

## Chapter N

# Steering system

### Section

- N1 Rack and pinion unit
- N2 Steering pump (Saginaw)
- N3 Steering wheel and Gear range selector unit
- N4 Steering column
- N5 Steering linkage
- N6 Fault diagnosis
- N7 Workshop tools

## Chapter N

## Issue record sheet 1

April 1980

The dates quoted below refer to the issue date of individual pages within this chapter.

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## Steering unit

Rolls-Royce Silver Shadow II,  
Silver Wraith II and Bentley T2  
Rolls-Royce and Bentley Corniche  
From car serial number DRH 32633  
Rolls-Royce Camargue  
From car serial number JRX 32035

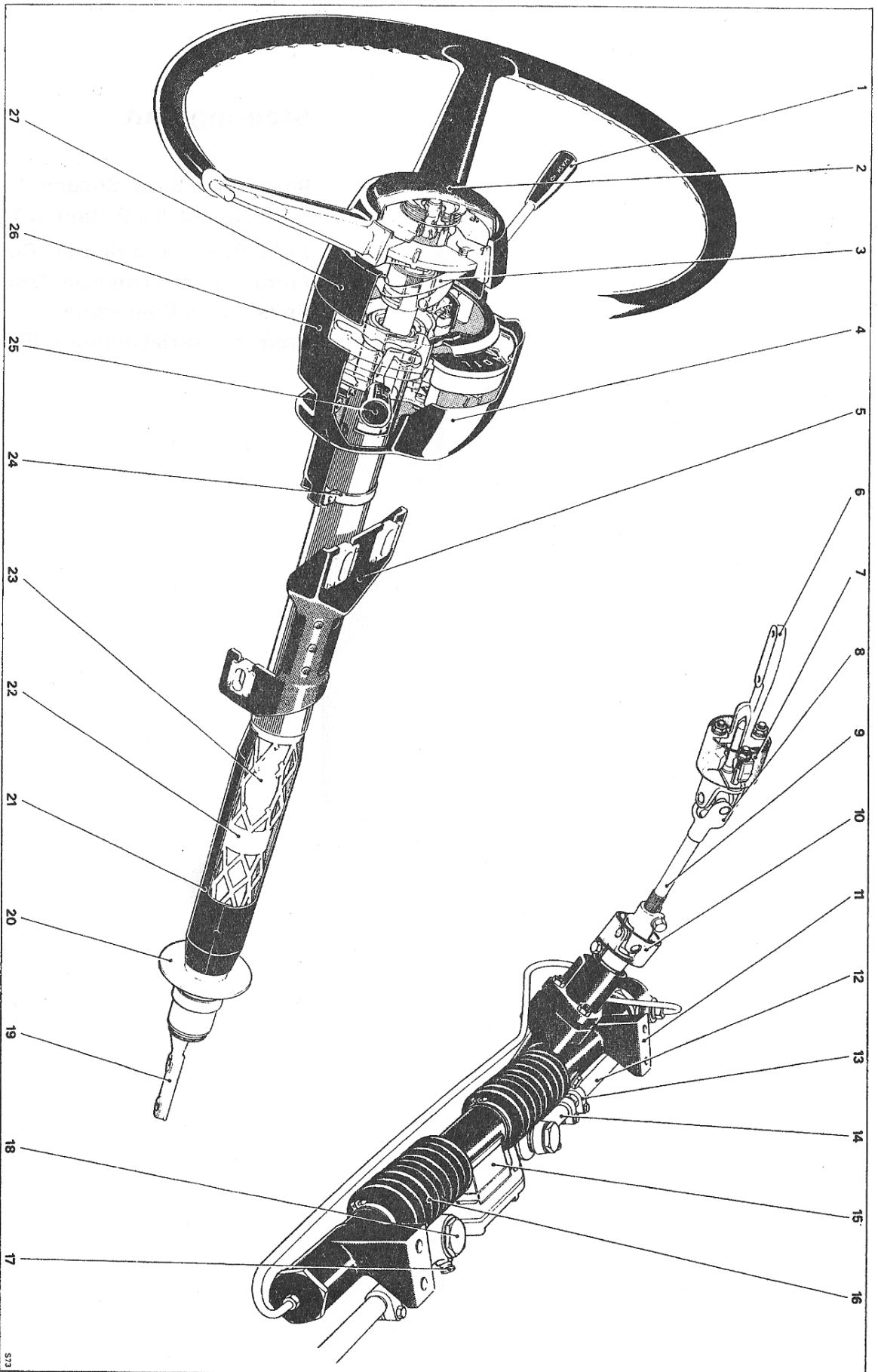


Fig. M1 Steering column with rack and pinion unit

- 1 Direction indicator, headlamp flasher and windscreen washer switch
- 2 Horn button
- 3 Energy absorbing device
- 4 Upper cowl
- 5 Upper steering column fixing
- 6 Upper link
- 7 Bonded coupling, safety stalk and heat shield
- 8 Upper universal joint
- 9 Intermediate link
- 10 Lower universal joint and heatshield
- 11 Mounting bracket
- 12 Outer track rod
- 13 Pinch bolt
- 14 Inner track rod
- 15 Spacer block and centre seal
- 16 Convolved seal
- 17 Grease nipple
- 18 Track rod inner ball pin unit
- 19 Lower extension
- 20 Toe-board plate
- 21 Plastic outer cover
- 22 Collapsible metal mesh
- 23 Inner column
- 24 Rear clip, lower cowl
- 25 Gear range selector lever and automatic speed control system switches
- 26 Lower cowl
- 27 Collar



## Steering unit

Rolls-Royce and Bentley Corniche

Prior to car serial number DRH 32633

Rolls-Royce Camargue

Prior to car serial number JRX 32035

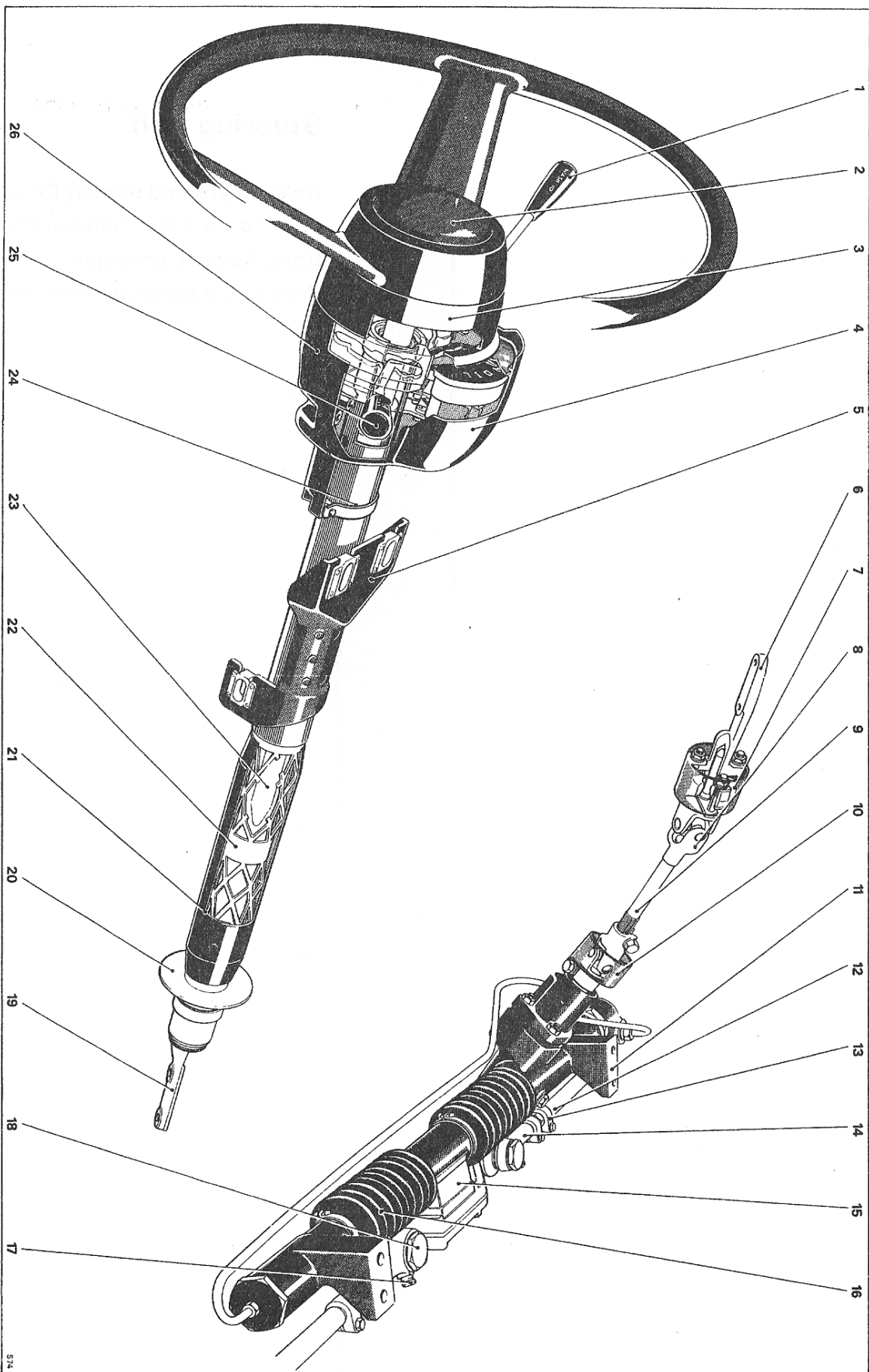


Fig. N2 Steering column with rack and pinion unit

- 1 Direction indicator, headlamp flasher and windscreen washer switch
- 2 Horn button
- 3 Hub assembly
- 4 Upper cowl
- 5 Upper steering column fixing
- 6 Upper link

- 7 Bonded coupling, safety stalk and heatshield
- 8 Upper universal joint
- 9 Intermediate link
- 10 Lower universal joint and heatshield
- 11 Mounting bracket
- 12 Outer track rod
- 13 Pinch bolt

- 14 Inner track rod
- 15 Spacer block and centre seal
- 16 Convoluted seal
- 17 Grease nipple
- 18 Track rod inner ball pin unit
- 19 Lower extension
- 20 Toe-board plate

- 21 Plastic outer cover
- 22 Collapsible metal mesh
- 23 Inner column
- 24 Rear clip, lower cowl
- 25 Gear range selector lever and automatic speed control system switches
- 26 Lower cowl

## Section N1

## Rack and pinion unit

## Introduction

The steering unit is a rack and pinion power assisted mechanism with centre connection to solid bar track rods. Toe-in can be set by the movement of an intermediate adjuster linking the track rod inner and outer components. An anti-joggle valve is fitted into the hydraulic pressure line, located in the spool valve housing, to minimise any feedback caused by external force on the rack in the opposite direction to that steered.

When assembling a steering unit, it must be noted that the main tube and end cap on the pinion box side of the unit are not interchangeable with similar components fitted to cars built to the earlier specification.

Reference must be made to Page N1 - 10 for car serial numbers applicable to this modification.

On later cars the steering rack is fitted with internal lock stops and all lock stop packings

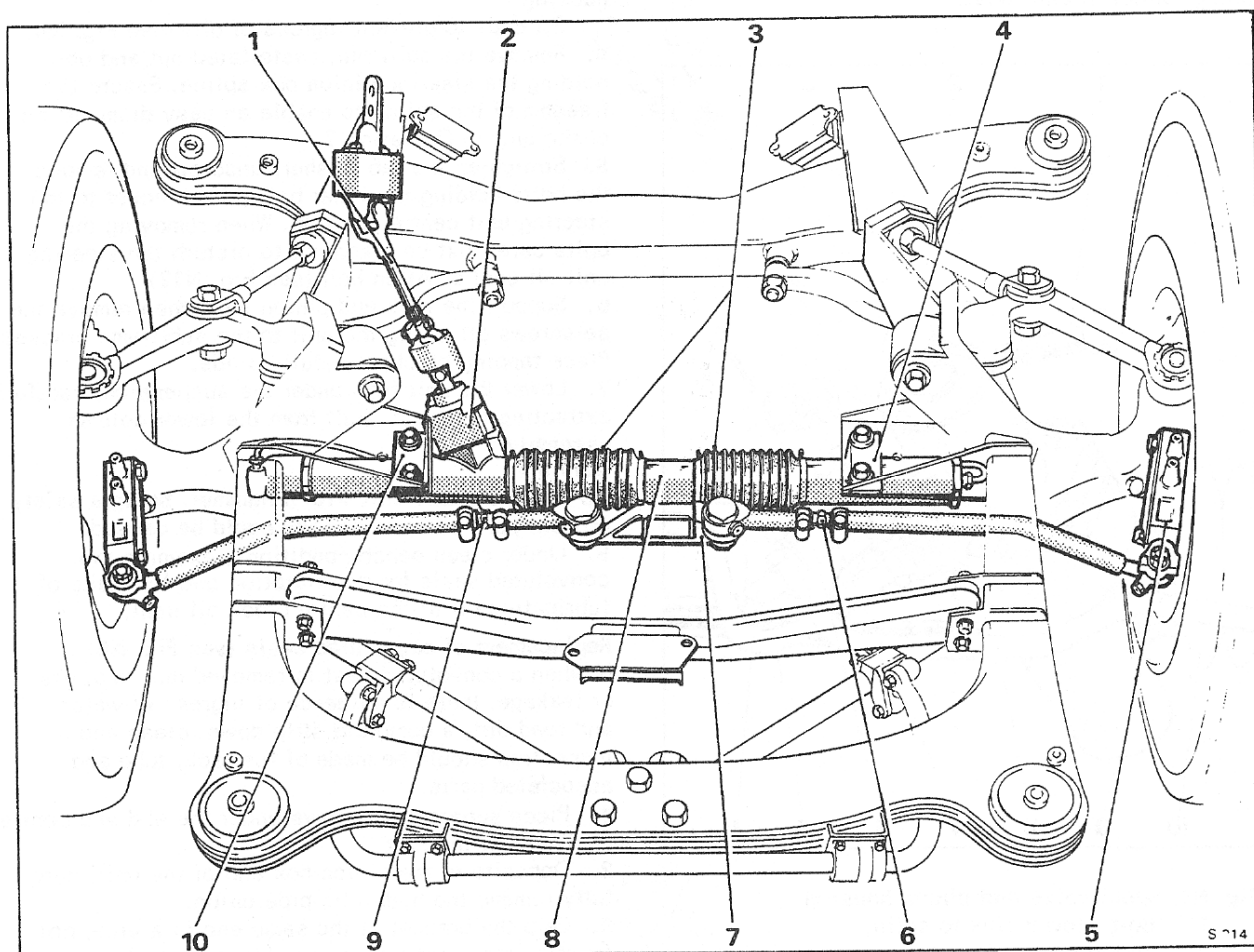


Fig. N3 Steering unit mounted in sub-frame

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| 1 Intermediate link                | 6 Track rod adjuster                |
| 2 Spool valve and pinion           | 7 Inner ball joint bracket          |
| 3 Convoluted seals                 | 8 Centre tube and seal              |
| 4 Steering to sub-frame attachment | 9 Track rod adjuster                |
| 5 Side steering lever              | 10 Steering to sub-frame attachment |

removed from the front triangle levers. Details are given in Chapter H Section H5.

#### Power assistance

Pressure is applied to the steering system rack in varying degrees to provide assistance at the steering wheel, dependent on the effort required to move the road wheels.

The degree of assistance is controlled by the passage or restriction of oil through a series of ports in the upper half of the pinion box creating a pressure differential, across the rack, proportional to the load applied at the steering wheel.

The system operates by causing a small torsion bar to twist, immediately the steering wheel is moved, rotating the concentric valve components to provide the pressure differential required. A 'fail safe' device prevents the torsion bar from being overstressed, by limiting the number of degrees through which it can twist.

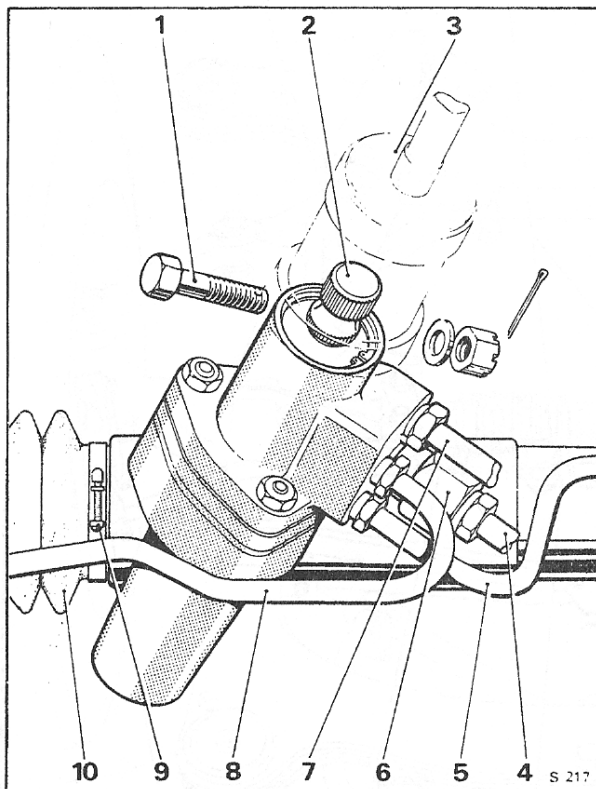


Fig. N4 Spool valve and pinion housing

- 1 Bolt - lower link to spline
- 2 Valve and pinion shaft
- 3 Heatshield
- 4 Hydraulic feed pipework
- 5 Fluid feed to end of rack
- 6 Anti-joggle valve adapter
- 7 Hydraulic return pipework
- 8 Fluid feed to end of rack
- 9 Seal attachment clip
- 10 Convoluted neoprene seal

#### Note

The steering unit is a safety critical part. The unit must be handled with great care. Avoid impact loads on the input shaft or the centre off-take and damage to the convoluted seals which could cause premature failure of the unit.

Do not disturb the end plug or locking nut whilst the rack and pinion unit is fitted in the car.

All threads on the rack assembly are metric, except the mounting bolts to the sub-frame and the lower steering column linkage, which remain Unified.

#### Rack and pinion unit - To remove from sub-frame

1. Drive the car onto a service workshop lift and raise to a convenient working height.
2. Remove the gear range selector thermal cut-out (see Chapter M - Electrical System).
3. Remove the high pressure feed and low pressure unions feeding external pipework into the spool valve housing.

Fit caps to prevent ingress of dirt (see Fig. N4).

4. Remove the split pin, castellated nut and bolt holding the steering pinion box spline. Ensure the freedom of the spline to enable an easy dismantling of the unit in Operation 7.
5. Straighten the tab washer, unscrew and remove the bolts holding the inner ball joint bracket to the steering unit centre position. When removing the bolts care must be taken not to disturb the steering unit oil seal or Allen bolt (see Fig. N12).
6. Support the rack and pinion unit, then remove the setscrews attaching the unit to the sub-frame brackets. Place tapping blocks carefully aside.
7. Lower the unit from under the suspension, carefully extracting the input shaft from the lower column assembly.

#### Warning

Do not strike this unit with a hammer. Being a safety critical part, extreme damage could be caused.

8. Under clean bench conditions, examine the convoluted seals for deterioration and for leaks of lubricating oil at the centre block oil seal.

#### Replacement of convoluted seals (see Fig. N6)

If when a convoluted seal is removed due to splits or leakage, there is evidence of ingress of water and road dirt, a complete strip down, clean and inspection should be made of the rack, tube and associated parts.

1. Place separate drip trays under the end and centre positions of the unit.
2. Opposite to the pinion box end of the unit, carefully remove the hydraulic pipe union.
3. Grip the bracket at the same end in a vice, not exerting too great a pressure. Unscrew and remove the blanking plug from the end of the rack tube and withdraw the outer tube and bracket. Cover the dismantled parts with a clean cloth.
4. Discard the 'O' rings fitted into the seat of the blanking plug and inside the mounting foot. Cover the dismantled parts with a clean cloth.

If it is necessary only to replace the convoluted seals at the dismantled end of the unit, there will

be no need to disturb the centre block and oil seal. If however, both convoluted seals are to be removed, the centre block must be dismantled as described in the following operations.

5. Unfasten the socket head cap screw holding the centre block in position against the rack gear. Withdraw the block and oil seal. Protect under a clean cloth.

6. Slacken the retaining screws holding the four ring clips to the convoluted seals.

7. Remove the seals, ring clips and centre sleeve. The latter component must also be covered to prevent ingress of dirt.

8. Turn the unit over with the elongated slot facing downwards to drain the lubricating oil.

9. Fit new seals, clipping these to the static end positions and the centre tube.

10. Ensure that the screw heads of all the retaining clips face downwards and to the rear of the rack, to facilitate service inspection checks on the tightness of the clips when the unit is fitted back into the vehicle. Lift the unit higher at the dismantled end and pour 60cc (0.10 pints) of new, approved lubricating oil through the slot in the centre sleeve.

11. Fit the centre block, using the flexible bonding agent 'Silastic 732 RTV Sealant' on the mating surfaces of the seal, to ensure a leak free joint.

12. Fit new 'O' rings and replace the outer tube and bracket.

#### Note

To ensure control over the relative flatness of the two suspension mounting bracket faces, place the assembly with brackets face down onto a surface table or suitable flat fixture.

Lightly clamp the brackets before torque tightening the blanking plug.

13. Screw in the blanking plug, ensuring the 'O' ring rests in its correct seating. Torque tighten to between 4,8 kgf.m and 5,5 kgf.m. (35.0 lbf.ft. and 40.0 lbf.ft.).

14. Screw the hydraulic pipe union carefully into the end of the blanking plug to form a good seal. Torque tighten to the figures quoted in Chapter P.

15. The unit is now ready for fitting to the car.

#### Rack and pinion unit - To dismantle (see Fig. N7)

If the unit has an internal fault which necessitates the removal of the rack, dismantling to the stage of withdrawing the centre block as shown from the heading - Replacement of convoluted seals, to Operation 8 inclusive - should be completed before continuing with the following.

1. After draining the lubricating oil, place the unit onto two 'vee' shaped wooden blocks.

2. Remove the remaining feed pipe and place carefully aside. Blank off the hole in the pinion box and end cover.

3. Mark the relationship between the input shaft spline and pinion box housing with the steering in the 'straight ahead' position. Use the screwed plug to ensure a correct setting.

4. Unscrew the three nuts and release the valve

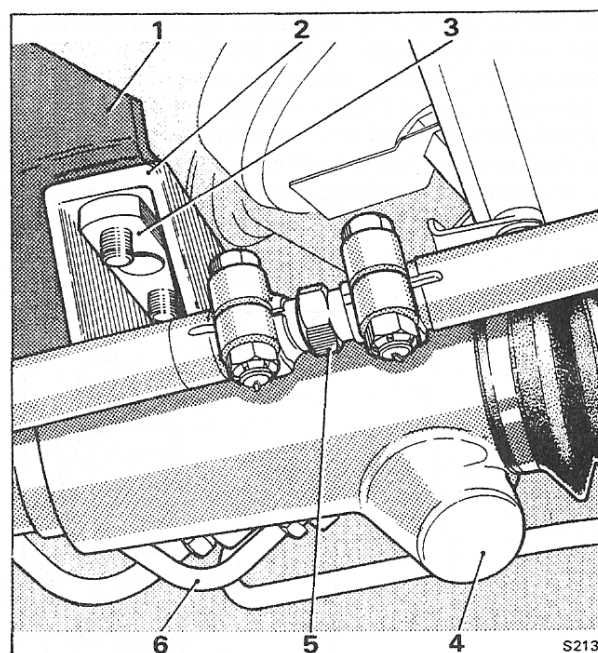


Fig. N5 Steering to sub-frame mounting

- 1 Sub-frame bracket
- 2 Steering unit mounting foot
- 3 Tapping block
- 4 Pinion housing
- 5 Track rod adjuster
- 6 Hydraulic pipework

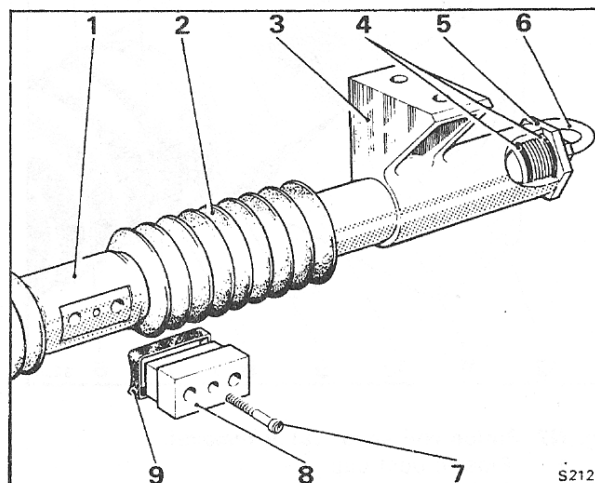


Fig. N6 Removal of convoluted seals

- 1 Centre tube
- 2 Seal
- 3 Mounting foot
- 4 'O' rings
- 5 Blanking plug
- 6 Fluid feed pipework
- 7 Cap head socket screw
- 8 Centre block
- 9 Shaped seal

## N1-4

and pinion assembly by gripping the pinion spline with one hand and keeping the two halves of the valve housing together with the other hand. With a turning movement lift the assembly, using the splined shaft, clear of the pinion box casting. Remove the setting shims but record the number and position.

5. Unscrew the remaining end cap and place safely aside. Discard the internal 'O' ring.

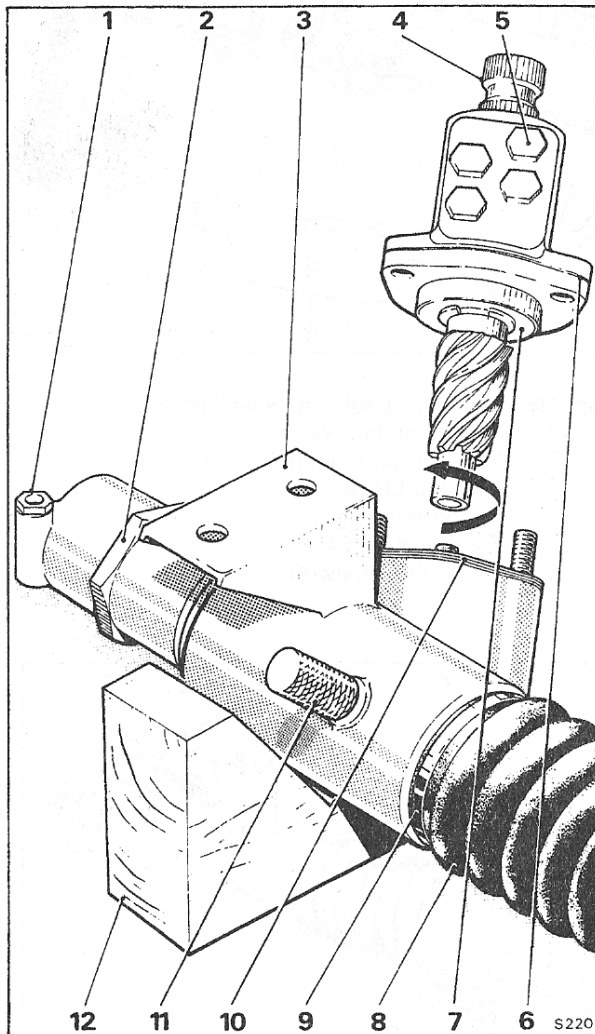


Fig. N7 Pinion and spool valve removal

- 1 Plastic dust cap
- 2 End cap locknut
- 3 Mounting foot
- 4 Pinion boss
- 5 Plastic dust caps
- 6 Bearing pre-load shim
- 7 Bearing carrier
- 8 Convoluted seal
- 9 Seal clip
- 10 Pinion pre-load shims
- 11 Rack centring plug
- 12 Support

6. Using an appropriate sized wooden dowel, carefully press the end of the rack until the P.T.F.E. ring and oil seal appear at the pinion end of the unit.

7. Support this end of the rack whilst continuing to withdraw from the tube. Ensure the rack and tube do not make contact or the P.T.F.E. bearing is not damaged during removal past the centre slot and pinion opening.

It is easy to cause damage to the internal surface of the tube. Care should be taken at this stage.

8. Inspect all components including the internal faces of the end caps, the lip seals and P.T.F.E. bearing. Wash all metal parts in 'Genklene' or an equivalent cleaning fluid. Ensure components are dry before new 'O' rings are fitted.

#### Pinion and spool valve assembly

The pinion and spool valve assembly comprises the following main service items, upper oil seal, P.T.F.E. rings, lower oil seal, lower oil seal carrier, 'O' rings, paper joint washers, pre-load shims and snap ring.

#### Upper oil seal - To replace

1. Remove the upper circlip and plastic washer, then carefully lift the housing off the spool valve unit ensuring the P.T.F.E. rings are not damaged.

Note the number and position of existing paper joint washers and pre-load shims between the ball race carrier and pinion housing.

2. Carefully prise out and discard the upper oil seal.

3. Fit a new upper oil seal using special applicator tool (RH 9121). This seal has a pressure lip and a dirt lip. In the cavity between the two lips, apply molybdenum disulphide grease.

Failure to do this could result in noisy seal action.

4. To protect the new seal, tightly wrap a single layer of clear adhesive tape around the spool valve spline.

5. Carefully fit the spool valve back into the housing, ensuring that each P.T.F.E. ring enters the bore squarely with no pinching of the edges against the bore.

Do not use force to assemble.

#### P.T.F.E. rings - To replace

1. Dismantle the unit to the stage of having removed the circlip, washer, spool valve housing, paper joint washers and pre-load shims. Discard the upper oil seal.

2. Cut into the P.T.F.E. rings with a sharp instrument having a smaller dimension than the width of the groove, taking care not to damage the finely machined surfaces of the spool valve. Use 'vee' shaped wooden blocks to support the end diameters during removal of the rings.

3. Inspect the P.T.F.E. ring grooves.

4. Remove the lower pinion oil seal, 'O' ring and carrier.

5. Withdraw the upper carrier of the ball race.

6. Remove the snap ring under the ball race carrier



housing taking care not to lose any of the (14) ball bearings when withdrawing the assembly. Place carefully aside.

**7. Immerse the new P.T.F.E. rings in warm oil prior to fitting onto the special applicator (RH 9117). Failure to warm up the rings before fitting could cause cracking.**

**8. Place the tool over the input shaft spline and adjust until the base edge of the tool corresponds with the upper edge of the lowest spline groove.**

**9. Slide one P.T.F.E. ring into the groove.**

**10. Adjust the tool to fit the remainder of the rings into their respective grooves.**

**11. Remove the sleeve tool then size the rings by carefully pressing special tool (RH 9118) over the rings to reduce their diameter.**

**12. Tightly wrap a single layer of clear adhesive tape around the spool valve to protect the P.T.F.E. rings during assembly of the ball race carrier and lower oil seal. With these assembled, fit the (14) ball bearings and locate the assembly by fitting a new snap ring.**

**13. Fit the upper ball race carrier into position.**

#### Lower oil seal - To replace

If the pinion unit is dismantled just to replace the lower oil seal it will be unnecessary to disturb the P.T.F.E. rings as shown in Operation 2 of the previous sub-section.

**1. To remove the lower oil seal, 'O' ring and carrier, wipe the spool valve shaft and spline with a lint free cloth to enable a single layer of clear adhesive tape to be wrapped tightly around the spool valve P.T.F.E. rings.**

**2. To facilitate removal of the seal and carrier, lubricate the outside of the tape with steering fluid.**

**3. Lift out the seal and carrier.**

**4. Press out and discard the oil seal from the lower oil seal carrier.**

**5. Check that the carrier is free from damage and burrs.**

**6. Press a new oil seal into the carrier ensuring that the lip face of the seal is uppermost.**

**7. Slide the new seal and carrier over the adhesive tape and locate into the lower housing.**

**At this stage it will be necessary to re-set the thrust ball race pre-load detailed in the next sub-section.**

#### Thrust ball race

If the spool valve and pinion unit is dismantled to the stage of inspecting the thrust ball race and it is found necessary to replace any thrust race components, the pre-load torque must be reset.

The following table gives a conversion of the spring balance readings quoted in the text, to a figure for use with a kgf.cm. (lbf.in.) torque spanner.

#### Note

If the readings are to be taken using a torque spanner, a slightly worn  $\frac{1}{4}$  in. A/F socket is preferred to fit over the input shaft spline.

To protect the components wrap clear adhesive tape over the spline and spool valve rings.

Spring balance and arm		Torque spanner	
kgf	lbf	kgf.cm.	lbf.in.
0,0544	0.120	0,553	0.480
0,272	0.600	2,765	2.400
0,510	1.125	5,185	4.500
0,820	1.800	8,330	7.200
0,910	2.000	9,251	8.000
1,130	2.500	11,500	10.010
1,950	4.300	19,810	17.200
2,040	4.500	20,700	18.000

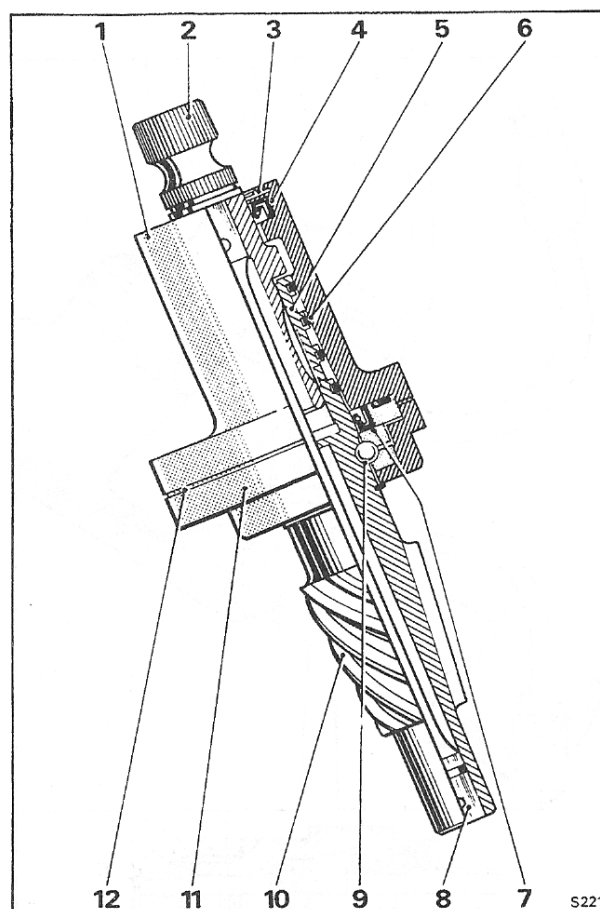


Fig. N8 Pinion and spool valve unit. Cut-away view

- 1 Spool valve housing
- 2 Spline
- 3 Circlip and plastic washer
- 4 Lip type oil seal
- 5 Spool valve
- 6 P.T.F.E. rings (4)
- 7 Lower oil seal
- 8 Torque arm
- 9 Thrust ball race
- 10 Pinion
- 11 Ball race carrier
- 12 Pre-load shim(s)

1. Fit the ball race, with any new components required and lubricate the assembly with a light application of new approved oil. Ensure the oil does not contaminate the area bounded by the two oil seals.
2. Replace the lower oil seal carrier as shown in sub-section, 'Lower oil seal - To replace'.
3. If a new lower oil seal has been fitted, first place a new paper gasket onto the face of the lower oil seal carrier, then the original stack of shims plus one additional shim of at least 0,254 mm (0.010in.) thickness and lastly a new paper gasket.

This additional shim will effectively remove any bearing pre-load when assembly is completed.

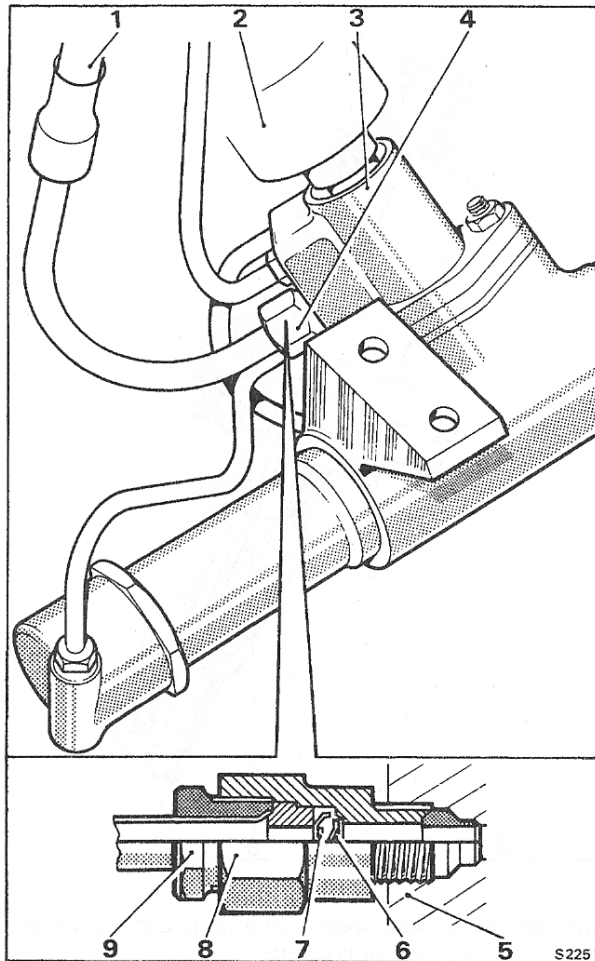


Fig. N9 Anti-joggle valve

- 1 High pressure fluid
- 2 Heatshield
- 3 Spool valve housing
- 4 Anti-joggle valve
- 5 Spool valve casting
- 6 Spring
- 7 Flap valve
- 8 Adapter
- 9 Pipe union

Shims are available in the following nominal sizes.

- 0,063 mm. (0.0025 in.)
- 0,127 mm. (0.005 in.)
- 0,254 mm. (0.010 in.)
- 1,270 mm. (0.050 in.)

4. Remove the adhesive tape from the spool valve shaft only and wipe the spool valve assembly with a clean lint free cloth. Lightly lubricate the spool valve assembly with power steering fluid.

**Do not fit the lower oil seal carrier 'O' ring at this stage.**

5. Carefully fit the spool valve housing onto the spool valve shaft ensuring that each P.T.F.E. ring enters the bore of the housing squarely with no pinching of the ring edges against the bore.

**Do not use force to assemble.**

6. Lightly 'nip' the housing and carrier together using three suitable nuts and bolts then rotate the input shaft a number of times to reduce initial drag.

7. Grip the sub-assembly in a soft-jawed vice and fit the special torque arm tool (RH 9123) to the input shaft spline.

8. Using a spring balance, note the reading required to rotate the input shaft to measure pinion seal drag and spool valve friction. This should be between 0,016 kgf. and 0,08 kgf. (0.120lbf. and 0.60lbf.).

If the reading is above 0,08 kgf. (0.60lbf.), bearing pre-load may still exist and it will be necessary to fit an additional shim.

#### Note

If after fitting additional shims to the extent that no bearing pre-load exists, ie. end float appearing in the spool valve, then some other source of tightness, such as, incorrectly size P.T.F.E. rings or other faulty compounds could be the cause.

9. Assemble and test the unit again as shown in Operations 5 to 8, until a figure within the limits noted in Operation 8 have been achieved.

10. Dismantle the spool valve housing then reduce the shim stack by one 0,063mm. (0.0025in.) shim.

11. Assemble the unit and torque tighten the flange nuts to between 2,04 kgf.m. and 2,55 kgf.m.

(14.75 lbf.ft and 18.50 lbf.ft.) to achieve a spring balance reading to rotate the shaft of not more than 0,510 kgf. (1.125 lbf).

Continue to reduce the shims, until the final spring balance reading shown in Operation 11 is attained.

#### Important

**Do not 'short cut' this exercise.** Excessive pre-load can damage the bearing parts.

12. Finally remove the spool valve housing to fit an 'O' ring into the lower oil seal carrier.

Ensure the paper gaskets are in good order and fitted top and bottom of the shim stack.

13. Lubricate the spool valve and pinion seals with steering fluid and the upper oil seal with a light coating of molybdenum disulphide grease.

14. Carefully assemble the spool valve housing.

15. Ensure new paper gaskets are fitted to the under-

side of the ball race carrier and the steering rack pinion housing face.

16. Fit the original number of shims and carefully fit the complete spool valve assembly into the pinion housing.

17. Ensure the hydraulic pipe connections of the spool valve housing are in the correct relative position.

18. The correlation mark on the input shaft should align with the mark on the spool valve housing when the assembly is fully engaged with the rack in the central position.

19. Tighten the retaining nuts to between 2,04kgf.m. and 2,55kgf.m. (14.75lbf.ft. and 18.5lbf.ft.).

20. Replace any rack lubricating oil up to the correct total amount of 60cc. (0.10 pints) of EP90 grade, that may have been lost during dismantling.

#### Anti-joggle valve (see Fig. N9)

1. With the steering dismantled remove the anti-joggle valve.

2. Check that the spring and flap are functioning by pressing a probe carefully onto the top of the flap to ensure that adequate compression of the assembly occurs and the flap seats correctly.

3. Wash out the assembly in 'Genklene' or equivalent cleaning solution then dry, using a controlled jet of dry pressurised air into the male thread end of the unit only.

4. Fit blanking plugs into each end of the adapter.

#### Pipe unions

If the olive which forms the seating of the pipe union is found to be damaged it will be necessary to remove the spool valve housing before it can be renewed.

1. Extract the faulty component by tapping a suitable thread into the bore of the seating and inserting a setscrew with a half nut under the head, a washer and distance tube.

2. Lift the setscrew by turning the nut against the face of the washer to withdraw the olive.

3. Fit a new seating in position by pressing it squarely into the bore using an appropriate diameter soft mandrel.

It must be emphasised that strict cleanliness must be observed when carrying out the above operations.

#### Rack and pinion unit - To assemble

It is essential that the rack should only be removed or refitted from the pinion end of the unit to ensure that the P.T.F.E. bearings or oil seals are not damaged by the internal thread at the blanking plug end of the assembly.

At this stage, check the bore of the rack tube for scoring or damage

1. With the rack unit out of the tube, fit the scarf-jointed P.T.F.E. rack bearings into their respective grooves in each end of the rack.

2. Gently press each scarf-joint together and measure that each gap gives an initial (nominal) measurement of 2,03mm (0.080in.)

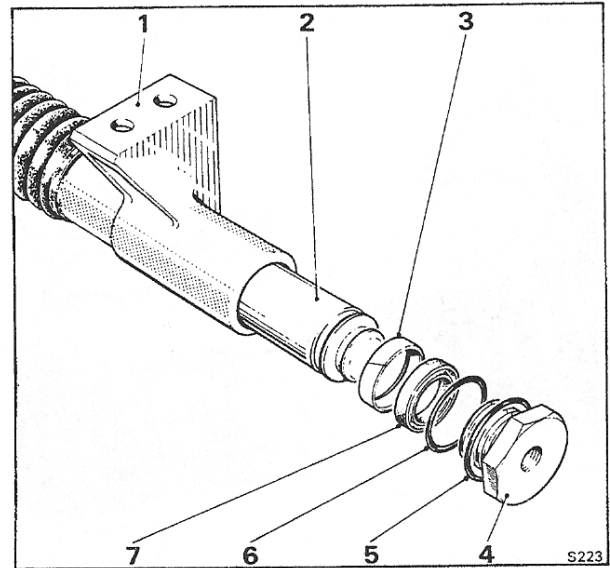


Fig. N10 Assembly of free end components

- 1 Mounting foot
- 2 Rack spindle
- 3 P.T.F.E. seal
- 4 Blanking plug
- 5 End plug 'O' ring
- 6 Tube 'O' ring
- 7 Oil seal

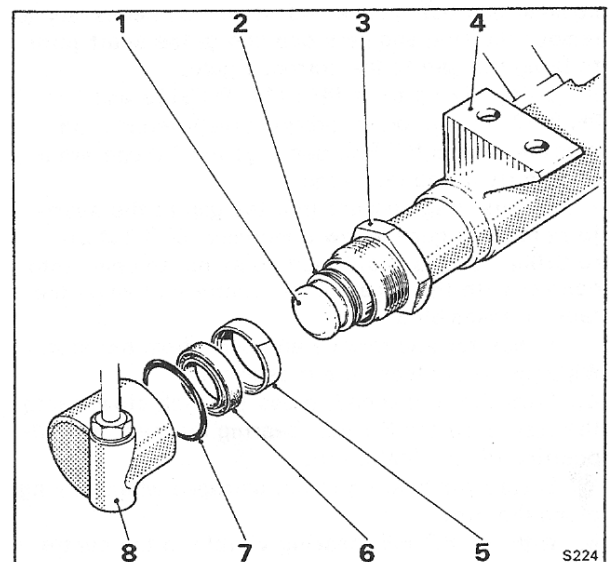


Fig. N11 Assembly of pinion box end components

- 1 Rack spindle
- 2 P.T.F.E. seal carrier
- 3 Locknut
- 4 Mounting foot
- 5 P.T.F.E. seal
- 6 Oil seal
- 7 End cap 'O' ring
- 8 End cap

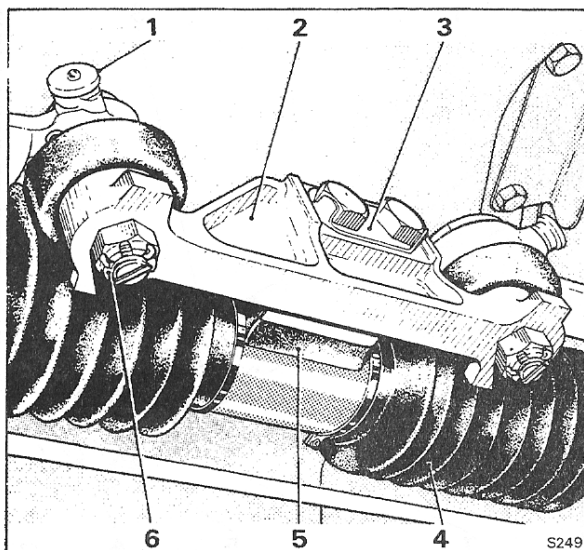


Fig. N12 Inner ball joint bracket in position

- 1 Ball joint grease nipple
- 2 Bracket
- 3 Tab washer
- 4 Convoluted seal
- 5 Centre block seal
- 6 Castellated nut and split pin

In the case where the two ends of the P.T.F.E. ring butt together or in the event of a smaller than nominal gap being observed, it will be necessary to remove the ring and pare one end of the scarf joint to bring the gap to the correct figure.

3. Using sizing tools RH 9114, RH 9113 and RH 9112, in this order, progressively reduce the diameter of the P.T.F.E. bearings until these are a sliding fit in the rack tube.

At this stage ensure that the gap at the scarf joint has not gone below a minimum of 0,254mm (0.010in.) and is positioned so as not to come into contact with the edges of the centre slot when the rack is assembled.

Check for and remove any burrs from the slot. Wipe the area clean before assembly.

4. From the pinion end, press the rack slowly into the tube until the P.T.F.E. bearing reaches the mid-position of the centre slot.

Ensure the bearing is not damaged when moving along the slot.

5. With the P.T.F.E. bearing visible in the centre slot, lightly lubricate a rack oil seal, fitting this through the slot in the tube, and using finger pressure, press the seal onto the end groove of the rack. If the rack is turned slowly, this will assist in the assembly of the seal.

6. Lubricate the other rack oil seal and again, using finger pressure fit this seal onto the pinion end groove.

7. Slide the rack unit slowly into the tube checking that no nipping occurs when the oil seal passes into

the closed portion of the tube. The pinion end seal must be manipulated into the tube by the fingers.

8. Lock the rack into the mid-position using centring plug (RH 9119).

9. Exercise and fit a new 'O' ring into the end cap of the unit ensuring it sits into its groove otherwise it can be nipped and damaged. A degree of feel must be applied when screwing on the cap to ensure the 'O' ring fits correctly.

10. Allow the end cap to butt against the inner face then back off the thread approximately one full turn to allow for hydraulic pipe alignment.

11. Torque tighten the lock-nut to the figures quoted in Chapter P using the open ended torque wrench adapter tool (RH 9125).

12. Fit new convoluted seals, clipping these to the static end positions and the centre tube.

13. Ensure that the screw heads of all the retaining clips face downwards to facilitate a check on the tightness of the clips at the vehicle servicing intervals. Lift the unit higher at the dismantled end and pour 60 cc (0.10 pints) of new EP90 lubricating oil through the slot in the centre sleeve.

14. To set the pinion mesh pre-load, ensure new paper gaskets are fitted to the underside of the ball race carrier and the steering rack pinion housing face.

15. Fit the original shim stack together with additional shims of approximately 3,8mm. to 5,08mm. (0.15in. to 0.20in.) over the studs of the pinion housing.

16. Carefully assemble the spool valve and pinion unit into the steering rack housing ensuring the correlation mark on the input shaft and spool valve housing align when the pinion is fully engaged in the rack, with the rack in the central position.

Remove the centring plug (RH 9119).

17. Tighten the flange retaining nuts to between 2,04 kg.m and 2,55 kg.m. (14.75 lbf.ft. and 18.5 lbf.ft)

18. Fit the special arm (RH 9123) to the input shaft spline and using a spring balance measure the load required to rotate the input shaft approximately one turn in each direction **from the centre position**.

19. The maximum load necessary to rotate the shaft and to overcome both rack seal drag and spool valve friction should be 0,91 kgf. (2.0 lbf).

20. If the force required is above this figure, then pinion mesh pre-load is still present and additional shims must be fitted between the pinion and rack housing assembly.

Alternatively, the steering rack P.T.F.E. bearings could be incorrectly sized and the rack will have to be withdrawn. Further reduce the diameter of the bearings using sizing tools RH 9114, RH 9113 and RH 9112, in this order.

21. Carefully replace the steering rack ensuring no damage occurs to the P.T.F.E. bearings and oil seals. Then fit the pinion unit.

Top up the system with lubricating oil.

22. Having obtained a maximum total figure for the seal drag and spool valve friction, of less than 0,91 kgf. (2.0lbf). with the special arm (RH 9123) and spring balance: progressively reduce the number of shims to give a minimum figure of 1,13kgf.

(2.5lbf.) **above** the seal drag and spool valve friction detailed in Operation 19.

#### Example

If the total rack drag and spool valve friction is equal to 0,82 kgf (1.8lbf) using a spring balance; then the minimum total load by progressively removing shims will be 0,82 kgf+1,13kgf (1.8lbf+2.5lbf) = 1,95kgf (4.3lbf).

**The maximum total turning load should not exceed a spring balance reading of 2,04 kgf (4.5 lbf)**

23. Return the rack to the straight ahead position and fit the centring plug (RH 9119).

24. Carefully assemble the pinion unit to the steering rack housing ensuring the correlation mark on the input shaft and spool valve housing align when the pinion is fully engaged with the rack. Check that new paper gaskets are fitted.

25. Tighten the flange retaining nuts to the figures quoted in Chapter P.

26. Fit the centre block, using the flexible bonding agent 'Silastic' 732 RTV Sealant on the mating surfaces of the seal to ensure a leak free joint. Secure the centre block in position using the socket head cap screw.

27. Exercise new 'O' rings before they are fitted to the blanking plug and lubricate with power steering fluid to ensure that the rings fit snugly into their respective locating channels. Replace the outer tube and bracket assembly.

28. Set the two suspension brackets of the assembly flat down onto a surface table and clamp firmly into this position.

29. Screw in the blanking plug to the torque figures quoted in Chapter P.

30. Fit pipe runs from the end caps to the pinion valve assembly using the torque figures quoted in Chapter P.

#### Important

The unit is now ready for fitting to the car, but do **not remove the centring plug at this stage.**

#### Rack and pinion unit - To fit to the sub-frame

1. Have the steering wheel held in a central position.

2. Carefully introduce the pinion box spline into the lower link yoke and support the unit in this position.

3. Fit the setscrews and washers to the sub-frame brackets, through the mounting feet of the unit and into the tapping blocks (see Fig. N5).

4. Tighten the four setscrews to the torque figures quoted in Chapter P using the special tool arm (RH 9122) fitted to the torque spanner. Release the support.

#### Important

**It is essential that the nuts indicated in Operation 4 are tightened to the correct torque figure.**

5. Align the spacer between the inner ball joint bracket and into the steering unit centre sleeve.

6. Fit a new tab washer and finger tighten the setscrews.

7. Torque tighten the inner ball joint bracket setscrews to the figures quoted in Chapter P, carefully checking that the oil seal is not displaced.

Bend the tab washer to lock the setscrews, avoiding any impact to the unit.

8. Connect the pipework from the pump and oil cooler to the pinion box, ensuring that the union joints are wiped clean before fitting. Torque tighten the unions to the figures quoted in Chapter P.

#### Important

Correct routing of the pipework is essential.

#### Kits of parts

To overhaul the rack and pinion assembly, the following kits of parts are available.

Spool valve renewal kit.

Rack overhaul kit.

Bellows replacement kit.

Modification of the steering unit main tube and end cap on the pinion box side of the unit has been incorporated onto the following cars and all subsequent car serial numbers.

#### Silver Shadow II and Bentley T2

##### Right-hand drive

SRH 34532	SRH 34664
SRH 34573	SRH 34678
SRH 34575	SRH 34680
SRH 34576	SRH 34710
SRH 34581	SRH 34712
SRH 34650	SRH 34714
SRH 34662	SRH 34715

##### Left-hand drive

SRG 34332	SRG 34481
SRX 34338	SRG 34482
SRG 34428	SBG 34486
SRG 34431	SRG 34499
SRG 34433	SRG 34505
SRX 34435	SRG 34508
SRG 34438	SRG 34522
SRG 34444	SRG 34526
SRG 34448	SRG 34537
SRG 34449	SRG 34547
SRG 34456	SRG 34548

#### Silver Wraith II

LRG 34304	LRG 34391
LRG 34308	LRG 34393
LRH 34390	LRH 34394

#### Corniche

DRG 32869	CRG 33109
CRG 33028	DRG 33113

#### Camargue

JRX 32181
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Some Silver Shadow II / T2 vehicles have been retrofitted with steering racks from the late SZ-series cars. In those cases, the following shall apply.

## Rack and pinion unit - To assemble (unit incorporating an external adjuster) (see fig. N2-2)

### N2-2 Pinion mesh adjustment (rack and pinion unit incorporating an external adjuster)

- 1.) Remove the rack bar from the vice and replace it with the pinion box and tube assembly. Clamp the tube horizontally in the vice with the valve housing mounting face uppermost and the rack slipper hole facing towards the operator.
- 2.) Smear 35 g (1.25 oz) of Rocol Sapphire grease onto the meshing gear of the rack bar, pinion, and pinion thrust ball race.
- 3.) From the pinion box end (smooth bore end) of the tube, push the rack bar into its central position. Ensure that the centralizing hose is in the middle of the rack slipper hole.
- 4.) Assemble the valve and pinion assembly (complete with shim pack, etc.) into the steering box.

Ensure that with the rack in the central position, the flat on the pinion spline is on the same side and at right-angles to the short tube for right-hand drive cars, and the long tube for left-hand drive cars.

- 5.) Fit the three setscrews and screw down. Do not torque tighten at this stage.

The torque required to rotate the valve should not exceed 0,9 Nm (0,09 kgf m; 8 lbf in). If it does exceed this figure, the rack PTFE bearing rings could be incorrectly sized. Withdraw the rack bar and using sizing tools (in the following order) RH 9114, RH 9113, and RH 9112, progressively reduce the diameter of the PTFE bearings.

- 6.) Torque tighten the three retaining setscrews to between 20 Nm and 25 Nm (2,0 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft) whilst rotating the pinion, to ensure that the pinion pre-load is still correct.
- 7.) Fit the rack bar piston seals to each end of the rack using fitting tool RH 12214.

When fitting the seal to the long end tube, ensure that the seal is not damaged by the threaded bore.

Ensure each seal seats correctly in its location groove.

- 8.) Fit the rack slipper, spring, spring seat, gasket, and coverplate. Torque tighten the setscrews to between 20 Nm and 25 Nm (2,0 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft). Then, fit the centre block to the rack.
- 9.) With the rack in the central position, adjust the rack mesh pre-load as follows.

Slacken the lock-nut and unscrew it at least one full turn. Then, screw in the adjuster screw (against spring pressure) until the pressure needed to rotate the screw begins to increase.

The torque required to rotate the valve should be between 1,13 Nm and 1,69 Nm (0,12 kgf m and 0,17 kgf m; 10 lbf in and 15 lbf in), with the rack in the central position.

If this torque figure is too high, screw out the adjuster screw in small steps (i.e. 20° at a time) until the correct torque figure is obtained, tighten the lock-nut. Then, check the centre block radial free play in the rack tube. This should be no more than 0,76 mm (0.030 in). Readjust if necessary.

- 10. Fit the centring plug RH 12465.
- 11. Fit new convoluted seals as described in, Replacement of convoluted seals, Operations 8 to 16 inclusive. Prior to Operation 13, fit the long oil pipe to the valve housing and torque tighten the retaining nut to between 23 Nm and 27 Nm (2,4 kgf m and 2,7 kgf m; 17 lbf ft and 20 lbf ft).
- 12. Screw the lock-nut onto the threaded end of the rack tube. Then, clean and prime the threads with Loctite primer.
- 13. Fit a new 'O' ring into the groove in the end cap.
- 14. Commence to screw the end cap onto the tube. After 2 or 3 complete turns, apply a ring of Loctite 542 to the next three threads. Then, continue to screw on the end cap until it abuts the end of the tube.

<b>Note:</b>
--------------

Ensure when carrying out this operation that the 'O' ring is not displaced.
---

- 15. Fit the short oil pipe to the valve housing. Unscrew the end cap up to one complete turn, until it lines up with the banjo fitting on the oil pipe.
- 16. Tighten the lock-nut to between 47 Nm and 54 Nm (4,8 kgf m and 5,5 kgf m; 35 lbf ft and 40 lbf ft), using spanner RH 9125.
- 17. Torque tighten the short oil pipe into the valve housing to between 23 Nm and 27 Nm (2,4 kgf m and 2,7 kgf m; 17 lbf ft and 20 lbf ft).

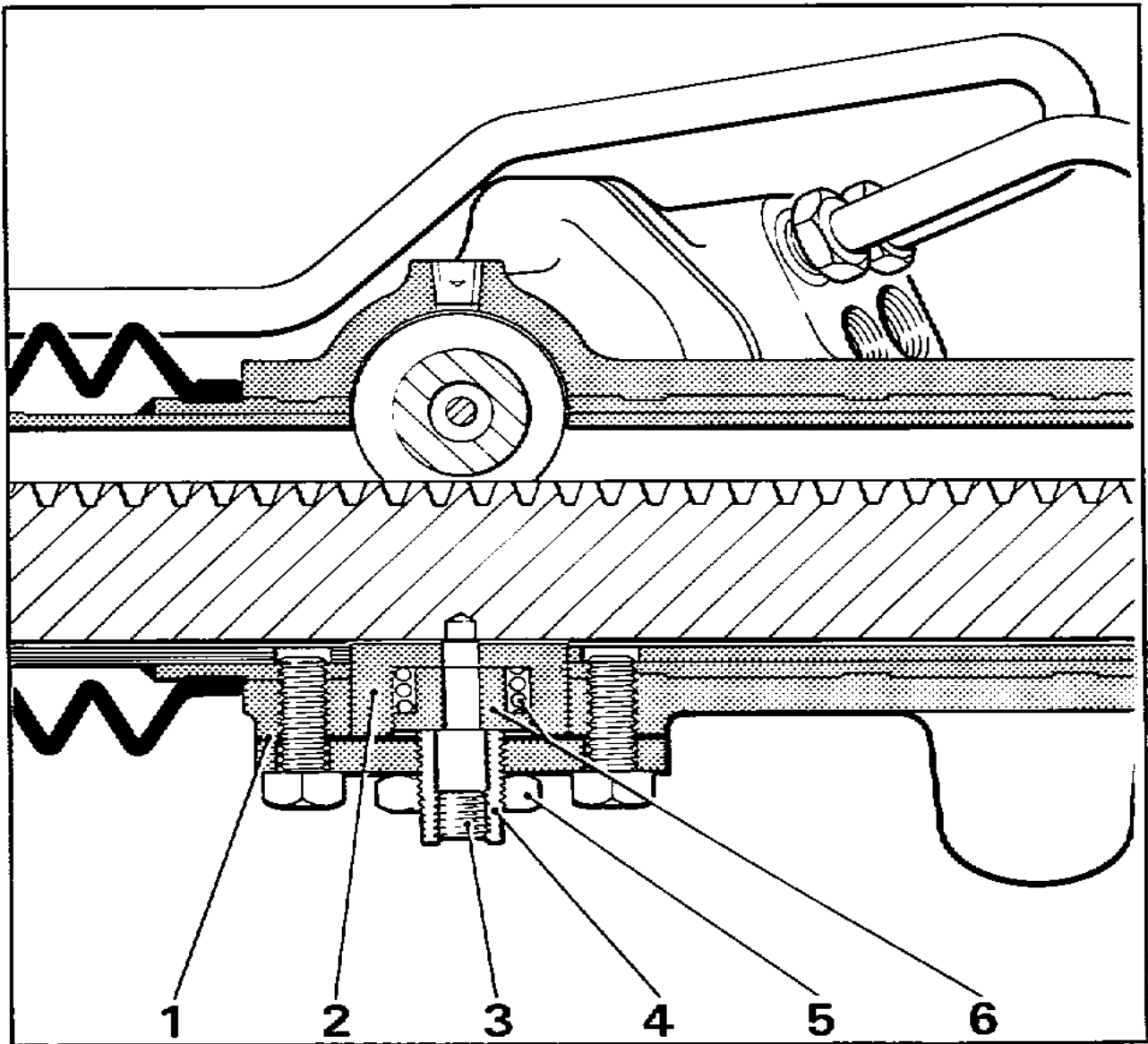
Fit the banjo bolt hydraulic fitting, ensuring new sealing washers are fitted.

Torque tighten the banjo bolts to between 35 Nm and 41 Nm (3,6 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).

- 18. The unit is now ready for fitting to the car, but do not remove the centring plug at this stage.



**Fig N2-2 Steering Rack Mesh Adjustment**  
Racks fitted with External Adjuster



## Section N2

## Steering pump

## Introduction

The assembly comprises a bottle shaped fluid reservoir with dipstick attached to the filler cap and a conventional rotor vane impellor. The pump is powered from the engine crankshaft via twin driving belts. The unit continually circulates oil to the rack and pinion assembly through a control valve at a constant flow rate, independent of the speed of the pump.

## Steering pump - Routine checks and topping-up procedure (see Fig. 14)

1. Remove the filler cap and check that the fluid level is at least up to the 'FULL COLD' mark on the dipstick. If necessary add steering fluid. Use only the approved steering fluids quoted on the Approved lubricants chart.
2. Start the engine and run until normal operating temperature is reached 77 ° C. (170 ° F.) then stop the engine.

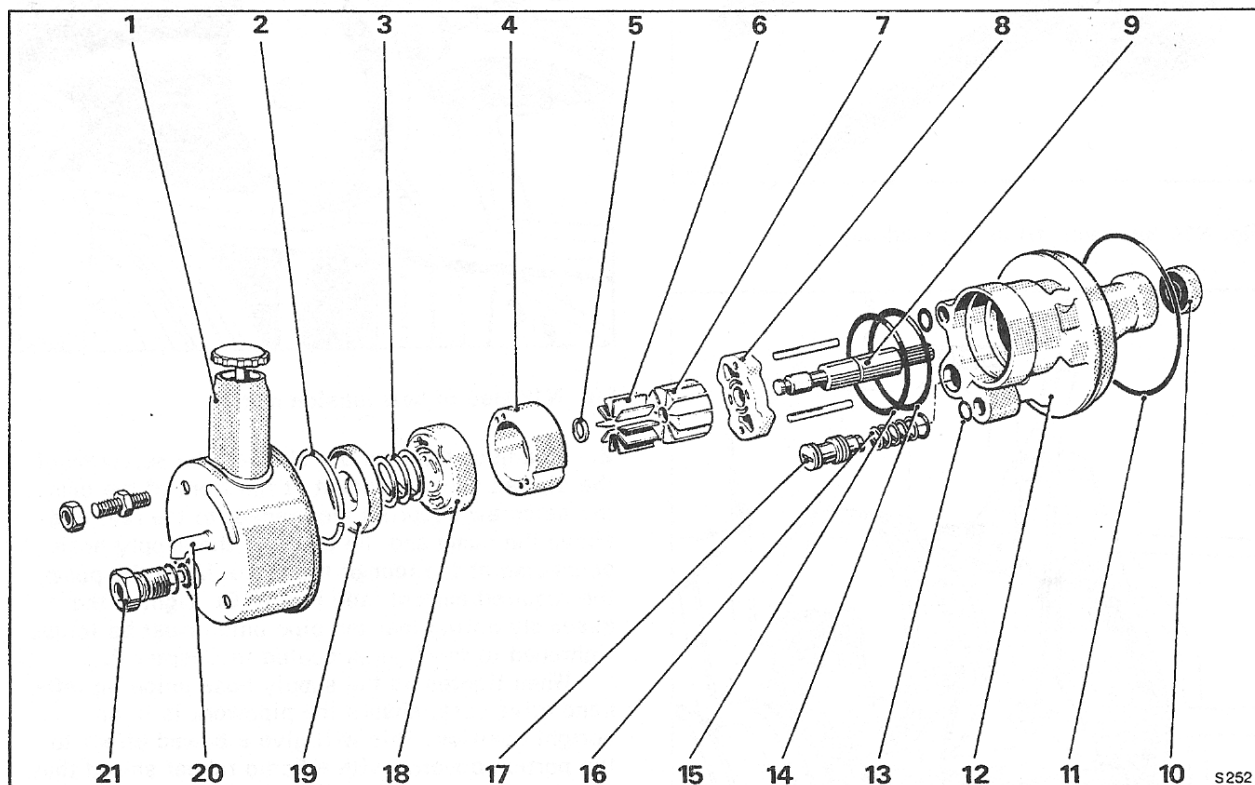


Fig. N13 Steering pump. Exploded view

- |    |                          |                                   |
|----|--------------------------|-----------------------------------|
| 1  | Reservoir and filler     |                                   |
| 2  | End plate retaining ring |                                   |
| 3  | Pressure plate spring    |                                   |
| 4  | Pump ring                | Supplied in kit<br>form as spares |
| 5  | Snap ring                |                                   |
| 6  | Vanes                    |                                   |
| 7  | Rotor                    |                                   |
| 8  | Thrust plate             |                                   |
| 9  | Drive shaft              |                                   |
| 10 | Oil seal                 |                                   |

- |    |   |
|----|---|
| 11 | 'O' ring. Reservoir seal                      |
| 12 | Pump housing                                  |
| 13 | 'O' rings. Reservoir to pump housing seal (2) |
| 14 | 'O' ring. Pressure plate                      |
| 15 | 'O' ring. End plate                           |
| 16 | Return spring. Flow control valve             |
| 17 | Flow control/pressure relief valve            |
| 18 | Pressure plate                                |
| 19 | End plate                                     |
| 20 | Return pipe                                   |
| 21 | Pressure pipe union                           |

## N2-2

3. Remove the filler cap and check the fluid level on the dipstick. If necessary add fluid to raise the level to the 'FULL HOT' mark. Do not overfill. Ensure the filler cap is secure when replaced.

**Belt tension - To check**

The steering and refrigeration pumps are driven by a matched pair of belts from the two front grooves of the engine pulley.

1. The tension of these belts when correct is 31,75 kg. (70 lb.). This is checked by applying a spring balance load of 4,1 kg. (9 lb.) to cause a 9,5 mm. ( $\frac{3}{8}$  in.) deflection of the belts when

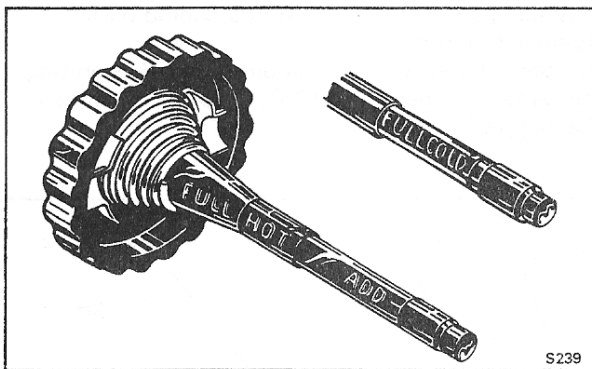


Fig. N14 Reservoir filler cap markings

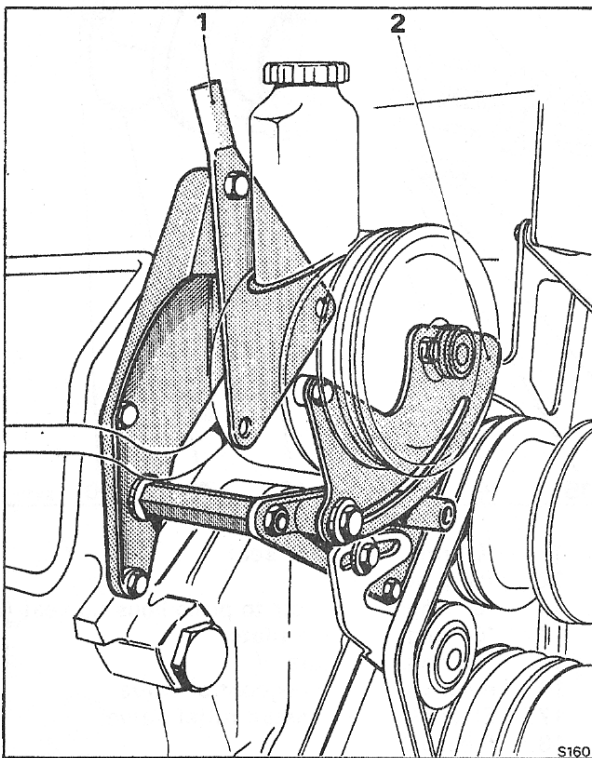


Fig. N15 Pump mountings and belt tensioning

- 1 Rear mounting bracket
- 2 Pivot plate

applied to a point midway between the steering and refrigeration pumps.

A belt tension meter, shown in Figure N16 can be used, giving a more accurate check than a visual approximation of the deflection.

If the tension in one belt differs markedly from the other, a new matched pair must be fitted.

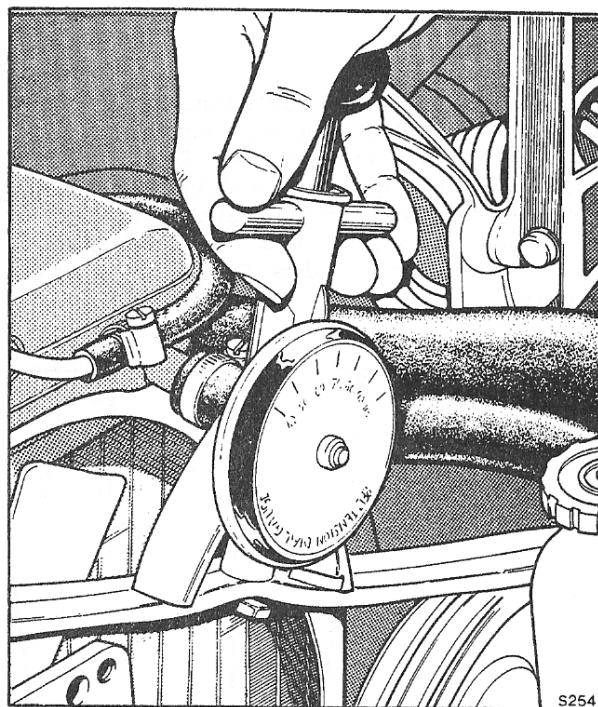


Fig. N16 Use of belt tension meter

2. To adjust the tension, slacken the setscrew of the slotted swivel bracket at the front of the pump, the setscrew securing the bracket to the rear and above the pump and the union of the supply hose connected at the rear of the pump. Move the pump the required amount (see Fig. N15). Tighten the assembly noting that the pipe union must be torque tightened to the figures quoted in Chapter P.

When tightening the supply hose union on left-hand drive cars, ensure the pipework is in an upright position. This will give a bowed effect to the portion covered with a Sorbo rubber shield thus clearing the engine components (see Fig. N26) and eliminating chafing of the piping.

**Note**

A slipping belt will squeal and produce judder at the steering wheel nearing full lock. **Belt dressing must not be applied to prevent slip.**

**Steering pump - To remove**

On later cars a metric pump is fitted. Refer to page N2 - 8 for further information.

1. Using a syringe, draw off as much fluid as possible from the steering pump reservoir and discard.

2. Slacken the pump belts by loosening the locking screw in the slotted adjustment bracket and the nut on the pivot bracket at the rear of the pump.
3. Unscrew the pressure pipe union.
4. Remove the setscrew and plain washer from the top hole of the rear plate.
5. Support the pump and remove the locking set-screw of the slotted adjustment bracket.
6. Draw the pump forward to expose the hose connection at the rear of the pump. Disconnect the hose, blanking off the holes in the pipes and the pump body.
7. Remove the pump and fasten the hose in a raised position.

#### Steering pump - To dismantle

This pump is a service exchange item and will normally be replaced by this method without the service engineer having to dismantle the unit.

In countries where difficulty may be experienced in obtaining a service replacement unit, the following information on servicing the existing pump, is provided.

1. Pour away any fluid remaining in the pump.
2. Remove the pulley using special tool (RH 9106). Never use a hammer to drive the pulley from the shaft as this will cause damage to the pulley and pump.
3. Remove the three setscrews securing the slotted adjustment bracket to the front of the pump. One of the screws is fitted with a distance piece; note the position to facilitate assembly.
4. Using suitable soft jaw covers lightly clamp the pump drive-shaft downwards in a vice.
5. Remove the pipe union from the rear of the pump.

#### Note

Care must be taken not to exert too much pressure on the shaft when removing fittings as this may distort the shaft bearing.

6. Remove the mounting studs from the reservoir housing.
7. Withdraw the reservoir by rocking this section and lifting to clear the sealing 'O' ring. Discard the 'O' ring.
8. Remove and discard the 'O' rings sealing the mounting stud and pipe union holes.
9. Press a centre punch into the small hole situated in the housing rim directly opposite the control valve bore and depress the end plate retaining ring.
10. Using a screwdriver, lever out the retaining ring (see Fig. N17). Withdraw the centre punch.
11. With the retaining ring removed the end plate, being spring loaded, will lay level with the housing rim. If sticking occurs, a rocking action should free the plate.
12. Remove the pump from the vice and invert. The flow control valve and spring will now drop into the hand (see Fig. N18). Place safely aside.
13. Remove the end plate 'O' ring and discard.
14. Place the pump housing onto a clean bench with the shaft uppermost then, using a soft-headed mallet, tap on the end of the shaft until the pressure plate is freed.

#### Important

Do not drive the shaft downward into the housing more than is necessary to free the pressure plate.

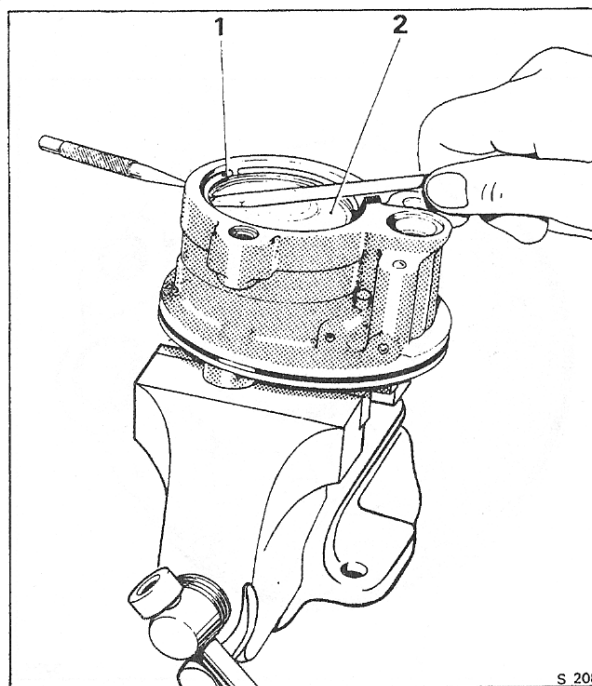


Fig. N17 End plate removal

- 1 Retaining ring
- 2 End plate

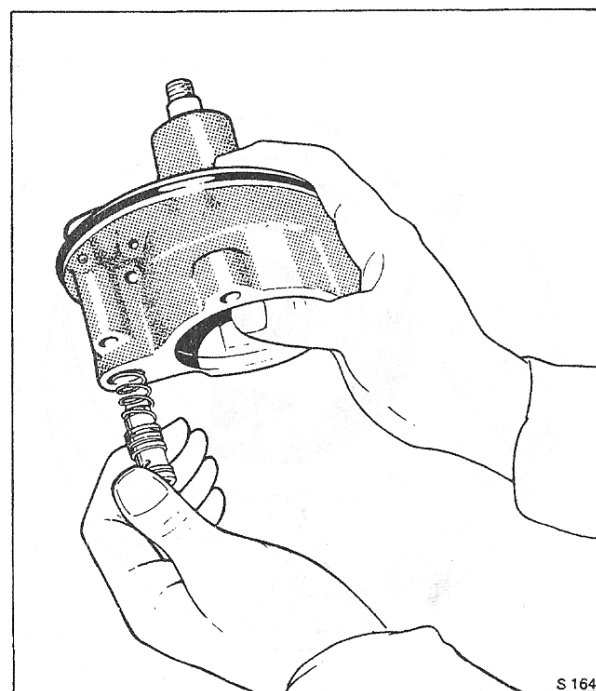


Fig. N18 Flow control/relief valve position

15. Remove the pressure plate, pump ring and vanes.
16. Grip the pump shaft in the vice with the open end uppermost.

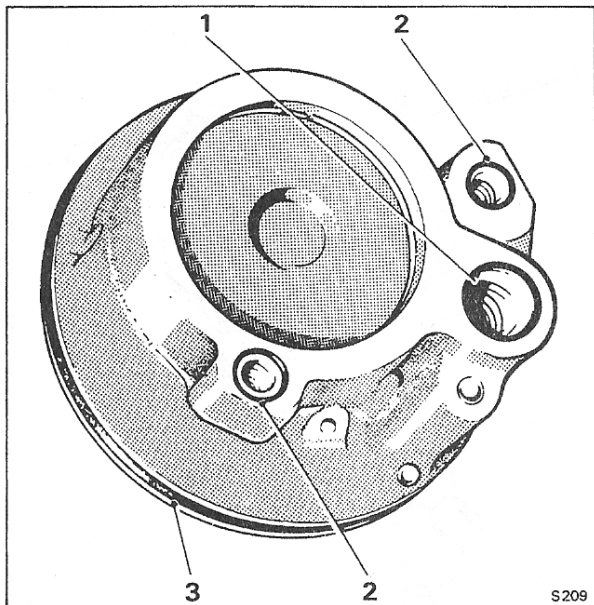


Fig. N19 Position of external sealing rings

- 1 'O' ring - pressure fluid adapter
- 2 'O' rings - reservoir securing studs (2)
- 3 'O' ring - reservoir to pump housing

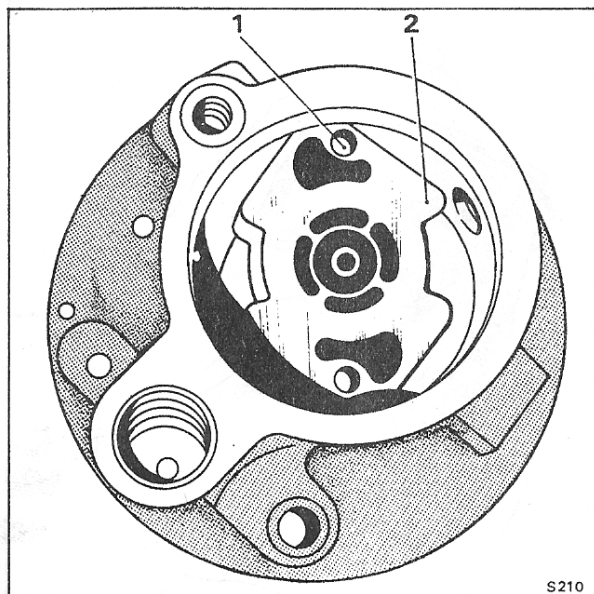


Fig. N20 Correct positioning of thrust plate

- 1 Dowel pin (2)
- 2 Thrust plate

17. With a small screwdriver withdraw the snap ring holding the vane rotor in position then remove rotor and thrust plate.
18. Withdraw the drive-shaft through the pulley end of the housing.
19. Inspect the lip-type oil seal. Renew, only if this component is damaged.
20. The dowel pins for locating the pressure plate remain in the pump housing.

**Steering pump - To inspect**

1. Clean all components prior to inspection. Apply an air pressure line to the pump housing to clean out all the fluid passages.
2. Check the pressure plate, thrust plate and rotor for scoring. Light scoring may be removed by lapping with a fine carborundum stone. Heavy scoring will necessitate renewal of the component concerned.
3. Ensure that the pressure plate is flat by checking it against the abutting surface of the pump ring.

**Note**

A high polish is always present on the inner faces of the thrust and pressure plates as a result of normal wear.

4. Check the contour surface of the pump ring for extreme wear. Normally there may be some scuff marks and uniform wear. This does not increase pump noise and is not detrimental to its function. However, if the wear comprises chatter marks or gouges that can be felt with the finger, renew the pump ring, rotor and rotor vanes (these items are supplied as a set).
5. Check the condition of the shaft bush in the pump housing.
6. Check the flow control valve for burrs or dirt which may cause the valve to stick in its bore. Check the bore.
7. Check the small screw on the end of the control valve for tightness. If loose, tighten; extreme care should be taken not to damage the machined surfaces.

**Steering pump - To assemble**

1. Before assembly carefully clean all components with the exception of the 'O' rings; these should be renewed.

Do not immerse the drive-shaft lip-type oil seal in a cleaning solvent as this could damage it.

2. Smear the new 'O' rings and shaft seal with petroleum jelly to facilitate correct location and fitting. Lubricate the internal metal components to be assembled with steering fluid.
3. Insert the drive-shaft into the front of the pump housing, passing through the lip-type seal.
4. Fit the thrust plate over the dowel pins and into position in the housing with the ported face uppermost, i.e. to the rear of the pump housing (see Fig. N20).
5. Fit the rotor to the splines on the shaft with the counterbore towards the thrust plate. The rotor must be a slide fit on the splines.

6. Position the pump ring on the dowel pins with the direction of rotation arrow uppermost.

The direction of rotation is anti-clockwise when viewed from the pump rear as shown in Figure N21.

7. Fit the drive-shaft snap ring to retain the rotor.

8. Fit the vanes into the rotor slots with the radiused edge facing outwards (see Fig. N22).

9. Fit the pressure plate 'O' ring. Lubricate the outside diameter of the pressure plate with petroleum jelly to prevent damage to the fitted 'O' ring, then locate it on the dowels, with the port face towards the pump ring.

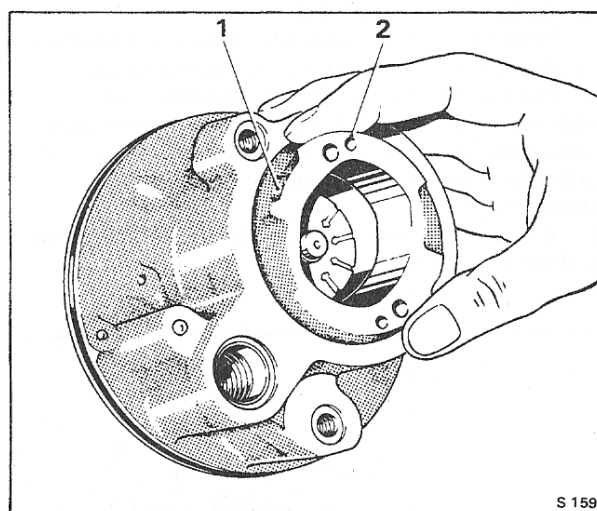


Fig. N21 Correct positioning of pump ring

- 1 Direction of rotation arrow
- 2 Dowel hole (2)

10. Apply pressure to the plate at its outer edges (see Fig. N23). Never apply great pressure or hammer the centre of the pressure plate as this will cause permanent distortion resulting in pump failure. The pressure plate will compress the seal by approximately 1.59 mm. (0.062 in.).

11. Position the pressure plate spring, locating the leading coil in the groove on the upper side of the plate.

12. Fit the end plate 'O' ring into the pump housing groove.

13. Lubricate the outer diameter of the end plate to prevent damage to the fitted 'O' ring. Position the pump under a suitable arbor press (see Fig. N24). and press the end plate into the housing sufficiently to allow the retaining ring to be fitted (see Fig. N19).

14. Fit the retaining ring ensuring that it is fully seated, then remove the pump from the press and tap the end plate to ensure correct seating.

15. Fit the flow control valve and spring as shown in Figure N18.

16. Fit the smaller 'O' ring seals to the stud and flow control valve holes.

17. Fit the large 'O' ring seal to the groove on the outer diameter of the pump housing then fit the reservoir.

18. Fit and tighten the two studs and union.

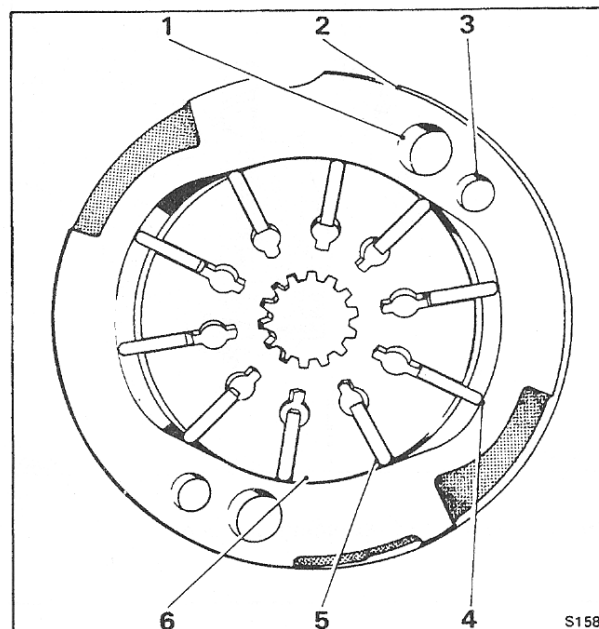


Fig. N22 Plan view. Rotor, vanes and pump ring

- 1 Oil transfer hole (2)
- 2 Pump ring
- 3 Dowel hole
- 4 Radiused edge of vane
- 5 Vane (10)
- 6 Rotor

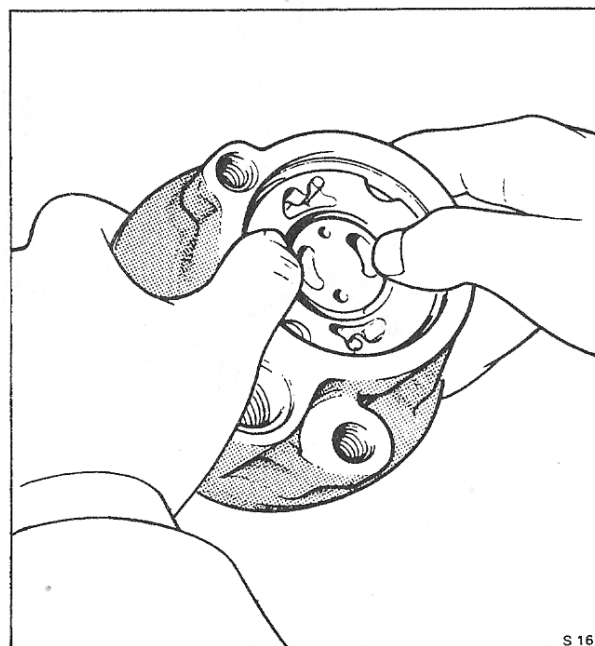


Fig. N23 Fitting the pressure plate



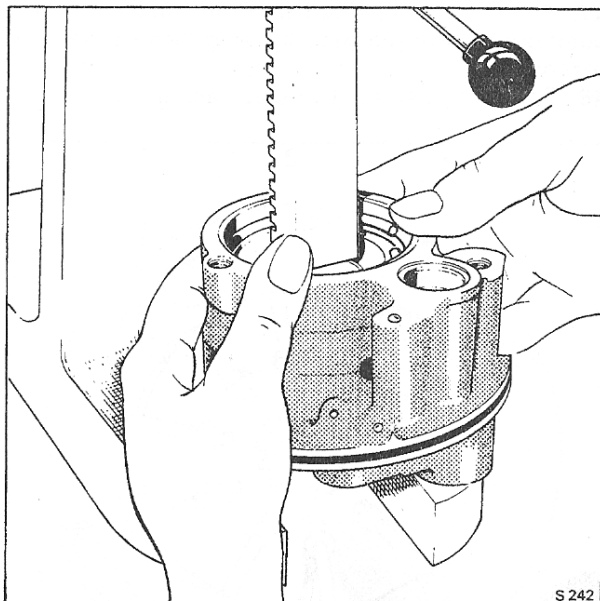


Fig. N24 Method of replacing end cap

**Note**

The reservoir must be fully seated prior to tightening the studs and union to prevent damage to the reservoir.

19. Fit the pump front mounting (adjusting) bracket using the three setscrews. Two of the three setscrews are fitted with distant pieces.

20. Press the pulley on the shaft using special tool (RH 9106).

**Steering pump - To fit**

1. Before attempting to fit the pump to the engine, check that all the steering system hoses and pipes are serviceable; renew any that are damaged or appear to have deteriorated.

Reverse the procedure adopted for the removal of the steering pump, noting the following points.

2. Prior to fitting the pump to the mounting brackets, connect but do not tighten the pressure pipe union (discharge) at the rear of the pump. Fit and tighten the hose clip to the rubber tube (reservoir return).

3. Ensure that the bolt distance pieces are fitted to their respective positions.

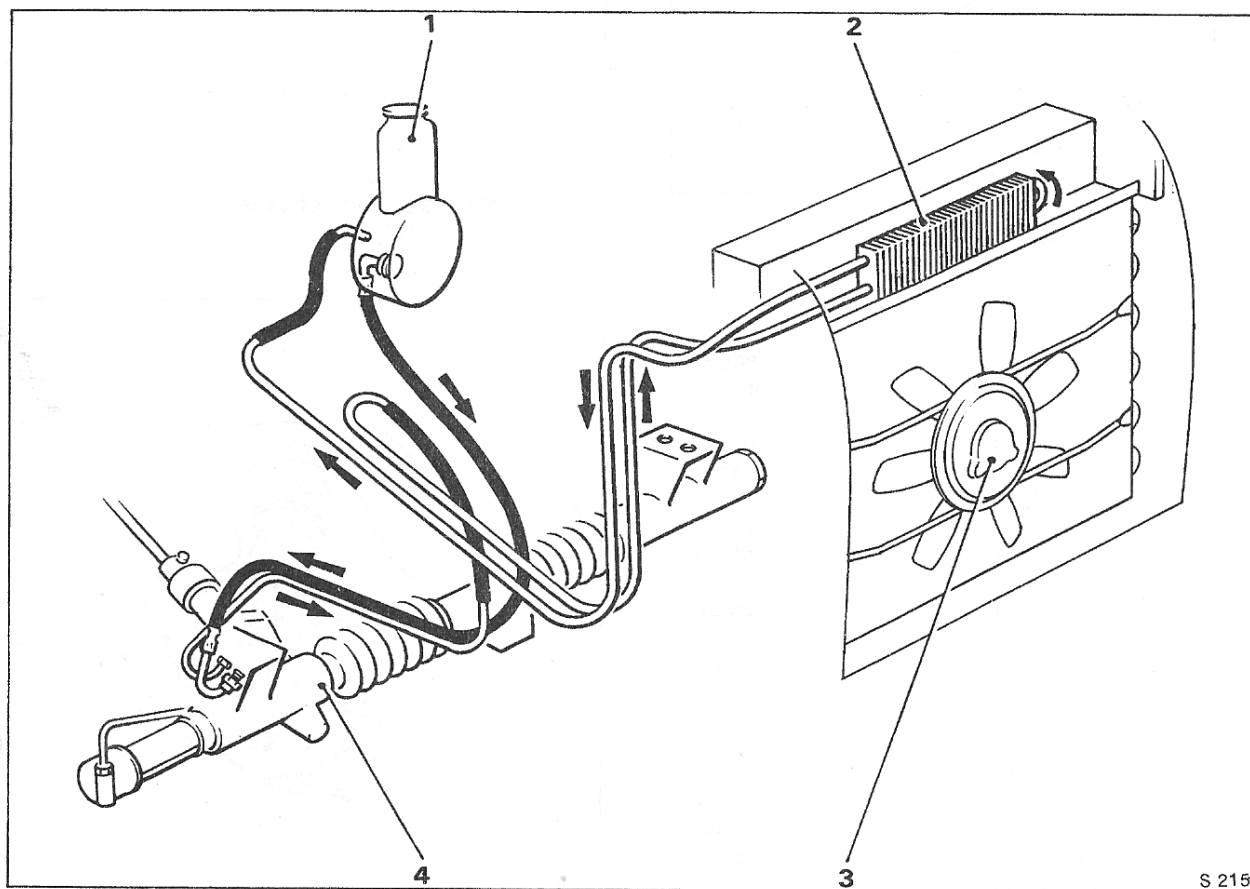


Fig. N25 Hydraulic pipe runs. Right-hand drive car

- 1 Steering pump
- 2 Fluid cooler

- 3 Booster fan
- 4 Steering unit

4. Fit and adjust the driving belts to the correct tension as described in 'Belt tension - To check'.
5. Fit and tighten the pipe union nut to the torque figures quoted in Chapter P.

### Steering pump - Priming and filling

#### Important

When refilling an empty system it is essential that at no time when the engine is running the fluid level in the pump reservoir is allowed to drop sufficiently for air to be drawn into the system. If this occurs, irreparable damage to the pump will result.

Use only approved fluid detailed in Chapter D - Lubricants.

1. Set the gear range selector to P and apply the parking brake.
2. Raise the front road wheels off the ground.
3. Remove the feed cables to the ignition coil to prevent the engine from firing when turned over using the starter.

4. Remove the reservoir filler cap. Add sufficient clean steering fluid to approximately 2,54 cm. (1 in.) from neck of reservoir.

5. Turn the engine, using the starter for approximately 30 seconds and continue to top-up the reservoir.

The fluid level drops very quickly therefore it is essential to ensure that it does not drop sufficiently for air to be drawn into the system. Continue this operation until the fluid level remains constant.

6. Replace the feed cables to the ignition coil, start the engine and ensure it is running at idle speed.

7. Very gently turn the steering wheel from side to side, gradually lengthening the stroke, but **do not** hold against the lock stop. Keep topping-up the system as the fluid level drops.

8. Allow the fluid to settle then top-up the reservoir to the 'FULL HOT' mark on the dipstick.

9. Steadily turn the steering wheel twice from lock to lock to expel any small amounts of air that may remain in the system.

10. Check the fluid level again and top-up if necessary.

11. Switch off the engine and lower the road wheels to the ground.

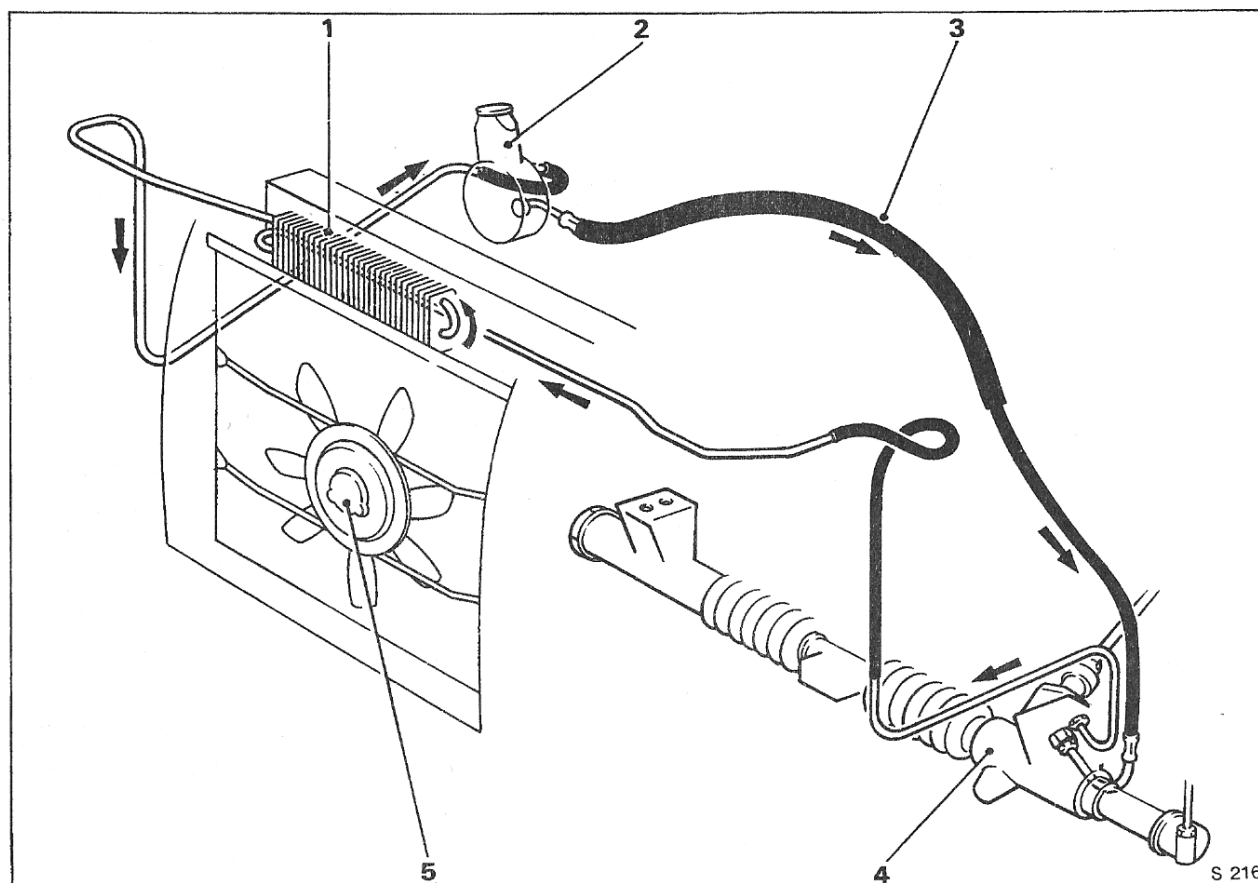


Fig. N26 Hydraulic pipe runs. Left-hand drive car

- 1 Fluid cooler
- 2 Steering pump

- 3 Protective Sorbo rubber
- 4 Steering unit
- 5 Booster fan

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**Metric steering pump**

From car serial numbers, Silver Shadow II 0039524 ; Silver Wraith II 38916 \*; Corniche 50334 and Camargue 0050352 including Camargue 0050298 and 0050350, the steering pump and all fittings, including attached pipework, will be metric.

\* Certain Silver Wraith II cars between serial numbers 38655 and 38916 have had metric steering pumps fitted. Care must be taken on this range of cars to establish the type of pump fitted before work is attempted.

## Section N3

## Steering wheel and Gear range selector unit

## Introduction

The Silver Shadow II, Silver Wraith II and Bentley T2 steering wheel is a two arm composite metal fabrication with the hub, spokes and rim covered in black plastic, the rim having gripping nodules moulded into the underside. A metal collar attached by adhesive is fitted around the lower rim of the hub to shroud the centre boss. The self-cancelling stalk is welded to the lower rim of the spline.

This steering wheel is also fitted to Corniche and Camargue cars from car serial number Corniche 32633 to 50233 inclusive and Camargue 32035 to 50244 inclusive.

On Corniche and Camargue cars prior to car serial number Corniche - 32633 and Camargue - 32035 the spokes and horn button are completely covered with black leather. Though of a similar construction to the Silver Shadow II wheel it has a different fixing for the horn button and attachment to the steering column hub (see Fig. N29).

New style leather covered wheels are fitted to Corniche cars from car serial number 50234 and Camargue cars from car serial number 50245.

If the steering wheel needs to be changed, on a Corniche or Camargue car the new leather covered wheel can replace the plastic type. If however, it is necessary to replace the earlier leather covered wheel with the new leather covered wheel, then a kit of parts is available, from Rolls-Royce Motors Ltd, Spares Department, to affect the conversion.

**Steering wheel - To remove (see Fig. N27)**  
Silver Shadow II, Silver Wraith II and Bentley T2.  
Also Corniche and Camargue cars from car serial number Corniche 32633 to 50233 inclusive and Camargue 32035 to 50244 inclusive.

1. Disconnect the battery leads.
2. Unscrew and remove the trim fairing and knee roll pads adjacent to the steering column.
3. Unscrew the three chromium plated setscrews and carefully remove the polished veneer facia. **Protect the steering wheel from marks and scratching when dismantling.**
4. Dismantle the steering column cowl. Unscrew two screws to remove the upper moulding. Unscrew a further four screws to remove the lower moulding.
5. Unscrew and remove the gear selector unit, then the combined screen wash, indicator and headlamp flasher unit. Allow both units to hang carefully from their connecting wires.

## Note

From car serial number 37513 the combined screen wash unit arm is reduced in length by approximately 6,35 mm. (0.250 in.).

6. Feed a 31 cm. (12 in.) length of strong thin string in a loop into the gap between the button push and plastic steering wheel surround to lay against the centre button push spindle.

7. Grip the two free ends of the string and with a sharp pull release the button push and withdraw the assembly. Retain the coil spring.

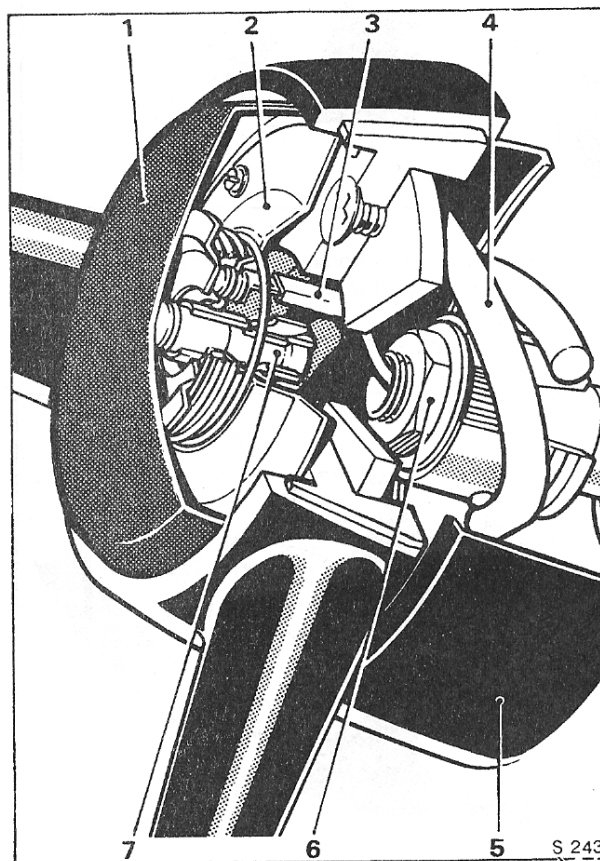


Fig. N27 Steering wheel components. Silver Shadow II, Silver Wraith II and Bentley T2

- 1 Horn button
- 2 Support plate
- 3 Connector
- 4 Energy absorbing device
- 5 Metal shroud
- 6 Column nut
- 7 Bearing pin

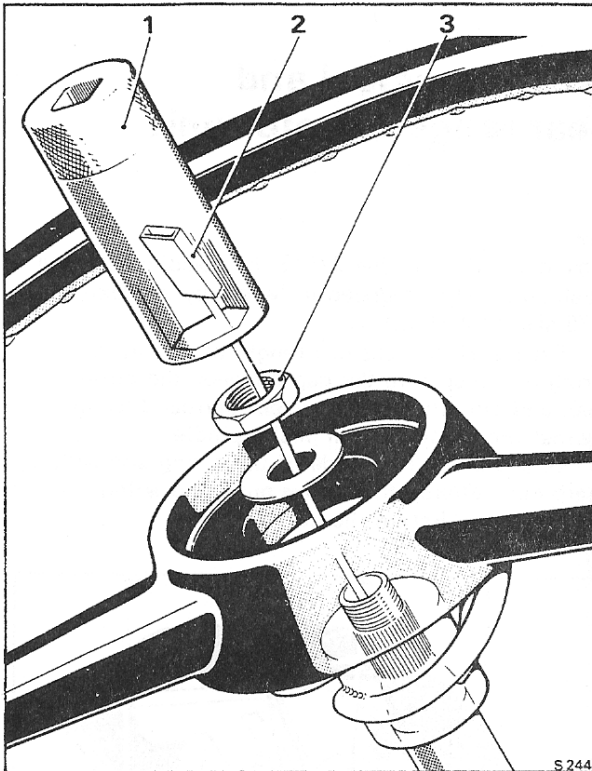


Fig. N28 Use of deep socket on steering wheel nut

- 1 Deep body hexagon socket
- 2 Connector
- 3 Steering wheel nut

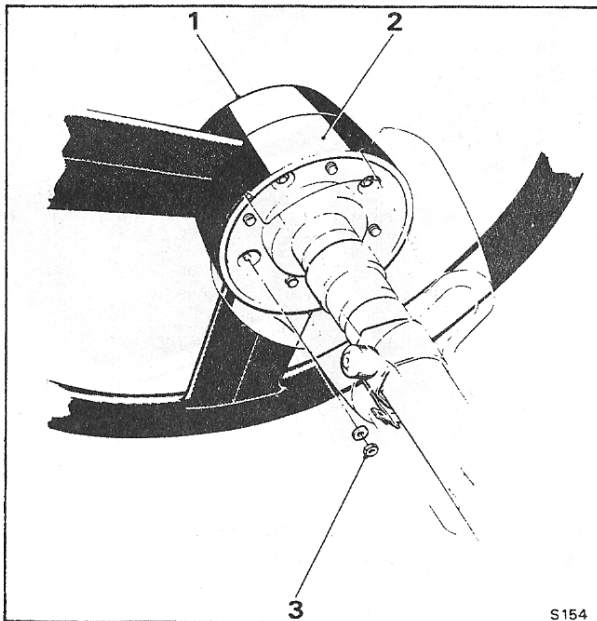


Fig. N29 Horn button removal. Prior to car serial numbers Corniche 32633 Camargue 32035

- 1 Horn button
- 2 Wheel hub
- 3 Nut and washer

8. Unscrew and remove the support plate taking care to disconnect the cable attached to the underside of the plate.

9. Remove the steering wheel centre nut and washer using a  $\frac{3}{8}$  in. A/F, deep body, hexagon socket spanner (see Fig. N28).

#### Important

Feed the horn wire and connector into the spanner body to ensure no pinching of the wire occurs. On no account should a bi-hexagon socket spanner be used due to the restricted length of the bore.

10. Scribe a mark across the steering wheel lower boss and inner column rim to ascertain the correct relationship of wheel to column splines.

11. Grip the steering wheel spokes and using a straight pull remove the wheel taking care not to damage the splines.

The wheel assembly must be removed as one unit. No part dismantling is advised.

12. Inspect support plate, contact rivet, cable connector, the bearing pin attached to the underside of the horn button and the return spring.

#### Steering wheel - To remove

Corniche and Camargue prior to car serial number

Corniche - 32633 Camargue - 32035

Protect the steering wheel from marks and scratching when dismantling.

1. Remove the gear range selector cowl, which is in two pieces, by unscrewing and removing the six recessed slot mushroom head setscrews located in the cowl lower half. The upper section of the cowl is secured by the four outer screws and the lower section by the remaining two setscrews.

2. Unscrew the four nuts located behind the steering wheel and remove the horn button assembly from the steering wheel centre (see Fig. N29).

3. Withdraw the horn contact plate and disconnect the electrical plug.

4. Unlock the tab washer then unscrew and remove the nut which secures the steering wheel to the column.

5. Before removing the wheel, the centre of the column and the steering wheel inner boss face should be suitably marked to ensure that the wheel is replaced in the same relative position on assembly.

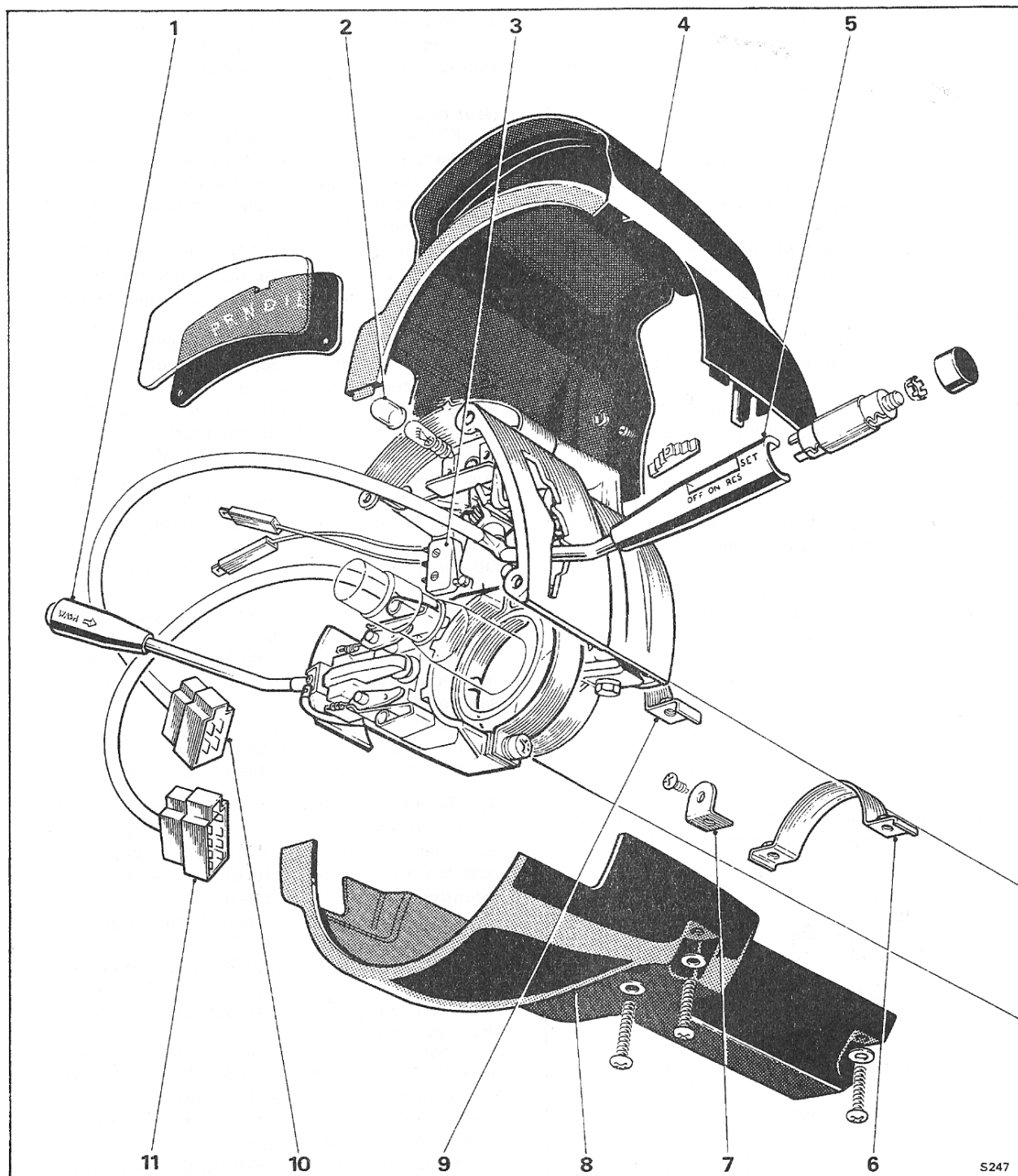
6. Replace the nut to prevent possible damage to the threaded end of the column, then, using special tool (RH 7870), extract the wheel. Remove the tool and the wheel securing nut and lift away the wheel.

#### Gear range selector unit - To remove (Fig. N30)

1. Disconnect the battery.

2. Unscrew the two outer mid-positioned setscrews from the lower cowl and remove the upper cowl.

3. Unscrew the two clamps holding the lower cowl and remove the cowl. Screw the clamps back onto the cowl before placing aside.



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Fig. N30 Cowl, gear range selector and wash unit

- |   |   |    |   |
|---|---|----|---|
| 1 | Indicator and washer switch unit                    | 8  | Lower cowl                                  |
| 2 | Bulb filter   | 9  | Front clamp - lower cowl                    |
| 3 | Micro switch  | 10 | Socket - speed control switch wiring        |
| 4 | Upper cowl  | 11 | Socket - indicator and washer switch wiring |
| 5 | Gear range selector and Speed control system switch |    |   |
| 6 | Rear clamp - lower cowl                             |    |   |
| 7 | Upper to lower cowl angle bracket                   |    |   |



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4. Disconnect the main loom wiring block (4-way) and the two single Lucar connectors to the micro-switch, situated behind the instrument panel.
5. Remove the gear range selector.

**Gear range selector unit - To dismantle**

1. Remove the screws securing the micro-switch mounting plate to the front face of the base assembly.
2. To remove the scale pointer, set the selector lever to (I) range exposing the single setscrew. Remove the pointer then replace the setscrew with any packing washers back into the selector quadrant.

Care must be taken not to scratch the pointer or the indicator scale.

3. Remove the two recessed head screws and shake-proof washers securing the indicator support bracket to the two bosses on the base assembly, then remove the indicator support bracket assembly.
4. Remove the two hexagon-headed 3 B.A. screws securing the gate assembly to the underside of the base.
5. Remove the circlip, clevis pin and spring securing the gear selector lever to the quadrant, then remove the lever with the gate assembly attached.
6. Remove the two recessed head screws securing the phosphor - bronze contact to the base plate. Retain the two insulating dowels and the two insulating strips.
7. Remove the circlip from the other end of the rocking arm.
8. Remove the rocking arm to quadrant, tension springs; detach the rocking arm assembly.

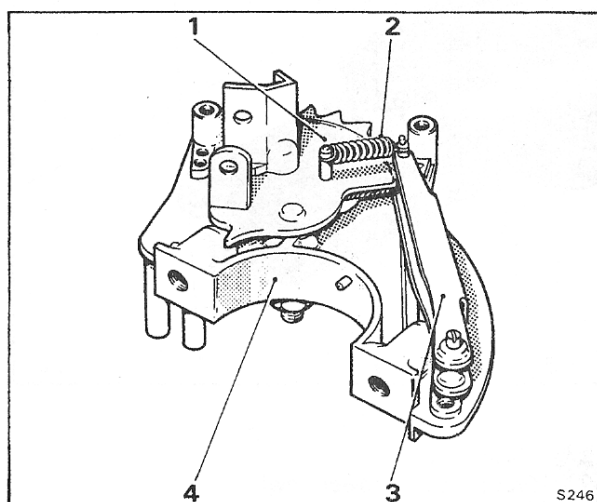


Fig. N31 Quadrant to rocking arm assembly

- 1 Gear selector quadrant
- 2 Tension spring, rocking arm
- 3 Rocking arm
- 4 Base casting

9. Remove the ¼ in. U.N.F. nut and washer from the quadrant spindle and remove the quadrant assembly from the base assembly.

**Gear range selector unit - To assemble**

1. Fit the quadrant assembly onto the base and nip the ¼ in. U.N.F. nut and washer onto the spindle. Check that the quadrant is free to rotate.
2. Remove the quadrant and lubricate the spindle with Ragosine 204G grease or its equivalent. Fit the quadrant and finally tighten the ¼ in. U.N.F. nut.
3. Do not overtighten the nut, since the bearing boss tends to spread slightly and a tight bearing may be formed.
4. Fit the rocking arm assembly, then check to ensure that the roller lines up correctly with the quadrant detent form (see Fig. N31).
5. Fit the two small coil springs between the spindle protruding through each side of the quadrant and the spindle through the centre of the rocking arm roller. Assembly is easier if the quadrant is rotated anti-clockwise, clear of the rocking arm, so that the springs are not under tension.

**Note**

Do not fit the retaining clip to the rocking arm at this stage.

6. Move the quadrant to a mid-way position and fit the phosphor-bronze contact. This contact is assembled between two insulating strips which are located by two insulating dowels; secure by two setscrews and washers.

**Important**

Extreme caution must be taken with the moving contact, so that it is not bent or damaged.

7. Before fitting the selector lever assembly carry out the following:
  - a. Check that the clevis pin will slide through both the fork end on the lever and the holes in the mounting arms on the quadrant.
  - b. Check that the fork end will also slide between the arms.
8. Lightly smear Ragosine 204G grease or its equivalent, on the bearing surfaces of the selector lever fork, the inside of the supporting arms and the clevis pin.
9. Loosely fit the selector lever through the gate assembly, then locate the fork and spring between the support arms. Fit the clevis pin and secure with the circlip. Check that the lever will return easily under the load of the spring.
10. Secure the gate assembly to the underside of the base by means of the two hexagon-headed 3 B.A. screws. Check that, when the position of the lever is controlled by the detents, it lines up with the profile of the gate liner and that the extreme positions of the lever are limited by the gate.
11. Fit the insulating plate complete with feed and supply contacts.

When the unit is secured, check that the inside leg of the moving contact is disposed centrally across the supply contact and that the pressure is correct when a piece of 0,025 mm. (0.001 in.) paper

is 'nipped' between the contacts. At the extremities of its travel the hemispherical head must still touch the supply contact.

This adjustment is most important, to ensure accurate spring weight during travel of the moving contact.

12. Each selection should then be made in turn, checking that the outside leg on the moving contact lines up correctly with each of the feed contacts.

13. Press the blue plastic filter cap over the bulb. Fit the indicator scale over the support bracket and secure with two self-tapping screws. The scale should drop onto the bracket and its lip must not be forced down.

14. Feed the pointer under the indicator scale; then with (I) range selected and using a small cross-blade screwdriver, feed the single 5 B.A. screw through the pointer leg into the quadrant boss together with any original packing washers replaced. Care should be taken not to mark either the pointer or the indicator scale.

15. Full selection should then be made and the alignment of the pointer checked.

16. As a sub-assembly, fit the neutral start micro-switch loosely to the mounting plate. Fit this sub-assembly to the base assembly.

17. With the selector quadrant set in the (N) Neutral position adjust the micro-switch roller to the peak of the cam. This setting should automatically fix the (P) Park position.

A simple battery powered test box, operating a buzzer or lamp, attached to the micro-switch Lucar connectors will indicate when a correct setting has been achieved.

#### **Gear range selector unit - To fit**

Refer to Operations 1 to 6 of Steering wheel - To remove, Silver Shadow II, for the sequence of removing the trim, the gear selector unit and the combination wash/indicator/flasher unit. Reverse the procedure for removal giving consideration to the following points.

1. Check that the combination screen wash/indicator unit is located and secured before fitting the selector unit.

2. Replace the upper and lower cowl moulding onto the steering wheel, loose enough to allow manual centralising of the assembly in relation to the gear range pointer and selector lever.

3. Remove the top cowl and secure the lower cowl, when suitably positioned. Fit the top cowl.

4. Finally, assemble the instrument facia panel, trim fairing and knee roll pads.

#### **Steering wheel - To fit**

Silver Shadow II, Silver Wraith II and Bentley T2. Also Corniche and Camargue from car serial number Corniche 32633 to 50233 inclusive and Camargue 32035 to 50244 inclusive.

**Protect the steering wheel from marks and scratching when assembling.**

1. Feed the connector and wire through the steering wheel centre boss then align the boss to

the marks on the lower boss and inner column rim, locating firmly on the splines.

2. Replace the washer and centre nut then using the  $\frac{7}{8}$  in. A/F, deep body, hexagon socket spanner torque tighten the assembly to the figures quoted in Chapter P. Carefully feed the shroud and wire into the spanner body (see Fig. N28).

If any adjustment of the straight ahead position is necessary, the procedure shown in Steering link - To remove and fit, Section N4, should be carried out.

3. Check that the self-cancelling stalk contacts the flasher switch arms and that the end of the stalk does not foul the gear selector lever when this is in the (L) position.

4. If a foul exists, the self-cancelling stalk must be filed down to clear the gear selector lever.

This procedure must take place when a new steering wheel is fitted, or the existing wheel is replaced.

5. After filing, the exposed metal must then be painted in a dull nickel colour.

6. Plug the centre wire into the connector attached to the underside of the support plate and secure the plate to the centre hub.

7. Lightly lubricate the bearing pin of the horn button with Rocol 204G Ragosine grease or equivalent making sure that the 'necked' portion of the bearing pin clips securely over the retaining spring.

8. Fit the combined screen wash unit switch onto the steering column using the locating stud. Secure in position.

9. Locate the gear range selector onto the column by its locating stud and secure.

#### **Note**

The screen wash unit switch must be replaced first otherwise access to the securing screws of this unit is covered by the gate of the gear selector unit.

10. Fit the upper and lower cowl mouldings onto the steering wheel loose enough to allow manual centralising of the assembly in relation to the gear range pointer and lever. Remove the top cowl and secure the lower cowl when suitably positioned.

11. Locate the top cowl onto the lower cowl and secure.

12. Finally, assemble the instrument facia panel, trim fairing and knee roll pads. Replace the knurled connector (purple/black wire) and Lucar (black wire) to the steering column.

#### **Steering wheel - To fit**

Corniche and Camargue prior to car serial number

Corniche - 32633 Camargue - 32035

**Protect the steering wheel from marks and scratching when assembling.**

1. Feed the connector and wire through the steering wheel centre boss. Align the marks on the boss and end of the steering column. Locate the wheel firmly on the splines.

2. Fit the tab washer, then tighten the centre nut to the torque figures given in Chapter P. Ensure

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the horn wire is not nipped when the torque spanner is fitted.

If any adjustment of the straight ahead position is necessary, the procedure shown in Steering link - To remove and fit, Section N4, should be carried out.

3. Check that the self-cancelling stalk contacts the flasher switch arms and that the end of the stalk does not foul the gear selector lever when this is in the (L) position.

4. If a foul exists, the self-cancelling stalk must be filed down to clear the gear selector lever.

This procedure must take place when a new steering wheel is fitted, or the existing wheel is replaced.

5. After filing, the exposed metal must then be painted in a dull nickel colour.

6. Fit the centre wire into the connector attached to the underside of the horn contact plate. Secure the contact plate to the centre boss.

7. Feed the four long bolts and spacers attached to the horn button assembly, through the steering wheel boss and secure on the underside with 2 BA full nuts and plain washers.

8. Replace the knurled connector (purple/black wire) and Lucar (black wire) to the steering column if these have been removed.

9. Fit the combined screen wash unit onto the steering column using the locating stud. Secure in position.

10. Locate the gear range selector onto the column by its locating stud and secure.

**Note**

The screen wash unit must be replaced first, otherwise access to the securing screws of this unit is covered by the gate of the gear selector unit.

11. Fit the upper and lower cowl mouldings onto the steering wheel loose enough to allow manual centralising of the assembly in relation to the gear change pointer and lever. Remove the top cowl and secure the lower cowl when suitably positioned.

12. Locate the top cowl onto the lower cowl and secure.

13. Finally, assemble the instrument facia panel, trim fairing and knee roll pads.

## Section N4

## Steering column

**Upper steering column - To remove with steering wheel and lower link dismantled**

The upper steering column is an energy absorbing unit. It comprises a lower extension and is fitted with a three point fixing bracket, spot welded on to the outer casing. Anti-vibration rubber mountings secure the column to under-facia steelwork whilst the lower end of the unit is fitted through a large rubber grommet and fastened to the toeboard by a circlip.

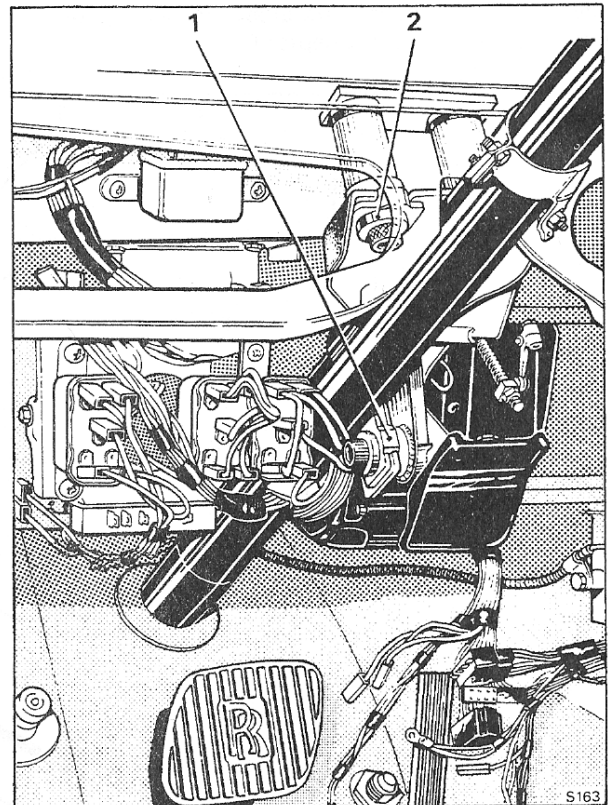
1. With the facia components dismantled, remove either the 4 in 1 instrument or the speedometer, to gain access to the steering column fixing behind the instrument panel. Carefully allow the instrument to hang from its connecting wires.
2. Slacken the two  $\frac{3}{8}$  in. U.N.F. socket head cap screws from the steering column upper mounting. Hold the tapping block and heavy washers through the instruments aperture.
3. Release the cap screws and extract the block and washers from behind the panel. Place components safely aside.
4. Replace the panel instrument.
5. Remove the large circlip and washer from the engine compartment side of the toeboard (see Fig. N33)
6. Unscrew and remove the knurled connector (purple/black wire) and unclip the Lucar connector (black wire) attached to the steering column.
7. From inside the car, support the column and release the single  $\frac{3}{8}$  in. U.N.F. socket head cap screw from the lower mounting. Retain the screw and washers but discard the nut.
8. From the driving position withdraw the steering column through the toeboard rubber grommet.
9. Inspect for worn and damaged components.

**Note**

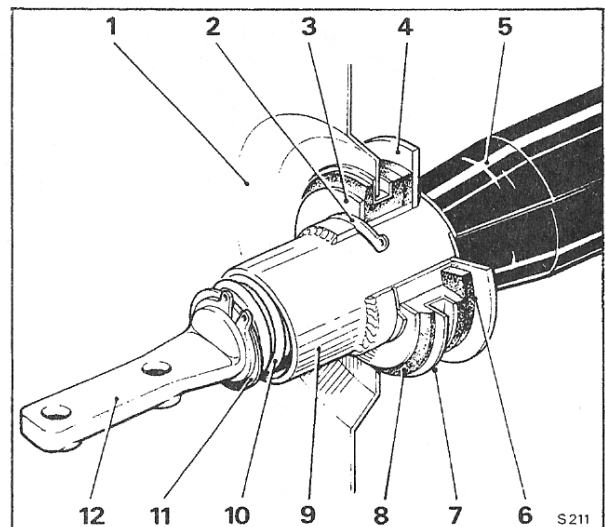
Care should be taken when manoeuvring the column inside the saloon to avoid damage to the woodwork and trim.

**Fig. N33 Toe-board fixing**

- 1 Toeboard bulkhead
- 2 Circlip
- 3 Washer
- 4 Flange
- 5 Plastic cover
- 6 Soft rubber washer
- 7 Bulkhead reinforcement
- 8 Bulkhead grommet
- 9 Main tube
- 10 Spring
- 11 Washer and circlip
- 12 Linkage arm

**Fig. N32 Steering column in position**

- 1 Lower mounting point
- 2 Upper mounting point



**Upper steering column - To fit**

Reverse the procedure for removal giving consideration to the following points.

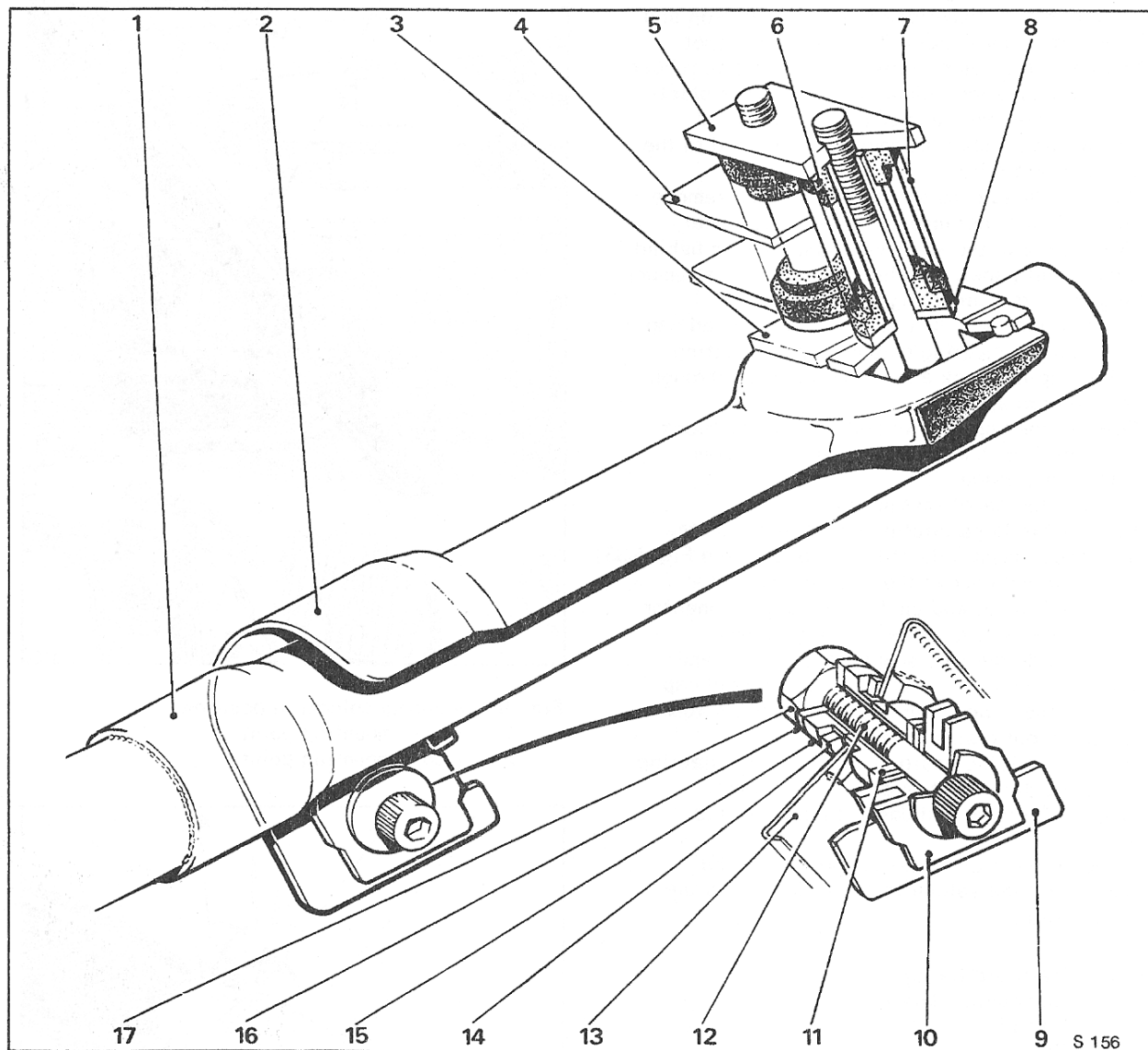
1. Before replacing the column into the toeboard a new rubber grommet and foam washer should be fitted.
2. Ensure that when replacing the two upper socket head cap screws the spigot rubbers and inner metal tube are not disturbed. Torque tighten to the figures given in Chapter P.

3. Locate a new nut to the column lower mounting, then finger tighten the cap screw until the washer just binds against the column locating capsule.

4. At this point check if the original slotted washer will make up the gap between the capsule and support bracket.

5. If a larger gap is apparent, measure this with feeler gauges and substitute the number of washers as necessary, using the following example.

With a measured gap of between zero and 0,35 mm. (0.014 in.), only one adjusting washer



**Fig. N34 Column mounting points**

- |                              |                                     |
|------------------------------|-------------------------------------|
| 1 Outer tube                 | 9 Lower flange                      |
| 2 Column mounting attachment | 10 Captive alloy washer             |
| 3 Captive alloy washers (2)  | 11 Shim washers (as required)       |
| 4 Bulkhead support           | 12 Distance tube                    |
| 5 Tapped plate               | 13 Bulkhead support and welded bush |
| 6 Flanged bush (Rubber)      | 14 Plain washer                     |
| 7 Distance tube              | 15 Flanged bush (Rubber)            |
| 8 Plain washer               | 16 Plain washer                     |
|                              | 17 Nut                              |

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will be necessary. With a large gap necessitating more than one washer, the following calculation can be applied.

Measured gap divided by      Number of washers  
0,35 mm. (0.014 in.)      =      required to complete the assembly.

Slotted adjusting washers are manufactured from 22 S.W.G. 0,70 mm. (0.028 in.) material, the size designed to compensate for the 0,70 mm. (0.028 in.) compression of the spigot rubbers.

#### Steering link - To remove and fit (Fig. N35)

The lower link unit comprises an upper safety stalk and bonded coupling attached to a universal joint and shaft splined at the lower end. The shaft connects with a lower universal joint which in turn is secured to the pinion box.

#### Warning

**Do not use impact force to remove any joint on or near to the steering unit. Irreparable damage to the unit, could result.**

1. With the rack and pinion unit removed from the suspension, release the two bolts securing the upper link to the steering column extension unit and carefully lower from under the car.
2. Remove the heat shields and inspect universal joints and bonded coupling.
3. Detach the bonded coupling from the flanged yoke to inspect the safety stalk.
4. Release the pinch bolt holding the lower universal joint to the intermediate shaft. Dismantle.

At this stage, inspect the splines, screw threads, bonded coupling and universal joints for wear, to ensure new parts are fitted where necessary.

5. When fitting the upper link to the bonded coupling, torque tighten the two bolts to the figures quoted in Chapter P.
6. Fit heatshield onto protruding bolt threads fitted in operation 5 and secure with washers and half nuts torque tightened to the figures quoted in Chapter P.
7. Fit the intermediate link flange to the bonded coupling with safety stalk positioned and special button headed bolts torque tightened to the figures quoted in Chapter P. Ensure washers are fitted between the bonded coupling and the safety stalk base plate.
8. Replace the intermediate shaft to lower link, ensuring the cut-away in the spline is in horizontal relation to the pinch bolt which should be finger tightened. Place the heat shield in position.

The upper and lower link assembly, can now be installed.

#### Note

To set the steering wheel in a straight ahead position, it may be necessary to offset the linkage in the adjustment, by one spline at the steering wheel (36 splines) and the pinion box (48 splines).

9. With the road wheels in the straight ahead position use the centring plug (RH 9119) to ensure the setting mark drilled into the steering rack is centrally disposed in the blanking plug aperture.

10. Replace the blanking plug.

11. Check that the steering column lower extension machined face is lying horizontal and facing upwards.

12. Fit the steering wheel on the nearest spline to the straight ahead position then adjust by turning the wheel slightly to give an exact setting.

13. Align the upper link to the lower extension face, then feed the lower splined clip over the pinion box spline and nip together with the pinch bolt and castellated nut.

14. Check at this stage if the upper link and lower extension faces are parallel. Any further adjustment must be made using the procedure shown in operations 12 and 13.

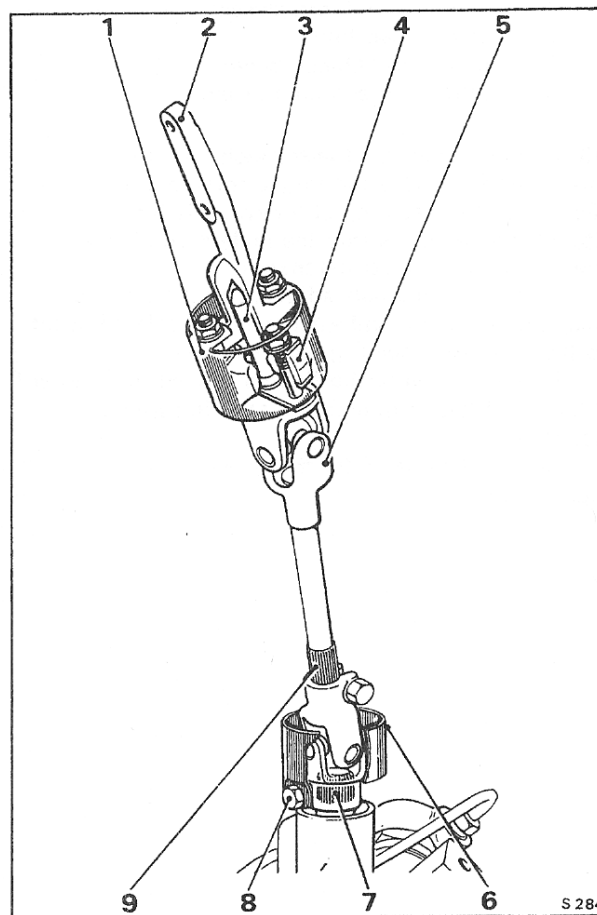


Fig. N35 Column to steering unit linkage

- |   |                          |
|---|--------------------------|
| 1 | Heatshield               |
| 2 | Link to column connector |
| 3 | Safety stalk             |
| 4 | Bonded coupling          |
| 5 | Universal joint          |
| 6 | Heatshield               |
| 7 | Spline                   |
| 8 | Pinch bolt               |
| 9 | Adjustable spline        |



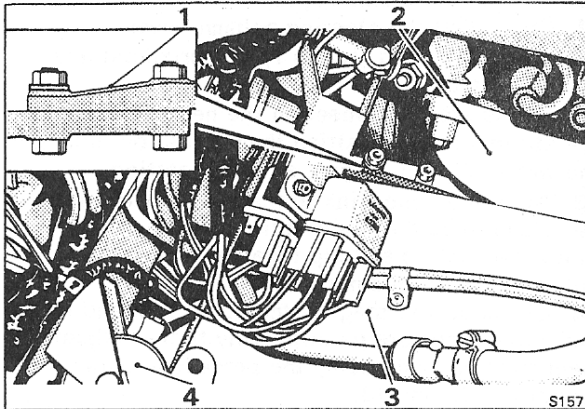


Fig. N36 Steering column extension to lower link

- 1 Column to link attachment (and inset)
- 2 Exhaust manifold
- 3 Right-hand valance panel
- 4 Pulley to speed control unit

15. Torque tighten the lower pinch bolt and castellated nut. Use the torque tolerance to allow the fitting and securing of a new split pin.

16. Fit the two bolts into the underside of the steering column lower extension.

Fit a **nut** to the bolt adjacent to the bonded coupling and a **nut and washer** to the bolt adjacent to the toe-board (see Fig. N36 - Inset).

Torque tighten to the figures quoted in Chapter P.

17. Fit and torque tighten the steering wheel column nut.

Refer to Chapter P for the above torque tightness figures.

## Section N5

## Steering linkage

**Introduction**

Steering linkage to the road wheels is by track rods attached with ball pin joints to the rack and pinion inner bracket at the centre and the side steering levers at the hubs.

Toe-in is readily adjusted by screwed connectors situated between the inner and outer track rod components. This function does not require the withdrawal of the hub ball joint. Grease nipples are fitted to all four ball pin locations.

**Adjustable track rod units - To remove**

1. Turn the steering unit onto full lock in any one direction.
2. Remove the split pin, castellated nut and washer from the ball pin assembly.
3. Using special tool (RH 8100) release the ball joint taper and withdraw this from the inner ball joint bracket.
4. Turn the steering unit onto full lock in the opposite direction and using the same procedure, withdraw the opposite ball joint.
5. Remove the split pins, castellated nuts and washers from the outer track rod ball joints.

6. Support the track rod, then using special tool (RH 8080) withdraw the outer ball joints from the side steering levers and remove the track rods from beneath the car.

7. Inspect the ball joint units and replace if necessary

**Ball pin unit - To remove**

1. Unscrew and remove the hexagon headed plug from the track rod end socket.
2. Using circlip pliers remove the clip and sealing boot then the ball pin.
3. Discard the unit.
4. Clean out the track rod socket using 'Genklene' or an equivalent solution.
5. Inspect internal surfaces for damage.

**Track rod socket - To renew**

If at this stage of dismantling the socket was found to be damaged, check the number of turns required to remove the damaged socket and to set the new socket into the approximate position. The final toe-in setting can be made only when the track rod assembly has been fitted into the car.

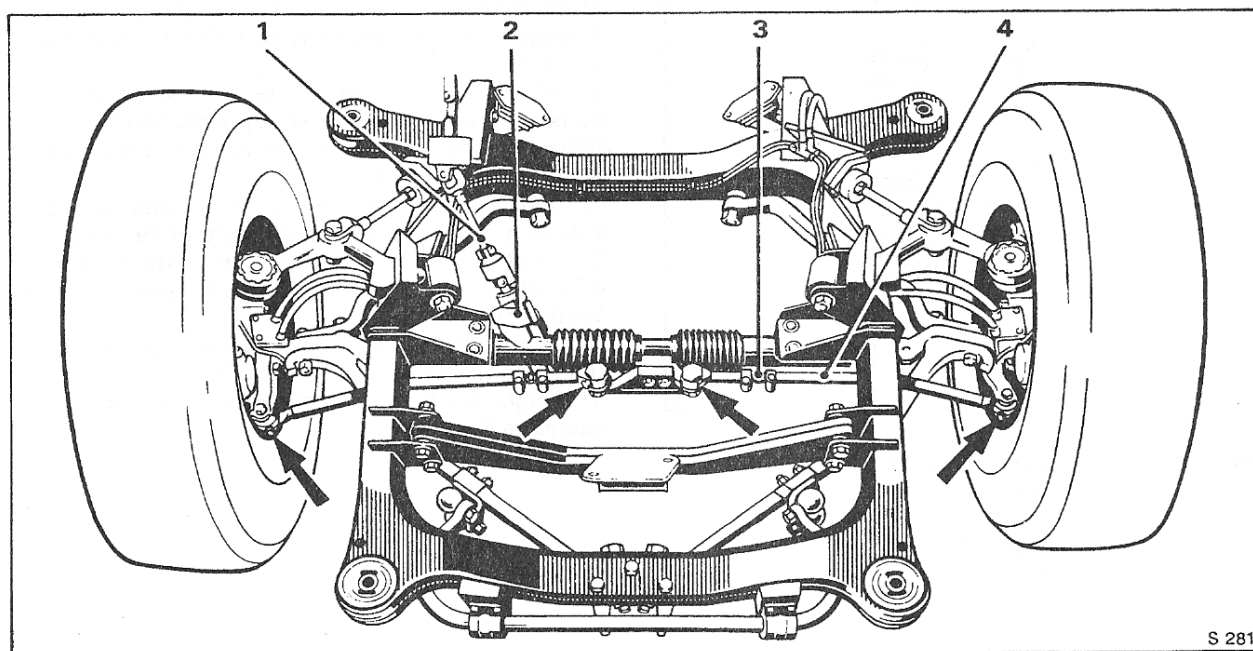


Fig. N37 Steering linkage

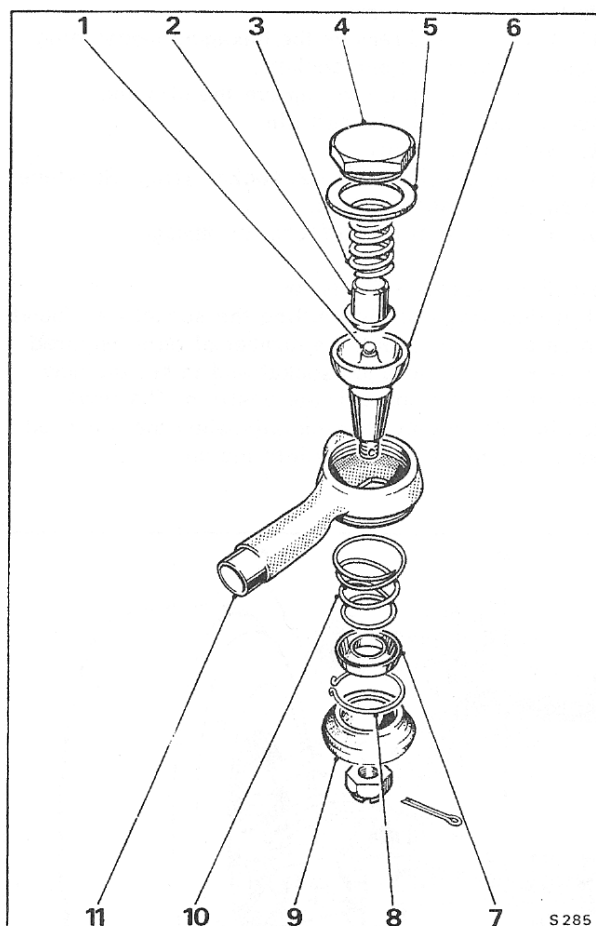
- 1 Lower link unit
- 2 Spool valve and pinion box

- 3 Track rod adjuster
  - 4 Outer track rod
- ➔ Grease points

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**Ball pin unit - To fit**

1. Place the ball pin components into the track rod socket in the following sequence, lightly lubricating each component with an approved grease.
2. Fit the taper pin through the rectangular hole with the shoulder bearing on the inner seat.
3. Smear the ball seat with approved grease and fit the ball bearing, spring seat, spring, alloy joint washer and finally the retaining plug.
4. Apply Rocol T 265 grease to the seal faces of the ball joint then fit the rubber seal with its assembled lower retaining clip, coil spring and upper seating.

**Fig. N38 Ball pin unit. Exploded view**

- 1 Ball bearing
- 2 Spring seat
- 3 Ball joint spring
- 4 Screwed plug
- 5 Alloy washer
- 6 Ball pin
- 7 Spring seat
- 8 Retaining spring
- 9 Dust cover
- 10 Dust cover expander
- 11 Track rod ball joint housing

5. Locate the clip and lower edge of the rubber seal under the lip of the track rod socket.
6. Fit the grease nipple into position then lubricate the assembly with approved grease, until it exudes from the seals.
7. Each joint will require approximately 9,5 gms. (0.66 oz.) of grease for an initial filling operation.

**Adjustable track rod units - To fit**

Clean the taper connections in the side steering levers, the centre ball joint bracket and the ball joint units assembled in the track rods.

1. Lightly smear the bearing surfaces before offering the assembly up to the steering unit.
2. Fit the inner ball joint down into the centre bracket and the outer ball joint up into the side steering lever socket.
3. Secure the ball joints with new castle nuts and split pins. Tighten the  $\frac{3}{4}$  in. U.N.F. ( $1\frac{1}{8}$  in. A/F) nuts to a torque tightness figure quoted in Chapter P using the tolerance to align the split pin holes.

**Front wheel toe-in - To adjust**

1. Place the car on a level surface and set the steering wheel in the straight ahead position.
2. Remove the gear selector thermal cut-out, as described in Chapter M - Electrical System.
3. Move the car forward a full half revolution of the road wheels. Moving the car backwards instead of forward will give an incorrect reading.
4. Take a reading using optical alignment equipment.
5. Move the car forward a further half revolution of the road wheels and take a second reading. An average of the two readings will give the true toe-in figure.
6. If setting is necessary slacken the two pinch bolts securing the track rod adjusters and rotate these to bring the wheels into the straight ahead position (zero toe-in).
7. Rotate the adjusters by equal amounts on each side to give an overall toe-in figure of between 0' 7" and 0' 17" ( $\frac{1}{32}$  in. and  $\frac{3}{32}$  in.) with the car in a 'levelled' or 'showroom' condition (see Chapter H Section H5).
8. Tighten the pinch bolts then re-check the toe-in as shown in Operations 4 and 5.
9. Torque tighten the pinch bolts to the figures quoted in Chapter P.

## Section N6

**Fault diagnosis**

Malfunction	Possible cause	Action
<b>Steering pump and reservoir</b>		
Hydraulic fluid leaks	Reservoir cover seal or filler cap seal leaking due to fluid level being too high or air in fluid	Check oil level and top-up if required. Bleed system to remove air by operating steering. Examine cap and cover for damage or distortion.
	Reservoir to pump 'O' rings leaking	Renew 'O' rings
	Flow control valve plug 'O' rings leaking	Renew 'O' rings
	Steering pump bearing seal leaking	Renew seal. Examine shaft for wear or damage
Momentary increase in effort when turning wheel quickly to right or left	Reservoir or filler cap seals damaged	Renew seals
	Low fluid level in reservoir	Check fluid level. Top-up if required. Examine system for leaks
	Pump drive belt(s) slipping	Correctly adjust pump drive belt(s)
	Heavy internal fluid leak	Check pump outlet pressure. If pressure is low renew combined flow control and relief valve. If pressure remains low, check system for internal leaks by dismantling steering unit
	Aerated fluid	Renew fluid or allow system to stand for at least one hour
<b>Noisy system</b>		
	Low fluid level	Fill reservoir to correct level with an approved fluid and bleed system by operating steering
	Loose drive belt(s)	Correctly adjust drive belt(s)
	Pressure hose not correctly fitted	Ensure correct run of hose
	Excessive back pressure due to partially blocked pipes or resistance to steering gear movement	Locate restriction and correct if necessary

Malfunction	Possible cause	Action
<b>Noisy system (continued)</b>		
	Scored rotor or rollers	Renew rotor and rollers or fit new pump if required
	Excessive wear on cam ring	Fit new steering pump
	Defective flow control valve	Renew valve
	Scored pressure plate	Lap to remove light scoring. Renew heavily scored components
	Vaness incorrectly fitted	Fit vanes correctly
	Vaness sticking in rotor slots	Free by removing burrs or dirt
	Extreme wear on pump ring	Renew pump ring, rotor and vanes
	Face of thrust plate scored	Lap to remove light scoring. Renew rotor, vanes and pump ring if rotor is heavily scored
	Scored rotor	Lap to remove light scoring. Renew heavily scored components
	Aerated fluid	Change fluid or allow system to stand for at least one hour
<b>Steering</b>		
Car pulls to one side or the other	Front end geometry misaligned	Check steering geometry
	Pump drive belt(s) slipping	Correctly adjust steering pump belt(s)
	Flow control valve sticking	Examine flow control valve. Renew valve if necessary
Heavy steering	Incorrect tyre pressures	Check and correct tyre pressures
	Loose pump drive belt(s)	Correctly adjust drive belt(s)
	Low fluid level in reservoir	Check level of fluid in reservoir. Top-up if required. Examine system for leaks
	Lack of lubricant in steering joints	Examine all steering joints. Grease with approved lubricant if required
	Insufficient fluid pressure	If the preceding checks do not reveal the cause of heavy steering, check pump pressure
	Faulty or obstructed flow control valve	Renew or replace if necessary

Malfunction	Possible cause	Action
Heavy steering (continued)	Incorrect front wheel alignment	Check and adjust if required
	Excessive castor or toe-in	Adjust castor or toe-in to within specified limits
	Incorrect camber angle	Correct camber angle to within specified limits
	Distorted flexible coupling or defective universal joint	Examine flexible coupling. Renew if necessary. Examine universal joint in lower steering column. Renew if necessary
	Triangle levers misaligned	Check wheel castor and camber
	Front sub-frame distorted	Check sub-frame for correct alignment. Correct or renew if required
	Kinks in hoses	Ensure correct run of hoses
	Obstruction in hose. Inner bore of hose swollen, caused by overheated or incorrect fluid	Renew hose
	Pressure loss in rack and pinion unit caused by worn P.T.F.E. seals, scored bore	Overhaul unit
Steering wheel	Leakage at pinion valve	Overhaul unit
	Excessive play at steering wheel	Adjust steering linkage or renew parts if required.
	Excessive play in steering linkage	Adjust steering linkage or renew parts if required.
	Insufficient pre-load	Strip and rebuild steering unit
	Defective bonded coupling	Replace
	Worn universal joints in lower linkage	Replace
	Front wheel bearings incorrectly adjusted or worn	Correctly adjust bearings or renew if required
	Worn check valve in pressure connection	Renew check valve



## N6 - 4

Malfunction	Possible cause	Action
Steering linkage	Steering linkage loose	Examine linkage pivot points for wear. Renew worn parts if required
Rack and pinion unit		
Oil leak from centre linkage	Loose convoluted seal clips	Tighten
	Defective centre seal	Fit new seal and bond
Hydraulic fluid leaks from hose connections and pipe unions	Loose hose connections or damaged 'O' rings	Tighten hose connections. If tightening fails to cure leak, examine ends of hoses for cracks or damage. Renew 'O' rings if necessary
	Damaged hose	Examine hose for fretting, fraying or deterioration. Renew hose if required. Ensure that correct hose run is obtained and that hose clips are correctly fitted.

## Section N7

**Workshop tools**

Tool Number	Description
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**Steering wheel**

RH 7870	Extractor — Corniche and Camargue
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**Spool valve and pinion**

RH 9120	Spline cover — Input shaft. Upper oil seal
RH 9121	Applicator — Input shaft. Upper and lower oil seal
RH 9117	Applicator — P.T.F.E. rings. Spool valve
RH 9118	Sizing tool — P.T.F.E. rings. Spool valve
RH 9123	Torque arm — Spool valve ball race pre-load (use with spring balance)

**Steering pump**

RH 7674	Pliers (two-way) — Circlip and snap ring
RH 9106	Fitting and extracting tool — Pulley

**Rack unit**

RH 9112	Sizing tool (small) — P.T.F.E. scarf jointed bearing
RH 9113	Sizing tool (medium) — P.T.F.E. scarf jointed bearing
RH 9114	Sizing tool (large) — P.T.F.E. scarf jointed bearing
RH 9119	Screwed location plug — Rack centring
RH 9125	Spanner (open ended) — To fit torque wrench
RH 9122	Torque wrench extension — Steering rack anchorage