

SAAB

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**SERVICE
MANUAL**

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Steering device

6 Front assembly Steering device

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Specifications

Wheel alignment

All the following figures apply to an unladen car

Caster

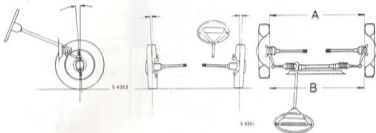
$+0.5^\circ \pm 0.5^\circ$

Camber

$+1^\circ \pm 0.5^\circ$

Toe-in

$B-A = 2 \pm 1 \text{ mm}$



S 4349

"King pin" inclination

$11.5^\circ \pm 1^\circ$

Turning angle:

20°

outside wheel

$20.5^\circ \pm 1^\circ$

inside wheel

Slip radius with 175/70 R 15 tyres

and 5.5 in wheel: 20.5 mm

Ball joints

Maximum play in ball joint when not under load:

Axial 2 mm
Radial 1 mm

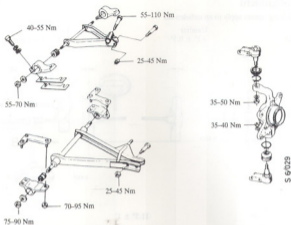


S 1 037



Tightening torques

10 Nm = 1 kgf m



Manual steering gear

Steering wheel turns, lock to lock:

Clearance between cover and pre-load piston

Thickness of internal shims

Pinion pre-load

Steering gear lubricant
quantity

4.2

0.05-0.15 mm

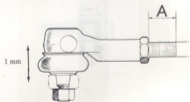
0.13, 0.19 and 0.25 mm

1.1-2 Nm (0.11-0.2 kgf m)

Liquid grease (BP Energrease FGL)

0.15 dm³ (0.15 l)

Tie rod ends

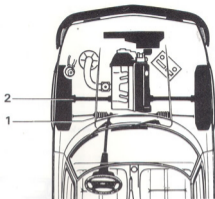


Dimension A on tie rod end,
manual steering

Maximum variation between left-hand and right-hand sides

25 mm max.

2 mm max.



S 6/024

Item	Lubrication point	Lubricant
1	Steering gear Rack, pinion and bearings Inner ball joint	BP Energrease FGL, Part No. (45) 30 08 703 Molybdenum paste, Part No. (45) 30 06 632
2	Steering knuckle joints	Saab Special chassis grease (Esso Nebula 2)

Special tools

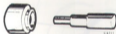


78 40 010 Toe-in measuring tool with extension

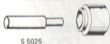
89 95 698 Measuring scale



78 41 067 (A2) Sleeve



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



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



83 90 197 (A2) C-spanner, removal and fitting of outer bearing cap



89 95 284 (A2) Puller, steering gear pinion. Used together with slide hammer 83 90 270. See special tools for the transmission.



89 95 300 (A2) Fitting key, steering gear plunger

89 95 318 (A3) Handle

89 95 326 (A3) Socket



89 95 375 (A3) Removal tool, bushing, steering gear



89 95 409 (A1) Taper breaker, removal of tie-rod ends and ball bolts



89 95 565 (A2) Spanner, locknut, steering gear



89 95 763 (A0-2) *Offset ratchet handle, adjustment of front suspension*



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



89 95 839 (A1) *Spring compression tool, removal and installation of front coil spring*

89 95 847

89 95 854 *Spring shanks*

89 95 862 *Spring cup, LH*

89 95 862 *Spring cup, RH*

89 95 714 *Screw, complete*

89 95 128 *Ball bearing*



89 95 938 (A2) *Installation tool, rack seal*

89 95 946 (A2) *Seal fitting tool, for use with the above*



89 95 953 (A2) *Setscrew*



89 95 961 (A2) *Spanner, ring nut*



89 95 979 (A2) *Spline guard*



89 95 987 (A2) *Rack thread guard*



89 95 995 (A2) *Spanner, rack end piece*



89 96 019 (A0-2) *Steering wheel puller*

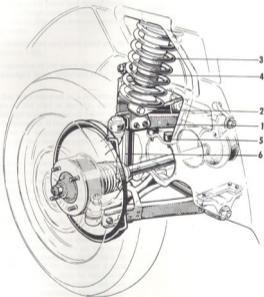


89 96 258 (A0-2) *Steering wheel puller*

General

Front suspension

All wheels are equipped with coil springs. The front wheels are individually suspended and are mounted on the steering knuckle housings, which are connected to the control arms by permanently lubricated ball joints. The inner ends of the control arms are journaled to the body in rubber bearings. The spring movement of the wheels is limited by rubber buffers. The lower front spring supports are pivot suspended.



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Front suspension

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

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 tyres are inflated to the correct pressure and that one front tyre 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, has been driven off the road or the like, then 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. 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. 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 forcefully to full steering-wheel lock. *There is a very serious risk of steering mechanism being damaged 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

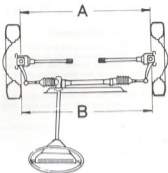
Seen from above, the wheels run at a certain angle to each other. Measurements A and B, made from rim to rim, level with the axles, must bear a given relationship to each other (see illustration). If A is smaller than B, the wheels are said to converge or toe in, and if A is greater than B, the wheels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

Wheel toe-in or toe-out is expressed in fractions of an inch or in millimetres, and is 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 should be:

2 ± 1 mm, i.e. $B - A = 2 \pm 1$ mm.



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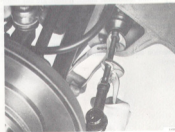
Toe-in

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. Measure dimension 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.

Adjustment

1. Undo the nut on the outer end of the tie rod and the outer clip on the steering gear rubber bellows.
2. Use a suitable pair of pliers to rotate the tie rod right or left, and adjust until the toe-in is correct. Hold the bellows while rotating the tie rod.
3. Tighten the lock nuts and the clamp on the bellows.



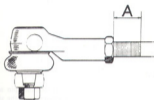
Adjusting the tie rod

Note

With the toe-in set correctly and the wheels pointing straight ahead, the lengths of the tie rods should be identical (the max. permissible difference is 2 mm) or, alternatively, the tie rods may be adjusted so that the clearance between the wheel and the wheel arch and wing will be the same for both wheels at full left hand and full right-hand locks. Also check the steering wheel setting. Remember to tighten the tie rod nut when you have finished adjusting the toe-in.

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. The free thread lengths (A) on both tie rods must not differ from each other by more than 5 mm.

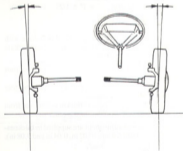
**Checking the tie-rod length**

A = 24 mm max.

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

Camber

Camber is the angle by which the centrelines 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 $+ 1/2^\circ \pm 1/2^\circ$.



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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 greater scope for adjustment. See the spare parts catalogue.



Location of camber adjustment spacers

Caster

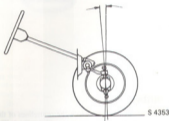
The caster is the angle by which the king pin axis departs from the vertical when viewed from the side and is expressed in degrees. The car has positive caster which means that the "king pin" leans backward.

The caster should be as follows: $+1^\circ \pm 1/2^\circ$

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 $+1^\circ \pm 1/2^\circ$



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.

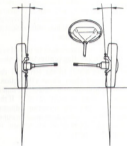
In either case, the total spacer thickness removed from one bracket must be added to the other one.

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

"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 centres of the ball joints and intersecting the ground near the wheel centreline. The steering knuckle axis should incline sideways from the vertical by $11\frac{1}{2}^\circ \pm 1^\circ$.

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.



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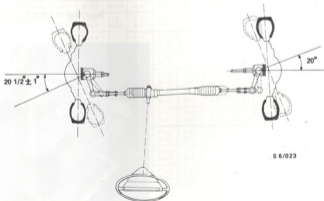
"King pin" inclination

Wheel turning angles

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

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.



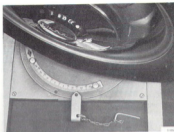
S 6/023

Cornering positions of front wheels

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

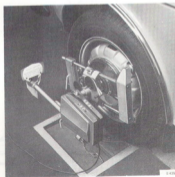
Turn the steering wheel to the left until the right wheel, i.e. the outer wheel, shows a deflection of 20° . If the cornering adjustment is correct, the inner wheel should show a deflection of $20 \frac{1}{2}^\circ \pm 1^\circ$. If the measurements reveal that the cornering adjustment is wrong, one or both steering arms must be out of true. Defective steering arms must not be bent back to shape, but must be replaced.



Outer wheel 20°



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



Optical measuring equipment

Wheel alignment table

The following tables 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 $1\ 1/4^\circ$
 - caster $1\ 1/2^\circ$
 on a car with manual steering gear.

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

F + 5

R + 3

which means:

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

Rear (R) 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.

		Axelstättning ⁰ - Manuell styrväxel (Caster)														
		-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		
A →	B ↓	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+5,5	F+7 B+5,5	F+7,5 B+5	F+8 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 B+3,5	F+6,5 B+3	F+7 B+2,5	F+7 B+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 B+2,5	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-5 B+1	F-5 B+0,5	
		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	F+4 B-1	
		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	Rätt värde	F+0,5 B-0,5	F+1 B-0,5	F+1,5 B-1	F+2 B-1,5	F+2,5 B-2	F+3 B-2	F+3 B-2,5
		1/4	F-4 B+1	F-3,5 B+1	F-3 B ⁰	F-2,5 B-0,5	F-2 B-0,5	F-1,5 B-0,5	F-1 B-1	F-0,5 B-1	F ⁰ B-1,5	F+0,5 B-2,5	F+1 B-3	F+1,5 B-3	F+2 B-3	F+2,5 B-3
		0	F-5 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	F-1 B-2,5	F-0,5 B-3	F+0,5 B-3	F ⁰ B-4	F+0,5 B-4	F+0,5 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	F-2 B-5	F-2 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	F-2 B-6,5	F-2 B-6,5
-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-5,5	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	F-3 B-7,5	F-3 B-7,5		

Toe-in measured on the rim

Toe-in reading	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

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. However, if the rear axle has been subjected to such abnormal strain that the wheels may have been knocked out of true, the wheel angles should be measured.

Toe-in 4 ± 1 mm (if possible both sides should be measured individually, i.e. 1-3 mm on each side)

Camber $-1/2^\circ \pm 1/4^\circ$ (negative camber)

Note

Special equipment for measuring the geometry of the wheels is required to determine the reason for incorrect toe-in.

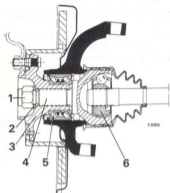
Note

If the difference between the left and right wheelbases is more than 0.2 in (5 mm), the wheel angles must be checked.

The wheel angles can however be out of true without the wheelbase being affected.

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 guard is bolted to the steering knuckle housing. In steering, the steering knuckle housing pivots about an imaginary axis, the "king-pin" or steering knuckle axis, which passes through the centres of both the ball joints and intersects the ground at a point close to the centre 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.



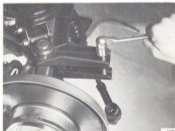
Steering knuckle housing

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

Ball joints

Changing ball joints

1. Jack and block up the car and remove the wheel. Clean the ball joint and surrounding parts.
2. Unbolt the brake housing and use a piece of wire to hook it out of the way to obviate damage to the brake lines.
3. Undo the nut on the ball-joint bolt in the steering knuckle housing and use tool 89-95 409 to remove the bolt.
4. Separate the ball joint from the control arm.



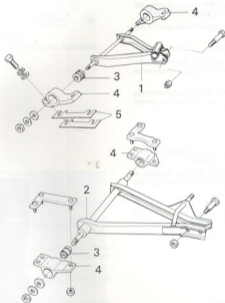
5. Fit a new ball joint, insert the ball-joint bolt through the steering knuckle housing and tighten the nut.
6. Using new locknuts, fit the ball joint to the control arm.
7. Refit the brake housing. Tighten with a torque of 20-110 Nm (9-11 kgf m).
8. Fit the wheel and lower the car.



Assembly of the steering knuckle housing and ball joints.

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. Shims

Upper control arm

Removal

Note

When removing the upper control arm on the left hand side the power unit must be lifted out.

1. Jack up the front of the car and remove the wheel.
2. Remove the shock absorber.
3. Compress the coil spring using tool 89 95 839.
4. Back off and remove the two bolts securing the upper ball joint to the upper control arm.
5. Undo the bolts in both upper control arm bearing brackets.
6. Remove the coil spring.
7. Remove the control arm. Save the shims under the bearings and note the number of shims under each bearing.
8. Undo both bearing nuts, after which the bearings and bushings can be removed from the control arm (see illustration).



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Installation

Thoroughly clean all parts before reassembly and replace any that are worn or damaged.

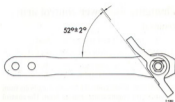
1. Fit the rubber bushings. Dip the bushings in soapy water pressing them into the bearings using tool 78 41 331.

Note

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



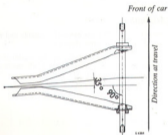
2. Bolt the bearings to the control arm. When both nuts are tightened and locked, the angle between the control arm and bearing should be $52^\circ \pm 2^\circ$.



Angle between upper control arm and bearing

Note

The control arm is asymmetrical (see illustration).



Control arm, asymmetrical

3. Line up the control arm but do not insert the bearing retaining bolts.
4. Check that the rubber buffers under the control arm are mounted.
5. Locate the compressed coil spring with spacer and stop buffer. Fit the support ring. Mount the ball joint to the controlarm.
6. Secure the control arm bearings to the body, not forgetting the spacers.
7. Gradually slacken the bolt of the spring compression tool until the tool can be removed.
8. Fit the shock absorber.
9. Fit the wheel and lower the front of the car.
10. Take the car out for a test run then check and, if necessary, adjust the wheel alignment (see section 601).

Changing the lower control arm

Removal

1. Jack up the car and remove the wheel.
2. Disconnect the lower end of the shock absorber.
3. Back off and remove the two bolts that secure the ball joint to the control arm.
4. Undo the lower control arm retaining bolts from under the engine compartment floor. The control arm can then be removed.
5. Undo both control arm bearing nuts and remove the bearings.

Installation

Thoroughly clean all parts before reassembly and replace any that are worn or damaged.

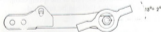
1. Fit the rubber bushings. Dip the bushings in soapy water before pressing them into the bearings, using tool 78 41 349.



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2. When both nuts are tightened and locked, the angle between the control arm and bearing should be $18^\circ \pm 2^\circ$.



Angle between lower control arm and bearing

3. Mount the control arm.
4. Secure the ball joint to the control arm.
5. Fit the shock absorber.
6. Fit the wheel and lower the car.

7. Take the car for a trial run.
8. Check and, if necessary, adjust the wheel alignment (see section 601).

Note

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

Inspecting 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.

Steering wheel

To remove

1. Remove the steering wheel emblem, using a screwdriver.



2. Remove the nut and remove the washer.



3. Fit extractor 89 96 258 to the steering wheel and pull of the wheel.



To refit

1. Replace the direction indicator switch actuator if it has been removed. Make sure that its centre line coincides with the centre line of the switch housing when the front wheels are straight ahead. Fit the plastic sleeve to the actuator.

Caution

The actuator is so designed that it grips the steering column. On no account must it be welded to the column.



2. Fit the steering wheel to the steering column. The front wheels should be aligned straight ahead and the steering wheel spokes should slope equally.

The tightening torque for the

steering wheel unit is 27 Nm (2.7 kfg m).

3. Fit the steering wheel emblem.

**Caution**

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

When fitting the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw is in line with the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account hammer the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. The wheel must not be hammered off or on. When the car is on a hoist, do not grip a front wheel and twist it forcibly to full steering-wheel lock. *There is a very serious risk of steering mechanism being damaged 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.*

Replacement of sealing bellows on inter-mediate shaft

To remove

1. Remove the shield from under the facia.
2. Remove the screw holding the steering column to the intermediate shaft.
3. Undo the four screws securing the steering column tube to the body.
4. Withdraw the steering column from the intermediate shaft.
5. Cut away the old sealing bellows.

To refit

1. Lubricate tool 89 95 813 with vaseline or soapy water. Place the tool against the intermediate shaft. Ease the new sealing bellows over the tool and the joint. Check that the bellows are undamaged.
2. Refit the steering column into the intermediate shaft. Make sure that it is pushed in so that the screw is located in line with the groove. Tighten the screw.
3. Secure the steering column to the body.
4. Check the position of the steering wheel and adjust if necessary.
5. Fit the bellows in the bulkhead.
6. Refit the shield below the facia.



Steering column tube

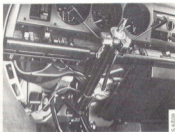
To remove

1. Remove the cover around the steering column tube and the shield below the fascia.

Remove the cover around the steering column tube and the shield below the fascia.
2. Remove the terminal block from the switch for the wipers/washers and remove the electric cable from the contact ring for the horn.

Remove the terminal block from the switch for the wipers/washers and remove the electric cable from the contact ring for the horn.
3. Unscrew the contacts for the light switch and release the cable harness from the steering column tube.

Unscrew the contacts for the light switch and release the cable harness from the steering column tube.



Remove the terminal block from the switch for the wipers/washers and remove the electric cable from the contact ring for the horn.



4. Remove the locking screw from the upper universal joint of the intermediate shaft.
5. Remove the screws and nuts for the mounting brackets.
6. Remove the steering wheel shaft from the universal joint of the intermediate shaft.

Note (safety component)

Handle the steering column tube with care and protect it from blows and rough handling.

To refit

Fitting must be carried out in the following order to avoid stresses between the steering wheel and steering gear.

1. Fit the steering column tube in position, with the steering column and steering wheel mounted.
2. Fit the steering column to the joint. Ensure that it is inserted so that the clamping bolt is in line with the groove in the shaft. Tighten the bolt. Check that there is no excessive play in the bearing and that it does not bind.

Caution

If the steering wheel is mounted after the steering column has been fitted to the joint, stresses may be induced between the steering wheel and steering column tube.

3. Fit the steering column tube to the pedal bracket and body. Check that no stresses are induced when it is secured. Connect the electric cables.
4. If necessary, adjust the steering wheel position.

Steering wheel bearing

To dismantle

1. Remove the steering wheel.
2. Remove the steering column tube.
3. Remove the rubber washer, plain washer and lower bearing assembly.
4. Remove the screw that retains the earth connection, slip ring, plastic bush and upper bearing assembly.
5. Remove the actuator from the steering wheel shaft.
NOTE the position of the actuator pad.
6. Remove the shaft.

Assemble in the reverse order.

Steering gear

General

- 5 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 on 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 dismantled unless absolutely necessary.

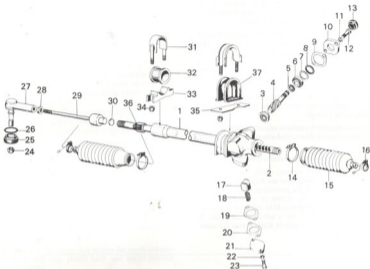
The steering gear is permanently lubricated.

In conjunction with service, check 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.



Note

When replacing the tie rod with ball joint, pos 29 in the picture, the steering gear must be removed from the car.

*Steering gear, exploded view*

- | | | |
|-----------------------------------|--------------------|--------------------------------------------------------------|
| 1. Steering gear housing assembly | 13. Seal ring | 26. Ring |
| 2. Rack | 14. Clip | 27. Tie rod end |
| 3. Ball bearing | 15. Rubber bellows | 28. Lock nut |
| 4. Pinion | 16. Clip | 29. Tie rod with ball joint assembly |
| 5. Sealing ring | 17. Plunger | 30. Spacer washer (fit only if the same tie rod is refitted) |
| 6. Ball bearing | 18. Spring | 31. Retaining cap |
| 7. Shim | 19. Shim | 32. Rubber bush |
| 8. Spacer | 20. Gasket | 33. Intermediate piece |
| 9. Gasket | 21. Cap | 34. Nut |
| 10. Cap | 22. Washer | 35. Washer |
| 11. Washer | 23. Screw | 36. Bush |
| 12. Screw | 24. Nut | 37. Rubber spacer |
| | 25. Rubber bellows | |

To remove

1. Remove the steering wheel.
2. Remove the covers around the steering column below the steering wheel and the left-hand shield below the fascia.
3. Remove the rubber bellows from the intermediate shaft where it passes through the body.
4. Raise the front end of the car and remove the wheels.
5. Remove the tie rod ends from the steering arms. Use tool 89 95 409.
6. Remove the clamp for the handbrake cable and remove both retaining caps.
7. Remove the screws retaining the steering column tube and remove the screw for the clamped joint on the lower universal joint of the intermediate shaft, and remove the shaft from the universal joint.
8. Suspend the steering wheel shaft. Take care not to damage the electric cables.

Note

For right-hand drive cars, operations 9, 10 and 11 apply in the reverse order.

9. Turn the rack as far as it will go to the right.
10. Lift the steering gear assembly to the right by a sufficient amount so that the left-hand tie rod can be lowered and withdrawn through the opening in the engine compartment floor.
11. Turn the rack as far as it will go to the left and lower the steering gear.

Note

Take care not to damage the rubber bellows on sharp edges of the body.

Remove the handbrake cable

Use the screwdriver to remove the clamp

Remove the handbrake cable

Use the screwdriver to remove the clamp

Remove the handbrake cable



To refit

Note

On right-hand drive cars, operations 1 and 2 should be carried out in the reverse order.

1. Turn the rack as far as it will go to the left and insert the steering gear through the opening in the engine compartment floor.
2. Turn the rack as far as it will go to the right and enter the left-hand tie rod through the opening.
3. Fit the clamped joint of the intermediate shaft to the steering gear pinion shaft. Ensure that the screw enters into the groove in the shaft.
4. Lift the steering gear into place and clamp it in position by means of the retaining caps.
5. Fit the steering column tube, rubber bellows, shield and covers.
6. Secure the tie rod ends to the steering arms.

Tighten with a torque of
49-69 Nm (5-7 kgf m).

7. Fit the front wheels.
8. Fit the steering wheel.
9. Check and, if necessary, adjust the toe-in.

Warning

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

When fitting the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw is in line with the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account hammer the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. When the car is on a hoist, do not grip a front wheel and twist it forcibly to full steering-wheel lock. There is a very serious risk of steering mechanism being damaged 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.

To dismantle

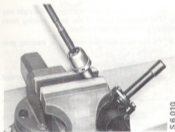
1. Back off the nuts and unscrew the tie-rod ends.
2. Release the clamps and remove the rubber bellows.
3. Removing the end piece:
 - Cover the rack and drill out the metal peened into the locking groove. Use a 4 mm dia. drill.



- Grip the toothed end of the rack in a vice fitted with soft jaws.

Caution

No load whatever must be applied to the pinion when the end piece is removed or refitted.



- Remove the end piece using tool 89 96 472.



4. Remove the screws for the rack adjustment and remove the cap, shims, gasket, spring and plunger.
-

5. Remove the screws for the pinion, remove the pinion, together with the gasket, shims, bearing and washer.
6. Withdraw the rack.
7. Remove the lower bearing of the pinion by tapping the housing against a porous surface. The bush in the end of the steering gear housing can now be replaced, if necessary.

To assemble

The steering gear must be thoroughly cleaned before it is reassembled.

Lubrication

Lubricate the moving parts of the steering gear and fill the steering gear with 150 cm³ (1.5 dl) of fluid grease, part No. (45) 30 08 703.

1. Press in the lower bearing for the pinion.

Note

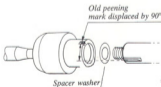
Make sure that both pinion bearings are the right way up. The extended parts of the inner bearing races should face towards one another.

2. Fit the bush into the end of the steering gear housing.
3. Fitting the end piece.
 - Grip the toothed end of the rack in a vice fitted with soft jaws.

Caution

No load whatever may be applied to the pinion when the end piece is removed or refitted.

- Screw the end piece into place. If the end piece is refitted, the old peening mark must be displaced at least 90°. This can be achieved by fitting a special spacer washer between the rack and the end piece.

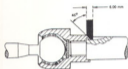


- Tighten the end piece using tool 89 96 472 and a torque spanner.

Tighten with a torque of 110-130 Nm (11-13 kgf m).

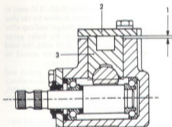


- Lock the end piece to the rack by peening down the flange into the groove.



84 003

4. Insert the rack into the housing. Then fit the pinion, washer and upper bearing. Adjust the pinion with shims so that there is no axial play when the gasket and cap are fitted. Shims are available in thicknesses of 0.005, 0.007 and 0.01 in (0.13, 0.19 and 0.25 mm). A 0.09 in (2.33 mm) spacer is also available.



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Cap and plunger fitted for measurement of play

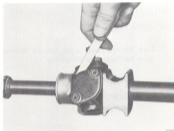
1. Clearance to be measured with feeler gauge
2. Cap
3. Plunger

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

- a. Fit the plunger without the spring and tighten the cap retaining bolts finger-tight (do not fit the gasket at this stage) until the cap 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.



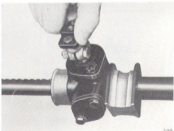
- c. Add 0.0027 in - 0.006 in (0.05 - 0.15 mm) to the measured clearance to allow for the play to be left between the plunger and cap after assembly. If for example the feeler gauge measurement is 0.022 (0.55 mm), the total thickness of gasket and shims should be 0.024 - 0.028 (0.60 - 0.70 mm).

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, 0.015 and 0.020 (0.13, 0.19, 0.25, 0.38 and 0.51 mm).



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

7. Check that the rack does not bind in any position by rotating the pinion with tool 89 95 284.



8. In the correctly adjusted steering gear, the torque should be 1.1–2.0 Nm (0.83–1.5 lb ft, 11.5–20.7 kgfcm). This is checked with the aid of a dynamometer, brake spring tool 89 95 607 and tool 89 95 284. Connect the brake spring tool as shown in the according to figure. A lever arm of about 6.03 (16 cm) is then obtained which corresponds to 7–14 N (5.5–11 lb ft, 0.7–1.4 kgf) on the dynamometer.



9. Fit the other end piece.
10. After fitting one bellows, fill it with grease and fit the other bellows.
11. Lubricate the contact surface between the rubber bellows and the tie rod with silicone grease. The ends of the clip screws should be provided with rubber covers to protect the bellows from chafing.
12. Screw on the lock nuts and fit the tie rod ends assemblies to the tie rods.

Changing the steering gear rubber bellows

It is advisable to remove the steering gear from the car should either of the bellows need replacing.

Lubrication

Fill each side with approx. 50 cm³ (0.5 dl) of FLUID GREASE when fitting new bellows. Part no. (45) 30 08 703.

Fit the rubber covers to the ends of the clip screws (protection against chafing).

Adjusting the steering gear

The adjustment that may be required is to the radial play of the rack.

The adjustment is best carried out with the steering gear fitted to the car. Adjust as described in operations 5–8 in the section "To assemble" the steering gear.

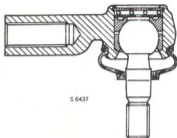
Tie rod assemblies

General

The outer ball joints, the tie rod end assemblies, are screwed on to the tie rods and secured by locknuts. By backing off the locknuts 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 dismantled; they adjust themselves to moderate wear and therefore seldom need exchanging.

However, damage caused by external force, as in a collision, 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 dismantled 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. Back off the nut that locks the end assembly to the tie rod.
3. Remove the nut on the tie rod.
4. Remove 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.
5. Unscrew the end assembly from the tie rod.
6. Screw a new end assembly onto the tie rod, but do not lock it.
7. Connect the ball bolt to the steering arm. Mount the nut and tighten it to a torque of 35–50 Nm (25–36 lb.ft, 3.5–5.0 kgf m).
8. Fit the wheel and lower the car.
9. Check and adjust the toe-in (see section 601).

Important

Remember to tighten the locknut on the tie rod after adjusting the toe-in.



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