

Chapter N

Steering system

Section

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- N2 Steering pump (Saginaw)
- N3 Steering wheel and Gear range selector unit
- N4 Steering column
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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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T.S.D. 42

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

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May 1978

T.S.D. 4200

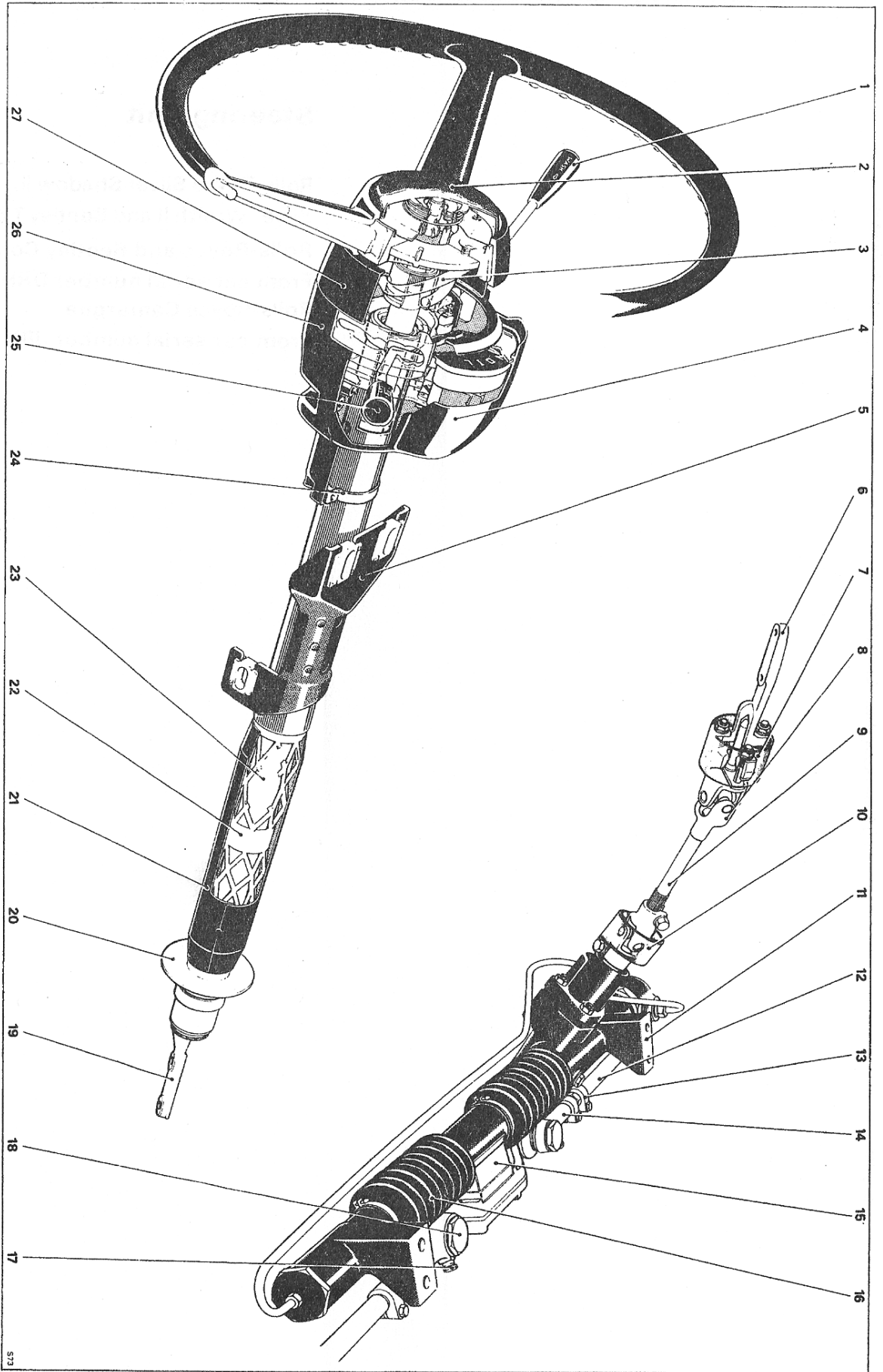


Fig. M1 Steering column with rack and pinion unit

- 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 stralk 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 Convuluted 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

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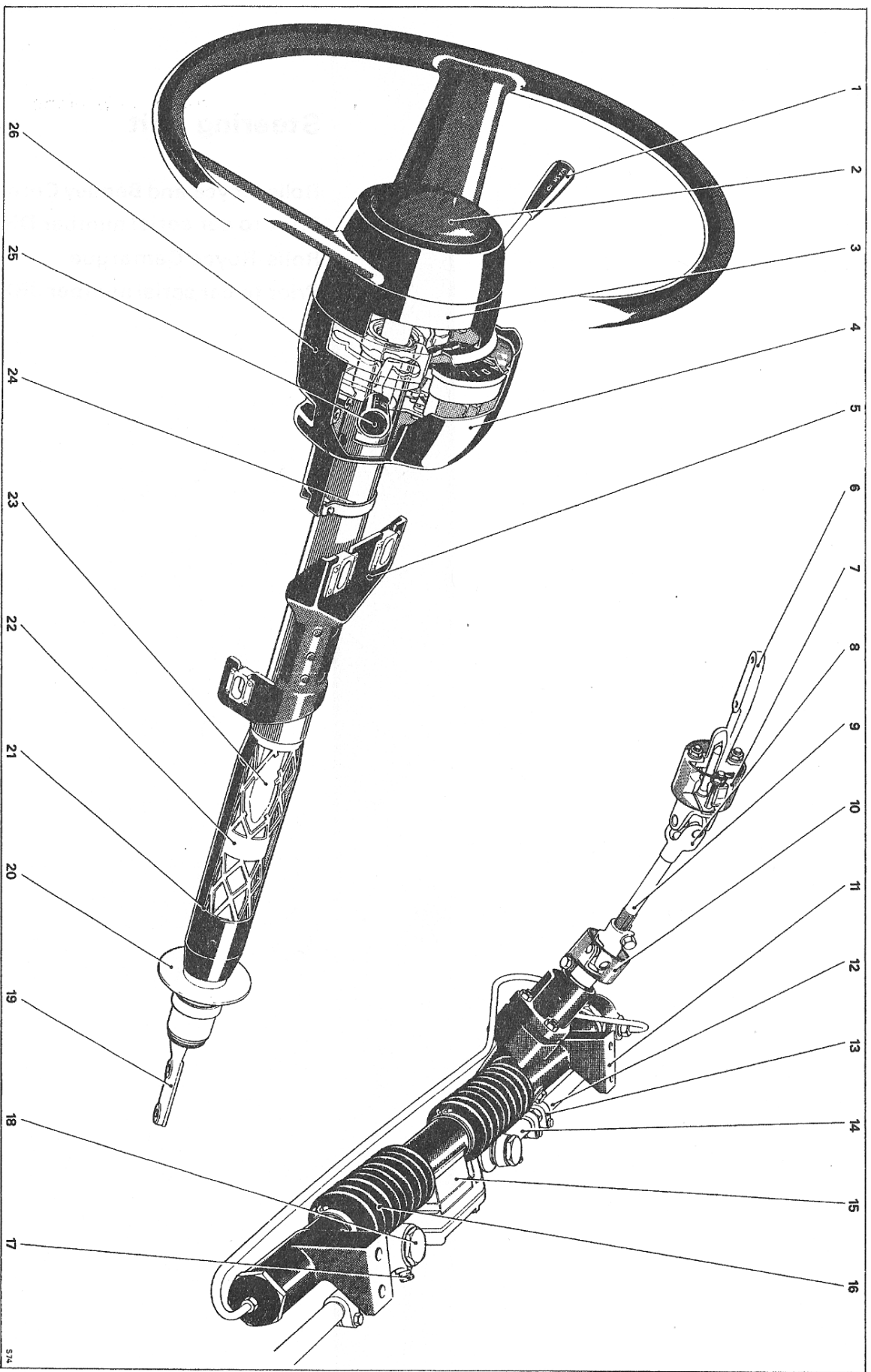


Fig. N2 Steering column with rack and pinion unit

- 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

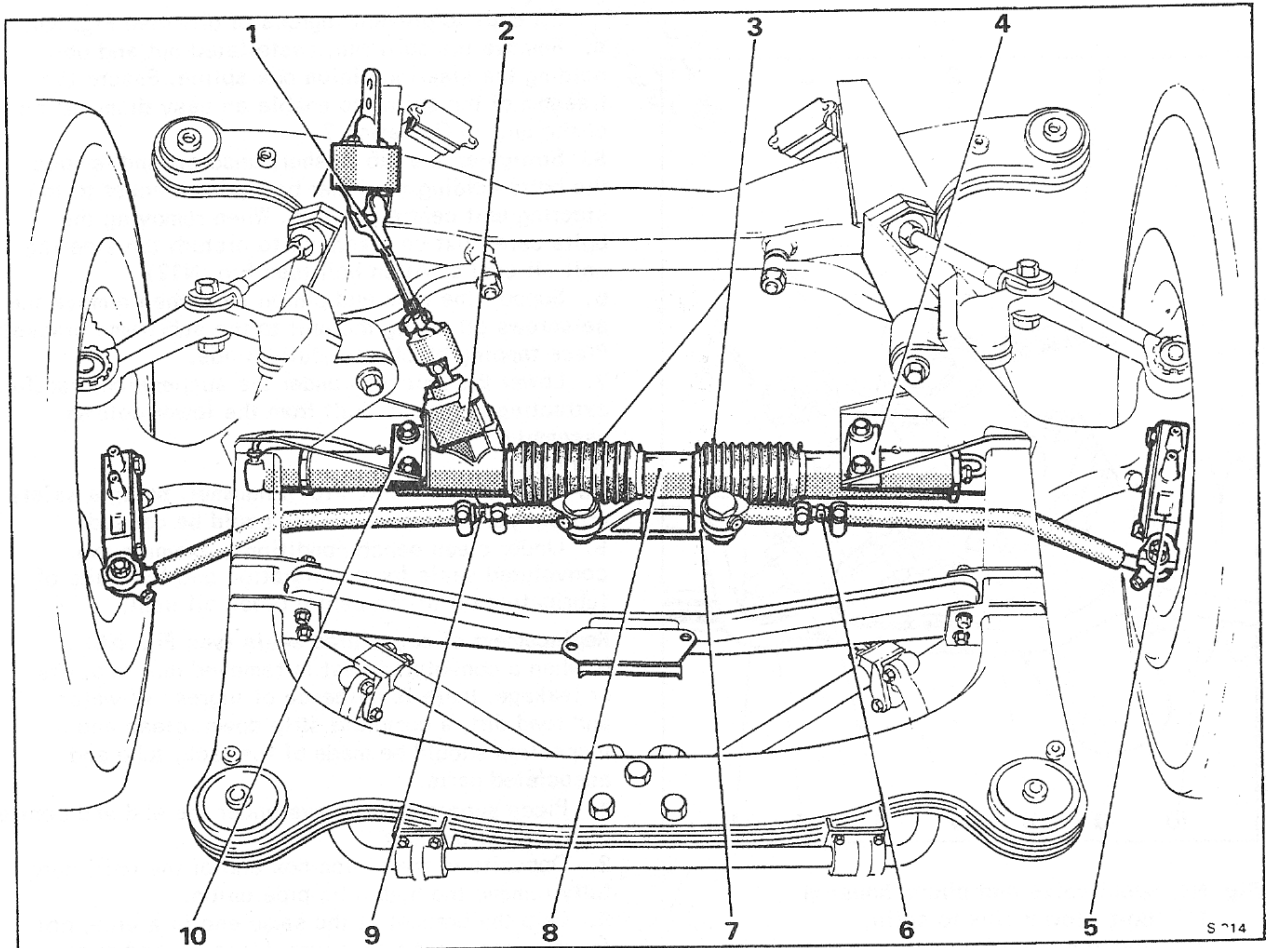


Fig. N3 Steering unit mounted in sub-frame

- | | |
|------------------------------------|-------------------------------------|
| 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.

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

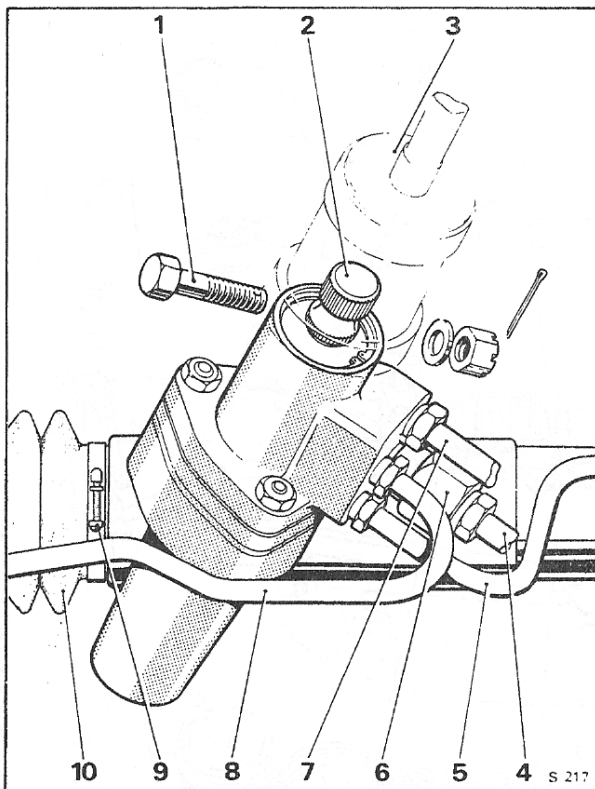


Fig. N4 Spool valve and pinion housing

- 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

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

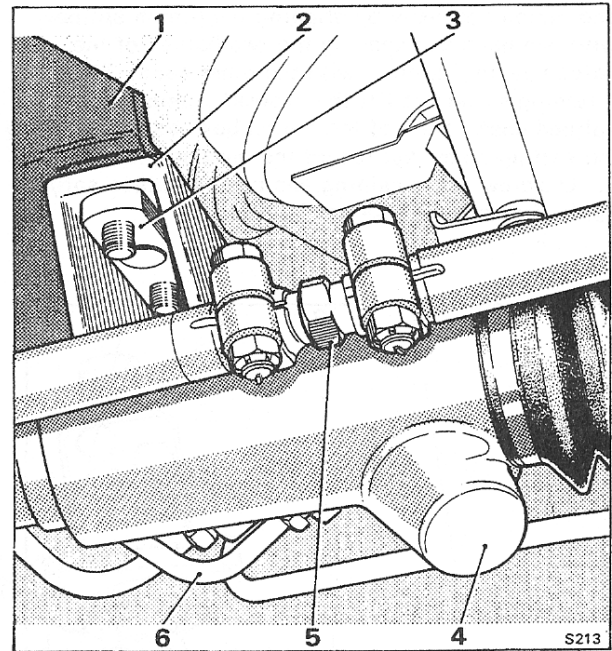


Fig. N5 Steering to sub-frame mounting

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

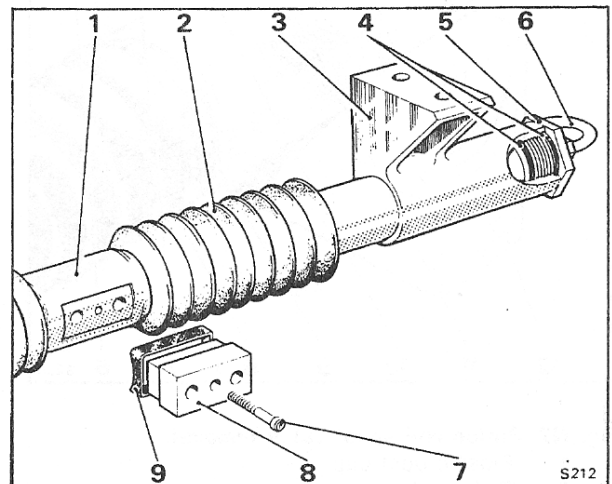


Fig. N6 Removal of convoluted seals

- 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.

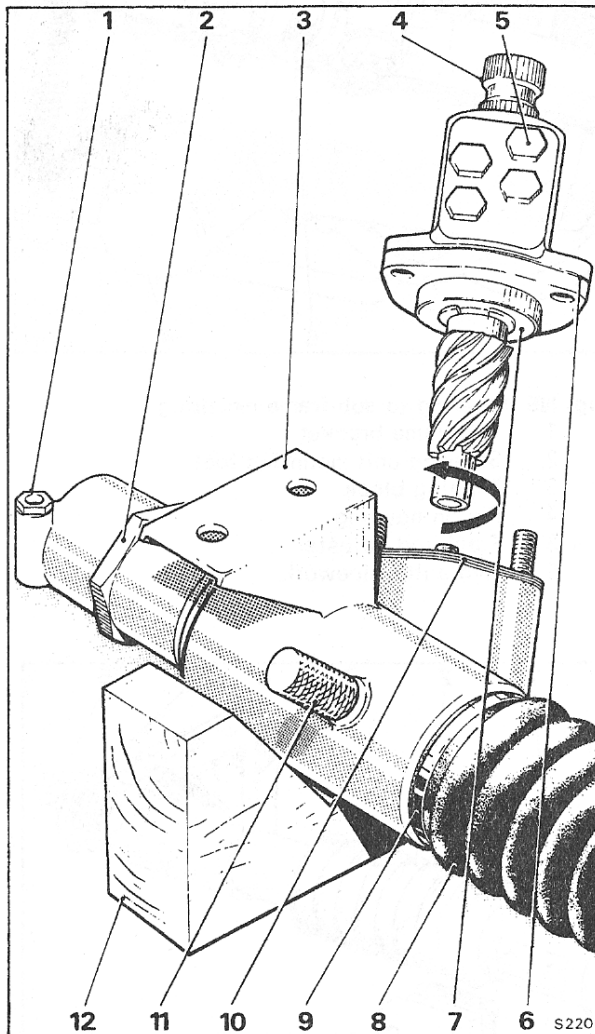


Fig. N7 Pinion and spool valve removal

- 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 'Genkline' 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 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

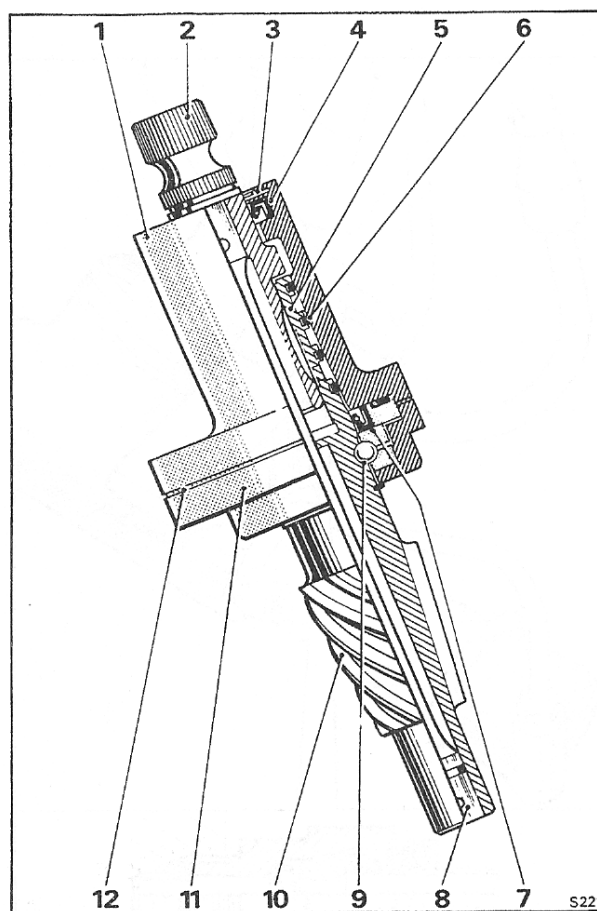


Fig. N8 Pinion and spool valve unit. Cut-away view

- 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)

N1-6

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.

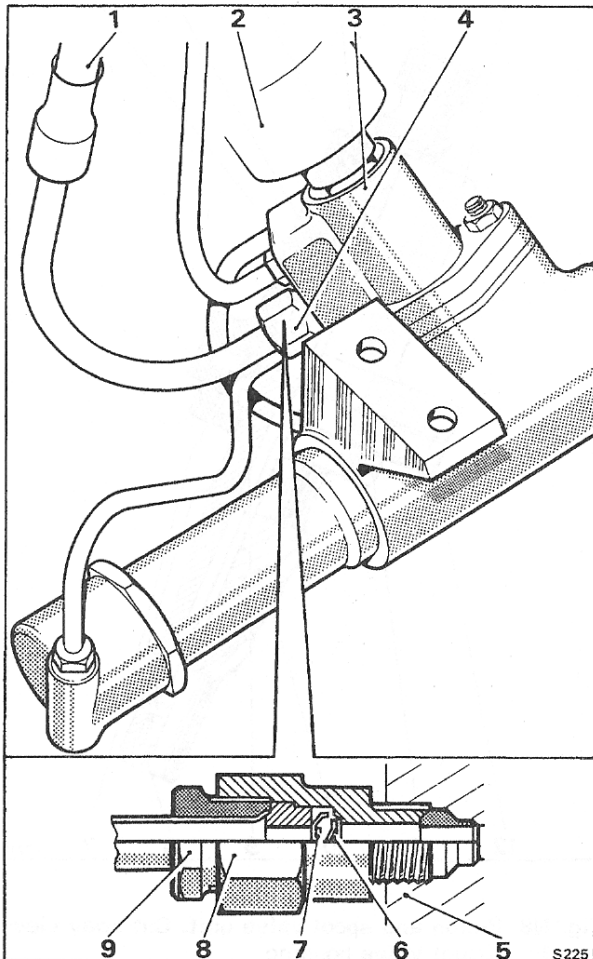


Fig. N9 Anti-joggle valve

- 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.)

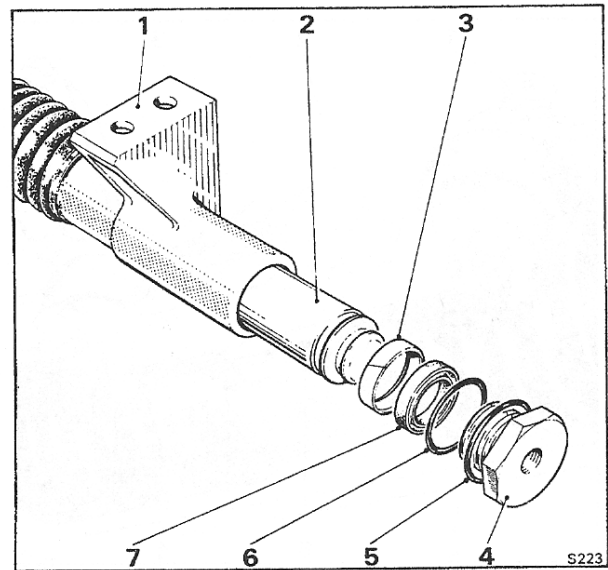


Fig. N10 Assembly of free end components

- 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

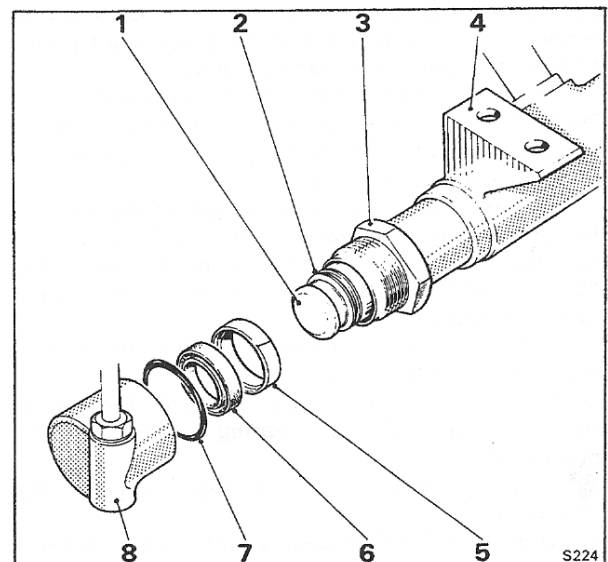


Fig. N11 Assembly of pinion box end components

- 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

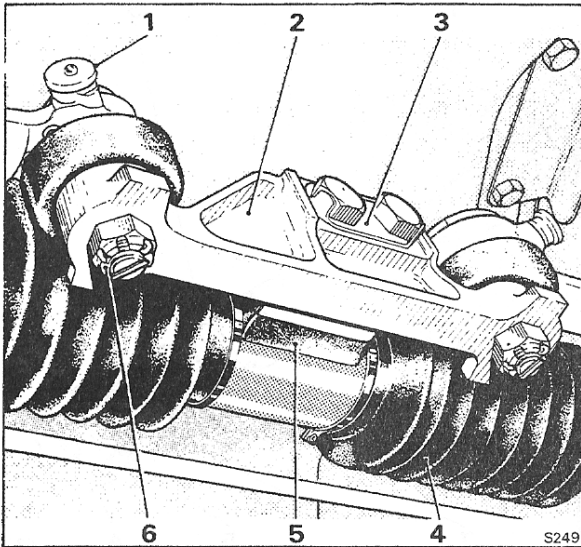


Fig. N12 Inner ball joint bracket in position

- 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

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.

Note:

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

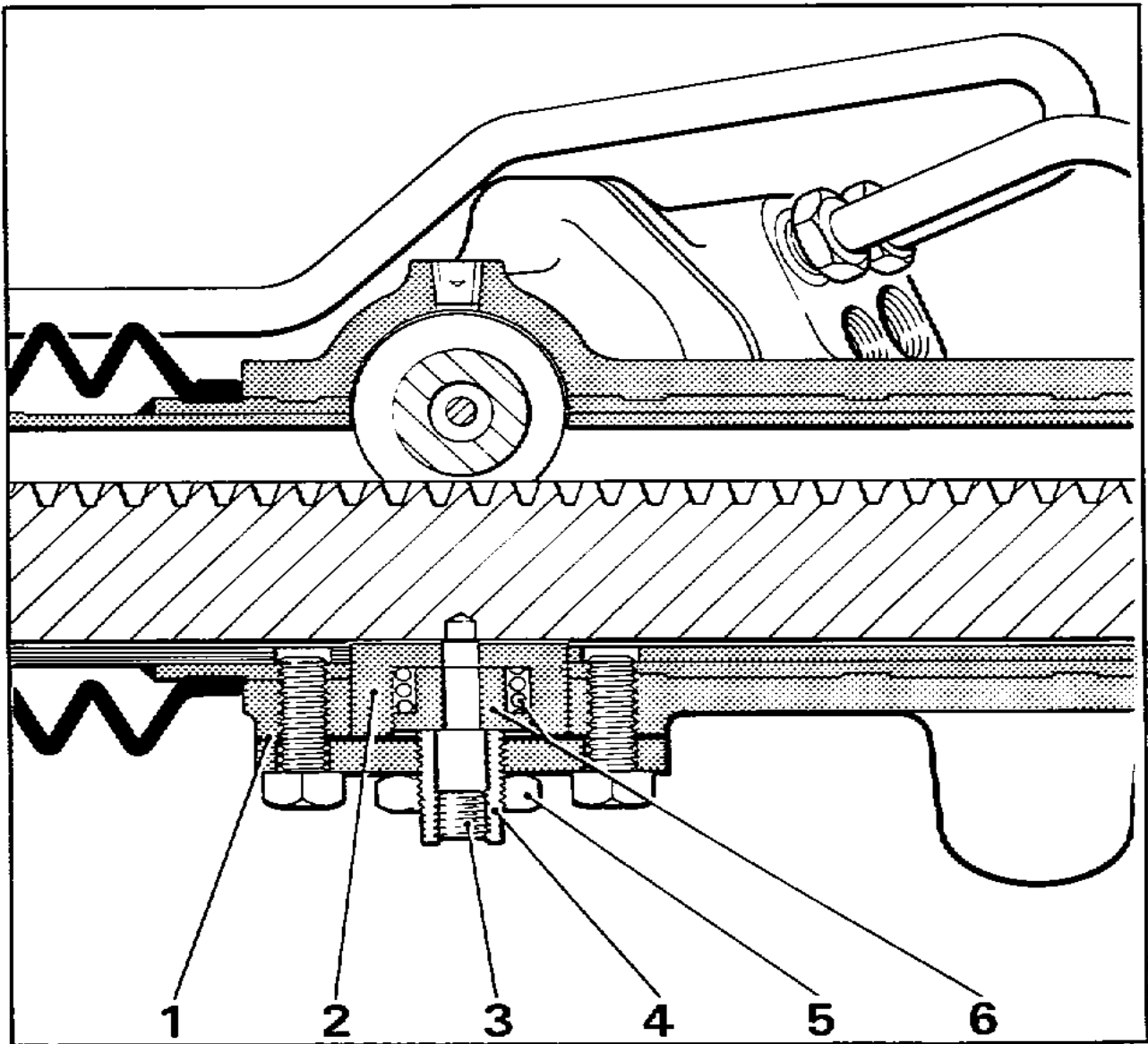
- 15. Fit the short oil pipe to the valve housing. Unscrew the end cap up to one complete turn, until it lines up with the banjo fitting on the oil pipe.
- 16. Tighten the lock-nut to between 47 Nm and 54 Nm (4,8 kgf m and 5,5 kgf m; 35 lbf ft and 40 lbf ft), using spanner RH 9125.
- 17. Torque tighten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

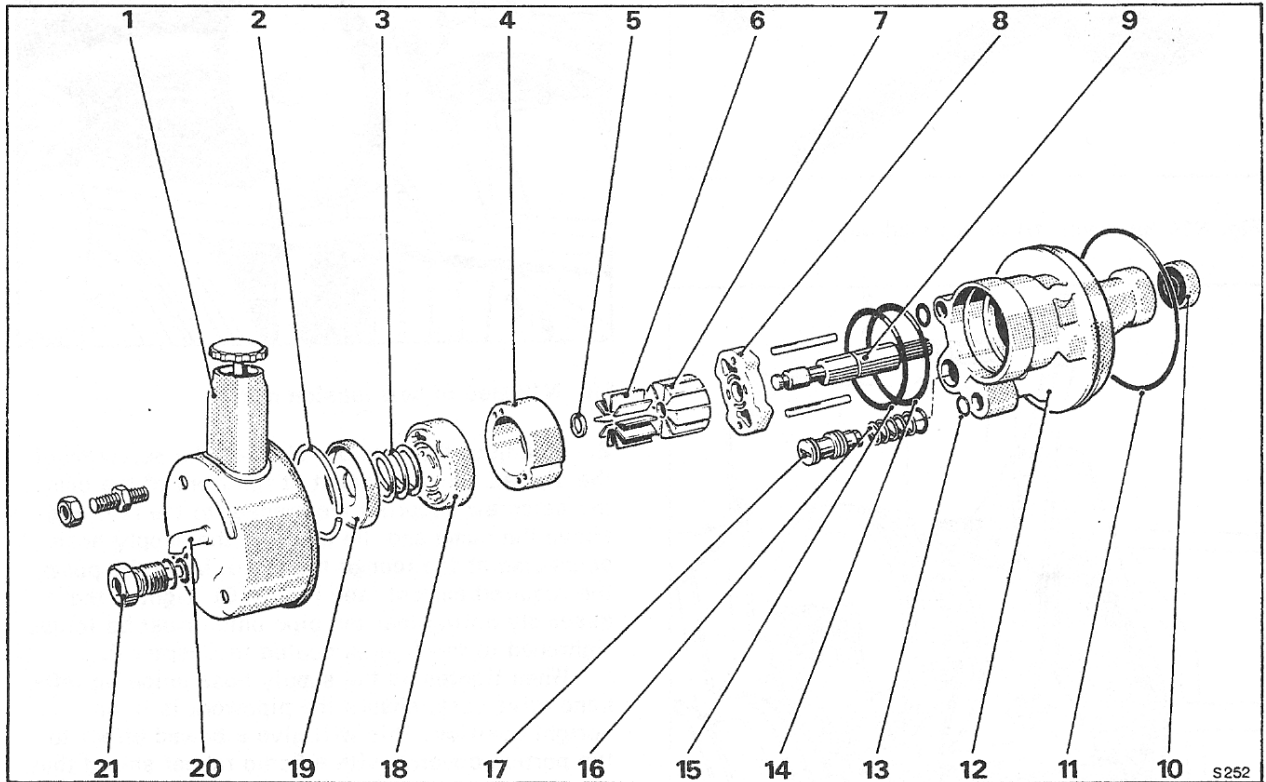


Fig. N13 Steering pump. Exploded view

- | | | |
|----|---|-----------------------------------|
| 1 | Reservoir and filler | |
| 2 | End plate retaining ring | |
| 3 | Pressure plate spring | |
| 4 | Pump ring | Supplied in kit
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 | |