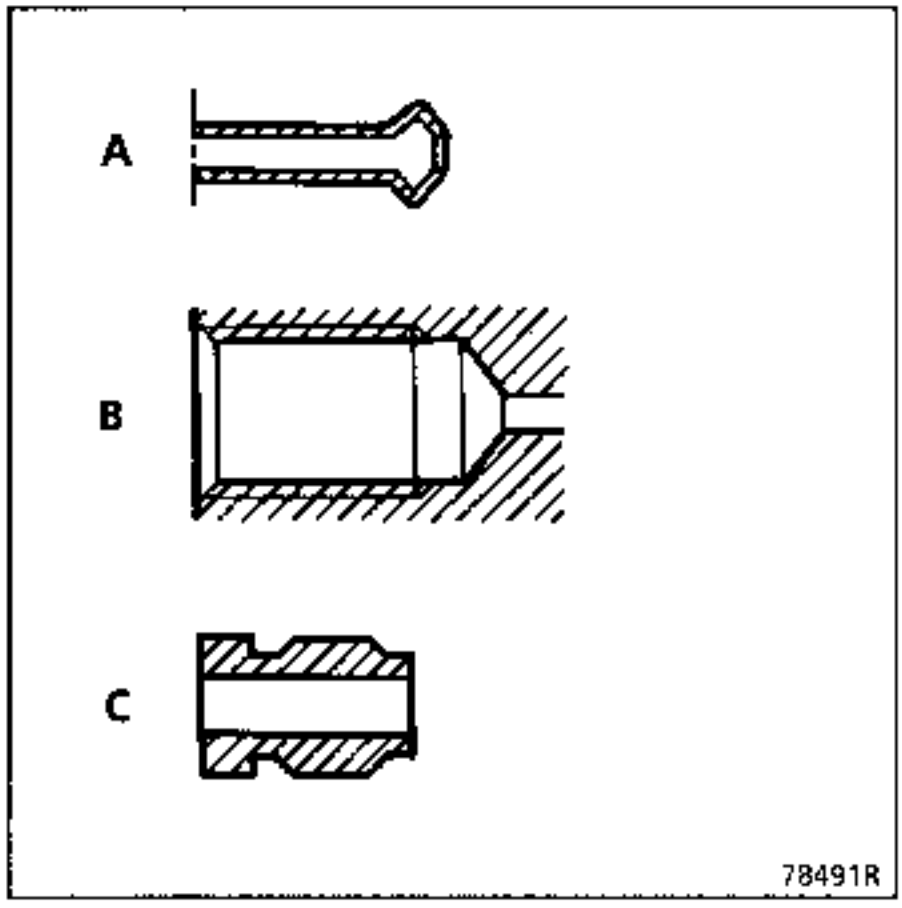
Mixing two incompatible brake fluids in the circuit will cause a risk of major leaks, mainly due to deterioration of the cups. To avoid such risks, it is important to use only those brake fluids which have been tested and approved by our Technical Department and which conform to standard SAE J 1703 dot 3 or dot 4.

The connection of the pipes between the master cylinder, calipers, compensator and the hydraulic assembly is made using threaded unions with a METRIC THREAD.

Consequently, only parts specified in the Parts Catalogue for this vehicle should be used.

Identification of parts

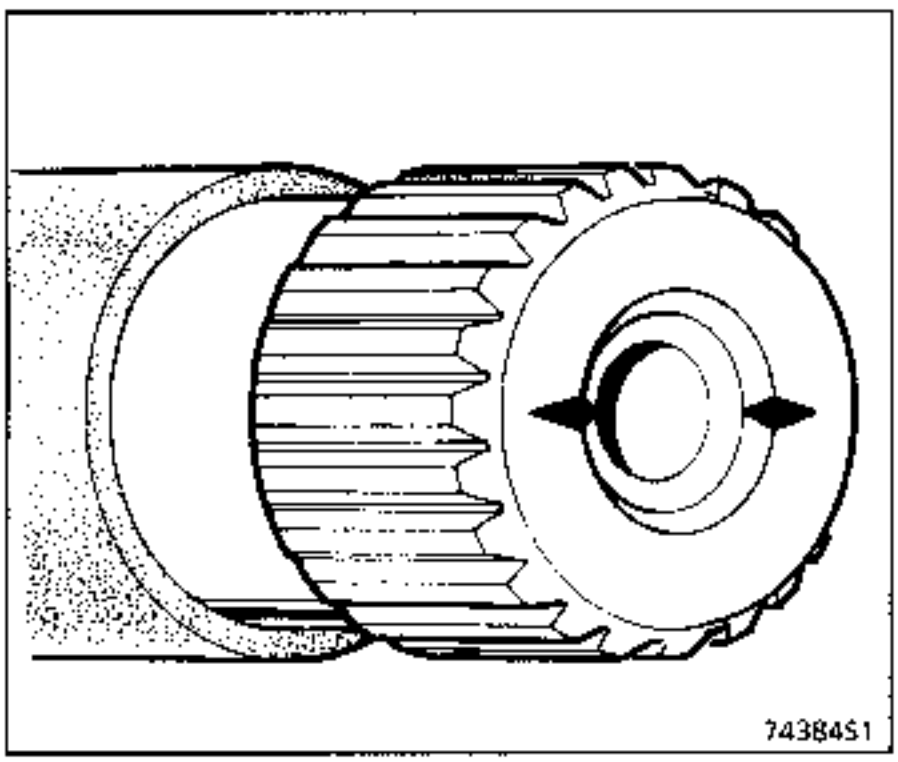
- SHAPE of the ends of PIPES in steel or copper (A),
- SHAPE of the THREADED LOCATIONS on components (B),
- pipe UNIONS coloured GREEN or BLACK: HEXAGONAL OUTSIDE 11 mm or 12 mm (C).



Rear torsion bar marking

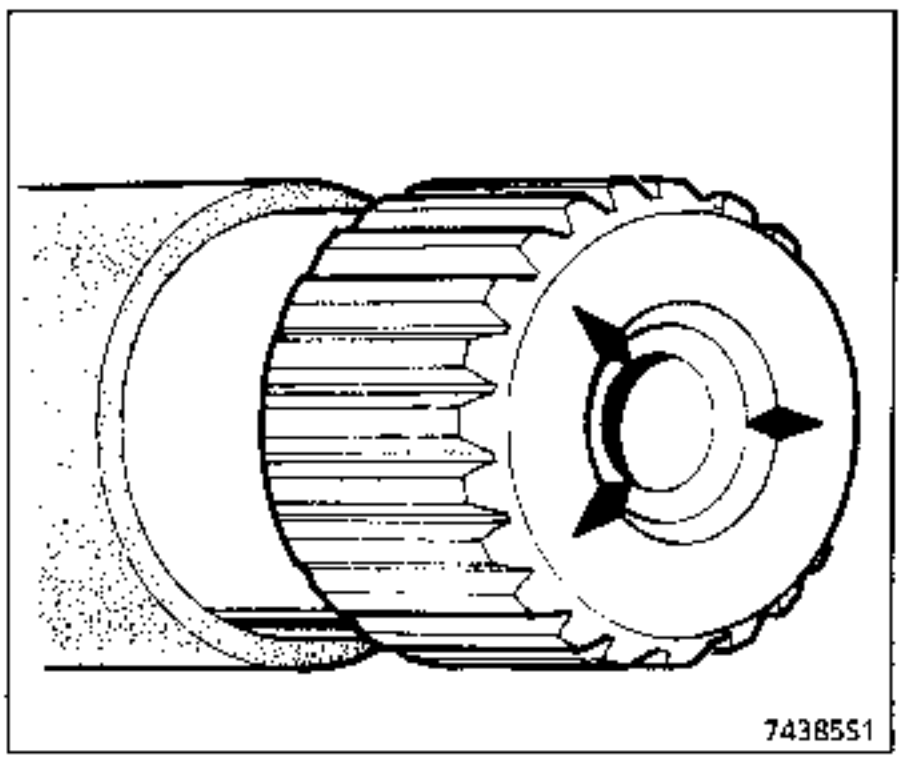
Since the torsion direction under load is inverted, the left and right hand bars are marked by a stamped mark on the end.

LEFT HAND BAR



2 marks

RIGHT HAND BAR



3 marks

Vehicle types	BA0A/BA0E BA0F/BA0G BA0L/BA0U
DIAMETER	23 mm

Specifications for the rear anti-roll bars

Vehicle types	TUBULAR REAR AXLE		4 BAR REAR AXLE
	BA0E BA0L	BA0A BA0F BA0U	BA0G
Diameter	15.5 mm	18 mm	23.15 mm
Number of splines, bearing side	–	–	31
Number of splines, shackle side	–	–	30

Specifications for the rear suspension bars

Vehicle types	TUBULAR REAR AXLE	4 BAR REAR AXLE
	BA0A / BA0E BA0F / BA0L BA0E	BA0G
Diameter	20.5 mm	23.8 mm
Number of splines, bearing side	25	27
Number of splines, shackle side	24	26

Influence of various angles on course holding and tyre wear.

CAMBER

Comparison of left hand and right hand angles is important. If there is a difference between the two sides of more than one degree, course holding will be affected, which must be corrected at the steering wheel, causing abnormal tyre wear.

This angle is generally small: approximately 1°.

CASTOR

Comparison of left hand and right hand angles is important. If there is a difference of more than one degree, course holding will be affected, which must be corrected at the steering wheel, causing abnormal tyre wear.

This is characterised by pulling at a stable speed towards the side where the angle is smaller.

STEERING HEIGHT

This angle affects the variation in parallelism when the suspension system moves.

Variations in parallelism between the right hand and left hand wheels will cause (without the steering wheel being moved) :

- pulling to one side on acceleration,
- pulling to the other side on braking,
- changes in course holding on poor road surfaces.

PARALLELISM

This adjustment has no affect on the vehicle behaviour.

It should be noted:

- that **excessive toe-out** will cause symmetrical wear on the inside edges of the tyres on both wheels
- that **excessive toe-in** will cause symmetrical wear on the outside edges of the tyres on both wheels

PRELIMINARY CHECKS

Before checking the axle assembly angles, the following points must be checked and repaired if necessary:

- symmetry of tyres on the same axle:
  - dimensions,
  - pressures,
  - degree of wear.

- articulation :
  - condition of rubber bushes and bearings,
  - ball joint play,
  - bearing play.

- wheel run-out: it should not exceed 1.2 mm (compensated for by measuring equipment).

- symmetry of underbody heights (condition of the suspension).

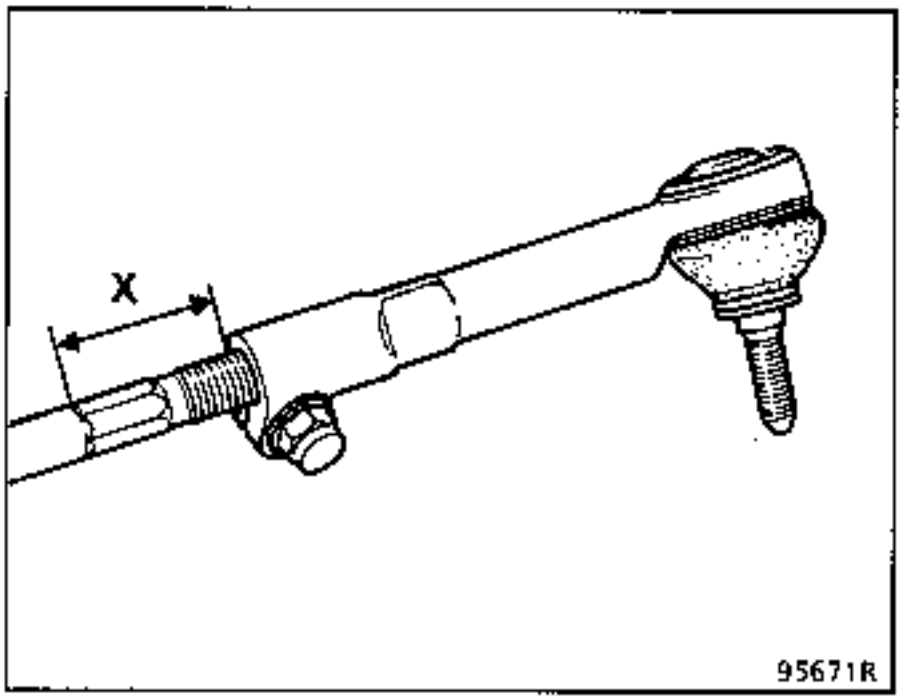
DETERMINATION OF THE STEERING CENTRE POINT

Checking and adjusting the front axle assembly requires the steering to be centred to avoid pulling faults.

- Remove the keys from the vehicle ignition.
- Set the wheels straight.
- Lock the steering: this gives the steering "centre point".

In this position, fit the measuring equipment and proceed with the test.

When adjusting parallelism, **ensure the symmetry of the track rod end lengths X is observed**.

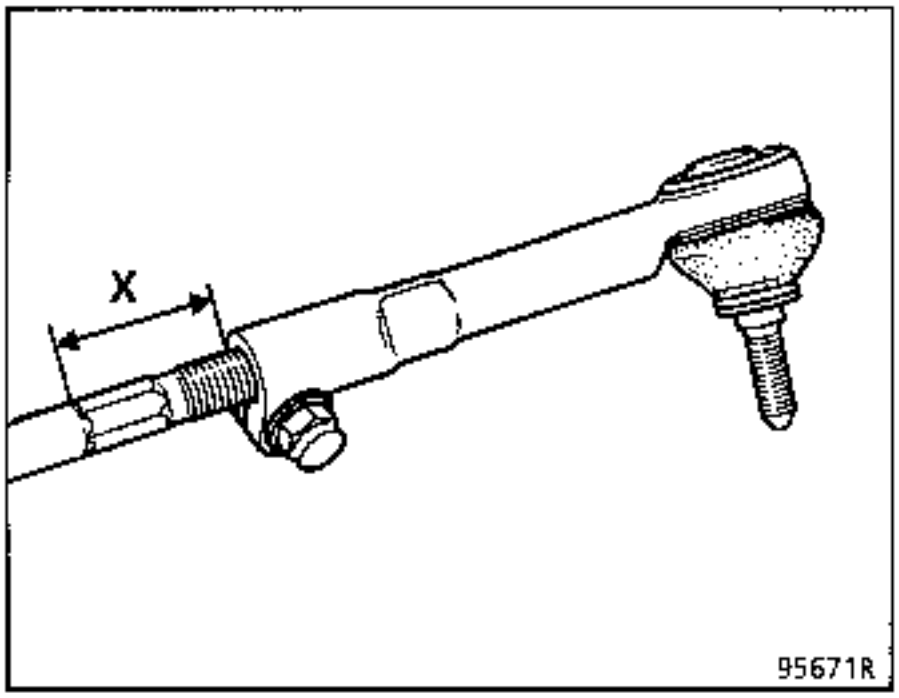


ORDER OF OPERATIONS

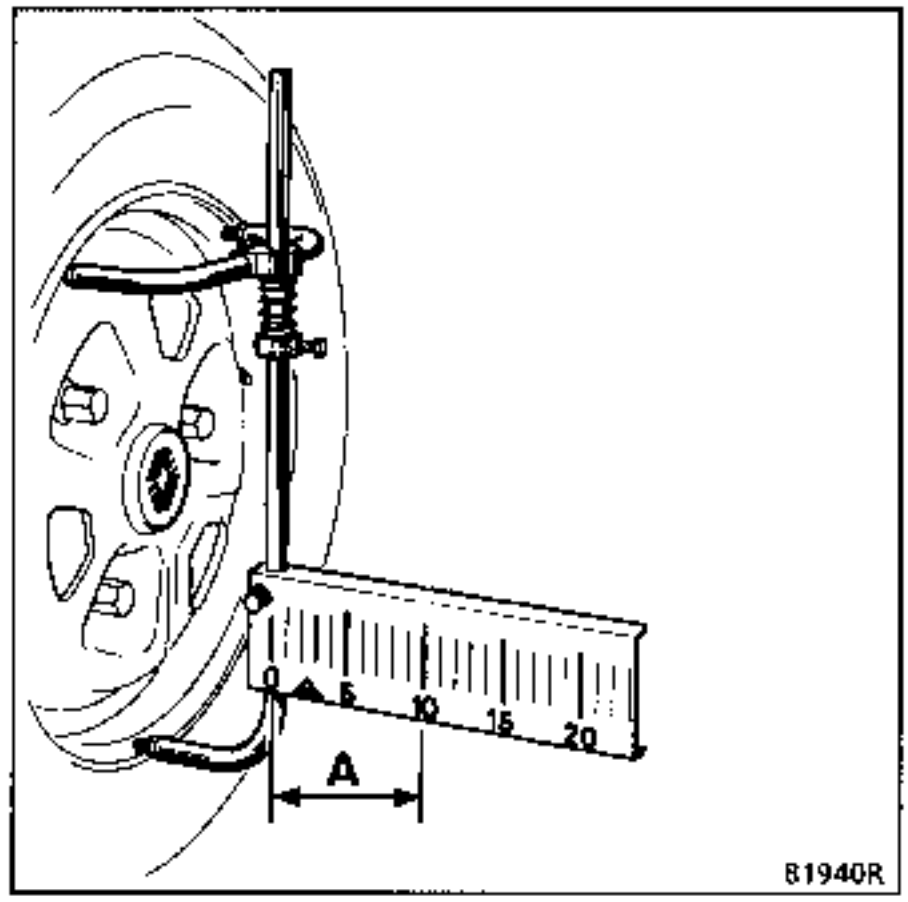
Because of the design of front axle assemblies, a modification to one of the angles (castor, camber, kingpin, parallelism and variation)has a greater or lesser effect on the values of the other angles. (The castor angle has the most influence).

The following order must therefore be strictly observed:

- fit the measuring equipment to the vehicle, following the manufacturer's instructions,
- determine the steering centre point (see previous paragraph) and lock the steering wheel,
- lift the vehicle under the body,
- compensate for wheel run-out,
- put the vehicle on floating plates,
- fit the brake pedal press,
- bounce the suspension to return the vehicle to free height,
- ensure the symmetry of the track rod end lengths X is observed,



- note the values A on the measuring scales.



(1) Symmetry of lengths X correct:

- dimension (A) should be equal.

(2) Symmetry of lengths X incorrect:

- measure dimensions (A) on the right and left hand sides, subtract and apply half of the result to each side.

Example :
Right hand side value: 16
Left hand side value: 10
16 − 10 = 6
6 : 2 = 3

Adjust the track rods to balance dimensions (A) on each side:
A = 13

- in this position, set the floating plates to zero,

- check in the following order:
  - castor,
  - kingpin,
  - camber,
  - parallelism.

ADJUSTING PARALLELISM

Several cases may arise:

	Parallelism	Distribution	Correction to apply
(1)	CORRECT	INCORRECT	Adjust the adjusting sleeve (or end) by the same number of turns, but in opposite directions on each side to obtain the same value (A) on both sides.
(2)	INCORRECT	CORRECT	Adjust the parallelism by the same value on each side, ensuring that the values (A) remain identical on both sides.
(3)	INCORRECT	INCORRECT	Make an initial adjustment to equalise values (A) on each side then adjust the parallelism as for case n° (2)

Fault finding for the front axle assembly

FAULTS	POSSIBLE CAUSES
Incorrect castor	- Arm bent - Side member or axle mounting bent
Camber + kingpin correct but Camber incorrect Kingpin incorrect	- Arm bent - Side member or axle mounting bent
Camber correct but Kingpin incorrect	- Stub axle carrier bent
Kingpin correct but Camber incorrect	- Stub axle carrier bent
Variation in parallelism incorrect	- See castor Arm bent Side member bent
Parallelism incorrect by more than 6 mm	- Left or right hand stub axle carrier bent

This fault finding information covers all types of circuits and braking components for the current range of vehicles without ABS.

For vehicles with ABS, refer to section 38.

Only components belonging to the vehicle described in this Workshop Repair Manual should be examined during fault finding.

This fault finding information has two separate parts to aid repair.

I **Faults noted at the pedal**
II **Faults noted in behaviour**

I FAULTS NOTED AT THE PEDAL

FAULTS	POSSIBLE CAUSES
Hard pedal: high degree of force required for low deceleration.	– **Assistance fault** – **Pads and Brake Shoes:** - greasy, - frozen, non conforming, - overheating, prolonged braking with the pedal constantly applied (descending a hill), non conforming. – **Piston seized** – **Brake pipe crushed**
Soft pedal **Note : since the amount of assistance in modern vehicles is high, this may give the impression of a soft pedal. To determine if there is a fault or if it is a question of normal use, two tests should be carried out.** 1. **Vehicle moving** Judgment test: ratio of pedal travel to deceleration 2. **Vehicle stationary, engine not running** Complementary test to the pedal travel test: depress the brake pedal 5 times to empty the brake servo, before noting the results of the test.	– **Air in the circuit : incorrect bleeding.** – **Internal leak in braking circuit** – **Lack of fluid in the reservoir** (external leak in braking circuit)

Spongy pedal Test to be carried out vehicle stationary, engine not running. **Note : depress the brake pedal 5 times to empty the brake servo, before noting the results of the test.**	– **Incorrect brake shoe adjustment** **Disc and drum brakes** Automatic adjustment: handbrake cable too tight. **Note : the automatic adjustment is made using the brake pedal if the handbrake cable is not abnormally tight when at rest.** – **High degree of asymmetrical wear to the linings** (concave or convex) – **Master cylinder clearance too large** – **Fluid bubbling or overheating**
Pedal goes to the floor Test to be carried out vehicle stationary, engine not running. **Note : depress the brake pedal 5 times to empty the brake servo, before noting the results of the test.**	– **Hydraulic leak** (check sealing) – **Sealing cup between two master cylinder circuits is faulty** – **Fluid bubbling**

II FAULTS NOTED IN BEHAVIOUR

FAULTS	POSSIBLE CAUSES
Brakes stick	– **Linings need backing off** – **Linings slightly greasy** – **Springs require replacing**
Brakes judder	– **Oval drums** – **Disc run-out too great** – **Disc thickness not constant** – **Abnormal deposits on the discs** (oxidation between the pads and disc)

Pulling under braking (front)	– **Suspension** front axle assembly, steering must be checked – **Piston seized *** – **Tyres** (wear - inflation pressures) – **Brake pipe crushed *** ***IMPORTANT:** on vehicles with a negative offset front axle assembly, pulling to one side results from a fault on the circuit on the opposite side
Offset braking (rear)	– **Braking compensator or limiter** (adjustment - operation) – **Piston seized** – **Incorrect adjustment of the brake shoes** Automatic adjustment : handbrake cable too tight **Note** : the automatic adjustment is made using the brake pedal if the handbrake cable is not abnormally tight when at rest. – **Return springs**
Brakes overheat	– **Master cylinder clearance too small, which does not permit the master cylinder to return to the rest position** – **Piston seized or does not return correctly** – **Brake pipe crushed** – **Handbrake control seized** – **Handbrake control incorrectly adjusted**

SPECIAL TOOLING REQUIRED	
M.S. 815	Bleeding equipment

As these vehicles are fitted with a brake servo, it is important that the assistance device is not activated during the bleeding operation, regardless of the method used.

The brake circuit should be bled using equipment **M.S. 815**, with the vehicle on a four post lift, with all four wheels on the ground.

Connect the pipes of equipment **M.S. 815** to the bleed screws of the :
- master cylinder
- brake cylinder
- compensator.

Connect the equipment to a source of compressed air (minimum pressure 5 bars).

Connect the filling system to the brake fluid reservoir.

Open:
- the supply, wait for the reservoir to fill (both sections) .
- the compressed air valve.

These vehicles are fitted with X type brake circuits. Proceed as follows:

Open:
- the bleed screw on **the rear right hand wheel** and allow fluid to run out for approximately 20 seconds,
- the bleed screw on **the front left hand wheel** and allow fluid to run out for approximately 20 seconds.

Ignore any air bubbles in the bleeding equipment pipes.

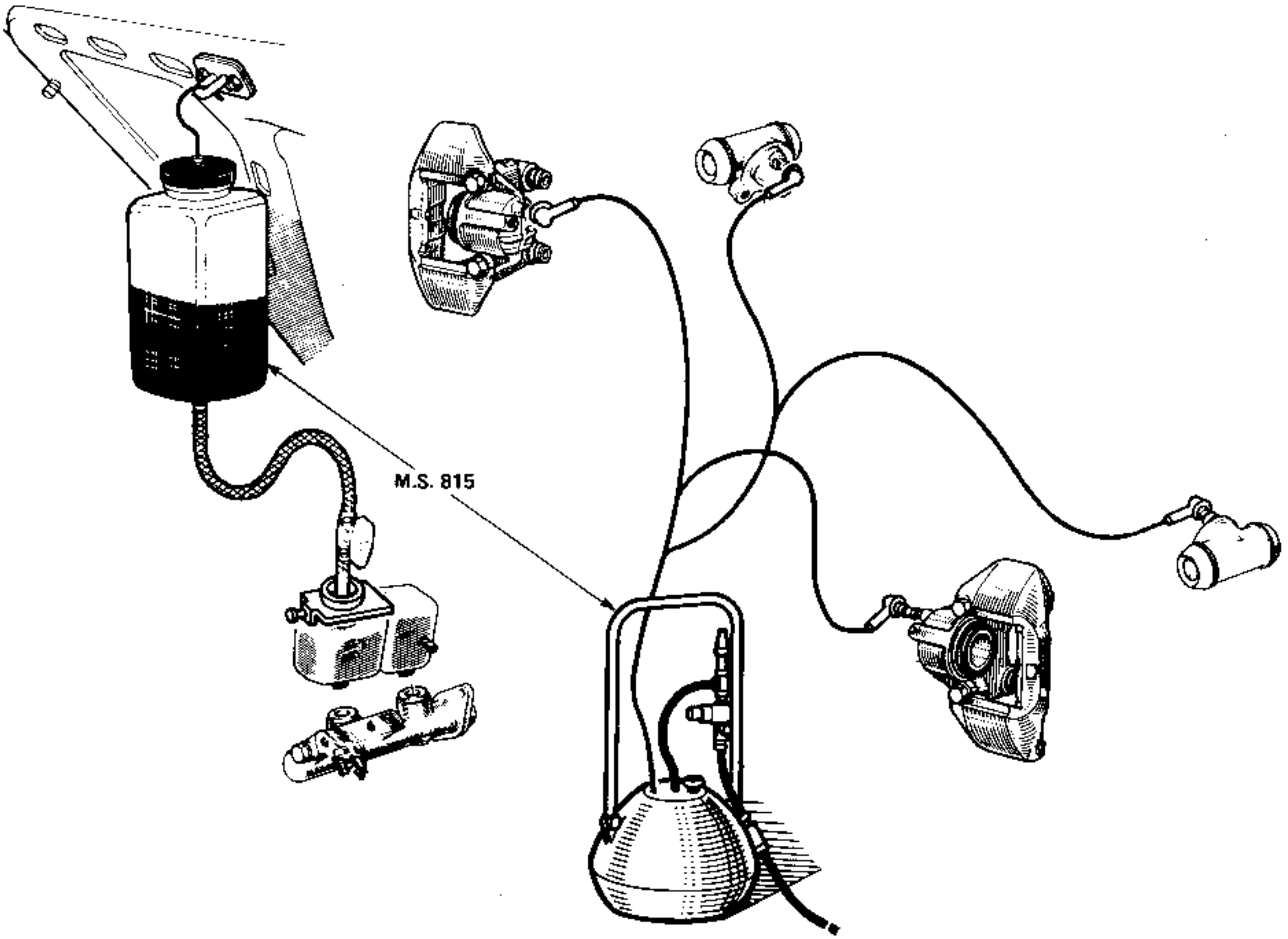
Carry out the same operation for the **rear left hand wheel and the front right hand wheel.**

Check there is pressure at the brake pedal when it is depressed (press it several times).

Repeat the bleeding operation if necessary.

Top up the fluid level in the reservoir after disconnecting the equipment.

(For bleeding the ABS braking circuit, refer to section 38).

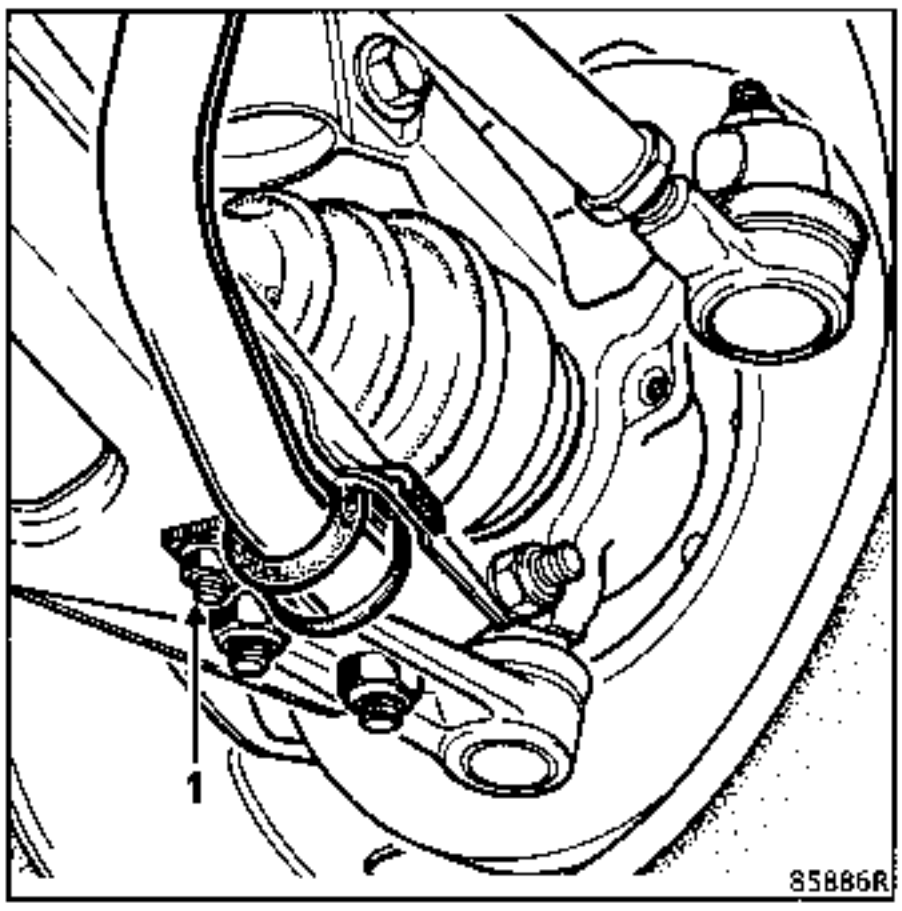


86037R

TIGHTENING TORQUES (in daN.m)	
Lower wishbone nuts on cradle	9
Key nuts on stub axle carrier	8
Anti-roll bar bearing nuts	3.2
Lower ball joint nuts	6
Wheel bolts	9

REMOVAL

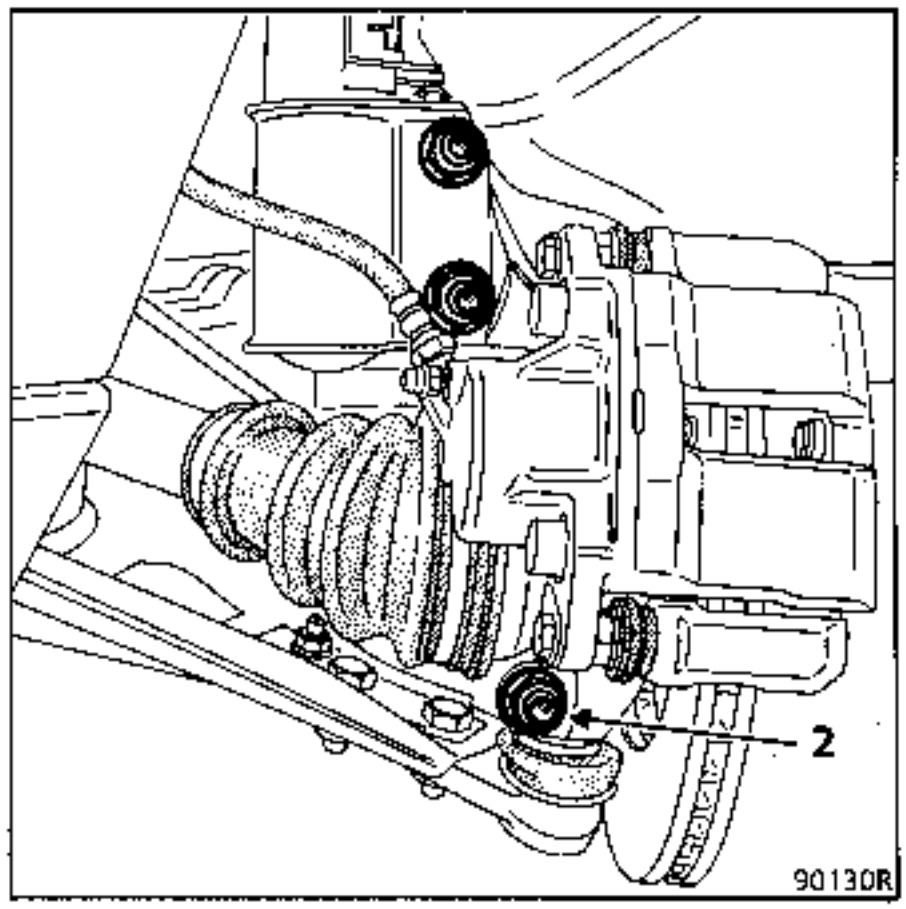
With the vehicle on its wheels, remove the bearings (1) from the anti-roll bar on the lower arms.



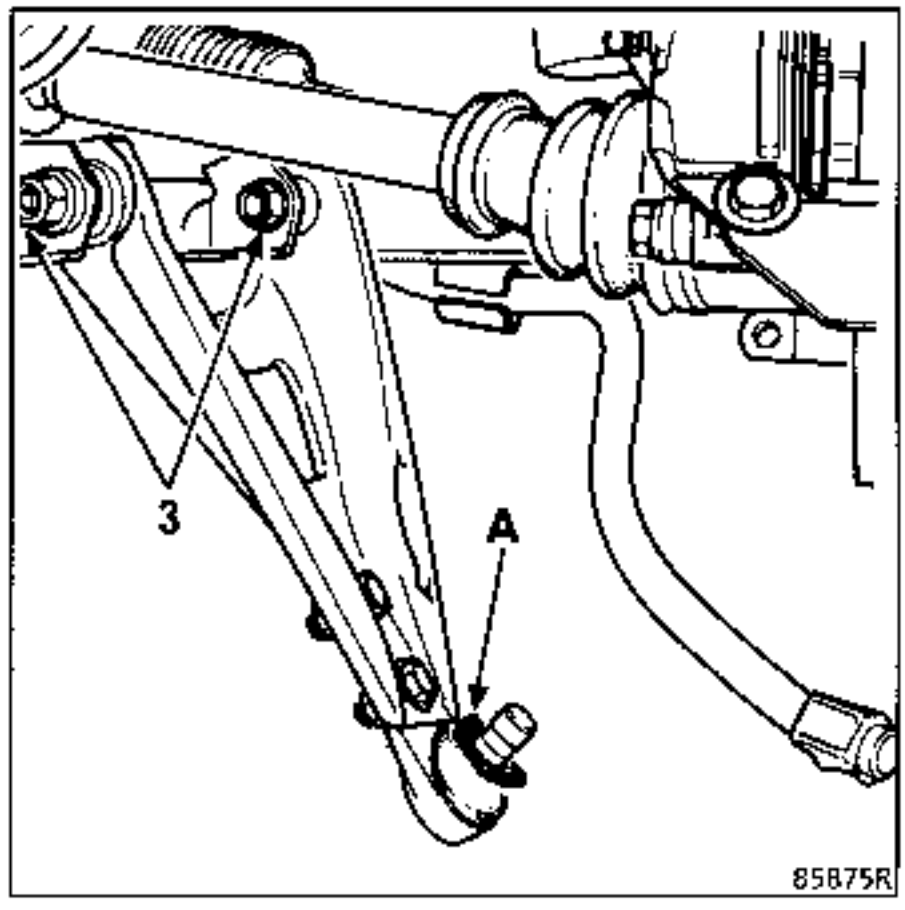
Release the anti-roll bar towards the rear.

With the vehicle on axle stands, remove:

– the nut and the key (2),



– the two mounting bolts (3) from the arm on the cradle,



– the arm.

REFITTING

Note : ensure the plastic protective washer (A) is present on the lower ball joint shaft.

Fit:
- the arm,
- the two bolts (3) but do not tighten them,
- the ball joint shaft in the stub axle carrier and tighten nut (2) for the key to the recommended torque.

Return the vehicle to its wheels.

Refit the anti-roll bar without tightening the bearings.

Bounce the suspension and tighten the nuts for the arm mountings and the anti-roll bar bearings to the recommended torques (tightening position: unladen).

Rubber bushes for steel lower arms

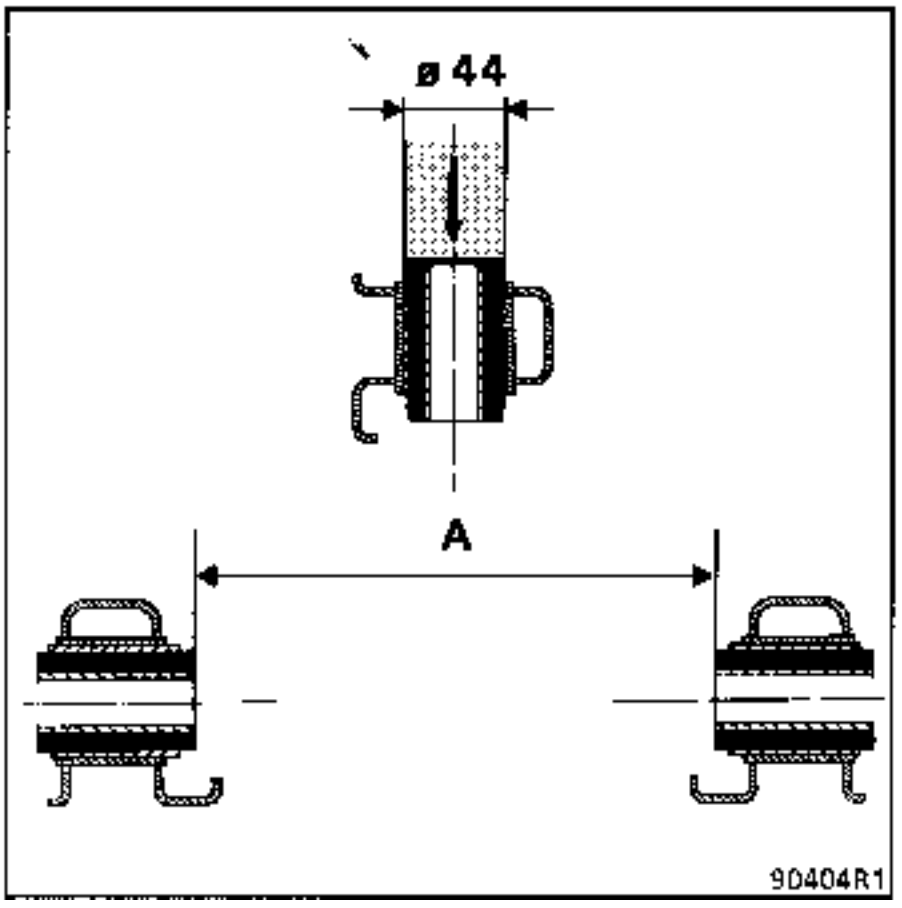
REPLACEMENT

In order to preserve the central positioning of the bushes in relation to the arm shaft, they are replaced one after the other.

Using a press, drift out one of the old bushes using a tube of external diameter **44mm** .

Refit a new bush to obtain:
dimension A = **147 ± 0.5 mm.**

Use a press to remove the remaining old bush and then proceed in the same manner as for the first bush to conserve the measurement:
A = **147 ± 0.5 mm**.

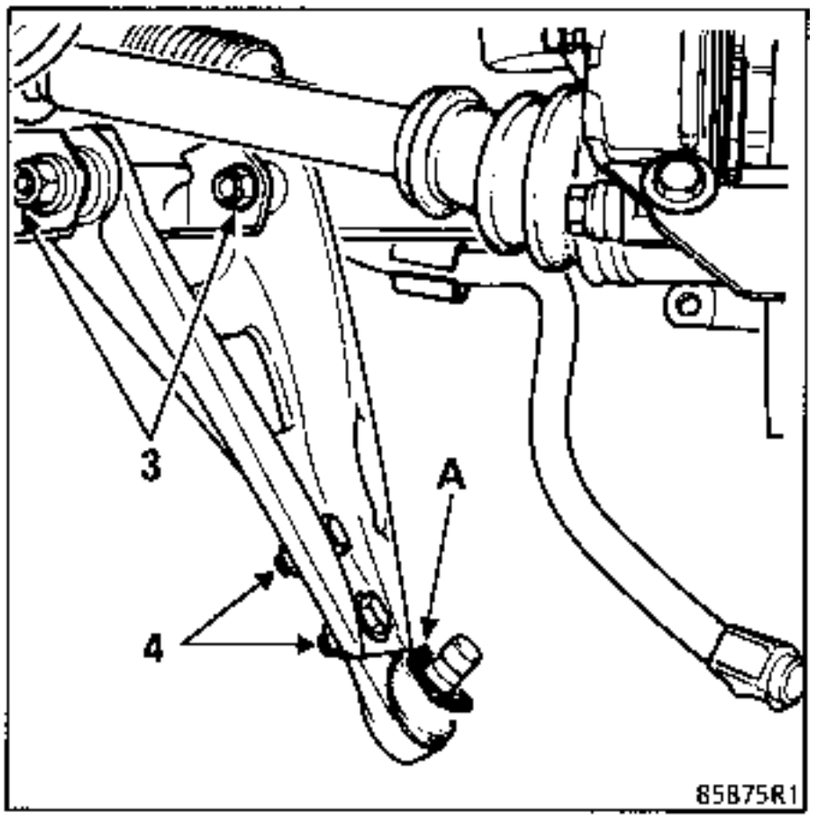


REMOVAL

If the gaiter has been damaged, the complete ball joint must be replaced.

Proceed in the same manner as for removing the lower arm.

Slacken but do not remove the two bolts (3) mounting the arm to the cradle.



Remove:

- the two ball joint mounting bolts (4) ,
- the ball joint.

REFITTING

Note : ensure the plastic protective washer (A) is present on the lower ball joint shaft.

Refit the ball joint and torque tighten the mountings.

Refitting is then the same as for refitting the lower arm.

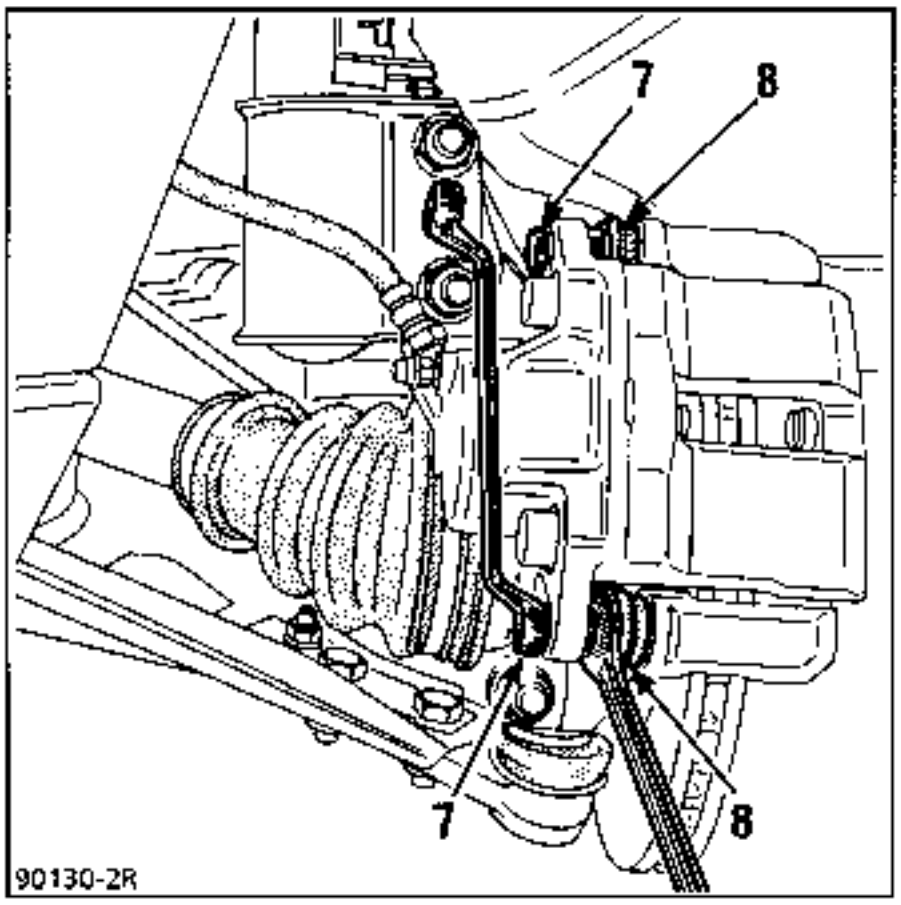
SPECIAL TOOLING REQUIRED	
Fre. 823	Tool for pushing caliper piston back

TIGHTENING TORQUES (in daN.m)	
Wheel bolts	9
Brake caliper guide bolt	3.2

REMOVAL

Disconnect the brake pad wear warning light wire.

Push the piston back, sliding the caliper by hand towards the outside.



Remove the guide bolts (7) using two wrenches.

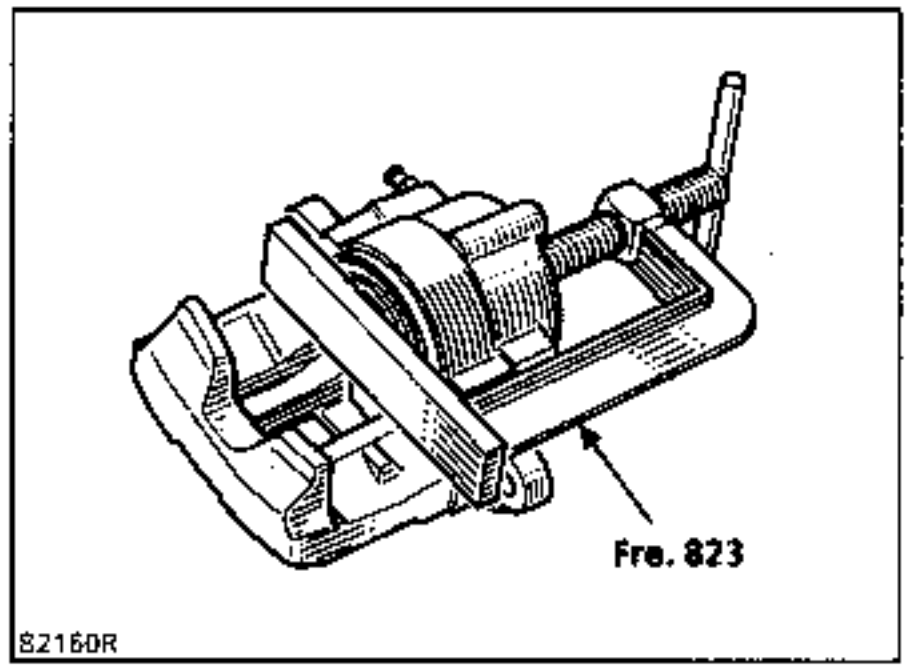
Do not re-use these bolts.

Remove:
- the sliding caliper,
- the brake pads.

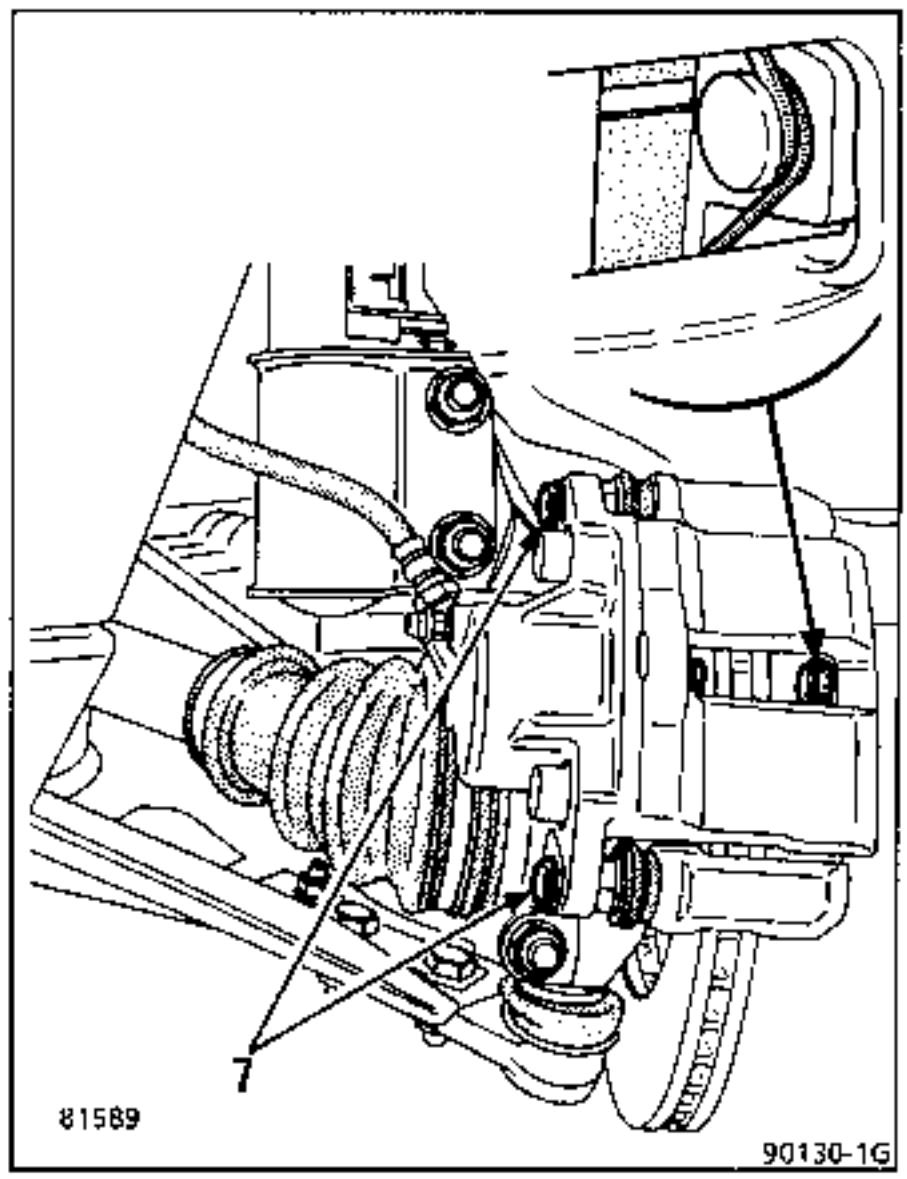
Verification
Check:
- the condition and mounting of the dust seal on the piston and its retaining spring,
- the condition of the dust seal (8) for the guides.

REFITTING

Push the caliper piston back using tool **Fre. 823**.



Fit the new pads with their springs, taking care to observe the correct fitting direction.



The pads with the wear warning light wire is fitted on the inner side.

Refit the caliper and fit a new lower guide bolt (7).

Press on the caliper and fit the new upper guide bolt.

Torque tighten the guide bolts, tightening the lower bolt first.

Reconnect the wear warning light indicator wire.

Press the brake pedal several times to ensure the piston is in contact with the pads.

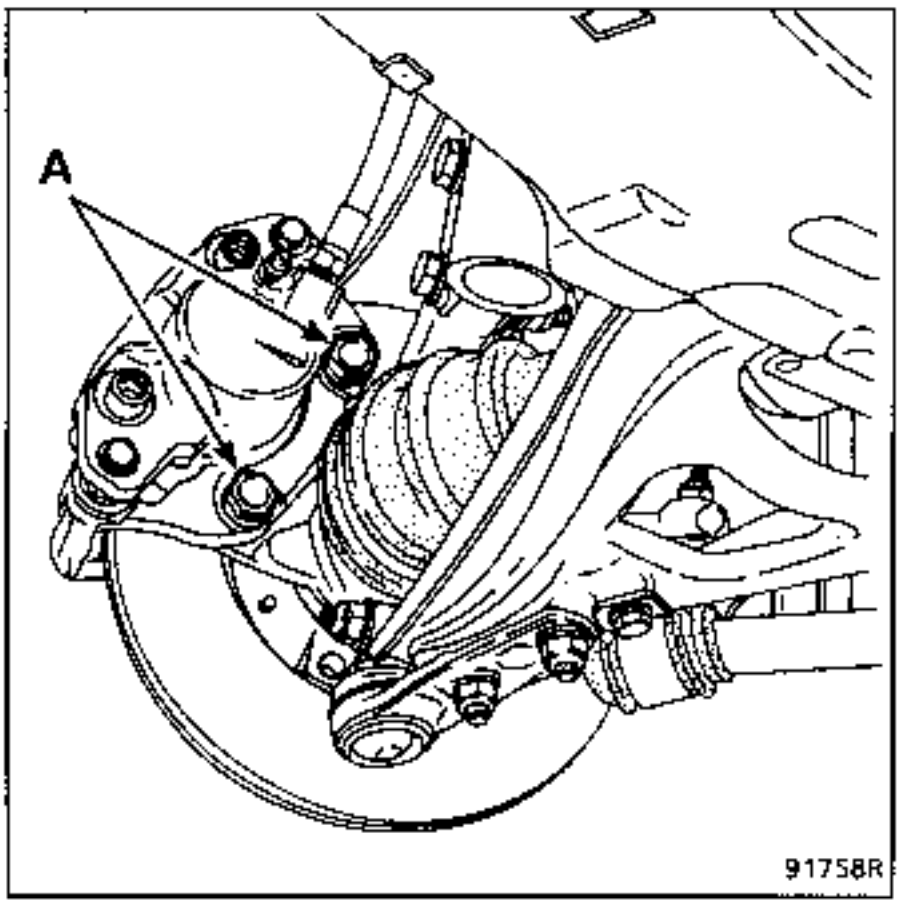
TIGHTENING TORQUES (in daN.m)	
Wheel bolts	9
Brake caliper guide bolt	3.2
Brake caliper mounting bolt	10

REMOVAL

Slacken the brake pipe on the brake caliper end.

Remove the brake pads (see corresponding paragraph).

Remove the two bolts (A) mounting the brake assembly.



Unscrew the brake caliper from the brake pipe (take precautions to catch the fluid which will run out).

Check the condition of the brake pipe and replace it if necessary (see replacing a brake pipe).

REFITTING

Screw the new brake caliper on to the brake pipe.

Slacken the brake caliper bleed screw and wait for brake fluid to run out (check that the fluid level in the compensation reservoir is sufficiently high).

Tighten the bleed screw.

Check the condition of the pads; if they are greasy, replace them.

Partially bleed the circuit if the compensation reservoir was not completely drained during the operation, otherwise carry out a full bleeding operation.

Press the brake pedal several times to ensure the piston is in contact with the pads.

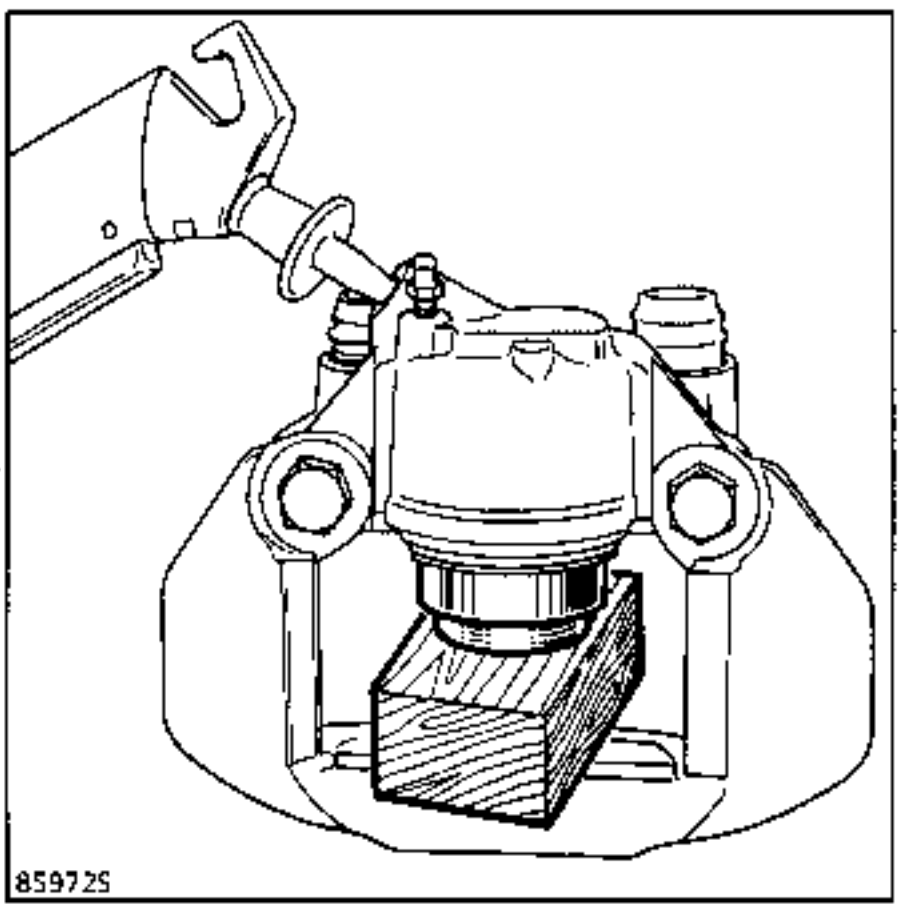
REPAIR

Any scratches in the caliper bore require the complete caliper to be renewed.

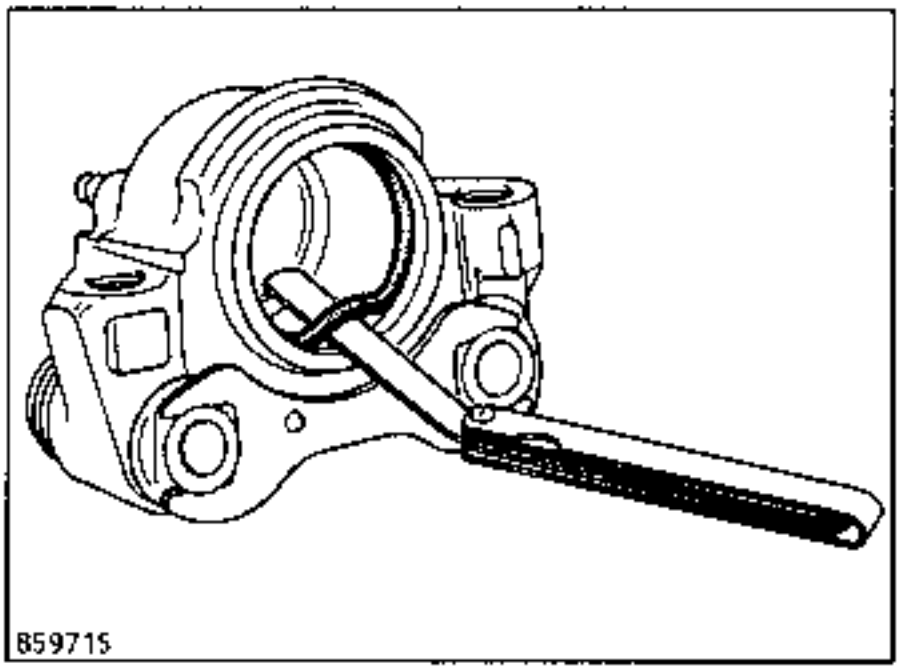
Remove the brake caliper.

Remove the rubber dust seal (GIRLING retaining spring).

Remove the piston using compressed air, inserting a wooden block between the caliper and the piston to prevent damage to the piston: any trace of damage to the piston skirt will render it unusable.



Using a rounded flexible blade (feeler gauge for example) remove the rectangular section seal from the caliper groove.



Clean the parts using methylated spirits.

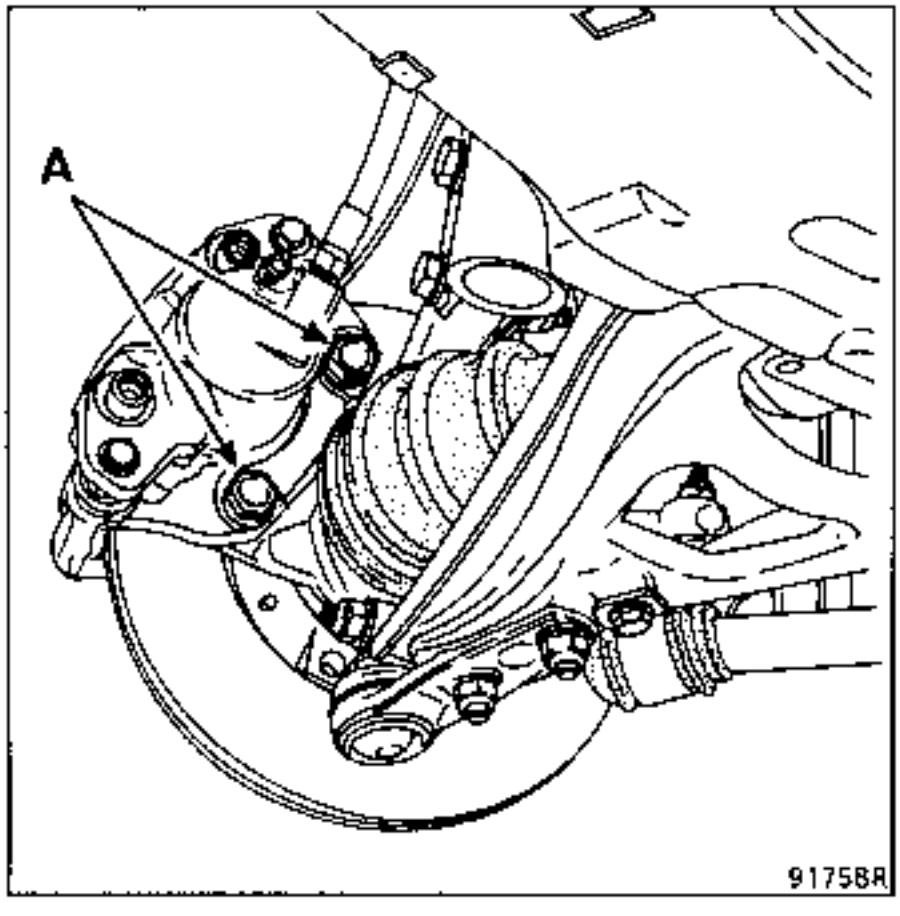
Replace any faulty parts using original parts and then refit the seal, piston and dust seal (with the GIRLING retaining spring).

Brake discs cannot be reground. If they are too heavily worn or are scratched they must be replaced.

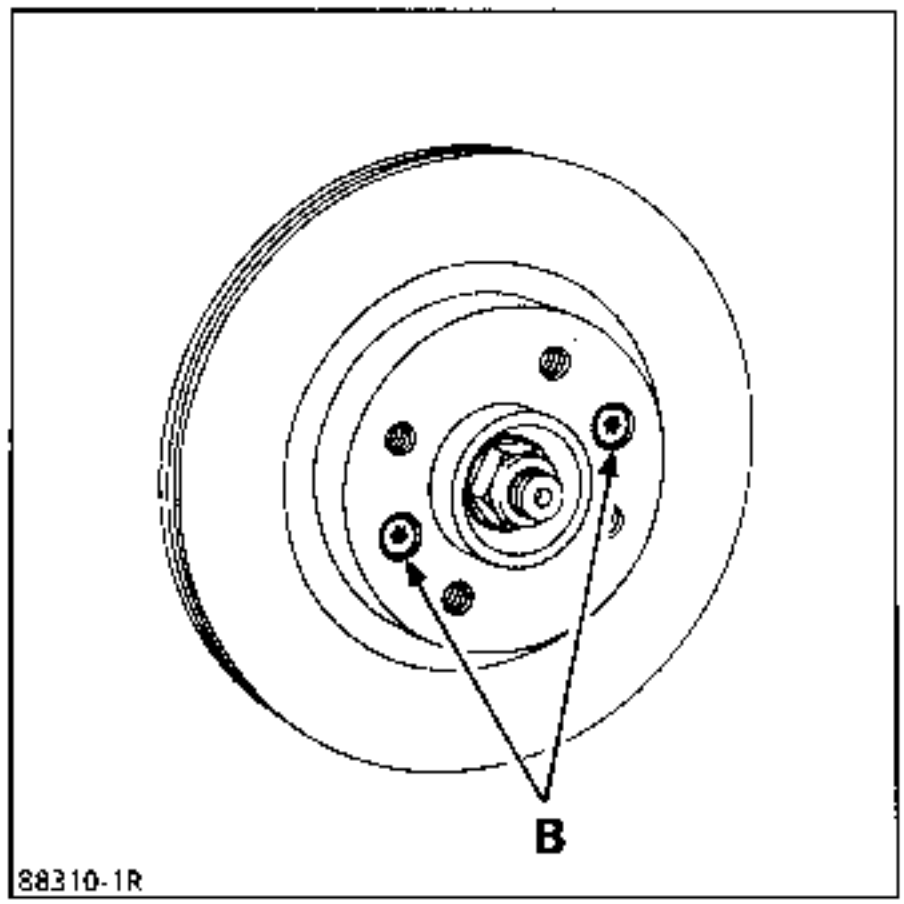
TIGHTENING TORQUES (in daN.m)	
Wheel bolts	9
Brake caliper guide bolt	3.2
Caliper mounting bolt	10

REMOVAL

Remove:
- the two bolts (A) mounting the brake assembly,



- the two disc mounting bolts (B),
- the disc.



REFITTING

Fit the disc onto the hub and secure it using the two bolts (B).

Refit the brake caliper, coat the bolts with **Loctite FRENBLOC** and torque tighten.

Press the brake pedal several times to ensure the piston is in contact with the pads.

REPLACEMENT

When replacing a disc, the pads must also be replaced.

In this case, the method for replacing the pads must be followed first, then the method for replacing the caliper clevices must be followed (see paragraph "Removal - Refitting").

SPECIAL TOOLING REQUIRED		
Rou.	604-01	Hub locking tool
T.Av.	476	Ball joint extractor
T.Av.	1050	Hub extractor

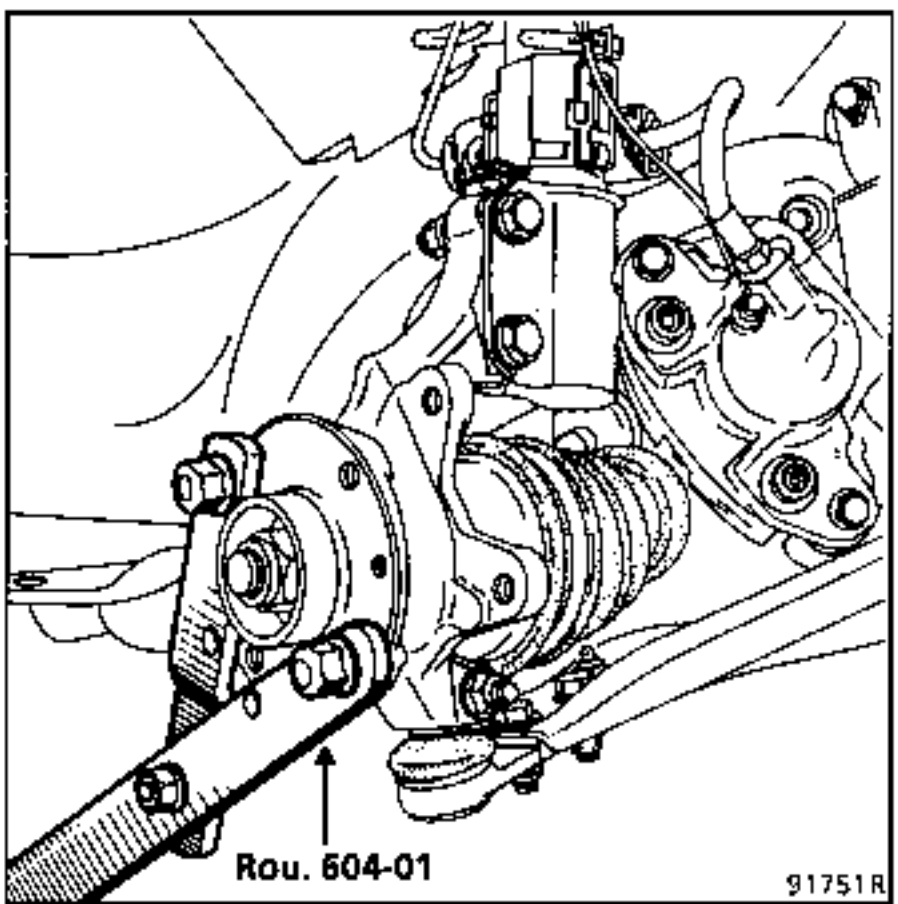
TIGHTENING TORQUES (in daN.m)	
Shock absorber base mounting bolt M14 × 150	17
Lower ball joint	6.5
Track rod end	4
Caliper mounting bolt	10
Driveshaft nuts	25
Wheel bolts	9

Checking play

Use a dial gauge on the hub to determine axial play : **0 to 0.05 mm.**

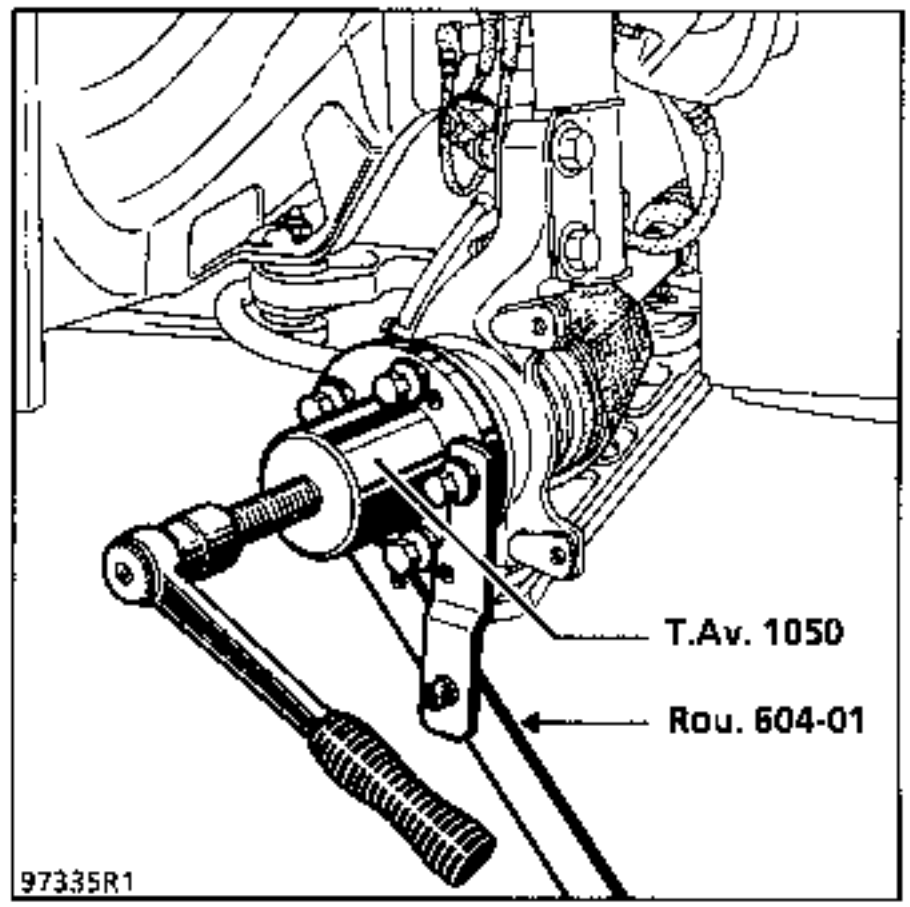
REMOVAL

Remove:
- the brake disc (see corresponding paragraph),
- the driveshaft nut using tool **Rou. 604-01**.

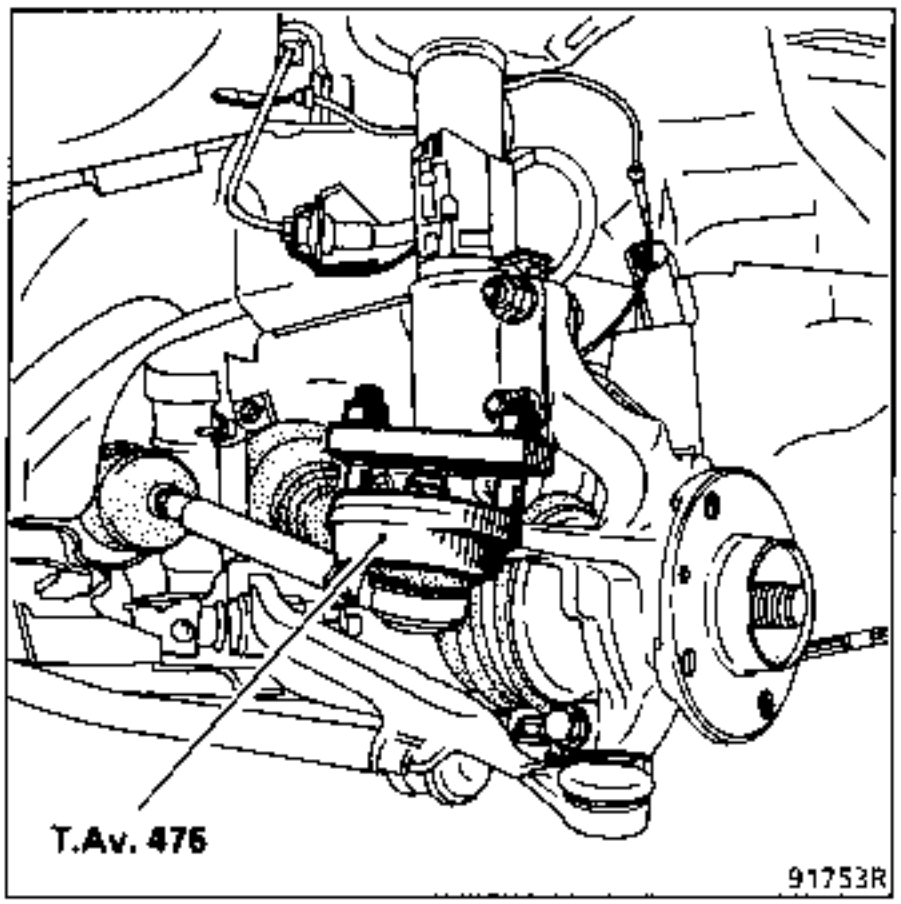


Fit a protector to the driveshaft gaiter.

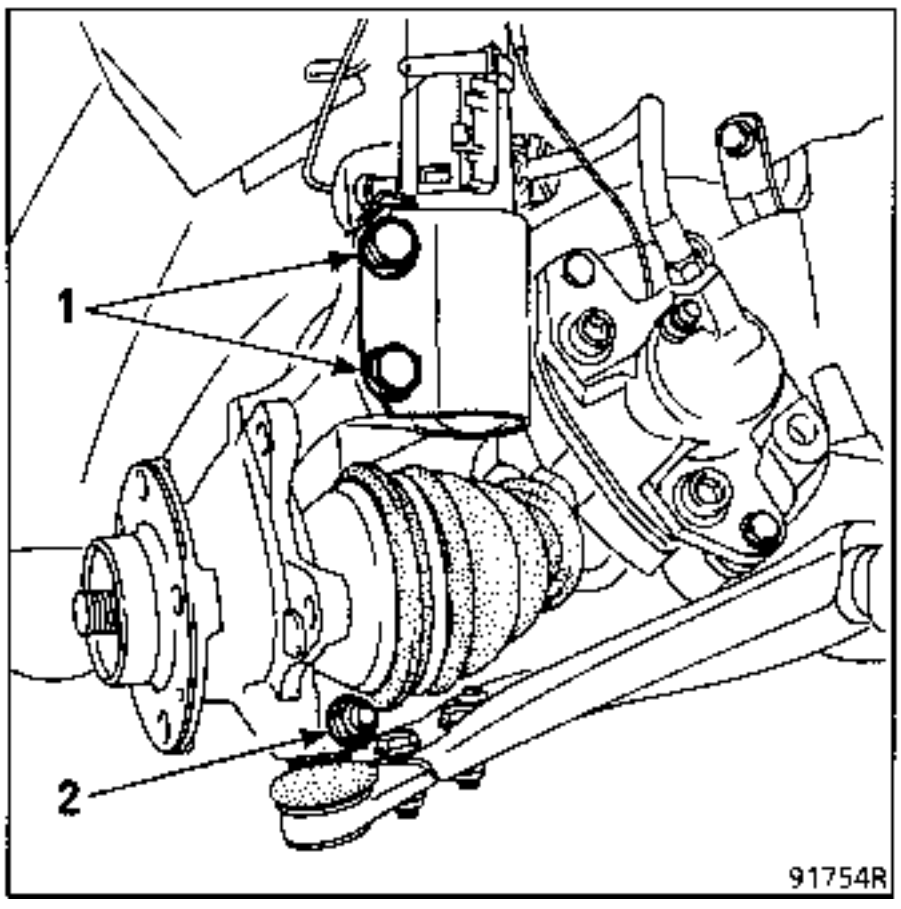
Push the driveshaft back using tool:
T. Av. 1050 + Rou. 604-01.



Disconnect the track rod: tool **T. Av. 476.**



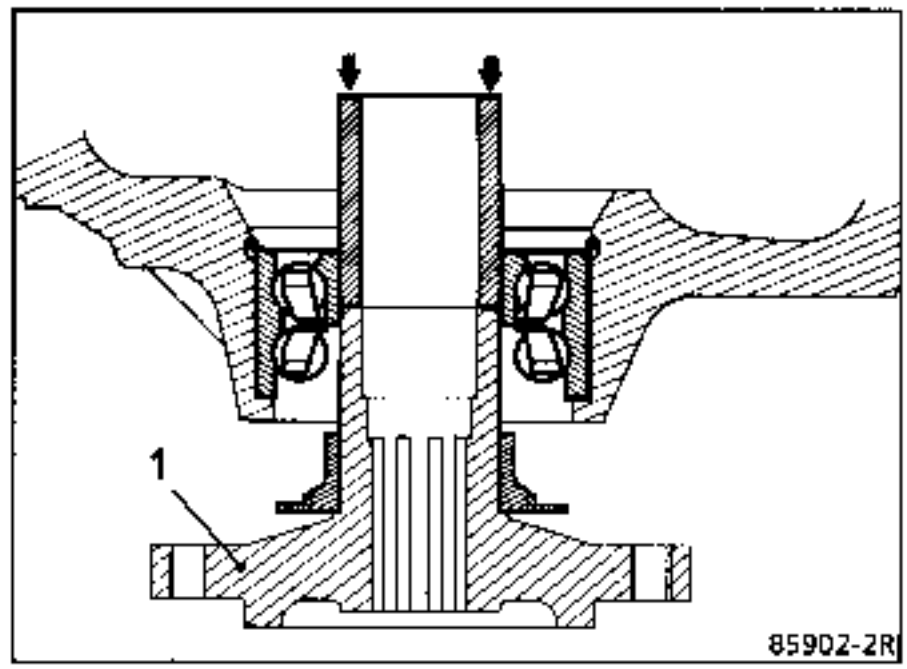
Remove:
- the mounting bolts (1),
- the nut and key (2).



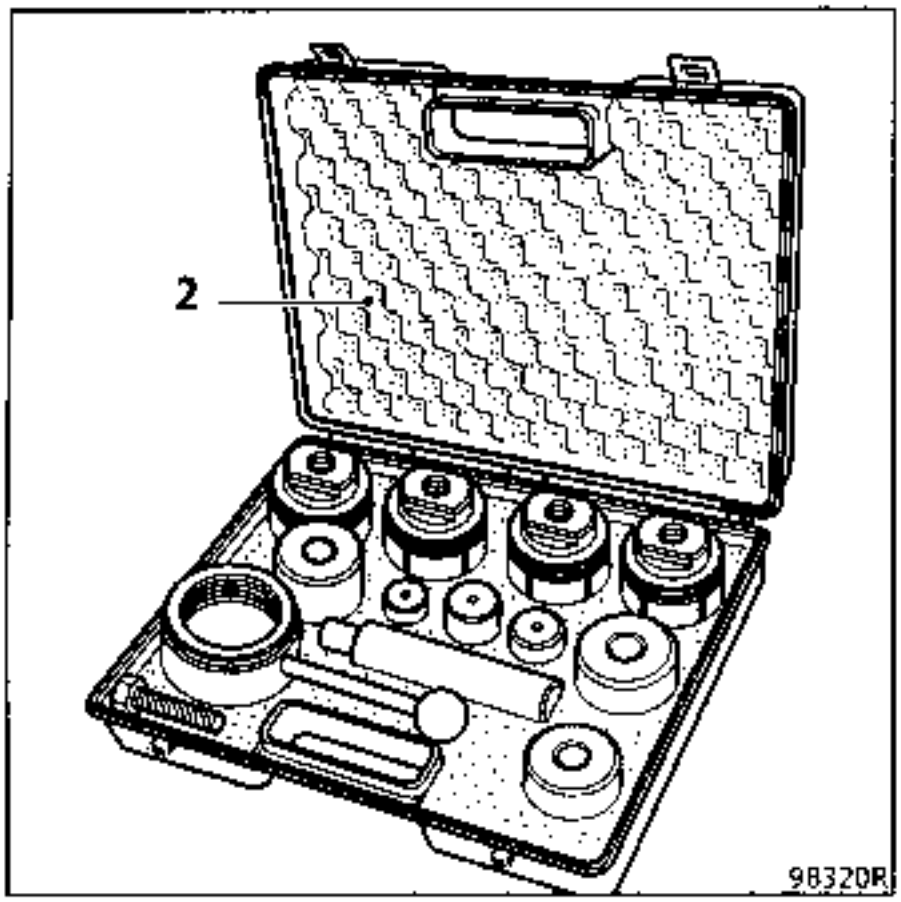
Fitting the bearing for the stub axle carrier

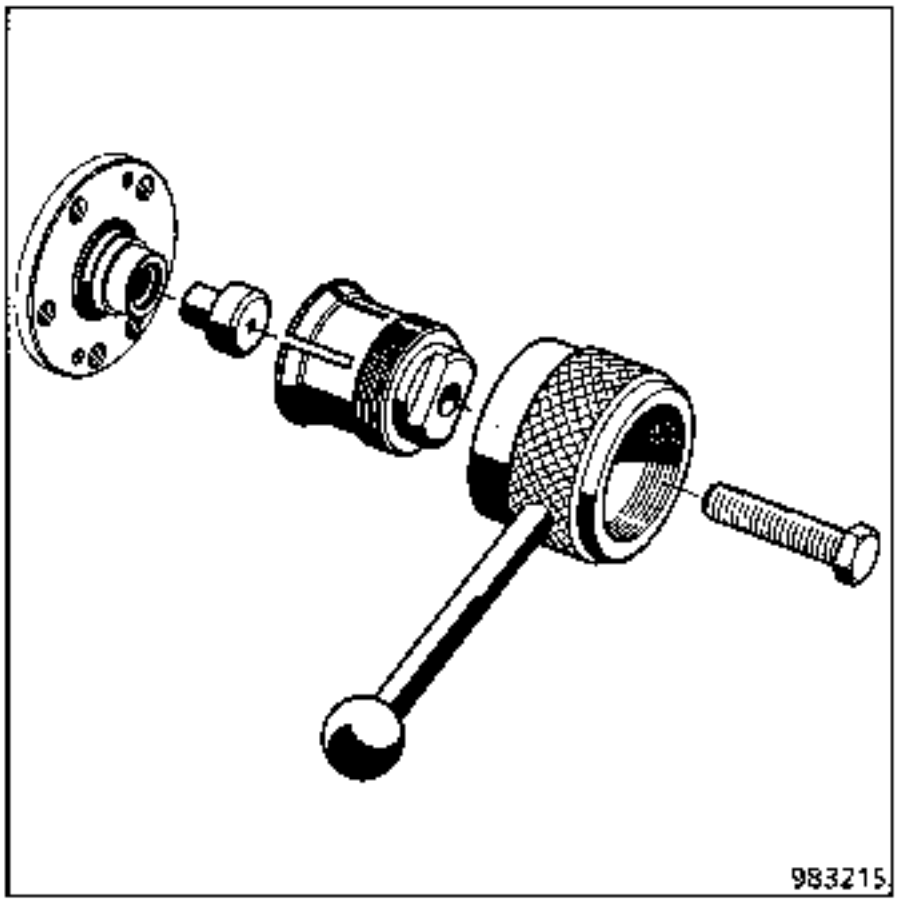
REMOVAL

Using a press, extract the hub (1).



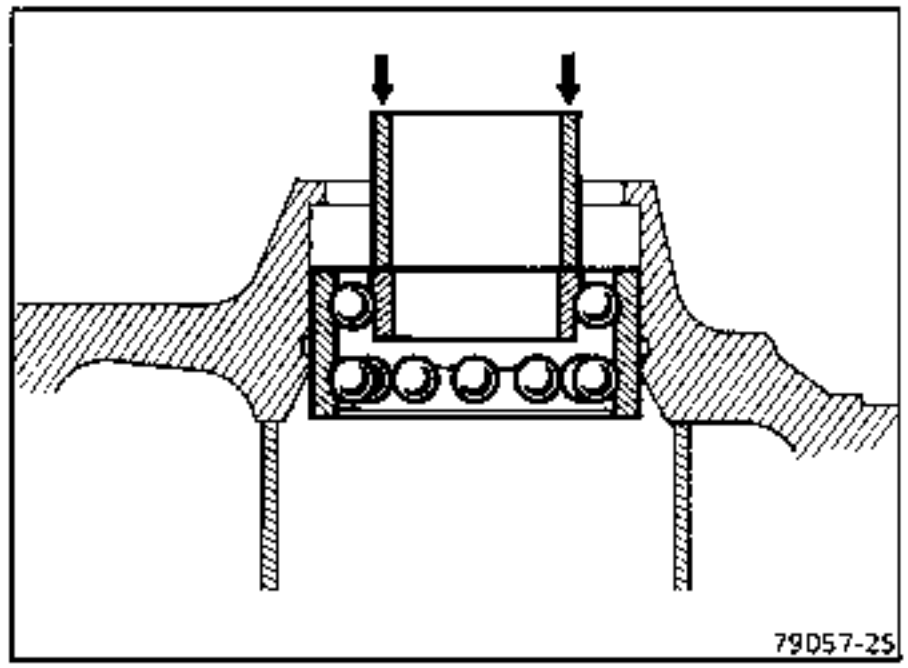
Remove the bearing inner ring using **the hub bearing extraction kit (2)** (see equipment catalogue Part Number. 914 0951).





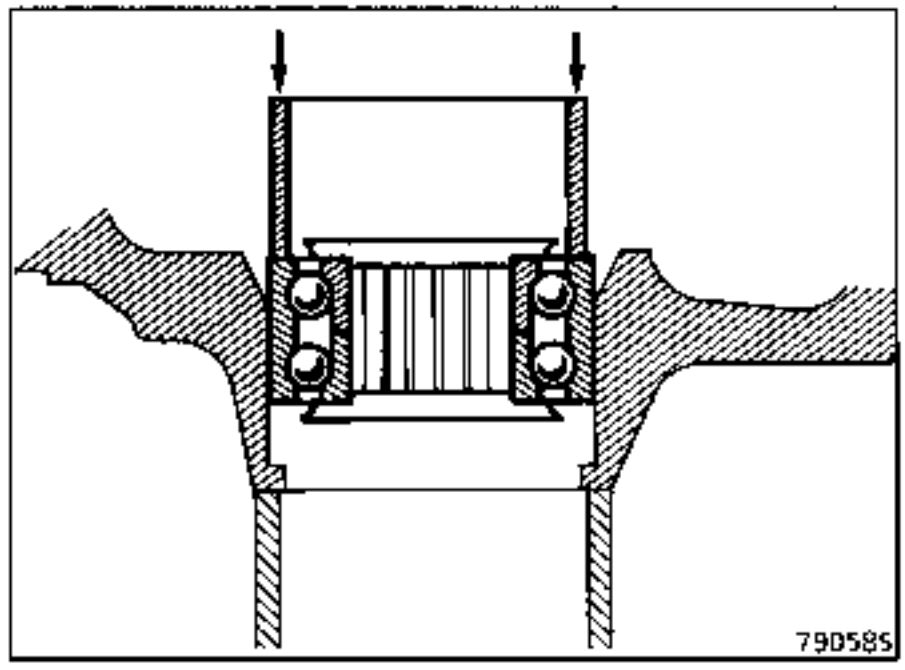
Remove the bearing locking ring.

Extract the bearing outer ring on the press using one of the two inner rings.



REFITTING

Fit the complete (new) bearing in the stub axle carrier on the press.

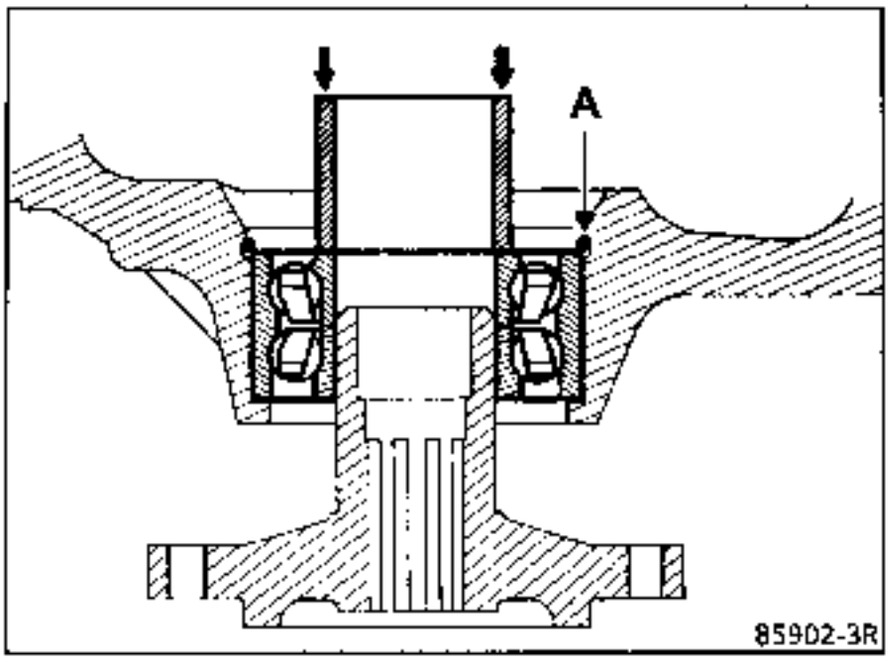


NOTE : do not use the inner ring for support as the bearing may be damaged since the force required to press the bearing into position is high. Use a ring from the extraction kit (2).

Fit a new locking ring (A).

Remove the plastic ring.

Take support on the inner bearing ring and fit the hub on the press.

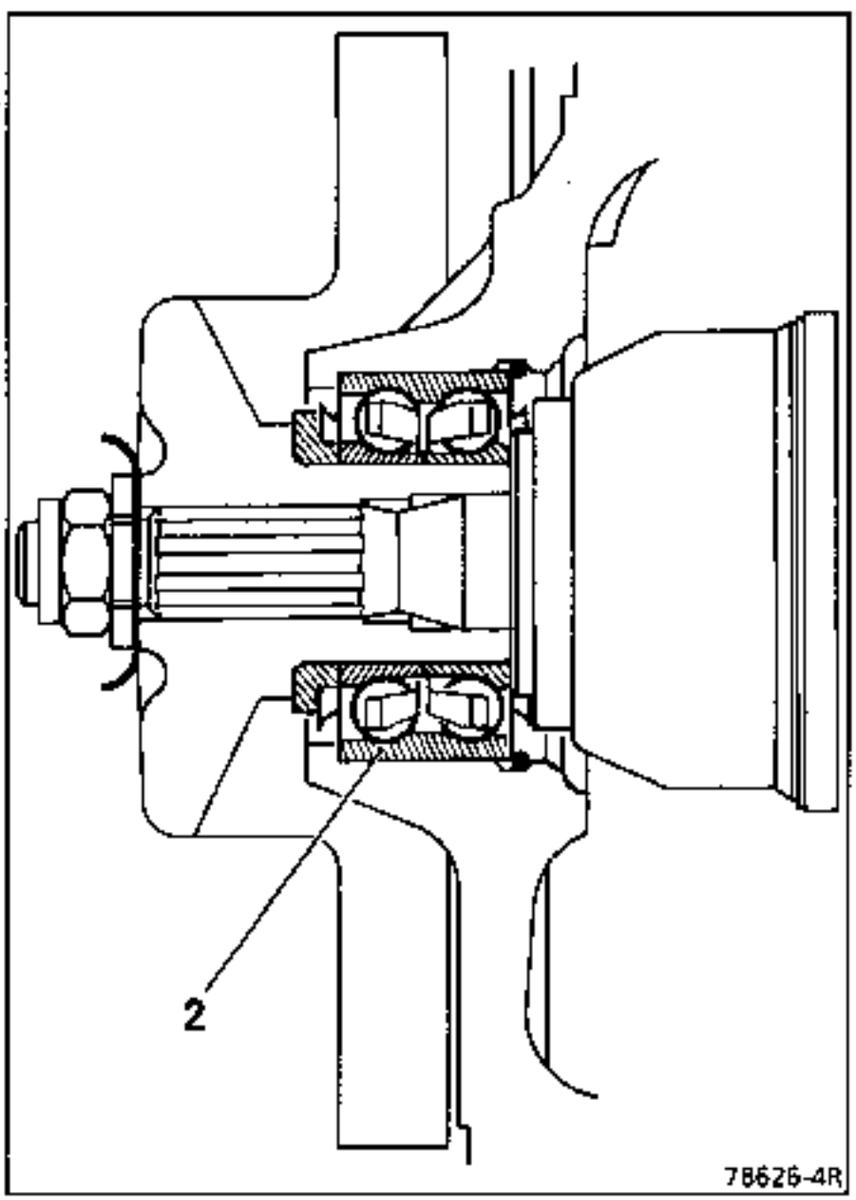


To refit the stub axle carrier - hub - bearing assembly, refitting is the reverse of removal but the following points should be observed:

- take care to protect the driveshaft gaiter,
- coat the stub axle with Loctite SCELBLOC,
- tighten the nuts to the recommended torque,
- when fitting the shock absorber base mounting bolt, fit the nuts on the track rod side.

The method for removing and refitting is identical to that used for replacing the bearing.

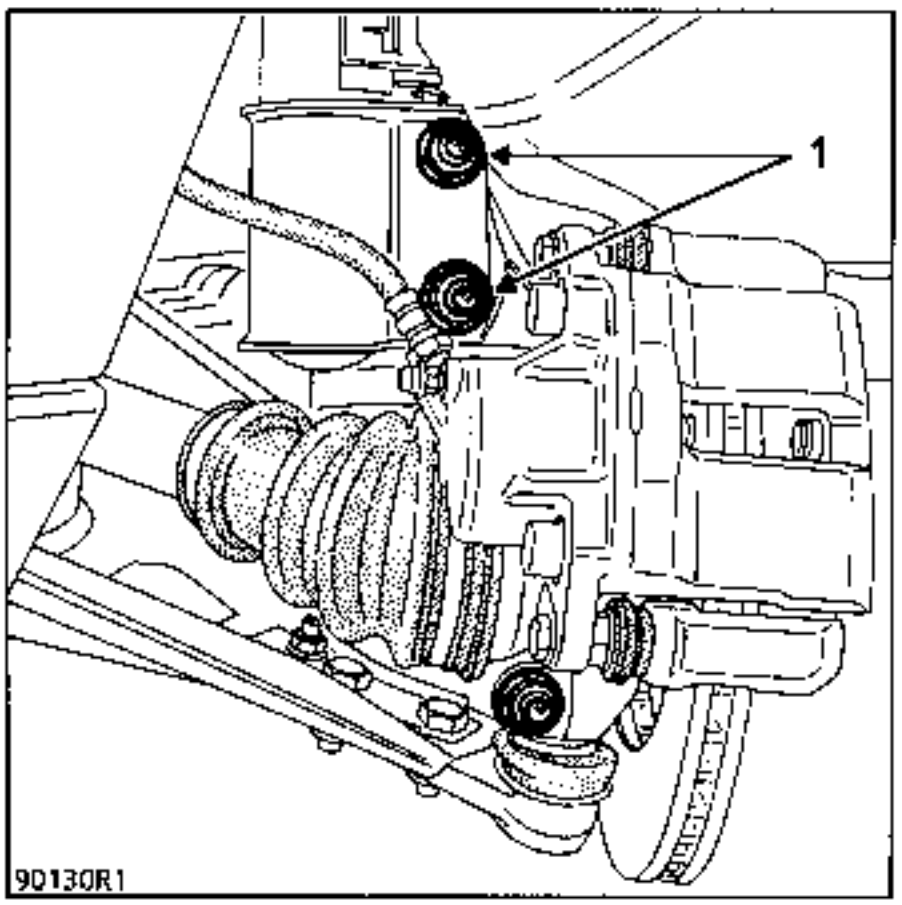
NOTE : the force required to fit the outer bearing ring (2) into its bore is quite high, so when this ring is removed the **complete bearing should be renewed,** since the bearing race will have been damaged.



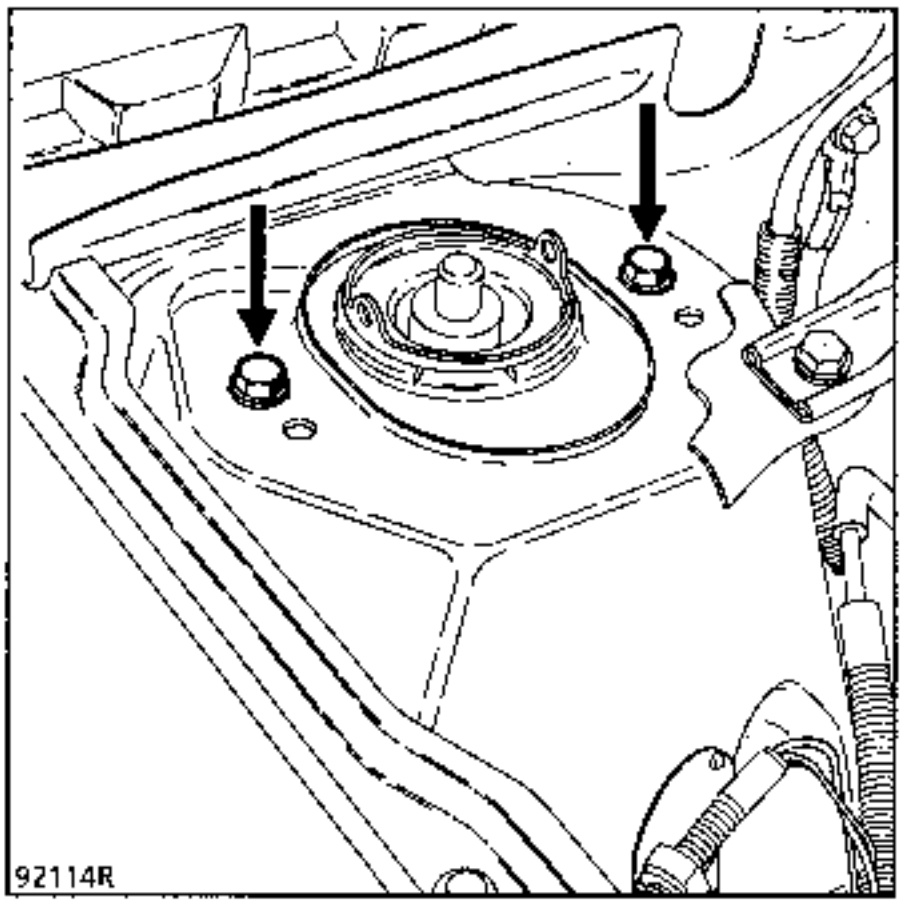
TIGHTENING TORQUES (in daN.m)	
Shock absorber rod nuts	6
Shock absorber base mounting bolt	17
Shock absorber bowl mounting bolt	3
Wheel bolts	9

REMOVAL

With the vehicle on axle stands on the side in question, remove
- the wheel,
- the two shock absorber base mounting bolts(1),



- the two upper mounting bolts,



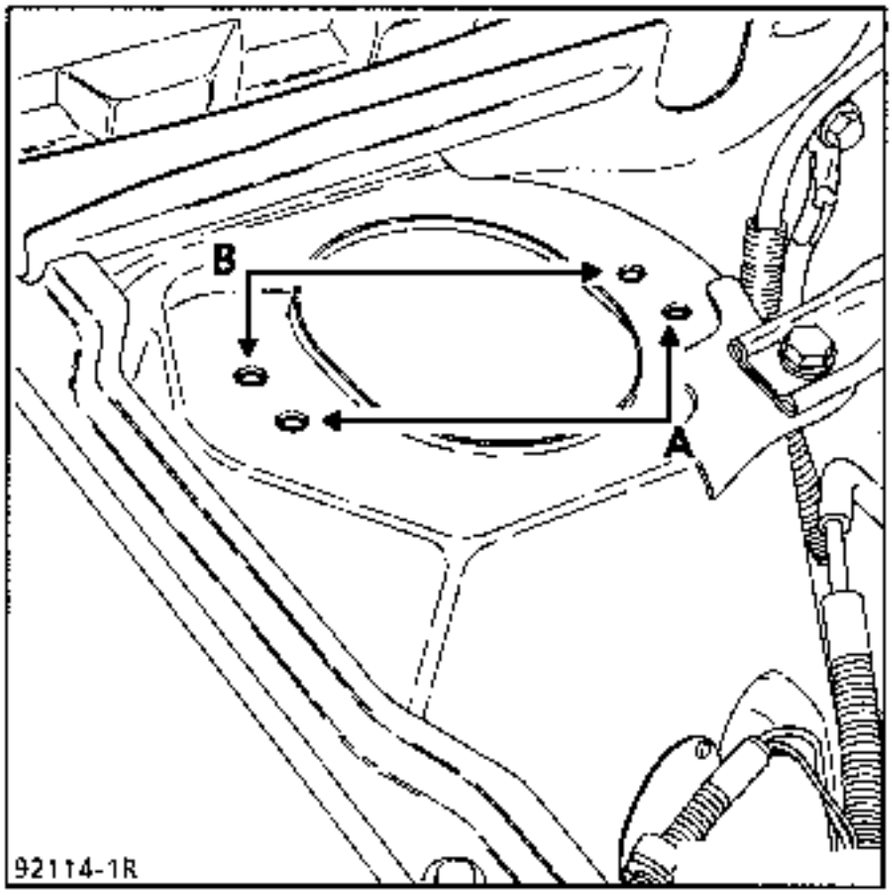
- the shock absorber, pressing on the lower arm **to avoid contact between the shock absorber and the driveshaft gaiter.**

REFITTING

Refitting is the reverse of removal, **taking care not to damage the driveshaft gaiter.**

Position the mountings for the upper cup in the appropriate holes .

A mechanical steering
B power assisted steering



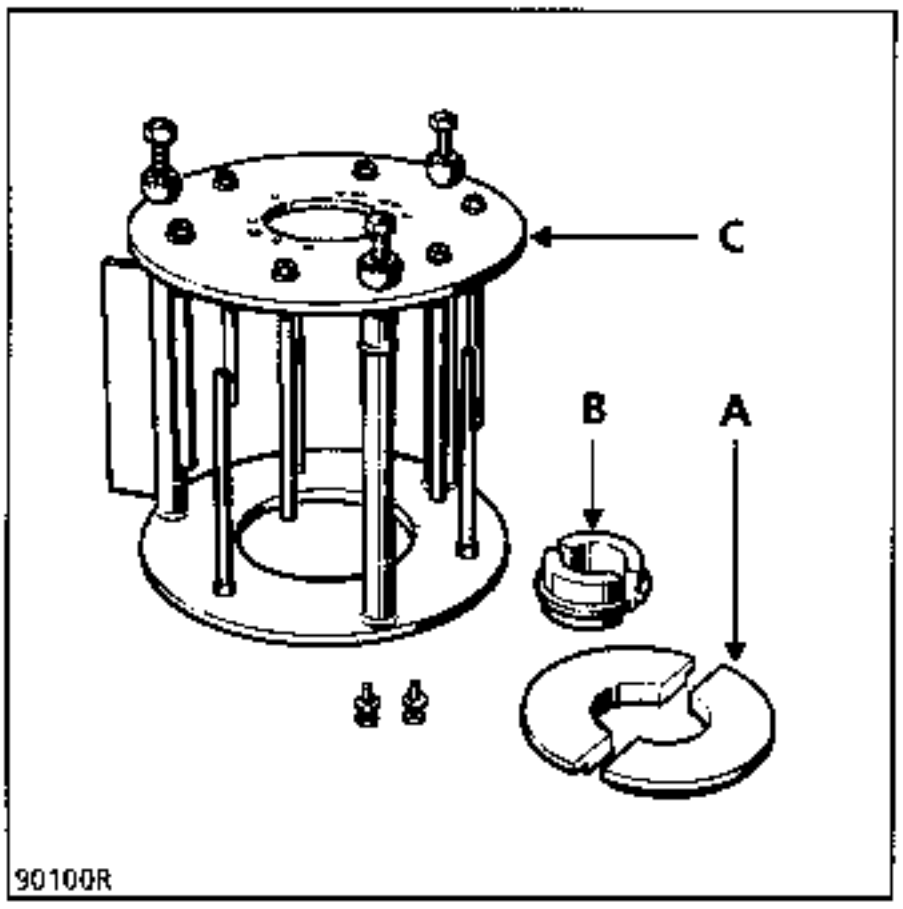
Torque tighten:

- the shock absorber base bolts (1),
- the upper mounting bolts.

In view of the high degree of energy in the spring it is vital to ensure the tooling is in perfect condition. This method takes longer than the method using the spring compressor.

SPECIAL TOOLING REQUIRED	
Sus. 1052	Tooling for front spring and shock absorber
Sus. 1052-02	Retaining shell R19

Use components (A) and (B) of tool **Sus. 1052.**



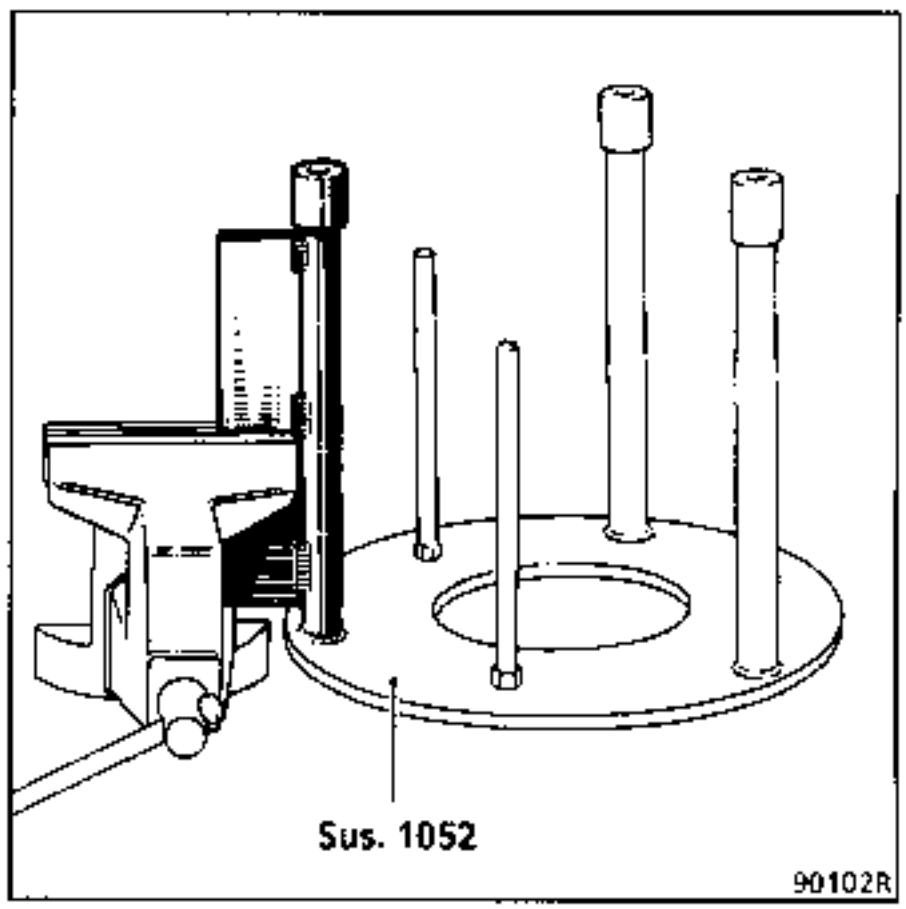
90100R

Upper and lower compression plates.

A Pressure cup
B Retaining shell R19

REMOVING THE SPRING AND SHOCK ABSORBER

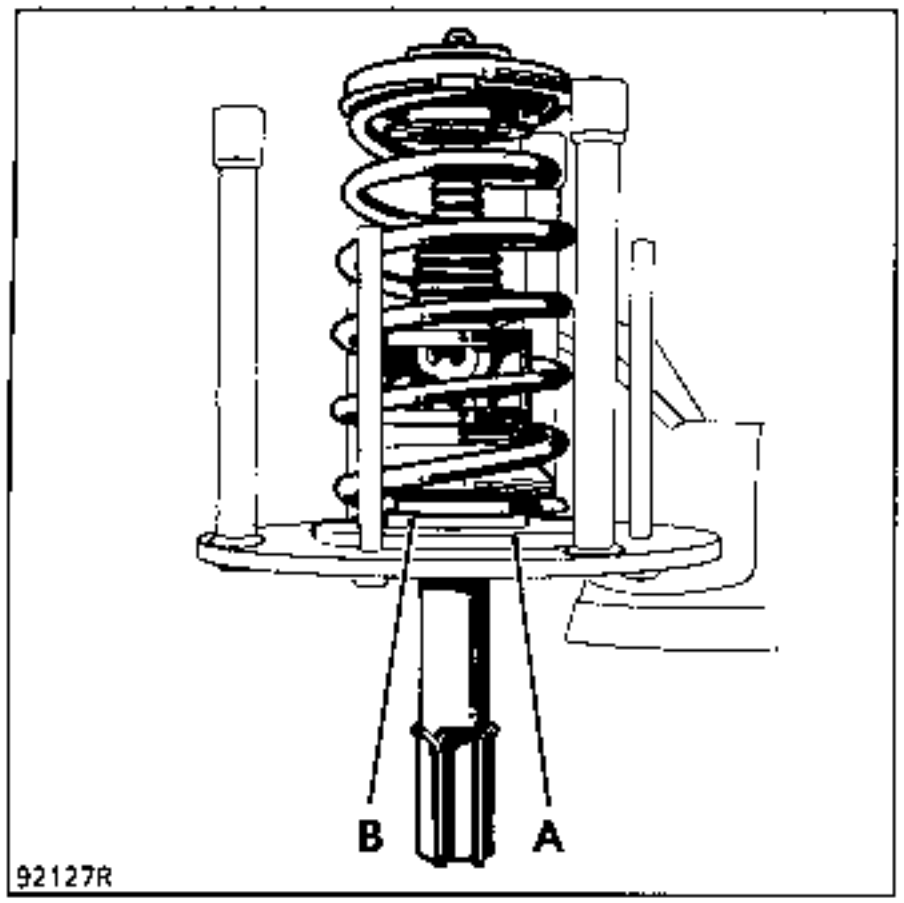
Fit the lower compression plate of tool **Sus. 1052** into a vice.



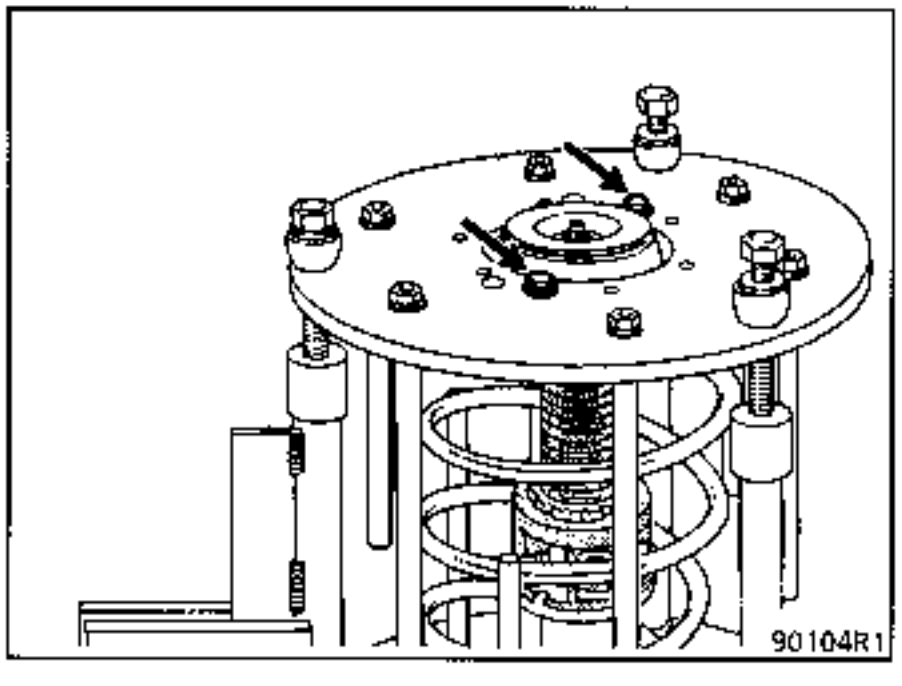
90102R

Fit:

- the shock absorber and spring assembly, positioning the two half cups (A) and the two half shells (B),

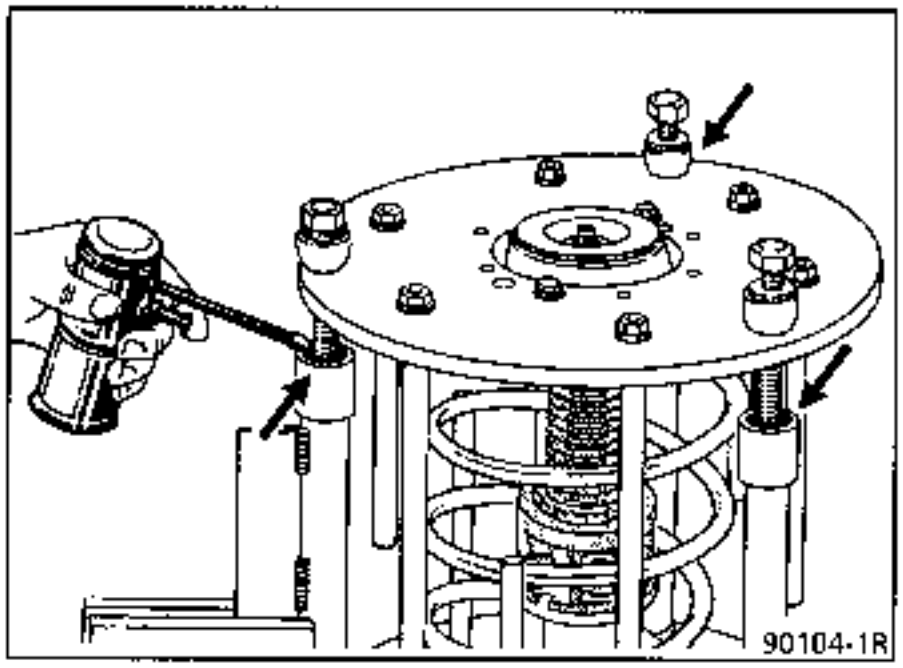


- the upper plate,
- the two bolts which retain the upper shock absorber cup in the marked holes (vehicle references stamped on the upper plate),



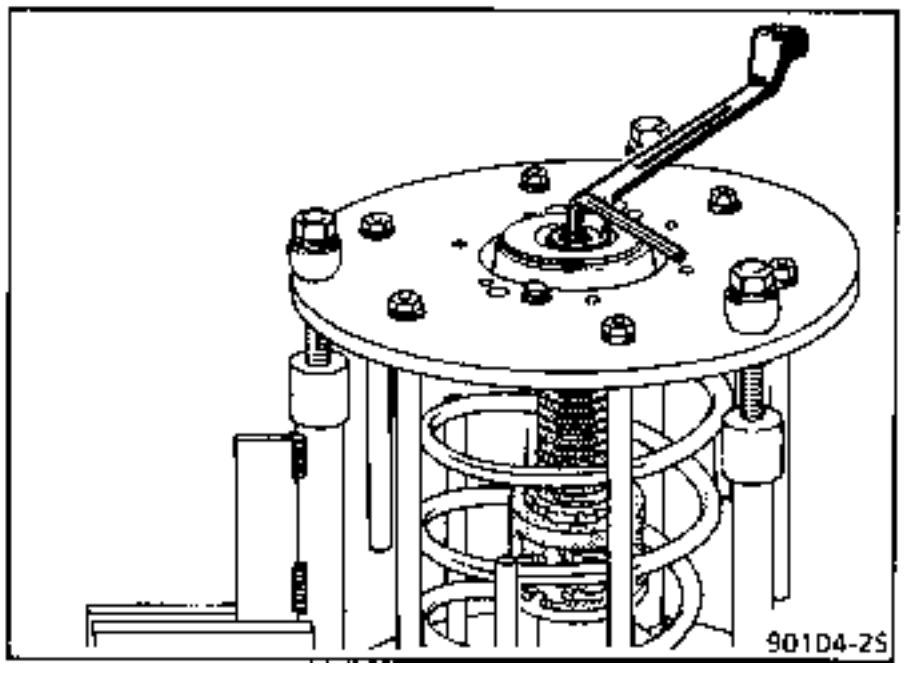
- the three compression bolts and put plenty of oil in the reservoirs provided.

NOTE : the threaded rods of the tool are subject to very high forces - they should be lubricated well.



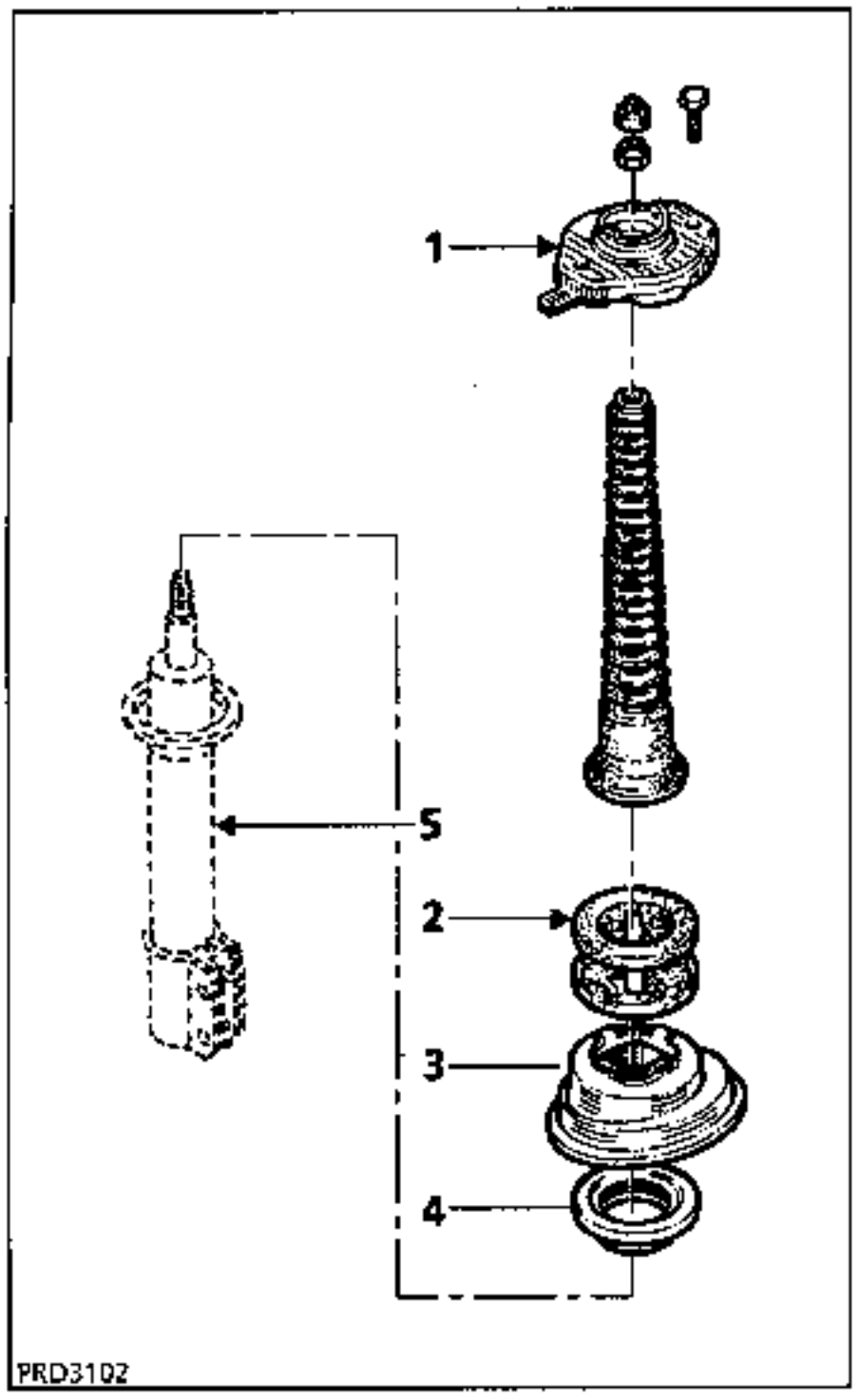
Compress the spring by approximately **10 mm.**

Remove the shock absorber rod nut.



Decompress the spring gradually.

Remove the parts in the order (1) to (5).

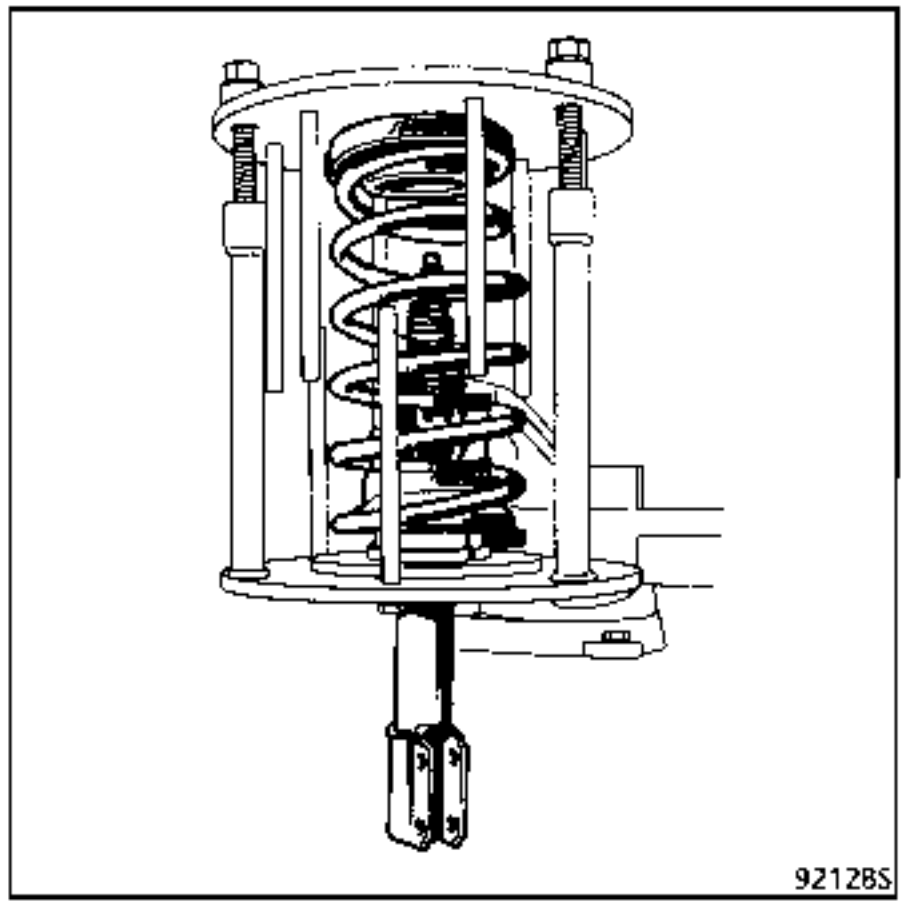


Parts (3) and (4) form the front axle pivot component.

REFITTING THE SPRING - SHOCK ABSORBER

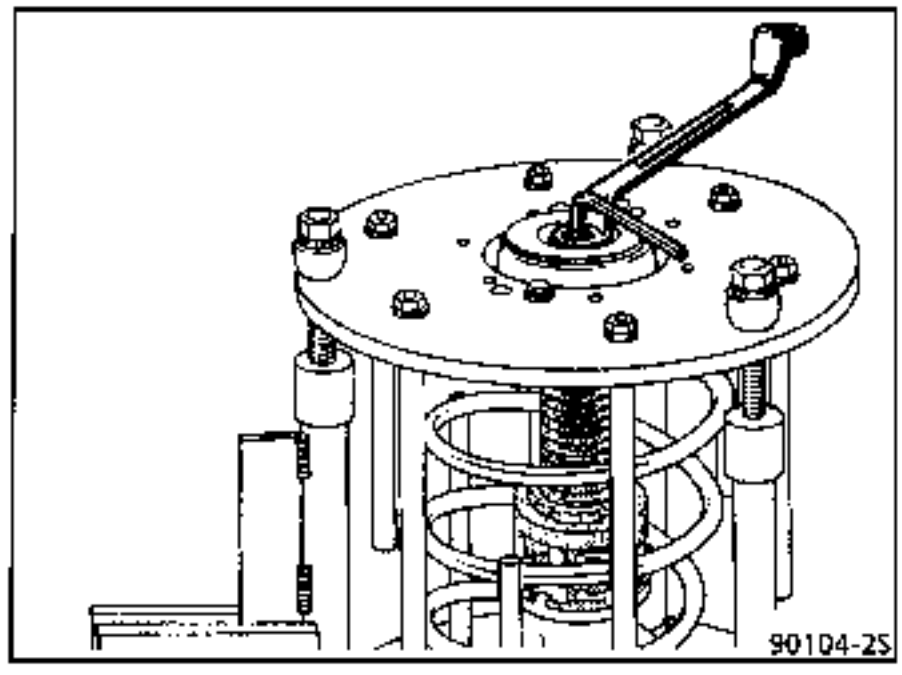
Position :
- the shock absorber (5),
- the bearing(4),
- the lower pressure cup for the spring (3),
- the spring on the lower cup, observing the position of the spring on the stop,
- the upper plate and upper spring pressure cup (1).

Observe the position of the spring on the upper stop.



Compress the assembly and insert the shock absorber rod.

Fit the nut and tighten to the correct torque.



Decompress the spring gradually.

Remove:
- the upper plate of the tool,
- the spring - shock absorber assembly from the compression tool.

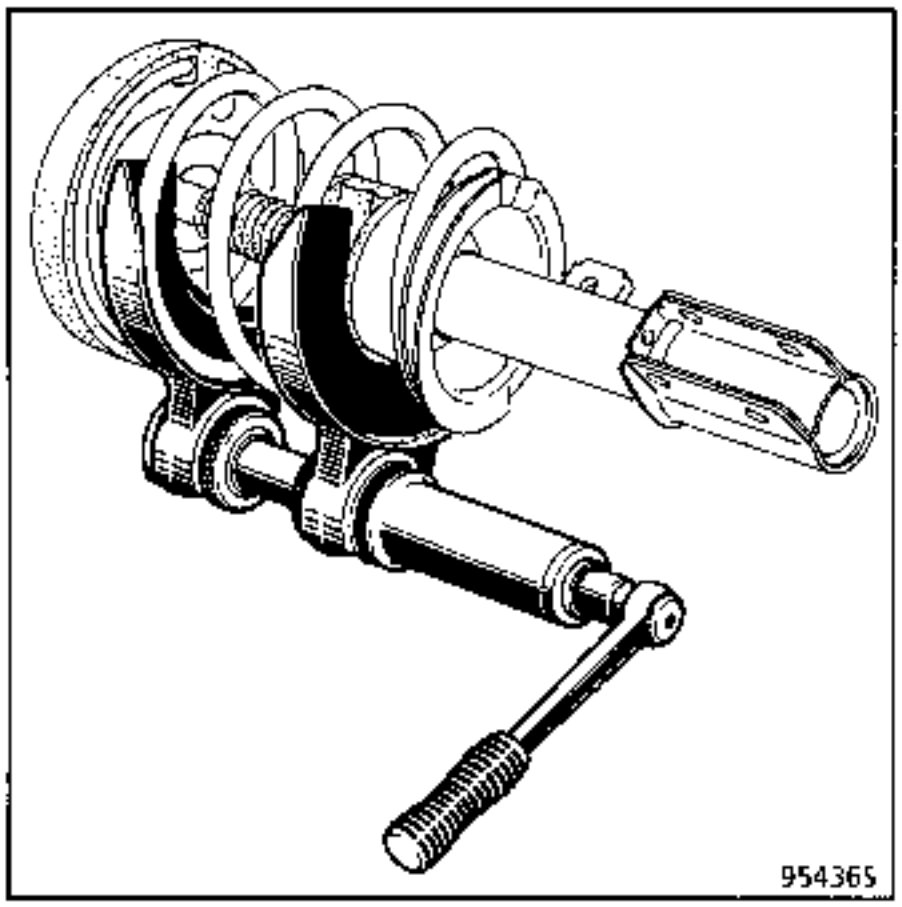
In view of the high degree of energy in the spring it is vital to ensure the tooling is in perfect condition.

EQUIPMENT REQUIRED			
Make	Type	Description	Cup
MG	M90	Spring compressor	M3
ZI	ZKE 2013 ZKL 0055	Spring compressor Vice	NO2
FACOM	D83 RENA	Tool for removing the shock absorber nut	

TIGHTENING TORQUES (in daN.m)	
Shock absorber upper mounting nut	6

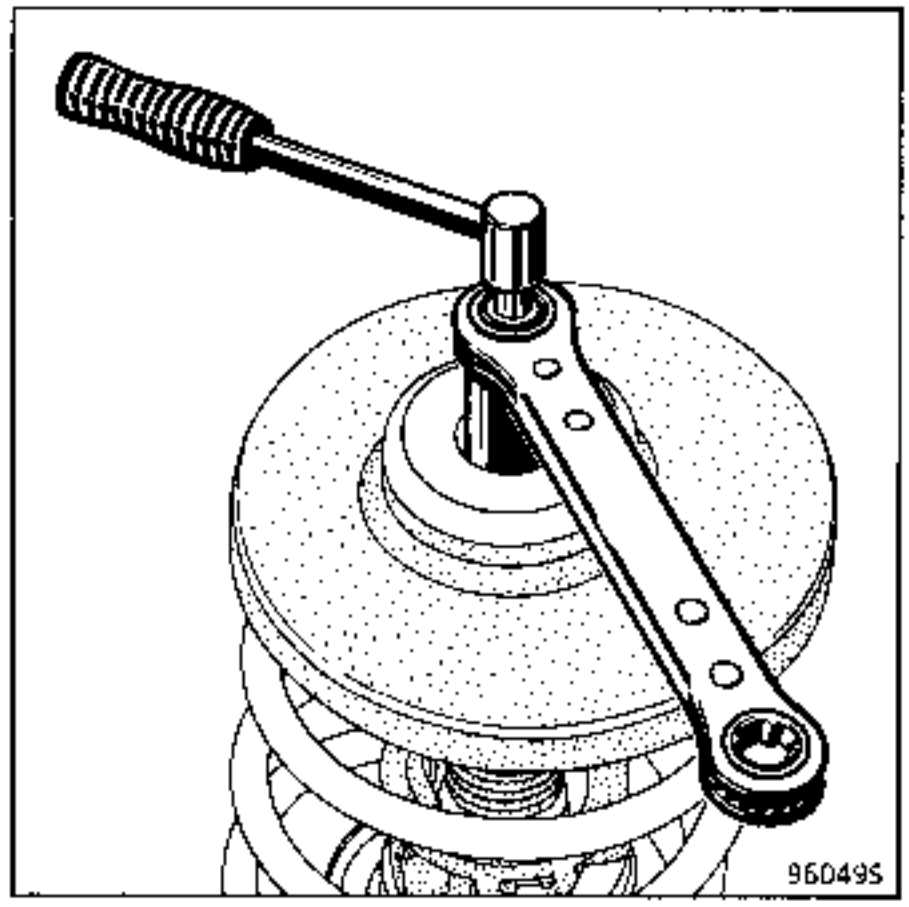
REMOVAL

Fit the cups to the compression tool and position the assembly on the spring.



Compress the spring until the spring no longer touches the pads on the cups.

Using tool **FACOM D83 RENA** remove the nut from the shock absorber rod.



Decompress the spring gradually.

Remove the parts in the order (1) to (5) as for removal using tool **Sus. 1052.**

REFITTING

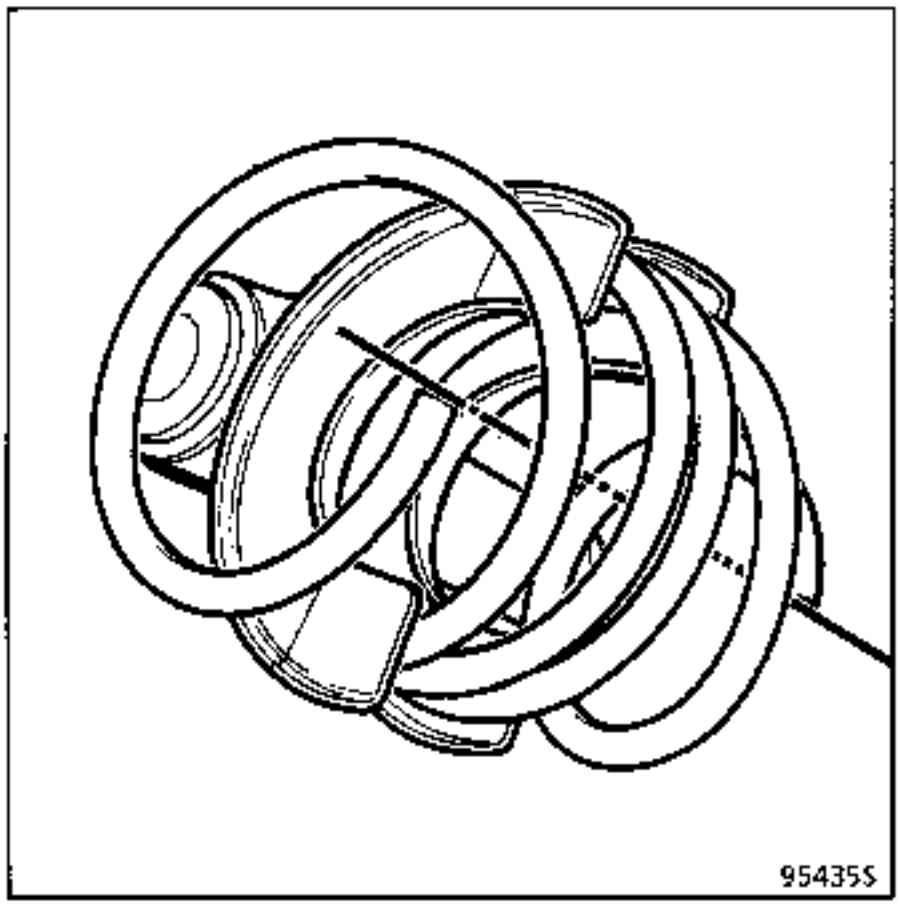
Precautions to be taken before fitting

Shock absorbers are stored horizontally in the Parts Stores.

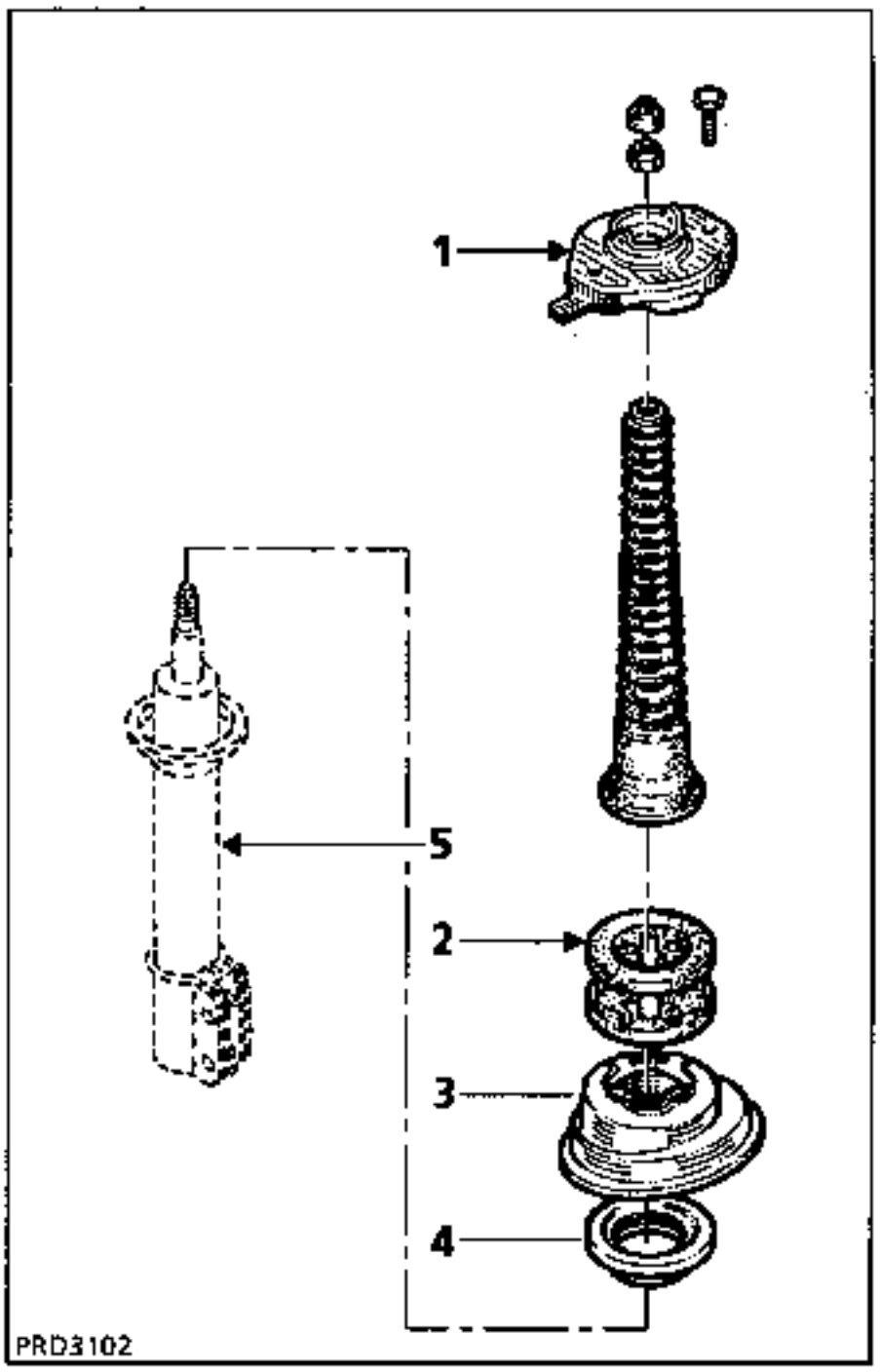
Under these conditions it is possible that the shock absorbers, which are designed to operate in a vertical direction, will have de-primed.

Before fitting the shock absorbers to the vehicle compress them a few times by hand in the vertical position.

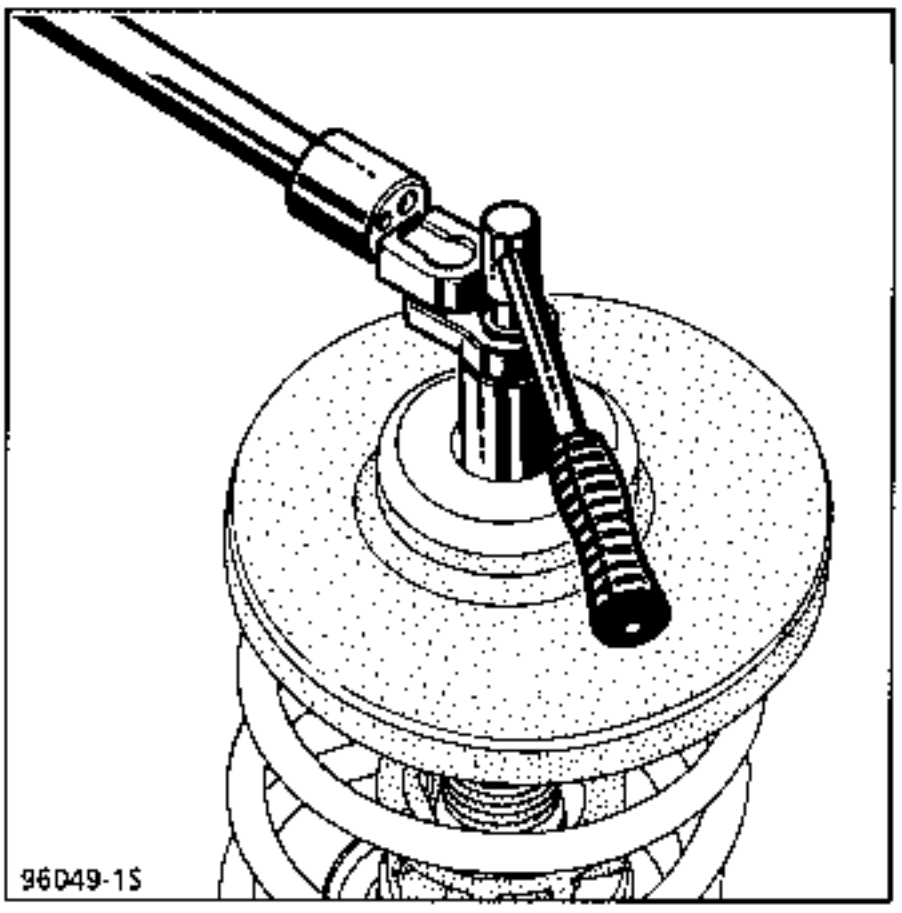
If the spring is to be replaced, to facilitate refitting, observe the position and alignment of the spring and cups of the tool.



Observe the fitting order and direction for the component parts.



Tighten the nut (new) to the correct torque using tool **FACOM D83 RENA.**



Decompress the spring and remove the tool.

TIGHTENING TORQUES (in daN.m)	
Mounting nuts for bearings on cradle	3.2
Mounting nut for bearing on wishbone	3.2

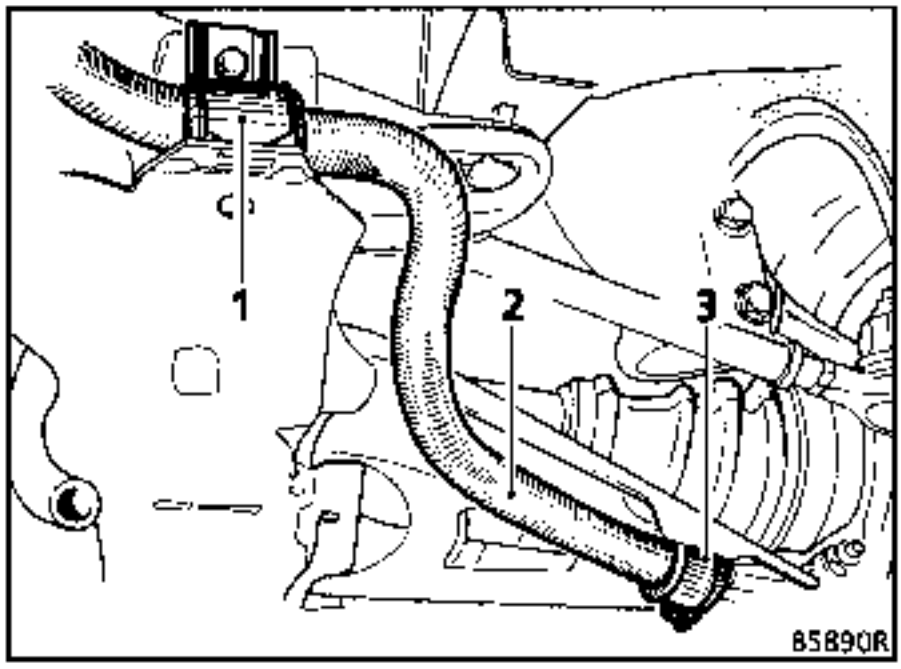
This operation requires the prior removal of:

- the exhaust downpipe,
- the gear selector control (manual gearbox).

REMOVAL

Remove:
- (1) and (3) on each side,
- the bar (2).

Check the condition of the bearings and the bushes - replace them if necessary.



1 Bearing on cradle
2 Anti-roll bar
3 Bearing on wishbone

REFITTING

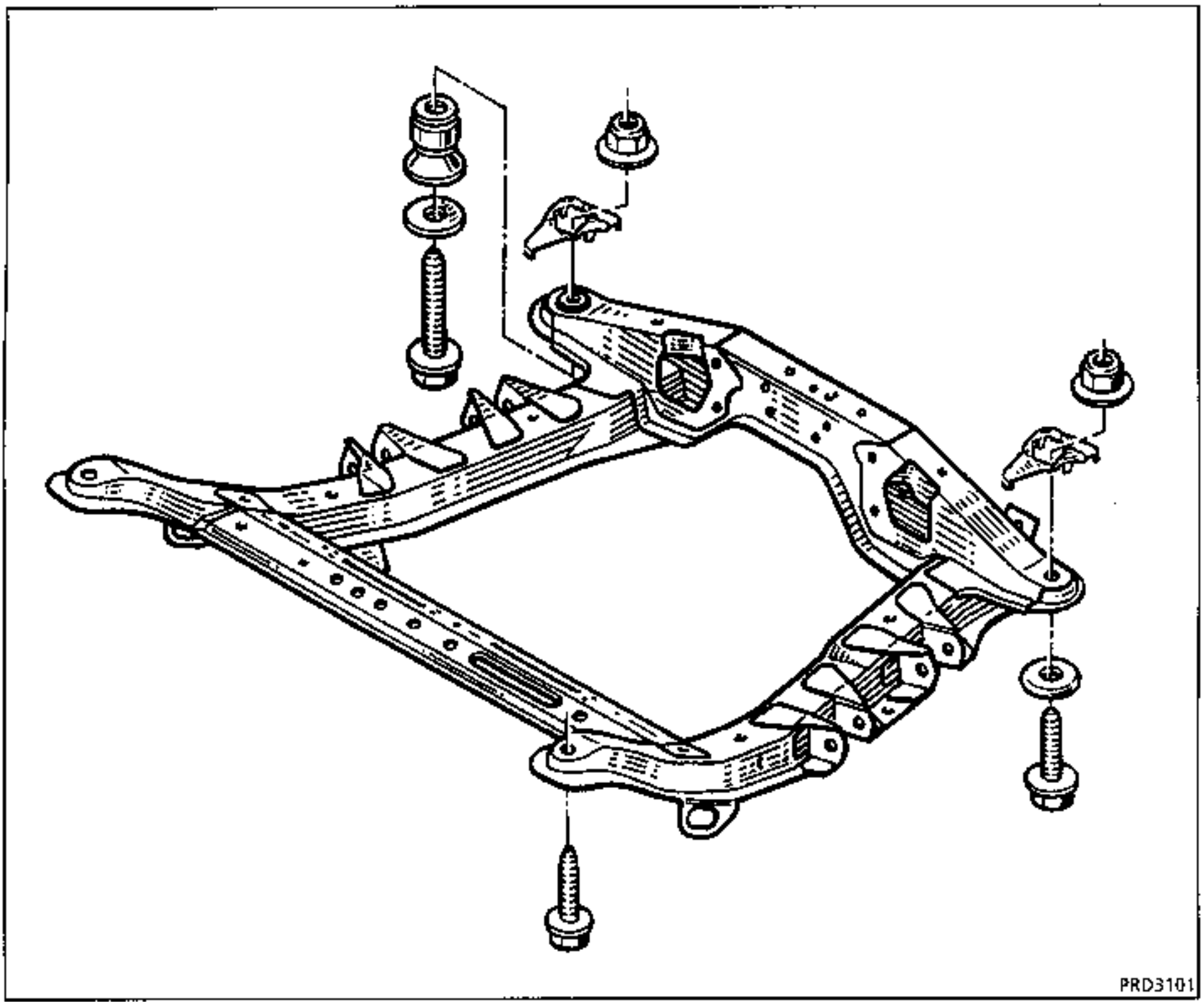
Only the bearings on the wishbone (3) must be coated with **Molykote 33 Medium grease**.

Lubrication of the bearings on the cradle (1) is not permitted (risk of the bar moving and causing noise).

Refit the parts (1) and (3) and the bar (2).

Position for locking the bearings : **UNLADEN.**

EXPLODED VIEW



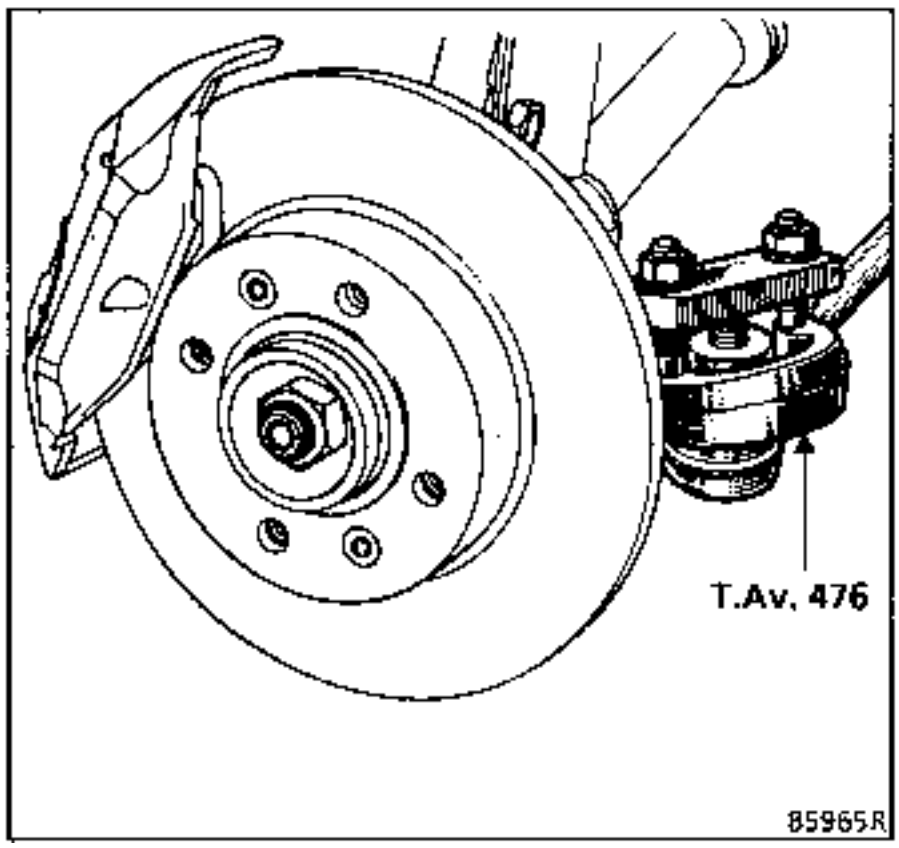
SPECIAL TOOLING REQUIRED		
Mot.	1040 -01	Dummy cradle for removing - refitting the engine and transmission assembly
T. Av.	476	Ball joint extractor

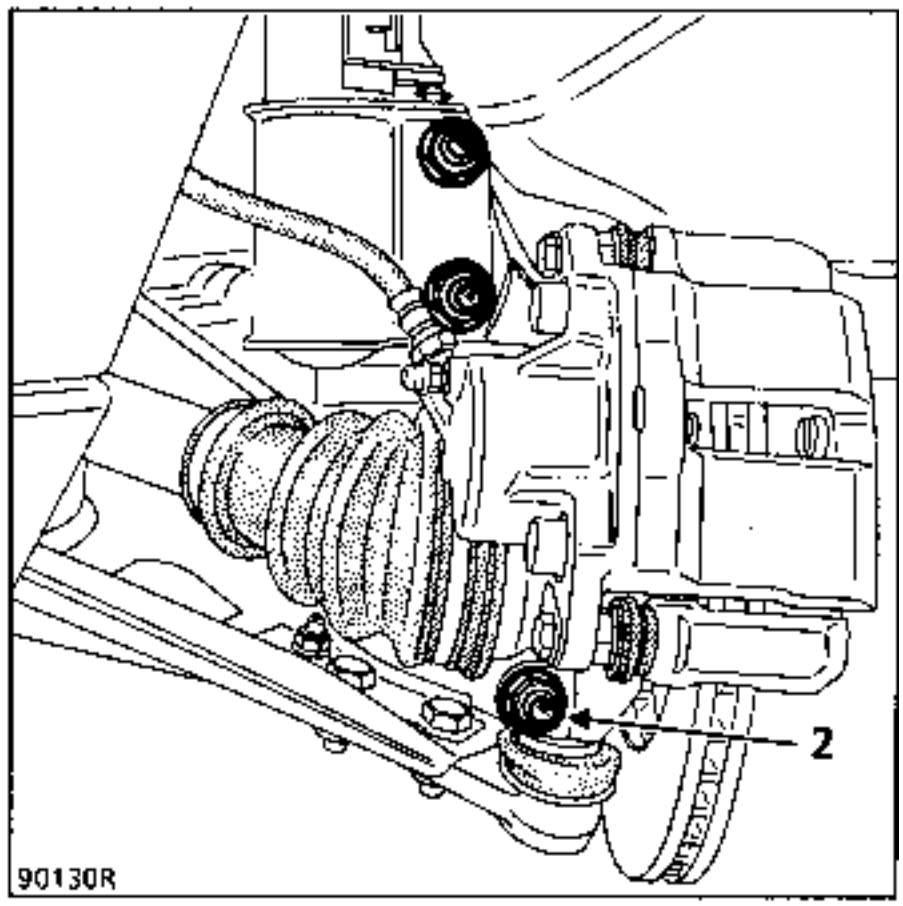
TIGHTENING TORQUES (in daN.m)		
Track rod end nut		3.5
Steering column universal joint bolt		2.5
Cradle mounting bolt	front diameter 10	6
	rear diameter 12	11
Nut for cradle - side member tie-rod		9
Bolt for cradle - side member tie-rod		3
Stub axle carrier key nut		8
Engine tie-bar , F engine		4.5 to 6.5

REMOVAL

Disconnect the battery.

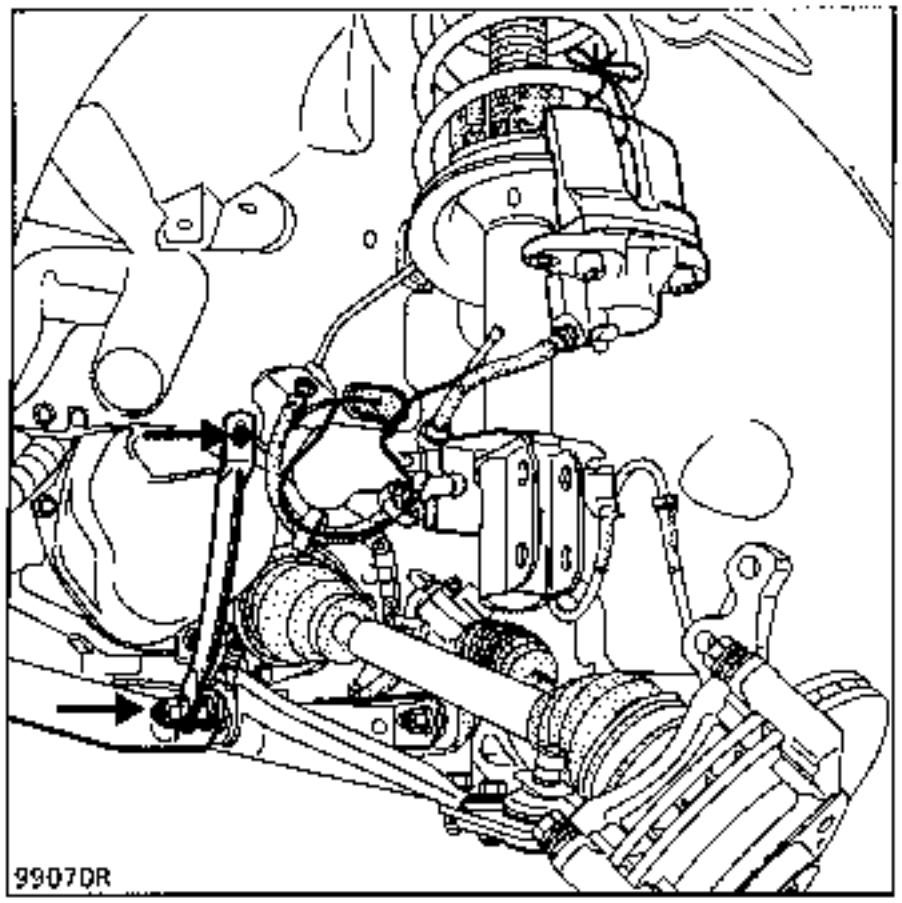
Remove:
- the wheels,
- the track rod ends using tool T. Av. 476,
- the key nut (2) on the stub axle carrier,



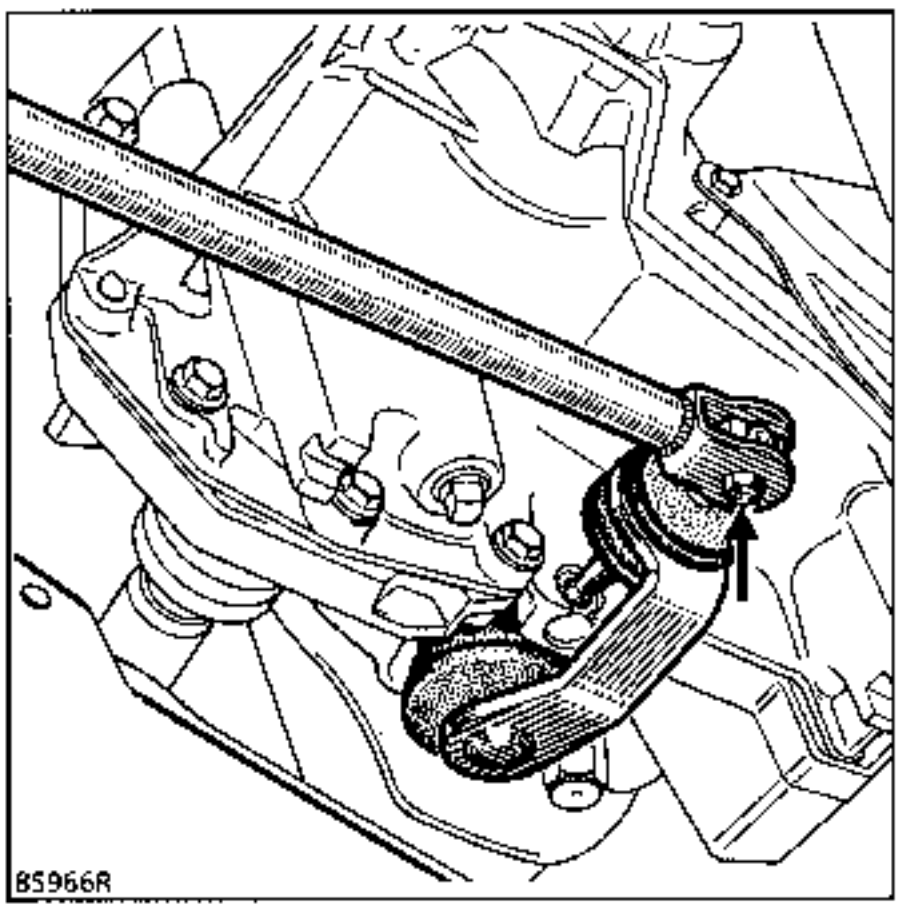


- the front mudguards,
- the bumper,
- the horn,
- the engine undertray.

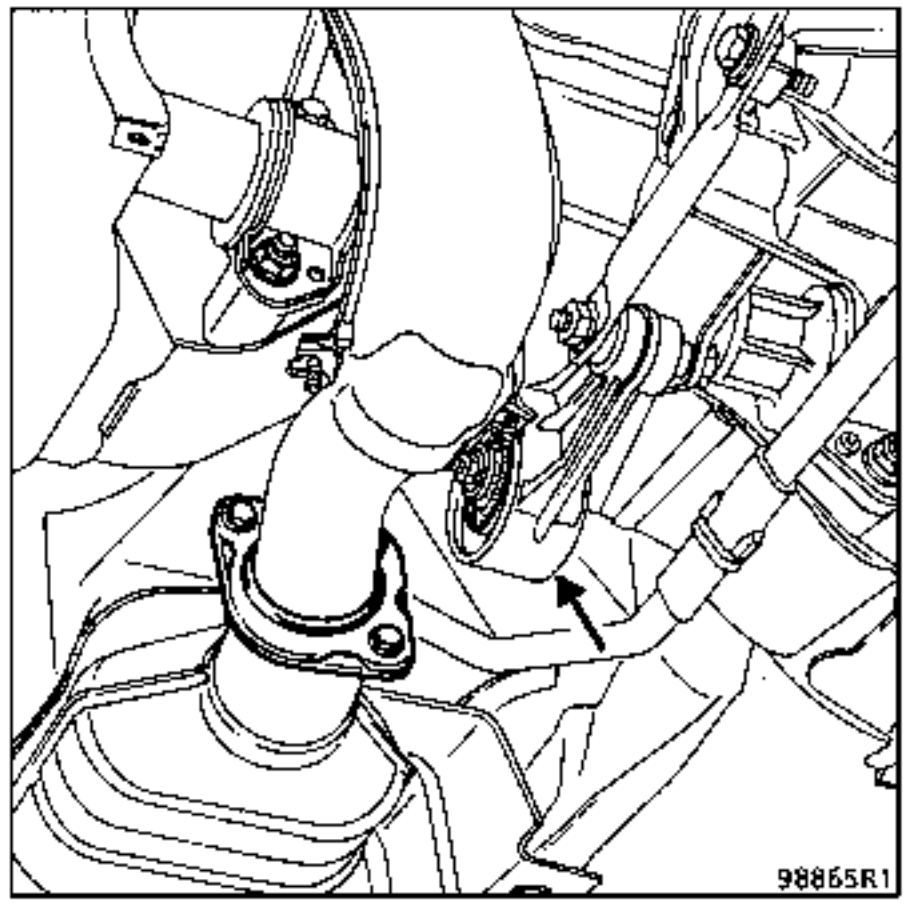
Remove the cradle - side member tie rod from the cradle.



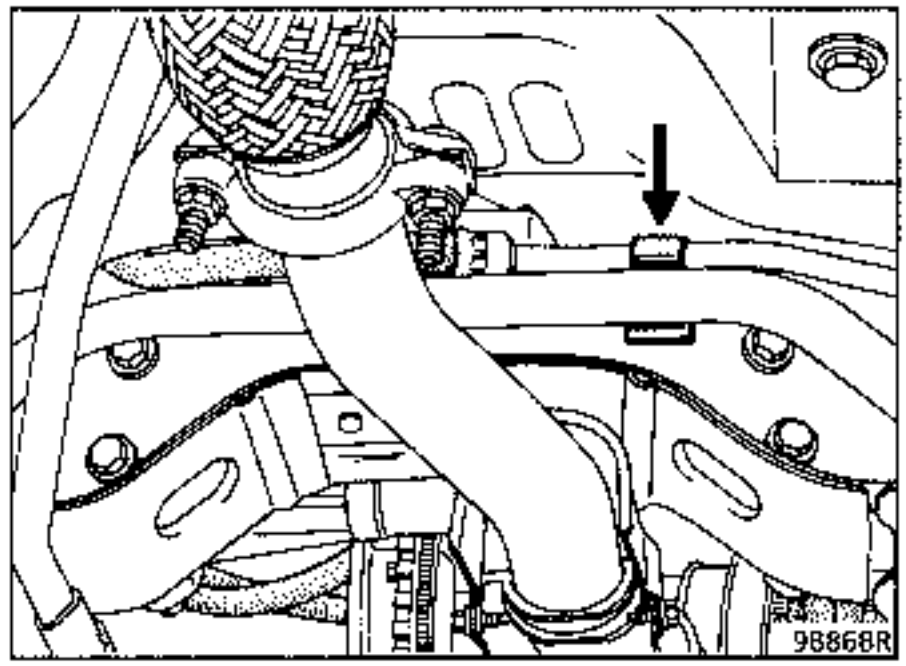
Remove:
- the gear control,

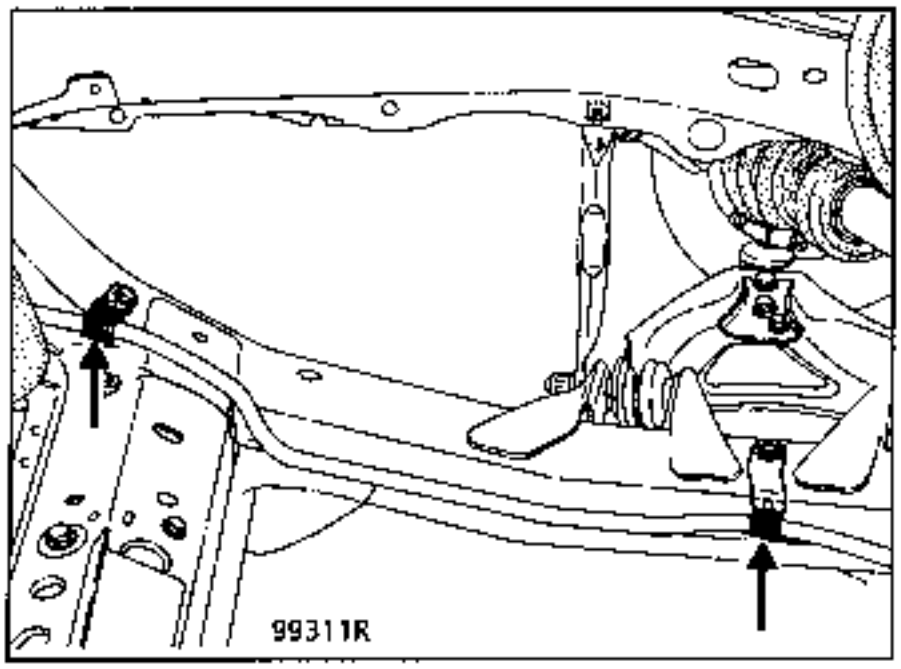


- the exhaust pipe from the manifold outlet and the flange on the expansion chamber end,
- the engine tie-bar,



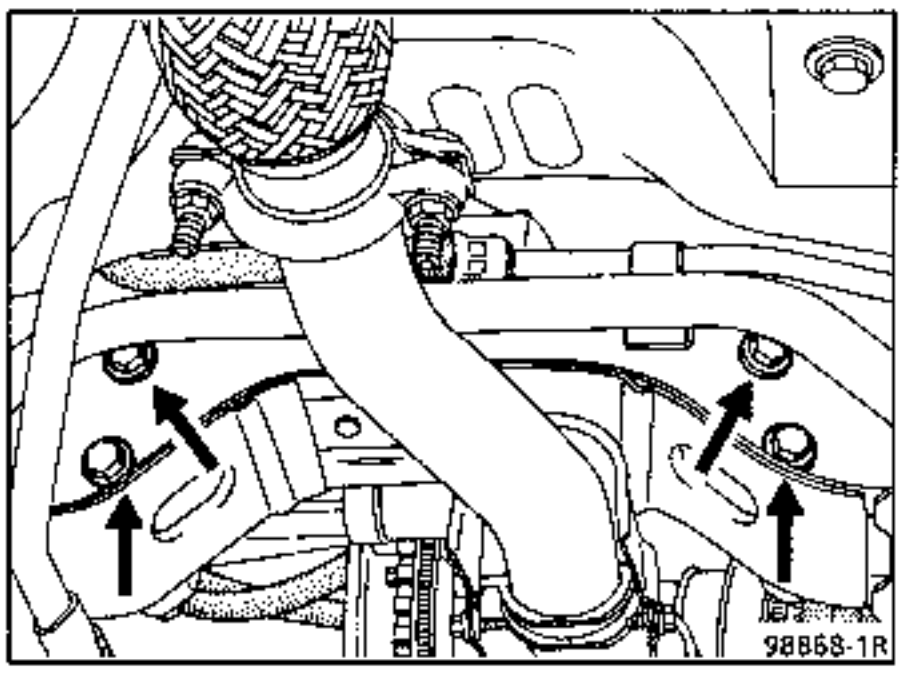
- the mounting brackets for the low pressure pipe.





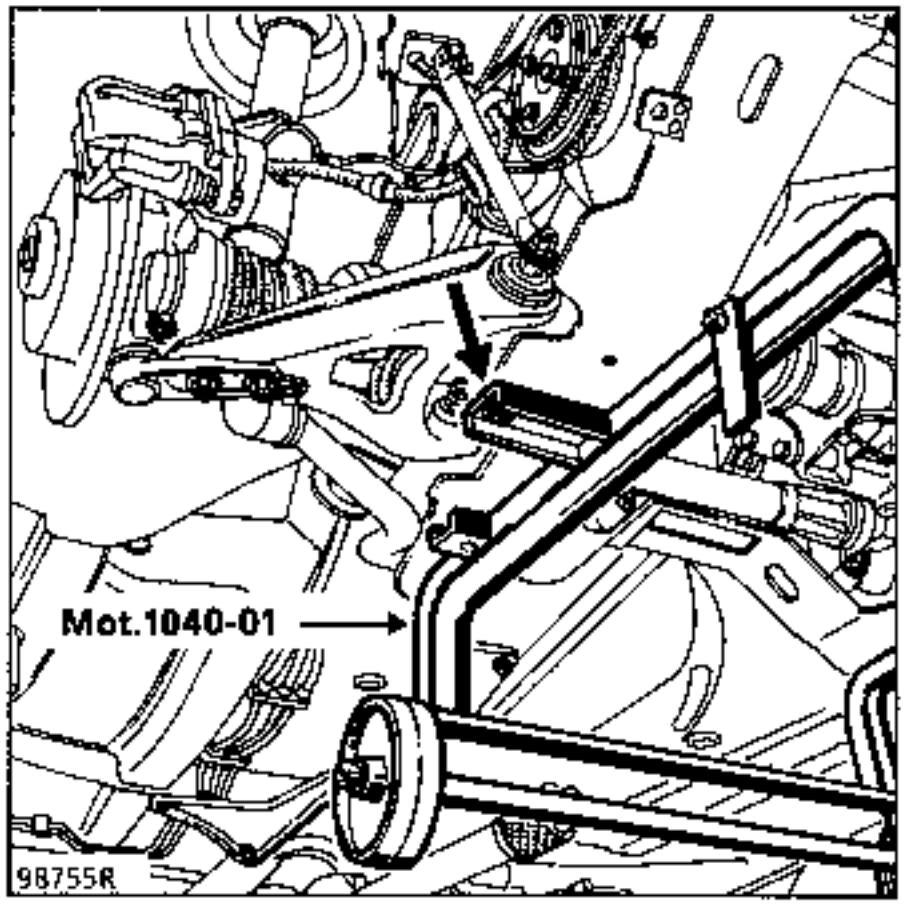
Remove:

- the mounting brackets for the high pressure pipe on the gearbox,
- the four mounting bolts for the steering box on the cradle.



Suspend the steering box and the cooling unit.

Fit tool **Mot. 1040-01** under the cradle.



Lower the lift until the the tool touches the ground.

Remove the cradle mounting bolts.

Raise the lift with care.

REFITTING (Special notes)

Renew all the cradle mounting bolts and observe the correct tightening torques.

Refitting is the reverse of removal.

NOTE : the cradle is refitted to the body in the following manner:

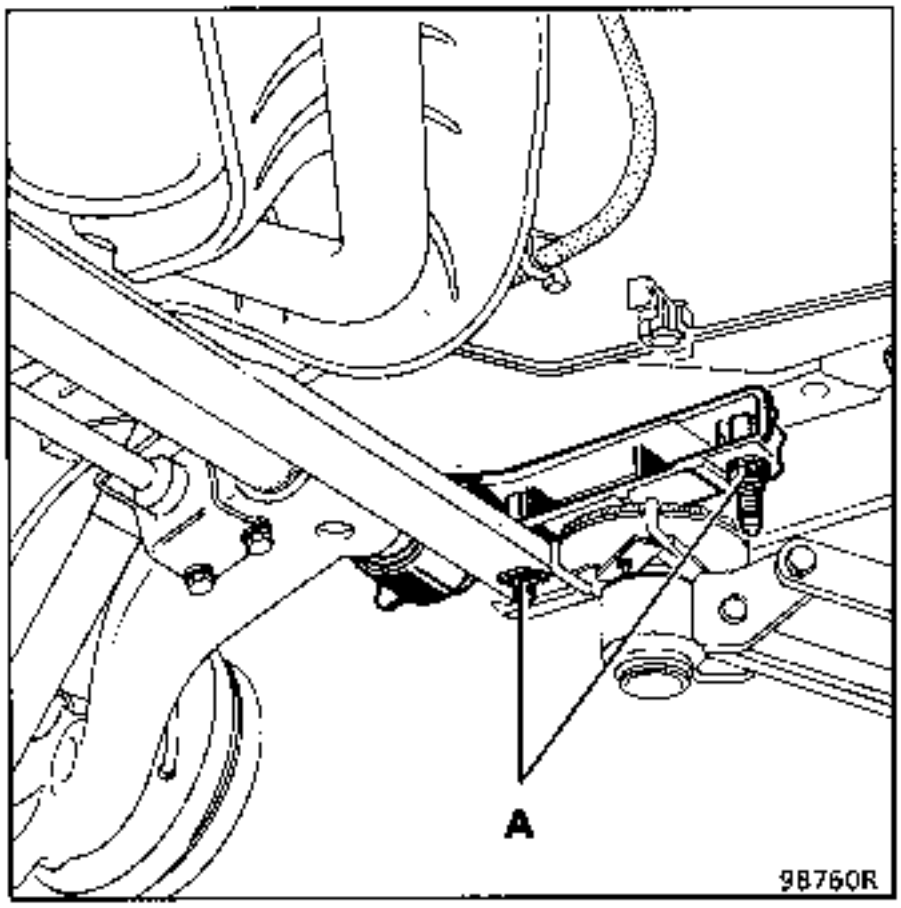
- fit two pins in the place of the front mounting bolts,
- offer up the cradle - axle assembly,
- tighten but do not lock the rear mounting bolts (start with the longer rear right hand bolt),
- replace the pins with the front mounting bolts,
- tighten the four mounting bolts to the correct torque, starting at the rear.

TIGHTENING TORQUES (in daN.m)	
Bearing mounting nut	10
Wheel bolt	9
Shock absorber base bolt	13.5

REMOVAL

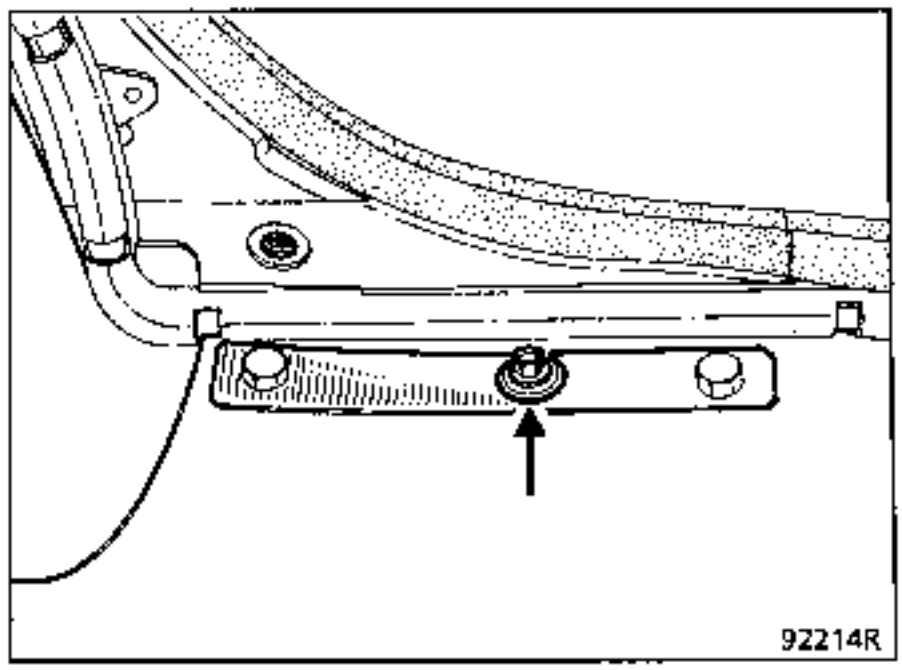
Vehicle on a two post lift, remove:
- the two lower shock absorber mountings,
- the brake pipes,
- the secondary handbrake cables, disconnecting them from the central unit under the vehicle,
- the compensator control rod.

Support the rear axle assembly and remove:
- the four bearing mounting nuts (A),



- the rear axle assembly.

NOTE : if one of the rear axle assembly bearing mounting bolts has been damaged, it can be replaced by removing the interior trim from the rear doors or the rear quarter panel to gain access to the bolt mounting plate.



REFITTING

Refitting is the reverse of removal.

Observe the correct tightening torques.

Bleed the braking circuit.

Adjust the handbrake control (see section 37).

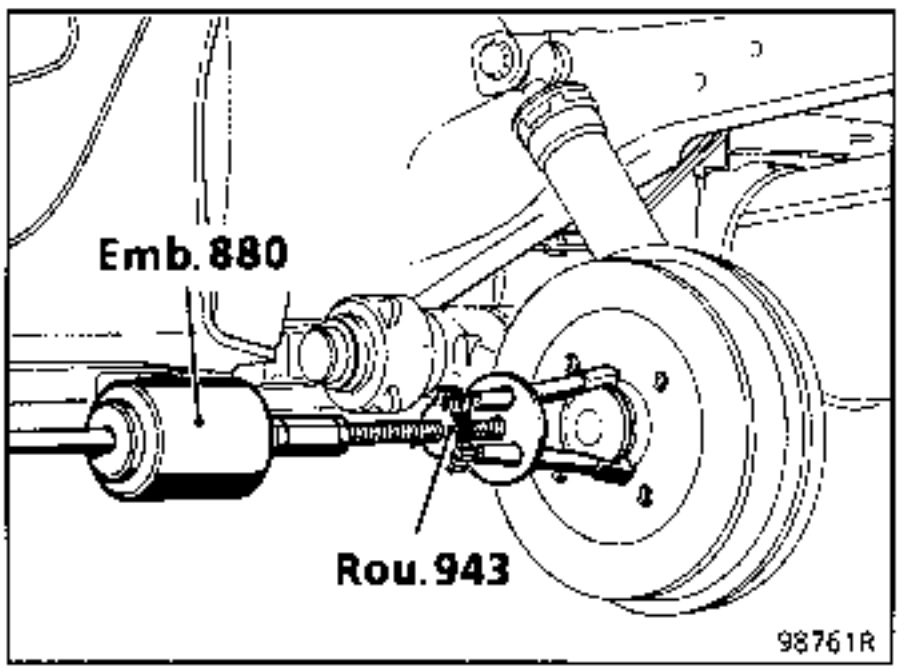
The two brake drums must be of the same diameter, if one is reground, the other must also be reground. A maximum regrinding dimension of 1 mm on the diameter is permitted.

SPECIAL TOOLING REQUIRED	
Emb. 880	Inertia extraction tool
Rou. 943	Hub cover plug extractor

TIGHTENING TORQUES (in daN.m)	
Wheel bolt	9
Hub nut	17.5

REMOVAL

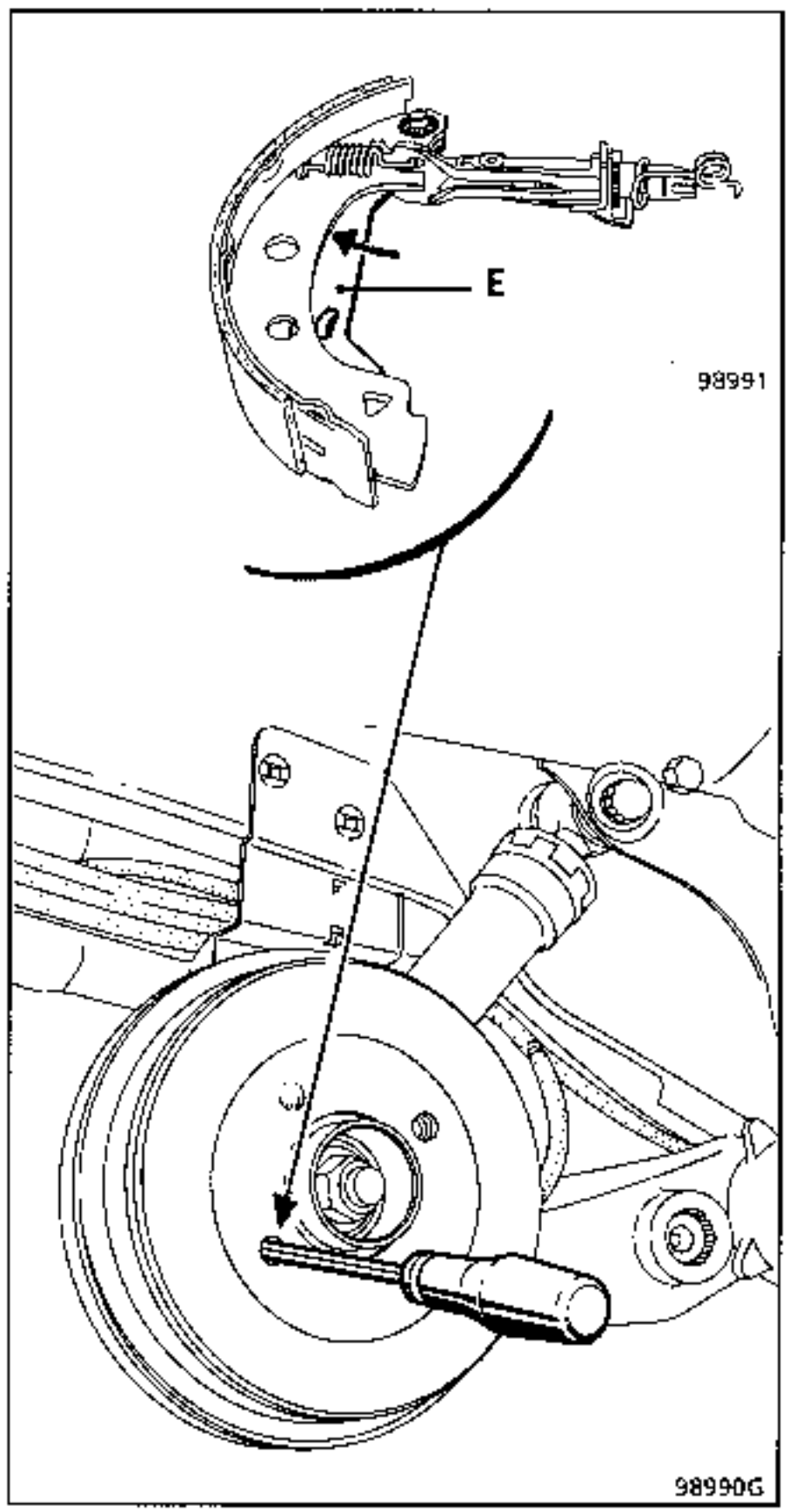
Remove the hub cover plug: use tools **Rou. 943** + **Emb. 880.**



Slacken the handbrake, slacken the secondary handbrake cables to allow the lever to move back.

Insert a screwdriver through one of the wheel mounting holes on the drum and push the handbrake lever to release the lug from the brake shoe (E).

Assist the lever in slackening off by pushing it to the rear.



Remove:
- the nut and the stub axle washer,
- the drum.

REFITTING

Remove all dust from the drum and the linings using brake cleaner.

Fit:
- the drum,
- the washer and the nut, tighten to the correct torque,
- the cover plug.

Adjust:
- the brake linings by repeatedly pressing the brake pedal,
- the handbrake (see section 37 "Controls").

TIGHTENING TORQUES (in daN.m)	
Wheel bolts	9
Hub nut	17.5
Bleed screw	0.6
Pipe bolt	1.3

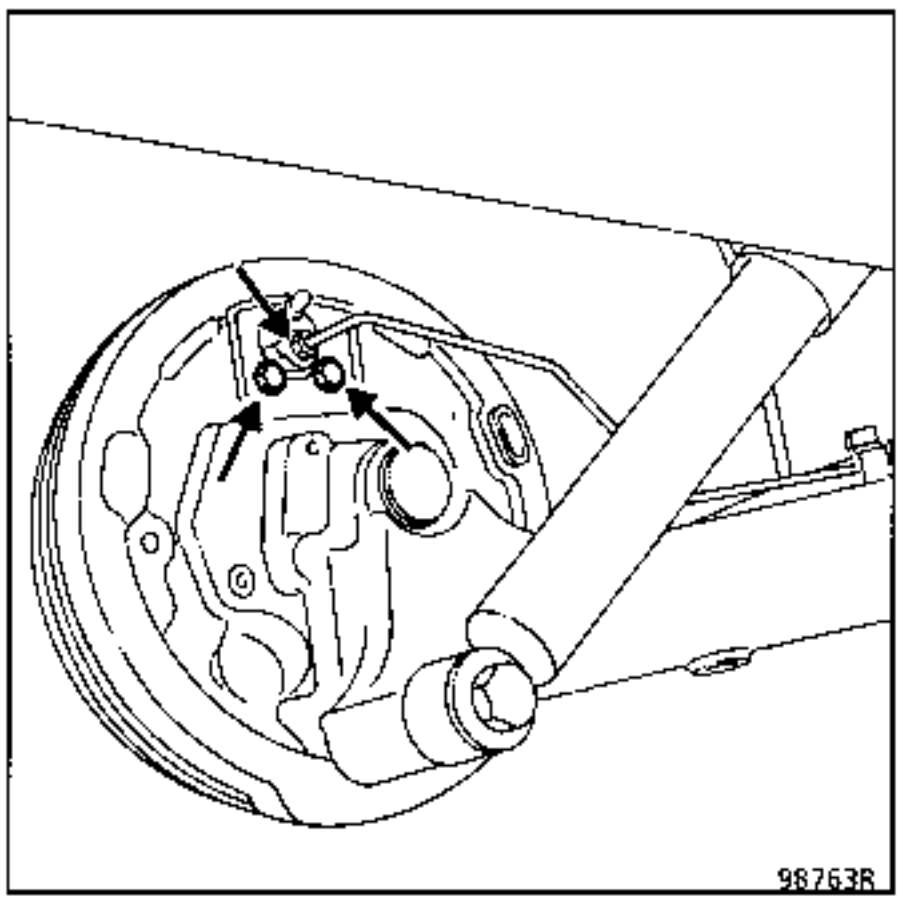
REMOVAL

Remove:
- the drum (see corresponding paragraph),
- the upper return spring (see paragraph "Brake linings").

Separate the brake shoes.

Unscrew:
- the rigid pipe union on the brake cylinder using a pipe wrench,
- the two mounting bolts securing the cylinder on the backing plate and remove it.

Check the condition of the brake shoes; particularly if they show traces of oil, renew them.



REFITTING

Remove all dust from the drum and the linings using brake cleaner.

Refitting is the reverse of removal.

Bleed the braking circuit.

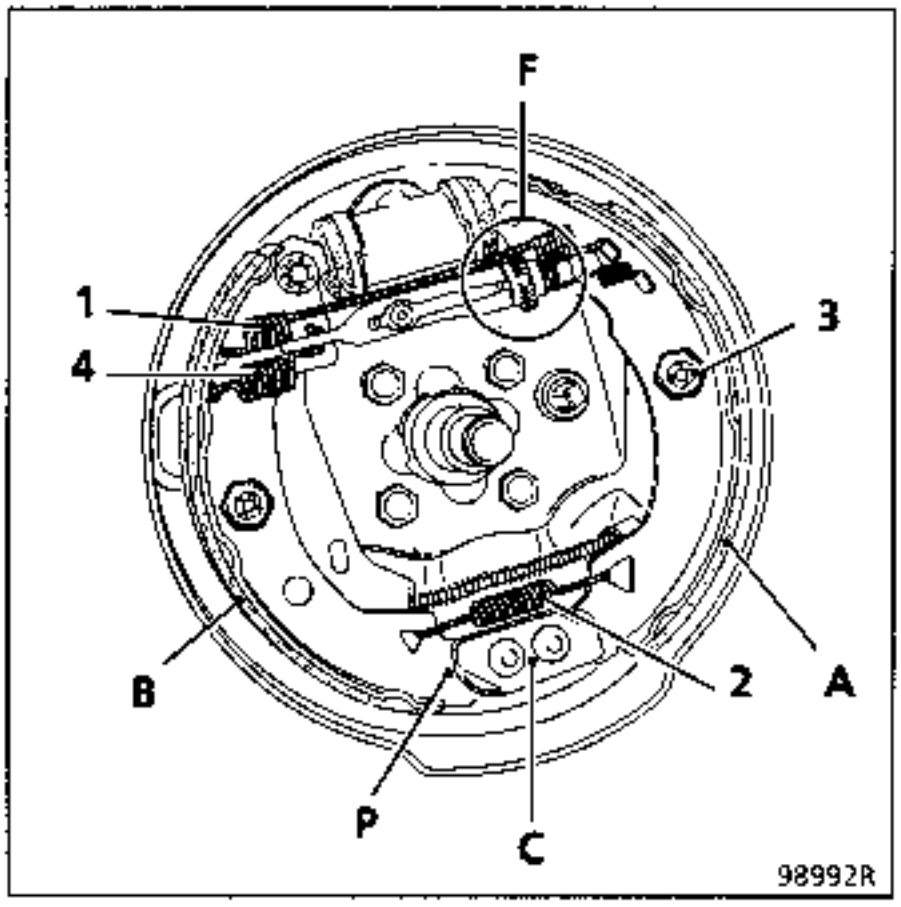
Adjust the linings by repeatedly pressing the brake pedal.

Check the cut-off pressure (see section 37 "Controls").

SPECIAL TOOLING REQUIRED	
Emb. 880	Inertia extraction tool
Rou. 943	Hub cover plug extractor

TIGHTENING TORQUES (in daN.m)	
Wheel bolts	9
Hub nuts	17.5

Composition of the BENDIX 203 x 38 RAI (Incremental automatic wear compensation) brake.

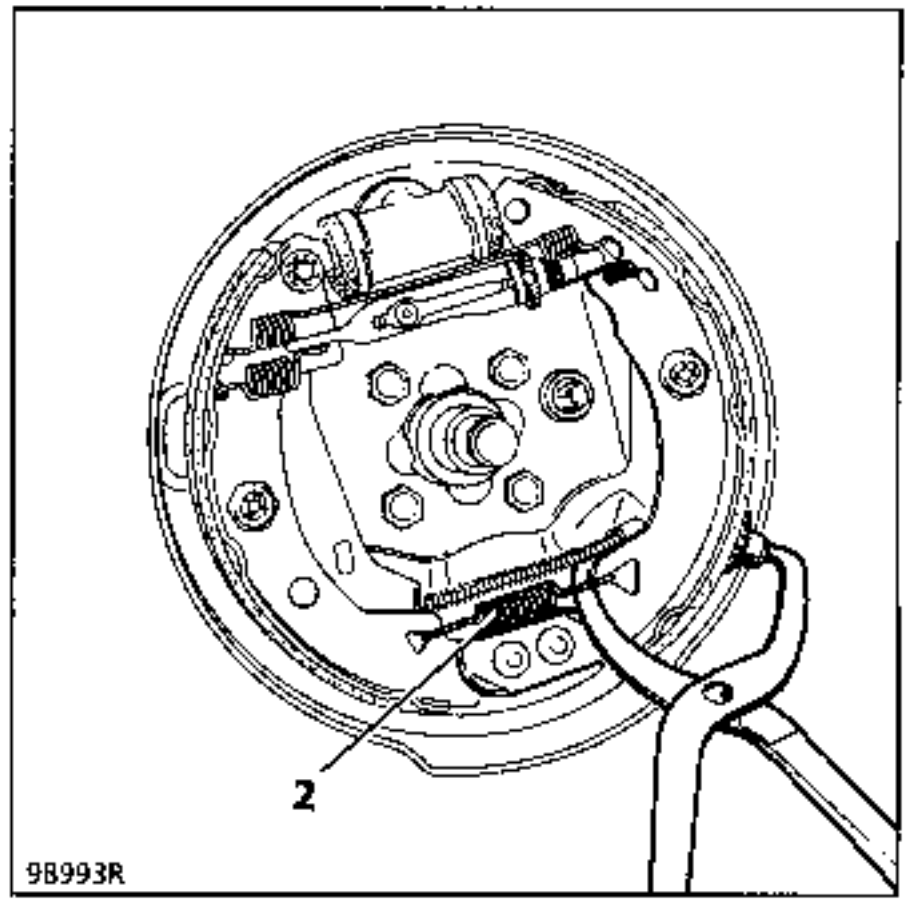


A Primary shoe
B Secondary shoe
C Fixed point
P Brake shoe base
F Incremental automatic wear compensation (RAI)
1 Upper return spring
2 Lower return spring (at base)
3 Lateral support
4 Handbrake lever return spring

REMOVAL

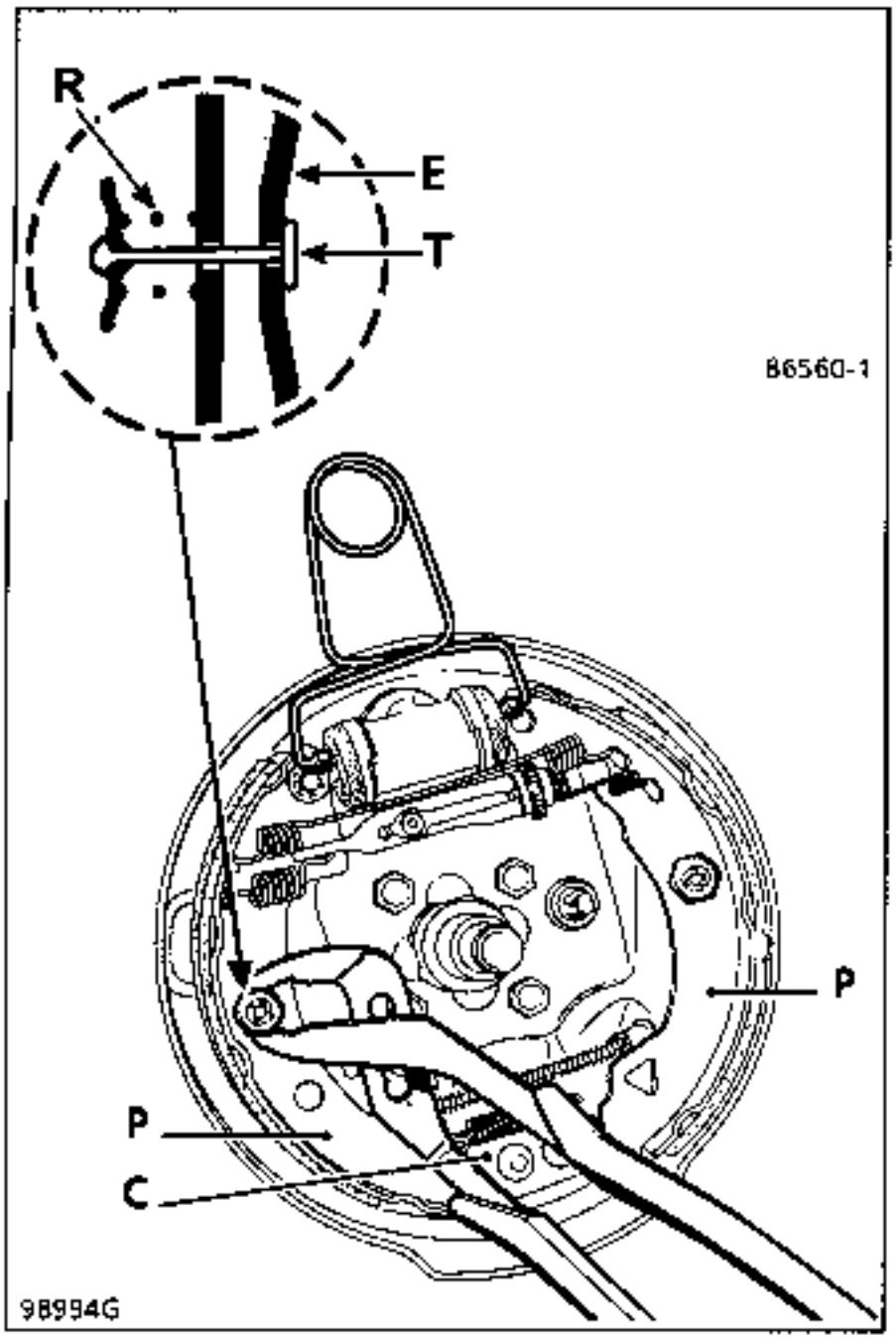
Both sets of brake shoes should be replaced on the same axle - never fit brake linings of different makes and qualities.

Remove:
- the brake drum (see corresponding paragraph),
- the lower spring (2) using brake shoe pliers.



Fit a clamp to the brake cylinder pistons.

Using adjustable pliers, remove the springs (R) supporting the brake shoes at the side while holding the connecting rod (T) in contact with the brake backing plate (E).

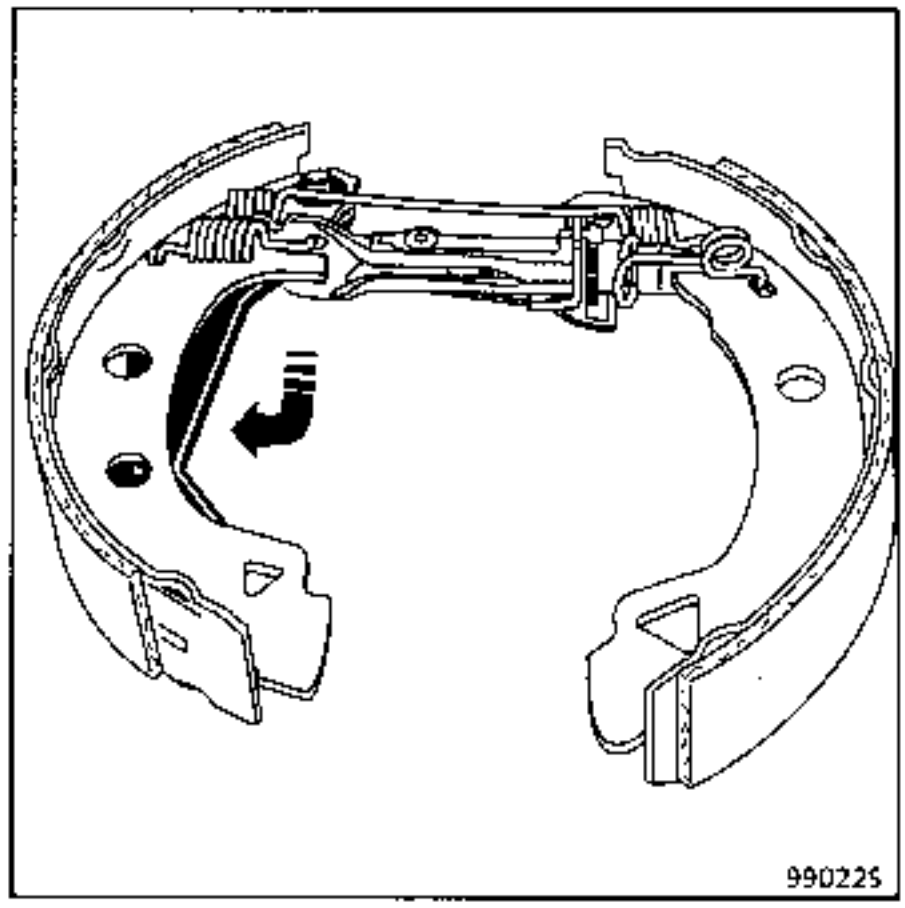


Pass the base of each brake shoe (P) above the fixed point (C) in turn. Squeeze the bases of the brake shoes together, to separate the other ends at the brake cylinder.

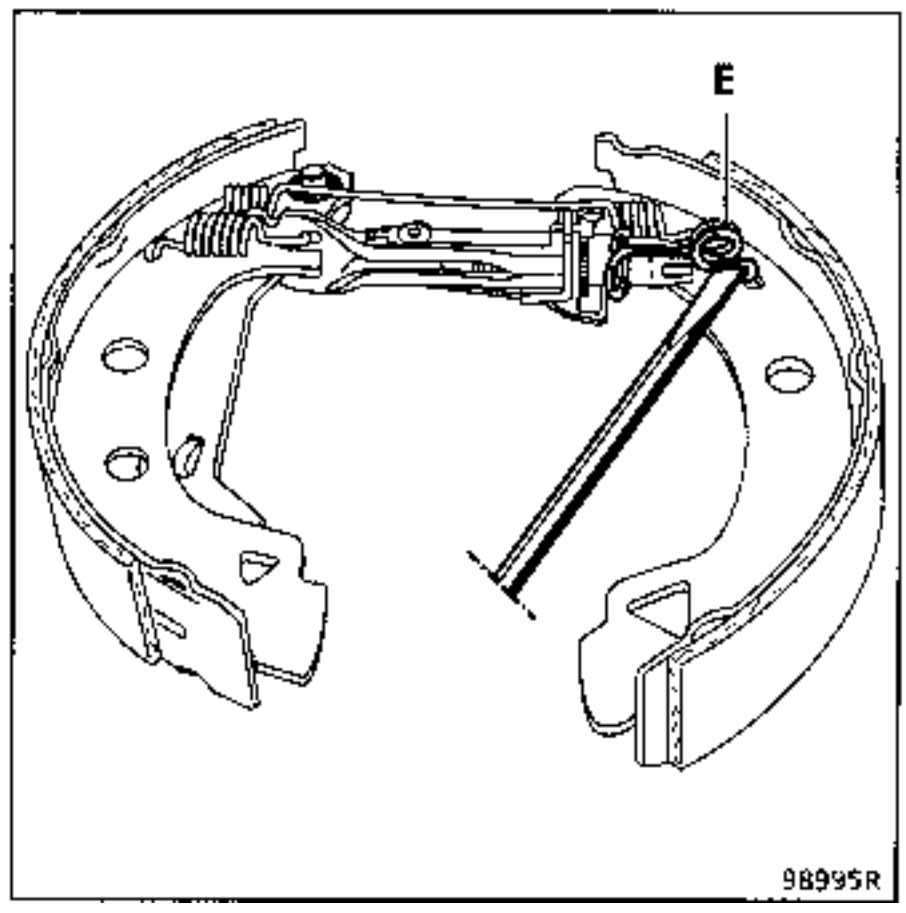
Separate the assembly (RAI and brake shoes) from the backing plate, then remove it after releasing the handbrake cable.

On the bench, separate the RAI and the brake shoes.

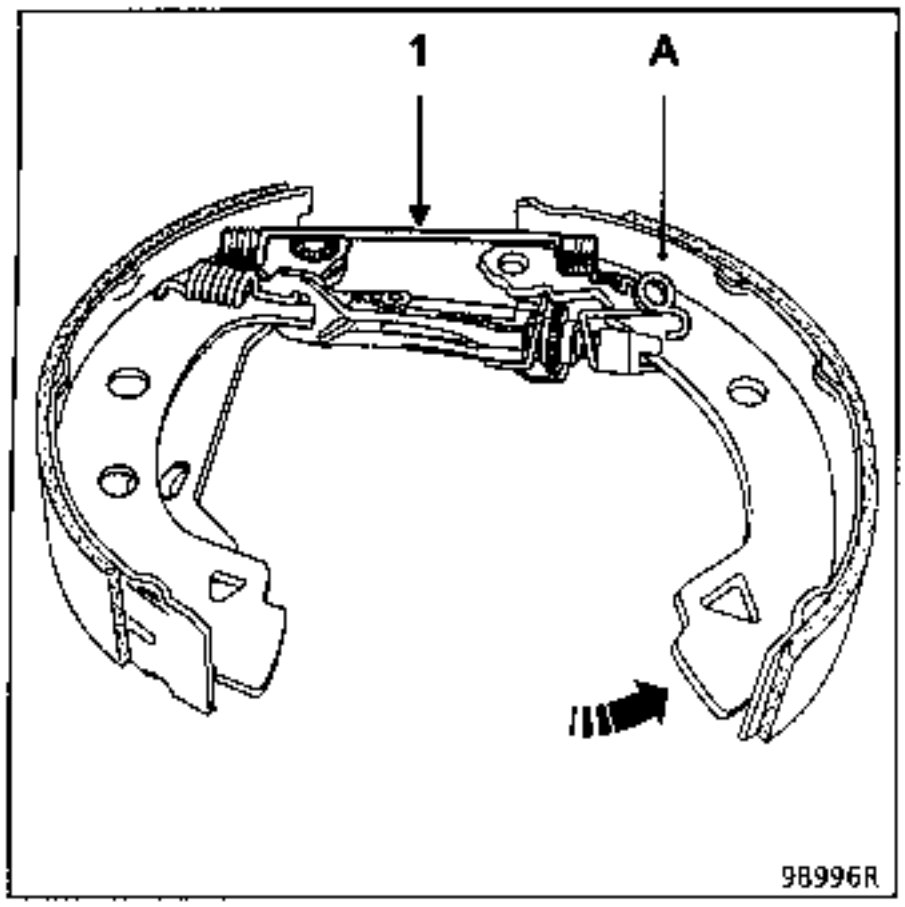
Disarm the handbrake lever.



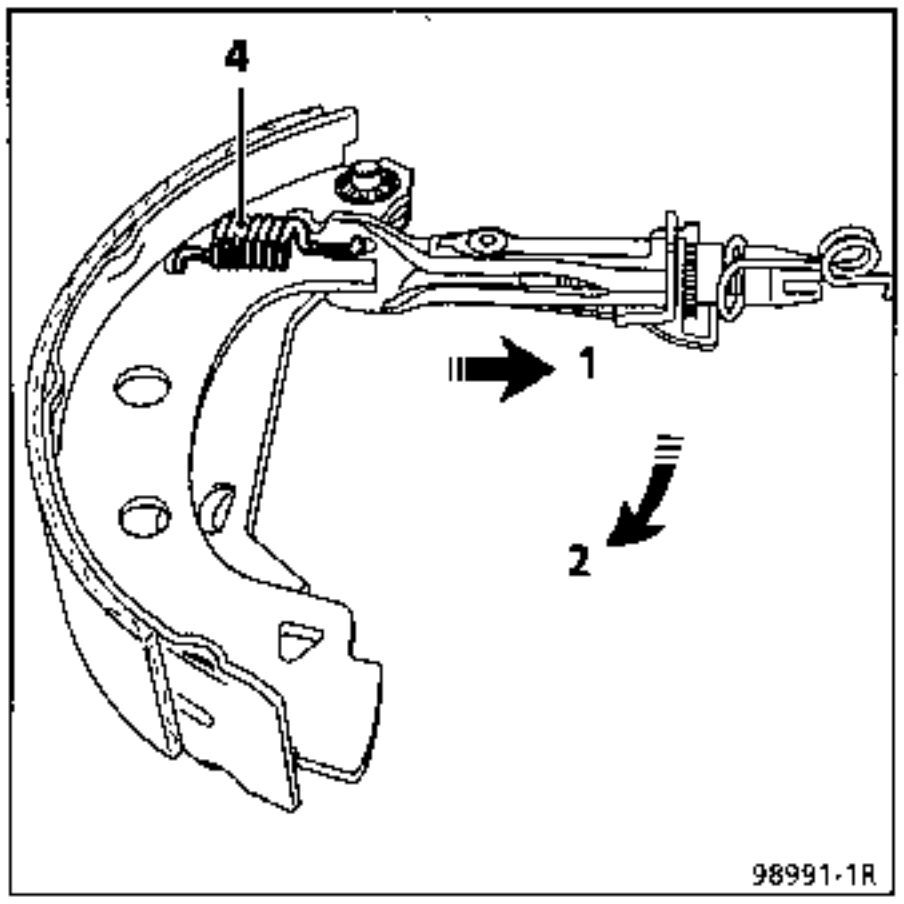
Use a screwdriver to release pin (E).



Pivot the primary brake shoe (A), following the arrow, so that the head of the RAI bolt is released. This allows the upper spring (1) to be easily removed.



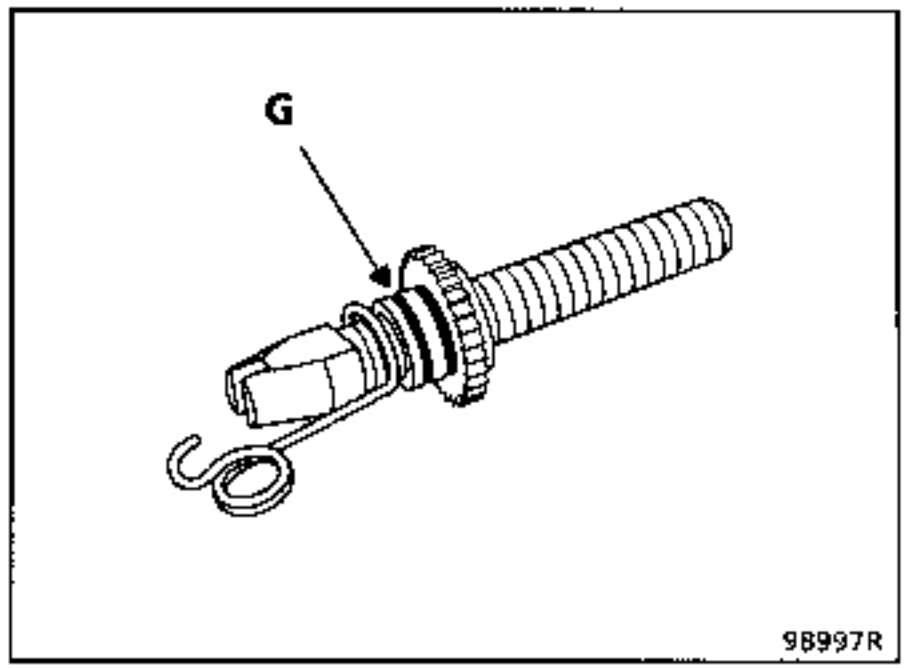
To remove the RAI assembly, pull in the direction of the arrow (1) then pivot as shown by arrow (2). Remove the spring (4) and the handbrake lever.



NOTE : Use brake cleaner to remove all the dust from the components.

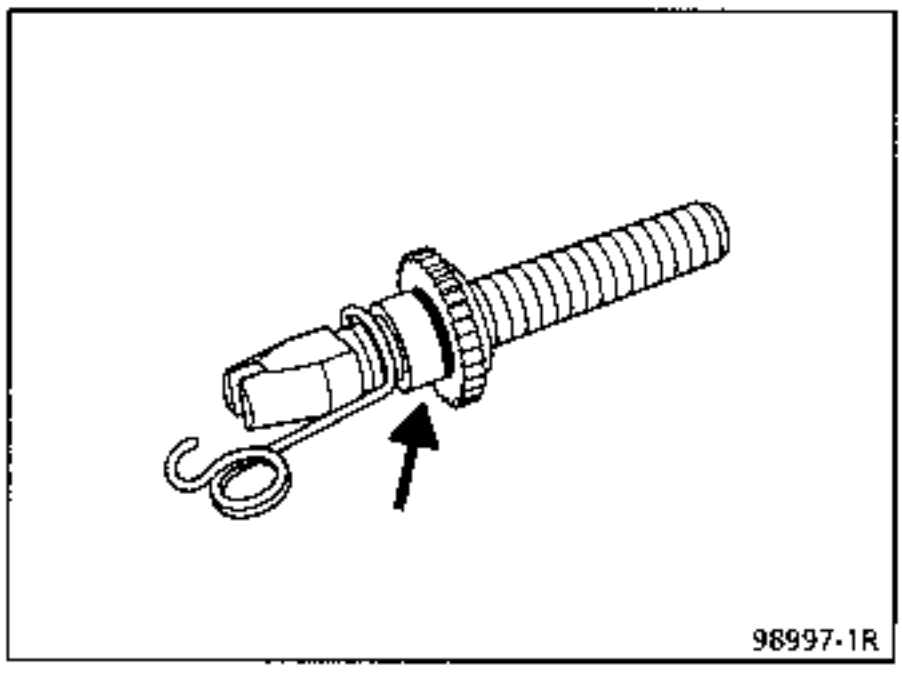
Marking and refitting of the RAI component parts

Left hand bolt and notched nut



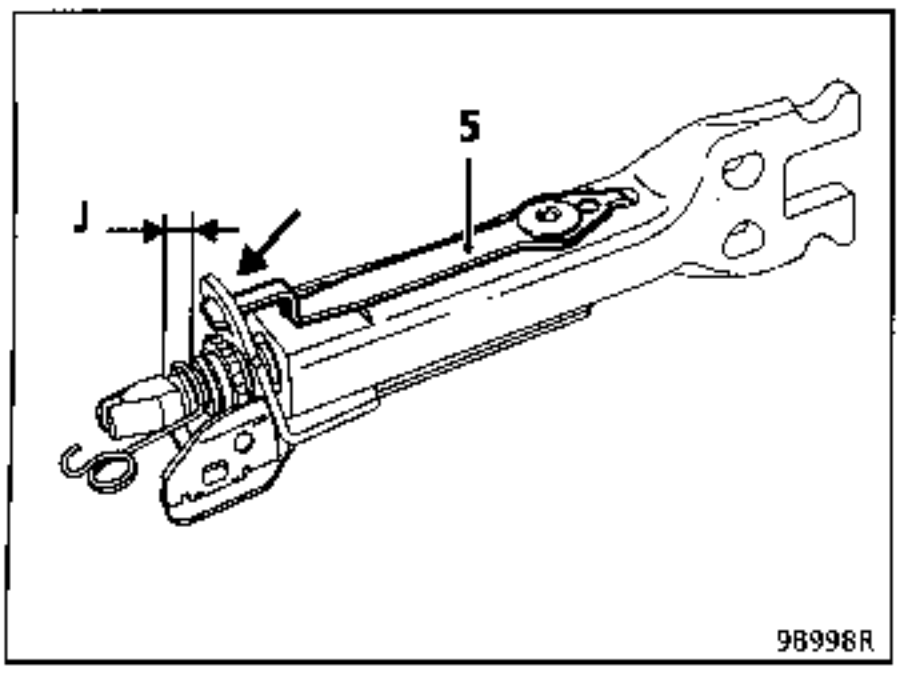
The bolt has a left hand thread, the notched nut has two grooves (G).

Right hand bolt and notched nut



The bolt has a right hand thread and the notched nut has one groove.

Left hand RAI assembly



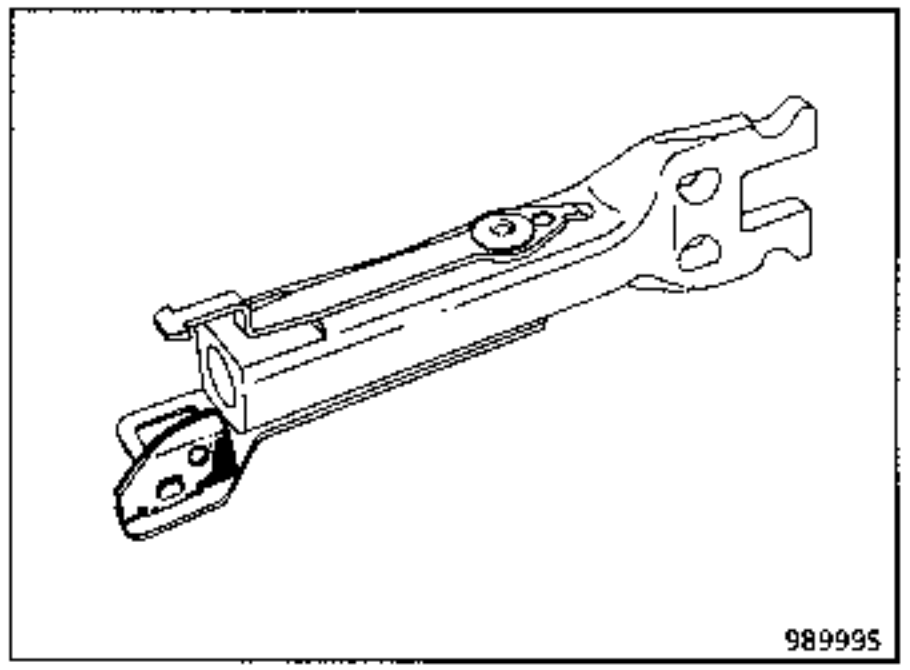
Right hand RAI assembly

The body and the bracket are inverted, but the blade (5) should be on the top.

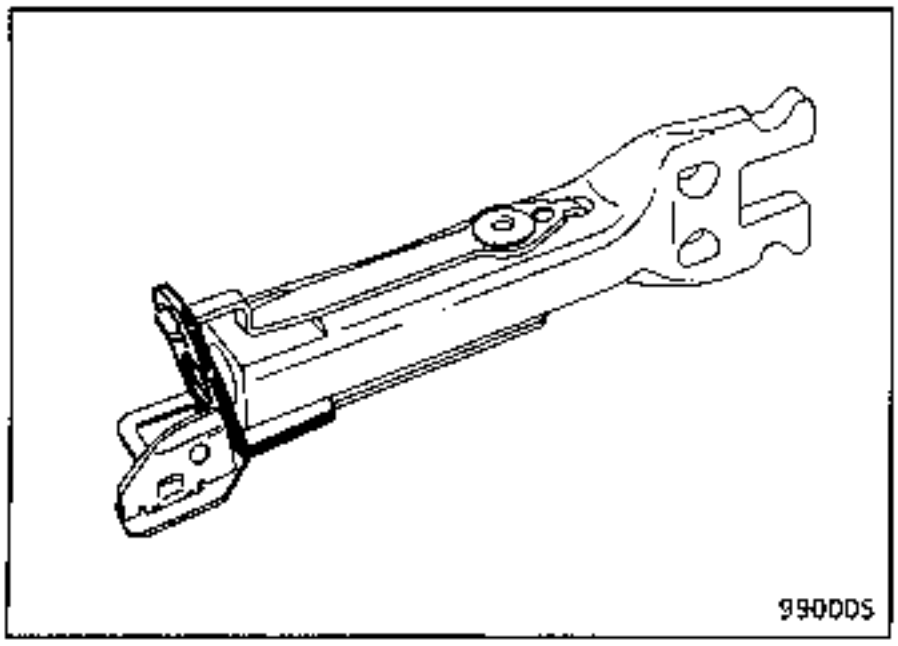
In both cases, the pin attachment point should not be held firmly between the head of the bolt and the notched nut - leave a slight amount of play (J).

Refitting the RAI

Ensure the ratchet is correctly positioned.



Refit the bracket so that the fuller section is between the blade and the bar.

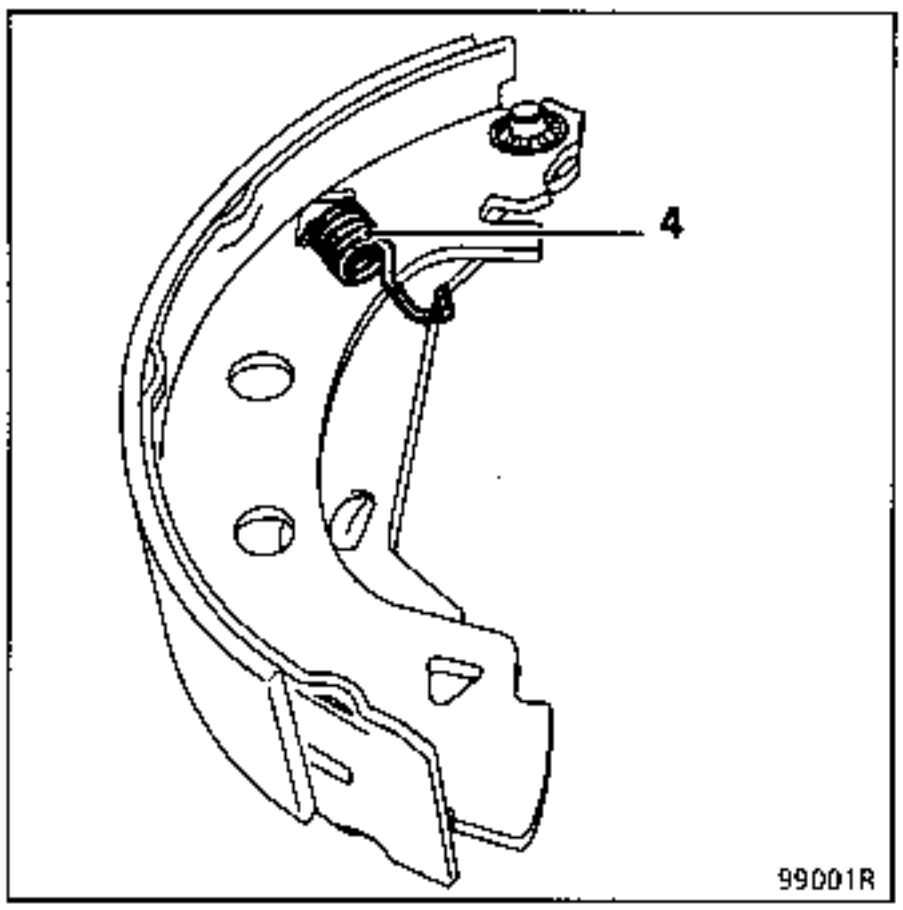


Now assemble the bars with their respective nuts and bolts. Right hand bolt, pin and nut in the right hand bar, through the hole in the bracket and the same on the left hand side.

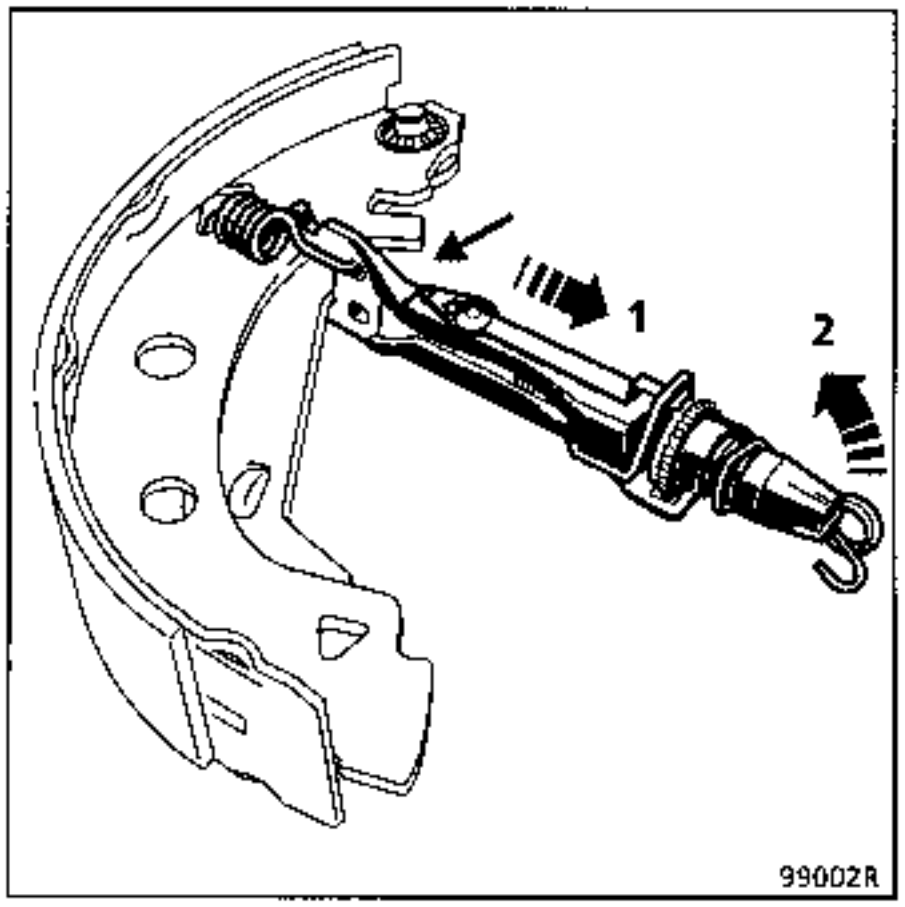
Refit the RAI assembly and the brake shoes on the bench.

Lift the handbrake lever on the secondary brake shoe using a new clip, then disarm the lever.

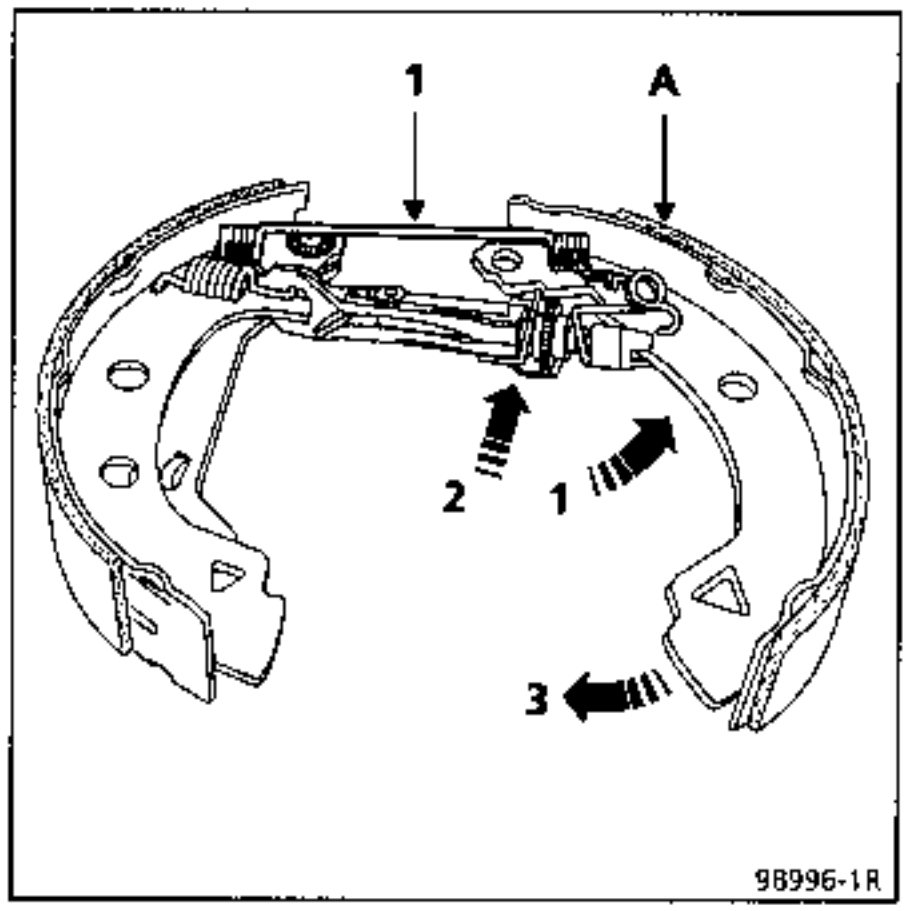
Position the spring (4) in the lug on the brake shoe, ensuring it is correctly fitted; the shorter hook is fitted to the brake shoe.



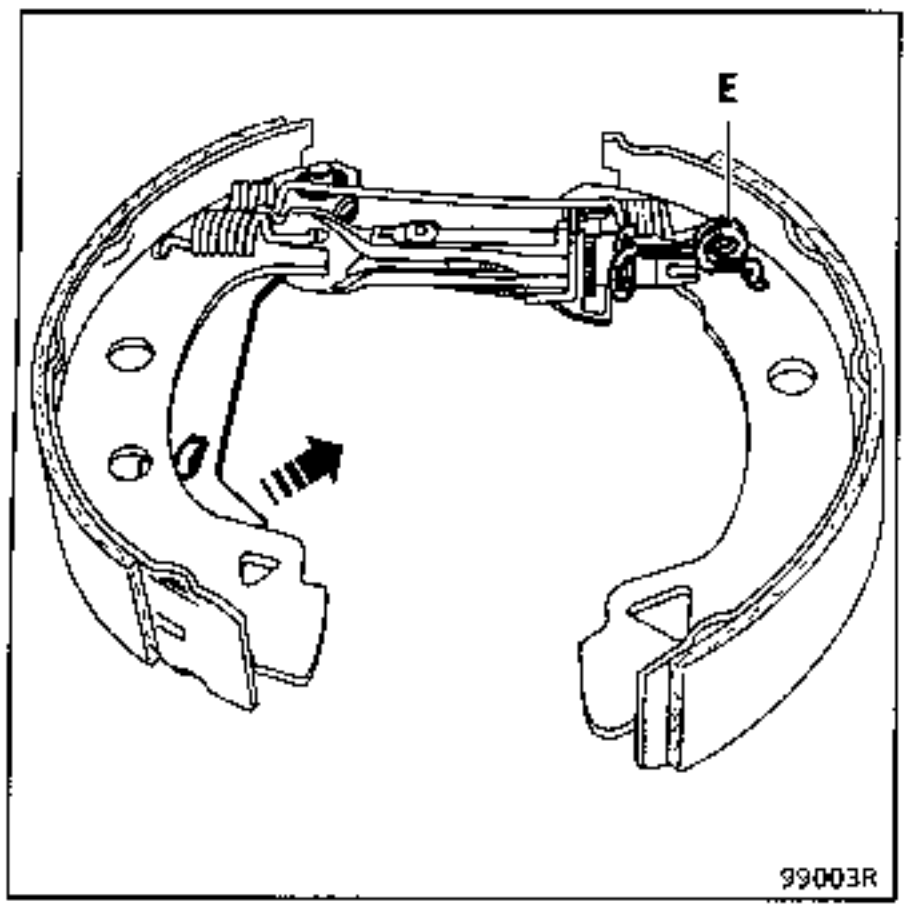
Attach the RAI assembly to the spring (4) then pull as shown by the arrows. The RAI assembly will automatically move to its operating position.



Position the upper spring (1) into the lugs on the two brake shoes, then pull as shown by the arrows, the slot of the bolt should be positioned in that for the primary brake shoe (A).



Attach the pin (E) and rearm the handbrake lever.



REFITTING

Position the assembly on the vehicle.

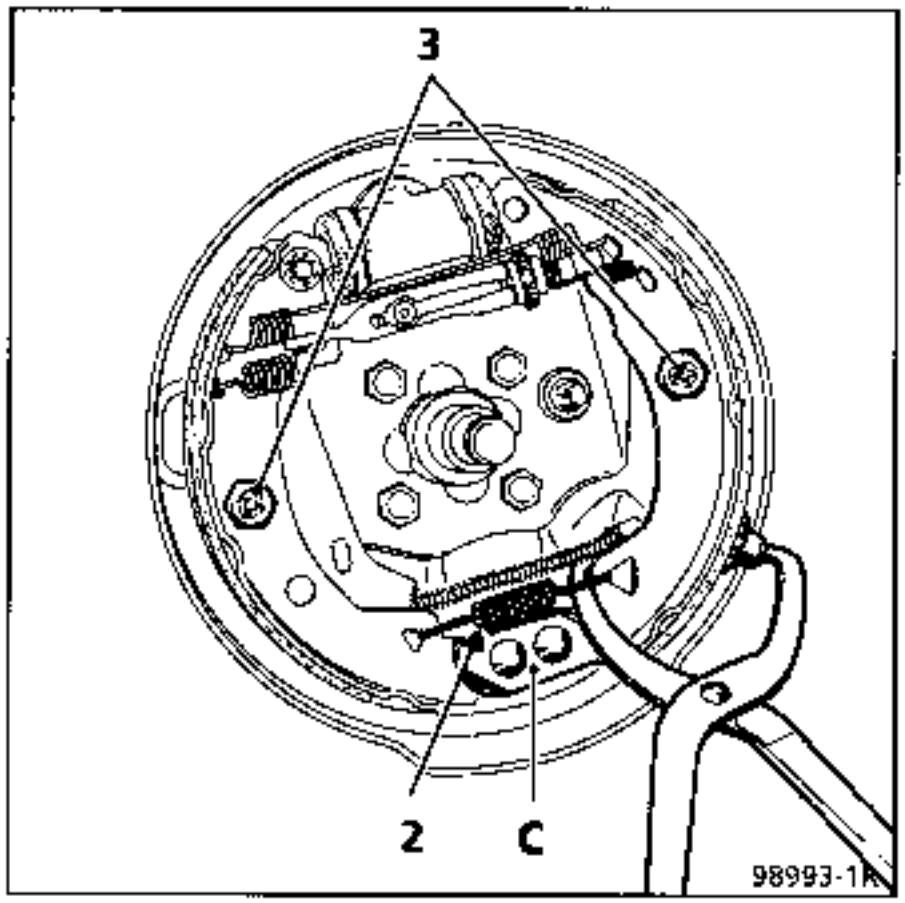
Attach the handbrake cable to the lever.

Squeeze the brake shoes and position the noses on the brake cylinder pistons. Take care not to damage the covers.

Position the brake shoes on the fixed point (C).

Fit the lateral supports into position (3).

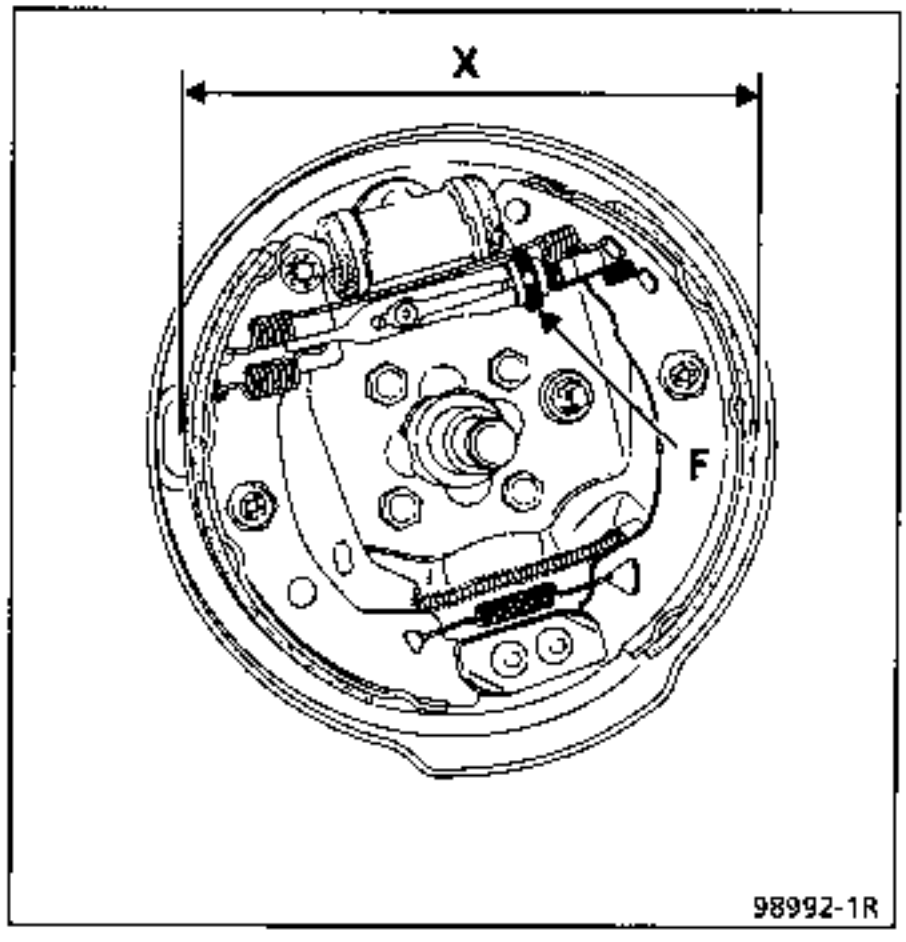
Remove the clamp from the brake cylinder pistons then refit the lower spring (2).



ADJUSTMENT

Using a screwdriver, adjust the brake shoe diameter using the notched segment (F) to obtain a diameter (X) between:

202.5 mm and **202.7 mm**.



Perform the same adjustment on the other brake backing plate.

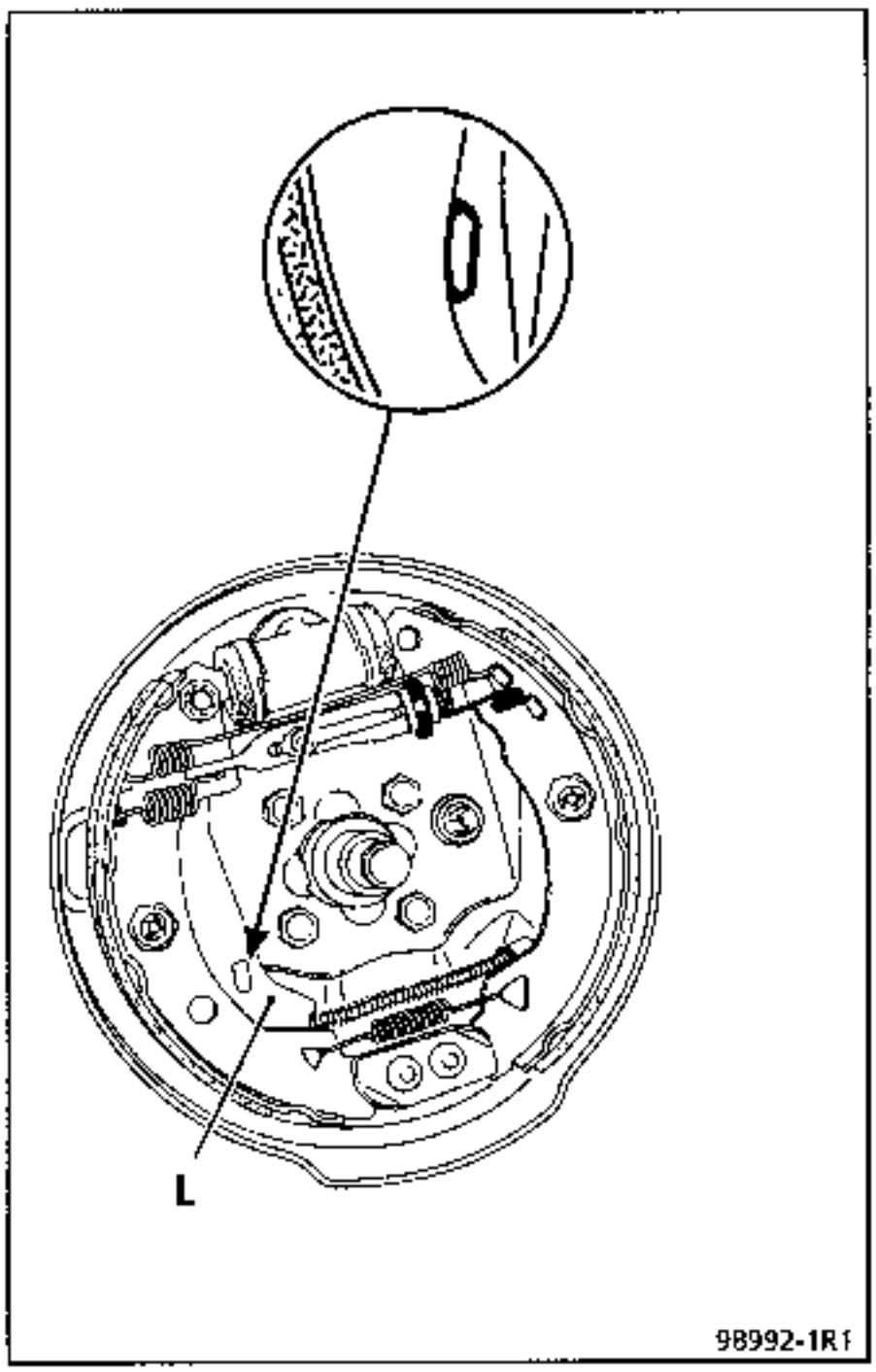
Refit the drums without tightening the nuts.

Adjust the linings by repeatedly applying the brake pedal (approximately 20 times).

Ensure the RAI is operating correctly (characteristic "click" from the drums).

Remove the drums.

Ensure:
- the cables slide correctly,
- the handbrake levers (L) are in the correct position against the brake shoes.



Progressively tighten the cables at the central adjustor so that levers (L) start to move between the 1st and 2nd notch of the control lever travel and remain applied from the 2nd notch.

Lock the lock nut on the central adjustor.

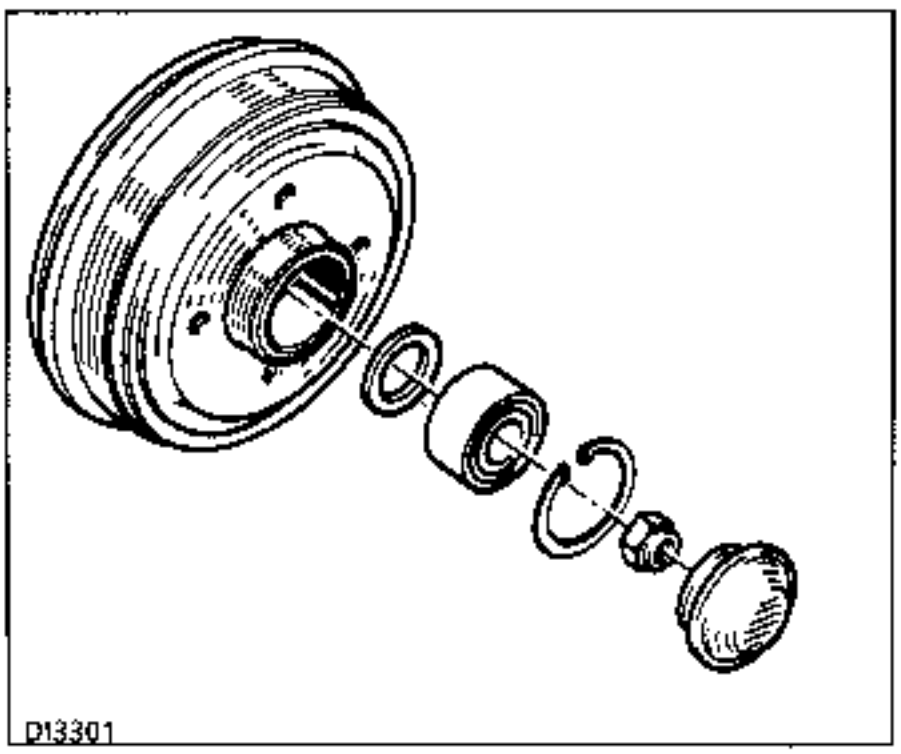
Refit:
- the drums and tighten the nuts to a torque of **17.5 daN.m,**
- the cover plugs.

SPECIAL TOOLING REQUIRED		
Emb.	880	Inertia extraction tool
Rou.	943	Hub cover plug extractor

TIGHTENING TORQUES (in daN.m)	
Hub nut	17.5
Wheel bolts	9

CHECKING

Use a dial gauge on the hub to check the axial play : **0 to 0.03 mm maximum.**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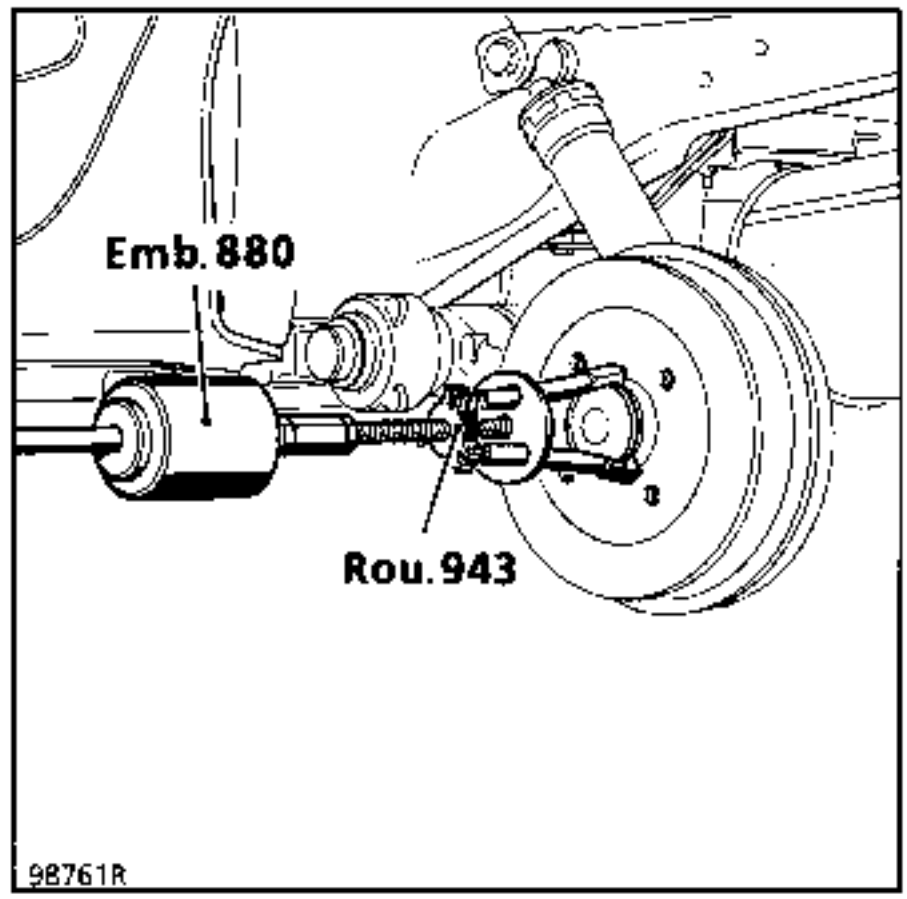
REMOVAL

Remove:
- the hub cover plug: tools **Rou. 943 + Emb. 880,**



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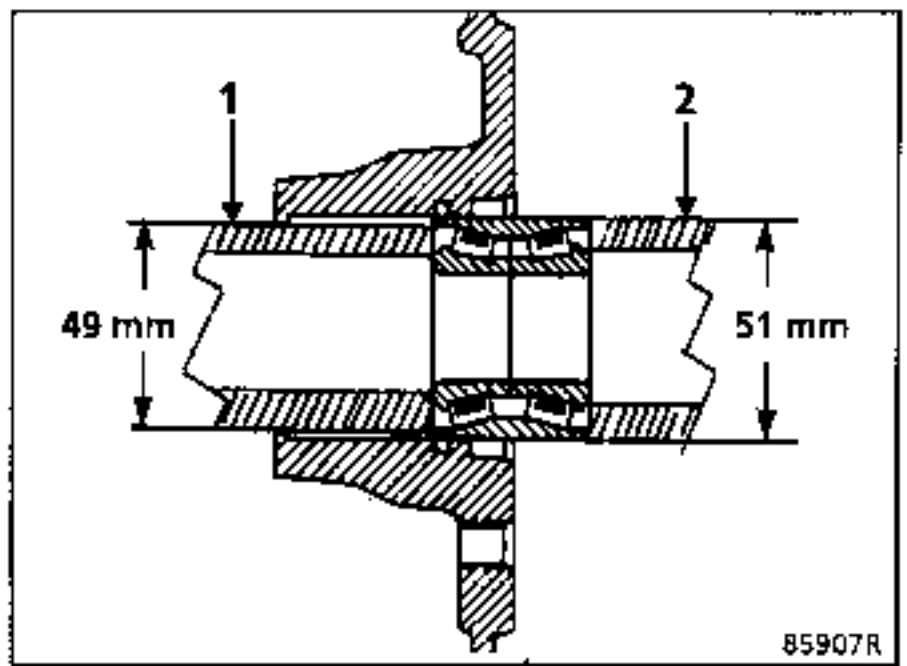
- the drum (see corresponding paragraph).

Extract from the drum:
- the bearing retaining clip,
- the bearing using a tube (1).



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REFITTING

Using a tube (2) and a press, press on the bearing until it touches the shoulder.

Fit:
- a new clip,
- the drum on the previously lubricated stub axle: SAE 80W oil,
- the new lock nut and torque tighten it,
- the hub cover plug.

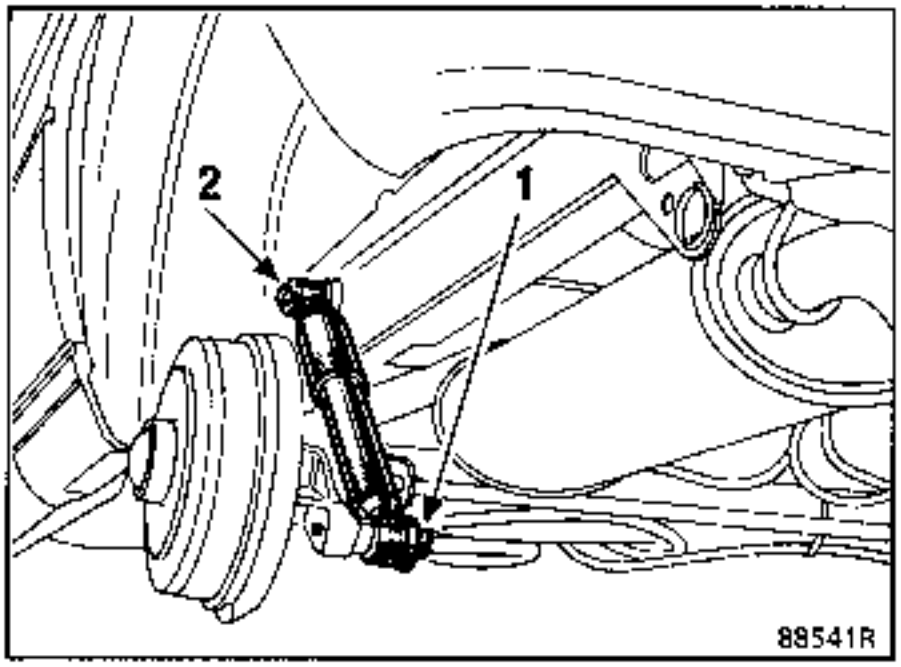
Adjust:
- the brake linings by repeatedly applying the brake pedal,
- the handbrake (see section 37 "Controls").

TIGHTENING TORQUES (in daN.m)	
Upper mounting bolt	10
Lower mounting bolt	13.5

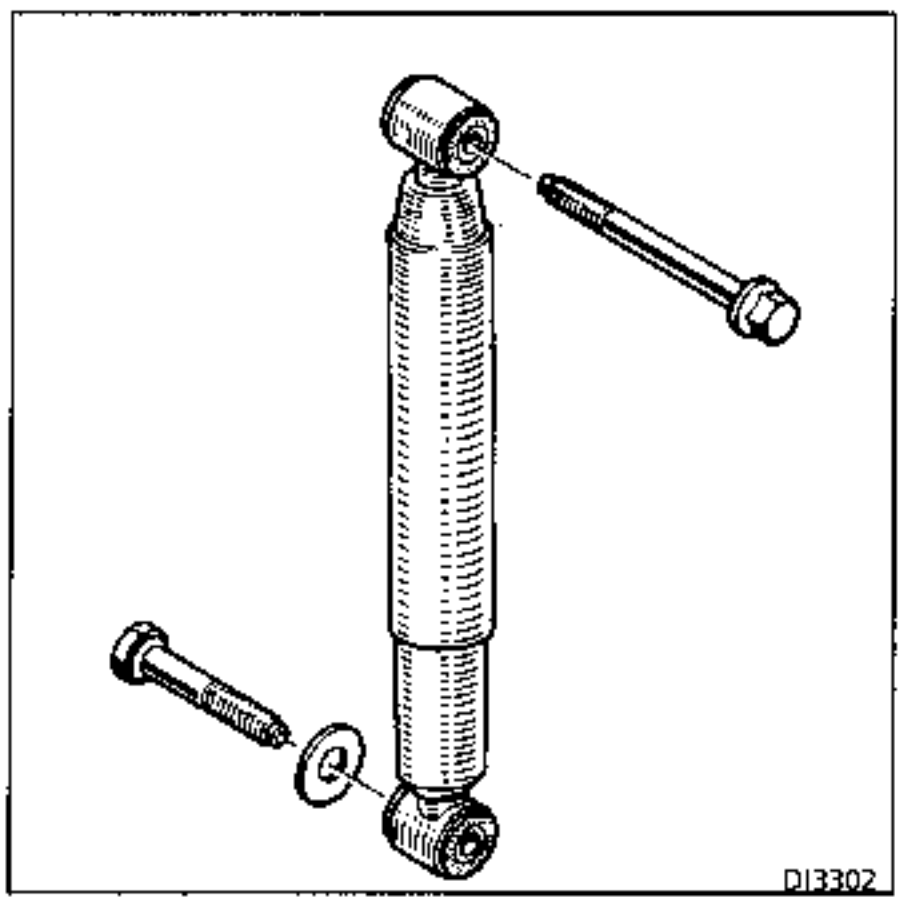
REMOVAL

With the vehicle on its wheels, remove the lower mounting bolt (1).

Lift the vehicle and remove:
- the wheel,
- the upper mounting bolt (2),



- the shock absorber.



PRECAUTIONS TO BE TAKEN BEFORE FITTING

Shock absorbers are stored horizontally in the Parts Stores.

Under these conditions it is possible that the shock absorbers, which are designed to operate in a vertical direction, will have de-primed.

Before fitting the shock absorbers to the vehicle, compress them a few times by hand in the vertical position.

REFITTING

Fit:
- the shock absorber,
- the upper mounting bolt coated with **MOLYKOTE BR2** without tightening it,
- the wheel.

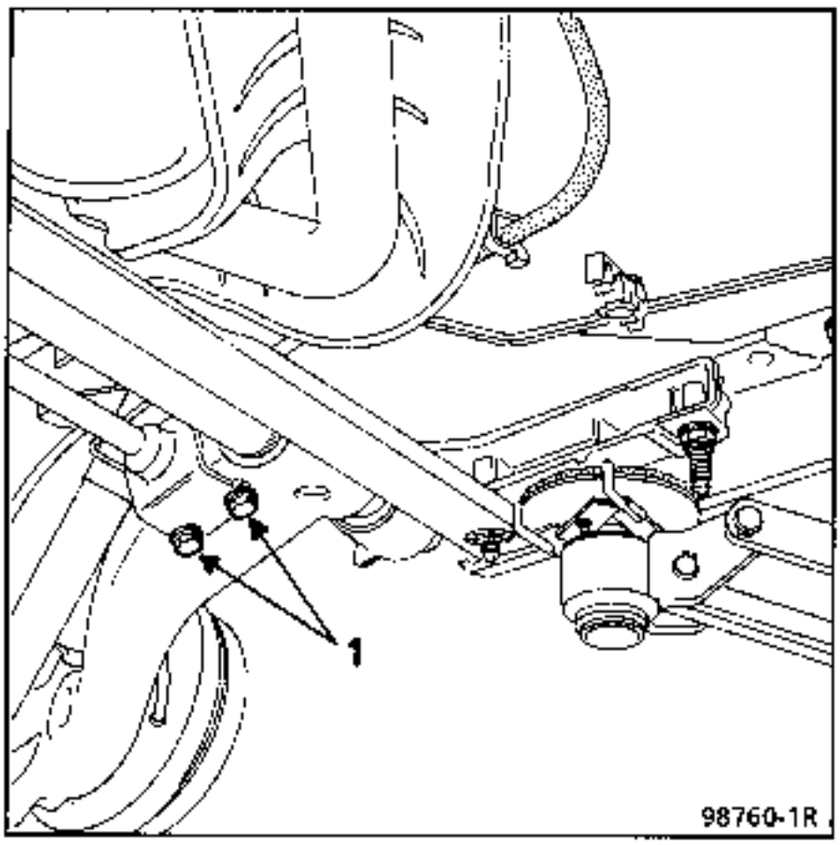
Lower the vehicle.

Position the lower mounting bolt coated with **MOLYKOTE BR2.**

Torque tighten both bolts.

TIGHTENING TORQUES (in daN.m)	
Bar mounting bolt	6

REMOVAL



1 Mounting bolt

Put the vehicle on a lift with the wheels hanging free.

From each side remove bolts (1), and retain the captive nuts.

Remove the bar.

REMOVAL

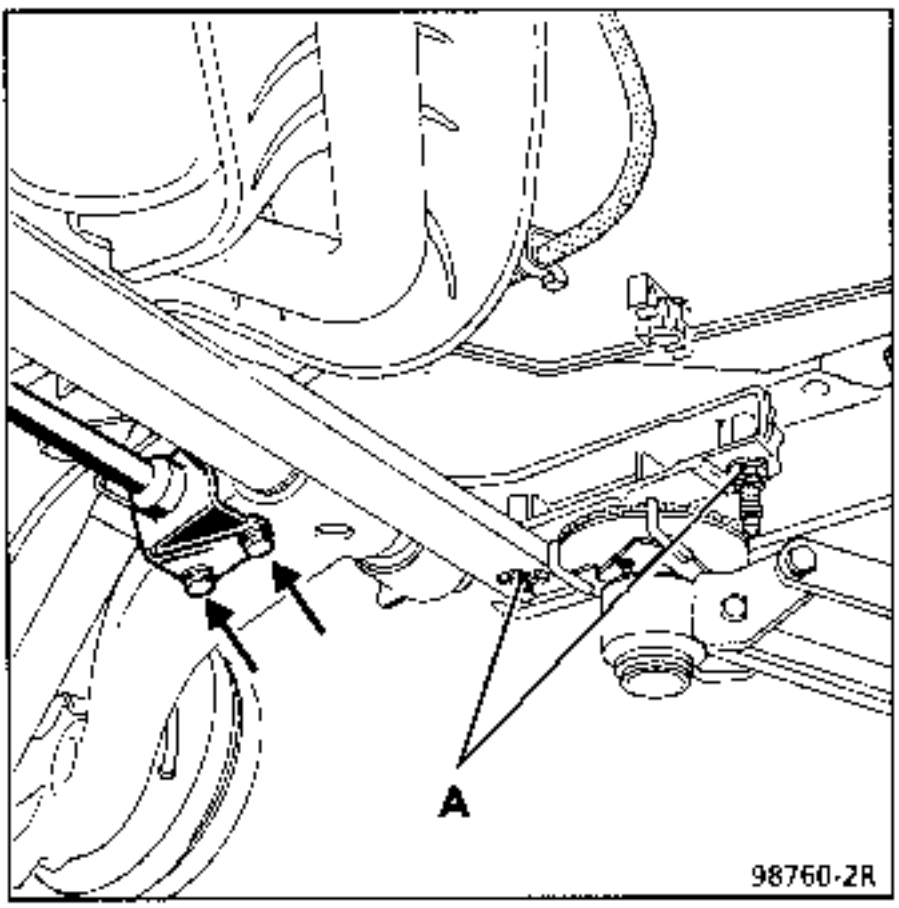
Fit the bolts (1) with their captive nuts on each side.

Tighten to the recommended torque.

TIGHTENING TORQUES (in daN.m)	
Bearing mounting nut	9
Anti-roll bar mounting bolt	6
Wheel bolt	9
Shock absorber base bolt	13.5

REMOVAL

With the vehicle on a 2 post lift, remove:
- the anti-roll bar,
- the lower shock absorber mounting,
- the secondary handbrake cable, disconnecting it from the central control under the vehicle,
- the brake pipe,
- the two bearing mounting nuts (A).



Slacken the two nuts (A) of the other bearing to allow the half shaft to be removed to be released from its anchorages.

Remove the half shaft, separating one from the other.

REFITTING

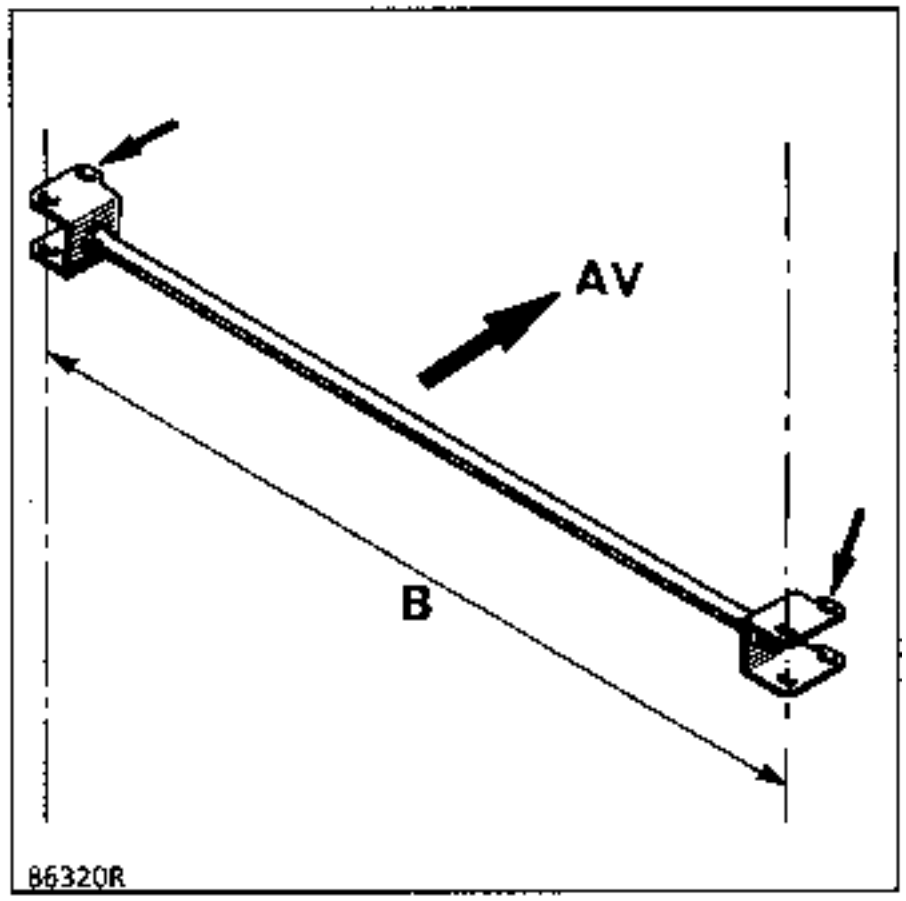
Check the bearing races or the needle roller rings are in perfect condition, otherwise replace them (see paragraph "Rings for tubular rear axle").

The needle roller rings are greased originally and do not require regreasing.

NOTE : new shafts from the Parts Department are fitted with bearing races or needle bearing rings (depending on side).

Fit the two half shafts into each other to obtain dimension (B).

NOTE : dimension (B) corresponds to the distance between the same two mounting points for the anti-roll bar on the shafts. It is therefore possible to obtain this dimension by fitting the anti-roll bar into position and checking the mounting bolts are correctly positioned. Ensure the components are fitted in the correct direction.



Refitting is then the reverse of removal.

NOTE : if the half shaft is to be replaced, use **Loctite FRENBLOC** to bond the brake back plate mounting bolts.

Bleed the braking circuit.

Adjust the handbrake control (see section 37).

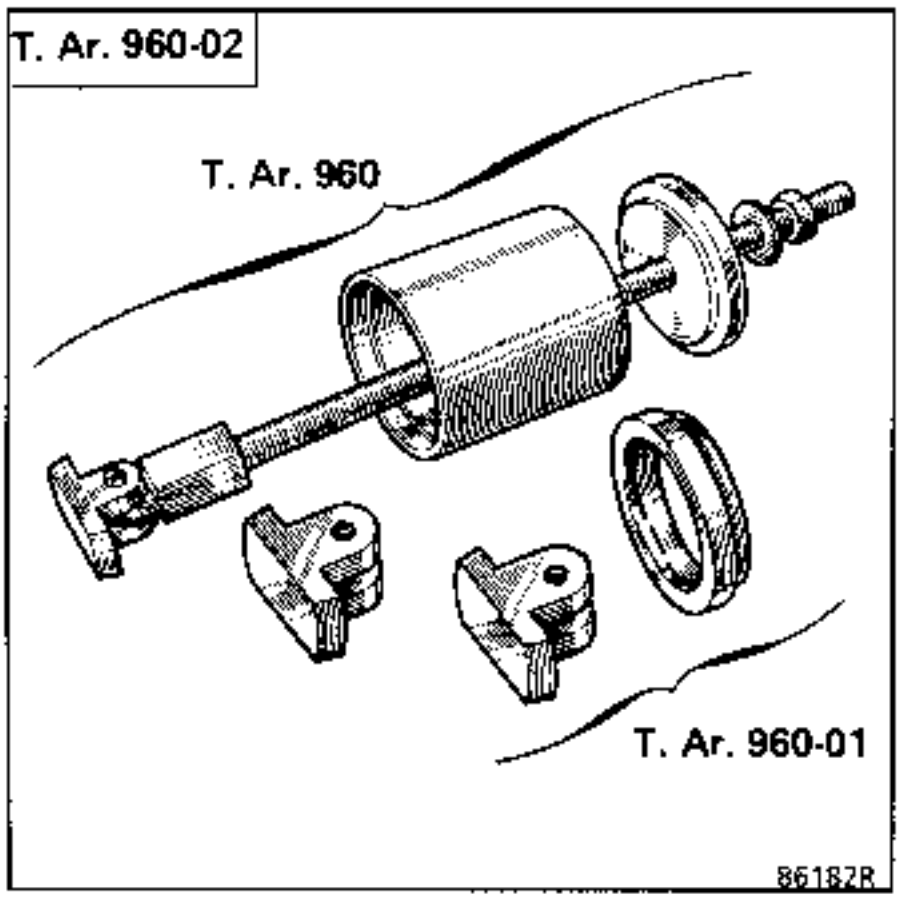
This operation is carried out after removing the complete rear axle assembly and separating the two arms.

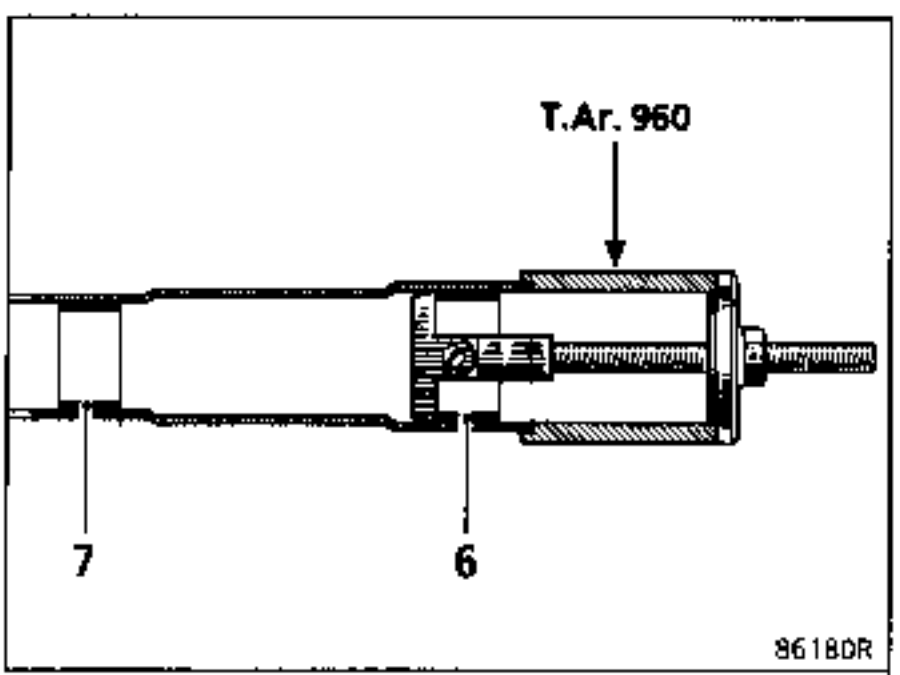
SPECIAL TOOLING REQUIRED	
T. Ar. 960-02	Extractor assembly ring + spacer
T. Ar. 960-05	Tooling for replacing needle roller rings.

REMOVAL

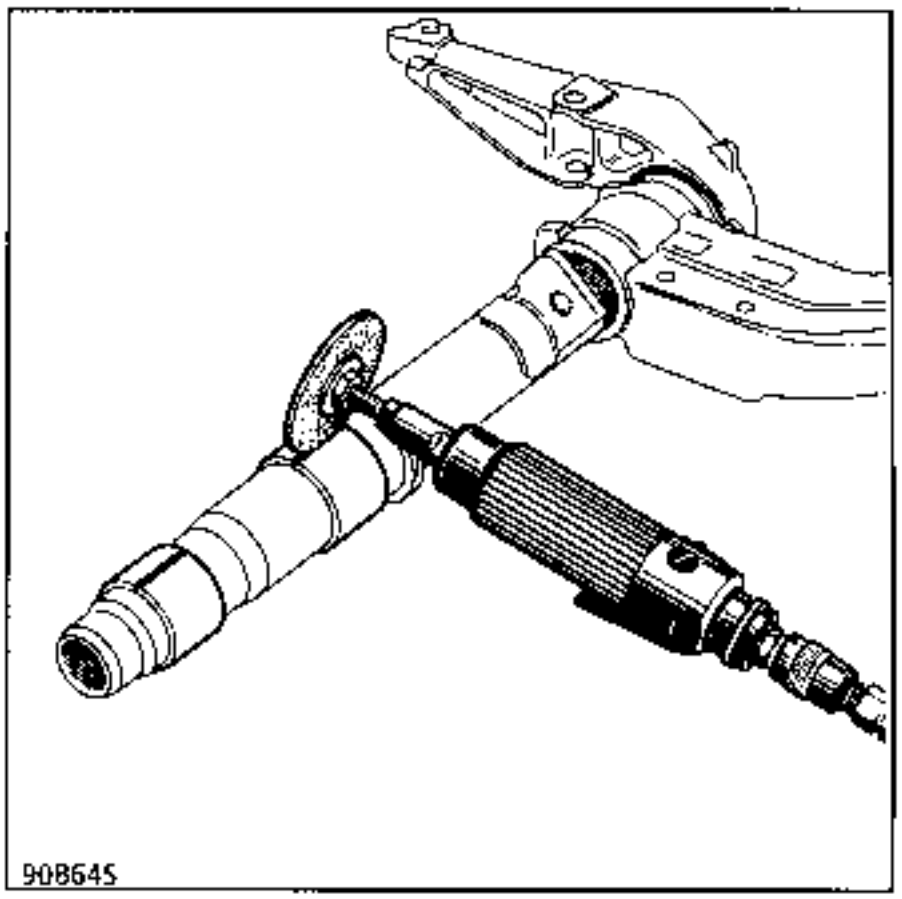
Extract the female arm (left hand side) :

- the outer ring (6) using tool **T.Ar. 960**,
- the inner ring (7) using the small socket from tool **T.Ar. 960**.



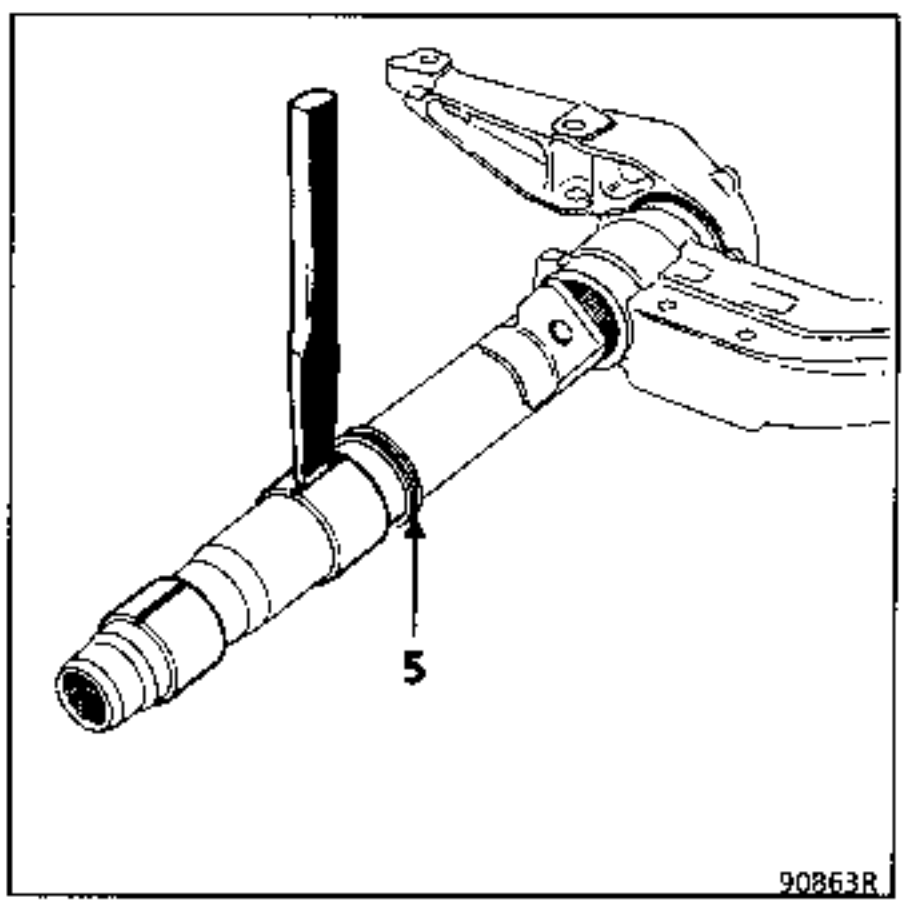


Grind the bearing races on the male arm (right hand side) using a straight grinder, taking care not to mark the tube.



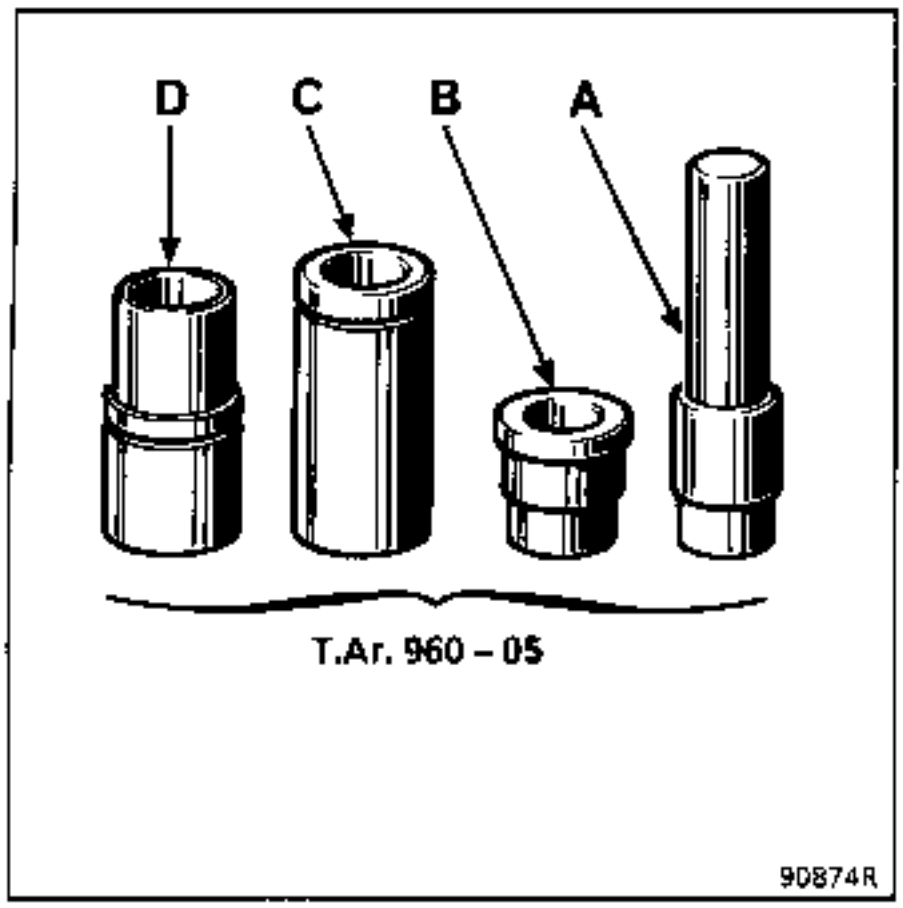
Split the bearing races with a chisel then remove them.

Cut and remove the seal (5).



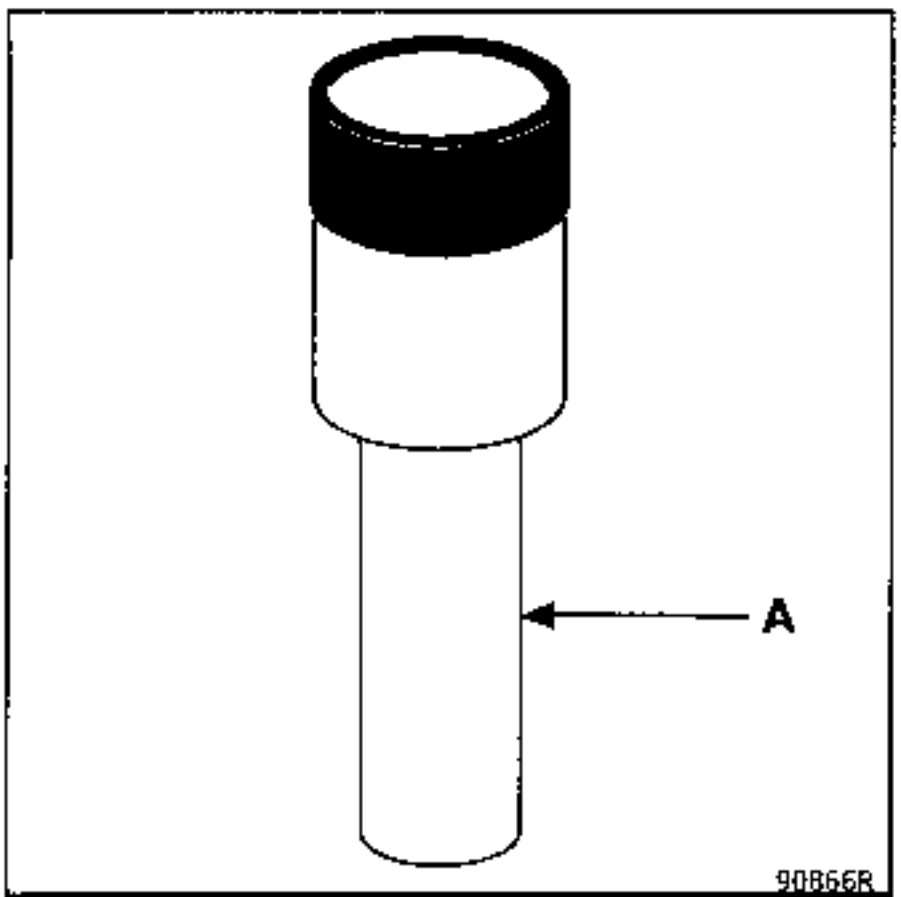
REFITTING

Fitting of the needle roller rings and the bearing races requires the use of tool **T.Ar. 960-05.**

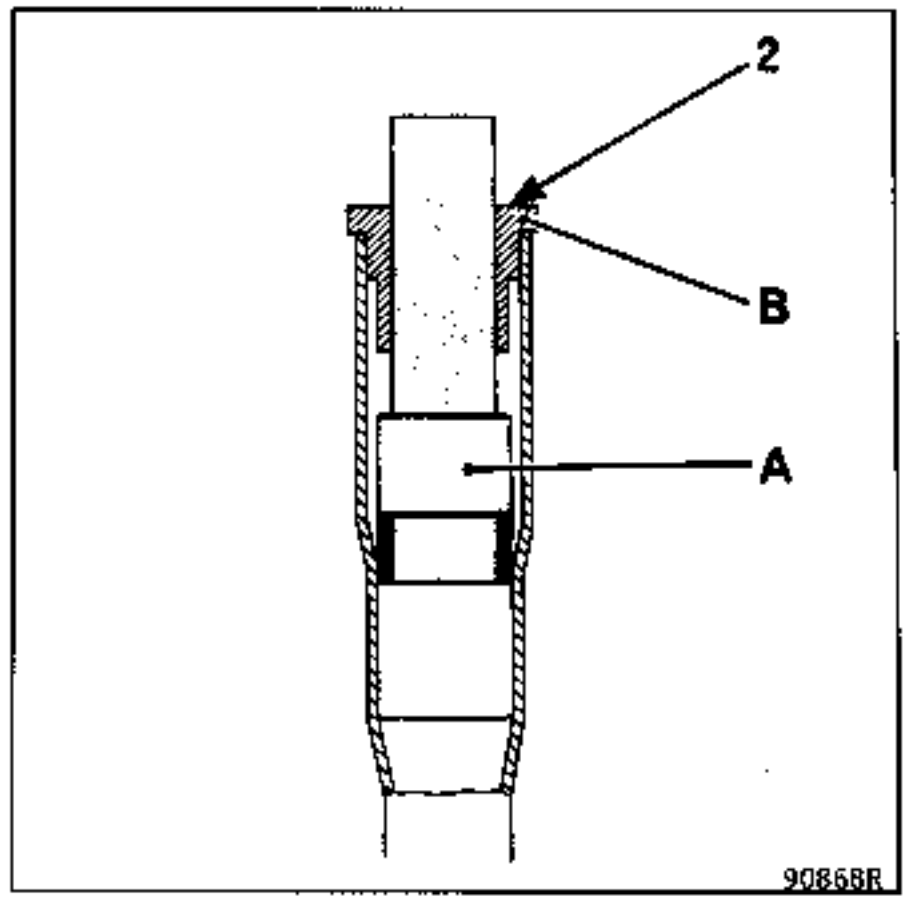


Fit:

- the small needle roller bearing ring on the mandrel (A),
- the mandrel (A) into the tube using mandrel (B) as a guide.

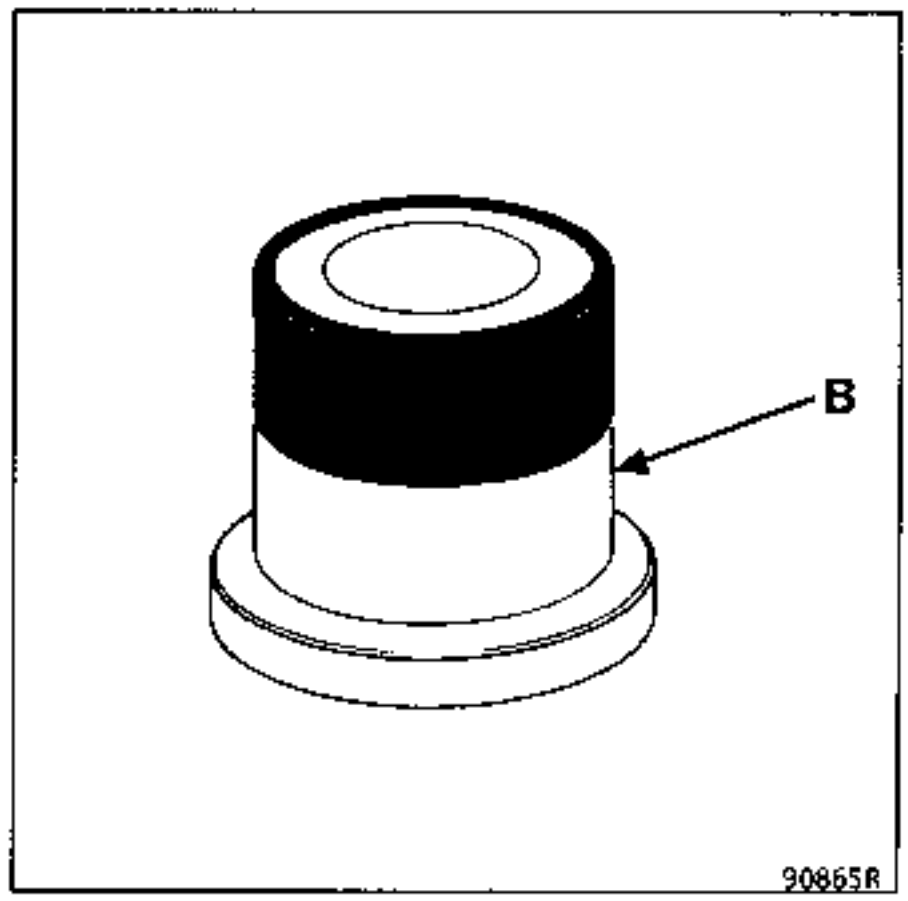


Press fit on the press until the mandrel (A) is flush with the face (2) of mandrel (B).

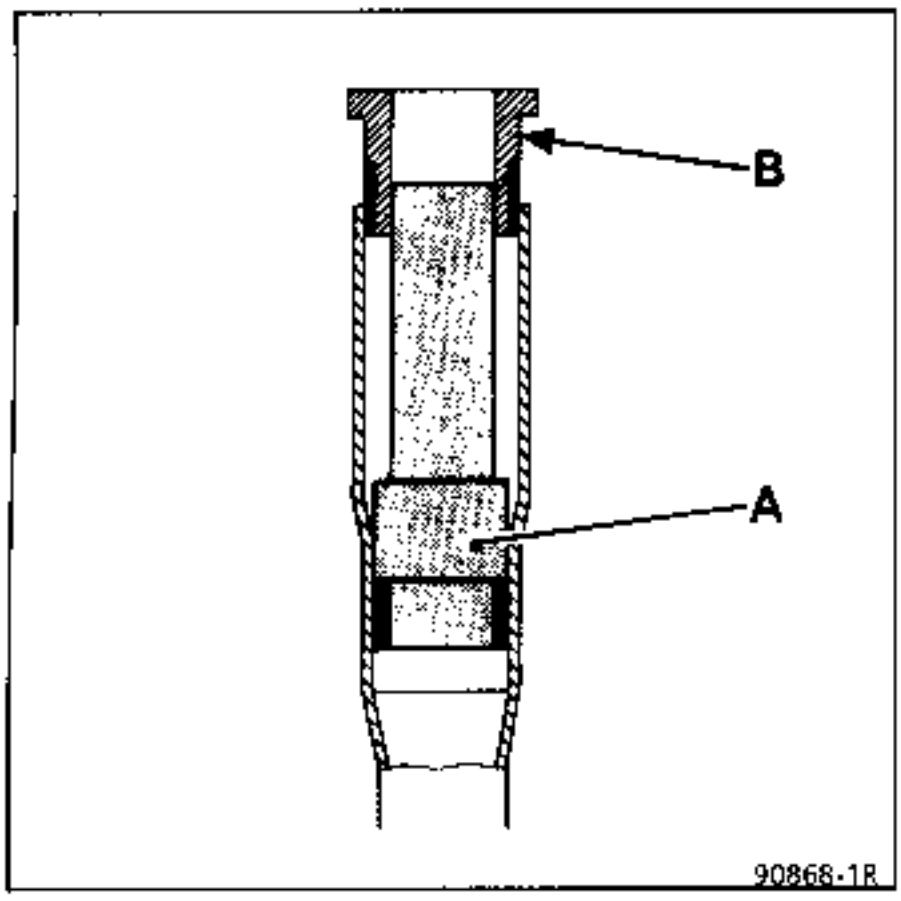


Position :

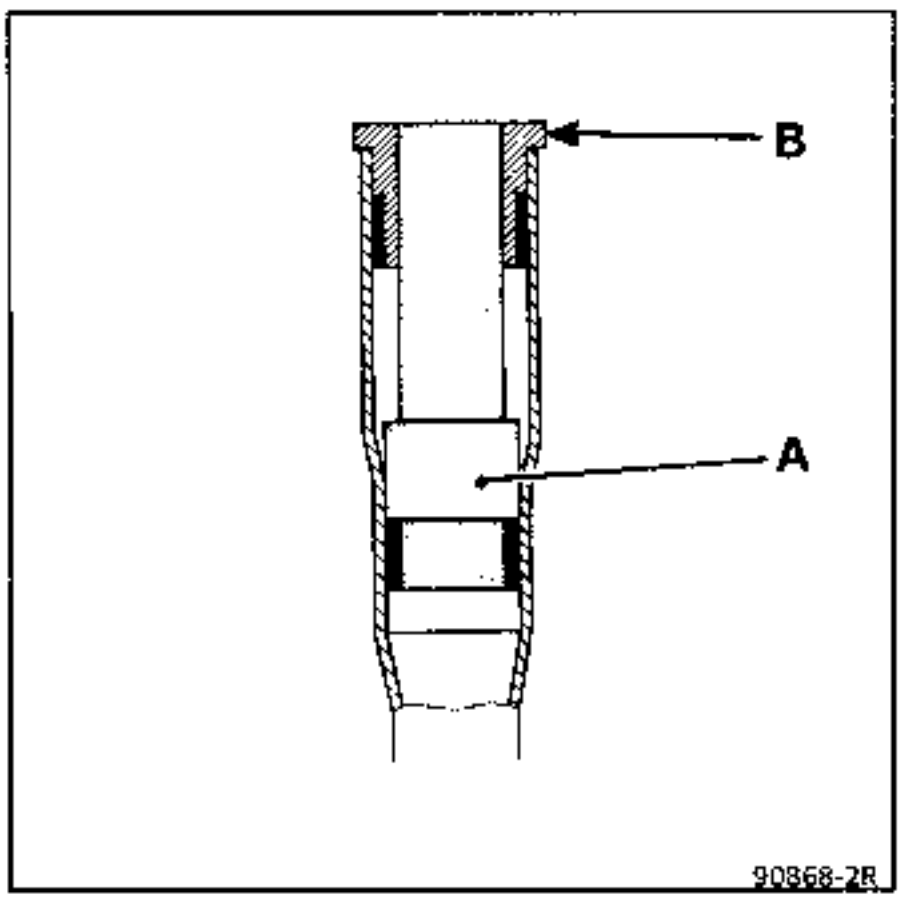
- the large needle roller bearing ring on mandrel (B),



– mandrel (B) into the tube, using mandrel (A) as a guide.



Press fit on the press until mandrel (B) touches the tube.

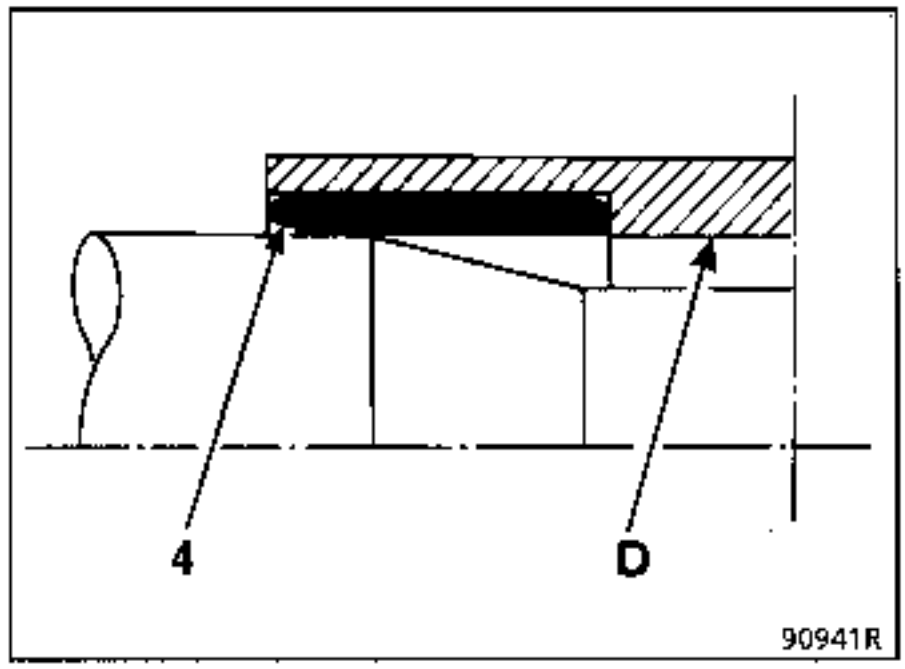


Remove mandrels (B) and (A).

Fit the new seal (5) to the male tube.

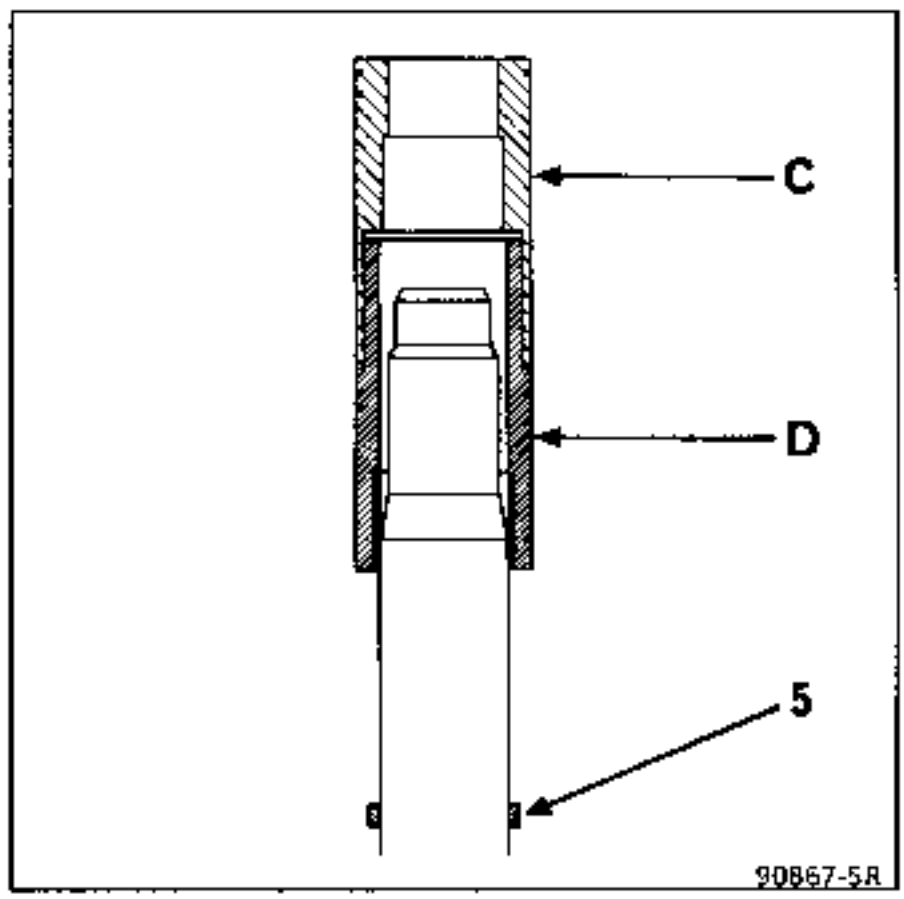
The bearing races have an input chamfer on one side.

The fitting direction must be observed: chamfer (4) positioned according to the diagram to ensure sufficient force may be applied for fitting on the press.

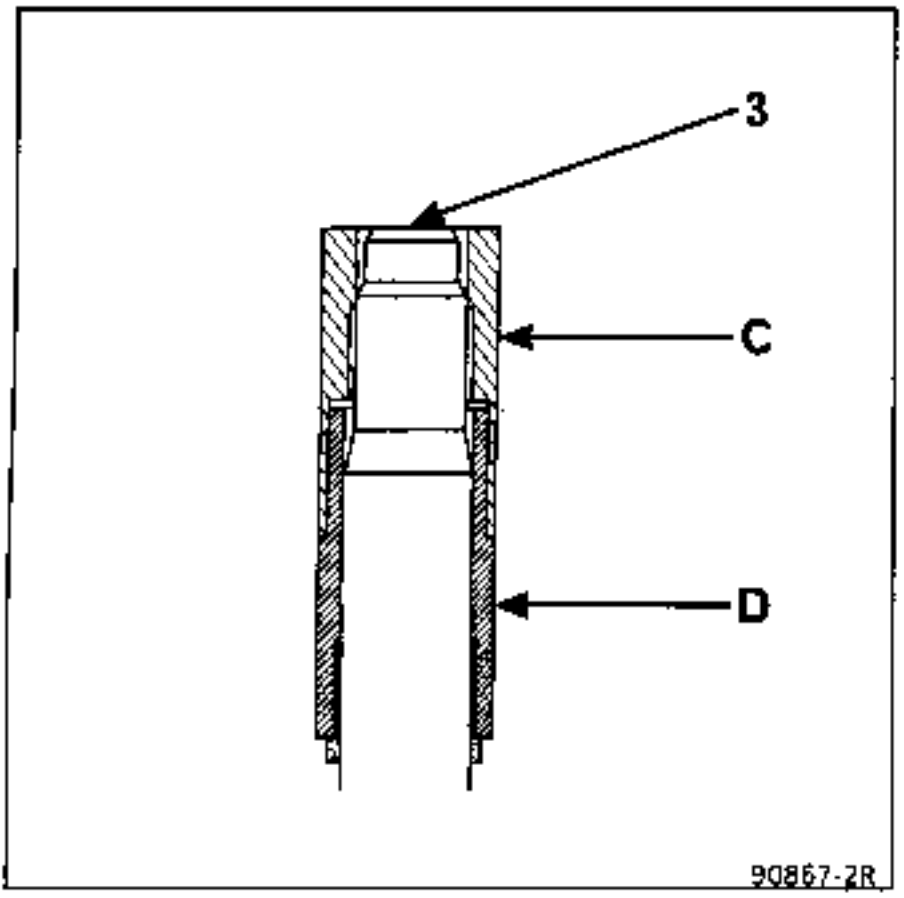


Fit :

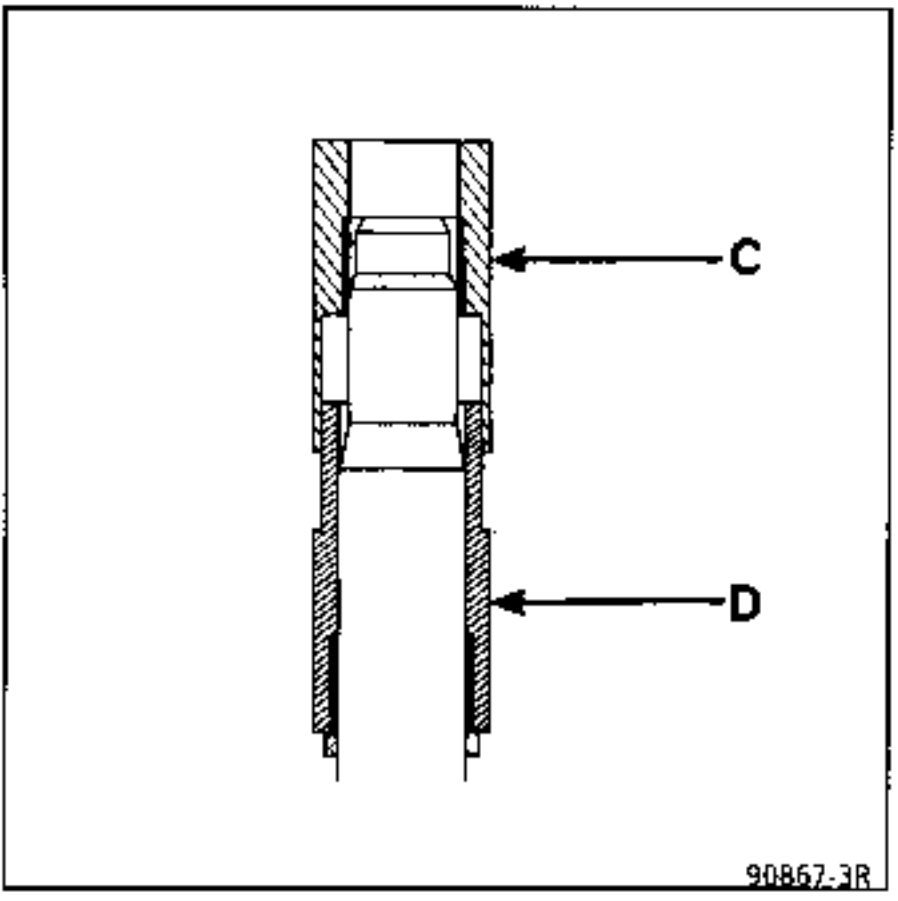
– the large bearing race in sleeve (D),
– the sleeve assembly (D) and (C) to the tube.



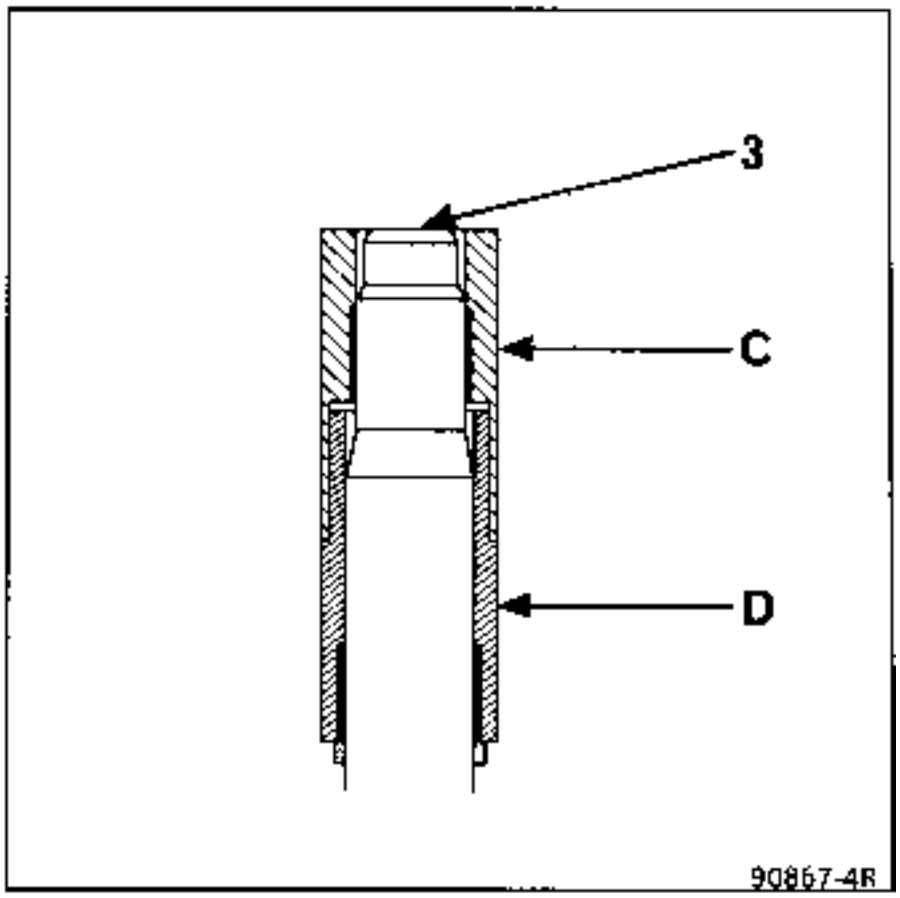
Press fit the assembly (D) and (C)until the sleeve (C) is flush with the edge (3) of the tube.



Position :
- the small bearing race in the sleeve (C),
- the sleeve (C) on the tube, using sleeve (D) as a guide.



Press fit on the press until sleeve (C) is flush with the edge (3) of the tube.



Remove the sleeves (C) and (D).

IMPORTANT

When fitting, if the axle mounting bearings are used for support, ensure the suspension bars are securely anchored (risk of movement).

Recentre them if necessary.

Assemble the two half shafts.

NOTE : the needle roller bearings do not require lubrication as they are supplied ready greased.

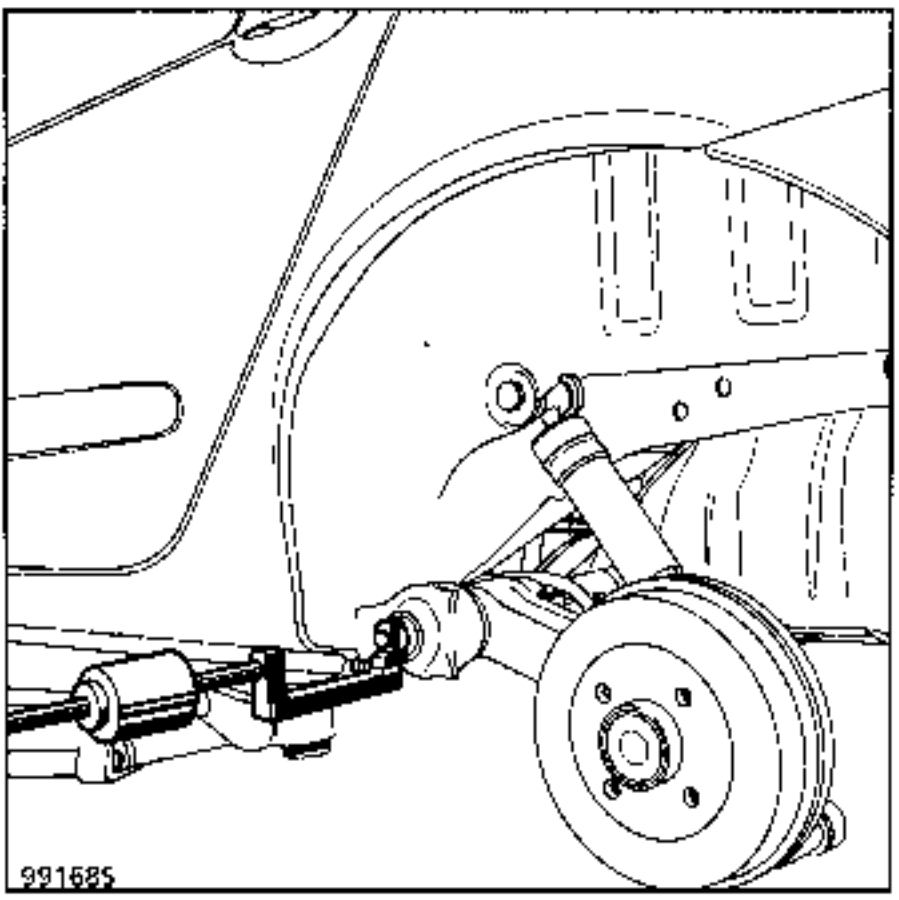
Re-join and refit the rear axle assembly to the vehicle (see corresponding paragraph).

SPECIAL TOOLING REQUIRED	
Emb. 880	Inertia extraction tool
Tar. 1362	Tool for removing suspension arms from the vehicle

TIGHTENING TORQUES (in daN.m)	
Upper shock absorber mounting	10
Lower shock absorber mounting	13.5

REMOVAL

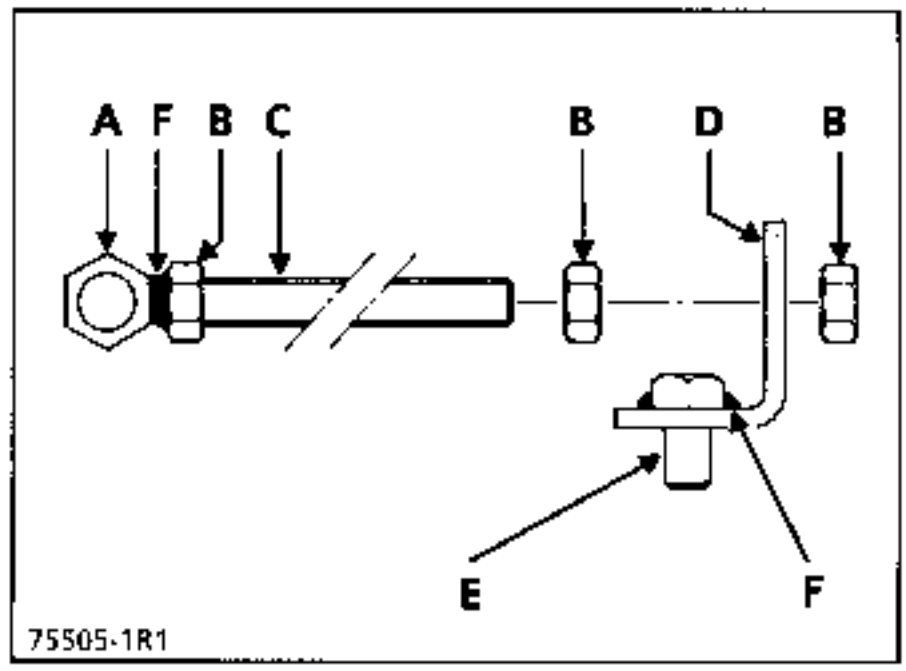
With the vehicle's wheels hanging free, remove the shock absorber from the side in question.
Release the arm from the side using tools **Emb. 880 and Tar. 1362.** These bars cannot be completely removed when the rear axle assembly is still in position.



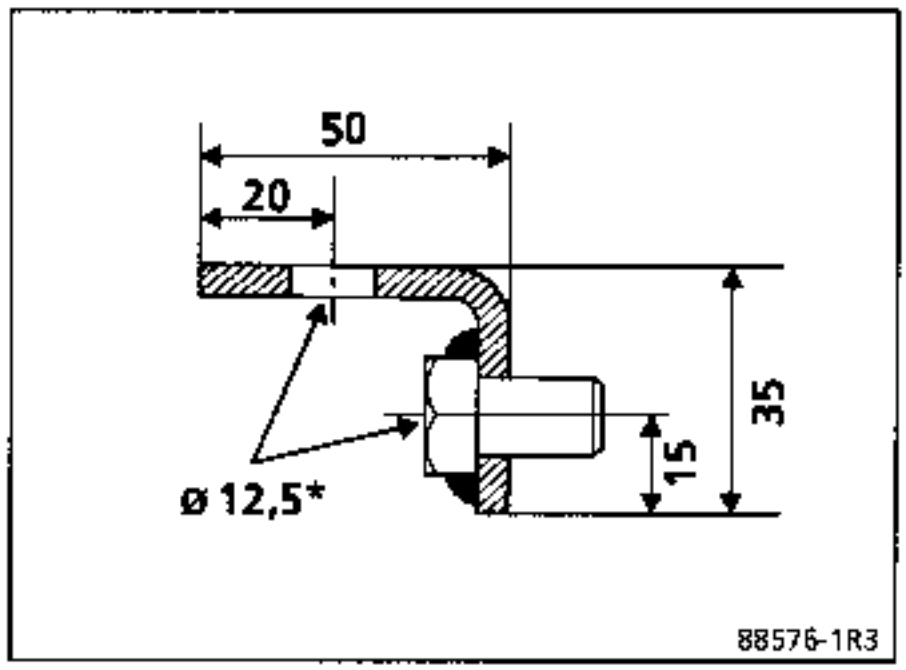
REFITTING

In order to ensure the arm is in the correct position for the bar to be replaced, a special tool must be locally made.

A Nut diameter **14 mm**
B Nut diameter **12 mm**
C Threaded rod, diameter **12 mm** - length **660 mm**
D Bracket from flat strip **30 x 5 mm**
E **12 x 60 mm** bolt cut to a length of **20 mm**
F Weld



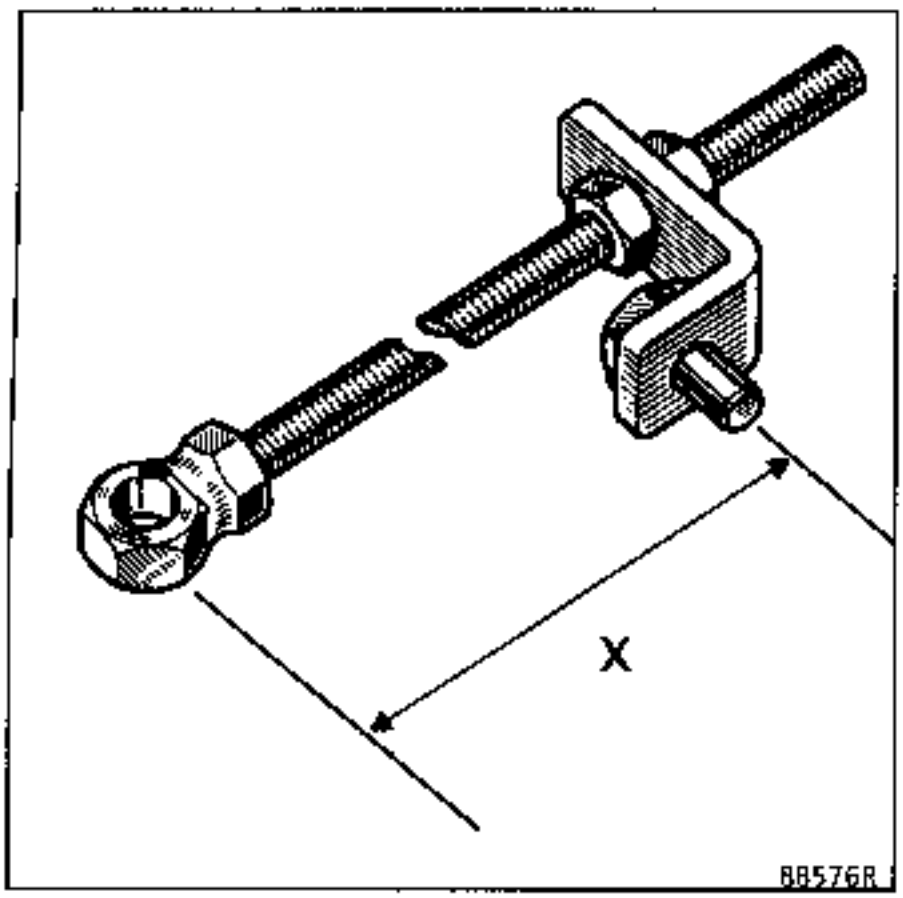
Bracket D



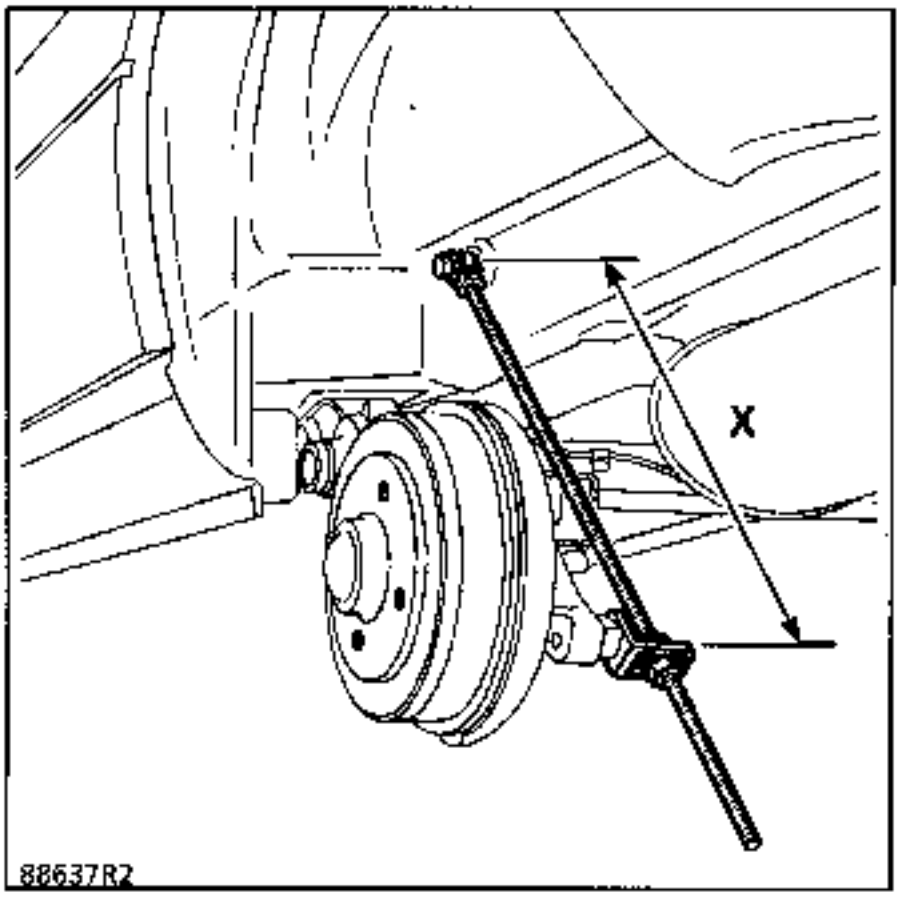
(*) Drilling diameter

Pre-adjust the tool to obtain dimension "X".

X = 465 mm



Fit the tool in place of the shock absorber.



Coat the splines of the bar with **MOLYKOTE BR2**, insert it into the bearing and the arm, trying to find the position, by rotating the bar, where it will engage **without force** into the splines of the arm and the bearing.

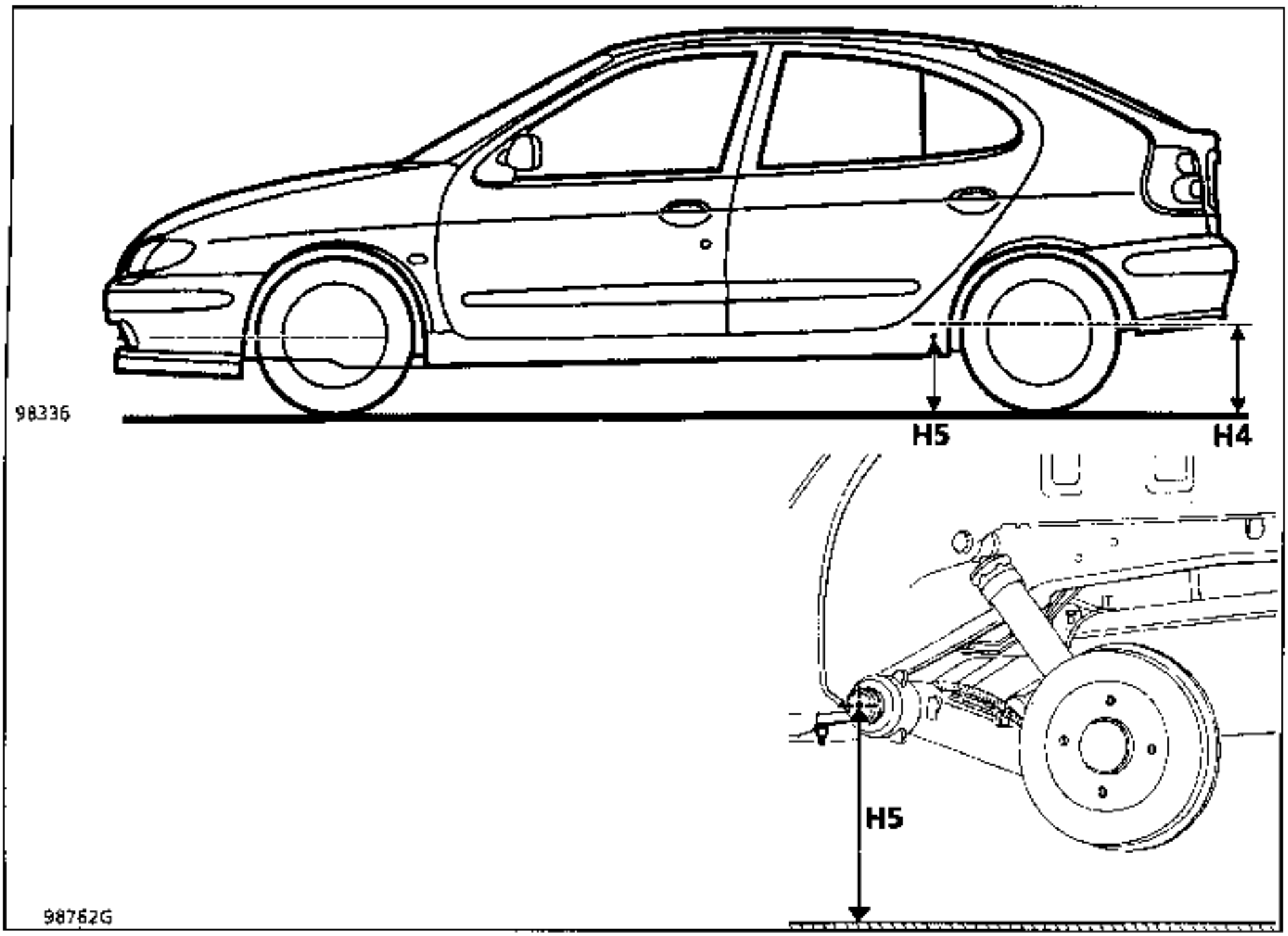
Remove the tool and fit the shock absorber.

Return the vehicle to its wheels and measure the underbody heights (see section "Values and settings").

Check and adjust if necessary:
- the braking compensator (depending on version),
- the adjustment of the headlights.

CHECKING

Vehicle unladen, fuel tank full, on a flat surface.



H4 Wheel axis to ground
H5 Suspension arm axis.
(see values in the section "values and settings")

ADJUSTMENT

Only the rear underbody height is adjustable by rotating the torsion bars.

Determine dimension "X" on the vehicle by adjusting the locally made bracket (D) until the bar can be slid in its anchorage points by hand.

Remove the bar.

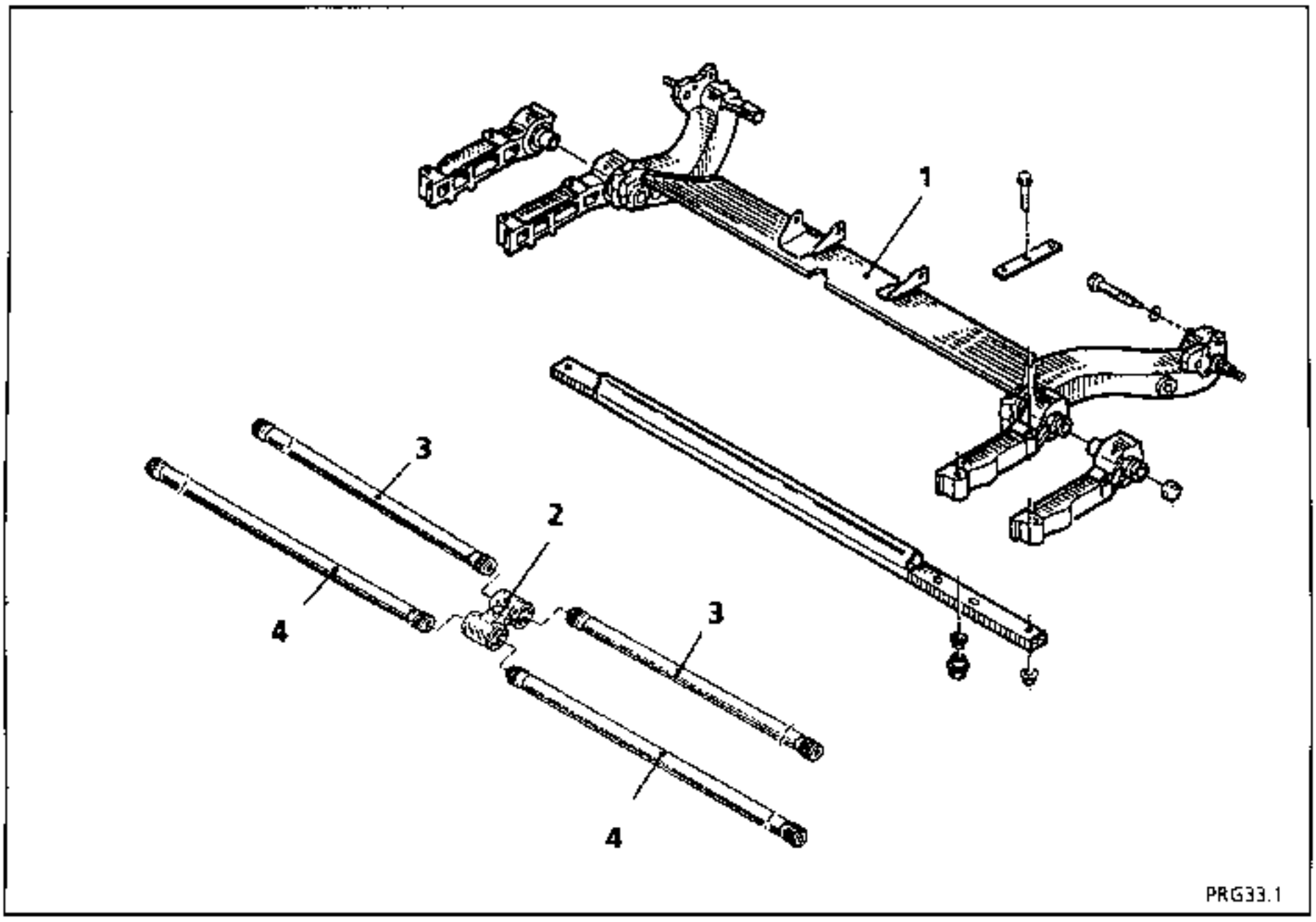
3 mm is the minimum possible value for an adjustment notch, so the height of the vehicle may only be varied in multiples of 3.

Lower the arm to adjust the bar by the number of notches corresponding to the height adjustment required:

Example : 10 mm = 3 notches

Replace the bar so that it engages freely into the splines on the arm and the bearing.

Check and adjust the headlight settings if necessary.



The rear axle assembly comprises:

- two arms connected by an "L" shaped section. This assembly (1) cannot be separated. If it is damaged, the complete assembly must be replaced,
- two anti-roll bars (3),
- two suspension arms (4),
- a shackle (2) connecting the bars.

The assembly is connected to the body by two bearings mounted on rubber bushes.

NOTE : **do not use the "L" shaped section (1) as a support point when lifting the vehicle with a jack.**

EXTRACTING THE BARS FROM THEIR SPLINES

Remove the wheels.

SPECIAL TOOLING REQUIRED	
Emb. 880	Inertia extraction tool
T. Ar. 1362	Tool for removing suspension arms from the vehicle

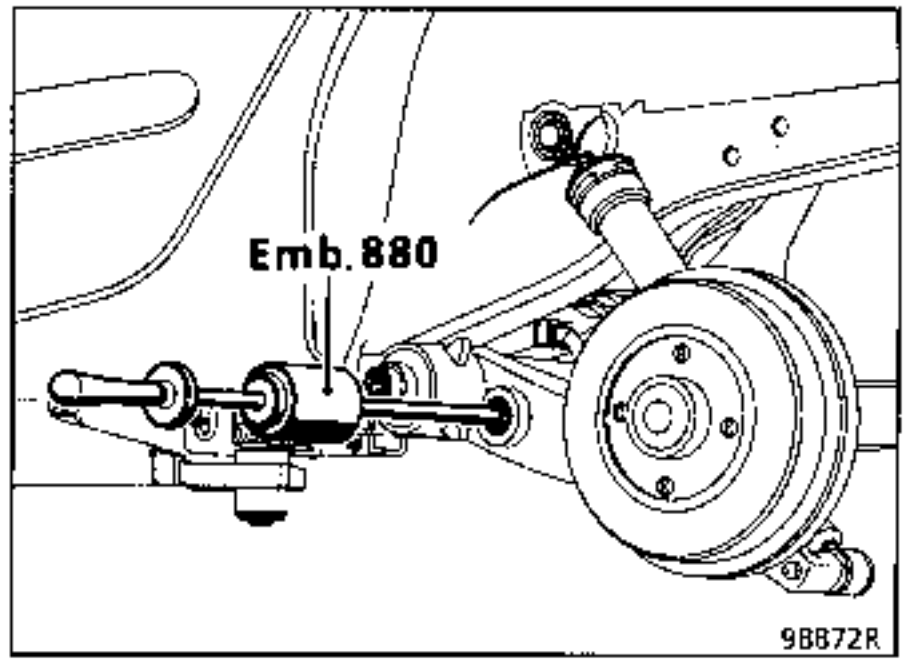
SUSPENSION ARMS

Release the suspension arms from their splines using tool **T. Ar. 1362** and the inertia extraction tool **Emb. 880.**

These bars may not be completely removed with the rear axle assembly in place.

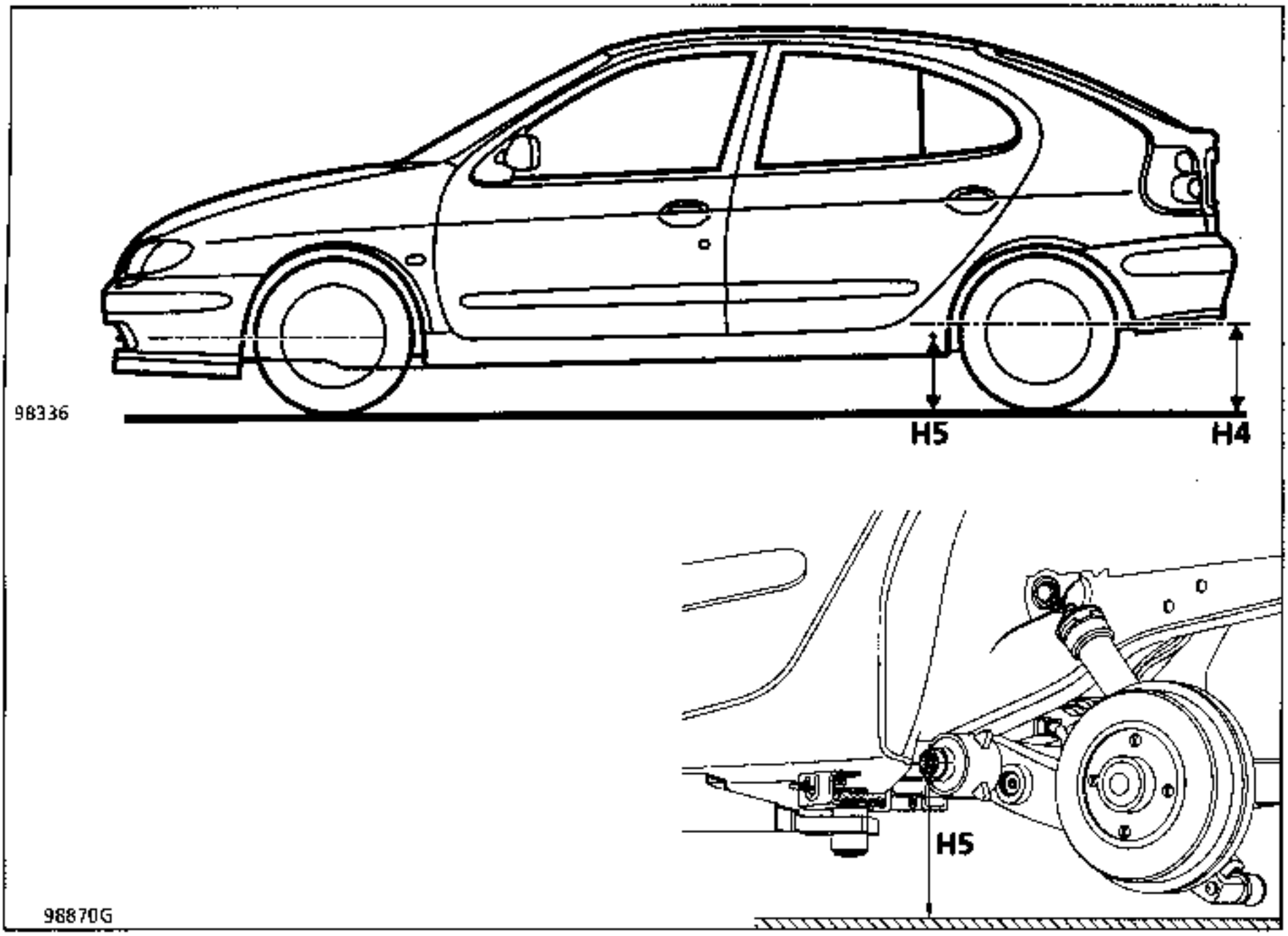
ANTI-ROLL BARS

Release the bars form their splines using the inertia extraction tool **Emb. 880.**



CHECKING

Vehicle unladen, fuel tank full, on a flat surface.



H4 Wheel axis to ground
H5 Suspension arm axis.

Measure dimensions **H4** and **H5** and subtract.

Maximum right / left difference : 5 mm.

Three cases which require adjustments may arise:

- height correct on one side but left / right difference too large,
- height incorrect and left / right difference too large,
- height incorrect but left / right difference correct.

(see values in the section "values and settings")

ADJUSTMENT

1. REPLACING THE REAR AXLE ASSEMBLY

A Height correct on one side but left / right difference too large

The adjustment to the left / right difference is always made by altering the anti-roll bar on the lower side.

NOTE : always act on the lower side to bring it back up to the higher side.

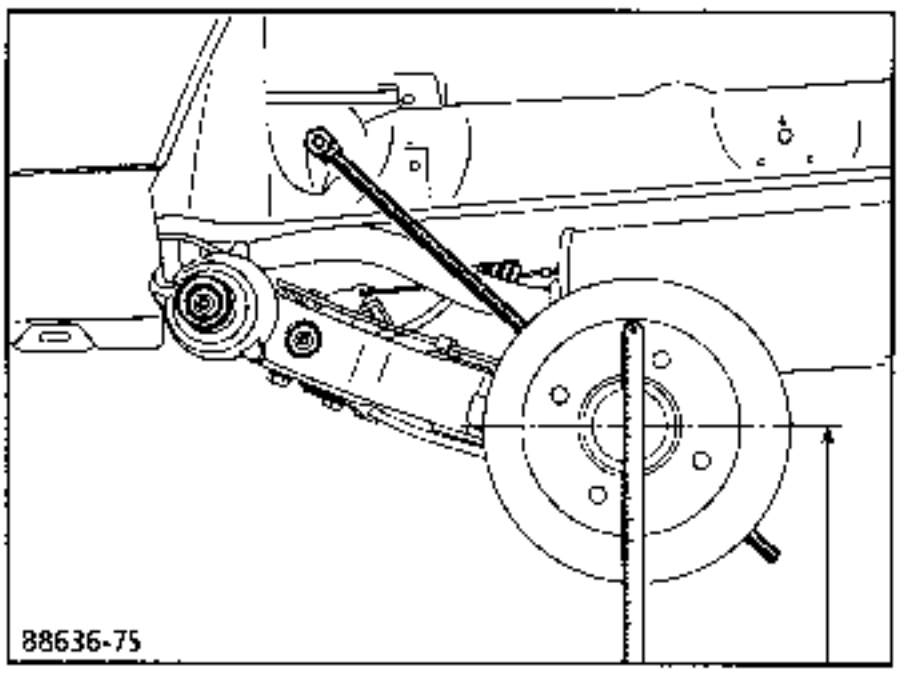
Mark the position of the suspension arms in the bearings and the shackle.

Set the tools to dimension "X" for the vehicle*.

X = 465 mm

Release:
- the suspension arms,
- the anti-roll bar on the lower side.

Measure from the centre of the wheel to ground (side without anti-roll bar).



Reduce this dimension by the value of the left / right difference previously noted by increasing the dimension "X" on the tool.

NOTE : do not alter the tool on the other side.

* Local manufacture of the two tools (see paragraph "Suspension arms for tubular rear axle") is required.

In this new position, refit:
- the anti-roll bar - free sliding,
- the two suspension arms in accordance with the reference marks.

Fit:
- the shock absorbers,
- the wheels.

With the vehicle on its wheels, check and adjust the headlight setting if necessary.

B Height incorrect and left / right difference too large

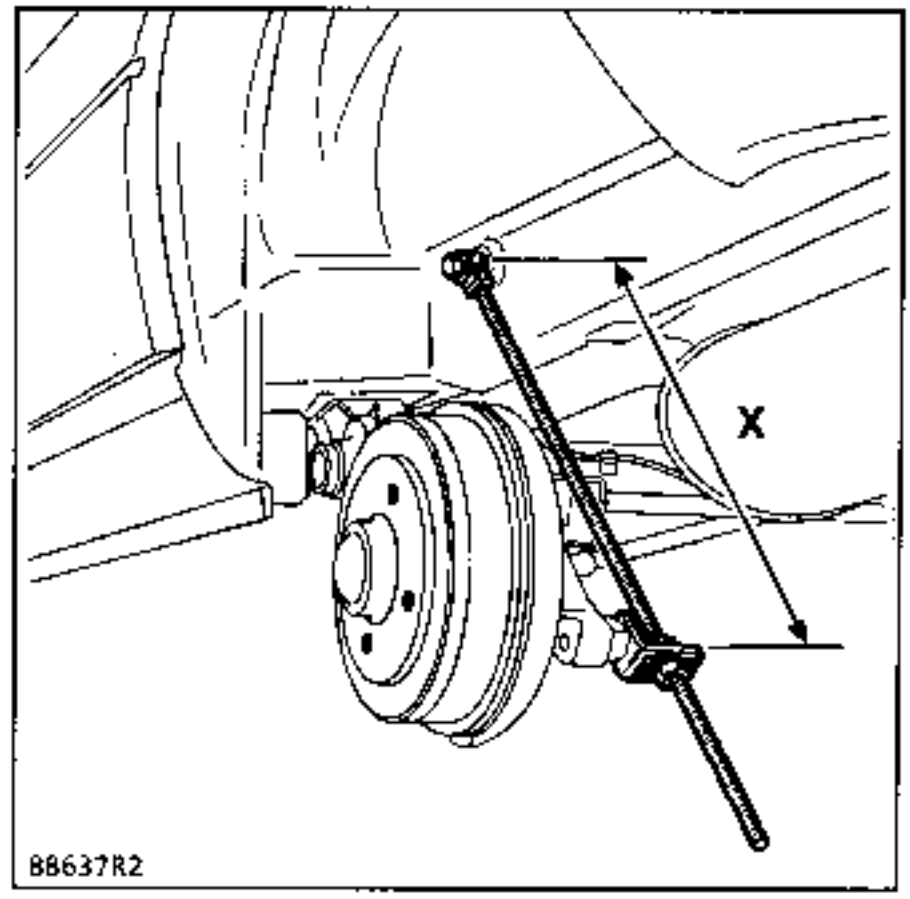
The adjustment to the left / right difference is always made by altering the anti-roll bar on the lower side.

NOTE : always act on the lower side to bring it back up to the higher side.

Set the tools to dimension "X" for the vehicle.

Release:
- the suspension arms,
- the anti-roll bar on the lower side.

Measure from the centre of the wheel to ground (side without anti-roll bar).



Reduce this dimension by the value of the left / right difference previously noted by increasing the dimension "X" on the tool.

NOTE : do not alter the tool on the other side.

In this new position, refit the anti-roll bar - free sliding.

Then, by adjusting the two tools, reduce or increase the dimension from the wheel axis to the ground, at the same time on both sides, by the height difference on the higher side noted when the vehicle was checked.

In this position, refit the suspension arms - free sliding.

Fit:
- the shock absorbers,
- the wheels.

With the vehicle on its wheels, **check and adjust** the headlight setting and the braking compensator if necessary.

C Height incorrect but left / right difference correct

The underbody height is adjusted by altering the suspension arms.

Mark the position of the suspension arms in the bearings and the shackle.

Set the tools to dimension "X" for the vehicle.

X = 465 mm

Release the suspension arms.

Measure the dimension from the wheel axis to the ground (on both sides).

By adjusting the two tools, reduce or increase this dimension, at the same time on both sides, by the height difference noted when the vehicle was checked.

Refit the suspension arms - free sliding.

Fit:
- the shock absorbers,
- the wheels.

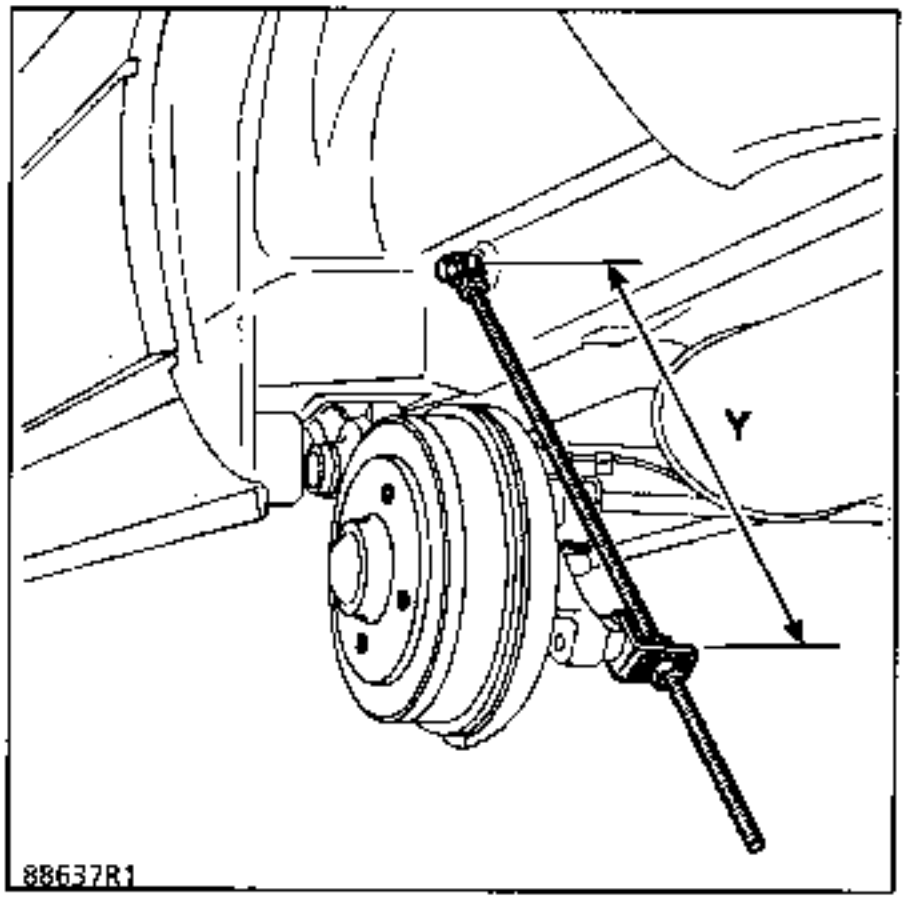
With the vehicle on its wheels, **check and adjust** the headlight setting and the braking compensator if necessary.

2. ADJUSTING A VEHICLE

When adjusting a vehicle which has already been driven, the free insertion position of the bars must be determined.

Remove the wheels and the shock absorbers.

Position the tools in place of the shock absorbers, setting them to **dimension "Y"** corresponding to **the free position** taken by the arms.



2.1 Left / right difference too large

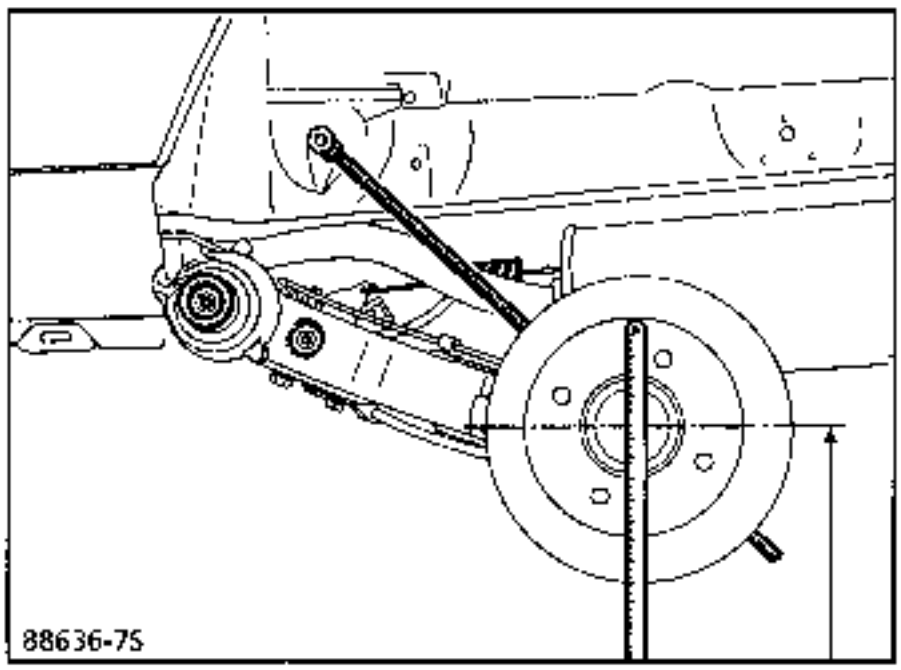
NOTE : always act on the lower side to bring it back up to the higher side.

Mark the position of the suspension arms in the bearings and the shackle.

Set the tools to dimension "Y" noted previously.

Release:
- the suspension arms,
- the anti-roll bar on the lower side.

Measure from the centre of the wheel to ground (side without anti-roll bar).



Reduce this value by the left / right difference noted previously by increasing the dimension "Y" on the tool.

NOTE : do not alter the tool on the other side.

In this new position, refit:
- the anti-roll bar - free sliding,
- the two suspension arms in accordance with the reference marks.

Fit:
- the shock absorbers,
- the wheels.

With the vehicle on its wheels, check and adjust the heights, headlight setting and the braking compensator if necessary.

2.2 Height incorrect but left / right difference correct

The underbody height is adjusted by altering the suspension arms.

Set the tools to dimension "Y" noted previously.

Release the suspension arms.

Measure the dimension from the wheel axis to the ground (on both sides).

By adjusting the two tools, reduce or increase this dimension , at the same time on both sides, by the height difference noted when the vehicle was checked.

In this position refit the suspension arms - free sliding.

Fit:
- the shock absorbers,
- the wheels.

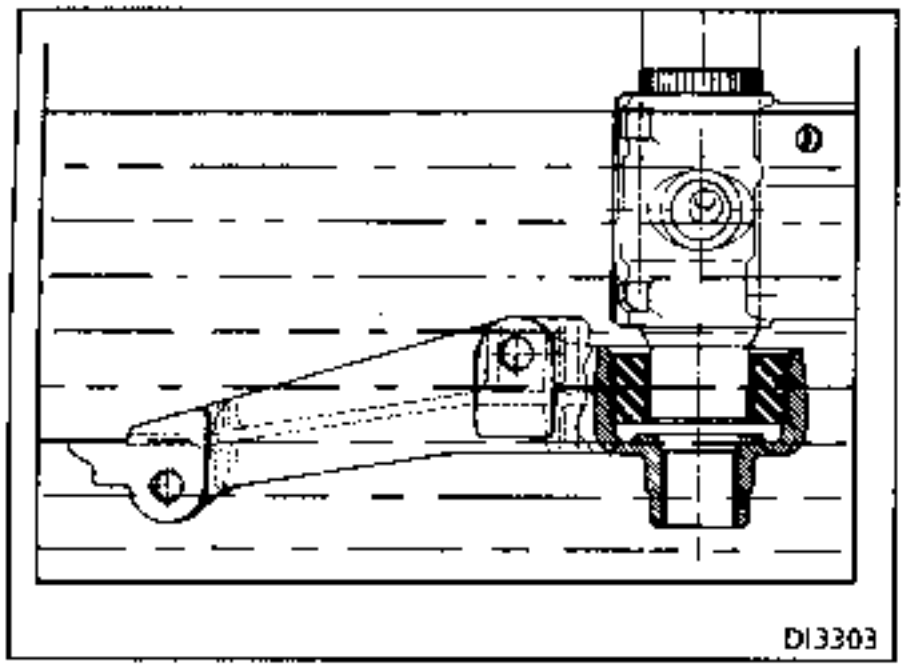
With the vehicle on its wheels, check the heights and check and adjust if necessary:
- the braking compensator,
- the headlight adjustment.

IMPORTANT: when readjusting, dimension "Y" is used for the adjustment, not dimension "X" given in this Workshop Repair Manual.

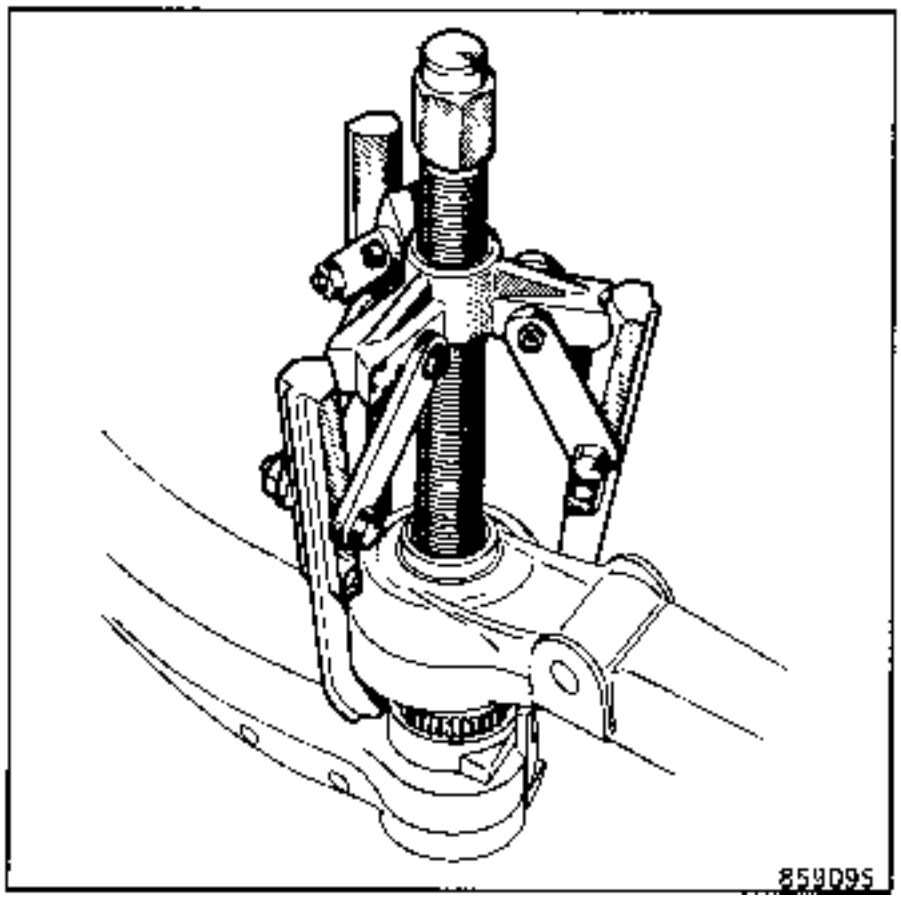
This operation is carried out after removing the rear arms and the suspension arms.

REMOVAL

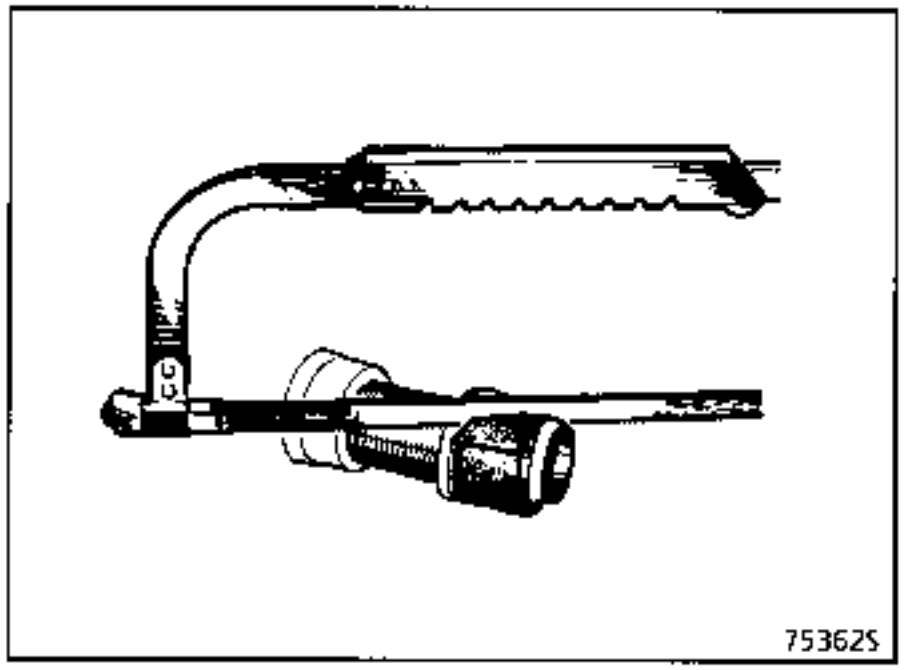
Submerge the bearing completely in brake fluid to soften the rubber bush.



Using a two or three claw extractor, extract the exterior section of the bearing by removing the rubber.



Saw through the inner ring taking care not to damage the tube.



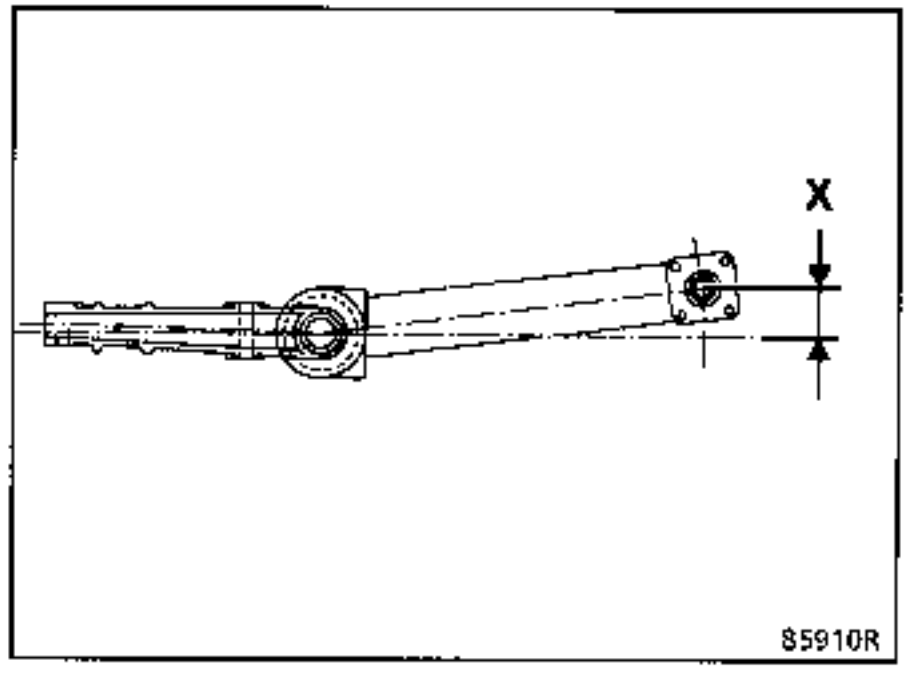
REFITTING

Refitting of the bearing in the arm is carried out on the press, ensuring the alignment and distance from the arm are correct.

Orientation

Observe dimension "X" between the pressure face of the bearing and the stub axle shaft:

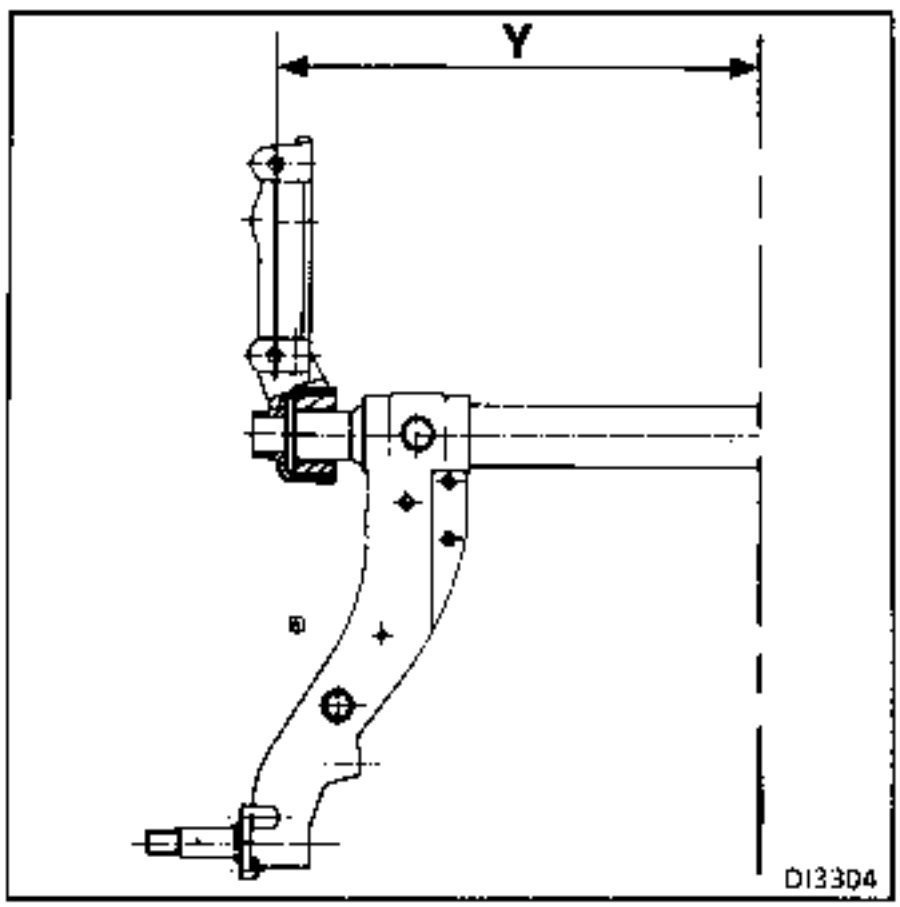
X = 37 mm



Gap

In this position, press on the bearing until the dimension between the bearings is obtained :

$$Y = 1268 \pm 1 \text{ mm}$$

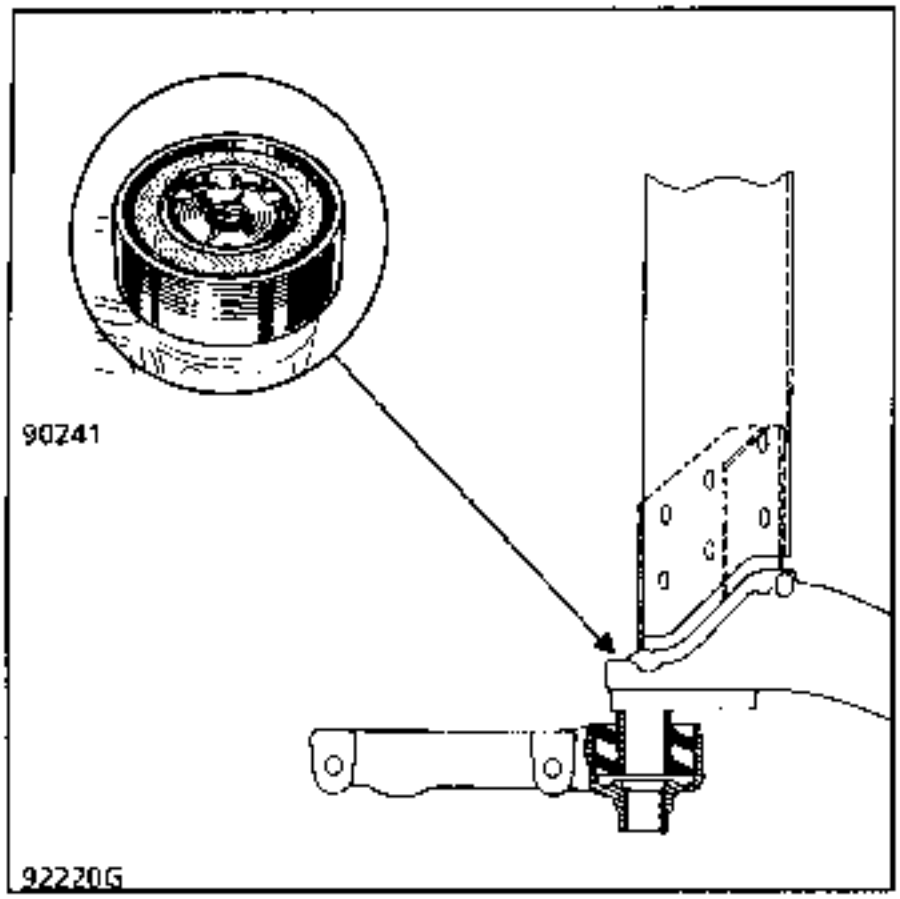


Refit the arm to the vehicle.

This operation is carried out after removing the rear axle assembly and the suspension arms.

REMOVAL

Weld a spacer (example : nut) in the central tube of the bush.



Extract the bush - bearing assembly using a press.

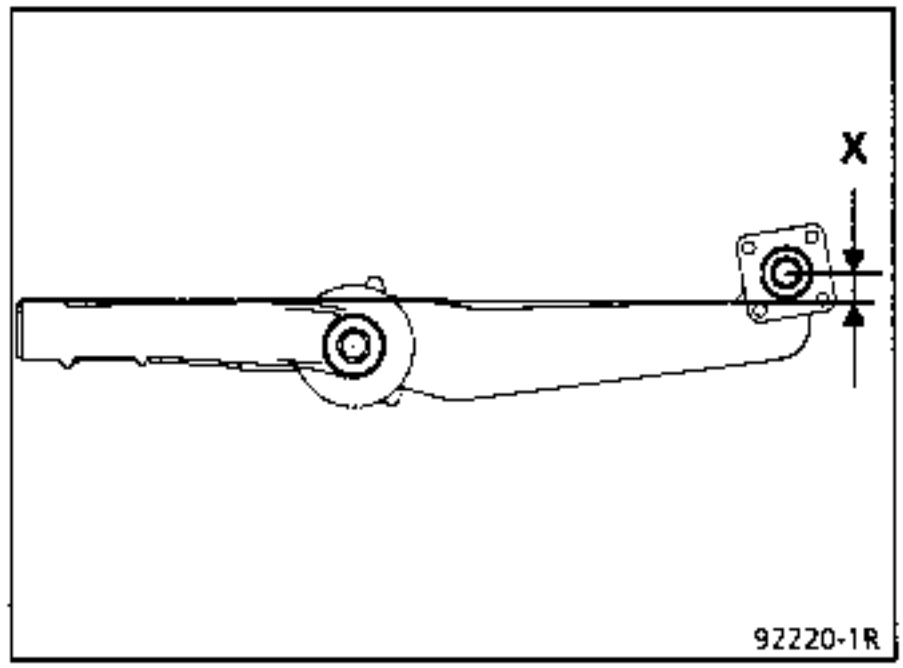
REFITTING

Refitting of the bearing in the arm is carried out on the press, ensuring the alignment and distance from the arm are correct.

Orientation

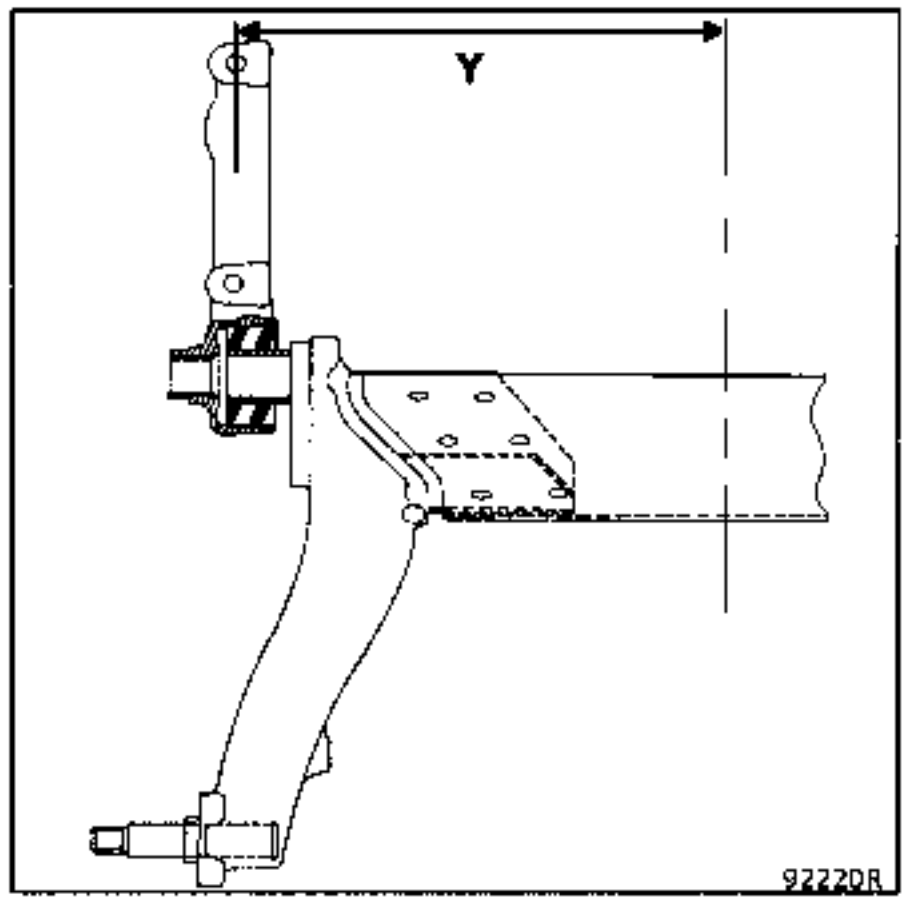
Observe dimension "X" between the pressure face of the bearing and the stub axle shaft:

X = 37 mm



Gap
In this position, press on the bearing until the dimension between the bearings is obtained :

Y = 1268 ± 1 mm



Refit the rear axle assembly to the vehicle and refit the suspension arms (see corresponding paragraph).

WHEELS

There are two forms of wheel identification marking:
- stamped marking for steel rims,
- cast marking for alloy rims.

The marking gives the main dimensional specifications of the wheel.

The marking may be complete:

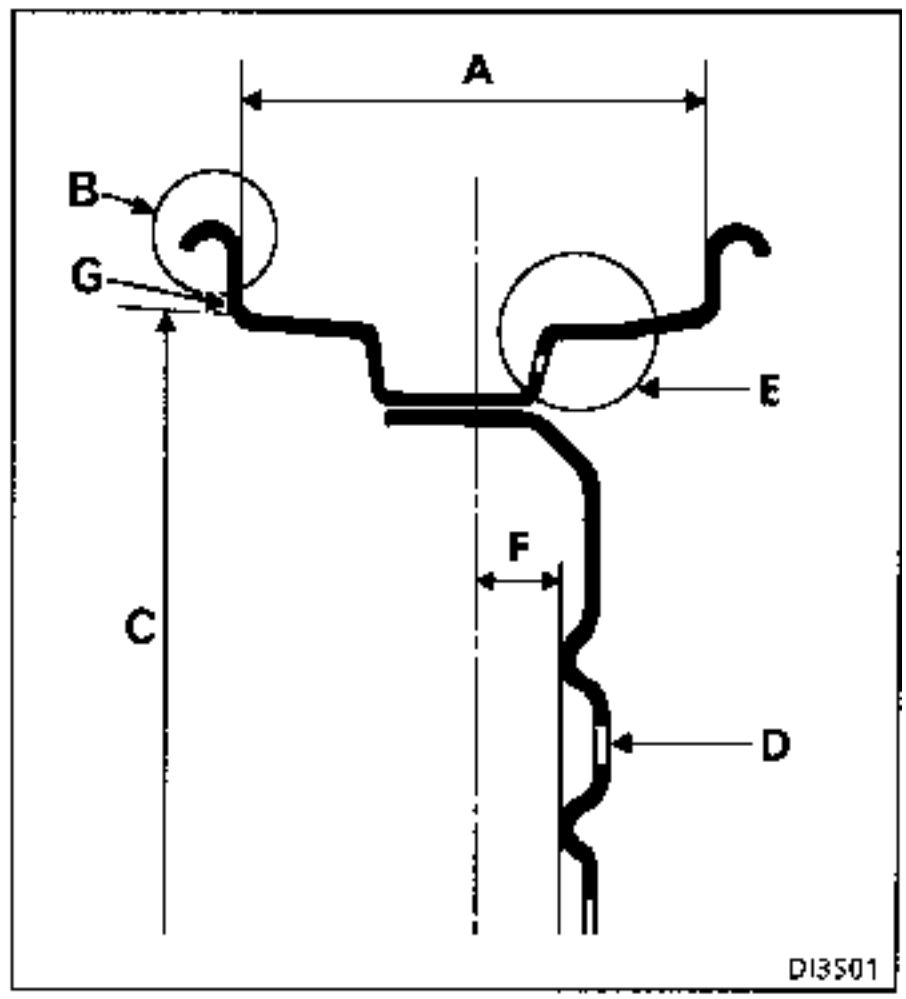
Example : 5 1/2 J 14 4 CH 36
or simplified
Example : 5 1/2 J 14

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

Wheel bolts are of diameter **100 mm** (4 mounting bolts).

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

Maximum eccentricity: **0.8 mm** measured on the pressure face of the tyre beads.



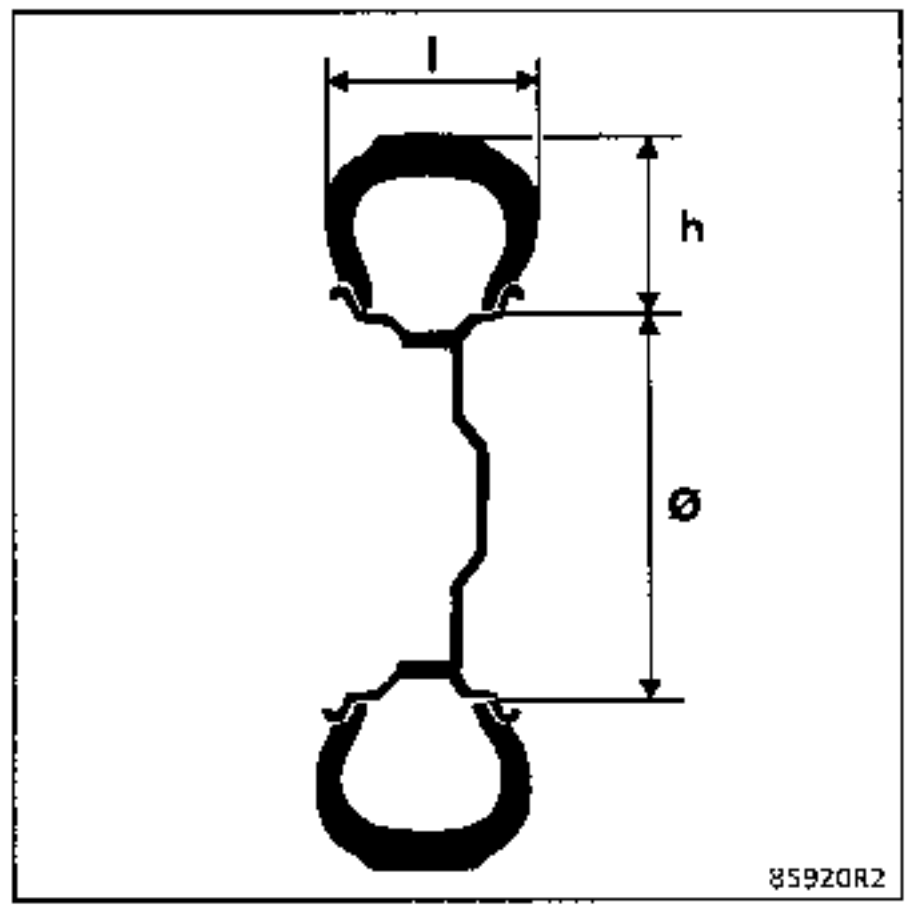
TYRES

There may be two types of identification marking for the same type of tyre.

Example : 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)



(1) 185 Tyre width in mm (S) section

(2) 70 Ratio h/l $\frac{\text{height}}{\text{width}}$

(4) R Radial structure

(5) 14 Inner diameter expressed in inches. Corresponds to the diameter of the rim.

(6) 88 Load index 88 (560 kg)

(3) H Speed index 210 km/h maximum

Some speed symbols :

	Maximum speed km/h
R	170
S	180
T	190
U	200
H	210
V	240
ZR	over 240

Types of structure :

Diagonal	No marking
Radial	R
Bias belted	B

Type	Rim	Rim run-out (mm)	Wheel bolt torque (daN.m)	Tyres	Inflation pressure (bar)	
					Front	Rear
BAOA BAOE BAOF BAOL-BAOU	5,5B13	1.2	9	175/70R13T	2.3	2.2
BAOG	5,5J14			175/65R14H	2.4	

The inflation pressure values are for "motorway" use.

The tyre inflation pressure must be checked when cold. The increase in temperature during driving increases the pressure by **0.2** to **0.3 bar.**

If the inflation pressures are checked when the tyres are warm, take this pressure increase into consideration. **Never deflate a warm tyre.**

Snow chains

For safety reasons it is strictly forbidden to fit snow chains to the rear axle.

"Snow" or "thermorubber" tyres : all four wheels must be fitted with these tyres to preserve the vehicle's adhesion qualities as far as possible.

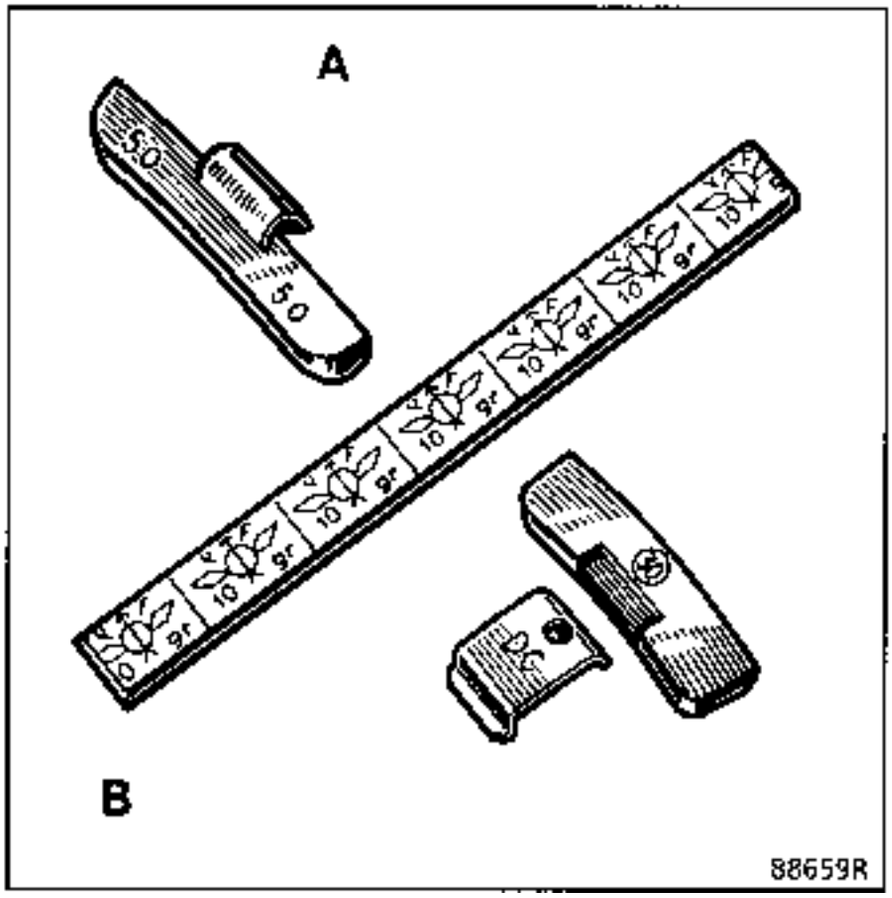
BALANCE WEIGHTS

Only use weights provided by the Parts Department:

- fitted using hooks to steel wheels (hook is part of the weight),

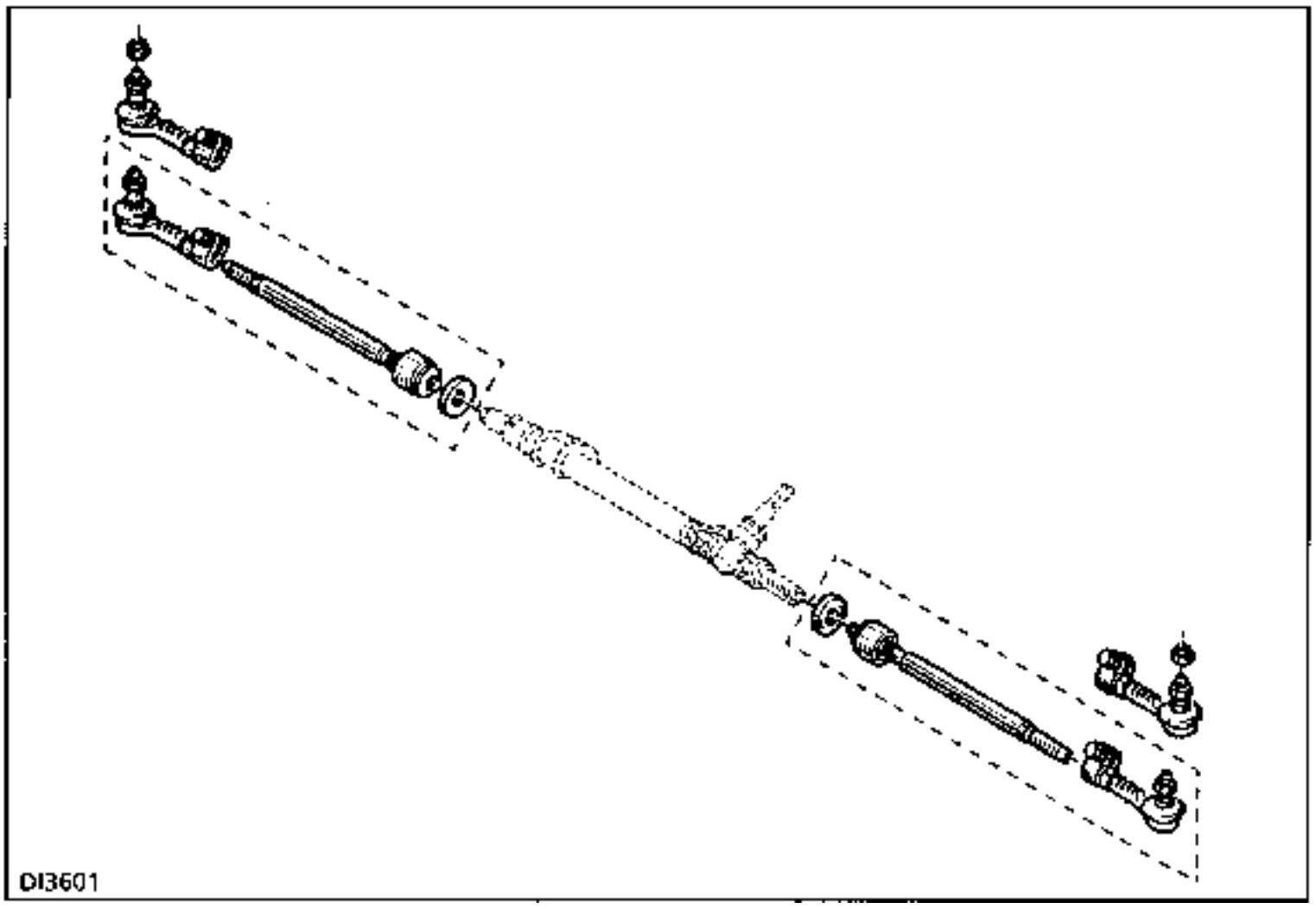
  fitted using hooks (flat hooks) or self adhesive for alloy wheels.

A Steel wheel rim
B Alloy wheel rim



The axial ball joint may be replaced with the steering box on the vehicle. Tool **Dir. 1306** or **Dir. 1306-01** is used to lock the steering rack to the steering box.

IMPORTANT : to avoid damaging the gear and the rack during this operation, it is **VITAL** to hold the rack using tool **Dir. 1306 for an SMI unit** or **tool Dir. 1306-01 for a TRW unit**.

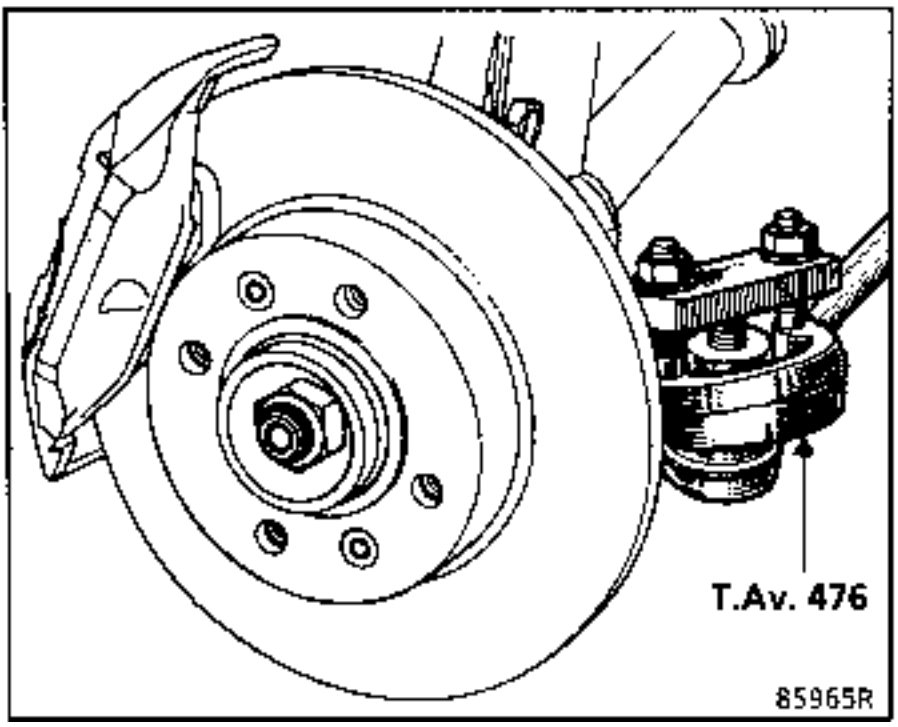


SPECIAL TOOLING REQUIRED	
Dir. 1305	Tool for removing - refitting the axial ball joint
Dir. 1306	Tool for retaining the rack - SMI unit
Dir. 1306-01	Tool for retaining the rack - TRW unit
T.Av. 476	Ball joint extractor

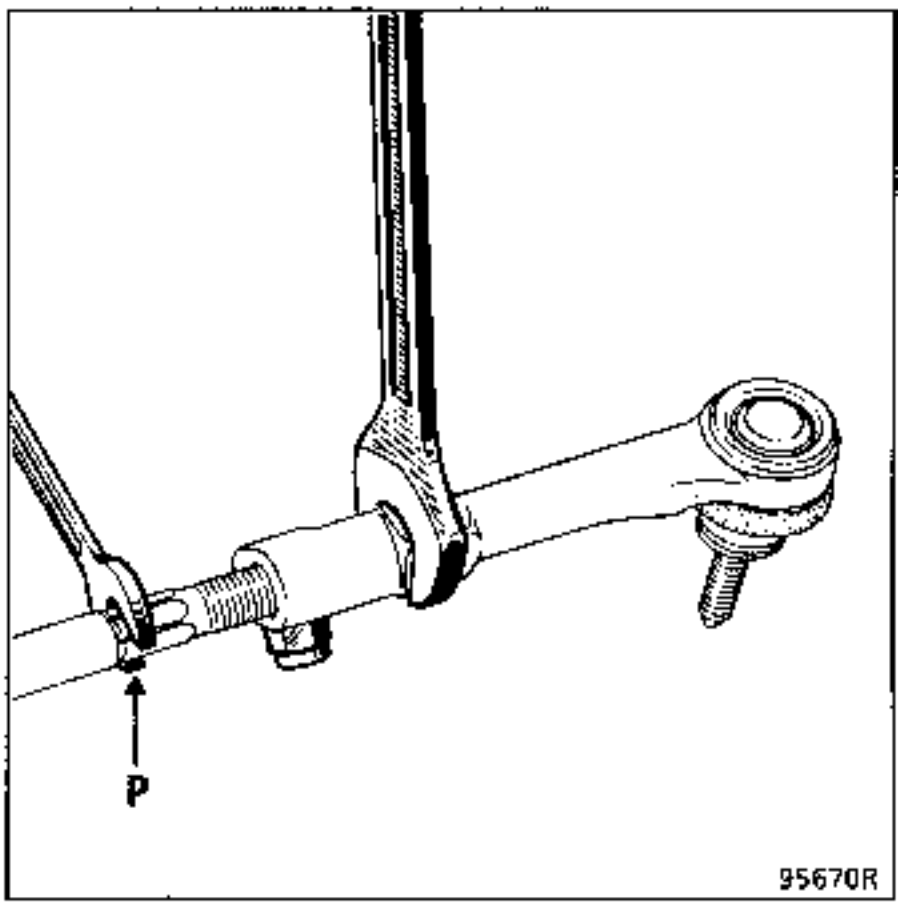
TIGHTENING TORQUES (in daN.m)	
Axial ball joint:	
SMI	5
TRW	8
Ball joint nut	3.5
Bolt on parallelism adjustment sleeve (tangential tightening)	2
Wheel bolts	9

REMOVAL

Disconnect the track rod end using tool T.Av. 476.



Slacken the parallelism adjustment sleeve and unscrew the ball joint unit while holding the axial ball joint with an open wrench at point "P".

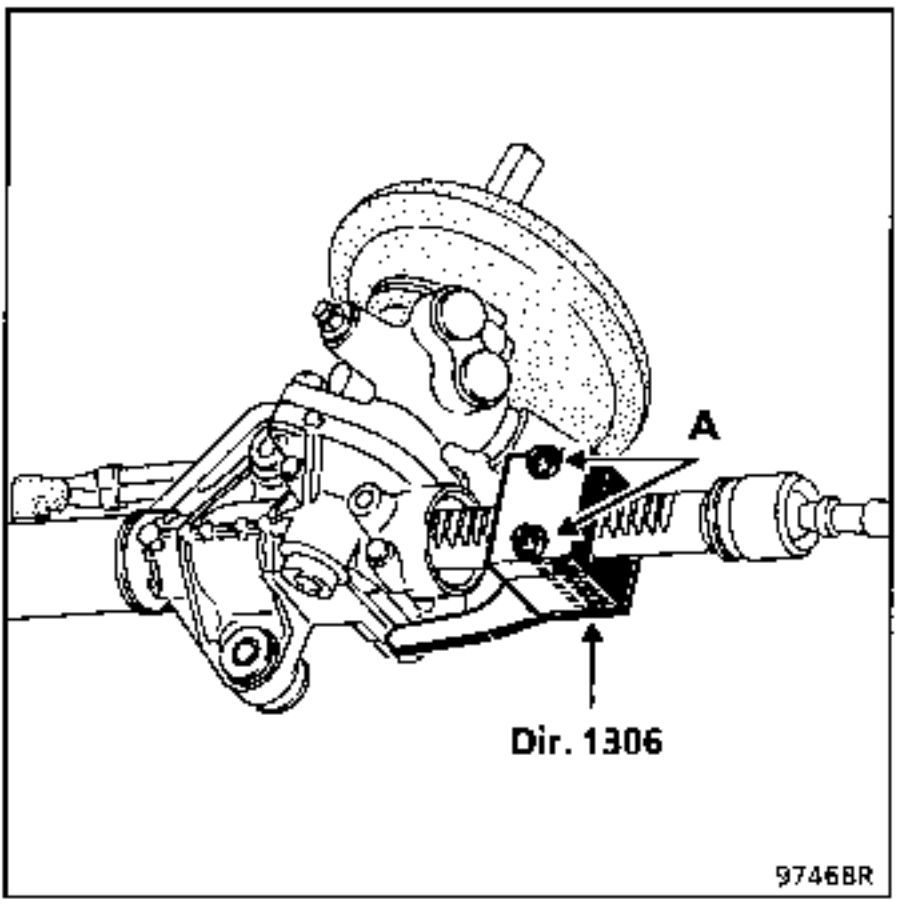


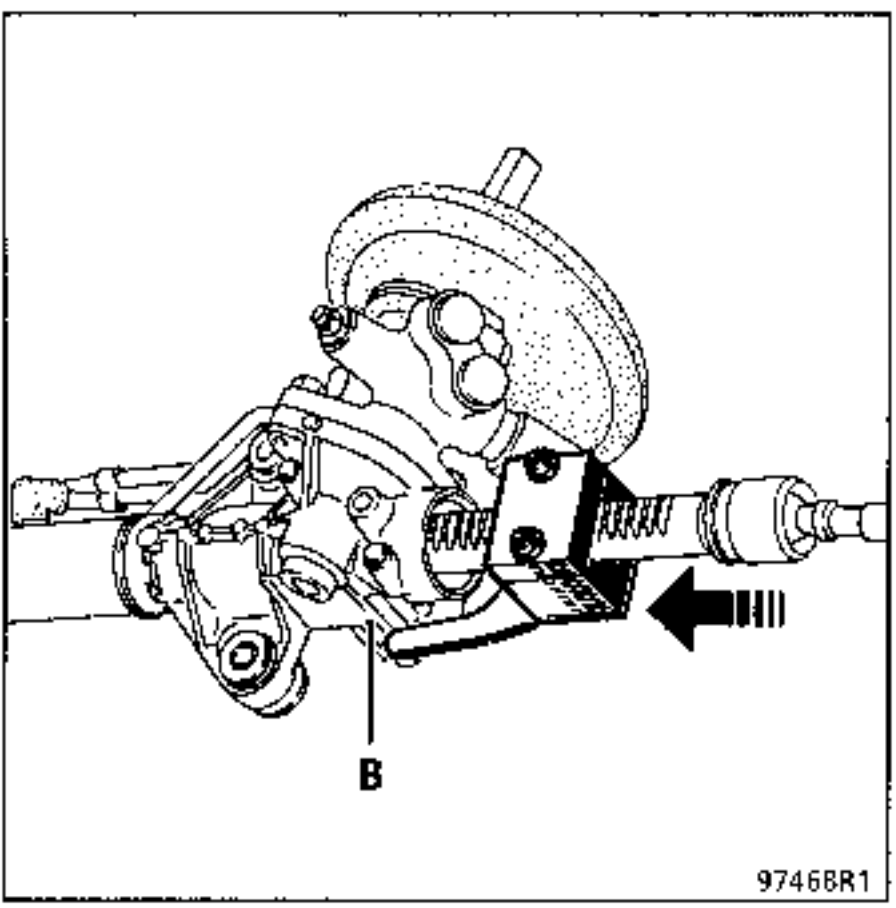
Count the number of threads used so the parallelism may be preset when refitting.

Remove the plastic gaiter clip and remove the gaiter (cannot be re-used) (two metal clips for the TRW unit).

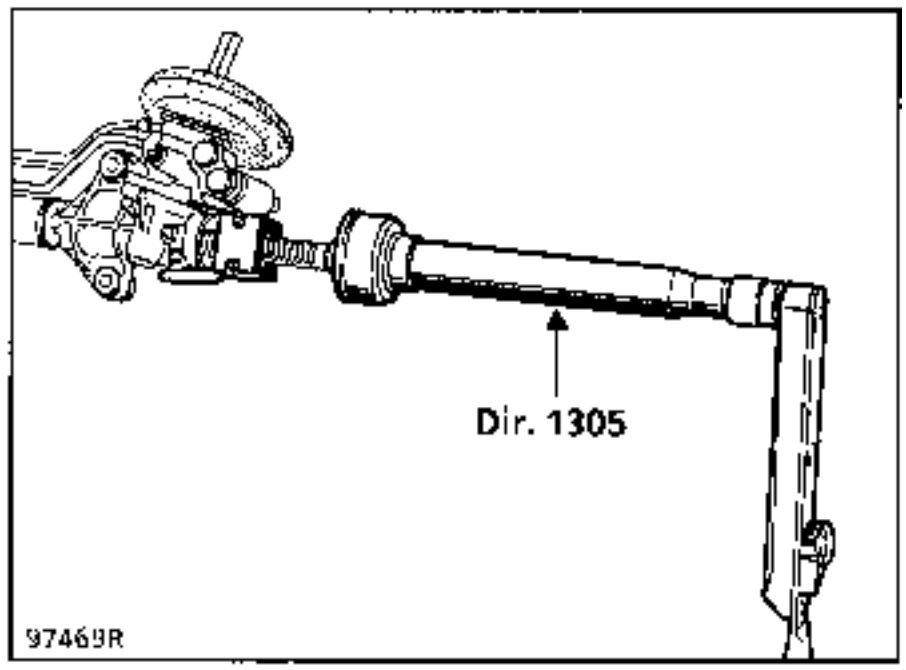
Turn the wheels to release the rack teeth on the valve end.

Fit tool Dir. **1306** or **Dir. 1306-01** engaging it into the pushrod housing (B), and tighten the two bolts (A).





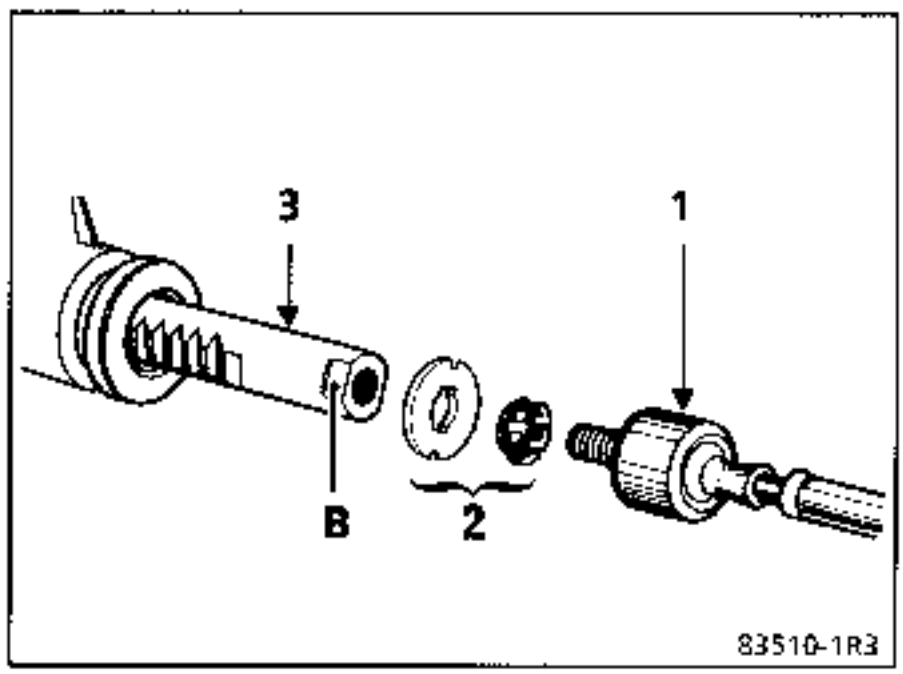
In this position, slacken the axial ball joint using tool Dir. **1305**.



REFITTING

NOTE : for SMI steering only, before refitting the new track rods, use **a 12 X 100 tap** in the threads at the end of the steering rack to remove all traces of **LOCTITE** from the original fitting and avoid any danger of the threaded parts seizing on refitting.

Renew the assembly (2) - **THIS IS ESSENTIAL**.

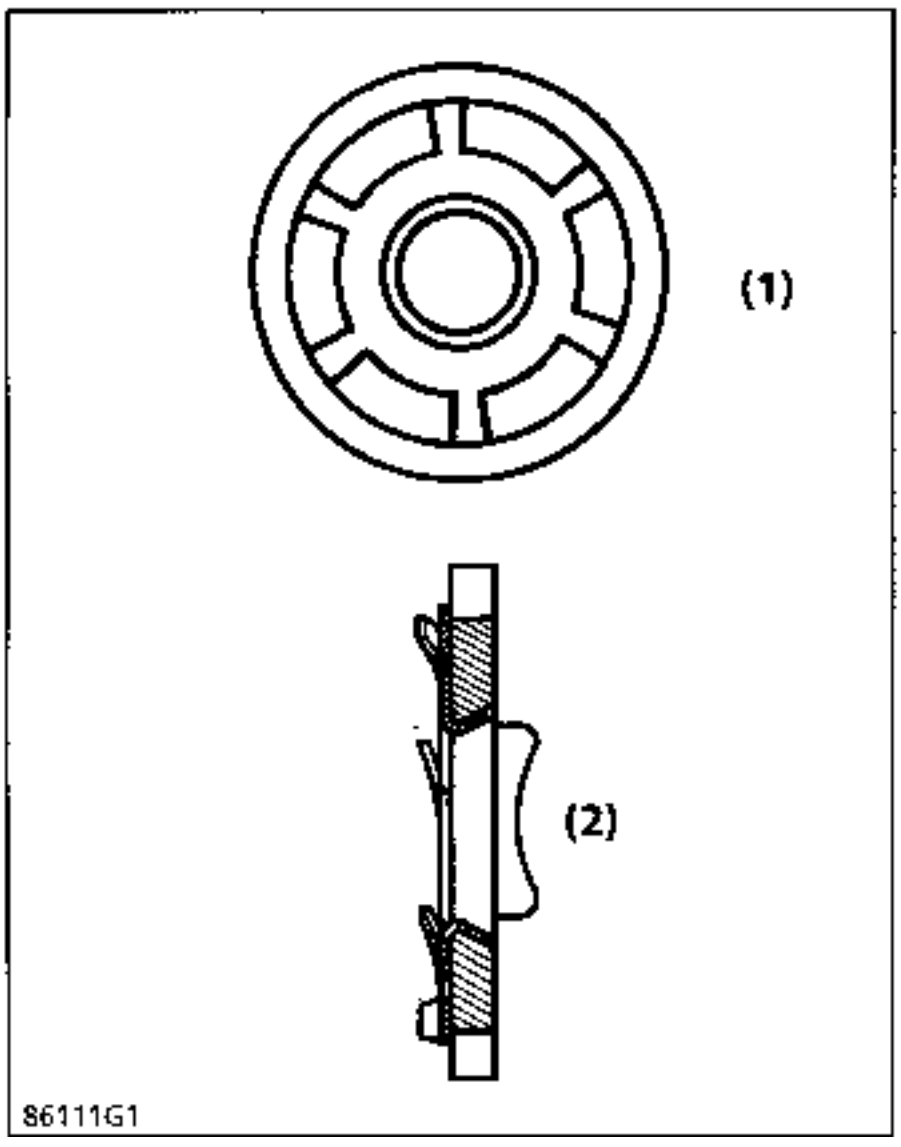


NOTE : this assembly (2) is not used for the **TRW** unit.

Refit to the steering rack (3) :
- the stop washer with the locking ring (2),
- the new axial ball joint (1) after lightly coating the threads with LOCTITE FRENBLOC, so that the air evacuation hole is not blocked.

Checking

Gently press on the gaiter to check the inflation of the other gaiter to verify the correct air circulation.

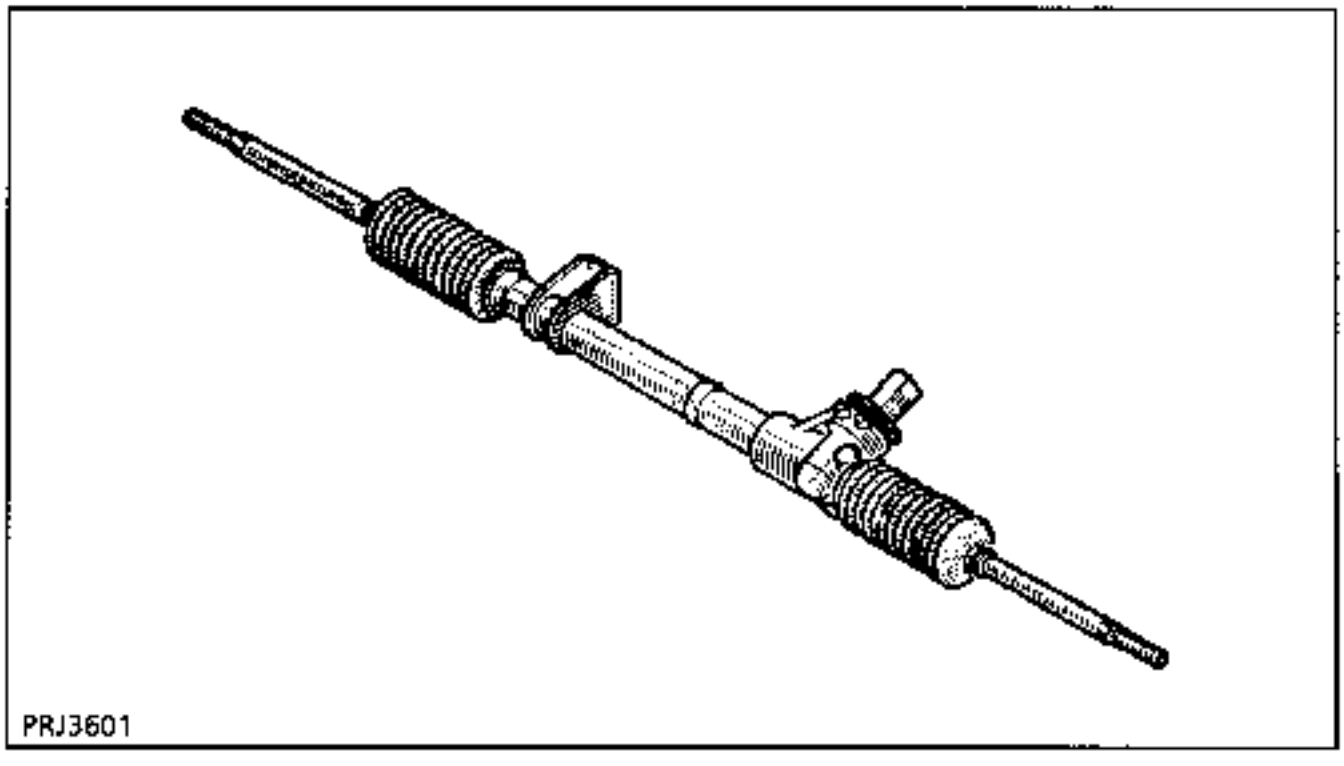


Before finally tightening the axial ball joint using tool Dir. 1305, check the tabs on the stop washer (2) fit correctly in the flats (B) on the steering rack.

Tighten the axial ball joint to the recommended torque.

Set the steering to the centre point to equalise the air in the gaiters.

Fit a new gaiter and secure it with a new clip (after coating the gaiter seat on the axial ball joint with grease).

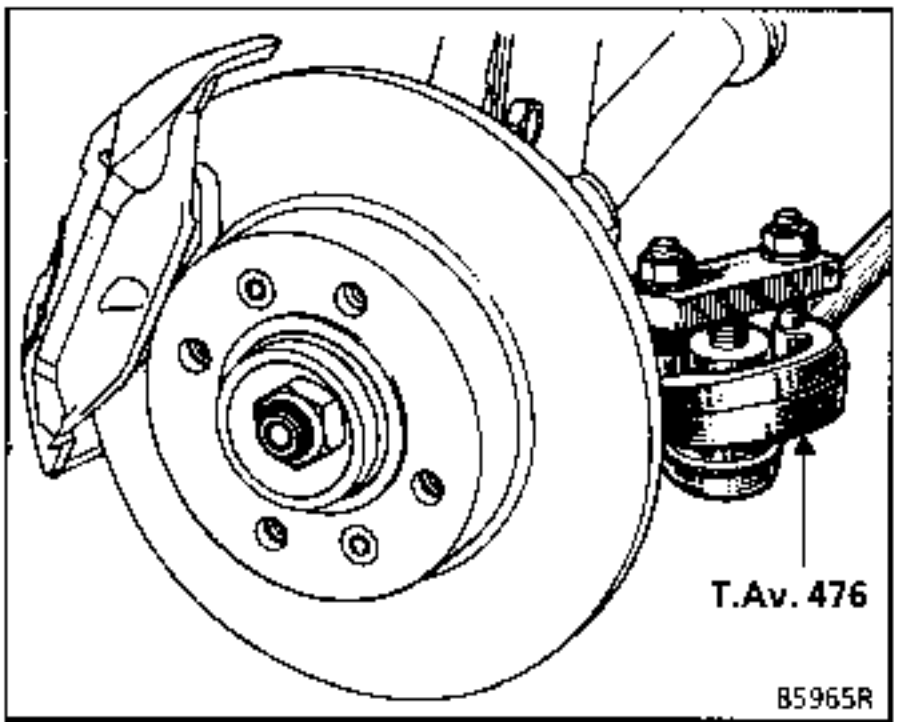


SPECIAL TOOLING REQUIRED	
T.Av. 476	Ball joint extractor

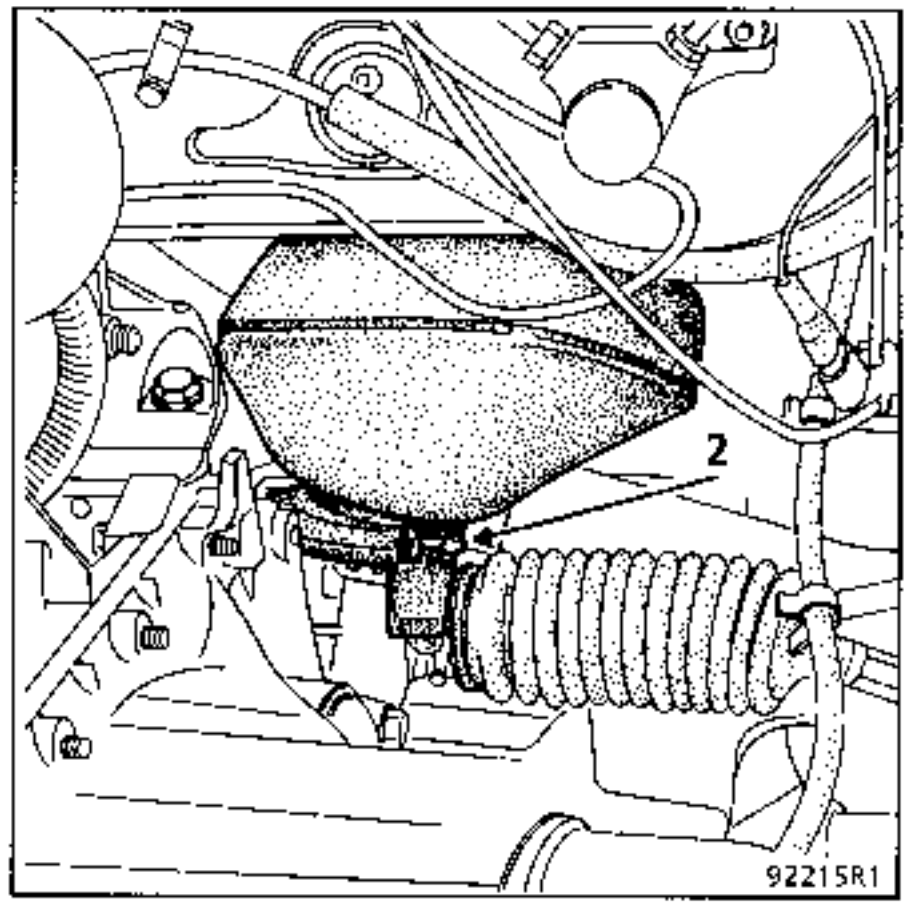
TIGHTENING TORQUES (in daN.m)	
Track rod end nuts	3.5
Axial ball joint	5
Steering box mounting bolts	5.5
Steering column universal joint eccentric bolt	2.5

REMOVAL

Disconnect the track rod ends using tool T.Av. 476.

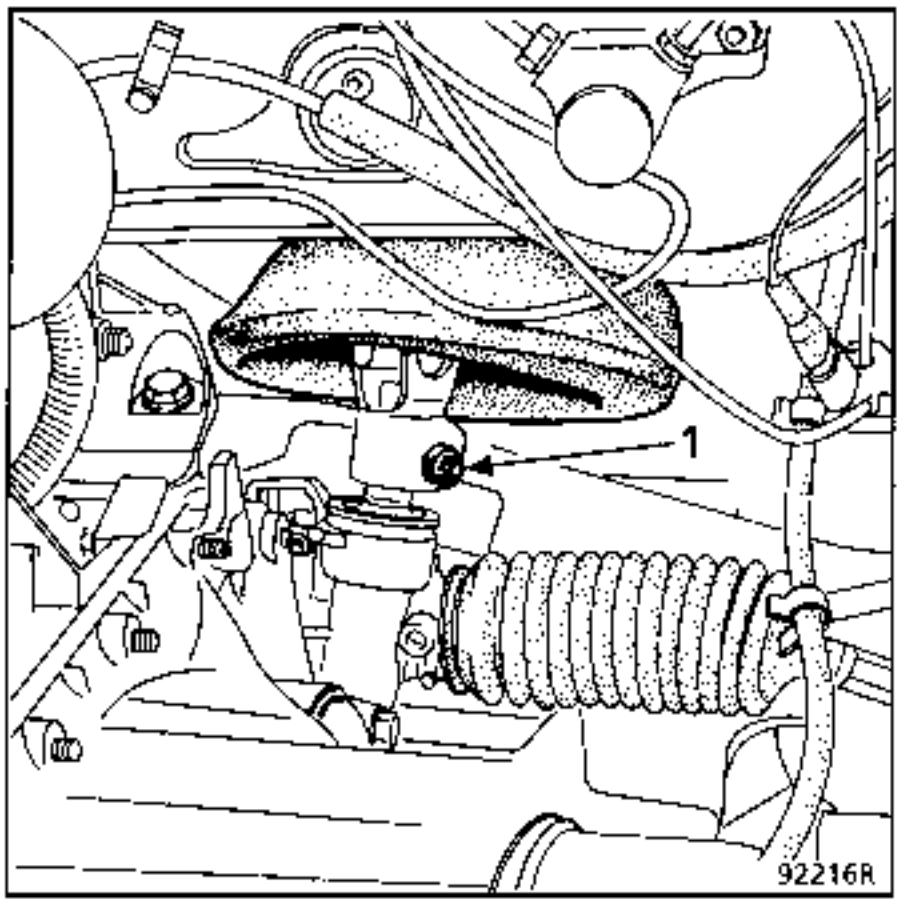


Cut the clip (2) securing the rubber protector.

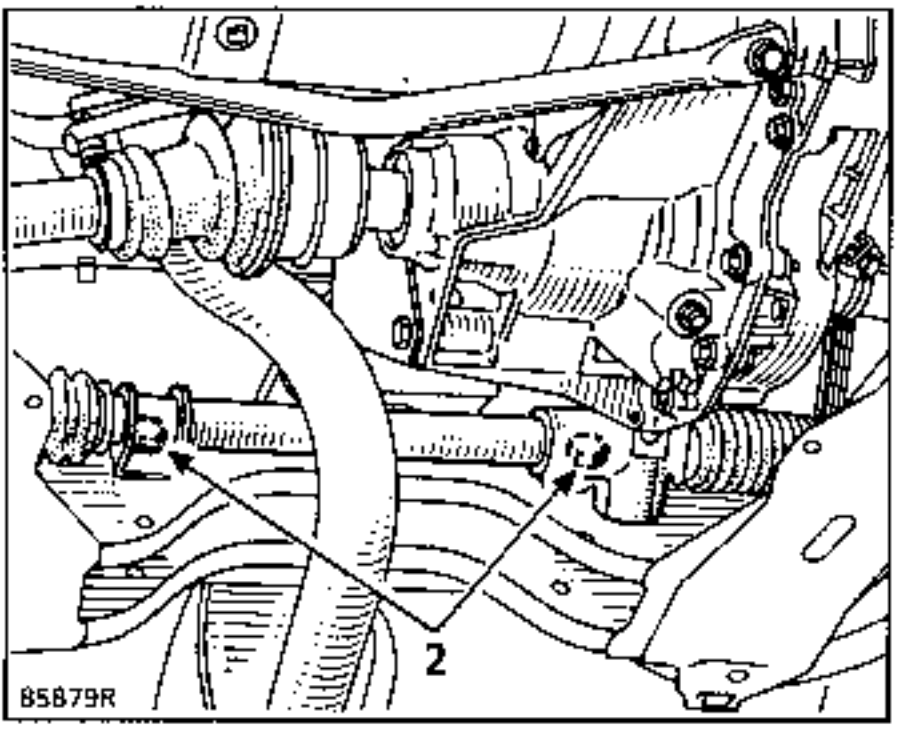


Push the protector back towards the bulkhead and remove:

- the eccentric bolt (1) from the steering column universal joint,



- the two bolts (2),

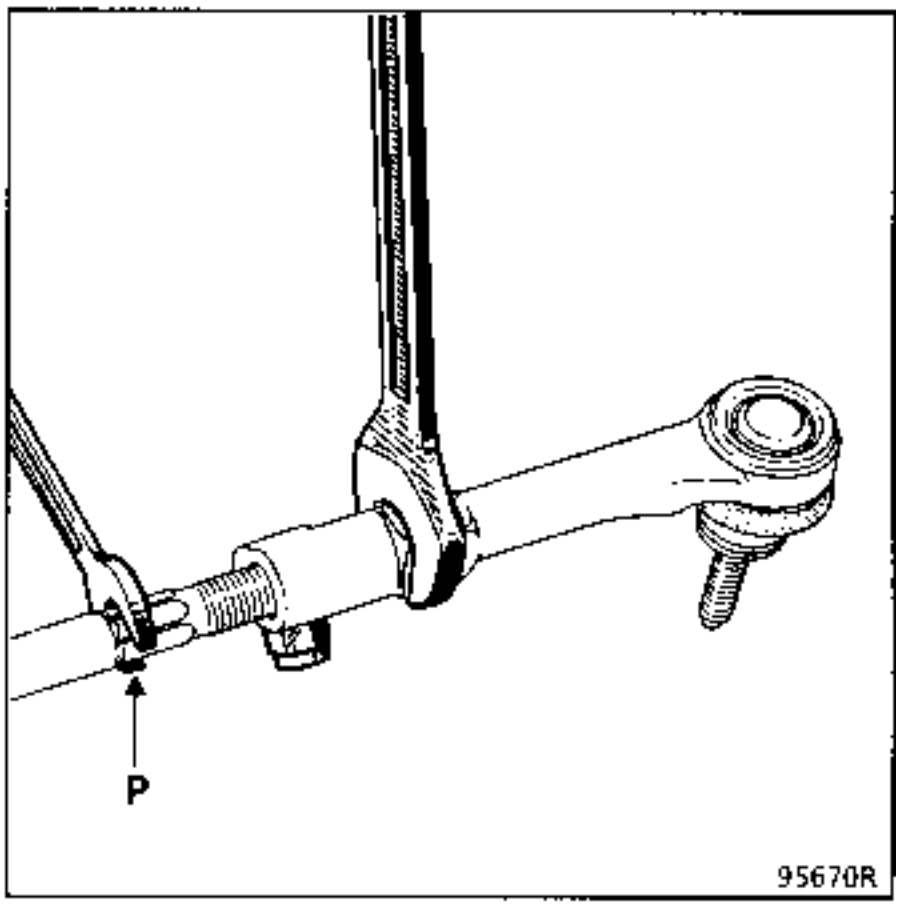


- the steering box.

Never unscrew the axial ball joints from the steering rack unless they are to be renewed.

If the steering box is to be replaced, the ball joint units at the stub axle carrier end must be retained.

To do this, slacken the parallelism adjustment sleeve and unscrew the ball joint unit while holding the axial ball joint with an open wrench at point "P".



REFITTING

Refitting is the reverse of removal.

If the steering box is new, fit the ball joint units in the position marked on removal.

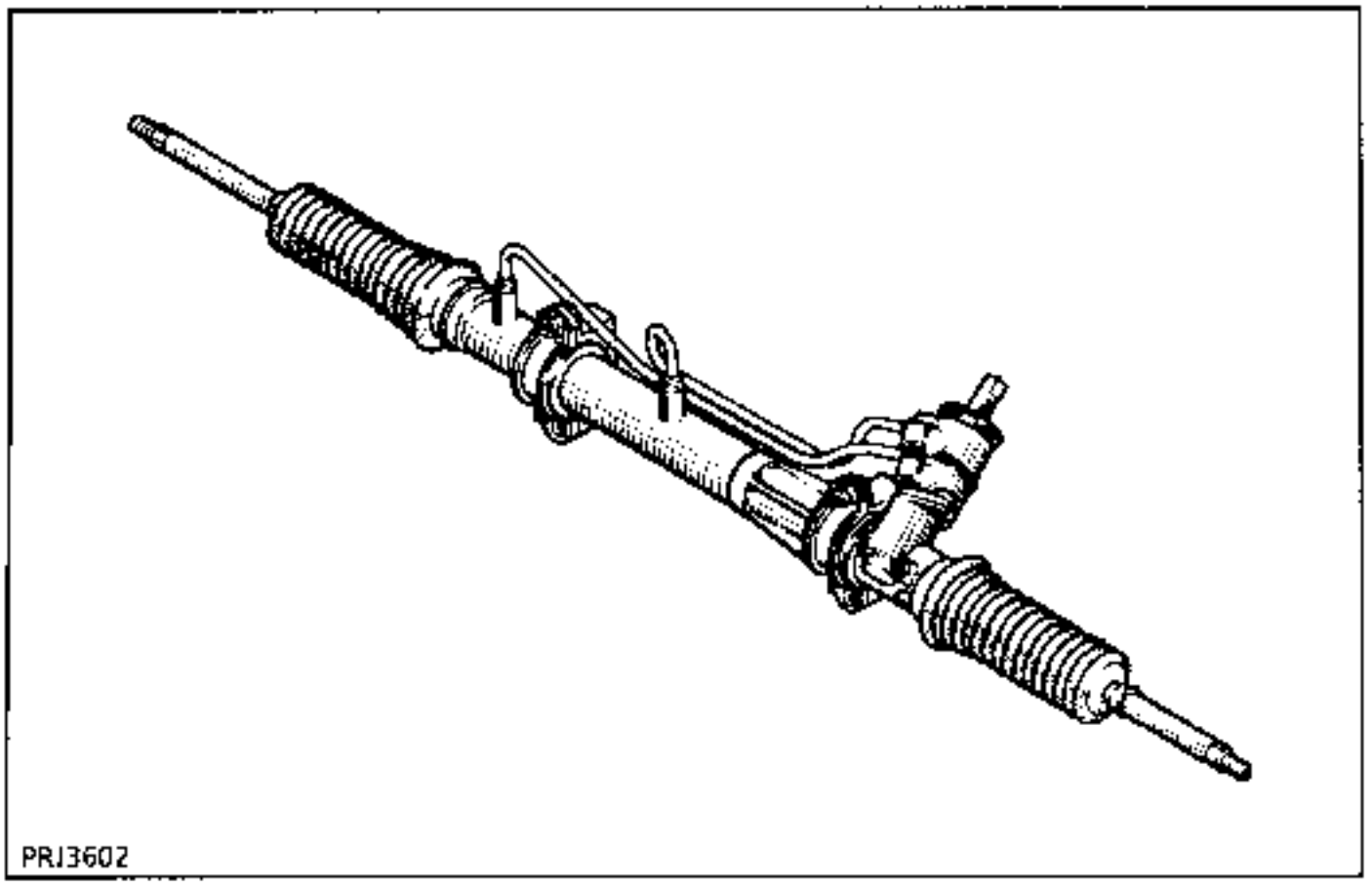
Refit the steering box and track rods to the vehicle.

Position the steering column universal joint and tighten the eccentric bolt.

Fit the rubber protector and secure it with a new plastic clip.

Check the parallelism.

NOTE : the ball joint reference marks **MUST** be observed (one mark on the right hand unit, two marks on the left hand unit).

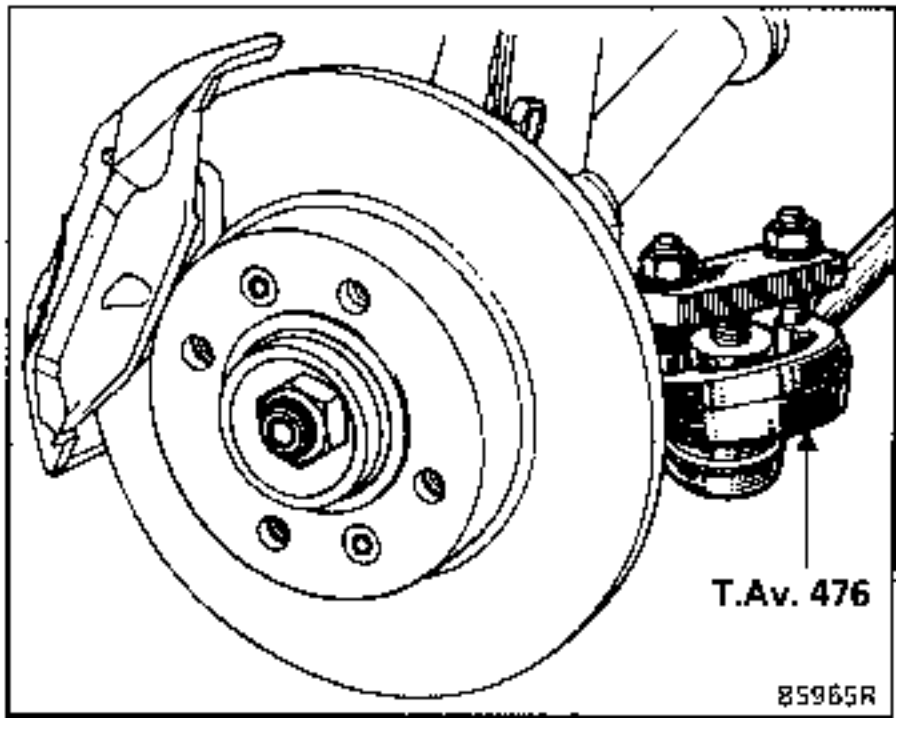


SPECIAL TOOLING REQUIRED	
M.S. 583	Hose clamp pliers
T.Av. 476	Ball joint extractor

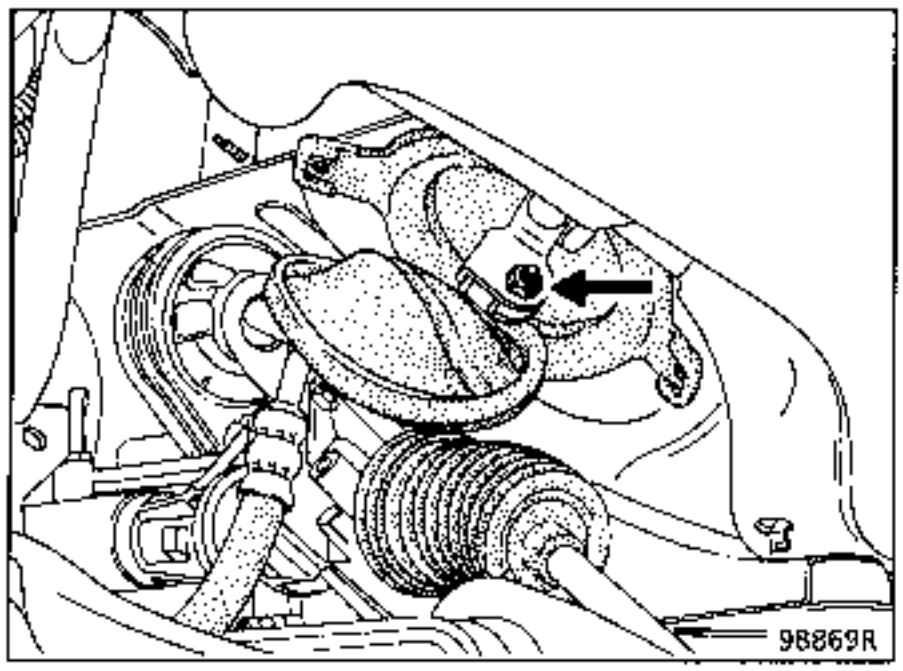
TIGHTENING TORQUES (in daN.m)	
Track rod end nut	3.5
Axial ball joint:	
SMI	5
TRW	8
Steering rack mounting bolts	5
Steering column universal joint eccentric bolt	2.5
High pressure pipe on valve and pump	2.4
Low pressure pipe on valve:	
aluminium	2.2
steel	2.8
Valve / cylinder pipe 1.7	1.4 to

REMOVAL

Disconnect the track rod ends using tool **T.Av. 476.**

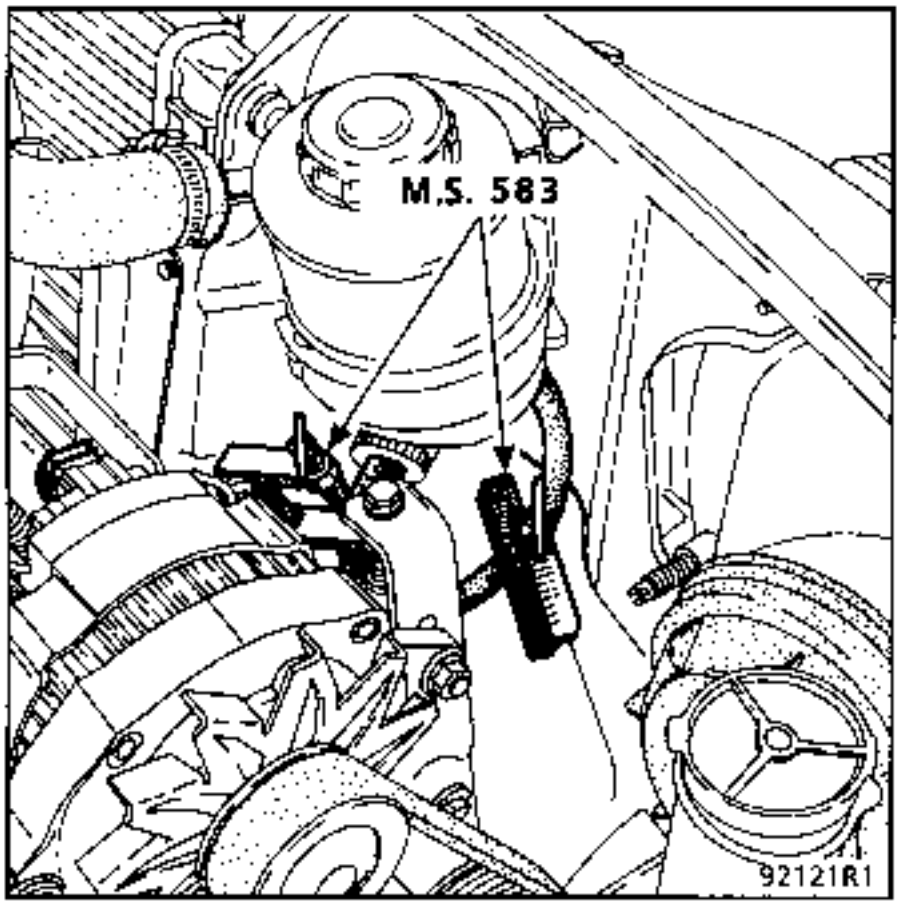


Remove the eccentric bolt from the steering column universal joint.

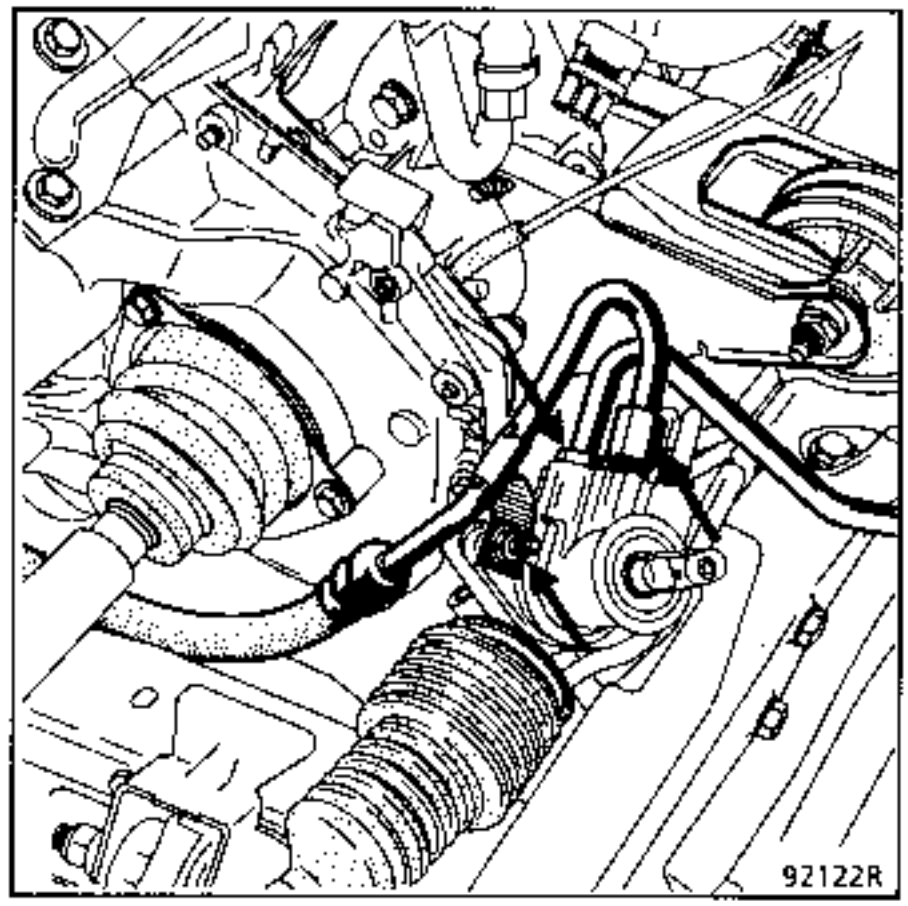


Fit a clamp **M.S. 583** to each of the pipes from the oil reservoir.

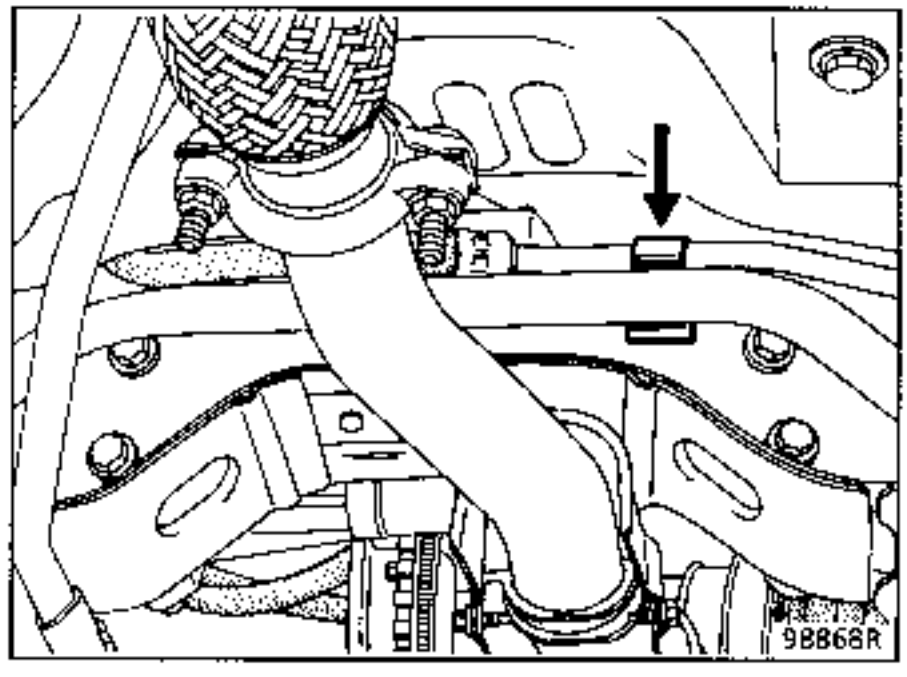
Never clamp the high pressure pipes.



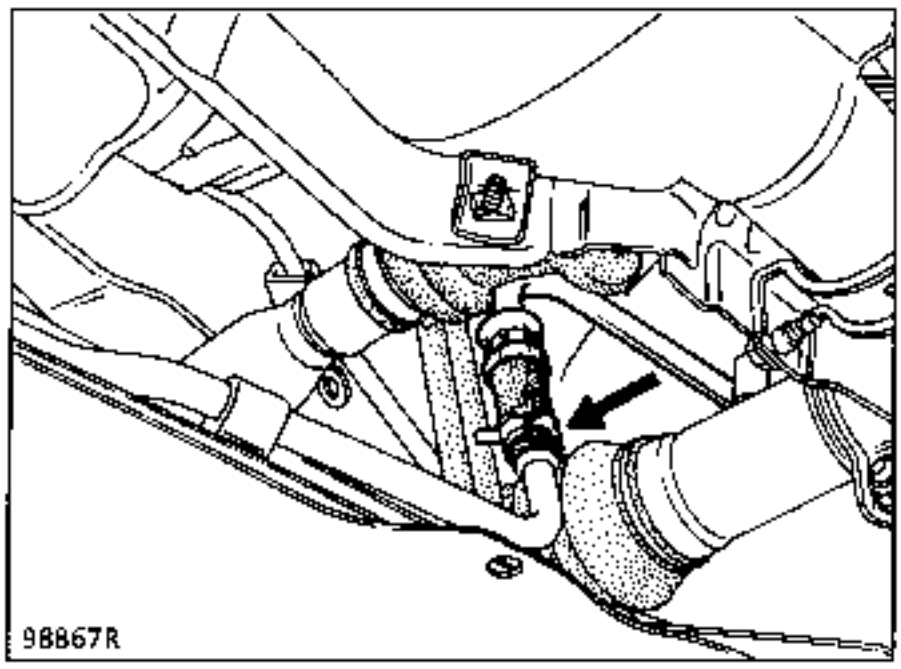
Remove:
- the air filter unit,
- the high pressure pipe retaining bracket mounting,



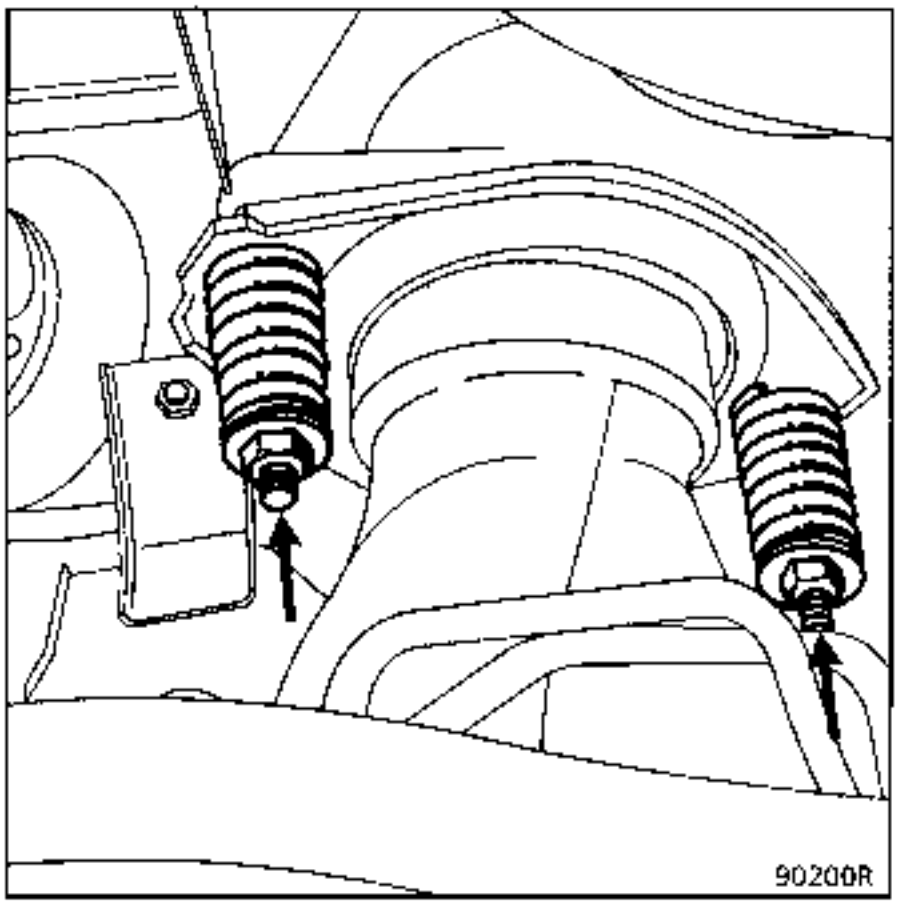
- the low pressure pipe retaining bracket mounting,

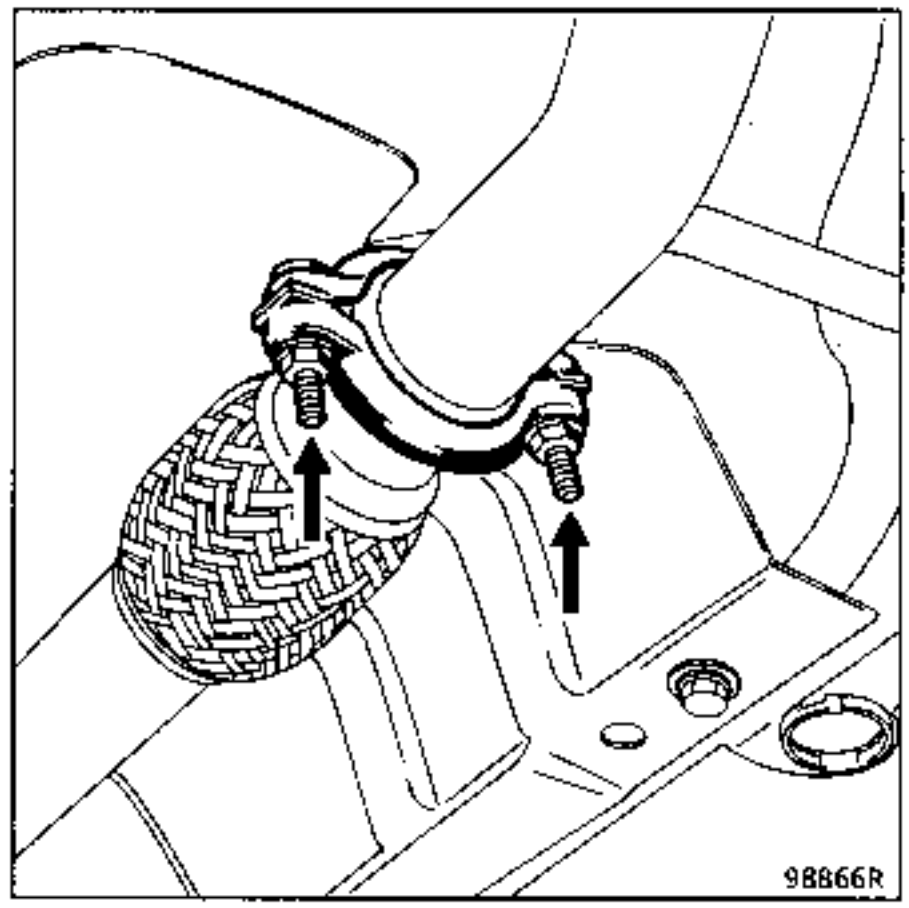


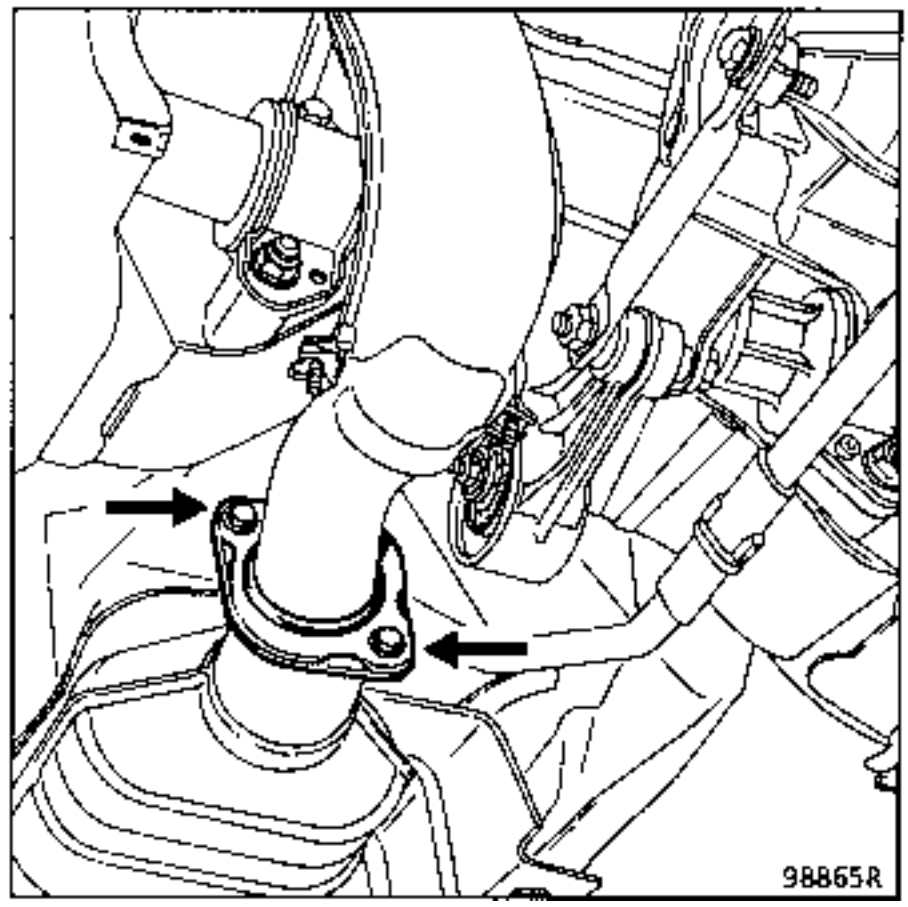
– the low pressure pipe flexible union,



– the exhaust downpipe at the manifold and the central connection under the vehicle (different types).

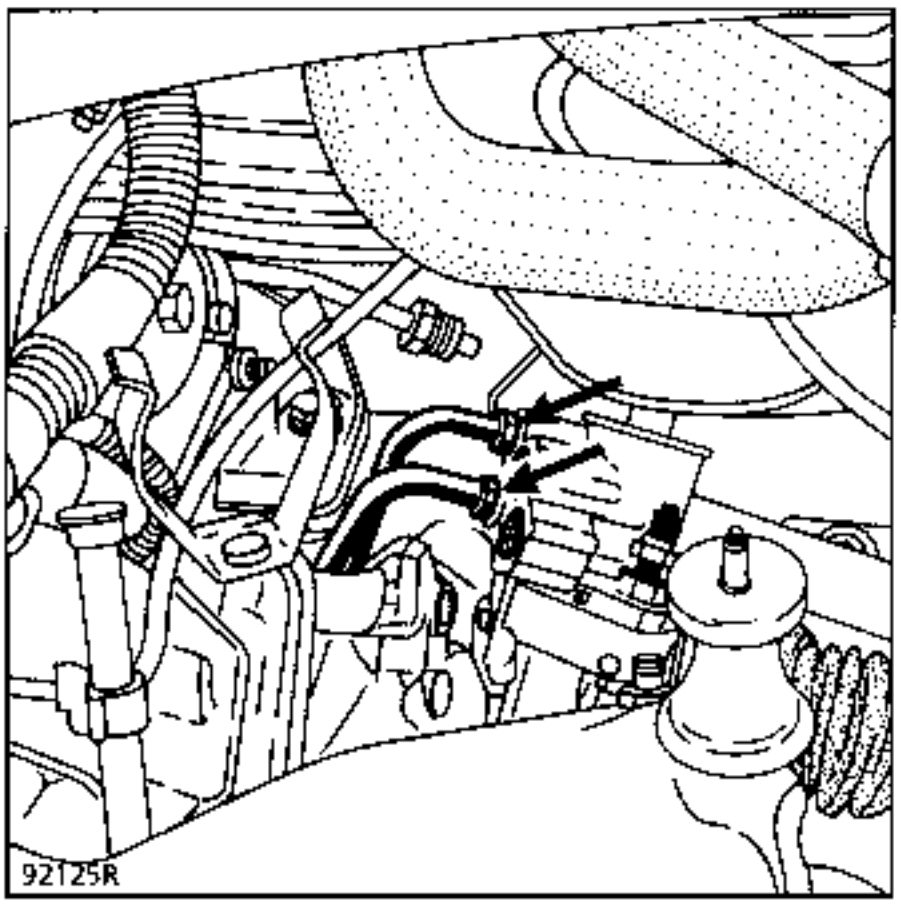


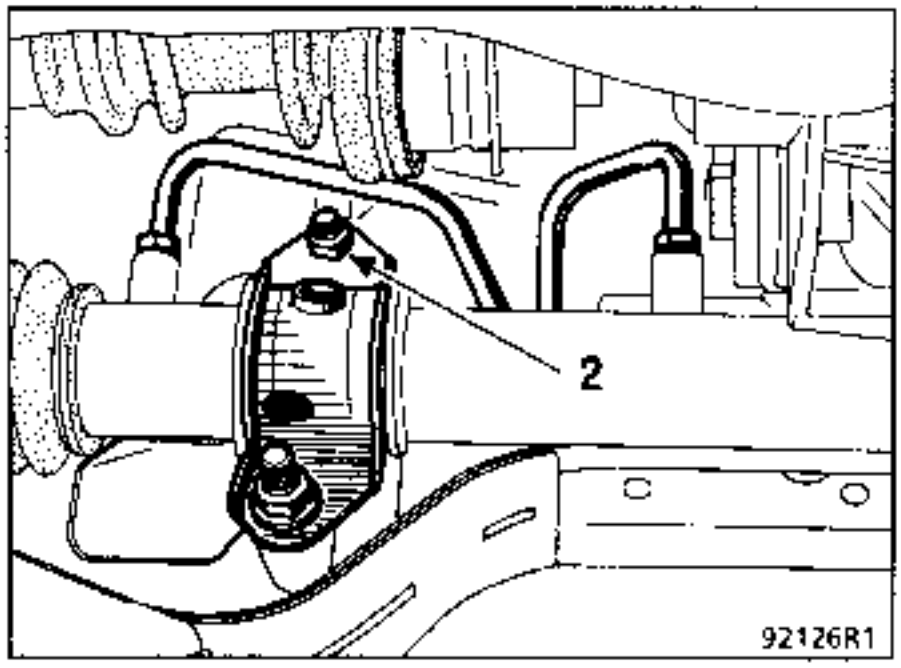




Under the vehicle, unscrew then remove the steering supply pipes (take precautions to catch the oil which will run out).

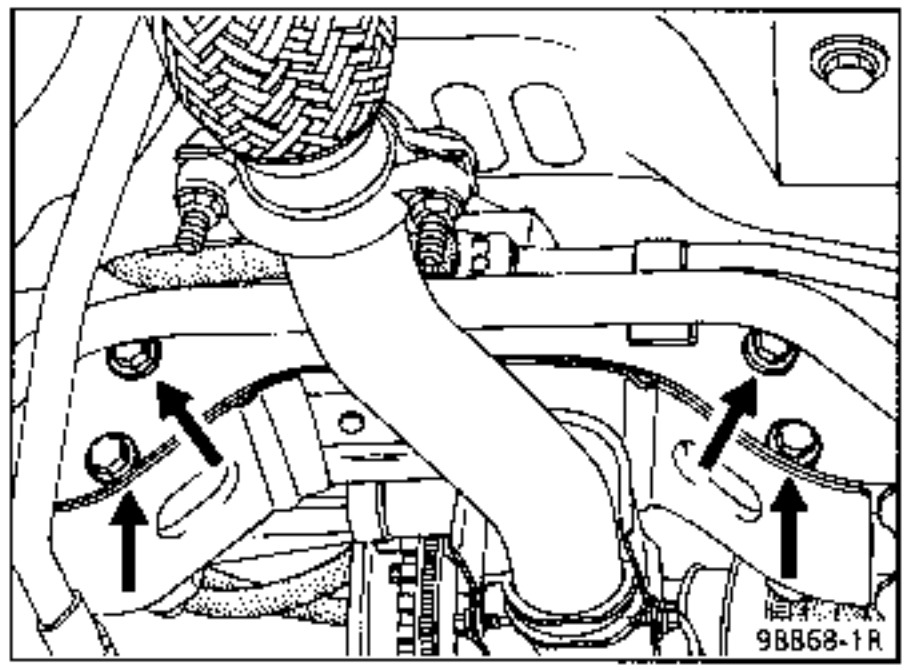
Do not remove the valve - cylinder pipes.





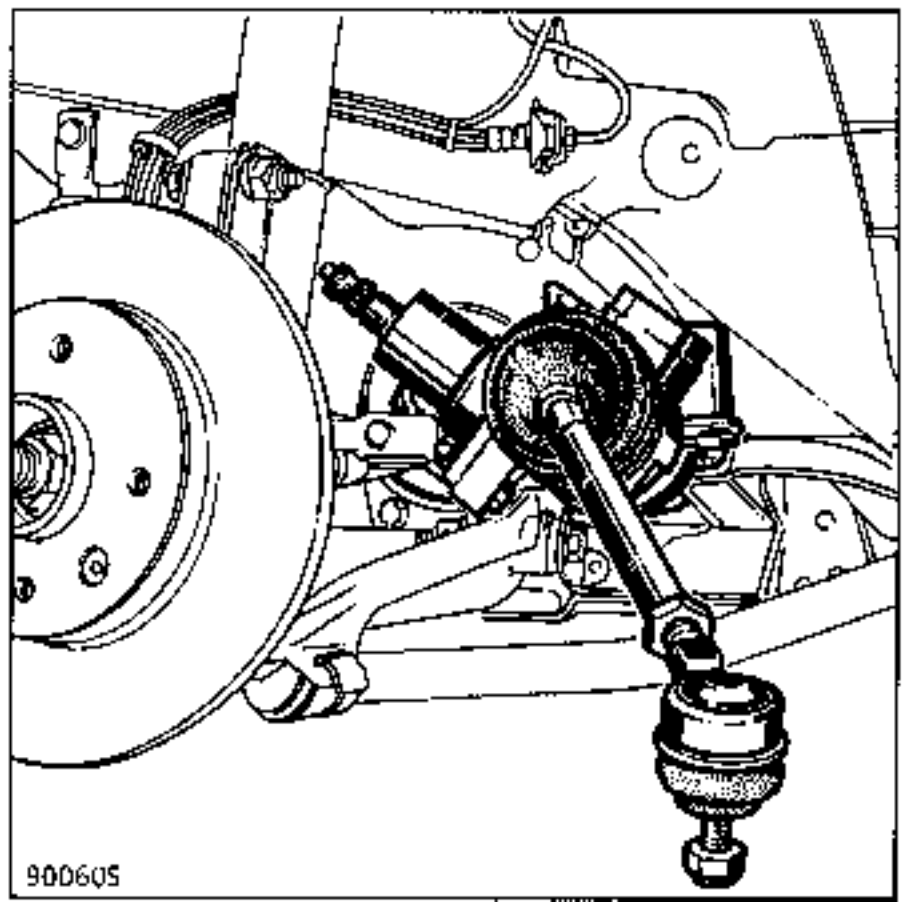
NOTE : fit plugs to the steering pipe openings to avoid the entry of impurities.

Remove:
- the bolt (2) from the steering rack right hand mounting,
- the four bolts mounting the steering box to the cradle.



Lower the unit and remove the right hand mounting.

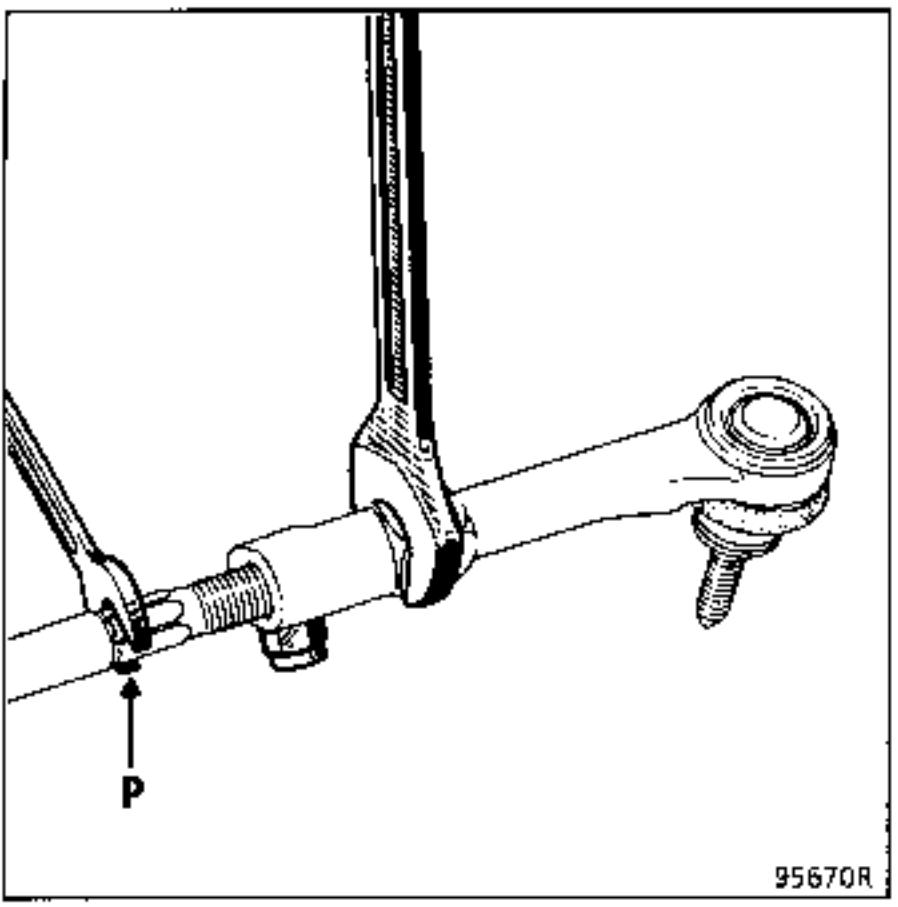
Remove the unit via the left hand scuttle panel by successive rotations to release the steering with the valve - cylinder pipes.



Never unscrew the axial ball joints from the steering rack unless they are to be renewed.

If the steering box is to be replaced, the ball joint units at the stub axle carrier end must be retained.

To do this, slacken the parallelism adjustment sleeve and unscrew the ball joint unit while holding the axial ball joint with an open wrench at point "P".



REFITTING

If new steering is to be fitted:

- fit the ball joint units in the position marked on removal,
- remove the right hand mounting for the unit and the cylinder supply pipes, plugging the openings to prevent the entry of impurities.

Fit the steering unit.

Position the right hand mounting and refit bolt (2).

Fit:
- the cylinder supply pipes on the valve and the body without tightening them,
- the four unit mounting points and torque tighten them.

Tighten the cylinder supply pipes and the right hand mounting bolt.

Reconnect the rotary valve supply pipes, positioning the low pressure pipe.

Tighten the mountings for the support brackets for the supply pipes and the flexible union.

Position the steering column universal joint and tighten the eccentric bolt.

Refit:
- the exhaust downpipe,
- the ball joints on the stub axles,
- the air filter unit.

Remove clamps **M.S. 583.**

Fill the circuit with oil up to the marker on the reservoir filter.

Turn the wheels from left to right (engine not running) to distribute the oil in the circuit.

Repeat the operation when the engine is running then top up the level.

Check the parallelism and adjust it if necessary.

NOTE : the ball joint reference marks **MUST** be observed (one mark on the right hand unit, two marks on the left hand unit).

The gaiter must be **RENEWED** each time an axial ball joint is removed.

Identification of the gaiter

- black gaiter → rubber or VAMAC
- grey gaiter → silicon

Fitting the gaiter

Use a cone on the axial ball joint to avoid damaging the gaiter on fitting.

Coat the gaiter seat on the axial ball joint with grease to avoid the gaiter twisting.

Secure the gaiter with a new clip (supplied with the gaiter).

NOTE : the steering **MUST** be put in the centre point to ensure the air is evenly distributed.

ADJUSTMENT

If the steering pushrod is noisy, before replacing the steering unit, ensure the pushrod is correctly adjusted.

1. Determining the source of the noise

Take hold of the steering rack on the pushrod side and check for transverse play (up - down). Movement followed by a click means the pushrod is clicking.

2. Adjustment for SMI steering

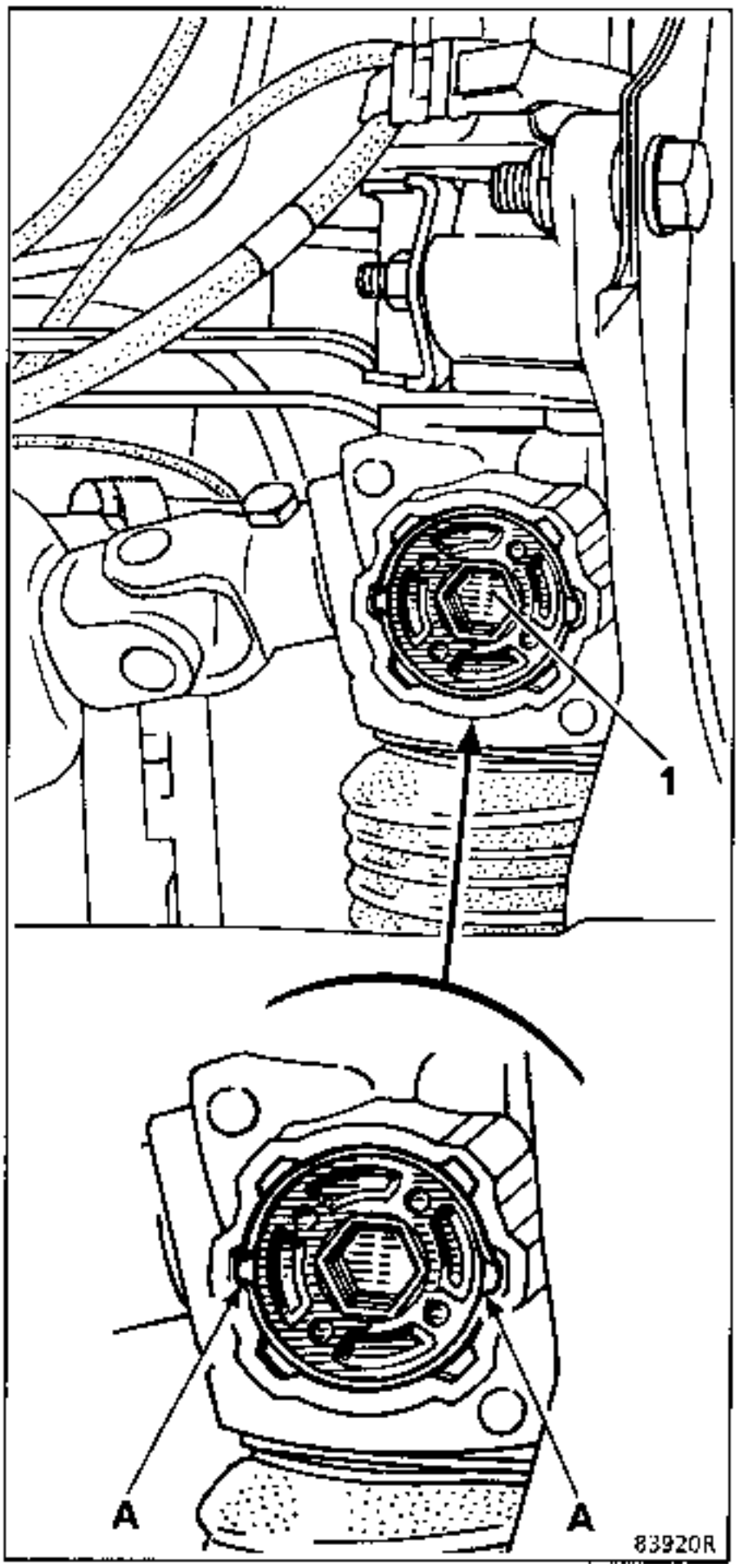
Release the adjusting nut (1) straightening the folded over sections (A) of the collar on the nut.

Tighten the adjusting nut by 2 notches using a 10 mm Allen key.

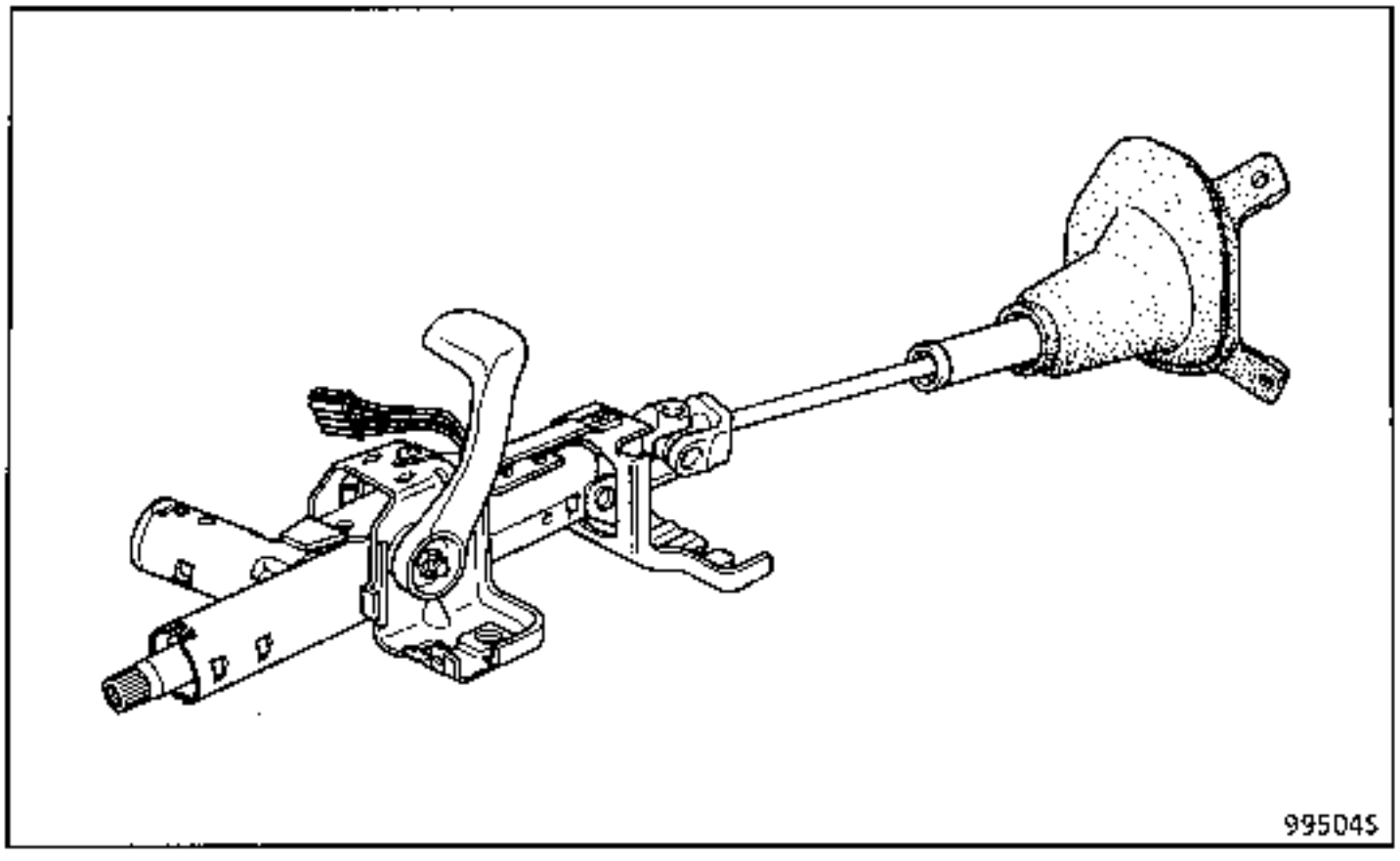
Check to see if the steering wheel returns to the centre point while driving.

Maximum adjustment : **3 notches.**

Lock the nut in two lugs opposite each other by folding down the collar on the nut.



The steering column is sold as a complete unit. No separate parts are available.



TIGHTENING TORQUES (in daN.m)	
Steering wheel bolt	4.5
Steering column universal joint eccentric bolt	2.5
Steering column mounting nuts	2

REMOVAL

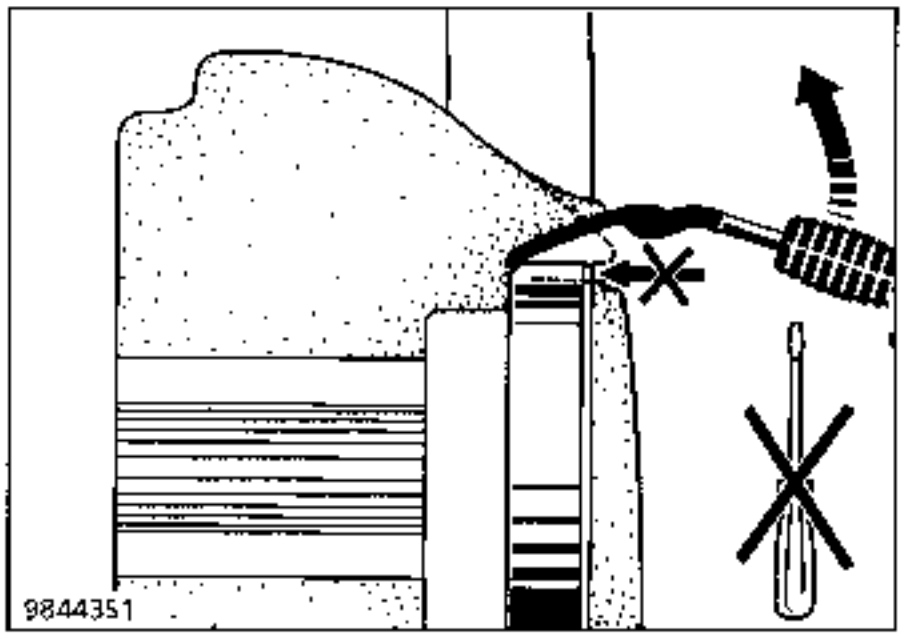
Disconnect the battery.

Set the vehicle's wheels straight.

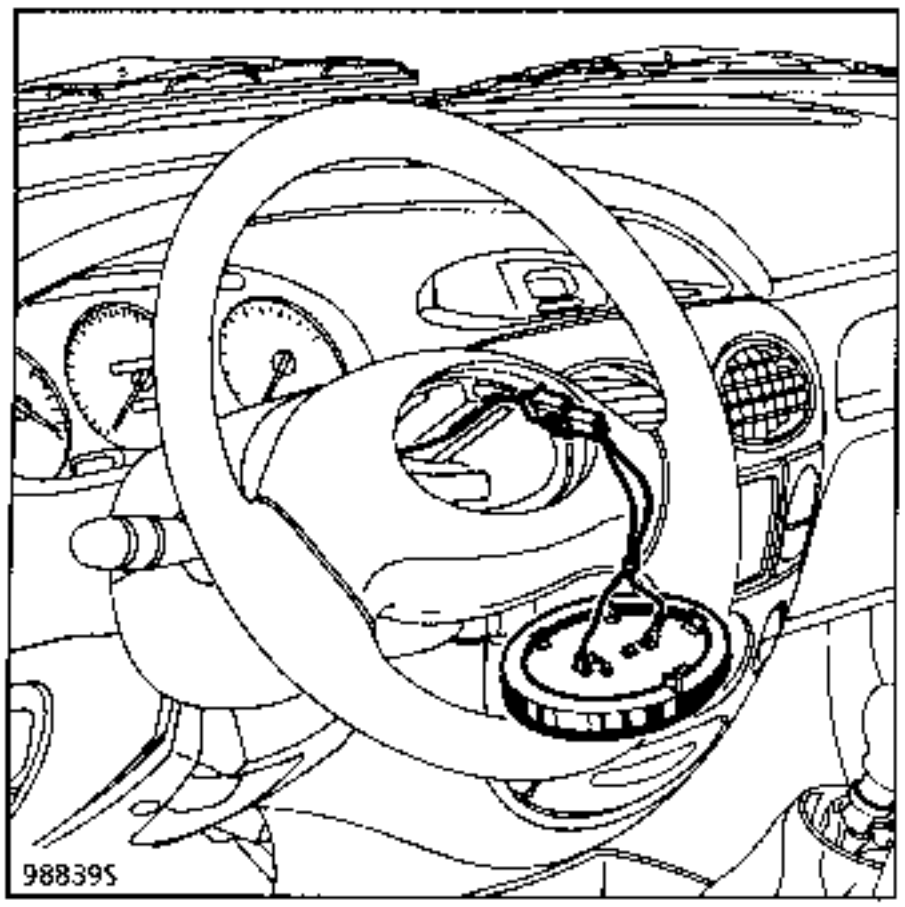
Remove the steering wheel in the following manner.

Without the airbag option

Release the horn assembly from the steering wheel using a tool of type FACOM D115.



Disconnect and remove the horn assembly.

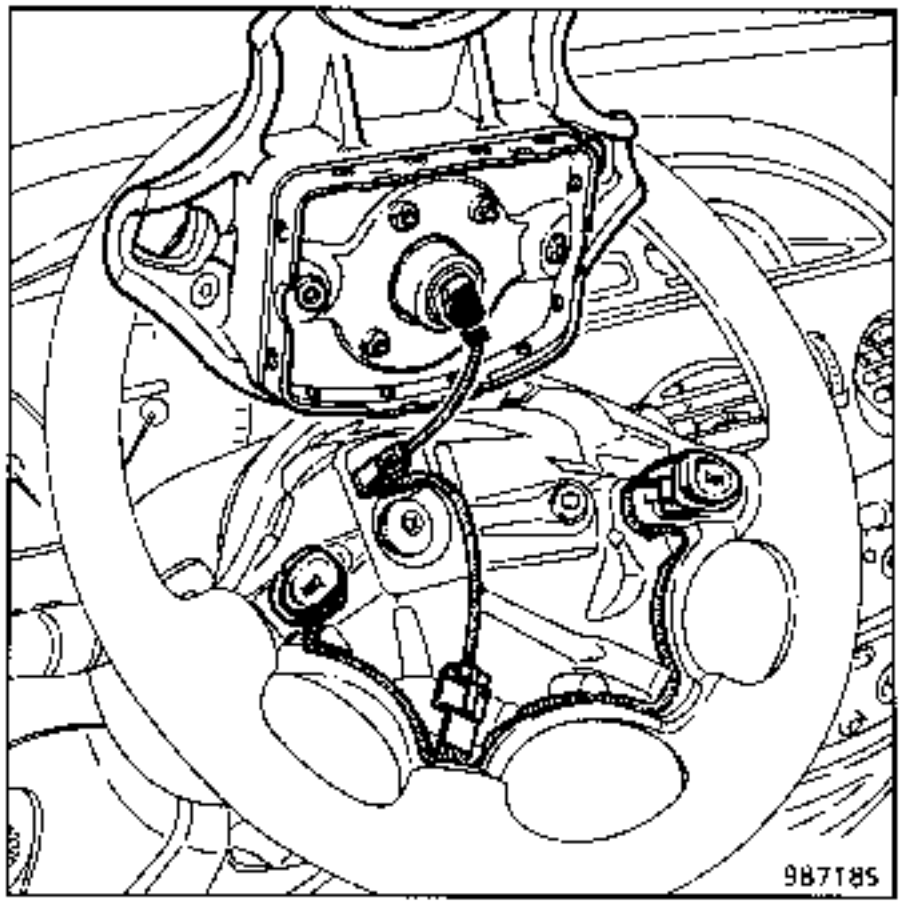


Remove:
- the steering wheel bolt (this **MUST** be renewed on refitting),
- the steering wheel.

With the airbag option

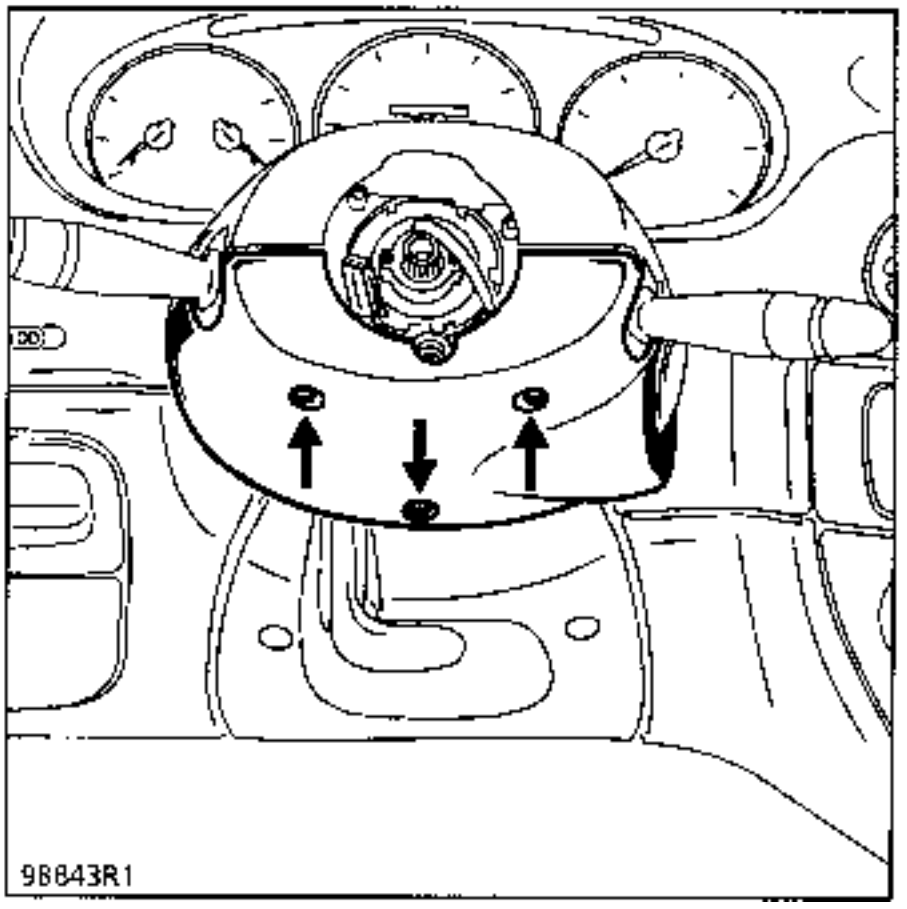
IMPORTANT: do not handle the pyrotechnic systems (airbag and pretensioners) near to a source of heat or a naked flame; there is a risk they may be triggered. Removal and refitting must be carried out by a specialist.

Remove:
- the airbag cushion, mounted by two bolts behind the steering wheel and disconnect the airbag connector (white) and the horn control connector,

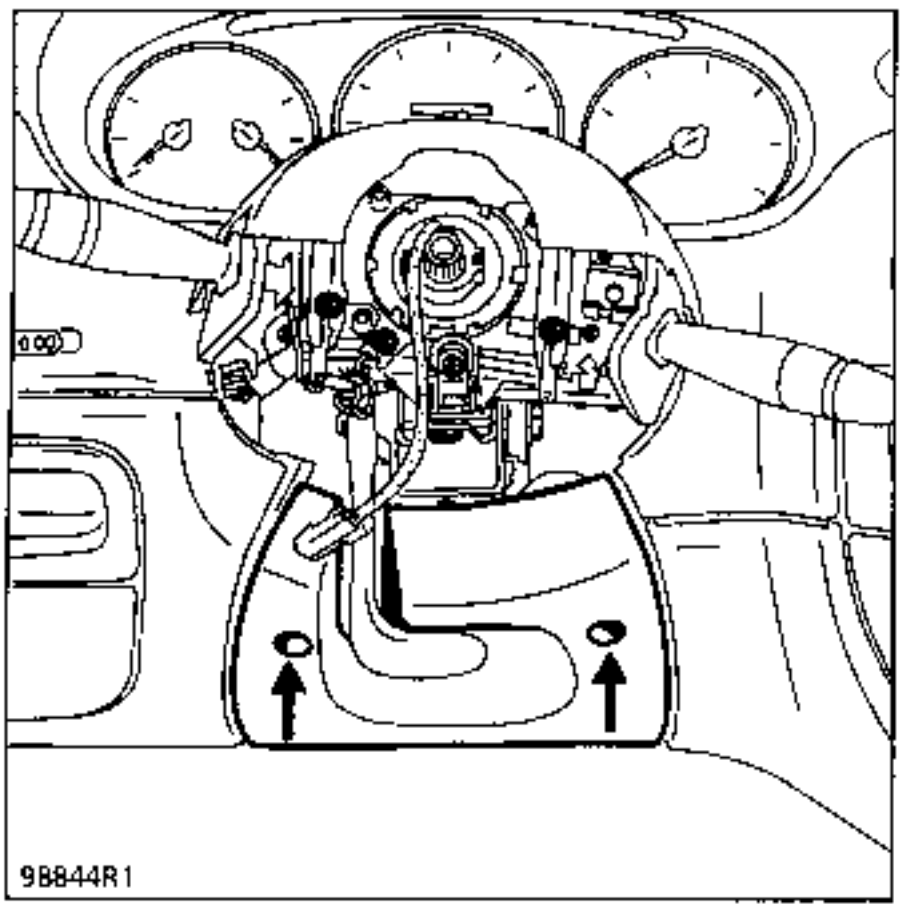


- the steering wheel **bolt** (this **MUST** be renewed on refitting),
- the steering wheel.

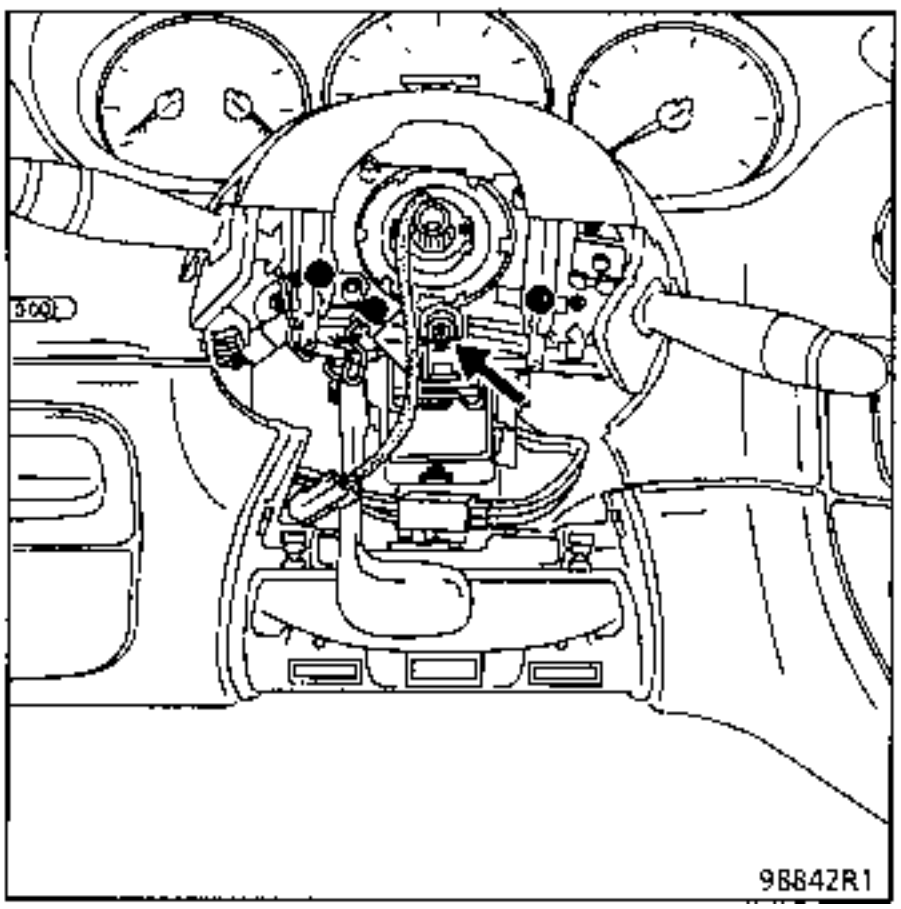
Remove:
- the half cowling under the steering wheel (three bolts),



– the lower steering column cover (two bolts),

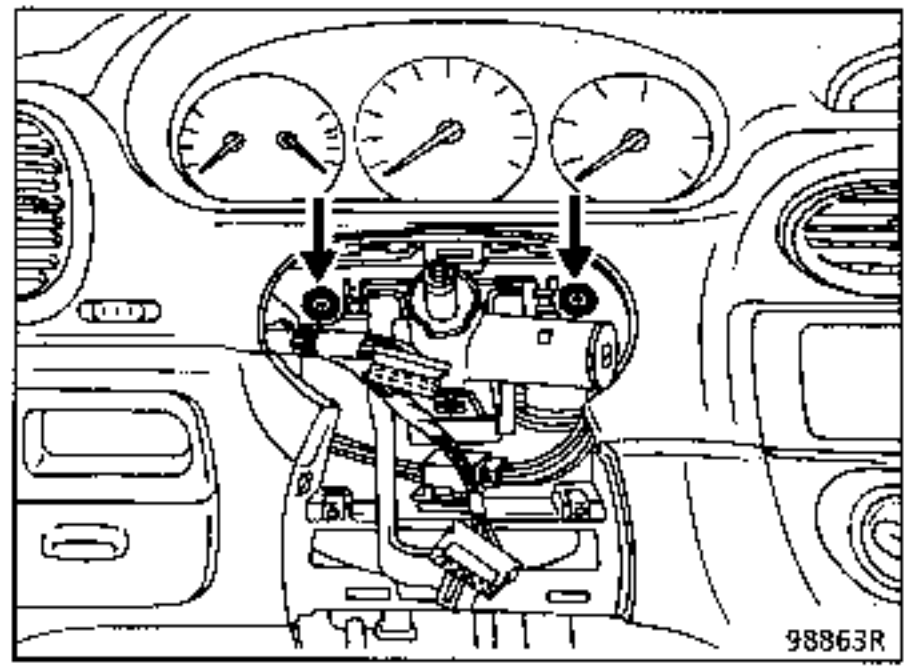


– the steering wheel half cowling (two bolts),
– the stalk assembly (one bolt).

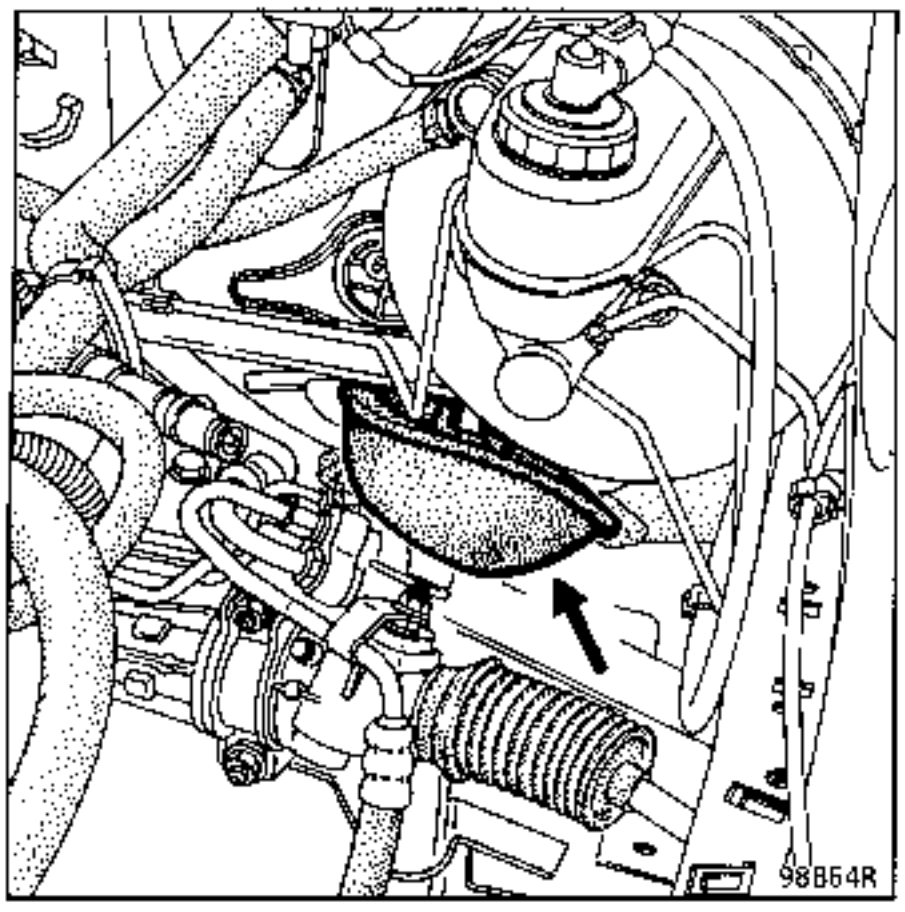


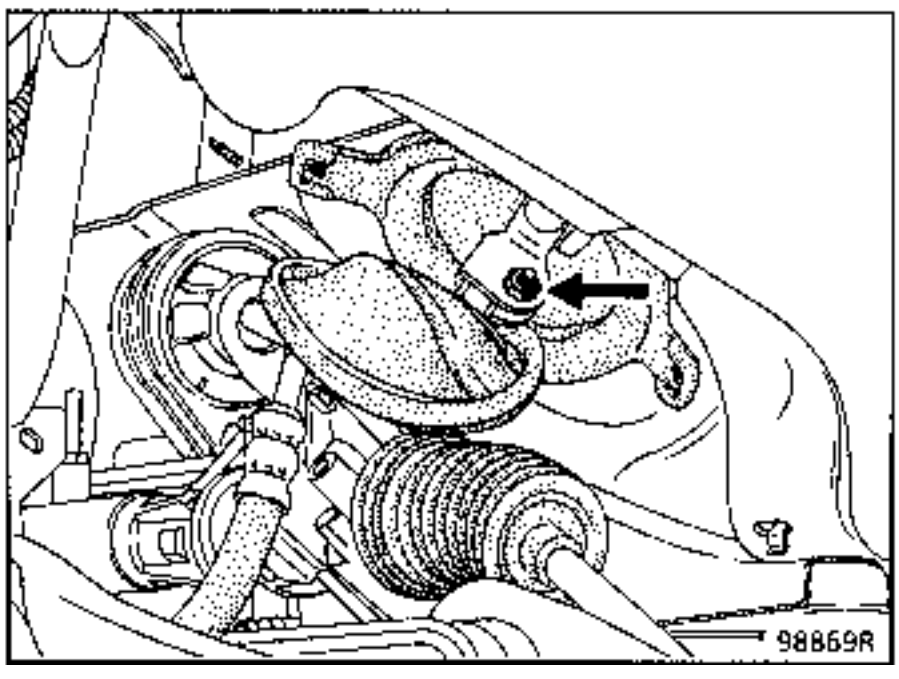
Disconnect the connectors.

Remove the two bolts mounting the dashboard to the steering column.

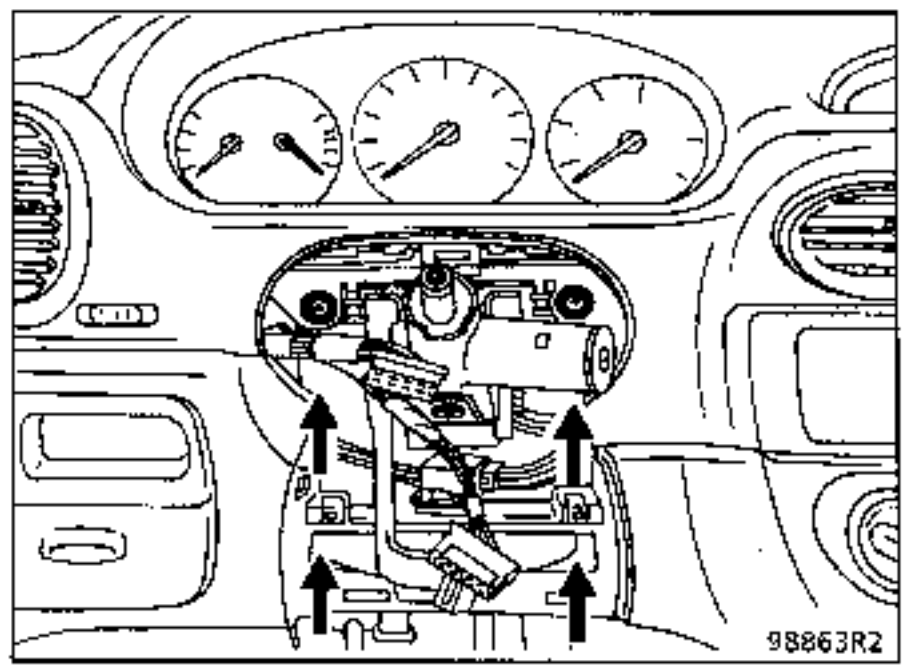


Push the rubber protector towards the steering box and remove the steering column universal joint eccentric bolt.





Remove the two mounting bolts and the two mounting nuts for the steering column.



Release:

- the column after disconnecting the ignition switch,
- the bulkhead gaiter (A) and remove it with the steering column.

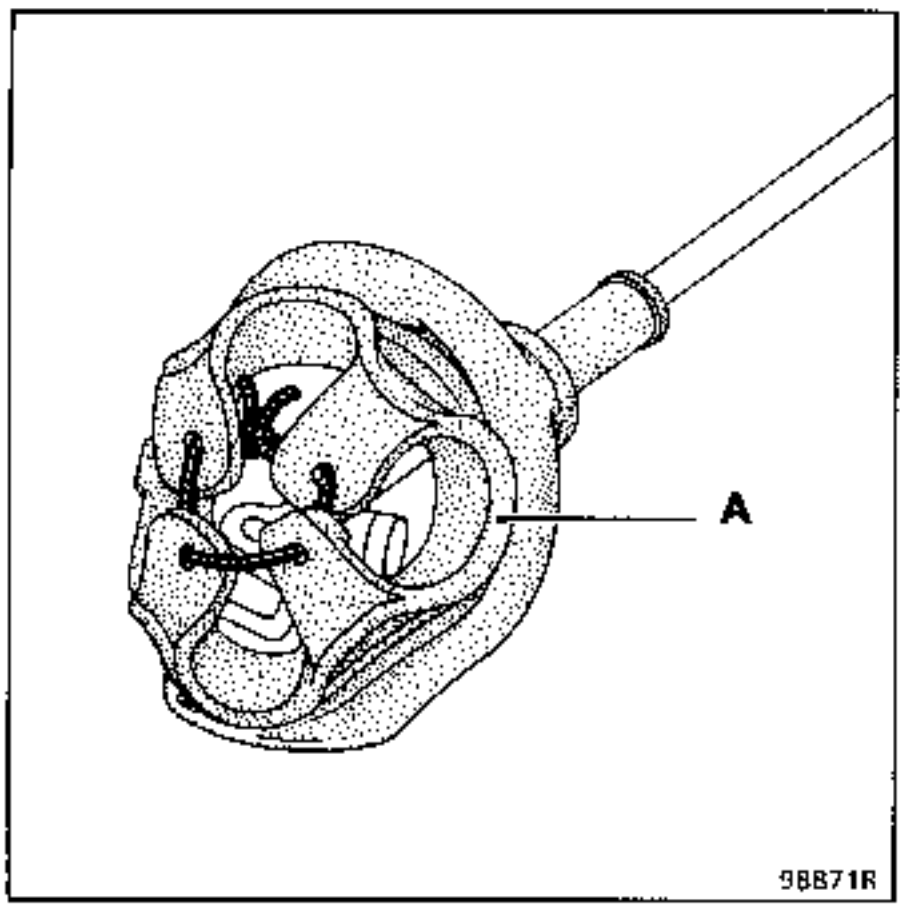
REFITTING

Check the length of the retractable shaft (see corresponding paragraph).

Fit the steering column.

Fit the gaiter (A) to the bulkhead.

Use string to tie the flaps together to facilitate refitting.



Remount:
- the steering column,
- the dashboard.

Reconnect the ignition switch.

Fit:
- the two bolts,
- the stalk assembly and reconnect the connectors,
- the upper and lower half cowlings for the steering wheel,
- the lower cover under the steering wheel,
- the steering wheel in the position marked when it was removed,
- the eccentric bolt,
- the rubber protector.

IMPORTANT
vehicle with airbag
For safety reasons, before reconnecting the airbag, check the state of the assembly using the test equipment **XRBAG (Elé. 1288)**.

CHECKING

Turn the ignition on.

With the airbag connector (white)disconnected, the airbag warning light should illuminate permanently for a few seconds then begin to flash.

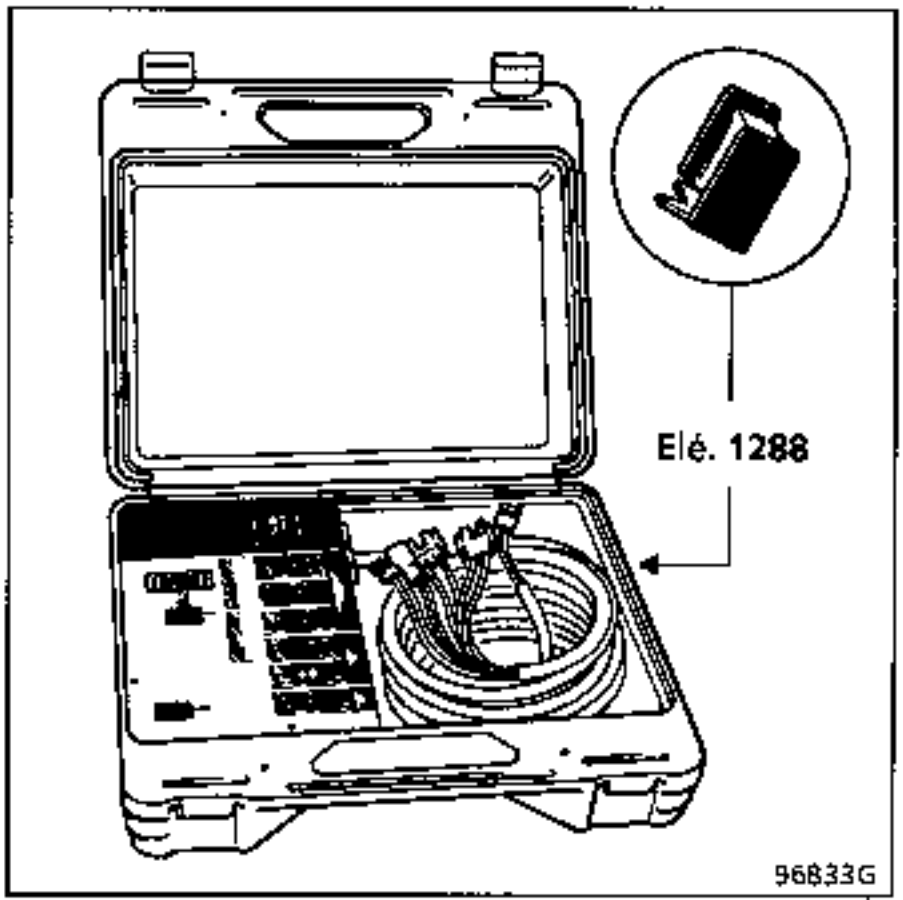
Turn the ignition off.

Connect the dummy ignition module of tool **XRBAG (Elé. 1288)** in place of the airbag.

Turn the ignition on, the airbag warning light will illuminate for a few seconds before extinguishing (and remaining extinguished).

Wait for one minute.

If the test is correct, fit the airbag to the vehicle after replacing the steering wheel bolt, otherwise refer to section "Fault finding" of the "Airbag" Workshop Repair Manual.



SPECIAL NOTES FOR VEHICLES FITTED WITH A DRIVER'S AIRBAG

IMPORTANT

In order to avoid all risks of damage to the rotary switch under the steering wheel, please observe the following rules:

- **Before separating the steering column and the steering rack, the steering wheel MUST be immobilised using a locking tool, when the wheels are straight for the duration of the operation.**

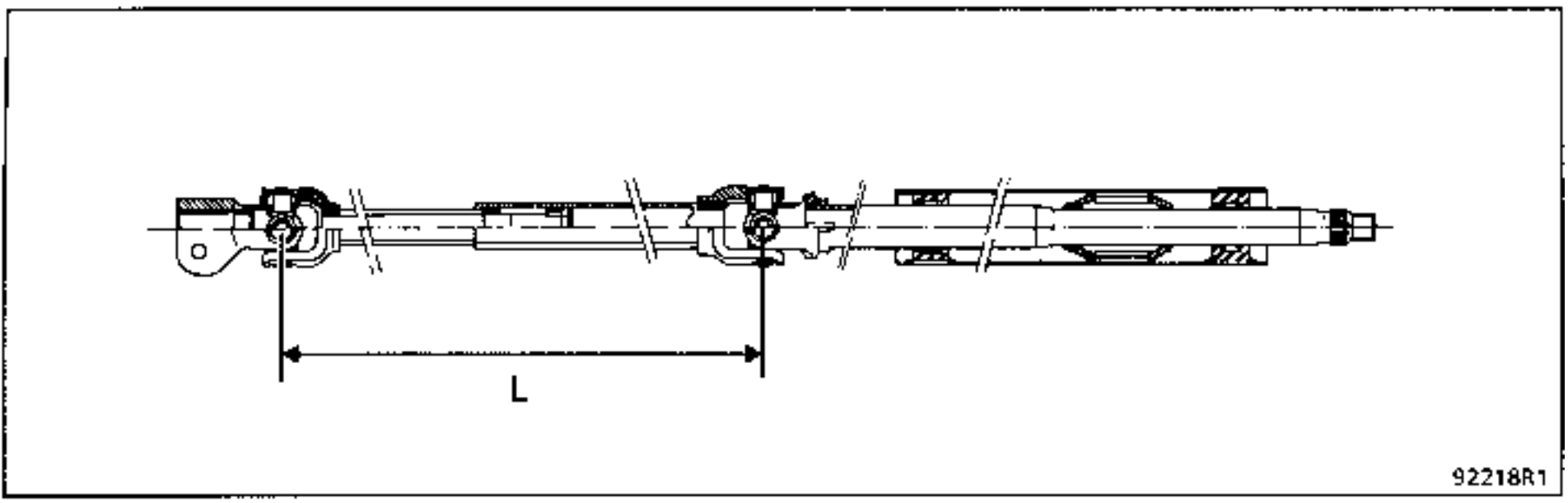
- **If there is any doubt about the correct centring of the rotary switch, the steering wheel must be removed and the centring method in chapter 88 of the "Airbag" Workshop Repair Manual must be applied.**

REMINDER: in this case, only qualified personnel who have been appropriately trained may carry out the operation.

REMOVAL - REFITTING

These vehicles are fitted with a retractable shaft - steering wheel shaft - steering column assembly which cannot be dismantled. If the eccentric bolt for the steering column universal joint cannot be fitted, check that the shaft length is correct otherwise replace the assembly (see steering column paragraph).

CHECKING



LEFT HAND DRIVE

Manual steering
L = 426.6 ± 0.5 mm

Power assisted steering
L = 370.4 ± 0.5 mm

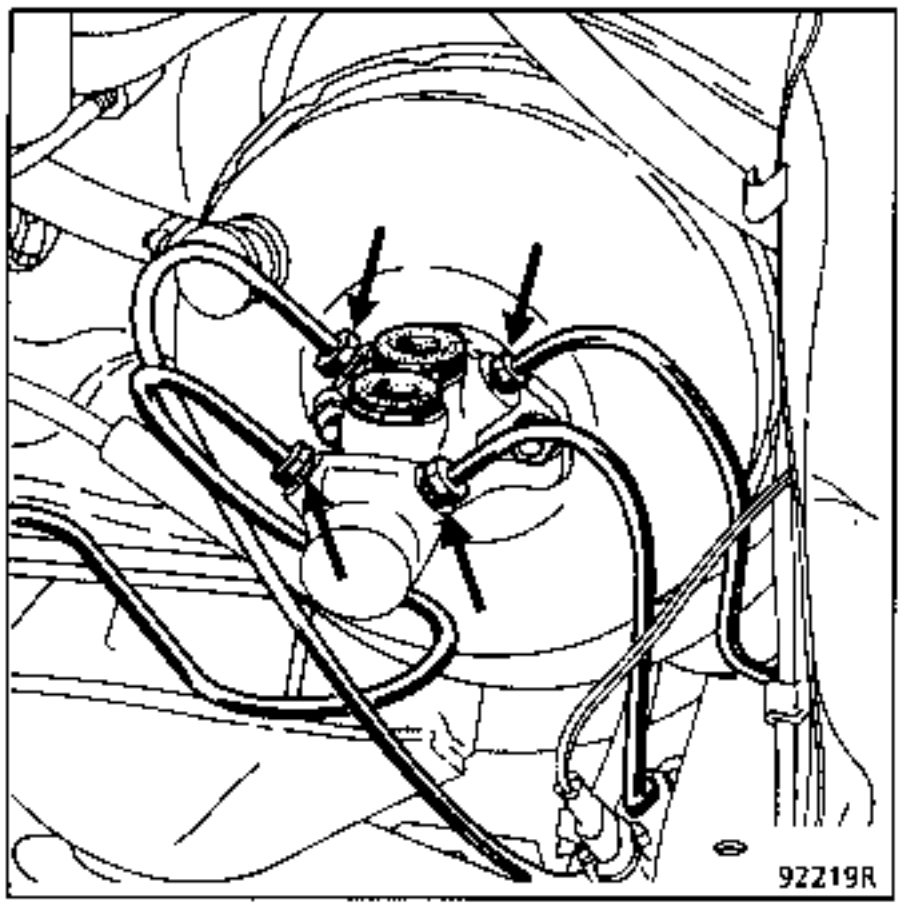
RIGHT HAND DRIVE

Power assisted steering
L = 373.5 ± 0.5 mm

TIGHTENING TORQUES (in daN.m)	
M 10 X 100	1.3
Brake servo mounting nut	2.3

REMOVAL

Drain and remove the brake fluid reservoir by pulling it from above (take precautions to catch the brake fluid which will run out).



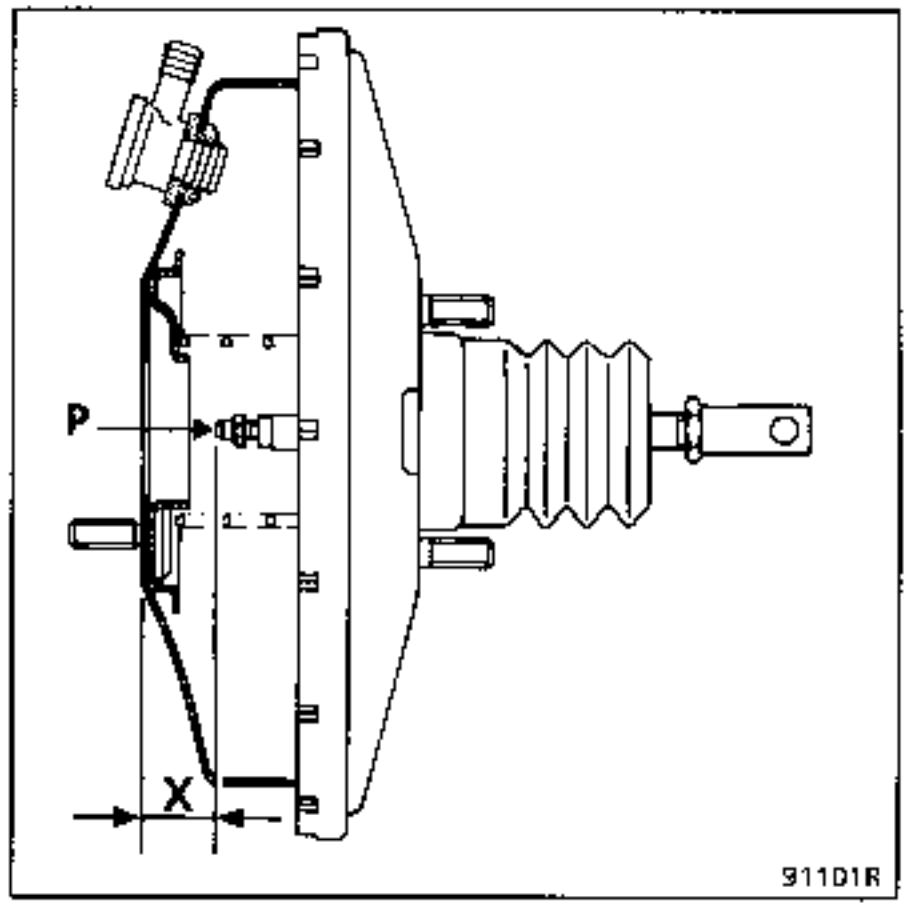
Remove:
- the pipes and mark their position,
- the two mounting nuts on the brake servo.

REFITTING

Check the length of the pushrod.

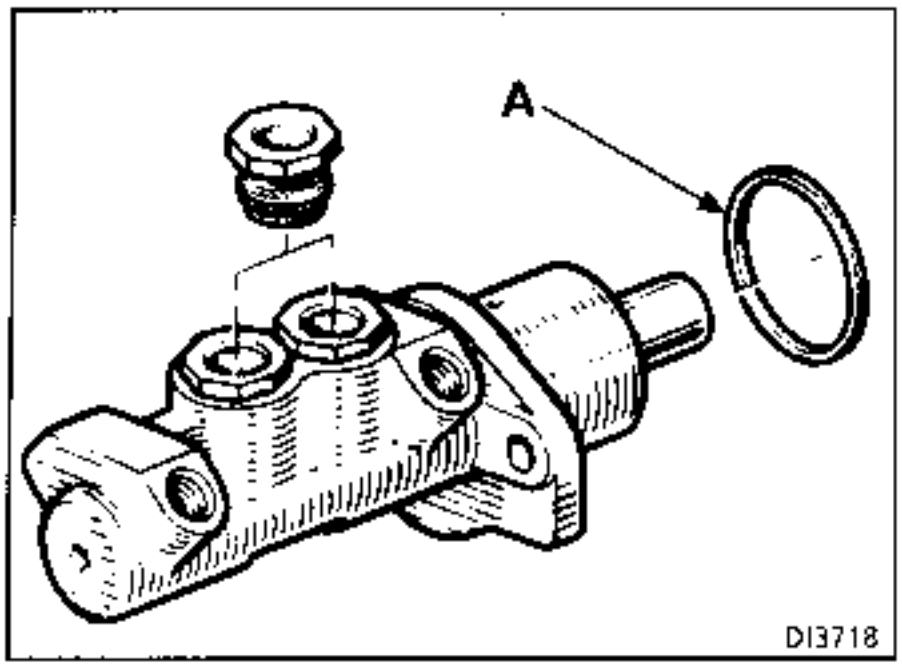
Dimension X = 22.3 mm.

Adjust depending on model using pin (P).

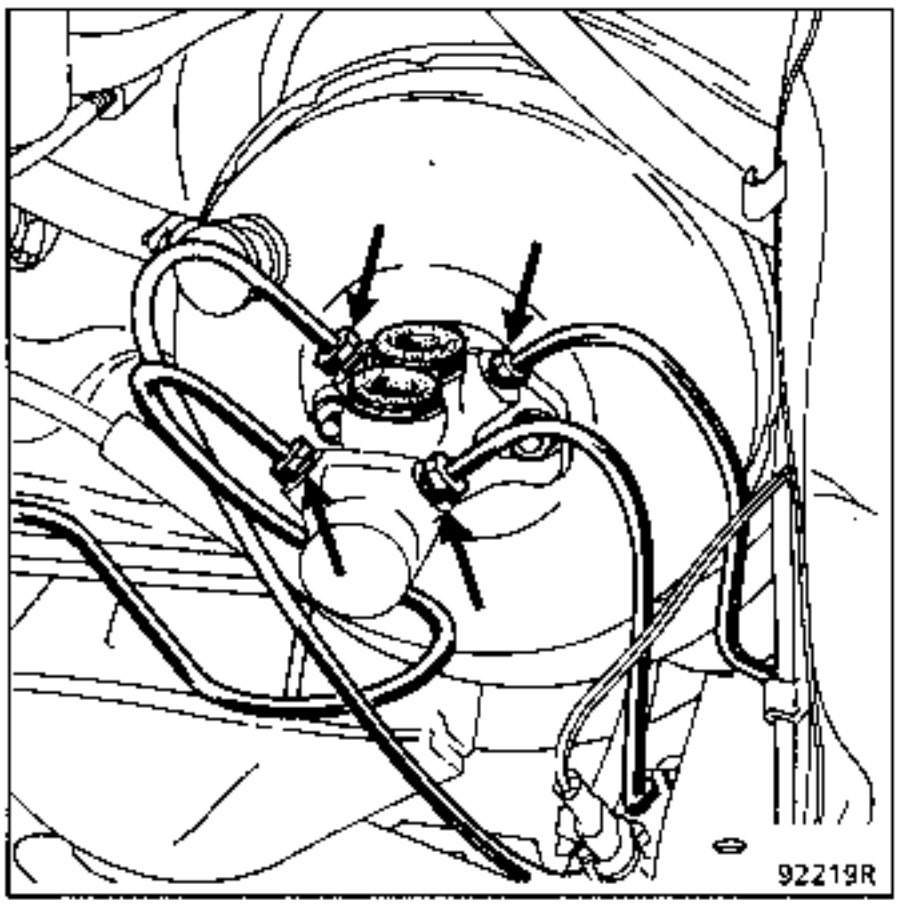


NOTE : these vehicles have a master cylinder which is integral to the brake servo. Sealing of the brake servo is directly linked to that of the master cylinder. During any operation, a new seal (A) must be fitted.

Fit the master cylinder in alignment with the brake servo so that pushrod pin (P) enters correctly into the master cylinder housing.



Reconnect:
- the pipes in the positions marked on removal,

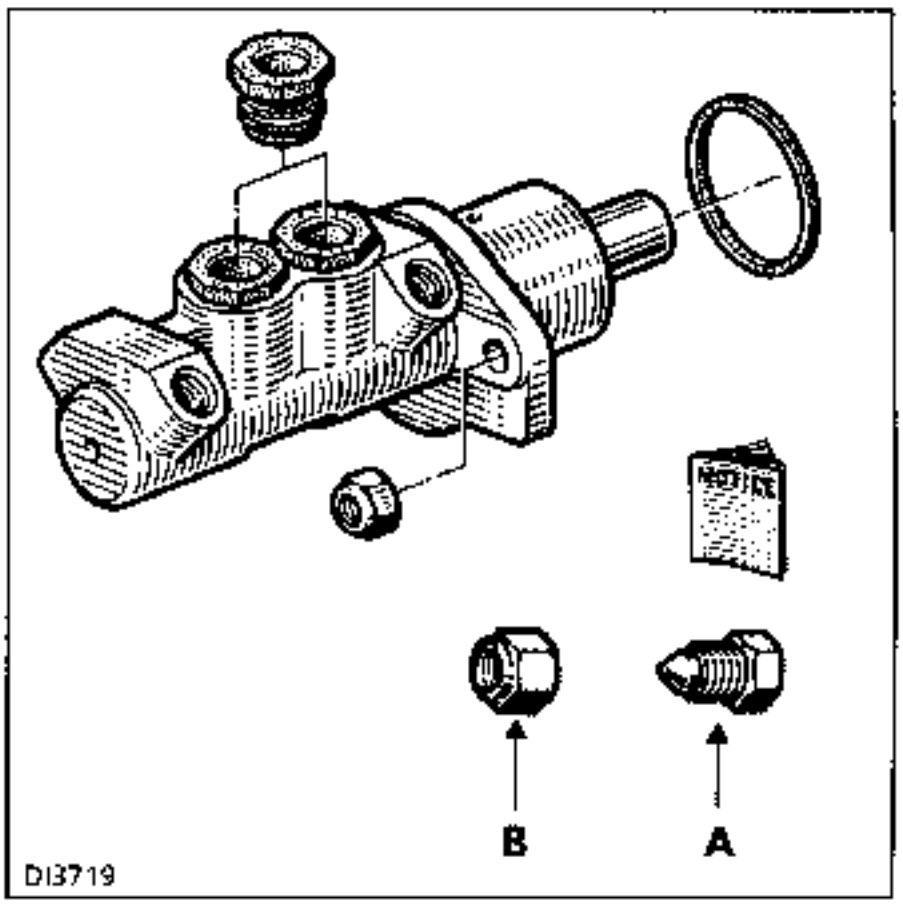


- the compensation reservoir, pressing on it to ensure it clicks into position in the master cylinder.

Bleed the braking circuit.

MASTER CYLINDER (EXCHANGE)

The kit sold by the Parts Department comprises :
- one master cylinder (4 outlets),
- two plugs (A),
- two mounting nuts (B).



For vehicles not fitted with ABS, all four outlets are used (the two plugs (A) are not used).

For vehicles with ABS, fit plugs (A) into the unused outlets.

TIGHTENING TORQUES (in daN.m)	
Master cylinder on brake servo	2.3
Brake servo on bulkhead	2

The brake servo cannot be repaired. Operations are only permitted on:
- the air filter,
- the non-return valve.

REMOVAL

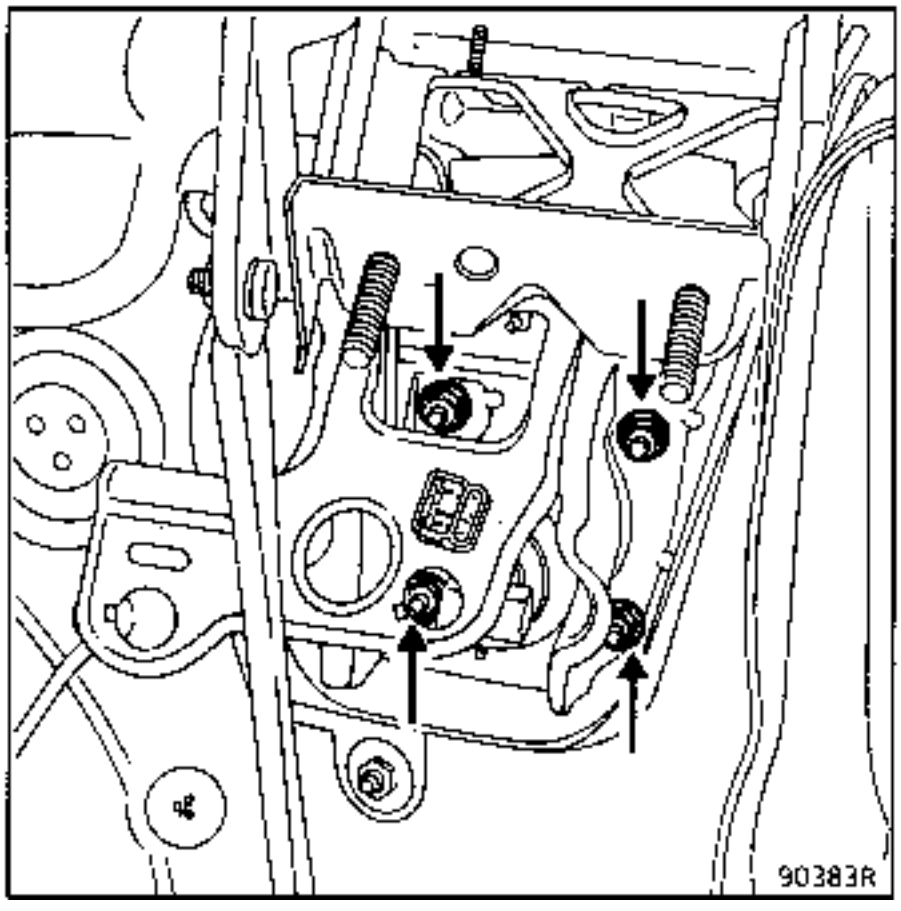
Disconnect the battery.

Remove the master cylinder.

Disconnect the flexible vacuum union from the brake servo.

Remove the pin from the clevice connecting the brake pedal to the pushrod.

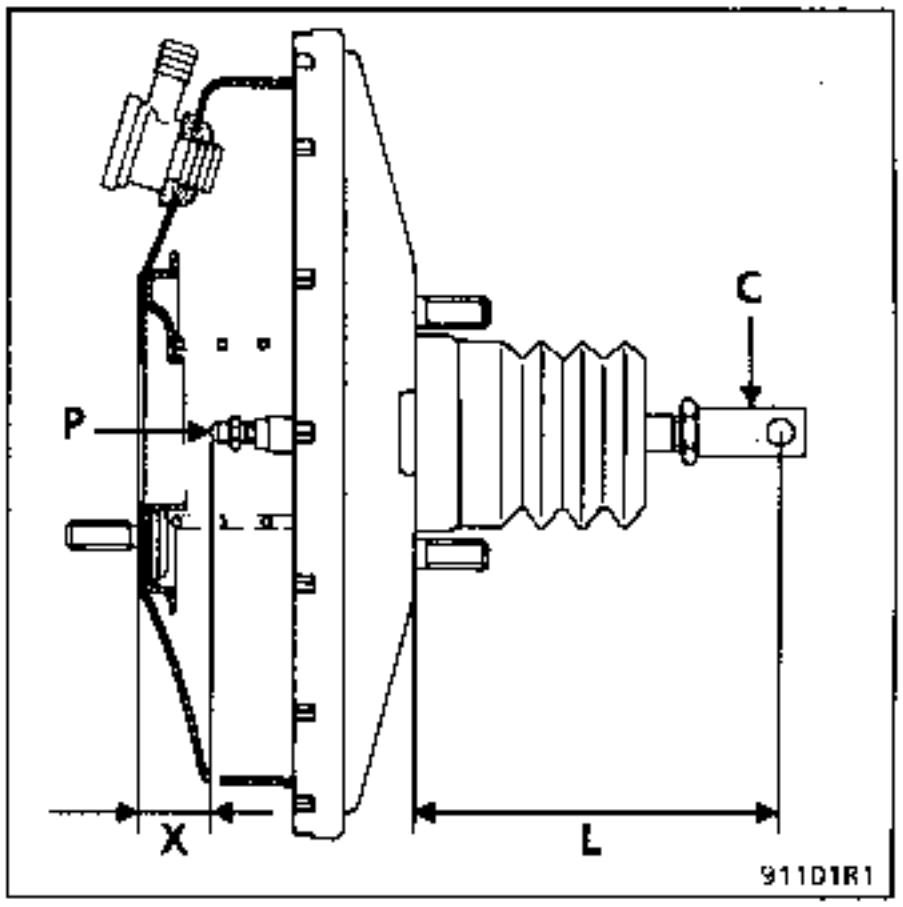
Slacken the brake servo mounting nuts and remove the brake servo.



REFITTING

Before refitting, check:

All types :
- dimension L = 133 mm adjustable depending on model using rod (C),
- dimension X = 22.3 mm adjustable depending on model using rod (P).



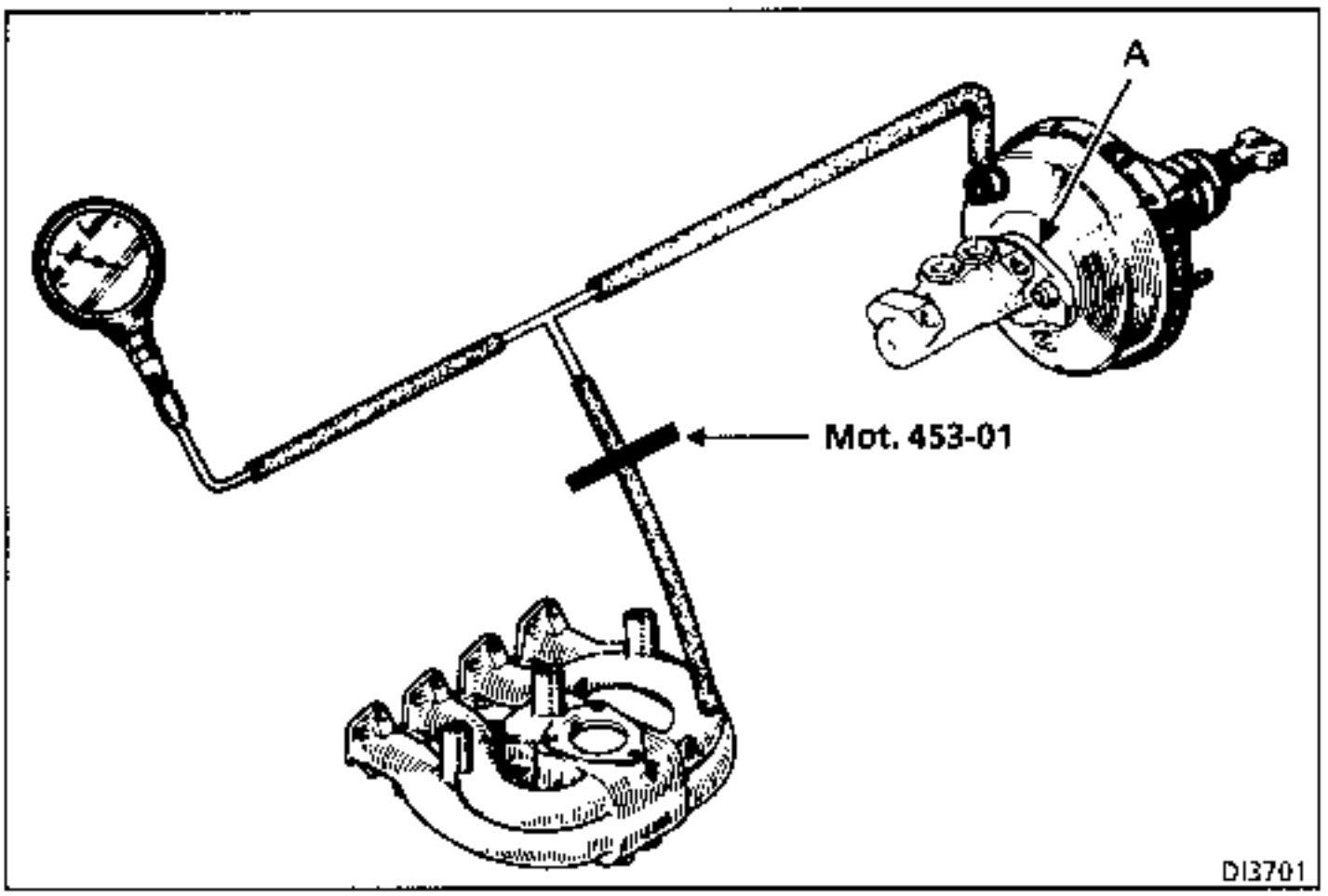
Fit the master cylinder (see advice given in corresponding section).

Bleed the braking circuit.

SPECIAL TOOLING REQUIRED		
Mot	453 -01	Hose clamp pliers
EQUIPMENT REQUIRED		
NAUDER* vacuum pump		

CHECKING SEALING

When checking the sealing of the brake servo, ensure the seal between the brake servo and the master cylinder is perfect. If there is a leak, replace the seal (A).



The sealing of the brake servo is checked on the vehicle when the hydraulic circuit is in operating condition.

Connect the NAUDER* vacuum pump between the brake servo and the vacuum source (inlet manifold) using a "T" union and the shortest possible pipe.

Run the engine at idle speed for one minute.

Clamp the pipe (clamp **Mot. 453-01**) between the "T" union and the vacuum source.

Turn the engine off.

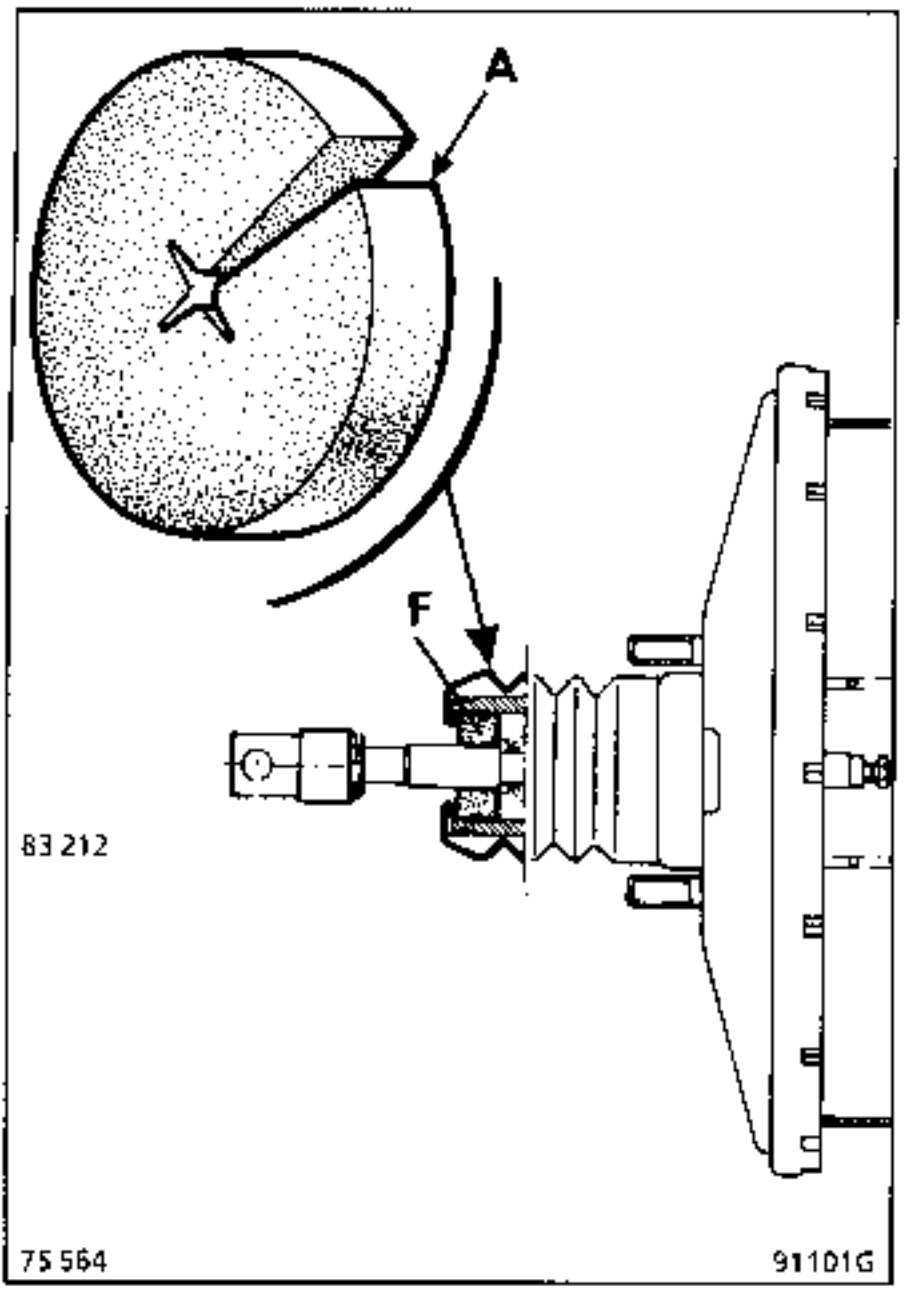
(*) Use as a vacuum gauge

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

- at the non-return valve (replace it),
- or at the pushrod diaphragm (replace the brake servo).

If the brake servo is not operational the braking system will operate but the force required at the pedal to obtain the equivalent deceleration as for assisted braking is considerably higher .

REPLACING THE AIR FILTER



To replace the air filter (F), the brake servo does not need to be removed.

Under the pedal mounting, use a screwdriver or a metal hook to extract the used filter (F). Cut the new filter at A (see diagram) and fit it around the rod before inserting it into position, checking that it extends to fill the bore to prevent non-filtered air from leaking round.

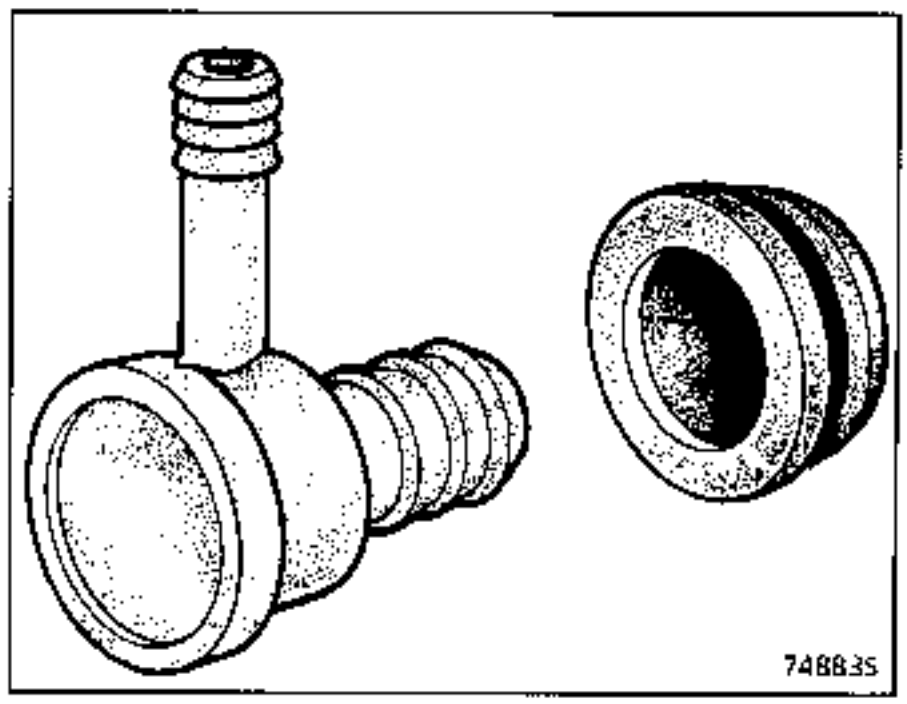
REPLACING THE NON-RETURN VALVE

This operation may be carried out on the vehicle.

REMOVAL

Disconnect the brake servo vacuum inlet pipe.

Pull the non-return valve while twisting it to release it from the rubber sealing washer.



REFITTING

Check the condition of the rubber sealing washer and the non-return valve.

Replace any faulty parts.

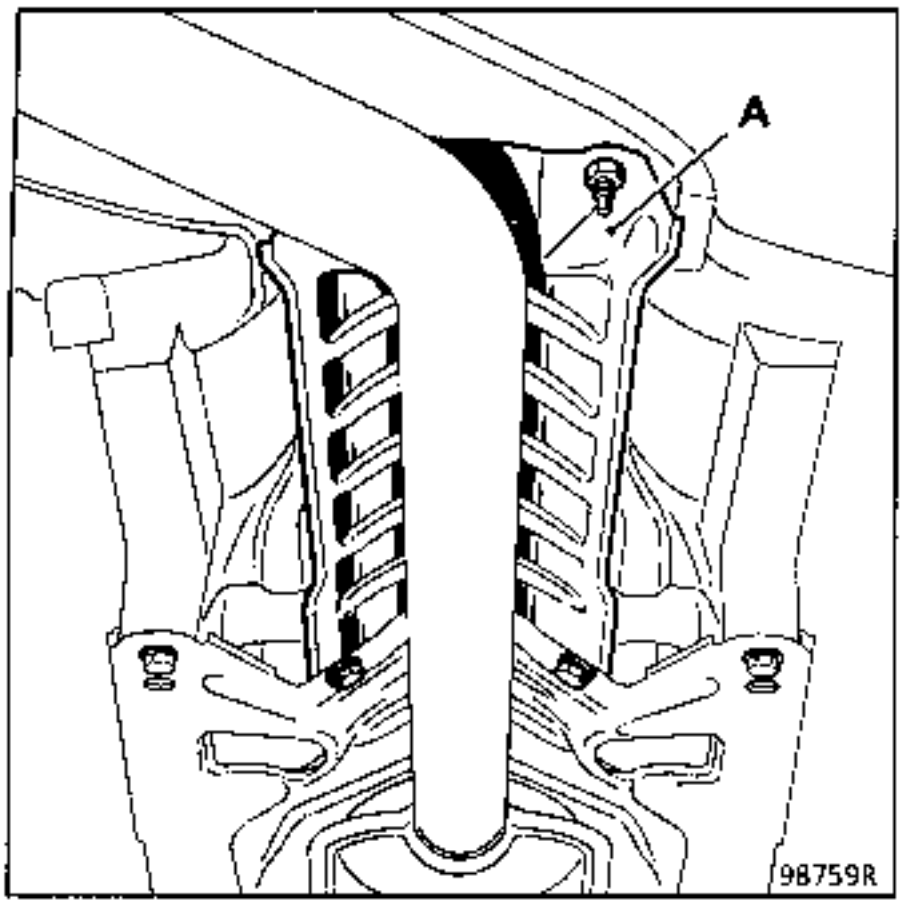
Refit the assembly into position.

REPLACEMENT

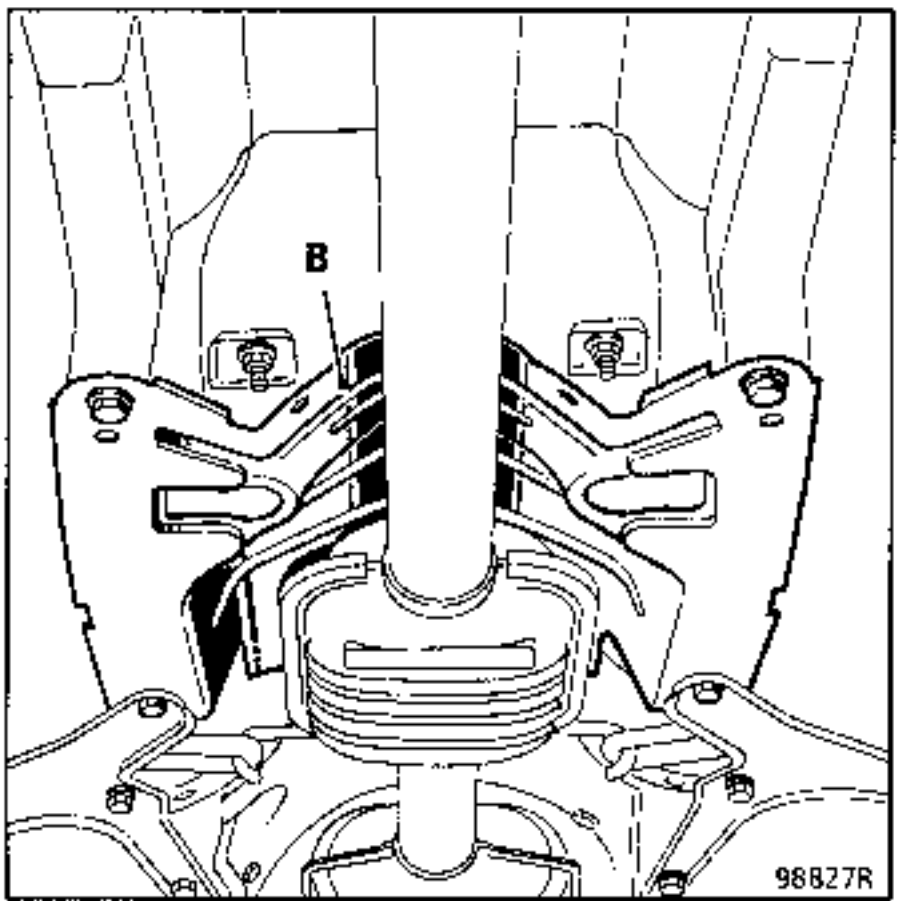
Release the handbrake.

Under the vehicle:

Remove:
- the heat shield (A),

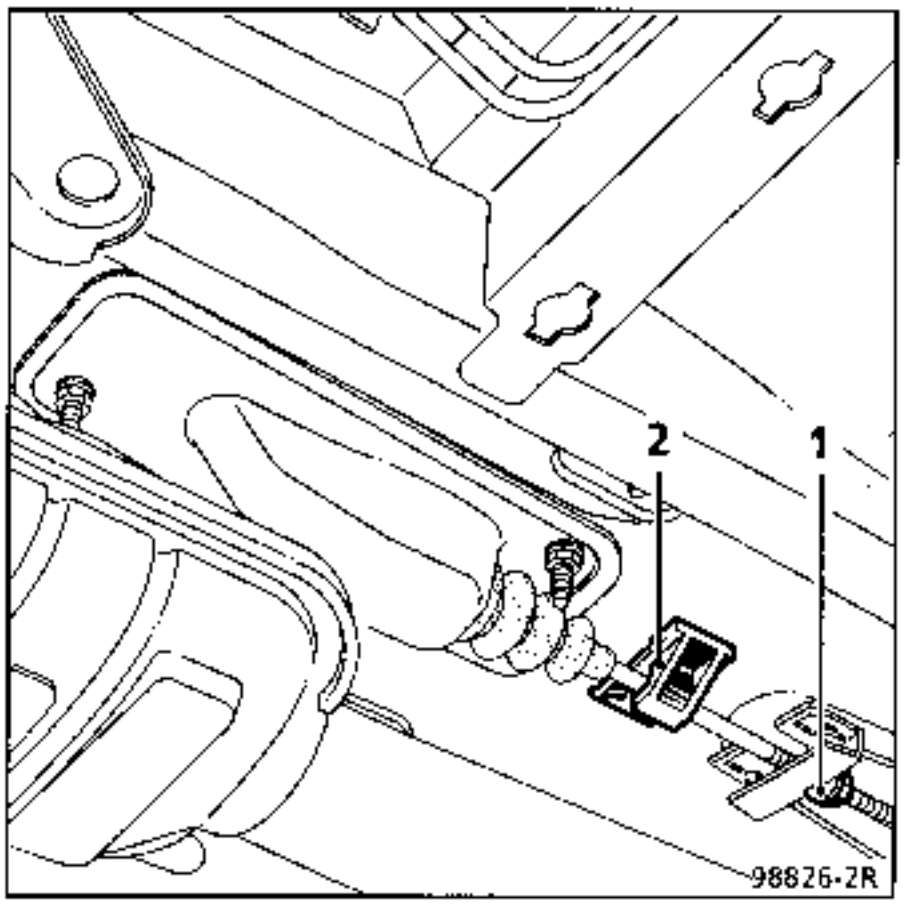


- the exhaust pipe rubber mounting brackets,
- the heat shield mountings (B) and allow it to rest on the exhaust pipe after pulling it towards the rear of the vehicle.



Mark the handbrake adjustment between the end of the rod and the caliper.

Slacken then remove nut (1).



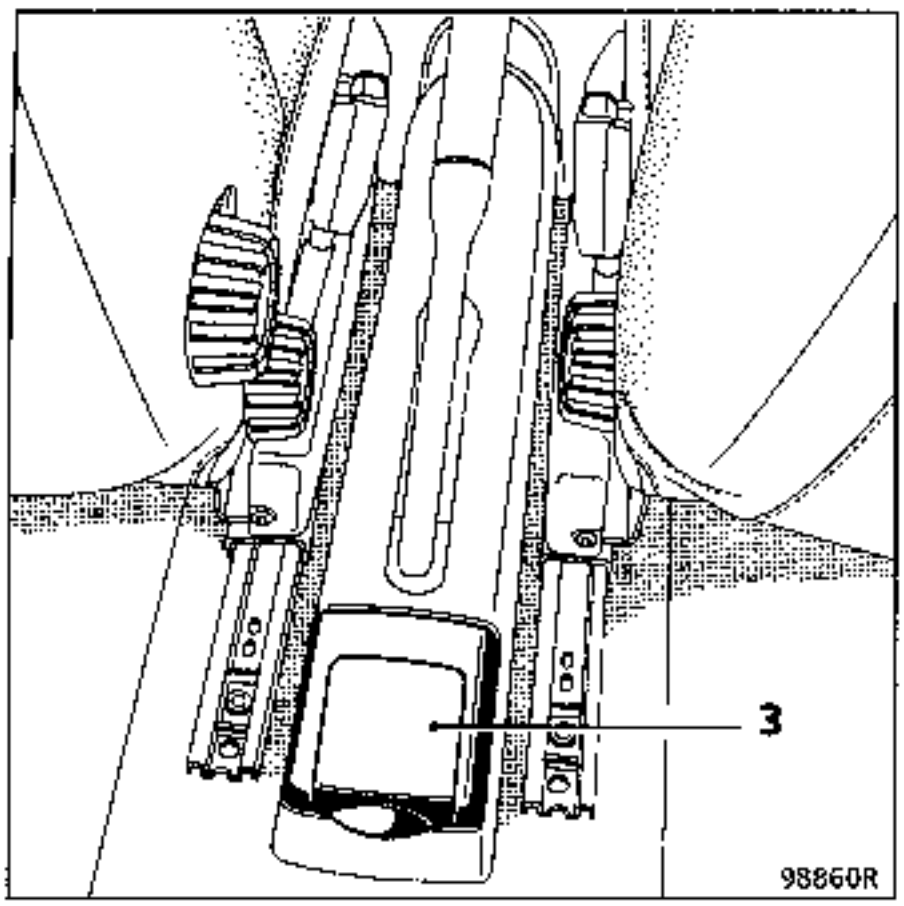
Release the linkage from its clip (2).

In the passenger compartment:

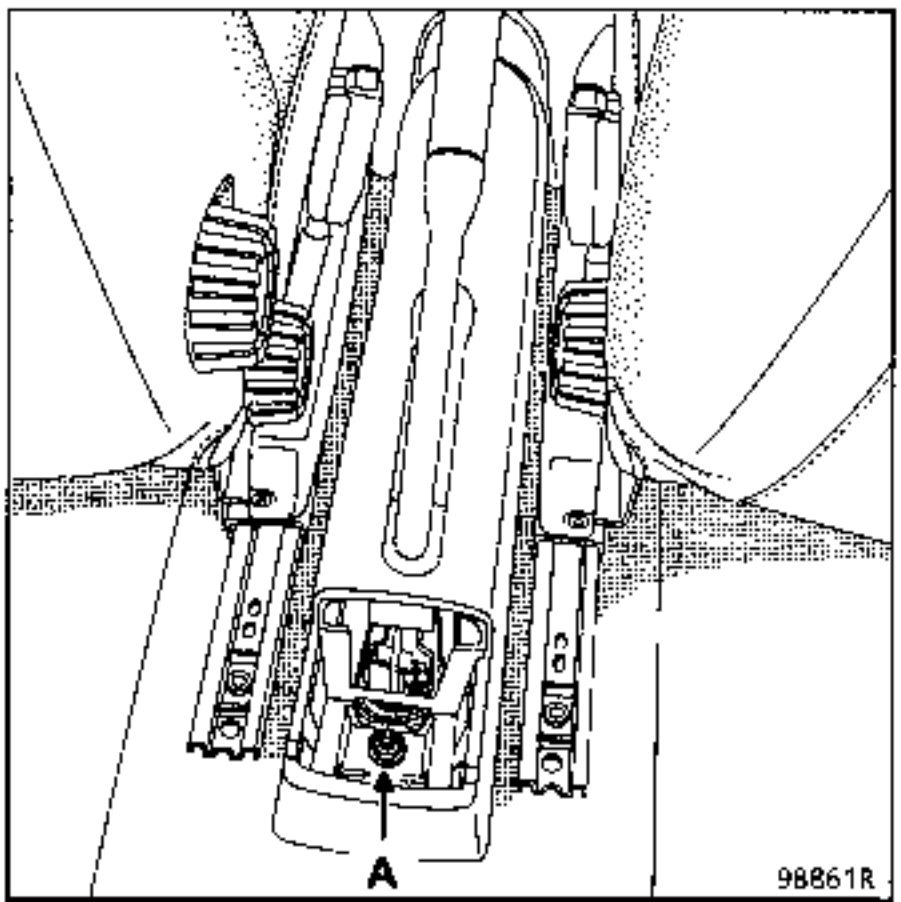
Remove the central console.

To do this:

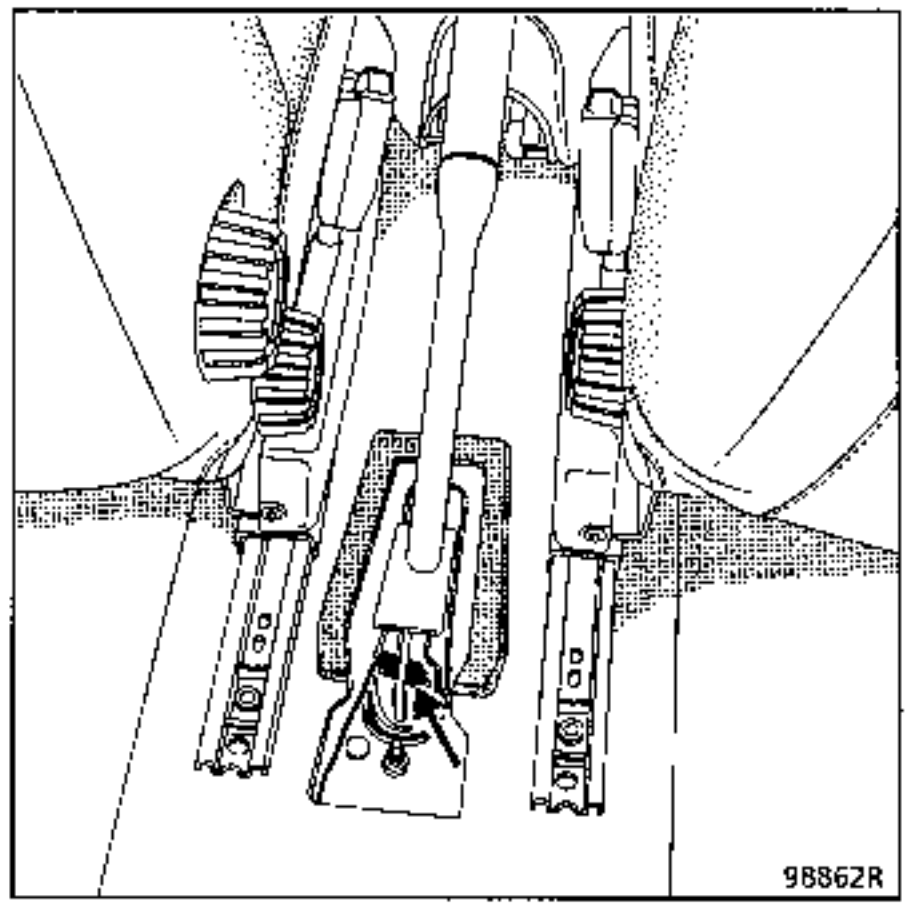
Move the front seats forward and remove the cover (3) from the end of the console (ashtray or switch mounting panel, depending on model).



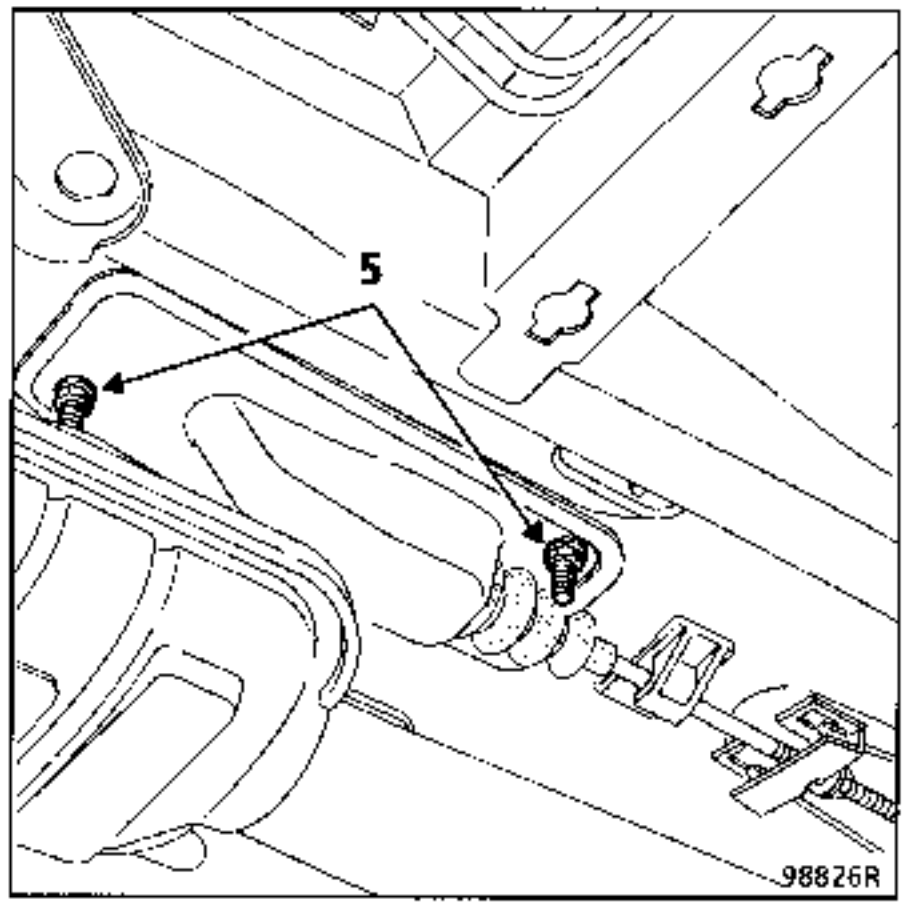
Remove the console mounting nut (A).



Remove the console.
Disconnect the handbrake connector and release the wiring (if there is a switch).



Remove the two lever mounting nuts (5).



Remove the handbrake lever.

REFITTING (Special notes)

Refitting is the reverse of removal.

Remember to refit the heat shields.

Ensure the handbrake linkage is set to the handbrake setting marked before removal.

If necessary, adjust the lever travel (see paragraph "Adjusting the control").

ADJUSTMENT

Incorrect adjustment of the handbrake where the cable is too tight:

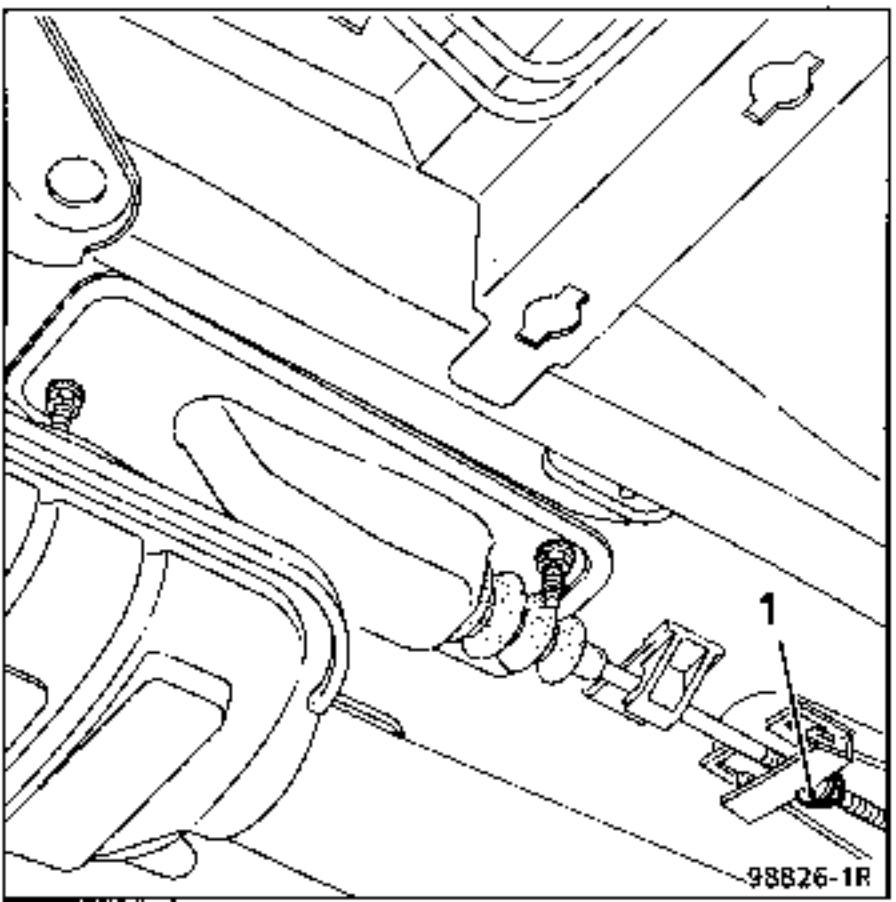
- **prevents the correct operation of the automatic compensation system for the brake shoes,**
- **causes long brake pedal travel.**

The cables should not be re-tensioned to correct this fault since it will quickly occur again.

The handbrake should not be used to adjust play, it should only be adjusted when replacing :
- brake linings,
- cables,
- the control lever.

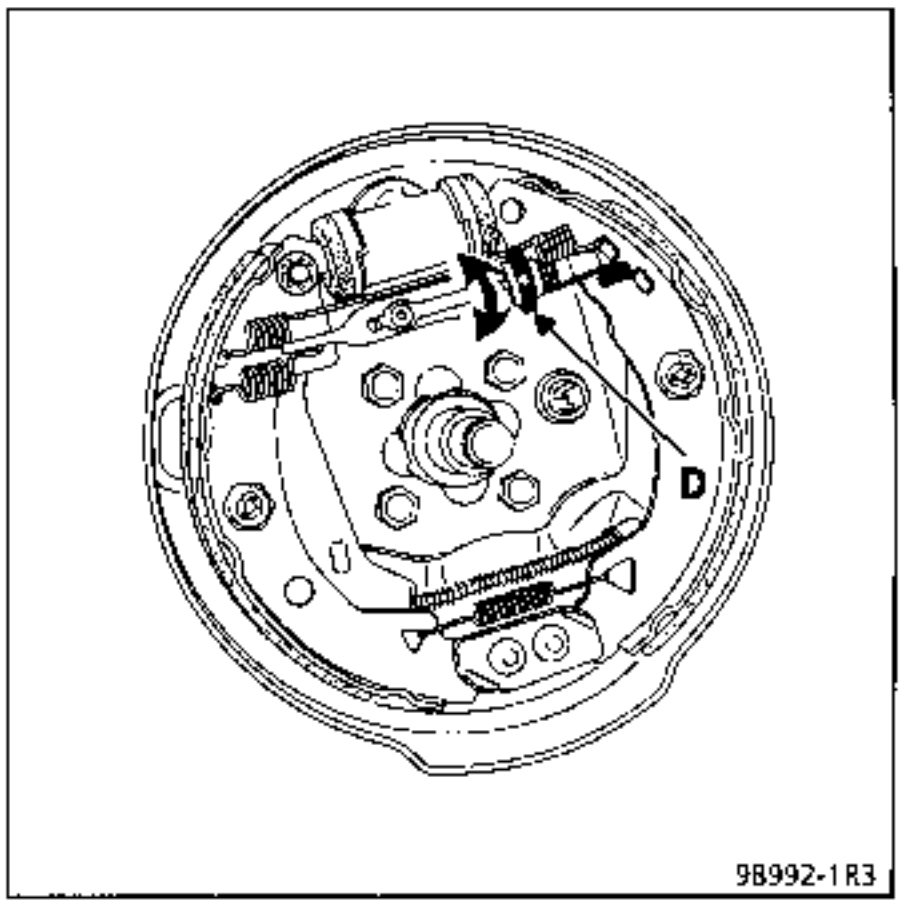
Any other adjustment except in the above cases is not permitted.

With the vehicle on a lift supported under the body, slacken nut (1) so the central adjuster is completely free.

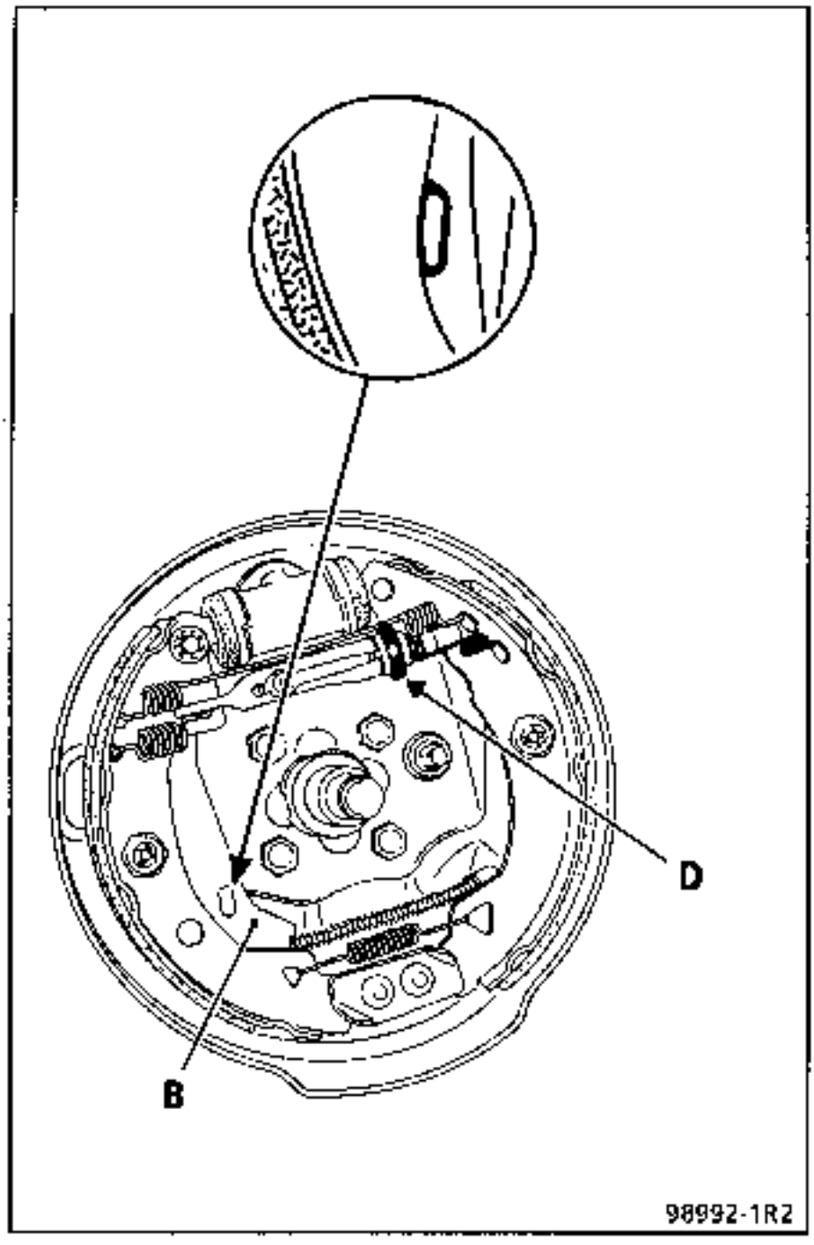


Remove:
- the two rear wheels,
- the two drums.

Check the operation of the compensation system by rotating the notched sector (D) (ensure it turns in both directions), then turn it back by **5 to 6 teeth.**



Ensure :
- the cables slide correctly,
- the handbrake levers (B) are in the correct position against the brake shoes.



Progressively tighten the cables at the central adjuster so that levers (B) **start to move between the 1st and 2nd notch** of the control lever travel and remain applied from the 2nd notch.

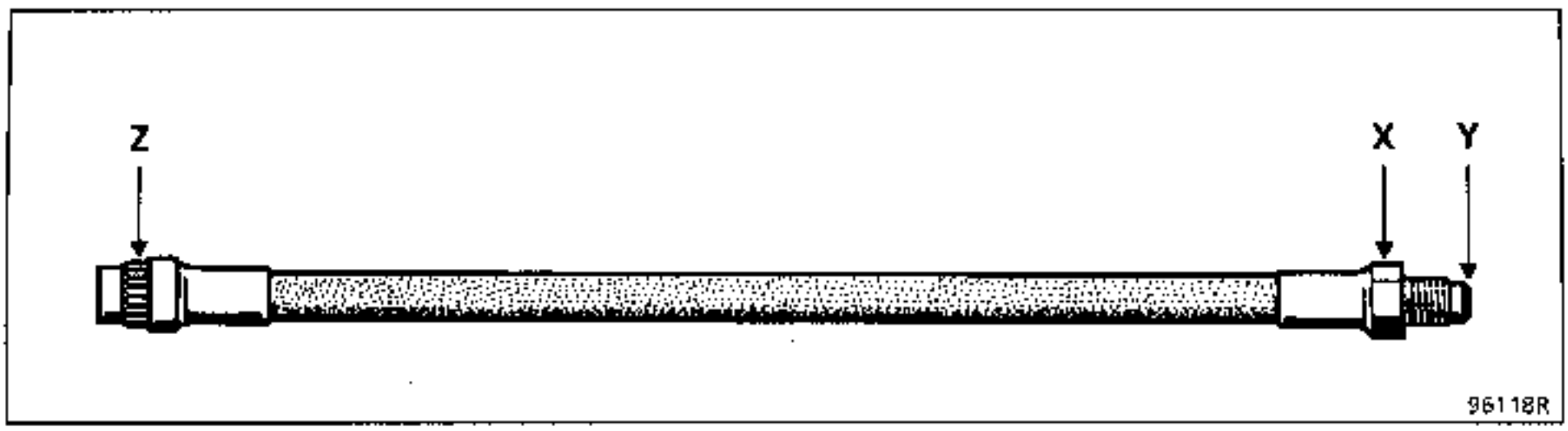
Tighten the lock nuts (4).

Refit the drums.

With the vehicle on its wheels, adjust the brake linings by pressing the brake pedal firmly and progressively for a number of times while listening for the automatic compensation system clicking.

These vehicles have brake pipes without a copper seal. The seal is by contact "at the bottom of the cone" of the shoulder (Y) on the pipe.

TIGHTENING TORQUES (in daN.m)	
X =	1.5
Z =	1.3

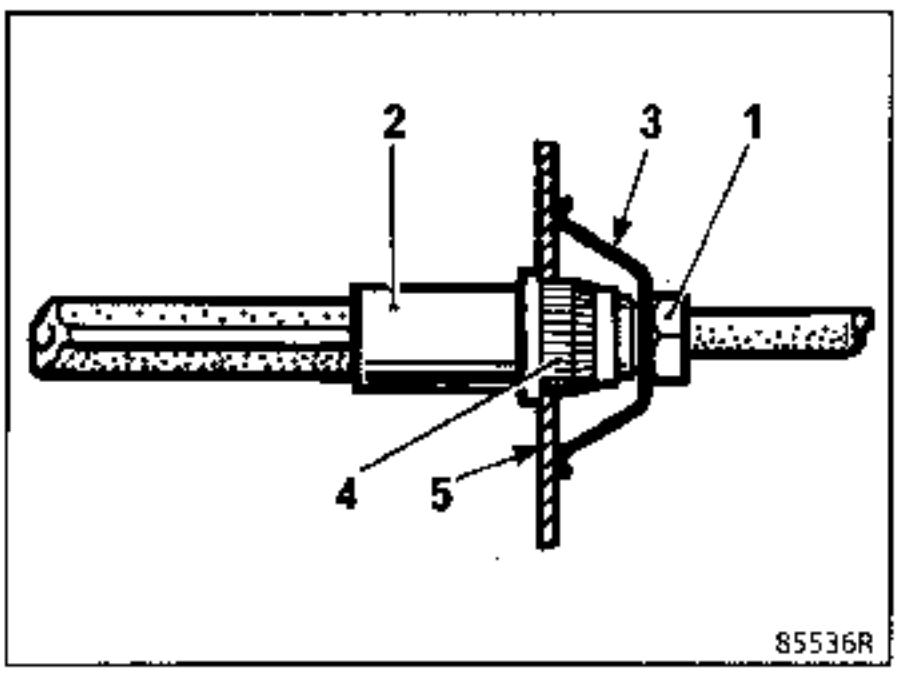


PRECAUTIONS TO BE TAKEN WHEN REMOVING - REFITTING A BRAKE CYLINDER OR A BRAKE PIPE.

For safety reasons and to ensure that the brake pipe is not twisted and is not liable to touch a suspension component the following order of operations must be observed:

REMOVAL

Slacken the union (1) (pipe wrench) between the rigid pipe and the hose (2)until the spring (3) becomes slack which releases the hose from the splines (4).



Remove the hose from the caliper and if necessary remove the caliper.

REFITTING

Fit the caliper to the brake and screw the hose onto it, then torque tighten to
1.5 daN.m.

The brake pipes are fitted when the axle assembly is in position:

- Wheels suspended (suspension in place)
- Axle assembly aligned (wheels straight)

Position the female end of the hose on the retaining bracket (5), without twisting it and check that the end piece (4) fits freely into the splines of the bracket, then fit:

- the spring (3),
- the rigid pipe to the hose, checking that the hose does not turn when the assembly is screwed together.

Torque tighten the union.

Bleed the braking circuit.

CHECKING PRINCIPLE

These vehicle are fitted with a load sensitive braking compensator.

The pressure is read in an X pattern, by comparing the pressure at the rear wheels with a given pressure at the front wheels.

The dual compensator has two totally separate bodies which act in an X pattern on one front wheel and one rear wheel.

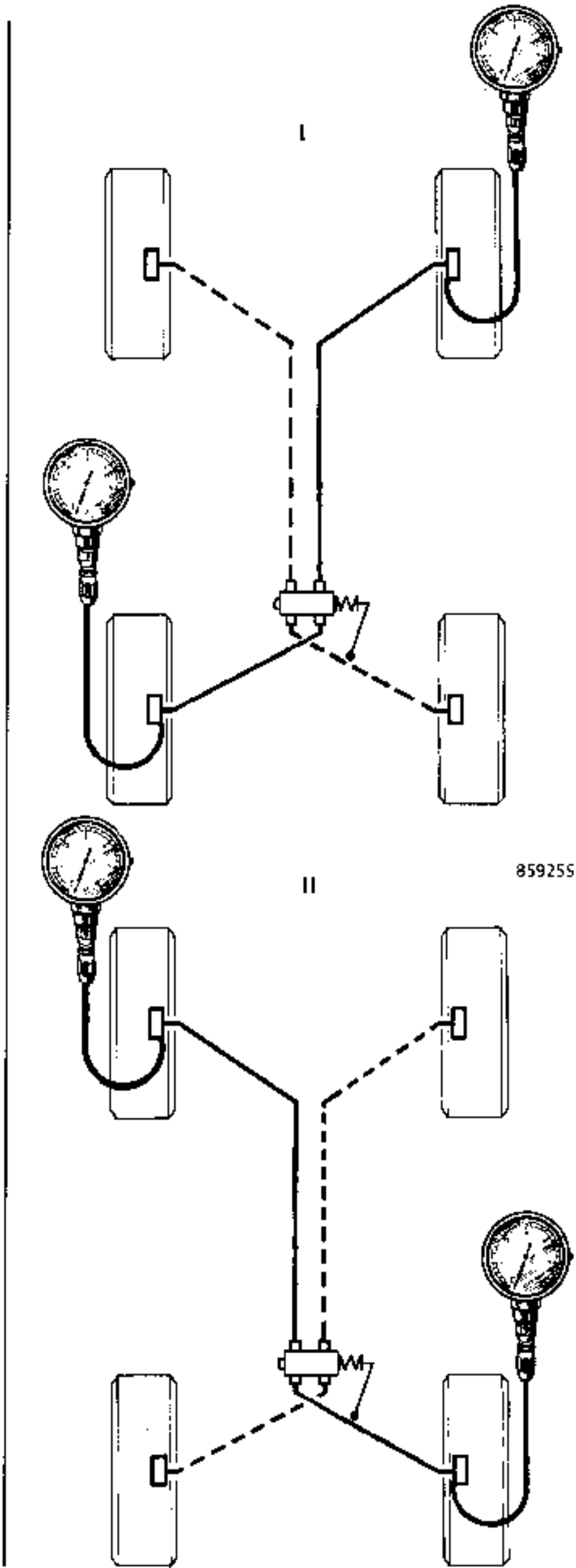
Both circuits must be checked.

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

Assisted compensators.

For assisted compensators, the adjustment allows alteration of the rear pressure depending on the front pressure.

The adjustment is made simultaneously in both bodies. If the pressure is incorrect for one of the two bodies, replace the compensator.



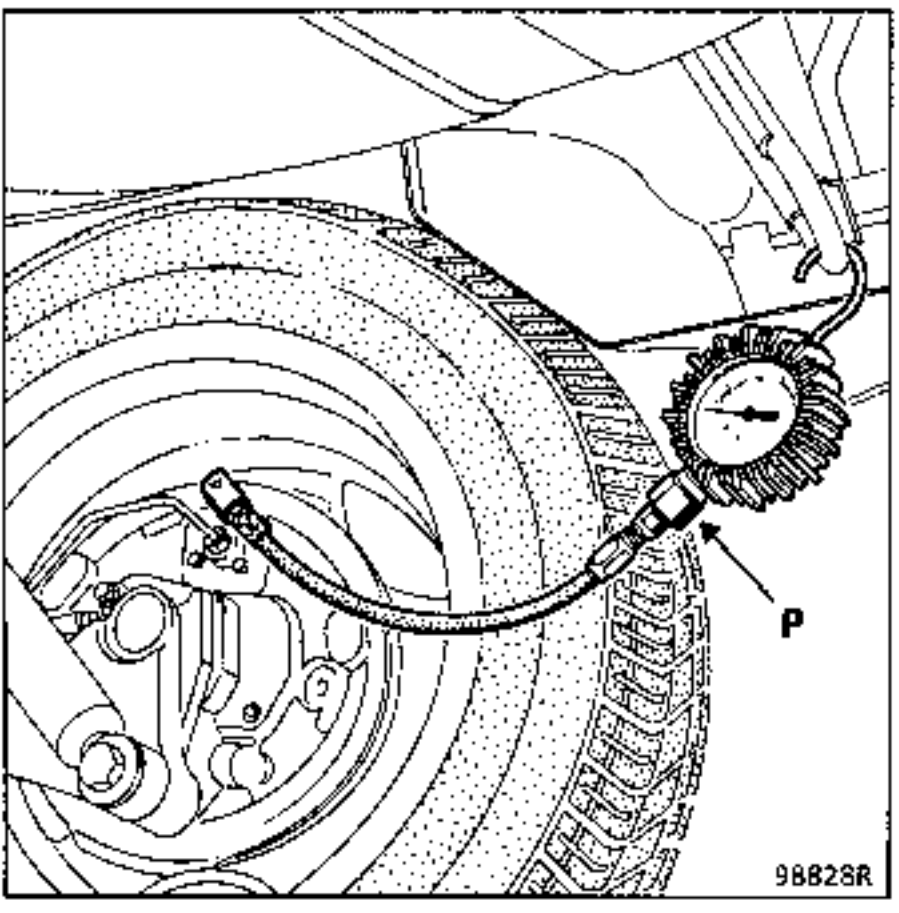
Checking and adjustment of the braking compensator is carried out with the vehicle on the ground with one person on board. The fuel tank must be full.

SPECIAL TOOLING REQUIRED	
Fre. 244 -03 or Fre. 1085-01	Pressure gauge for checking compensator rating

CHECKING

Connect two pressure gauges Fre. 244-03 or Fre. 1085-01 :
- one at the front right hand side,
- one at the rear left hand side.

Bleed the pressure gauges via screw (P).



Progressively press the brake pedal until the pressure at the front wheels is the setting pressure (see table of values). Read the corresponding pressure at the rear wheels; correct it if necessary.

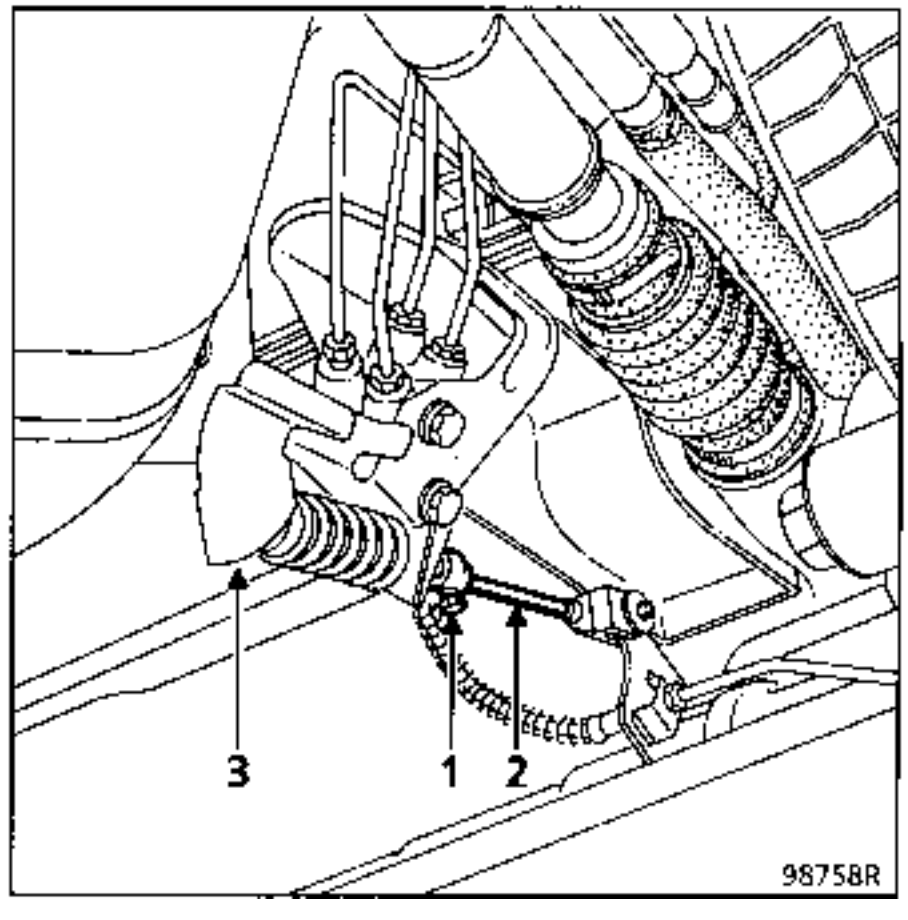
Carry out the same operation on the other circuit:
- one at the front left hand side,
- one at the rear right hand side.

If there is a large difference (values exceed tolerance ranges), **replace the compensator since no repair is permitted.**

ADJUSTMENT

To adjust the compensator, slacken bolt (1) and alter the position of the rod (2) in the sleeve.

NOTE : do not alter the position of the nut (3).

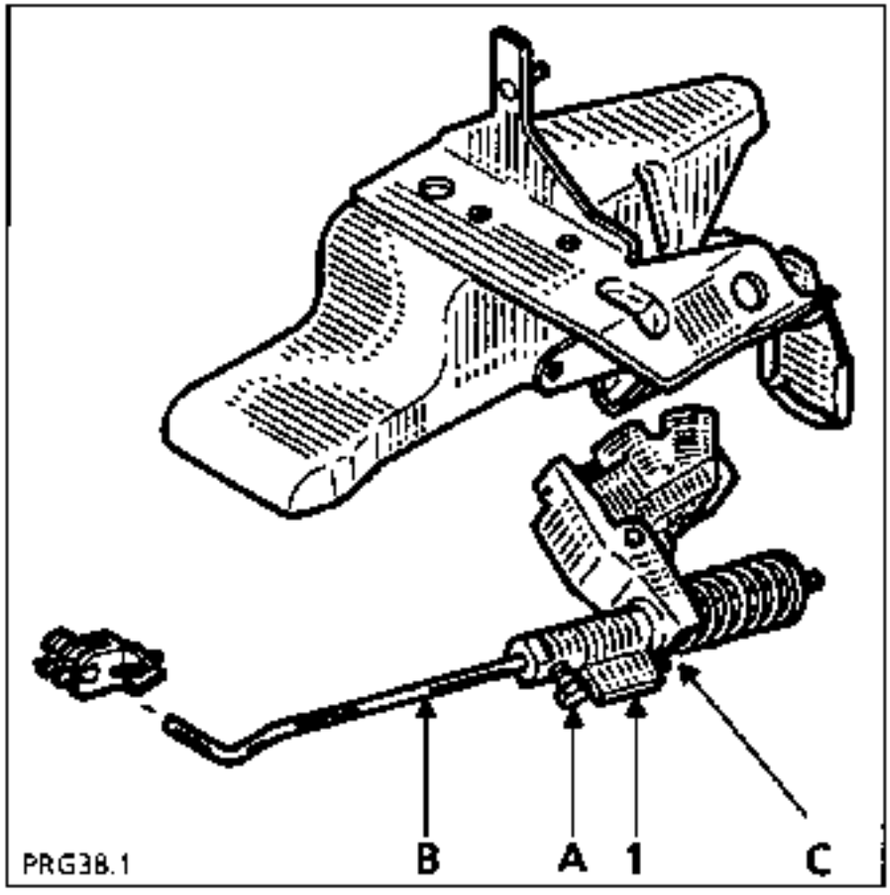


REPLACEMENT

The Parts Department supplies pre-adjusted compensators with a pin (1).

Ensure the vehicle meets the adjustment conditions.

Fit the new compensator with the pin (1).



Slacken bolt (A).

Position the rod (B) in the connecting opening.

Tighten bolt (A) while holding sleeve (C).

Remove the pin (1).

Bleed and check the circuit (see paragraph "Checking - Adjustment").

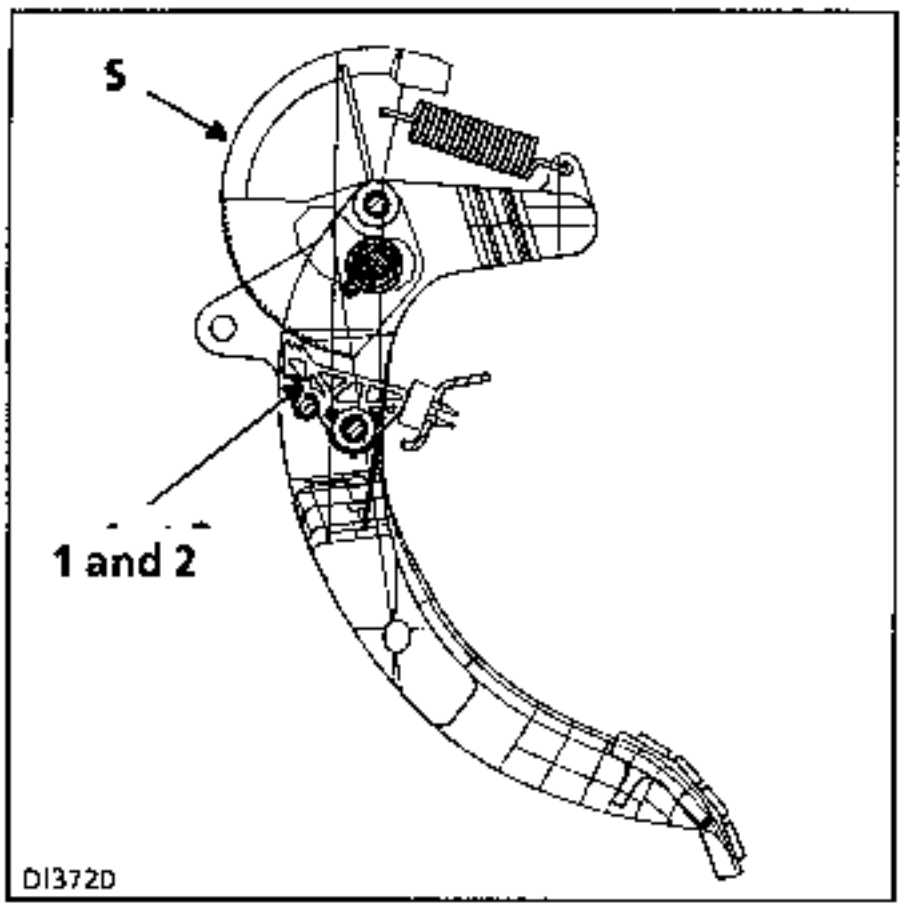
REMOVAL

In the engine compartment, release the cable from the fork.

Press the pedal to pull the cable through.

Remove the pedal (see "Removing the clutch pedal").

Remove the cable end from its position on the adjustment sector (S).



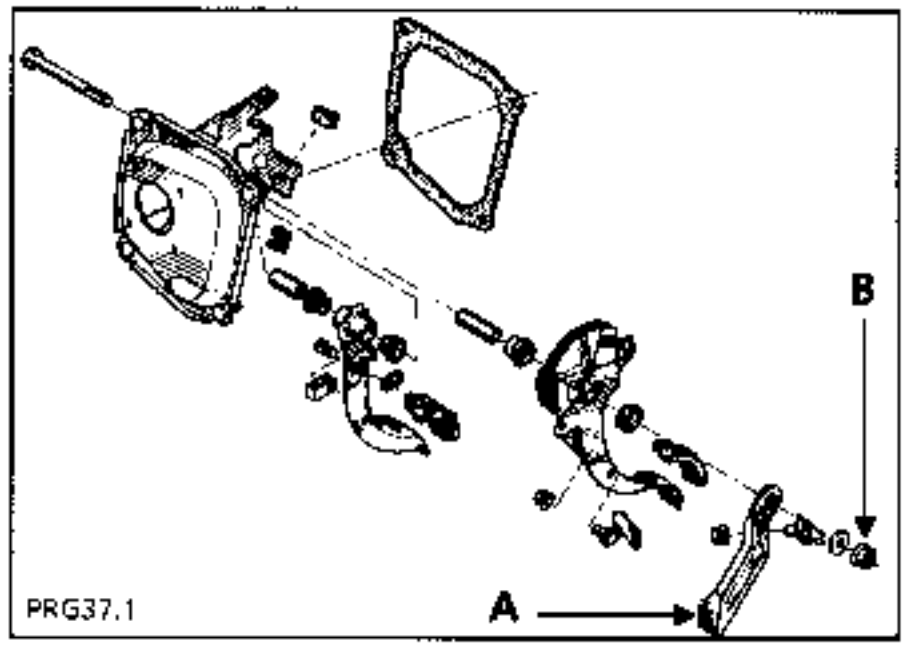
Remove the cable sleeve stop from the pedal mounting.

Remove the complete cable from the engine compartment.

REFITTING

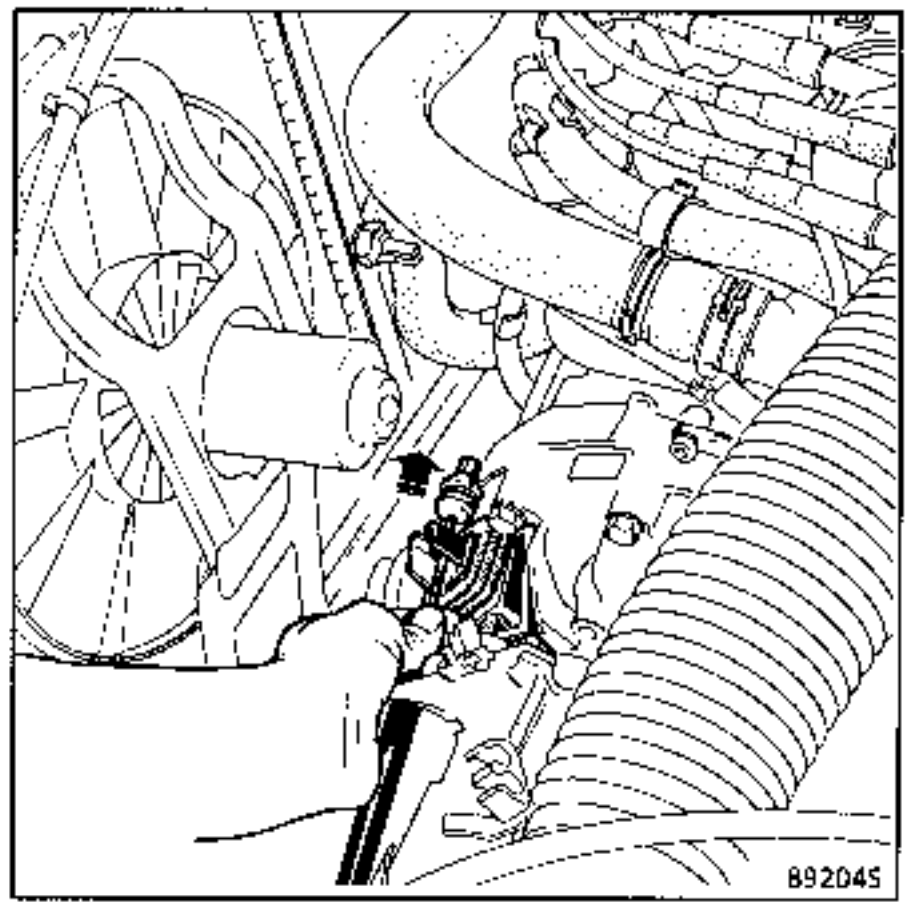
From the engine compartment, thread the cable through to the passenger compartment.

In the vehicle, check the ratchets (1) and (2)return to the rest position easily.



Thread the cable through the notched cam ring and fit the cable sleeve stop in position on the toothed sector (S).

Refit the shaft and the pedal. Fit the cable to the clutch fork.



Check the alignment of the cable sleeve stop on the bulkhead.

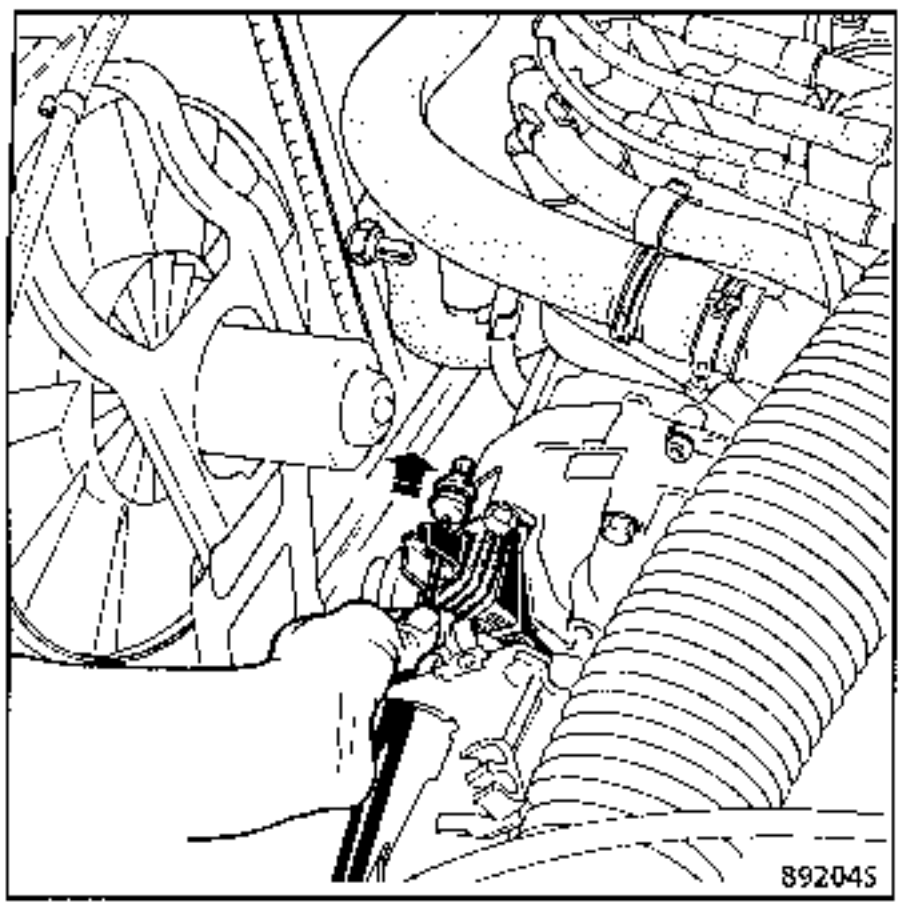
Press the clutch pedal to clip the cable sleeve stop to the bulkhead. The adjustment is made automatically.

REMOVAL

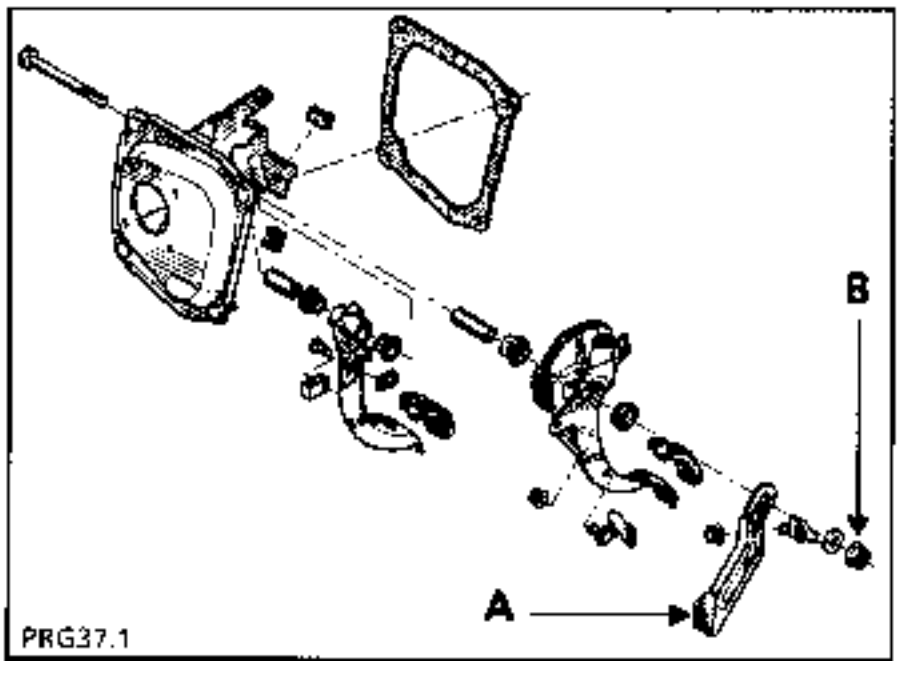
Disconnect the battery.

Special notes for F engine:
- remove the air filter.

Release the cable from the clutch fork.



Remove:
- the stiffener, nut (A),
- the pedal shaft nut (B).



Pull the shaft to release the pedal. The shaft does not need to be completely removed, the brake pedal may remain in position.

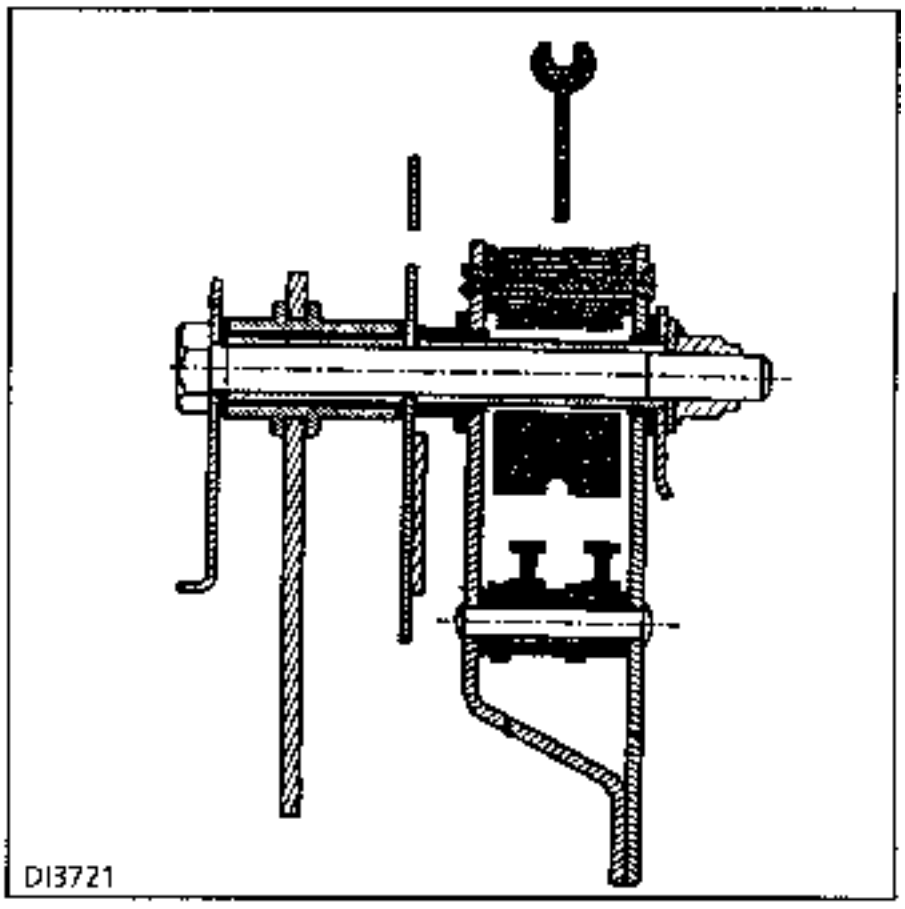
Release the cable from the toothed sector.

REFITTING

Coat the shaft and the toothed sector with N° 30 grease.

Fit the cable to the toothed sector.

Fit the clutch pedal into position on the pin.



NOTE : do not use a hammer to refit the shaft.

Fit the stiffener into position, and hand tighten the nut (A).

Refit the nut (B) for the pedal mounting shaft.

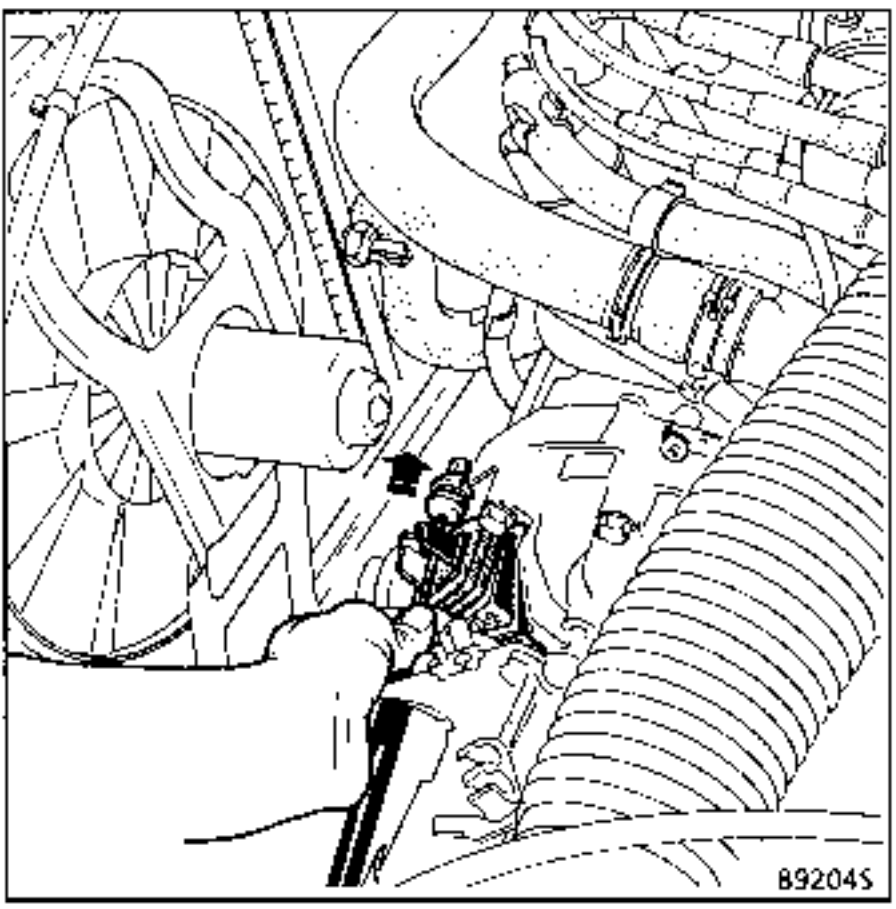
Tighten nut (A).

Refit the cable to the clutch fork.

Check the assembly operates correctly.

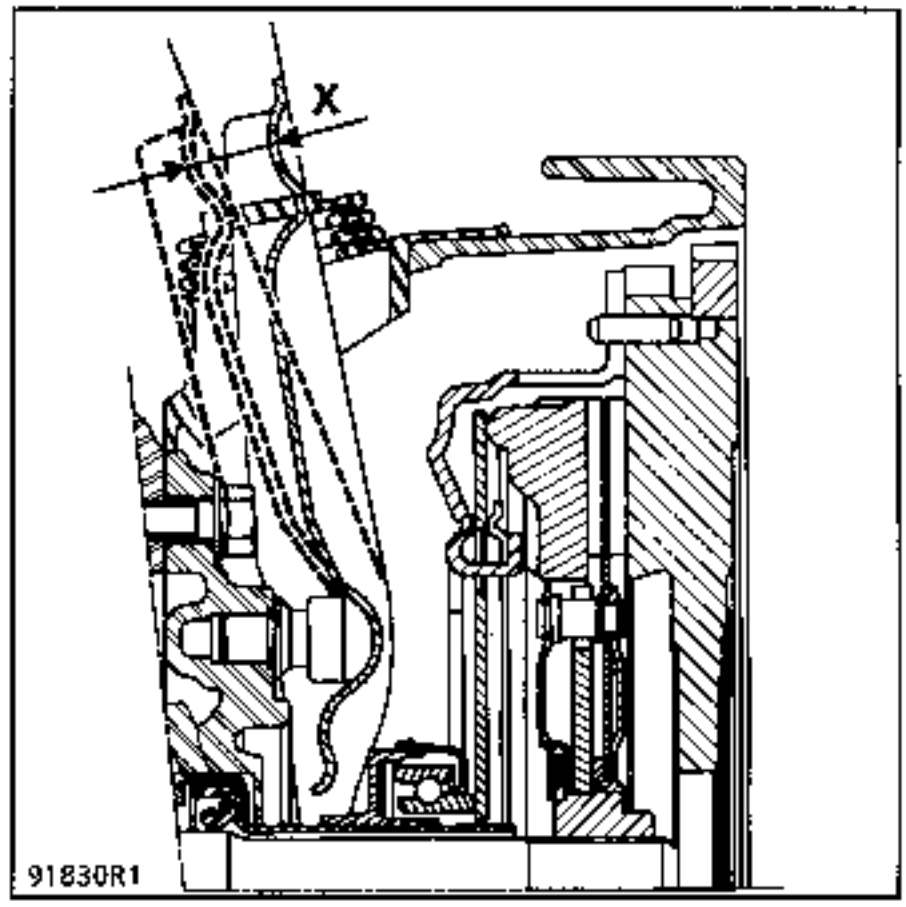
With the pedal at rest, clutch in, pull the cable at the clutch fork on the gearbox.

The cable should have a minimum of 2 cm slack.

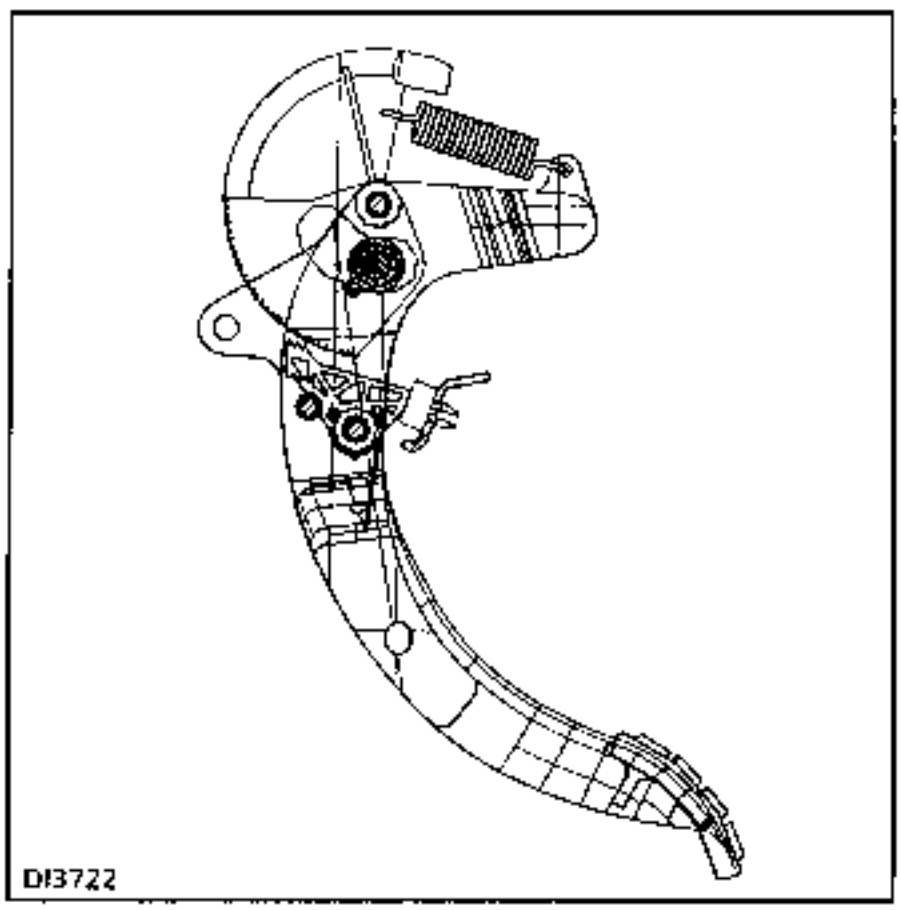


Check the fork travel.

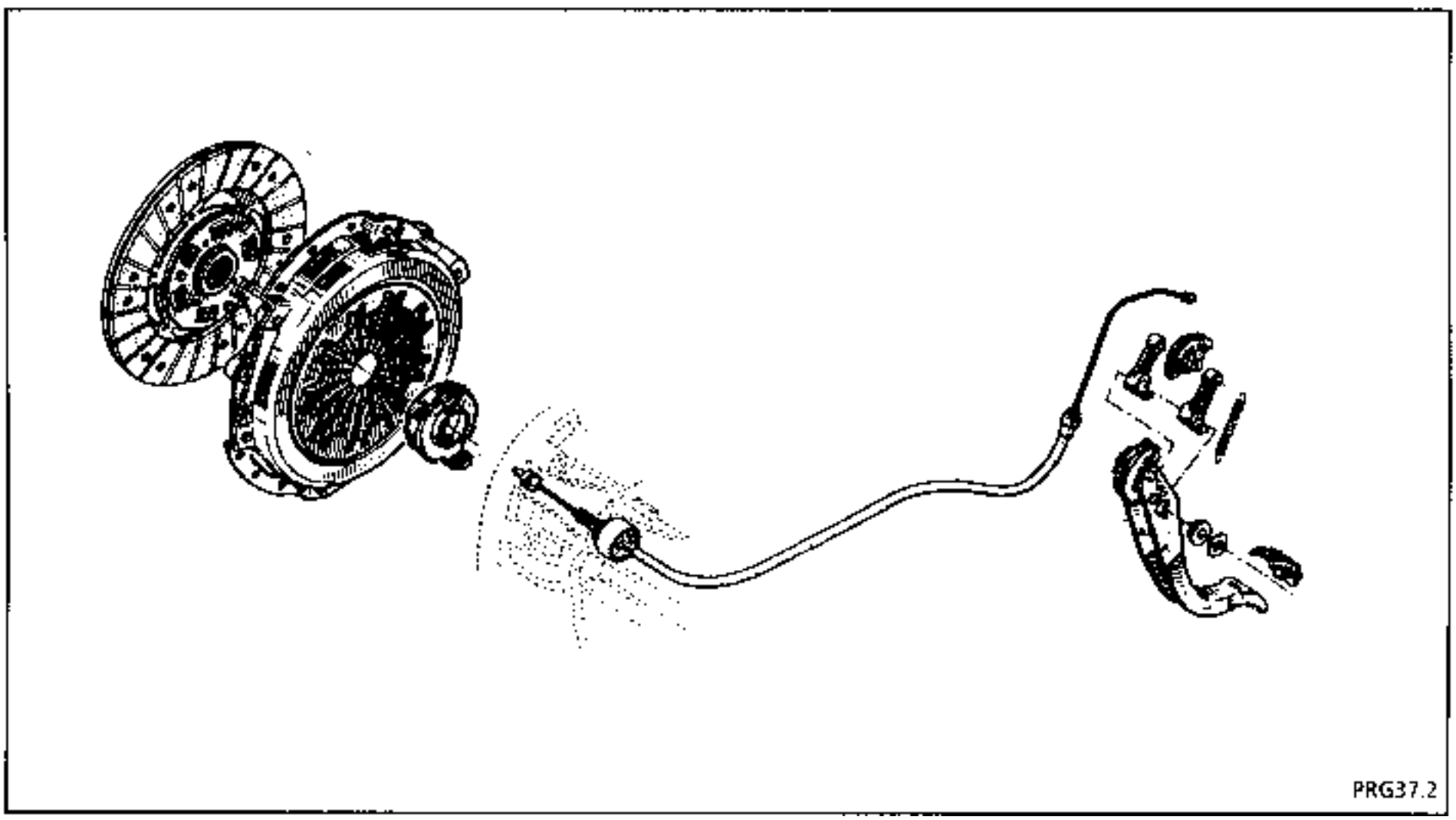
It should be : X = 27.4 to 30.7 mm.



SECTION VIEW



EXPLODED VIEW



OPERATION

AUTOMATIC COMPENSATION

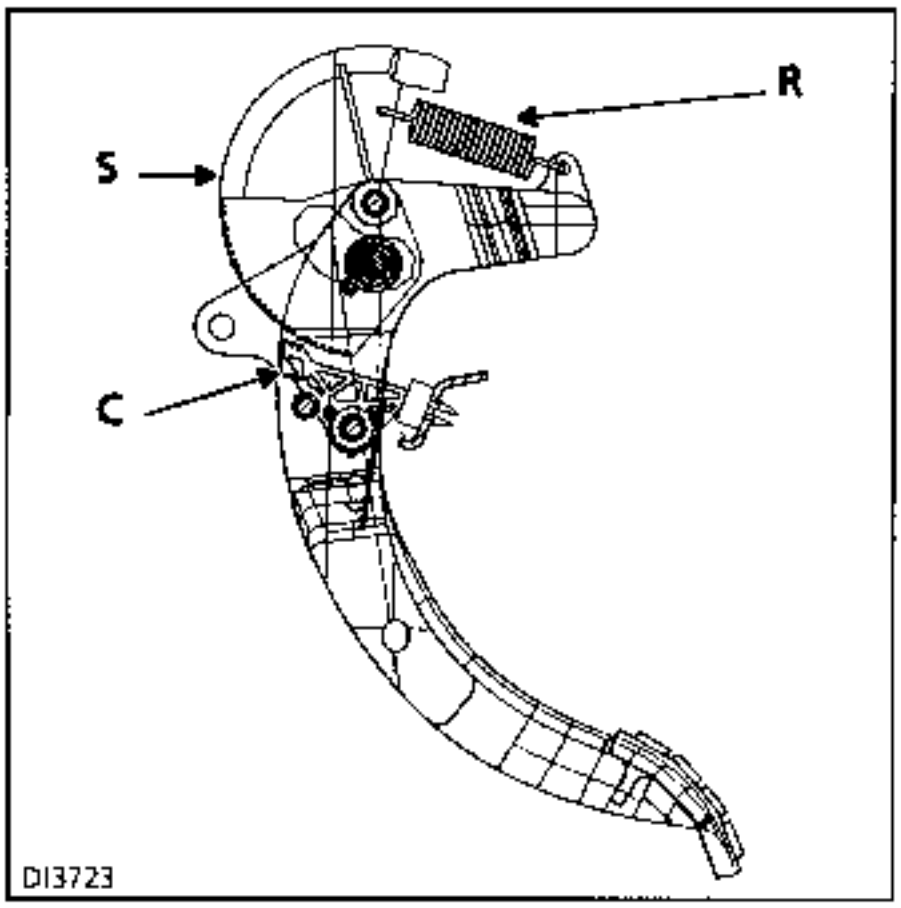
The spring (R) permanently acts on the play compensation sector (S).

The cable is always taut, which pulls on the fork and therefore brings the thrust pad into constant contact with the diaphragm.

Adjustment is automatic.

CLUTCH DEPRESSED OPERATION

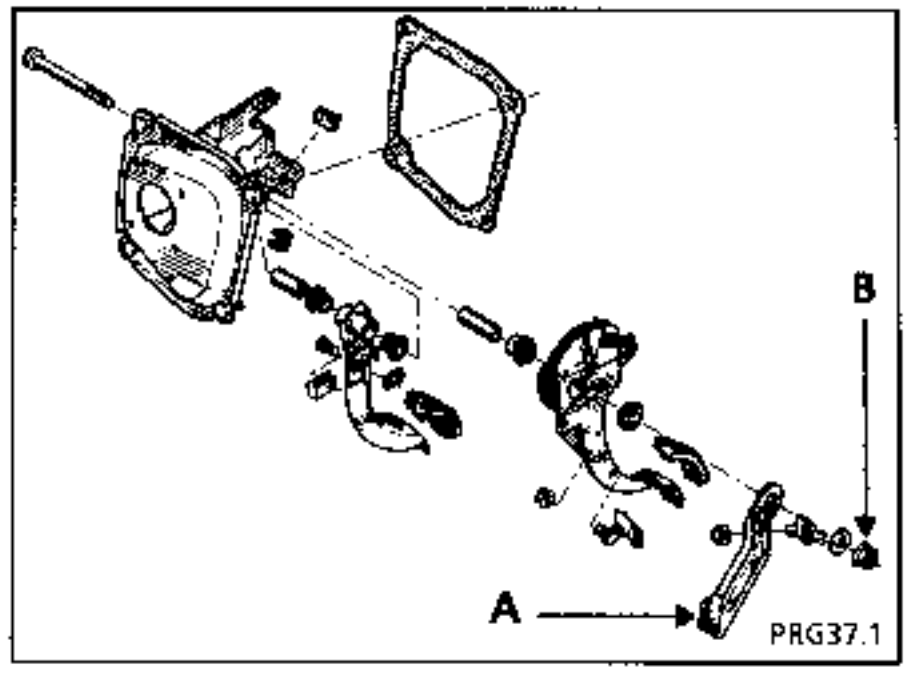
By pressing the pedal, the notched ratchets (C) engage on the compensation sector teeth (S) to prevent it pivoting and allow the cable to be pulled.



CHECKING

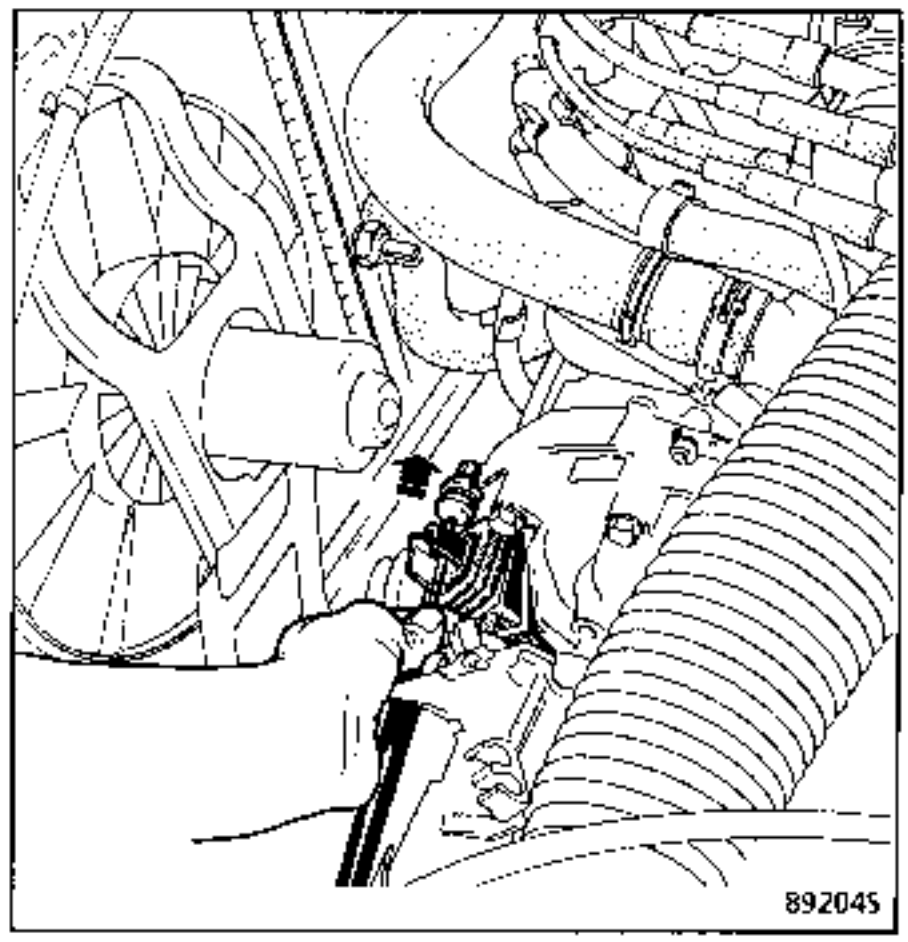
To ensure the assembly is operating correctly, check:

- that the notched sector (C) pivots on its pin,
- that the ratchets (1) and (2)return to the rest position easily.



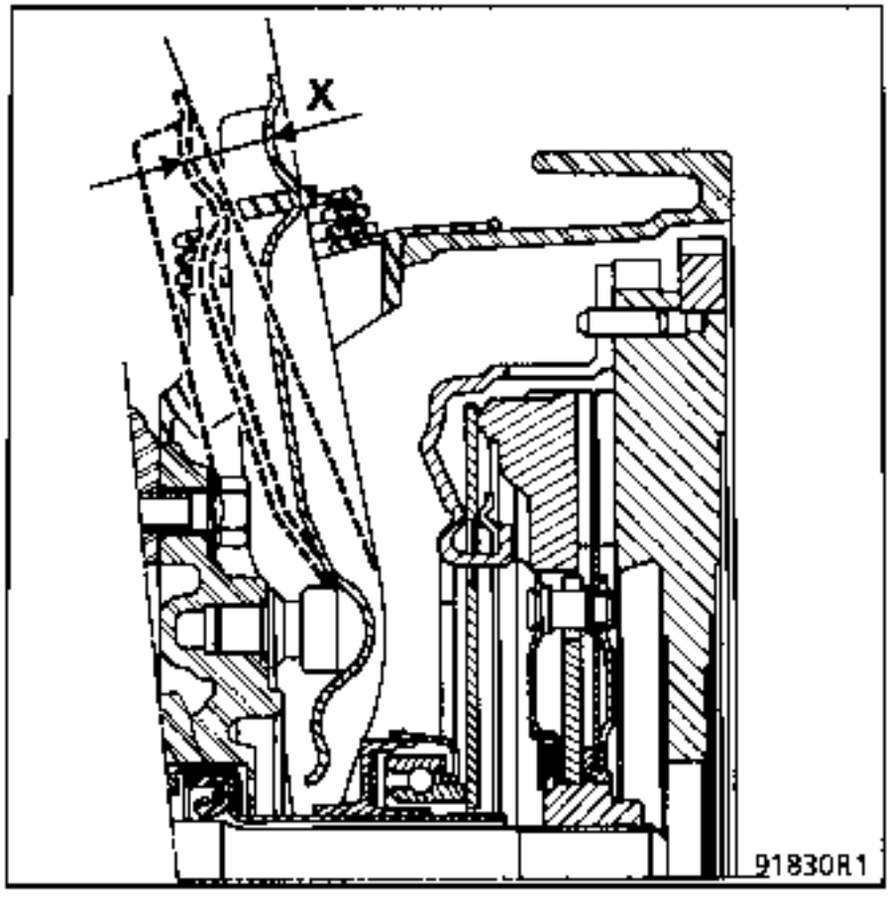
- pull the cable at the clutch fork on the gearbox.

The cable should have a minimum of 2 cm slack.



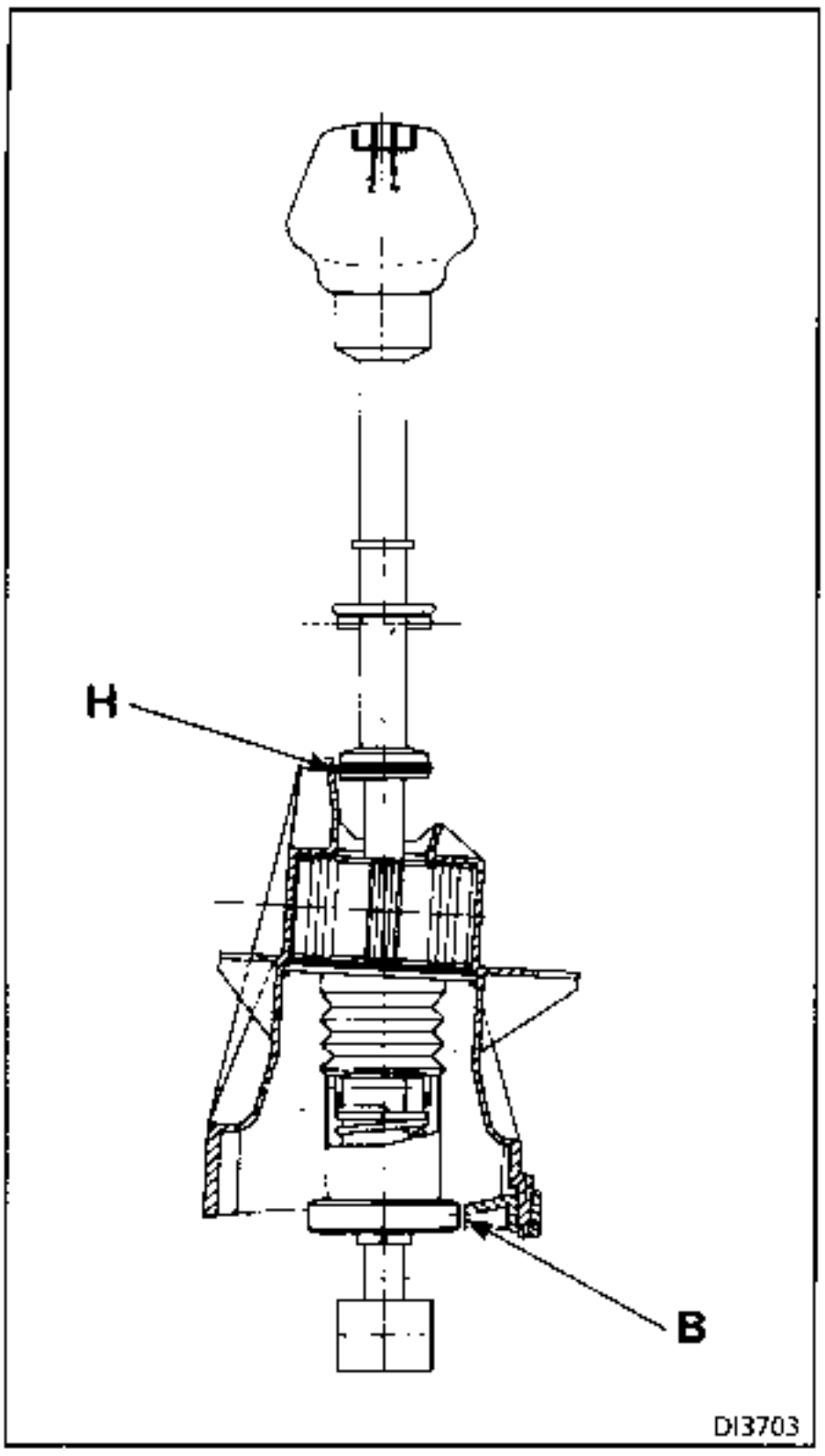
These tests allow verification that the notched cam (C) and the toothed sector (S) are free in the "clutch ok" position.

Check the fork travel. It should be :
X = 27.4 to 30.7 mm.



This is a preliminary check before any operation on the clutch itself.

These vehicles have a dual lock external gear control which prevents changing to reverse gear instead of first gear without releasing the locking ring.

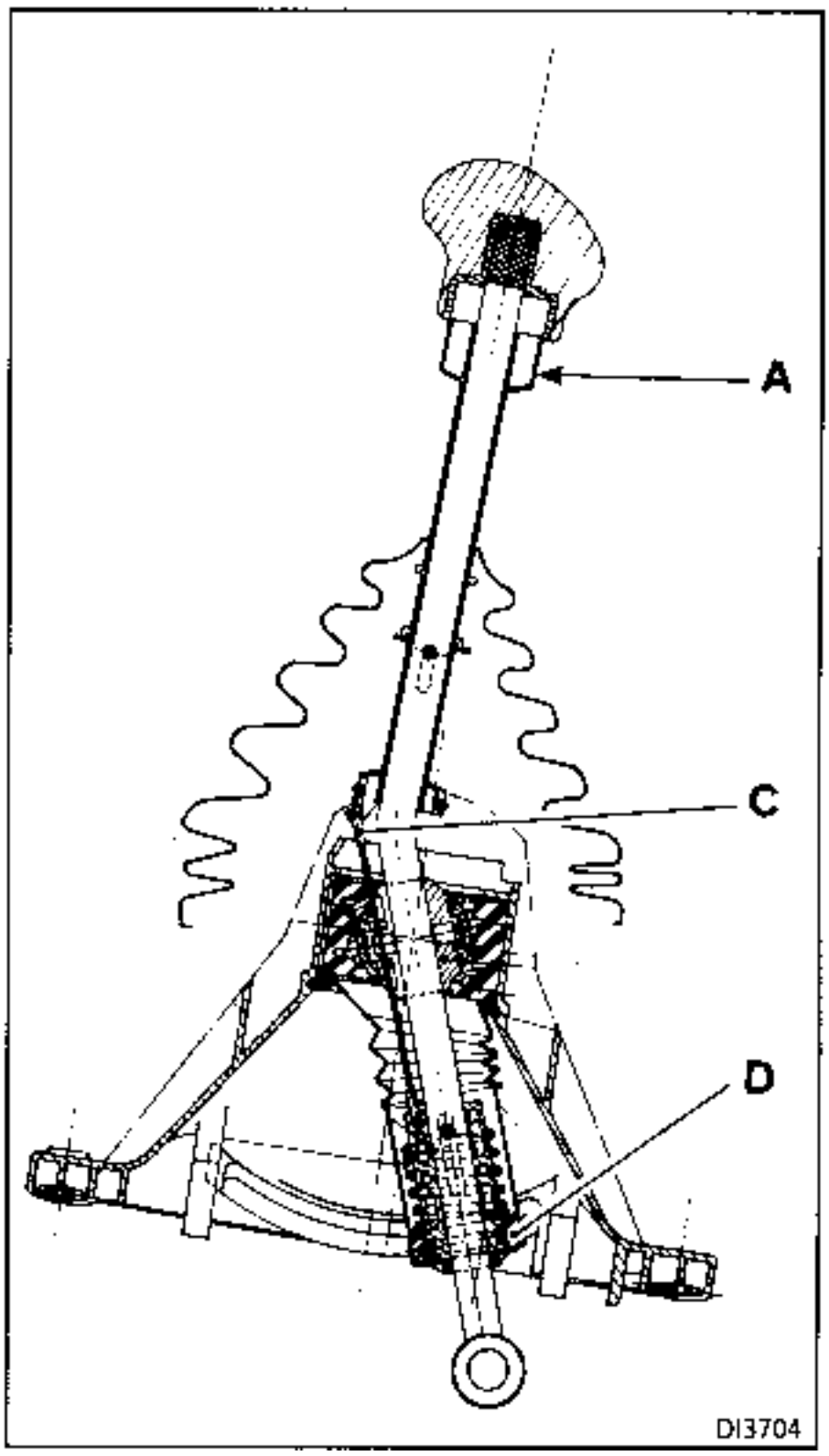


OPERATION

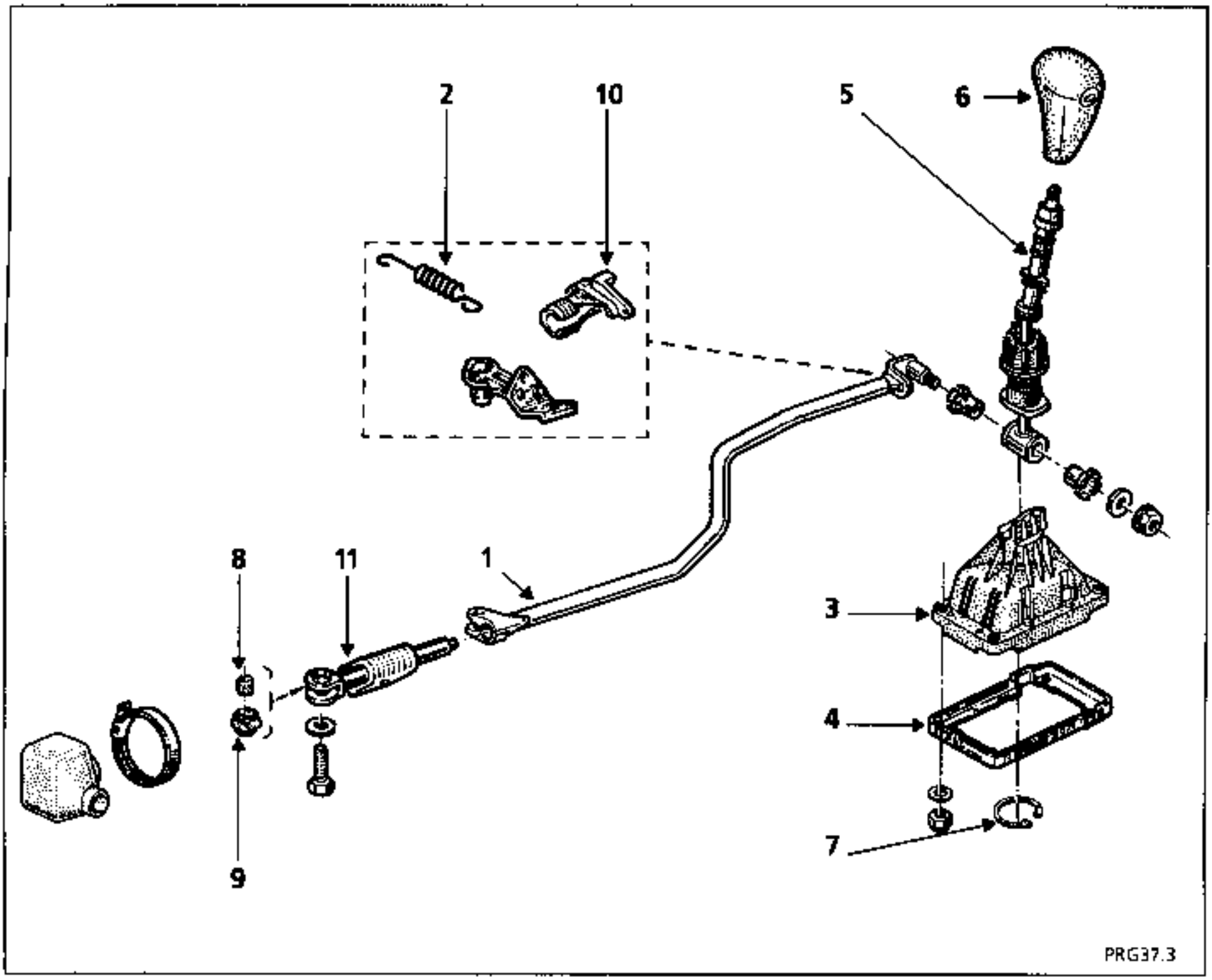
The upper locking ring (A) operates via a cable (C) on a second locking ring (D) located on the lower part of the lever.

The lever is prevented from moving at the bottom (B) and the top (H) at the same time.

NOTE : this control must be adjusted with first gear engaged.



EXPLODED VIEW



1 Bar
2 Return spring to 3/4 position
3 Gear lever retainer
4 Base plate
5 Lever and locking rings assembly
6 Gear lever knob
7 Stop ring
8 Ring
9 Sleeve
10 Retaining clip
11 Clevice

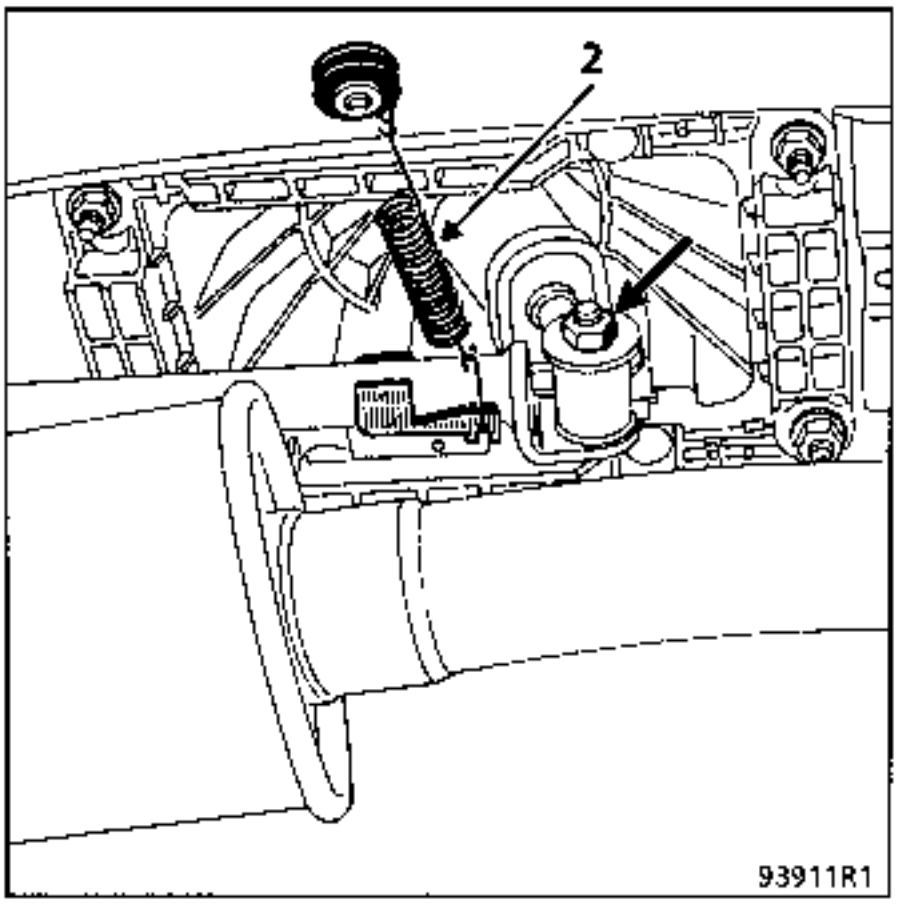
TIGHTENING TORQUES (in daN.m)	
Mounting nut for gear lever retainer on body	1.5
Bolt for bar mounting clip on clevice	3
Bar - lever mounting nut	3

CONSUMABLES
33 Medium grease : Control lever joints

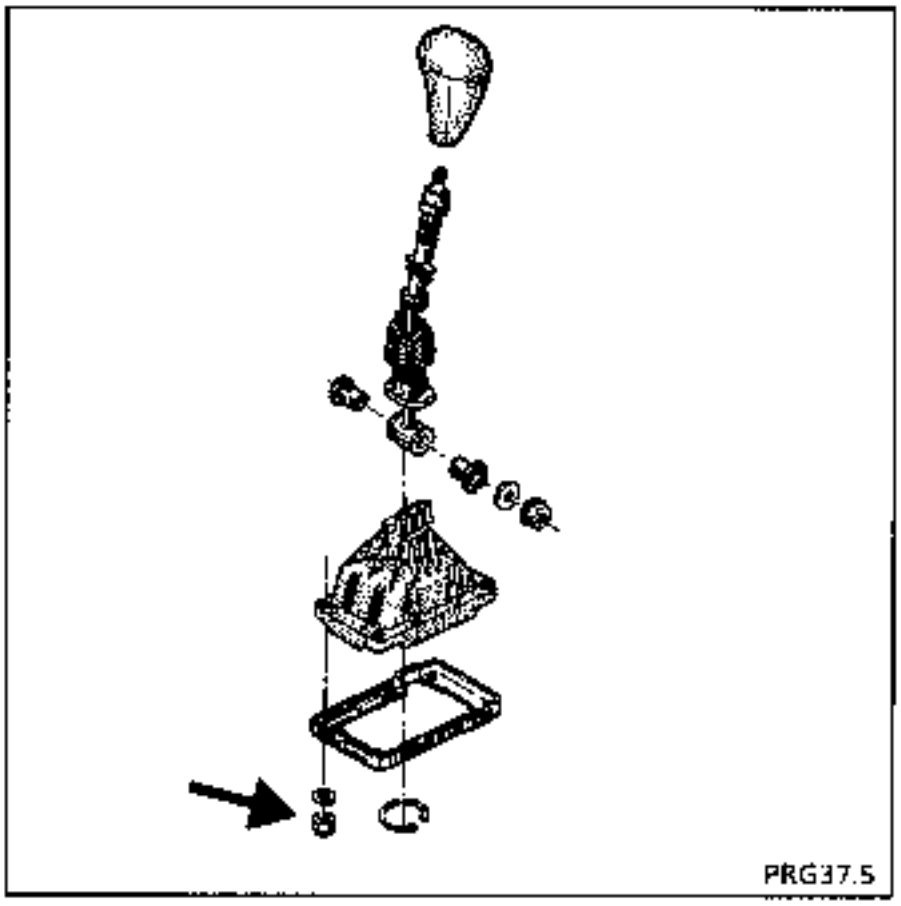
REMOVAL

In the vehicle, release the gaiter (6) on the console.

Under the vehicle, remove:
- the heat shield,
- the exhaust downpipe mounting bolts,
- the exhaust pipe rubber mounting brackets,
- the return spring(2),
- the bar - lever mounting nut.



Remove the mounting nuts from the gear lever retainer and remove the lever - gear unit assembly, moving the exhaust pipe to one side.



Place the gear lever clevice in a vice with soft jaws and remove:

- the gear lever knob,
- the gaiter,
- the stop ring.

Remove the lever and locking rings assembly from the gear unit.

NOTE : the Parts Department supplies the lever and locking rings assembly.

REFITTING

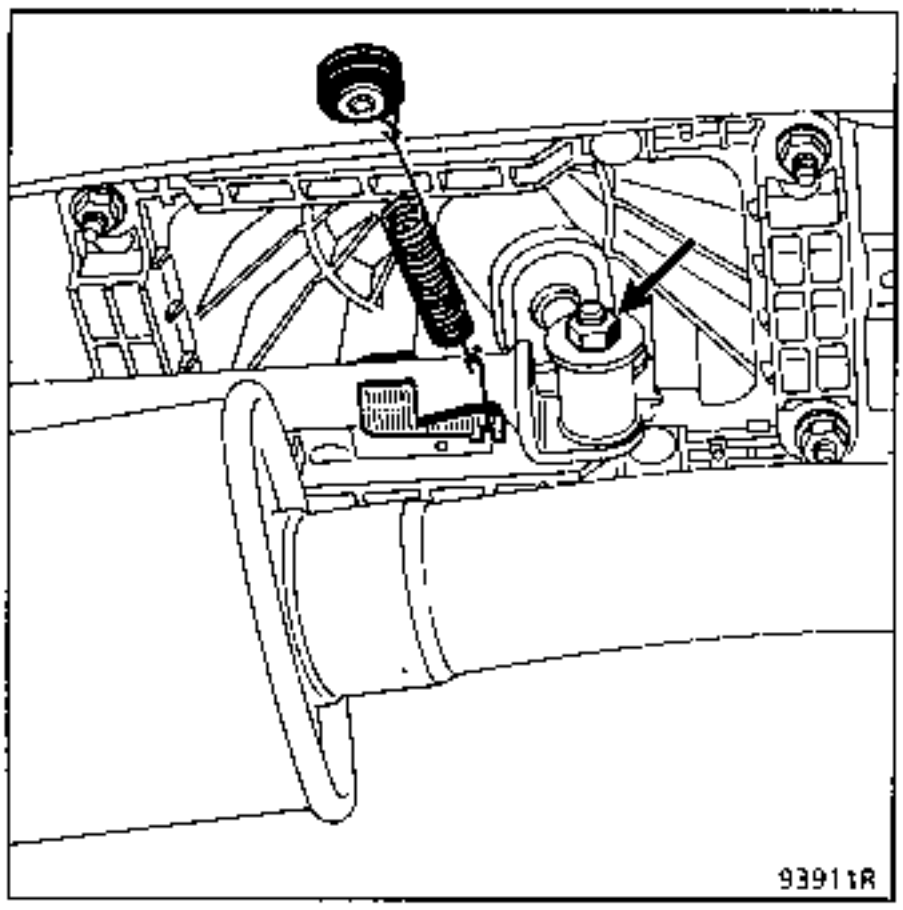
Coat the joints of the lever and the bar shaft with **33 Medium** grease.

Fit the gear lever retainer to the floor.

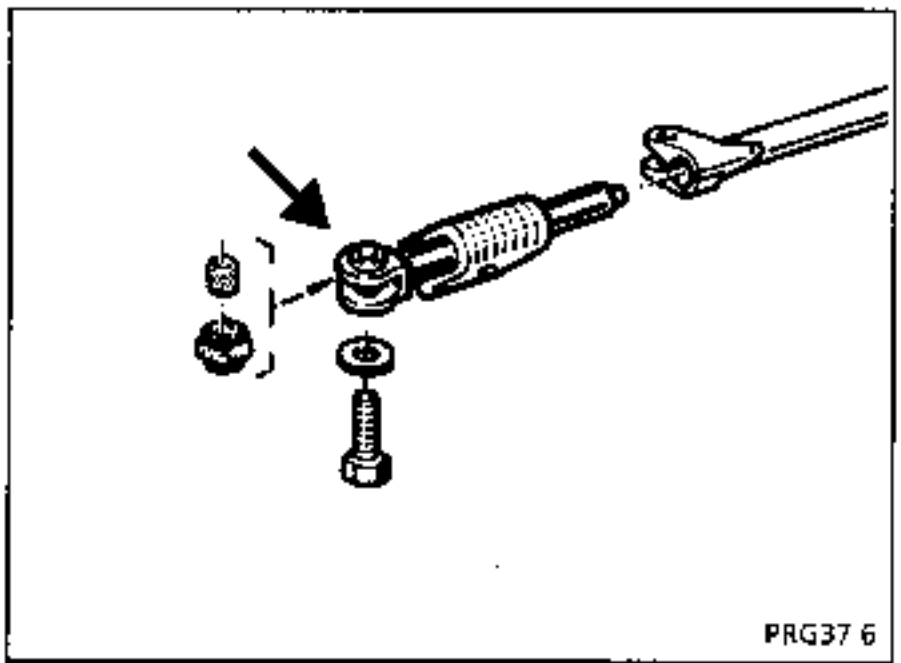
Fit the bar (1) into the clevice (12).

Place the joint on the bar (1) into the bottom of the lever (5) with the two rings.

Fit the washer and the nut and torque tighten the assembly.

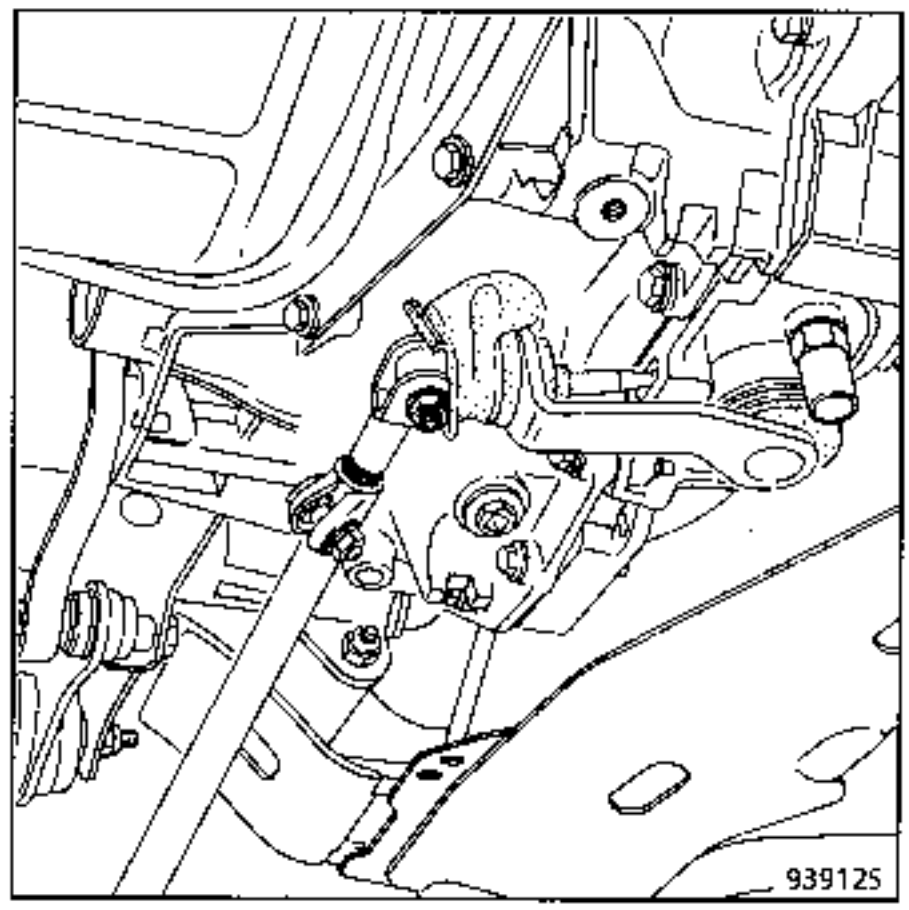


Ensure the clevice is correctly fitted (12) : offset on gearbox side.



Fit the bar (1) to the end of the clevice (12).

Leave a space (X) of approximately 7 to 8 mm between the bar and the end of the knurled section of the clevice end, then check the longitudinal positioning.



Fit the gaiter and bond the knob to the gear lever.

Adjust the control.

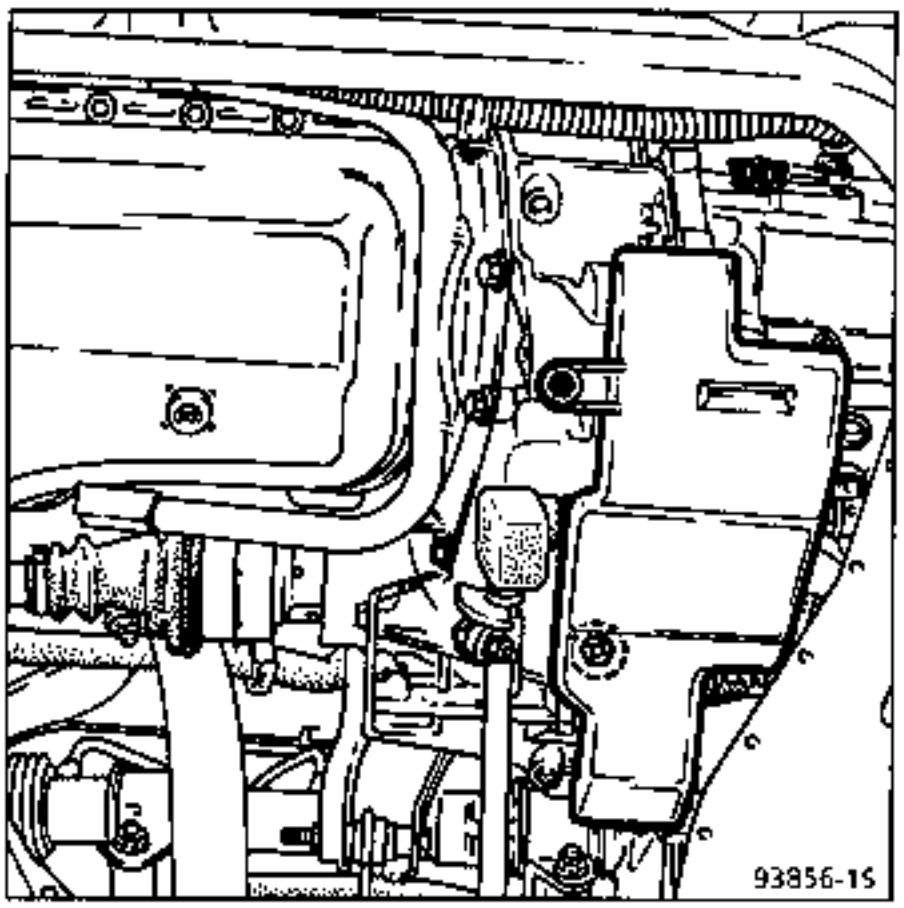
Tighten all nuts and bolts to the recommended torques.

SPECIAL TOOLING REQUIRED	
B.Vi. 1133	Tool for locking the gearbox input lever in 1st gear

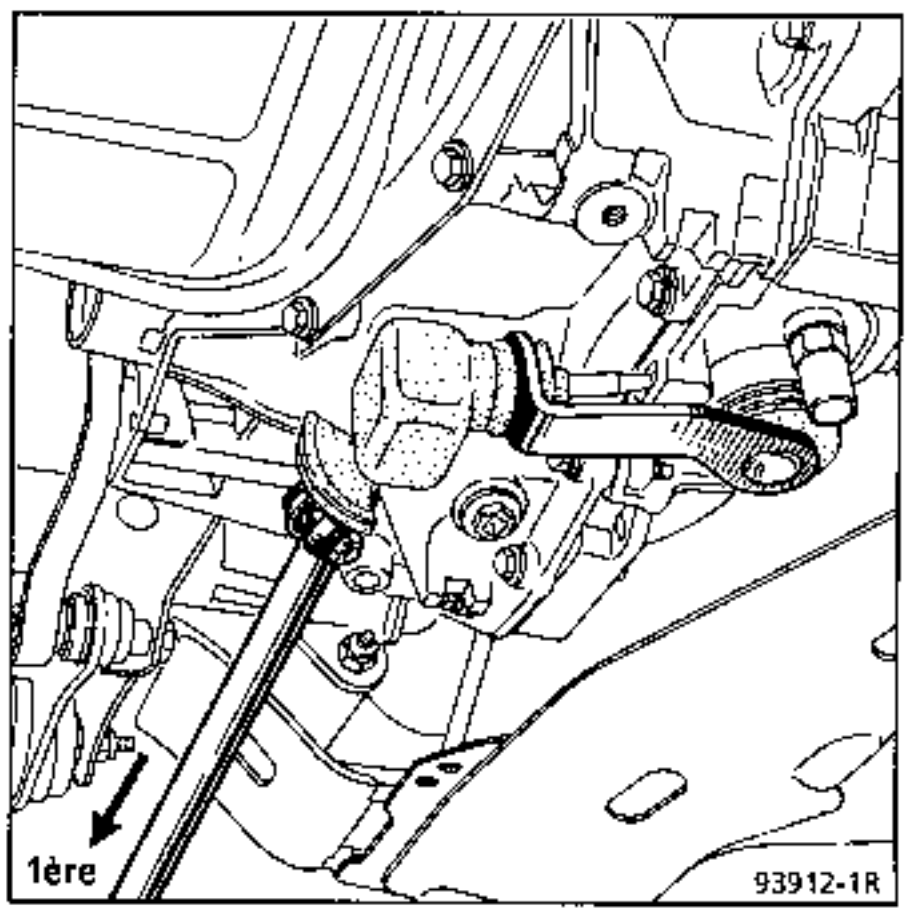
TIGHTENING TORQUES (in daN.m)	
Bolt for bar mounting clip on clevice	3

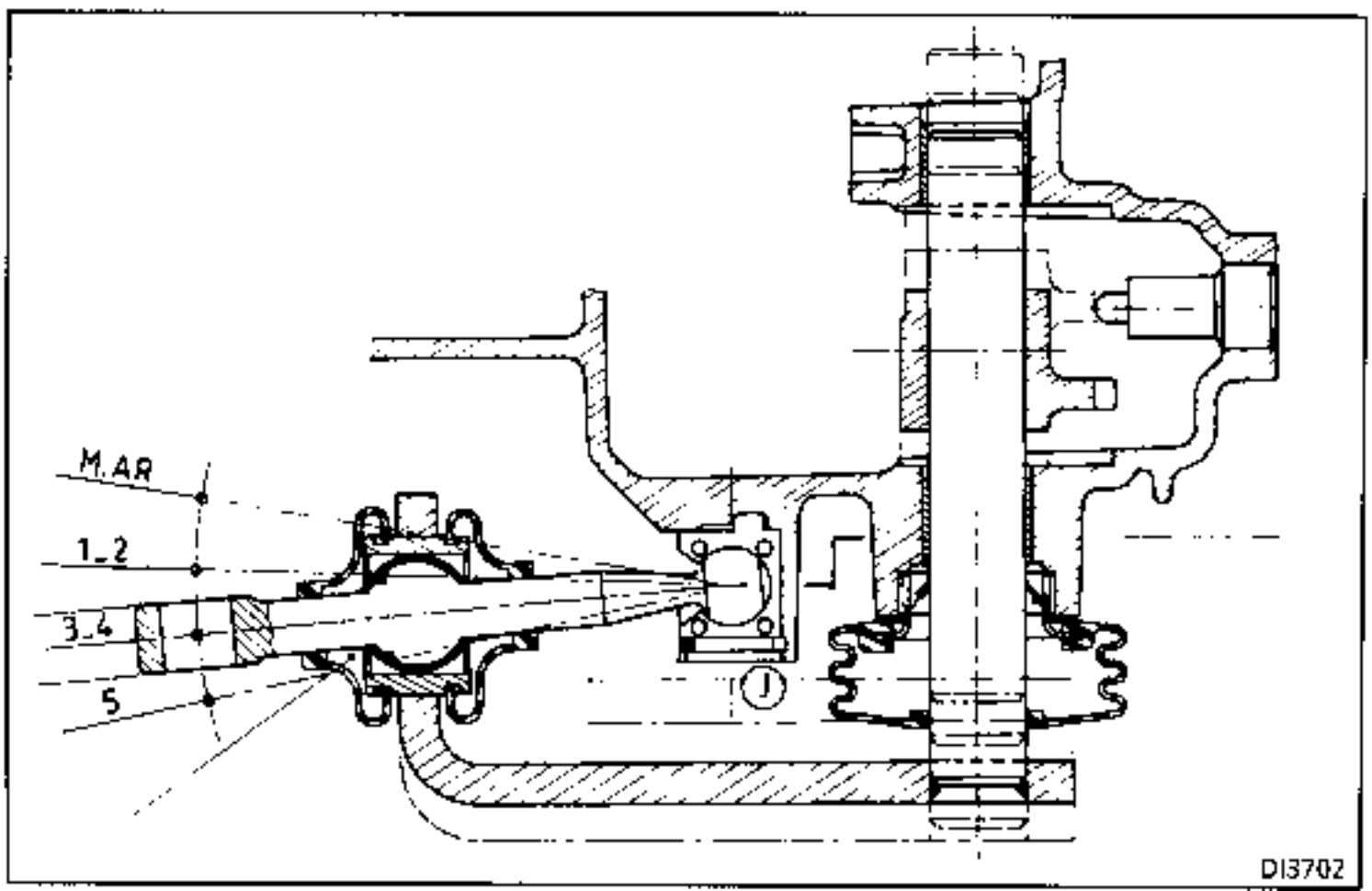
ADJUSTMENT

Remove the collector.



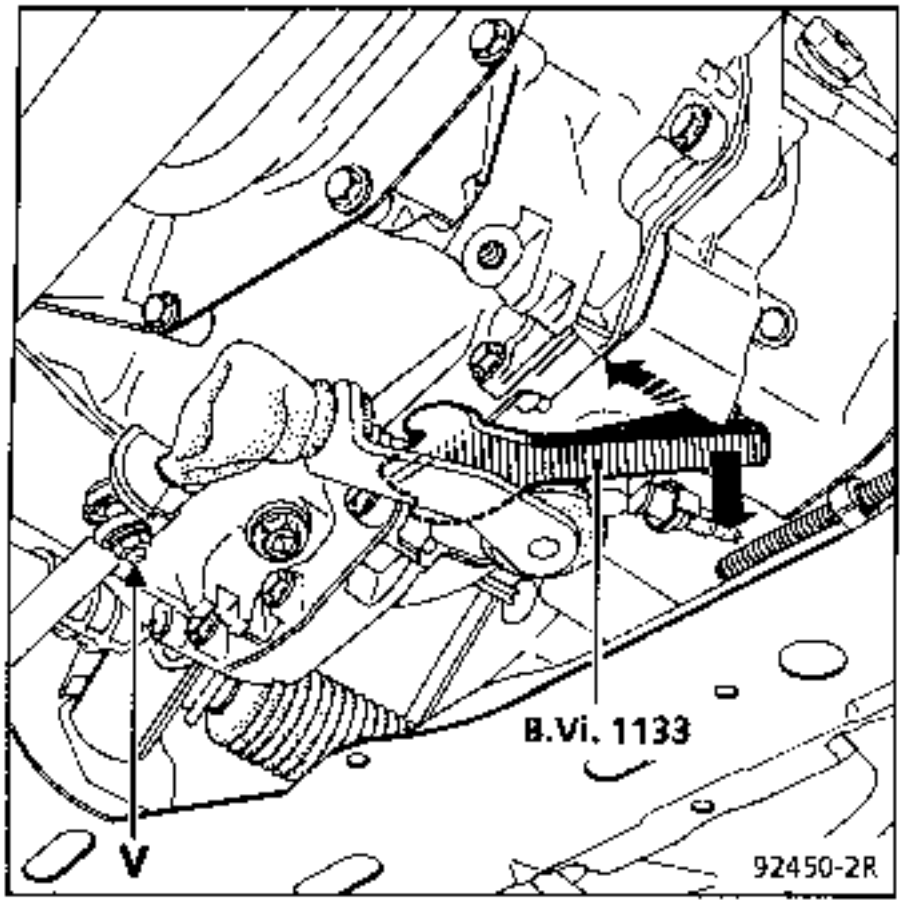
Engage 1st gear.



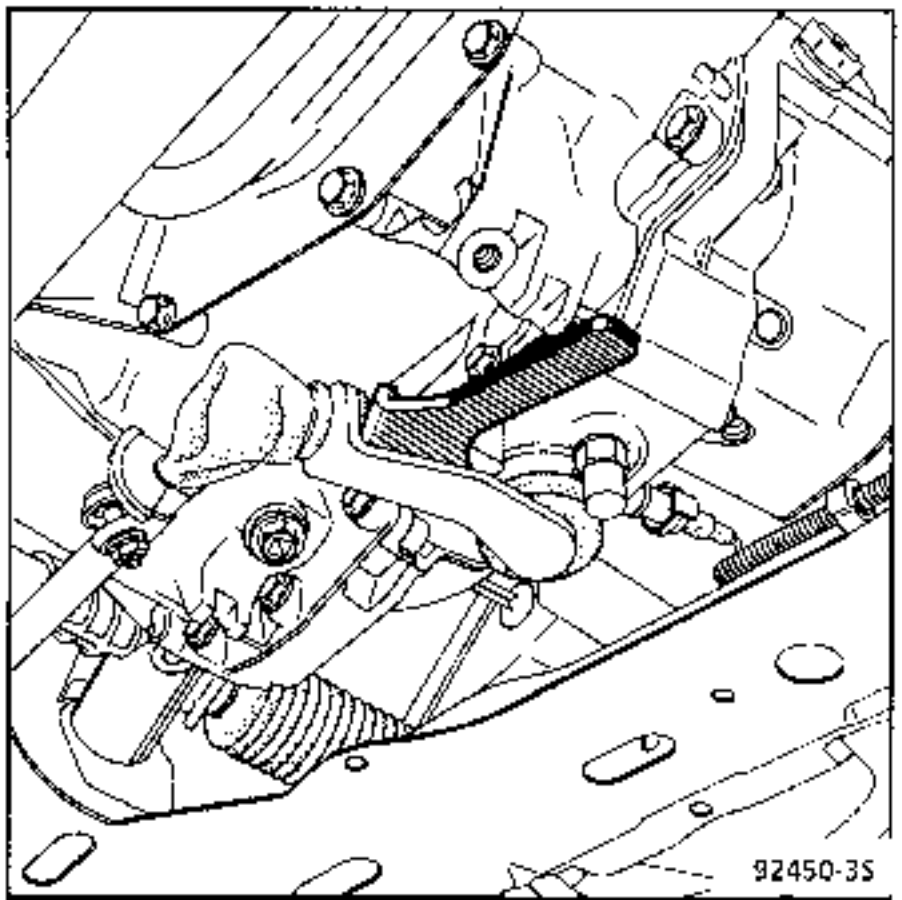


Slacken bolt (V).

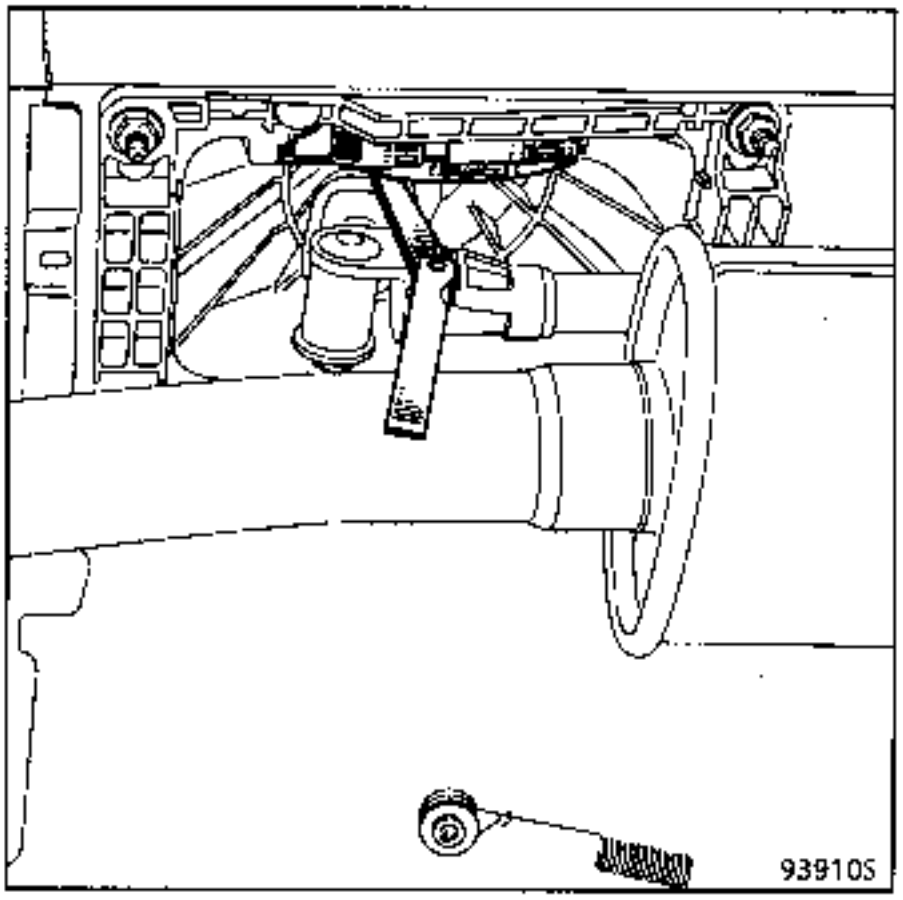
Fit tool **B.Vi. 1133** to compensate for any play.



At the same time, pull the end of the clevice down and pivot it through **45°** until it touches the lug on the housing.

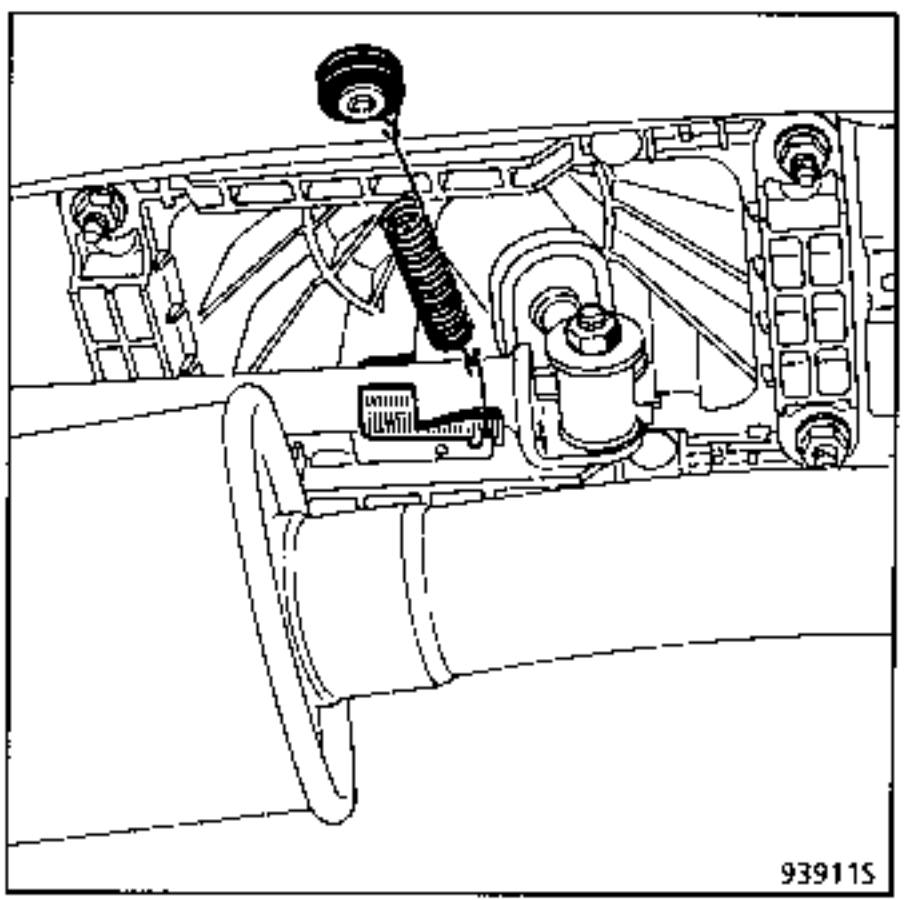


Put the lower lever locking ring against the gear unit wall, inserting a **3 mm** shim.

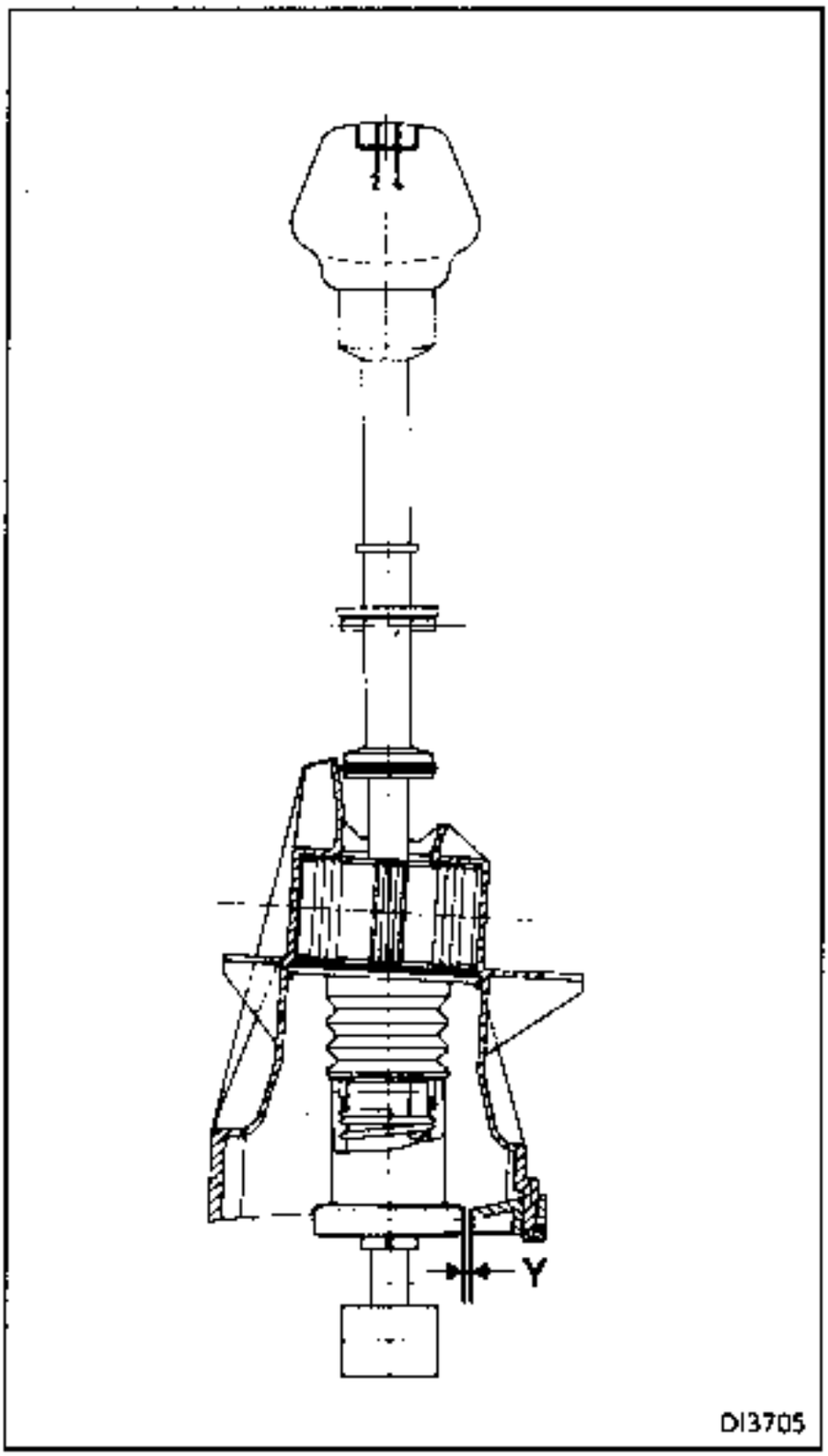


In this position, tighten bolt (V).

Remove the shim and replace the return spring on the retaining clip.



Check the resulting play "Y" which should be between 3 and 6 mm.

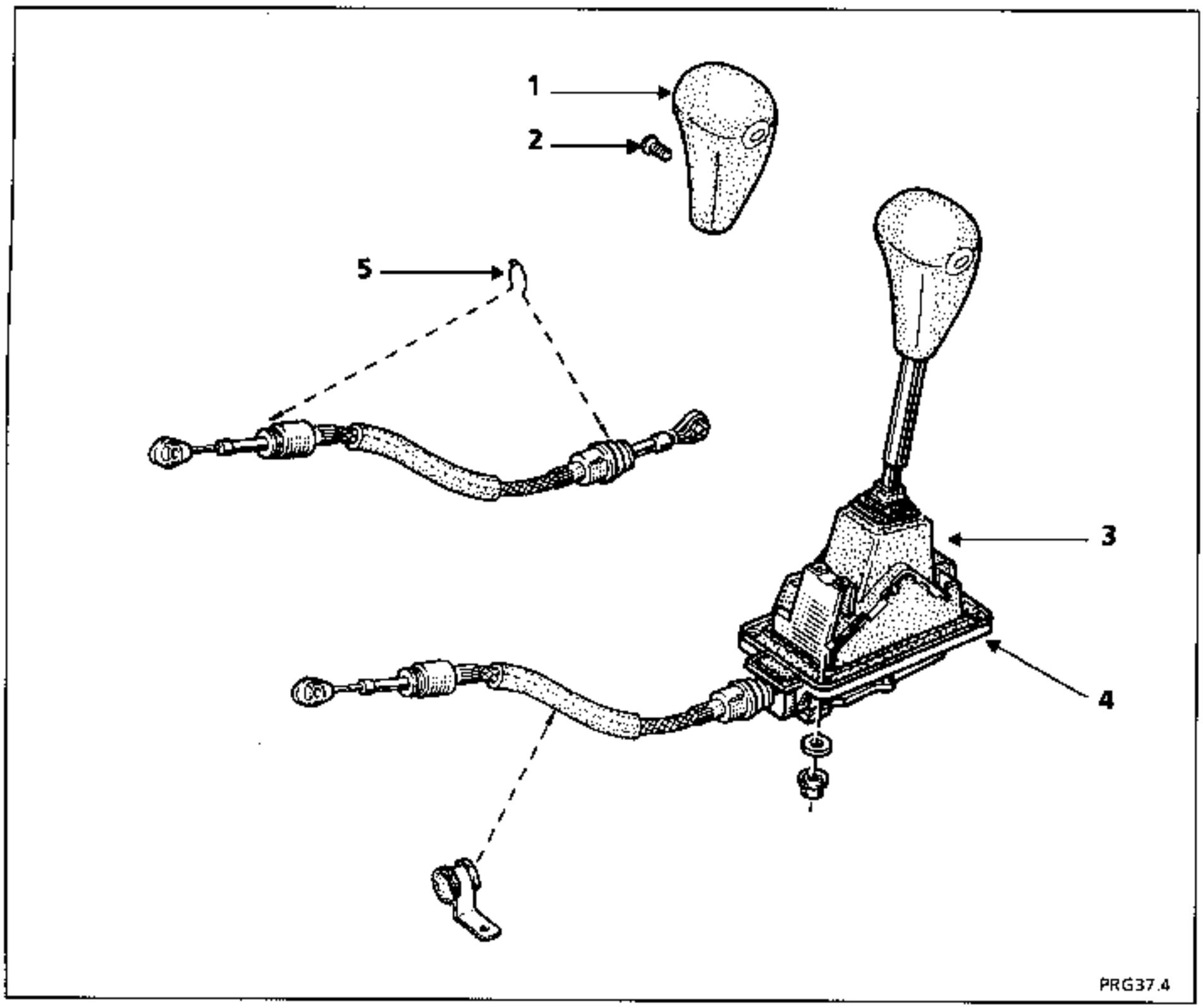


Remove tool B.Vi. 1133.

Check the gears engage correctly.

Refit the collector.

EXPLODED VIEW



1 - Control lever handle
2 - Retaining bolt
3 - Control unit
4 - Lower cover
5 - Locking key

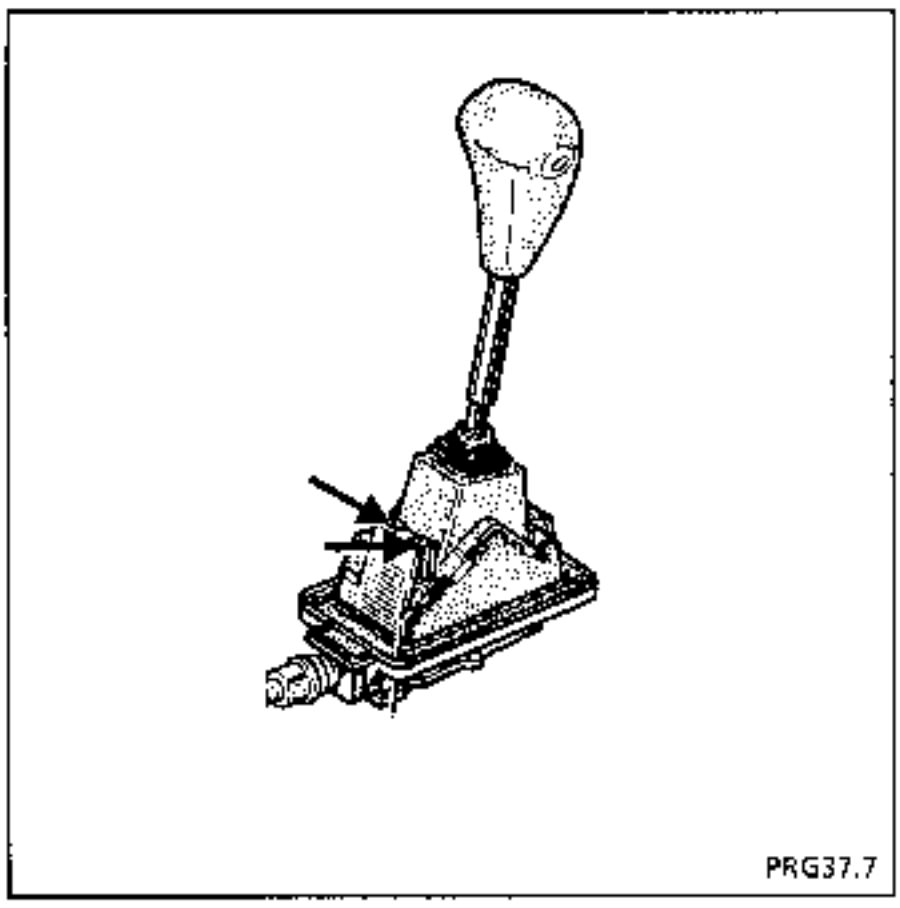
REMOVAL

In the passenger compartment:

Remove:
- the control lever knob retaining bolt,
- the console trim, using a screwdriver as a lever, taking care not to mark the plastic.

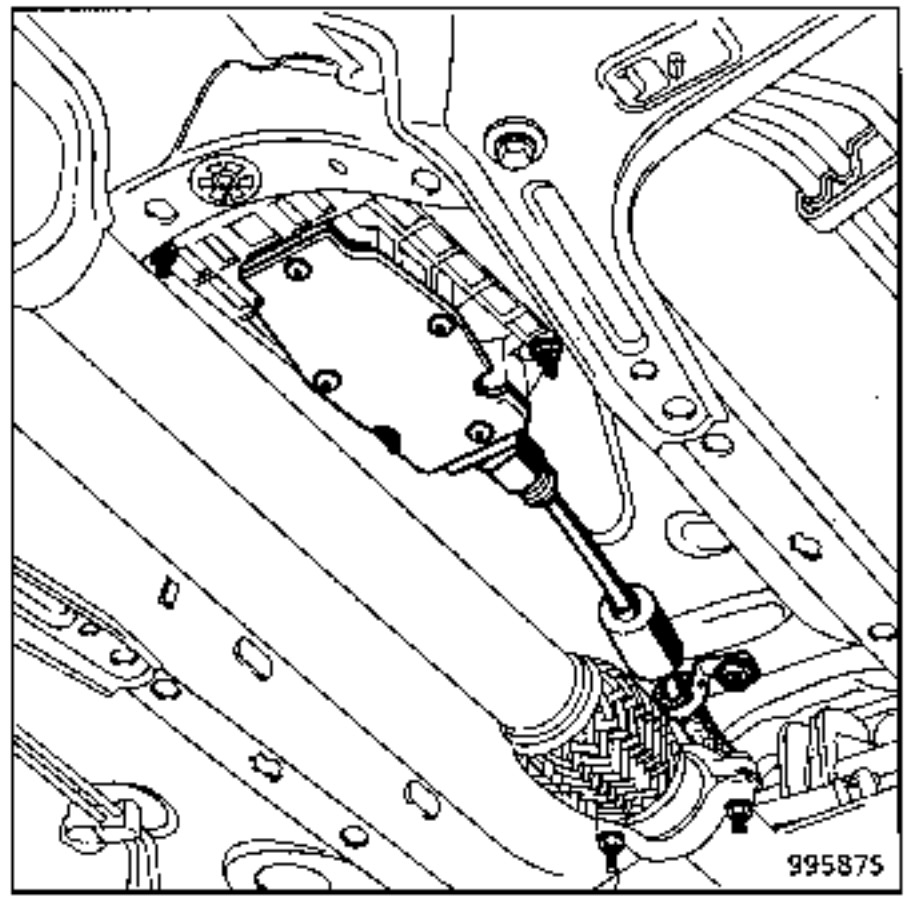
Disconnect the connectors.

Remove the two gearbox unit / console mounting bolts.

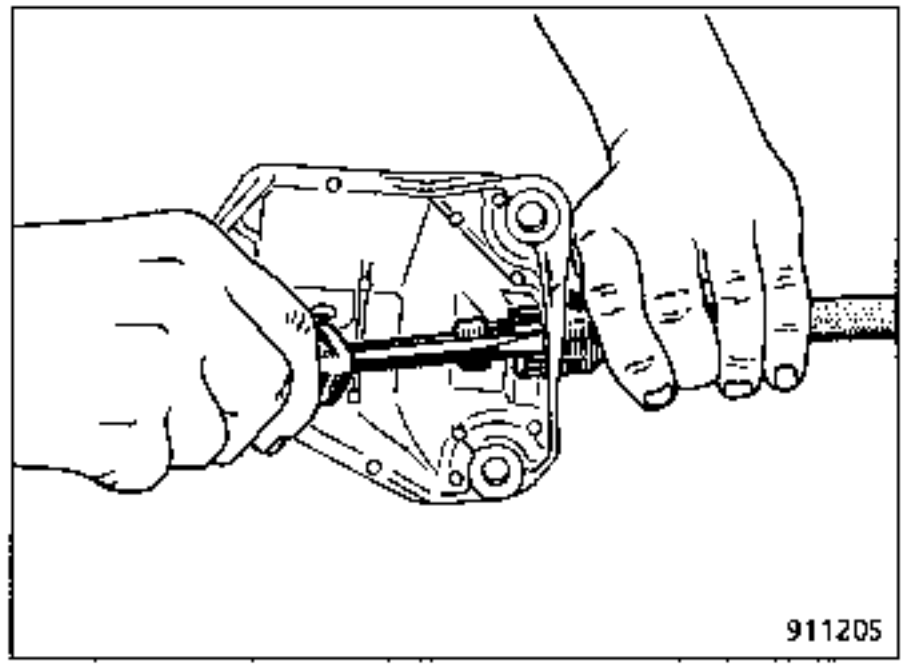

PRG37.7

Under the vehicle:

Remove:
- the heat shields,
- the plate under the selector unit,
- the mounting bolt retaining the selector cable.

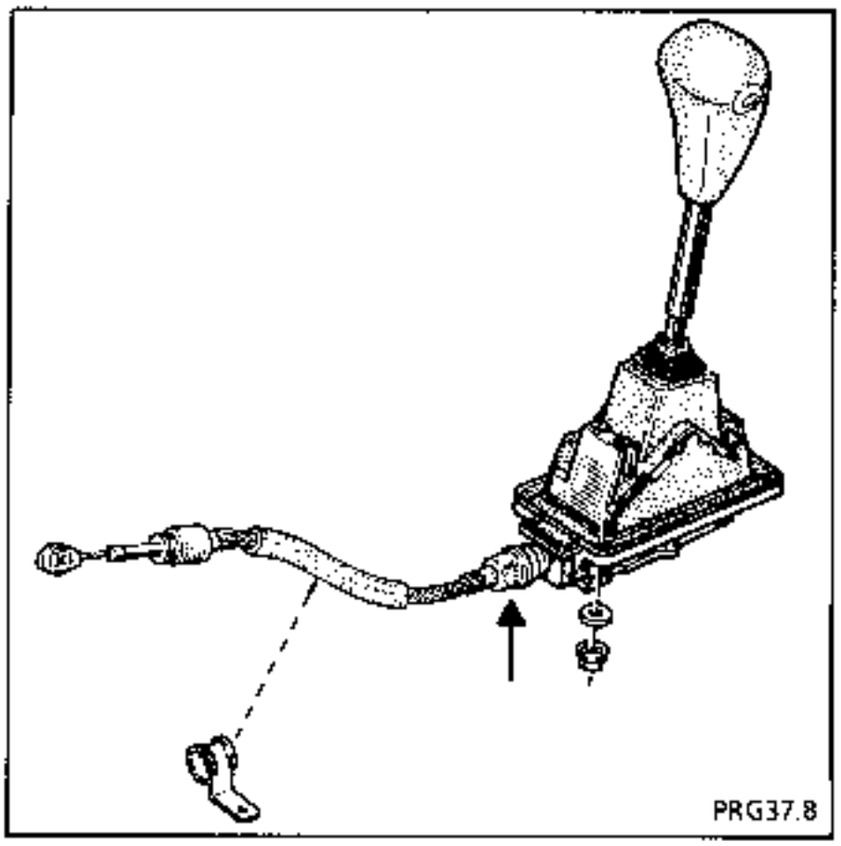

995875

Unclip the control cable from the ball joint.
Remove the cable retaining clip from the unit.


911205

REFITTING - ADJUSTMENT

The cable must be free. To ensure this, release the clip on the gearbox side and unclip the cable from the ball joint.
Clip the cable to the base of the gear selector lever.
Turn the ring to free the cable sleeve laterally.



Put the gearbox and the lever in 1st gear hold.

Align the cable ball joint with the ball joint on the lever on the gear unit, adjusting the position of the cable sleeve.

Clip the control cable to the gearbox lever when it is in the correct position.

Lock the adjustment by turning the ring to stop the sleeve from moving laterally.

Fit the retaining clips to the unit and the gear selector.

Refitting is then the reverse of removal.

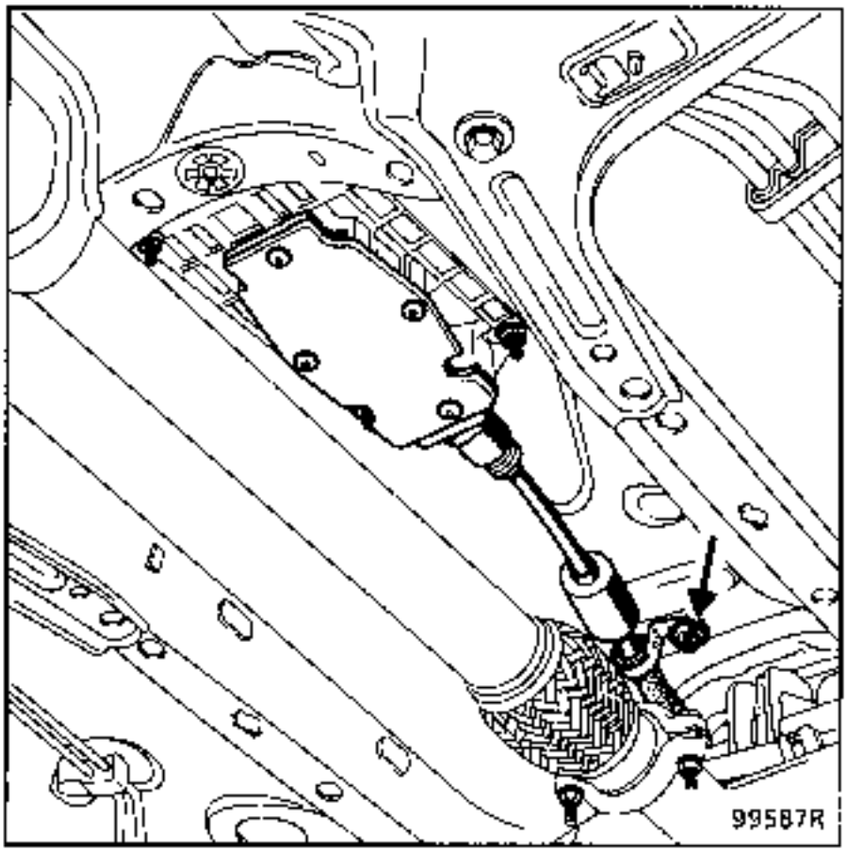
Check the gears engage correctly.

REPLACEMENT

The control assembly must be removed to remove the control cable (see section on removing the control).

Unclip the cable from the lever on the gear lever retainer and the base of the gear selector lever.

Remove the mounting bolt retaining the cable on the body.



Release the cable, removing it near the steering column.

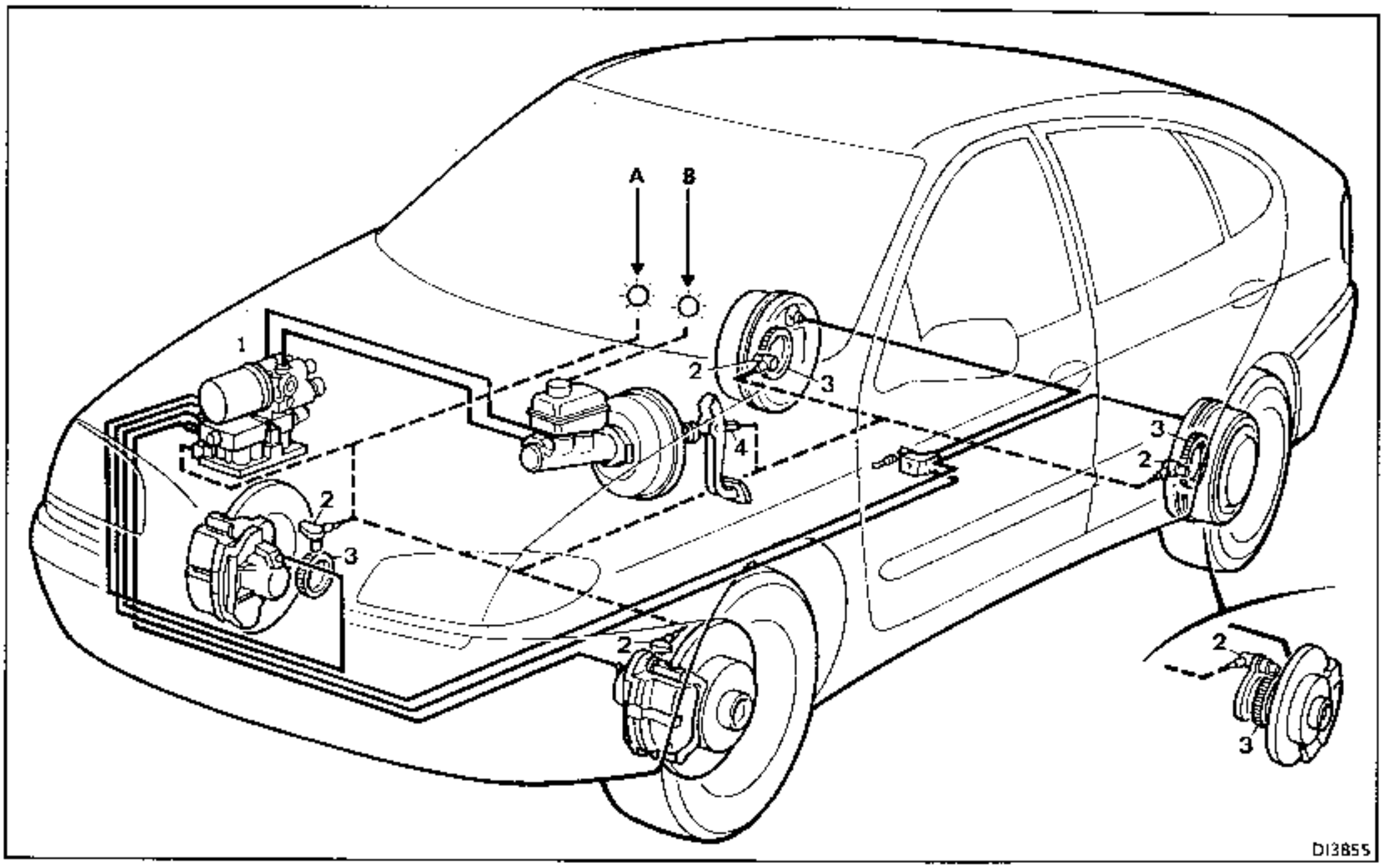
REFITTING

Fit the new cable from under the vehicle, passing near the steering column.

Adjust the cable.

Refit the assemblies as described in the preceding pages.

PRESENTATION OF TEVES ABS MARK IV GI



——— Hydraulic connections
- - - Electrical connections

A ABS warning light
B Nivocode warning light

1 Hydraulic unit
2 Wheel speed sensor
3 Toothed target
4 Stop lights switch

RECOMMENDATIONS CONCERNING HANDLING OF THE VARIOUS COMPONENTS IN THE TEVES ABS

Vacuum amplifier (master cylinder + brake compensator)

- When transporting, do not hold the part by the piston rod .
- Do not lift the part by the vacuum inlet.
- Only remove the protectors when the part is fitted.
- Avoid impacts (do not drop the part).
- Store in a dry place (avoid damp and pollution).
- Comply with the recommended packaging position during transport.
- Do not stack parts (individual packaging).
- Comply with the usage recommendations when draining or adding fluid.
- Do not use mineral oil.

The hydraulic and electrical regulation unit

- Comply with the recommended packaging position during transport.
- Do not pull on the electric wires of the motor connector.
- Only remove the protectors when the part is fitted.
- Avoid impacts (do not drop the part).
- Do not stack parts (individual packaging), nor put them down on the hydraulic connections (risk of damaging the computer connector).
- Store in a dry place (avoid damp and pollution).
- Comply with the storage time.
- Hold the part by the motor and not by the bracket (risk of distortion).
- Ensure that the computer connector is clipped on properly.
- Comply with the tightening torques when connecting the pipes.
- Do not touch the computer connector contacts.

The motor-pump assembly

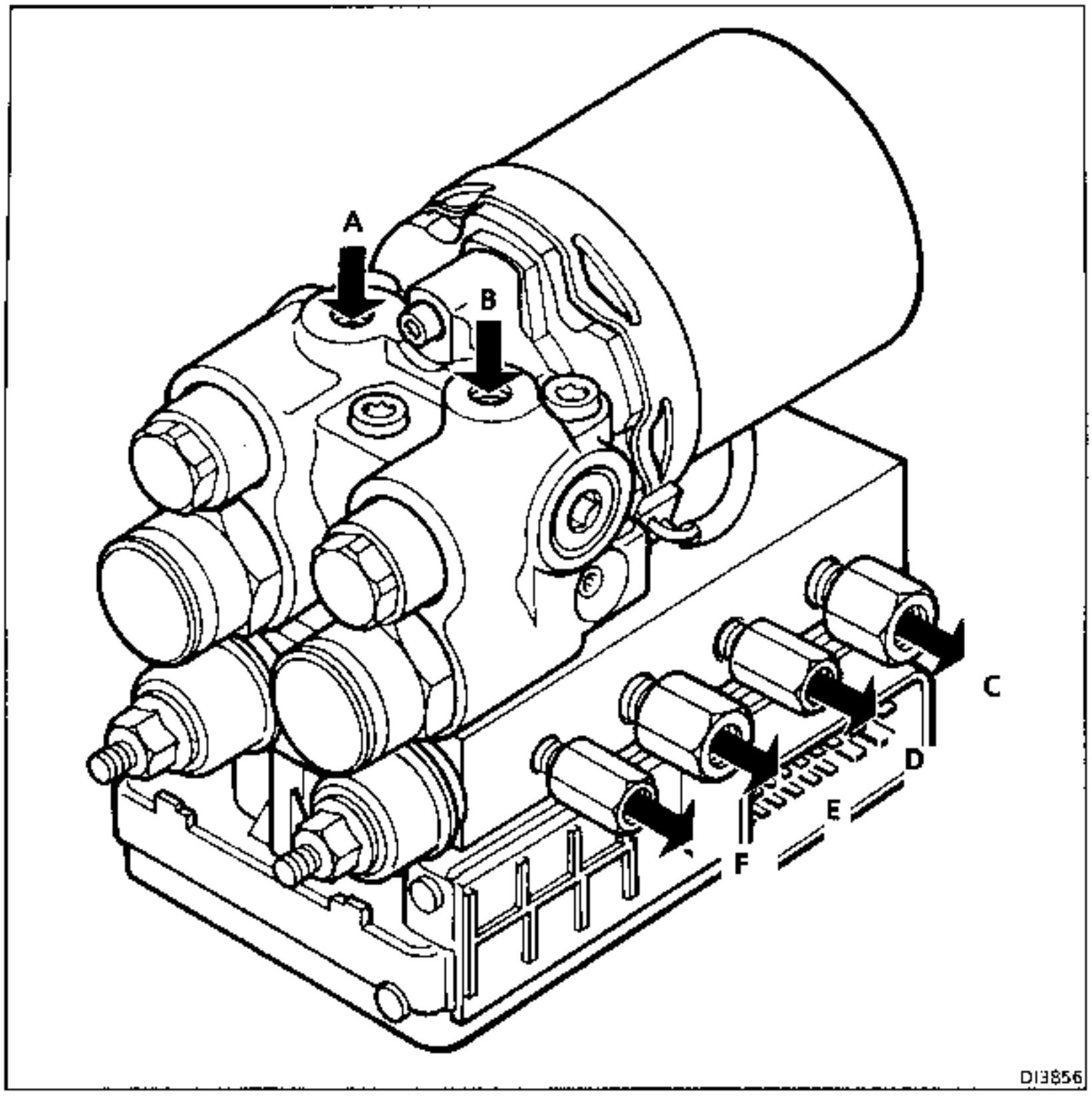
- Never cause the pump to operate via an external source if the brake pedal has been mechanically locked.

Wheel sensors

- When fitting, do not twist the wire.
- Do not pull on the wire guides.
- Comply with the tightening torques when fitting.
- Ensure that the connector is clipped on properly.

PRESENTATION OF THE HYDRAULIC REGULATION UNIT

(Located at the front on the right hand side behind the bumper).



A Inlet pipe from the master cylinder (primary circuit).
B Inlet pipe from the master cylinder (secondary circuit).
C Outlet pipe from the regulation unit going to the front left hand wheel (yellow).
D Outlet pipe from the regulation unit going to the rear right hand wheel (red).
E Outlet pipe from the regulation unit going to the rear left hand wheel (blue).
F Outlet pipe from the regulation unit going to the front right hand wheel (green).

FORWARD

DESCRIPTION

The MARK IV GI ABS consists of a hydraulic unit and an integrated electronic unit and four wheel speed sensors.

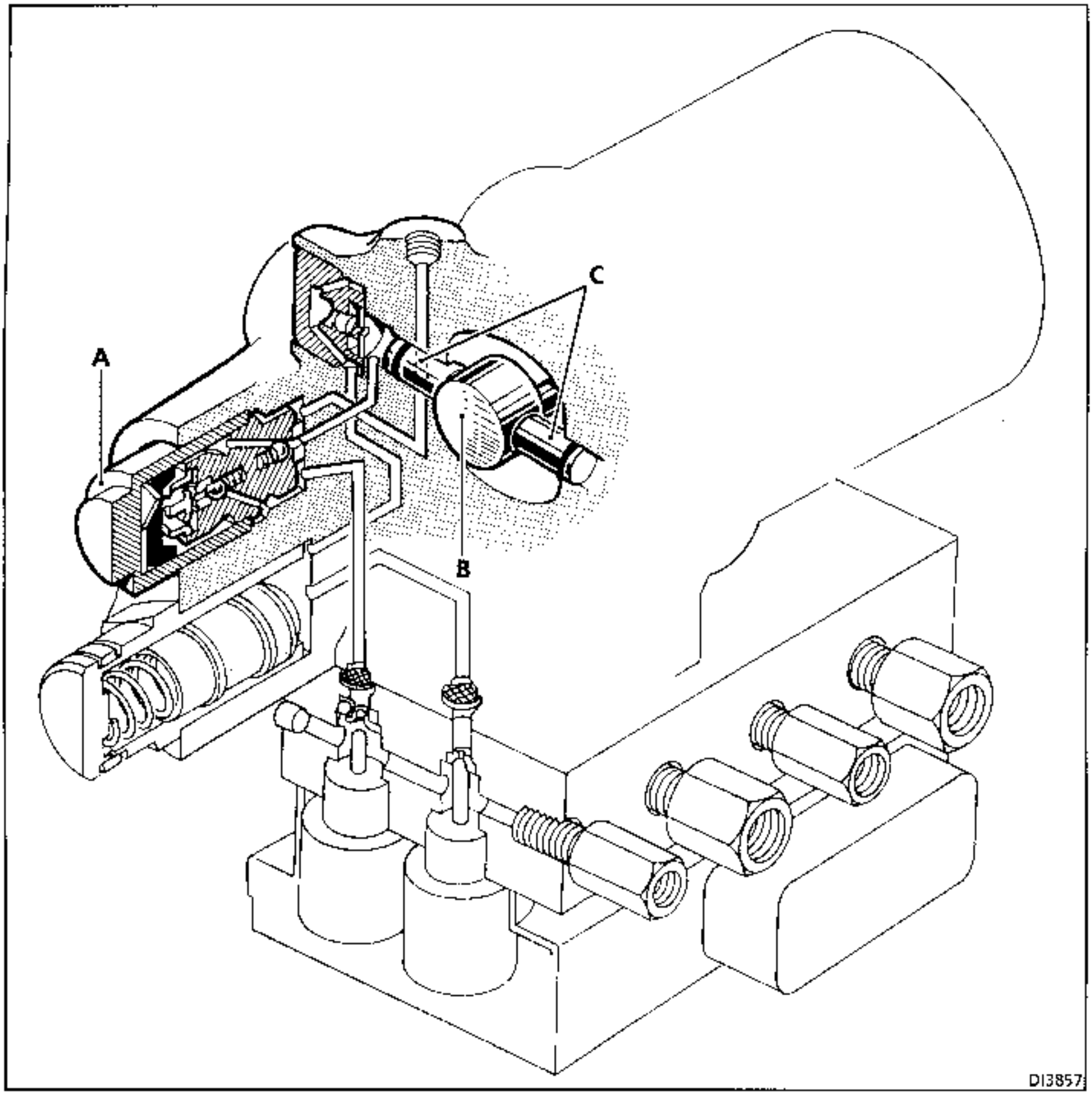
The ABS is of add-on type with four channels; conventional braking equipment and ABS equipment are separate.

SPECIAL FEATURES

The system has four wheel speed sensors. Each hydraulic braking track is linked to a sensor fitted to each wheel. Thus, the front wheels are regulated separately. However, the rear wheels are regulated simultaneously in the same way according to the select low principle (the first wheel which starts to lock causes the regulating cycle to begin immediately for the whole axle). The compensator operates normally

DESCRIPTION OF COMPONENTS

- **The motor-pump assembly**



A Damping chamber. Its role is to reduce the noise generated by the pressure oscillations at the pump outlet.
B Eccentric drive.
C Pistons.

The motor-pump assembly consists of an electric motor and a dual circuit hydraulic pump .

Role

During the regulation phase (pressure drop), it returns the fluid from the brakes to the master cylinder. This can be felt at the brake pedal in the form of movement.

Location

The assembly is flange-mounted on the hydraulic unit; drilled holes and pipes are incorporated into the flange. The primary and secondary circuits of the master cylinder are connected on the delivery side and each has its own pump circuit. The assembly is connected electrically to the computer.

Operation

The shaft of the electric motor is fitted with an eccentric drive which converts the rotary movement into an alternate stroke movement with two pistons fitted opposite each other.

The motor is monitored by the computer which measures the voltage at the pump terminals and checks that the motor has actually rotated by checking the counter-electromotive force generated during the stop phases. If the pump motor is faulty, the ABS function ceases immediately and the warning light on the instrument panel illuminates.

Specifications

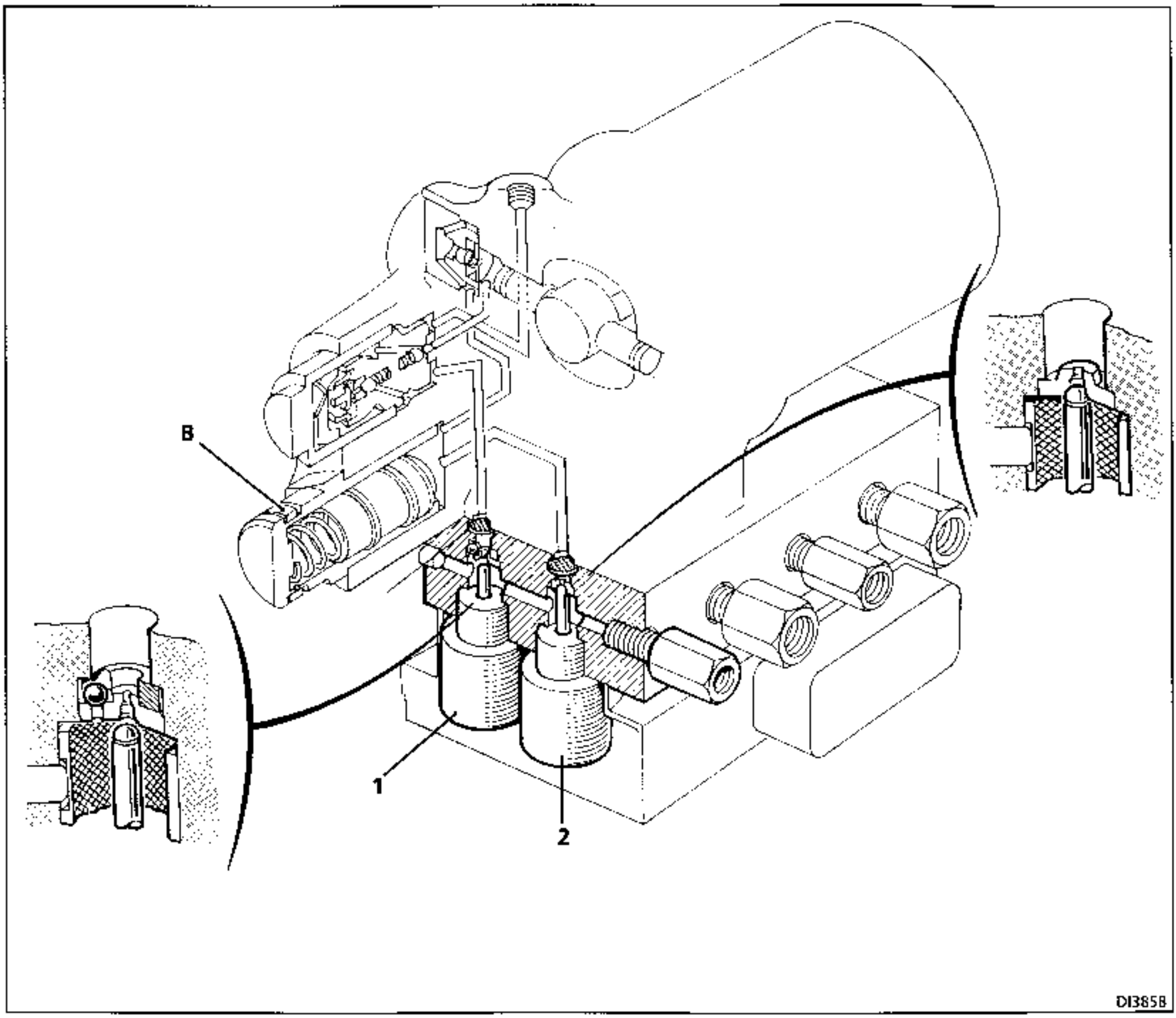
- Pressure : suction : ambient pressure.
  delivery : function of the action on the brake pedal, which approximately corresponds to the pressure exerted on the pedal.

- Motor power : 250 Watts.

- Consumption : 18 amps at 200 bar.

DESCRIPTION OF COMPONENTS (continued)

- The solenoid valves



1 Inlet solenoid valve.
2 Outlet solenoid valve.
B Low pressure accumulator.

DESCRIPTION OF COMPONENTS (continued)

- Low pressure accumulator

This stores the brake fluid which flows through the outlet solenoid valve when there is a large variation in adherence (change from high to low adherence).
The pressure level required for filling the low pressure accumulator must be sufficiently low so as not to affect the pressure drop during the regulation phase, but sufficiently high to be able to overcome the rating of the pump inlet valve in all circumstances.
The average flow evacuated by the pump is lower than the maximum volume supplied in a pressure drop situation.
Each brake circuit is fitted with two inlet solenoid valves, which are open when idle and two outlet solenoid valves which are closed when idle.
The separate or simultaneous operation of the solenoid valves enables to pressure in the brake circuits to be modified.

Location

The hydraulic connections are incorporated into the flange and are provided by pipes for the wheel connections. The assembly is linked electrically to the computer .

Operation

The solenoid valves consist of a solenoid and a moving armature which performs the opening and closing functions. The idle position is provided by the action of an integrated spring. All inlets and outlets to the solenoid valves are protected by filters.

In order to be able to reduce the pressure in the brakes at any moment, independently to the electrical state of the solenoid valve, a non-return valve has been incorporated into the inlet valve. The valve opens when the "master cylinder" pressure is lower than the caliper pressure.

Example: brakes released during regulation.

Specifications

- Voltage : 12 volts d.c..
- Operating pressure : 180 bar maximum
- Switching time : < 3 ms.
- Resistors : inlet : ≈ 6 Ω.
  outlet : ≈ 3 Ω.
- Consumption : inlet : 2 A at 13 V.
  outlet : 3.9 A at 13 V.

DESCRIPTION OF COMPONENTS (continued)

- **The computer**

Operating principle

The information measured by the sensors is electrically converted and processed in parallel by two microprocessors.

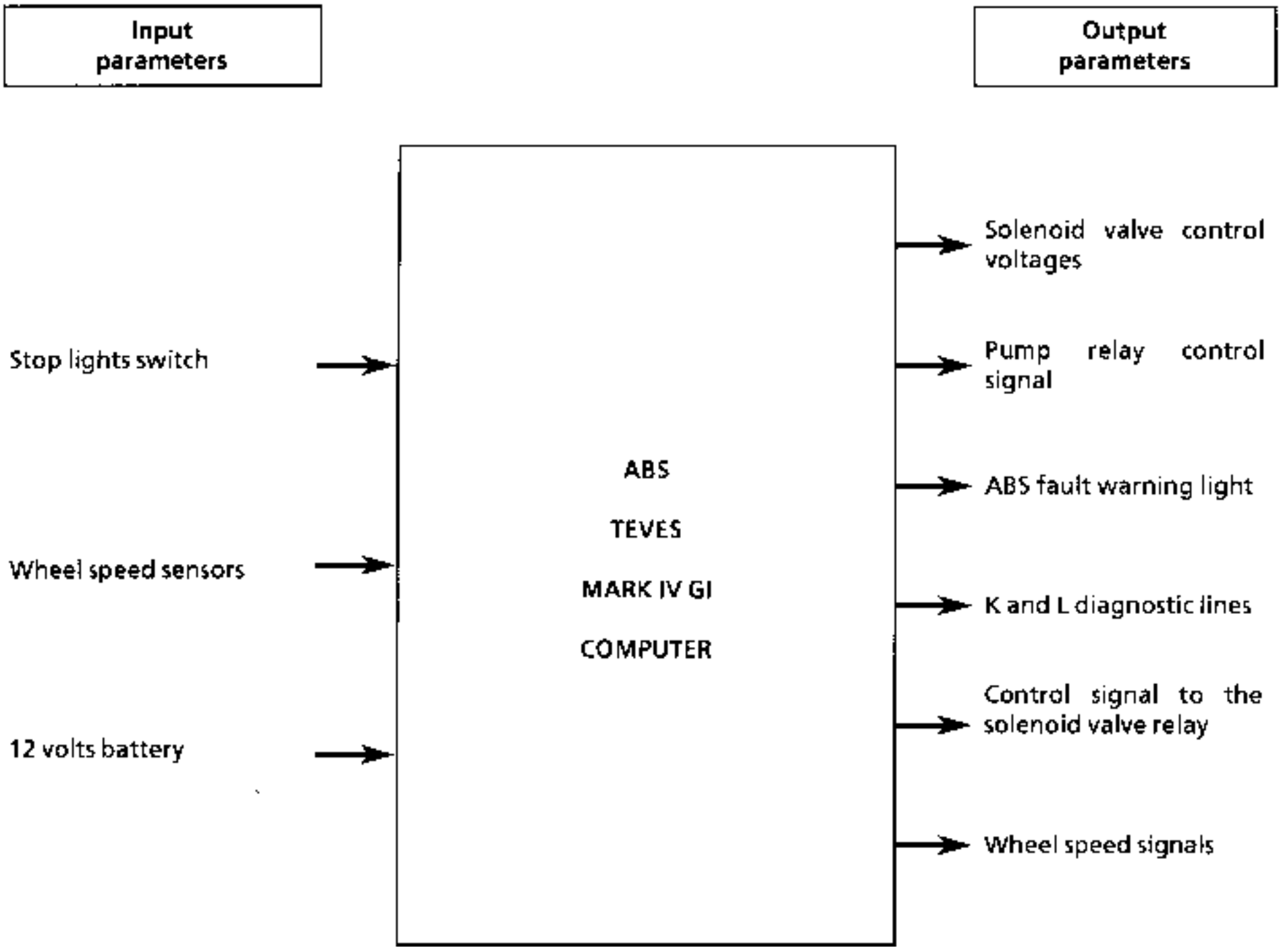
After being amplified, the output signals control the solenoid valves and the pump motor.

Safety

The computer works according to the asymmetric redundant principle: the two microprocessors are different and process the same information (e.g.: acquisition of wheel speed, calculation of reference speed, deceleration) and use a hierarchical information exchange mechanism for communicating. Each microprocessor is programmed with different calculation algorithms. If there is a discrepancy between the processed signals or the calculated parameters, or if the system develops a fault or breaks down, the computer limits the operation of the systems according to a suitable procedure. The fault is signalled by the warning light on the instrument panel and can be interpreted using the fault finding kit (XR25).

The whole system - sensors, electrical connections and solenoid valves - is constantly monitored.

PARAMETERS CONTROLLED BY THE ABS COMPUTER



DESCRIPTION OF COMPONENTS (continued)

- **Wheel sensors**

General

The wheel sensors measure the instantaneous speed of each wheel.
The assembly consists of a sensor and a pulse generator (or target) fitted to a rotating component.
The layout can be axial, radial or tangential (axial (front wheels) and tangential (rear wheels)). To obtain a correct signal, a predetermined gap is maintained between the sensor and the target. The sensor is connected to the computer by the wiring loom.

Operation

The sensor operates according to the induction principle; two permanent magnets and a coil are fitted into the head of the sensor. The magnetic flux is altered as the teeth on the target move. The variation in the magnetic field passing through the coil generates a practically sinusoidal alternating voltage, the frequency of which is proportional to the wheel speed. The amplitude of the sensor voltage is a function of the gap between the tooth and the sensor and the frequency.

Attention: the sensor gaps cannot be adjusted.

Technical specifications

Coil resistance	:	1000 Ω
Number of teeth on the target	:	44

ELECTRICAL OPERATION OF THE SYSTEM

When the ignition is switched on, the computer is supplied electrically by terminals 22 and 23.
Connections to the vehicle earth are made through terminals 24 and 25. The ABS warning light illuminates.
The computer performs its start-up cycle (2.5 s.) :

1) Test of the 12 volt supply.

2) Test of the 5 volt supply in the slave microprocessor.

3) Test of the solenoid valve static relay (measures the reference voltage before the relay closes):

   a) If the reference voltage is approximately 5 volts then the solenoid valve relay is controlled after the solenoid valve test.

   b) If the reference voltage is approximately 12 volts, there is an ABS fault.

4) Solenoid valve test.

5) Test of the wheel speed sensors.

6) The warning light is extinguished.

The main relay is constantly switched (internal signal) between the passing and locked state so that any operating faults are dètected immediately: if the main relay cannot be switched, there is a solenoid valve fault or current leak ...

Stop lights switch

The information is provided by terminal 10 of the computer.

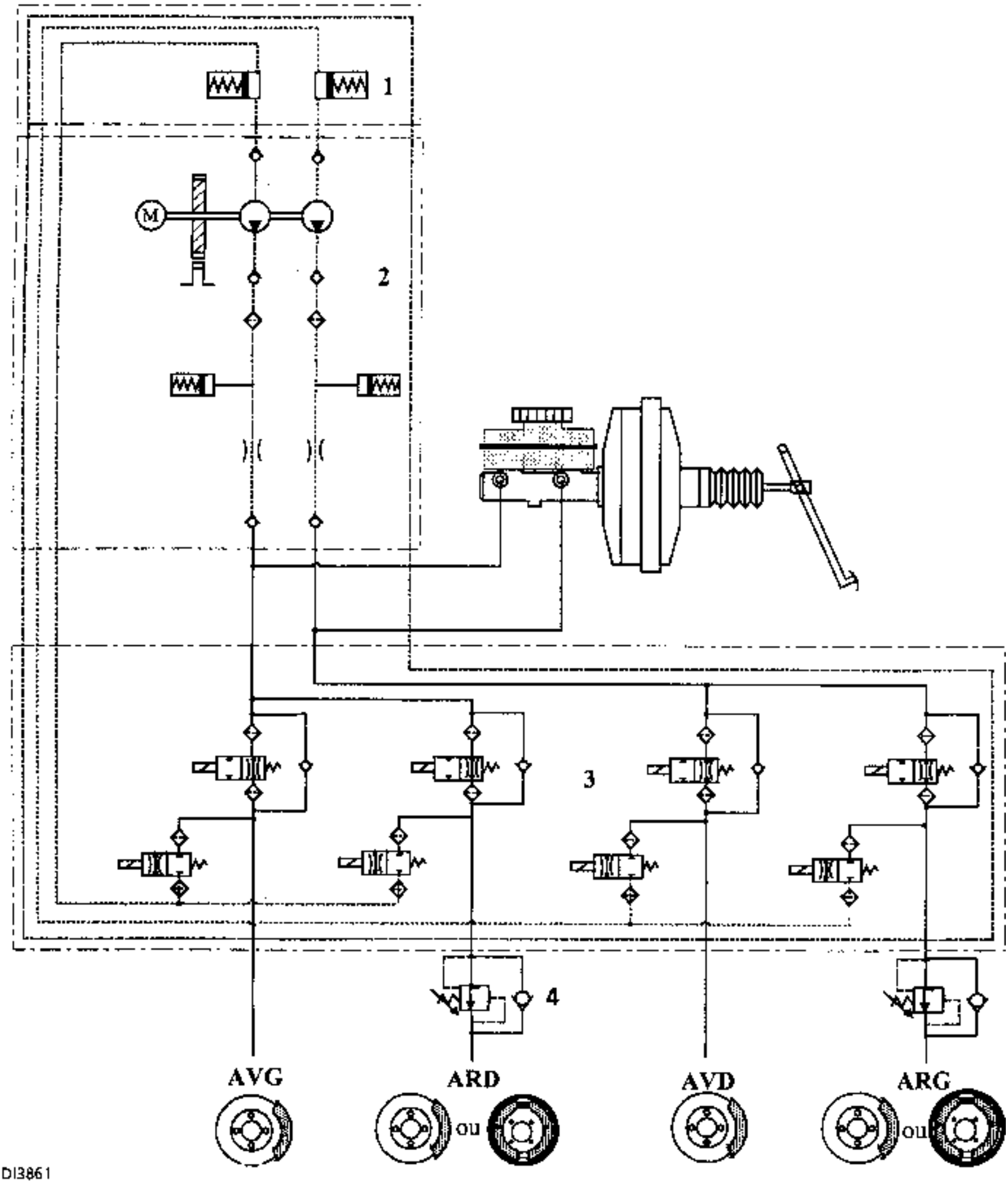
Solenoid valves

These are controlled by being successively earthed, the main relay being switched to the passing position.

Wheel sensors

Internal signals are measured for speeds above 0.6 km/h.

HYDRAULIC OPERATION OF THE SYSTEM



1 Low pressure accumulator
2 Damping chamber and pump-motor
3 Solenoid valve unit
4 Compensator

HYDRAULIC OPERATION OF THE SYSTEM (continued)

The description below is for a single circuit. When idle, the central valves of the master cylinder are open such that the upstream and downstream chambers are connected. The inlet solenoid valves are open and the outlet solenoid valves are closed. The hydraulic pump is stationary.

Braking without regulation (braking torque < adherence torque)

After the central valves have closed, a hydraulic pressure is set up and determines a braking torque proportional to the action on the brake pedal by the foot. The solenoid valves and the pump are still idle.

Braking with regulation (braking torque > adherence torque)

There are three states:

- pressure maintained,
- pressure reduced,
- pressure increased.

Pressure maintained

The inlet solenoid valve closes and isolates the master cylinder from the wheel caliper. The braking pressure cannot increase.

Pressure reduced (reduction in the tendency to lock)

This phase only occurs when the effect of the pressure maintenance phase is not sufficient.

The inlet solenoid valve is still closed. Simultaneously, the outlet solenoid valve opens and the pump starts to operate.

The pressure is reduced immediately due to the variable capacity low pressure accumulator. The action of the pump allows the fluid stored in the accumulators to be returned to the master cylinder.

Pressure increased (increase in braking)

The outlet solenoid valve closes and the inlet solenoid valve opens. The master cylinder is once again connected to the brake.

The hydraulic supply is provided by means of the master cylinder, but also through the pump (in the case where the accumulator is not empty).

As the volume of brake fluid delivered is on average greater than the volume going from the consumer components to the low pressure accumulators, the accumulators only act as intermediate accumulators for short flow peaks. The pump returns the brake fluid from the low pressure accumulators to the brake circuit (master cylinder or brake caliper, depending on the setting of the inlet solenoid valves).

Depending on the pump flow, the position of the master cylinder pistons, and therefore the position of the pedal, corresponds to the instantaneous absorption by the brake caliper, with a slight offset. As a result, the pedal is in the raised position for low pressures and in the down position for high pressures. This regular change in pressure causes pedal movement (pulses) and informs the driver that a regulation sequence is being performed.

Note: *independently to the electrical state of the solenoid valves, the brake pressure can be reduced at any moment by releasing the brake pedal. The pressure is reduced by means of a non-return valve in parallel with the inlet solenoid valve.*

When the pedal is released, the central valves allow the pressure between the reservoir and the master cylinder to be balanced.

ELECTRICAL STATE OF THE SOLENOID VALVES AND THE MOTOR

	Inlet	Outlet	Pump-motor	
Increase	0	0	0	No regulation
Maintain	1	0	0 *	With regulation
Reduce	1	1	1	
Increase after reduction	0	0	1	

0 : not electrically supplied

1 : electrically supplied

* *During the first maintenance period, the pump does not operate (0).*
For subsequent maintenance periods, the pump operates (1).

ABS OPERATING PRINCIPLE

During braking which is likely to cause one or several wheels to lock up, the role of the ABS is to alter the pressure level of the fluid in each brake in order to prevent the wheel locking up and therefore to optimise steerability-stability-stopping distances. To do this, the ABS computer decides when to carry out the hydraulic operations using a computer programme known as the logic programme, the operating principle of which is described in brief below.

MAIN PARAMETERS USED BY THE ABS LOGIC PROGRAMME

Physical information (transmitted by the electrical signals)

- Speed of the four wheels (the four wheels can be travelling at different speeds as a function of the acceleration or deceleration phases, the road condition, etc...),
- Stop lights switch information,
- Results of the operating control tests (pump rotation, states of the sensors and states of the solenoid valves).

Calculated information

- **Reference speed**

  For reasons of precision and safety, the logic programme calculates the vehicle speed from the speeds of the four wheels. This information is called the reference speed. To calculate it, the logic programme also takes into account physical limits (maximum accelerations and decelerations which can be attained on the various adherences) in order to check the coherence of the result, and to correct the value obtained where necessary.

- **Slip at the various wheels**

  A wheel slips where there is a difference between the speed of the wheel and the speed of the vehicle. For the programme, which only has the reference speed as an approximation of the vehicle speed, slip is calculated from the wheel speed and the reference speed. It is defined by the following formula:

$$\text{Wheel slip } X = \frac{\text{Reference speed - Wheel speed } X}{\text{Reference speed}}$$

MAIN PARAMETERS USED BY THE ABS LOGIC PROGRAMME

- **Wheel accelerations and decelerations**

  From the instantaneous speed of a wheel (provided by the speed sensor), the acceleration or deceleration of the wheel in question can be calculated by watching the change in the speed with time.

- **Recognition of the longitudinal type-ground adherence**

  The logic programme calculates the exact instantaneous adherence from the wheel behaviour. In effect, each type of adherence results in different values of acceleration an deceleration. In addition, the logic programme considers two areas of adherence: low (ice and snow) and high (wet ground to dry ground) which correspond to different regulation strategies.

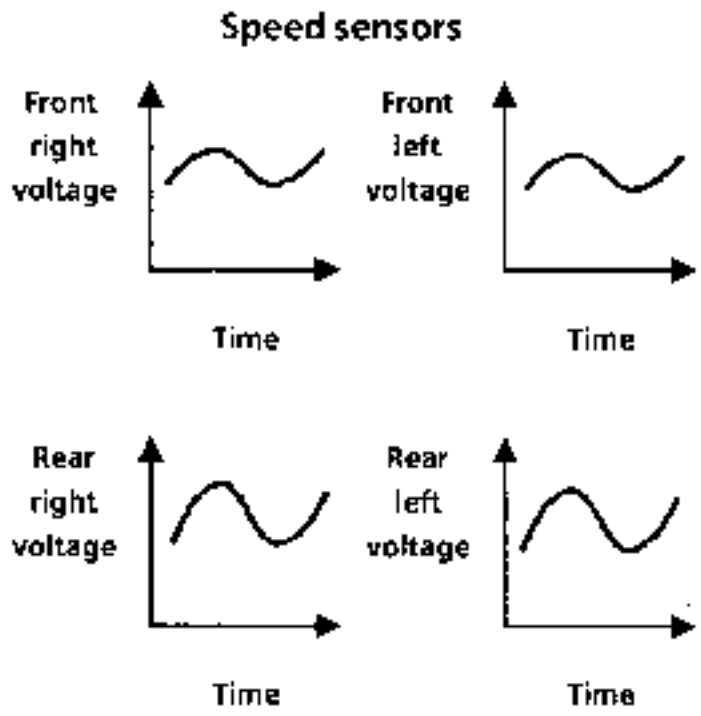
- **Recognition of the driving conditions**

  The logic programme knows how to adapt itself to a certain number of driving conditions which it can recognise. The main ones amongst these are:

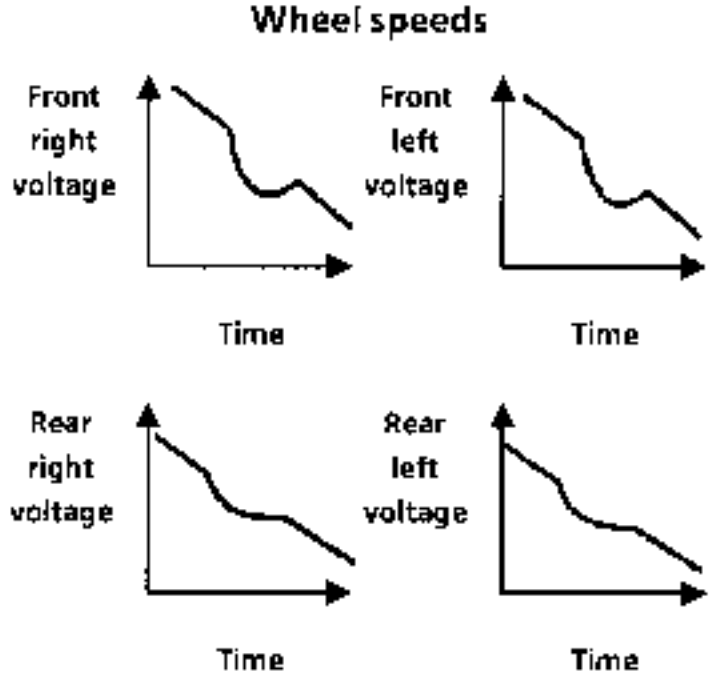
  - Bend: curves are detected by watching the difference in the speeds of the rear wheels (the inner wheel in a bend is moving slower than the outer one).
  - Change in adherence (changing from high adherence to low adherence or vice versa): wheel slip, acceleration and decelerations are taken into account in order to recognise this situation.
  - Asymmetric (two wheels on the same side on high adherence, the other wheels on low adherence): wheel slip on the same side is compared to wheel slip on the other.

OPERATING SUMMARY OF THE LOGIC PROGRAMME

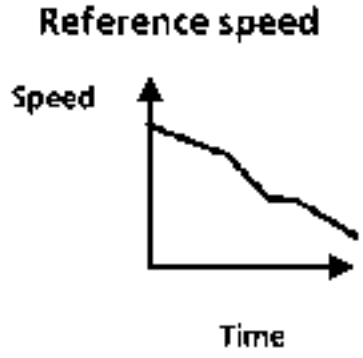
- The four wheel sensors associated to each of the wheels supply a voltage which is proportional to the speed of each wheel respectively.



- The four voltages are converted by the computer into four wheel speeds.



- Using these fours wheel speeds, the logic programme determines a value called the reference speed which is close to the actual speed of the vehicle.

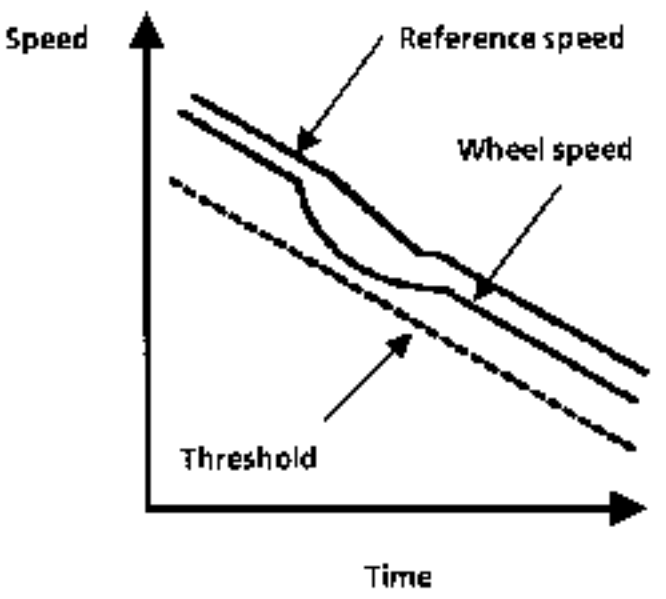


- Using these same wheel speeds, the logic programme "recognises" the type of adherence and the driving conditions (ice, wet road, high adherence, bend, etc...). From this, it deduces an optimum speed (or slip) threshold suited to each of the four wheels.

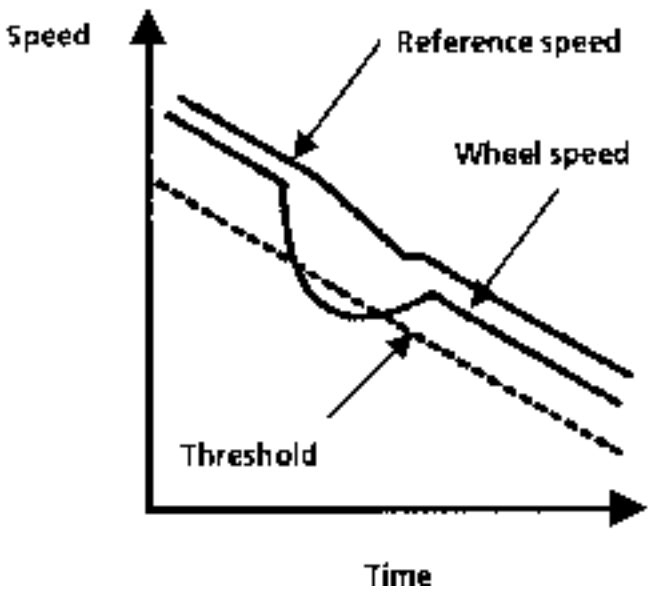
OPERATING SUMMARY OF THE LOGIC PROGRAMME (continued)

- Each of the four wheel speeds is permanently compared with the reference speed (slip calculation). For each wheel, two cases can arise:

1) The wheel in question does not fall below the speed threshold (suited to the adherence and driving conditions) with respect to the reference speed (slip does not reach a certain value). This means that the wheel speed is not too different from the vehicle speed. The wheel does not tend to lock and therefore the ABS does not intervene.



2) The wheel in question falls below the speed threshold (suited to the adherence and driving conditions) with respect to the reference speed (slip reaches a certain value). This means that the wheel speed is not close enough to the vehicle speed. There is therefore a danger that the wheel may lock and the ABS starts hydraulically regulating the wheel in question.



Regulating commands

The operation decided upon by the logic programme results in electrical commands which are sent to the solenoid valves and the pump-motor unit in accordance with the following table:

	Inlet solenoid valve	Outlet solenoid valve	Pump-motor	
Increase in pressure	0	0	0	No regulation
Maintain pressure	1	0	0 *	With regulation
Decrease in pressure	1	1	1	
Increase in pressure after a reduction	0	0	1	

0 : not electrically supplied

1 : electrically supplied

* *During the first maintenance period, the pump does not operate (0).*
For subsequent maintenance periods, the pump operates (1).

***Comment:* role of the stop lights switch**

The role of the information from the stop lights switch is to allow the ABS mode to be exited more quickly when required. In effect, if the ABS is operating and the driver releases the brake pedal in order to stop braking, the signal transmitted by the stop switch allows regulation to be stopped more quickly.

Regulating noise and comfort

ABS regulation leads to solenoids valves being opened and closed, the pump-motor unit operating as well as fluid movements in a closed circuit, in other words fluid return to the master cylinder. This generates noise during regulation, accompanied by brake pedal movements. The noises will be increasingly noticeable in the passenger compartment depending on the location of the hydraulic unit and the type of soundproofing fitted to the vehicle.

This noise, together with the brake pedal movements, nonetheless has the advantage of informing the driver that the ABS is operating and therefore that he is driving in precarious conditions. Driving should therefore be adapted as a result.

SELF DIAGNOSIS

INTRODUCTION

As systems incorporating electronics are becoming more and more complex, designers have had to provide greater accessibility to the operation of the assembly, by using the enormous flexibility and performance provided by electronics. The diagnosis is the result of this process and aims to facilitate repairs.

Fault finding for a computer covers two difference aspects.

The first aspect corresponds to the actions performed by the computer in an autonomous manner to check its environment, as well as its own operation: this is the self diagnosis.

The other part of the fault finding relates to accessing information or data relating to the status of the system, whether memorised or not, by an external operation: this is "external" diagnostics.

AIM

The self diagnosis is an automatic process which allows the computer to:

- checks its environment,
- adopt a downgraded operating mode designed for each type of fault detected,
- memorise the fault or faults found in the permanent memory in order to allow subsequent repairs.

ABS TEVES SELF DIAGNOSIS ORGANISATION

All faults detected by the self diagnosis system can be stored in memory and retained, even when there is no electrical supply.

SELF DIAGNOSIS (continued)

When initialised

During initialisation (ignition switched on), the computer performs a certain number of tasks designed to check that the system is in a condition to be started. These are mainly:

- internal computer tests,
- connection tests: supply, solenoid valve relay, sensors,
- external interfaces.

If the tests are correct, this phase is completed by extinguishing the fault warning light after 2.5 seconds.

When operating

There are several types of self-check: some are performed permanently, others require specific operating conditions (vehicle speed greater than a certain threshold for example); in all cases, the possible tests are carried out simultaneously and continually.

SAFETY FEATURE - PRINCIPLES OF MONITORING REDUNDANCY

Information from the wheel sensors is sent to the microprocessors which operate in a synchronous and prepared way in logic units working independently. With this input information, the signals for controlling the solenoid valves are calculated.

These external signals as well as important internal values which are required for regulation are checked independently by the two comparison units.

If there is a discrepancy, the device detects a fault and a safety measure is initialised.

SELF DIAGNOSIS (continued)

MONITORING THE VARIOUS COMPONENTS

Wheel sensors

Errors on the wheel sensors are detected by the test signals and plausibility criteria.

The sensors are an integral part of a comparative circuit which allows certain faults to be detected even when the vehicle is stationary:

- break or short circuit or a sensor signal line on the earth or + terminal,
- sensor fault,
- superposition of direct voltage (caused, for example, by leakage currents or by high frequency interference radiation).

Other types of fault can be detected using the plausibility criteria, such as, for example, by comparing wheel speeds.

At low speeds, the difference in speed between the fastest wheel and the slowest wheel is worked out by comparing the wheel speeds calculated by the processors. When there is no slip, the speed remains close to 0 mph whilst when the fastest wheel is travelling must faster than the slowest wheel, one of the following faults is deduced:

- sensor cables short circuited,
- faulty target,
- sensor incorrectly fitted, but connected electrically,
- gap between the sensor and the toothed wheel too big,
- sensor magnetic short circuit (for example: metallic swarf between the sensor and the target).

SELF DIAGNOSIS (continued)

Additional conditions ensure that faults are detected when a driving wheel is slipping.

At high driving speeds, if the speed of the slowest wheel, for a determined time, is lower than a certain percentage of the fastest wheel, the device detects a mechanical fault in the sensor, which must have appeared whilst driving.

In both cases, up to three faulty sensors can be detected at the same time.

Another safety measure is based on the continuity of the wheel speed signals. A jump in the signal from one calculating step to the next, which from the dynamics point of view of the wheel is physically impossible, can occur for the following reasons:

- break or short circuit (poor contacts) in the sensor cables,
- teeth missing from the wheel sensor,
- high frequency phenomena.

For sensor disturbances such as this, the last speed calculated is not used for the following calculating steps in the regulating logic programme and the wheel is immediately excluded from "normal" regulation. For the affected wheel, a replacement speed is determined by extrapolating the previous speeds.

If the measured and extrapolated values are, after a very short time (less than a tenth of a second) within the same range of values, no action detectable by the driver is taken by the system. Nevertheless, the system remains sensitive to the disturbance for quite a long time. For longer disturbance durations, a different reaction occurs.

SELF DIAGNOSIS (continued)

In extreme driving conditions, for example: side-slipping, abnormal changes in wheel speeds occur. The safety system recognises the sideways movements of the vehicle and, as soon as such driving conditions occur, provides optimum stability for the vehicle by suitable regulation. If however, stability cannot be reestablished, the vehicle cannot, through the ABS, be underbraked or even deprived of braking ability. In this case, ABS regulation is abandoned so that the braking pressure is controlled directly by the driver's action.

Computer

The computer only operates correctly if the operating voltage is within defined limits. Low or high voltages are detected by the suitable connections.

The use of two different microprocessors, using different calculating algorithms, allows pertinent data from a regulation point of view to be constantly exchanged and compared. Using this asymmetric monitoring redundancy, faults can be detected very quickly, for example, those which are caused by interference radiation:

- faults within or around the microprocessors (for example: computer fault),

- dynamic disturbances (for example: synchronisation errors).

SELF DIAGNOSIS (continued)

Solenoid valves

The voltage in the coil of the valve lifting electro-magnet is constantly compared with reference values, for both the closed state and the open state.

In addition, periodic test pulses are used to check whether the solenoid valves can be electrically controlled. The test pulses are so short that the overall mechanical / hydraulic system does not react.

These checks occur when ABS regulation is both operating and not operating. Thus, all electrical or electronic malfunctions in the whole solenoid valve control system are detected:

- connections by sockets and cables,
- preamplifiers and final power stages,
- solenoid valve lifting magnet coils,
- signal preparation and returns,
- both microprocessors, including input and output channels.

Hydraulic power supply

The power supply is monitored electrically and using plausibility criteria. Measuring the electromotive force of the pump motor determines whether the motor operation corresponds correctly to the command. The faults are as follows:

- the motor does not work although it is controlled,
- the motor is operating although it is not controlled (important for the "feel" of the pedal, power consumption, wear and noise).

Every time the supply is switched on, a test designed to detect any "dormant" faults in the motor is performed at low driving speeds. Monitoring the electromotive force in the motor allows any mechanical seizing of the motor driving the pump , electrical faults in the supply conductors, in the electrical motor relay and in the electrical motor itself to be detected.

SELF DIAGNOSIS (continued)

FAULTS AFTER THE IGNITION HAS BEEN SWITCHED ON (vehicle stationary)

Component tested	Test type	Conditions for performing test	Customer complaint	Fault memorising
ABS warning light	Visual	Illuminated for 2 seconds after supply connected.	Does not illuminate	NO
Computer	Redundancy test	Test performed after supply connected (information exchanged between the two microprocessors)	ABS disconnected, ABS warning light illuminated.	YES
Battery supply	Supply check	a) Battery voltage < 9.5 volts b) Battery voltage > 18.5 volts	Standby mode, ABS warning light illuminated. ABS disconnected, ABS warning light illuminated	NO YES
Diagnostic links		The K and L connections are not tested when the computer supply is connected. 1) If the L line is connected to earth, it is not possible to enter diagnostic mode (test tool connected to diagnostic socket). 2) If the L line is connected to earth whilst the diagnostic mode is operating, this test is interrupted after 10 seconds.	ABS warning light extinguished. In DIAG mode, the warning light flashes. When DIAG mode is exited, the ABS warning light extinguishes	NO
Solenoid valves	CO, CC performed permanently	Solenoid valves tested by electrical pulses.	ABS disconnected, ABS warning light illuminated.	YES
Stop lights switch	CO, CC	No test.	ABS warning light extinguished.	NO
Speed sensors	Continuity fault CO, CC+, CC-	CO, CC+, CC- for more than 50 ms.	ABS disconnected. ABS warning light illuminated.	YES
Pump circuit	CO, CC	Pump not tested when the vehicle is stopped	ABS warning light extinguished	NO
Static relay incorporated into the computer	Relay check	Leakage current of main relay is measured and solenoid valves tested by electrical pulses.	ABS disconnected, ABS warning light illuminated	YES

SELF DIAGNOSIS (continued)

DRIVING FAULTS (speed greater than 10 km/h - 7.5 mph)

Component tested	Test type	Conditions for performing test	Customer complaint	Fault memorised
Computer	Permanent test	When driving	ABS disconnected, ABS warning light illuminated.	YES
Supply	Voltage too low	Battery voltage < 9.5 volts.	ABS warning light illuminated.	NO
	Voltage too high	Battery voltage > 18.5 volts.	ABS disconnected, ABS warning light illuminated.	YES
Diagnostic links	K or L line CC+, CC-		Warning light extinguished	NO
Speed sensor	Long term monitoring	Pressure drop for more than 14 seconds during ABS regulation.	ABS disconnected, ABS warning light illuminated.	YES
	Wheel speed comparison	a) speed of fastest wheel > 12.5 mph, 20 km/h speed of slowest wheel <3.75 mph, 6 km/h after two minutes. b) speed of fastest wheel >25 mph, 40 km/h and speed of slowest wheel < 60 % of the speed of the fastest wheel after two minutes.	ABS disconnected, ABS warning light illuminated.	YES
	Extrapolation	CO or intermittent CC detected lasting more than 70 ms.	ABS disconnected, ABS warning light illuminated.	YES
		Speed >25 mph, 40 km/h.	Warning light illuminated for 3 1/2 seconds (standby mode).	NO
		Speed <25 mph, 40 km/h.		
	Disturbances detected	Result of wheel speed comparison by both microprocessors incorrect, probable cause: electromagnetic radiation.	ABS disconnected, ABS warning light illuminated.	YES

SELF DIAGNOSIS (continued)

Component tested	Test type	Conditions for performing test	Customer complaint	Fault memorised
Solenoid valves	CO, CC tests of the 8 solenoid valves	Test performed permanently	ABS disconnected, ABS warning light illuminated.	YES
Pump and pump circuits	Pump test	The pumps are tested for 2 seconds, when the speed of the four wheels is greater than 20 km/h (12.5 mph), the rotation is checked by measuring the current in the pump circuit.	ABS disconnected, ABS warning light illuminated.	YES
Static relay incorporated into the computer	Relay check	Leakage current from the main relay measured, and solenoid valves tested using test pulses.	ABS disconnected, ABS warning light illuminated.	YES

DEFECT MODES

Defect modes are safety operating modes which the system switches to if a fault is found.

For the ABS, several cases should be considered:

- during ABS regulation/not during ABS regulation,
- low/normal supply voltage.

KEY

CO Electrical link or component in open circuit.
CC Electrical link or component in short circuit.
CC+ Electrical link or component at + 12 V.
CC– Electrical link or component in short circuit to earth or permanent control.

ABS COMPUTER STRATEGIES

If a fault appears, when the ignition is switched off, the fault is put into the memory in the computer.

This memory can be consulted at any moment using the XR25 test kit and the suitable cassette. However, the fact of switching off and switching the ignition on again risks modifying the interpretation of the bargraphs in certain cases. To avoid any confusion, a road test (1) has to be performed with the vehicle showing the fault (ABS warning light permanently or intermittently illuminated) in order to be able to read the diagnostic signal without switching the ignition off.

(1) After erasing the memory (GO**). As a precaution, note the memorised fault bargraphs so as to be able to locate the faults should the road test not allow the fault to be reproduced.

Fault types

a) Permanent fault
A fault is declared "permanent" when it appears (ABS warning light illuminated) on the XR25 shown by a bargraph other than 1 and 13 right hand side being illuminated permanently).

b) Intermittent fault
A fault is declared "intermittent" after being memorised and after the fault has disappeared (shown on the XR25 by the bargraph flashing).

Important notes

The appearance of a fault in the computer's diagnostic signal switches the ABS off by cutting the earth of the main relay coil. In this case, the computer causes the bargraphs corresponding to all faults previously taken into consideration to illuminate permanently .

If several faults appear at the same time, only one will be memorised. It is therefore essential, after this fault has been repaired, to carry out another check after a road test.

Condition for entering diagnostic mode:

- if no fault is present → Speed < 6.25 mph, 10 km/h,
- if faults are present → regardless of speed.

FAULT FINDING USING THE XR25

The XR25 test kit is essential for repairing the ABS whatever the cause of the faults.

Communications between the computer and the XR25 allows:

- the computer's identity to be displayed (30 X . 5),
- memorised fault information to be displayed,
- system parameters to be displayed (wheel speed, < 6.25 mph, 10 km/h, brake pedal position),
- the solenoid valves of the pump motor to be controlled,
- the fault memory to be erased (to be done after each ABS operation).

Initialising dialogue

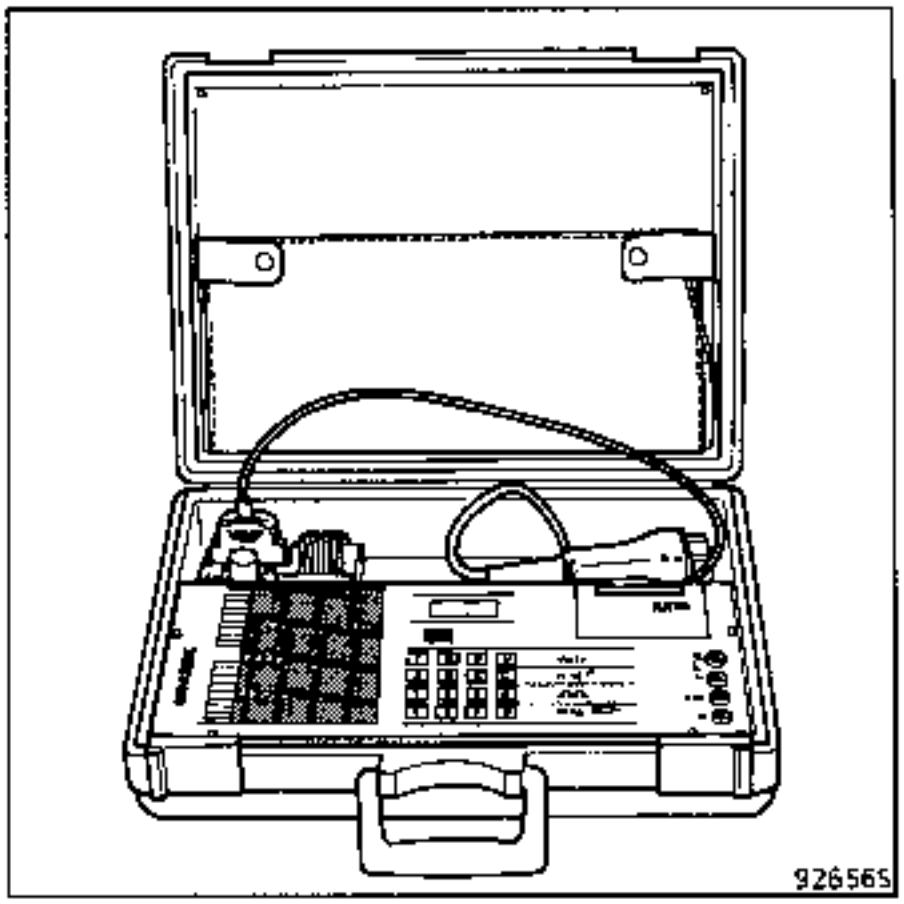
To be carried out after connecting the test kit following a road test and without having switched off the ignition at the end of the road test:

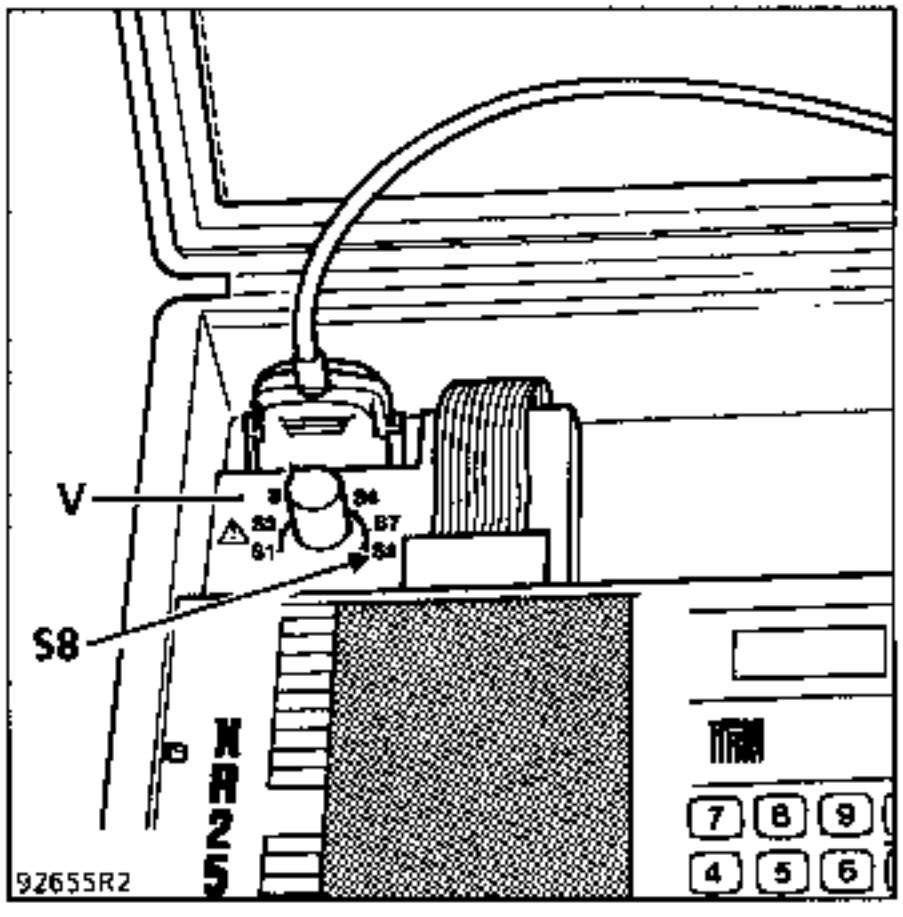
- turn the ISO selector to S8,
- initialse the computer by entering:

D 1 1 sending simultaneous information on both lines (K and L).

After having communicated with the XR25 (D11 - 58) :

- the ABS warning light is flashing: no fault present,
- the ABS warning light is permanently illuminated: 1 fault present.





NOTE: the "V" warning light must be extinguished. If this illuminates, disconnect and then reconnect the diagnostic socket, if it remains illuminated, check the XR25 wiring and the battery voltage.

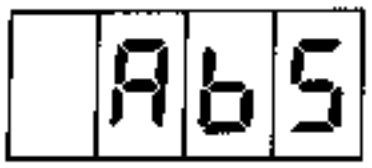
Operational analysis of the system with the XR25 test kit and the latest cassette following the road test causing the "ABS" warning light to illuminate.

At the end of the road test and without switching off the ignition, connect the XR25 test kit.

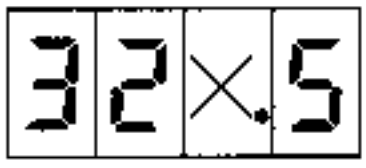
Enter the code [D] [1] [1]

Turn the ISO selector to 58.

The following should appear on the central display:

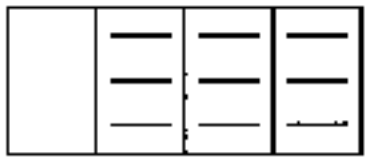


(1 second) then



3 TEVES make
2X Computer number
5 ABS tested product

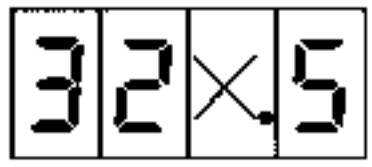
or



Indicates that dialogue has not been established

If initialisation has been successful:

- on the central display, the following message should be displayed



- **CASE OF ABS WITHOUT A FAULT**
  (2 bargraphs illuminated)

  Bargraph n° 1 right hand side: code present
  Bargraph n° 13 right hand side: brake circuit pedal raised

- **CASE OF ABS WITH FAULT(S)**

  IMPORTANT DEFINITIONS

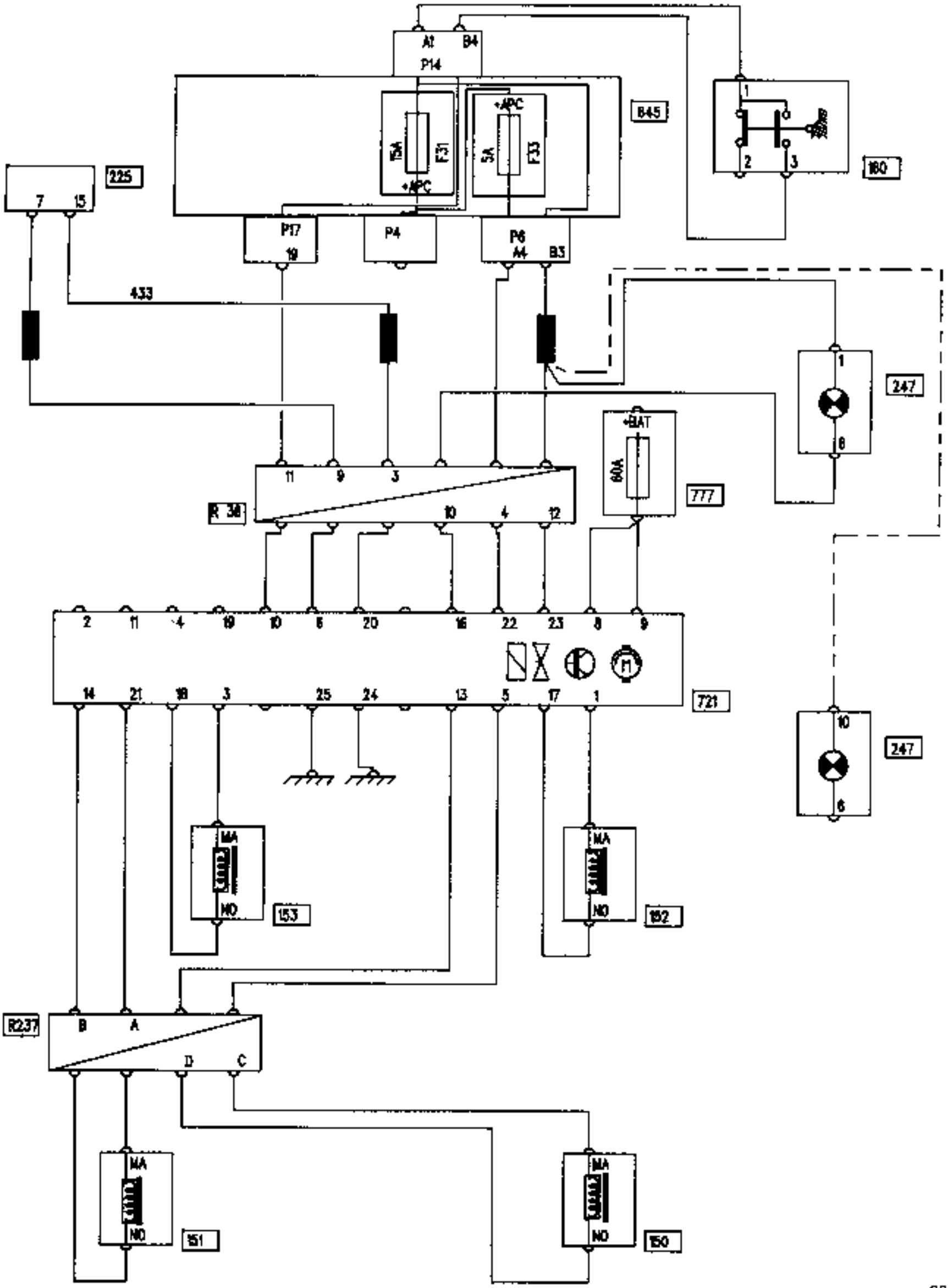
  An intermittent fault (or temporary fault): is a fault which has occurred (ABS warning light illuminated on the instrument panel) and then disappeared at a given moment (after ignition switched off and then on again). This type of fault is represented by a flashing bargraph.

  A permanent fault: is a fault which is present when a diagnostic test is performed using the **XR25** test kit. This type of fault is represented by a permanently illuminated bargraph.

IMPORTANT: if [D] [1] [1] is entered when the computer is in the checking sequence, the diagnostic mode may appear after a period which may be up to 40 seconds long. To reduce this time, type: **G13*** (beep) then: [D] [1] [1]

OPERATIONAL WIRING DIAGRAM

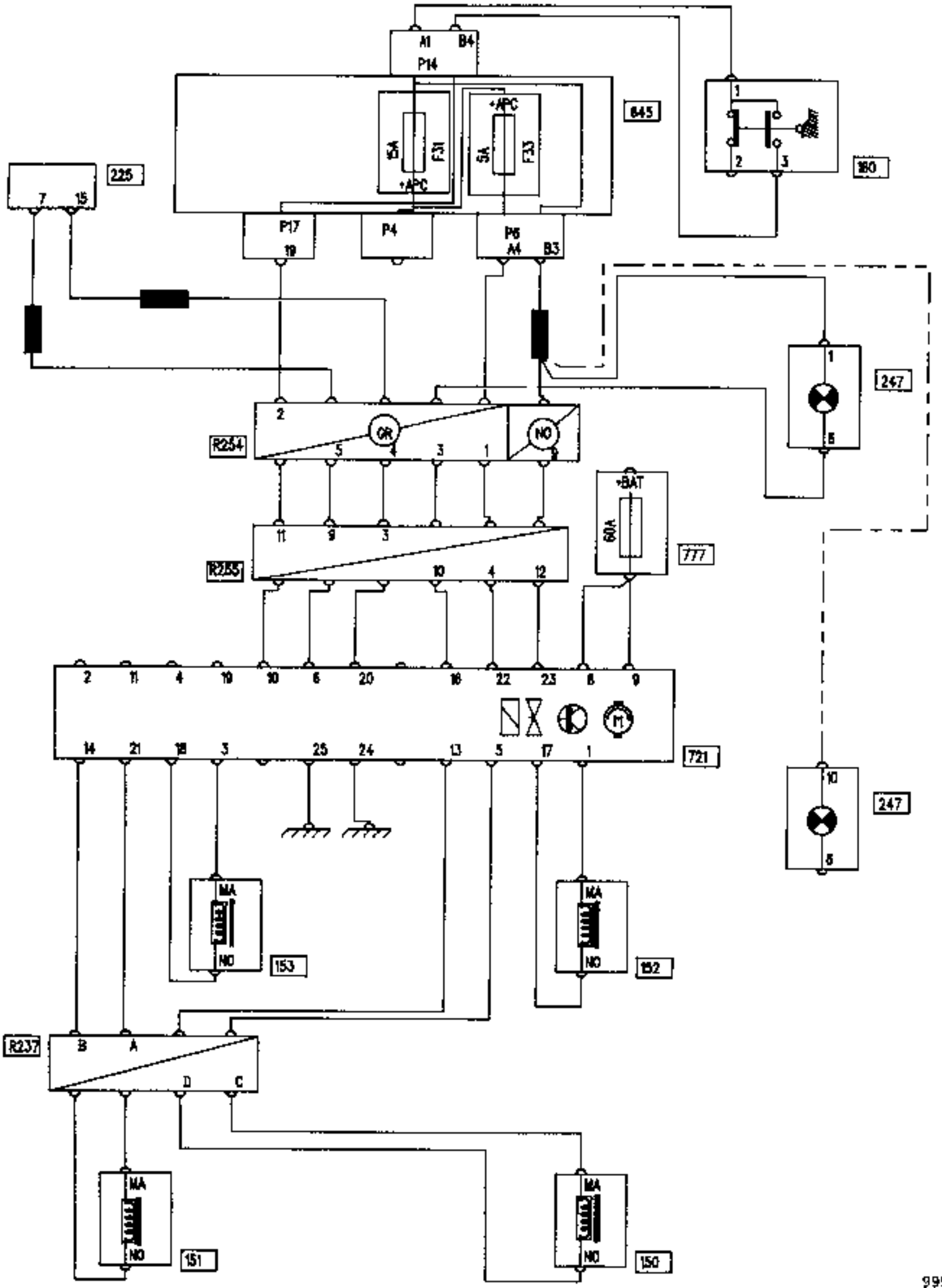
Vehicle fitted with left hand drive



99572S

OPERATIONAL WIRING DIAGRAM (continued)

Vehicle fitted with right hand drive



99571S

OPERATIONAL WIRING DIAGRAM KEY

Component:

150 Rear right wheel sensor

151 Rear left wheel sensor

152 Front right wheel sensor

153 Front left wheel sensor

160 Stop switch

225 Diagnostic socket

247 ABS fault warning light

645 Interconnection unit in passenger compartment

721 ABS hydraulic unit computer assembly

777 Fuse

R36 ABS/Dashboard

R237 ABS engine compartment/ABS under body

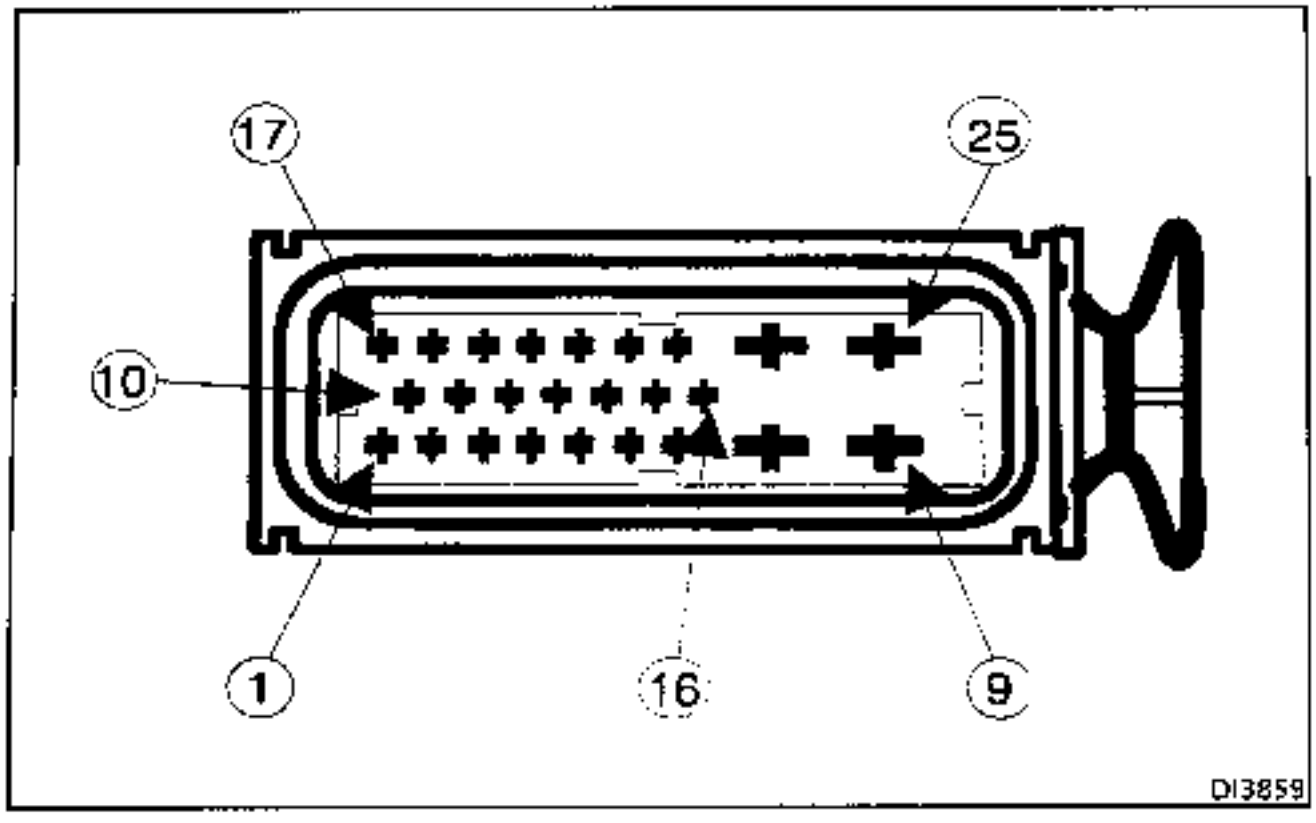
Right hand drive vehicles

R254 Dashboard/Scuttle panel

R255 ABS/Scuttle panel

NOTE: never disconnect the computer when the circuit is supplied.
Earths and resistances are to be checked with the battery disconnected.

Allocation of pins on the computer 25 track connector



25 track connector

Track N°	Allocation
1	Front right sensor
2	Not connected
3	Front left sensor
4	Not connected
5	Rear right sensor
6	K diagnostic line
7	Not connected
8	+ Battery
9	+ Battery
10	Stop lights switch
11	Not connected
12	Not connected
13	Rear right sensor

Track N°	Allocation
14	Rear left sensor
15	Not connected
16	ABS fault warning light
17	Front right sensor
18	Front left sensor
19	Not connected
20	L diagnostic line
21	Rear left sensor
22	Computer - after ignition
23	+ stop, ABS warning light, computer
24	Earth
25	Earth

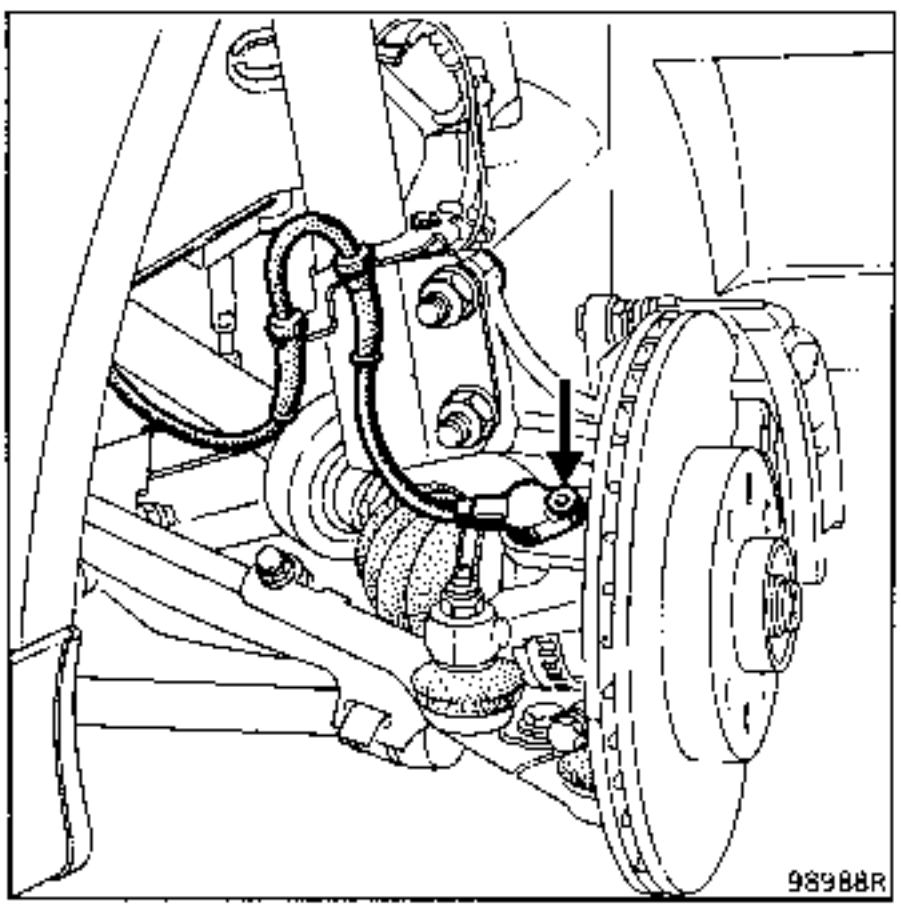
REMOVING - REFITTING THE MAIN COMPONENTS

1 - *FRONT WHEEL SENSOR*

TIGHTENING TORQUES (in daN.m)	▽
Wheel nut	9
Sensor mounting bolt	0.8 ± 0.2

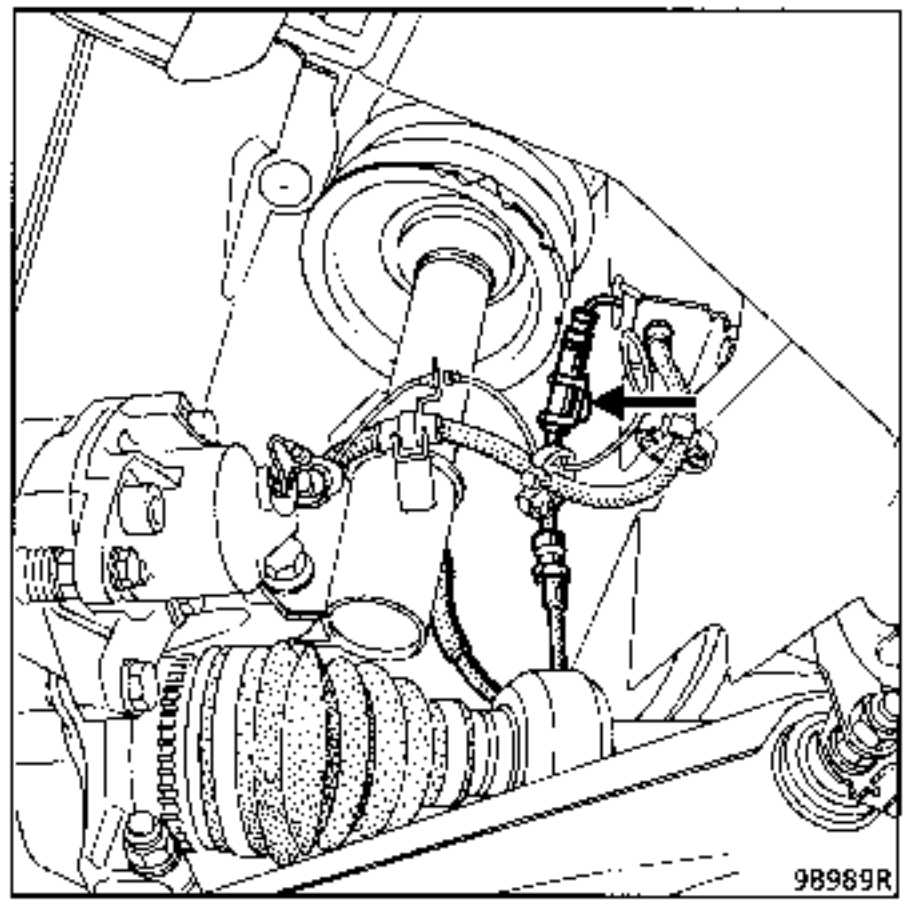
REMOVING

Remove:
- the wheel,
- the sensor mounting bolt (star-shaped head T30).



Unclip the wire from the brackets.

Disconnect the connector located next to the engine sub-frame front mounting.



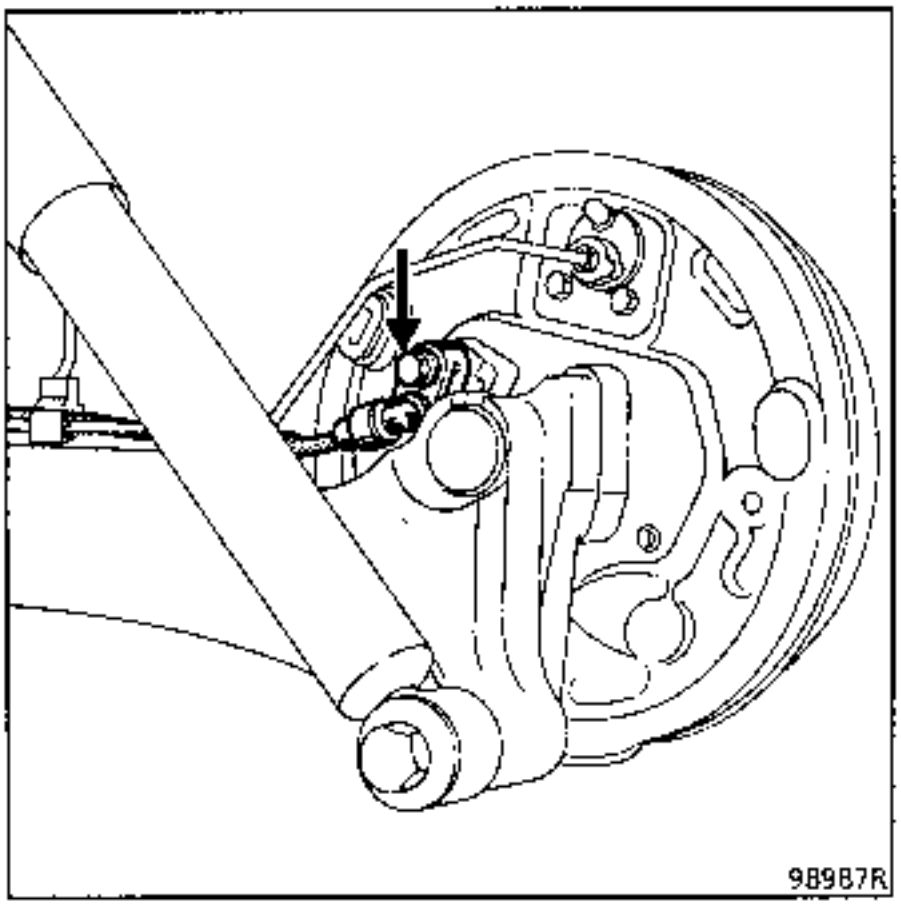
Remove the sensor.

2 - REAR WHEEL SENSOR

TIGHTENING TORQUES (in daN.m)	
Wheel nut	9
Sensor mounting bolt	0.8 ± 0.2

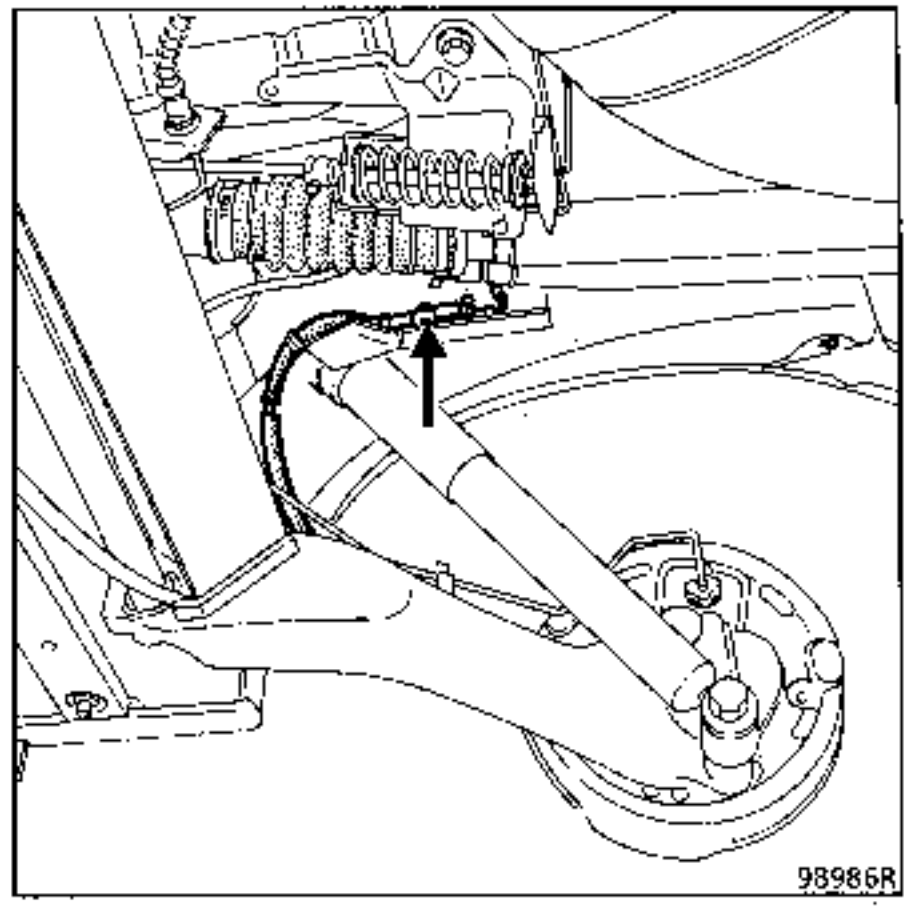
REMOVING

Remove:
- the wheel,
- the sensor mounting bolt (10 mm hexagonal head).



Unclip the wire from the brackets.

Disconnect the sensor from its connector located under the vehicle, next to the bearings of the rear axle arm.



REFITTING SENSORS (front or rear)

Position the sensor which has previously been coated with **Multipurpose grease Part Number : 77 01 422 308**, then clip the wire into the brackets and reconnect it.

Check the recommended air gap over 1 target rotation with a set of shims (not adjustable).

NOTE: to avoid the risk of faults, ensure that the connector is properly connected.

The sensor must be fitted by hand. Do not hit it when positioning it.

Do not use the wire for pulling or pushing it.

3 - FRONT AND REAR WHEEL TARGET

The front and rear wheel targets are not removable.

4 - HYDRAULIC AND ELECTRICAL REGULATION UNIT

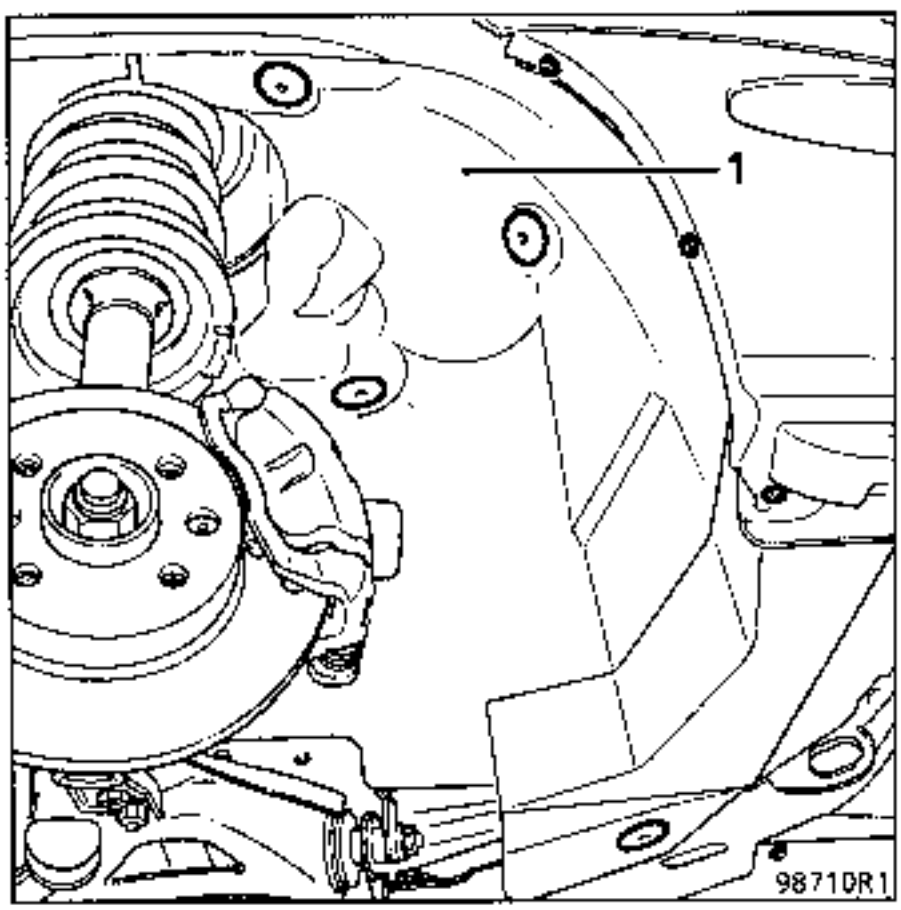
TIGHTENING TORQUES (in daN.m)		
Hose connections	M10 × 100	1.2
	M12 × 100	1.5

REMOVAL

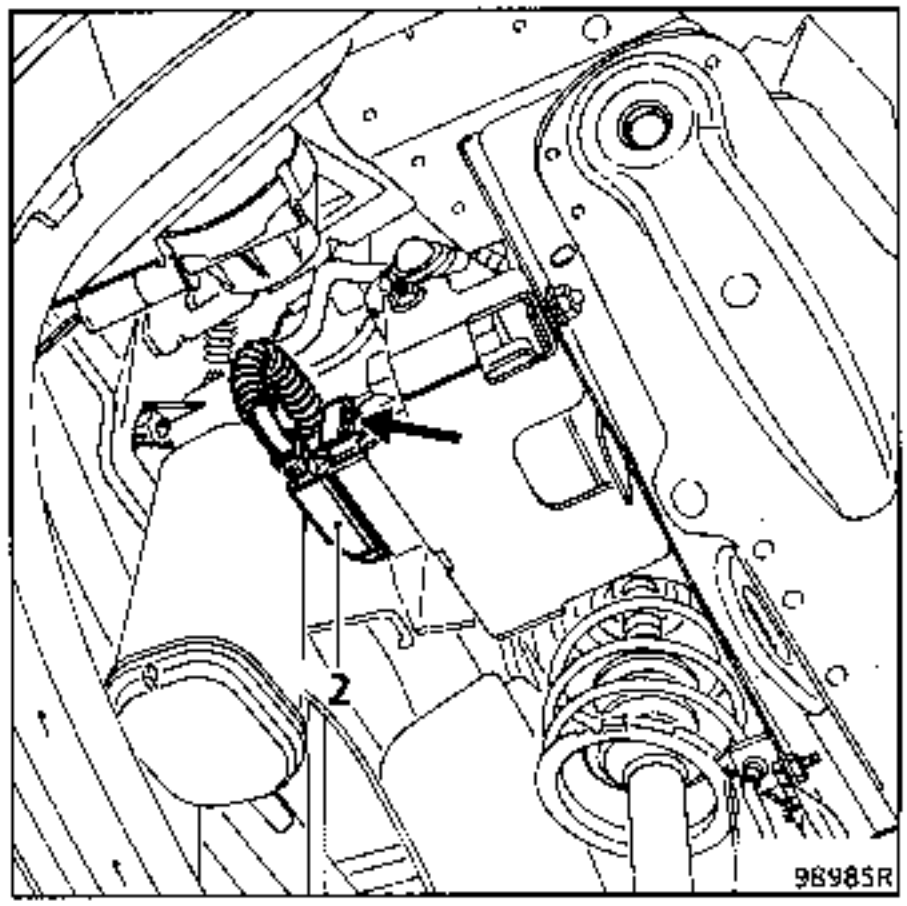
Position a pedal press (limits the flow).

Disconnect the battery.

Remove the plastic cover (1).

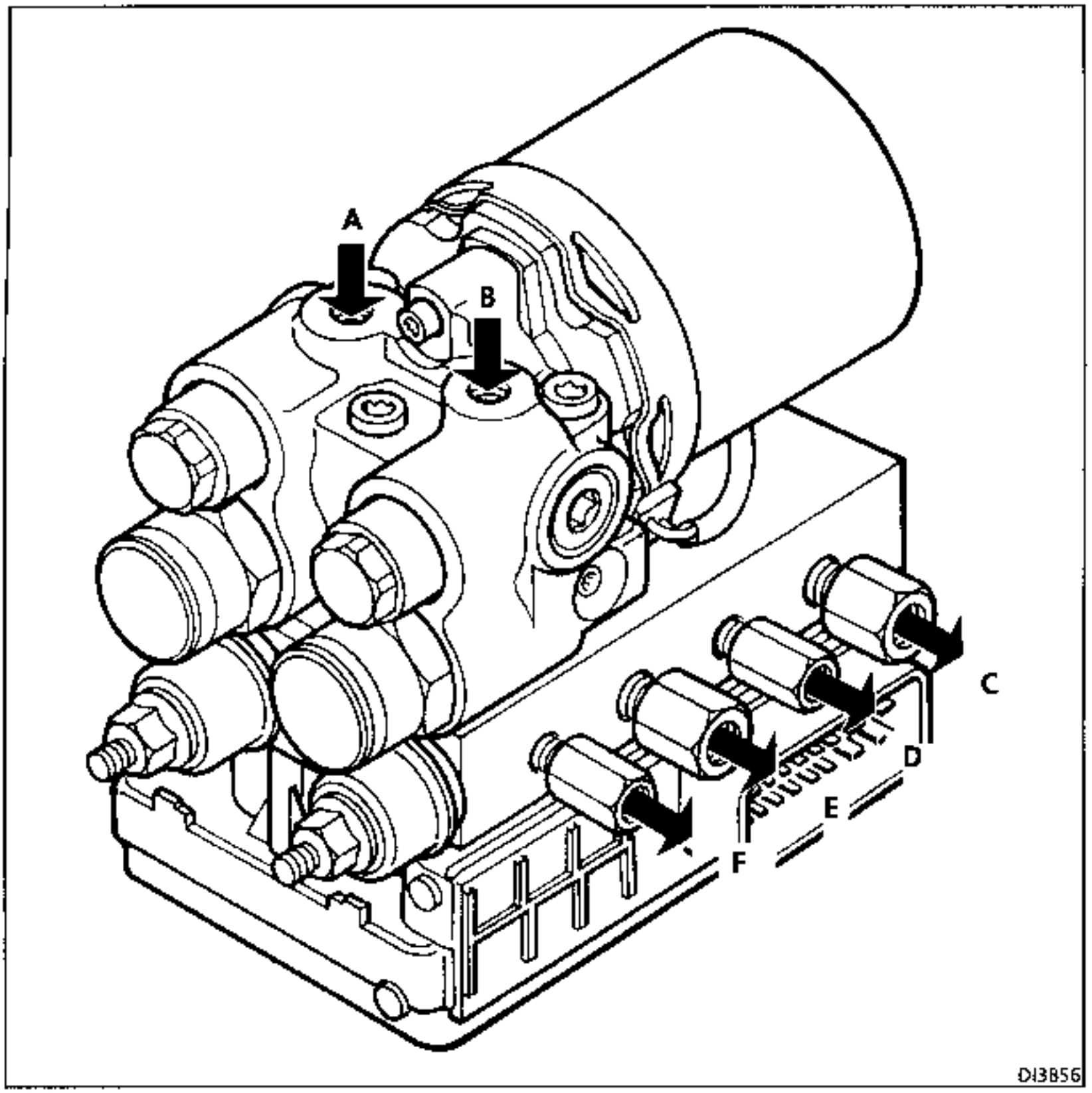


Disconnect the 25 track connector (2) after having unclipped it by pulling it towards the front of the vehicle (orange bracket).



Remove the 6 pipe connections, using a pipe wrench.

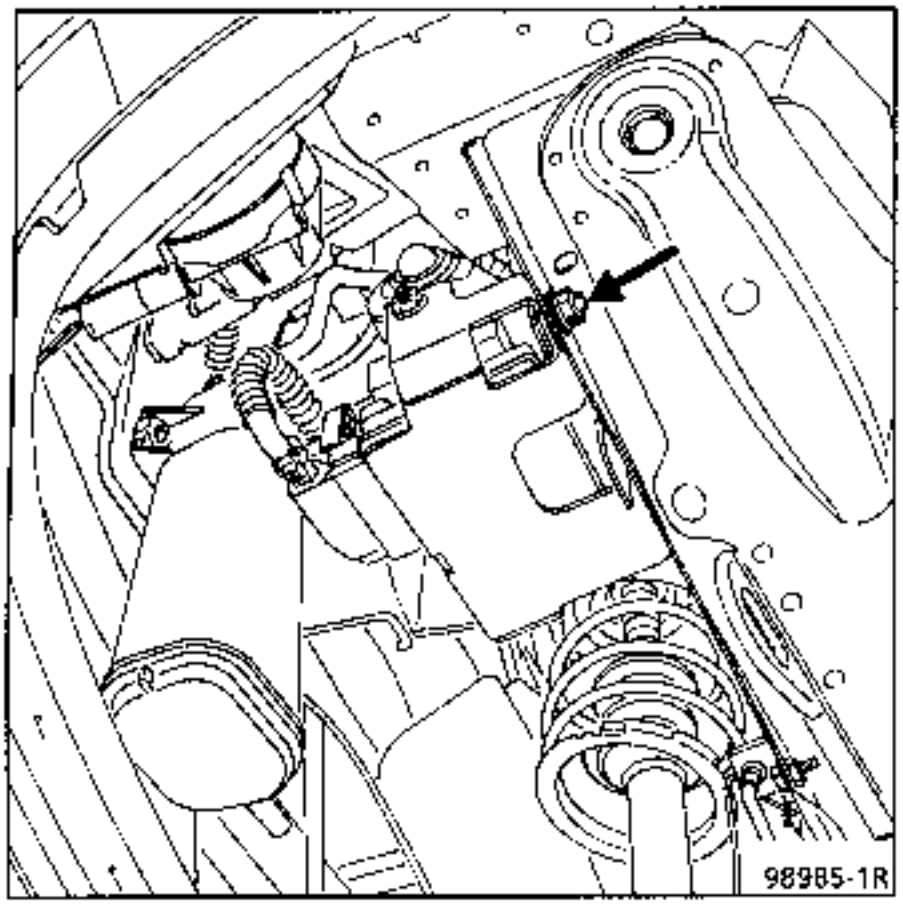
Disconnect the supply pipes on the ABS unit as follows.

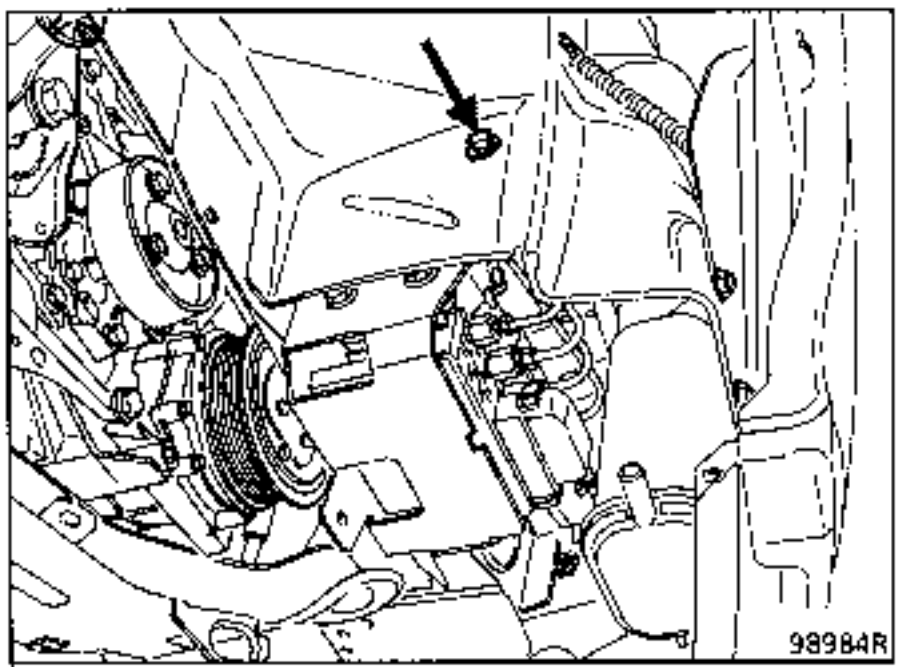


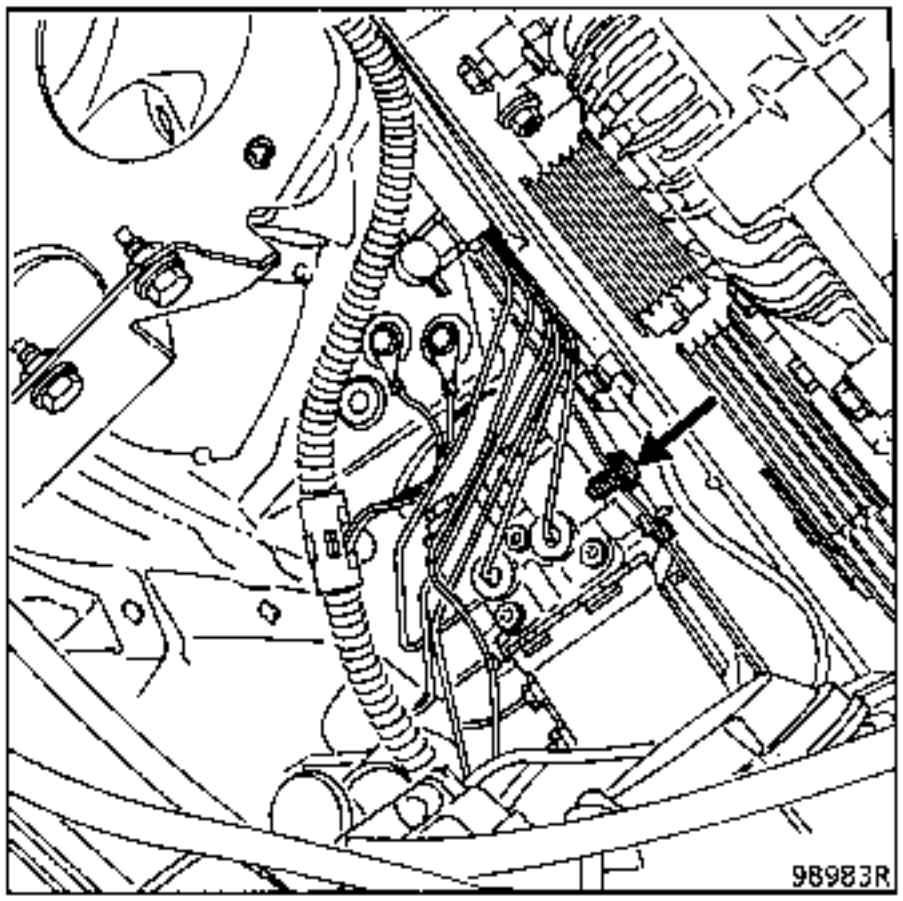
A Inlet pipe from the master cylinder (primary circuit).
B Inlet pipe from the master cylinder (secondary circuit).
C Outlet pipe from the regulation unit going to the front left hand wheel (yellow).
D Outlet pipe from the regulation unit going to the rear right hand wheel (red).
E Outlet pipe from the regulation unit going to the rear left hand wheel (blue).
F Outlet pipe from the regulation unit going to the front right hand wheel (green).

Fit the blanking plugs onto the unions (limits the flow of brake fluid).

Remove the 3 mounting bolts from the hydraulic and electrical regulation unit





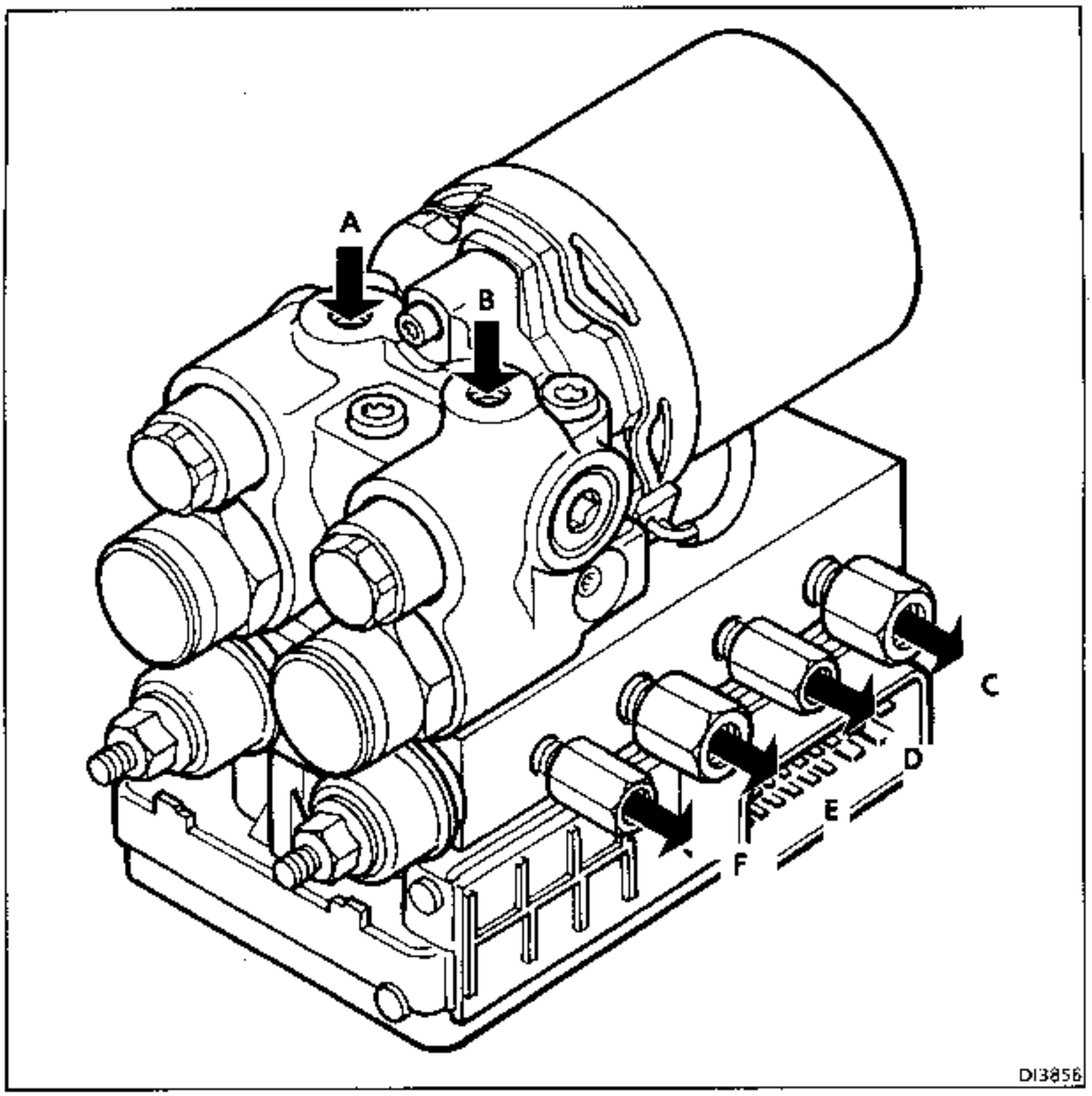


Remove the hydraulic and electrical regulation unit.

REFITTING

Refitting is the reverse of removal.

Position the hydraulic and electric regulation unit complying with the position of the pipes.



A Inlet pipe from the master cylinder (primary circuit).
B Inlet pipe from the master cylinder (secondary circuit).
C Outlet pipe from the regulation unit going to the front left hand wheel (yellow).
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E Outlet pipe from the regulation unit going to the rear left hand wheel (blue).
F Outlet pipe from the regulation unit going to the front right hand wheel (green).

Bleed complying with the order of operations (see following pages).

Check the system using the G function on the XR25 test kit.

After a road test (with ABS regulation), check the ABS function with the XR25 test kit.

Validate the end of the test: G13*.

BLEEDING

ATTENTION

The order of the operations for bleeding the "ABS" hydraulic circuit must be complied with .

1) *BLEEDING AFTER REPLACING A BRAKE CALIPER*

Conventional bleeding after replacing a caliper:

- fill the brake fluid reservoir,
- secure the compensator (only for a rear caliper),
- connect the end of the bleed screw to a collecting bottle,
- open the bleed screw of the caliper, press the pedal down, close the bleed screw and then release the pedal. Wait for 3 seconds,
- repeat the operation at least 10 times until the fluid appears clear and free from bubbles,
- perform 2 bleed operations subjecting the circuit to high pressure (3 successive "pumpings" of the pedal), open the bleed screw until the pedal reaches the floor and then close the bleed screw,
- remove the compensator support (if necessary),
- fill the container to the maximum limit.

2) *BLEEDING AFTER REPLACING A COMPENSATOR*

Secure the compensator.

Perform a conventional bleeding operation (see point 1) on the 2 rear brakes.

3) *BLEEDING AFTER REPLACING A MASTER CYLINDER*

Fitting the container.

Block the master cylinder outlets with the bleed screws .

Fill the container with the brake fluid specified by the RENAULT Technical Department.

Open the bleed screw of the primary circuit (circuit next to the brake servo) of the master cylinder and press the brake pedal and keep it in this position.

Close the bleed screw and release the brake pedal slowly.

Wait for 3 seconds every time the brake pedal is released to allow the master cylinder to fill.

Repeat this operation at least 5 or 6 times.

Bleed the secondary circuit in the same way.

Before fitting the pipes, press the brake pedal down (minimum 30 mm) so that no brake fluid from the reservoir is supplied to the master cylinder and can leave the master cylinder.

Refit the the brake pipes to the master cylinder.

Bleed the pipes before connecting the ABS unit.

Then bleed the complete brake circuit in the conventional way (see point 1) in the following order:

1) front left brake,
2) rear right brake,
3) front right brake,
4) left rear brake.

(Check the level of the brake fluid between each bleed operation and when securing the compensator).

4) *BLEEDING AFTER REPLACING THE HYDRAULIC AND ELECTRIC UNIT OF THE TEVES ABS SYSTEM*

When replacing the hydraulic unit, keep the brake pedal pressed down using a pedal press so that no fluid is released.

Plug the master cylinder/hydraulic unit connecting pipes so that they retain their fluid (otherwise, fill them before fitting).

Fit the hydraulic unit and connect the pipes.

Then bleed the complete brake system in the conventional way (see point 1) in the following order:

1) front left brake,
2) rear right brake,
3) front right brake,
4) rear left brake.

Under no circumstances should the ABS system be operated with a unit which has not been bled. If the delivery pump draws in air and it is then very difficult, even impossible, to bleed it.

Therefore, the replacement hydraulic unit is supplied filled with brake fluid.

5) *COMPUTER*

REMOVAL

Disconnect the battery.

Remove the plastic protector.

Slacken the three mounting bolts on the bracket of the hydraulic and electric unit.

Disconnect the 25 track connector.

Remove the three mounting bolts on the bracket of the hydraulic and electric unit.

Remove the bracket (lift it to release the upper bracket and lower it).

Disconnect the connector from the pump-motor assembly.

Remove the two mounting bolts from the computer and remove it.

REFITTING

Refitting is the reverse of removal.

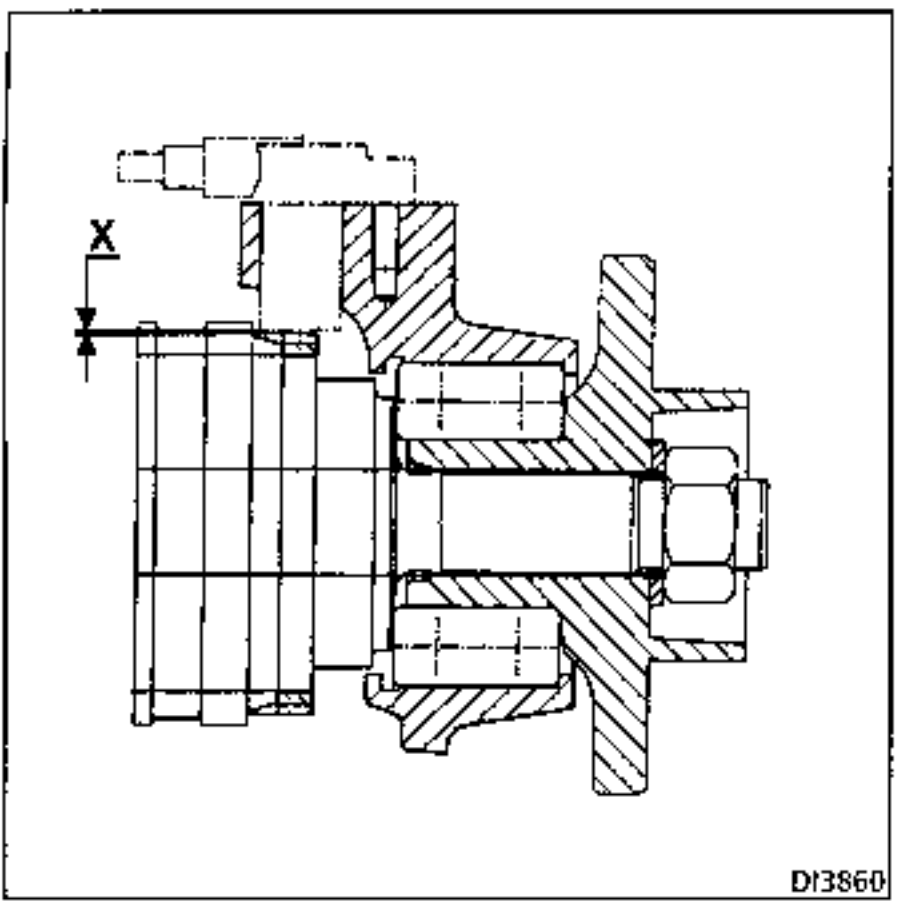
ADDITIONAL CHECKS

1 - AIR GAP BETWEEN TARGET/SENSORS

Position the target so that the top of a tooth is parallel with the sensor.

Front sensor

X = 1 mm ± 0.6



Rear sensor

Tangential sensors which cannot be adjusted.
The air gap cannot be checked.

2 - SENSOR RESISTANCE

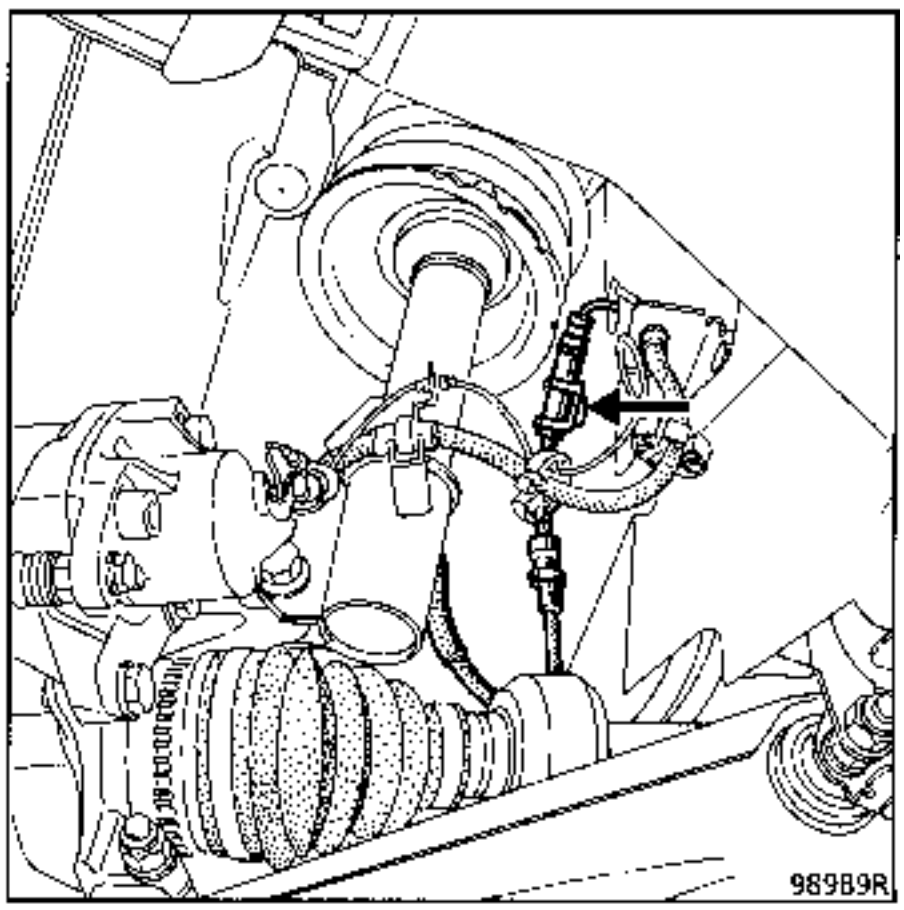
Sensor resistance:

front	:	1000 Ω
rear	:	1000 Ω

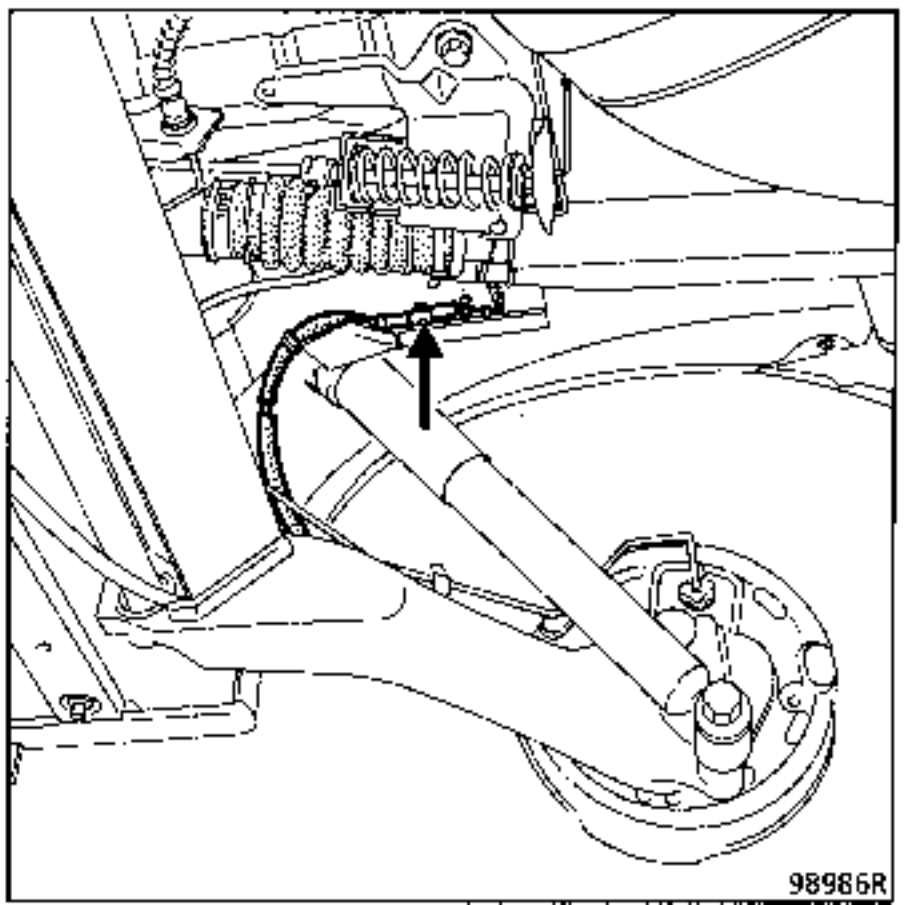
3 - CHECKING THE WHEEL SENSOR CONNECTORS

If the ABS warning light illuminates intermittently, firstly check the wheel sensor connectors and clean them with ELECTRONEX **Part Number : 77 01 408 464.**

Front sensor connector



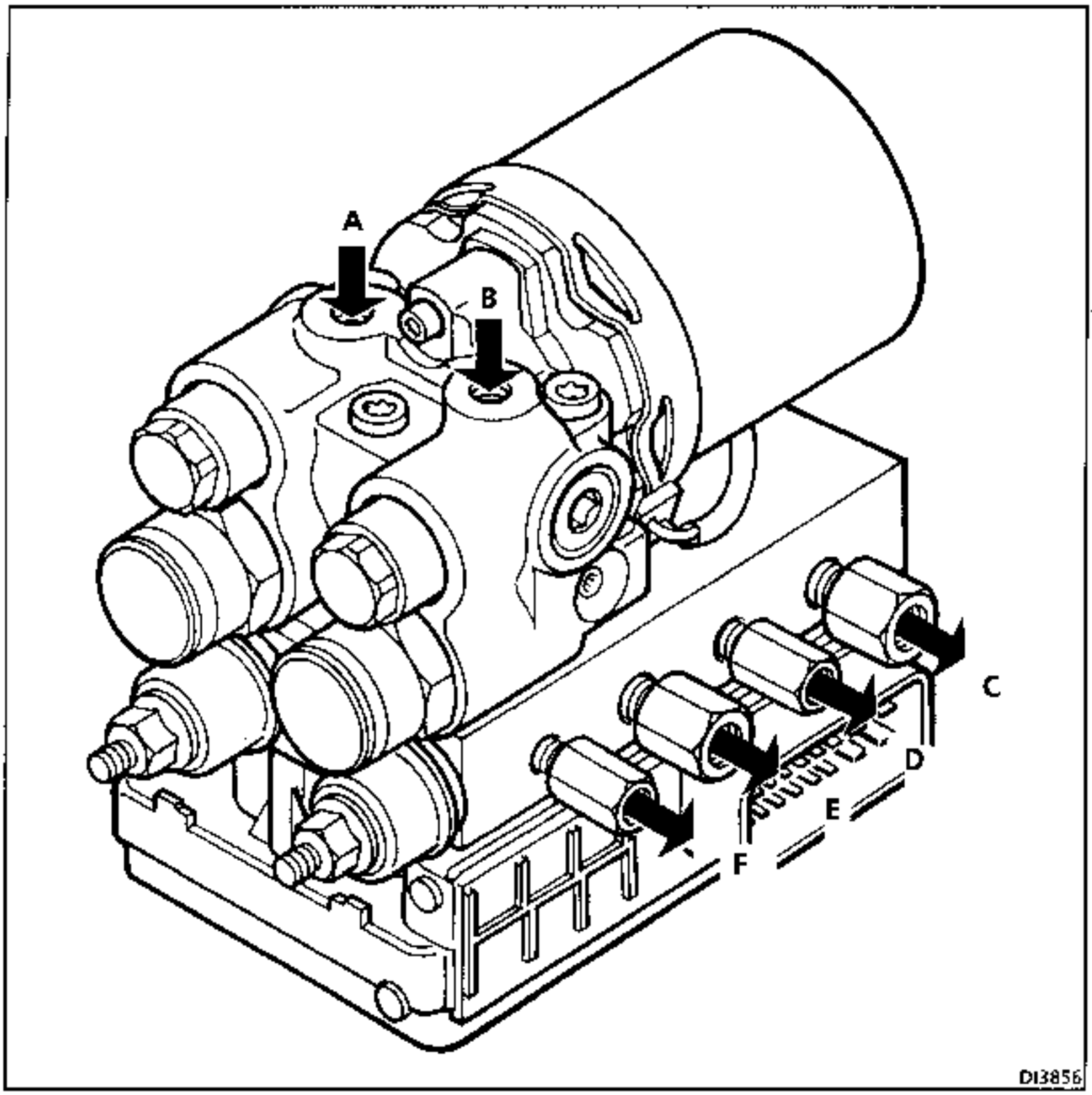
Rear sensor connector



NOTE

- When disconnecting, avoid using a tool which might damage the retainer lugs on the 2 parts of the connector.
- Take care to comply with the connections and wiring routing (the reliability of the ABS function relies on this).

Hydraulic unit hose references



A Inlet pipe from the master cylinder (primary circuit).
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C Outlet pipe from the regulation unit going to the front left hand wheel (yellow).
D Outlet pipe from the regulation unit going to the rear right hand wheel (red).
E Outlet pipe from the regulation unit going to the rear left hand wheel (blue).
F Outlet pipe from the regulation unit going to the front right hand wheel (green).

To avoid inverting the hydraulic connections, the unit and the pipes are colour coded.

CHECKING PRINCIPLE

These vehicle are fitted with a load sensitive braking compensator.

The pressure is read in an X pattern, by comparing the pressure at the rear wheels with a given pressure at the front wheels.

The dual compensator has two totally separate bodies which act in an X pattern on one front wheel and one rear wheel.

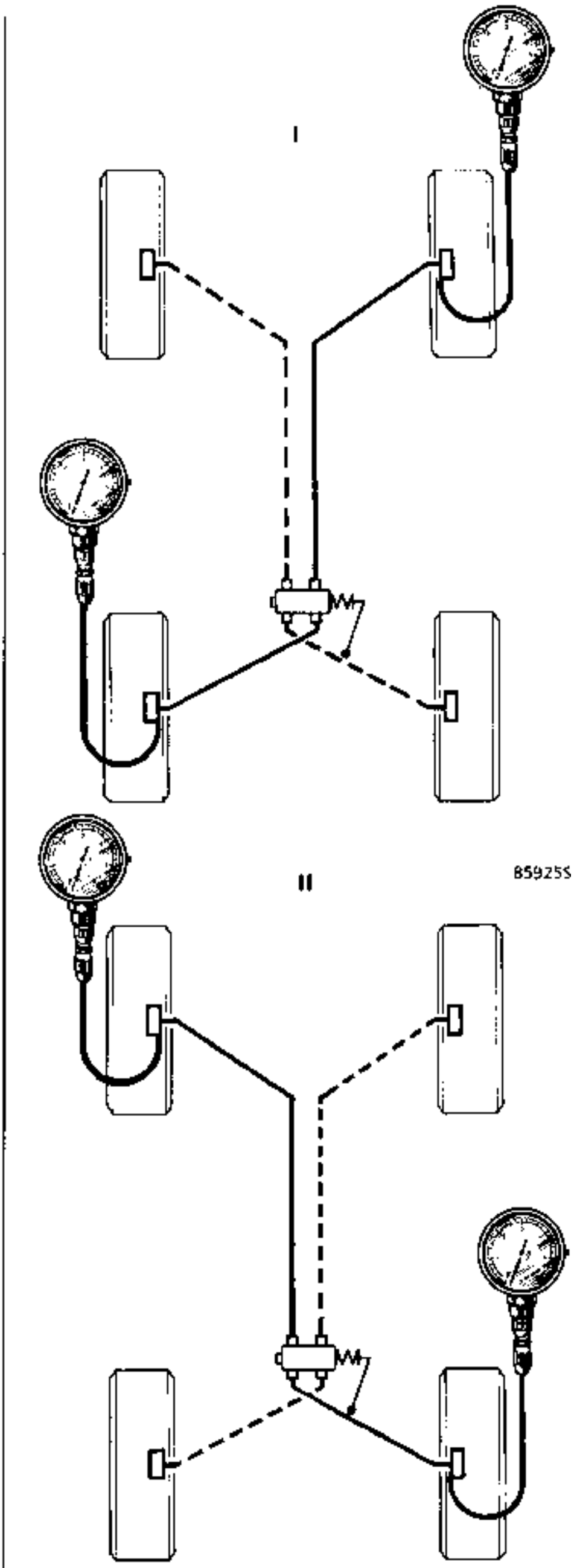
Both circuits must be checked.

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

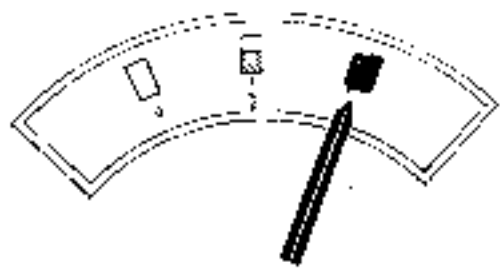
Assisted compensators.

For assisted compensators, the adjustment allows alteration of the rear pressure depending on the front pressure.

The adjustment is made simultaneously in both bodies. If the pressure is incorrect for one of the two bodies, replace the compensator.



Checking is carried out when the vehicle is unladen, with a full fuel tank and the driver on board.

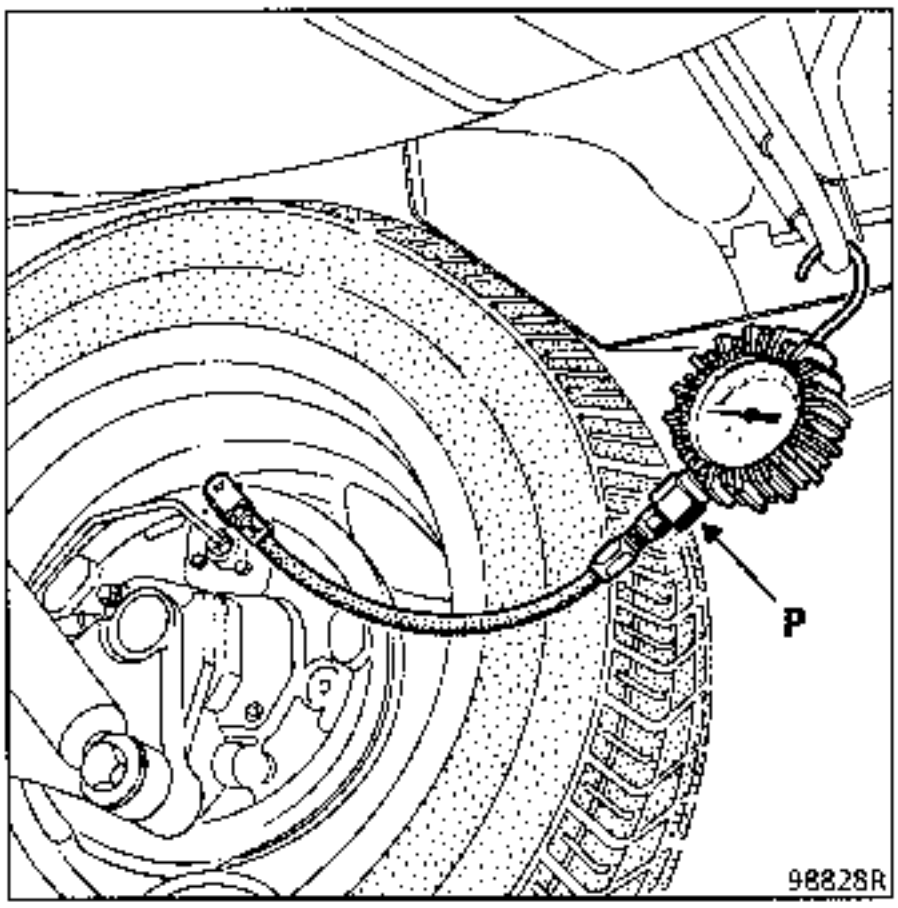
Vehicle type	Fuel tank	Checking pressure (bar)	
		Front	Rear
BA0G	 Full 909665	100 →	72 $^{+0}_{-8}$
BA0A BA0E BA0F BA0L BA0U		100 →	62 $^{+0}_{-8}$

The brake compensator must be checked and adjusted when the vehicle is on the ground with one person on board

SPECIAL TOOLING REQUIRED	
Fre. 244-03 or Fre. 1085-01	Pressure gauge for checking the compensator rating

CHECKING

Connect the two pressure gauges **Fre. 244-03** or **Fre. 1085-01** (P):
- one to the front right,
- one to the rear left.



Press progressively on the brake pedal until the setting pressure (see table of values) is obtained at the front wheels. Read the corresponding pressure at the rear wheels; correct it if necessary.

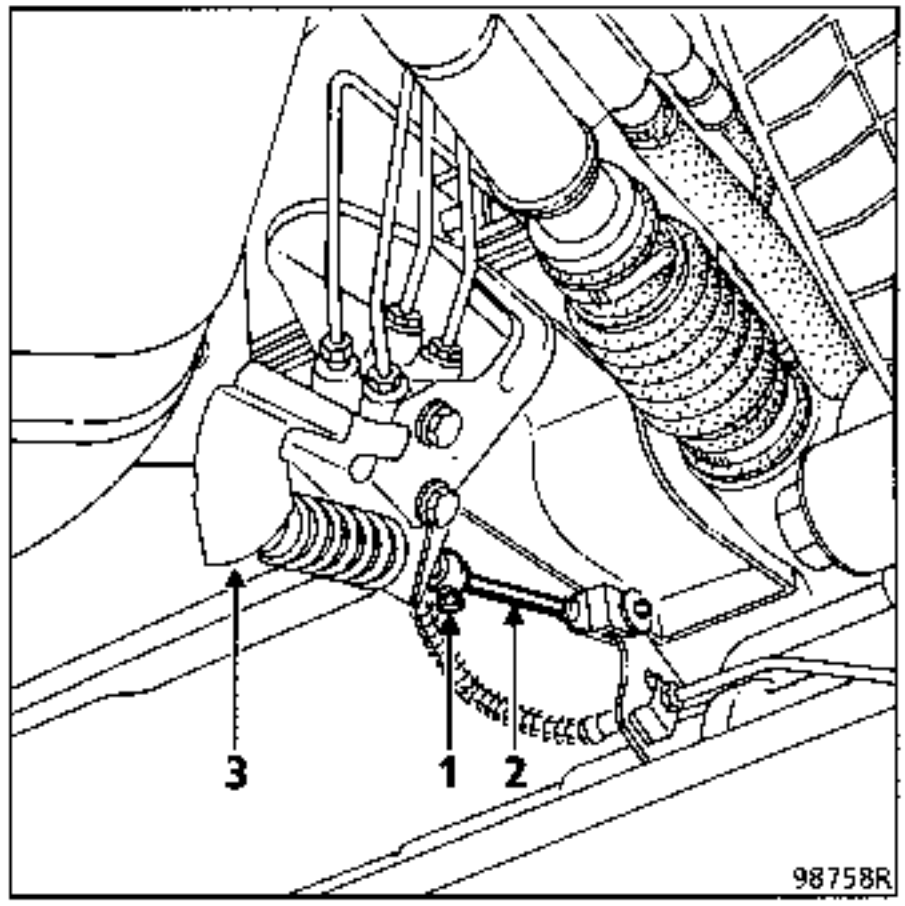
Perform the same operation on the other circuit:
- one on the front left,
- one on the rear right.

If there is a large difference (values outside the tolerance limits), replace the compensator as repairs are not allowed.

SETTING

To set the compensator, slacken the bolt (1) and alter the position of the rod (2) in the sleeve.

NOTE: do not alter the position of the nut (3)

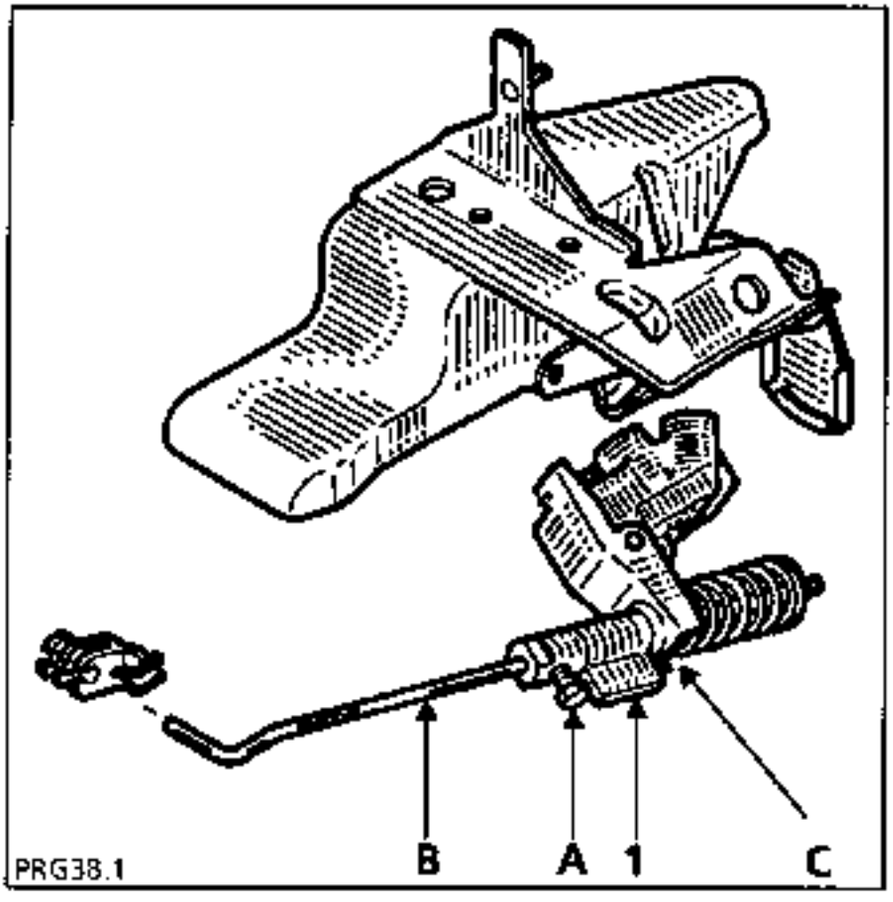


REPLACEMENT

The Parts Department supplies preadjusted replacement compensators fitted with a pin (1).

Prepare the vehicle for adjusting.

Fit the new compensator fitted with the pin (1).



Slacken the bolt (A).

Position the rod (B) in the connecting hole.

Tighten the bolt (A) whilst holding the sleeve (C).

Remove the pin (1).

Bleed and check the circuit (see "Checking-Setting" paragraph).

CONDITIONS FOR APPLICATION OF TESTS SPECIFIED IN FAULT FINDING

The conditions defined in this fault finding are only applied when the fault bargraph is permanently illuminated, signalling that the fault is present on the vehicle at the time of the test.

If the fault is not present but simply memorised, the bargraph flashes and applying the tests recommended in the fault finding will not allow the reason why this fault was memorised to be located. In this case, testing the wiring and the connections of the faulty component is the only operation which must be performed (the wiring in question can be activated in the diagnostic mode to try and get the bargraphs, other than 8, 9 and 10 to be illuminated permanently).

Some faults are only taken into account by the computer's self diagnosis when moving (vehicle speed ≥ threshold).

If the ignition has been switched off between when the fault appeared and when the XR25 test kit is connected, these faults, even if they are present at the time of testing, will only be signalled by the bargraph in question flashing. Therefore if bargraphs 8, 9 and 10 are flashing, the presence of a fault must be confirmed by a road test followed by a check using the XR25 without turning the ignition off.

If the bargraph is illuminated permanently, the fault must be considered as being present and fault finding can be applied. If it flashes, testing the wiring and the connections of the faulty component is the only operation which must be performed (the fault is memorised only, since it was not present at the time of testing).

ESSENTIAL TOOLING FOR WORKING ON THE ABS SYSTEM

- XR25 test kit.
- Cassette XR25 N° 15 minimum.

REMINDER

- Bargraphs 10 right and 11 right of XR25 fiche N° 31 as well as #10 do not relate to this vehicle (Laguna specific).

- The engine compartment / passenger compartment connection is different on the right hand drive version as opposed to the left hand drive version:

  - left hand drive : ABS / dashboard R36 connection.
  - right hand drive : dashboard / scuttle panel R254 + ABS / scuttle panel R255 connection.

  Therefore, on right hand drive, there is an additional scuttle panel cable, the R255 connection being the same as the R36 on the left hand drive version.

- When an intermittent fault on the speed sensor has been memorised, the ABS warning light will illuminate when the engine is started and will remain so until the vehicle speed is equal to 12.5 mph (20 km/h). When this sensor fault is memorised, a counter associated to the fault is initialised to a value of 40. This counter is decremented every time the vehicle is started if the fault is not present when the vehicle speed exceeds 12.5 mph (20 km/h). When the value of the counter reaches 0, the memorised fault is erased.

N° 31 | S8 | code : D 1 1 | lire : 3X X5

1	CALCULATEUR	CODE PRESENT	
2	AV.G	CIRCUIT ELECTROVANNES ADMISSION	AV.D
3	AR.G		AR.D
4	AV.G	CIRCUIT ELECTROVANNES ECHAPPEMENT	AV.D
5	AR.G		AR.D
6	AV.G	CIRCUIT CAPTEURS DE VITESSE ROUES	AV.D
7	AR.G		AR.D
8	AV.G	SIGNAUX CAPTEURS VITESSE ROUES	AV.D
9	AR.G		AR.D
10	HYDRAULIQUE	CIRCUITS MOTEUR POMPE	

A.B.S. TEVES

Effacement mémoire défauts : G 0★★
Fin de diagnostic : G 1 3★

11	CAPTEUR COURSE PEDALE	RELAIS PRINCIPAL
12	★12 DEFAUT ALIMENTATION	
13	PEDALE DE FREIN ENFONCEE ◄——► RELACHEE	
14		
15		
16		
17		
18		
19		
20		MEMOIRE XR25 0

CONTROLES ANNEXES : # . .

01	Vitesse roue AV.D	Km/h
02	Vitesse roue AV.G	Km/h
03	Vitesse roue AR.D	Km/h
04	Vitesse roue AR.G	Km/h
10	Position pédale de frein	

MODES COMMANDES : G . . ★

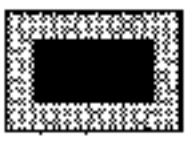
(si vitesse véhicule nulle et, pour tests E.V. appuyer sur la pédale de frein)

03	Test électrovannes AV.G
04	Test électrovannes AV.D
05	Test électrovannes AR.G
06	Test électrovannes AR.D
09	Test relais moteur pompe

FI11531

MEANING OF THE BARGRAPHS

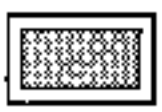
FAULTS (always on a coloured background)



If illuminated, a fault is signalled on the component tested, the associated text defines the fault.

This bargraph can be:
- Permanently illuminated : fault present.
- Flashing : fault memorised.
- Extinguished : fault absent or not tested.

STATES (always on white background)



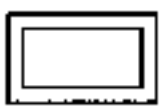
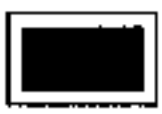
Bargraph always located in the top right.

If illuminated, this signals that a dialogue with the component's computer has been established.

If it remains extinguished :
- the code does not exist,
- the tool, the computer or the XR25 / computer connection is faulty.

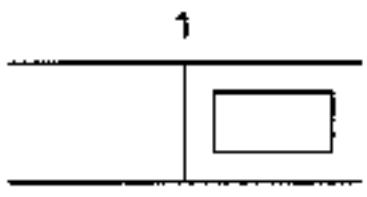
The following bargraph representation indicates their initial state:

Initial state: (ignition on, engine off, no operation action)

 or 	Undefined	is illuminated when the function or condition stated on the fiche is performed.
	Extinguished	
	Illuminated.	extinguishes when the function of condition stated on the fiche is no longer performed.

ADDITIONAL INFORMATION

Some bargraphs have a *. The *... command, when the bargraph is illuminated, allows additional information about the type of fault or state which has arisen to be obtained.



Bargraph 1 right extinguished

Fiche n° 31

Code present

NOTES	None

Ensure that the XR25 test kit is not the cause of the fault by trying to communicate with a computer on another vehicle.

Check that the ISO interface is indeed in position S8, that you are using the latest version of the XR25 cassette and that the access code is correct.

Check the battery voltage and perform the necessary operations to obtain a conforming voltage (9.5 volts < Battery voltage < 18.5 volts).

Check that the presence and the condition of the ABS fuse in the passenger compartment interconnection unit (5 A).

Check the computer connector connection and the condition of its connections.

Check the connection of 14 track R36 ABS / dashboard connector (R254 - R255 on right hand drive) in the scuttle panel near to the battery and check the condition of its connections.

Check the ABS earths (tighten the 2 earth bolts above the hydraulic assembly).

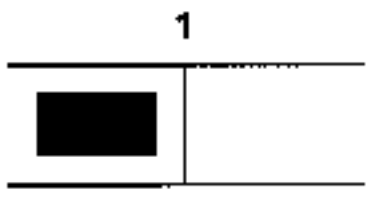
Check that the computer is correctly fed:
- earth on tracks 25 and 24 of the 25 track connector,
- + after ignition on track 33 of the 25 track connector.

Check that the diagnostic socket is correctly supplied:
- ~ before ignition on track 16,
- earth on track 5.

Check the continuity and the insulation of the diagnostic socket / ABS computer connection lines:
- between track 20 of the computer connector and track 15 of the diagnostic socket,
- between track 6 of the computer connector and track 7 of the diagnostic socket.

If dialogue has still not been established after these various tests, change the ABS computer.

AFTER REPAIR	When a dialogue has been established, deal with any illuminated bargraphs.



Bargraph 1 left permanently illuminated Fiche n° 31

Computer

NOTES

None

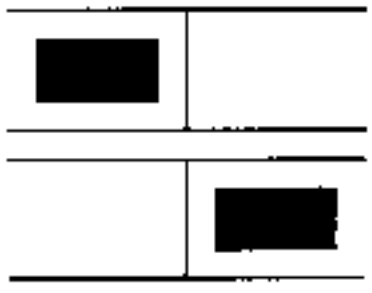
Check the wiring on the 25 track connector of the computer.

Check the ABS earths and visually check all of the ABS wiring.

If the "computer" fault persists, change the ABS computer.

AFTER REPAIR

If the computer has been changed, carry out a test with the XR25 test kit.

2 - 3 - 4 - 5 	**Bargraphs 2, 3, 4 and 5 right or left permanently illuminated** Fiche n°
NOTES	None

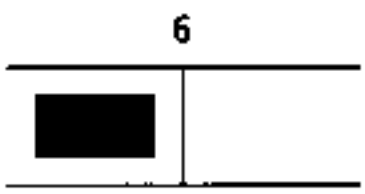
Check the ABS earths (tighten the 2 bolts above the hydraulic unit).

Check the connection and the condition of the wiring on the 25 track connector of the computer (solenoid valve earth on track 25).

Check the condition and the position of the ABS 60A fuse in the scuttle panel next to the battery.

If the "solenoid valve circuit" fault persists, replace the ABS computer.

AFTER REPAIR	Erase the computer's memory (G0**). Carry out a road test, followed by a test with the XR25 test kit.



Bargraph 6 left permanently illuminated Fiche n° 31

Front left hand wheel sensor circuit

NOTES

None

Check the connection and the condition of the sensor wiring.

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

If the resistance is correct, check and ensure the continuity of the connections between the sensor connector and the computer connector:
- track 1 of the sensor / track 3 of the computer connector,
- track 2 of the sensor / track 18 of the computer connector.

Also check the insulation between the connections.

Visually check the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all these checks are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

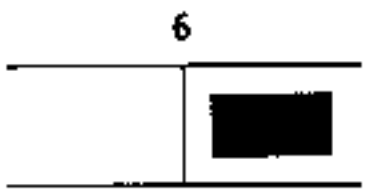
Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, change the computer.

AFTER REPAIR

Erase the computer's memory (G0**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 6 right permanently illuminated Fiche n° 31

Front right hand wheel sensor circuit

NOTES

None

Check the connection and the condition of the sensor wiring.

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

If the resistance is correct, check and ensure the continuity of the connections between the sensor connector and the computer connector:
- track 1 of the sensor / track 1 of the computer connector,
- track 2 of the sensor / track 17 of the computer connector.

Also check the insulation between the connections.

Visually check the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all these checks are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

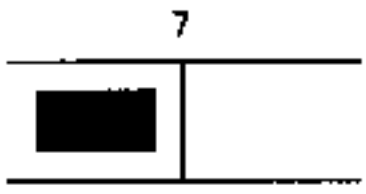
Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, change the computer.

AFTER REPAIR

Erase the computer's memory (G0**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 7 left permanently illuminated

Fiche n° 31

Rear left hand wheel sensor circuit

NOTES

If both bargraphs 7 right and 7 left are illuminated, start by checking the under body connection which links the 2 rear sensors and the computer.

Check the connection and the condition of the sensor wiring.

Check the connections of the intermediate connection under the body (R237).

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

If the resistance is correct, check and ensure the continuity of the connections between the sensor connector and the computer connector:
- track 1 of the sensor / track 14 of the computer connector, (via track B of the under body connection R237)
- track 2 of the sensor / track 21 of the computer connector (via track A of the under body connection R 237).

Also check the insulation between the connections.
Visually check the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all these checks are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

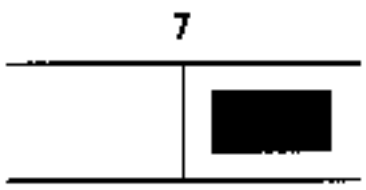
Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, change the computer.

AFTER REPAIR

Erase the computer's memory (G0**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 7 right permanently illuminated

Fiche n° 31

Rear right hand wheel sensor circuit

NOTES

If both bargraphs 7 right and 7 left are illuminated, start by checking the under body connection which links the 2 rear sensors and the computer.

Check the connection and the condition of the sensor wiring.

Check the connections of the intermediate connection under the body (R237).

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

If the resistance is correct, check and ensure the continuity of the connections between the sensor connector and the computer connector:
- track 1 of the sensor / track 5 of the computer connector, (via track B of the under body connection R237)
- track 2 of the sensor / track 13 of the computer connector (via track A of the under body connection R 237).

Also check the insulation between the connections.
Visually check the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all these checks are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

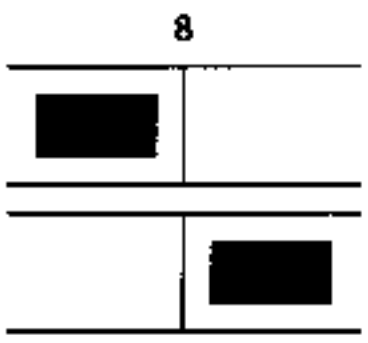
Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, change the computer.

AFTER REPAIR

Erase the computer's memory (G0**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 8 right or left permanently illuminated

Fiche n° 31

Front left hand or front right hand wheel sensor circuit

NOTES

If bargraph 8R or 8L is flashing, refer to the preliminary section.
If bargraphs 6 and 8L are both illuminated, start by dealing with bargraph 6.
If bargraphs 6 and 8R are both illuminated, start by dealing with bargraph 6.

Check the quality of the wheel speed sensor mounting (position and tightening torque).

Check the sensor / target air gap over one wheel revolution: 0.31 < air gap < 1.52.

Check the conformity of the target (condition, number of teeth = 44).

Check the connection and the condition of the sensor wiring.

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

Perform a visual inspection of the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all the tests are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, it may be caused by a solenoid valve operating fault. It is therefore necessary to test the solenoid valves hydraulically using the XR25 test kit with the commands G03*, G04*, G05* and G06* (refer to the "assistance" chapter).

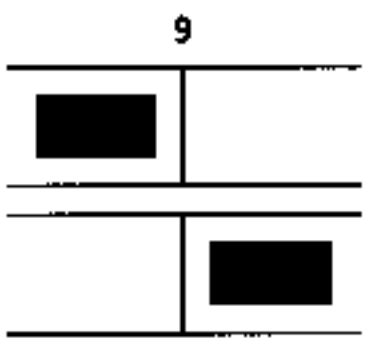
If 10 unlocking / locking cycles are not performed at one of the wheels, replace the hydraulic assembly.

If the hydraulic assembly is not faulty, replace the computer.

AFTER REPAIR

Erase the computer's memory (GO**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 9 right or left permanently illuminated

Fiche n° 31

Rear right or rear left hand wheel sensor circuit

NOTES

If bargraph 9R or 9L is flashing, refer to the preliminary section.
If bargraphs 7 and 9L are both illuminated, start by dealing with bargraph 7.
If bargraphs 7 and 9R are both illuminated, start by dealing with bargraph 7.

Check the quality of the wheel speed sensor mounting (position and tightening torque).

Check the sensor / target air gap over one wheel revolution: 0.21 < air gap < 1.47 (disc brakes).

Check the conformity of the target: condition, number of teeth = 44 (disc brakes).

Check the connection and the condition of the sensor wiring.

Check the connections of the intermediate connection under the body (R237).

If the connector is correct, check the resistance of the sensor at its connector. Change the sensor if its resistance is not approximately 1 Kohm.

Perform a visual inspection of the sensor wiring and check the quality of the connections on the 25 track connector of the computer.

If all the tests are correct, reconnect the computer and the wheel speed sensor then erase the computer's memory.

Exit fault finding (G13*) and perform a road test. Change the sensor if the fault reappears.

If the fault reappears after changing the sensor, it may be caused by a solenoid valve operating fault. It is therefore necessary to test the solenoid valves hydraulically using the XR25 test kit with the commands G03*, G04*, G05* and G06* (refer to the "assistance" chapter).

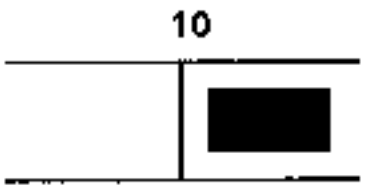
If 10 unlocking / locking cycles are not performed at one of the wheels, replace the hydraulic assembly.

If the hydraulic assembly is not faulty, replace the computer.

AFTER REPAIR

Erase the computer's memory (GO**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 10 right permanently illuminated

Fiche n° 31

Pump motor circuit

NOTES

If bargraph 10 is flashing, refer to the preliminary section.

Check the 60A fuse of the pump motor (next to the battery).

Check the ABS earths (tighten the 2 earth bolts above the hydraulic assembly).

Check the continuity between the 60A fuse and tracks 8 and 9 of the computer connector.

Check the continuity between the ABS earth and track 24 of the computer connector.

Check the connection and the condition of the pump motor connection and the connection between the computer and the motor. In particular, check the position of the connector clips (even if the connector is correctly secured, contact may not be made).

If the connector is correct, check the resistance of the motor coil. Change the hydraulic unit if the resistance is not approximately 1 ohm.

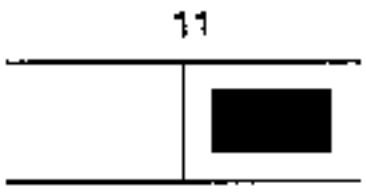
If all the tests are correct, reconnect the computer and the pump motor then erase the computer's memory.

Exit fault finding (G13*) and perform a road test. Changes the computer if the fault reappears.

AFTER REPAIR

Erase the computer's memory (GO**).

Perform a road test, followed by a test using the XR25 test kit.



Bargraph 11 right permanently illuminated Fiche n° 31

Main relay

NOTES

None

Check the condition of the battery terminals and ensure they are tight.

Check the ABS 60A fuse (next to the battery).

Check the ABS earths (tighten the 2 earth bolts above the hydraulic assembly).

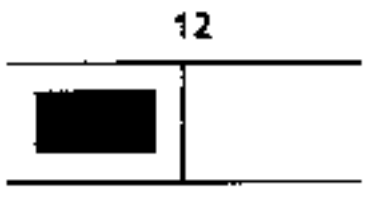
Carry out the necessary operations to obtain a correct voltage between tracks 8/9 and 25 of the computer connector (9.5 volts < correct voltage < 18.5 volts).

If all these tests are correct, reconnect the computer then erase the computer's memory.

Exit fault finding (G13*) and perform a road test. Change the computer if the fault reappears.

AFTER REPAIR

Erase the computer memory (G0**).
After replacing the computer, test with the XR25 again.



Bargraph 12 left permanently illuminated Fiche n° 31

Supply

XR25 assistance: *12 : 1.dEF : Low voltage
2.dEF : Excess voltage

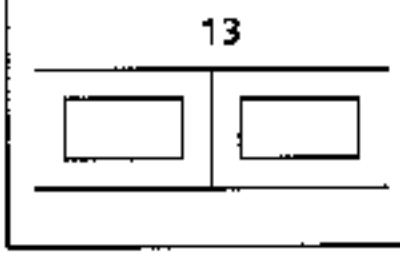
NOTES	None

Carry out the necessary operations to obtain a correct supply voltage for the computer (9.5 volts < correct voltage < 18.5 volts).

- Check the battery charge.
- Check the charging circuit.
- Check the condition of the battery terminals and ensure they are tight.
- Check the ABS earths (tighten the 2 earth bolts above the hydraulic assembly).

Ensure that there is a + after ignition feed on track 22 of the computer connector (5A fuse).

AFTER REPAIR	Erase the computer memory (G0**). Test with the XR25 again.



Bargraph 13 right and left Fiche n° 31

Brake pedal — Illuminated on left if pedal is depressed
Illuminated on right if pedal is not depressed

NOTES

Perform these tests only if the bargraph illumination is not coherent with the pedal position.

Bargraph 13 left extinguished, brake pedal depressed

Bargraph 13 right should therefore be permanently illuminated.

If the stop lights work:
- Check the continuity between track 19 of the P17 connector of the passenger compartment interconnection unit and track 10 of the ABS computer connector.
- Change the passenger compartment interconnection unit if its internal continuity between tracks B4 of the P14 and 19 of the P17 is not correct.

If the stop lights do not work:
- Check the condition and the setting of the stop switch as well as the 15A fuse of the stop lights (on the passenger compartment interconnection unit). Change it if necessary.
- Disconnect the stop switch then check/ensure the presence of a + after ignition feed at track 1 of the connector (continuity between this track 1 and track A1 of the P14 connector of the passenger compartment interconnection unit).
- Check the operation of the stop switch contact (contact when closed between tracks 1 and 3).
- Check and ensure the continuity between track 3 of the connector of the stop switch and track B4 of the P14 connector of the passenger compartment interconnection unit.
- Replace the passenger compartment interconnection unit if the internal continuity between tracks B4 of the P14, B5 of the P13 and 19 of the P17 is not correct.
- Also check the continuity between track 19 of the P17 connector of the passenger compartment interconnection unit and track 10 of the ABS computer connector ((intermediate R36 ABS / dashboard connection for left hand drive, R254 + R255 for right hand drive).

Bargraph 13 left permanently illuminated

- Check the condition and the setting of the stop switch. Change it if necessary.
- Check the operation of the stop switch contact (contact when closed between tracks 1 and 3). Change the stop switch if there is permanent continuity between these 2 tracks.
- Check and ensure the 12 volt insulation of the connection between track 3 of the stop switch connector and track 10 of the ABS computer connector.
  Intermediate connections (links inside the passenger compartment interconnection unit) :
  - track B4 of the P14 connector,
  - track 19 of the P17 connector.
  Intermediate connection: R36 ABS / dashboard on track 11 (R254 track 2 + R255 track 11 for right hand drive).

AFTER REPAIR

Perform a road test, then check using the XR25 test kit.

NOTES	Only carry out conformity checks after a complete test using the XR25 test kit.

Order of operations	Function to be checked	Action	Bargraph	Display and comments
1	XR25 test kit dialogue	D11 (selector on S8)		320.5
2	Operation of the warning light Computer initialisation check	When ignition switched on		Warning light illuminated for 3 seconds when ignition switched on (refer to the fault finding if it remains illuminated or if it does not illuminate).

NOTES Only consult this customer complaint chart after a complete check using the XR25.

FAULTS NOTED BY WARNING LIGHT OPERATION

ABS warning light does not illuminate for 2 s. when ignition turned on	Chart 1
ABS warning light permanently illuminated when ignition is on	Chart 2
ABS warning light illuminates again when the engine has been started	Chart 3
ABS warning light illuminates intermittently while driving	Chart 4

FAULTS NOTED DURING BRAKING WITH ABS REGULATION

One or more wheels lock	Chart 5
Pulling	Chart 6
Wandering	Chart 7
Unexpected ABS operation at low speed and low pedal effort	Chart 8
Unexpected ABS operation on poor road surfaces	Chart 9
Unexpected ABS operation when using special equipment (radio telephone, CB, ...)	Chart 10
Brake pedal travel increases after regulation (with irregular pedal when regulation began)	Chart 11
Spongy pedal	Chart 12
Vibrations / jerky operation of the brake pedal	Chart 13
Noise from the pump, pipes or hydraulic assembly	Chart 14

OTHER CASES

ABS warning light does not illuminate, computer disconnected	Chart 15
No communication with ABS computer	Chart 16

Chart 1	FAULTS NOTED BY WARNING LIGHT OPERATION ABS warning light does not illuminate for 2 s. when ignition turned on
NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Turn the ignition off.
Disconnect the computer,
then turn the ignition on again.
Does the warning light illuminate?

yes → Test the connections on the 25 track connector.
Replace the computer if the fault persists.

no ↓

Check the 15A AP10 fuse on the passenger compartment connection unit.
Check the condition of the warning light bulb. Ensure continuity of the line between track 16 on the computer connector and the warning light.
Intermediate connection: R36 14 tracks in scuttle panel on track 10
(if right hand drive: R255 track 10 + R254 track 3 grey module).

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 2	FAULTS NOTED BY WARNING LIGHT OPERATION ABS warning light permanently illuminated when ignition is on

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Disconnect the computer and check the position of the shunt in the 25 track connector (between track 16 and track 24). Check the shunt opening pin between tracks 16 and 24 on the computer connector is present at the computer end.

Reconnect the computer.
Check if there is continuity between track 10 of connection R36 14 tracks on the engine compartment side (close to the battery) and earth. On right hand drive vehicles, the test is made between track 10 of R255 ABS / scuttle panel.
Is the continuity correct?

yes → Look for a fault at the shunt or a short circuit to earth on the line between track 16 on the computer connector and Track 10 on R36 (Track 10 on R255 for right-hand drive vehicles).

no ↓

Look for a short circuit to earth of the line between track 10 of connection R36 and the ABS warning light (track 10 of R255 for a right hand drive vehicle).

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 3	FAULTS NOTED BY WARNING LIGHT OPERATION ABS warning light illuminates again when the engine has been started

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Check the computer feed voltage : 9.5 volts < correct voltage < 18.5 volts.

If necessary, carry out the following operations:
- check the battery charge (check the charging circuit if necessary),
- check the tightness of the battery terminals,
- check the ABS earths (tightness of the two earth bolts above the hydraulic assembly).

Disconnect the computer and check the condition of the connections and the positioning of the shunt in the 25 track connector (between track 16 and track 24).

On the computer end, check the shunt opening pin between tracks 16 and 24 on the connector.

Also check the connections on connection R36 near to the battery (R254 + R256 for right hand drive vehicles).

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 4	FAULTS NOTED BY WARNING LIGHT OPERATION ABS warning light illuminates intermittently while driving

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Check the computer feed voltage : 9.5 volts < correct voltage < 18.5 volts.

- check the battery charge (check the charging circuit if necessary),
- check the tightness of the battery terminals,
- check the ABS earths (tightness of the two earth bolts above the hydraulic assembly).

Disconnect the computer and check the condition of the connections and the positioning of the shunt in the 25 track connector (between track 16 and track 24).

On the computer end, check the shunt opening pin between tracks 16 and 24 on the connector.

Also check the connections on connection R36 near to the battery (R254 + R256 for right hand drive vehicles).

Carry out a complete check of the speed sensor circuits (condition of connections, wiring , ...) looking for an intermittent short circuit or open circuit at low speed (< 25 mph (40 km/h)).

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 5	FAULTS NOTED DURING BRAKING WITH ABS REGULATION One or more wheels lock

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Reminder: Locking of the wheels on a vehicle fitted with ABS or tyre squeal, which the driver perceives to be the wheels locking, may be due to the normal reactions of the system and should not be automatically considered as a fault:

- locking permitted below 3.75 mph (6 km/h) (system is not active),
- braking with ABS regulation on a very poor road (high degree of tyre squeal).

On the other hand, if the wheels really are locking, lift the vehicle so that the wheels may be turned and check :

- For a possible incorrect speed sensor connection.
  Use functions #01, #02, #03 and #04 while turning the respective wheels and check the results are coherent.
  If the value measured is zero, turn the other wheels to confirm an incorrect sensor electrical connection and repair the wiring.
- For a possible inversion of the pipes at the hydraulic assembly.
  Use functions G03*, G04*, G05* and G06* while pressing the brake pedal and check for the 10 locking / unlocking cycles at the appropriate wheel.
  If the 10 cycles are not performed at the wheel tested (wheel remains locked), check to see if they are being performed at another wheel (confirmation of an incorrect connection : repair).
  If the 10 cycles are not performed at a wheel and the pipe connections are correct, replace the hydraulic assembly.
  Check the condition of the ABS targets and their conformity.
  Also check the target / sensor gap over one rotation of each of the wheels:
  Front 0.3 mm < gap over one rotation < 1.5 mm
  Rear 0.2 mm < gap over one rotation < 1.5 mm (for disc brakes)

If the fault persists after these tests, replace the hydraulic assembly.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 6	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Pulling

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Remove the 5A ABS fuse from the passenger compartment connection unit and carry out a road test with the ABS non operational.
Does the fault persist under these conditions?

yes → If the brake pedal travel is relatively long, bleed the braking circuit.
If the brake pedal travel is normal, check the tyre inflation pressures, the front axle assembly and check for any leaks in the circuit.

no ↓

Lift the vehicle so the wheels may be turned and check for :
- a possible incorrect speed sensor connection,
- a possible incorrect pipe connection on the hydraulic assembly.

For both these tests, use the methods described in Chart 5.
Check the condition of the ABS targets and their conformity. Also check the target / sensor gap over one rotation of each wheel. If the fault persists, replace the hydraulic assembly.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 7	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Wandering

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Remove the 5A ABS fuse from the passenger compartment connection unit and carry out a road test with the ABS non operational.
Does the fault persist under these conditions?

yes → Road holding fault not connected with the ABS system.
Check the condition and conformity of the brake linings, check the tyre inflation pressures and front axle assembly, ...

no ↓

Normal behaviour connected to the operation of the system during the regulation phase, mainly under conditions of asymmetrical adherence or on poor road surfaces.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 8	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Unexpected ABS operation at low speed and low pedal effort

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Vibration or jerky pedal action may be experienced at the brake pedal. This is connected to the reactions of the system under particular circumstances :

- crossing speed bumps,
- tight bends when the inner rear wheel lifts.

If the fault occurs under other circumstances, check the speed sensor connections (micro-cuts) and the gaps.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 9	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Unexpected ABS operation on poor road surfaces

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

On poor road surfaces it is normal to notice vibrations and jerky pedal action as well as a higher than normal degree of tyre squeal than for good road surfaces.

The resulting impression of a variation in efficiency is normal.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 10	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Unexpected ABS operation when using special equipment (radio telephone, CB, ...)

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Check that this equipment has been correctly fitted with no modification to the original wiring, especially that for the ABS system.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 11	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Brake pedal travel increases after regulation (with irregular pedal when regulation began)

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Air in the hydraulic assembly regulation pipes to the braking circuits.

Bleed the brake circuits following the procedure in the Workshop Repair Manual, then use commands G03* to G06* on the XR25.

After the operation carry out a road test with ABS regulation.

If the fault persists, repeat the operation once or twice more.

If the customer complaint is particularly serious, and bleeding has not improved the situation, replace the hydraulic assembly.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 12	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Spongy pedal

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Air in the braking circuits.

Bleed the system following the instructions in the Workshop Repair Manual.

Repeat the operation if necessary.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 13	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Vibrations / jerky operation of the brake pedal

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Normal brake pedal reaction during ABS regulation.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 14	FAULTS NOTED DURING BRAKING WITH ABS REGULATION Noise from the pump, pipes or hydraulic assembly

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

- **Vibration of the assembly**: check the rubber mounting blocks for the assembly are fitted and are in good condition
- **Vibration of the pipes**: check that the pipes are correctly clipped into their mountings and there is no contact between pipes or between pipes and the bodywork.

To determine the source of the noise, use functions G03*, G04*, G05* and G06* on the XR25.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 15	OTHER CASES ABS warning light does not illuminate, computer disconnected

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Disconnect the ABS computer.
Check for the shunt between tracks 16 and 24 on the computer connector.

Ensure continuity between track 24 on the computer connector and the ABS earth.

AFTER REPAIR	Carry out a road test then check using the XR25.

Chart 16	OTHER CASES No communication with ABS computer

NOTES	Only consult this customer complaint chart after a complete check using the XR25.

Ensure the XR25 is not faulty by trying to communicate with the computer on another vehicle.

Check the ISO interface is set to position S8, that the latest XR25 cassette and the correct access code are being used.

Check the battery voltage and carry out any operations necessary to ensure a correct voltage is obtained (9.5 volts < Battery voltage < 18.5 volts).

Check the presence and condition of the ABS fuse in the passenger compartment connection unit (5 A).

Check the connection of the computer connector and the condition of its connections.

Check the connection of the 14 track connection R36 ABS / Dashboard (R254 + R255 for RHD) in the scuttle panel near the battery and check the condition of the connections.

Check the ABS earths (tightness of the two earth bolts above the hydraulic assembly).

Check the computer is correctly fed:
- earth on tracks 25 and 24 of the 25 track connector,
- + after ignition on track 33 of the 25 track connector.

Check the diagnostic socket is correctly fed:
- + before ignition on track 16,
- earth on track 5.

Check the continuity and insulation of the lines between the diagnostic socket / ABS computer:
- between track 20 on the computer connector and track 15 on the diagnostic socket,
- between track 6 on the computer connector and track 7 on the diagnostic socket.

If dialogue still cannot be established after these tests, replace the ABS computer.

AFTER REPAIR	Carry out a road test then check using the XR25.

USING THE COMMAND MODES

Operating the solenoid valves for hydraulic testing : G03* to G06*

Lift the vehicle so the wheels may be turned and check they are free to move.
Hold the brake pedal down to prevent the wheel being tested from turning when rotated by hand (do not apply too great a pressure to the pedal - ensure the wheel is at the locking limit).

Enter G0X* ⟶ 10 locking / unlocking cycles should be noted at the wheel concerned.

Operating the pump motor: G08*

Enter G08* ⟶ The motor should operate for 2 seconds.