

SAAB

900

**SERVICE
MANUAL**

6 **Front assembly
Steering device**

M 1979-82

Specifications

Wheel alignment

Front wheel alignment (unladen)

"King pin" inclination

Caster

Camber

Toe-in, measured at rim

Turning angles

Outer wheel

Inner wheel

Slip radius

163 SR 15, 3"

175/70 HR 15, 3"

165 HR 15, 5 1/2"

180/65 HR 390, 1 1/2"

195/60 HR 15, 5 1/2"

185/65 SR 15, 3"

Rear wheel alignment

Toe-in

Camber

Wheelbase

Up to chassis no:

AB1019263

AB2006762

ABX007213

AB6004139

As from chassis no:

AB1019264

AB2006763

ABX007214

AB6004140

Steering mechanism

Steering wheel turns, lock to lock

Length steering wheel axle

Adjustment of manual steering

Adjustment of plunger

Steering gear torque (pinion torque)

Adjustment of ball joint

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644 Power steering

EMS

3.5

Specifications

Wheel alignment

Front wheel alignment (unladen car)

Deviation power steering

"King pin" inclination	$11 \frac{1}{2}^{\circ} \pm 1^{\circ}$	
Caster	$+ 1^{\circ} \pm \frac{1}{2}^{\circ}$	$+ 2^{\circ} \pm 1^{\circ}$
Camber	$+ 1/2^{\circ} \pm 1/2^{\circ}$	
Toe-in, measured at rims	$0.08 \pm 0.04"$ (2 ± 1 mm)	
Turning angle:		
Outer wheel	20°	
Inner wheel	$20 \frac{3}{4}^{\circ} \pm 1/2^{\circ}$	
Slip radius 165 SR 15, 5"	0.55" (14 mm)	
175/70 HR 15, 5"	0.59" (15 mm)	
165 HR 15, 5 1/2"	0.75" (19 mm)	
180/65 HR 390, 135 mm	0.63" (16 mm)	
195/60 HR 15, 5 1/2"	0.83" (21 mm)	
185/65 SR 15, 5"	0.63" (16 mm)	

Rear wheel alignment

Toe-in	0.08-0.24" (2-6 mm) (if possible each side should be measured individually, i.e. 0.04-0.12" (1-3 mm) per side).
Camber	$- 1/2^{\circ} \pm 1/4^{\circ}$ (negative camber)

Wheelbase

Up to chassis no: AB1019263 AB2006762 AB3007213 AB6004139	$99.4 \pm 0.4"$ (2525 ± 10 mm)
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As from chassis no: AB1019264 AB2006763 AB3007214 AB6004140	$99.1 \pm 0.4"$ (2517 ± 10 mm)
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Steering mechanism

	Power steering	EMS
Steering wheel turns, lock to lock	4.2	3.6
Length steering wheel axle	$16.46 \pm 0.04"$ (418 ± 1 mm)	3.5

Adjustment of manual steering gear

Adjustment of plunger

Steering gear torque (=pinion torque)	0.8-1.7 Nm (7-24 in.lb, 8-17 kpcm)
Adjustment of ball joint	The rod should be moveable to its full limit in all directions without seizing. If the rack is kept in a horizontal level the ball joint should be tightened so that the rod can be put in any position with the ball joint mounted without falling down of its own weight.

Clearance between cover and plunger
0.002-0.006" (0.05-0.15 mm)
0.8-1.7 Nm (7-24 in.lb, 8-17 kpcm)
The rod should be moveable to its full limit in all directions without seizing. If the rack is kept in a horizontal level the ball joint should be tightened so that the rod can be put in any position with the ball joint mounted without falling down of its own weight.

Ball joint, lubrication

Lubricant, type

Lubricant, quantity

Tightening torques:

Tie rod end lock nut

Tie rod end, ball joint to steering arm

Inner ball joint lock nut

Screws in cover

Steering gear installation

Clamp screw, steering shaft joint

Steering wheel nut

Inner ball joint, should be lubricated when fitted with Saab Special grease (Esso EF 125 or similar lubricant).

Liquid grease (BP Energrelase FGL)

0.15 dm³ (5 fl.oz., 1.5 dl)

60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)

50-60 Nm (35-44 ft.lb., 5.0-6.0 kpm)

45-50 Nm (30-36 ft.lb., 4.5-5.0 kpm)

16-20 Nm (12-15 ft.lb., 1.6-2.0 kpm)

60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)

35-42 Nm (26-30 ft.lb., 3.5-4.2 kpm)

30 Nm (22 ft.lb., 3.0 kpm)

Adjustment of power steering gear

Adjustment of plunger

Screw plunger tight, then back off 70-90°.

Check that the cog rod does not stick in any position.

Not adjustable. Shall be replaced if play arise.

Ball joints

Permissible wear:

Ball joint, front suspension

Tie rod end

Ball joint, steering unit

End float

2 mm

2 mm

1 mm

Radial play

1 mm

1 mm

-

Lubricant, type

Lubricant quantity

Servo oil, type

Servo oil, quantity

Servo oil, level

Litiumgrease type Shell EP B2 Code 71303

2.1 oz (60 g)

Texaco power steering fluid 4634

0.85 Imp.quart (0.75 dm³)

According to dip stick. Fill if level is below the "ADD" mark. There are maximum marks for cold oil and hot oil as well.

Tightening torques:

Tie rod end lock nut

Tie rod end, ball joint to steering arm

Steering gear installation screws

Clamp screw, steering shaft

Steering wheel nut

Connection joints hydraulic lines

60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)

50-60 Nm (35-44 ft.lb., 5.0-6.0 kpm)

60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)

35-42 Nm (26-30 ft.lb., 3.5-4.2 kpm)

27 Nm (19 ft.lb., 2.7 kpm)

20-34 Nm (15-25 ft.lb., 2.0-3.4 kpm)

Tie rod ends

Distance from end of thread to lock nut:

Manual steering

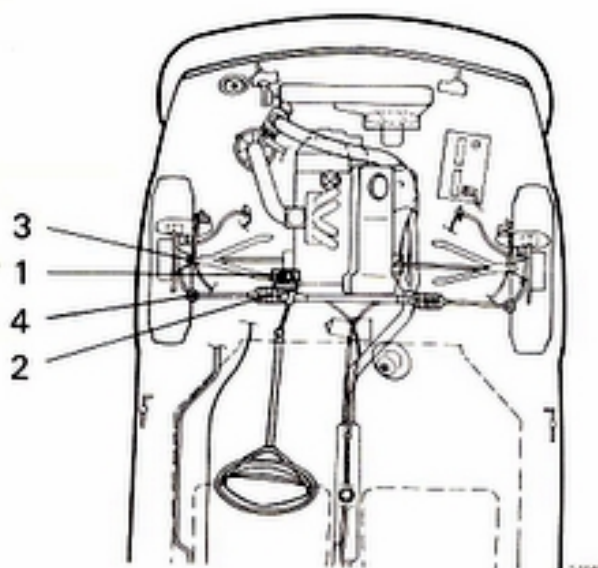
Power steering

Max. permissible difference between above measurements on both sides

0.94" (24 mm)

1.0" (25 mm)

0.08" (2 mm)

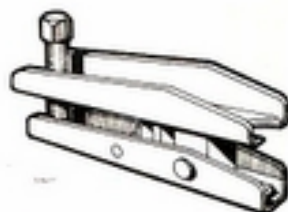


Point	Lubrication point	Lubricant
1	Power steering, hydraulic fluid reservoir	GM Saginaw hydraulic oil (Texaco power steering fluid 4634) Part no. (45) 30 09 800
2	Manual steering gear rack, pinion and bearings inner ball joint Power steering gear	BP Energrease FGL Part no. (45) 30 08 703 Molybdenum paste Part no. (45) 30 06 632 Litiumgrease Shell EP B2 (Shell Retinax A) or similar
3	Steering knuckle joints	Saab Special chassis grease (Esso EF 125)
4	Tie-rod end assemblies	Saab Special chassis grease (Esso EF 125)

Special tools



78 41 067 (A2) Sleeve



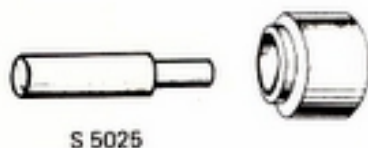
89 95 409 (A1) Puller, removal of tie rod ends and ball joints



78 41 331 (A2) Pressing tool, upper rubber bushing in control arm bearing



89 95 813 (A3) Installation tool, bellows steering wheel shaft



78 41 349 (A2) Pressing tool, lower rubber bushing in control arm bearing



89 95 839 (A1) Spring tool cpl., removal and installation of front spring

- 89 95 847 Spring scissors
- 89 95 854 Spring cup L
- 89 95 862 Spring cup R
- 89 95 714 Screw cpl.
- 89 95 128 Ball bearing



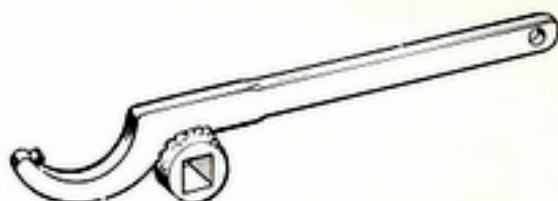
83 90 197 (A2) Key, removal of outer bearing cap



89 96 258 (A0-2) Steering wheel puller



89 96 399 (A2) Removing yoke, inner hydraulic seal, power steering gear



89 96 472 Hook wrench, removal and installation of totally enclosed ball joint, manual steering unit.



89 96 407 (A2) Pressing sleeve
I. For installing sealing ring between servo valve and pinion.
II. Insertion of housing when removing circlip, servo cylinder



89 96 480 Wrench, removal and installation of ball joint, servo assisted steering



89 96 415 (A2) Installation tool, pulley, servo pump



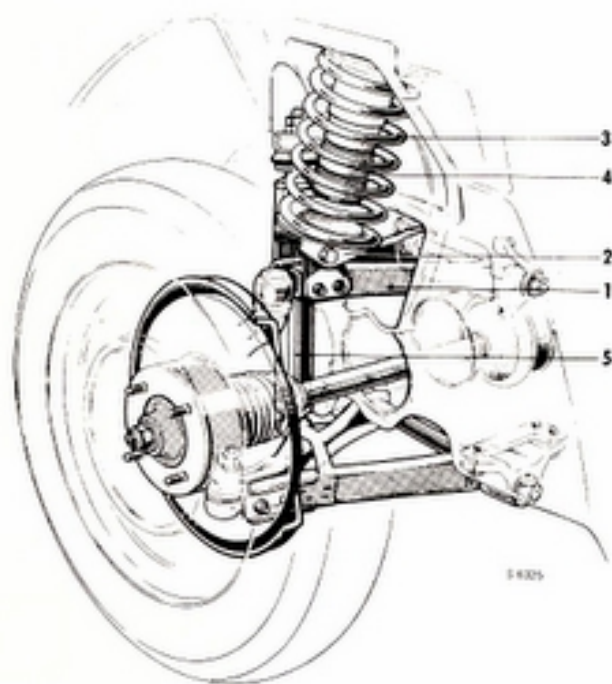
89 96 423 (A2) Puller, pulley servo pump

General

Front wheel suspension

The front wheels have independent suspension and the hub and drive shafts are mounted in bearings in the steering knuckle

housing. The steering knuckle housings are connected to the control arms by means of permanently lubricated ball joints. The inner ends of the control arms are seated in rubber bearings at the body.



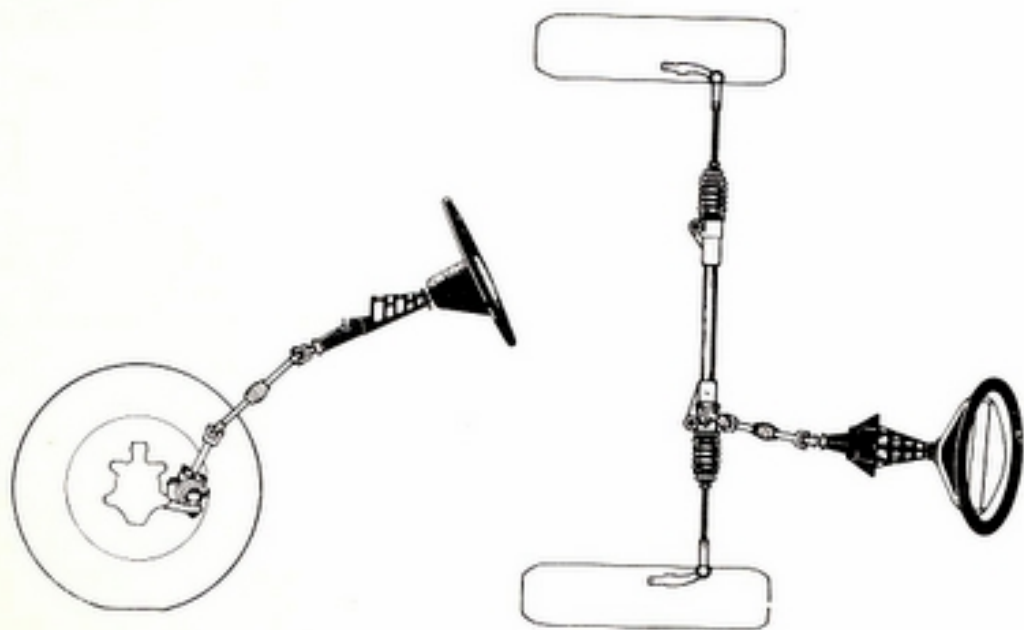
Front wheel suspension

1. Upper control arm
2. Lower spring seat
3. Coil spring
4. Rubber buffer
5. Shock absorber

Steering gear

The steering gear is of the rack and pinion type and has a purely mechanical version and a power-assisted version. Tie rods and tie rod ends connect the steering gear to the steering arms, which are bolted to the

steering knuckle housing. The steering column assembly consists of a steering wheel, steering column (mounted in a steering joint) and an intermediate shaft, linking the steering column with the steering gear.



Wheel alignment

Checking and adjustment

If there is reason to suspect that the front wheel alignment is faulty, which manifests itself through abnormal tyre wear, impaired steering and road-holding characteristics, etc., the following action should be taken:

1. Check that the tires are inflated to the correct pressure and that one front tire is not much more heavily worn than the other.
2. Check the front wheel bearings, control arm bearings, steering knuckle joints and tie-rod joints, and adjust or exchange parts as necessary to eliminate any faults of alignment that may be due to worn components.
3. Check the steering gear and make good any defects (see section 642).
4. Check the operation of the shock absorbers and exchange damaged shock absorbers and rubber bushings.
5. If the car has been involved in a collision, crash, etc., any resulting damage must be repaired before wheel alignment is measured. If the suspension control arms are bent no attempt must be made to straighten them, they must be replaced by new ones.
6. Just before the measurements are made, the car should be driven without hard cornering and with normal suspension movement to work the wheels into their natural positions. For the same reason, the car should be rocked up and down a few times on its springs.

When the measurements are made, the car should be empty and should be standing on a flat horizontal surface; this is the only way to get reliable readings. Adjustment with the help of spacers must be kept within reasonable limits. If there are any deformations due to body damage, the body must be straightened up properly. If the suspension control arms are bent out of true, they must be replaced by new ones. For checking the wheel alignment there are various instruments, which are fitted either on the rim or directly on the axle. Each instrument has its own instruction manual explaining exactly how it is to be used.

Note

With front-wheel-drive cars it is important that the wheels are immobilized by the brakes while the measurements are being made in cases where the wheels are set up on turntables or the like, or when a measuring instrument is mounted on the end of the axle.

Warning

When the car is on a hoist, do not seize a front wheel and twist it by main force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.

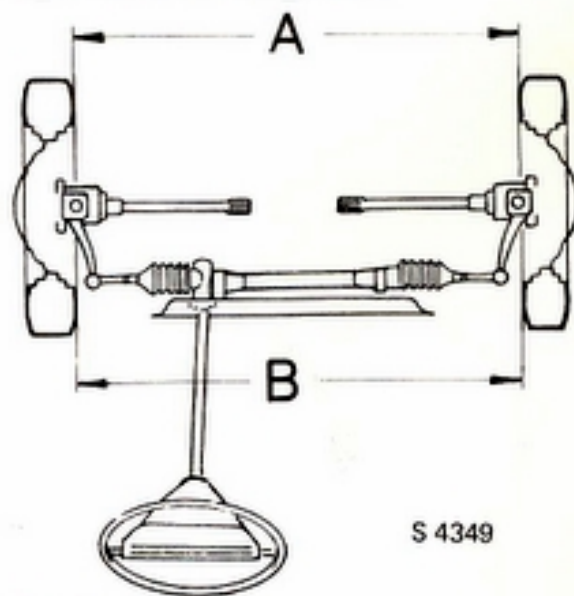
Toe-in

Seen from above, the wheels run at a certain angle to each other. Measurements A and B, made from rim to rim level with the axles, must bear a given relationship to each other (see illustration). If A is smaller than B, the wheels are said to converge or toe in, and if A is greater than B, the wheels diverge or toe out.

Wheel toe-in or toe-out is expressed in fractions of an inch or millimeters, being the difference between A and B.

Toe-in is zero if the wheels are parallel, in which case both measurements are exactly the same.

The correct toe-in is as follows:
 2 ± 1 mm i.e. $B - A \ 2 \pm 1$ mm.



S 4349

Toe-in

Checking adjustment by means of measuring tool:

1. Roll the car straight forward on a level floor and stop it without using the brakes. It must not be moved backward after this.
2. Take a reading of measurement A with the toe-in gauge between the front wheel rims level with the axles. Mark the measurement points with chalk. Roll the car forward until the chalk marks are level with but behind the axles, and take a reading of B.
Any necessary adjustment is made by altering the length of the tie rod.
3. Undo the nut on the outer end of the tie rod and the outer clip on the steering gear rubber bellows.
4. Use a suitable pair of grippers to twist the tie rod right or left, adjust until the toe-in is right. Hold the bellows during the twisting.

For adjustment using toe-in equipment refer to the instructions accompanying the equipment.



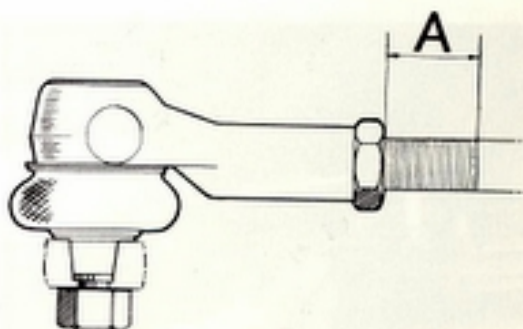
Adjusting the tie rod

Note

With the correct toe-in and the wheels line up straight ahead, both tie rods should be the same length - or so adjusted that both wheels have the same clearance to the fenders and wheel housings at full right and left lock respectively. Check also that the steering wheel spokes are horizontal when the front wheels are pointing straight ahead. Do not forget to tighten the tie rod nut after adjusting.

Note

After adjustment of toe-in, the free length of thread on the tie rod (length A, see illustration) must not on any account be more than 24 mm (power steering gear 25 mm). The free thread lengths (A) on both tie rods must not differ from each other by more than 5 mm.



Checking the tie-rod length

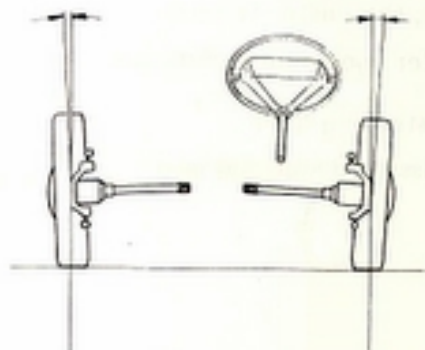
A = 24 mm max (power steering 25 mm max)

The maximum permissible difference between the value dimension A on the two sides of the car is 5 mm.

Tightening torque, lock nut
60-80 Nm (6-8 kpm)

Camber

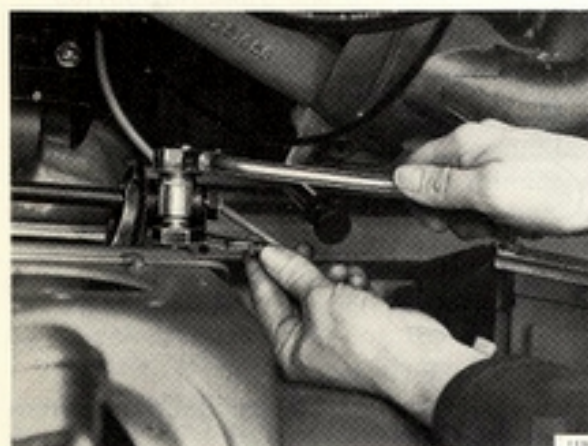
Camber is the angle by which the center-lines of the wheels lean from the vertical (see illustration). The camber is positive (+) if the wheels lean outward, and negative (-) if they lean inward. The correct front-wheel camber is $+ 1/2^{\circ} \pm 1/2^{\circ}$.



S 4351

Camber

The camber, and with it the "king pin" angle, can be adjusted with spacers placed under the two bearing brackets of the upper control arms. The desired result can thus be obtained by increasing or reducing the number of spacers used. To increase or reduce camber, use the same number of spacers under both brackets. The rear bearing bracket is available in a lower design that gives bigger adjustment possibilities. See the spare parts catalogue.



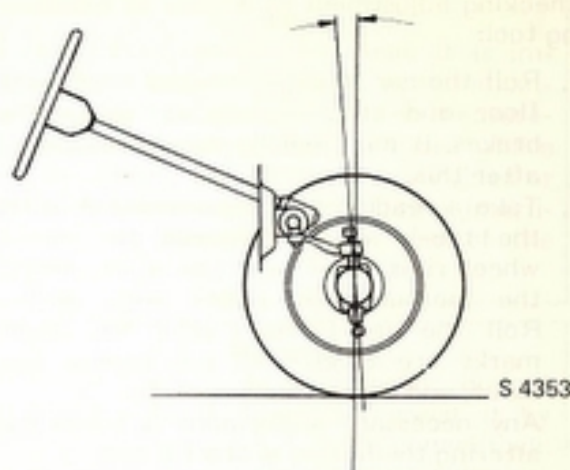
Location of camber adjustment spacers

Caster

The caster is the angle by which the king pin axis departs from the vertical when viewed from the side and is generally expressed in degrees. Caster varies a great deal from one type of car to another, although in most cases the "king pin" leans backward as illustrated below; in such cases the caster is said to be positive (+), whereas if the "king pin" leans forward the caster is negative (-). If the "king pin" is vertical, the caster is zero.

The caster should be as follows:

Manual steering gear	$+ 1^{\circ} \pm 1/2^{\circ}$
Power-assisted steering gear	$+ 2^{\circ} \pm 1/2^{\circ}$



Caster

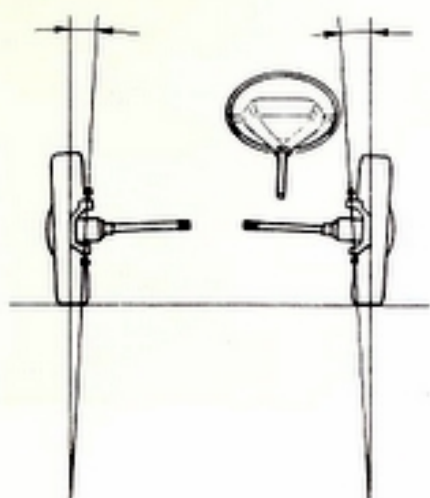
If the caster angle needs adjusting, this is done with the help of spacers placed under the bearing brackets of the upper control arms.

To increase the caster, transfer spacers from the front bracket to the rear bracket. To reduce the caster, transfer spacers from the rear bracket to the front bracket. In either case, the total spacer thickness removed from one bracket must be added to the other one.

Spacers for caster adjustment are supplied in thicknesses of 0.5, 1.0 and 2.0 mm (0.02", 0.04" and 0.08").

"King pin" inclination

The car does not have king pins as such; the wheels pivot on two ball joints instead. It is thus more correct in this case to speak of the steering knuckle axis, i.e. the line passing through the centers of the ball joints and intersecting the ground near the wheel centerline. The steering knuckle axis should incline sideways from the vertical by $11 \frac{1}{2}^{\circ} \pm 1^{\circ}$.



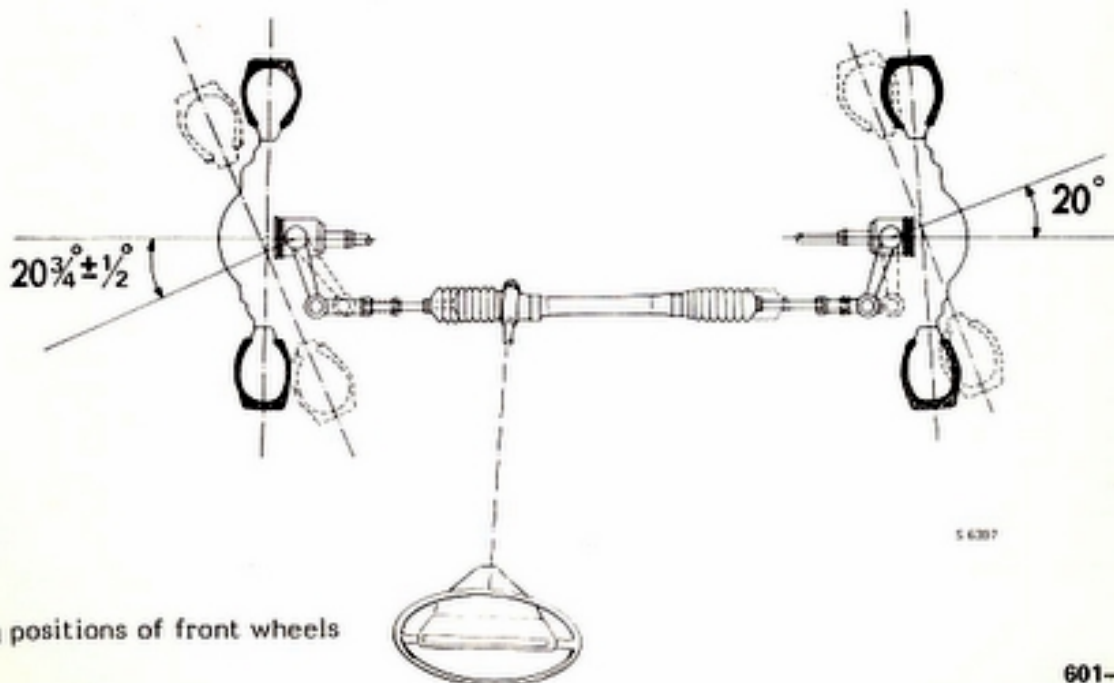
S 4354

"King pin" inclination

When the wheel camber is adjusted, the inclination of the steering knuckle axis is automatically altered by the same amount at the same time. The latter angle cannot be adjusted independently, as it is determined by the dimensions of the steering knuckle housing. If the steering knuckle axis is found to be out of true when the camber is correctly adjusted, this indicates that there is something wrong with the steering knuckle housing, which should therefore be exchanged.

Wheel turning angles

Wheel alignment which allows perfect running of all four wheels on bends varies somewhat depending on speed and the sharpness of the bend owing to suspension movement and tire deformation.



S 6307

Cornering positions of front wheels

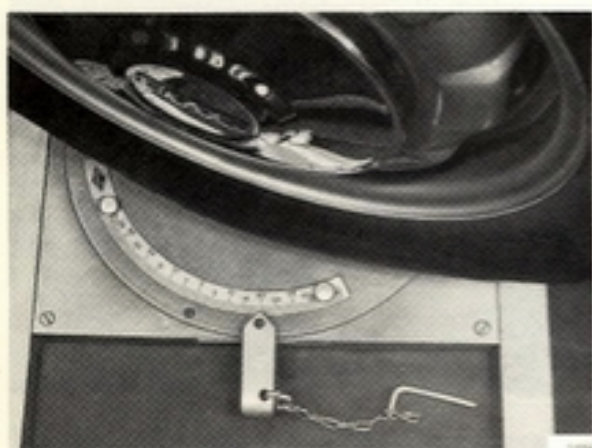
The turning angles have been adapted to the most common driving conditions.

As the tie-rods point slightly inwards in relation to the travelling direction (driving straight ahead), the steering angle of the inside wheel on a bend will be slightly greater.

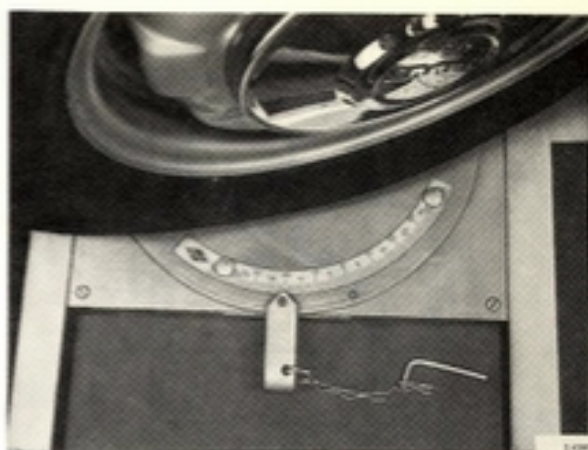
Before the wheel turning angles are measured, the toe-in must be correctly adjusted. To measure the turning positions, use two turntables of standard type with scale graduations combined with optical measuring equipment (see illustration).

The centers of the turntables must be placed as close as possible under the pivoting centers of the wheels.

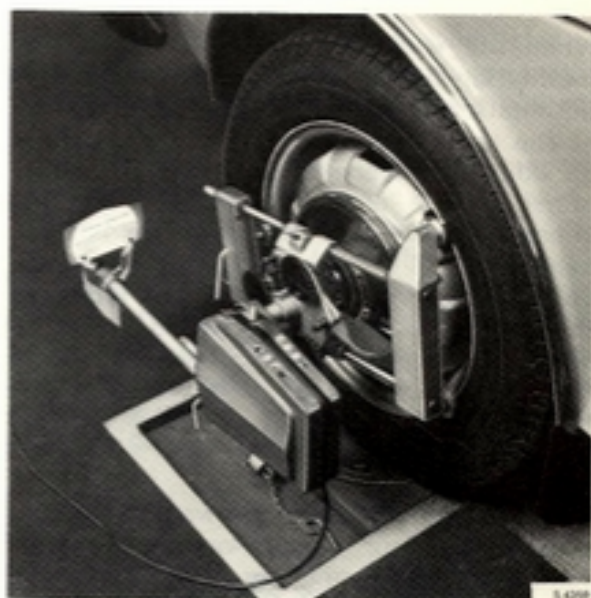
Turn the steering wheel to the left until the right wheel, i.e. the outer wheel, shows a deflection of 20° . If the cornering adjustment is correct, the inner wheel should show a deflection of $20 \frac{3}{4}^{\circ} \pm 1/2^{\circ}$. Then make the same measurement with the wheels turned to the opposite side. If the measurements reveal that the cornering adjustment is wrong, one or both steering arms be out of true. Defective steering arms must not be bent back to shape, they must be replaced.



Outer wheel 20°



Inner wheel $20 \frac{3}{4}^{\circ} \pm 1/2^{\circ}$



Optical measuring equipment

Wheel alignment table

The following table can be used as an aid to the adjustment of wheel alignment angles.

Camber - caster

The table is used as follows:

- Measurement of the front wheel angles gives readings of, for example
 camber $1 \frac{1}{4}^{\circ}$
 caster $1 \frac{1}{2}^{\circ}$
 on a car with manual steering gear.

- Find the box in the table where the row and column respectively for these two values intersect, and read off:

F + 5

B + 3

which means:

Front (F) bearing bracket spacers to be increased (+) by 5 mm.

Back (B) bearing bracket spacers to be increased (+) by 3 mm.

- Changing the spacers as indicated will correct both camber and caster angles simultaneously.

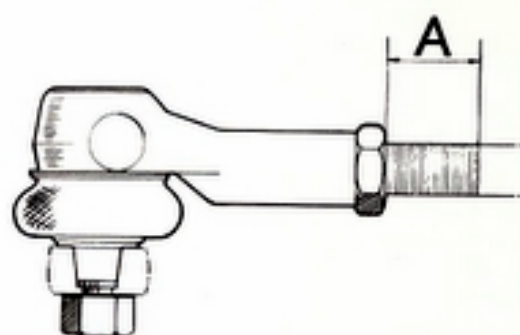
4.

The figures enclosed by the broken lines in the table are within the permitted tolerances; no adjustment is needed in these cases.

Caster ° MANUAL STEERING GEAR													
	-1/2	-1/4	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2
Camber °	1 3/4	F+3 B+7,5	F+3 B+7	F+3,5 B+6,5	F+4 B+6,5	F+4,5 B+6	F+5 B+6	F+6 B+6	F+6,5 B+5	F+7 B+5,5	F+7 B+5	F+7,5 B+4,5	F+8 B+4
	1 1/2	F+2 B+6,5	F+2 B+6	F+2,5 B+5,5	F+3 B+5,5	F+3,5 B+5	F+4 B+5	F+5 B+5	F+5,5 B+4,5	F+6 B+4	F+6,5 B+3,5	F+7 B+3	F+7 C+2,5
	1 1/4	F+1 B+5	F+1,5 B+5	F+1,5 B+4,5	F+2 B+4,5	F+2,5 B+4	F+3 B+4	F+4 B+4	F+4,5 B+3,5	F+5 B+3	F+5,5 B+2,5	F+6 B+2	F+6 B+1,5
	1	F-0,5 B+4	F±0 B+4	F+0,5 B+3	F+1 B+3	F+1 B+2,5	F+1,5 B+2,5	F+2 B+2	F+3 B+2	F+3,5 B+2	F+4 B+1,5	F+4,5 B+1,5	F+4,5 B+1
	3/4	F-1,5 B+3	F-1 B+2,5	F-1 B+2	F-0,5 B+2	F±0 B+1,5	F+0,5 B+1,5	F+1 B+1	F+1,5 B+1	F+2 B+0,5	F+2,5 B+0,5	F+3 B±0	F+3,5 B-0,5
	1/2	F-3 B+2,5	F-3 B+2	F-2,5 B+1,5	F-2 B+1	F-1 B+0,5	F-0,5 B+0,5	Correct value	F+0,5 B-0,5	F+1 B-0,5	F+2 B-1	F+2,5 B-1,5	F+3 B-2
	1/4	F-4 B+1	F-3,5 B+0,5	F-3 B±0	F-2,5 B-0,5	F-2 B-0,5	F-1,5 B-1	F-1 B-1	F-0,5 B-1,5	F±0 B-1,5	F+0,5 B-2	F+1 B-2	F+1 B-2,5
	0	F-0 B-0,5	F-4,5 B-1	F-4,5 B-1,5	F-4 B-1,5	F-3,5 B-2	F-3 B-2	F-2 B-2	F-1,5 B-2,5	F-1 B-2,5	F-1 B-3	F-0,5 B-3	F±0 B-4
	-1/4	F-6 B-1,5	F-6 B-2	F-5,5 B-2,5	F-5 B-2,5	F-5 B-3	F-4,5 B-3,5	F-4 B-4	F-3 B-4	F-2,5 B-4	F-2 B-4,5	F-1,5 B-4,5	F-1,5 B-5
	-1/2	F-7 B-2,5	F-7 B-3	F-6,5 B-3,5	F-6 B-3,5	F-6 B-4	F-5,5 B-4,5	F-5 B-5	F-4 B-5	F-3,5 B-5	F-3 B-5,5	F-2,5 B-5,5	F-2 B-6
	-3/4	F-8 B-4	F-8 B-4,5	F-7,5 B-5	F-7 B-5	F-7 B-5,5	F-6,5 B-5	F-6 B-6	F-5 B-6	F-4,5 B-6	F-4 B-6,5	F-3,5 B-6,5	F-3 B-7
Caster ° POWER STEERING GEAR													
	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2

Toe-in measured on the rim

Read value of toe-in		Screw tie rod in or out the following number of turns
Toe-out in mm	6	1 3/5 out
	5	1 2/5 out
	4	1 1/5 out
	3	1 out
	2	4/5 out
	1	3/5 out
	0	2/5 out
Toe-in in mm	1	1/5 out
	2	correct value
	3	1/5 in
	4	2/5 in
	5	3/5 in
	6	4/5 in
	7	1 in
	8	1 1/5 in
	9	1 2/5 in
	10	1 3/5 in



Checking the tie-rod length

A = 24 mm max (power steering 25 mm max)

The maximum permissible difference between the value dimension A on the two sides of the car is 5 mm.

Tightening torque, lock nut
60-80 Nm (6-8 kpm)

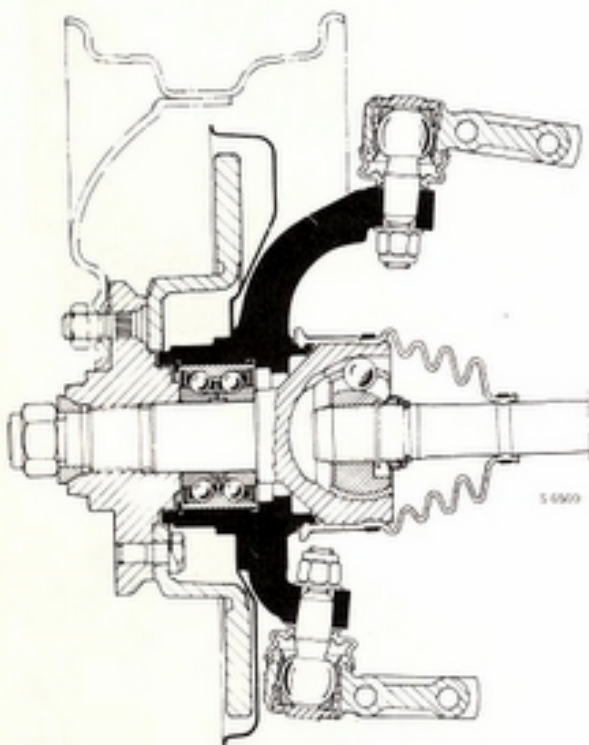
Rear wheel alignment

Checking

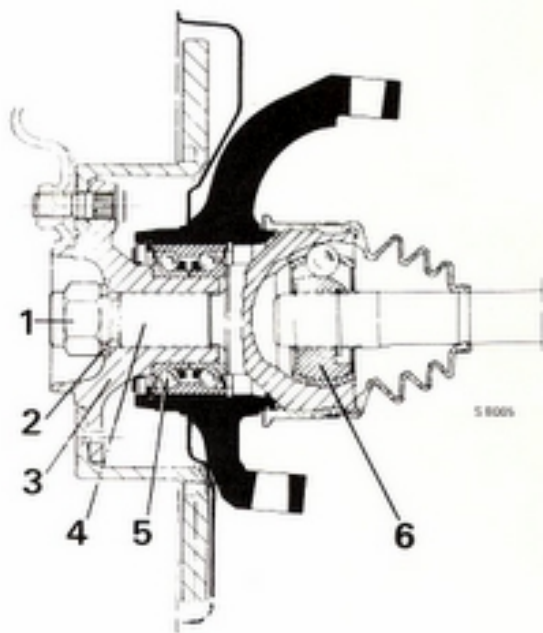
If the rear axle has been subjected to abnormal strain in a collision or similar circumstances, it must be checked carefully for signs of failure and deformation. Rear wheel alignment is not normally adjusted.

Steering knuckle housing

The front suspension consists of separate left-hand and right-hand units. The steering knuckle housing, on which the wheel is mounted, consists of a bearing housing with two inward-curving pivot arms. The wheel is journaled on a double-row angular contact bearing. The outer drive shaft is splined and force-fitted to the hub. The brake disc is mounted on the hub, and the brake shield is bolted to the steering knuckle housing. The steering arm is fastened to the steering knuckle housing by two screws. In steering, the steering knuckle housing pivots about an imaginary axis, the "king-pin" or steering knuckle axis, which passes through the centers of both the ball joints and intersects the ground at a point close to the center line of the wheel. The outer and inner drive shafts are connected by the outer universal joint, which is protected from dirt by a rubber bellows.



Steering knuckle housing
Up to and incl model 1980



Steering knuckle housing as from model 1981

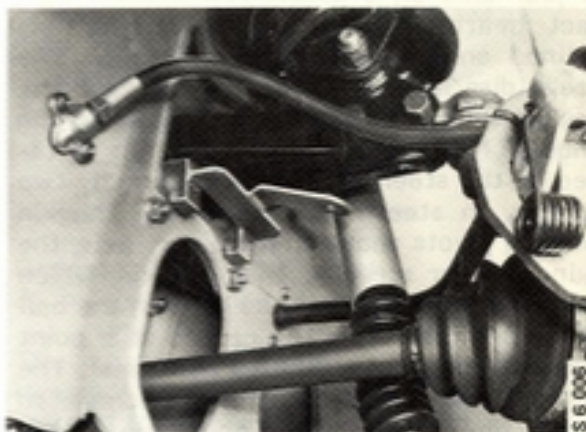
1. Lock nut
2. Washer
3. Hub
4. Outer drive shaft
5. Bearing with seals
6. Outer drive shaft joint

Ball joints

To check for play in ball joints

The pressure of the coil spring and shock absorber must be removed from the wishbones in order to be able to check for play in the ball joints.

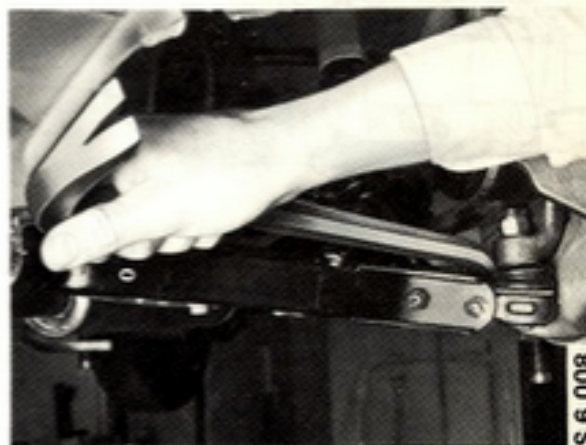
1. Position spacer 83 93 209 under the upper wishbone.



2. To check for end float:
Use a pair of polygrip pliers to compress the ball joint.
Maximum permissible end float 2 mm.



3. To check for radial play:
Apply pressure between the wishbone and the vertical link. Care should be taken so that the ball joint seal is not ruptured.
Maximum permissible radial play 1 mm.



4. Check that the ball joint seals are whole and replace any that are damaged.

Changing ball joints

1. Jack and block up the car and remove the wheel. Clean the ball joint and parts in the vicinity.

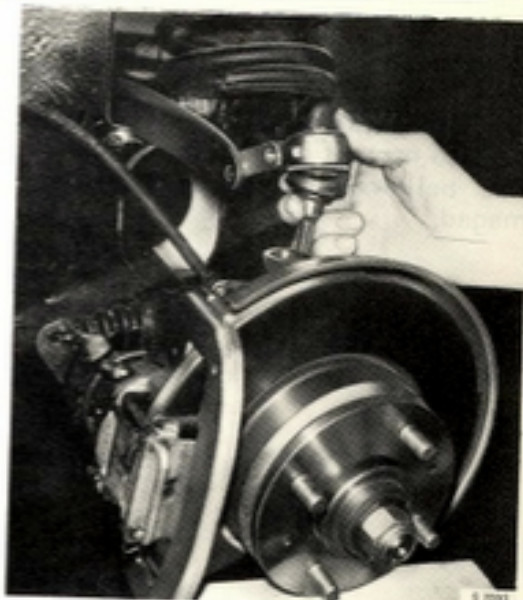
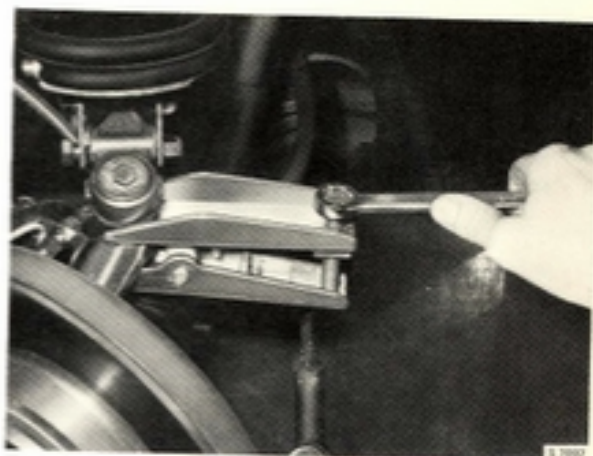
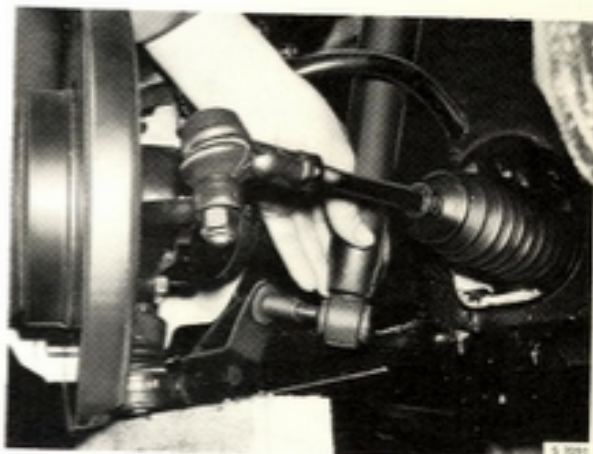
Note

The maximum travel (i.e. the downward movement of the control arm) is limited by the shock absorber. Take the weight off the travel stop before undoing the shock absorber. See point 2.

2. Position a jack under the outer end of the lower control arm and raise it slightly. Undo the lower shock absorber mounting.
3. Lower the jack so that the drive shaft meets the body flush at the grommet aperture. (Leave the jack in position to provide support when undoing the ball joint).

4. Remove the nut on the ball joint in the steering knuckle housing. Remove the bolt using tool 89 95 409.

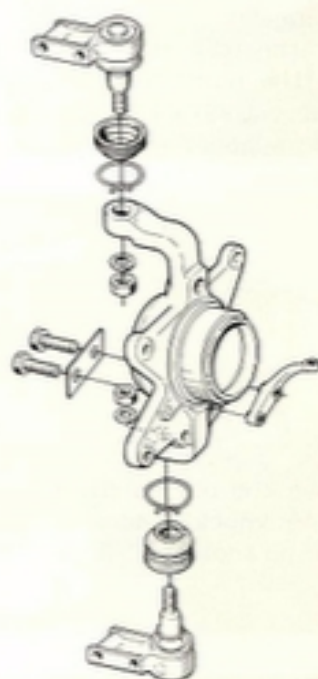
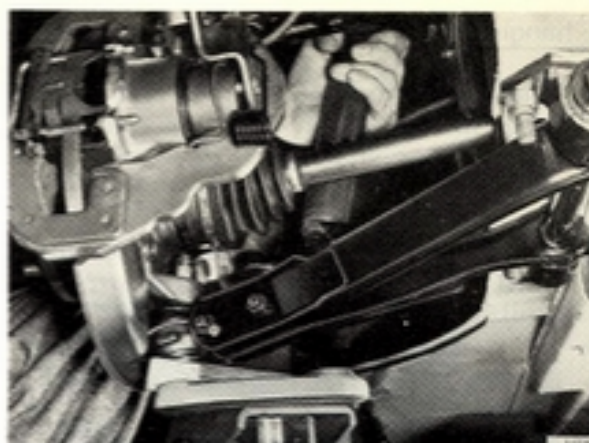
5. Separate the ball joint from the control arm. Put a threstle under the steering knuckle housing thus preventing damage to the brake hose.
6. Fit a new ball joint, install the bolt in the steering knuckle housing and tighten the nut.
7. Fit the ball joint to the control arm using new lock nuts.



8. Raise the control arm slightly by means of a jack and fit the shock absorber.
9. Fit the wheel and lower the car.

Note

The ball joints must not be dismantled but must be replaced as complete units.



Steering knuckle housing and ball joint fastenings

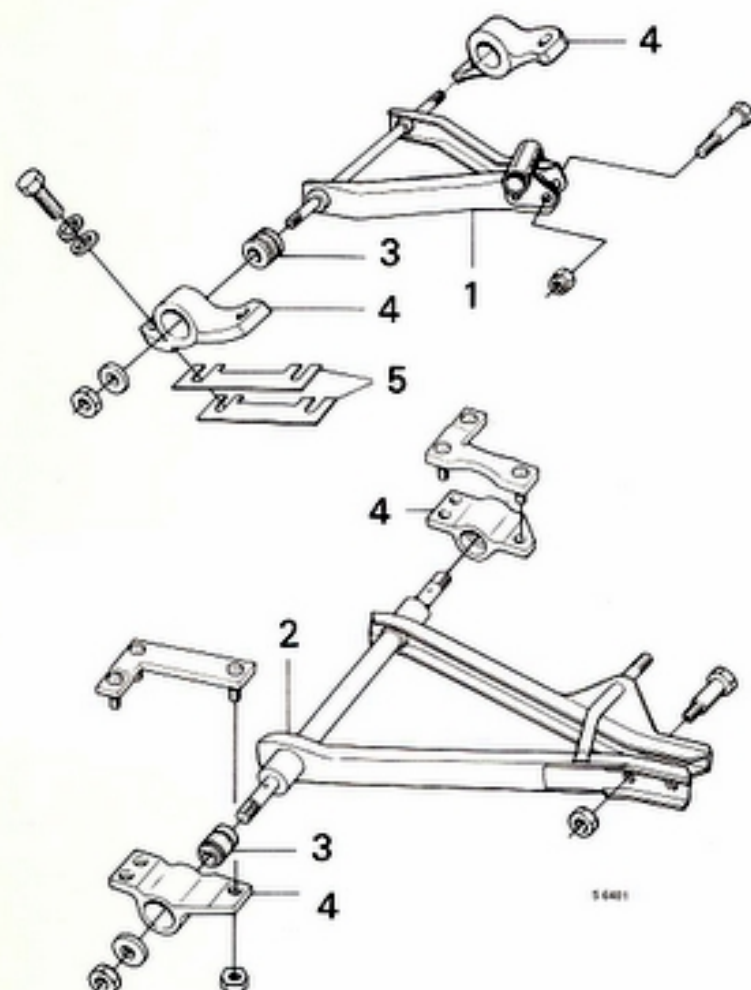
Changing ball joint sealing bellows

The ball joints are fitted with sealing bellows to protect them from abrasion by dirt. The bellows must be exchanged if damaged.



Control arms

The front axle, forming a separate unit on each side, is bolted to ball joints forming the outer ends of the control arms. There are two control arms on each side, each journaled in rubber bushings in two bearing brackets. The upper control arms carry the coil spring supports, which also serve as compression stops for the rubber buffers.



Control arms, bearings and bushings

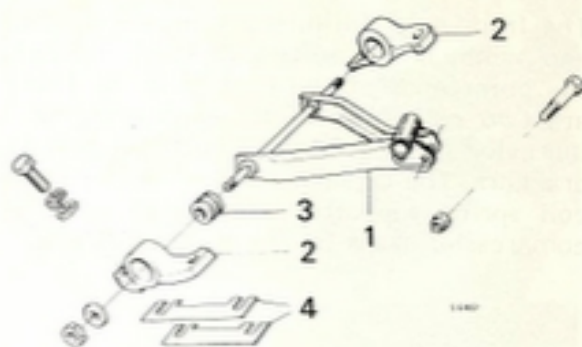
- 1. Upper control arm
- 2. Lower control arm
- 3. Rubber bushing
- 4. Bearings
- 5. Spacers

Upper control arm

Removal

Note

The power unit must be removed before the upper control arm on the left-hand side can be removed.



1. Control arm
2. Bearing
3. Rubber bushing
4. Spacer

1. Before jacking up the car, remove the upper shock absorber nut.

Note

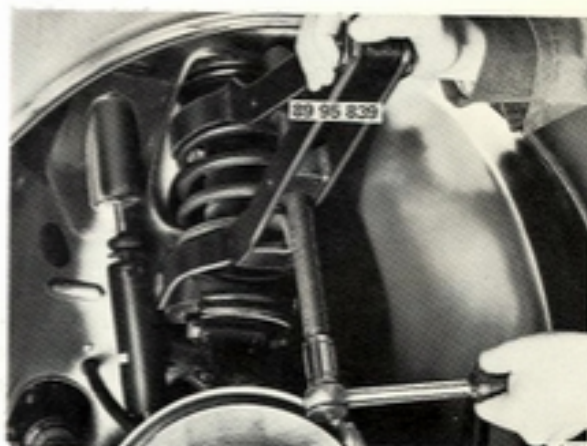
The maximum downward movement of the control arm is limited by the shock absorber. Accordingly, remove the shock absorber either:

- Before jacking up the car
- Or by raising the outer end of the lower control arm slightly by means of a jack.

2. Block up the car and remove the wheel.



3. Compress and remove the coil spring by means of tool 89 95 839.



Lower control arm

Removal

4. Remove the two bolts securing the upper ball joint to the control arm. Provide suitable support for the knuckle housing to prevent the brake lines from being damaged.
5. Remove the bolts securing the two control arm bearings.
6. Remove the control arm and bearings. Save the spacers under the bearings, noting the number and position.
7. Remove the two bearing nuts, after which the bearing and bushings can be removed from the control arm (see illustration).

Installation

The parts must be well cleaned before they are assembled. Worn or damaged parts should be replaced by new ones.

1. Fit the rubber bushings. The bushing should be forced into the bearing with the aid of tool 78 41 331. Soap the bushings before inserting.

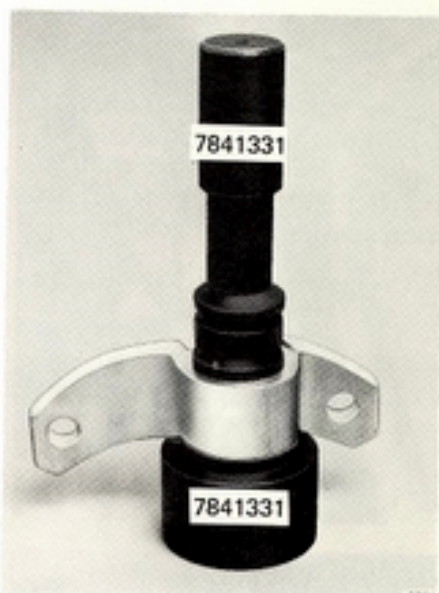
Note

On no account should oil or grease be used to assist insertion of rubber bushings. If lubrication is needed, use soapy water.

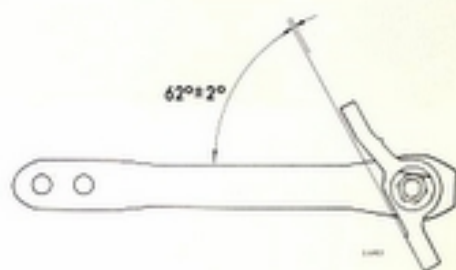
2. Fit the bearings to the control arm. Once the two nuts are tight, the angle between the control arm and bearing should be $62^{\circ} \pm 2^{\circ}$.

Tightening torque

75-90 Nm (54-66 ft.lb., 7.5-9.0 kpm)



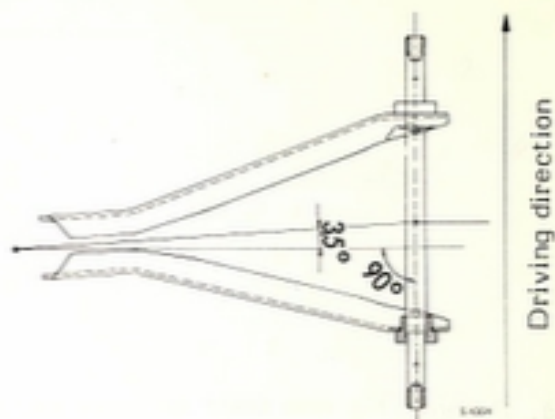
Tool 78 41 331



Angle between upper control arm and bearing

Note

The control arm is asymmetrical (see illustration).



Control arm, asymmetrical

3. Install the control arm, fit the bolts and spacers and tighten the bearing at the body.
4. Fit the upper ball joint to the control arm by means of the two bolts.
5. Fit the coil spring. Check that the supporting ring and rubber buffer in the upper spring seating are in position.



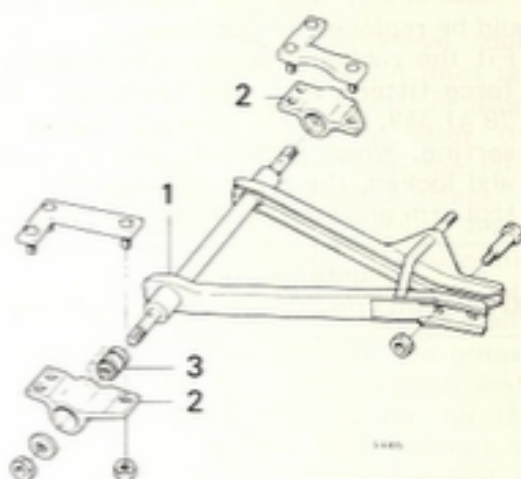
6. Raise the outer end of the lower control arm slightly by means of a jack. Fit the shock absorber.
7. Refit the wheel and lower the car.
8. Test drive the car and then check the wheel alignment and adjust as necessary.



Lower control arm

Removal

1. Control arm
2. Bearing
3. Rubber bushing



1. Before jacking up the car, remove the upper shock absorber lock nut.

Note

The maximum downward movement of the control arm is limited by the shock absorber.

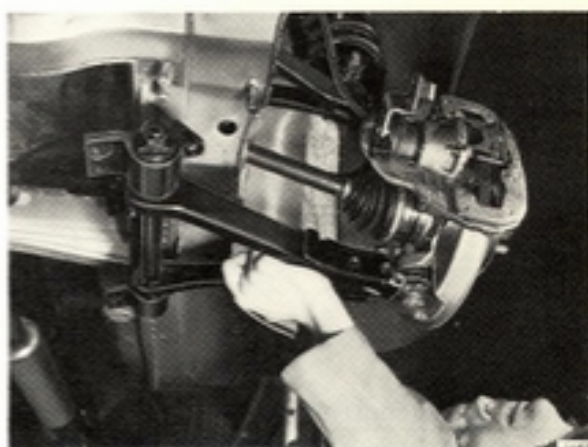
Accordingly, remove the shock absorber either:

- before jacking up the car
- or by raising the outer end of the lower control arm slightly by means of a jack.

2. Block up the car and remove the wheel.



3. Back off and remove the two screws that secure the ball joint to the control arm.
4. Undo the lower control arm attachment screws under the engine compartment floor. The control arm and brackets can then be removed.
5. Undo both control arm bearing nuts and remove the bearings.



Installation

The parts must be well cleaned before they are assembled. Worn or damaged parts should be replaced by new ones.

1. Fit the rubber bushings. The bushing is force-fitted with the help of tool 78 41 349. Soap the bushings before inserting. When both nuts are tightened and locked, the angle between the control arm and bearing should be $18^{\circ} \pm 2^{\circ}$.

Tightening torque
100-120 Nm (70-77 ft.lb., 10.0-12.0 kpm)



Tool 78 41 349

2. Fit the control arm by bolting the bearing to the body.
3. Secure the ball joint to the control arm.
4. Raise the control arms slightly by means of a jack and fit the shock absorber.
5. Refit the wheel and lower the car.
6. Test drive the car.
7. Check, if necessary adjust, the wheel alignment, see section 601.

Note

On no account should oil or grease be used to assist insertion of rubber bushings. If lubrication is needed, use soapy water.



Adjusting the control arms

If the control arms have been subjected to severe strain in a collision or similar circumstances, they must be checked carefully for failure and distortion. If the arms are out of true, they must be exchanged.



Angle between lower control arm and bearing

Steering column assembly

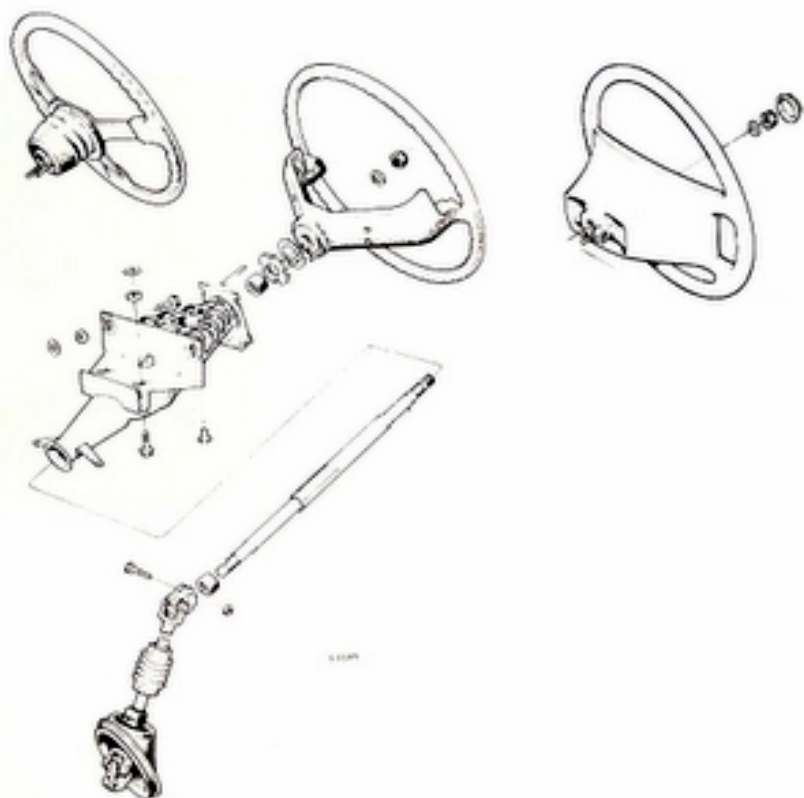
General

The steering column is mounted in two needle bearings, suspended in rubber mountings in the steering column support. The steering column support is bolted to the cross member below the instrument panel, which also serves as a support member for the instrument panel and ventilation system. An intermediate shaft, with a joint at either end, connects the steering column with the steering gear. The axial position of the steering column is governed by the steering gear. For safety reasons in the event of a collision, the steering wheel bearing support is of steel-basket design, the steering column is telescopic, and the intermediate shaft is of steel-bellows design, to provide the requisite deformation under a given force. The angles of the intermediate shaft joints also contribute to the steering shaft being directed in the desired in the event of a collision. In addition, the safety padding on the steering wheel is designed to protect the driver from injury.

Warning

The collapsible steering wheel shaft must be handled with care. It must not be subjected to impacts, jolts or other rough treatment liable to alter the adjusted length of the telescope joint or impair its shock absorbing effect.

When installing the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw comes opposite the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account knock on the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. The wheel must not be knocked off or on. When the car is on a hoist, do not seize a front wheel and twist it by force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.



Steering wheel

Removal

1. Remove the steering wheel safety padding:

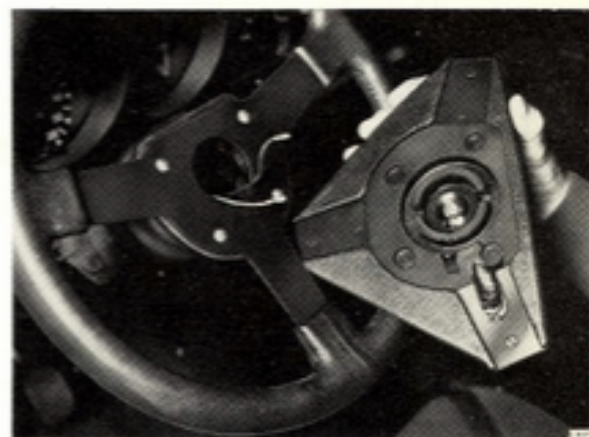
Standard steering wheel: Remove the four screws in the back of the wheel.



1981 models: Remove the steering wheel emblem, see picture.



EMS steering wheel: Lift the rubber flaps free from the spokes.



2. Remove the steering wheel nut and pull the wheel off the steering column using extractor 89 96 258 fixed to the two threaded holes in the steering wheel hub. The extractor fits both standard and EMS steering wheels.



Note

As from 1981 models the direction indicator arm return actuator is removable.



Fitting

1. Make sure that the wheels are pointing straight ahead and fit the steering wheel on the steering column, with the spokes properly aligned. Tighten the steering wheel nut to the correct torque.

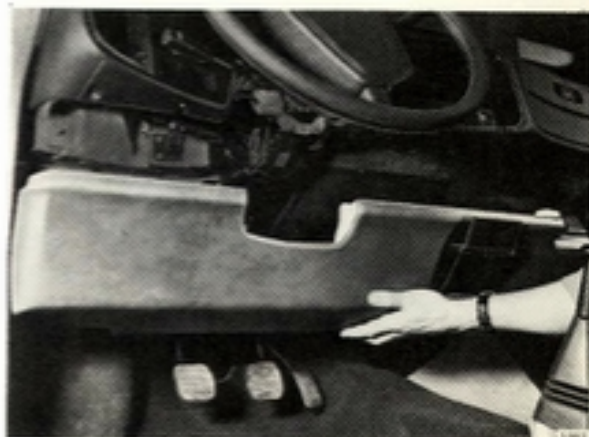
Tightening torque:
27 Nm (19 ft.lb., 2.7 kpm)

2. Refit the safety padding. 1981 models: refit the steering wheel emblem.

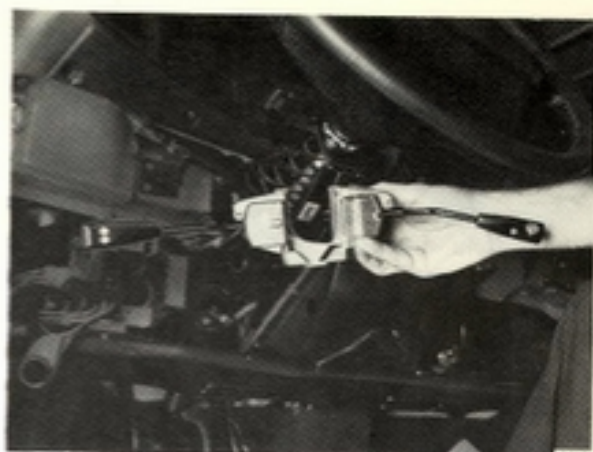
Steering column assembly

Removal

1. Remove the locking screw in the joint at the steering gear.
2. Remove the lower bearing cover and the safety padding under the instrument panel.



3. Remove the direction indicator and wiper switch assembly.

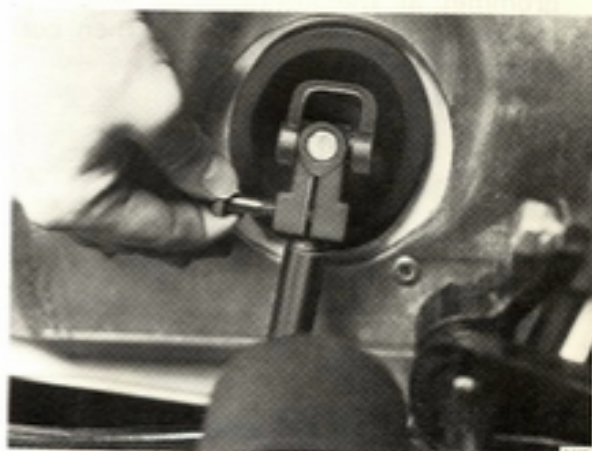


4. Remove the rubber boot at the dash panel.
5. Remove the four screws in the steering column bearing support and then the complete steering column assembly.



Refitting

1. Connect the lower steering column joint to the steering gear pinion and fit the locking screw. Check that the locking screw actually engages the groove in the shaft.



2. Insert the four steering column bearing support screws and tighten slightly. Position the support so that its holes line up with those in the panel and tighten the four screws.
3. Fit the rubber boot to the dash panel. Apply adhesive to the groove in the boot.



4. Refit the switch assembly, the lower safety padding and the steering joint cover.
5. If necessary, adjust the position of the steering wheel.
6. Refit the safety padding under the instrument panel. Seal the mounting holes in the instrument panel with plastic compound



Changing the rubber bellows on the intermediate shaft

The rubber bellows on the intermediate shaft can be removed and replaced once the intermediate shaft has been removed.

- a. Remove the old bellows, prize out the grommet at the intermediate shaft by means of a screwdriver, and then cut away the bellows.



- b. Install the new bellows by positioning the conical installation tool 89 95 813 against the joint and then ease the bellows over the tool and the joint. Lubricate the tool with Vaseline. The older model of tool 89 95 814 can be adapted for use on the Saab 900 by filing the groove up to 32 mm.



- c. Insert the grommet in the hole in the bellows.

When refitting the intermediate shaft, apply adhesive to the groove in the bellows



where they fit against the bulkhead.

General

The steering wheel is a circular disk with a central hub and a rim. The hub is mounted on a vertical shaft which is journaled in a frame. The rim is made of a material which is spring-loaded and can move around the shaft. The steering wheel is connected to the front wheel by a steering arm and a steering knuckle.



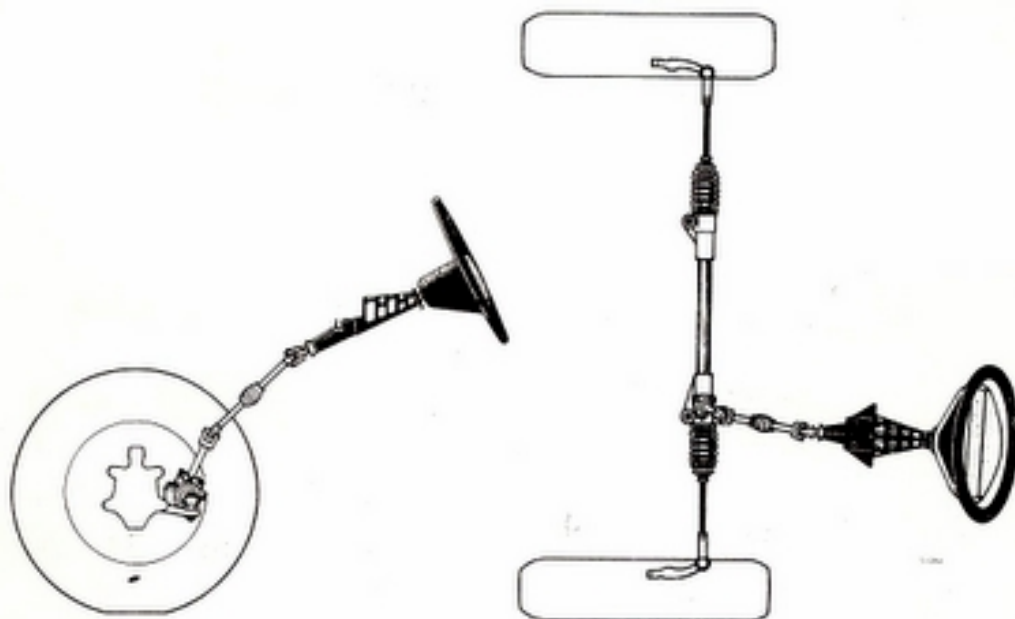
Steering gear, standard

General

The steering mechanism is of the rack and pinion type with a helical spur gear which engages a mesh on the rack. The rack is journaled in a housing of cast light-alloy in which a steel tube is press-fitted.

The pinion bearing is provided with a spring-loaded plunger that presses the rack against the pinion. The other end of the rack is journaled in a bushing. Steering wheel movement is transmitted to the

pinion by a two-piece steering column and two joints. This imparts an axial movement to the rack, which moves the two tie rods connected by ball joints to the ends of the rack. The tie rods in turn move the steering arms fastened to the steering knuckle housing and connected by ball joints to the tie rods.



The steering gear is precision adjusted before delivery and should not be disassembled unless absolutely necessary. Disassembly and reassembly of the steering gear, see the following pages.

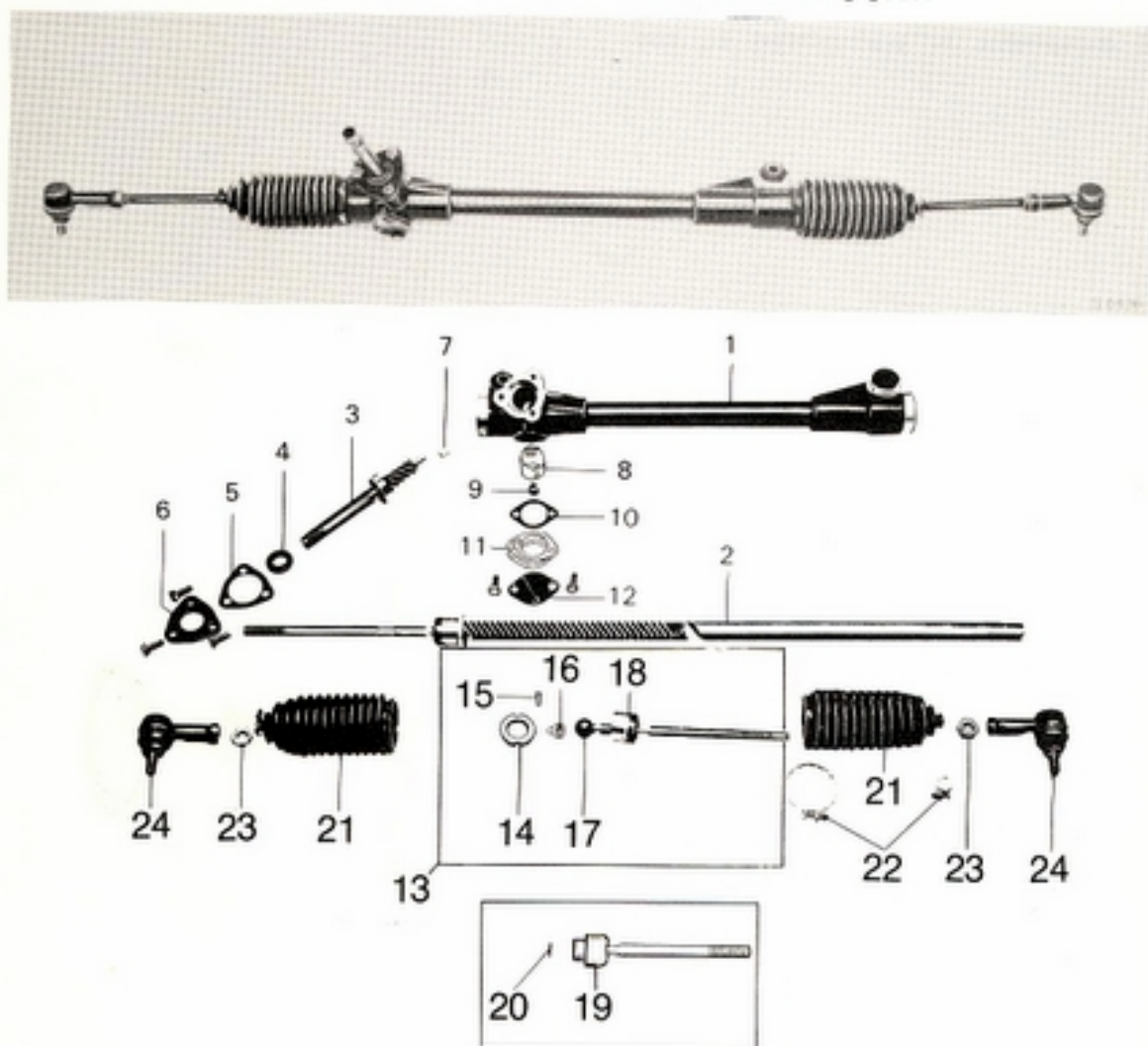
The steering gear is permanently lubricated with liquid grease. On assembly, the inner tie-rod joints are greased with molybdenum disulphide grease.

Check periodically that the rubber bellows on the steering gear are free from defects.

If noise emanates from the steering gear, adjustment is necessary (refer to the section on adjustment). Any worn or damaged parts should be replaced. The steering gear illustrated is for a left-hand drive car. In principle, the steering gear in RHD cars is the same.

During the 1981 model the ball joint on the steering unit was changed from an adjustable joint to a totally enclosed (nonadjustable) ball joint.

Refer to page 644-1 for details of power-assisted steering gear.



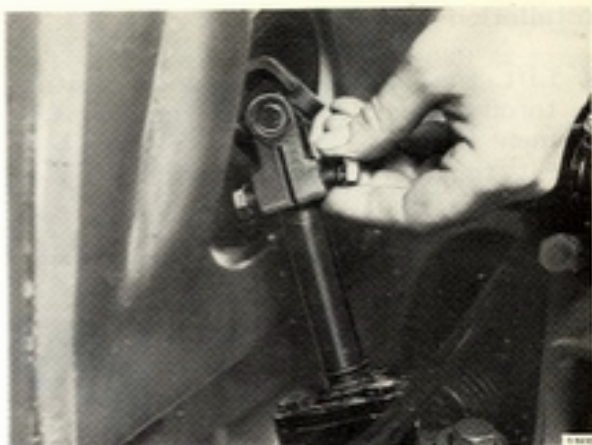
Steering gear, exploded view

1. Steering gear housing assembly
2. Rack
3. Pinion gear incorporating bearing
4. Sealing ring
5. Gasket
6. Cap
7. Needle bearing
8. Needle bearing piston
9. Spring
10. Gasket
11. Shims

12. Cap
13. Adjustable ball joint
14. Lock nut
15. Locking pin
16. Inner bearing cup
17. Tie rod
18. Outer bearing cup
19. Fully enclosed ball joint
20. Shims
21. Bellows
22. Clips
23. Lock nut
24. Tie rod end

Removal

1. Remove the clamp bolt where the joint of the steering column intermediate shaft is connected to the steering gear.



2. Block up the car and remove the front wheels.
3. Remove the tie-rod end nuts and separate the tie-rod ends from the steering arms using extractor 89 95 409.



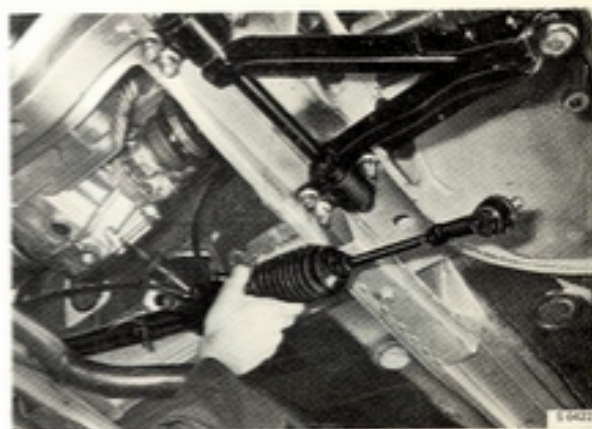
4. Remove the two steering gear bolts.



5. Separate the steering column joint from the steering gear, lift the steering gear to the side and remove by guiding it diagonally downwards through the opening in the engine compartment floor.

Note

Take care not to damage the rubber bellows by catching them against the edges of the bodywork.



Installation

1. Lift the steering gear into position through the hole in the engine compartment floor.
2. Fit together the joint on the intermediate shaft and the steering gear. Ensure that the clamp bolt engages the groove in the pinion shaft.

Tightening torque, clamp bolt:
35-42 Nm (26-30 ft.lb., 3.5-4.3 kpm)

3. Fit the two bolts attaching the steering gear to the body.

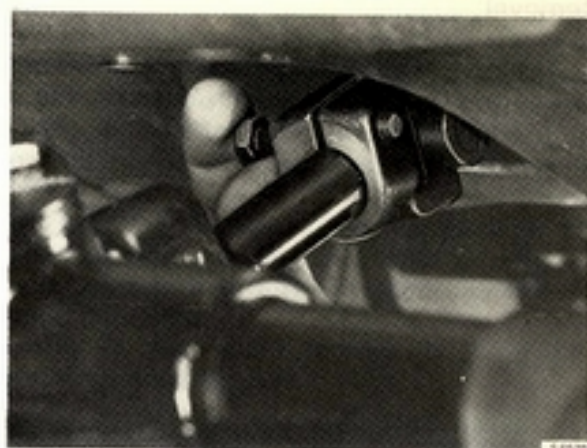
Tightening torque:
60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)

4. Fit the tie-rod ends to the steering arms.

Tightening torque:
50-60 Nm (37-44 ft.lb., 5.0-6.0 kpm)

5. Check the toe-in and steering wheel alignment and adjust as necessary. Tighten the lock nuts on the tie-rods.

Tightening torque:
60-80 Nm (44-60 ft.lb., 6.0-8.0 kpm)



Warning

The collapsible steering wheel shaft must be handled with care. It must not be subjected to impacts, jolts or other rough treatment liable to alter the adjusted length of the telescope joint or impair its shock absorbing effect. When installing the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw comes opposite the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account knock on the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. The wheel must not be knocked off or on. When the car is on a hoist, do not seize a front wheel and twist it by force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.

Disassembly

1. Back off the lock nuts and unscrew the tie-rod ends.
2. Undo the clips and remove the rubber bellows.
3. Disassembling adjustable ball joint:
 - Drill out the cotter pins from the inner ball joints using a 4 mm bit. The pins are 3/8" (9.4 mm) long.

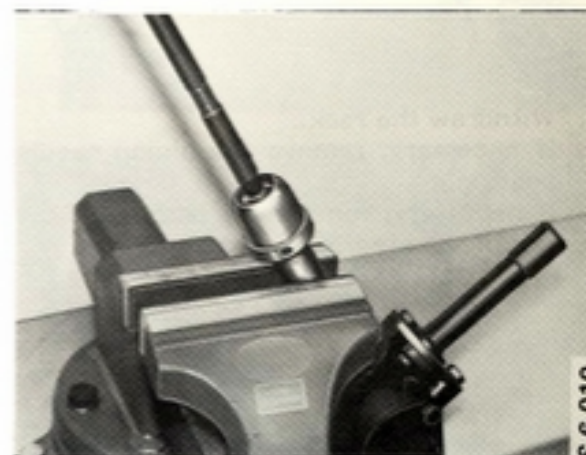
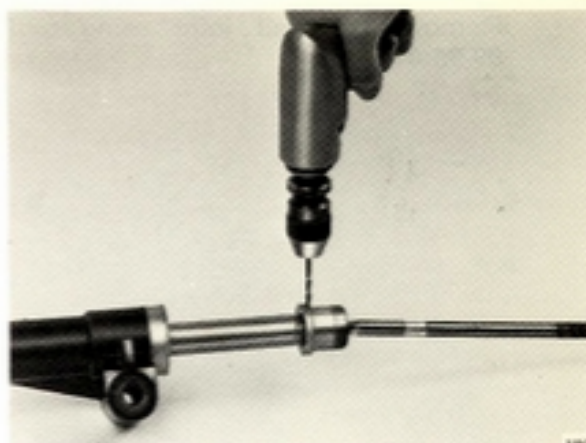
Caution
Do not drill too deep.

- Remove the outer bearing cups and lock nuts using tool 83 90 197 and polygrip pliers.

4. To remove totally enclosed ball joint:
 - Support the rack and drill out the tab from the groove. Drill bit $\varnothing 4$ mm.

- Clamp the toothed end of the rack in a vice with protected jaws.

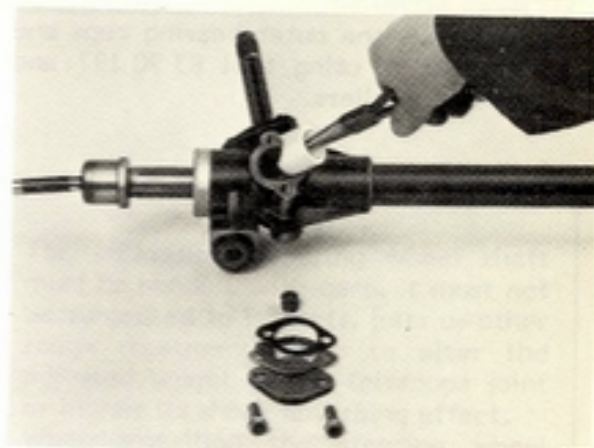
Caution
Absolutely no load must be put on the pinion when loosening or tightening the ball joint.



- Remove the ball joint using tool 89 96 472.

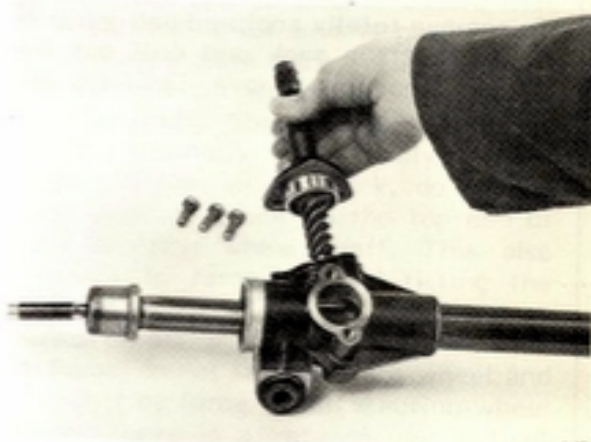


5. Undo the rack adjustment screw and remove the cap, shims, spring and plunger.



6. Remove the bolts securing the pinion and remove the pinion and bearing, and cap with sealing ring.

The bearing is factory-fitted to the pinion shaft and can therefore not be replaced separately. Only pinion shaft assemblies including the bearing will be carried as a spare part.



7. Withdraw the rack.
8. If necessary, remove the pinion needle bearing.
9. If necessary, remove the bushing at the end of the steering gear housing.

Assembly

The steering gear should be thoroughly cleaned before assembly.

Lubrication

Lubricate the moving parts of the steering gear and fill the gear with 0.15 dm³ (5 fl.oz., 1.5 dl) of BP Energrease FGL, part no. (45) 30 08 703.

1. Fit the bushing at the end of the steering gear housing.
2. Install the needle bearing in the steering gear housing using a drift.
3. Fitting adjustable ball joint:
Fitting tie rod with fully enclosed ball joint, see point 12.
Fit the inner ball joint on the pinion end of the rack as follows:
 - Thread the lock nut onto the rack.

Lubrication

Lubricate the ball and bearing cups with Molybdenum Paste, part no. (45) 30 06 632.

- Insert the plastic cup in the hole in the rack, fit the tie rod and screw on the outer bearing cup.
4. Set the joint at the right loosening torque (see below). Tighten the lock nut to the correct torque using the hook wrench while holding the socket immobile with a pair of polygrip pliers.

Tightening torque

35 ± 2 ft. lb. (48 ± 3 Nm, 4.8 ± 0.3 kpm)

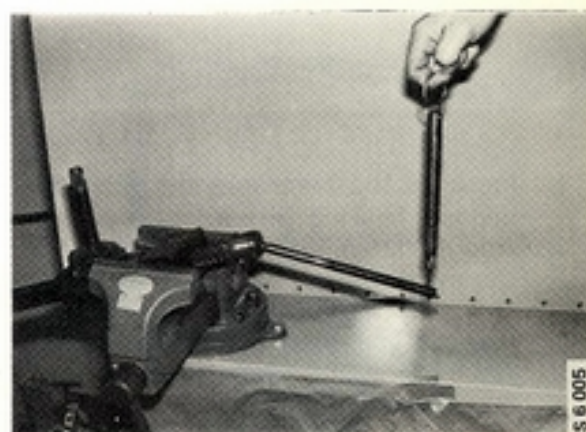
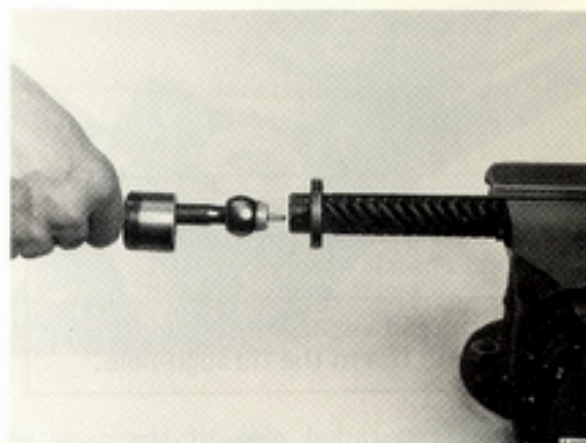
Loosening torque

1.6-7.2 lbf. (7.3-32.0 N, 0.75-3.2 kp)

Caution

The maximum loosening torque of 7.2 lbf. (32.0 N) must be obtainable in all of the tie rod's directions. If it is not possible to obtain the stated figure then the tie rod and joint socket must be replaced.

The loosening torque is measured using a spring scale which is attached to the outer end of the tie rod. →



5. Tighten the lock nut against the bearing cup using Hook wrench 83 90 197 and polygrip pliers.

Tightening torque, inner
ball joint lock nut:
41-51 Nm (33-38 ft.lb., 4.5-5.1 kpm)

Check again that the ball joint is neither too tight nor too slack. Drill a new hole for the cotter pin 4 mm in diameter and 3/8" (9.4 mm) deep and insert a new cotter pin, securing it by four center punch blows at the edge of the hole. Be extremely careful that no drill shavings get into the steering gear.

6. Insert the rack in the housing. Fit the pinion (complete with bearing), the gasket and the cap with sealing ring.

Lubrication:
Lubricate the sealing ring with Saab
Special chassis grease

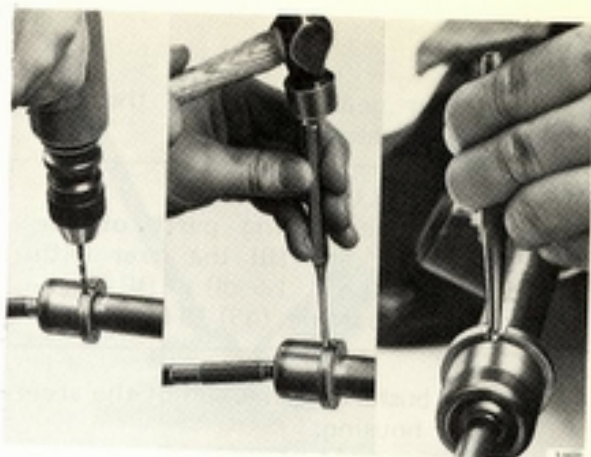
Apply thread sealing compound to the
bolt which fits in the through-hole.

7. Adjust the radial play of the rack as follows:

- a. Fit the plunger without the spring and screw on the cap without the gasket by hand until it butts against the plunger (see illustration). If a wrench is used, the cap will be deformed.

It is also possible to adjust the radial play of the rack when the steering gear is in place in the car.

- b. Measure the clearance between the cap and housing with a feeler gauge.
c. Add 0.002"-0.006" (0.05-0.15 mm) to the measured clearance to allow for the play to be left between the plunger and cap after assembly. If for example the feeler gauge measurement is 0.022" (0.55 mm),



the total thickness of gasket and shims should be 0.024-0.028" (0.60-0.70 mm).

Measure the thickness of the gasket and shims with a micrometer (see illustration).

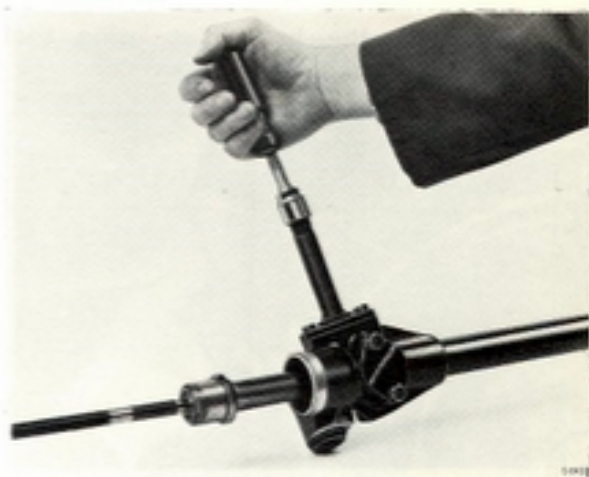
Shims are available in thicknesses of 0.005", 0.0075", 0.010" (0.13, 0.19, 0.25 mm)



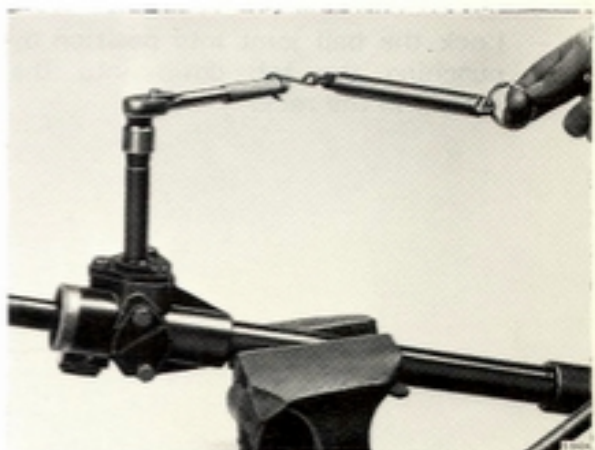
8. Fit the plunger, spring, shims, gasket and cap.



9. Check that the rack is not sticking in any position by rotating the pinion by means of an 0.7 in (18 mm) dodecagonal 12 - sided socket fitted over the splines on the pinion shaft.



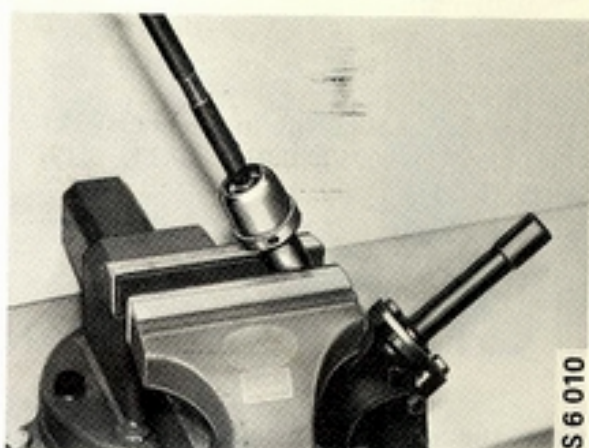
10. Properly adjusted, the torque of the pinion should be 0.8-1.7 Nm (7-24 ft.lb., 0.8-1.7 kpm). This is checked by means of a dynamometer, an 0.7 in (18 mm) dodecagonal socket and a suitable handle. If a lever of approximately 5.9 in (150 mm) is used, the dynamometer should indicate 5-11 N (0.5-1.1 kpm)



11. Fit the other ball joint and adjust in the same way as before.
12. Totally enclosed ball joint, to fit:
 - Clamp the toothed end of the rack in a vice with protected jaws.

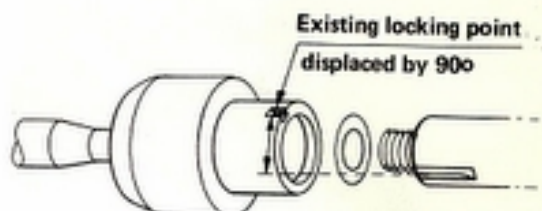
Caution

Absolutely no load must be put on the pinion when loosening or tightening the ball joint.



S 6 010

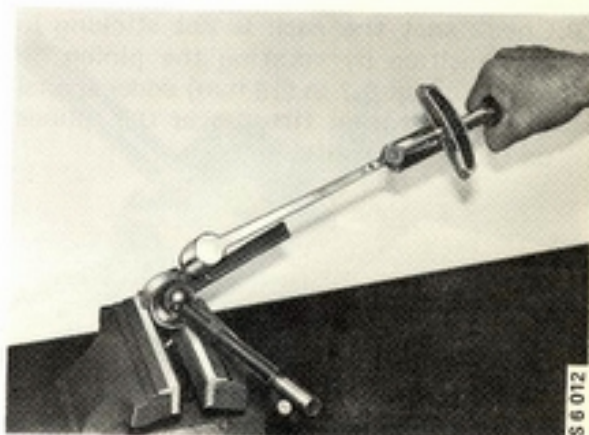
- Screw on the ball joint.
If the old ball joint is to be re-used the existing locking mark must be displaced by at least 90°. This is achieved by using a special spacer which is inserted between the rack and the ball joint.



S 6 002

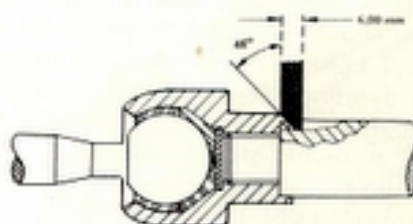
- Tighten the ball joint using tool 89 96 472 and a torque wrench.

Tighten torque
80-94 ft.lb. (110-130 Nm, 11-13 kpm)



S 6 012

- Lock the ball joint into position by punching the tab down into the groove in the rack.



S 6 003

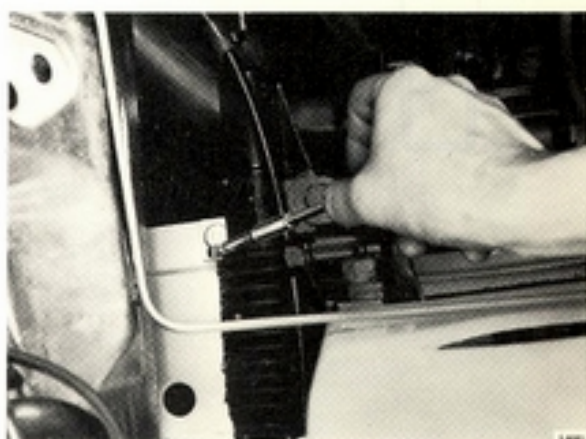
13. Fit the rubber bellows.

Lubrication

Apply silicone grease to the contact surfaces between the rubber bellows and the tie rod. Lubricate with 0.3 pints (1.5 dl) lubricant (BP Energrelase FGL) before attaching the bellows over the end of the pinion.

Fit rubber caps to the threaded ends of the clamps.

14. Thread on the lock nuts and fit the tie-rod ends to the tie rods.



Changing the steering gear rubber bellows

If either of the rubber bellows needs re-newing, this can be carried out with the steering gear in place by removing the tie-rod end and lock nut.

Lubrication:

When fitting new rubber bellows apply approximately 50 cm³ of BP Energrelase FGL, part no. (45) 30 08 703 to each side.

Adjustment of steering gear

The adjustments that may be required are as follows:

- A. Adjustment of rack radial play.
- B. Adjustment of tie-rod inner ball joints.

The steering gear assembly must be removed from the car for adjustment of the inner ball joints, but the radial play of the rack can conveniently be adjusted with the steering gear in place, unless it has had to be removed for some other reason.

The inner ball joints will seldom need adjustment, as there is very little wear on them, besides which they are selfadjusting to some extent.

See assembling the steering gear.



Tie-rod assemblies

General

The outer ball joints, the tie rod end assemblies, are screwed on to the tie rods and secured by lock nuts. By backing off the lock nuts and twisting the tie rods clockwise or counterclockwise, it is possible to reduce or extend the length of the tie rod. This is how the toe-in of the front wheel is adjusted.

The tie rod is connected to the steering arm of the steering knuckle housing by a tapered ball bolt, which is secured by a self-locking nut. The tie-rod end assemblies cannot be disassembled; they adjust themselves to moderate wear and therefore seldom need exchanging.

However, damage caused by external force, as in a collision or crash, may make it necessary to renew both the tie rods and end assemblies. These components are vital to vehicle safety and must therefore be checked over with the utmost care if there is any reason to suspect that they are damaged or bent.

Changing tie rod end assemblies

The tie rod end assemblies cannot be disassembled and must therefore be exchanged complete if they have worn loose.

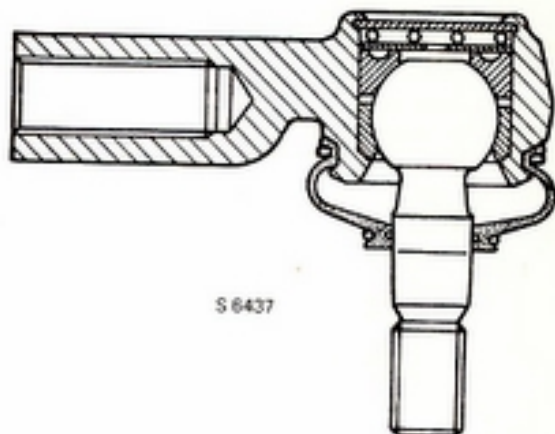
1. Jack up the front of the car and take off the wheel.
2. Remove the nut.
3. Disconnect the ball bolt from the steering arm using puller 89 95 409 (see illustration). Do not knock the ball bolt out, as this is liable to damage the ball bolt and other parts.
4. Back off the nut that locks the end assembly to the tie rod.
5. Unscrew the end assembly from the tie rod.
6. Screw a new end assembly on to the tie rod, but do not lock it by tightening the nut yet.
7. Fasten the ball bolt to the steering arm. Fit the nut and tighten to the following torque:

Tightening torque:
50-60 Nm (37-44 ft.lb., 5.0-6.0 kpm)

8. Mount the wheel and lower the car.
9. Check and adjust the toe-in (see section 601).

Important

Do not forget to tighten the lock nut on the tie rod after adjusting.



Changing the rubber bellows

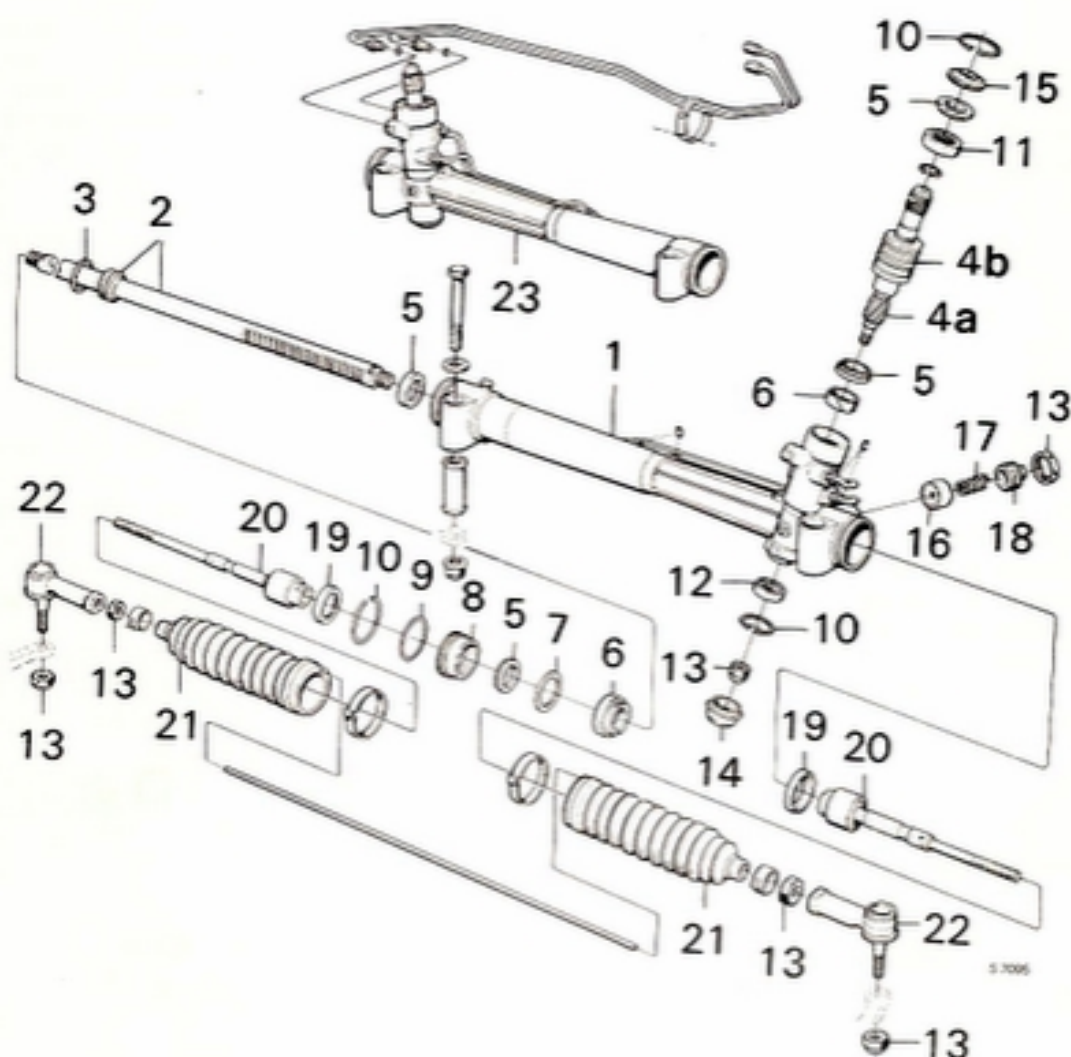
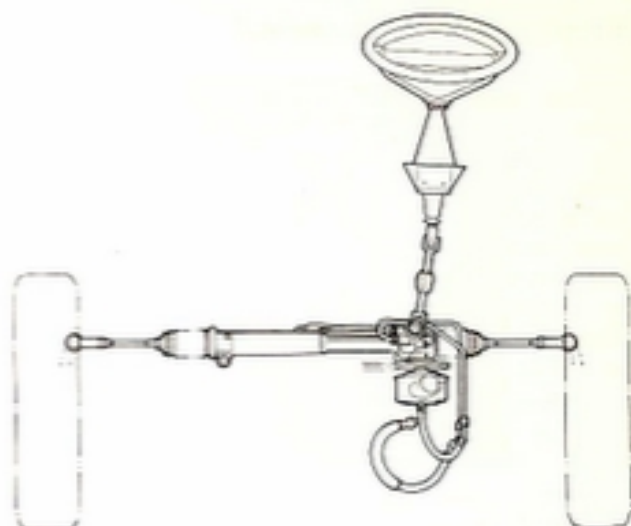
The rubber bellows is fitted at every ball joint. If the bellows are worn or damaged so that they no longer provide an effective seal, they must be renewed. To change the bellows, the tie-rod end must be removed from the steering arm. Refer to the section, "changing the tie-rod ends", items 1, 2, 3, 7 and 8.



Power steering

Certain models are equipped with hydraulic power-assisted steering.

The steering gear is of the rack and pinion type, with a steering valve which directs the flow of fluid to a power piston on the rack. The hydraulic pressure is generated by a pump, driven by a V-belt from the crankshaft pulley.



Power steering gear

- | | | |
|--------------------------|--|-------------------------------------|
| 1. Steering gear housing | 9. O-ring | 17. Spring |
| 2. Rack with piston | 10. Circlip | 18. Adjustment screw |
| 3. Piston ring | 11. Bearing holder with needle bearing | 19. Damper ring (end stop position) |
| 4a. Pinion | 12. Ball bearing | 20. Inner ball joint with tie rod |
| 4b. Servo valve | 13. Lock nut | 21. Rubber bellows |
| 5. Hydraulic seal | 14. Cover | 22. Tie rod end |
| 6. Bushing | 15. Dust cover | 23. RHD version |
| 7. Washer | 16. Radial bearing, piston | |
| 8. Sealing retainer | | |

Power steering gear, general

The steering gear is of the rack and pinion type with an hydraulic servo unit.

A steering valve at the input shaft to the steering gear directs the flow of fluid to either side of an hydraulic piston, which is geared to the rack. The ends of the cylinder in which the piston runs are hydraulically sealed against the rack.

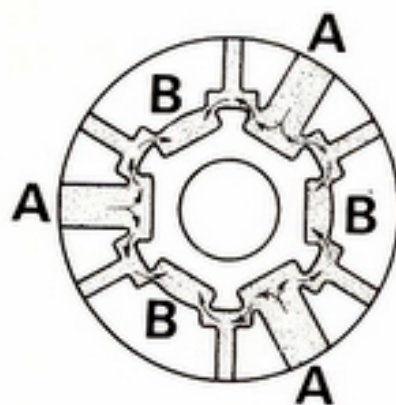
The servo valve consists of a torsion rod, connected to the input stub axle of the steering gear, and a valve which is governed by the rotary movement of the torsion rod. The mechanical components of the steering gear, that are not part of the hydraulic system, are permanently greased. An equalizing tube runs between the end pieces of the steering gear to obviate the formation of a vacuum or over-pressure on operation of the steering gear.

Warning

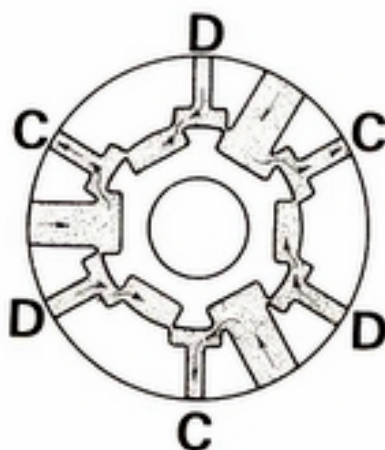
The oil pump can be damaged by the following causes:

1. If the steering wheel is kept against one of the end positions with a strong torque and the engine is running at the same time the oil pump can be overheated and damaged.
2. If dirt is entering the hydraulic system, for example when checking or filling oil.
3. If the pump is allowed to run without oil in the hydraulic system.

Driving straight ahead



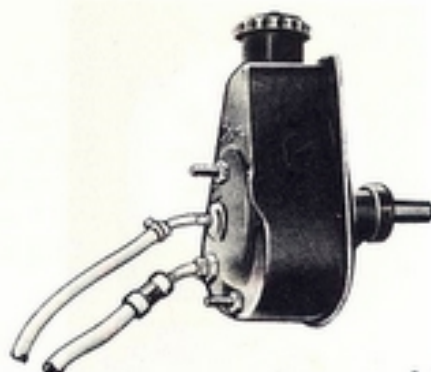
Turning to the right



S 4078

Servo valve function

- A Servo pressure from the oil pump
- B Return to oil reservoir
- C To the servo cylinder (power assistance for turning right)
- D To the servo cylinder (power assistance for turning left)



S 6577

Servo pump, general

The servo pump is driven by a V-belt from the crankshaft pulley. The pump is integrated in a steel container that also serves as the hydraulic reservoir. The upper section of the container is in the form of a filler pipe with cap. The cap incorporates a dipstick for checking of the fluid level. In addition to the pump unit itself, the pump also comprises a control valve which regulates the pressure and flow.

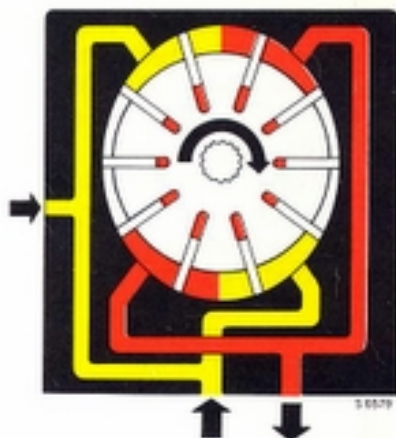
Pump operation

The pump unit consists of a rotor (1) containing a number of openings, a vane (2) for each opening, a pump ring (3) and two end plates (4) with inlet and outlet passages for the pump element. The oval design of the pump ring causes an increase and decrease in the volume between the vanes, twice per



S 6578

revolution of the rotor. The inlet passage leads to the areas where the volume expands, and the outlet passages from the areas where the volume decreases, thereby creating a pumping action.

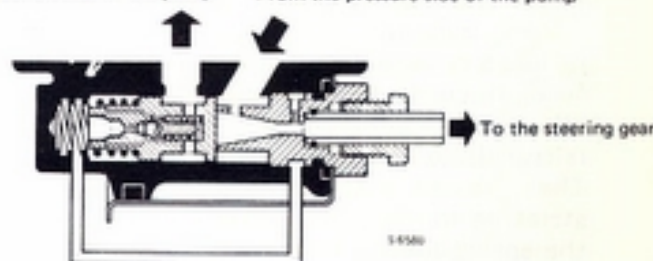


In addition to the pump vanes being thrown out by the centrifugal force, they are also pressed out against the pump ring by the hydraulic fluid which flows in the grooves on the insides of the vanes.

Regulation of pressure and flow

The control valve regulates the pressure and flow according to the requirements of the steering gear. One side of the control valve is connected direct to the pump pressure. The outlet from the pump contains a restriction, from which a connecting passage runs to the other side of the valve, which is equipped with a spring. When at rest, the valve is pressed towards the outlet side. Inside the control valve is pressed towards the outlet side. Inside the control valve is a relief valve which, at high pressure, is operated by the hydraulic pressure on the spring-loaded side of the control valve.

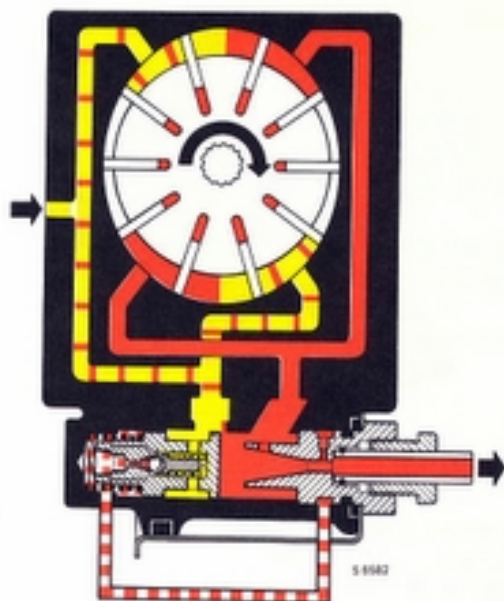
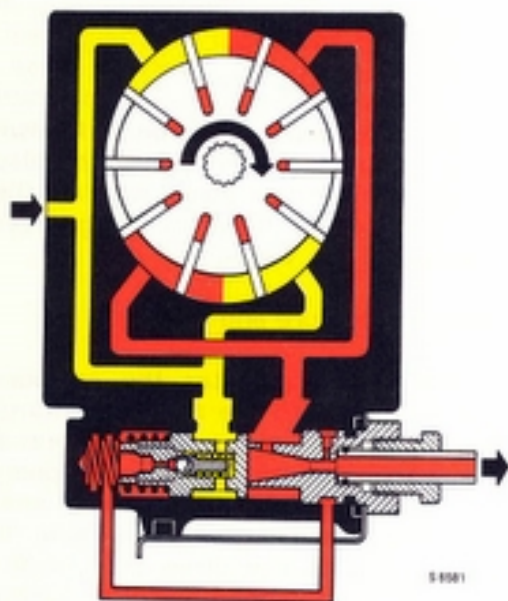
To the suction side of the pump From the pressure side of the pump



The pump delivers a maximum pressure of approximately 60 bar and a maximum flow of 8.5 dm³ or 8.5 l per hour.

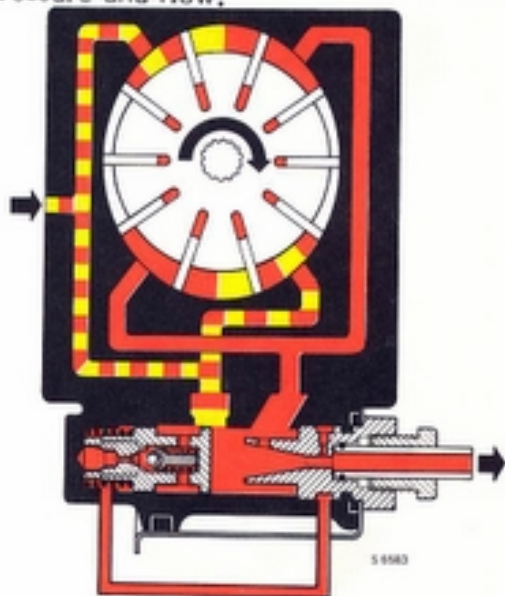
Normal steering, slow driving

The pressure generated by the pump is reduced slightly by the restriction in the outlet side of the pump. The reduced pressure is also led to the spring-loaded side of the control valve, reducing the difference in pressure between the two sides of the valve. However, owing to the low speed of the pump, the hydraulic pressure is not sufficient to actuate the valve.



Hard turning of steering wheel or turning to full lock

When a load is applied to the steering gear and the pressure increases in the line from the pump, there will be a corresponding increase in pressure of the springloaded side of the control valve. This will cause the relief valve inside the control valve to open, reducing the pressure upstream of the valve to open, reducing the pressure upstream of the valve and allowing the valve to open the internal recirculation. The consequent overcharging effect in the pump will thereby provide the requisite pressure and flow.



Driving at higher speeds

When the car is being driven at higher speeds, external circulation of the hydraulic fluid is necessary to limit the temperature. Accordingly, the steering gear valve allows a certain through-flow when the car is travelling in a straight line.

The reduced pressure caused by the restriction in the pump outlet is also led to the spring-loaded side of the control valve, causing the control valve spring to compress. This opens a passage for internal recirculation. Since this will result in overpressure at the suction side of the pump, a certain over-charging effect will occur. This implies that a relatively high flow in conjunction with high pressure can be generated simultaneously as required.

Dismantling the power steering gear

Thoroughly clean the areas around the hydraulic connections and disconnect the return and pressure lines from the steering gear. Plug the openings in the lines and steering gear to prevent dirt from entering the system. The procedure will then be the same as that for dismantling the manual steering gear (refer to the section on page 642).

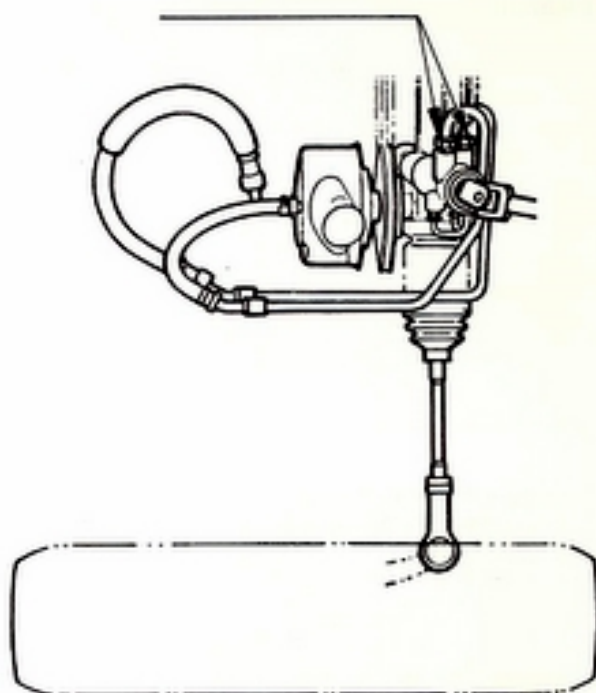
Installing the power steering gear

Refer to the section on page 642 (installing the manual steering gear).

When connecting the hydraulic lines to the steering gear, tighten the couplings to the specified torque.

<p>Tightening torque: 20-34 Nm (15-25 ft.lb., 2.0-3.4 kpm)</p>
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N.B. Over-tightening will damage the connecting nipple seals.



5 6439

Dismantling the power steering gear

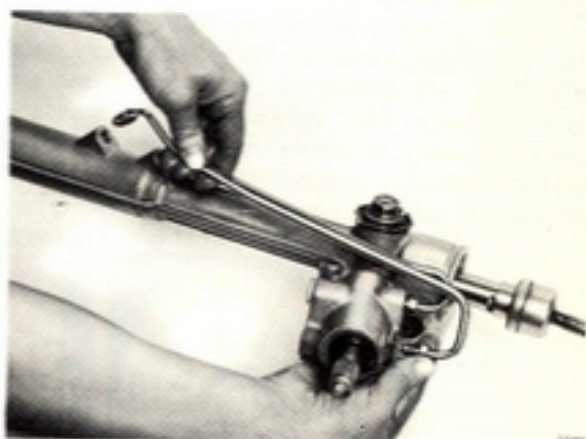
1. Remove the lock nuts and the tie-rod ends.



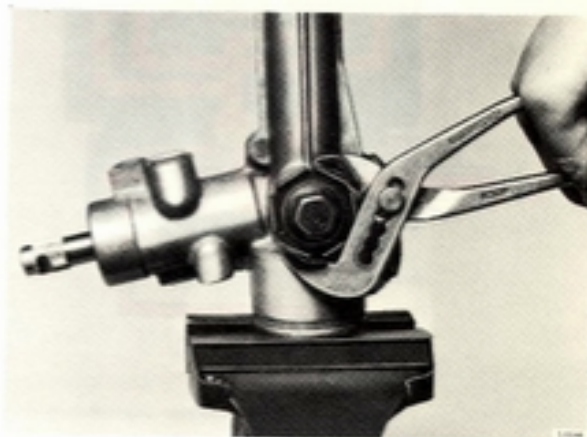
2. Undo and remove the rubber bellows and breathing tube.



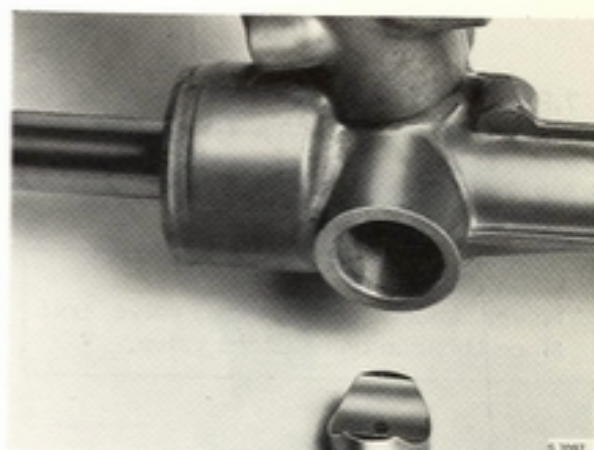
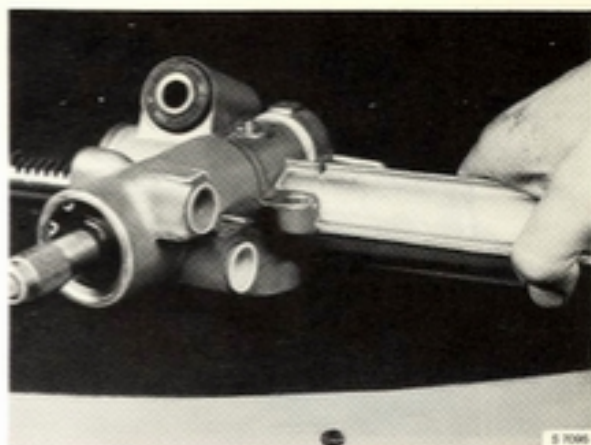
3. Disconnect the hydraulic lines to the steering valve and hydraulic cylinder from the steering gear.



4. Remove the radial adjustment lock nut from the rack and remove the adjusting plug and spring. Use a pair of polygrip pliers or a 45 mm socket if required.



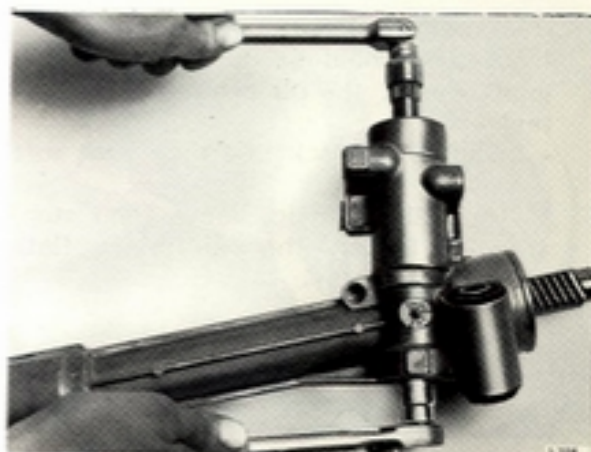
Tap the steering knuckle housing carefully against the workbench to remove the bearing piston.



5. Remove the cover under the steering valve and undo the nut on the shaft.



Use an 11/16 in socket to grip the top of the steering valve shaft, or grip it in a vice fitted with soft jaws.



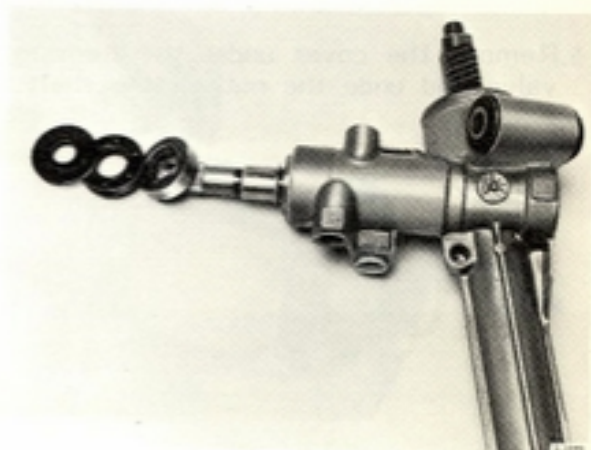
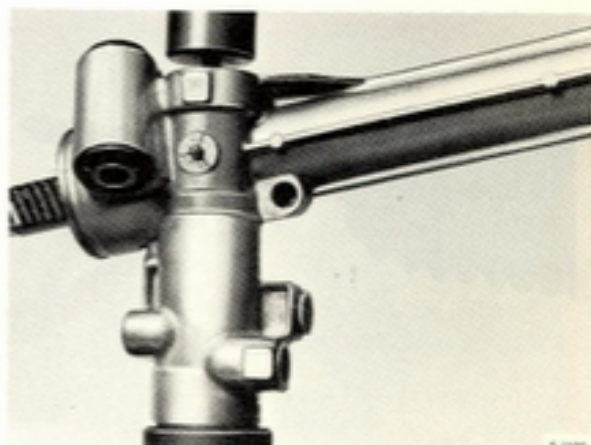
6. Remove the dust cover lock ring from the upper end of the steering valve.



7. Press the steering valve out of the steering gear housing. The needle bearing and the bearing support, the hydraulic seal and dust cover seal will also come free with the valve.

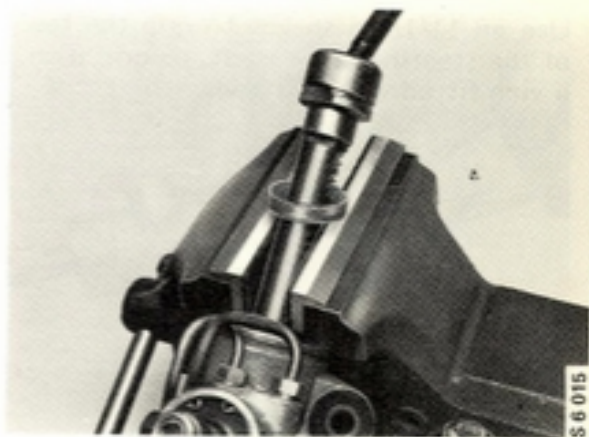
Caution

Never knock or tap the valve unit since this can damage the valve.

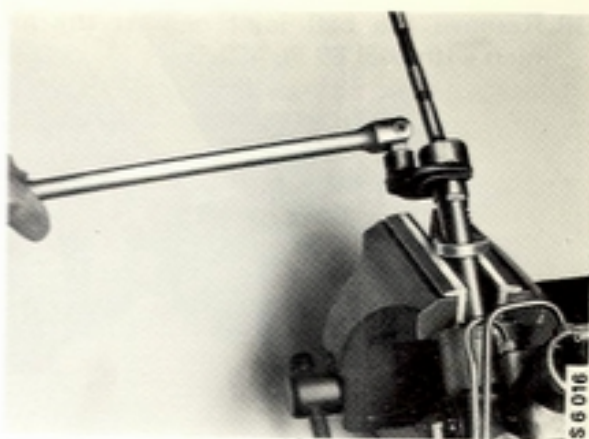


8. Remove the inner ball joint furthest from the pinion as follows (the ball joint nearest the pinion is removed later).

- Clamp the rack in a vice with soft jaws.
- Push the plastic sleeve (end stop) which covers the ball joint's flats out of the way.



- Unscrew the ball joint with tool 89 96 480.

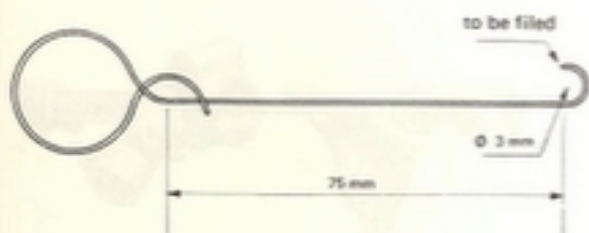


9. Remove the lock ring in the end of the hydraulic cylinder as follows.

- Push the rack as far towards the hydraulic cylinder as it will go.
- Install sleeve 89 96 407 over the rack and press in the spring seal housing by screwing in the inner ball joint.



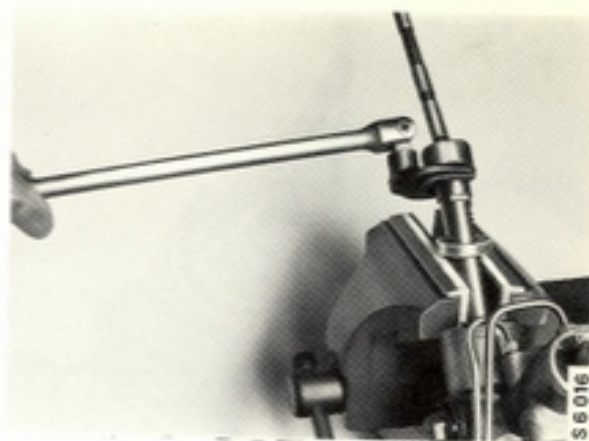
- Press in the wire end of the lock ring in the tiny hole in the steering gear housing (normally covered by a rubber cap) and pry off the lock ring by means of two screwdrivers or a wire hook made from a 1 mm piano wire according to fig.
- Remove the ball joint and the sleeve tool.



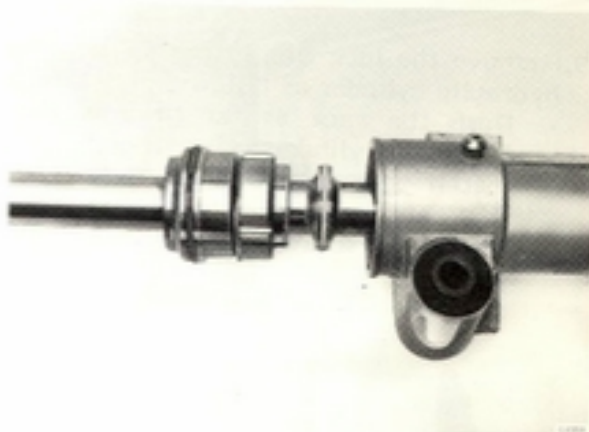
S 8023



10. Remove the ball joint nearest the pinion with tool 89 96 480.



11. Press out the rack together with the hydraulic seal, washer and bushing. (Before removing the bushing and hydraulic seal from the rack, remove any burrs on the end of the rack by means of a fine file).



12. Remove the inner rack seal using tool 89 96 399 and a long drift.



13. Remove the lock ring and the lower pinion bearing.



14. Remove the sealing ring and bushing on the top of pinion.



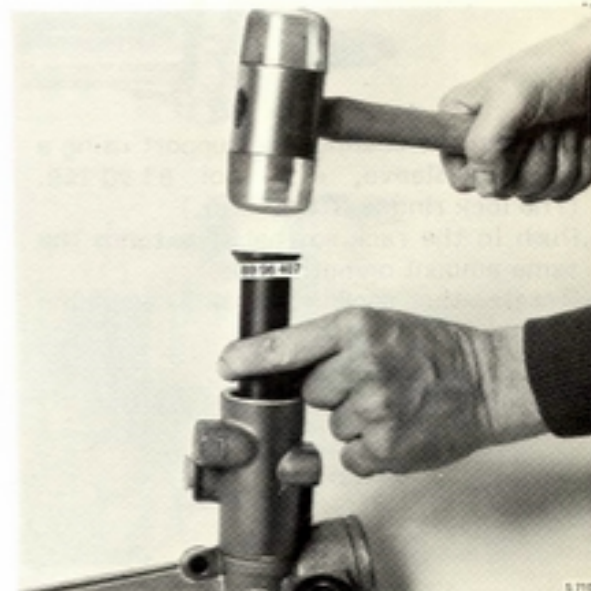
Assembly

Lubricate the pinion, the rack teeth, the bearings and the dust cover seal using 2.1 oz (60 g) lithium grease equivalent to Shell EP2, B2, Code 71303. Lubricate the hydraulic components with Texaco power steering fluid 4634, part no. (45) 30 09 800.

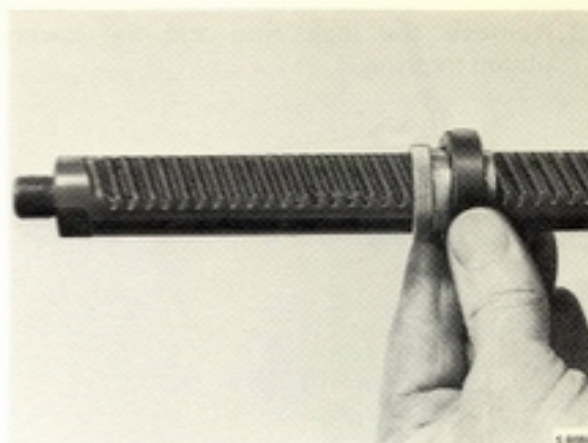
N.B.

The enclosed side of the bearing should face down. The chamfer of the lock ring should face outwards.

1. Install the lower pinion bearing and lock ring.
2. Fit the upper bushing for the pinion and the hydraulic seal using the sleeve 89 96 407.
Maximum force: 2600 N (573 lb., 260 kp)



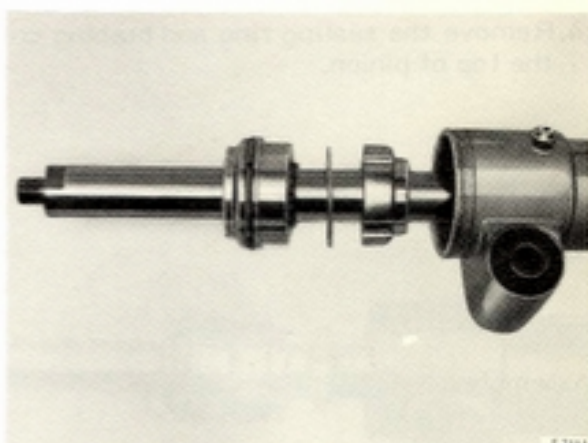
3. Fit the inner hydraulic seal to the rack to prevent the sealing lip from being damaged by the rack teeth. Use tool 89 95 938.



4. Install the rack in the housing and press in the inner hydraulic seal by means of the rack piston. Maximum force: 2200 N (220 kp).

Caution

If a greater force is applied, the piston may come apart from the rack. Avoid withdrawing the rack too far after the inner seal has been fitted, as this may damage the inner sealing ring.

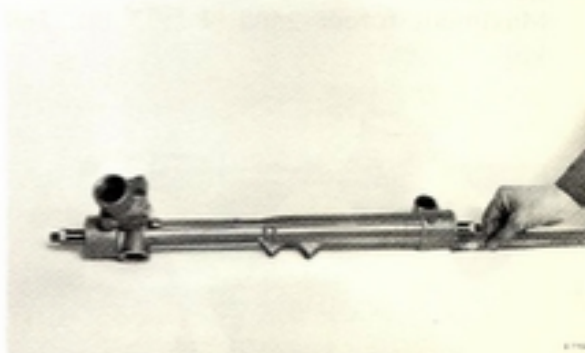


5. Fit the bushing in the cylinder with the smaller bore facing inwards.
6. Install the washer against the bushing.
7. Fit a new O-ring on the outer hydraulic seal support. Inspect the seal. Refit the seal if it is free from defects. Use tool 89 96 407 to insert the new seal. Slide the sealing ring support carefully onto the rack and avoid damaging the sealing lip.



Press in the sealing ring support using a suitable sleeve, e.g. tool 83 90 148. (The lock ring is fitted later.)

8. Push in the rack so that it extends the same amount on both sides. Rotate the rack so that the pinion meshes in the teeth.



9. Assemble the steering valve as follows:

- Hold the valve unit so that the groove in the end of the shaft (for the tensioning screw) points towards the left 9 o'clock in relation to the direction of movement of the car) when the pinion engages the rack.

- Insert the pinion. The valve unit should then rotate so that the groove in the end of the shaft in the withdrawn position points to the front (12 o'clock when the rack is centralized).

10. Fit the nut at the pinion. Grip the top end of the shaft using an 11/16 in socket (or in a vice equipped with padded jaws).

Tightening torque:

30-45 Nm (22-34 ft.lb., 3.0-4.5 kpm)

Fit the cover.

11. Fit the washer and needle bearing, the sealing ring and dust cover, and the lock ring at the top of the steering valve. Protect the sealing lips by means of a protective sleeve of plastic film or metal foil. Use 78 41 067 to insert the seal.

12. Fit the radial bearing piston, the spring and the adjusting plug.

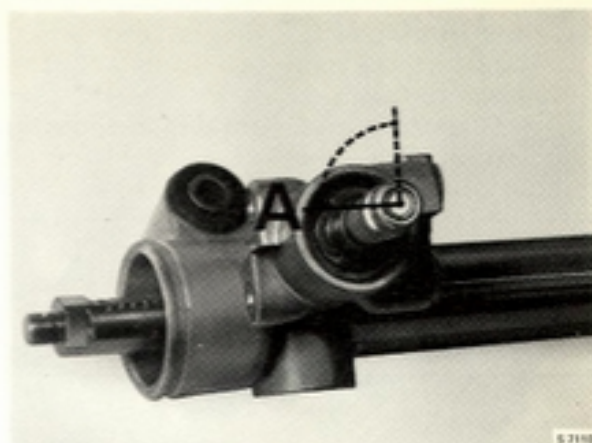
Setting the radial adjustment:

Screw home the adjusting plug (clockwise) and then back off (counterclockwise) 30° - 50° .

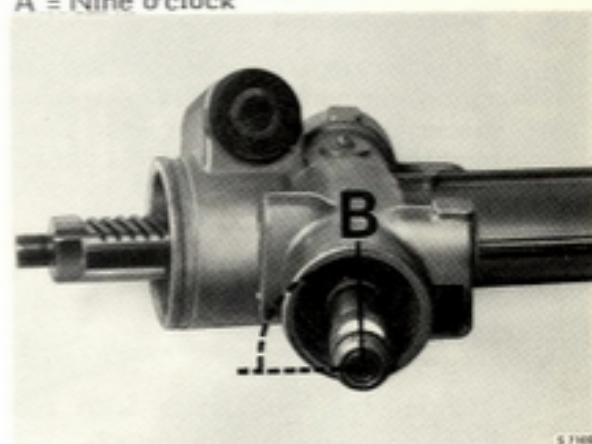
13. Fit the lock nut.

Tightening torque:

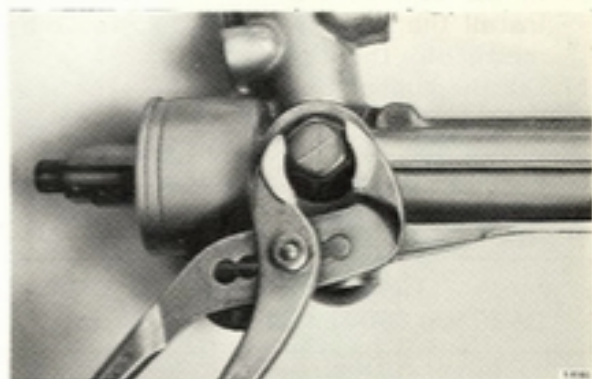
65-75 Nm (48-55 ft.lb., 6.5-7.5 kpm)



A = Nine o'clock



B = Twelve o'clock



14. Insert the plastic sleeves (end stops) and attach the inner ball joints with the tie rod to the rack.
- Clamp the rack firmly in a vice with protected jaws.

Note

The pinion must absolutely not be used as support when loosening or tightening the ball joints.

- If the locking flange was destroyed during dismantling then a special spacer is to be installed when reassembling the ball joint. This displaces the locking point by 90° .

- Tighten the ball joints with tool 89 96 480 and a torque wrench.

Tightening torque:
80-100 Nm (59-72 ft.lb., 8.0-10.0 kpm)

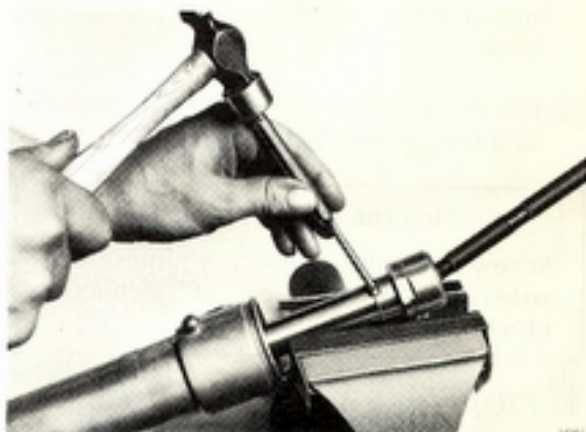
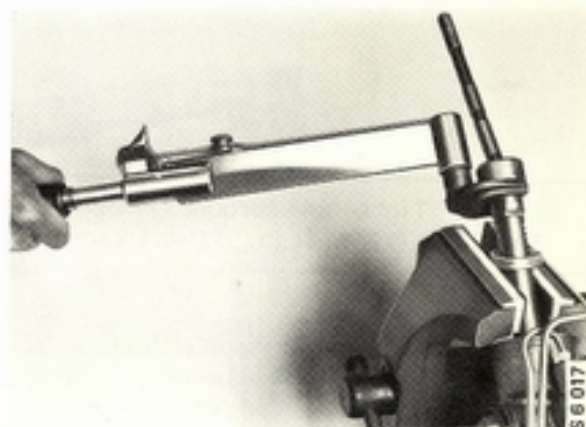
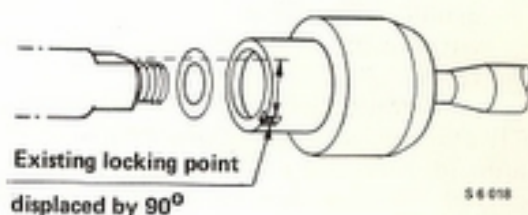
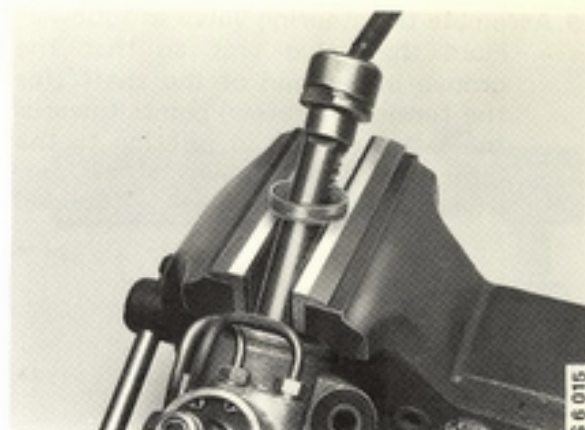
Note

The torque must not be transferred to the pinion.

15. Lock the inner ball joints by upsetting the flange in the two surfaces of the rack using a drift.
16. Fit the lock ring for the sealing ring support in the end of the hydraulic cylinder as follows:
Using an 11/16" socket, turn the pinion so that the inner ball joint presses against the sealing ring support. Press in the support and, at the same time, install the sealing ring in the groove by means of a thin screwdriver.
17. Fit the rubber bellows and the breathing tube between the two bellows.
18. Install the hydraulic lines between the steering valve and the hydraulic cylinder.

Tightening torque:
20-30 Nm (14-22 ft.lb., 2.0-3.0 kpm)

19. Fit the tie-rod ends and the lock nuts.



Removal of servo pump

1. Clean the area around the hose connections. Undo the return hose at the pump and run off the fluid.

Year model 1981:

The servo pump is situated to the left of the engine.

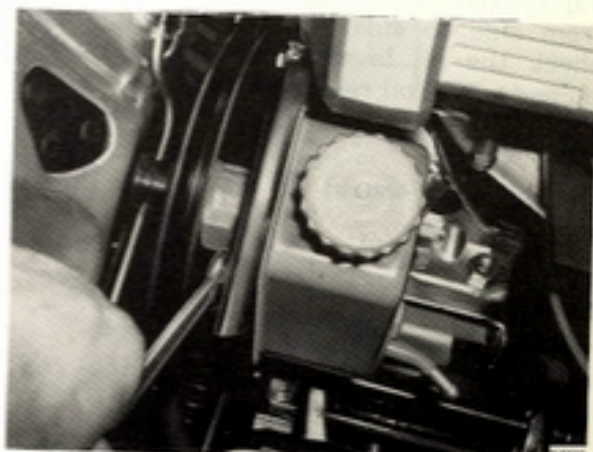
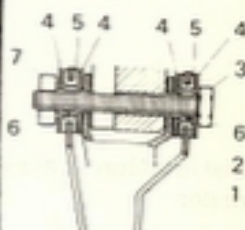
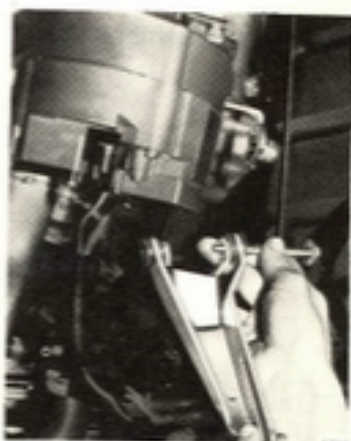
2. Undo one of the battery cables and remove the alternator and place it to one side.

3. Remove the adjusting links for both the alternator and the servo pump.

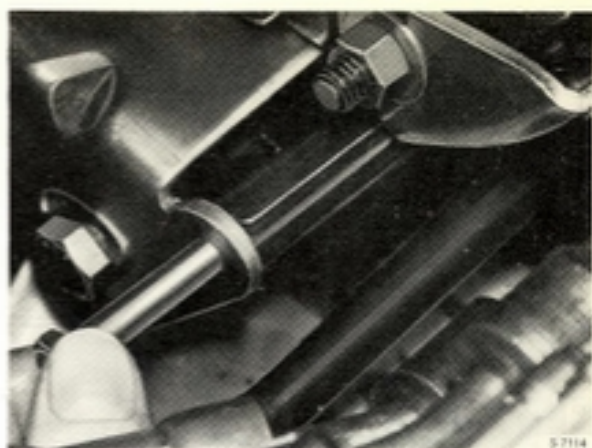
1. Generator adjusting link
2. Servo pump adjusting link
3. Screw
4. Flat washer (4 pcs)
5. Rubber bushing (2 pcs)
6. Sleeve (2 pcs)
7. Nut

Year model 1981:

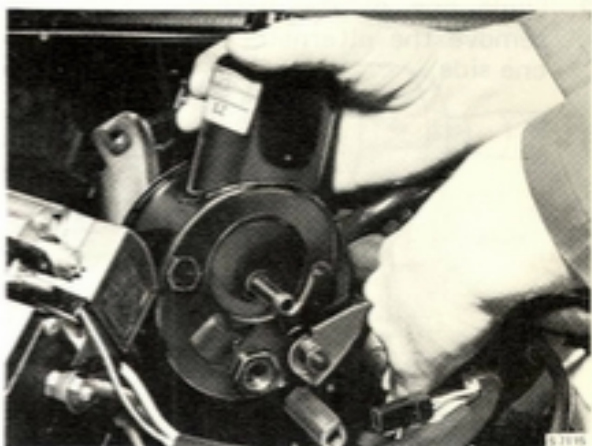
Undo the screw and nut for the pump fitting. Loosen the tension screw and remove the drive belt. Move the pump to one side and remove the screw for the adjust link.



4. Remove the servo pump's mounting screw and undo the pressure hose.



5. Lift out the servo pump



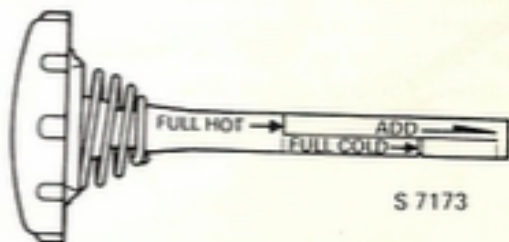
As from model 1981:
Remove the pump and the adjustment link.

Installation takes place in the reverse order



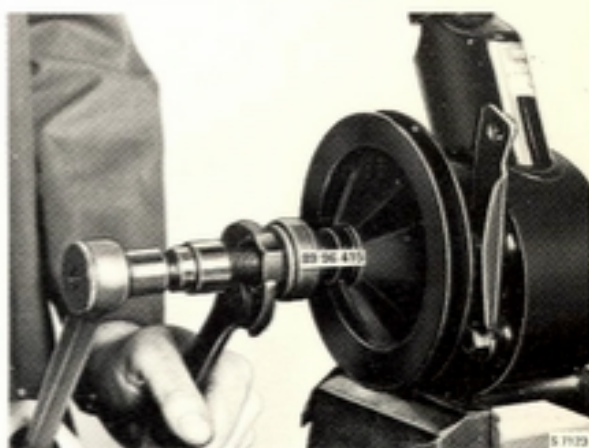
Fill with fluid (as per specification) and run the engine until it reaches normal operating temperature. Turn the steering wheel from side to side. Start the engine and check the oil level on the dip stick attached to the oil reservoir cap.

The oil level should lie within the limits indicated.



Removal and installation of servo pump pulley

1. Use puller 89 96 423 to remove the pulley from the pump shaft.
2. Use installation tool 89 96 415 to refit the pulley on the pump shaft.

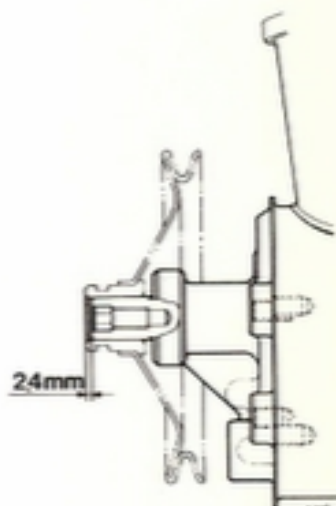


Up and incl. 1980 model:
The shaft should end 2.4 mm inside the pulley's hub.

As from 1981 model:
The shaft end should be in line with the pulley's hub.

Caution

Do not subject the pump shaft to load when installing or removing the pulley.



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