



Land Rover  
Range Rover

# Workshop Bulletin

ATTENTION SERVICE MANAGER

JUNE 1987  
BULLETIN NUMBER SLR 621 EN WB1

# LAND ROVER

## SU CARBURETTORS

## GEMMER POWER ASSISTED STEERING

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P.O. Box 534, Erdington, Birmingham B24 0QS

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## INTRODUCTION

This Bulletin covers the Introduction of the twin SU H.I.F. 44 Carburetters on the Land Rover 90 and 110 V8 Engine, and the Gemmer Power assisted steering box prior to it being included in the updated 90-110 Workshop Manual, which will be numbered as follows

- SLR 621 EN WM — English
- SLR 622 DU WM — Dutch
- SLR 623 FR WM — French
- SLR 624 GR WM — German
- SLR 625 IT WM — Italian

## CARBURETTER OVERHAUL — S.U. HIF 44 — Right hand

### DISMANTLE

1. Remove the carburetters from the engine and clean the exteriors with a suitable solvent.
2. Remove the two nuts and spring washers and withdraw the air intake adaptor and joint washer.
3. Unscrew and remove the piston damper assembly and drain the oil.
4. Remove the three screws and lift-off the suction chamber complete with piston and spring.
5. Remove the spring clip from the top of the piston rod and withdraw the piston and spring.
6. Unscrew the fuel metering needle guide locking screw. If the needle cannot be removed from the piston with the fingers, hold the needle as close to the piston as possible, in a soft jawed vice and with a sharp pull withdraw the needle, guide and spring assembly.
7. Remove the four screws and withdraw the float chamber cover plate and sealing ring.
8. Remove the jet adjusting lever retaining screw and spring.
9. Withdraw the jet complete with the bi-metal lever and separate the lever from the jet.
10. Unscrew and remove the float pivot spindle and plain washer, and remove the float.
11. Lift-out the needle valve.
12. Unscrew and remove the needle valve and filter.
13. Unscrew and remove the jet bearing nut.
14. Invert the carburetter body to allow the jet bearing to fall out. If the bearing sticks, carefully tap it out from the bridge side.
15. Remove the piston guide peg.
16. Remove the suction chamber-to-body sealing ring.
17. Unscrew and remove the mixture adjusting screw and seal. Use thin nosed pliers to finally withdraw the screw.
18. Bend-back the cam lever nut lock tabs and remove the nut and lock washer.
19. Remove the cam lever and spring.
20. Remove the end seal cover and seal.
21. Remove the two screws and withdraw the cold start valve body and seal together with the valve spindle. **Also** collect the paper joint washer.
22. Note the position of the throttle levers and return spring.
23. Bend-back the lock washer tabs and remove the throttle lever nut.
24. Remove the lock washer, bush washer and throttle actuating lever.
25. Release the throttle return spring and remove the throttle adjusting lever from the throttle butterfly spindle and remove the return spring.
26. Hold the butterfly closed and mark the relationship of the butterfly to the carburetter flange.
27. Remove the butterfly two retaining screws and withdraw the butterfly from the spindle.

28. Withdraw the throttle butterfly spindle from the carburetter body together with the two seals.
29. Clean all components with petrol or de-natured alcohol ready for inspection. Do not use abrasives for the removal of stains or deposits.

### INSPECTION

30. Examine the throttle spindle and bearings for excessive axial clearance.
31. Check the float needle and seating for wear and the float for punctures and renew if necessary.
32. Check the condition of all rubber seals, 'O' rings and joint washers and renew if necessary. The float cover plate seal must be renewed.
33. Examine the carburetter body for cracks and damage.
34. Ensure that the inside of the suction chamber is clean and fit the piston into the chamber without the spring. Hold the assembly horizontally and spin the piston. The piston should spin freely in the suction chamber without any tendency to stick.
35. Inspect the metering needle for wear, scores and distortion. Check also that it has the correct designation number — see Engine Tuning Data, Section 05.
36. Examine the bi-metal jet lever for cracks.
37. Check all springs for cracks and distortion.

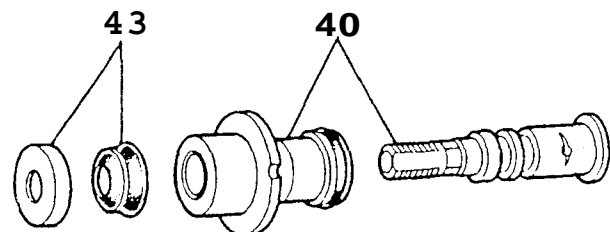
### ASSEMBLE

#### Fit throttle butterfly

38. Fit the throttle spindle to the carburetter body and insert the throttle disc into the spindle in its original position. Secure the disc with new screws and ensure that before tightening the throttle disc is correctly positioned and closes properly. Splay the split ends of the screws to prevent turning.
39. Fit new seals to both ends of the throttle spindle ensuring that they are fitted the correct way round.

#### Fit cold start assembly

40. Fit a new 'O' ring to the valve body and assemble the valve spindle to the valve body.

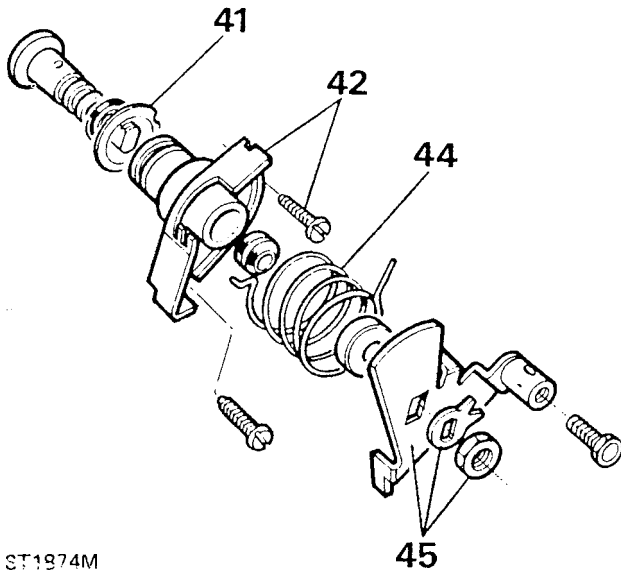


ST1873M

41. Fit a new paper joint washer to the valve noting that the half-moon cut-out in the washer is clearance for the top retaining screw.

continued

42. Fit the starter assembly to the carburettor body and secure with the two screws.
43. Fit the end seal and cover.
44. Fit the return spring.
45. Fit the cam lever and tension the spring. Fit a new lock washer and secure with the nut and bend the tabs over a convenient flat.
46. Adjust the coils of the spring, if necessary, to prevent coil binding.

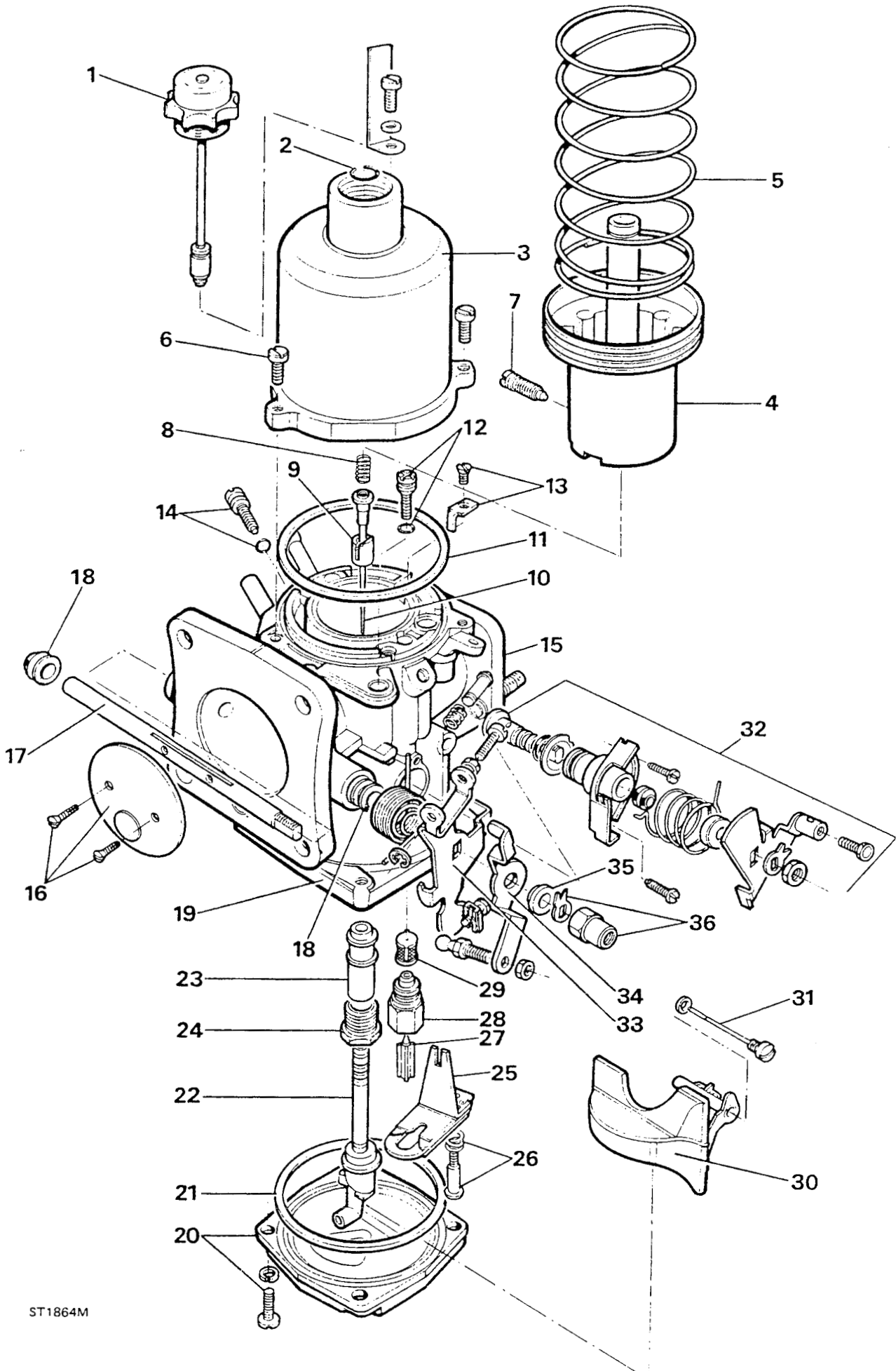


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#### KEY TO S.U. CARBURETTER COMPONENTS

- |  |  |
|--|--|
| 1. Piston damper.                            | 20. Float chamber cover and retaining screws.              |
| 2. Spring clip.                              | 21. Float chamber cover seal.                              |
| 3. Suction chamber.                          | 22. Jet assembly.  |
| 4. Piston.                                   | 23. Jet bearing.   |
| 5. Piston spring.                            | 24. Jet bearing nut.                                       |
| 6. Suction chamber retaining screws — 3 off. | 25. Bi-metal jet lever.                                    |
| 7. Needle retaining screw.                   | 26. Jet retaining and adjusting screw and spring.          |
| 8. Needle bias spring.                       | 27. Float needle.  |
| 9. Needle guide.                             | 28. Float needle seat.                                     |
| 10. Needle.                                  | 29. Float needle seat filter.                              |
| 11. Suction chamber sealing ring.            | 30. Float  |
| 12. Throttle adjusting screw and seal.       | 31. Float pivot spindle.                                   |
| 13. Piston key and retaining screw.          | 32. Cold start and cam lever assembly.                     |
| 14. Mixture adjusting screw and seal.        | 33. Throttle adjusting lever and lost motion assembly.     |
| 15. Carburetter body.                        | 34. Throttle actuating lever.                              |
| 16. Throttle butterfly and retaining screws. | 35. Bush washer.   |
| 17. Throttle spindle.                        | 36. Throttle lever assembly retaining nut and lock washer. |
| 18. Throttle spindle seals — 2 off.          |  |
| 19. Float chamber.                           |  |

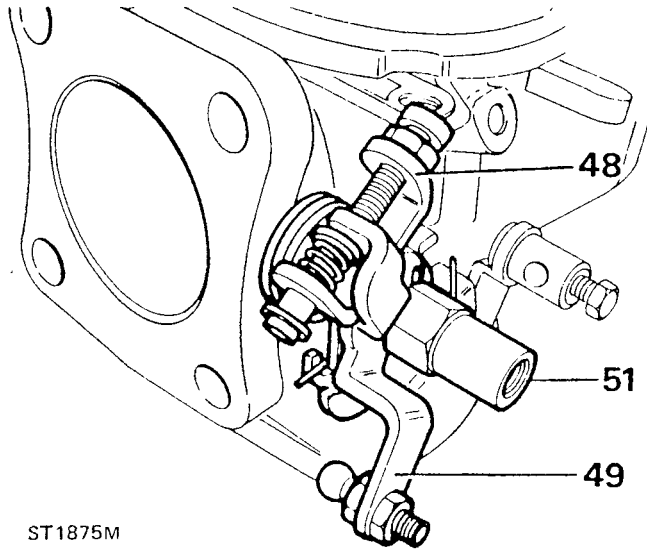
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ST1864M

**Fit throttle lever assembly**

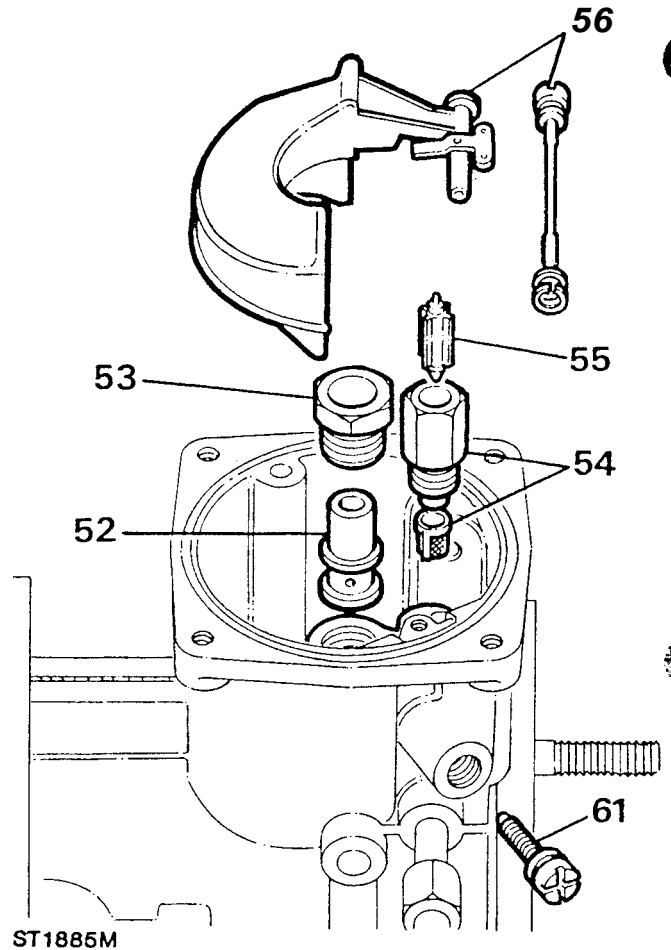
47. Fit the return spring so that the longest leg rests against the throttle adjusting screw housing.
48. Fit the throttle adjusting lever and lost motion assembly and tension the return spring.
49. Fit the throttle actuating lever.
50. Fit the bush washer and lock washer.
51. Fit and tighten the special nut and bend the lock tabs over a convenient flat.



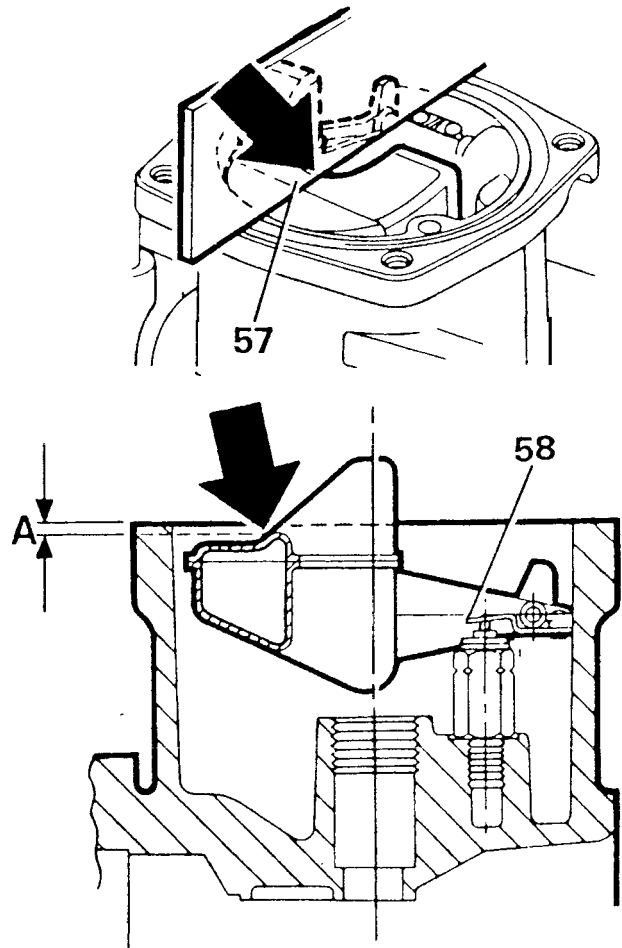
ST1875M

**Fit jet and float assembly**

52. Fit the jet bearing, long end towards the float.
53. Fit the jet bearing nut.
54. Clean or renew the filter and fit the float needle seat.
55. Fit the needle valve, spring loaded pin uppermost.
56. Fit the float and secure with the pivot pin.
57. Hold the carburettor in the inverted position so that the needle valve is closed by the weight of the float only. Check using a straight edge that the point on the float, arrowed on the illustration, is 1.0 to 1.5 mm (0.04 to 0.062 in) below the level of the float chamber face, dimension 'A'.
58. Adjust the float position by carefully bending the brass pad until the correct dimension is achieved. After adjustment, check that the float pivots freely about the spindle.



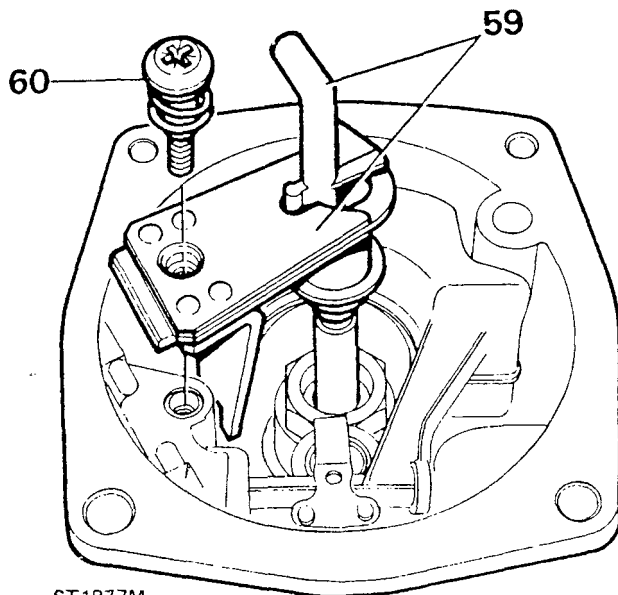
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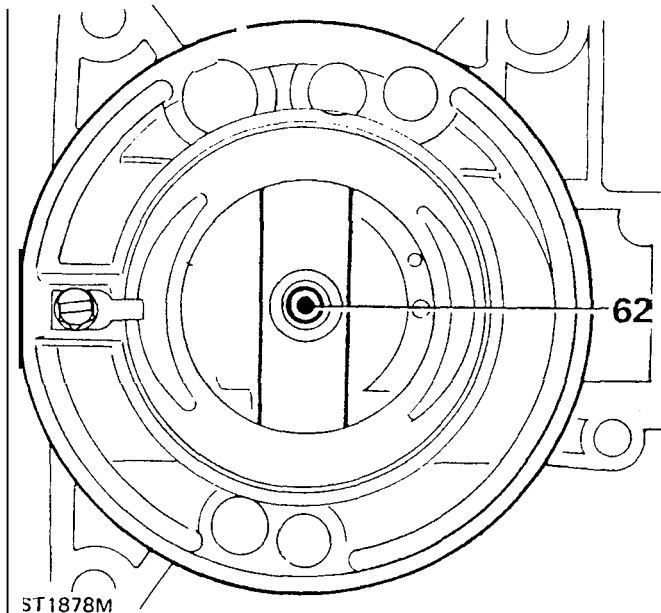
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59. Assemble the jet to the bi-metal jet lever and ensure that the jet head moves freely in the cut-out.
60. Fit the jet and bi-metal jet lever to the carburettor and secure with the spring loaded jet retaining screw.
61. Fit the mixture adjusting screw.



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62. Adjust the mixture screw until the jet is flush with the carburettor bridge, then turn the screw a further three and one half turns clockwise.

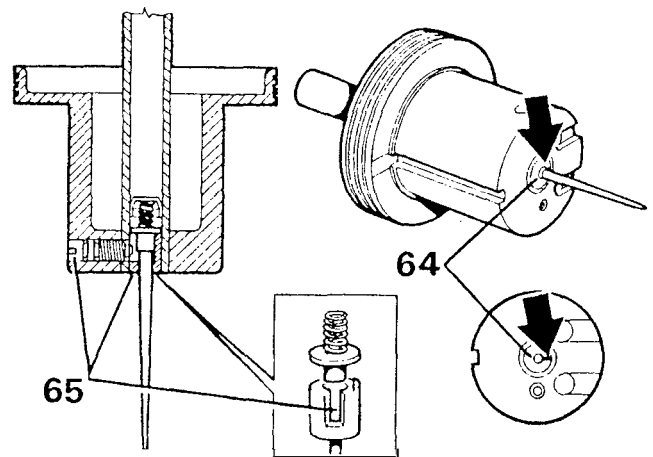


ST1878M

63. Using a new sealing ring, fit the float chamber cover, noting that it can only be fitted one way. Secure with the four screws and spring washers and evenly tighten.

### Fit piston and suction chamber

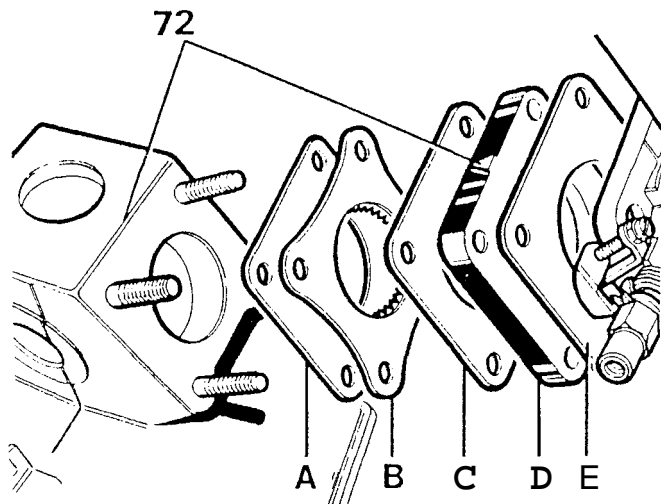
64. Fit the needle, spring and guide assembly to the piston ensuring that the etched arrow head on the needle locating guide is aligned between the piston transfer holes, as illustrated.
65. Secure and ensure that when the screw is tightened the guide is flush with the piston and that the screw locates in the guide slot.



ST1879M

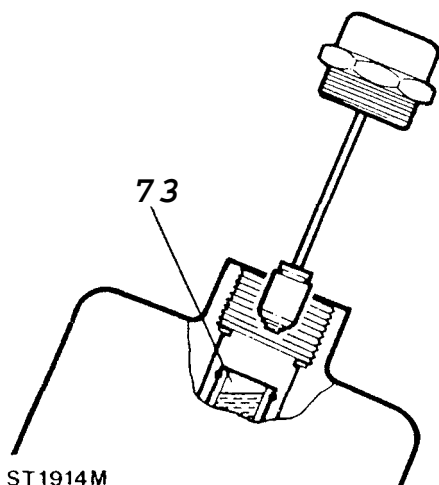
66. Fit the piston key to the carburettor body using a new screw. Tighten the screw and splay the end.
67. Fit a new suction chamber sealing ring to the groove in the carburettor body.
68. To prevent the piston spring being 'wound-up' during assembly, temporarily fit the piston and suction chamber less the spring to the body. Kcmove the suction chamber and fit the spring to the piston. Hold the suction chamber above the spring and piston, align the pencil marks and lower the chamber over the spring and piston, taking care not to rotate the suction chamber. Secure the chamber to the body with the three screws, tightening evenly and check that the piston moves freely.
69. Hold the piston at the top of its stroke and fit the spring clip.
70. Fit the piston damper.
71. Using a new joint washer, fit the air intake adaptor and secure with the two nuts and spring washers.
72. Fit the carburettors to the inlet manifold ensuring that the joint washers, deflector and insulator are fitted in the sequence illustrated. The insulator must be fitted with the arrow head uppermost and pointing inwards towards the manifold. Secure with the four nuts and spring washers and tighten evenly to the correct torque.
  - A. Joint washer.
  - B. Deflector-teeth pointing inwards.
  - C. Joint washer.
  - D. Insulator.
  - E. Joint washer.

continued



ST1880M

- 73. Connect the linkages and top-up the carburettor dampers with a recommended oil to the top of the hollow piston rod.
- 74. Tune and adjust the carburetters.



ST1914M

**TUNE AND ADJUST — SU HIF 44 CARBURETTERS**

**Special tools:**

- Carburettor balancer 605330 or B89
- Non-dispersive infra-red exhaust gas analyser.

**General Requirements Prior to Tuning Carburetters.**

Accurate engine speed is essential during carburettor tuning, therefore the distributor pick up air gap and ignition timing must be checked together with the vacuum advance system.

Whenever possible the ambient air temperature of the tuning environment should be between 15° to 26°C (60° to 80°F). When checking engine speed, use an independent and accurate tachometer.

Idling adjustments should be carried out on a fully warmed up engine, that is, at least 5 minutes after the thermostat has opened. This should be followed by a run of one minute duration at an engine speed of approximately 2,500 rev/min before further adjustments or checks are carried out. This cycle may be repeated as often as required. It is important that the above cycle is adhered to, otherwise overheating may result and settings may be incorrect. The piston dampers must always be kept topped-up with the correct grade of oil.

Before any attempt is made to check settings a thorough check should be carried out to ensure that the throttle linkage between the pedal and carburetters is free and has no tendency to stick. Ensure that the choke control lever is pushed fully down.

**NOTE: References to left and right hand are as from the drivers seat.**

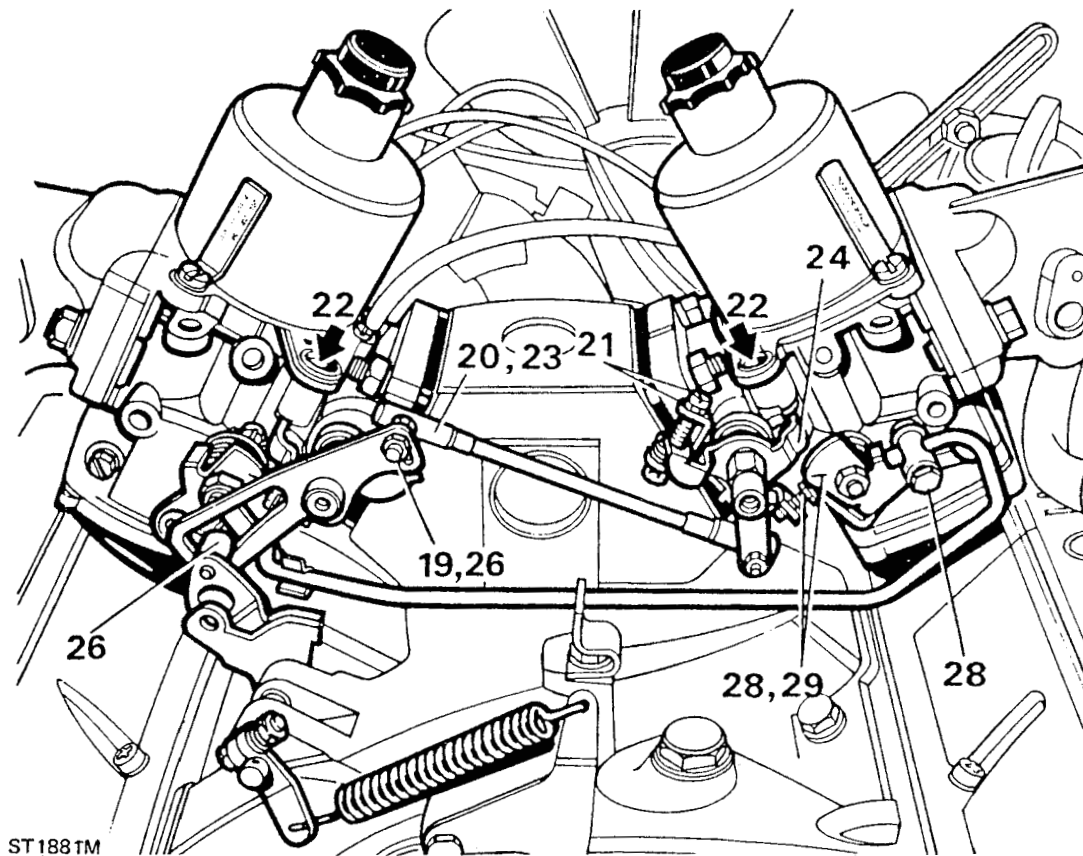
**TAMPER — PROOFING**

To comply with E.C.E. regulations the idle speed and mixture adjusting screws must be tamper — proofed following any adjustments. **A** red blanking plug; **Part number — JZX 1258** must be fitted into the mixture screw resess and a red cap; **Part number JZX 1197** fitted over the idle adjustment screw (throttle adjustment screw).

continued

MODEL	CARBURETTER PART No.	S.U. SPEC No.	EXHAUST CO (NEW ENGINE)	EXHAUST (After 3000 km)	IDLE SPEED R.P.M.	FAST IDLE SPEED R.P.M.
ALL HICOMP V8 ENGINES	ETC7122 ETC7123	FZX2006			600 - 700 NEW ENGINE	1100 ± 50
ALL UCOMP V8 ENGINES	ETC7124 ETC7125	FZX2005			700 - 800 RUN-IN ENGINE	





ST188TM

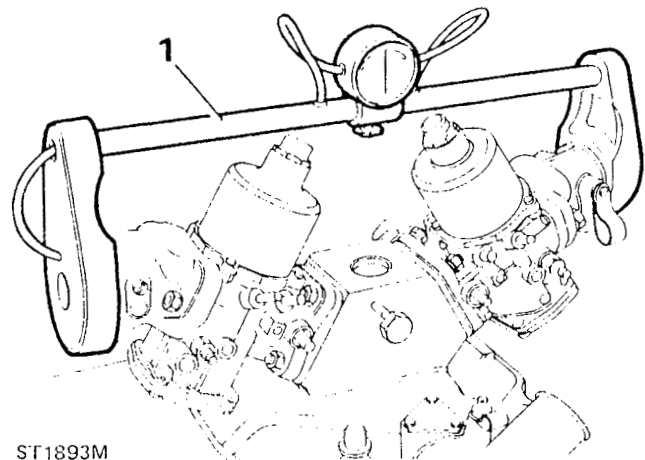
The following instructions apply to both carburetters unless otherwise stated.

Before commencing the following instructions, remove the air cleaner, air intake elbows, mixture adjustment screw plug and mixture screw cap.

### CARBURETTER BALANCE

#### Using balancer 605330

1. Disconnect the interconnecting link between the two carburetters. Fit the balancer to the carburetter intakes and ensure that there are no air leaks, if necessary, zero the gauge with the adjustment screw.
2. Start the engine, and if necessary allow it to reach normal operating temperature. If the needle moves to the right, decrease the air flow through the left hand carburetter by unscrewing the idle screw. Alternatively, increase the air flow through the right hand carburetter by screwing down the idle screw. Reverse the procedure if the pointer moves to the left. Reconnect the carburetter interconnecting link.



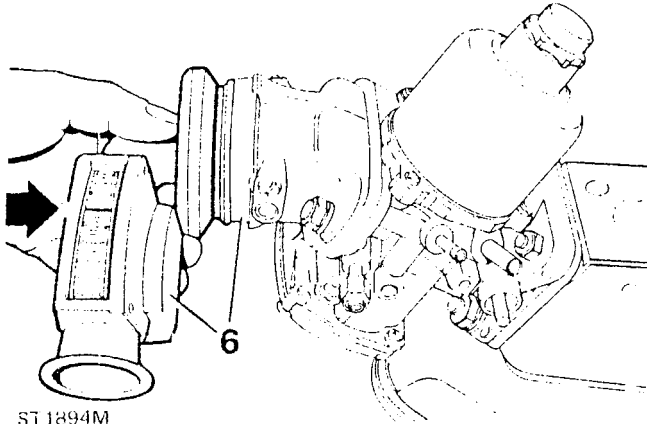
ST1893M

#### Using balancer I389

3. Disconnect the inter-connecting throttle link between the two carburetters.
4. Back-off the idle adjusting screw on each carburetter, clear of the throttle lever.
5. Turn each throttle adjusting screw so that it touches the throttle lever, then turn the screws by equal amounts to achieve an approximate idle speed of 700 to 800 rev/min.
6. Press the balancer firmly over the carburetter intake. Press or withdraw the control on the side of the balancer to adjust the meter needle reading to approximately half scale, and note the reading.

continued

7. Without altering the position of the balancer control, place the balancer on the second carburettor intake and adjust the idle screw as necessary to achieve the same reading.

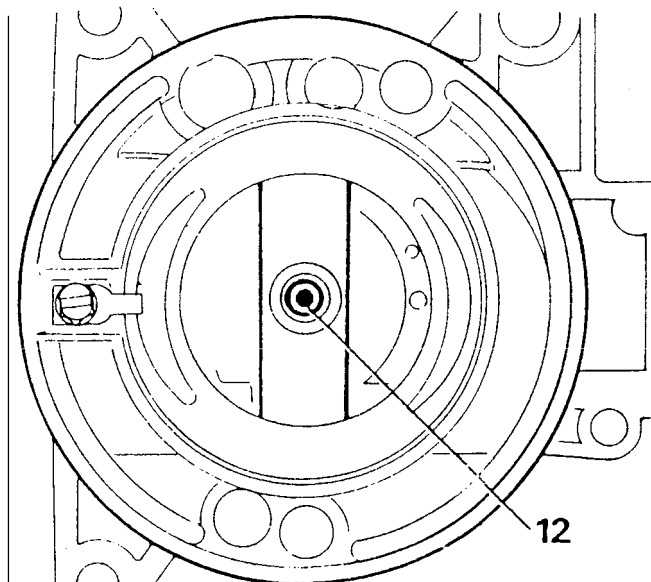


ST1894M

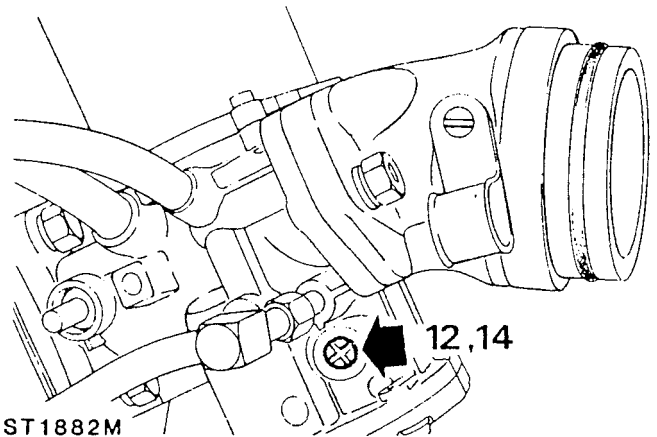
8. Alternatively, adjust and check the balance of both carburetters until an idle speed of 700 to 800 rev/min is obtained.  
9. Reconnect the throttle inter-connecting link, and again check the idle speed and balance.

#### Mixture setting

10. Ensure that the engine is still at normal operating temperature.  
11. Mark the relationship of the suction chamber to the carburettor body, remove the retaining screws and lift off the suction chamber complete with pistons.  
12. To achieve a datum setting for the mixture screw, turn it anti-clockwise until the jet is level with the carburettor bridge. Check by placing a straight edge across the bridge and adjust as necessary so that the jet just touches the straight edge.  
13. Refit the suction chamber and piston, evenly tighten the retaining screws. Check that the piston moves freely without sticking. Top-up the piston damper.

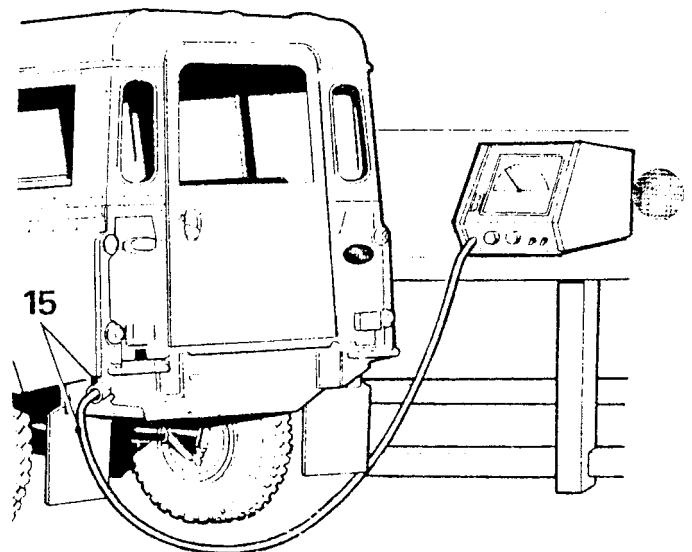


ST1883M



ST1882M

14. Turn the mixture adjustment screw three and one half turns clockwise.  
15. Insert the probe of an infra-red exhaust gas analyser as far as possible up the exhaust pipe, start the engine and allow a one and one half minute stabilisation period.  
16. Adjust the mixture screw on both carburetters by equal amounts, rich or weak to achieve a CO reading of 0.5 to 2.5%.  
17. If after approximately two minutes the CO level is not satisfactory run the engine at 2000 rev/min for one minute to stabilise the equipment, continue the setting procedure until a stable CO reading of 0.5 to 2.5% at an idle speed of 700-800 rev/min is obtained.



ST1915M

#### Idle speed and linkage adjustment

18. Check that the engine is at normal operating temperature.  
19. Slacken the nut, at the left hand carburettor securing the inter-connecting link ball to the throttle cam lever.

20. Disconnect the inter-connecting link between the carburetters at the left hand carburetter.
21. At the right hand carburetter, release the lock nut and slacken off the lost motion adjustment screw, until it is well clear of the spring loaded pad.
22. If necessary adjust the idle screw to maintain the correct idle speed. Check the CO level and carburetter balance, adjust if required.
23. Re-connect the inter-connecting link to the left hand carburetter.
24. Hold the right hand throttle lever against the idle screw stop and adjust the lost motion screw until contact is made with the spring loaded pad, tighten the lock nut.
25. Check the idle speed and balance. Adjust the lost motion screw to restore balance if necessary.
26. Ensuring that the roller is firmly seated in the lower corner of the cam lever, tighten the nut which secures the inter-connecting link ball to the cam lever.

#### **Fast idle adjustment**

27. Pull out the cold start control (choke) until the scribed line on the left hand fast idle cam is in-line with the centre of the fast idle screw head.
  28. Check that the scribed line on the right hand fast idle cam is similarly in-line with the fast idle screw head. If there is mis-alignment, slacken the fast idle cam link rod screw at the right hand carburetter and move the cam until the scribed line coincides with the centre of the screw head. Tighten the cam rod screw.
  29. Turn the fast idle screw clockwise, on each carburetter, until just clear of the cam.
  30. Turn the fast idle screw of the leading (left-hand) carburetter down (clockwise) until a slight change in engine speed is noted.
  31. Similarly turn the fast idle screw of the second carburetter (right-hand) down until a further slight change of engine speed is noted.
  32. Adjust the fast idle screws of both carburetters by equal amounts to achieve a fast idle speed of 1100 to 1150 rev/min.
  33. Tighten the fast idle screw lock-nut on both carburetters. Push the cold start (choke) fully home then pull it out again to its full extent and re-check the fast idle speed.
  34. Fit the appropriate blanking plug and cap to the mixture screw recess and idle adjusting screw.
  35. Fit the Carburetter air intake elbows and air cleaner.
-

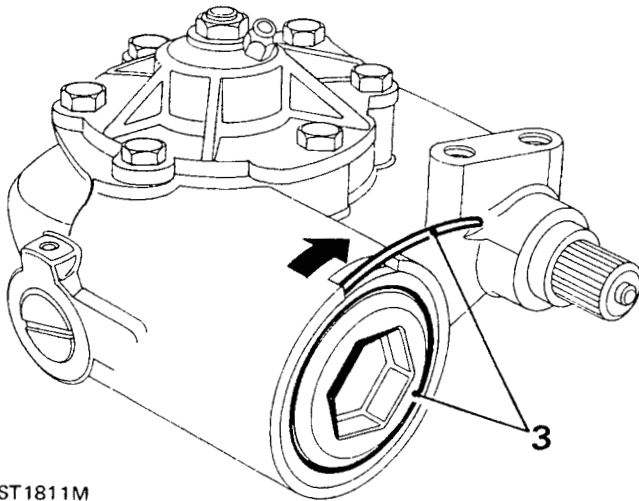


**Special tools:**

<b>Drop arm puller</b>	<b>MS 252A</b>
<b>End cover wrench adaptor</b>	<b>LST123</b>
<b>Input shaft oil seal installer</b>	<b>LST124</b>
<b>Sector shaft oil seal installer</b>	<b>LST125</b>
<b>Valve seal installer and valve ring compressor</b>	<b>LST126</b>
<b>Preload setting tool</b>	<b>RO1016</b>

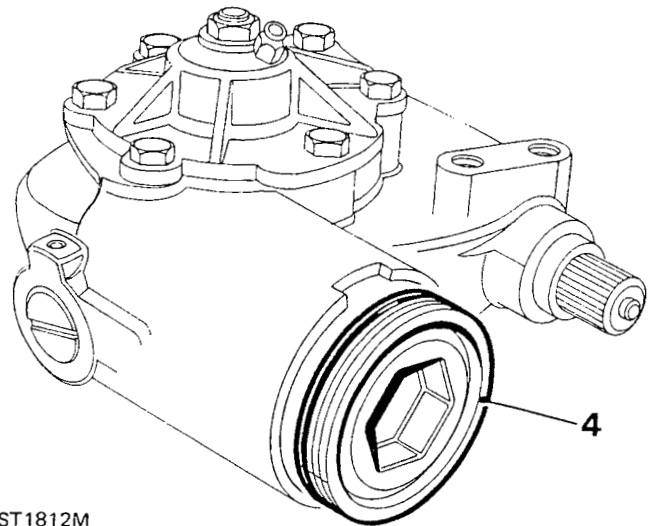
**Dismantle**

1. Remove the steering box from the vehicle.
2. Bend back the locking tab and remove the drop arm nut. Using special tool MS 252 A or a suitable alternative, withdraw the drop arm from the sector shaft.
3. Using special adaptor tool LST123 turn the cylinder cover anti-clockwise to expose end of the locking ring. Now turn the cover clockwise to extract the ring.



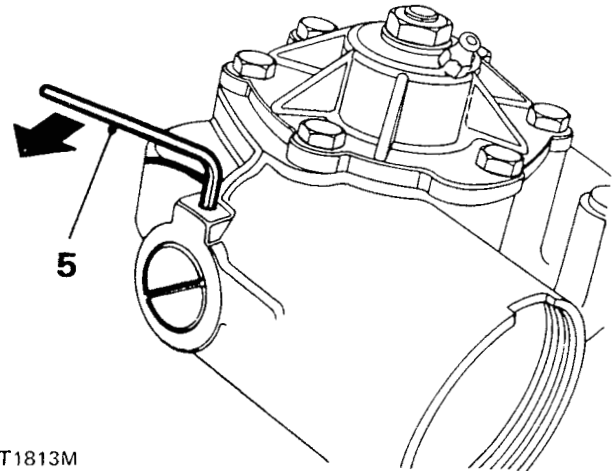
ST1811M

4. To remove the cover, turn the input shaft to the left lock for a LHD drive steering box or to the right for a RHD drive steering box until the rack piston pushes the cover out to enable it to be withdrawn by hand.



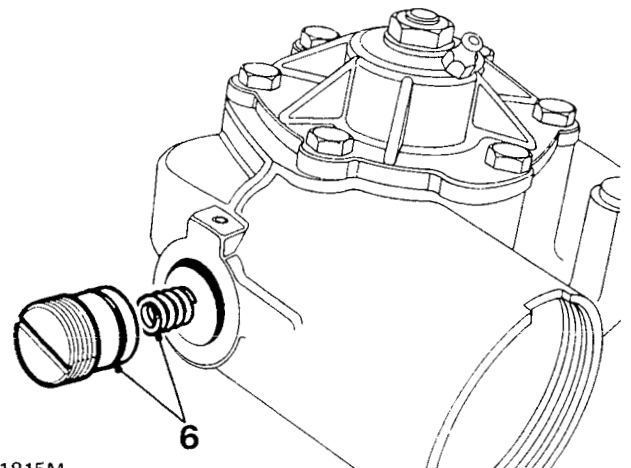
ST1812M

5. Slacken the grub screw securing the rack pad adjuster.



ST1813M

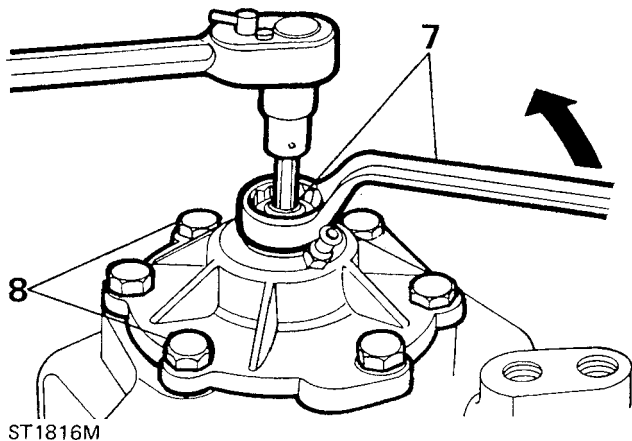
6. With a screwdriver remove the rack pad adjuster, 'O' ring and spring.



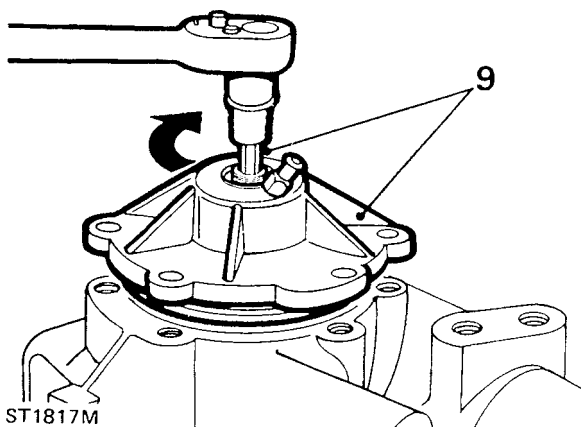
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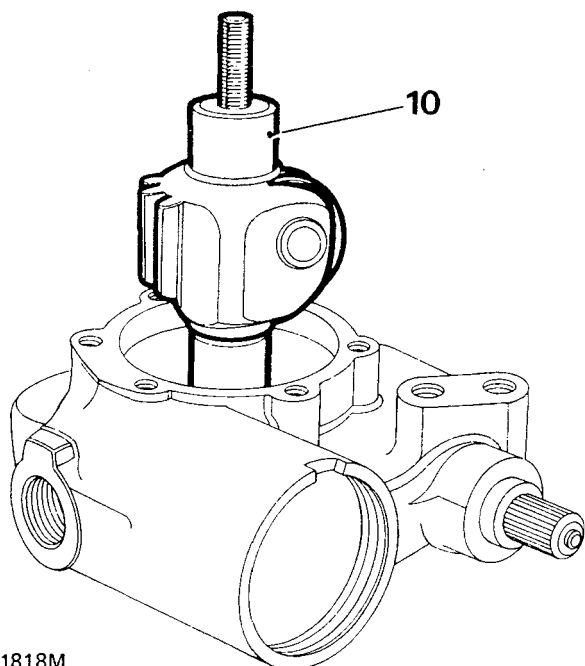
7. Restrain the sector shaft adjuster with a 6 mm hexagonal key and remove the locknut.
8. Remove the six bolts securing the sector shaft cover.



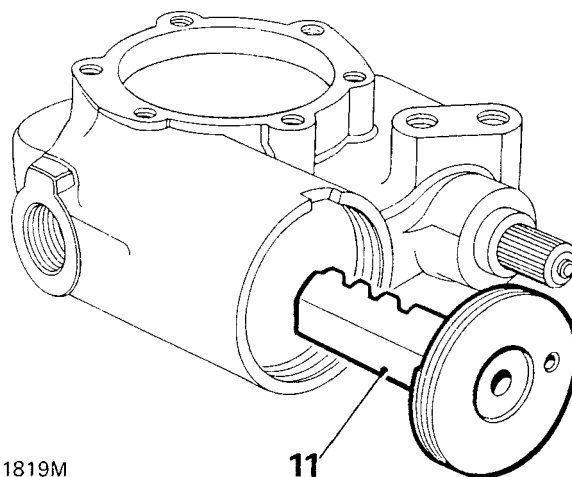
9. Hold the sector shaft cover and turn the adjuster and screw clockwise until the cover can be removed.



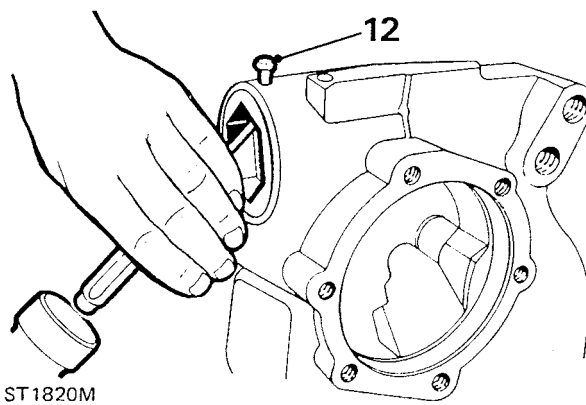
10. Lift-out the sector shaft.



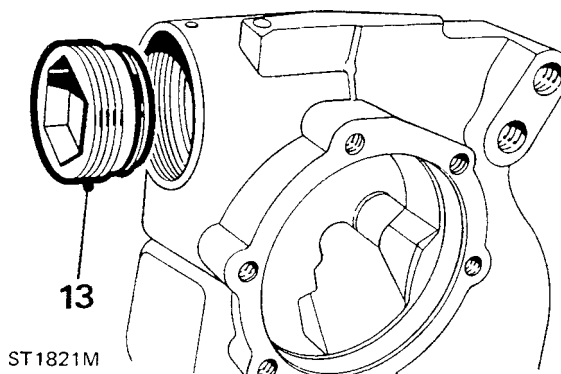
11. Remove the rack and piston assembly and collect the rack adjuster thrust pad.



12. Drive-out the worm adjusting screw locking pin.

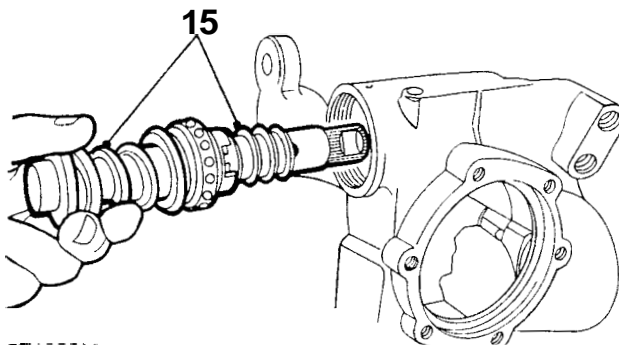


13. Using special tool LST123, remove the input shaft worm adjusting screw anti-clockwise.



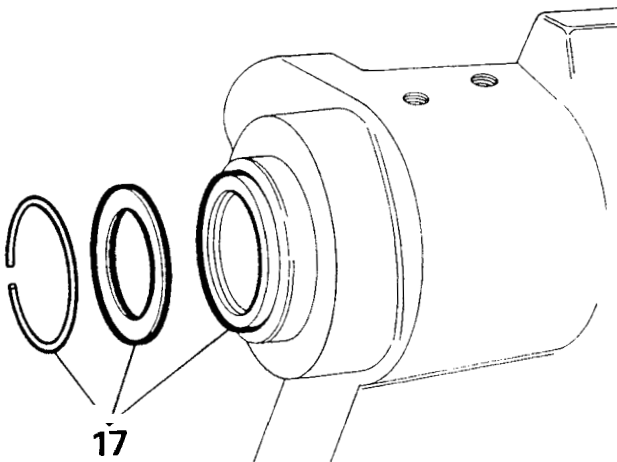
14. Tap the splined end of the input shaft to free the outer bearing. Remove the bearing track and ball cage assembly.

15. Withdraw the input shaft, worm and valve assembly.

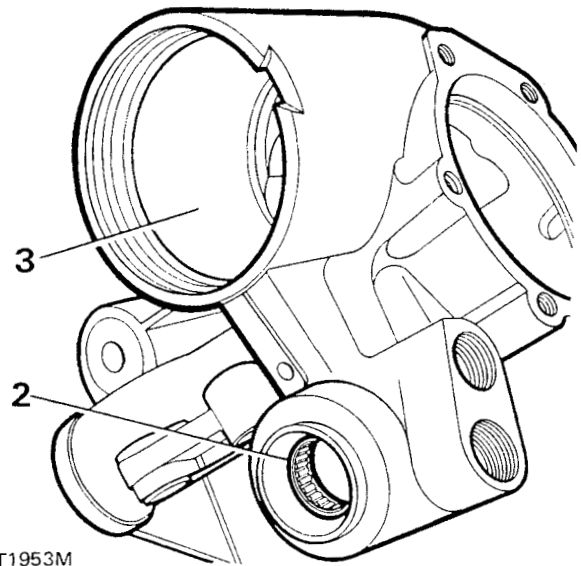


ST1822M

16. Release the circlip and remove the steel washer and oil seal from the sector shaft housing.
17. Remove the wire circlip, anti-extrusion washer and oil seal from the input shaft housing.



ST1949M



ST1953M

#### Sector shaft assembly

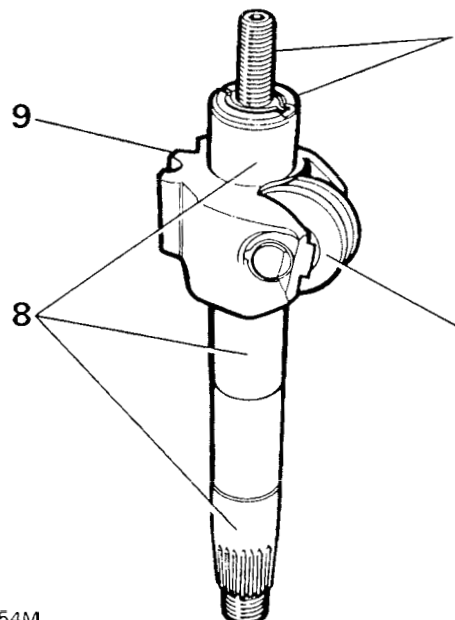
5. Check that no side play or wear exists in the roller.
6. Check the condition of the adjuster and its retainer and that the crimping is sound.
7. The axial clearance of the adjuster should not exceed 0,20 mm (0.008 in).
8. Examine the bearing journals on the shaft for wear and damage.
9. Check the gear teeth for excessive and uneven wear, scores and pitting.

continued

## INSPECTION AND OVERHAUL OF COMPONENTS

### Steering box housing

1. Examine the sector shaft upper and lower needle roller bearings and if necessary drive them from the housing with a suitable drift.
2. Inspect the input shaft needle bearing and if worn drive it from the housing and press-in a replacement.
3. Examine the piston bore for wear and scores.
4. Check the input shaft bores for wear and scores.



ST1954M

**Valve and worm assembly**

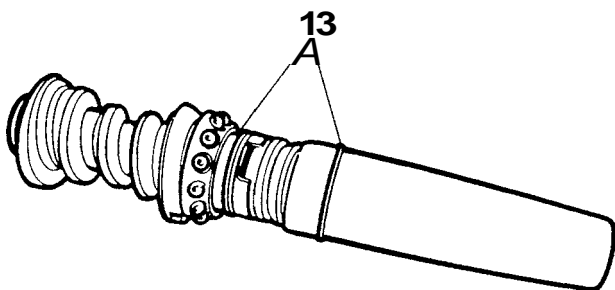
**NOTE:** If the inner ball race is faulty and unfit for further service it cannot be renewed and a new valve and worm assembly must be obtained and fitted. Should this be the *case*, the following checks of the valve and worm can be ignored.

10. Examine the valve rings which must be free from cuts, scratches and scores. Also, the rings should be a loose fit in the grooves.
11. If any ring is unsatisfactory, all the rings must be renewed. When removing the rings take care not to damage the valve grooves.
12. To fit new rings use special tool LST126, which consists of the following three parts:-

- a) Ring expander.
- b) Split coller.
- c) Ring compressor

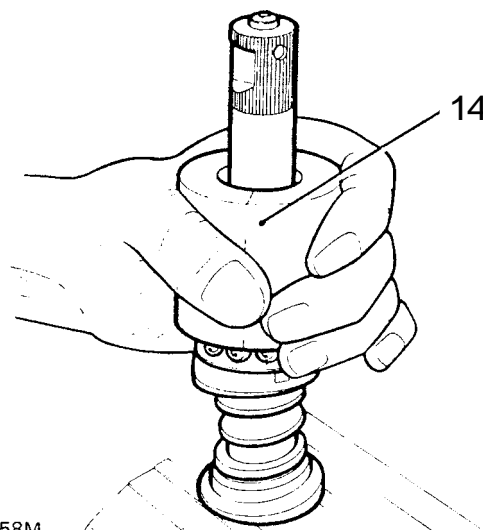
Before using the tool lubricate each part with the recommended power steering fluid.

13. Warm the five rings in hot water leaving them in the water until ready for fitting. When pliable, feed the ring for the lower groove (nearest the roller bearing) over the expander and position the expander over the input shaft, slide the ring into the groove and mould it into position with the fingers.



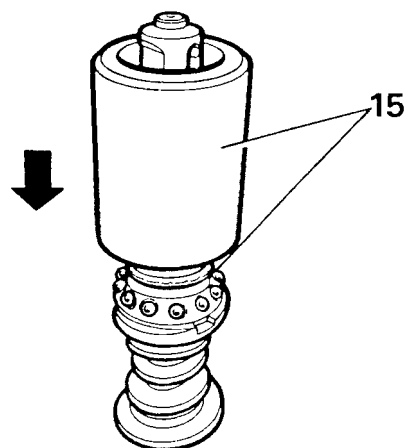
ST1941M

14. Encircle the ring with the split coller and squeeze the coller together, by hand, and hold for approximately thirty seconds.



ST1958M

15. Remove the split coller and with care, case the compressor tool over the ring and leave for a few minutes to cool before carefully removing the tool.



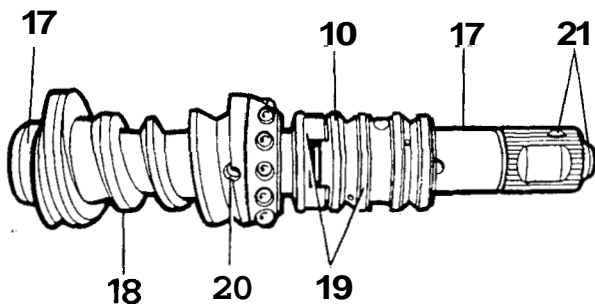
ST1942M

16. Using the expander tool, as before, fit the remaining four rings, one at a time, into the grooves and mould with the fingers. It is important that only one ring at a time is placed on the expander since in the meantime the remaining rings could cool in an expanded condition making it difficult to locate and contract the rings in the valve grooves. Encircle the four rings with the split coller and squeeze together for approximately thirty seconds. Then, with care, ease the compression tool over the four rings and allow to cool for about five minutes before carefully withdrawing the compressor.

continued



worm.



ST1955M

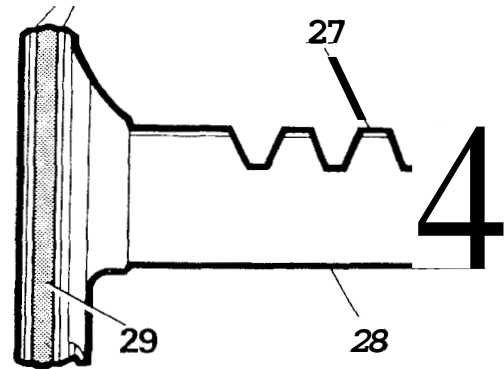
22. The valve and worm assembly should be renewed if there is wear at the following points:
- Inner and outer bearing tracks.
  - Worm.
  - Valve locator.
  - Input shaft needle bearing journal.
23. Examine the outer ball race and track for wear and general condition. The race should be renewed if there is wear and pitting or if a new valve and worm assembly is being fitted.

#### Thrust pad and adjuster

- Examine the thrust pad for scores.
- Check that the thrust pad seat in the adjuster is not worn or scored.
- Check that the thrust pad spring is not broken.

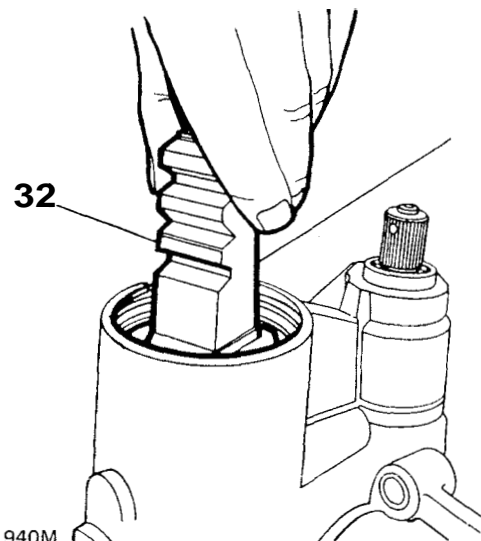
#### Rack and piston

- Examine the rack teeth for wear and pitting.
- Check that the surface on which the thrust pad bears is not worn and scored.



ST1957M

32. To fit a new plastic seal to the piston, warm the seal in hot water and fit to the piston groove. Insert the piston in the inverted position i.e. piston first into the cylinder and leave to cool.



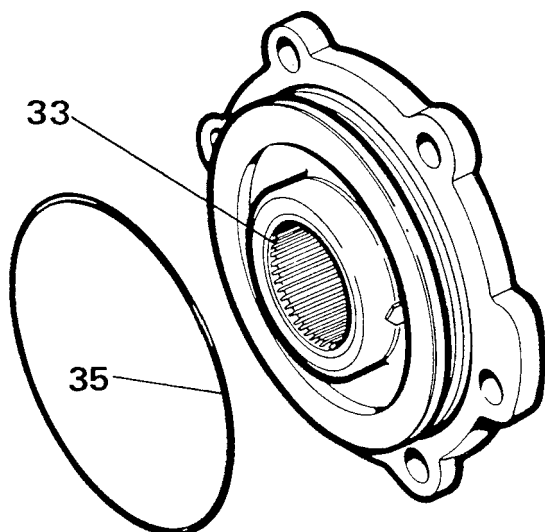
ST1940M

#### Sector shaft cover

33. Examine the sector shaft cover needle bearing and if necessary extract the bearing taking care not to damage the housing.

continued

34. Drive-in a new bearing, up to the shoulder, with the bearing number and chamfered ends of the rollers trailing.
35. Fit a new 'O' ring seal to the cover.
36. Check that the cover bearing lubrication passage and bleed nipple hole is clear.

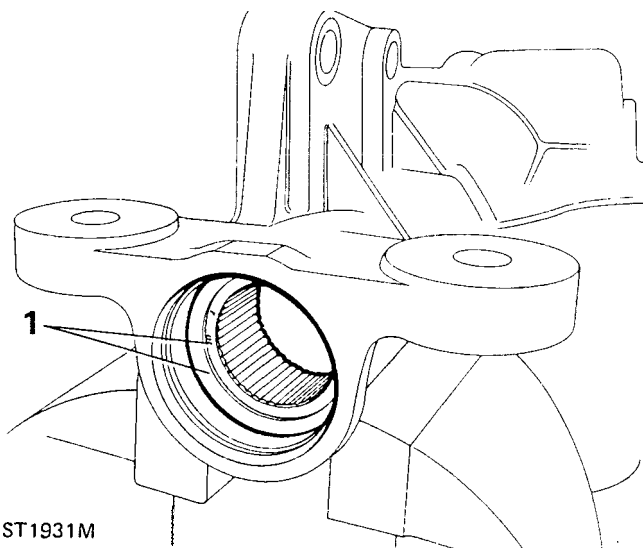


ST 1946M

### Assemble

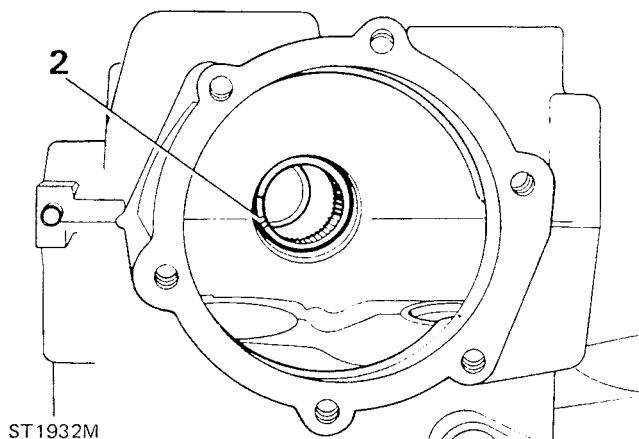
During the following assembly instructions absolute cleanliness must be observed. Also when fitting components and oil seals they must only be lubricated with the recommended fluid, or petroleum jelly.

1. If removed, fit the sector shaft lower needle bearings, numbers outwards, to the steering box to just below the chamfer.



ST1931M

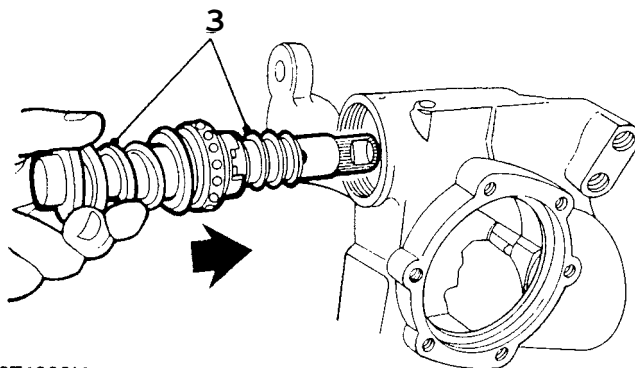
2. Fit the sector shaft upper needle bearings, numbers outwards, up to the shoulder



ST1932M

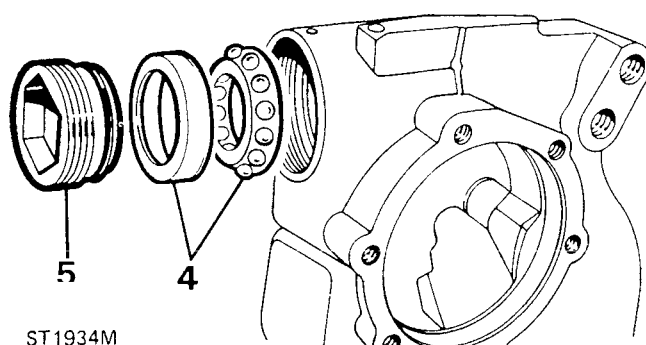
### Fitting the valve and worm assembly (input shaft)

3. Fit the input shaft to the steering box housing and lubricate with the recommended fluid. Turn the shaft to the straight ahead position.

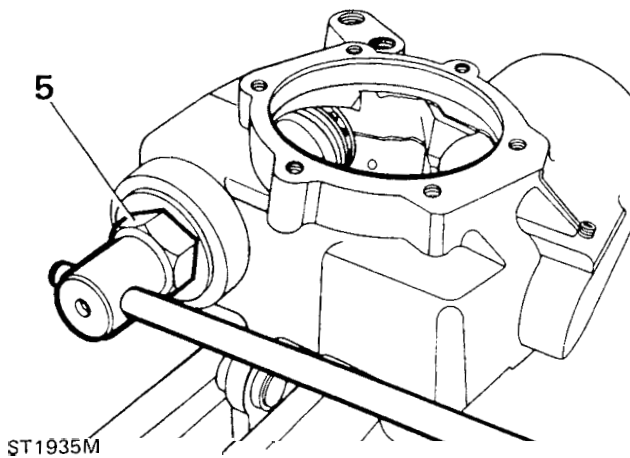


ST1933M

4. Fit the input shaft outer bearing and track.
5. Lubricate and fit the input shaft cover and 'O' ring seal using special tool LST123.

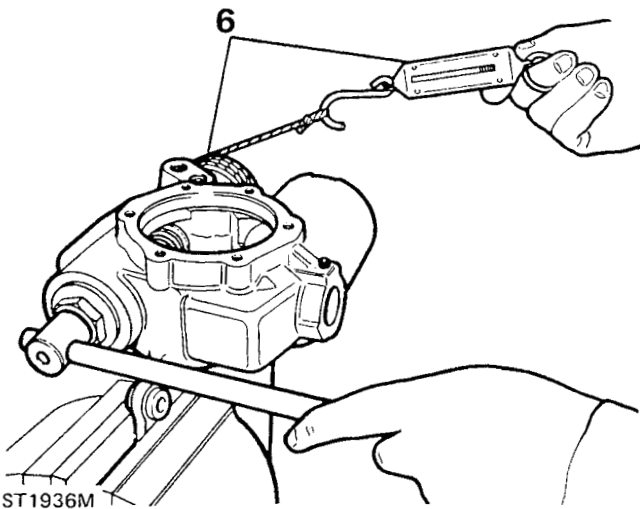


ST1934M



ST1935M

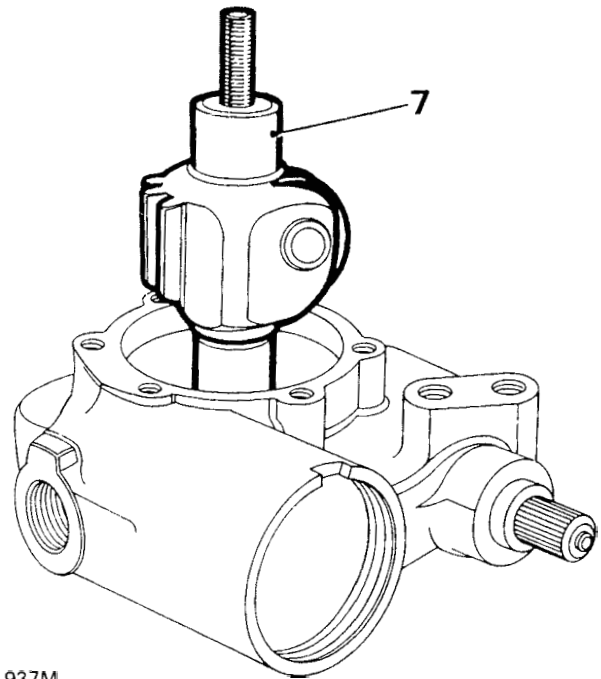
6. Secure preload setting tool R01016 to the input shaft with the grub screw. Wind string round the tool and tie a spring balance to the free end of the string. Whilst turning the input shaft cover clockwise, pull the spring balance until a constant preload reading of 0,69 Nm is achieved.



ST1936M

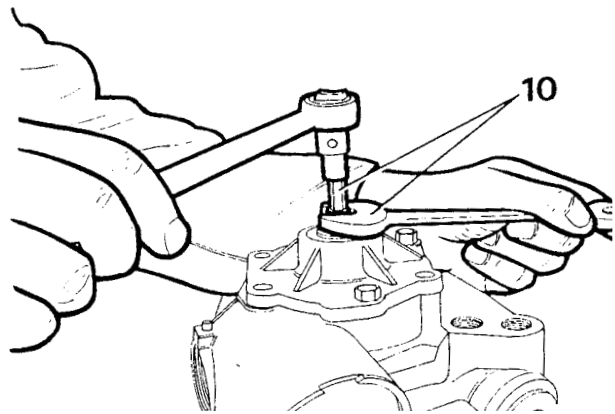
#### Fitting sector shaft and piston-rack assembly

7. Fit the sector shaft to the housing and engage it with the input shaft worm in the straight ahead position.
8. Screw-on, to the sector shaft adjuster, the sector shaft cover and secure with two or three of the six retaining screws.
9. Turn the adjuster screw clockwise, with a 6 mm hexagonal key, until the sector shaft just makes contact with the input shaft worm.



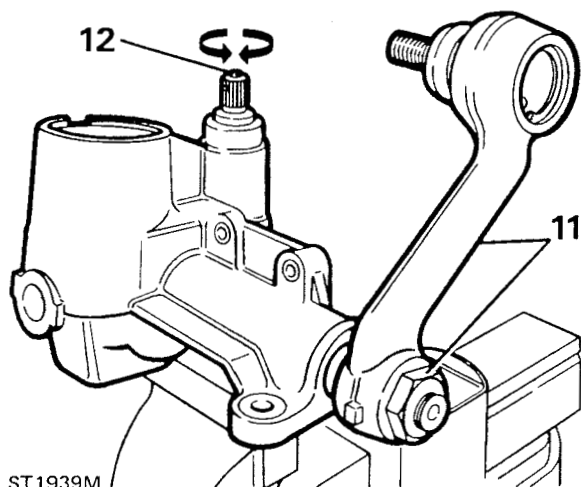
ST1937M

10. Without moving the adjuster, fit the locknut whilst restraining the adjuster screw with the 6 mm key and just nip the locknut with an open-ended spanner.



ST1938M

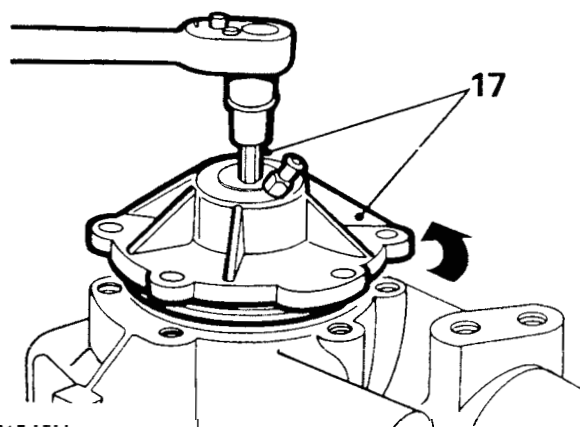
11. Temporarily fit the drop arm and tighten the locknut until no clearance is felt between the sector shaft and drop arm.
12. Rotate the input shaft one turn clockwise, then turn the shaft back to the straight ahead position whilst noting the point at which the backlash to the drop arm disappears or is 'taken-up'.
13. Repeat instruction 12 and rotate the input shaft anti-clockwise on to the opposite lock.



14. If the difference between the two points at which the backlash is 'taken-up' or disappears is greater than 90° (¼ of a turn) it will be necessary to change the shimming behind the input shaft inner bearing cup.
15. If the shimming requires adjustment, add a shim on right-hand drive steering boxes if backlash starts too quickly on clockwise rotation. Should backlash start too quickly for anti-clockwise rotation, remove a shim. For a left-hand drive steering box, reverse the foregoing procedure.

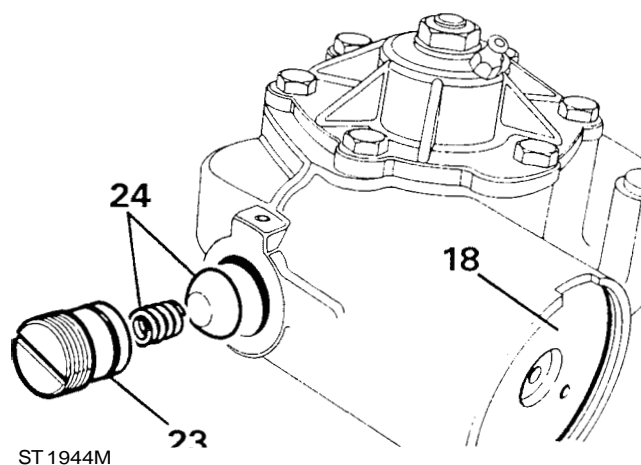
**NOTE: If it is necessary to perform instruction 15, instructions 3 to 13 must be repeated afterwards.**

16. Remove the drop arm and whilst restraining the sector shaft adjuster, so that it does not turn, remove the locknut.
17. Remove the sector shaft cover screws and while still restraining the adjuster, unscrew clockwise, the cover from the sector shaft and withdraw the sector shaft.



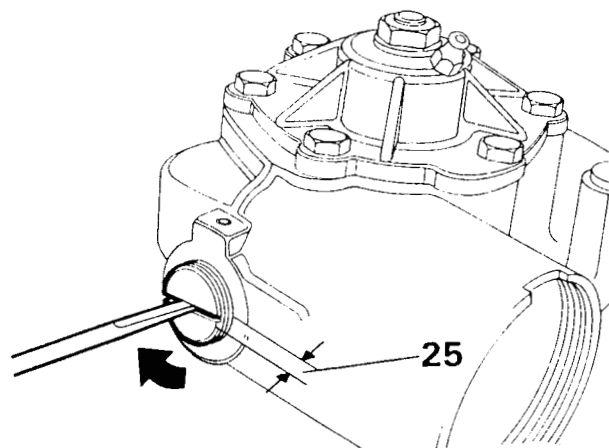
ST1943M

18. Lubricate the rack piston plastic seal and insert the piston into the piston bore, rack end first, as in instruction 11 of the dismantling procedure, to a depth of 37 mm below the lip of the bore.
19. Lubricate and fit the sector shaft in the straight ahead position.
20. Lubricate and fit 'O' ring seal to the sector shaft cover.
21. Restrain the sector shaft adjuster and screw-on the cover, reversing instruction 17. Secure with the six bolts, tightening evenly to 25 to 30 Nm (18 to 22 lbs ft).
22. Restrain the sector shaft adjuster and fit and tighten the locknut, as instruction 10.
23. Fit and lubricate an 'O' ring seal to the rack adjuster screw.
24. Fit the rack pad and spring noting that the larger flat side of the pad is towards the rack.



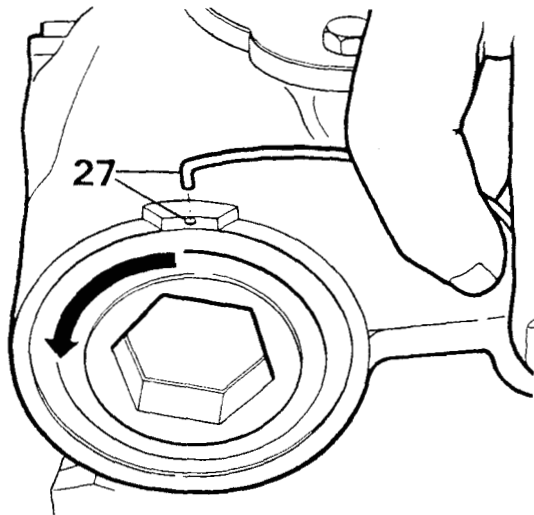
ST1944M

25. Screw-in the rack pad adjuster until the head is 4 mm from the steering box face.



ST1945M

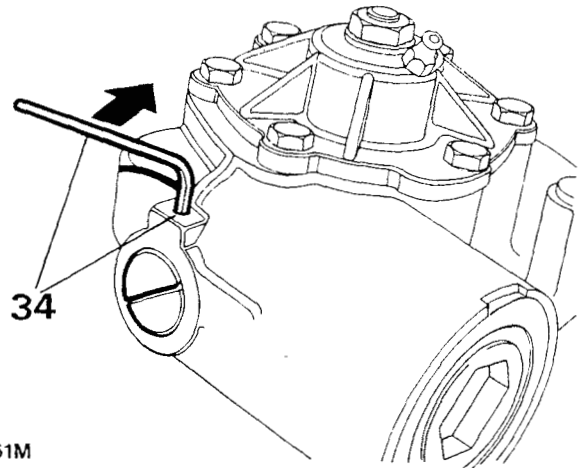
26. Lubricate and fit an 'O' ring seal to the piston-rack cover.
27. Fit the piston cover to steering box. Align the retaining ring hole in the cover with the cut-out in steering box housing and insert hooked end of the retaining ring in the hole. Using special tool LST123, rotate the cover anti-clockwise to feed the ring into the groove until the ring is fully seated. This is a reversal of instruction 3 of the dismantling procedure.



ST1956M

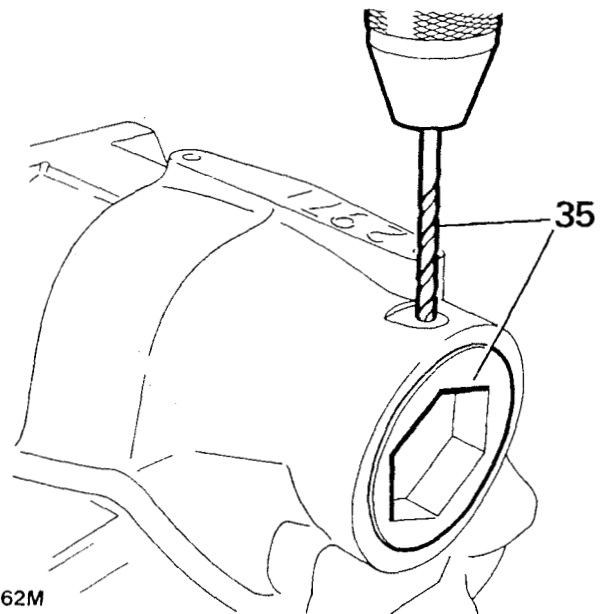
28. Temporarily fit the drop arm and secure with the nut so that no backlash is present between the arm and sector shaft. Set the steering in the straight ahead position.
29. Fit the preload setting tool R01016 to the input shaft and secure with the grub screw. Rotate the input shaft in both directions clockwise and anti-clockwise  $\frac{1}{2}$  to  $\frac{3}{4}$  of a turn to check the backlash distribution.
30. To check the drop arm angular travel for a LHD drive steering box use the preload setting tool to turn the input shaft two turns clockwise and one and three-quarter turns anti-clockwise. For RHD drive boxes, the opposite applies.
31. Remove the drop arm.
32. Return to the straight ahead position and screw the rack adjuster clockwise until the adjuster pad just contacts the pad.

33. Restrain the sector shaft adjuster, as in instruction 10, and tighten the locknut to 70 to 90 Nm (52 to 66 lbs/ft).
34. Secure the rack adjuster with the grub screw, reversing the dismantling procedure instruction 5.



ST1961M

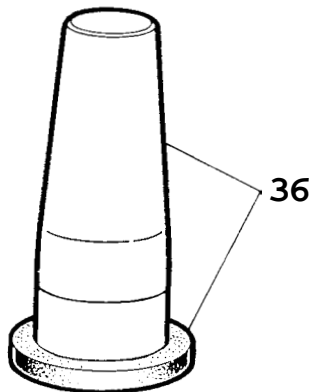
35. Secure the worm adjuster with a new pin. If necessary, drill a new 4 mm hole in the adjuster through the hole in the steering box housing to locate the pin. Check, before drilling that the new hole will not break into the side of the existing hole.



ST1962M

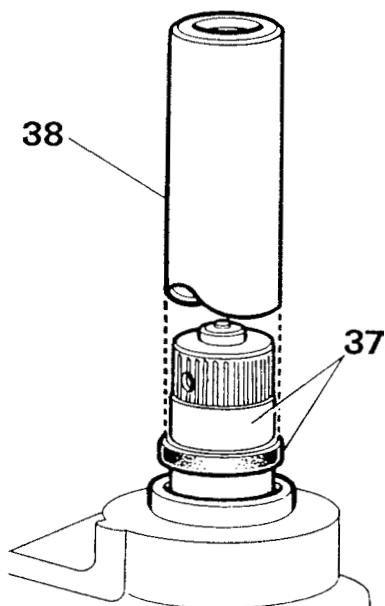
### Fitting input shaft oil seal

36. Using the three part tool LST124, lubricate a new seal and slide it, lip side leading, over the conical seal-saver to the detachable lower part of the tool.



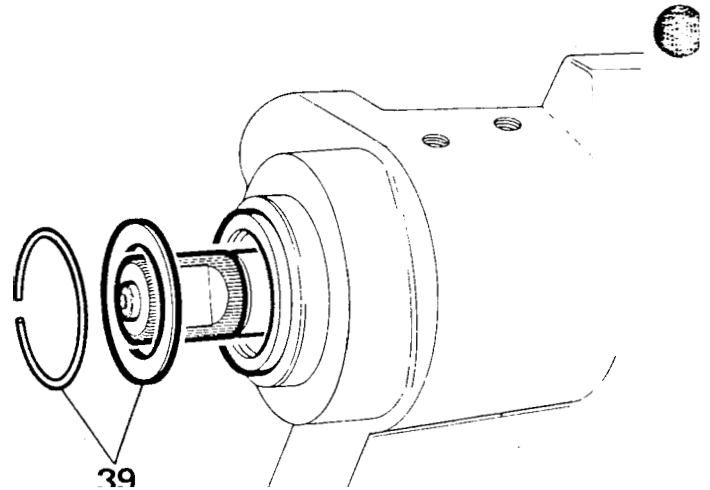
ST1947M

37. Withdraw the conical seal-saver and place the lower part of the tool with the seal, lip side downwards, over the input shaft.  
38. Place the seal-driver part of the tool on top of the seal and drive it fully home.



ST1948M

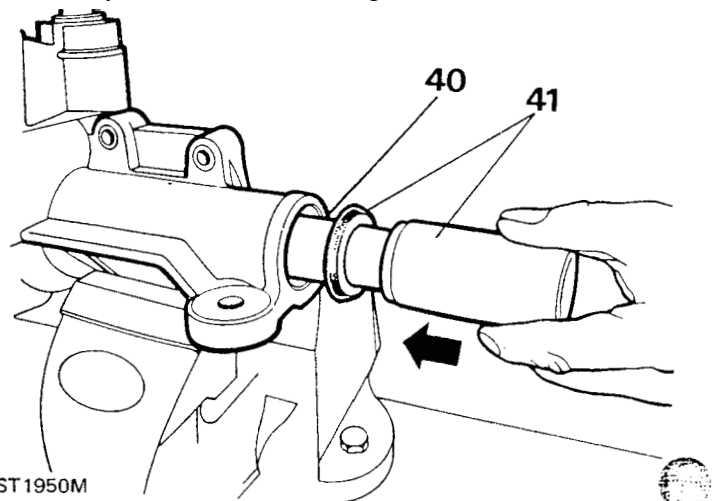
39. Fit the anti-extrusion washer and secure the assembly with the wire circlip.



ST1952M

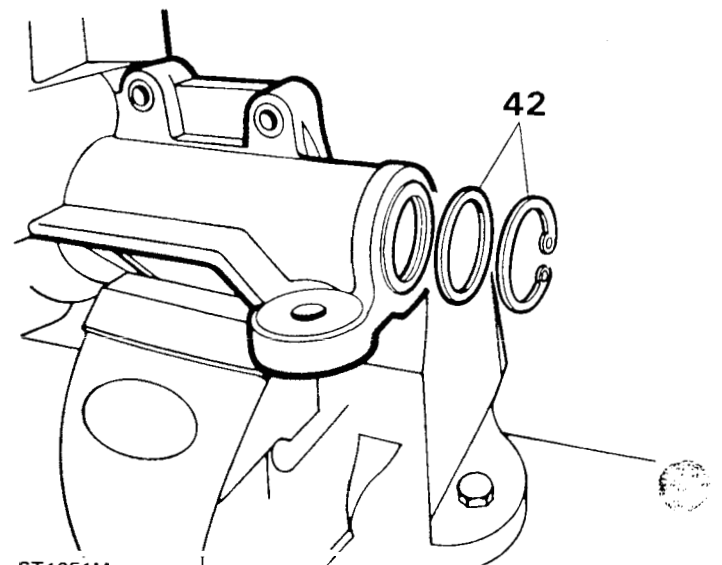
### Fitting sector shaft oil seal

40. Lubricate the oil seal and seal-saver LST125, and slide the seal over the tool, lip side leading.  
41. Using the seal-driver part of the tool, push the seal fully home into the housing.



ST1950M

42. Fit the steel washer and secure the assembly with the circlip.



ST1951M

43. Fit the drop arm, tab washer and nut. Tighten the nut to 170 to 180 Nm (125 to 132 lbs/ft). Fold one side of the tab washer over the **drop** arm and the other over a flat against the nut.
44. Refit the steering box to the vehicle and bleed the hydraulic system.

**NOTE: Bleeding and test of the power steering box is the same as that for the Adwest Lightweight box.**







Land Rover  
Range Rover

# Workshop Bulletin

ATTENTION SERVICE MANAGER

SEPTEMBER 1987  
BULLETIN NUMBER SLR 621 EN WB2

# LAND ROVER

## TURBO-CHARGER MAINTENANCE

### 2.5 LITRE TURBO-CHARGED DIESEL ENGINE

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**Land Rover Merchandising Service**  
P.O. Box 534, Erdington, Birmingham B24 0QS



The following supplementary maintenance schedule for the 2.5 litre Turbo-Charged Diesel engine replaces the schedule printed in Workshop Bulletin 01/86 dated October 1986.

**Daily or Weekly depending on operating conditions, and at every maintenance inspection.**

— Check engine oil level.

**At 1,600km (1,000 miles), 10,00km (6,000 miles) and 20,000km (12,000 miles) then every 20,000km (12,000 miles).**

— Check tappets, and adjust if required.

**Every 40,000km (24,000 miles)**

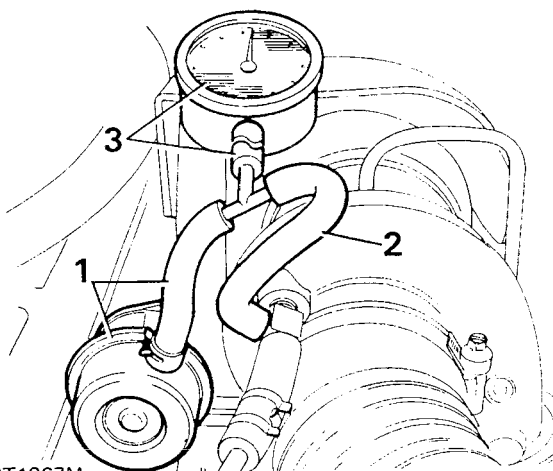
— check the turbo-charger boost pressure and if below the bottom limit – 44cm Hg – (8.5 p.s.i.g.), clean the turbo-charger compressor housing internally, as described in the following pages.

**CHECKING BOOST PRESSURE**

Maximum boost pressure – 50cmHg (9.7 p.s.i.g.)

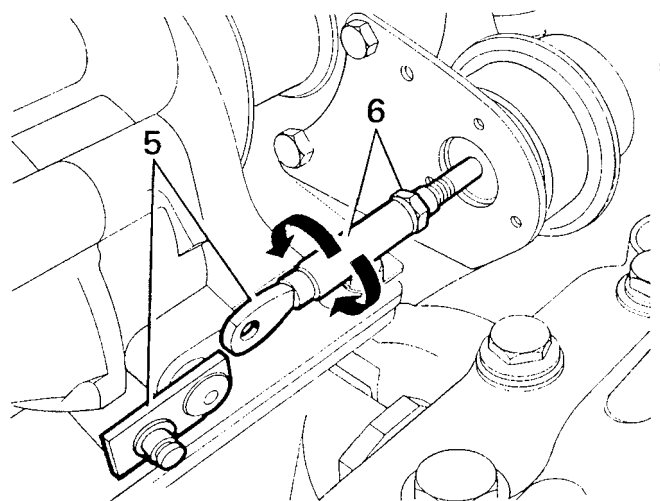
Minimum boost pressure – 44cmHg (8.5 p.s.i.g.)

1. Disconnect, from the turbo-charger, the hose to the actuator and insert into the free end a suitable 'T' piece.
2. Connect a short length of slave hose to the turbo charger and connect the other end to the 'T' piece.
3. Connect a further slave hose to the third leg of the 'T' piece and the other end to a pressure gauge capable of reading in excess of 50cm of Mercury. The pressure gauge hose must be long enough to reach into the cab of the vehicle so that the gauge can be observed by the driver or passenger.



ST1867M

4. To check the maximum boost pressure drive the vehicle normally but in such a manner that full throttle can be maintained whilst climbing a hill with the engine speed held steady between 2,500 – 3,000 r.p.m. Under these circumstances, the boost pressure should be between 44-50 cmHg (9.7-8.5 p.s.i.g.). If the pressure requires adjustment carry out the following instructions.
5. Taking care not to burn the fingers remove the retaining clip and disconnect the actuator control rod from the waste gate lever.
6. Hold the rod with a pair of grips and release the locknut.
7. Turn the rod-end, by no more than one turn, clockwise to increase the boost pressure or anti-clockwise to decrease the pressure.



ST1993M

8. Reconnect the actuator rod to the waste gate lever, secure with the clip and tighten the locknut.
9. Road test the vehicle again and if necessary repeat instructions 5 to 8.
10. Disconnect the test equipment and reconnect the hoses.
11. If the correct boost pressure range is not attained after several attempts, a general condition check of the engine should be undertaken. Examine the air intake system for damaged pipes or a blocked air filter. Check that the inlet manifold nuts and bolts are tight and if necessary retorque. Examine and if necessary, renew the hose between the turbo-charger compressor housing and the actuator and the boost control pipe from the distributor pump. Inspect the exhaust system for general condition and check that the joints are secure and not leaking. Check also that the hose between the

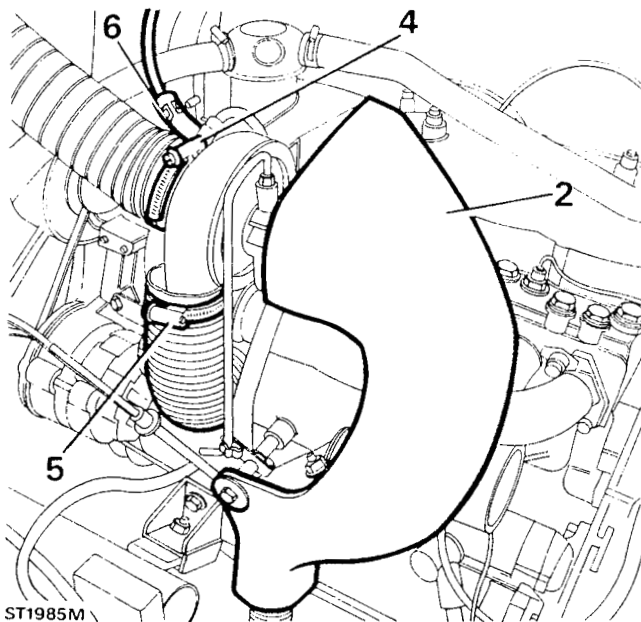
turbo-charger and inlet manifold is satisfactory and the clips are tight. Check that the four nuts securing the turbo-charger to the exhaust manifold are correctly torqued to 21-26  $\nabla \nabla$  (15-19lbf.ft).

12. If any defects were found and corrected, reconnect the test equipment and road test the vehicle again. Should the boost pressure figure still be unsatisfactory clean the compressor housing.

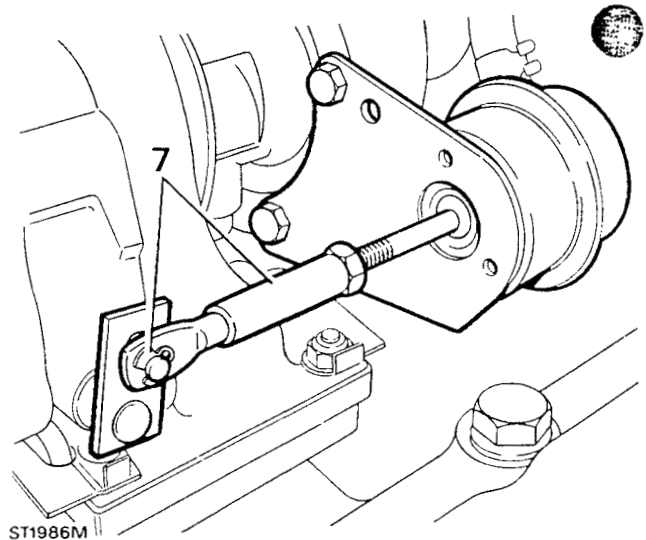
### CLEANING TURBO-CHARGER COMPRESSOR HOUSING

#### Removing

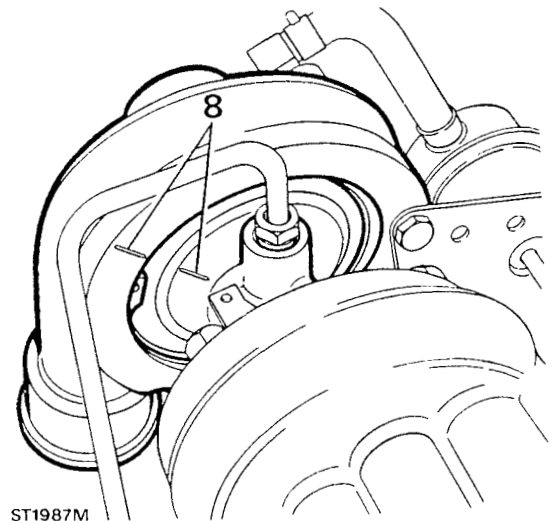
1. Remove the vehicle bonnet panel.
2. Remove the heat shield.
3. Clean the exterior of the turbo-charger with a non-caustic solvent.
4. Disconnect, at the turbo-charger, the air inlet hose from the air cleaner.
5. Remove the inlet manifold to turbo-charger hose.
6. Disconnect the boost control pipe.



7. Remove the clip and disconnect the actuator rod from the waste gate lever pin. This can be more easily achieved if a pressure of 57 to 62cm HgG (11 to 12Psi) is applied to the actuator.

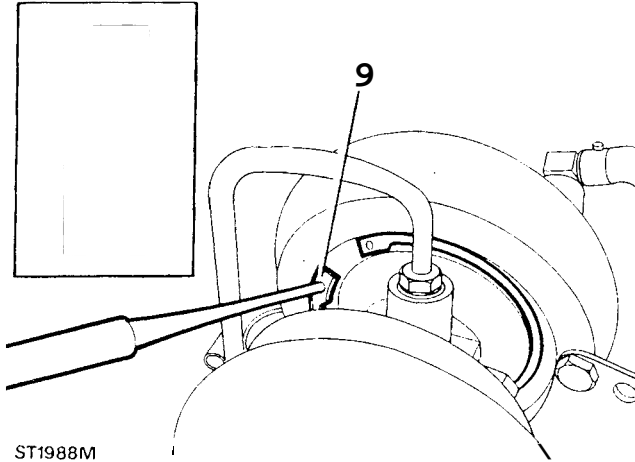


8. Mark the position of the compressor housing relation to the centre housing with a scribe line to assist reassembly.

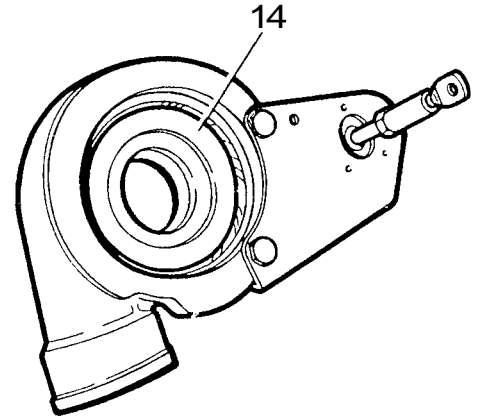


9. The circlip retaining the compressor housing to the centre housing is tapered, in cross section, on one side. It is necessary to 'break' the taper to enable the circlip to be removed in the usual manner. Using a flat nosed punch, carefully tap each ear of the circlip away from the groove in the compressor housing.

continued

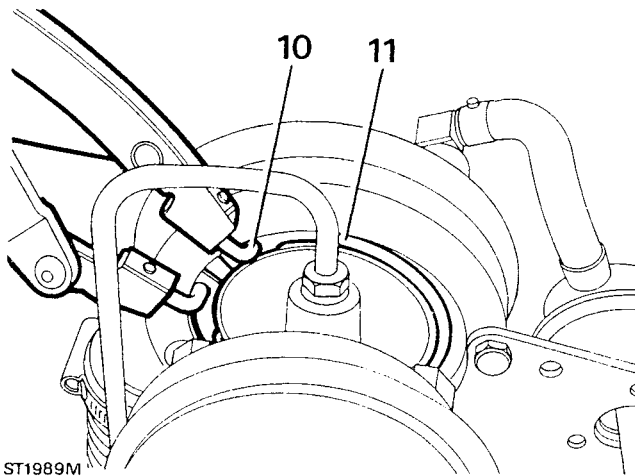


ST1988M



ST1991M

10. Remove the circlip using a strong pair of circlip pliers with well fitting 90 degree angle tips.
11. Remove any burrs made on the back plate clearance diameter of the compressor housing before removing it from the centre housing.



ST1989M

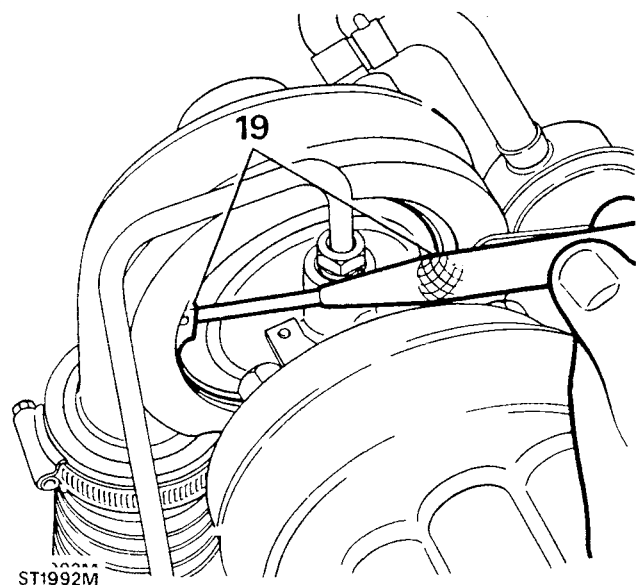
12. Withdraw the compressor housing complete with the actuator. To avoid damaging the compressor wheel withdraw the housing squarely without tilting the housing.

Cleaning

13. Remove the 'O'ring seal from the back plate.
14. Clean the internal surfaces of the compressor housing, the compressor wheel and back plate with a soft brush and a non-caustic solvent. Do not use compressed air to dry the compressor wheel and back plate.
15. Clean the circlip, remove burrs, and repair any damage caused during removal.

Refitting

16. Fit a new 'O'ring seal to the back plate.
17. Place the circlip in position over the centre housing with the tapered side towards the rear of the vehicle.
18. Offer-up the compressor housing, taking care not to damage the compressor wheel and back plate, and line up the scribe marks made before removal.
19. Secure the housing with the circlip and carefully tap the ears and inner diameter of the circlip with a flat nosed punch to ensure that it is fully seated in the groove.



ST1992M

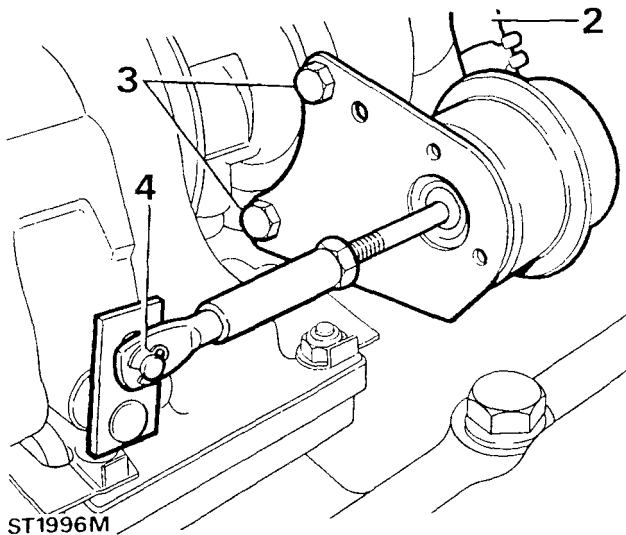
20. Connect the actuator rod to the wastegate lever and secure with the clip.

continued

21. Connect the boost control pipe.
22. Fit the inlet manifold to turbo charger hose and secure with the clips.
23. Connect the air intake hose and secure with the clip.
24. Fit the heat shield.
25. Fit the bonnet.
26. Re-check the boost pressure.
27. If the boost pressure is still not satisfactory, change the actuator.

### RENEW TURBO-CHARGER ACTUATOR

1. Remove the heat shield.
2. Remove the actuator hose.
3. Remove the two screws securing the actuator bracket to the turbo-charger.
4. Remove the clip retaining the actuator rod to the wastegate lever pin and withdraw the actuator from the engine.



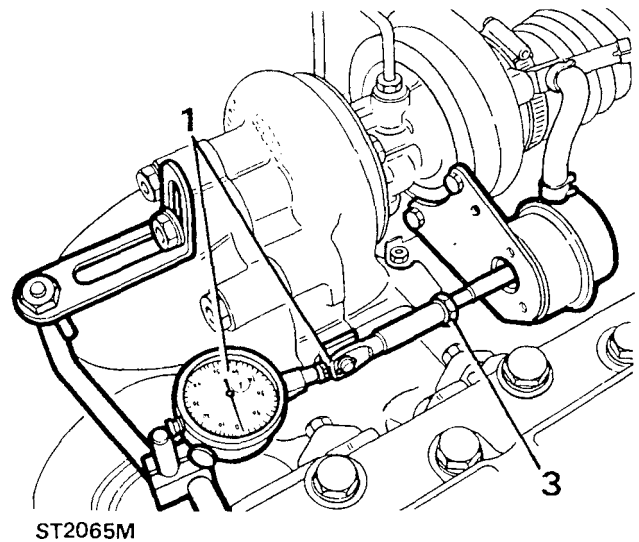
5. Fit the replacement actuator with the two bolts and single nut and bolt. Tighten the bolts to 12.5 to 14.0 Nm (111 to 124 ins lbs.)
6. Push the wastegate lever as far as possible towards the actuator and apply pressure to keep the lever in this position.
7. Pressurise the actuator to 57 to 62cm HgG (11 to 12 p.s.i.g.) and hold this pressure.

**CAUTION:** Use only the threaded rod-end to make adjustments. Forcing the complete rod in or out will change the calibration with the possibility of damaging engine boost.

8. Screw the rod end in either direction until the rod end eye will locate easily over the wastegate lever pin and secure with the retaining clip.
9. Release the pressure and tighten the rod end lock nut.

### STATIC CALIBRATION OF ACTUATOR

1. Mount a dial test indicator so that the stylus rests on the end of the actuator rod.
2. Pressurise the actuator until the lever moves 0.38mm (0.015ins). At this point the pressure should be 11.5p.s.i.g.  $\pm$  0.5 p.s.i.g.
3. If the pressure is higher, slacken the lock nut and lengthen the actuator rod. Should the pressure be lower, shorten the rod.
4. When the correct pressure is achieved, tighten the rod end lock nut.



5. Fit the heat shield.
6. Check the boost pressure on the road as previously described.



Land Rover  
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## Workshop Bulletin

ATTENTION SERVICE MANAGER

DECEMBER 1987

BULLETIN No. SLR 621 EN WB 3

**LAND ROVER**

**LT85 LIGHTWEIGHT  
DIVIDED-CASE GEARBOX**

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SERVICE

Land Rover Service Division

## INTRODUCTION

This Workshop Bulletin is a supplement to the current Land Rover Workshop Manual Publication SLR 621 EN **WM** and covers the introduction and overhaul of the LT 85 light weight divided case gearbox. This unit replaces the earlier heavy duty LT 85 gearbox fitted to the basic V8 engined Land Rover 90 and 110 models. The heavy duty version is still being used for certain non-standard applications.

The new gearbox, which is interchangeable with the heavy duty version, can be recognised by the prefix 22C before the serial number. The gearbox was first fitted from the following vehicle numbers:

Land Rover 90 V8. VIN SALLD VBV 7AA 299109.  
Gearbox number 22C 00070.

Land Rover 110 V8. VIN SALLD HAV 8BA 298614.  
Gearbox number 22C 00061.

The individual gears and shafts are not, however, interchangeable between the two gearboxes.

## GEARBOX DATA

Ratios: as heavy duty version.

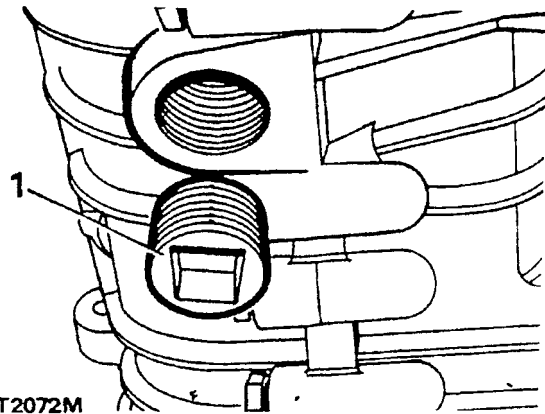
Lubrication: as heavy duty version.

Torque figures: as heavy duty gearbox where applicable with the exception of the following:

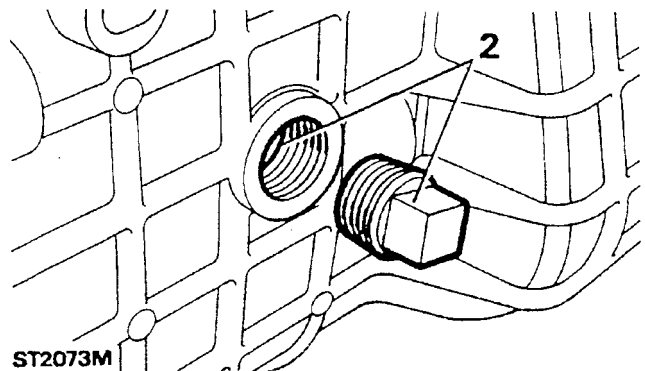
Divided case retaining bolts M8- 7off (5 bolts and two bolts and nuts) 22- 28 Nm (16-21 lbs.ft.)

Maintenance: Oil check and top-up and drain and renew oil are at the same mileage intervals but the drain and refill method differs from the heavy duty gearbox, as follows:

1. Immediately after a run, when the oil is warm, park the vehicle on level ground and disconnect the battery. Drain-off the oil into a container by removing the drain plug anti-clockwise from beneath the gearbox casing using a 12,7mm (1/2in) square socket drive. When all the oil is drained, clean and refit the drain plug and tighten to the correct torque.



2. Remove the square headed oil level/filler plug from the left-hand side of the gearbox and inject oil of the correct grade until the oil is level with the filler hole. Clean and fit the level/filler plug and tighten to the correct torque. Wipe away any surplus oil and reconnect the battery.



## GEARBOX AND TRANSFER BOX REMOVAL

This operation is the same as that described in Supplement LSM 25WS and the current Land Rover Workshop Manual Publication SLR 621 EN WM for the heavy duty LT 85 gearbox.

In the interests of safety, it is essential that the locally manufactured cradle is used with the hydraulic ramp. Before fitting the cradle the gearbox filler/level plug must be removed and a suitable blank fitted.



**OVERHAUL LT85 LIGHT WEIGHT DIVIDED CASE GEARBOX.**

**Service Tools**

- 18C 284      Impulse extractor.
- LST 284-1    Reverse idler shaft remover adaptor.
- LST 101      Gauge first gear end-float.
- LST 102      Mainshaft oil seal remover, replacer.
- MS 47        Hand press.

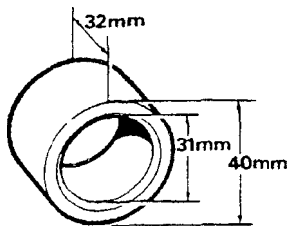
With the exception of MS 47 the above are existing tools used on the heavy duty IT 85 integral case gearbox.

**Special sockets and spanners.**

- 41mm socket -      Layshaft fifth gear retaining nut.
- 5mm Allan key -    Reverse shaft retaining plate

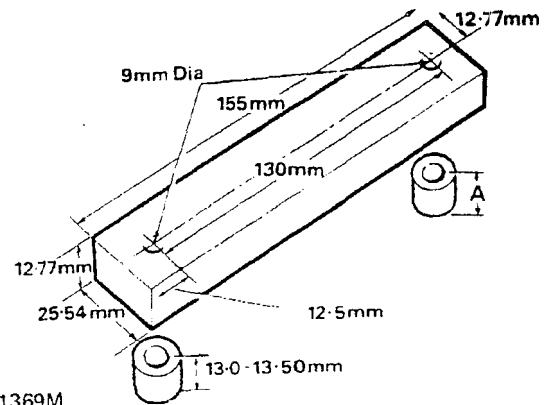
**Locally manufactured tools.**

In addition to the above service tools, the following tools can be locally manufactured to assist the dismantling and assembly of the gearbox. These tools are the same as for the heavy duty gearbox except the stand to which a small modification is necessary.



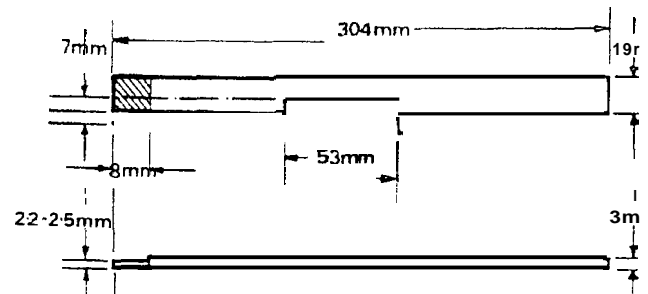
ST1476M

Spacer for retaining layshaft rear bearing.



ST1369M

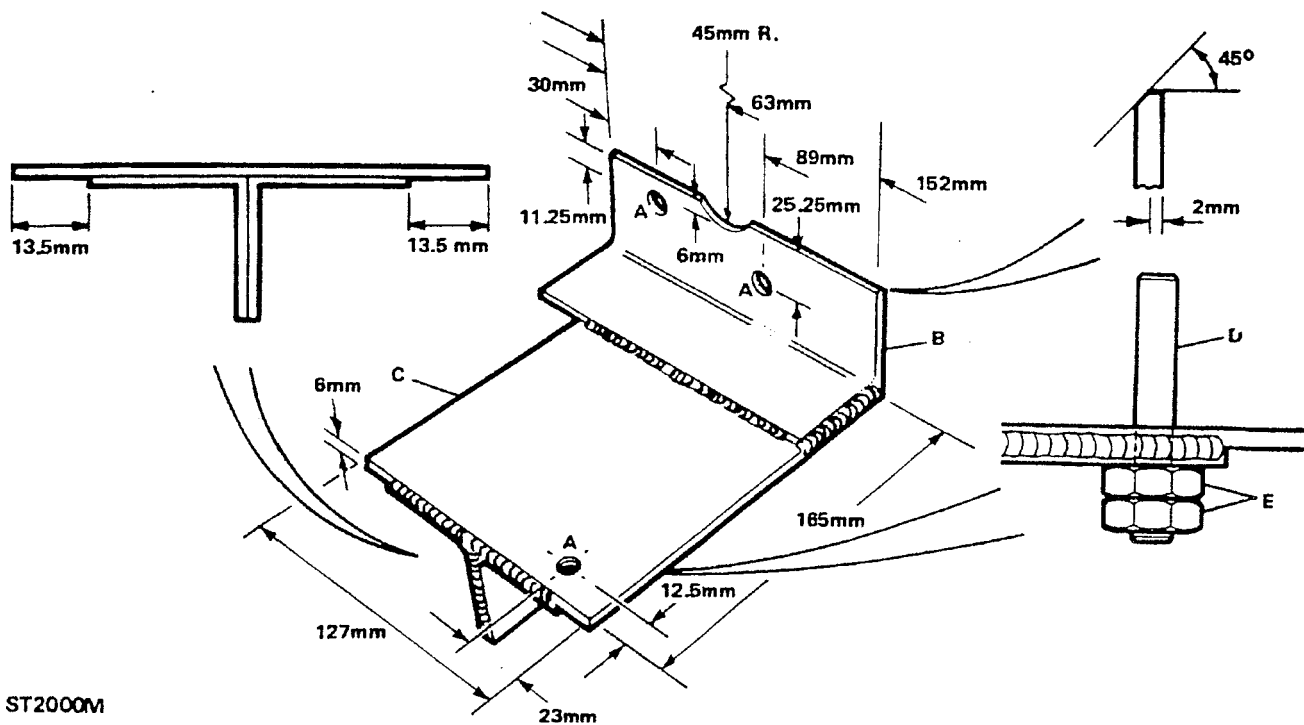
Selector detent spring retaining tool and spacers.



ST1371M

Gauge for reverse cross-over lever adjustment.

**Continued**



ST2000M

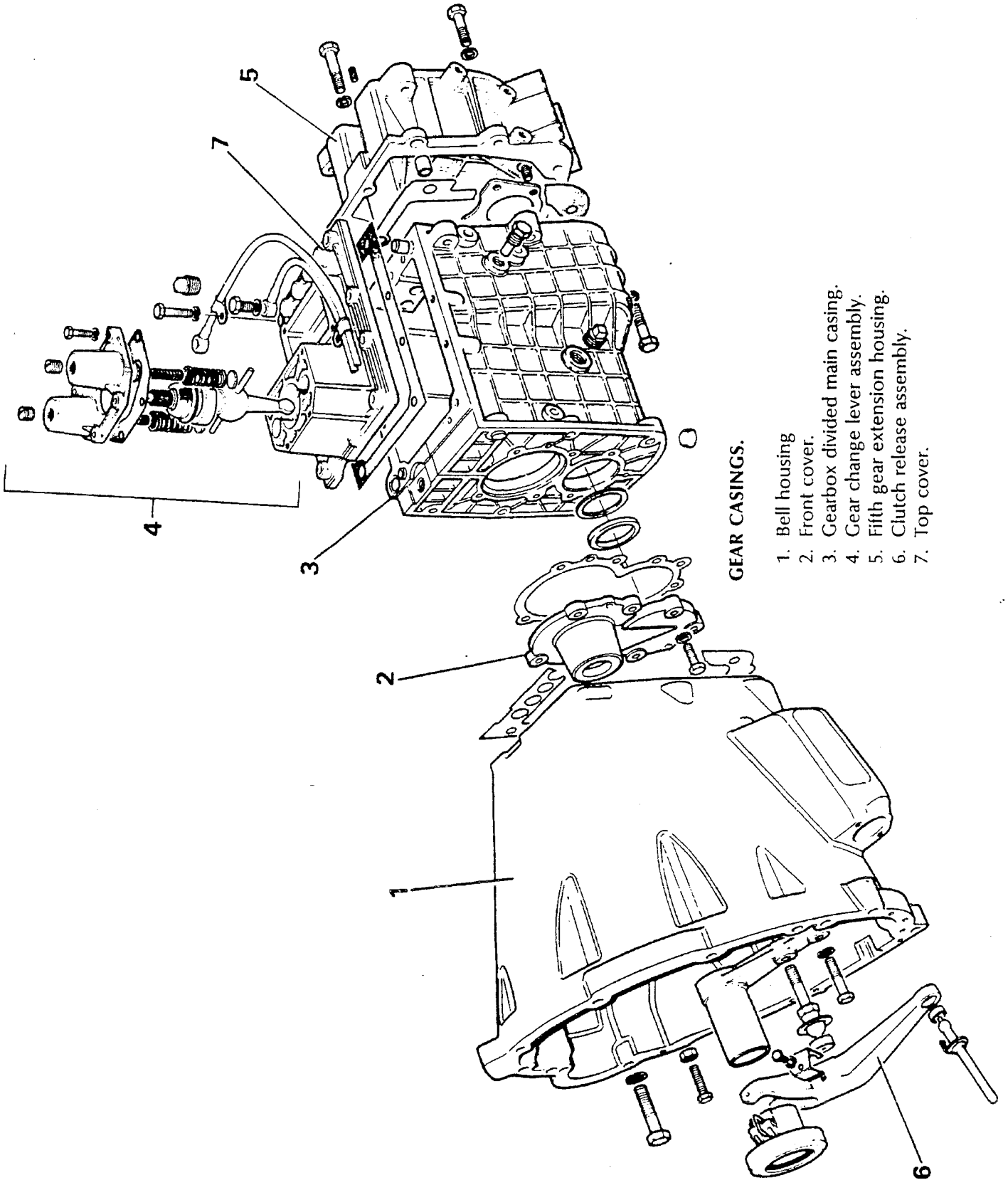
**Stand for securing the gearbox in a vice**

- A. 11mm diameter holes.
- B. Make from 50mm x 6mm steel angle.
- C. Make from 6mm steel plate.
- D. 10mm diameter stud 70mm long with 25mm of thread for adjustment.
- E. 10mm nuts.

Note: Item D is where the modification to the original stand is necessary.

**Material and welding specification**

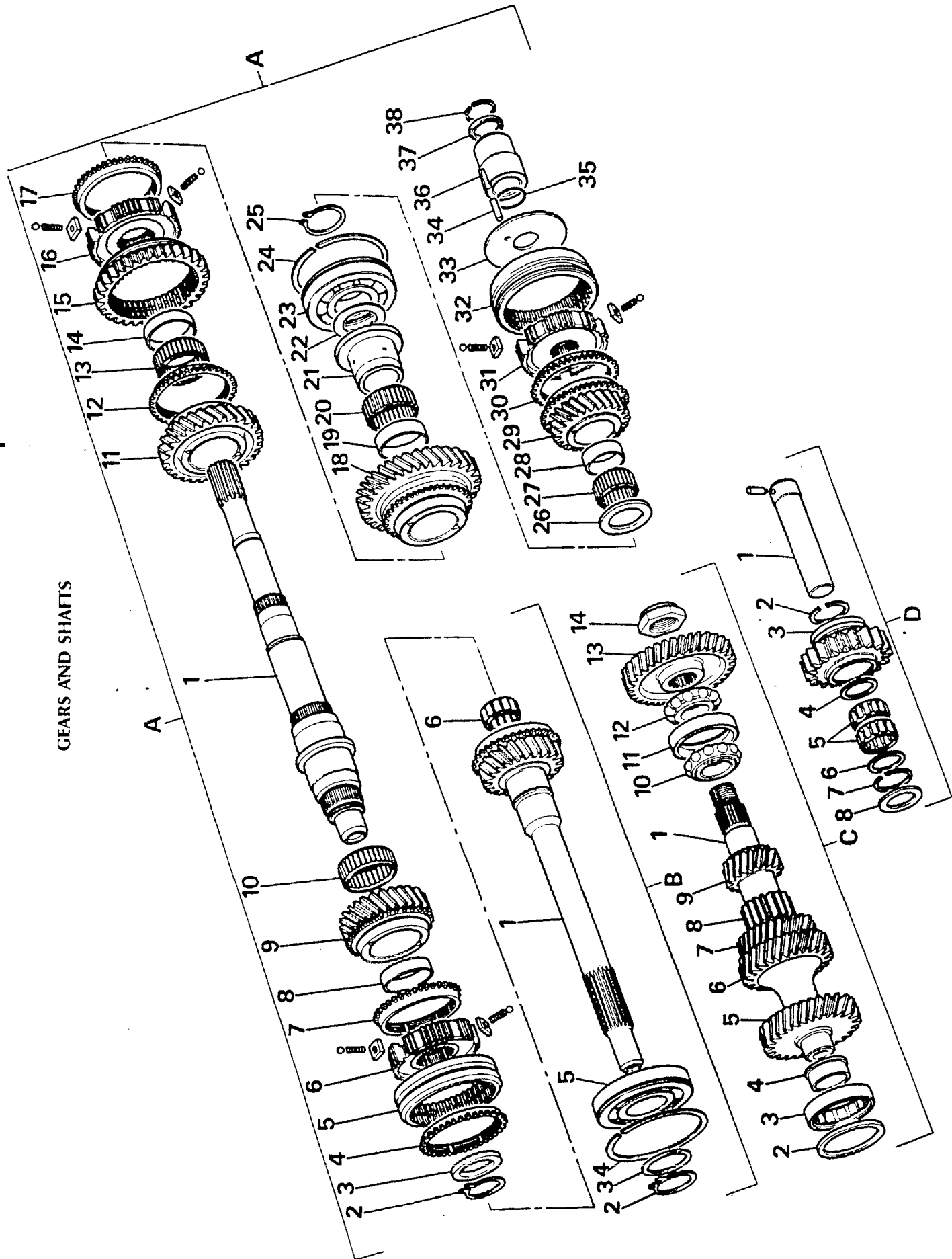
Steel plate BS 1449 Grade 4 or 14  
Arc welding BS 5135.



**GEAR CASINGS.**

- 1. Bell housing
- 2. Front cover.
- 3. Gearbox divided main casing.
- 4. Gear change lever assembly.
- 5. Fifth gear extension housing.
- 6. Clutch release assembly.
- 7. Top cover.

GEARS AND SHAFTS



## KEY TO GEARS AND SHAFTS

### MAINSHAFT ASSEMBLY A.

1. Mainshaft.
2. Circlip.
3. Selective washer.
4. 4th gear baulk ring.
5. 3rd/4th gear synchromesh sleeve.
6. 3rd/4th gear synchromesh hub.
7. 3rd gear baulk ring.
8. Spacer.
9. 3rd gear.
10. Needle roller bearing.
11. 2nd gear.
12. 2nd gear baulk ring.
13. Needle roller bearing.
14. Spacer.
15. 1st/2nd synchromesh sleeve and reverse gear.
16. 1st/2nd gear synchromesh hub.
17. 1st gear baulk ring.
18. 1st gear.
19. Spacer.
20. Needle roller bearing.
21. 1st gear bush.
22. Selective washer.
23. Ball bearing.
24. Snap ring.
25. Circlip.
26. Washer.
27. Needle roller bearing.
28. Spacer.
29. 5th gear.
30. 5th gear baulk ring.
31. 5th gear synchromesh.
32. 5th gear synchromesh sleeve.
33. 5th gear Synchromesh plate.
34. Dowel retaining plate.
35. "O" ring seal.
36. Sleeve
37. Selective
38. Circlip.

### INPUT SHAFT ASSEMBLY B.

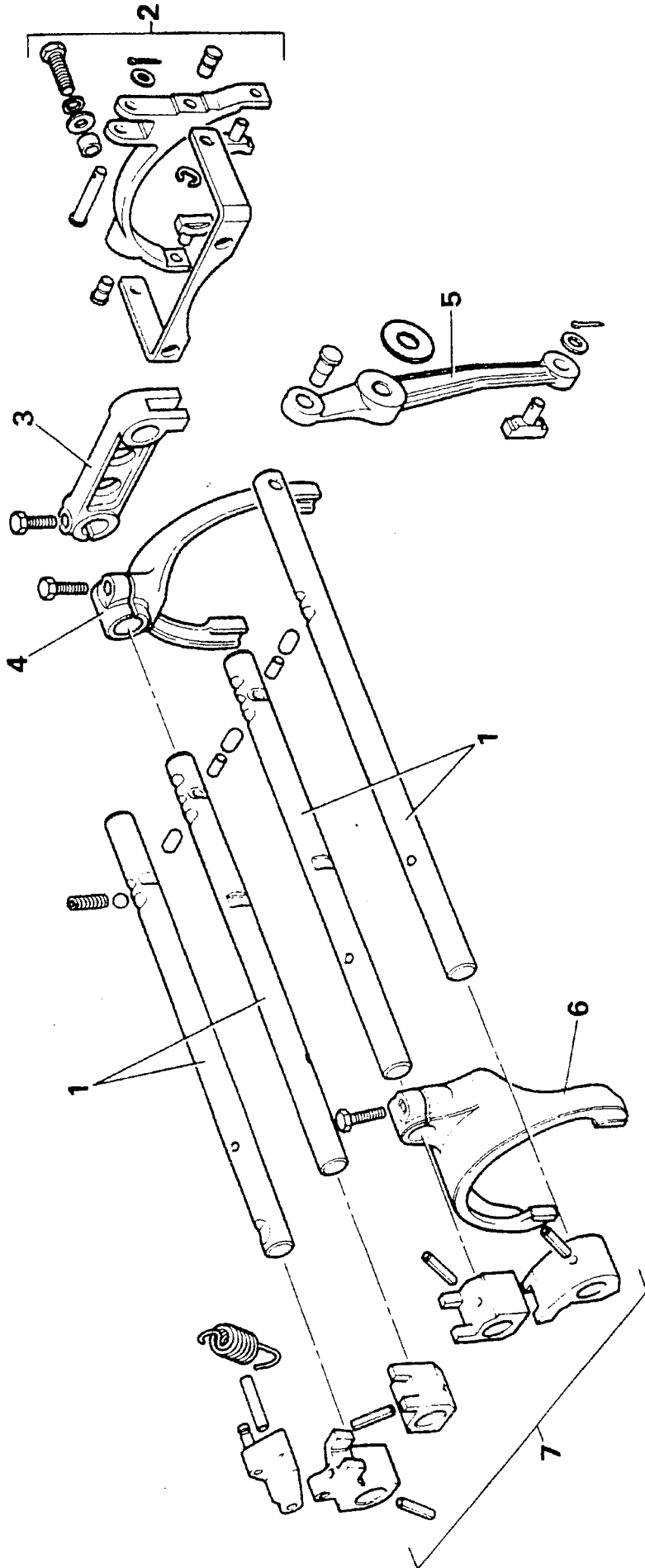
1. Input shaft and 4th gear
2. Circlip.
3. Selective washer
4. Snap ring.
5. Ball bearing.
6. Needle roller bearing.

### LAYSHAFT ASSEMBLY C.

1. Layshaft
2. Spacer.
3. Roller bearing.
4. Roller bearing track.
5. 4th gear.
6. 3rd gear.
7. 2nd gear.
8. Reverse gear.
9. 1st gear.
10. Inner ball bearing race.
11. Bearing track.
12. Outer ball bearing race.
13. 5th gear.
14. 5th gear retaining nut.

### REVERSE SHAFT ASSEMBLY D

1. Reverse idler gear shaft
2. Wire circlip.
3. Reverse idler gear.
4. Washer.
5. Needle roller bearing.
6. Washer.
7. Wire circlip.
8. Thrust washer.

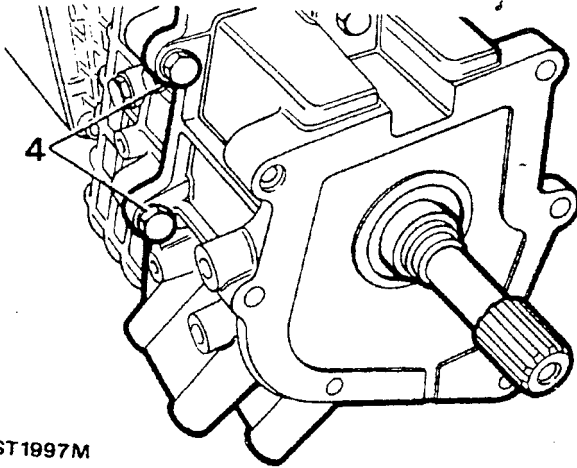


**GEAR SELECTORS.**

1. Selector rails.
2. Fifth gear selector fork assembly.
3. Reverse gear cross-over lever.
4. First and second gear selector fork.
5. Reverse gear lever.
6. Third and fourth gear selector fork.
7. Selector jaws.

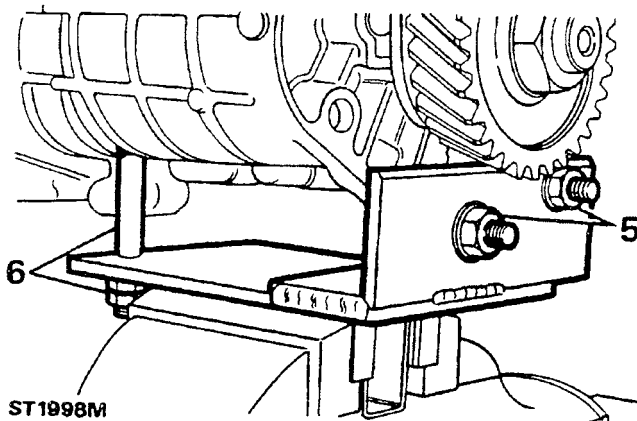
**DISMANTLE**

1. Ensure that the gearbox oil has been drained.
2. Position gearbox on a bench and support with a suitable block of timber.
3. Remove the four bolts and detach the L.H. mounting bracket.
4. Remove the eight bolts, four forward facing and four rearward facing and withdraw the extension housing and gasket.



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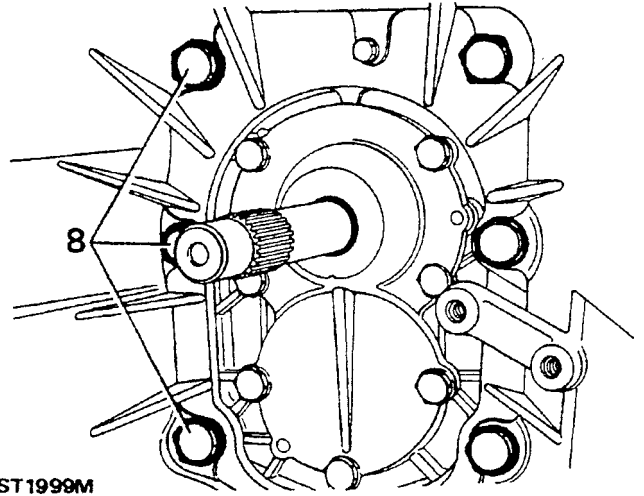
5. Fit the locally manufactured stand to the gearbox and secure with two bolts, nuts, spring and plain washers.
6. Adjust the stud under the gearbox case as necessary so that it just contacts the case to provide support.



ST1998M

7. Secure the gearbox and stand in a vice.

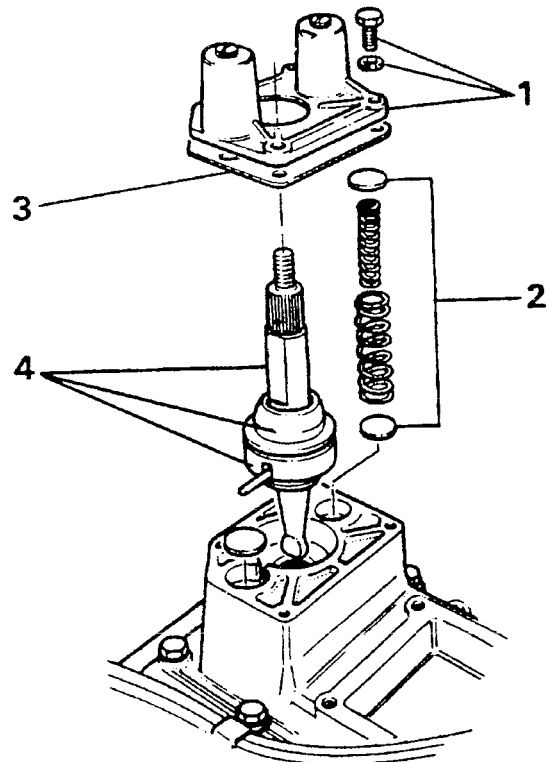
8. Remove the six bolts and withdraw the bell housing complete with clutch release lever, sleeve and thrust bearing from the gearbox.
9. Remove the bell housing gasket.



ST1999M

**Bias spring housing and gear lever.**

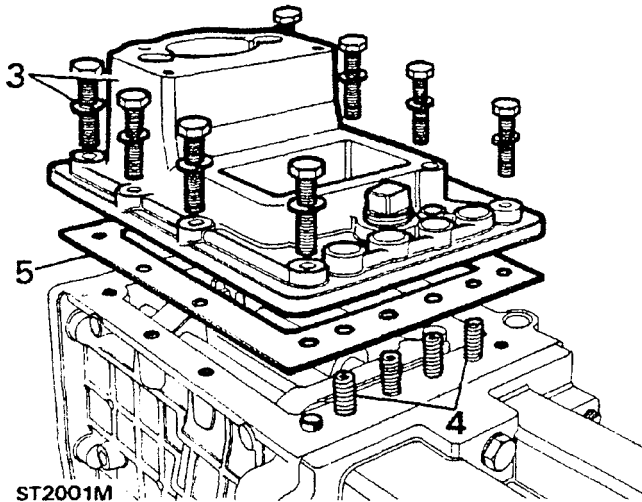
1. Remove the four bolts and lift the bias spring housing from gearbox.
2. Remove the bias springs and shims. Take care not to allow the lower shims to slip under the gear lever pivot bar into the gearbox.
3. Remove the bias spring housing gasket.
4. Remove the gear lever complete with gaiter and nylon cup.



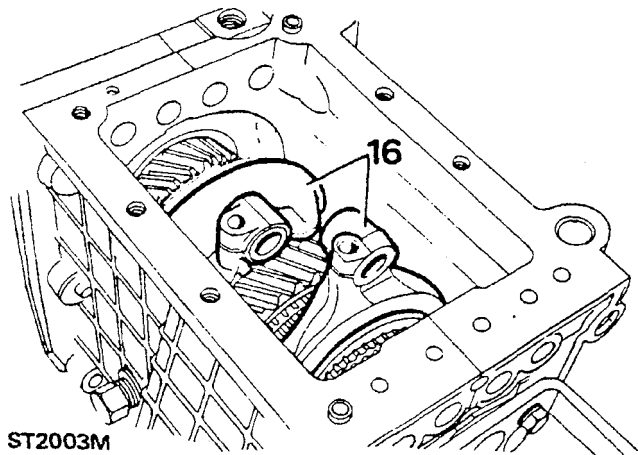
ST2074M

## Gearbox top cover.

1. Remove the reverse light switch, if fitted.
2. Remove breather pipe banjo union fixing bolt.
3. Remove the eight bolts and lift the top cover and breather pipes from gearbox whilst taking care not to allow the detent springs to fall into the gearbox.
4. Remove the detent springs.
5. Remove the top cover gasket.



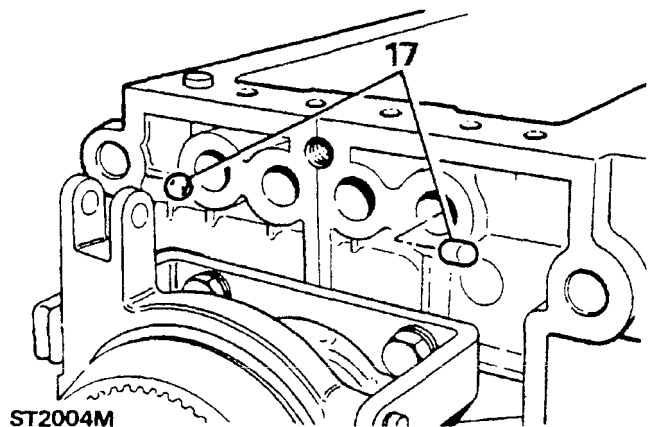
8. Remove the clamp bolt from the third/fourth selector fork and move the selector rail forward.
9. Tap-down the third/fourth jaw roll pin until jaw is free on the selector rail.
10. Withdraw the third/fourth selector rail and jaw.
11. Remove the interlock from the third/fourth selector rail.
12. Tap-down the first/second jaw roll pin until the jaw is free on the selector rail.
13. Remove the clamp bolt from the first/second selector fork and withdraw the first/second selector rail and jaw.
14. Remove the interlock from the first/second selector rail.
15. Lift the reverse cross-over lever from the gearbox.
16. Remove the first/second and third/fourth selector forks.



## Selector rails and forks.

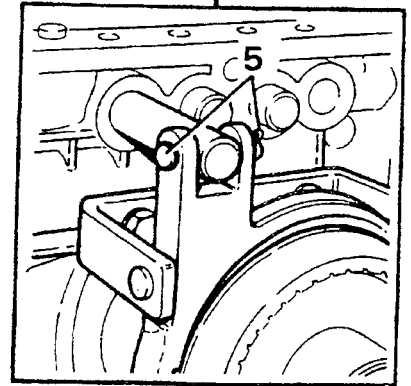
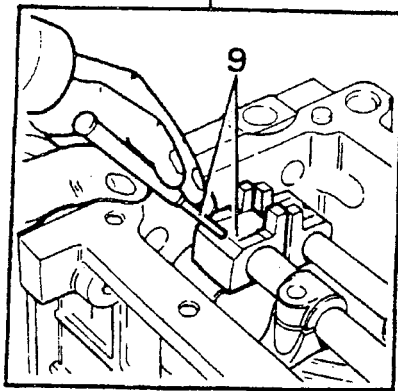
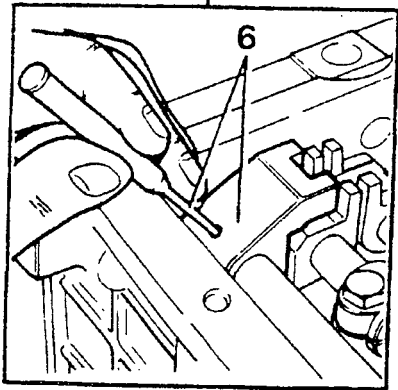
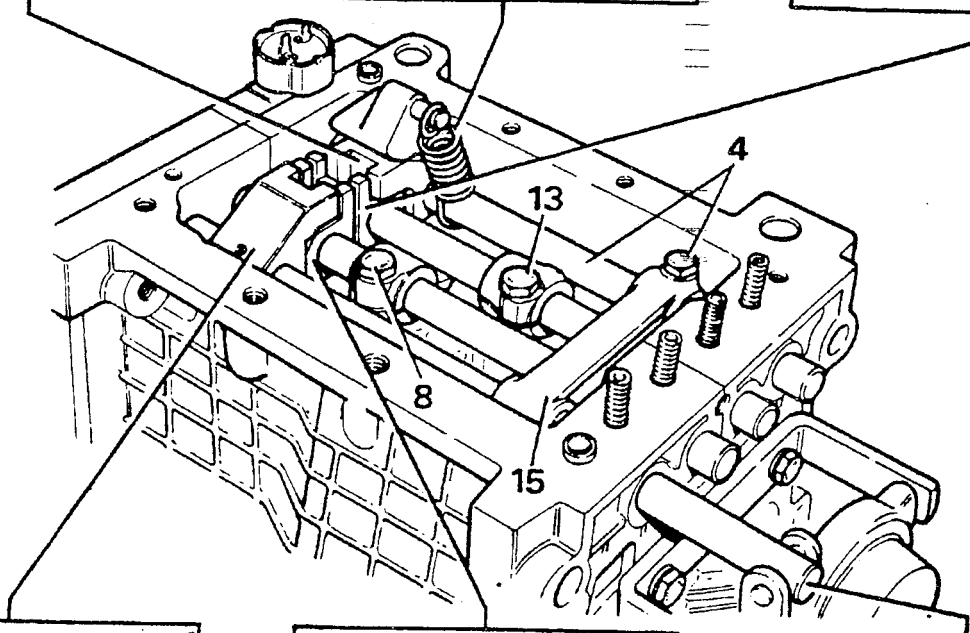
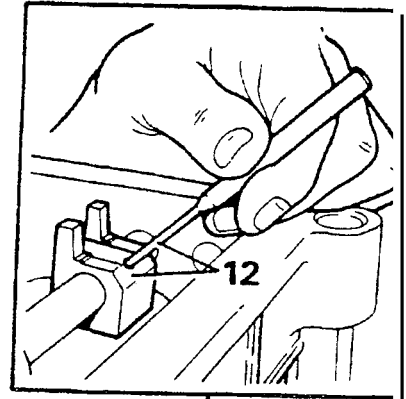
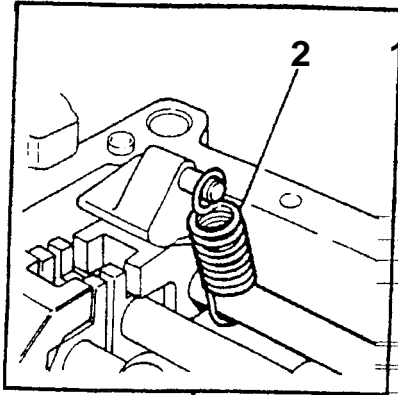
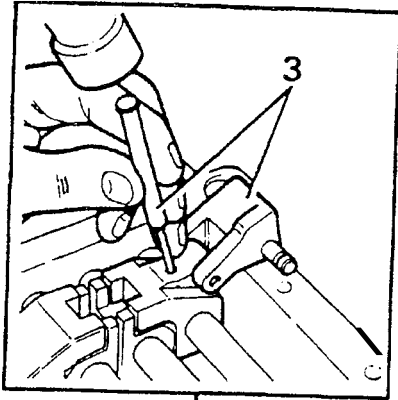
1. Using a magnet, withdraw the selector rail detent balls from drillings in gearbox. If the balls are tight leave until the selector rails have been removed.
2. Release reverse gate spring from the knock-over lever and remove from reverse gear rail.
3. Raise the knock-over lever and tap down the reverse jaw roll pin until the jaw is free on the rail.
4. Remove the clamp bolt from the reverse gear cross-over lever, slide the reverse selector rail out from the gearbox and remove the jaw.
5. Remove the split pin, washer, and clevis pin securing the fifth-gear selector fork to the fifth gear rail.
6. Push the selector rail forwards and tap down the fifth-gear jaw roll pin until the jaw is free on the rail.
7. Withdraw the fifth-gear selector rail and jaw from the gearbox.

17. Remove the interlock plungers, and the detent balls, if the latter were not removed in instruction 1.



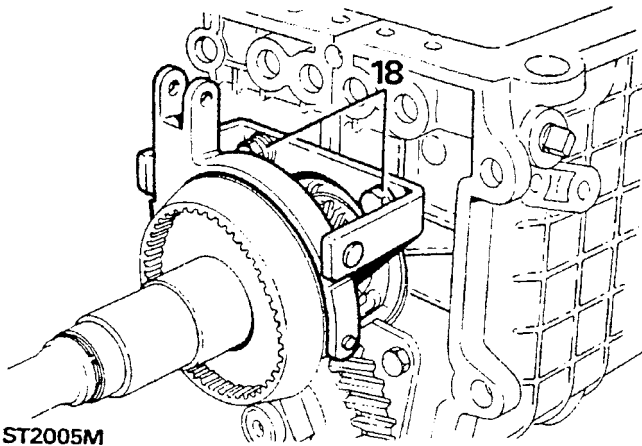


SELECTOR RAILS AND FORKS

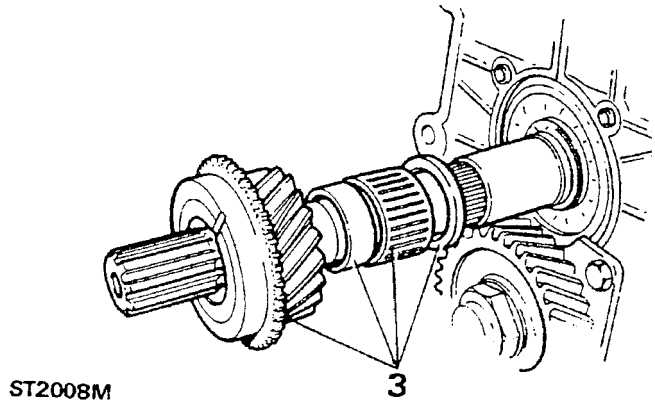


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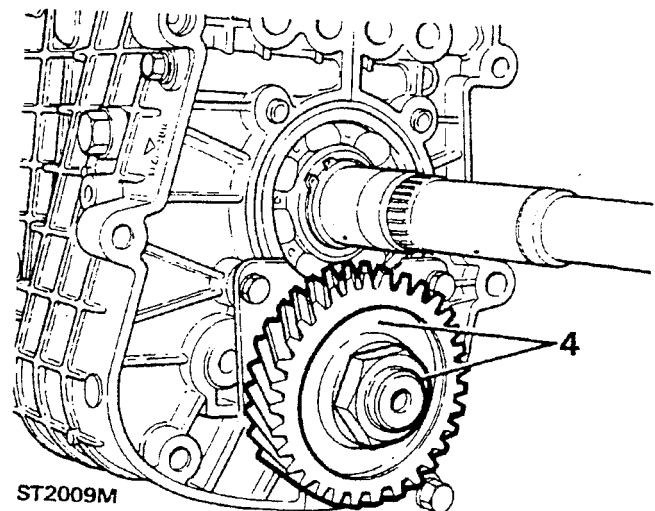
- Remove the two bolts securing the fifth gear fork and bracket assembly to the gearbox. Do not displace the selector fork slipper pads when removing the fork.



- Remove the fifth gear, spacer, needle roller bearing and thrust washer.

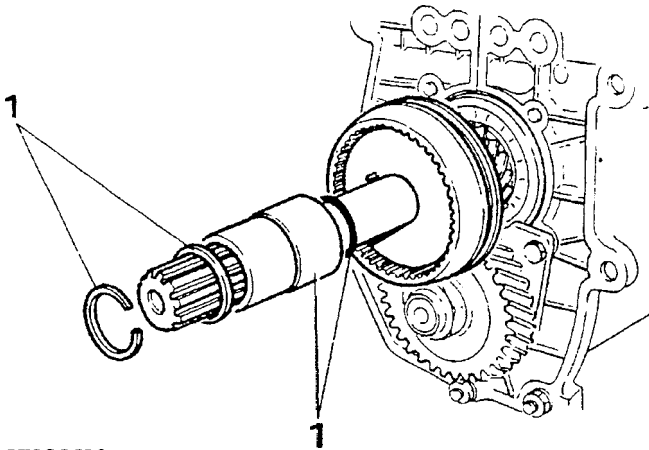


- Engage both first and fourth gears to lock the gearbox. Release the stake nut collar from the recess in the layshaft and remove the nut and fifth gear.

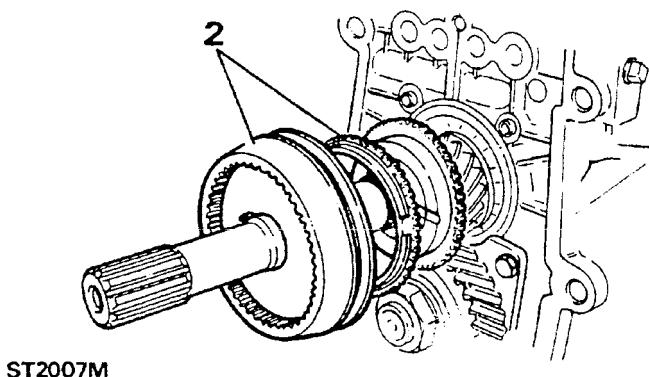


### Reverse shaft, mainshaft, and layshaft.

- Remove the circlip, selective washer, oil seal collar, and "O" ring from the mainshaft.

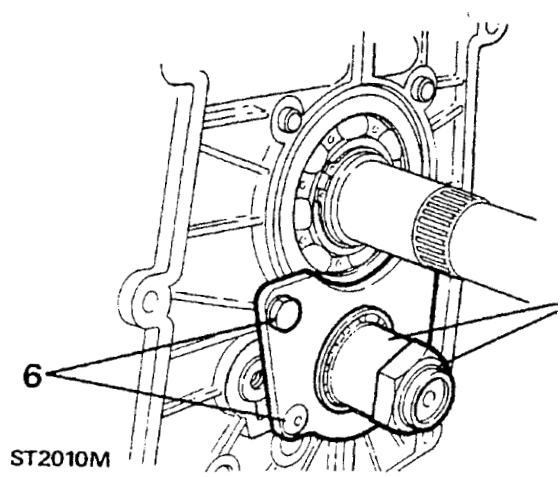


- Remove the fifth gear synchromesh hub and baulk ring.

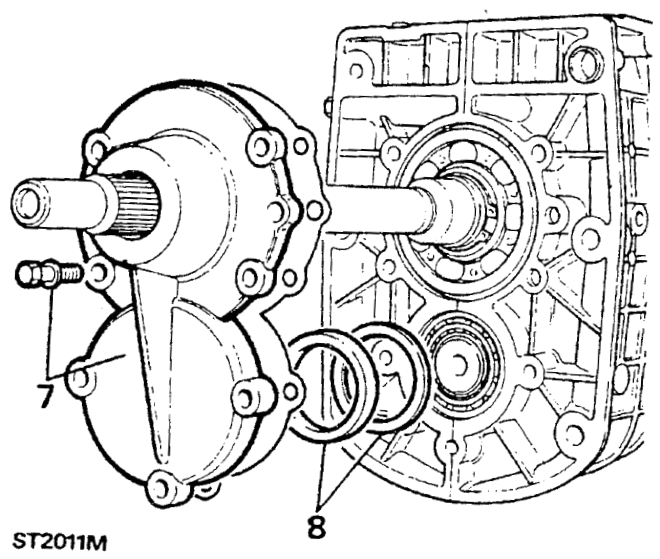


- Fit the manufactured spacer to the layshaft to keep the rear bearing in position and retain with the stake nut, finger-tight only. Disengage the first and fourth gears.

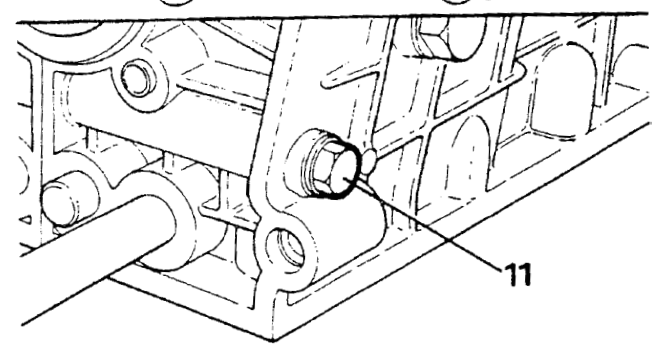
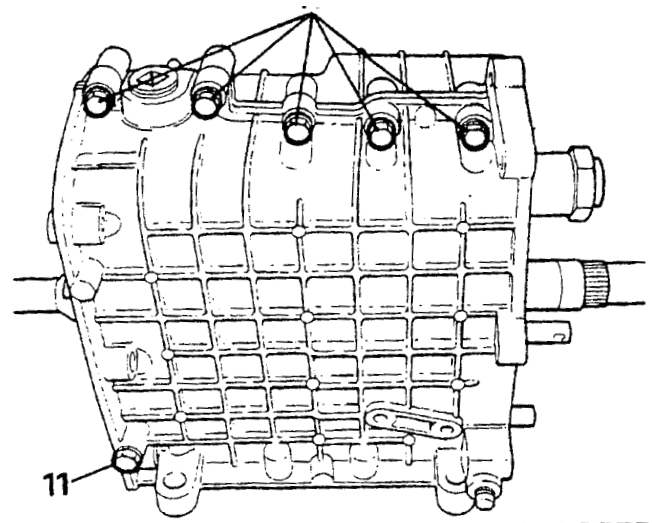
- Remove the two socket-headed set screws and two bolts and remove the plate that retains the layshaft bearing track and reverse shaft.



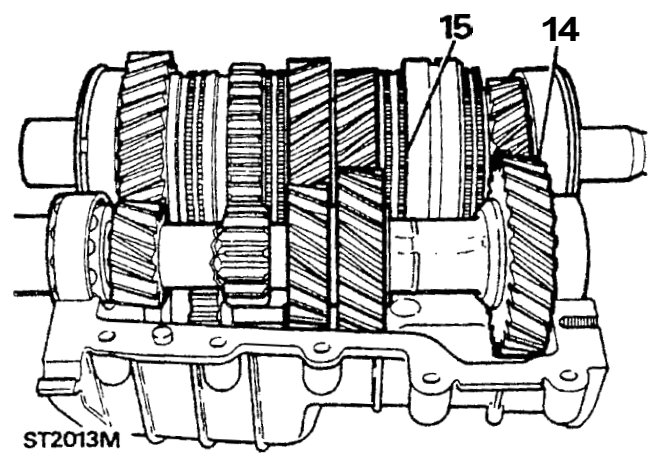
- 7. Remove the seven bolts and withdraw the front cover and gasket.
- 8. Remove the layshaft front bearing spacer and shims.



- 9. Remove the gearbox case and stand from the vice.
- 10. Remove the stand from the case.
- 11. Remove the seven bolts that secure the two halves of the case together.
- 12. Rest the case on the bench with the reverse gear idler side downwards.
- 13. Carefully separate the case by tapping with a hide mallet alternately at the four corners, to break the seal.

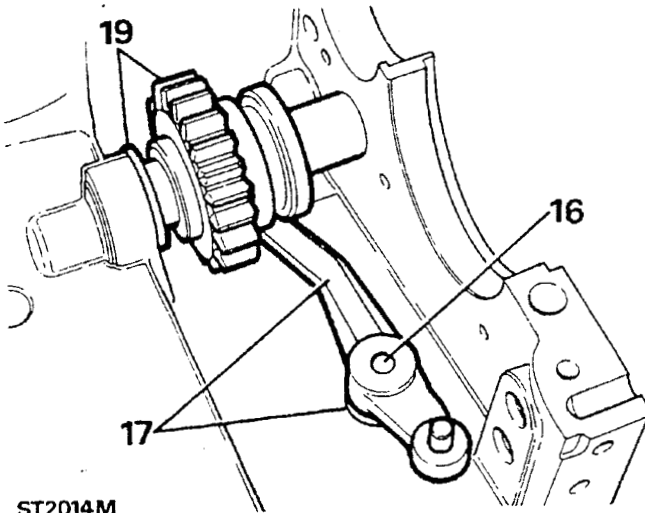


- 14. Lift-out the layshaft assembly.
- 15. Remove the mainshaft assembly.



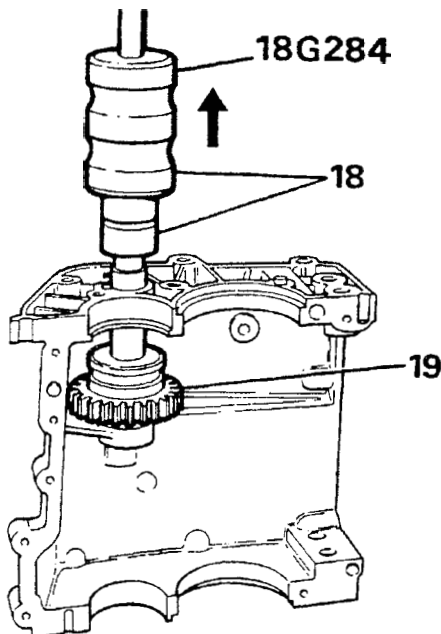
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16. Remove the reverse lever pivot bolt from the outside of the casing.
17. Remove the reverse lever and spacer from the idler gear and case.



ST2014M

18. To remove the reverse gear idler shaft, place the case on a block of timber and with assistance, hold the case firmly and drive-out the shaft using impulse extractor 18G 284 and adaptor LST 284-1.
19. Remove the reverse idler gear and thrust washer.



ST2015M

## INSPECTION AND OVERHAUL.

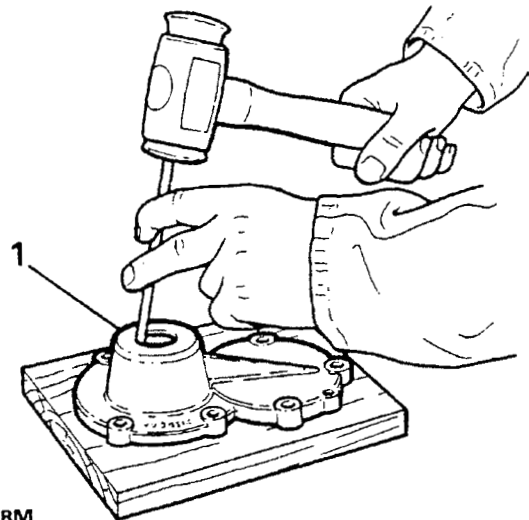
### Main gearbox case

**Note:** The following instructions 1 to 4 are only necessary if the gear casings, plugs or dowels are being renewed.

1. Remove the drain plug.
2. Remove the filler/level plug.
3. Remove the interlock cross drilling plug
4. Remove the six hollow dowels.

### Front cover.

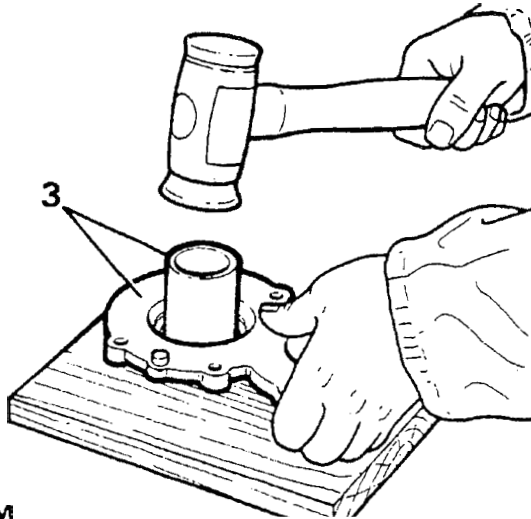
1. Place the front cover on a block of timber and drift-out the oil seal.



ST2018M

2. Clean the cover and check for damage or burrs.
3. Lubricate the outer diameter of a new seal and using a suitable tube, drift-in the seal, lip side trailing, squarely into the cover.

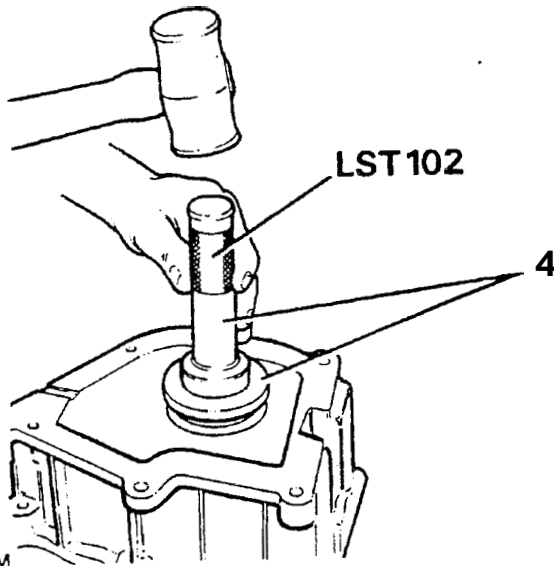
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**Gearbox fifth gear extension housing.**

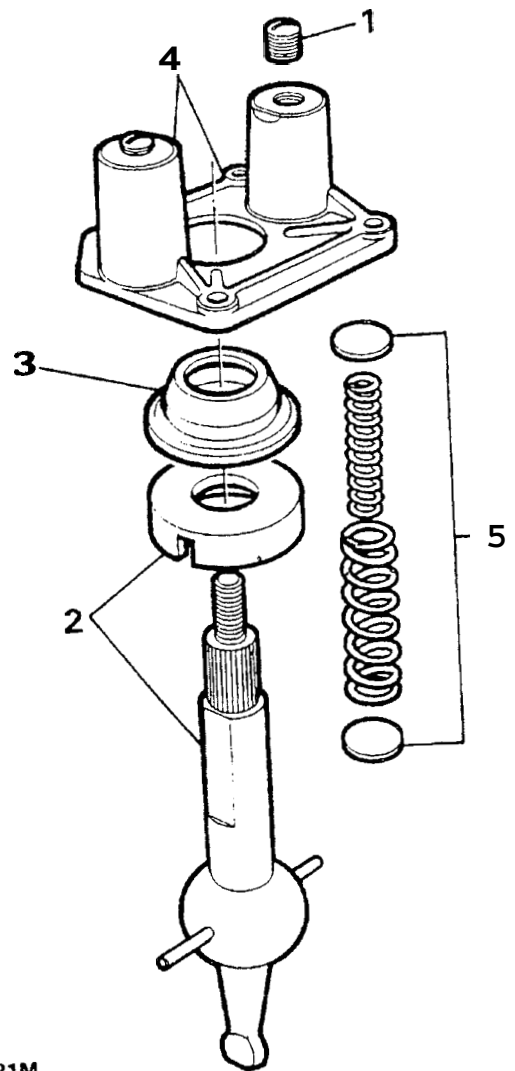
1. Remove the rear oil seal from the extension housing using a suitable drift.
2. If necessary, renew the extension housing dowels.
3. Clean the the exterior and interior and the mating faces.
4. Using service tool LST 102 fit a new seal to the extension housing.



ST1349M

**Bias spring housing and lower gear lever**

1. Secure the housing in a vice and remove the bias spring adjusting screws.
2. Clean the lower gear lever and nylon cup. Check for wear and damage.
3. Check the rubber dust cover for damage.
4. Clean the housing, adjusting screws and bias spring bores.
5. Clean and examine the bias springs.
6. Refit the bias spring screws, two turns only at this stage.



ST2021M

**Top cover**

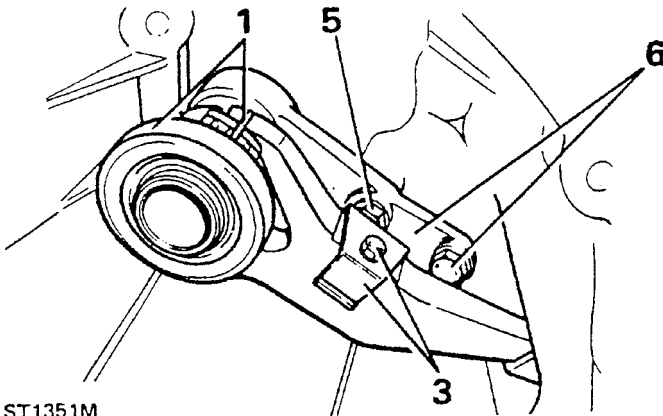
1. Clean top cover gasket faces and the interior and exterior surfaces.
2. Remove the top filler plug, clean, apply sealant and refit.
3. Clean the gear lever housing and check for cracks and wear.

## Bell housing.

1. Remove the clip retaining the thrust bearing carrier to the clutch operating lever fork if still in position.

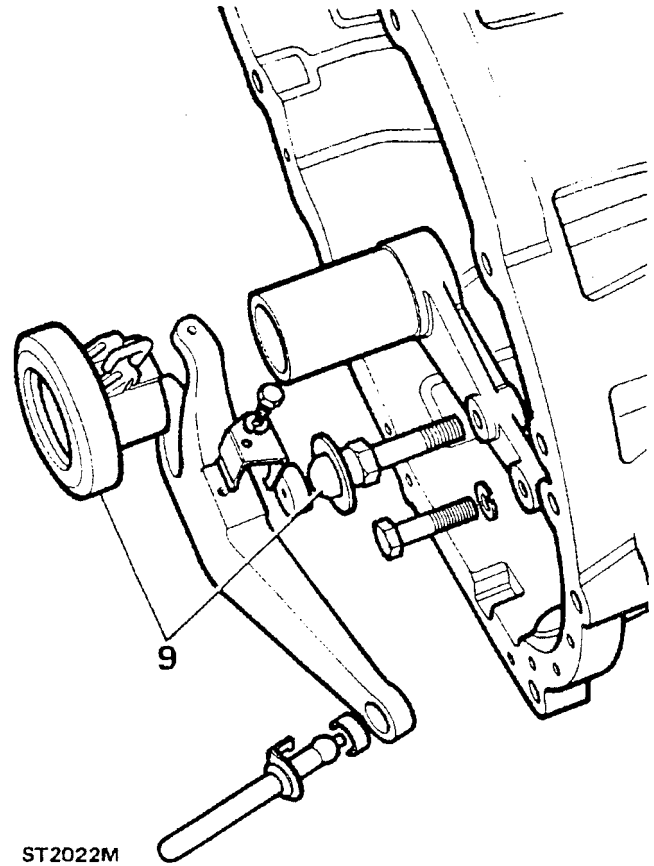
**Note: the clip is fitted during assembly to prevent the bearing sliding forward when the gearbox is being fitted to the engine and it may become dislodged in service without detriment.**

2. Withdraw the thrust bearing and carrier assembly from the sleeve.
3. Remove the bolt and spring washer securing the operating lever pivot clip to the lever.
4. Remove the operating lever and pivot slotted washer.
5. Remove the operating lever pivot.
6. Unscrew the single-bolt and remove the bearing sleeve from the bell housing.



ST1351M

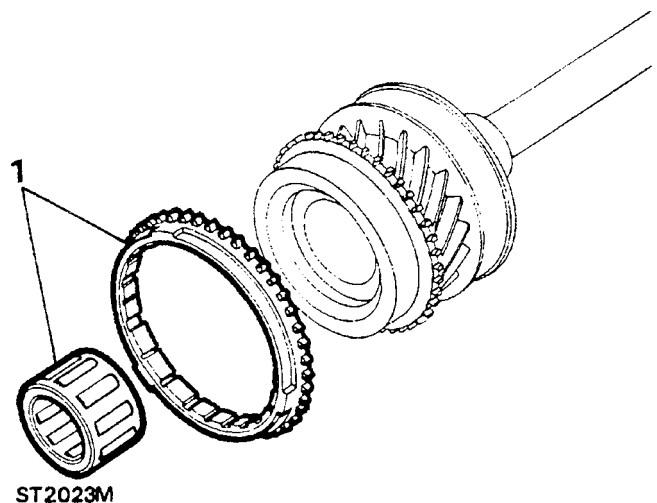
7. If necessary, remove the bearing sleeve dowels.
8. Clean the bell housing exterior and interior and mating faces.
9. **Apply** grease to the lever pivot and inner diameter of bearing carrier.
10. Reassemble the bell housing in the reverse order of dismantling.



ST2022M

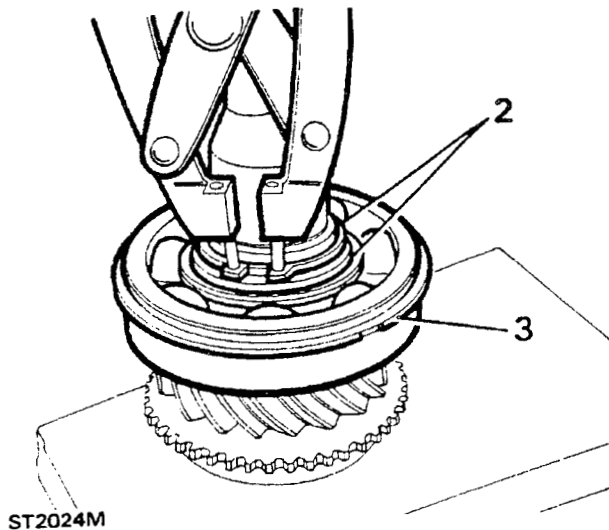
## Input shaft

1. Remove the fourth gear baulk ring and needle roller bearing.

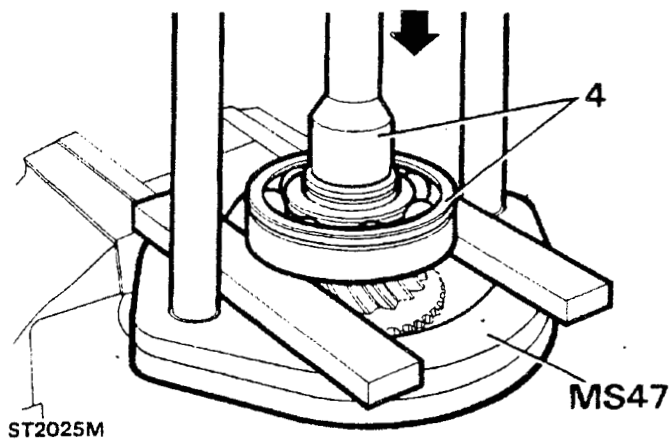


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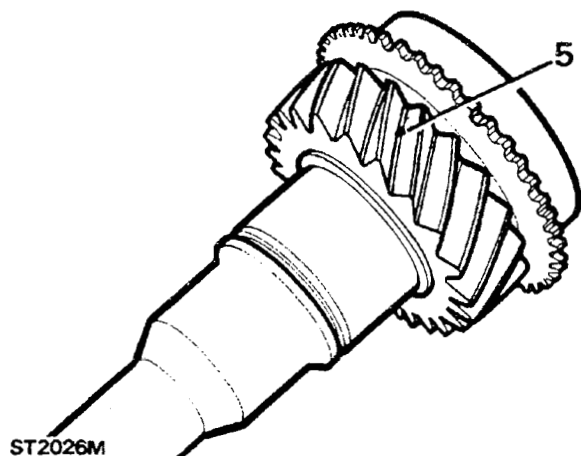
2. Remove the circlip and selective thrust washer.
3. Remove the snap ring from the bearing.



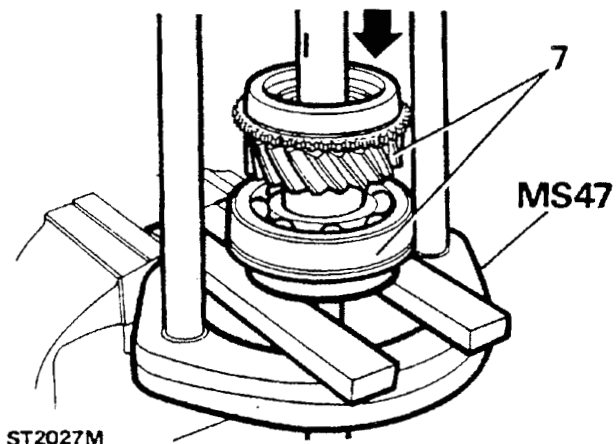
4. Using press MS 47 and two suitable steel blocks, press the input shaft from the bearing.



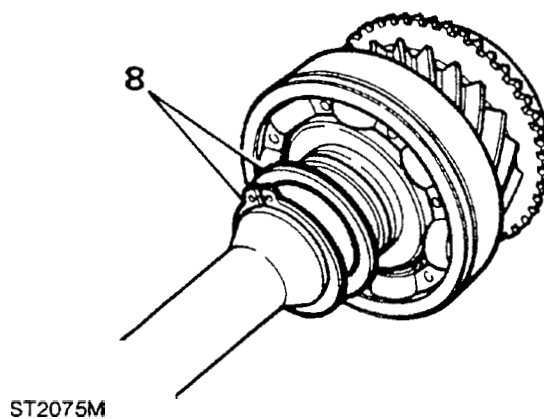
5. Clean all components and ensure that the two oil-ways in the input shaft are clear by blowing through with an air line.



6. Check the input shaft and gear for wear, scores and pits.
7. Using press MS 47 and a suitable tube, fit the input shaft to the bearing with the snap ring groove outwards.

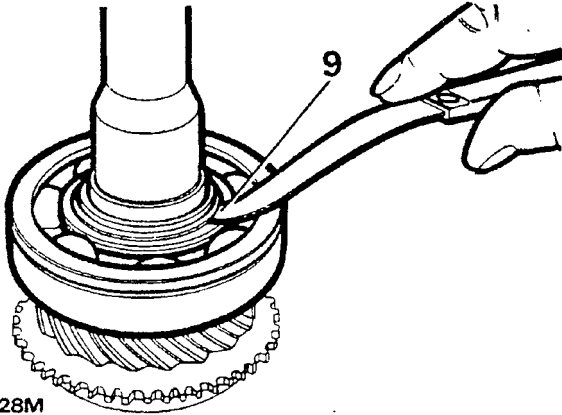


8. Fit the original selective washer and circlip.

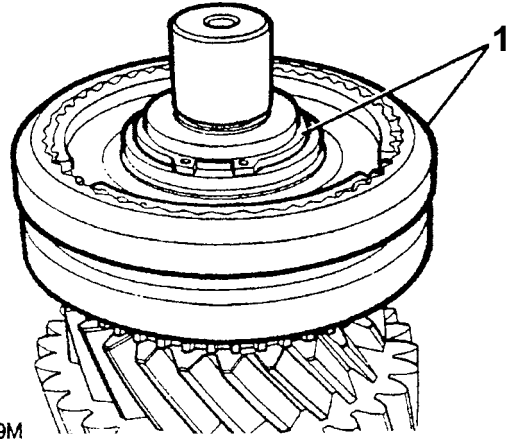


9. Check, with a feeler gauge, the clearance between the bearing and washer. If the clearance is in excess of 0,075mm remove the circlip and washer and select and measure a new washer to take-up the excess clearance.

Continued

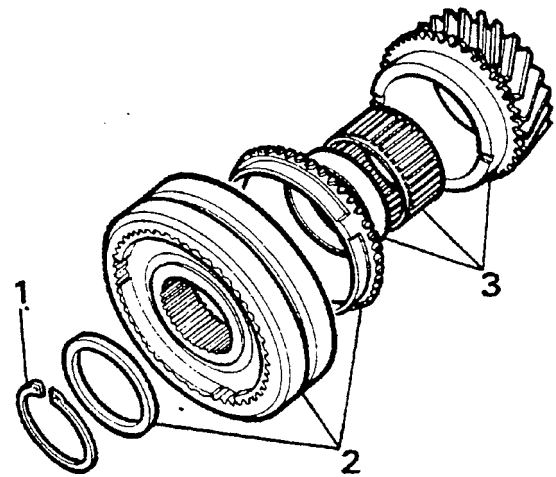


ST2028M

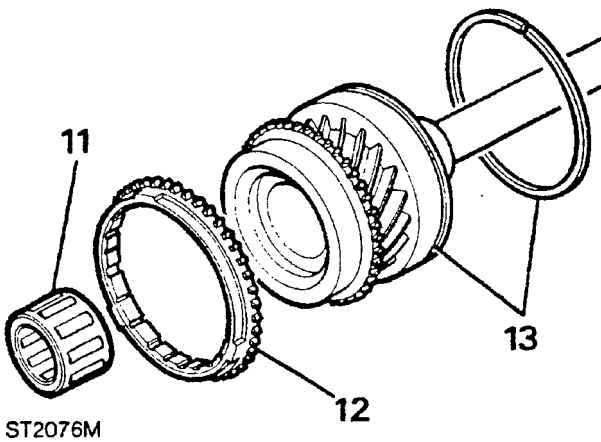


ST2029M

10. Fit the new selective washer, retain with the circlip and recheck that the above clearance is maintained.
11. Lubricate the mainshaft pilot bearing and fit to the mainshaft.
12. Fit the fourth gear baulk ring to the input shaft.
13. Fit the snap ring to the bearing.

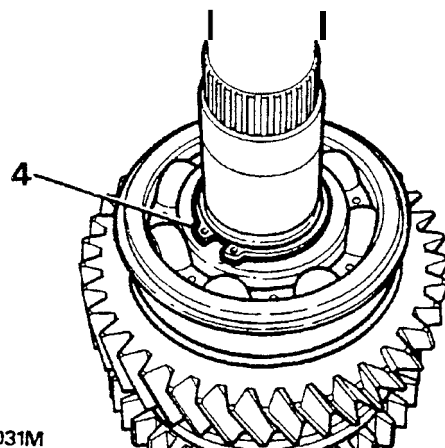


ST2030M



ST2076M

4. invert the mainshaft assembly, in the vice, and remove the mainshaft rear bearing circlip.



ST2031M

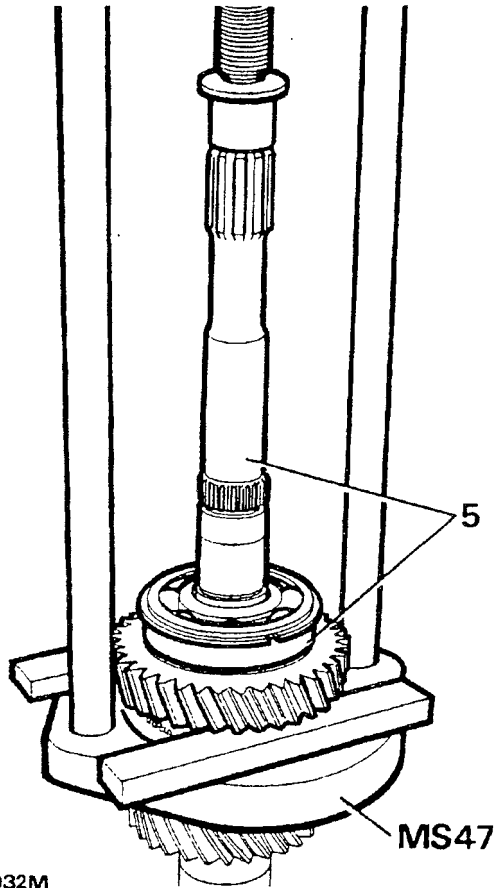
## Mainshaft

1. Secure the mainshaft assembly in a vice and remove the circlip retaining the third/fourth synchrohub and gear assembly.
2. Remove the selective washer, third/fourth synchrohub assembly and baulk ring.
3. Remove the third gear, spacer, and needle roller bearing.

Continued

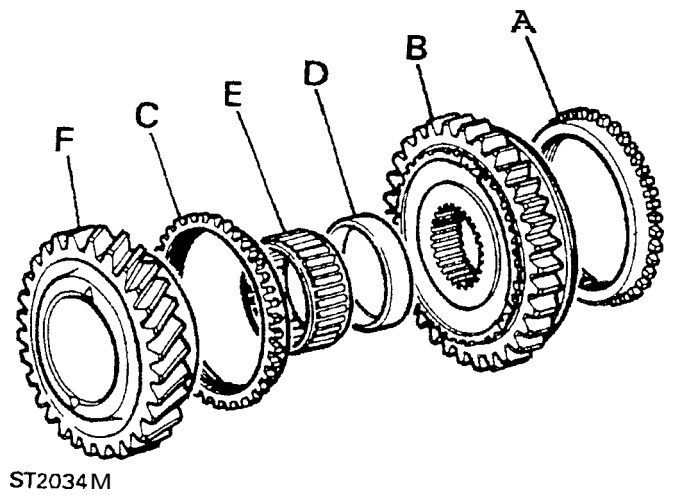


5. Using press MS 47, and a support under the first gear, press the mainshaft assembly from the rear bearing.



7. In addition remove the remaining items:-

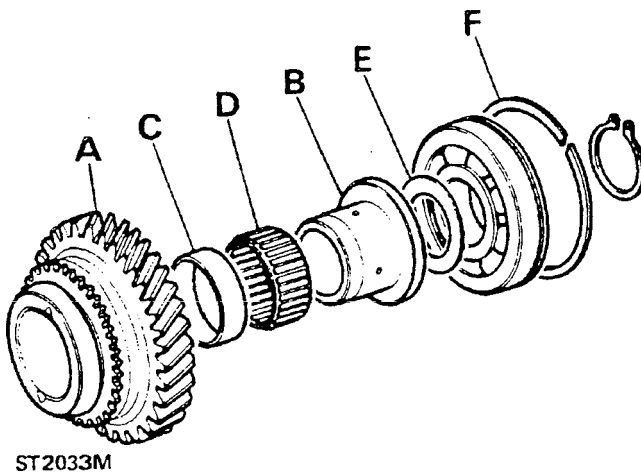
- A. First gear baulk ring.
- B. First and second synchromesh.
- C. Second gear baulk ring.
- D. Second gear spacer.
- E. Second gear needle roller bearing.
- F. Second gear.



8. Clean the mainshaft and all components and examine for obvious wear.

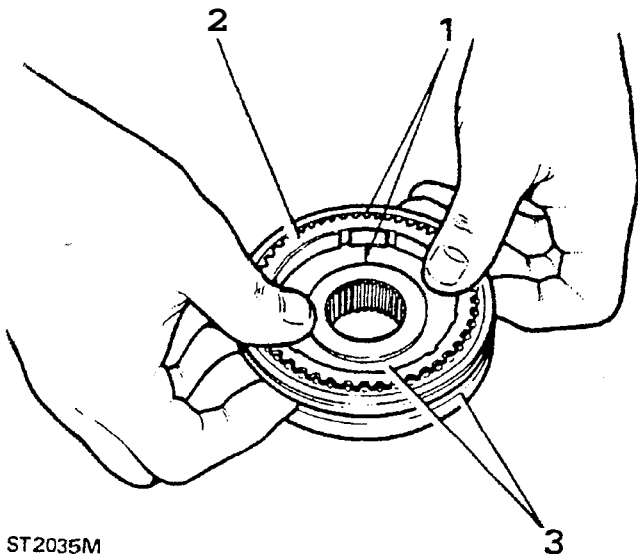
6. Separate the following components from the assembly:-

- A. First gear.
- B. First gear bush.
- C. Spacer.
- D. needle roller.
- E. Selective washer.
- F. Rear bearing snap ring.



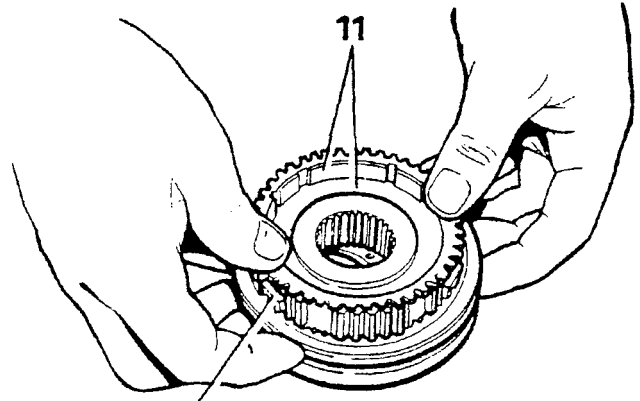
## First/second synchromesh assembly.

1. Before dismantling, mark the relationship of the synchromesh hub to the sleeve.
2. Fit the baulk rings to the synchromesh assemblies to facilitate dismantling and to prevent damage to the springs.
3. Place the synchromesh assembly in a clear plastic bag, to prevent the components being lost and whilst in the bag, press the sleeve from the hub.



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4. Retrieve the synchromesh balls, springs and slipper pads and remove the baulk ring.
5. Clean all the synchromesh assembly components.
6. Before reassembling the synchromesh units carry out the checks for third and second gear end floats as described under the heading "Mainshaft and gear train clearance checks".
7. Fit the synchromesh hub to the sleeve ensuring that the alignment marks line-up.
8. Place the hub and sleeve on a level block.
9. With the hub resting on the block adjust the height of the hub sufficiently to fit the springs.
10. Locate the slipper pads, fit the springs and press the balls down to be retained by the synchromesh sleeve.
11. Fit the baulk ring to the hub and sleeve.



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12. Carefully invert the synchromesh assembly and fit the second baulk ring.
13. Press the synchromesh sleeve over the hub to locate the balls in position.
14. Remove the baulk rings.

## Third/fourth synchromesh assembly.

1. Repeat the instructions as for the first/second synchromesh assembly but omit the gear end-float checks.
2. when reassembling the synchromesh unit, ensure that the large chamfer on the sleeve faces the small boss on the hub.

## Fifth gear synchromesh assembly.

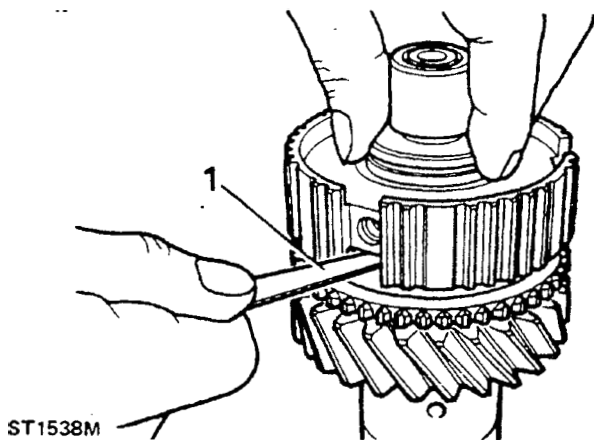
1. Repeat the instructions relating to the first/second synchromesh assembly.
2. Note that when reassembling the fifth gear synchromesh, the chamfer on the hub, faces to the rear.

**Mainshaft and gears clearance checks.****Running clearances**

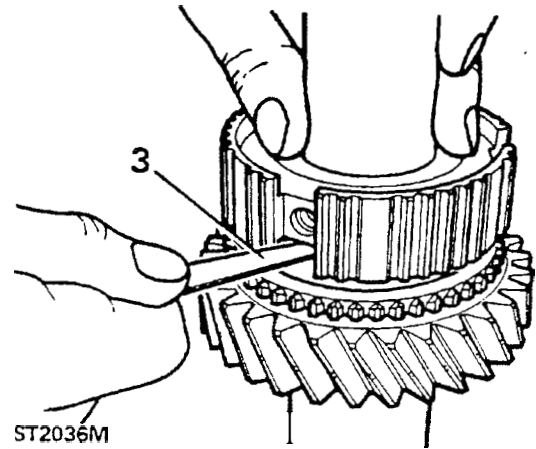
Mainshaft 1st gear	0,075mm maximum
Mainshaft 3rd gear	0,075mm maximum
Mainshaft 5th gear	0,075mm maximum
Input shaft bearing	0,075mm maximum

**Third gear end-float.**

1. Locate the mainshaft in a vertical position as shown. Fit the third gear, needle roller bearing and spacer to the mainshaft and replace the third/fourth synchronesh inner member. Press down on the synchronesh inner member and check the gear running clearance with a feeler gauge. A clearance in excess of 0,19mm (0.008ins.) indicates that the thrust faces are worn and may be the cause of gear noise or transmission back-lash. New or little worn components will usually have a clearance of between 0,075mm and 0,125mm (0.003in to 0.005in)

**Second gear end float**

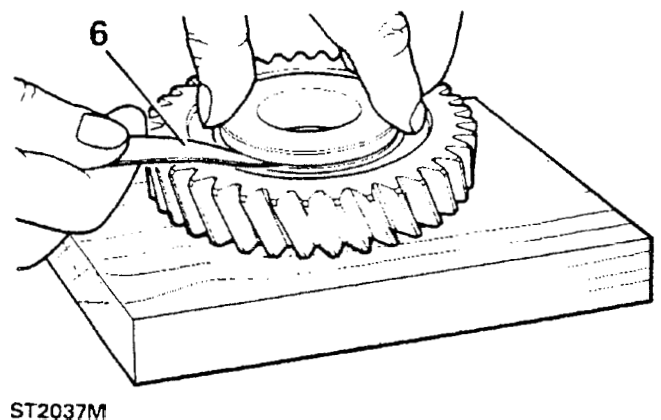
2. Invert the mainshaft for assembly of the rear end components.
3. Fit the second gear needle roller bearing, spacer, Second gear and synchronesh inner member. Press down on the synchronesh inner member and check the second gear end float which is the same as the third gear previously described.



4. Remove the synchronesh inner member and assemble it to the outer member with the slippers, balls and springs.
5. Fit the second gear baulk ring to the mainshaft and the first and second synchronesh hub with the selector groove towards the rear end of the shaft. See items 11 to 17 mainshaft gears, illustration ST2071M page 6.

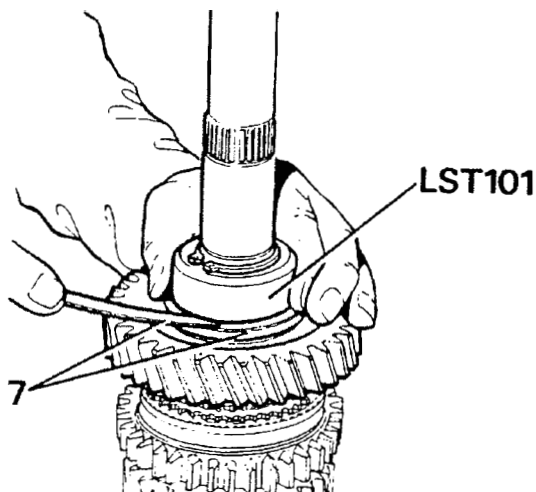
**First gear to bush end-float.**

6. To carry-out the first gear check, do not assemble the components to the mainshaft. Assemble the spacer, needle bearing and bush to the first gear and using a suitable straight edge or flat plate, check the end float of the first gear on the bush, as shown. The tolerance is the same as for the third and second gears.



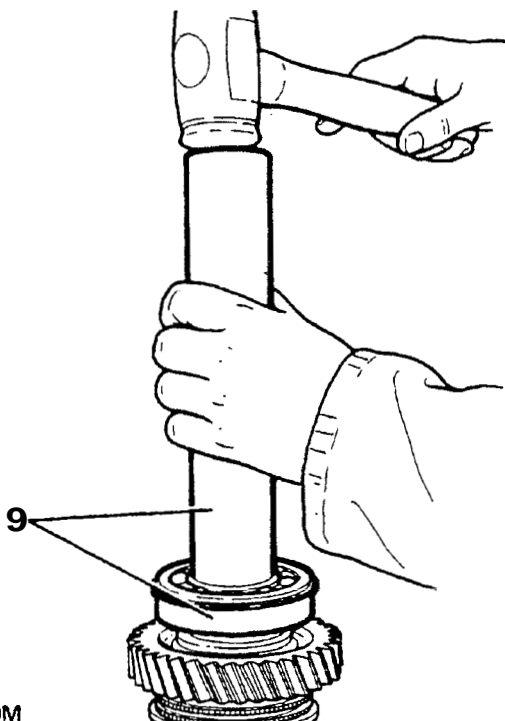
## First/second synchronesh end float.

- Assemble, to the first gear, the spacer, needle roller bearing and first gear bush and fit the assembly to the mainshaft. Fit the original selective washer and dummy mainshaft rear bearing LST 101 and retain with the circlip. With a feeler gauge, check the end-float as shown. Choose a suitable selective washer to obtain a minimum clearance of 0,075mm (0.003ins.)



ST2038M

- Remove the dummy bearing and fit the selective washer.
- Start the mainshaft rear bearing squarely on the mainshaft then,

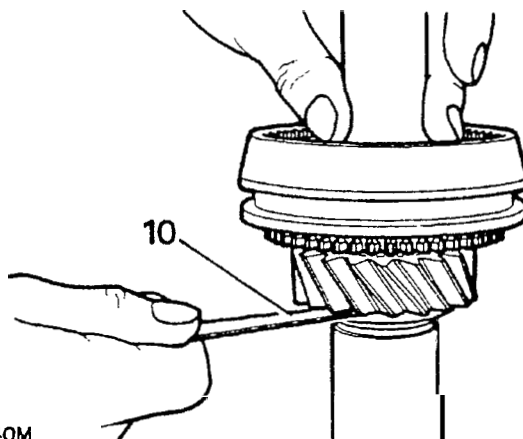


ST2039M

without inverting the shaft, use either a press, capable of accomodating the complete mainshaft assembly, or drive the bearing into position using a suitable tube. Secure the assembly with the circlip.

## Fifth gear end-float.

- Fit the fifth gear thrust washer with the scallop side towards the gear. Fit the fifth gear, needle bearing and spacer followed by the synchronesh assembly, less the baulk ring at this stage. Press down on the synchronesh inner member and check the gear end float, as shown, between the gear and thrust washer. The tolerance is the same as that for the third gear end float.



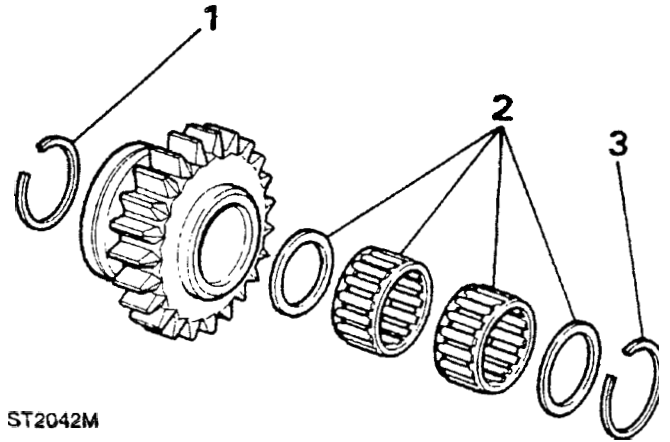
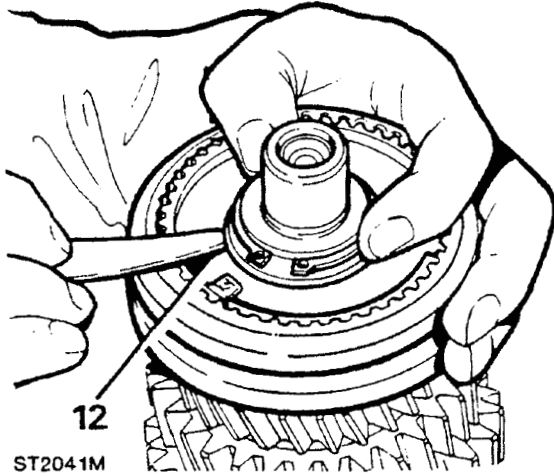
ST2040M

## Third- fourth synchronesh end float.

- Invert the mainshaft to a vertical position, as shown. Fit the third gear needle roller bearing, spacer, third gear, baulk ring and synchronesh with the larger thrust face towards third gear and the chamfer on the outer member towards the front. Fit the original selective washer and retain with the circlip.

Continued

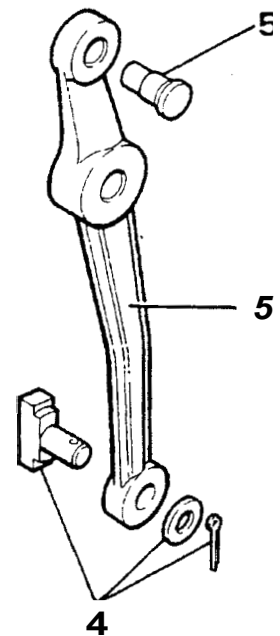
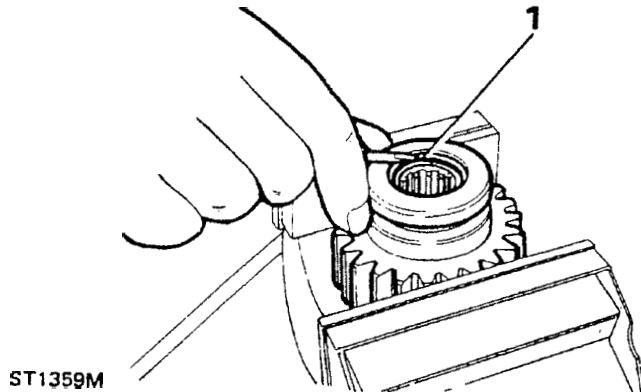
12. Check the clearance between the washer and the synchromesh hub. the clearance must not exceed 0,075mm (0.003ins). The condition is ideal when the selective washer can be just turned by hand.



4. If necessary, remove the split pin and withdraw the slipper pads and washer from the reverse gear lever.
5. Press-out the reverse lever cross link pin, if necessary.

**Reverse idler gear, shaft and lever.**

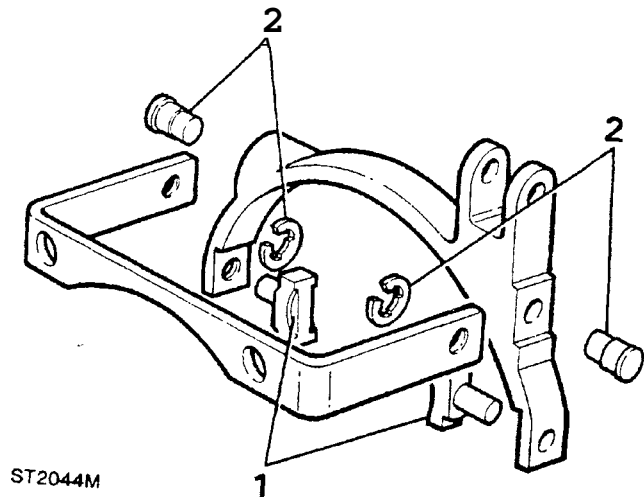
1. Secure the reverse gear in a vice and remove one of the two circlips retaining the bearings.



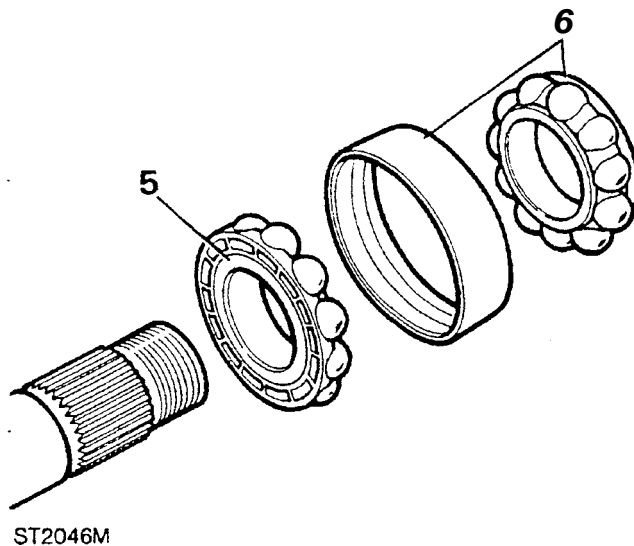
2. Remove the upper thrust washer, two needle roller bearings and lower thrust washer.
3. Invert the reverse gear and remove the second circlip.

## Fifth gear selector fork and bracket.

1. Remove the slipper pads from the selector fork and check for wear.
2. If necessary, remove the circlips and withdraw the pivot pins.
3. Clean all components and refit or renew in reverse order.

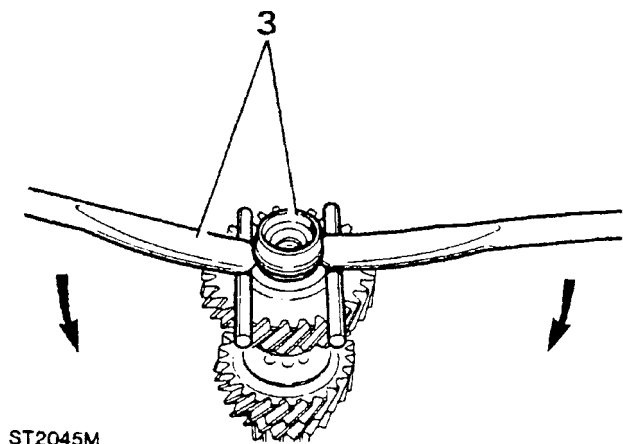


4. Clean the layshaft and bearings and check for wear, pitting and scores.
5. Fit the rear bearing assembly and note that the inner track must be fitted with the identification numbers facing inwards towards the layshaft first gear.
6. Fit the track and outer bearing with the identification numbers facing outwards towards the fifth gear.

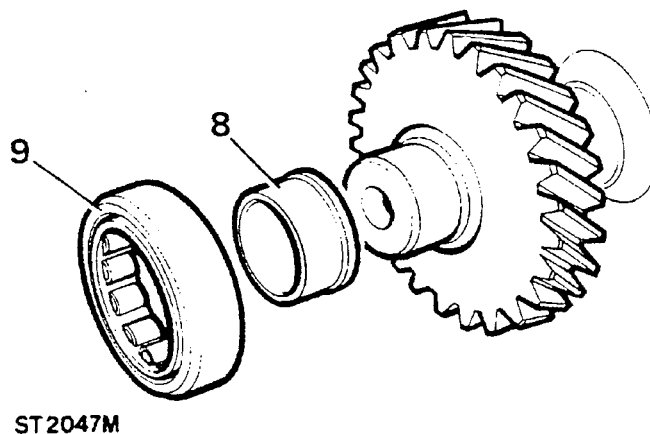


## Layshaft.

1. Remove the stake nut and spacer and withdraw the complete rear bearing.
2. Remove the layshaft front bearing.
3. Secure the layshaft in a vice and lever-off the front bearing inner track.



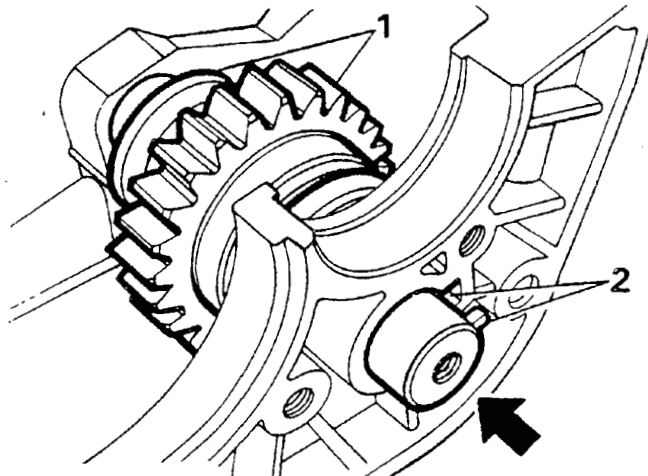
7. Fit the dummy spacer and stake nut loosely to retain the bearing assembly in position on the shaft.
8. Fit the front bearing inner track with the shoulder towards the gear. carefully tap the track squarely into position with a hide mallet.
9. Fit the front bearing race.



**ASSEMBLE.**

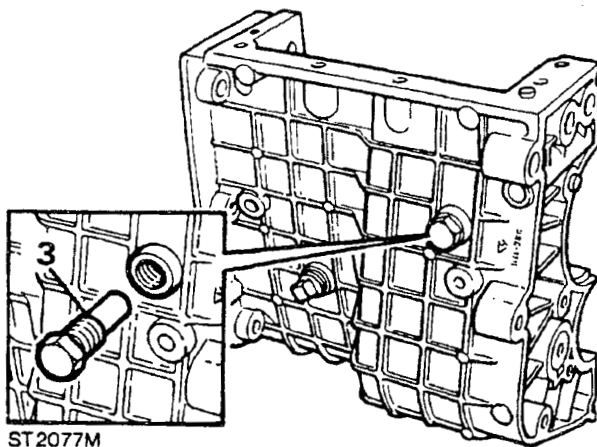
**Fitting reverse idler shaft and gear.**

1. Position the reverse idler gear and thrust washer in the casing with the thrust washer and the chamfer on the thrust washer, towards the gear.
2. Insert the idler shaft into the casing and through into the idler gear and washer. Ensure that the oil pin in the shaft lines-up with the cut-out in the casing, then drive the shaft fully home.



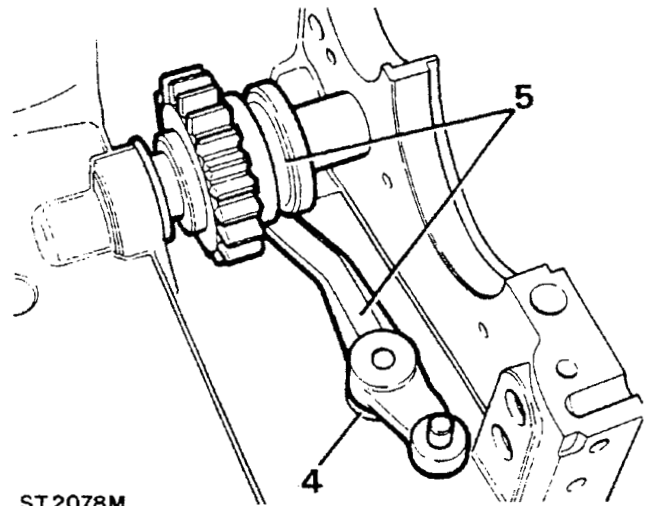
ST 2048M

3. Coat the threads of the reverse lever pivot bolt with Loctite 270 and fit to the casing and tighten to the correct torque.



ST 2077M

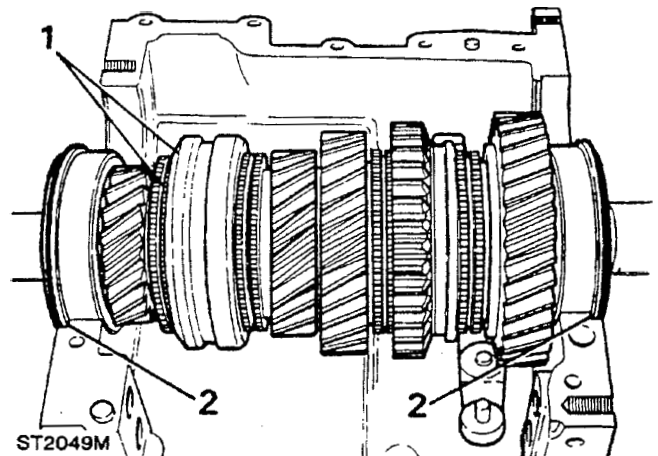
4. Fit the spacer next to the casing.
5. Fit the lever to the pivot whilst ensuring that the slipper locates in the reverse idler gear groove.



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**Fitting mainshaft and input shaft.**

1. Fit the input shaft to the mainshaft assembly ensuring that the baulk ring engages correctly into the third/fourth synchromesh hub.
2. Lower the above assembly into the gear case noting that the snap ring on the front and rear bearings locate against a shoulder in the casing.



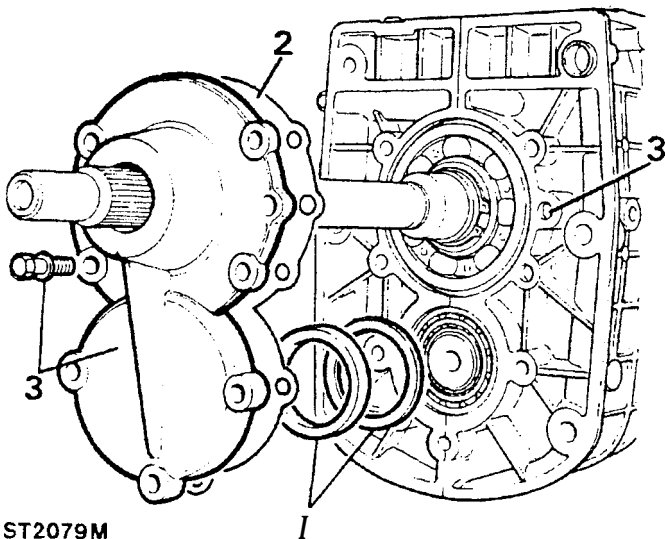
ST 2049M

## Fitting layshaft.

1. Hold the layshaft above the mainshaft assembly and engage the two sets of gears into mesh and roll the layshaft into position in the case. Check that the rear bearing locates against the shoulder in the case.
2. Wipe clean the mating faces of both cases and apply Loctite instant Casket in accordance with the manufacturers instructions.
3. Lower the empty case into position over the gears locating on the dowels.
4. Loosely secure the cases with the seven bolts and tighten evenly to the correct torque 22 to 28 Nm. (16 to 21 lbs.ft.). Clean away any surplus sealant.
5. Refit the stand to the gearbox and secure in the vice.

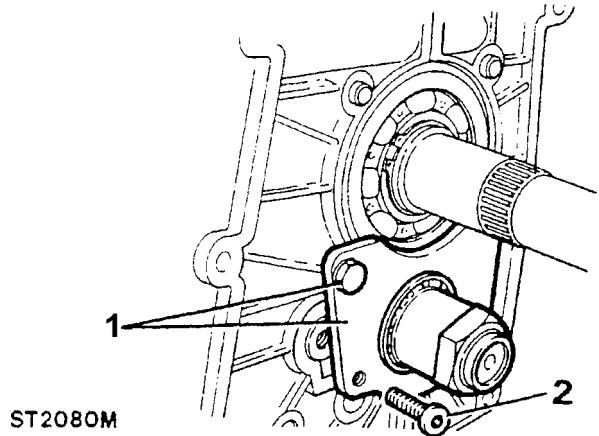
## Fitting front cover

1. Fit the original shim and spacer to the layshaft front bearing.
2. Fit a new joint washer to the cover and lubricate the oil seal lip.
3. Taking care not to damage the seal lip, fit the cover to the gearbox locating it over the dowels. Secure with the seven bolts and spring washers and tighten evenly to the correct torque.



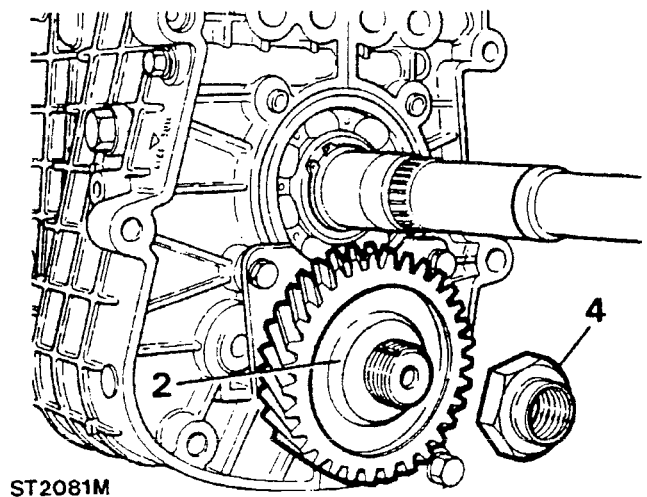
## Fitting rear retainer plate

1. Fit the retainer plate to the gearbox and secure the top of the plate with the two bolts and spring washers.
2. Apply Loctite 270 (stud and bearing fit) to the socket headed screw threads and secure the lower end of the retaining plate.



## Fitting layshaft fifth gear.

1. Remove the nut and dummy spacer from the layshaft.
2. Fit the fifth gear to the layshaft with the large boss to the rear.
3. To facilitate the next instruction, lock the gearbox by engaging first and fourth gears.
4. Fit a new fifth gear retaining nut and tighten to the correct torque. Do not stake the nut at this stage.

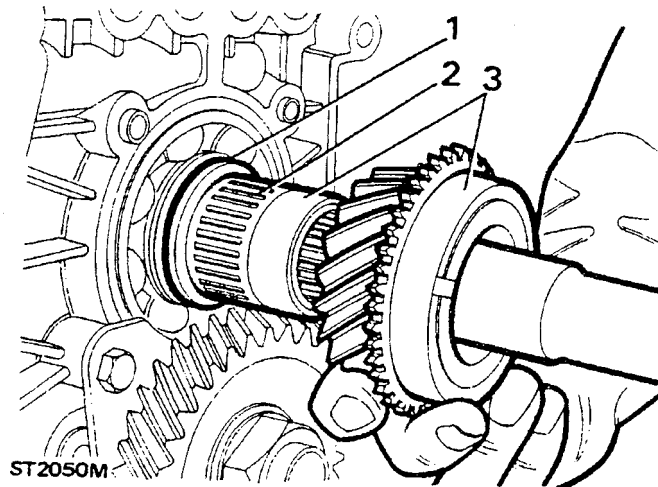




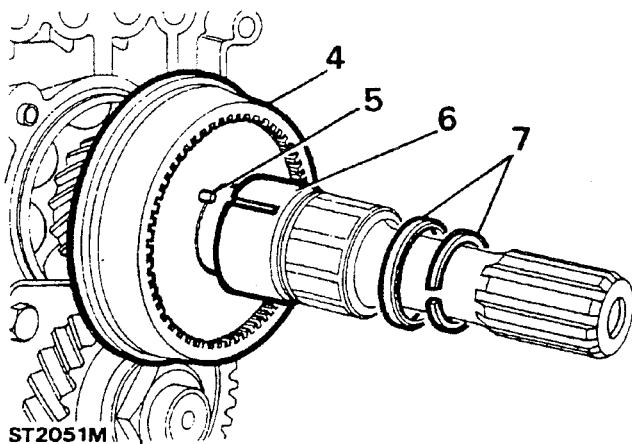
5. Disengage the first and fourth gears.

**Fifth gear synchromesh end float.**

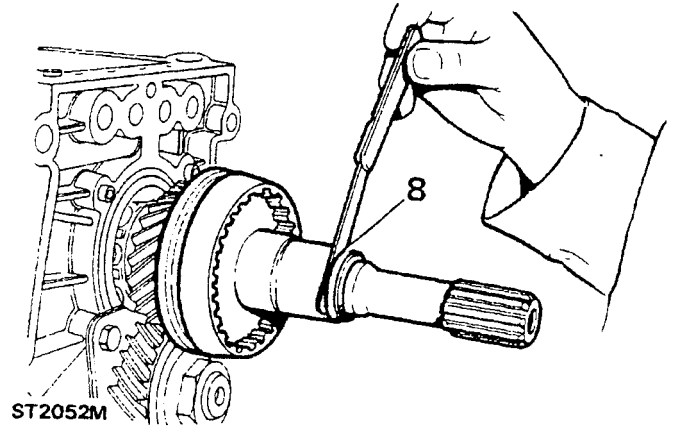
1. Fit the thrust washer, grooves outwards, towards fifth gear.
2. Lubricate and fit the needle roller bearing to the mainshaft.
3. Fit the spacer and fifth gear.



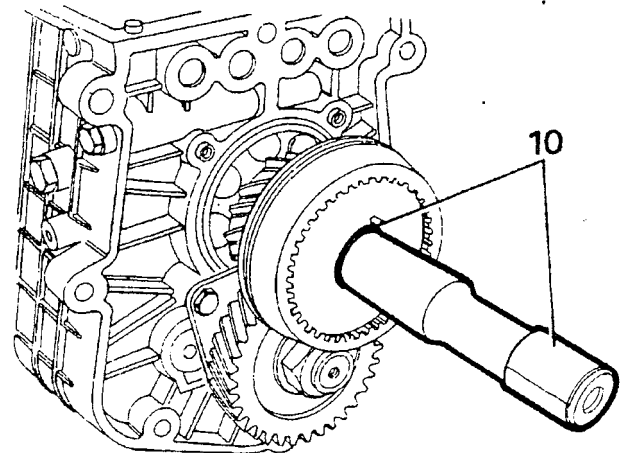
4. Fit the fifth gear synchromesh cone and hub assembly.
5. Fit the fifth gear synchromesh hub retaining plate, peg outwards.
6. Omit the "O" ring and fit the sleeve with the slot over the peg.
7. Fit the original selective washer and retain with the snap ring.



8. Using a feeler gauge, measure the clearance between the washer and the sleeve. If necessary exchange the washer for one that will provide a clearance of 0,075mm (0.003ins.)



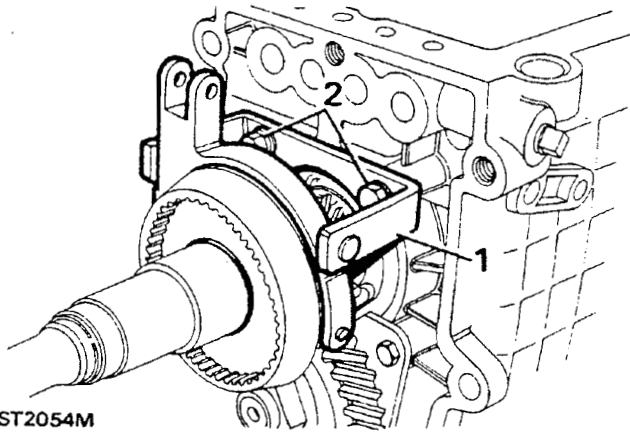
9. Remove the snap ring, selective washer and sleeve.
10. Wind protective tape round the mainshaft splines and fit the "O" ring seal against the synchromesh hub retaining plate.



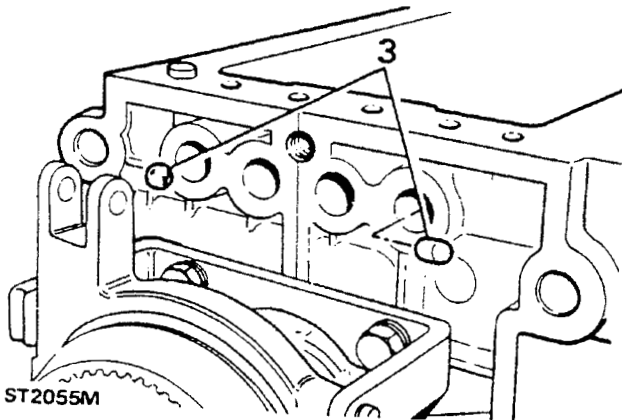
11. Refit the sleeve, selective washer and snap ring and remove the protective tape.

## Fitting selector rails and forks.

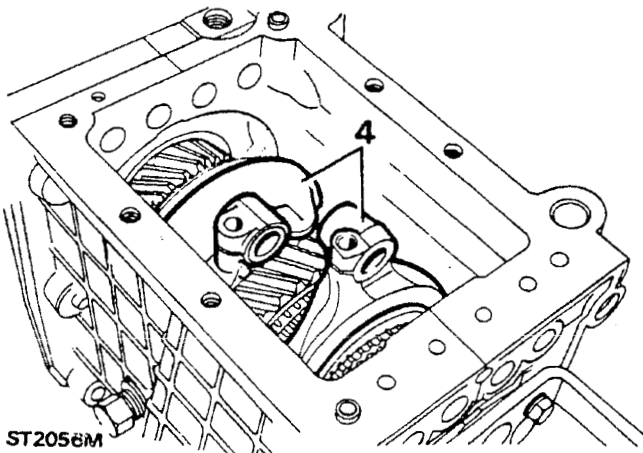
1. Locate the fifth gear fork and bracket on to the synchromesh hub and gearbox dowels.
2. Secure the fork bracket to the gearbox with two bolts and plain washers.



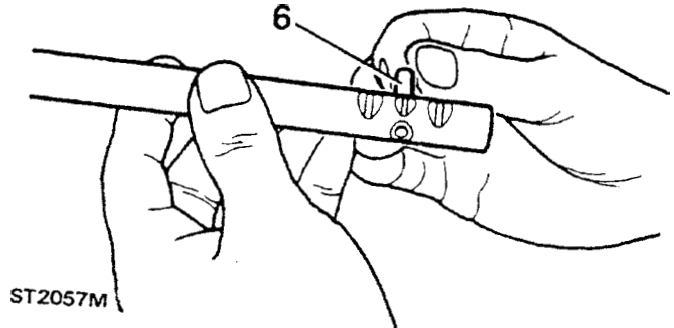
3. Fit the selector rail interlock plungers to the gearbox case.



4. Fit the first/second and third/fourth selector forks.



5. Place the reverse gear cross-over lever in position in the gearbox locating the fork end over the reverse lever operating pin.
6. insert the interlock plunger into the first/second selector rail.

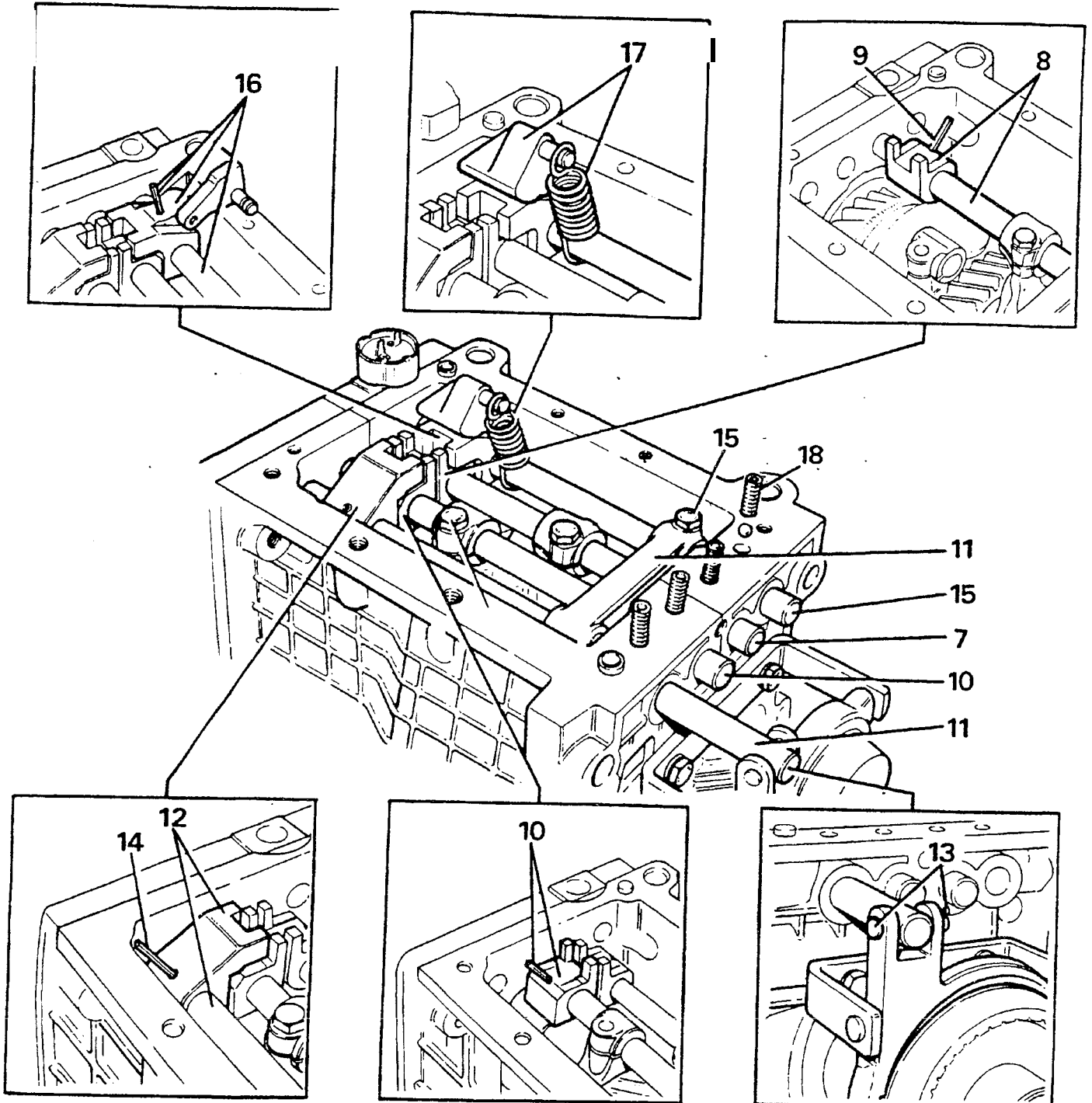


7. Push the first/second selector rail into the gearbox and locate in the reverse cross-over lever and selector fork. Do not tighten the fork clamp bolt at this stage.

**Note: the first/second fork clamp bolt is not a set bolt unlike the third/fourth fork clamp bolt.**

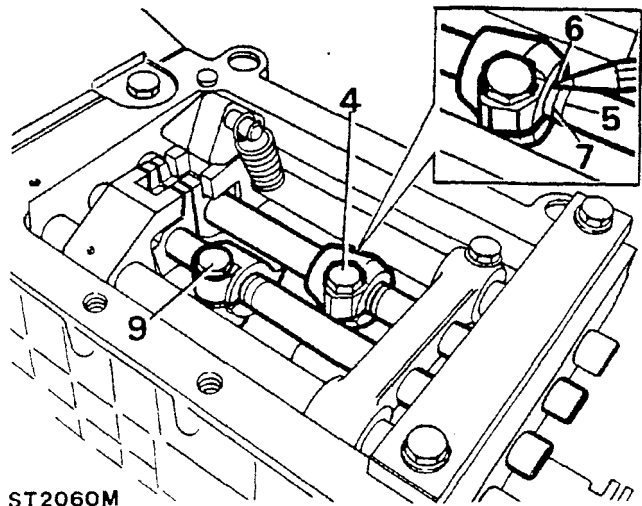
8. Fit the first/second selector jaw to the rail and align to accept the retaining roll pin.
9. Using a suitable drift, tap-in the roll pin to secure the jaw and rail.
10. Repeat instruction 9 for the third/ fourth selector rail and jaw.
11. Push the fifth gear selector rail through the gearbox and the reverse cross-over lever.
12. Fit the fifth gear selector jaw to the rail and align to accept the roll pin.
13. Locate the selector rail into the fifth gear selector fork and secure with the clevis pin, washer and split pin.
14. Secure the jaw to the fifth gear selector rail with the roll pin.
15. Push the reverse selector rail through the gearbox and reverse cross-over lever but do not tighten the lever clamp bolt at this stage.

Continued



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16. Fit the **jaw** to the reverse selector rail, align the holes, and secure with the roll pin using a suitable drift. The pin must be inserted so that it is flush with the underside of the jaw to ensure that the jaw is adequately retained.
17. Fit the reverse gate spring to the selector rail and knock-over lever.
18. Fit the detent balls and springs.

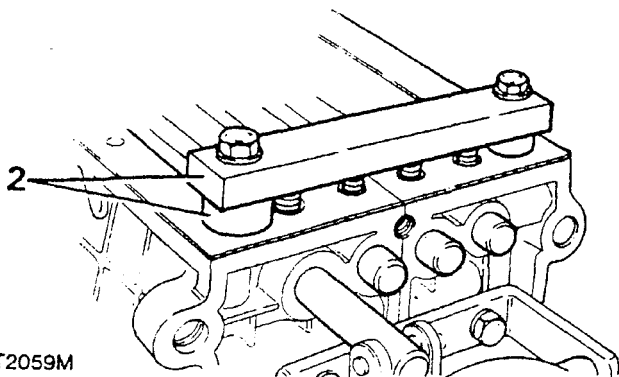


ST2060M

9. Repeat instructions 4 to 8 to adjust the third/fourth selector fork and rail.

### Selector fork adjustment.

1. Fit the top cover gasket.
2. Secure the detent spring retaining tool and spacers (manufactured tool) to the gearbox with two 8 x 50mm bolts and plain washers.



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3. Tighten the bolts to compress the detent springs until the retaining plate contacts the two spacers.
4. Ensure that the first/second selector rail and synchromesh sleeve are in the neutral position. Tighten the clamp bolt sufficiently to eliminate any rock in the selector fork and move the selector fork rearwards.
5. Scribe a pencil line on the rail at the rear of the fork yoke.
6. Move the fork forwards, to the original position and scribe another line at the rear of the yoke.
7. Now scribe a line midway between the two lines on the selector shaft.
8. Move the selector fork rearwards so that the yoke coincides with the centre line and tighten the clamp bolt.

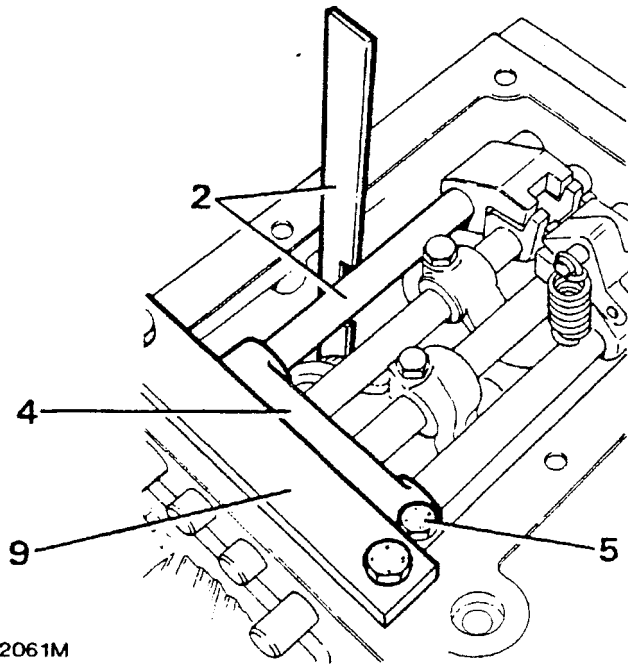
### Reverse cross-over lever adjustment.

The purpose of the following adjustment is to ensure that when first gear is selected the outer member of the first/ second synchromesh unit is not also engaged with the reverse idler gear.

1. Move the reverse idler gear thrust washer fully forward.
2. Fit the manufactured gauge to the reverse idler gear shaft so that it is between the idler gear and thrust washer.
3. Move the reverse gear selector rail rearwards to engage reverse gear.
4. Move the cross-over lever rearwards to lightly nip the gauge between the reverse gear and thrust washer.
5. Tighten the reverse cross-over lever clamp bolt and return the selector rail to the neutral position and remove the gauge.
6. Move the first/second selector rail rearwards to select first gear.

**Continued**

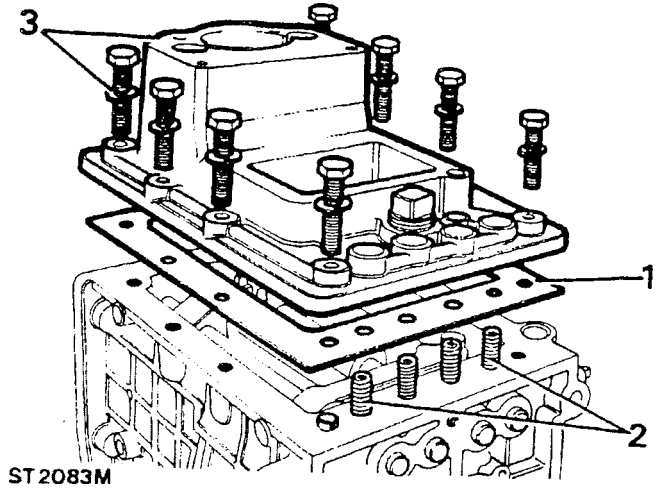
7. Check that a minimum clearance of 1,0mm exists between the front face of the reverse idler gear and the rear face of the reverse gear on the first/second synchromesh sleeve. If the clearance is insufficient, adjust the cross-over lever again.
8. Return the first/second selector rail back to neutral.
9. Remove the detent spring retaining tool and spacers



ST2061M

**Gearbox top cover.**

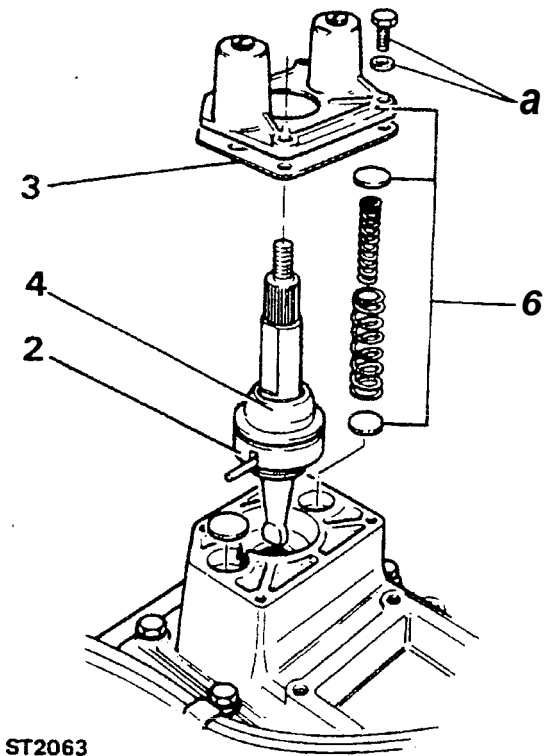
1. Fit the top cover gasket.
2. Fit the top cover locating it over the detent springs.
3. Position the breather pipe, locate retaining clips and secure the top cover with the eight bolts and spring washers.
4. Fit the breather pipe banjo union and fibre washers.
5. Fit the reverse light switch.
6. Place clean rag in top cover gear lever aperture to prevent the entry of dirt.



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**lower gear lever and bias spring housing**

1. Remove the rag from gearbox top cover.
2. Lubricate and fit the gear lever ball lower yoke and nylon cup.
3. Fit a new gasket to the housing.
4. Fit the rubber grommet.
5. Apply grease to the bias springs.
6. Fit the shims and bias springs, followed by the spring housing.
7. Secure with the four set screws and spring washers.



ST2063

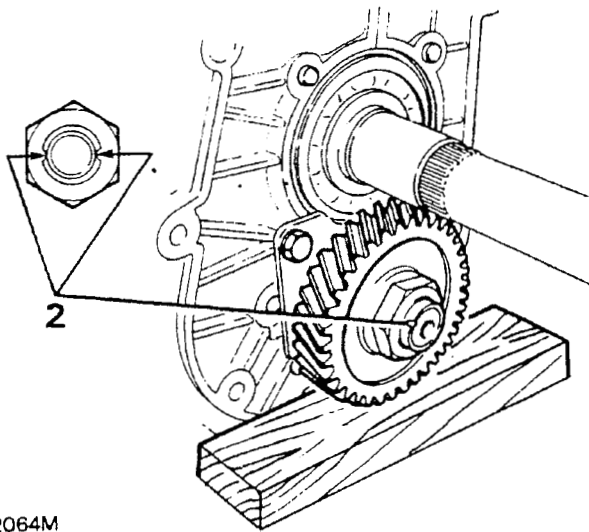
## Bell housing.

1. Fit a new bell housing gasket.
2. Locate the bell housing squarely on the dowels and secure to the gearbox with the six bolts and spring washers.

## Gearbox extension housing.

1. Remove the gearbox assembly from the vice and detach the stand.
2. The special nut retaining the fifth gear to the layshaft must be secured by carefully forming the collar of the nut into the layshaft slots, as illustrated.

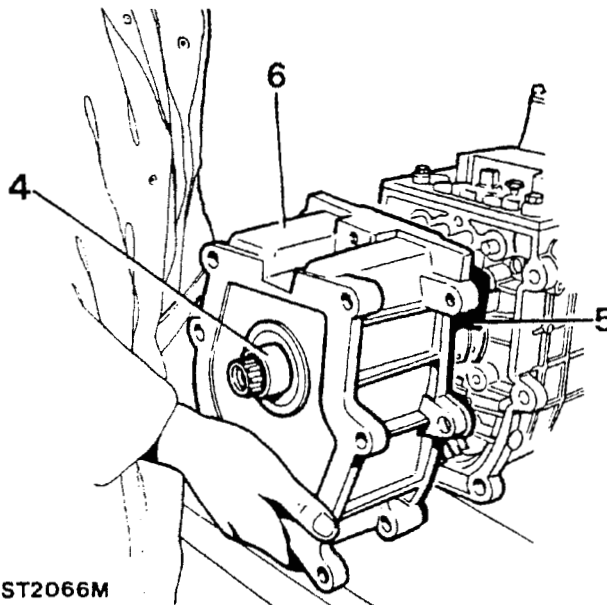
**CAUTION:** A round nose tool must be used for this operation to avoid splitting the collar of the nut. Also, the layshaft fifth gear should be supported by a block of timber whilst the nut is being deformed to prevent damage to the adjacent bearing.



ST2064M

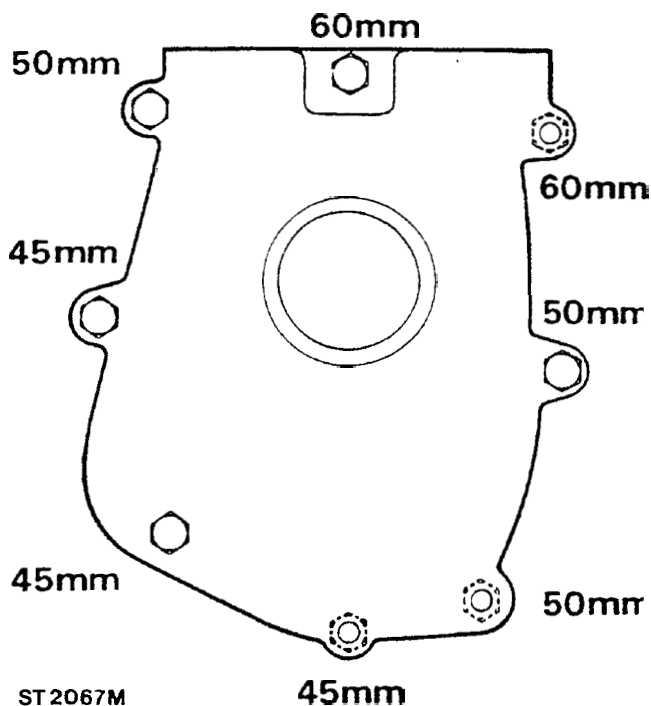
3. Support the underside of the gearbox with a block of timber.
4. Lubricate the oil seal protection sleeve LST 102 and insert it into the oil seal from inside the extension housing.
5. Fit a new gasket to the extension housing.

6. Carefully slide the extension housing, with the seal protection sleeve in position, over the mainshaft and locate on the dowels.



ST2066M

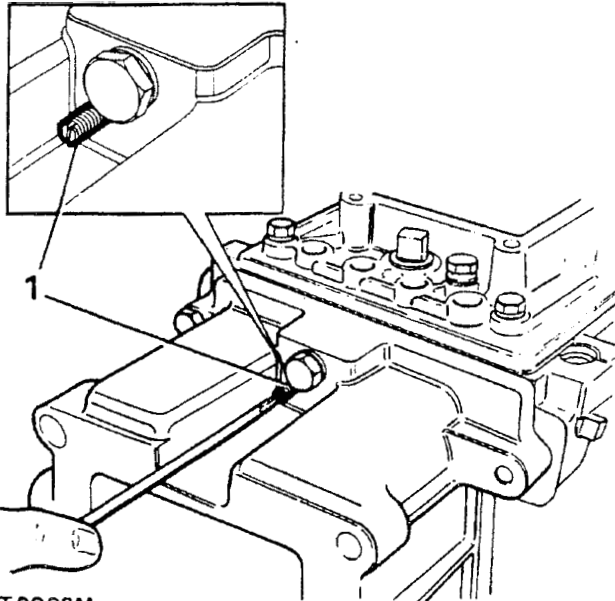
7. Withdraw the oil seal protection sleeve.
8. Secure the extension housing with the eight bolts, spring washers and single nut. The illustration below shows the correct length of bolt for each of the eight locations.



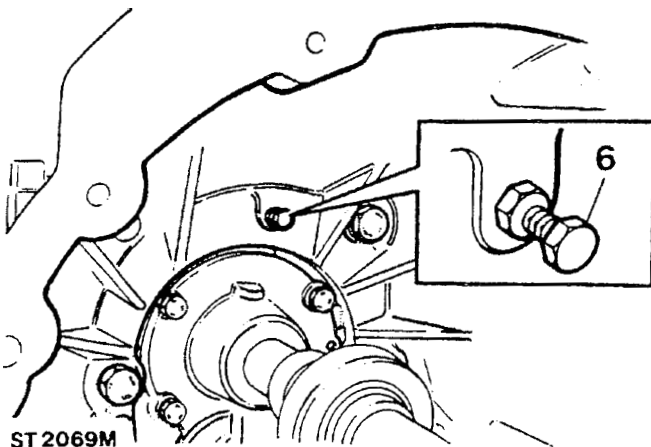
ST2067M

**Third/fourth selector rail adjustment**

1. Slacken the third/fourth stop screw in the extension housing.



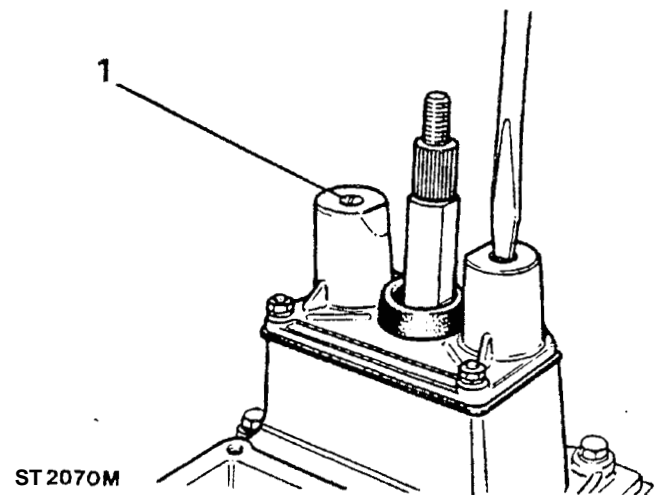
2. Select third gear.
3. Tighten the stop screw until it makes contact with the third/fourth selector rail.
4. Turn back the stop screw one turn.
5. Return the gear lever to the neutral position.
6. Slacken the locknut on the third/fourth stop bolt inside the bell housing.



7. Unscrew the stop bolt.
8. Select fourth gear and screw-in the stop bolt until contact is made with the third/fourth selector shaft.
9. Turn back the stop bolt one turn and tighten the locknut.
10. Return the gear lever to the neutral position.

**Bias spring adjustment.**

1. Apply Loctite stud and bearing fit 270 to the bias spring screws and turn the screws clockwise until the heads are flush with the top face of the bias spring housing.



**Gearbox mounting**

1. Fit the mounting to the extension housing and secure with the four bolts.







**Land Rover**

# Workshop Bulletin

ATTENTION SERVICE MANAGER

FEBRUARY 1988  
BULLETIN NUMBER SLR621ENWB4

## LAND ROVER 1988 MODEL IMPROVEMENTS

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Further supplies of this Bulletin can be obtained, free of charge, from:

Land Rover Merchandising Service  
P.O. Box 534, Erdington Birmingham B24 0QS

**SERVICE**

Land Rover Service Division

# 01 INTRODUCTION

## INTRODUCTION

Also included in the 1988 Year Land Rover model improvements are the following items which are fully described to assist the workshop. The first operation, whilst not being part of the improvement programme is, nevertheless, a continuation of the policy to replace material gaskets, where practicable, with liquid sealants. The opportunity has, therefore been taken to include, in this Bulletin, the latest, most significant change under this policy.

# 12 ENGINE

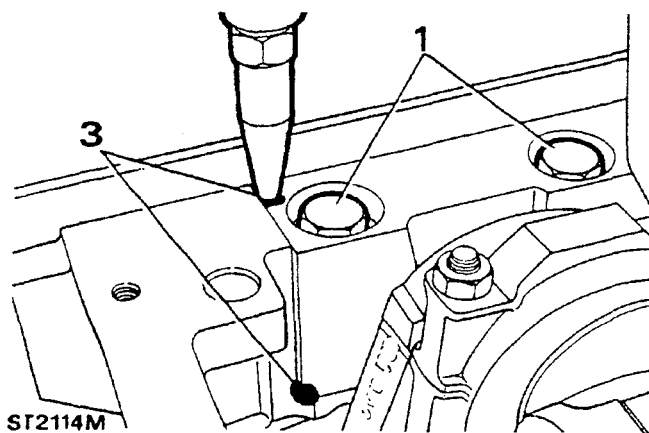
## ALL LAND ROVER FOUR CYLINDER ENGINES

### Rear main bearing cap sealing.

A change has recently been introduced to the method of sealing the rear main bearing cap. Hitherto sealing was accomplished using "T" shaped cork packing strips one each side of the cap. Sealing is now achieved by injecting "Hylosil" 102 (black) into the slots formally occupied by the packing strips. This material may also be used on all earlier engines where the caps were sealed with packing strips.

### The method is as follows:-

1. With the sump removed, fit the main bearing cap and tighten the bolts to the correct torque, 130-136 Nm (96- 100 lbf.ft.).
2. Turn the crankshaft to bring numbers two and three pistons to Top Dead Centre so that the crankshaft webs will not obscure the rear bearing cap.
3. Using a suitable applicator, inject the sealant into the main bearing cap slot adjacent to the bearing cap bolt recess until it emerges from the upper end of the slot.



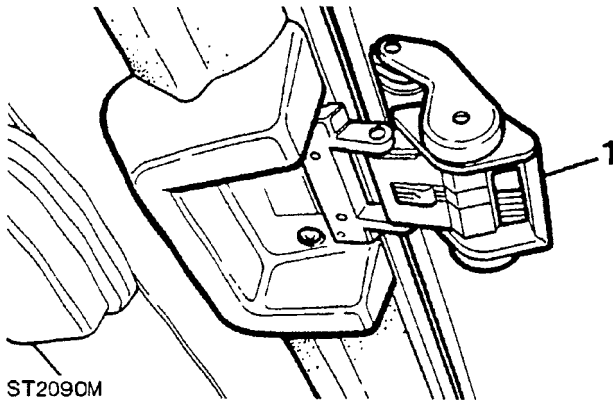
4. Repeat instruction 3 on the opposite side of the bearing cap.
5. Remove surplus sealant and fit the sump.

**Note: When removing surplus sealant from the sump gasket face, ensure that the sealant is cleaned-off level to the cylinder block machined face.**

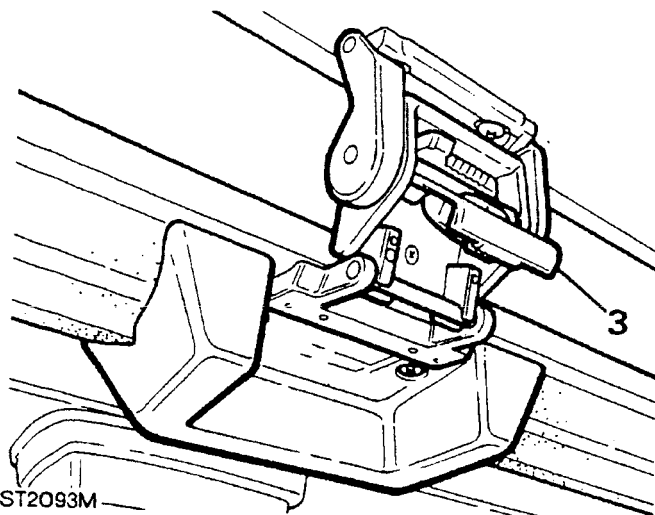
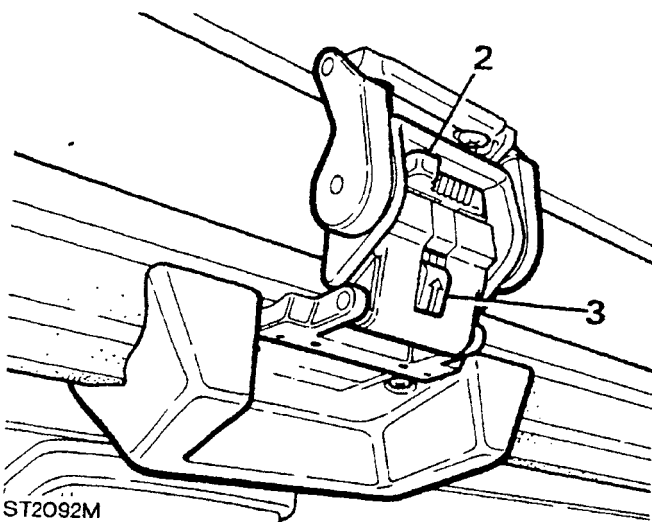
**SUN ROOF LAND ROVER "90"and"110".**

**To remove**

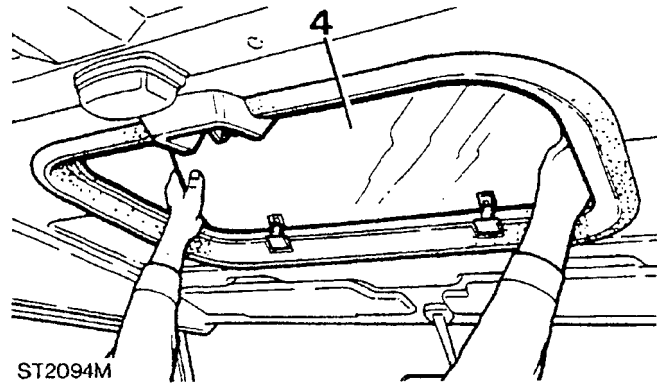
1. Open the roof panel to its fullest extent by pulling the latch handle down to the first open position.



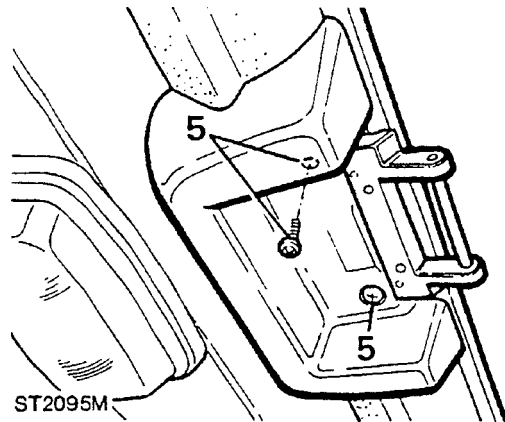
2. Then move the green button to the right and push the panel up as far as the latch will allow to the fully open position.
3. Move the red button upwards and open the retaining hasp.



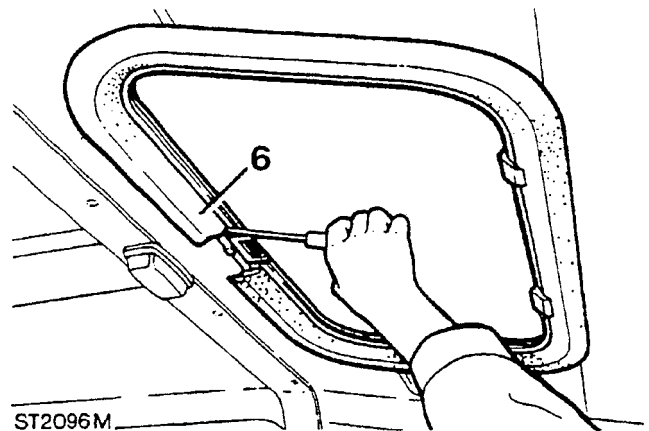
4. Raise-up the rear of the panel and withdraw it rearwards from the sun roof exterior surround.



5. Remove the two screws and withdraw the latch finisher.



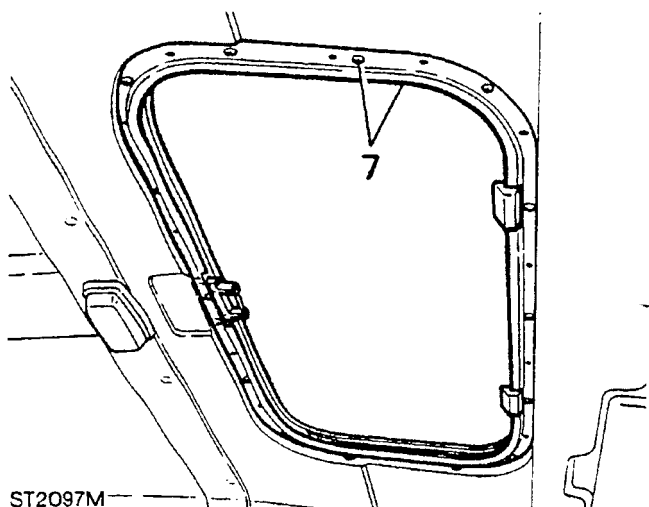
6. The sun roof interior finisher is secured by fourteen dowels to the sun roof outer frame retainer. To remove the finisher, carefully lever the finisher away from the retainer using a screwdriver with a broad blade.



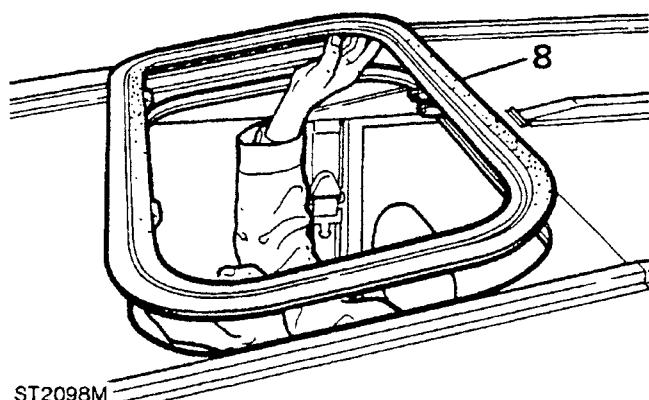
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# 76 BODY

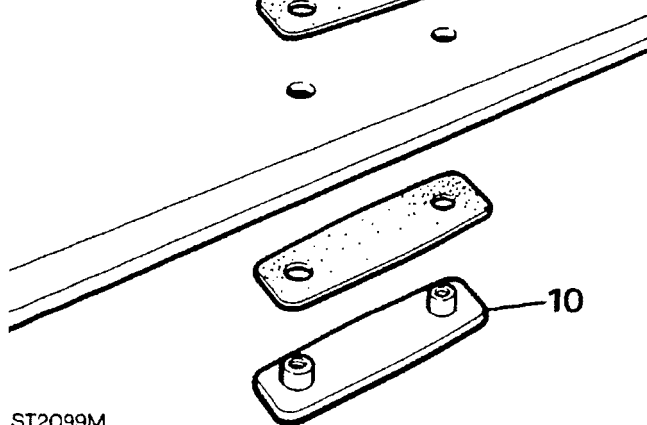
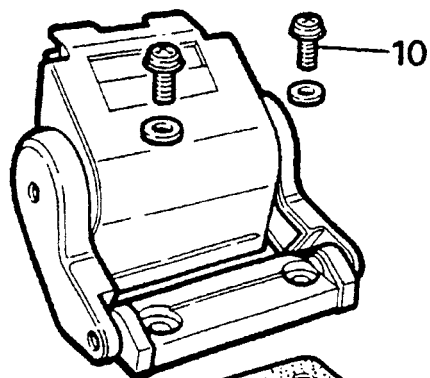
7. Remove the fifteen screws and withdraw the outer frame retainer.



8. Lift the sun roof external frame from the vehicle.

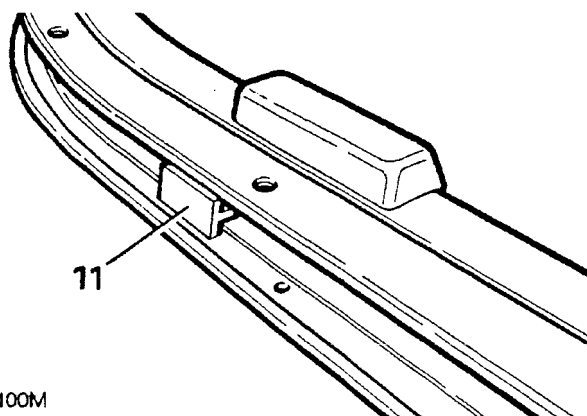


9. If necessary, remove the adhesive-backed seal, from the inner edge of the frame, that seals it to the vehicle roof.
10. To release the latch from the glass panel, remove the **two** screws and withdraw the latch and backing plate.



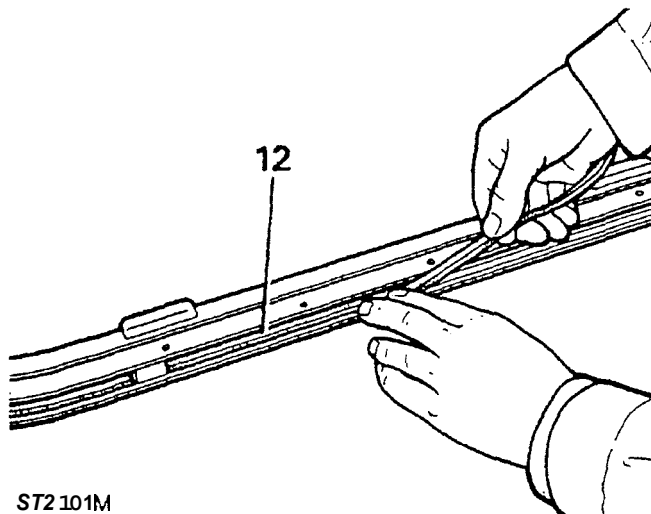
### To refit

11. If, removed, fit the **two** centralising blocks to the outer frame and secure with adhesive.



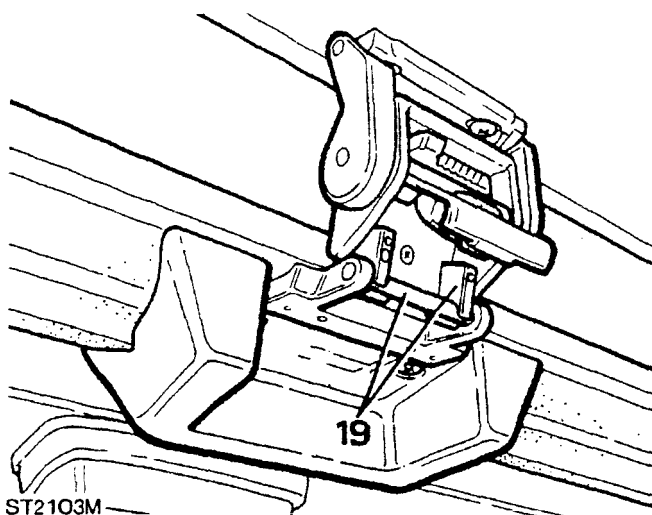
12. Secure a new seal to the outer closing edge of the frame avoiding a join along the hinge side.

Continued



ST2101M

13. Clean the area of contact on the vehicle roof then Lower the frame into position on the roof.
14. From inside the vehicle, offer-up the retaining frame and secure to the outer frame with the fifteen screws.
15. If removed, fit the latch to the glass panel with the backing plate and two screws, reversing instruction 10.
16. Secure the interior finisher to the retaining frame with the fourteen dowels.
17. Fit and secure the latch finisher with the two screws.
18. Fit the glass panel and latch assembly squarely to the outer frame.
19. Lower the latch on to the pivot bar, ensuring that the bar locates in its cradle, and whilst pushing the red button upwards, close the latch hasp over the bar until it locks reversing instruction 3.



ST2103M

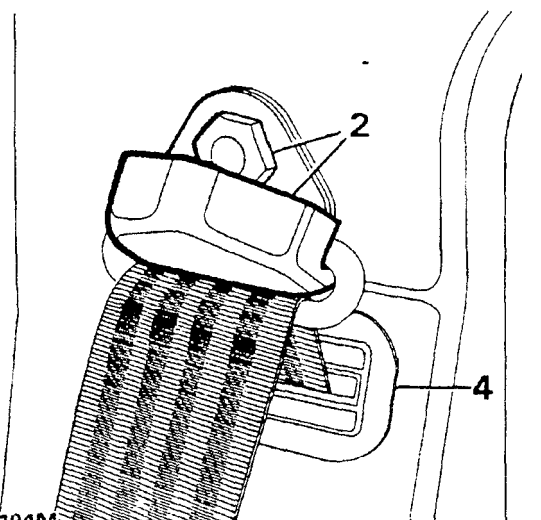
20. To check the operation and to close the panel, move the green button to the right whilst pulling the latch handle downwards until it snaps into the locked position.

**IANDROVER "110" STATION WAGON.**

**Rear side window trim.**

**To remove**

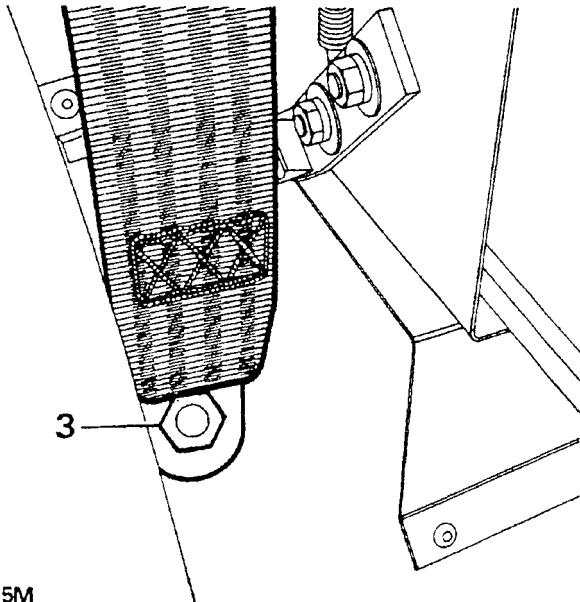
1. To gain access to the trim lower fixings remove the rear seat and squab frame complete.
2. Remove the plastic cover and the seat belt anchorage bolt from the "C" post.



ST2104M

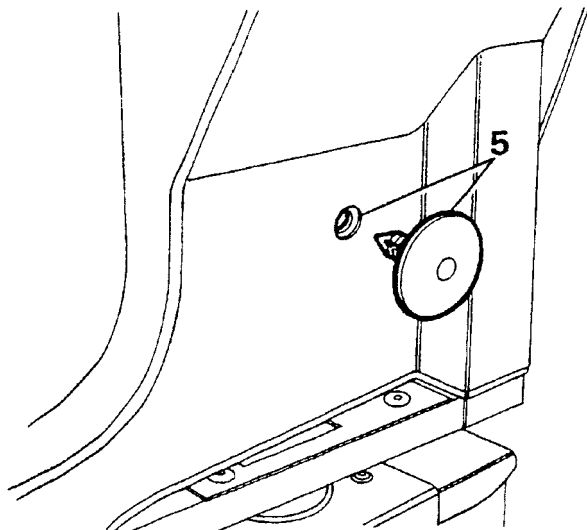
3. Remove the lower anchorage bolt for the same seat belt.
4. Remove the seat belt aperture finisher from the trim panel and remove the rear quarter light trim from the side concerned.

Continued



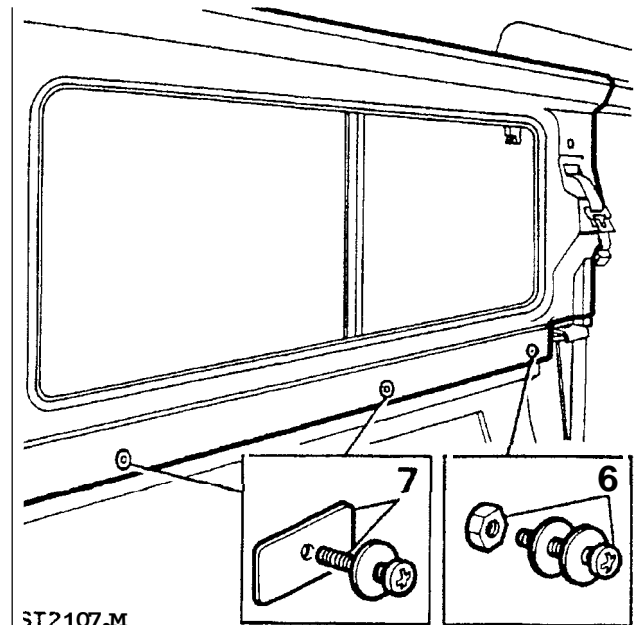
ST2105M

- Using a screwdriver, carefully lever the trim retaining button from the "C" post. The button is held by a "fir-tree" type peg.



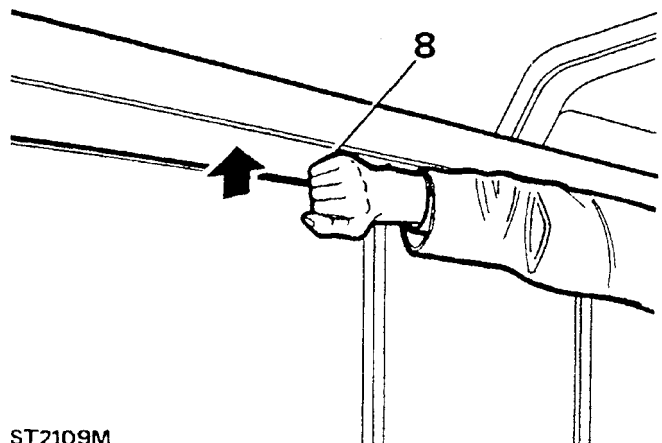
ST2106M

- Remove the trim lower three fixings. The forward fixing is a screw, two washers and a nut.
- The rear and centre fixings are a screw, washer and a nut welded to a plate. When the screw is removed the plate will fall into the boxed section of the attachment side member.



ST2107M

- The top edge of the trim is held to the inner cant rail by three spring clips. Strike upwards, with the hand, as illustrated, to release the trim.



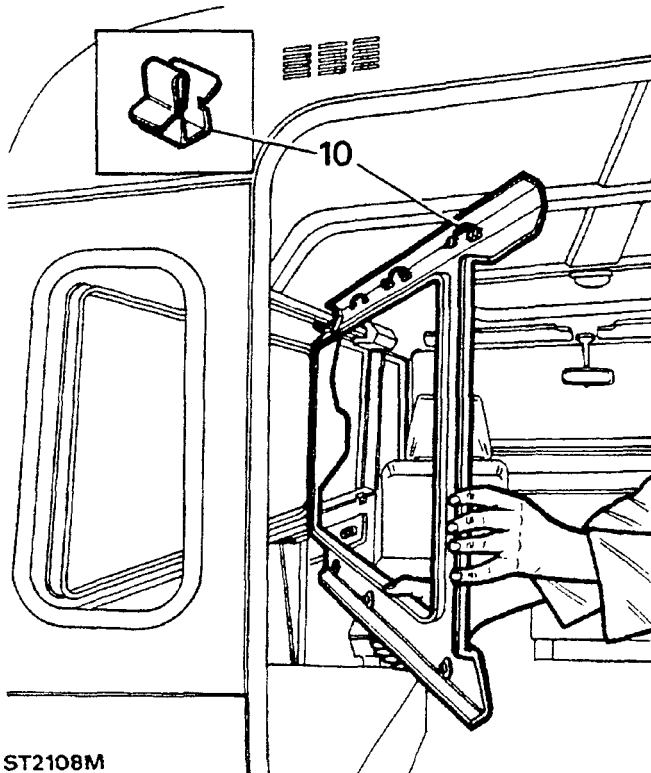
ST2109M

- Feed the seat belt through the aperture and remove the trim from the vehicle.

Continued

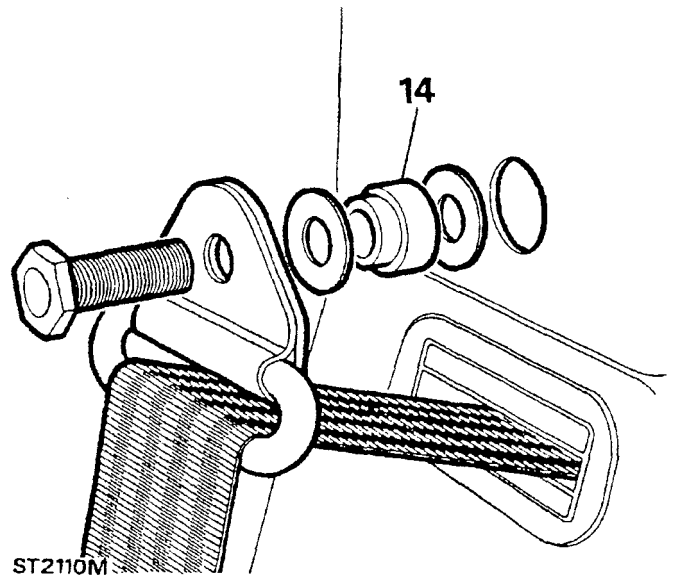
**To refit.**

10. Feed the seat belt through the trim aperture. Fasten the top edge of the trim to the inner cant rail with the three spring clips.



ST2108M

11. Secure the lower edge of the trim with the three screws by reversing the removal process. Secure the rear and centre screws first and note that the nut is to the rear, the plate towards the trim.
12. Fit the plastic retaining button.
13. Fit the seat belt lower anchorage and secure with the special bolt, spacer and washers, as illustrated. Tighten the bolt to 20,3Nm. (15ft.lbs.)
14. Similarly, fit the seat belt upper anchorage and tighten the special bolt to 20,3 Nm (15ft.lbs.). Fit the finisher to the seat belt aperture in the trim panel and the plastic cover to the anchorage bolt.



ST2110M

15. Fit the seat and squab frame and secure the seat cushion to the frame with the tapes.
16. Fit the rear quarter light trim.

**"B" Post trim Land Rover "110" only.**

**To remove.**

1. Remove the plastic cover from the seat belt upper anchorage.
2. Remove the upper anchorage bolt and fittings.
3. Carefully lever-out the plastic button and remove the trim.

**To refit.**

4. Reverse the removal procedure ensuring that the upper anchorage bolt and fittings are correctly fitted and tightened to the specified torque as described in instruction 14 for refitting the rear side trim.
5. Fit the plastic cover over the anchorage bolt and secure the lower end of the trim with the retaining button.

## LAND ROVER "90" STATION WAGON

### Rear side window trim.

The rear side trim on the Land Rover "90" is secured in a similar manner to that of the "110" station wagon. Since the fixings are common, removal of the inward facing seats will release the lower attachment of the trim to the side rail. The squab frames of the individual inward facing seats are each attached at two points to the side rail. The bench type seat squabs are also secured at two points.

To remove the rear side trim of vehicles fitted with individual seats, the squabs only need to be removed. When bench type seats are fitted the complete seat and squab frame must be removed in order to release the trim lower attachment.

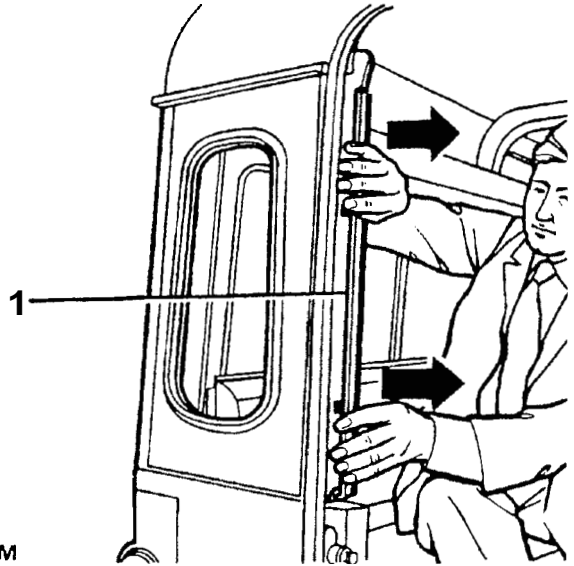
Once the trim lower fixings have been released and the rear quarter light trim removed, the seat belt upper anchorage bolt assembly must be removed together with the plastic button retaining the trim to the "B" post. The trim upper fixings are the same as the "110" and an upward tap with the hand will release it from the inner cant rail enabling the trim to be removed.

Fitting the trim is a reversal of the removal procedure. It is, however, most important that the seat belt upper anchorage fixing assembly is fitted correctly as described and illustrated under instruction 14 of the Land Rover "110" trim refitting instructions. The bolt must also be tightened to 20,3 Nm (15ft.lbs.) Note that the foremost bushed hole in the trim, nearest the "B" post, is not used.

### Rear quarter light trim. "90" and "110"

#### To remove.

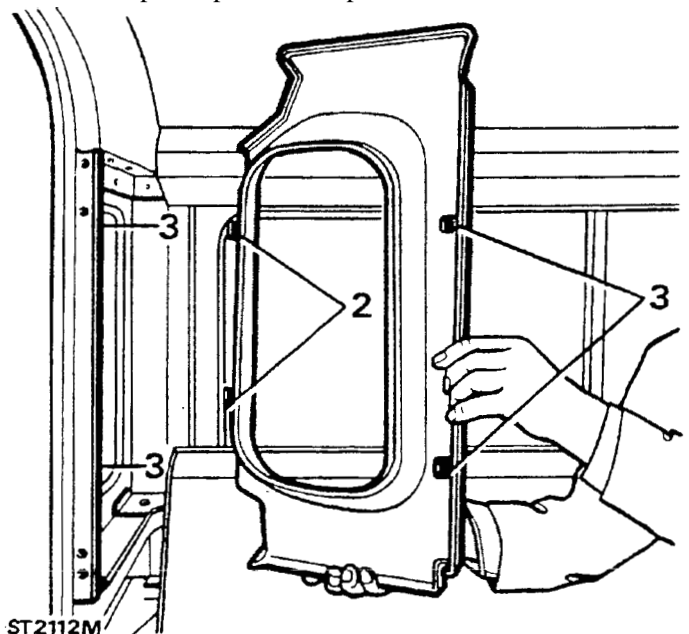
1. Pull the trim panel away from the quarter light with the fingers thereby releasing the retaining spring clips from the vertical rail and withdraw the panel.



ST2111M

#### To refit.

2. Reverse the removal procedure whilst ensuring that the two metal lugs locate behind the side trim.
3. Align the two spring clips with the vertical rail and tap the panel into position with the hand.



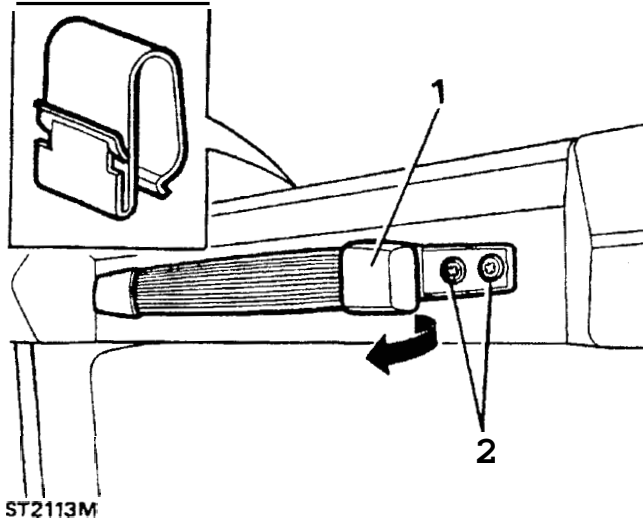
ST2112M



Grab handles.

To remove.

1. Lift the plastic finishers to expose the securing screws.
2. Remove the four screws to release the grab handle.



Note:- In order to remove the trim above the door between the "B" and "C" post, on "110" station wagons, the "B" post trim as well as the grab handle must be removed. The trim above the door is held by clips, the same as used for the side trim.

To refit.

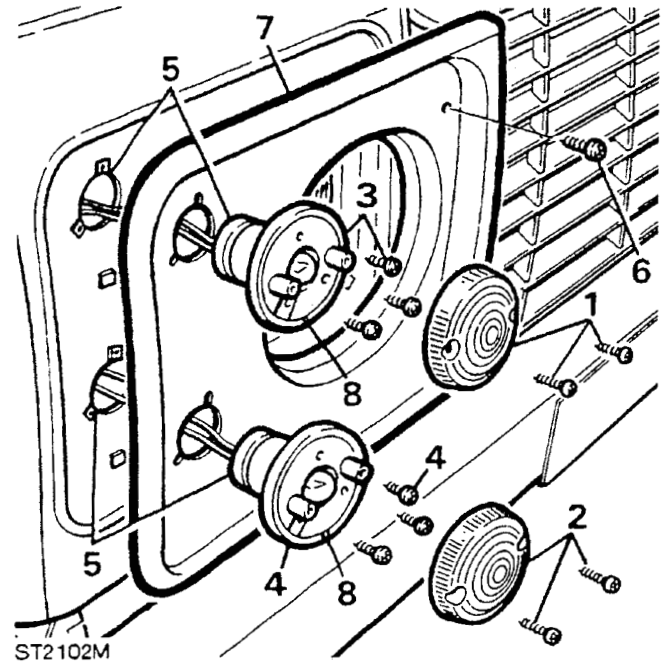
4. Reverse instructions 1 and 2.

HEADLAMPS.

To remove or renew bulb or light unit.

1. Remove the two screws and withdraw the front side lamp lens.
2. Similarly, remove the front flasher lens.
3. Remove the three screws retaining the side lamp to the wing.
4. Also remove the screws securing the flasher lamp.

5. Ease the side and flasher lamps from their locations in the wing and pull them out as far as the leads will allow.
6. Remove the two screws retaining the plastic bezel to the wing.
7. Withdraw the bezel sufficiently to gain access to the the headlamp retaining screws.



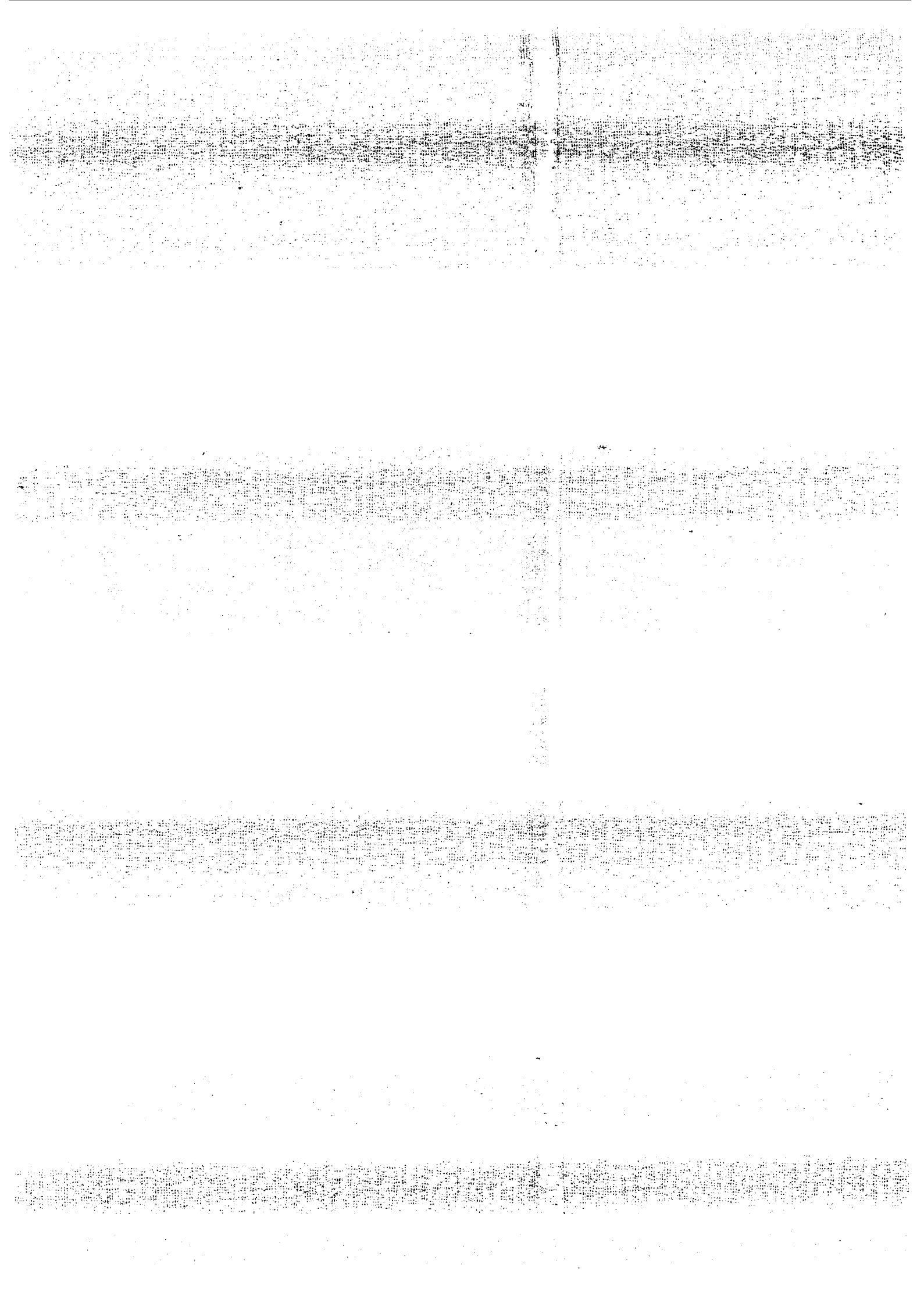
NOTE:- From this stage onwards the procedure for renewing the headlamp bulb or light unit or removing and overhauling the headlamp, is the same as that described in section 86 page 48 of the current Land Rover Workshop Manual SLR 621 EN WM. (English).

To refit.

8. Refitting of the plastic bezel and lamps is a reversal of instructions 1 to 7. Ensure, however, that when fitting the side and flasher lamps the gap in the seal surround is located at the bottom to provide for drainage and ventilation.
9. Remember to replace or renew the rubber sealing washers over the screws inside each lens. Also check that the fibre washers are in place under the screw heads on the outside of the lens.







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## INTRODUCTION.

This Workshop Manual covers the Land Rover Ninety and One Ten range of vehicles. It is primarily designed to assist skilled technicians in the efficient repair and maintenance of Land Rover vehicles.

Using the appropriate service tools and carrying out the procedures as detailed will enable the operations to be completed within the time stated in the 'Repair Operation Times'.

The Manual has been produced in separate books; this allows the information to be distributed throughout the specialist areas of the modern service facility.

A table of contents in Book 1 lists the major components and systems together with the section and book numbers. The cover of each book details the sections contained within that book.

The title page of each book carries the part numbers required to order replacement books, binders or complete Service Manuals. This can be done through the normal channels.

### REFERENCES

References to the left- or right-hand side in the manual are made when viewing the vehicle from the rear. With the engine and gearbox assembly removed, the water pump end of the engine is referred to as the front.

To reduce repetition, operations covered in this manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out particularly where safety related items are concerned.

### DIMENSIONS

The dimensions quoted are to design engineering specification. Alternative unit equivalents, shown in brackets following the dimensions, have been converted from the original specification.

During the period of running-in from new, certain adjustments may vary from the specification figures given in this Manual. These adjustments will be re-set by the Distributor or Dealer at the After Sales Service, and thereafter should be maintained at the figures specified in the Manual.

### REPAIRS AND REPLACEMENTS

When replacement parts are required it is essential that only Land Rover parts are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories:

Safety features embodied in the vehicle may be impaired if other than Land Rover parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the vehicle manufacturer's specification. Torque wrench setting figures given in the Repair Operation Manual must be strictly adhered to. Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed. Owners purchasing accessories while travelling abroad should ensure that the accessory and its fitted location on the vehicle conform to mandatory requirements existing in their country of origin. The terms of the Owners Service Statement may be invalidated by the fitting of other than Land Rover parts.

**All** Land Rover parts have the full backing of the Owners Service Statement.

Land Rover Distributors and Dealers are obliged to supply only Land Rover service parts.

### POISONOUS SUBSTANCES

Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed and should as far as possible be kept away from open wounds. These substances among others include antifreeze, brake fluid, fuel, windscreen washer additives, lubricants and various adhesives.

### FUEL HANDLING PRECAUTIONS

The following information provides basic precautions which must be observed if petrol (gasoline) is to be handled safely. It also outlines the other areas of risk which must not be ignored.

This information is issued for basic guidance only, and in any case of doubt appropriate enquiries should be made of your local Fire Officer.

### GENERAL

Petrol/gasoline vapour is highly flammable and in confined spaces is also very explosive and toxic.

When petrol/gasoline evaporates it produces 150 times its own volume in vapour, which when diluted with air becomes a readily ignitable mixture. The vapour is heavier than air and will always fall to the lowest level. It can readily be distributed throughout a workshop by air current, consequently, even a small spillage of petrol/gasoline is potentially very dangerous.

Always have a fire extinguisher containing FOAM CO<sub>2</sub> GAS, or POWDER close at hand when handling or draining fuel, or when dismantling fuel systems and in areas where fuel containers are stored.

Always disconnect the vehicle battery BEFORE carrying out dismantling or draining work on a fuel system.

Whenever petrol/gasoline is being handled, drained or stored, or when fuel systems are being dismantled all forms of ignition must be extinguished or removed, any head-lamps used must be flameproof and kept clear of spillage.

NO ONE SHOULD BE PERMITTED TO REPAIR COMPONENTS ASSOCIATED WITH PETROL/GASOLINE WITHOUT FIRST HAVING HAD SPECIALIST TRAINING.

## FUEL TANK DRAINING

**WARNING: PETROL/GASOLINE MUST NOT BE EXTRACTED OR DRAINED FROM ANY VEHICLE WHILST IT IS STANDING OVER A PIT.**

Draining or extracting petrol/gasoline from vehicle fuel tank must be carried out in a well ventilated area.

The receptacle used to contain the petrol/gasoline must be more than adequate for the full amount of fuel to be extracted or drained. The receptacle should be clearly marked with its contents, and placed in a safe storage area which meets the requirements of local authority regulations.

WHEN PETROL/GASOLINE HAS BEEN EXTRACTED OR DRAINED FROM A FUEL TANK THE PRECAUTIONS GOVERNING NAKED LIGHTS AND IGNITION SOURCES SHOULD BE MAINTAINED.

## FUEL TANK REMOVAL

On vehicles where the fuel line is secured to the fuel tank outlet by a spring steel clip, it is recommended that such clips are released before the fuel line is disconnected or the fuel tank unit is removed. This procedure will avoid the possibility of residual petrol fumes in the fuel tank being ignited when the clips are released.

As an added precaution fuel tanks should have a PETROL/GASOLINE VAPOUR warning label attached to them as soon as they are removed from the vehicle.

## FUEL TANK REPAIR

Under no circumstances should a repair to any tank involving heat treatment be carried out without first rendering the tank SAFE, by using one of the following methods:

**STEAMING:** With the filler cap and tank unit removed, empty the tank. Steam the tank for at least two hours with low pressure steam. Position the tank so that condensation can drain away freely, ensuring that any sediment and sludge not volatilised by the steam, is washed out during the steaming process.

**BOILING:** With the filler cap and tank unit removed, empty the tank. Immerse the tank completely in boiling water containing an effective alkaline degreasing agent or a detergent, with the water filling and also surrounding the tank for at least two hours.

After steaming or boiling a signed and dated label to this effect should be attached to the tank.

## SPECIFICATION

Purchasers are advised that the specification details set out in this Manual apply to a range of vehicles and not to any one. For the specification of a particular vehicle, purchasers should consult their Distributor or Dealer.

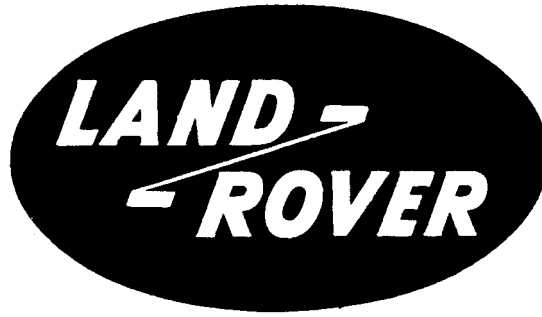
The Manufacturers reserve the right to vary their specifications with or without notice, and at such times and in such manner as they think fit. Major as well as minor changes may be involved in accordance with the Manufacturer's policy of constant product improvement.

Whilst every effort is made to ensure the accuracy of the particulars contained in this Manual, neither the Manufacturer nor the Distributor or Dealer, by whom this Manual is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

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# Special Service Tools

The use of approved special service tools is important. They are essential if service operations are to be carried out efficiently, and safely. The amount of time which they save can be considerable.

Every special tool is designed with the close co-operation of Land Rover Ltd., and no tool is put into production which has not been tested and approved by us. New tools are only introduced where an operation cannot be satisfactorily carried out using existing tools or standard equipment. The user is therefore assured that the tool is necessary and that it will perform accurately, efficiently and safely.

Special tools bulletins will be issued periodically giving details of new tools as they are introduced.

**All** orders and enquiries from the United Kingdom should be sent direct to V. L. Churchill. Overseas orders should be placed with the local V. L. Churchill distributor, where one exists. Countries where there is no distributor may order direct from V. L. Churchill Limited. P.O. Box 3, Daventry, Northamptonshire, England NN11 4NF.

The tools recommended in this Workshop Manual are listed in a multi-language, illustrated catalogue obtainable from Messrs. V. L. Churchill at the above address under publication number 2217/2/84 or from Land Rover Ltd., under part number LSM0052TC from the following address, Land Rover Limited, Service Department, Lode Lane, Solihull, West Midlands. England B92 8NW.

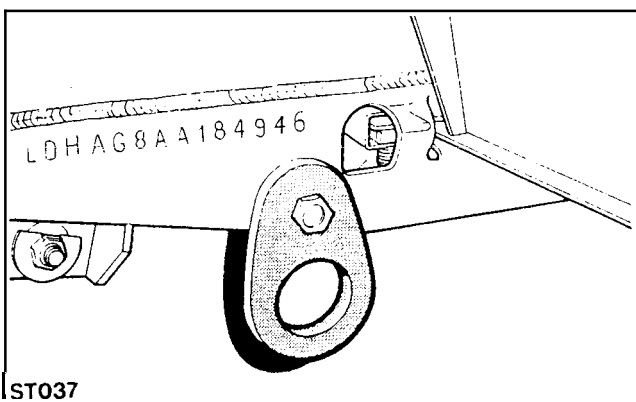
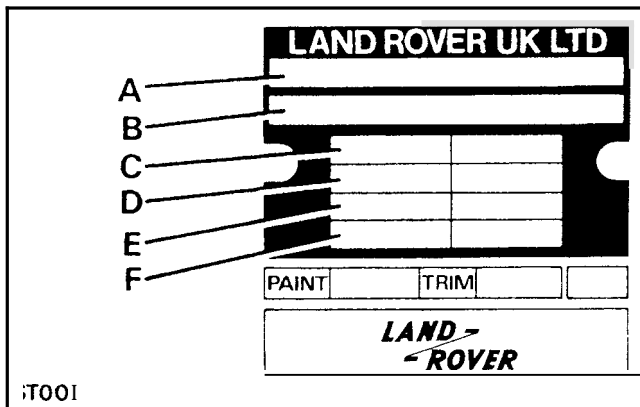
**VEHICLE IDENTIFICATION NUMBER (MN)**

The Vehicle Identification Number and the recommended maximum vehicle weights are stamped on a plate riveted to the top of the brake pedal box in the engine compartment.

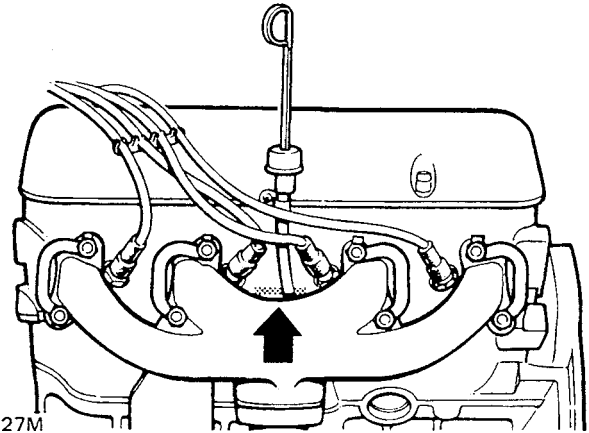
The number is also stamped on the right-hand side of the chassis forward of the spring mounting turret. Always quote this number when writing to Land Rover Limited.

**Key to Vehicle Identification Number Plate**

- A Type approval
- B VIN (minimum of 17 digits)
- C Maximum permitted laden weight for vehicle
- D Maximum vehicle and trailer weight
- E Maximum road weight — front axle
- F Maximum road weight — rear axle

**ENGINE SERIAL NUMBER — V8 ENGINE**

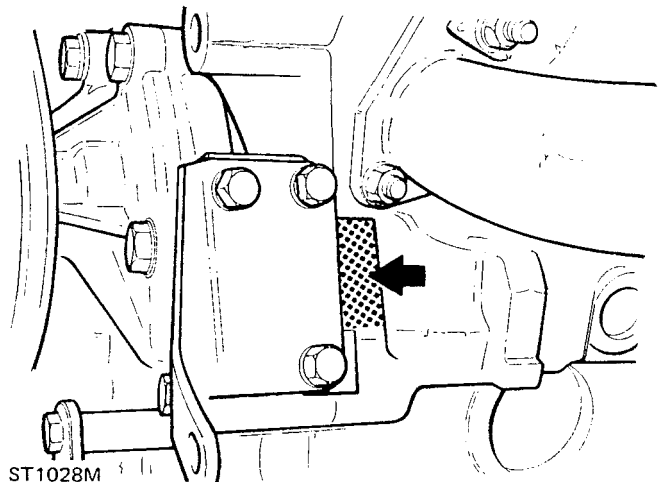
The V8 engine serial number is stamped on a cast pad on the cylinder block between numbers 3 and 5 cylinders.



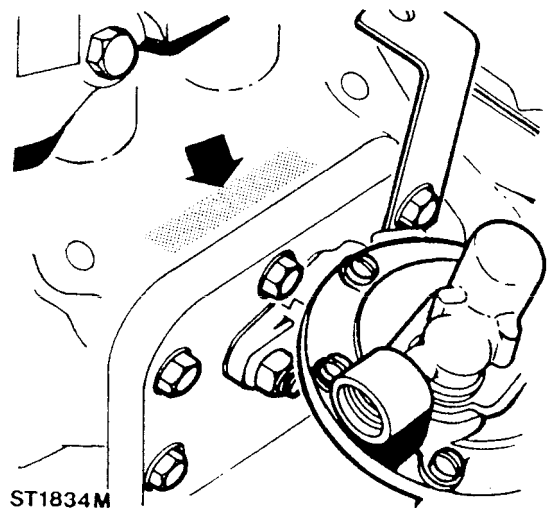
ST1027M

**ENGINE SERIAL NUMBER — 4 CYLINDER ENGINES**

The 4 cylinder engine number is stamped on a machined surface at the front left-hand side of the engine adjacent to the exhaust manifold front flange. On later engines the number is stamped above the rear side cover, as the second illustration shows.



ST1028M

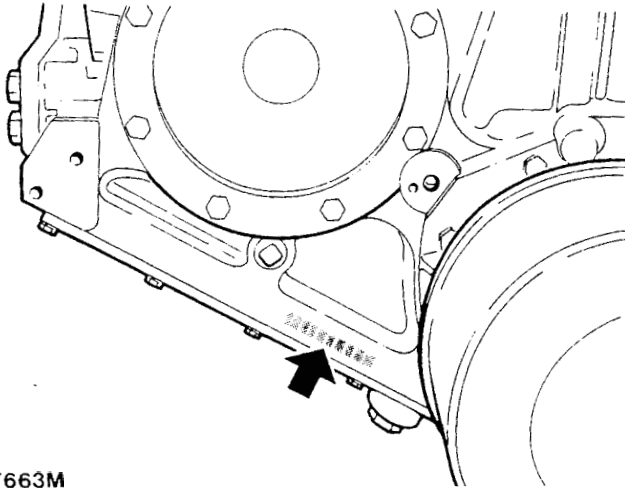


ST1834M

## LOCATION OF VEHICLE IDENTIFICATION AND UNIT NUMBERS

### MAIN GEARBOX AND TRANSFER BOX LT95 — V8

Stamped on the rear of the transfer box on the opposite side to the transmission brake.



ST663M

### FRONT AXLE

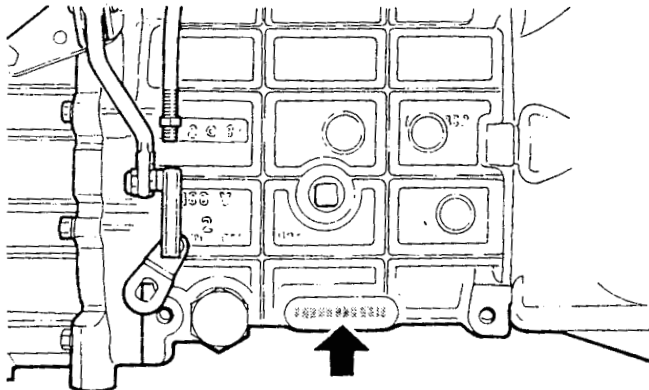
Stamped on top of the left-hand axle tube.

### REAR AXLE

Stamped on rear of left-hand axle tube.

### MAIN GEARBOX LT77 — 4 CYLINDER VEHICLES

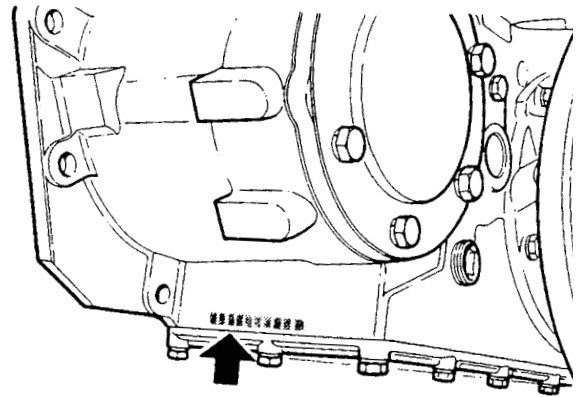
Stamped on a pad on the right-hand side of the gearbox immediately below the oil filler level plug.



ST665M

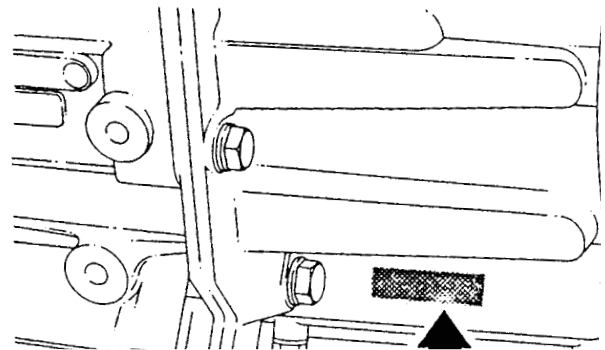
### TRANSFER GEARBOX LT230R — 4 CYLINDER VEHICLES

Stamped on the casing on the left-hand side of the gearbox below the mainshaft rear bearing housing adjacent to the bottom cover.



ST664M

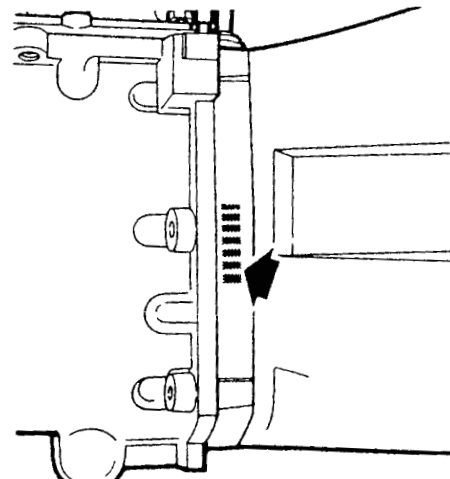
### TRANSFER GEARBOX LT230T — 4 CYLIN AND V8 VEHICLES FROM SERIAL NUM SUFFIX 'B' ONWARD



RR 470M

### MAIN GEARBOX LT85 FIVE SPEED —

Stamped on the right-hand side of the front bearing plate.



ST1546M



## GENERAL SPECIFICATION DATA

## V8 ENGINE

**ENGINE**

Type .....	V8
Number of cylinders .....	Eight, two banks of four
Bore .....	88,90 mm (3.500 in)
Stroke .....	71,12 mm (2.800 in)
Capacity .....	3528 cc (215 in <sup>3</sup> )
Valve operation.....	Overhead by push-rod
Maximum power — B.H.P.....	113
Maximum power — KW .....	84.6
Maximum torque .....	251 Nm (185 lb ft) at 2500 rpm

**Crankshaft**

Main journal diameter .....	58,409 - 58,422 mm (2.2996 - 2.3001 in)
Minimum regrind diameter .....	57,393 - 57,406 mm (2.2596 - 2.2601 in)
Crankpin journal diameter .....	50,800 - 50,812 mm (2.0000 - 2.0005 in)
Minimum regrind diameter .....	49,784 - 49,797 mm (1.9600 - 1.9605 in)
Crankshaft end thrust .....	Taken on thrust washers of centre main bearing
Crankshaft end-float.....	0,10 - 0,20 mm (0.004 - 0.008 in)

**Main bearings**

Number and type.....	5, Vandervell shells
Material .....	Lead-indium
Diametrical clearance .....	0,010 - 0,048 mm (0.0004 - 0.0019 in)
Undersizes .....	0,254 mm, 0,508 mm (0.010 in, 0.020 in)

**Connecting rods**

Type .....	Horizontally split big end, plain small end
Length between centres.....	143,81 - 143,71 mm (5.662 - 5.658 in)

**Big end bearings**

Type and material.....	Vandervell VP lead-indium
Diametrical clearance .....	0,015 - 0,055 mm (0.0006 - 0.0022 in)
End-float on crankpin .....	0,15 - 0,36 mm (0.006 - 0.014 in)
Undersizes .....	0,254 mm, 0,508 mm (0.010 in, 0.020 in)

**Gudgeon pins**

Length .....	72,67 - 72,79 mm (2.861 - 2.866 in)
Diameter .....	22,215 - 22,22 mm (0.8746 - 0.8749 in)
Fit-in connecting rod .....	Press fit
Clearance in piston.....	0,002 - 0,007 mm (0.0001 - 0.0003 in)

**Pistons**

Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin .....	0,018 - 0,033 mm (0.0007 - 0.0013 in)
---	---------------------------------------

**Piston rings**

Number of compression .....	2
Number of oil .....	1
No. 1 compression ring .....	Chrome parallel faced
No. 2 compression ring .....	Stepped to 'L' shape and marked 'T' or 'TOP'
Width of compression rings .....	1,56 - 1,59 mm (0.0615 - 0.0625 in)
Compression ring gap .....	0,44 - 0,57 mm (0.017 - 0.022 in)
Oil ring type .....	Perfect circle, type 98-6
Oil ring width .....	4,811 mm (0.1894 in) max
Oil ring gap .....	0,38 - 1,40 mm (0.015 - 0.055 in)

**Camshaft**

Location .....	Central
Bearings .....	Non-serviceable
Number of bearings .....	5
Drive .....	Chain 9,52 mm (0.375 in) pitch x 54 pitches

**Valves**

Length:	
Inlet .....	116,59 - 117,35 mm (4.590 - 4.620 in)
Exhaust .....	116,59 - 117,35 mm (4.590 - 4.620 in)
Seat angle:	
Inlet .....	45° - 45½°
Exhaust .....	45° - 45½°
Head diameter:	
Inlet .....	39,75 - 40,00 mm (1.565 - 1.575 in)
Exhaust .....	34,226 - 34,480 mm (1.3475 - 1.3575 in)
Stem diameter:	
Inlet .....	8,664 - 8,679 mm (0.3411 - 0.3417 in)
Exhaust .....	8,651 - 8,666 mm (0.3406 - 0.3412 in)
Stem to guide clearance:	
Inlet .....	0,025 - 0,066 mm (0.0010 - 0.0026 in)
Exhaust .....	0,038 - 0,078 mm (0.0015 - 0.0031 in)
Valve lift (inlet and exhaust) .....	9,49 mm (0.374 in)
Valve spring length fitted .....	40,4 mm (1.590 in) at pressure of 29,5 kg (65 lbs)

**Lubrication**

System .....	Wet sump, pressure fed
System pressure, engine warm at 2400rpm .....	2,1 - 2,8 kgf cm <sup>2</sup> (30 - 40 lbf in <sup>2</sup> )
Oil filter (external) .....	Full-flow, self-contained cartridge
Oil filter (internal) .....	Gauze. Pump intake filter
Oil pump type .....	Gear

**Oil pressure relief valve**

Type .....	Non-adjustable
Relief valve spring:	
Free length .....	81,2 mm (3.200 in)
Compressed length at 4,2 kg (9.3 lb) load .....	45,7 mm (1.800 in)

**Oil filter by-pass valve**

Type .....	Non-adjustable
By-pass valve spring:	
Free length .....	37,5 mm (1.48 in)
Compressed length at 0,34 kg (0.75 lb) .....	22,6 mm (0.89 in)



## 2.25 LITRE PETROL ENGINE

**ENGINE**

Type .....	4 cylinder
Bore .....	90,47 mm (3.562 in)
Stroke .....	88,9 mm (3.500 in)
Capacity .....	2286 cm <sup>3</sup> (139.500 in <sup>3</sup> )
Valve operation .....	Overhead by push-rod
Compression ratio .....	8.0: 1
Maximum power @ 4000 rpm .....	55.2 Kw (74 bhp)
Maximum torque @ 2000 rpm .....	163 Nm (120 lbf ft)

**Crankshaft**

Main journal diameter .....	63,487 - 63,500 mm (2.4995 - 2.500 in)
Minimum regrind diameter .....	63,246 - 63,2333 mm (2.4900 - 2.4895 in)
Crankpin journal diameter .....	58,725 - 58,744 mm (2.312 - 2.31275 in)
Minimum regrind diameter .....	58,48985 - 58,47080 mm (2.30275 - 2.30200 in)
Crankshaft end thrust .....	Taken on thrust washers at centre main bearing
Crankshaft end-float .....	0,05 - 0,15 mm (0.002 - 0.006 in)

**Main bearings**

Number and type .....	5 halved shells
Material .....	Steel shell, tin-aluminium lined
Diametrical clearance .....	0,020 - 0,063 mm (0.0008 - 0.0025 in)
Undersizes .....	0,25 mm (0.010 in)

**Connecting rods**

Type .....	Horizontally split big end, plain small end
Length between centres .....	175,36 - 175,46 mm (6.904 - 6.908 in)

**Big end bearings**

Type and material .....	Steel shell, copper-lead lined
Diametrical clearance .....	0,019 - 0,068 mm (0.00075 - 0.0027 in)
End-float on crankpin .....	0,20 - 0,30 mm (0.007 - 0.012 in)
Undersizes .....	0,25 mm (0.010 in)

**Gudgeon pins**

Type .....	Floating
Fit in piston .....	Push fit by hand
Clearance in connecting rod .....	0,007 - 0,015 mm (0.0003 - 0.0006 in)

**Pistons**

Type 8.0:1 compression ratio .....	Aluminium alloy, flat top
Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin:	
Standard size pistons .....	0,06 - 0,07 mm (0.0023 - 0.0027 in)
Oversize pistons .....	0,043 - 0,055 mm (0.0017 - 0.0022 in)

**Piston rings**

Compression .....	2
Gap in bore .....	0,38 - 0,50 mm (0.015 - 0.020 in)
Clearance in groove .....	0,046 - 0,097 mm (0.0018 - 0.0038 in)
Oil control .....	1
Gap in bore .....	0,38 - 0,50 mm (0.015 - 0.020 in)
Clearance in groove .....	0,038 - 0,089 mm (0.0015 - 0.0035 in)

**Camshaft**

Location .....	Right-hand side (thrust side) of engine
End-float .....	0,06 - 0,13 mm (0.0025 - 0.0055 in)
Number of bearings .....	4
Material .....	Steel shell, white metal lined
Drive .....	Chain

**Valves**

Length:	
Inlet .....	111,20 - 111,66 mm (4.378 - 4.396 in)
Exhaust .....	111,22 - 111,58 mm (4.388 - 4.412 in)
Seat angle:	
Inlet .....	30"
Exhaust .....	45"
Head diameter:	
Inlet .....	44,32 - 44,57 mm (1.744 - 1.755 in)
Exhaust .....	34,93 - 35,18 mm (1.378 - 1.380 in)
Stem diameter:	
Inlet .....	7,899 - 7,912 mm (0.3109 - 0.3115 in)
Exhaust .....	8,682 - 8,694 mm (0.3418 - 0.3422 in)
Stem to guide clearance:	
Inlet .....	0,033 - 0,048 mm (0.0013 - 0.0019 in)
Exhaust .....	0,058 - 0,073 mm (0.0023 - 0.0029 in)
Valve lift:	
Inlet .....	10,236 mm (0.403 in)
Exhaust .....	9,85 mm (0.388 in)

**Valve springs**

Type .....	Duplex interference coil
Inner:	
Length, free .....	42,67 mm (1.680 in)
Length, under 8,0 kg (17.7 lb) load .....	37,13 mm (1.462 in)
Outer:	
Length, free .....	46,28 mm (1.822 in)
Length, under 21 kg (46 lb) load .....	40,30 mm (1.587 in)

**Lubrication**

System .....	Wet sump, pressure fed
System pressure, engine warm at 2000 rpm .....	2,45 - 4,50 kgf cm <sup>2</sup> (35 - 65 lbf in <sup>2</sup> )
Oil pump: Early type	
Type .....	Double gear
Drive .....	Splined shaft from camshaft skew gear
End-float of gears:	
Steel gear .....	0,05 - 0,12 mm (0.002 - 0.005 in)
Aluminium gear .....	0,07 - 0,15 mm (0.003 - 0.006 in)
Radial clearance of gears .....	0,02 - 0,10 mm (0.001 - 0.004 in)
Backlash of gears .....	0,15 - 0,28 mm (0.006 - 0.012 in)

**Lubrication (continued)**

Oil pump: Latest type	
Type .....	Double gear, 10 teeth, sintered iron gears
Drive .....	Splined shaft from camshaft skew gear
End-float of both gears .....	0,026 - 0,135 mm (0.0009 - 0.0045 in)
Radial clearance of gears .....	0,025 - 0,075 mm (0.0008 - 0.0025 in)
Backlash of gears .....	0,1 - 0,2 mm (0.0034 - 0.0067 in)

**Oil pressure relief valve**

Type .....	Non-adjustable
Relief valve spring:	
Full length .....	67,82 mm (2.670 in)
Compressed length at 2,58 kg (5.7 lb) load .....	61,23 mm (2.450 in)

**2.5 LITRE PETROL ENGINE****ENGINE**

Type .....	4 cylinder
Bore .....	90,47 mm (3.562 in)
Stroke .....	97 mm (3.82 in)
Capacity .....	2495 cm <sup>3</sup> (152.25 in <sup>3</sup> )
Valve operation .....	Overhead by push-rod
Compression ratio .....	8.0: 1
Maximum power @ 4000 rpm .....	59.5 Kw (80 bhp)
Maximum torque @ 2000 rpm .....	175 Nm (129 lbf ft)
Commencing serial no. ....	17H00011C

**Crankshaft**

Main journal diameter .....	63,487 - 63,500 mm (2.4995 - 2.500 in)
Minimum regrind diameter .....	63,246 - 63,2333 mm (2.4900 - 2.4895 in)
Crankpin journal diameter .....	58,725 - 58,744 mm (2.312 - 2.31275 in)
Minimum regrind diameter .....	58,48985 - 58,47080 mm (2.30275 - 2.30200 in)
Crankshaft end thrust .....	Taken on thrust washers at centre main bearing
Crankshaft end-float .....	0,05 - 0,15 mm (0.002 - 0.006 in)

**Main bearings**

Number and type .....	5 halved shells
Material .....	Copper-lead lined
Diametrical clearance .....	0,018 - 0,06 mm (0.0007 - 0.0026 in)
Undersizes .....	0,25 mm (0.010 in)

**Connecting rods**

Type .....	Horizontally split big end, plain small end
Length between centres .....	175,36 - 175,46 mm (6.904 - 6.908 in)

**Connecting rod bearings**

Type and material .....	Steel shell, copper-lead lined
Diametrical clearance .....	0,025 - 0,075 mm (0.001 - 0.003 in)
End-float on crankpin .....	0,20 - 0,30 mm (0.007 - 0.012 in)
Undersizes .....	0,25 mm (0.010 in)

**Gudgeon pins**

Type .....	Floating
Fit in piston .....	Push fit by hand
Clearance in connecting rod .....	0,007 - 0,015 mm (0.0003 - 0.0006 in)

**Pistons**

Type 8.0:1 compression ratio .....	Aluminium alloy. Recessed crown.
Clearance in bore measured @ 17mm from bottom of skirt at right angles to gudgeon pin: Standard and oversize pistons .....	0,043 - 0,067 mm (0.0017.-0.0026 in)

**Piston rings**

Compression .....	2
Gap in bore .....	0,40 - 0,65 mm (0.016 - 0.026 in)
Clearance in groove.. .....	0,046 - 0,097 mm (0.0018 - 0.0038 in)
Oil control .....	1
Gap in bore .....	0,30 - 0,55 mm (0.012 - 0.022 in)
Clearance in groove. ....	0,026 - 0,076 mm (0.0012 - 0.003 in)

**Camshaft**

Location .....	Right-hand side (thrust side) of engine
End-float .....	0,06 - 0,13 mm (0.0025 - 0.0055 in)
Number of bearings.. .....	4
Material .....	Steel shell, white metal lined
Drive .....	76 link chain

**Valves**

<b>Length:</b>	
Inlet .....	111,20 - 111,66 mm (4.377 - 4.396 in)
Exhaust .....	111,12 - 111,59 mm (4.374 - 4.393 in)
<b>Seat angle:</b>	
Inlet .....	30"
Exhaust.. .....	45"
<b>Head diameter:</b>	
Inlet .....	44,32 - 44,58 mm (1.744 - 1.755 in)
Exhaust .....	34,43 - 34,18 mm (1.355 - 1.345 in)
<b>Stem diameter:</b>	
Inlet .....	7,899 - 7,912 mm (0.3109 - 0.3115 in)
Exhaust.. .....	8,697 - 8,679 mm (0.3424 - 0.3416 in)
<b>Stem to guide clearance:</b>	
Inlet .....	0,033 - 0,048 mm (0.0013 - 0.0019 in)
Exhaust.. .....	0,035 - 0,076 mm (0.0014 - 0.0022 in)
<b>Valve lift:</b>	
Inlet .....	10,236mm (0.403 in)
Exhaust .....	9,85 mm (0.388 in)
<b>Exhaust valve seat insert:</b>	
External diameter. ....	36,576 - 36,601 (1.440 - 1.441 in)
Internal diameter. ....	28,448 - 28,702 mm (1.120- 1.130 in)
Width .....	5,055 - 5,105 mm (0.199 - 0.201 in)
Seat angle and depth .....	45°. 0,635 - 0,889 mm (0.025 - 0.035 in)

**Valve springs**

Type .....	Duplex interference coil
Inner:	
Length, free .....	42,67 mm (1.680 in)
Length, under 8,0 kg (17.7 lb) load .....	37,13 mm (1.462 in)
Outer:	
Length, free .....	46,28 mm (1.822 in)
Length, under 21 kg (46 lb) load .....	40,30 mm (1.587 in)

**Lubrication**

System .....	Wet sump, pressure fed
System pressure, engine warm at 2000 rpm .....	2,45 - 4,50 kgf cm <sup>2</sup> (35 - 65 lbf in <sup>2</sup> )
Oil pump:	
Type .....	Double gear, 10teeth, sintered iron gears
Drive .....	Splined shaft from camshaft skew gear
End-float of both gears .....	0,026 - 0,135 mm (0.0009 - 0.0045 in)
Radial clearance of gears .....	0,025 - 0,075 mm (0.0008 - 0.0025 in)
Backlash of gears .....	0,1 - 0,2 mm (0.0034 - 0.0067 in)

**Oil pressure relief valve**

Type .....	Non-adjustable
Relief valve spring:	
Full length .....	67,82 mm (2.670 in)
Compressed length at 2,58 kg (5.7 lb) load .....	61,23 mm (2.450 in)

**2.25 LITRE DIESEL ENGINE****ENGINE**

Type .....	4 cylinder
Bore .....	90,47 mm (3.562 in)
Stroke .....	88,9 mm (3.500 in)
Capacity .....	2286 cm <sup>3</sup> (139 in <sup>3</sup> )
Valve operation .....	Overhead by push-rod
Compression ratio .....	33:1
Maximum power .....	44Kw (59 bhp) at 4000 rpm
Maximum torque .....	136Nm (100 lbf ft) at 1800rpm

**Crankshaft**

Main bearing journal diameter .....	63,487 - 63,500 mm (2.4995 - 2.500 in)
Regrind dimensions:	
63,246 - 63,2333 mm (2.490 - 2.4895 in) .....	Use 0.010 in U/S bearings
Crankpin journal diameter .....	58,725 - 58,744 mm (2.312 - 2.31275 in)
Regrind dimensions:	
58,48985 - 58,4708 mm (2.30275 - 2.30200 in) .....	Use 0.010 in U/S bearings
Crankshaft end thrust .....	Taken on thrust washers at centre main bearing
Crankshaft end-float .....	0,05 - 0,15 mm (0.002 - 0.006 in)

**Main bearings**

Number and type .....	5 halved shells
Material .....	Steel <b>shell</b> , copper-lead lined tin plated
Diametrical clearance .....	0,020 - 0,063 mm (0.0008 - 0.0025 in)

**Connecting rods**

Type .....	Horizontally split big end, plain small end
Length between centres .....	175,38 - 175,43 mm (6.905 - 6.907 in)

**Big end bearings**

Type and material .....	Steel shell, copper-lead lined
Diametrical clearance .....	0,020 - 0,0635 mm (0.0008 - 0.0025 in)
End-float on crankpin .....	0,15 - 0,356 mm (0.006 - 0.014 in)

**Gudgeon pins**

Type .....	Floating
Fit in piston .....	Push fit by hand
Clearance in connecting rod .....	0,0196 - 0,0036 mm (0.0007 - 0.00014 in)
Diameter .....	30,1564 - 30,1625 mm (1.18726 - 1.1875 in)

**Pistons**

Type .....	Aluminium alloy, with V shape recess in crown
Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin:	
Standard size pistons .....	0,111 - 0,134 mm (0.0044 - 0.0053 in)
Oversize pistons .....	0,111 - 0,157 mm (0.0044 - 0.0062 in)

**Piston rings**

Compression No. 1 (top):	
Type .....	Square friction edge, chrome plated
Gap in bore .....	0,35 - 0,50 mm (0.014 - 0.019 in)
Clearance in groove .....	0,06 - 0,11 mm (0.0025 - 0.0045 in)
Compression Nos. 2 and 3:	
Type .....	Bevelled friction edge. Marked 'T' or 'TOP' on upper side
Gap in bore .....	0,25 - 0,38 mm (0.010 - 0.015 in)
Clearance in groove .....	0,06 - 0,11 mm (0.0025 - 0.0045 in)
Oil control No. 4:	
Type .....	Ring and spring
Gap in bore .....	0,279 - 0,406 mm (0.011 - 0.016 in)
Clearance in groove .....	0,038 - 0,064 mm (0.0015 - 0.0025 in)

**Valves**

Length:	
Inlet .....	116,26 - 116,51 mm (4.377 - 4.587 in)
Exhaust .....	116,79 - 117,25 mm (4.598 - 4.616 in)
Seat angle:	
Inlet .....	45°
Exhaust .....	45°
Head diameter:	
Inlet .....	39,12 - 39,37 mm (1.540 - 1.550 in)
Exhaust .....	33,25 - 33,50 mm (1.309 - 1.318 in)
Stem diameter:	
Inlet .....	7,912 - 7,899 mm (0.3114 - 0.3109 in)
Exhaust .....	8,682 - 8,694 mm (0.3418 - 0.3422 in)
Stem to guide clearance:	
Inlet .....	0,033 - 0,048 mm (0.0013 - 0.0019 in)
Exhaust .....	0,058 - 0,073 mm (0.0023 - 0.0029 in)
Valve lift:	
Inlet .....	9,85 mm (0.388 in)
Exhaust .....	10,26 mm (0.404 in)

**Camshaft**

Location .....	Right-hand side (thrust side) of engine
End-float .....	0,1 - 0,2 mm (0.004 - 0.008 in)
Number of bearings .....	4
Material .....	Steel shell, white metal lined
Drive .....	Chain

**Valve springs**

Type .....	Duplex Interference double coil
Inner:	
Length, free .....	42,67 mm (1.680 in)
Length, under 8,0 kg (17.7 lb) load .....	40,30 mm (1.587 in)
Outer:	
Length, free .....	46,28 mm (1.822 in)
Length, under 21 kg (46 lb) load .....	40,30 mm (1.587 in)

**Lubrication**

System .....	Wet sump, pressure fed
System pressure, engine warm at 2000 rpm .....	2,5 - 4,57 kgf cm <sup>2</sup> (35 - 65 lbf in <sup>2</sup> )
Oil pump:	
Type .....	Double gear
Drive .....	Splined shaft from camshaft skew gear
End-float of gears:	
Steel gear .....	0,05 - 0,12 mm (0.002 - 0.005 in)
Aluminium gear .....	0,07 - 0,15 mm (0.003 - 0.006 in)
Radial clearance of gears .....	0,02 - 0,10 mm (0.001 - 0.004 in)
Backlash of gears .....	0,15 - 0,28 mm (0.006 - 0.012 in)

**Oil pressure relief valve**

Type .....	Non-adjustable
Relief valve spring:	
Full length .....	67,82 mm (2.670 in)
Compressed length at 2,58 kg (5.7 lb) load .....	61,23 mm (2.450 in)

**2.5 LITRE DIESEL ENGINE****ENGINE**

Number of cylinders .....	4
Bore .....	90,47 mm (3.562 in)
Stroke .....	97,00 mm (3.810 in)
Capacity .....	2495 cc
Compression ratio .....	21:1
Piston area (total) .....	257,1 cm <sup>3</sup> (39.86 in <sup>3</sup> )
Maximum power at 4000 rpm .....	65.5 bhp
Maximum torque at 1800rpm .....	113 lbf ft

**Crankshaft**

Main bearing journal diameter.....	63,487 - 63,500 mm (2.4995 - 2.5000 in)
Regrind dimensions:	
63,246 - 63,2333 mm (2.490 - 2.4895 in) .....	Use 0.010 in U/S bearings
Crankpin journal diameter .....	58,725 - 58,744 mm (2.312 - 2.31275 in)
Regrind dimensions:	
58,48985 - 58,4708 mm (2.30275 - 2.30200 in).....	Use 0.010 in U/S bearings
Crankshaft end thrust .....	Taken on thrust washers at centre main bearing
Crankshaft end-float .....	0,05 - 0,15 mm (0.002 - 0.006 in)

**Main bearings**

Number and type .....	5 halved shells
Diametrical clearance .....	0,018 - 0,061 mm (0.0007 - 0.0024 in)

**Connecting rods**

Length between centres.....	175,38 - 175,43 mm (6.905 - 6.907 in)
Diametrical clearance (big-end bearings).....	0,025 - 0,075 mm (0.001 - 0.003 in)
End-float on crankpin .....	0,15 - 0,356 mm (0.006 - 0.014 in)

**Pistons**

Type .....	Aluminium alloy 'V' shaped valve recess in crown
Skirt diametrical clearance (at right angle to gudgeon pin) .....	0,025 - 0,05 mm (0.001 - 0.002 in)

**Gudgeon pins**

Type .....	Floating
Fit in piston .....	Hand push fit
Diameter .....	30,1564 - 30,1625 mm (1.18726 - 1.18750 in)
Clearance in connecting rod .....	0,0196 - 0,0036 mm (0.00077 - 0.00014 in)

**Piston rings**

Type: Top .....	Square friction edge, chrome plated
Second .....	Taper faced
Oil control .....	Expander and rails

**Camshaft**

Drive .....	25,4 mm (0.1 in) wide dry toothed belt
Location .....	Right-hand side (thrust side)
End-float .....	0,1 - 0,2 mm (0.004 - 0.008 in)
Number of bearings.....	4
Material .....	Steel shell, white metal lined

**Valves**

Seat angle:	
Inlet .....	45"
Exhaust .....	45"
Head diameter:	
Inlet .....	39,12 - 39,37 mm (1.540 - 1.550 in)
Exhaust .....	33,25 - 33,50 mm (1.309 - 1.319 in)
Valve lift:	
Inlet .....	9,85 mm (0.388 in)
Exhaust .....	10,26 mm (0.404 in)
Cam lift:	
Inlet .....	6,81 mm (0.268 in)
Exhaust .....	7,06 mm (0.278 in)
Stem diameter:	
Inlet .....	7,912 - 7,899 mm (0.3114 - 0.3109 in)
Exhaust .....	8,682 - 8,694 mm (0.3418 - 0.3422 in)



**Valve springs**

Type .....	Duplex Interference double coil
Inner:	
Length, free .....	42,67 mm (1.680 in)
Length, under 8,0 kg (17.7 lb) load .....	40,30 mm (1.587 in)
Outer:	
Length, free .....	46,28 mm (1.822 in)
Length, under 21 kg (46 lb) load .....	40,30 mm (1.587 in)

**Lubrication**

System .....	Wet sump, pressure fed
System pressure, engine warm at 2000 rpm .....	2,5 - 4,57 kgf cm <sup>2</sup> (35 - 65 lbf in <sup>2</sup> )
Oil pump: Early type	
Type .....	Double gear
Drive .....	Splined shaft from camshaft skew gear
End-float of gears:	
Steel gear .....	0,05 - 0,12 mm (0.002 - 0.005 in)
Aluminium gear .....	0,07 - 0,15 mm (0.003 - 0.006 in)
Radial clearance of gears .....	0,02 - 0,10 mm (0.001 - 0.004 in)
Backlash of gears .....	0,15 - 0,28 mm (0.006 - 0.012 in)
Oil pump: Latest type	
Type .....	Double gear, 10teeth, sintered iron gears
Drive .....	Splined shaft from camshaft skew gear
End-float of both gears .....	0,026 - 0,135 mm (0.0009 - 0.0045 in)
Radial clearance of gears .....	0,025 - 0,075 mm (0.0008 - 0.0025 in)
Backlash of gears .....	0,1 - 0,2 mm (0.0034 - 0.0067 in)

**Oil pressure relief valve**

Type .....	Non-adjustable
Relief valve spring:	
Full length .....	67,82 mm (2.670 in)
Compressed length at 2,58 kg (5.7 lb) load .....	61,23 mm (2.450 in)

**GENERAL DATA****FUEL SYSTEM — 2.25 Petrol**

Carburetter .....	See 'ENGINE TUNING DATA'
Air cleaner .....	Oil bath with built-in centrifugal pre-cleaner

**Fuel pump — Early Models**

Type .....	Mechanical with sediment bowl and hand primer
Pressure range .....	3 - 5 psi

**Fuel pump — Latest Models**

Make and Type .....	Facet, electric. Mounted on R. H. side of chassis
Pressure range .....	3 - 5 psi

**FUEL SYSTEM — 2.25 and 2.5 Diesel**

Injection pump .....	See 'ENGINE TUNING DATA'
Fuel lift pump type .....	Mechanical, with hand primer
Pressure range .....	0,35 - 0,56 kgf cm <sup>2</sup> (5 - 8 lbf ft <sup>2</sup> )

**FUEL SYSTEM — V8 engine**

Carburettor .....  
 Fuel pump — Make, type .....  
 Air cleaner.....

See 'ENGINE TUNING DATA'  
 Facet, electric mounted vertically on R.H. side of chassis  
 Cyclone, replaceable element

**COOLING SYSTEM — 2.25 Petrol, 2.25 and 2.5 Diesel**

Type .....  
 Thermostat .....  
 Pressure cap .....  
 Type of pump .....

Pressurized spill return system with thermostat control,  
 pump and fan assisted  
 82°C  
 0,6 kgf cm<sup>2</sup> (9 lbf in<sup>2</sup>)  
 Centrifugal

**COOLING SYSTEM — V8 engine**

Type.....  
 Thermostat .....  
 Type of pump .....

Pressurized spill return system with thermostat control,  
 pump and fan assisted  
 Emission and non-emission 82°C, Australia 88°C  
 Centrifugal

**CLUTCH — 2.25 Petrol**

Type .....  
 Centre plate diameter .....  
 Facing material .....  
 Facing material identification colour .....  
 Number of damper springs .....  
 Damper spring colour .....  
 Clutch release bearing.....

Borg and Beck diaphragm spring  
 242,1 mm (9.500 in)  
 Raybestos 1488-05  
 White/violet on periphery  
 6  
 Dark grey/light green  
 Ball journal

**CLUTCH — 2.25 and 2.5 Diesel engine — Early type**

Type .....  
 Centre plate diameter .....  
 Facing material .....  
 Number of damper springs .....  
 Damper spring colour .....  
 Clutch release bearing.....

Verto diaphragm spring  
 242,1 mm (9.500 in)  
 Raybestos 1488-05  
 8  
 2 off white/green  
 2 off pigeon blue  
 4 off ruby red  
 Ball journal

**CLUTCH — Later type**

Type .....  
 Centre plate diameter (friction plate) .....  
 Facing material .....  
 Number of damper springs .....  
 Damper spring colour .....  
 Clutch release bearing.....

Verto diaphragm spring  
 235 mm (9.25 in)  
 Verto 791  
 8  
 2 off white/green — suffix 'C'  
 2 off pigeon blue — suffix 'A'  
 4 off ruby red — suffix 'B'  
 Ball journal

**CLUTCH — V8 engine**

Type .....  
 Centre plate diameter .....  
 Facing material .....  
 Damper spring colour .....  
 Release bearing.....  
 Number of damper springs .....

Borg and Beck diaphragm spring  
 267 mm (10.5 in)  
 Raybestos 1488-05. Grooved. White/violet  
 Light blue/dark blue  
 Ball journal  
 6

**TRANSMISSION — 2.25 Petrol, 2.25 and 2.5 Diesel engine****Main gearbox**

Type LT77 .....	Single helical constant mesh
Speeds .....	5 forward 1 reverse
Synchromesh .....	All forward speeds
Ratios:	
Fifth .....	0.8314:1
Fourth (direct) .....	1.0000:1
Third .....	1.5074:1
Second .....	2.3008:1
First .....	3.5850:1
Reverse .....	3.7007:1

**Transfer box**

Type LT230R ..... Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential

## Ratios:

High .....	1.6670
Low .....	3.3198

## Overall ratios (final drive):

	<b>In high transfer</b>	<b>In low transfer</b>
Fifth .....	4.9042:1	9.7666:1
Fourth .....	5.8987:1	11.7471:1
Third .....	8.8917:1	17.7075:1
Second .....	13.5715:1	27.0272:1
First .....	21.1472:1	42.1138:1
Reverse .....	21.8293:1	43.4723:1

Input gear ..... 26 Teeth

Intermediate gear ..... 19 x 41 x 35 Teeth

Output gear ..... 40 x 37 Teeth

**TRANSMISSION — V8 Engine****Main gearbox**

Type LT95 .....	Single helical constant mesh
Speeds .....	4 forward 1 reverse
Synchromesh .....	All forward speeds
Ratios:	
Fourth (direct) .....	1.0000:1
Third .....	1.5049:1
Second .....	2.4480:1
First .....	4.0691:1
Reverse .....	3.6643:1

**Transfer box**

Type LT95 ..... Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential

## Ratios:

High .....	1.3362
Low .....	3.3206

## Overall ratios (final drive):

	<b>In high transfer</b>	<b>In low transfer</b>
Fourth .....	4.7281:1	11.7497:1
Third .....	7.1154:1	17.6822:1
Second .....	11.5745:1	28.7634:1
First .....	19.2390:1	47.8101:1
Reverse .....	27.3250:1	43.0538:1

**TRANSMISSION — Ninety and One Ten V8 with 5-speed gearbox**

**Main gearbox**

Type — Manual.. .. .	LT85 5-speed helical constant mesh, with synchromesh on all forward gears	
Main gearbox ratios.. .. .	Fifth (Cruising gear)	0.7951
	Fourth	1.0000
	Third	1.4362
	Second	2.1804
	First	3.6497
	Reverse	3.8242

**Transfer gearbox**

Type .. . LT230T. Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential.

— Ninety models .. .	High	1.1923
	Low	3.3198
— One Ten models .. .	High	1.410
	Low	3.3198

Overall ratio (including final drive) — Ninety models	<b>In high transfer</b>	<b>In low transfer</b>
	Fifth (Cruising gear)	0.3401
	Fourth	11.7471
	Third	16.8712
	Second	25.6134
	First	42.8734
	Reverse	44.9233

Overall ratio (including final drive) — One Ten models	<b>In high transfer</b>	<b>In low transfer</b>
	Fifth (Cruising gear)	9.3401
	Fourth	11.7471
	Third	16.8712
	Second	25.6134
	First	42.8734
	Reverse	44.9233

**REAR AXLE — One Ten only**

Type .. .	Salisbury 8HA
Ratio .. .	3.538
Track .. .	1485,90 mm (58.50 in)

**FRONT AXLE — All models and Ninety rear**

Type .. .	Spiral bevel, enclosed constant velocity joints
Ratio .. .	3.538

**PROPELLER SHAFTS — All Models**

Type: Front and rear .. . Single Hookes universal needle roller joints. Sliding portion on front shaft gaitered, rear shaft open

**SUSPENSION — All Models**

Type .....	Coil springs controlled by telescopic dampers front and rear
Front .....	Transverse location of axle by Panard rod, and fore and aft location by two radius arms
Rear .....	Fore and aft movement inhibited by two tubular trailing links. Lateral location of axle by a centrally positioned 'A' bracket bolted at the apex to a ball joint mounting. An optional levelling unit is positioned between the ball joint and upper cross member

**BRAKES 2.25 Petrol and V8 Engine**

System .....	Direct acting servo assisted dual braking system with Girling tandem master cylinder and pressure differential warning actuator, combination valve, or G. valve
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**Footbrake — All Models**

Front .....	Lockheed Disc
Disc diameter .....	300 mm (11.81 in)
Number of pistons per wheel .....	4
Total lining area .....	232 cm <sup>2</sup>
Lining material.. ..	Don 230
Rear .....	Girling single cylinder drum brake
Drum diameter .....	280 mm (11 in)
Total lining area .....	493 cm <sup>2</sup>
Brake drum width.. ..	63.9 mm
Lining material.. ..	Ferodo 2629

**Handbrake — All Models**

Type .....	Transmission drum brake cable operated
Drum diameter .....	254 mm (10 in)
Lining material.. ..	Don 269

**BRAKES — 2.25 and 2.5 litre Diesel engine**

System .....	Direct acting servo assisted dual braking system with Girling tandem master cylinder and pressure differential warning actuator, combination valve, or G. valve. Servo assistance initiated by an engine driven air evacuation pump and sustained by a vacuum tank (vacuum tank deleted on 2.5)
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**Evacuation pump — 2.25 litre Diesel**

Maximum speed .....	5000 rpm. Belt drive
Oil capacity .....	40 cm <sup>3</sup> (2.4 in <sup>3</sup> ) SAE 15W-50

**Evacuation pump — 2.5 litre Diesel**

Maximum speed .....	4000 rpm. Gear drive from camshaft
Lubrication .....	Oil feed via skew gear
Minimum vacuum level at 2500 rpm .....	0,8 bar

**STEERING — All Models**

Type:	
Manual — Early Models only .....	Burman recirculating ball
Manual .....	Gemmer Hour-glass worm and wheel
Optional power assisted — Early Models .....	Adwest Varamatic
Optional power assisted — Later Models .....	Adwest Lightweight or Gemmer
Ratios:	
Manual Burman straight ahead .....	20,55:1
Manual Gemmer .....	20,2:Constant
Power assisted straight ahead .....	17,5:1
Number of turns lock to lock:	
Manual .....	4.75
Power assisted .....	3.49
Camber angle .....	Zero
Castor angle .....	3"
Swivel pin inclination .....	7"
Front wheel toe-out — permanent 4-wheel drive .....	1,19 - 2,38 mm ( $\frac{3}{64}$ - $\frac{3}{32}$ in)
Turning circle between kerbs:	
Right-hand drive .....	14,0 m (45.67 ft)
Left-hand drive .....	13,28 m (43.58 ft)
Steering wheel diameter .....	420 mm (16.5 in)
Steering damper .....	Fitted to drag link
Track .....	1485,90 mm (58.50 in)
Steering column type .....	Collapsible coupling

**WHEELS AND TYRES — All Models**

Type of wheel .....	Ventilated disc
Wheel size .....	5.50 in F x 16 in
Number of studs .....	5
Tyre size .....	7.50 x 16

**ELECTRICAL EQUIPMENT — All Models**

System .....	12 volt, negative earth
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**Battery — 2.25 litre Petrol and V8 engine**

Type:		
Lucas — standard 9 plate .....	B.B.M.S. No. 371	Designation
Chloride — standard 9 plate .....	B.B.M.S. No. 291	190/84/90
Lucas — cold climate 13 plate .....	B.B.M.S. No. 389	Designation
Chloride — cold climate 13 plate .....	B.B.M.S. No. 369	315/120/92

**Battery — 2.25 and 2.5 litre Diesel engine**

Type .....	Chloride B.B.M.S. No. 243 15 plate designation 395/175/90
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**Alternator — 2.25 litre Petrol and Diesel and 2.5 Diesel**

Type .....	Lucas A115-34
Maximum D.C. output at 6000 rpm .....	34 amps
Rotor — winding resistance .....	3.27 ohms at 20°C ± 5%
Stator — winding resistance per phase .....	0.138 ohms at 20°C ± 5%
New brush length .....	20 mm
Renew brush at .....	10 mm
Brush spring pressure .....	1.3- 2.7 N (4.7- 9.8 oz)
Regulator controlled voltage .....	13.6- 14.4 volts measured across battery

**Note:** From the following engine numbers a 45 amp output alternator is fitted.

12J05497C	Land Rover 90/110 2.5 litre Diesel
11H05639C	Land Rover 90 2.3 litre Petrol
11H05629C	Land Rover 110 2.3 litre Petrol

**Alternator — V8 engine**

Type .....	Lucas A115-45
Maximum D.C. output at 6000 rpm .....	45 amps
Rotor — winding resistance .....	3.2 ohms at 20°C ± 5%
Stator — winding resistance per phase .....	0.092 ohms at 20°C ± 5%
New brush length .....	20 mm
Renew brush at .....	10 mm
Brush spring pressure .....	1.3- 2.7 N (4.7- 9.8 oz)
Regulator controlled voltage .....	13.6- 14.4 volts measured across battery

**Starter motor — 2.25 Petrol engine**

Type .....	Lucas 2M100
Brush spring tension .....	1020 gms (36 ozs)
Minimum brush length .....	9,5 mm (0.375 in)

**Starter motor — 2.25 and 2.5 Diesel engine**

Type .....	Lucas 2M113
New brush length .....	22.2 mm (0.875 in)
Renew brush at .....	8 mm (0.312 in)
Armature end-float —	
Cast aluminium intermediate bracket .....	0,03 - 1,4 mm (0.001 - 0.056 in)
Pressed steel intermediate bracket .....	0,03 - 1,55 mm (0.001 - 0.061 in)
Commutator minimum diameter .....	38 mm (1.5 in)

**Starter motor — V8 engine**

Type .....	Lucas 3M100 pre-engaged
Brush spring tension .....	1020 gms (36 ozs)
Brush minimum length .....	9,5 mm (0.375 ins)

**Distributor — All Petrol engines** .....

**Coil — All Petrol engines** .....

} See 'ENGINE TUNING DATA'

**Fuses — All Models**

Type .....

12 cartridge **fuses** of the following values:  
Three 10amp  
Six 8 amp  
One 12 amp  
Two 2.5 amp

**Starter motor — 2.5 litre Diesel — Later Models**

Type .....

Paris Rhone D9R91 12volt



TYRE PRESSURES

Tyres — size and type		Normal		Emergency soft			
		All load conditions		Unladen		Laden	
		Front	Rear	Front	Rear	Front	Rear
6.00-16 CROSS-PLY	bar	2,4	3,25	1,1	1,1	1,1	1,6
	lbf/in <sup>2</sup>	35	47	16	16	16	23
	kgf/cm <sup>2</sup>	2,5	3,3	1,1	1,1	1,1	1,6
7.50-16 CROSS-PLY	bar	1,9	2,4	1,1	1,1	1,1	1,6
	lbf/in <sup>2</sup>	28	35	16	16	16	23
	kgf/cm <sup>2</sup>	2,0	2,5	1,1	1,1	1,1	1,6
205R16 RADIAL-PLY	bar	1,9	2,4	1,1	1,1	1,1	1,6
	lbf/in <sup>2</sup>	28	35	16	16	16	23
	kgf/cm <sup>2</sup>	2,0	2,5	1,1	1,1	1,1	1,6
7.50R16 RADIAL-PLY	bar	1,9	2,75	1,1	1,1	1,1	1,6
	lbf/in <sup>2</sup>	28	40	16	16	16	23
	kgf/cm <sup>2</sup>	2,0	2,8	1,1	1,1	1,1	1,6
7.50-16 CROSS-PLY	bar	1,9	2,9	1,1	1,1	1,1	1,8
	lbf/in <sup>2</sup>	28	42	16	16	16	26
	kgf/cm <sup>2</sup>	2,0	3,0	1,1	1,1	1,1	1,8
750R16 RADIAL-PLY	bar	1,9	3,3	1,1	1,1	1,1	1,8
	lbf/in <sup>2</sup>	28	48	16	16	16	26
	kgf/cm <sup>2</sup>	2,0	3,4	1,1	1,1	1,1	1,8

General Notes

- Emergency soft pressures should only be used in extreme conditions where extra flotation is required. Max. speed 40 km/h (25 mph). Return pressures to normal immediately firm ground is regained.
- For extra ride comfort at part load the normal rear tyre pressures may be reduced to following:  
 90 models — Not more than 1050 kg rear axle load.  
 6.00-16 tyres: 2,4 bar (35 lbf/in<sup>2</sup>) 2,5 kgf/cm<sup>2</sup>  
 All other tyre sizes: 1,9 bar (28 lbf/in<sup>2</sup>) 2,0 kgf/cm<sup>2</sup>  
 110 models — Not more than 1250 kg rear axle load.  
 Cross-ply and radial tyres: 2,2 bar (32 lbf/in<sup>2</sup>) 2,25 kgf/cm<sup>2</sup>
- Towing: When vehicle is used for towing the reduced rear tyre pressures for extra ride comfort are **not** applicable.

REPLACEMENT BULBS AND UNITS

Headlamps:

—UK and Europe (except France) .....	60/55 W Halogen bulb
—France and Algeria .....	60/55 W Halogen bulb, yellow
—Rest of world, right-hand steering .....	75/50 W Sealed beam unit
—Rest of world, left-hand steering .....	60/50 W Sealed beam unit
Front side lamps .....	12 v 5 w
Side repeater lamps .....	12 v 4 w
Stop/tail lamps .....	12V21/5W
Flasher lamps .....	12 v 21 w
Number plate lamp .....	12 v 4 w
Reverse lamp .....	12 v 21W
Rear fog guard lamp .....	12 v 21 w
Interior lamp .....	12 v 21 w
Warning lights .....	12 v 12 w
Instrument illumination .....	12" 3W
Hazard switch warning light .....	12V0.6W

## VEHICLE WEIGHTS AND PAYLOAD

Payload figures quoted in the accompanying table are nominal values for a base specification vehicle and will in general represent the maximum, as any options or extras fitted to the vehicle will increase its unladen weight and hence decrease its allowable payload.

When loading a vehicle to its maximum (Gross Vehicle Weight), consideration must be taken of the unladen vehicle weight and the distribution of the payload to ensure that axle loadings do not exceed the permitted maximum values. It is the customer's responsibility to limit the vehicle's payload in an appropriate manner such that neither maximum axle loads nor Gross Vehicle Weight are exceeded.

Land Rover Ninety													
Model — Petrol/Diesel	Soft Top			Pick-up			Hard Top			Station Wagon			
	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	
Gross Vehicle Weight	STANDARD SUSPENSION 2400 kg												
EEC Kerb Weight	kg	1606	1643	1602	1635	1672	1631	1648	1685	1644	1690	1727	1686
EEC Payload	kg	794	757	798	765	728	769	752	715	756	710	673	714
Unladen Weight	kg	1487	1519	1483	1516	1548	1512	1529	1561	1525	1571	1603	1567
Payload	kg	913	881	917	884	852	888	871	839	875	829	797	833
Maximum Axle Weights, all Ninety models with Standard Suspension													
Front Axle 1200 kg Rear Axle 1380 kg													
Gross Vehicle Weight	HIGH LOAD SUSPENSION 2550 kg												
EEC Kerb Weight	kg	1633	1670	1629	1662	1699	1658	1675	1712	1671	1717	1754	1713
EEC Payload	kg	917	880	921	888	851	892	875	838	879	833	796	837
Unladen Weight	kg	1514	1546	1510	1543	1575	1539	1556	1588	1522	1598	1630	1594
Payload	kg	1036	1004	1040	1007	975	1011	994	962	998	952	920	956
Maximum Axle Weights, all Ninety models with High Load Suspension													
Front Axle 1200 kg Rear Axle 1500 kg													

Land Rover One Ten																
Model — Petrol/Diesel	Soft Top			Pick-up			Hard Top			Station Wagon			High Capacity Pick-up			
	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	2.5P	2.5D	3.5P	
Gross Vehicle Weight	UNLEVELLED SUSPENSION 3050 kg															
EEC Kerb Weight	kg	1723	1742	1698	1724	1743	1699	1777	1796	1752	1887	1906	1862	1813	1859	1778
EEC Payload	kg	1327	1308	1352	1326	1307	1351	1273	1254	1298	1163	1144	1188	1237	1191	1272
Unladen Weight	kg	1588	1599	1563	1589	1600	1564	1642	1653	1617	1752	1763	1727	1678	1716	1643
Payload	kg	1462	1451	1487	1461	1450	1486	1408	1397	1433	1298	1287	1323	1372	1334	1407
Maximum Axle Weights, all One Ten models with Unlevelled Suspension																
Front Axle 1200 kg Rear Axle 1850 kg																
Gross Vehicle Weight	LEVELLED SUSPENSION 2950 kg															
EEC Kerb Weight	kg	1733	1752	1708	1734	1753	1709	1787	1806	1762	1897	1916	1872	1823	1869	1788
EEC Payload	kg	1217	1198	1242	1216	1197	1241	1163	1144	1188	1053	1034	1078	1127	1081	1162
Unladen Weight	kg	1598	1609	1573	1599	1610	1574	1652	1663	1627	1762	1773	1737	1688	1726	1653
Payload	kg	1352	1341	1377	1351	1340	1376	1298	1287	1323	1188	1177	1213	1262	1224	1297
Maximum Axle Weights, all One Ten models with Levelled Suspension																
Front Axle 1200 kg Rear Axle 1750 kg																

**V8 PETROL ENGINE TUNING DATA**  
(with 4-speed gearbox and without electronic ignition)

**ENGINE**

Compression ratio.....	9.35:1 or 8.13:1 Dependent upon market
Firing order .....	1—8—4—3—6—5—7—2
Cylinder numbering system, front to rear:	
Left bank .....	1—3—5—7
Right bank .....	2—4—6—8
Compression pressure (minimum) .....	9,5 kgf cm <sup>2</sup> (135 lbf in')
Timing marks.....	On crankshaft pulley vibration damper
Valve clearance.....	Not adjustable

**Valve timing:**

Inlet opens .....	36" B.T.D.C.
Inlet closes .....	64" A.B.D.C.
Inlet duration.....	280"
Inlet peak .....	99" A.T.D.C.
Exhaust opens.....	74" B.B.D.C.
Exhaust closes.....	26° A.T.D.C.
Exhaust duration .....	280°
Exhaust peak .....	119" B.T.D.C.

**CARBURETTERS**

Type .....	Two Solex
European Australian .....	175 CDSE
Other markets — non-emission .....	175 CD3
Needle:	
Australian.....	BIFH
Other markets — non-emission.....	BIFQ
— emission.....	BIFK
Idle speed (engine hot):	
Australian .....	700 - 750rpm (run-in) 550 - 650rpm (new engine)
Other markets — non-emission .....	550 - 650rpm
— emission.....	700 - 750rpm (run-in) 550 - 650rpm (new engine)
Fast idle speed (engine hot) .....	1050 - 1150rpm
Mixture setting — CO at idle:	
Australian.....	2% - 3.5% Pulsair connected
Other markets.....	1.5% - 3% Pulsair connected

**IGNITION**

Coil make/type .....	AC Delco with ballast resistor
Primary resistance at 20°C (68°F).....	1.2- 1.4ohms
Consumption, ignition on, at 2000 rpm .....	1 amp
Sparking plug type .....	Champion N12Y or Unipart GSP131
Sparking plug gap .....	0,71 - 0,84 mm (0.028 - 0.033 in)
Ignition timing, dynamic or static.....	5" to 7" B.T.D.C.
Fuel octane rating Australia.....	97 RON minimum
Non-emission .....	97 RON minimum
Emission .....	90 RON minimum
Engine idle speed.....	750 rpm maximum with vacuum pipe disconnected



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