



POWER STEERING BOX

Service repair no - 57.10.07

Overhaul



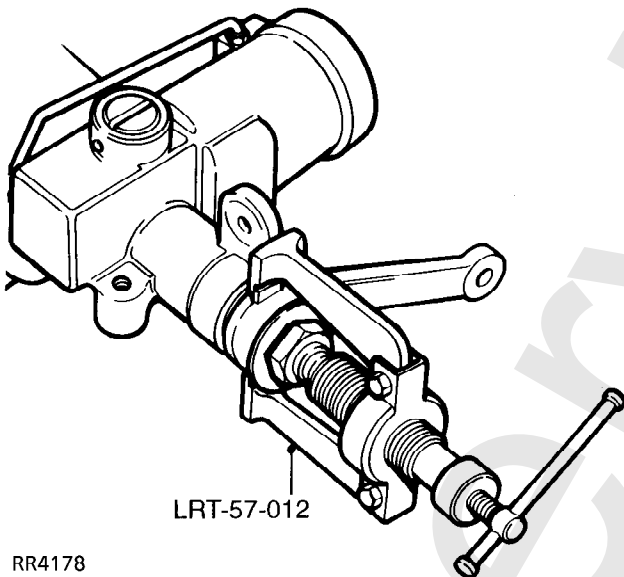
NOTE: Overhaul of steering box should not be carried out during the warranty period.



WARNING: Wear safety glasses while removing and refitting circlips and retaining ring.



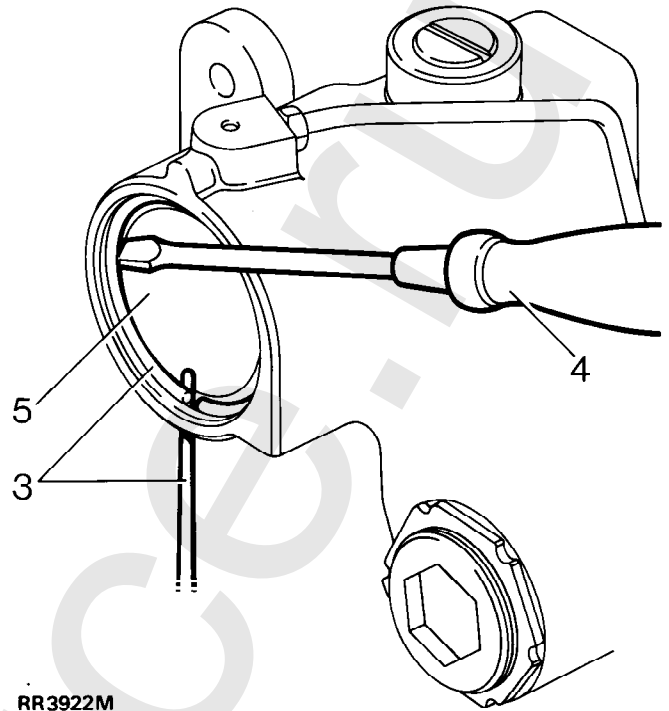
CAUTION: Absolute cleanliness is essential when overhauling power steering box.



1. Remove steering box from vehicle. **See Repair, Power Steering Box**

Remove drop arm using extractor LRT-57-012. Loosen drop arm securing nut, but do not remove before using extractor. Remove dirt excluder from output shaft.

2. Drain oil, remove blanking plugs and bleed screw. Hold steering box over suitable container, turn input shaft from lock to lock, until oil is drained. Refit bleed screw.
3. Rotate retainer ring until one end is 12 mm from extractor hole. Using a drift through hole in cylinder, lift retaining ring from groove in cylinder bore.
4. Remove retainer ring, using a screwdriver.

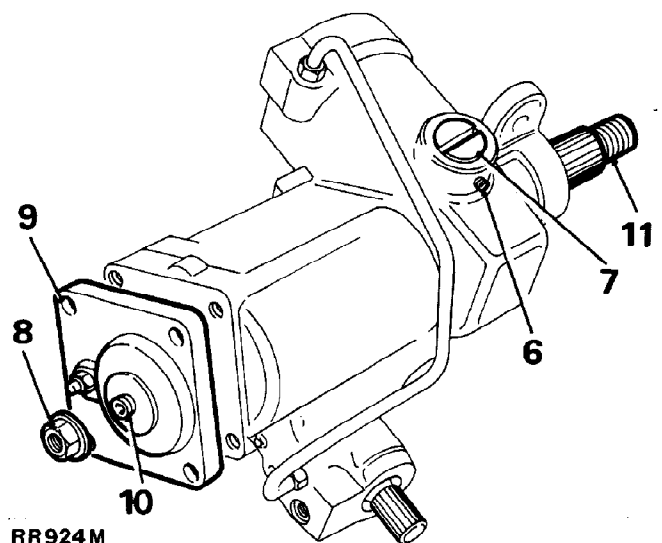


5. Turn input shaft (left lock on left hand drive, right lock on right hand drive) until piston pushes out cover. Turn input shaft fully in opposite direction, applying pressure to piston.
6. Remove set screw retaining rack pad adjuster.
7. Remove rack adjuster and pad.
8. Remove sector shaft adjuster locknut.
9. Remove four bolts from sector shaft cover.
10. Screw in sector shaft adjuster until cover is removed.

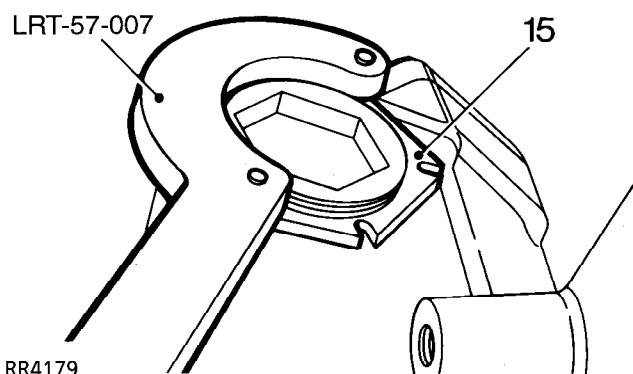


NOTE: Sealant is applied to hexagon socket to 'tamperproof' sector shaft adjuster

11. Slide out sector shaft.



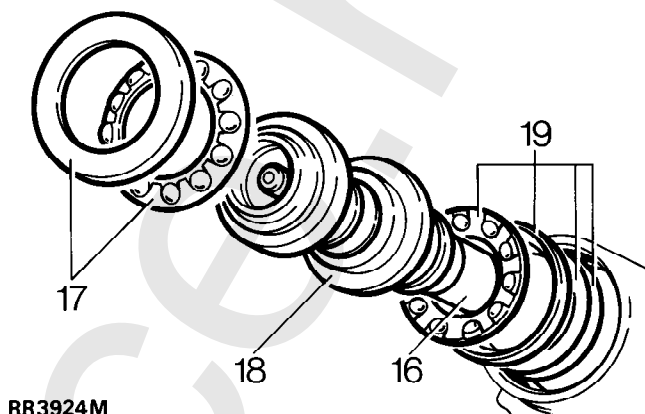
12. Remove piston, a bolt screwed into piston will assist removal.
13. Remove input shaft dirt excluder.



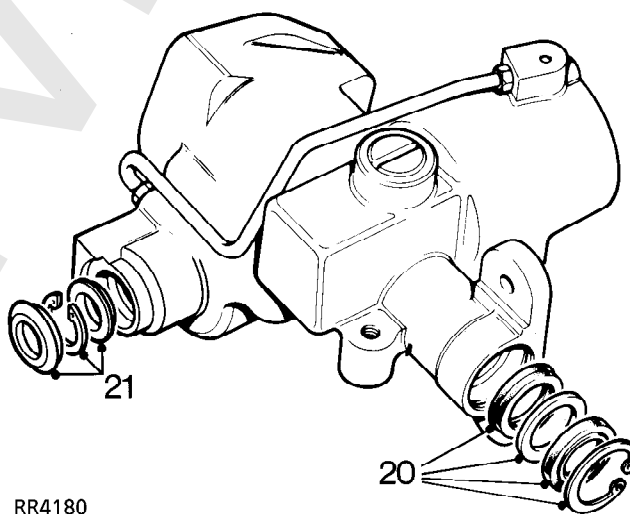
14. Remove worm adjuster locknut using 'C' wrench LRT-57-007.
15. Remove worm adjuster using wrench LRT-57-006.
16. Tap splined end of shaft to free bearing.
17. Remove bearing cup and caged ball bearing assembly.
18. Remove valve and worm assembly.
19. Remove inner bearing cage, cup and shim washers. Retain shims for reassembly.



NOTE: Should difficulty be experienced warm casing and bearing assembly. Cool bearing cup using a mandrel and tap steering box on a bench.



Steering box seals



20. Remove circlip and seal from sector shaft housing bore.



CAUTION: Do not remove sector shaft bearings from casing. Replacement parts are not available. If sector shaft bearings are worn fit a new steering box.

21. Remove dirt excluder, circlip and seal from input shaft housing bore.



CAUTION: The use of a seal puller is recommended to prevent damage to casing, and possible oil leaks.

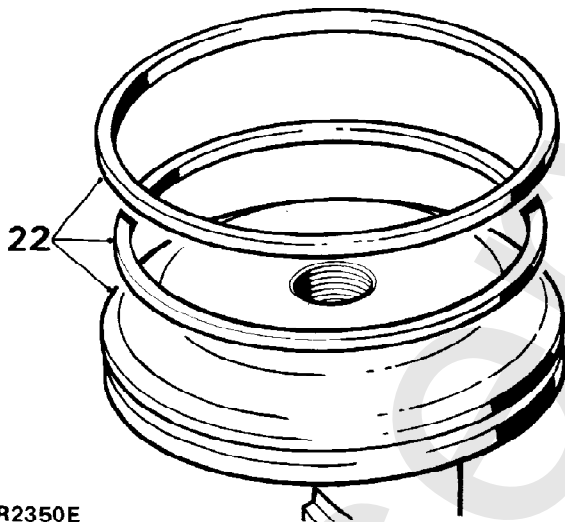
INSPECTING

Piston

22. Discard all rubber seals and provide replacements.



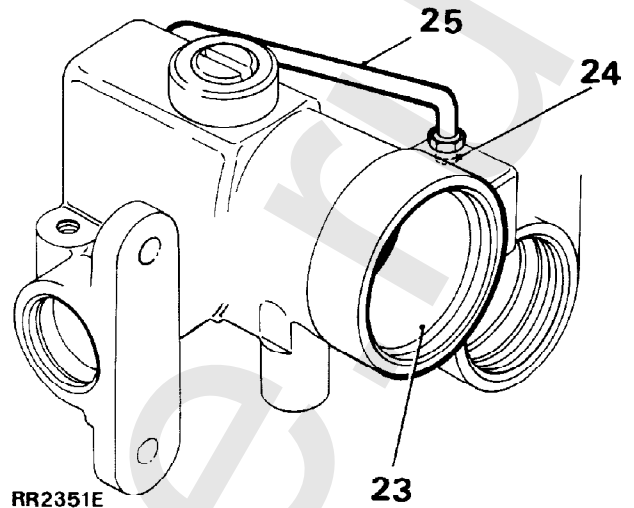
NOTE: A rubber seal is fitted behind plastic ring on rack piston. Discard seal and plastic ring.



RR2350E

Steering box casing

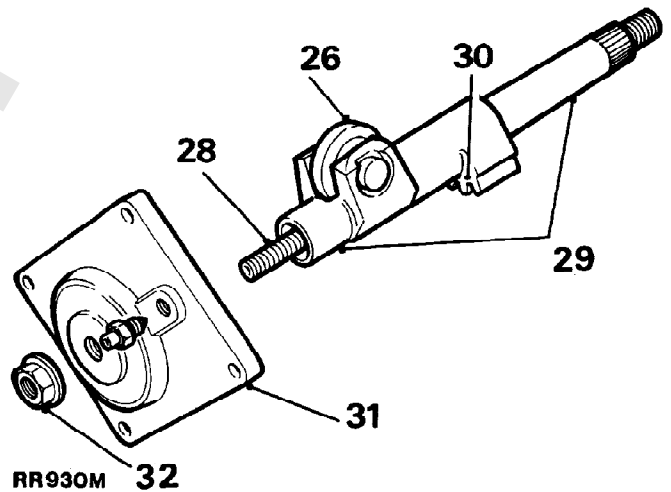
23. Examine piston bore for scoring and wear.
24. Examine feed tube.
25. Fit a new feed tube if damaged. Tighten to 22 Nm.



RR2351E

Sector shaft assembly

26. Check there is no side play on roller.
27. If side play on roller exists fit a new sector shaft.
28. Check condition of adjuster screw threads. Check adjuster end float. Fit new adjuster if end float exceeds 0.15 mm.
29. Examine bearing areas on shaft for excessive wear.
30. Examine gear teeth for uneven or excessive wear.



RR930M 32

Sector shaft cover assembly

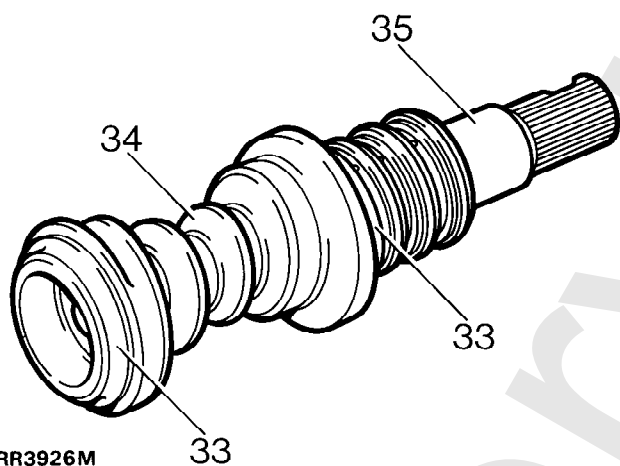
31. Inspect cover and bearing. If worn or damaged, replacement parts are not available, fit a new steering box.

Sector shaft adjuster locknut

32. The locknut is also a fluid seal. Fit new nut at overhaul.

Valve and worm assembly

33. Examine bearing areas for wear. The areas must be smooth and not indented.
34. Examine worm track which must be smooth and not indented.

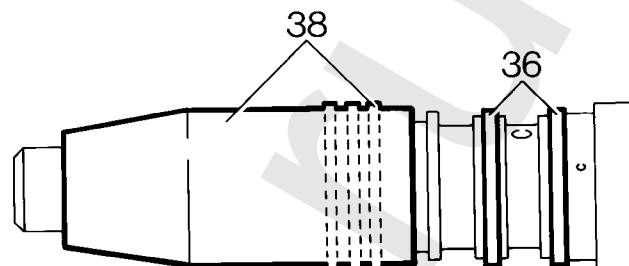


RR3926M

35. Check for wear on torsion bar assembly pin. No free movement should exist between input shaft and torsion bar or between torsion bar and worm.

NOTE: Any sign of wear makes it essential to fit new valve and worm assembly.

36. Examine valve rings for cuts, scratches and grooves. The valve rings should be free to rotate in grooves.

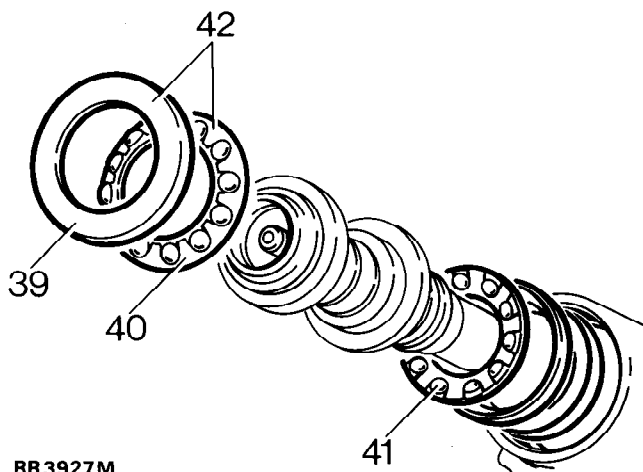


RR3925M

37. If required, replace all three rings, using ring expander LRT-57-019. The expander will not pass over rings already fitted. Remove rings to allow access without damaging seal grooves.
38. Warm rings and expander tool to aid assembly. Fit rings to expander, slide expander over valve and worm assembly. In turn fit rings to their grooves. Remove expander, slide valve and worm assembly into ring compressor LRT-57-020 and allow to cool.

Ball bearing and cage assemblies

39. Examine ball races and cups for wear and general condition.
40. If ball cage has worn against bearing cup, fit replacements.
41. Bearing balls must be retained by cage.
42. Bearing and cage repair is carried out by complete replacement of assembly.

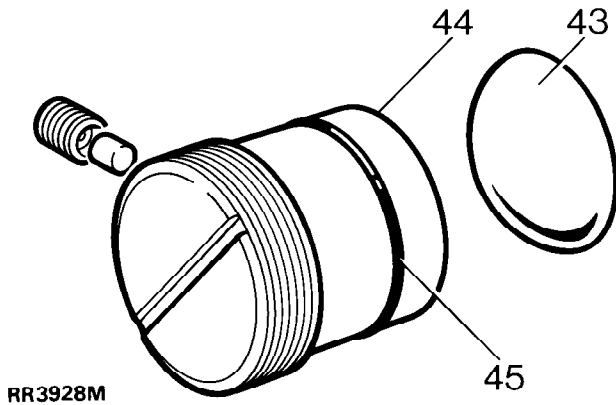


RR3927M



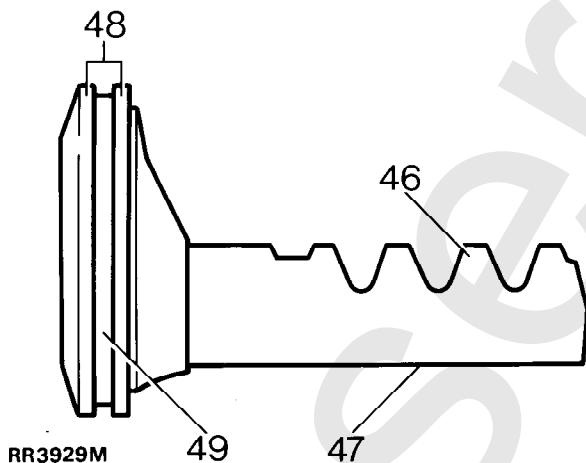
Rack thrust pad and adjuster

43. Examine thrust pad for scores.
44. Examine adjuster for wear in pad seat.
45. Fit new sealing ring to rack adjuster.



Rack and piston

46. Examine for excessive wear on rack teeth.
47. Ensure thrust pad bearing surface is free from scores and wear.
48. Ensure piston outer diameters are free from burrs and damage.



49. Examine seal and ring groove for scores and damage.
50. Fit new ring to piston. Warm nylon seal and fit to piston.
51. Slide piston assembly into cylinder with rack tube outwards.

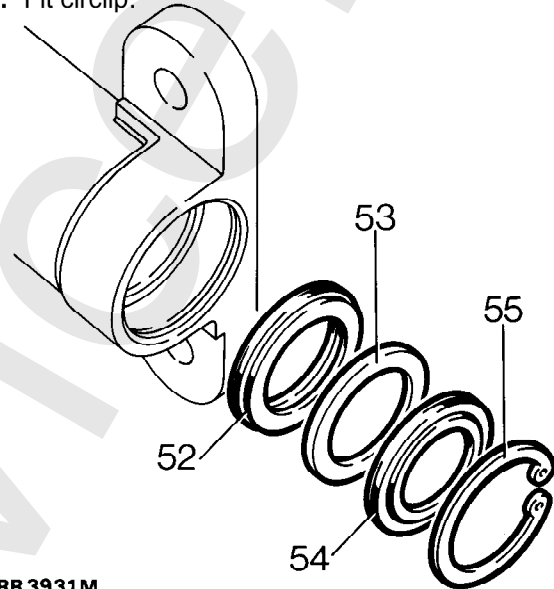
Reassemble



NOTE: When fitting replacement oil seals lubricate with recommended fluid and ensure absolute cleanliness.

Sector shaft oil seal

52. Fit oil seal, lip side first.
53. Fit extrusion washer.
54. Fit dust seal, lipped side last.
55. Fit circlip.



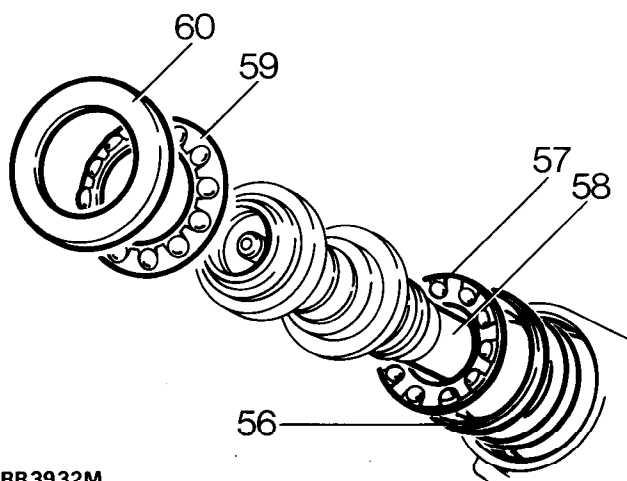
Fitting valve and worm assembly

56. Refit original shims and inner bearing cup. Use Petroleum Jelly to aid assembly.



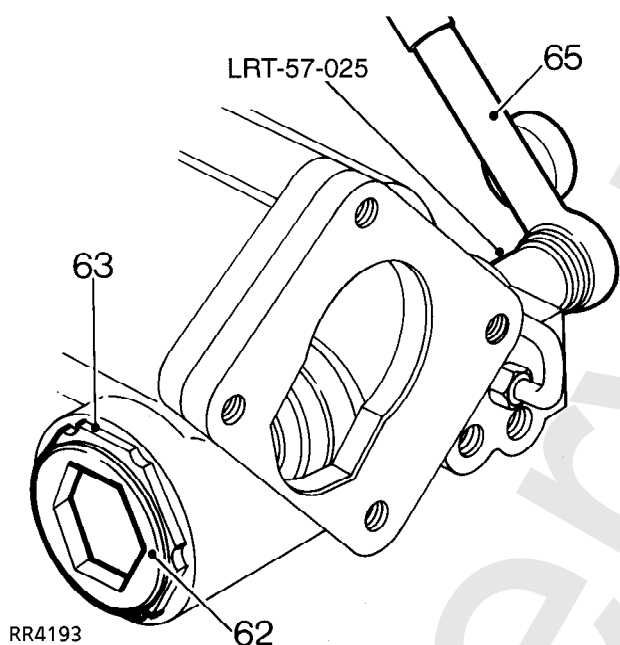
NOTE: If original shims are not used, fit shims of 0.76 mm thickness.

57. Fit inner cage and bearings assembly.
58. Fit valve and worm assembly.
59. Fit outer cage and bearings assembly.
60. Fit outer bearing cup.



RR3932M

61. Fit new worm adjuster sealing ring.



RR4193

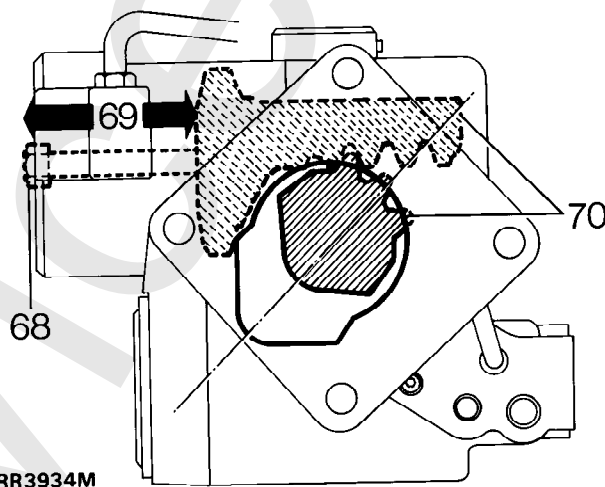
62. Loosely screw adjuster into casing.
63. Fit locknut, do not tighten.
64. Turn in worm adjuster until end float is almost eliminated. Ensure bearing cages are seated correctly.
65. Measure maximum rolling torque of valve and worm assembly, using a torque wrench and spline socket LRT-57-025.
66. Turn in worm adjuster while rotating shaft to increase figure measured in instruction 65. to 0.56 Nm.
67. Back off worm adjuster 1/4 turn. Turn in worm adjuster to increase reading at 65. by 0.21 - 0.34 Nm with locknut tight, **100 Nm**. Use worm adjusting wrench LRT-57-006 and locknut wrench LRT-57-028.

Fitting rack and piston

68. Screw slave bolt into piston to aid assembly.
69. Fit piston and rack so piston is 70 mm from outer end of bore.

Fitting sector shaft

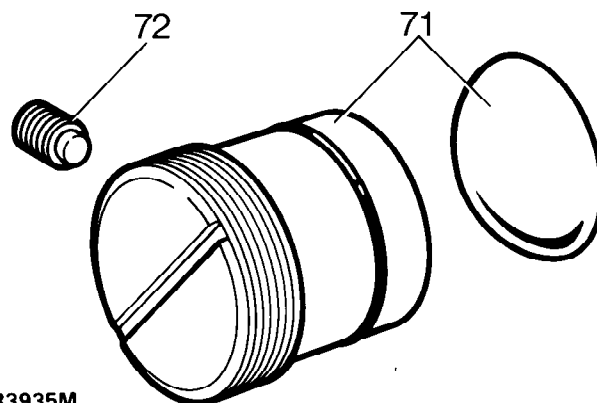
70. Fit sector shaft using seal saver LRT-57-021. Align roller with cut out in casing - see RR3934M. Push in sector shaft while rotating input shaft to allow sector roller to engage worm.



RR3934M

Fitting rack adjuster

71. Fit rack adjuster and thrust pad to engage rack. Back off half turn on adjuster.
72. Loosely fit new nylon pad and adjuster set screw assembly.

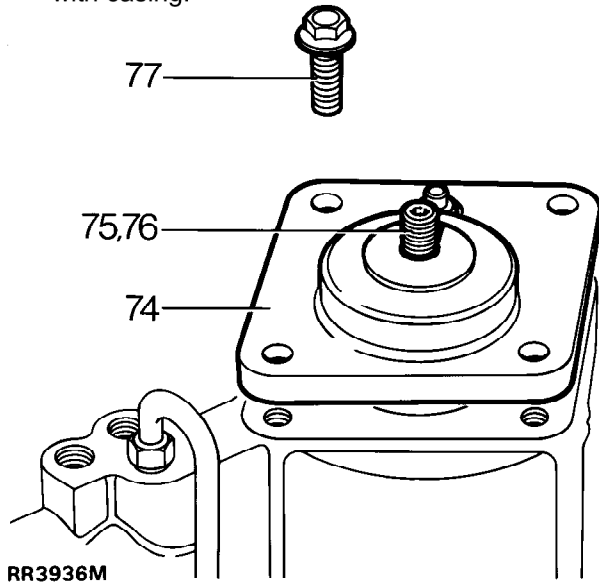


RR3935M



Fitting sector shaft cover

73. Fit new sealing ring to cover.
74. Align cover with casing.
75. Screw cover assembly fully on to sector shaft adjuster screw.
76. If necessary back off sector shaft adjuster screw. Tap cover in place to allow cover to joint fully with casing.

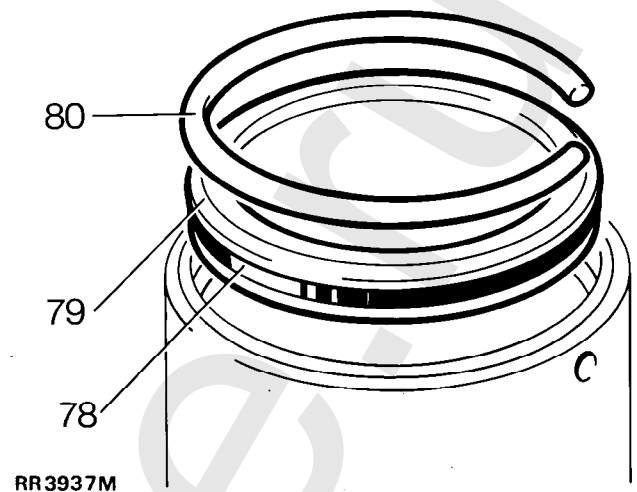


NOTE: Before tightening fixings, rotate input shaft to ensure sector shaft roller is free to move in valve worm. If initial resistance is left, turn adjuster screw approximately two turns in a clockwise direction.

77. Fit cover bolts. Tighten to **75 Nm**.

Fitting cylinder cover

78. Fit new square section seal to cover.
79. Remove slave bolt fitted at instruction 68. Press cover into cylinder just to clear retainer ring groove.
80. Fit retaining ring to groove with one end of ring positioned 12 mm from extractor hole.

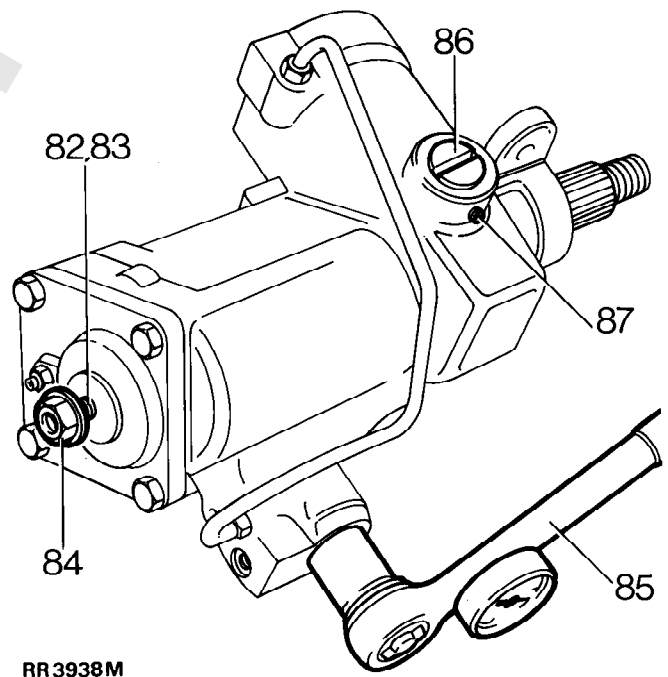


Adjusting sector shaft



NOTE: Refit drop arm and tighten nut sufficiently to ensure that no backlash exists between drop arm and sector shaft.

81. To set worm on centre, rotate input shaft to full inner-lock (full right lock for a left hand drive vehicle, full left lock for a right hand drive vehicle). Rotate input shaft back towards centre two full turns.
82. The box is now on centre and can be adjusted.



83. Hold input shaft and rock drop arm to establish backlash is present. Continue rocking and slowly turn sector shaft adjusting screw clockwise. Continue rotating adjuster screw until backlash has almost been eliminated.
84. Refit locknut and tighten.



NOTE: It is important steering box is centralised before any adjustments are made.

85. Check maximum rolling torque one and a quarter turns either side of centre position, using a torque wrench and spline socket LRT-57-025. Rotate adjuster screw to obtain across centre torque of 0.34 Nm plus torque figure at one and a quarter turns. Tighten adjuster locknut to **60 Nm**.

Adjusting rack adjuster.

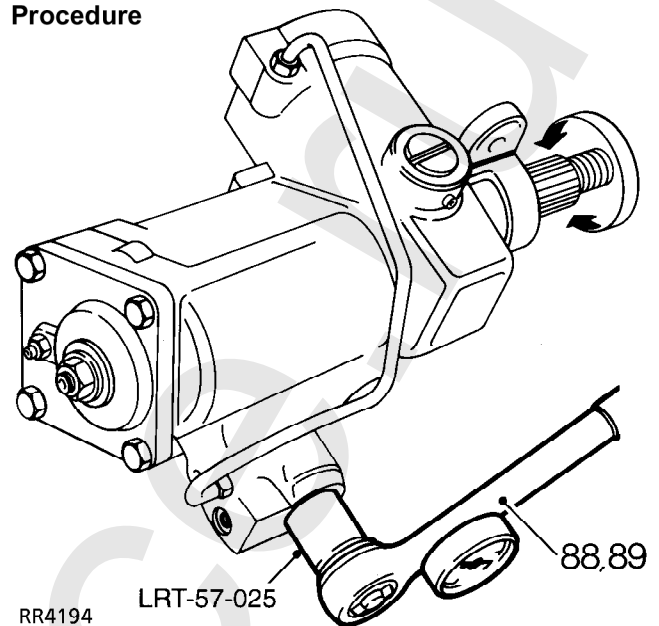
86. Turn in rack adjuster to increase figure measured in instruction 85. by 0.23 - 0.34 Nm. **The final figure may be less, but must not exceed 1.35 Nm.**
87. Lock rack adjuster in position with grub screw. Tighten to **5 Nm**.

Torque peak check

With input shaft rotated from lock to lock, rolling torque figures should be greatest across centre position and equally disposed about centre position.

The condition depends on value of shimming fitted between valve and worm assembly inner bearing cup and casing. The original shim washer value will give correct torque peak position unless major components have been replaced.

Procedure



88. With input coupling shaft toward the operator, turn shaft fully counter-clockwise.
89. Check torque figures obtained from lock to lock using torque wrench and spline socket LRT-57-025.
90. Check also for equal engagement either side of centre.

Adjustments

91. Note where greatest figures are recorded relative to steering position. If greatest figures are not recorded across centre of travel (steering straight-ahead), adjust as follows:

If torque peak occurs **before** centre position, **add** to shim washer value; if torque peak occurs **after** centre position, **subtract** from shim washer value, **refer to fitting valve and worm assembly**.

Shim washers are available as follows:
0.03mm, 0.07mm, 0.12mm and 0.24mm.



NOTE: Adjustment of 0.07mm to shim value will move torque peak area by 1/4 turn on the shaft.

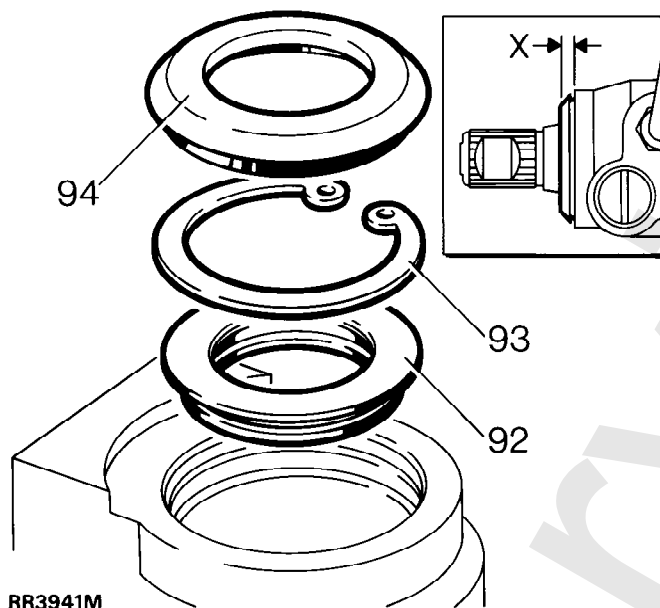


CAUTION: When reshimming valve and worm, extreme caution must be exercised to prevent seal damage during reassembly.

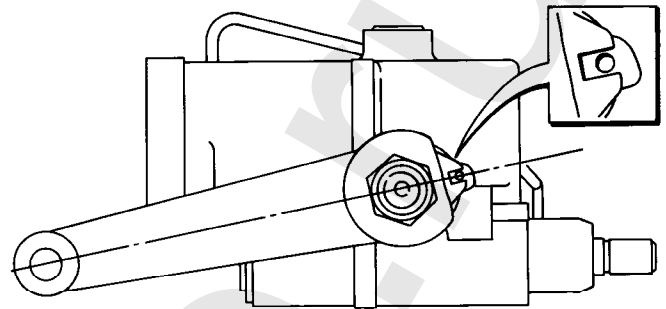


Input shaft oil seal

92. Fit seal, lip side first, into housing. Use seal saver LRT-57-016 and seal installer LRT-57-026. Note that seal is fitted to a depth of 4.75 - 5.00 mm from face of box.
93. Secure seal with circlip.
94. Smear inner lip of dirt excluder with PTFE grease. Fit dirt excluder using LRT-57-027. When fitted correctly outer shoulder of excluder is 4.00 - 4.50 mm from face of box, dimension X in RR3941M.



RR3941M



RR3940M

97. Fit steering box. *See Repair, Power Steering Box*

95. Remove drop arm. Smear inner lip of dirt excluder with PTFE grease and refit, ensuring outer lip is flush with casing.
96. With input shaft on centre, line up centralising holes in drop arm and steering box see inset in RR3940M. Fit drop arm to steering box using a new tab washer. Tighten to **176 Nm**, bend over tab.



STEERING PUMP

Make/type - V8i	ZF 'Unicorn'
Make/type - Tdi	Hobourn Eaton 500 series
Operating pressure - straight ahead position - at idle	7 bar, 100 lbf/in ² maximum
Full lock (left or right) at idle	28 bar, 400 lbf/in ² minimum
Full lock (left or right) 1000 rev/min	70-77 bar, 1000-1100 lbf/in ²

TORQUE VALUES



NOTE: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

	Nm
Ball joint nuts	40
Clamp bolt nuts	14
Steering column bracket nuts	22
Steering wheel nut	50
Tie bar to mounting nut	110
Universal joint pinch bolt	25
PAS box	
Adjuster locknut	60
Drop arm nut	176
Sector shaft cover to steering box	75
Steering box to chassis	81
Steering box fluid pipes 14mm thread	15
Steering box fluid pipes 16mm thread	20
Tie bar	81
PAS pump	
High pressure fluid pipe	20
Power steering pump mounting	35
Pulley bolts, power steering pump	10
Hose clamp	3
Front mounting plate bolts	9
PAS reservoir	
Hose clamp	3

* Torque values below are for all screws and bolts used except for those that are specified otherwise.

METRIC	Nm
M5	6
M6	9
M8	25
M10	45
M12	90
M14	105
M16	180

UNC / UNF	Nm
1/4	9
5/16	24
3/8	39
7/16	78
1/2	90
5/8	136